
PROJECT: P-SL-GB0-004 Lesotho Metropolitan Fiber Distribution Network (LEMOFI) Feasibility Study

COUNTRY: Lesotho

ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT



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REVISION RECORD SHEET

<table>
<tr><td colspan="2">INTERNAL PROJECT NUMBER</td><td colspan="4">ASSIGNMENT TITLE</td></tr>
<tr><td colspan="2">P-LS-GB0-004</td><td colspan="4">Lesotho Metropolitan Fiber Distribution Network (LEMOFI) Feasibility Study</td></tr>
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DEFINITION OF TERMS

Aggregate, Soil - Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Accelerated Erosion - Erosion much more rapid than normal, natural, geological erosion, primarily as a result of the influence of the activities of man or, in some cases, of animals.

Alluvium - Unconsolidated material, such as gravel, sand, silt, clay, and various mixtures of these, deposited on land by running water.

Association, Soil - A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available Water Capacity (available moisture capacity) - The capacity of soils to hold water available for use by most plants.

Area of Influence - The area within which the impacts of the proposed development are likely to be Expressed.

Alternative – A possible course of action, in place of another, that would meet the same purpose and need (of the proposal). Alternatives can refer to any of the following but are not limited to: alternatives sites for development, alternative site layout, alternative designs, alternative processes and alternative materials.

Assessment – The process of collecting, organizing, analysing, interpreting and communicating data relevant to some decision.

Audit – A verification process that is used to obtain information regarding the implementation of the ESMP by the Contractor. It is an objective tool used to make improvements at the workplace.

Berm – A barrier that is designed to divert surface water flow.

Bedrock - The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Biodiversity - The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity species, between species, and of ecosystems.

Bund – An impervious containment system for potential spillages from tanks/containers stored on site. The bunded area shall have a capacity greater than 110% of the total volume contained. The bunding shall be constructed of a material impermeable and resistant to the stored material.

Clay - As a soil separate, the mineral soil particles less than 0.002 mm in diameter. As a soil textural class, soil material that is 40% or more clay, less than 45% sand, and less than 40% silt.

Coarse Texture - The texture exhibited by sands, loamy sands, and sandy loams except very

fine sandy loam.

Construction – Means erection or establishment of an infrastructure through activities that include but are not limited to excavation, masonry works, concrete batching, civil works, electro-mechanical works.

Contractor – Main Organisation appointed by the developer, to undertake the construction activities.

Consultation - Consultation refers to a two-way communication between the consultants, Project proponent and the affected communities.

Critical Habitat - Areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered (CR) and/or Endangered (EN) species; (ii) habitat of significant importance to endemic and / or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and / or unique ecosystems; and/or (v) areas associated with key evolutionary processes.

Critically Endangered - A taxon is Critically Endangered (CR) when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by IUCN criteria (www.iucnredlist.org).

Drainage, Surface - Runoff, or surface flow of water, from an area.

Ecoregion - An ecoregion is defined as a "relatively large unit of land or water containing a characteristic set of natural communities that share a large majority of their species, dynamics, and environmental conditions."

Ecosystem Services - Defined as the benefits that people obtain from nature. These are typically divided into four categories.

- Provisioning services are the goods or products obtained from ecosystems, such as food, timber, medicines, fibre, and freshwater.
- Regulating services are the benefits obtained from an ecosystem's control of natural processes, such as climate, disease, erosion, water flows, and pollination, as well as protection from natural hazards.

- Cultural services are the nonmaterial benefits obtained from ecosystems, such as recreation, spiritual values, and aesthetic enjoyment.
- Supporting services are the natural processes that maintain the other ecosystem services, such as nutrient cycling and primary production.

Endangered - A taxon is Endangered (EN) when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future, as defined by the IUCN criteria (www.iucnredlist.org) or provisionally assessed by an expert group.

Endemic - A species that has ≥ 95 % of its global range inside the country or region of analysis (IFC PS6 GN79).

Environment – Surroundings in which organisms operate, including air, water, land, natural resources, flora, fauna, humans and their interrelations. The environment is made up of: the soil, water and atmosphere.

Environmental Aspect – Means an element or function of a product that can interact with the environment during its life cycle.

Environmental Control Officer – Representative of the Contractor, responsible for day-to-day implementation of the ESMP.

Environmental Feature – Sensitive ecological feature within the Project Site, like wetland areas and remaining natural forest and riparian habitat.

Environmental Impact – The effect of an activity on the environment, whether desirable or undesirable. Undesirable or negative environmental impacts will result in damage and/or pollution or detriment to the environment, or danger to the public, whether immediate or delayed.

Environment and Social Management Plan – The ESMP for the project sets out general instructions that will be included in a contract document for the construction phase of the project. The ESMP will ensure the construction activities are conducted and managed in an environmentally sound and responsible manner. The ESMP also details the organisational structure required to ensure the effective implementation of the ESMP and measures to monitor and improve the application of the ESMP.

Environmental Specifications – Instructions and guidelines for specific construction activities designed to help prevent, reduce and/or control potential environmental implications of these construction activities.

Erosion - Erosion (geologic)

The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (accelerated)

Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or a catastrophe in nature, such as a fire, which exposes the surface.

Excavation – Involves removal of soil or rock from site to form an open face, hole or cavity using tools, machinery or explosives.

Fine Texture - Consisting of or containing large quantities of fine fractions, particularly of silt and clay. (Includes all clay loams and clays; that is, clay loam, sandy clay loam, silty clay loam, sandy clay, silty clay, and clay textural classes).

Flood Plain - The nearly level plain that borders a stream and is subject to flooding unless protected artificially.

Fossorial - Animal that digs burrows.

Footprint – Refers to the surface area of land directly affected by a proposed development or activity. Directly related to the physical extent and size of the development or activity.

General Waste – Domestic and non-hazardous waste as well as builder's rubble e.g., paper, plastics, food, cans, etc.

Ground-Truth – to check the design on the site and make sure the design interacts with site sensitivities on the ground, as intended in the design.

Gully - A small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gully Erosion - The erosion process whereby water accumulates in narrow channels and, over short periods, removes the soil from this narrow area to considerable depths, ranging from 1 or 2 feet to as much as 75 to 100 feet.

Habitat - The environmental or ecological area in which an animal, plant species or other organism lives.

Hazardous Waste – Any organic or inorganic element or compound that because of its toxicological, physical, chemical or persisting properties, may exercise detrimental acute or chronic impacts on human health or development.

Hazardous Substance – Any substance that is of risk to health and safety, property or environment. Hazardous substances typically include, but are not limited to:

- Human excrement, fuel, lubricating oils, hydraulic and brake fluid, acids, paints, anti-corrosives, insecticides, pesticides, detergents, cement, etc.; and
- By-products and wastes associated with the use of hazardous substances as well as potentially hazardous items such as spent batteries, old oil filters, light bulbs, circuit boards, sharp objects etc. which requires special collection and handling.

Heavy Soil - A soil with a high content of the fine separates, particularly clay, or one with a high drawbar pull and hence difficult to cultivate.

Horizon, Soil - A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes.

Humus - The well decomposed, more or less stable part of the organic matter in mineral soils.

Infiltration - The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration Capacity - The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Issues/ grievance Log - A document used to record and track stakeholder issues/ concerns/ comments.

Invasive Alien (vegetation) - Species are identified as invasive aliens when (i) they are non-native to an ecosystem, and (ii) their introduction is liable to cause environmental harm, or harm to human health and livelihoods, because they spread rapidly and have negative effects on native species through competition, predation, or disease. Invasive species can be flora, fauna, or other organisms (e.g. microbes) but
generally, refer to plants.

IUCN Red List - This list has been developed by the International Union for Conservation of Nature (IUCN) and details the global conservation status of a wide range of biological species. The Red List website is http:/www.redlist.org.

Land Capability - The ability of the land to sustain a type of land use permanently. The key is matching the type and intensity of land use with its natural capability.

Land Classification - The arrangement of land units into various categories based upon the properties of the land or its suitability for some particular purpose.

Landscape - All the visible features of an area of land. Physical elements of geophysical defined landforms such as mountains, hills, water bodies such as rivers, living elements of land cover including vegetation, human elements, different forms of land use, buildings and structures etc.

Land Use – The activities that take place within a given area or space.

Loam - Soil material that is 7 to 27% clay particles, 28 to 50% silt particles, and less than 52% sand particles.

Local Community - Community within the Project's Area of Influence.

Method Statement – A written submission by the Contractor to the Project Engineer in response to the specifications setting out the plant, materials, labour, timing and method the Contractor proposes using to carry out an activity. The Method Statement shall cover applicable details with regard to:

- Construction procedures.
- Materials and equipment to be used.
- Getting the equipment to and from site.
- How the equipment/material will be moved while on site.

- How and where material will be stored.
- The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or solid material that may occur.
- Timing and location of activities.
- Compliance/non-compliance with the specifications; and
- Any other information deemed necessary by the Project Engineer.

Mitigation – Measures designed to avoid, reduce or remedy adverse negative impacts.

Modified Habitat - An area that may contain a large proportion of plant and/or animal species of non-native origin, and / or where human activity has substantially modified the primary ecological functions and species composition.

Monitoring – The process which ensures that the environmental requirements stipulated in the ESMP are being complied with and allows for on-going impacts to be tracked in order to measure the effectiveness of the mitigation. The repetitive and continued observation, measurement and evaluation of environmental data to follow changes over a period of time to assess the efficiency of control measures.

Natural Erosion - Wearing away of the earth's surface by water, ice, or other natural agents under natural environmental conditions of climate. Vegetation, and the like, undisturbed by man. Synonymous with geological erosion.

Natural Habitat - An area composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary functions and species composition.

Organic Matter - Plant and animal residue in the soil in various stages of decomposition.

Parent Material - The unconsolidated organic and mineral material in which soil forms.

Plateau (geomorphology) - A comparatively flat area of great extent and elevation; specifically, an extensive land region that is considerably elevated (more than 100 meters) above the adjacent lower lying terrain, is commonly limited on at least one side by an abrupt descent and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

Profile, Soil - A vertical section of the soil extending through all its horizons and into the parent material.

Project Area - The area within which most of the project impacts are likely to be expressed.

Public – Any individual or group concerned with or affected by the project and its consequences.

Public Participation Process - The public participation process (PPP) is a requirement of Lesotho's EIA guidelines (2009) that requires all Interested and Affected Parties (I&APs), including affected communities, to be consulted during the EIA. This ESIA favours the term Stakeholder Engagement Plan.

Rangeland - Land on which the potential natural vegetation is predominantly grasses, grass-like plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reasonable Measures – Measures that a reasonable (ordinary) person would regard necessary for the specific purpose.

Rehabilitation – The return of a disturbed area, feature or structure to a state that approximates to the state (where possible) that it was before disruption, or to an improved state.

Remediation – Measures implemented to clean-up a polluted environment to a stable state in order to avoid long-term leaching/spread of pollutants or health risks; or repair an altered/disturbed environment to avoid long-term visual scarring, safety risks, erosion and further degradation and secondary impacts.

Runoff - The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand - A soil particle between 0.05 and 2.0mm in diameter.

Sensitive Habitat – A sensitive area or environment can be described as an area or environment where a unique ecosystem, habitat for plant and animal life, wetlands or conservation activity exists or where there is a high potential for ecotourism.

Series, Soil - A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Servitude – A servitude is a right to access which allows a local authority/ proponent to a property for inspection or installation of electricity cables and so on. It is registered against the title deed.

Side Slope (geomorphology) - A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland water flow is predominantly parallel. Side slopes are dominantly colluvium and slope-wash sediments.

Silt - (1) A soil separate consisting of particles between 0.05 and 0.002mm in equivalent diameter.

(2) A soil textural class.

Similar soils - Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Soil - A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief and by the passage of time.

Soil Conservation - A combination of all management and land use methods that safeguard the soil against depletion or deterioration by natural or by man-induced factors.

Soil Fertility - The status of a soil with respect to the amount and availability of elements necessary for plant growth.

Soil Morphology - The physical condition, particularly the structural properties, of a soil profile, and by the texture, structure, consistency, and porosity of each horizon.

Soil Productivity - The capacity of soil for producing a specified plant or sequence of plants under a specified system of management. Productivity emphasizes the capacity of soil to produce crops and should be expressed in terms of yields.

Soil Profile - A vertical section of the soil through all its horizons and extending into the parent material.

Soil Series - The basic unit of soil classification being a subdivision of a family and consisting of soils that are essentially alike in all major profile characteristics except of the texture of the A horizon.

Stakeholder Engagement Process - The stakeholder engagement process is equivalent to the statutory required 'public participation process' referred to in Lesotho's EIA Guidelines (2009) but is used in this report as it infers a wider range of stakeholders; notably the authorities/ international governments who are not considered to be 'public'. Stakeholder engagement is aligned with international good practice terminology and also indicates on-going, Solum proactive management of stakeholders and their concerns throughout the operational life of the Project. PPP refers only to the process undertaken for the ESIA.

Stakeholder Engagement Plan - The Stakeholder Engagement Plan (SEP) execution plan for ESIA stakeholder engagement activities. The SEP details the method and approach of stakeholder consultation, timeframes, communication mechanisms and tools, as well as monitoring, recording and tracking of stakeholder issues during the ESIA process.

Stockpile – includes any heap, pile and accumulation of any substance where such substance is stored as a product or stored for use at any activity.

Structure, Soil - The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or sub-angular), and granular. Structure-less soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Soil Survey - The systematic examination, description, classification, and mapping of soil in an area. Soil surveys are classified according to the kind and intensity of field examinations.

Subsoil - Technically, the B horizon; roughly, the part of the solum below plough depth.

Texture, Soil - The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topsoil - The upper part of the soil, which is the most favourable material for plant growth. It is ordinarily rich in organic matter and is used to top-dress road banks, lawns, and land affected by mining.

Vulnerable - A taxon is Vulnerable (VU) when it is not Critically Endangered (CR) or Endangered (EN) but is facing a high risk of extinction in the wild in the medium-term future, as defined by the IUCN criteria (www.iucnredlist.org).

Workforce – people employed by the proponent or the contractor, persons involved with project activities including permanent, contract, or/and casual labour.

EXECUTIVE SUMMARY

INTRODUCTION

The Government of the Kingdom of Lesotho is committed to fostering a competitive telecommunications sector and expanding broadband access across the nation. However, the sector is currently dominated by Mobile Network Operators (MNOs), and the high costs associated with building new infrastructure have hindered smaller entrants from establishing a foothold. This lack of competition has led to high data and broadband prices, preventing many citizens from accessing affordable broadband and participating fully in the 4th Industrial Revolution.

To address these gaps, the **Lesotho Metropolitan Fiber Infrastructure Expansion Project (LEMOFI)** project should focus on developing comprehensive fiber distribution networks within towns and metropolitan areas to enhance access and promote competition. The design should account for existing fiber coverage from Econet, Vodacom, and the Lesotho Electricity Company (LEC), whose network primarily follows long-distance transmission lines.

Additionally, it should consider other local ISPs with smaller or expanding fiber deployments to ensure a more integrated infrastructure.

LEMOFI BACKGROUND

Currently, LEC's fiber infrastructure is primarily laid along long-distance electricity transmission lines, which typically do not extend into commercial and residential areas. To address this limitation and make these services more accessible to users, it is imperative to expand fibre distribution networks within these urban and suburban areas.

The Project Implementing Unit (PIU) is the LEC Communications (LECC) which was established in 2015, as a special purpose vehicle by the Government of Lesotho through Lesotho Electricity Company (LEC), to commercialize existing fiber optic infrastructure deployed on LEC’s network.

LECC currently has 2 x 1Gbps IP Transit links from Cogent and Afr-IX and 2 x 1Gbps Layer 2 transport from Broadband Infraco (BBI) and OpenServe. It is currently deploying pilot Fiber to the Home (FTTH) network at Ha Foso covering 2.5 square kilometres and 904 house passes (Density = 368 houses/km2). Estimated 110 km of OPGW fibre will be rolled-out through the Ministry of Information, Communications, Science, Technology and Innovation funding (loan from the African Development Bank - AfDB) between Roma and Thaba Tseka with multiple drop-offs throughout the route – valued at approximately LSL32m.

LECC's dark fiber network is almost entirely based on LEC's fiber infrastructure. Smaller sections of the network are constructed on LEC's 11kV distribution network and are owned directly by LECC. To connect distant substations, LEC uses Optical Ground Wire fiber (OPGW) (usually on 88kV and 132kV lines, rarely on 33kV) whereas for connecting substations within a metro area like Maseru, All Dielectric Self-Supporting fiber (ADSS) is more commonly used (33kV lines). ADSS is also exclusively used for pole attachments. OPGW is generally stronger and more reliable than ADSS. The fact that LEC's fibre runs on electricity lines makes it less prone to vandalism because of the inherent danger associated with high-voltage electricity. This is one of the factors which make it attractive for Unified Licensees.

LOCATION OF PROJECT

The Project is going to be implemented in all 10 districts of Lesotho (**Figure A**); thus, Maseru Metropolitan and 11 other major towns and commercial centres.

- **Year 1: Berea:** Teyateyaneng. **Leribe:** Maputsoe (Including Nyenye). **Mafeteng:** Mafeteng. **Maseru:** Highway- Central-IEMS. **Maseru:** Maseru Industrial. **Maseru:** Parliament - Maseru Mall. **Maseru:** A2 - Lekhaloaneng - Matala
- **Year 2: Leribe:** Hlotse. **Butha Buthe:** Botha Bothe. **Mohale's Hoek:** Mohale's Hoek. **Mokhotlong:** Mokhotlong Town. **Thaba Tseka:** Thaba Tseka. **Maseru:** Thetsane Industrial

- **Year 3: Maseru:** Old Europa – Downtown. **Maseru:** Tikoe Industrial. **Quthing:** Quthing – Moyeni. **Qacha's Nek:** Qacha's Nek Town.



Figure A: Project Location

LEMOFI OBJECTIVES

The primary objective of the LEMOFI is to determine:

- **Technical Feasibility:** To review existing designs and specifications for the national fibre network, focusing on infrastructure that expands coverage into urban and suburban areas, with the objective of proposing an optimized network design and architecture, including technology options and infrastructure requirements.
- **Regulatory and Legal Framework impact:** To review the regulatory telecommunications laws, and compliance requirements impacting the LEMOFI project.
- **FTTx network coverage gaps: To** Identify coverage gaps, particularly in towns and residential areas, and provide recommendations for extending the network into these areas.
- **Recent technological advancements and best practices** – To assess the FTTH and FTTB models, and the use of OPGW and ADSS fibre and associated technology compliant with international standards and best practices.
- **Environment and Social:** Undertake an ESIA and prepare the associated ESMP to inform all stakeholders of the potential environmental and social risks associated with the project, and inform the detailed design based on findings of the study.

PROJECT CATEGORIZATION

The LEMOFI project is a Fiber Network expansion project and falls under **Item 15** "***Communication facilities, including telephone, television, and radio transmission masts"*** in the First Schedule Part A of the Environment Act No.10 of 2008 of the Kingdom of Lesotho, hence require a full ESIA for it to be implemented. However, LEMOFI Project utilises already existing electricity supply infrastructure therefore, its footprint is very minimal and does not require an ESIA with specialist studies.

Furthermore, the proposed LEMOFI project is to be funded by the African Development Bank (AfDB) therefore, this project falls under **Category 2** according to AfDB Categorisation procedures, the Intergrated Safeguards System and Guidance Notes.

APPROACH TO THE ASSESSMENT

The generation of this ESIA was initiated by literature review of available existing project information to provide background information and identify key socio-economic and environmental aspects and impacts for consideration. The following key stages have applied through the generation of the ESIA:

- **Screening:** The LEMOFI project was screened to determine the level of assessment required, its significant impacts on the environmental and social aspects, and existing opportunities. The screening also analysed the possibilities to avoid impacts or develop mitigation measures. ESIA is not mandatory for this project because projects of this nature are not listed in the First Schedule Part A of the Environment Act No.10 of 2008 of the Kingdom of Lesotho.

- **Scoping –** An Inception Report presenting scoping information has been generated by the Consultant presented scoping information, in addition to baseline information understood at that time.

  Scoping was carried out to determine the scope of work to be undertaken in assessing the likely environmental and social impacts of the proposed development.

  Consultative meetings were held with various stakeholders, including local communities and authorities, to determine the issues of most importance for consideration during detailed assessment. Finally, analysis of alternatives to be considered was also done.

- **Establishing Baseline Conditions –** to establish a reliable set of baseline condition data the Consultant has supplemented existing information with further desk-based review and site verification visits.

- **Impact Assessment –** having established baseline conditions, this information was analysed and modelled in order to establish potential positive and negative project impacts of the project for the construction and operational phases. Possible mitigation measures were developed for proper management of impacts

- **Decision Making:** Based on the findings of the ESIA, The Department of Environment will decide on whether to issue an Environmental Licence or not for the implementation of LEMOFI.

IMPACT ASSESSMENT METHODOLOGY

The overall intent of the ESIA study is to identify and characterise all the associated and potential impacts that will be caused by the proposed project. The ISO 14001 has been selected for evaluation of impacts for this ESIA. The ISO 14001 method is simple to apply, provides a high level of detail, and relies on limited data.

DESCRIPTION OF THE PROJECT

The process of implementing the project for each of the identified sites (**Table A**) involves the following activities:

1) **Construction of Points of Presence (POP)**
   Components of POP: Outdoor Cabinet, Plinth, Switch, Optical Line Terminals, Environment Monitoring System, Electrical Distribution, Rectifier, Battery

2) **Construction of Fibre Distribution Network**
   Components of Distribution Network: Backhaul Fibre, feeder fibre, poles, microducts, distribution fibre, 1:2 splitters, 1:4 splitters, 1:8 splitters, drop cable, fibre distribution terminals, fibre access terminals

Table A Quantity of Project Construction Components for Identified Sites

Activity	Description
1. Construction of ring and distribution networks (Highway – Central – IEMS)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **6.859km** Estimated Ring Trenched Cable length: **3.06km** Estimated Distribution Aerial Cable length: **6.192km** Estimated Distribution Trenched Cable length: **1.053km** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **26 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **210 Poles** Manhole: **0**
2. Construction of ring and distribution networks (Parliament-MSU Mall)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **9.159km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **7.761km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **7 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **11 Poles** Manhole: **0**
3. Construction of ring and distribution networks (Old Europa - Downtown)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **5.080km** Estimated Ring Trenched Cable length: **1.459km** Estimated Distribution Aerial Cable length: **11.102km** Estimated Distribution Trenched Cable length: **1.705km** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **50 Poles** Manhole: **2**

4. Construction of ring and distribution networks (A2-Lekhaloaneng Matala)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **7.258km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length:**12.032km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **61 Poles** Manhole: **0**
5. Construction of ring and distribution networks (Thetsane-Tikoe)	Number of PoPs: **Two** Estimated Ring Aerial Cable length: **12.160km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **13.112km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **51 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **87 Poles** Manhole: **0**
6. Construction of ring and distribution networks (Maseru Industrial)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **12.234km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **13.389km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **8 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles** Manhole: **0**
7. Construction of ring and distribution networks (Teyateyaneng)	Number of PoPs: **Two** Estimated Ring Aerial Cable length: **9.749km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **11.138km**

	Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **89 Poles** Manhole: **0**
8. Construction of ring and distribution networks (Mafeteng)	Number of PoPs: **Two** Estimated Ring Aerial Cable length: **9.056km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length:**31.434km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **11 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles** Manhole: **0**
9. Construction of ring and distribution networks (Maputsoe)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **12.144km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **17.977km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **0 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **0 Poles** Manhole: **0**
10. Construction of ring and distribution networks (Hlotse)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **11.682km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **10.336km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles**

	SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **46 Poles** Manhole: **0**
11. Construction of ring and distribution networks (Butha Buthe)	Number of PoPs: **One** Estimated Ring Aerial Cable length:**7.480km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **16.463km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **46 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **115 Poles** Manhole: **0**
12. Construction of ring and distribution networks (Mohale's Hoek)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **7.699km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **12.025km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **0 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **4 Poles** Manhole: **0**
13. Construction of ring and distribution networks (Lower & Upper Moyeni)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **7.449km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **6.203km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **0 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **4 Poles** Manhole: **0**

14. Construction of ring and distribution networks (Mokhotlong)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **7.225km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **9.70km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **20 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **284 Poles** Manhole: **0**
15. Construction of ring and distribution networks (Thaba Tseka)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **6.758km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **7.983km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **47 Poles** Manhole: **0**
16. Construction of ring and distribution networks (Qacha's Nek)	Number of PoPs: **One** Estimated ring aerial cable length: **6.842km** Estimated ring trenched cable length: **N/A** Estimated Distribution Aerial Cable length: **12.512km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **0 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **8 Poles** Manhole: **0**

Table B Summary Quantity of Project Construction Components for Identified Sites

Manholes	Ring Arial Cable	Ring Arial Cable Trenched	Distribution Cable	Distribution Cable Trenched	Poles 9m (140mm-160mm	Poles 7m (140mm-160mm	PoPs
2	138.834km	4.519km	12, 185.576km	2.758km	219	1032	19

Table B above indicates the approximate LEMOFI footprint which is very minimal and can be managed through implementation of the proposed mitigation measures

DESCRIPTION OF PHYSICAL AND SOCIAL ENVIRONMENT

Climate

The climate of Lesotho is described as continental and temperate with four distinct seasons dominated by warm wet summers, and cool dry winters. Lesotho enjoys an average of 310 sunshine days per year, with the summeraverage being 24 sunny days per month. Floods and droughts are a common occurrence, with high intensity rainfall producing flash floods that contribute to erosion and high sediment loads in the rivers (NES, 1999).

Topography

Lesotho is divided into four topographical regions, namely the Highlands (>2,200 masml), Foothills (1,800-2,200 masml), Lowlands (1.400-1,800 masml) and the Senqu River Valley.

Geology

The geology of Lesotho forms layers that lie more or less horizontal. The geological formations layers are as follows; the Stormberg group, Beautfort group, and Drakensburg group.

Soils

Eleven (11) benchmark soil series were described and analysed as representing the most important agricultural soils in Lesotho. These soil series are:

- Berea
- Khabos (Bonheim Forum)
- Leribe (Hutton Forum)
- Maseru Forum
- Sephula (Estcourt Forum)
- Tumo (Hutton Forum)
- Fusi (Inhoek Forum)
- Bosiu
- Machache (Shortland Forum)
- Qalabane (Clovelly Forum)
- Rama (Bainsvlei Forum)
- Matela (Hutton Forum)
- Thabana (Arcadia Forum)
- Sefikeng (Hutton Forum)

Erosion Potential

Lesotho has the highest erosion hazard of any single county in southern and central Africa (Chakela, et. al 1989).

BIODIVERSITY

Vegetation

Lesotho is situated in the grassland biome. This biome is centrally located in southern Africa, andadjoins all except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the grassland biome include:

- Seasonal precipitation; and
- The minimum temperatures in winter (Mucina & Rutherford, 2006).

Alien and Invasive Plants

K Kobisi 2017, lists 65 invasive plant species in Lesotho, of which 51 are terrestrial species and 14 are aquatic species. The International Union for the Conservation of Nature (IUCN) defines alien invasive species as "*animals, plants or other organisms introduced by man into places out of their natural range of distribution, where they become established and disperse, generating a negative impact on the local ecosystem andspecies.*"

Riverine system

The vegetation along the shores of the rivers are composed of mainly sedges and rushes. Typical grass-like species and herbs found near water and damp places are Scirpus sp, Juncus sp, Cyperus sp, Plantago sp, Schoenoplectus sp, Imperata cylindrica, Miscanthus sorghum, Persicaria, polygonum sp, Anagallis sp, Verbena sp, Bromus sp, Schisostylis coccinea, Poa sp, Homeria sp and Moraea sp. The grass-like species are mainly used for handicrafts.

Plantations

This is composed mainly of Pine, Acacia, dealbata and Poplar trees. All these are exotic introduced species. The acacia and poplar trees have invaded extensive areas of formerly indigenous thickets.

FAUNA

Mammals

Poor land management, rapid population growth, excessive exploitation, and disturbance by humans have significantly affected the biological resources of Lesotho and have led to highly modified ecosystems. All large mammals have disappeared from Lesotho due to over-hunting and habitat loss leaving only five species of large mammals, but these are limited to mountain areas.

Some of the large mammals known to occur in the mountain areas are Eland (*Taurotragus oryx*), Southern Reedbuck (*Redunca arundinum*), Mountain Reedbuck (*Redunca fulvorufula*), Grey Rhebok (*Pelea capreolus*), Black Wildebeest (*Connochaetes gnou*)

and Oribi (*Ourebia ourebi*). Natal Red Rock Hare (*Pronolagus crassicudatus*) is near-endemic and does occur in eastern Lesotho (Avenant, 2007).

Avifauna

Some 340 bird species have been recorded in Lesotho over the last 100 years. Although not a species-rich country, the mountains of Lesotho, and the Drakensberg escarpment and foothills of South Africa form an internationally important biogeographic province, and Lesotho is well endowed with many endemic and near-endemic taxa. It also supports 10 globally threatened and near-threatened bird species. Lesotho holds nearly 12% of the world population of Gyps coprotheres (VU), comprising some 600 breeding pairs. Geronticus calvus (VU) is also fairly common in the highlands, and Lesotho supports globally significant numbers of this species. A tiny population of Anthus chloris (VU) is found in Sehlabathebe National Park, but this is estimated not to exceed 50 individuals. Falco naumanni (VU) and F. amurensis are common in the lowlands during the austral summer and roost in hundreds in large trees in urban centres (Keith Barnes, 1998).

Herpetofauna

Three endemic frog species occur in fast-flowing streams at high altitudes in Lesotho, namely Maluti River Frog (*Amietia vertebralis*), Phofung River Frog (*Amietia hymenopus*) and Natal Cascade Frog (*Hadromophryne natalensis*). Ambrose (2006) lists 45 reptiles for Lesotho, of which one species is now considered extinct in the country (Southern African Python *Python natalensis*). Bates and Haacke, 2003, documented 23 amphibian species for Lesotho, many of which are confined to the western lowlands

Protected Areas

Sehlabathebe, Lesotho's only national park, is situated on the eastern border of the country in Qacha's Nek and lies adjacent to South Africa's uKhahlamba–Drakensberg Park (IBA ZA064) to the west of Himeville, Underberg and Kokstad.

In addition to Sehlabathebe, there is Tšehlanyane Nature Reserve, Bokong Nature Reserve, and Letšeng la Letsie. Table below summarises the conservation priority areas and protected areas of Lesotho.

SOCIO-CULTURAL ENVIRONMENT

Demographic Profile

According to the national Census, in 2016 Lesotho had a total *de jure* population of 2,003,962, representing a population growth rate of 7.0% from 2006 (BoS, 2016). According to Bureau of Statistics (2016), male population accounted for 982, 133 which is 48.9% while the female population had about 1,025,068 constituting 51.1% of the entire Lesotho population.

Population aged less than 15 years has increased from 34.1 to 37.8% from 2006 to 2016 while population aged 65 and above has increased from 5.7 to 6.1% from 2006 to 2016. The average household size has declined from 4.4 in 2006 to 3.7 persons in 2016.

Fertility

The 2016 Population and House Census (PHC) Age Specific Fertility Rates (ASFR) indicates that most females were giving birth at the age of 25 to 29 years and female of childbearing ages decrease with an increase in age. Therefore, the age pattern of fertility in Lesotho has not changed over years. In 1976 census, the Total Fertility Rate was estimated at 5.4 children per woman and it declined to 3.2 children per woman in the 2026 census hence, a decline of 2 children from 1976. According to the PHC, the overall fertility had declined.

Mortality

Mortality refers to the occurrence of deaths in a population over a period of time. There is a decline from 94 deaths in 2006 to 53 children dying per 1000 births in 2016. Urban settlements have the least infant mortality rate at approximately 50.9 children than peri-urban and rural settlements. Infants, child and under-five born to mothers residing in the

rural settlements tend to experience higher mortality rate than those mothers who reside in the urban and in the peri-urban (BoS, 2016).

Orphanhood

An orphan is defined as a child who has lost either one of the biological parents or both of them through death and that child must be aged 0 to 17 years of age. The population aged 0 to 17 years has been estimated at 765,614 and out of that, 210,712 were orphans (BoS, 2016).

Youth

According to the Ministry of Gender, Youth, Sports and Recreation, youth are persons aged 15 to 35 years. In 2016 census, youth were 794,940 accounting for 39.6% of the Lesotho total population. Males were 403,000 which is 50.7 % of the total youth while female youth constitute 49.3% (BoS, 2016)

Elderly

These are people aged 60 years and above and age group 60-64 constituted the largest proportion of the elderly population. There is a higher proportion of males at age 60-74 years than that of females of the same age. However, there is a higher proportion of elderly females at older ages relative to males (BoS 2016).

Migration

It is the movement of people from one geographic area to another. The least number of people estimated at 2.0 % moved into Mokhotlong while 3.4% moved out of Qacha's Nek. On average, Maseru gained more people at 22.5% while Mafeteng lost most people at about 8.0%.

Urbanization

The total number of 636,729 out of the total population that was estimated in 2016 census was Basotho who were residing in urban areas. The total population residing in urban areas accounted for 31.7%.

Employed Population

The 2016 PHC results show that employed population aged 10 years and above comprised of 38.8% of females and 61.2% males.

Unemployed Population

The 2016 PHC results show that unemployed population aged 10 years and above comprised of 34.2% of females and 65.8% males.

Community Livelihood

Land is of primary importance to sustain livelihoods in Lesotho. Agriculture is an important livelihood activity for household subsistence. The main farming crops found in Lesotho are maize and sorghum, wheat, beans and peas (in order of priority) while animal hus. In other words, the most common means of livelihood in the country is subsistence farming and formal employment.

Land Tenure Systems

The traditional system of land tenure in Lesotho is such that the king holds the land in trust for the Basotho nation, while individuals hold user rights. There are various modes of acquiring land by household members, these include: allocation by a chief, inherit piece of land from parents or extended family members, bought landfrom somebody else or chief, acquiring land through a private developer etc. Lesotho's land tenure system recognises three types of title: leasehold, Form C and license. Some households occupy land without the appropriate title in place, i.e., through the traditional/ customary tenure system under which the land was allocated to citizens through chiefs and headmen on behalf of the King.

The 2026 PHC indicates that 12% has Lease, 41% Form C, 4% Title Deed, 27% other and 12% nothing.

Religion

Christianity is the most widely practiced religion in the project area, so Basotho are predominantly a Christiansociety though there are few who follow the Muslim religion. The main Christian denominations found are the Apostolic Faith Mission, Roman Catholic, Lesotho Evangelical and Anglican. Furthermore, most Basotho, perhaps like in any other African country also follow their traditional belief systems, like appeasing their ancestors 'balimu' in Sesotho.

Vulnerability and Marginalisation

Most of the population living at the project area are vulnerable people due to unemployment, lack of income earning opportunities, harsh conditions for generating a reliable source of food throughout the year, and poor educational standard level or illiteracy. This is as a result of inadequate social infrastructure and services. Theolder male population (56 and above) are the most poorly educated, perhaps due to the need to drop out of school early in order to participate in domestic and subsistence activities.

Within this already vulnerable population, groups of people are considered more vulnerable. These include households that do not 'own' land or do not have the ability to farm (e.g., older persons and people with disability; and households that are headed by children or older persons who have been left to care for young children due to parental absence or incapacity. In the project AoI, the broad categories of people who should be considered to have some level of vulnerability include: women; older persons; youth; herders; orphaned children; and people with disability or chronically ill persons.

Services and Infrastructure

Almost all essential services are available throughout the country. Services that are commonly found include: large businesses, banks, cooperatives, small shops / kiosks, day care centres/pre-schools, primary and high schools, churches, hospitals, clinics, government offices. Local courts, electricity, and water supply and telecoms infrastructure. Notably, communication via cellular phones is common throughout the country.

Community Structure

Rural population settlement patterns are characterised by scattered villages, small sized villages, and large extended family units. Urban settlements comprise large rapidly growing towns with a degree of industrialization.

The types of housing units commonly found in the Lesotho are traditional huts for most of the population in rural areas and the modern structures in urban and peri-urban areas or a mixture of traditional and modern structures. In urban areas there are also Malaene (rental flats) and informal structures.

HIV / AIDS

The previous studies conducted by Ministry of Health (2015), U.S. President's Emergency Plan for AIDS Relief(PEPFAR) (2016) & World Health Organisation (WHO) (2014) quoted in UN Lesotho Country Analysis Report(2017) revealed that in Lesotho HIV/AIDS is a burden to the health sector and is one of the factors that have contributed to the slow economic growth and social progress in Lesotho. AIDS has become the leading cause for morbidity and mortality in Lesotho. Twenty five percent of adults aged 15-49 years old in Lesotho are infected with HIV and is one of the highest prevalence rates in the world. The prevalence of HIV is significantly higher among women (29.7%) than men (18.6%), with women aged 35-39 years old having the highest prevalence of 46%. Of particular concern is HIV prevalence among vulnerable and risk populations. Theprevalence is reported at 72% among sex workers, 43% in factory workers, 33% in men who have sex with men,and 31% among prison inmates.

Cultural and Historical Resources

During the survey (local interviews) undertaken, several people were interviewed in order to understand their appreciation of cultural heritage. There were positive responses to cultural heritage assets as follows:

Musical Instruments

Lesiba and 'Mamokhorong are the only instruments currently still played by herders, though they are quickly being replaced by modern electronic instruments. Both are played by herders while herding livestock, althoughthere are very few episodes of this lately. 'Mamokhorong is played by herders mostly and is still highly fashionable amongst young herders.

These instruments are described below:

- ***Lesiba*** is a mouth bow. A stringed-wind instrument with a quill attached to a long string. Its historical origin can be traced to the San who converted their hunting bows to musical instruments.
- ***Mamokhorong*** is a sinew string 'violin' developed in Lesotho. There are modern versions of it, which make use of tin cans in place of a calabash and a piece of wire in place of sinew.

Most herders throughout the country may be seen carrying either pre-recorded music players (Blue tooth speaker, tape players,disc-players etc.) or cell phones. The indication is that modern technology has a strong influence on musical composition trends.

The Songs

Rural communities are dominated by initiation practices. The ceremonial songs for initiates have gained access into the current media and in shops, taverns and hand-held gadgets. Initially this seemed to be male dominated, but lately women have joined the practice.

- ***Mokhibo*** is one traditional women's dance that is still highly popular in the proposed project area.
- ***Mokorotlo*** performed largely by men, is actively sung at local ceremonies.
- ***Mangae***, sung mainly by teenage boys as part of going through initiation.
- ***Pitiki,*** performed by married women during childbirth ceremony.

The urban areas listen more to modern western music for example Hip hop, Jazz and House.

Oral History

Embedded story telling in the evenings (Litšomo – traditional fictional stories), has mostly declined, although this still takes place in a very few households. There are also riddles (Lilotho - puzzles) that lately feature mostly through media intervention (radio), as practice in the household has declined. Again, as in the case of original music instruments, people have gained access to electricity and therefore television and radio have replaced the useof evening family time. Overall, oral history is depreciating.

Language

There are two official languages in Lesotho: Sesotho and English however, the are also minor languages: Sephuthi, Sethepu, Xhosa and dialects mixing Afrikaans with any of these (*Fanakaloko*) due primarily to community members employment in South African mining activities which are predominantly men. It is explained that this mining language is typically used to seclude others fromunderstanding discussions.

Another area of seclusion is the new economic hardship experiences of drug dealers' language and symbolism,which takes various forms, but the most visual is hanging of pairs of shoes on telephone and electricity lines especially in urban areas.

Arts and Crafts Skills

The community has indicated that they have the following cultural skills, which they still practice:

- Livestock rearing
- Weaving grass sun hats – Tšetše; Molia-nyeoe
- Thatching ropes – Lithapo
- Weaving of grass mats – Meseme with the special Nguni type called Leqasa

- Traditional beer brewing although the strainers are not weaved any more due to scarcity of natural resources. Instead, the mealie bags from modern industry have replaced traditional ones
- Hut making and plastering (*ho lila*); and,
- Grass thatching.

Games

Lesokoana (stick used to stir porridge), is still actively played especially in the dry periods by young girls. The main purpose of Lesokoana is a rainmaking ritual. Herders actively practice Ho kalla – stick fighting, which is also done by initiates. These games are mostly common in the rural areas of Lesotho however, recently initiation has become common in the urban and peri-urban hence normalising stick fighting throughout the country.

Cultural Practices

The following cultural practices were recorded to be still active, in almost all community groups within theproject area:

- ***Mekete ea Balimo***: a thanksgiving ceremony for one's ancestors
- ***Lebollo*****:** the initiation or coming of age of both boys and girls, which prepares them for adulthood
- ***Thapo*****:** following a death in a family, the rest of the family would observe a month-long mourning periodwhile the mother and wife who have lost either a husband or a child must observe an extended mourning period and wear distinct clothing, normally black; and,
- ***Ho beha lejoe*****:** this is unveiling of a tombstone, in a solemn ceremony of relatives joined by locals.

ENVIRONMENT AND SOCIAL IMPACTS

Impact Identification

Impact identification accounts for the potential and associated biophysical, social and health impacts making sure that both adverse and beneficial significant and insignificant

impacts are accounted for. The anticipated impacts were determined based on the interaction between project activities and environmental sensitivities. The identified potential impacts during the different phase of the proposed project are listed in **Table C** below.

Table C Identified Proposed Project Impacts

Impacts	**Phases of the Project**	
	Construction	**Operation**
Acceleration of erosion	√	
Alteration of local topography	√	
Alteration of soil profile	√	
Blockage of drainage pattern	√	
Blockage of roads	√	
Change in land use	√	
Change in water quality	√	√
Contamination of groundwater	√	√
Contamination of surface water	√	√
Contamination of soil	√	√
Damage to communication cables	√	
Exposure to heat and light	√	
Impairment of air	√	√
Improved telecommunication		√
Improved livelihood	√	√
Increased demand for social infrastructure	√	√
Increased surface water turbidity	√	
Increase in incidence of STIs and HIV	√	
Increase in income	√	√
Increase in price of locally sources material	√	
Increase in social vices	√	√
Increase in opportunity for business and employment	√	√
The influx of migrant workers and camp-followers	√	√
Land utilised for temporary camps	√	
Legal issues	√	√
Loss of land	√	√
Loss of employment/income	√	

Noise and vibration nuisance	√	
Road accidents	√	√
Worksite accidents	√	√

Impact Qualification

The identified impacts of the proposed project were qualified using four criteria as follows:

- Positive or negative
- Short-term or long-term
- Reversible or irreversible
- Direct or indirect

Definitions

- Positive Impacts – Impacts which enhance the quality of the environment.
- Negative Impacts – Impacts that adversely affect the biophysical, health and social environments.
- Short term – a period less than three months
- Long term – any period greater than three months
- Reversible – the environment can revert to previous conditions
- Irreversible – the environment remains permanent when activity causing impact is terminated

Impact Rating

The qualification scale of 0, 1, 3, and 5 were used to evaluate impacts in order to determine their significance. The ratings are adopted from the International Organisation

for Standardization (ISO) 14001 – Environmental Management System Approach. The criterial and weighing scale used for evaluating significance are:

- Legal/regulatory requirements (L)
- Risk factor (R)
- Frequency of occurrence of impact (F)
- Importance of impact on an affected environmental component (I)
- Public perception/interest (P)

Table D Impact Value and Rating Colour Code

Impact Value	Cut Off Values	Impact Rating
L + R + F + I + P	<8	Low
L + R + F + I + P	≥8 but <15	Medium
L + R + F + I + P	≥15	High
F + I	>6	
P	=5	
Positive		Positive

The final ratings of the identified impacts are presented in **Tables E - H** below. In this study, low, medium and highly significant negative impacts were judged to require mitigation, and all positive impacts required enhancement.

Table E Potential and Associated Impacts of the Proposed Project – Pre-Construction Phase

Key: L = Legal/Regulatory, R = Risk, F = Frequency, I = Importance, P = Public Interest/perception

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
Pre – Construction	Land Acquisition	Loss of land		√	√		√	√	√		3	1	1	1	1	7	2	L
		Change in land use		√	√			√	√		3	1	1	1	1	7	2	L
		Legal issues		√	√			√	√		3	1	1	1	1	7	2	L
	Mobilisation (Transport) to the site (equipment, personnel and construction modules)	Road Traffic accidents		√	√		√	√	√		3	3	1	1	1	9	2	M
		Noise nuisance		√	√		√		√		3	3	1	1	1	9	2	M
		Impairment of air quality		√	√		√		√		3	1	1	1	1	7	2	L
		Loss of biodiversity		√	√		√	√	√		3	1	1	1	1	7	2	L
	Energy consumption (provision of energy for pre-	Impairment of air quality		√	√		√		√		3	1	1	1	1	7	2	L
		Noise and vibration nuisance		√	√		√		√		3	3	1	1	1	9	2	M

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
	construction activities)	Increased opportunity for business and employment	√		√		√		√		-	-	-	-	-	-	-	P
		Contamination of soil by waste oil		√	√		√		√		3	1	1	1	1	7	2	L
	Site preparation – land clearing and removal of vegetation	Acceleration of erosion		√	√		√		√		3	1	1	1	1	7	2	L
		Alteration of topography		√	√		√		√		3	1	1	1	1	7	2	L
		Blockage of drainage pattern		√	√		√		√		3	1	1	1	1	7	2	L
		Contamination of soil by run-offs		√	√	√	√		√		3	1	1	1	1	7	2	L
		Impairment of air quality		√	√	√	√		√		3	1	1	1	1	7	2	L
		Noise and vibration nuisance		√		√		√	√	√	3	3	3	3	3	15	6	M
		Worksite accidents		√		√		√	√	√	3	3	3	3	3	15	6	M
		Security/artificial light at night		√	√		√		√		0	1	3	1	1	6	4	L
		Habitat alteration		√	√			√		√	3	1	1	1	1	7	2	L

Table F Potential and Associated Impacts of the Proposed Project – Construction Phase

Key: L = Legal/Regulatory, R = Risk, F = Frequency, I = Importance, P = Public Interest/perception

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
Construction	Transport activities during construction	Road traffic accidents		√	√		√		√		3	3	3	3	3	15	6	M
		Noise nuisance from heavy vehicles		√	√		√		√		3	3	3	1	3	13	4	M
		Impairment of air quality – emission from heavy vehicles		√	√		√		√		3	1	1	1	1	7	2	L
	Trenching of Fibre route and laying of Fibre cables and pole holes	Loss of vegetation cover with possible impact on biodiversity loss		√	√	√	√	√	√		3	1	1	1	1	7	2	L
		Impairment of air quality		√	√		√		√		3	1	1	1	1	7	2	L
		Waste generation from excavated materials		√	√		√		√		3	1	1	1	1	7	2	L
		Contamination due to oil spills from equipment and machinery		√	√			√	√		3	1	1	1	1	6	8	L

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
	Construction of poles and installation of various equipment, power generation equipment of data center and access system	Waste management – aesthetics and general waste nuisance.		√	√		√		√		3	1	3	1	1	9	2	L
		Impairment of air quality		√	√	√	√		√		3	1	1	1	1	7	2	L
		Noise and vibration nuisance		√		√		√	√	√	3	1	3	1	1	9	2	L
		Road/worksite accidents		√		√		√	√	√	3	3	3	3	3	15	6	M
		Slowing traffic fluidity due to construction vehicles		√	√		√		√		5	1	1	3	1	11	4	M
	Water utilization for construction	Changes in surface water hydrology		√	√		√		√		0	1	1	1	1	4	2	L
	Backfilling of micro trenches and pole holes	Surface water pollution			√	√		√		√	3	1	1	1	1	7	2	L
		Alteration of hydrological patterns resulting in temporary or permanent flooding, soil erosion, and			√	√		√		√	3	1	1	1	1	7	2	L

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
		destruction of biodiversity.																
		Habitat alteration		√	√		√		√		3	1	1	1	1	7	2	L
		Worksite accidents			√	√		√		√	3	3	3	3	1	15	6	M
		Increased in communicable diseases (including STDs and HIV/AIDS		√	√		√		√		5	1	1	3	1	11	4	M
	Site demobilisation	Road Traffic Accidents		√	√			√		√	3	3	2	3	3	14	5	M

Table G Potential and Associated Impacts of the Proposed Project – Operation Phase

Key: L = Legal/Regulatory, R = Risk, F = Frequency, I = Importance, P = Public Interest/perception

Project Phase	**Project Activity**	**Description of Impact**	**Impact Qualification**								**Impact Quantification**							**Impact Rating**
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
Operation/ Maintenance	Operation and maintenance or inspection of the Fibre Network, maintenance of data center and access system locations	Soil / groundwater contamination due to fuel and oil spill		√	√			√		√	3	1	1	1	1	7	2	L
		Air emission during Maintenance / servicing of production equipment and ancillaries		√	√	√	√		√		3	1	1	1	1	7	2	L
		Noise and vibrations nuisance from generating set		√	√			√		√	3	1	1	1	1	7	2	L
		Road accidents due to transportation activities during data center operation and maintenance Fibre		√	√			√		√	3	1	1	1	1	7	2	L

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
		Stealing and vandalism of fibre cables		√	√			√		√	3	5	5	5	5	23	10	H
		Generation of waste during operation		√	√			√		√	3	1	1	1	1	7	2	L
		The threat of Naturally Occurring Radioactive Material (NORM) to the environment		√	√			√		√	3	3	3	3	3	15	6	M
		Thermal effects due to exposure to the EMF experienced by residents located around the data centre		√	√	√	√		√		3	1	1	3	1	9	4	M
		Public Perceptions and fears		√	√	√	√		√		3	1	1	3	1	9	4	M
		Worksite related accidents		√	√			√		√	3	1	1	1	1	7	2	L
		Hazardous waste generation		√	√			√		√	3	1	1	1	1	7	2	L
		Improvement of network services	√		√		√		√		-	-	-	-	-	-	-	P

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
	Transportation activities during operation	Road traffic accidents		√	√		√		√		3	1	1	1	1	7	2	L
	Recruitment of personnel from the surrounding communities	Employment generation: Personnel will be recruited from the communities. This employment will cause an increase in the earnings of the project communities.	√		√		√		√		-	-	-	-	-	-	-	P

Table H Potential and Associated Impacts of the Proposed Project – Decommissioning Phase

Key: L = Legal/Regulatory, R = Risk, F = Frequency, I = Importance, P = Public Interest/perception

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
Decommissioning	Decommissioning and Evacuation	Interference with road transportation		√	√		√		√		3	3	3	1	3	13	4	M
		Noise and vibrations nuisance		√	√		√		√		3	1	1	1	1	7	2	L
		Contamination of ground and/or surface water		√	√	√	√		√		3	1	1	1	1	7	2	L
		Contamination of soil		√	√	√	√		√		3	1	1	1	1	7	2	L
		The threat of Naturally Occurring Radioactive Material (NORM) to the environment		√	√			√		√	5	1	5	5	1	25	10	M
		Poor disposal of waste		√	√	√	√		√		3	1	3	3	1	11	6	M
		Loss of Jobs		√	√	√	√		√		3	1	3	3	1	11	6	M
		Injury/fatalities in workforce		√	√	√	√		√		3	1	3	3	1	11	6	M

		Agitation of project communities due to loss of employment		√	√	√	√		√		3	1	3	3	1	11	6	M

MITIGATION MEASURES

The health, social and environment (HSE) design and operation objectives of the project are to implement all cost-effective measures to reduce the risks and impacts of routine or major hazards including accidents. Thus, the steps taken in the HSE process for the proposed project include the following:

- Design based standards and regulations
- Improved operation based on qualitative risk assessment
- Best international practice

Criteria for Selection of Mitigation Measures

Selection of mitigation measures for the identified impact is based on the following consideration:

- Engineering design of the Fibre
- The practicability of the measures
- Regulatory requirements
- Industry and international best practices

Mitigation Measures

Mitigation Measures are actions taken to minimise negative impacts, while also enhance positive ones. Mitigation measures are often implemented continuously throughout the project's life span. These measures aim to improve the environmental sustainability of the proposed project. Mitigation measures are recommended for the project identified impacts on:

- Environment
- Occupational health and safety
- Community health and safety

The comprehensive mitigation measures for the project phases are presented in **Tables I-L** below.

Table I Mitigation Measures of the Proposed Project Activities – Preconstruction

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Land Acquisition	• Loss of Land • Change in land use • Legal issues	L	This impact is negative and reversible, the probability of the impact arising is also low because there are already existing sites for construction. However, the LECC will ensure: • Continuous consultation and engagements with project communities and other stakeholders shall be maintained to forestall unrest in line with LECC's grievance redress mechanism (GRM). • Proper land acquisition procedures must be followed where there is need for land acquisition.	L
Mobilisation (Transport) to the site (equipment, personnel and construction materials)	• Road Traffic accidents	M	To prevent road accidents, the LECC will ensure: • Vehicles are inspected before mobilisation and an inspection certificate must be issued. • The use of PPE at sites; daily tool box talks and carry out job hazard analysis • Speed breakers at sections traversing communities • Conformance with national road traffic laws • All safety incidents will be reported and investigated. Corrective actions will be implemented.	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	Noise nuisance	M	The LECC will ensure: • Regular maintenance of vehicles • Vehicles are turned off when not in use	L
	Impairment of air quality	L	The LECC will ensure: • Nose masks and earmuffs are worn by site workers during excavation • Water shall be sprayed on construction sites to reduce dust levels • Regular maintenance of backup generators • Generators are switched off when not in use	L
	Loss of Biodiversity	L	• Implement good housekeeping practice on site • Storing and handling of the hazardous waste following approved Waste Management Plan (WMP) • Limiting land clearing • Avoid erodible areas	L
Energy consumption (provision of energy for pre-construction activities	Impairment of air quality	L	• Regular maintenance of backup generators • Generators are switched off when not in use	L
	Noise and Vibration Nuisance	M	• Generators are fitted with effective silencers • Regular maintenance of generators • Noise barriers are erected	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Generators are switched off when not in use	
	Contamination of soil	L	• Soil disturbance will be kept to the minimum required for operation and safety • Oil spill containment will be provided to prevent an oil spill from getting to the soil • Implement good housekeeping practice on site • Storing and handling hazardous waste following approval of the WMP.	L
Site preparation – land clearing, removal of vegetation	Acceleration of erosion	L	• Stabilise soil within the camp site mechanically using compactors to reduce erosion potential • Avoid erodible areas	L
	Alteration of local topography	L	• Re-grading of the sites • Restoring top soil • Restoring the original profile of the topography and the soil • Strictly regulating heavy equipment traffic	L
	Blockage of drainages	L	• Regular cleaning of drainages	L
	Contamination of soil	L	• Soil disturbance will be kept to the minimum • Oil spill containment will be provided to reduce soil contamination	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Store and handle hazardous waste following approval of the WMP • Place filtration berms and sediment barriers • Prohibiting refueling near waterways	
	Impairment of air quality	L	• Only inspected and approved equipment is used • Equipment engines are turned off when in use • Construction of soundproofing walls around stationary power generation	L
	Noise and Vibration nuisance	M	• Equipment must be fitted with effective silencers • There will be regular maintenance of equipment • Vibration containment be made for equipment which is likely to cause vibrations • PPE will be used at all times	L
	Worksite accidents	M	• Workers and visitors use appropriate PPE • Use of warning signs • Non-consumption of alcoholic beverages on work site • Well stocked First aid kit will always be available within the site	L
	Habitat Alteration	L	• Contain oil spills	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Minimise destruction or modification of the vegetation cover by restoring vegetation at the end of the work	

Table J Mitigation Measures of the Proposed Project Activities – Construction Phase

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Operation and maintenance or inspection of the optic fibre and associated infrastructure	Noise and vibration nuisance from generators	M	• Regular maintenance of generators • Generators are switched off when not required • Use of renewable energy e.g. solar	L
	Impairment of air quality emissions from trucks and equipment	L	The LECC will ensure: • Maintenance of engines and exhaust gas check • Nose masks and earmuffs are worn by site workers during excavation • Use of loading and unloading equipment that minimises the height of fuel drop to the stockpile to reduce the generation of fugitive dust • Regular maintenance of backup generators • Generators are switched off when not in use	L
Trenching of Optic Fibre and laying of Fibre cables	Loss of vegetation cover with possible impact on biodiversity loss	L	• Place filtration berms and sediment barriers • Contain oil spills • Minimise destruction or modification of the vegetation cover by restoring vegetation at the end of the work	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	Noise and Vibration Nuisance	M	• Generators are fitted with effective silencers • Regular maintenance of generators • Noise barriers are erected • Generators are switched off when not in use	L
	Impairment of air quality	L	• Maintenance of engines and exhaust gas check • Nose masks and earmuffs are worn by site workers during excavation • Use of loading and unloading equipment that minimises the height of fuel drop to the stockpile to reduce the generation of fugitive dust • Regular maintenance of backup generators • Generators are switched off when not in use • Dust suppression	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	Contamination due to oil spills from equipment and machinery	L	• Oil spill containment • Regular maintenance of equipment • Soil disturbance will be kept to the minimum required for operation and safety • Oil spill containment will be provided to prevent an oil spill from getting to the soil • Implement good housekeeping practice on site • Storing and handling hazardous waste following approval of the WMP.	L
	Waste generation from excavated materials	L	• All other waste generated including environmentally deleterious materials generated by construction activities will be disposed of appropriately at designated disposal sites • Generation of all waste is minimised as much as practically possible • Unsuitable excavated materials shall be systematically carried away from areas prone to erosion • Reuse waste material wherever possible and use designated disposal sites	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Used oil and lubricants will be recovered and reused or removed from site to an approved disposal facility in South Africa • Oil waste, debris, and/or other waste materials must not be burned • All the construction camps and facilities will be dismantled and removed from the site unless otherwise desired by the local authorities or communities • The site will be restored to a condition in no way inferior to the condition prior to the commencement of activities • Safety measures must be followed while disposing waste • Prepare waste management plan (WMP)	
Construction of poles and installation of various equipment, power generation equipment	Waste Management • Potential effects will be of aesthetics and nuisance of waste such as scrap metals, paper, wood, optic fibre cables etc.	M	• All other waste generated including environmentally deleterious materials generated by construction activities will be disposed of appropriately at designated disposal sites • Generation of all waste is minimised as much as practically possible • Unsuitable excavated materials will be systematically carried away from areas prone to erosion	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Reuse waste materials wherever possible and use designated areas for disposal • Used oil and lubricants will be recovered and reused or removed from site to an approved disposal facility in South Africa • Oil waste, debris, and/or other waste materials must not be burned • Safety measures must be followed while disposing waste • Prepare waste management plan (WMP)	
	Impairment of air quality	L	• Only inspected and approved equipment is used • Equipment engines are turned off when in use • Construction of soundproofing walls around stationary power generation • Regular maintenance of engines and equipment • Nose masks are worn by all workers during excavations	L
	Noise and Vibration nuisance	M	• Equipment must be fitted with effective silencers • There will be regular maintenance of equipment • Vibration containment be made for equipment which is likely to cause vibrations • PPE will be used at all times	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Monitoring the air quality at least three times a day	
	Road/Worksite accidents	M	• Vehicles are inspected on a daily basis before commencement of works • Workers and visitors use appropriate PPE • Use of warning signs • Non-consumption of alcoholic beverages on work site • A well-stocked First aid kit will always be available within the site • Flag personnel will be deployed to guide traffic where necessary • Informatory and warning signages provided will be retro-reflective for visibility in the night • All vehicles will be parked in designated parking areas • Speed breakers at sections transversing communities	L
	Presence of transport vehicles and site machinery could restrict traffic fluidity and lead to quarrelling with Contractor	M	• Installing retro-reflective mobile signage in the work areas, especially at night and speed limit signs in dangerous areas • Restoring access for local residents, which had been restricted by the works • Ensuring compliance with local customs and traditions	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Backfilling	Surface water may be polluted due to increased erosion, runoff from a construction site, and contamination by oil spills from equipment and machinery	L	• Soil disturbance will be kept to the minimum required for operation and safety to reduce erosion • Oil spill containment shall be provided to reduce oil spill from getting to the soil and surface • There will be regular maintenance of the equipment and machinery • Mechanically stabilizing the soil to reduce the potential for erosion • Avoid excavation/trenching and burial in the steeply sloped ground and avoiding the creation of great breaks • Limiting activities in erodible soil • After work, levelling the disturbed soil and revegetation to control erosion	L
	Waste Management Potential effects will be of aesthetics and nuisance of waste shall mainly come from discarded packaging materials such as scrap metals, empty plastic containers, poor disposal methods can lead to	M	• Toilets must be available on site • The site remains clean, well maintained, and free of hazards, with the thoughtful location of litter bins • Proposal disposal of solid waste from construction activities and camps • Storage of lubricants, fuels and other hydrocarbons in self-contained enclosures	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	environmental problems due to their non-biodegradable nature. Most of the packaging wastes are expected to be reused.		• Sanitation facilities to avoid the release of wastewater and sewage to the environment • Reuse waste materials wherever possible and use designated disposal sites • Minimum wastes are generated • Used oil and lubricants will be recovered and reused or removed from site in full compliance with national regulatory frameworks • Oil waste, debris and/or other waste materials will not be burned • Safety measures are followed while disposing of wastes	
	Alteration of hydrological patterns resulting in soil erosion and destruction of biodiversity	L	• Mechanically stabilizing the soil to reduce the potential for erosion • Avoiding excavation and burial in the steeply sloped ground and avoiding the creation of great breaks • Limiting activities in erodible soil • At the completion of the work, levelling the disturbed soil and quickly revegetation to control soil erosion	L
	Habitat alteration	L	• Implement good housekeeping practice on site	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Store and handle hazardous waste following approved WMP • Use of appropriate PPE • Backfilling must be followed by mechanical compaction to retain the original level • Re-vegetation with indigenous plants	
	Worksite accidents	M	• Workers and visitors use proper PPE • Use of warning signs • Non-consumption of alcoholic beverages on work site • First aid kill will always be well stocked and available	L
	Increase in communicable disease (including HIV/AIDS and STDs	M	• Inductions will be given to workers on communicable diseases • As much as possible provide psychological support to persons living with HIV/AIDS • Condoms to be provided in work areas	L
Site demobilisation	Road traffic accidents	M	• Enforcement of the use of PPE • Daily tool box talks • Job hazard analysis is carried out • Prepare and implement Traffic Management Plan	L

Table K Mitigation Measures of the Proposed Project Activities – Operation/Maintenance Phase

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Operation and maintenance or inspection of the Fibre Network, maintenance of data center and access system locations	Noise and vibration nuisance	L	• Regular maintenance of backup generators • Vehicles are turned off when not in use • Noise barriers are erected	L
	Emissions during maintenance/servicing of production equipment and ancillaries	L	• Maintenance of engines and exhaust gas check • Regular maintenance of backup generators • Generators are switched off when not in use • Use of solar for backup	L
	Contamination due to oil spills from equipment and machinery	L	• Oil spill containment • Regular maintenance of equipment • Implement good housekeeping practice on site • Storing and handling hazardous waste following approval of the WMP.	L
	Road Traffic accidents	L	• Vehicles are inspected on regular basis • Ensure that drivers obey traffic rules • All vehicles to be parked at assigned areas • Informatory and warning signages will be retro-reflective for visibility during the night	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Engage flag personnel when necessary to direct traffic	
	Soil/groundwater contamination due to fuel, oil, paints and coating as a result of spillage	L	• Containment of spills • Implement management controls (Procedures, inspections, communication and trainings) • Paints and solvents will be stored on an impervious ground and the area will be constructed as a spill tray to avoid the spread of accidental spills	L
	Major accidents related to fires and explosions	L	• Define fire zones and equip them with firefighting equipment • Use of engineering controls (automatic alarms) • Installation of smoke detectors • Safe ventilation for storage of volatile materials shall be provided	L
	Worksite accidents	M	• Vehicles are inspected on daily basis before commencement of works • Use of warning signs • Non-consumption of alcoholic beverages on work site • Well stocked First aid kit will always be available within the site	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Flag personnel will be deployed to guide traffic where necessary • Informatory and warning signages provided will be retro-reflective for visibility in the night • All vehicles will be parked in designated parking areas	
	Threat of Naturally Occurring Radioactive Material (NORM) to the environment (Soil, water and air)	M	• Regular maintenance or servicing of production equipment • Regular NORM monitoring to detect material and equipment with NORM • Carrying out personal dosimetry for external radiation exposure to confirm that exposures fall into range expected from external radiation surveillance monitoring • Measuring airborne radioactive dust during maintenance activities to check that the assumptions upon which respirator selections were made are accurate – or if respirators are needed • Sampling and analysis of waste streams to confirm that they remain within regulatory limits • Materials used in NORM control procedures, e.g. gloves, disposable overalls will be disposed with hazardous waste	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	Thermal effects due to exposure to EMF	M	• Prepare and implement an EMF safety program • Training of workers in the identification of occupational EMF levels and hazards • Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained personnel	L
	Waste Management Potential effects will be of aesthetics and nuisance of waste shall mainly come from discarded packaging materials such as scrap metals, empty plastic containers, poor disposal methods can lead to environmental problems due to their non-biodegradable nature. Most of the packaging wastes are expected to be reused.	L	• Toilets must be available on site • The site remains clean, well maintained, and free of hazards, with the thoughtful location of litter bins • Proposal disposal of solid waste to appropriate waste disposal facility • Storage of lubricants, fuels and other hydrocarbons in self-contained enclosures • Sanitation facilities to avoid the release of wastewater and sewage to the environment • Reuse waste materials wherever possible and use designated disposal sites • Minimum wastes are generated	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Used oil and lubricants will be recovered and reused or removed from site in full compliance with national regulatory frameworks • Oil waste, debris and/or other waste materials will not be burned • Safety measures are followed while disposing of wastes	
	Stealing and Vandalization of fibre cables	H	• Daily security reports shall be reviewed • Engage security for fibre protection • A liaison to foster a partnership with community to guarantee security for the project is established and sustained	L
	Hazardous waste	L	• Good housekeeping will be instituted and maintained • Hazardous waste will be collected, stored and disposed off at an approved disposal site • Proper PPE must be used for personnel handling hazardous waste	L

Table L Mitigation Measures of the Proposed Project Activities – Decommissioning

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Demolition and Evacuation	Noise and vibration nuisance	L	• Regular maintenance of generators and vehicles • Vehicles and generators are turned off when not in use • Noise barriers are erected	L
	Impairment of air quality	L	• Maintenance of engines and exhaust gas check • Regular maintenance of generators and vehicles • Generators and vehicles are switched off when not in use • Use of solar for backup • Use of nose masks • Dust suppression,	L
	Road Traffic accidents	M	• Vehicles are inspected on regular basis • Ensure that drivers obey traffic rules • All vehicles to be parked at assigned areas • Informatory and warning signages will be retro-reflective for visibility during the night • Engage flag personnel when necessary to direct traffic	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	Soil/groundwater contamination due to fuel, oil, paints and coating as a result of spillage	L	• Soil disturbance must be kept to the minimum for operation and safety • Containment of spills • Implement management controls (Procedures, inspections, communication and trainings) • Cleanup in compliance to the specifications • Hazardous material/waste will be stored on an impervious ground and the area will be constructed as a spill tray to avoid the spread of accidental spills • Restore the affected area to a condition in no wat inferior to the condition prior to the commencement of the works.	L
	Injury/fatalities in workforce/communities	M	• Vehicles are inspected on daily basis before commencement of works • Use of warning signs • Non-consumption of alcoholic beverages on work site • Well stocked First aid kit will always be available within the site • Flag personnel will be deployed to guide traffic where necessary	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Informatory and warning signages provided will be retro-reflective for visibility in the night • All vehicles will be parked in designated parking areas • Ensure safety awareness training for the workforce • Emergency preparedness plan shall be in place and implemented	
	Poor Waste Management	M	• None of the wastes generated are disposed of into any water body or open land • Keep all waste consignment, treatment and disposal • The site remains clean, well maintained, and free of hazards, with the thoughtful location of litter bins • Proposal disposal of solid waste to appropriate waste disposal facility • Storage of lubricants, fuels and other hydrocarbons in self-contained enclosures • Sanitation facilities to avoid the release of wastewater and sewage to the environment • Reuse waste materials wherever possible and use designated disposal sites • Minimum wastes are generated	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Used oil and lubricants will be recovered and reused or removed from site in full compliance with national regulatory frameworks • Oil waste, debris and/or other waste materials will not be burned • Safety measures are followed while disposing of wastes	
	Hazardous waste	M	• Good housekeeping will be instituted and maintained • Hazardous waste will be collected, stored and disposed off at an approved disposal site • Proper PPE must be used for personnel handling hazardous waste	L
	Loss of job	M	• Give enough notice as per the Labour Act 2024 • Counsel workers being retrenched	L
	Agitation due to employment issues and loss of direct benefits as project communities	M	• Continuous engagements with workers and project communities including local authorities	L

CONCLUSION

The goal of the ESIA process was to get to a position where the Project does not have any major residual impacts on the environment therefore, following the application of mitigation measures, the residual negative impacts became short-term, mostly localised, reversible of low significance. There are **no Medium and High negative residual impacts** associated with this project.

Even though the proposed mitigation measures cannot sufficiently reduce probability of these impacts, implementation of the ESMP mitigation measures will be able to manage them.

The project therefore has been categorised as **Category 2** because of the coverage (country wide) not the residual impacts since all residual impacts are of low significance.

RECOMMENDATIONS

LECC Should engage a permanent Environmental and Social Safeguards Officer to insure the implementation of the Environment and Social Management Plan; Grievance Redress Mechanism (GRM) and continuous engagements with the stakeholders.

The Environmental and Social Management Plan (ESMP) should be used as an on-site reference document during all phases of this project. Monitoring/Auditing should take place in order to determine compliance with the ESMP. Parties responsible for transgression of the ESMP should be held responsible for any rehabilitation that may need to be undertaken. Parties responsible for environmental degradation through irresponsible behaviour/negligence should receive penalties as per PART XV-OFFENCES of the Environment Act 2008 of the Kingdom of Lesotho.

CONTENTS

1.0 INTRODUCTION 91
1.1 Project Rationale 91
1.2 Executive Agency and Implementers 92
1.3 LEMOFI Background 93
1.4 LEMOFI Objectives 95
1.5 Purpose of the ESIA and Project Categorization 95
1.5.1. Objectives of the Environmental and Social Impact Assessment Study 96
1.5.2 ESIA Process 96
1.6 Project Location 98
1.7 ESIA Structure 98
1.8 terms of reference for ESIA undertaking 99
1.9 Author Credentials 100
2.0 POLICY, LEGISLATIVE AND REGULATORY FRAMEWORK 101
2.1 National Legislative Framework 101
2.1.1 The Constitution of Lesotho, 1993 102
2.1.2 Environmental Act No. 10 of 2008 103
2.1.3 Mines and Minerals Act No. 4 of 2005 104
2.1.4 Water Act No. 15 of 2008 105
2.1.5 Local Government Act (Amended) (Act No. 5 of 2004) 105
2.1.6 Local Administration Act (Act No. 13 of 1969) 106
2.1.7 National Heritage Resources (Act No. 2 of 2012) 106
2.1.8 Traffic Act No. 8 of 1981 107
2.1.9 Legal Capacity of Married Persons Act, 2006 107
2.1.10 Sexual Offence Act (Act No. 3 of 2003) 107
2.1.11 Anti-Trafficking in Persons Act (Act No. 1 of 2011) 108
2.1.12 Workmen's Compensation Act (Act No. 13 of 1977) 108
2.1.13 Labour Act 2024 108
2.1.14 Weeds Eradication Act No. 18 of 1969 109
2.1.15 Minerals and Mining Act No. 4 of 2015 109
2.1.16 Roads Directorate Act (Act 16 of 2010) 111
2.1.16 Occupational Safety and Health Act, 2024 111
2.1.17 Public Health Order (1970) 112
2.1.18 Communications Act of 2012 112
2.1.19 Town and Country Planning Act, No. 11 of 1980 115
2.2 Relevant National Policies, Plans and Strategies 115
2.2.1 Environmental Policy, 1998 115
2.2.2 Gender and Development Policy 2003 117
2.2.3 Lesotho Water and Sanitation Policy (LWSP) (2007) 117
2.2.4 Lesotho Electricity Corporation Safety, Health, Environment and Quality (SHEQ) Management System 117
2.2.5 Lesotho Communications Policy 2008 118
2.2.6 National HIV and AIDS Strategic Plan 118
2.2.7 Lesotho Environmental Impact Assessment Guidelines 2010 118
2.3 International Obligations 119

2.3.1The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989) 119
2.3.2 Convention on Biological Diversity (1992) 119
2.3.3 Protocol to Prevent Suppression and Punish Trafficking in Persons, Especially Women and Children, 2003 120
2.3.4 Revised African Convention on Conservation of Nature and Natural Resources, 2004 120
2.3.5 International Labour Organisation Convention, 1998 121
2.3.6 Convention on the Rights of the Child; 1990 121
2.3.7 African Development Bank Integrated Safeguards System - 2023 121
2.3.8 International Standards 122
2.3.9 Potential Permits Required 125
2.4 Administrative framework for EIA in Lesotho 126
2.5 Institutional Arrangements 127
2.6 Gap Analysis 129
3.0 ESIA METHODOLOGY 133
3.1 Overall Process 133
3.1.2 Environmental Management Systems 134
3.2 Terms of Reference 135
3.3 Impact Assessment Methodology 135
3.3.1 Social Impact Assessment Model 137
3.3.2 Social Research Design 138
3.4 Impact Mitigation 138
3.5 Public Consultation 139
3.5.1 Sensitisation Consultation and Stakeholder Identification 140
3.6 Environmental and Social Management Plan 141
3.7 Environmental and Social Impact Assessment Report 141
3.8 ESIA Phase Public Disclosure 141
3.8.1 AfDB Integrated Safeguards System (ISS) Requirements 142
3.9 Limitations 143
3.10 Assumptions 143
4.0 ANALYSIS OF ALTERNATIVES 145
4.1 Alternatives to the Project Design 146
4.1.1Recommendation ITU-T L.151 Installation of Optical Ground Wire Cable OPGW 146
4.1.2 Recommendation ITU-T L.26 Optical Fibre Cables for Aerial Applications 146
4.1.3 Optical Fibres, Cables and Passive Components and ITU-T Recommendations 147
4.1.4 LEMOFI Network Compliant with ITU-T G.984.4 G-PON: ONT Management and Control Interface Specification OMCI 148
4.1.5 LEMOFI Management Layer Points of Interconnect National and International Interconnect 149
4.2 Environmental and Social Alternatives 150
4.2.1 Recruitment of Labour 152
4.2.2 Solid Waste Management 153
4.2.3 Ablution facilities 154
4.2.4 Sources of water 156

4.2.5 Energy 157
4.2.6 Storage of Construction Material 159
4.2.7 Housing for the Workforce 160
4.3 “Without Project”/ No Action Alternative 161
4.4 Project Implementation Alternative 162
5.0 PROJECT DESCRIPTION 163
5.1 Project Purpose 163
5.2 Project Location 164
5.3 Current Infrastructure 185
5.3.1 Lesotho Electricity Company Communication 185
5.4 Project Components 187
5.5 Project Activities 195
5.6 Benefits of the Project 197
6.0 STAKEHOLDERS ENGAGEMENTS 199
6.1 Approach 199
6.2 Key Engagement Risks 199
6.3 Local Authorities 200
6.4 Local Communities Engagements 204
6.5 Limitations 205
6.6 Outcome of Engagements 205
6.6.1 Key Findings 206
6.6.2 Uptake of the Proposed Project by the Communities 207
6.6.3 Local Authorities Uptake 213
7.0 GRIEVANCE REDRESS MECHANISM 214
7.1 Grievance Redress Mechanism 214
7.1.1 Potential Grievances 216
7.1.2 Types of Remedies Available Under the GRM 217
7.1.3 Implementation Steps for the GRM 218
7.2 General GRM and the GBV/SEA/SH-Specific GRM 227
8.0 BASELINE DATA (BIO-PHYSICAL AND SOCIO-ECONOMIC) 228
8.1biophysical Environment 228
8.1.1 Climate 228
8.1.2 Topography 229
8.1.3 Geology 231
8.1.4 Soils 233
8.1.5 Erosion Potential 242
8.1.6 Biodiversity 243
8.1.7 Fauna 248
8.2 Socio-Cultural Environment 251
8.2.1 Demographic Profile 251
8.2.2. Vulnerability and Marginalisation 256
8.2.3 Services and Infrastructure 257
8.2.4 Community Structure 257
8.2.5 HIV / AIDS 258
8.2.6 Cultural and Historical Resources 259
9.0 ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS 263
9.1 Introduction 263

9.2 Impact Assessment Methodology 264
9.3 Environmental Impact Indicators 264
9.4 Impact Identification and Evaluation 265
9.4.1 Impact Identification 265
9.4.2 Impact Qualification 267
9.4.3 Impact Rating 267
10.0 MITIGATION MEASURES 283
10.1 Criteria for Selection of Mitigation Measures 283
10.2 Mitigation Measures 284
10.3 Summary of Residual Impacts after Mitigation 308
10.3.1 Community Unrest 308
10.3.2 Influx of People and Increase in Social Vices 308
10.4 Enhancing Positive Impacts 309
10.4.1 Job Creation 309
10.4.2 Business Opportunities 309
10.4.3 Greenhouse Gas Emissions 309
10.5 Biodiversity Mitigation Hierarchy and Relevant Bank Operational Safeguards 310
11.0 CAPACITY ASSESSMENT OF THE PUBLIC ENTITIES IN CHARGE OF ESIA ENFORCEMENT AND OVERSIGHT 312
11.1 Institutional Responsibilities for ESIA Monitoring and ESMP Implementation 312
11.1.1 Department of Environment 312
11.1.2 Lesotho Electricity Company Communications (LECC) 312
11.1.3 Local Government 313
11.1.4 Traditional Leaders 313
12.0 CONCLUSION AND RECOMMENDATIONS 315
12.1 Background Information 315
12.2 Conclusion 315
12.3 Recommendations 315
13.REFERENCES 316
14.ANNEXURES 321
ANNEXURE 1 322
PUBLIC NOTICE 322
ANNEXURE 2 324
GRIEVANCE REGISTRATION FORM 324
ANNEXURE 3 327
GRIEVANCE REGISTRATION FORM – SESOTHO VERSION 327
ANNEXURE 4 330
GRIEVANCE INVESTIGATION REPORT 330
ANNEXURE 5 334
GRIEVANCE INVESTIGATION REPORT – SESOTHO VERSION 334
ANNEXURE 6 337
CHANCE FIND PROCEDURES 337
ANNEXURE 7 341
PUBLIC GATHERINGS ATTENDANCE REGISTERS 341
ANNEXURE 8 350
STAKEHOLDER'S ENGAGEMENTS PHOTOS 350
ANNEXURE 9 355

STAKEHOLDERS' ENGAGEMENT MINUTES 355
ANNEXURE 10 372
PROJECT DESIGN REVIEW REPORT 372
1. CONTENTS 374
2. EXECUTIVE SUMMARY 376
Finding 1 DRAFT – LCA – ADMINISTRATIVE – RULES – 2024 PUBLIC CONSULTATION FINAL: The most important 384
3. INTRODUCTION 388
3.1 GOVERNMENT AMBITION 388
3.2 BACKGROUND INFORMATION 389
3.3 SCOPE AND OBJECTIVES 389
3.4 METHODOLGY 389
Step 1 – Consultation and fact finding 390
Step 2 – Analysis 390
Step 3 – Reporting 391
4. CURRENT INFRASTRUCTURE 391
4.1 LECC 391
Figure 1 394
The End-to-End Management Layer: 397
Figure 2 402
Figure 3 404
Generic physical configuration of the optical distribution network ODN – compliant with G984.2 405
Figure 4 406
Recommendation ITU-T G.984.4 Gigabit-capable Passive Optical Networks (G-PON): ONT management and control interface specification – Reference Model 407
Figure 5 408
4.1.16 BDCOM OLT STANDALONE AND INTEROPERABILITY WITH MULTIPLE ONU'S TECHNICAL CAPABILITIES 414
4.2 LEC 418
4.3 ETL 420
4.4 VCL 421
4.5 COMNET 422
4.6 LEO 426
4.7 JENNY LESOTHO 428
5. REVIEW OF ANY ADDITIONAL TELECOMMUNICATIONS OR INFRASTRUCTURE ASSETS THAT COULD SUPPORT BROADER NETWORK EXPANSION AND INTEGRATION. 430
5.1 SPACEX'S STARLINK 430
5.2 ECONET TELECOMS LESOTHO ETL INFRASTRUCTURE ASSETS 431
5.3 VODACOM LESOTHO VCL INFRASTRUCTURE ASSETS 432
6. REGULATORY AND LEGAL FRAMEWORK ANALYSIS REVIEW 432
6.1 TELECOMMUNICATIONS LAWS, REGULATIONS, AND COMPLIANCE REQUIREMENTS IMPACTING THE PROJECT 432
6.1.3 SPACEX'S STARLINK LICENSE 434
7. GAPS AND AREAS FOR IMPROVEMENT 435

7.1 IDENTIFICATION OF COVERAGE GAPS 435
7.2 COVERAGE GAPS IN TOWNS AND RESIDENTIAL AREAS AND RECOMMEDATIONS FOR EXTENDING LEMOFI 437
7.3 MAPPING OF THE GAPS ONTO THE LEMOFI ROLL-OUT PLAN 448
8. TECHNOLOGICAL RECOMMENDATIONS - TECHNOLOGICAL ADVANCEMENTS AND BEST PRACTICES 451
8.1 ITU-T FTTX STANDARDS AND BEST PRACTICES: 452
8.2 ITU-T GPON, XG-PON, XGS-PON, XG-PON COMBO, XGS-PON COMBO STANDARDS TECHNOLOGY ROADMAP COMPLIANCE 452
8.3 LECC PIZZA BOX OLT MUST SUPPORT ALL FTTX APPLICATIONS..... 452
8.4 ITU-T STUDY GROUP 15 GSUPPL. 74 NETWORK SLICING IN A PASSIVE OPTICAL NETWORK 452
8.5 NETWORK MANAGEMENT SYSTEM OLT SLICING CONFIGURATION 452
8.6 INDEPENDENT QOS CONFIGURATION FOR DIFFERENT USERS AND SERVICES 452
8.7 DIGITALIZED ODN MANAGEMENT SYSTEM 453
8.8 END TO END MANAGEMENT FOR ALL FTTX APPLICATIONS..... 453
8.9 TELECOMMUNICATIONS INFRASTRUCTURE PROVIDER OPERATIONS SUPPORT SYSTEMS (OSS) KEY FEATURES 453
8.10 TELECOMMUNICATIONS INFRASTRUCTURE PROVIDER BUSINESS SUPPORT SYSTEMS (BSS) KEY FEATURES 454
8.11 TM FORUM TMF STANDARDS FOR BUILDING THE FUTURE OF OSS/BSS: THE TMF AGILE OSS TOOLKIT 455
8.12 NETWORK ENGINEERING, SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF THE LEMOFI NETWORK 455
8.13 RECOMMENDATION ITU-T L.151 INSTALLATION OF OPTICAL GROUND WIRE CABLE OPGW 456
8.14 RECOMMENDATION ITU-T L.26 OPTICAL FIBRE CABLES FOR AERIAL APPLICATIONS 457
8.15 [IEC 60794-4-20] IEC 60794-4-20 (2012), OPTICAL FIBRE CABLES – PART 4-20: AERIAL OPTICAL CABLES ALONG ELECTRICAL POWER LINES 457
8.16 SPECIFICATION FOR ADSS (ALL DIELECTRIC SELF SUPPORTED) OPTICAL CABLES, ... 457
9. CONCLUSION 458
10. APPENDIX 1 REFERENCE DOCUMENTATION..... 460
11. APPENDIX 2 DEFINITIONS, ACRONYMS AND ABBREVIATIONS 470
11.1 DEFINITIONS..... 470
11.2 ACRONYMS AND ABBREVIATIONS 477
12. APPENDIX 3: INTERNATIONAL STANDARDS AND BEST PRACTICES COMPLIANCE 484
END OF APPENDIXES 499
ANNEXURE 11 500
TERMS OF REFERENCE 500
TERMS OF REFERENCE 501
ANNEXURE 12 511
PROJECT AREA PHOTOS 511

LIST OF TABLES

Table 1 Listed Activities in First Schedule of Environment Act 2008..... 103
Table 2 Policy and Regulatory Environment 112
Table 3 Required Environmental Permits and/or Licenses..... 125
Table 4 Summary of how this report satisfies the Legislative requirements of Section 21 Environmental Act 2008 126
Table 5 Relevant Institutions for the Proposed LEMOFI Project 128
Table 6 African Development Bank Safeguards, Legal and thrir identified Gaps.. 130
Table 7 Below illustrates the implications and recommendations of each model: 150
Table 8 Altrnatives for Recruiting Workers..... 152
Table 9 Possible Options for Solid Waste Management..... 153
Table 10 Possible Options for Ablution Facilities..... 155
Table 11 Water Supply Options for Construction and Drinking 156
Table 12 Energy Option for Production Activities 157
Table 13 Storage for Construction Material (night Storage)..... 159
Table 14 Quantity of Project Construction Components for Identified Sites..... 190
Table 15 Identified Engagement Risks and Remedial Action Taken 200
Table 16 Dates for Sensitization meetings with the Local Authorities..... 200
Table 17 Public Gathering Information..... 204
Table 18 Key Concerns of Stakeholders..... 206
Table 19 Issues Covered During Public Gatherings..... 208
Table 20 Project Team Roles and Responsibilities in GRM Implementation 220
Table 21 shows the General GRM and the GBV/SEA/SH-Specific GRM 227
Table 22 Stratigraphy of Lesotho..... 232
Table 23 Geomorphological Units and Associated Soil Series (Schmitz & Rooyani, 1987)..... 234
Table 24 Benchmark Soils of Lesotho 236
Table 25 Protected Area of Lesotho 250
Table 26 Environmental Components and Potential Impacts Indicators 264
Table 27 Identified Proposed Project Impacts 266
Table 28 Probability of Occurrence..... 269
Table 29 Consequence 269
Table 30 Frequency Rating and Criteria 270
Table 31 Importance Criteria 271
Table 32 Public Perception Criteria..... 271
Table 33 Impact Value and Rating Colour Code 272
Table 34 Potential and Associated Impacts of the Proposed Project - Pre-Construction Phase..... 273
Table 35 Potential and Associated Impacts of the Proposed Project - Construction Phase..... 275
Table 36 Potential and Associated Impacts of the Proposed Project - Operation Phase..... 278

Table 37 Potential and Associated Impacts of the Proposed Project - Decommissioning..... 281
Table 38 Mitigation Measures of the Proposed Project Activities - Pre-Construction 285
Table 39 Mitigation Measures of the Proposed Project Activities - Construction Phase..... 290
Table 40 Mitigation Measures of the Proposed Project Activities - Operation/Maintenance Phase..... 299
Table 41 Mitigation Measures of the Proposed Project Activities - Decommissioning 304

LIST OF FIGURES

Figure 1 Impact Assessment Mitigation Hierarchy..... 139
Figure 2 A line diagram of the optical fibres, cables and passive components 148
Figure 3 Recommendation ITU-T G.984.4 Gigabit-capable Passive Optical Networks (G-PON): ONT management and control interface specification – Reference Model 149
Figure 4 LEMOFI Project Location 166
Figure 5 Parliament and Maseru Mall Ring Distribution Layout 167
Figure 6 Parliament and Maseru Mall Design Layout..... 168
Figure 7 Maseru Industrial FTTB - Metro Ring and Distribution Design Layout..... 169
Figure 8 Thetsane Industrial Ring and Distribution Layout 170
Figure 9 Tikoe Maseru Industrial Ring and Distribution Design Layout..... 171
Figure 10 Highway - Central - EIMS Ring and Distribution Design Layout 172
Figure 11 A2 FTTB Lekhaloaneng – Matala Distribution Layout..... 173
Figure 12 Old Europa - Downtown FTTB Ring and Distribution Layout 174
Figure 13 Teyateyaneng Berea TY CBD FTTB Ring Layout..... 175
Figure 14Maputsoe CBD Design Layout 176
Figure 15 Butha Buthe Metro Ring and Distribution Layout 177
Figure 16 Hlotse Metro Ring and Distribution Layout 178
Figure 17 Mafeteng CBD FTTB Ring and Distribution Layout..... 179
Figure 18 Mokhotlong CBD FTTB Ring and Distribution Layout..... 180
Figure 19 Thaba Tseka CBD FTTB Ring and Distribution Layout 181
Figure 20 Qhacha's Nek CBD FTTB Ring and Distribution Layout 182
Figure 21 Quthing CBD FTTB Ring and Distribution Layout 183
Figure 22 Mohale's Hoek CBD FTTB Ring and Distribution Layout 184
Figure 23Open Standard Based Layered Architecture..... 187
Figure 24 Purpose and Objectives of GRM 215
Figure 25 Grievance Flow in GRM..... 225
Figure 26 Institutional Grievance Flow in GRM..... 226
Figure 27 Climate Classification Map of Lesotho..... 229
Figure 28 Topographic Regions of Lesotho..... 231
Figure 29 Geology of Lesotho 232
Figure 30 Map of Lesotho Soil Association..... 235

Figure 31Erosion Hazard Map of Lesotho (Chakela,et al, 1989 243
Figure 32 Lesotho Vegetation Types 244
Figure 33 Xanthium spinosum 246
Figure 34 Riparian Vegetation in Lesotho 247
Figure 35Typical Tree Plantations in Lesotho 248
Figure 36 Risk Matrix 270

ACRONYMS

ADSS	All Dielectric Self Supporting
AIDS	Acquired Immunodeficiency Syndrome
AfDB	African Development Bank
BBI	Broadband Infraco
DA	District Administrator
DCS	District Council Secretary
DoE	Department of Environment
DRWS	Department of Rural Water Supply
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
ES	Environment and Social
ESAP	Environmental and Social Assessment Procedures
ESIA	Environment and Social Impact Assessment
ESMP	Environment and Social management Plan
ESMS	Environment and Social Management Systems
ESSS	Environmental and Social Safeguards Specialist
FGD	Focus Group Discussion
FTC	Famers Training Centre
FTTH	Fiber to the Home
GHG	Greenhouse Gases
GIS	Geographical Information Systems
GoL	Government of Lesotho

HIV	Human Immunodeficiency Virus
HSMP	Health and Safety Management Plan
I&AP	Interested and Affected Person
IFC	International financing Corporation
ILO	International Labor Organisation
ISP	Internet Service Providers
KII	Key Informant Interview
LCA	Lesotho Communications Authority
LEC	Lesotho Electricity Company
LECC	Lesotho Electricity Company Communications
LIXP	Lesotho Internet Exchange Point
MNO	Mobile Network Operators
MOHSW	Ministry of Health and Social Welfare
MPW	Ministry of Public Works
NGO	Non-Government Organisation
NSP	Network Service Providers
OPGW	Optical Ground Wire
OS	African Development Bank Operation Safeguards
PoP	Points of Presence
PAP	Project Affected Person
PS	Policy Statement
RD	Roads Directorate
SIA	Social Impact Assessment

SE	Stakeholders' Engagement
SEP	Stakeholders' Engagement Plan
SMP	Social Management Plan
ToR	Terms of Reference
UNICEF	United Nations International Children's Emergency Fund
WASCO	Water and Sewage Company

1.0 INTRODUCTION

The Government of the Kingdom of Lesotho is committed to fostering a competitive telecommunications sector and expanding broadband access across the nation. However, the sector is currently dominated by Mobile Network Operators (MNOs), and the high costs associated with building new infrastructure have hindered smaller entrants from establishing a foothold. This lack of competition has led to high data and broadband prices, preventing many citizens from accessing affordable broadband and participating fully in the 4th Industrial Revolution.

To address these gaps, the **Lesotho Metropolitan Fiber Infrastructure Expansion Project (LEMOFI)** project should focus on developing comprehensive fiber distribution networks within towns and metropolitan areas to enhance access and promote competition. The design should account for existing fiber coverage from Econet, Vodacom, and the Lesotho Electricity Company (LEC), whose network primarily follows long-distance transmission lines.

Additionally, it should consider other local ISPs with smaller or expanding fiber deployments to ensure a more integrated infrastructure.

1.1 Project Rationale

The Government of the Kingdom of Lesotho, through the Ministry of Information, Communications, Science and Technology (MICST), is the client and lead proponent of the Lesotho Metropolitan Fiber Infrastructure Expansion Project (LEMOFI). This initiative reflects the government's strategic commitment to fostering a competitive telecommunications sector and ensuring equitable access to affordable, high-speed broadband services across the country.

Currently, Lesotho's telecommunications landscape is dominated by two major Mobile Network Operators (MNOs)—Econet Telecom Lesotho and Vodacom Lesotho. While

these companies have made notable investments in network infrastructure, their services remain concentrated in urban areas. The high capital costs associated with infrastructure development have created significant barriers to entry for smaller Internet Service Providers (ISPs). As a result, limited competition has led to elevated broadband prices, restricted service coverage, and constrained innovation—ultimately hindering digital inclusion and broader participation in the Fourth Industrial Revolution.

To address these challenges, the LEMOFI project aims to develop comprehensive fiber distribution networks in key metropolitan areas. These networks will function as neutral, open-access infrastructure, reducing deployment costs for new ISPs and enabling a more competitive broadband market. By supporting infrastructure sharing and expanding access, the project will help lower broadband prices, improve service quality, and stimulate innovation. This aligns directly with Lesotho's national digital transformation agenda and broader development goals.

1.2 Executive Agency and Implementers

The project will be executed under the leadership of the Lesotho Electricity Company Communications (LECC), which will serve as the executing agency. The LECC will oversee project management, procurement, stakeholder engagement, and regulatory compliance.

The LECC will be staffed with specialists in network engineering, procurement, monitoring and evaluation, and environmental and social safeguards. The PIU will also collaborate with key stakeholders to ensure alignment and sustainability, including:

- Ministry of Information, Communications, Science and Technology (MICST): Provides policy guidance, strategic oversight, and ensures alignment with national ICT priorities.
- Lesotho Electricity Company (LEC): Facilitates access to existing fiber infrastructure along its transmission network, promoting cost-effective integration.

- Econet Telecom Lesotho and Vodacom Lesotho: Their existing infrastructure will be reviewed to inform optimal network design, avoid redundancy, and promote infrastructure sharing.
- Local ISPs and new market entrants: Will be actively engaged to ensure the infrastructure supports a fair and open-access model, promoting innovation and service diversity.

Through this collaborative framework, the LEMOFI project will establish a foundation for a more inclusive, competitive, and digitally empowered Lesotho—enhancing economic opportunities, supporting public service delivery, and accelerating the country's participation in the digital economy.

1.3 LEMOFI Background

Currently, LEC's fiber infrastructure is primarily laid along long-distance electricity transmission lines, which typically do not extend into commercial and residential areas. To address this limitation and make these services more accessible to users, it is imperative to expand fiber distribution networks within these urban and suburban areas.

The Project Implementing Unit (PIU) is the LEC Communications (LECC) which was established in 2015, as a special purpose vehicle by the Government of Lesotho through Lesotho Electricity Company (LEC), to commercialize existing fiber optic infrastructure deployed on LEC's network.

LECC's dark fiber network is almost entirely based on LEC's fiber infrastructure. Smaller sections of the network are constructed on LEC's 11kV distribution network and are owned directly by LECC. To connect distant substations, LEC uses Optical Ground Wire fiber (OPGW) (usually on 88kV and 132kV lines, rarely on 33kV) whereas for connecting substations within a metro area like Maseru, All Dielectric Self-Supporting fibre (ADSS) is more commonly used (33kV lines). ADSS is also exclusively used for pole attachments. OPGW is generally stronger and more reliable than ADSS. The fact that LEC's fiber runs

on electricity lines makes it less prone to vandalism because of the inherent danger associated with high-voltage electricity. This is one of the factors which make it attractive for Unified Licensees.

LECC has a total of six (6) Points of Presence (POPs) at LECC Offices (New Europa), Mabote Substation, Maputsoe Substation, Teraco Isando, MS07 Mini substation (Ha Foso), and at the Lesotho Internet Exchange Point (LIXP) (hosted at the LCA building). Mabote Substation is the designated central location of LECC's network considering its centrality with respect to LEC's electricity network. Backbone links between LECC Offices, LIXP and Mabote Substation are 40Gbps while the link from Mabote to Maputsoe is 10Gbps.

LECC currently has 2 x 1Gbps IP Transit links from Cogent and Afr-IX and 2 x 1Gbps Layer 2 transport from Broadband Infraco (BBI) and OpenServe. It is currently deploying pilot Fiber to the Home (FTTH) network at Ha Foso covering 2.5 square kilometres and 904 house passes (Density = 368 houses/km2). Estimated 110 km of OPGW fibre will be rolled-out through the Ministry of Information, Communications, Science, Technology and Innovation funding (loan from the African Development Bank - AfDB) between Roma and Thaba Tseka with multiple drop-offs throughout the route – valued at approximately LSL32m.

The government has realised that new and smaller Network Service Providers (NSPs) and Reseller Internet Service Providers (ISPs) have had difficulties in entering and succeeding in Lesotho's telecommunications market which is currently dominated by Unified Licensees (providers of mobile and fixed network services – voice and data). The most significant barrier to entry for NSPs and ISPs is the prohibitively high cost of deploying their own infrastructure. The resulting lack of competition within the telecommunications market leads to relatively high data costs for Basotho.

LEC's existing fibre infrastructure runs on long distance electricity transmission lines which do not typically run within business and residential areas. To bring these services

closer to users, it is necessary to deploy fibre distribution networks in ten districts of the country within business and residential areas.

1.4 LEMOFI Objectives

- The primary objective of the LEMOFI is to determine:
- **Technical Feasibility:** To review existing designs and specifications for the national fibre network, focusing on infrastructure that expands coverage into urban and suburban areas, with the objective of proposing an optimized network design and architecture, including technology options and infrastructure requirements.
- **Regulatory and Legal Framework impact:** To review the regulatory telecommunications laws, and compliance requirements impacting the LEMOFI project.
- **FTTx network coverage gaps: To** Identify coverage gaps, particularly in towns and residential areas, and provide recommendations for extending the network into these areas.
- **Recent technological advancements and best practices** – To assess the FTTH and FTTB models, and the use of OPGW and ADSS fibre and associated technology compliant with international standards and best practices.
- **Environment and Social:** Undertake an ESIA and prepare the associated ESMP to inform all stakeholders of the potential environmental and social risks associated with the project, and inform the detailed design based on findings of the study.

1.5 Purpose of the ESIA and Project Categorization

The LEMOFI project is a Fibre Network expansion project and falls under **Item 15** "***Communication facilities, including telephone, television, and radio transmission masts"*** in the First Schedule Part A of the Environment Act No.10 of 2008 of the Kingdom of Lesotho, hence require a full ESIA for it to be implemented. However, LEMOFI Project

utilises already existing electricity supply infrastructure therefore, its footprint is very minimal and does not require a full ESIA with specialist studies.

Furthermore, the proposed LEMOFI project is to be funded by the African development Bank (AfDB) therefore, this project falls under **Category 2** according to AfDB categorisation procedures, the Intergrated Safeguards System and the Guidance Notes.

1.5.1. Objectives of the Environmental and Social Impact Assessment Study

This ESIA provides an opportunity to determine potential negative and positive impacts of the LEMOFI project. It provides opportunities to mitigate negative impacts, while enhancing the positive ones. In addition to impact identification and management the ESIA, provides avenues to enable meaningful stakeholders' engagements thus facilitating project social acceptability.

The specific objectives of the ESIA are as follows:

- To identify and assess potential environmental and social impacts and recommend appropriate mitigation measures (avoid, minimize, restore and compensate)
- To identify and analyse project alternatives with a view of avoiding and minimising adverse impacts and risks, and to optimize the benefits to socio-economic development and other development activities in the country
- To undertake meaningful stakeholders' consultations
- Prepare a ESIA compliant to the relevant authorities (and international best practice); and,
- Prepare an ESMP that details mitigation measures, the monitoring process, training support and institutional structure required for implementation.

1.5.2 ESIA Process

The following key stages have applied through the generation of the ESIA:

- **Screening:** The LEMOFI project was screened to determine the level of assessment required, its significant impacts on the environmental and social aspects, and existing opportunities. The screening also analysed the possibilities to avoid impacts or develop mitigation measures. ESIA is not mandatory for this project because projects of this nature are not listed in the First Schedule Part A of the Environment Act No.10 of 2008 of the Kingdom of Lesotho.

- **Scoping –** An Inception Report presenting scoping information has been generated by the Consultant presented scoping information, in addition to baseline information understood at that time.

  Scoping was carried out to determine the scope of work to be undertaken in assessing the likely environmental and social impacts of the proposed development.

  Consultative meetings were held with various stakeholders, including local communities and authorities, to determine the issues of most importance for consideration during detailed assessment. Finally, analysis of alternatives to be considered was also done.
- **Establishing Baseline Conditions –** to establish a reliable set of baseline condition data the Consultant has supplemented existing information with further desk-based review and site verification visits.

- **Impact Assessment –** having established baseline conditions, this information was analysed and modelled in order to establish potential positive and negative project impacts of the project for the construction and operational phases. Possible mitigation measures were developed for proper management of impacts

- **Decision Making:** Based on the findings of the ESIA, The Department of Environment will decide on whether to issue an Environmental Licence or not for the implementation of LEMOFI.

1.6 Project Location

The following are the district and target areas/constituencies for the LEMOFI Fibre Network:

- **Year 1: Berea:** Teyateyaneng. **Leribe:** Maputsoe (Including Nyenye). **Mafeteng:** Mafeteng. **Maseru:** Highway- Central-IEMS. **Maseru:** Maseru Industrial. **Maseru:** Parliament - Maseru Mall. **Maseru:** A2 - Lekhaloaneng - Matala
- **Year 2: Leribe:** Hlotse. **Butha Buthe:** Botha Bothe. **Mohale's Hoek:** Mohale's Hoek. **Mokhotlong:** Mokhotlong Town. **Thaba Tseka:** Thaba Tseka. **Maseru:** Thetsane Industrial
- **Year 3: Maseru:** Old Europa – Downtown. **Maseru:** Tikoe Industrial. **Quthing:** Quthing – Moyeni. **Qacha's Nek:** Qacha's Nek Town.

1.7 ESIA Structure

The Environment and Social Impact Assessment Report is divided into 12 Chapters as indicated below:

- **Chapter 1 Introduction** – Provides a background of the project, project justification and the need for Environmental and Social Management
- **Chapter 2 Project Description** – describes the project location and project technical designs
- **Chapter 3 Study Methodology** – provides the methods used in collection of baseline as well as impacts identification and analysis

- **Chapter 4 Policy, Legal and Institutional Framework** – presents an overview of the legal and institutional framework under which the ESIA has been conducted national and international ESIA study requirements
- **Chapter 5 Baseline Data (Biophysical, Socio-Economic)** – description of the existing environment condition both biological and physical parameters. Also, the socio-economic settings.
- **Chapter 6 Stakeholders Consultation and Disclosure** – provides an overview of public disclosure and consultation activities undertaken in connection with the ESIA study process
- **Chapter 7 Grievance Redress Mechanism** – provides strategies for handling grievance and complaints
- **Chapter 8 Analysis of Alternatives** - provides an analysis of project alternatives
- **Chapter 9 Environmental Risks and Impacts** – describes the potential positive and negative environmental and social impacts, their magnitude and presents the anticipated overall impacts of the project.
- **Chapter 10 Mitigation Measures** – provides mitigation and enhancement measures for management of project impacts
- **Chapter 11 Capacity Assessment of the Public Entities in Charge of ESIA Enforcement and Oversight** - analysis includes an assessment of the capacity of implementation entities to manage environmental and social safeguards
- **Chapter 12 Conclusion and Recommendations** – summarize the main findings and suggest future action required.
- **References**
- **Annexures**

1.8 terms of reference for ESIA undertaking

The ToR states that the Consultant will prepare an Environmental and Social Impact Assessment (ESIA) including implications of the rehabilitation measures to be put in place and provision of the ESMP for the appropriate mitigation measures. Therefore, the preparation of ESIA shall be done in close collaboration with all categories of affected

communities, local chiefs, Community Councils and other interested and affected parties (Annexure 11)

1.9 Author Credentials

The compiler of this report, Nthame Monare, has 17 years of experience in providing technical input in the environmental, social, health and safety management field especially in infrastructure development projects in Water & Sanitation sector, Health sector, Electricity sector, Telecommunication sector, mining as well as Transport sector. Specialising in Strategic Evaluation, Social and Environmental Impact Assessment (ESIAs), Environmental and Social Management Plans (ESMPs), Environmental and Social Frameworks (ESMFs), Integrated Catchment Management Plans, Stakeholders Engagement Plans (SEPs), Grievance Redress Mechanisms (GRMs), Mining Inspection, Occupational Health and Safety (OHS), Environment and Social Commitment Plans (ESCPs), Labour Management Plans (LMPs), Resettlement Action Plans (RAPs) as well as Resettlement Policy Frameworks (RFPs) and Environmental Compliance Monitoring (Construction Supervision on ESMPs), peer review of Environmental Impact Assessment Reports and processes, strategy and guideline development as well as public participation/stakeholder's involvement.

2.0 POLICY, LEGISLATIVE AND REGULATORY FRAMEWORK

This section outlines the legal and institutional framework within which the Lesotho E-Government and Modernization of Fiber Infrastructure (LEMOFI) Project will be implemented. The Environmental and Social Management and Monitoring Plan (ESMP) has been developed in compliance with the applicable national laws and regulations of the Kingdom of Lesotho, as well as relevant international environmental and social safeguard standards.

The objective of this section is to ensure that the Project aligns with national legislative requirements governing environmental protection, land use, occupational health and safety, and social accountability. It also highlights the Project's adherence to the policies and guidelines of development financing institutions, particularly the African Development Bank's Integrated Safeguards System (AfDB ISS, 2023) and the International Finance Corporation (IFC) Performance Standards (2012).

The LEMOFI Project, being supported by multilateral development partners, is subject to both domestic regulatory compliance and international environmental and social performance obligations. This dual compliance approach strengthens the accountability and sustainability of the Project, ensuring that environmental and social risks are adequately mitigated throughout the Project life cycle.

The subsections that follow provide an overview of:

- The national environmental and social legal instruments;
- Institutional responsibilities relevant to ESMP implementation;
- Applicable international treaties, conventions, and guidelines;
- Lender environmental and social requirements to which the Project is aligned.

2.1 National Legislative Framework

2.1.1 The Constitution of Lesotho, 1993

The constitution is the supreme law of the country. It also provides an overarching environmental legislative framework for environmental management. Section 36 of the Constitution particularly addresses the need for environmental protection. It states that" Lesotho *shall adopt policies designed to protect and enhance the natural and cultural environment of Lesotho for the benefit of both present and future generations and shall endeavour to assure to all citizens a sound and safe environment adequate for their health and well-being*".

Furthermore Section 17 stipulates that no property (movable or immovable) shall be compulsorily acquired without paying any compensation to the entitled individual.

The Constitution also entitles everyone to the protection of health through the adoption of policies aimed at ensuring the highest attainable standard of physical and mental health for its citizens, including policies designed to *inter alia*: "*provide for the prevention, treatment and control of epidemic, endemic, occupational and other diseases"* (Article 27(c)). This Article implicitly includes HIV and AIDS as a disease.

Chapter 2 of the Constitution is devoted to the protection of fundamental human rights and freedoms, two of which are freedom from discrimination and the right to equality before the law. Section 18 provides that no law shall make any provision that is discriminatory either of itself or in its effect (Hodges, 2007).

Relevance to the Project: The project will need to adhere to the Environmental and Social Management Plan (ESMP) requirements and Environmental Impact Assessment (EIA) licence conditions (once issued) to ensure that social, health and environmental management considerations are taken into account throughout the project cycle without compromising both present and future generations.

2.1.2 Environmental Act No. 10 of 2008

The Environmental Act is the principal underlying framework for environmental legislation for matters concerning the environment in Lesotho. It makes provision for protection and management of the environment and conservation and sustainable utilisation of the country's natural resources.

Section 4 stipulates that "*Every person living in Lesotho has a duty to safeguard and enhance the environment including the duty to inform the Director of all activities and phenomena that may affect the environment significantly.*"

Section 25 further stipulates that no activity listed in the First Schedule may be undertaken without an Environmental Impact Assessment (EIA) licence issued by the Director. The categories of project and/or activities for which an EIA is required are outlined in **Table 1**.

Relevance to the Project: As per the requirements of the Act, the proposed development requires an EIA licence to commence with construction. The listed activities (in Part A of the First Schedule of the Act) that will be triggered by the proposed project are listed in **Table 1.**

Table 1 Listed Activities in First Schedule of Environment Act 2008

Item	Description of the Activity	Relevance to the Project
15	***Communication facilities, including telephone, television, and radio transmission masts***	Even though LEMOFI Project results in communication facilities, it utilises already existing electricity supply infrastructure hence Its footprint is very minimal and does not require ESIA.
6	***Mining, mineral extraction including quarrying and opencast extraction of –*** *(d) aggregates, sand and gravel.*	Aggregate will be required for all concrete works. It is not known whether this material will be supplied from commercial suppliers or existing or new borrow pits/quarries and rivers.
11	***Waste handling, storage, transport, treatment and disposal including –*** *(i) transportation and storage of hazardous substances or waste*	Domestic and hazardous waste generated from construction activities will be temporarily stored on site until it is transported by a service provider to a registered disposal facility.

2.1.3 Mines and Minerals Act No. 4 of 2005

According to Section 57 of the Act, acquisition of land for a public purpose is in terms of the Land Act 1979. Section 56 deals with compensation for disturbance of rights of a lawful occupier of land subject to a mineral concession, including damage done to the surface of the land which may concern “crops, trees, buildings or works damaged during the course of such operations”.

Relevance to the Project: Quarrying, borrow pit usage and river sand abstraction activities undertaken as part of this project will require a natural resources abstraction and or extraction permit.

2.1.4 Water Act No. 15 of 2008

The Water Act provides for the ownership of all water resources to be vested in the Basotho nation and held in trust by the King. It also makes provision for the management, protection, conservation, development, and sustainable use of the Lesotho's water resources. It further makes provision for different types of water use permits and the manner of obtaining them. According to Section 20 of the Act no person shall engage in an activity of using or abstracting water without a water use permit which is valid for a period of 5 years from the date of issue. Activities which are considered as water uses by the Act are listed in Section 5 (3) of the Act.

Relevance to the Project: Wherever, water from rivers/natural water bodies is required for construction purposes, water use permit will be obtained from the Department of Water Affairs.

2.1.5 Local Government Act (Amended) (Act No. 5 of 2004)

This Act provides the legal basis for establishment and operational functioning of local councils (district, municipal, urban and community councils) and de-concentrated administrative structures. The Act further provides for the inclusion of chiefs in councils through nomination by fellow chiefs.

Relevance to the Project: The project will require the support of the local communities and other local institutions/authorities for its success. All the relevant local structures have been involved and/or consulted on an on-going basis from the early stages of the project to obtain local knowledge about the area and provide inputs/review opportunities at key stages in the ESIA process.

2.1.6 Local Administration Act (Act No. 13 of 1969)

This Act and various other health notices contain provisions relating to fumes, smoke and gaseous emissions which are likely to have human health impacts.

Relevance to the Project: Potential localised air quality impacts from dust and exhaust gases from construction equipment will be experienced and their impacts on the surroundings is dealt with in the ESMP and would also need to form part of the good practice guidelines in the project specifications.

2.1.7 National Heritage Resources (Act No. 2 of 2012)

This Act provides for the protection of man-made cultural sites and artefacts, as well as flora and fauna. Section 9 (2) of the Act states that "*no person shall, without the written consent of the commission destroy or damage any monument or relic or make any alteration thereto or remove it from its original site or export it from Lesotho*". Section 10 also states that no fauna or flora may be destroyed, damaged or removed from original site or habitat without a written consent from the commission. Failure to comply with the any provision of Section 9 or 10 could result in fine and/or imprisonment.

Relevance to the Project: Even though the construction activities will take place within the already existing road alignment; in accordance with the Act, the Contractor has the responsibility to conserve any cultural heritage material that might be encountered during the road rehabilitation.

2.1.8 Traffic Act No. 8 of 1981

This Act regulates and controls the use of a public road and road traffic. The Act also stipulates that traffic signs may not be displayed on public roads without authorisation from the Minister.

Relevance to the Project: Roads Directorate has to approve the designs and approve the wayleaves along or near national road infrastructure.

2.1.9 Legal Capacity of Married Persons Act, 2006

The Lesotho's Legal Capacity of Married Persons Act No. 9 of 2006 introduces the principle of equality between men and women and mandates married couples to consult one another on all matrimonial issues – a considerable change from the common law. This gives equal rights to men and women to own land.

Relevance to the Project: This gives equal rights to men and women to own land. This implies that both men and women must be consulted equally during the ESIA planning and implementation.

2.1.10 Sexual Offence Act (Act No. 3 of 2003)

This Act recognises marital rape as an offence and criminalises all offences of unlawful sexual nature. It does not discriminate against any gender group; provides for compulsory HIV testing of perpetrators of sexual violence and imposes heavy penalties on perpetrators who committed the offence knowing their HIV and AIDS positive status.

Relevance to the Project: Evidence shows that the increased availability of cash amongst construction workers and the potential influx of job seekers create an environment that is conducive to increased extra-marital sexual behaviour, often resulting in the spread of communicable diseases such as HIV and teenage pregnancies. In a country where the average HIV prevalence rate is 25%, the knowing transmission of HIV is likely.

2.1.11 Anti-Trafficking in Persons Act (Act No. 1 of 2011)

The **Anti-Trafficking in Persons Act (Act No. 1 of 2011)** criminalizes all forms of slavery and provides for harsh penalties for the perpetrators, and protection and support of victims who are usually women and children. Inadequate dissemination of information about this law makes it difficult for victims to use it for their safety. Poverty and vulnerability of women expose them to trafficking and undermine efforts by law enforcers to protect them.

Relevance to the Project: All employees on the project will be inducted on this act. Also, contractors must not engage trafficked personnel.

2.1.12 Workmen's Compensation Act (Act No. 13 of 1977)

This Act does not cover all labour groupings. Domestic workers, mostly women, as well as herd-boys and herd-men are the most vulnerable because there is no legal framework to provide basic standards of protection, compensation and terminal benefits for them.

Relevance to the Project: All employees on the project must be covered by this Act and compensated as per the Act in the event of any lost-time injuries.

2.1.13 Labour Act 2024

According to the Labour Act 2024 of the Kingdom of Lesotho, every Mosotho has a right to get employment anywhere in the country. However, to avoid the nuisance caused by job seekers who camp outside construction areas it is advised that general and casual labour be recruited through the Community Council System that already exist within communities. The Labour Act 2024 therefore makes provision for various conditions for labour employment.

- Part III covers Fundamental Principles
- Part V covers Collective Bargaining
- Part VI Covers the Employment Relationship and Termination
- Part VII covers Recruitment, Local and Foreign Contracts

Relevance to the Project: There are no policy guidelines that stipulate the priorities of the local communities' vis-á-vis outsiders in employment in the construction projects. Common practice might suggest the local be given first preference. Efficiency considerations might dictate that qualifications and skills be used, thereby increasing the chances of employment of outsiders who qualify and of potential conflicts over employment with the locals. During employment of both the skilled and non-skilled labourers, the ACT is to be observed.

2.1.14 Weeds Eradication Act No. 18 of 1969

The Act declares certain plants as weeds and places a duty on every person who occupies land to eradicate all weeds growing on that land.

Relevance to the Project: During project implementation invasive species need to be managed properly.

2.1.15 Minerals and Mining Act No. 4 of 2015

Lesotho mining industry is currently being guided by the adopted Minerals and Mining Act No. 4 of 2015, further there are multiple laws that regulate and/ or affect the mining industry.

Mineral permit

Generally, a mineral permit, confers onto the holder the following rights:

- The right to mine the minerals to which the permit relates
- The right to dispose of the mineral to which the permit relates; and
- The right to erect such temporary structures, other than residential buildings, as may be necessary for the purpose of mining.

Minerals permits are provided to those who wish to conduct small scale mining operations, over an area not exceeding 100m^2, of any mineral apart from precious stones. Application of the permit is done through the Mining Board by any citizen of Lesotho, and the permit is valid for a year and renewal of permit can only be granted for one year.

- Backfilling – Under Section 7(6) and Section 58 (5) 'Before abandoning any land, all excavations shall be backfilled and made safe.
- Environmental Obligations are covered by Section 58 and include the need to conform with other laws and 'good mining industry practices' relating to the natural environment, pollution and contamination. Under Section 58(5) and Section 7(6) 'during and at the end of operations in any mine, excavation, waste dump or pond, the holder of (a) mineral right shall take such measures as required to maintain and restore the topsoil of affected areas and otherwise to restore the land substantially to the condition in which it was prior to the commencement of the operations.'

Relevance to the Project

All Contractors are obligated by the provisions of this statute to acquire Mineral permit for acquisition of borrow pits and sand mining.

Also, all Contractors will need to liaise with the Community Councils regarding the use of quarry and borrow pit sites. The Client should also form part of the negotiations between the Contractor and Community Councils.

2.1.16 Roads Directorate Act (Act 16 of 2010)

This Act makes provision for the establishment of the Roads Directorate as a body responsible for the planning, development and maintenance of roads as defined in the regulations and carrying out of quality assurance of all roads.

Relevance to the Project

Roads Directorate has to approve the designs and approve the wayleaves along or near national road infrastructure.

2.1.16 Occupational Safety and Health Act, 2024

The Act establishes an occupational, safety and health management system thus, ensures a progressive improvement of safety and health of persons at work, protection of persons, other than persons at work and provision for effective and appropriate compliance and enforcement measures.

Part I – Preliminary under Purpose (2) state that the purpose of the Act is to ensure safe and healthy:

(a) Workplace environment

(b) Working conditions; and

(c) Structures, plant and substance designed for use at work.

Relevance to the Project: The Contractor must produce a Health and Safety Management Plan (HSMP) before commencement of construction for approval by the Project Engineer.

2.1.17 Public Health Order (1970)

It provides for among other things requirements for human dwellings and operating in healthy housing and including issues of sanitation as a measure of disease prevention.

Relevance to the Project: The Act will inform the project during establishment of the camp site for the contractor to ensure that there is good sanitation for the contractor employees.

2.1.18 Communications Act of 2012

The Communications Act of 2012 sought to set out the terms for the regulation (**Table 2**) of the telecommunications, broadcasting and postal sectors.

Table 2 Policy and Regulatory Environment

Regulatory area	Purpose of policy	Outcomes
Lesotho Communications Authority	• Specifies the general duties and powers of the authority and details surrounding the Organisation and operation of the Authority. • Minister shall appoint and may remove the chairman of the	Appointment process and powers bring into question the extent of separation of powers within the regulator

	Board, as well as the CEO, bringing into question the extent of separation of powers within the regulator. • Provisions on the finances of the Authority and liability insurance are included in the Act	
Competition Management	• Provides for competition management regarding the classification of dominant licences, abuse of power, anti-competitive behaviour and competitive safeguards.	LCA has conducted a market review which found dominance 11 of the 14 markets identified, but it did not find abuse of dominance and thus no remedies have been applied. From other evidence gathered for this report a review of the competitiveness of in fixed line wholesale market seem necessary in the light of the prices and failure to offer basic services.
Interconnection	• Agreements involving a dominant player and individualized interconnection agreement clauses are all spelt out. Grounds for rejection of an interconnection agreement include charges that exceed the dominant licensee's cost including an allowance for a	Seamless communication between competing networks

	reasonable rate of return.	
Universal Service Fund	• Rules under which the Fund is to be established, including financing and the operation thereof.	Established in 2009 and successfully implemented.
Broadcasting	• Covers broadcasting licensing including public, private commercial and community broadcasting services. • Provides for the establishment of a Broadcasting Disputes Resolution Panel (BDRP) and a Broadcasting Code of Conduct.	The Licensing regime exists as well as the BDRP (set up in 2013). Broadcasting rules have also been in place since 2004.
Postal Services:	• LCA is authorized to grant licenses for public and commercial postal services, under rules developed by it. Postage rates are regulated according to the act.	Implemented but no new licensees.
Enforcement and Transitional Proceedings:	• LCA is authorized to conduct investigations and initiate enforcement proceedings in the event of it having reason to believe a party has contravened the Act. Penalties are payable by guilty parties	Investigations have taken place in areas relating to the illegal use of spectrum and remedial measures have been taken, including the imposition of penalties. In the area of content broadcasting, enforcement proceedings

		have taken place in response cases broad to the BDRP.

Relevance to the Project: During the project implementation these regulations should be used to guide LECC activities in delivering the project and operating the infrastructure.

2.1.19 Town and Country Planning Act, No. 11 of 1980

This Act controls the types of developments that can be undertaken within certain areas according to the particular zoning assigned to that area. It dictates whether proposed activities are permissible within particular areas, and can include activities that are not planned for the actual operation activities that may occur during construction phase of this project, as well as that which occur off-site; such as areas zoned for disposal of waste.

Relevance to the Project: With the presence of the urban councils as custodians of land in towns and peri-urban areas it is of outmost importance to understand this regulation as the project is going to take place in the urban areas. Therefore, the urban councils should be involved in the progress and technical meetings during the construction phase of the project.

2.2 Relevant National Policies, Plans and Strategies

2.2.1 Environmental Policy, 1998

The **Environmental Policy, 1998** has 14 different objectives covering a wide range of issues focussing on social and economic dimensions of environmental management,

the management and conservation of natural resources, and the promotion of community participation. Those that relate specifically to this project are discussed below:

1. *To secure for all Basotho a high quality of environment to enhance their health and well-being*. Clearly this means that any development which is hazardous to health and wellbeing is not in the long-term interests of the country. On the other hand, this project aims to provide treated bulk water supplies to improve *inter alia* health and well-being.
2. *To raise public awareness and promote understanding of essential causal linkages between development and environment, and to ensure that environmental awareness is treated as an integral part of education at all levels*. This objective goes to the heart of the role that ESIA has to play in development planning.
3. *To encourage and facilitate individual, NGO, community, religious organisations, and business community participation in environmental management*. This supports the need for comprehensive consultation to be carried out with all relevant stakeholders.
4. *To put in place comprehensive environmental regulatory measures to stimulate sustainable economic and social development. Such development will be complemented by social and economic incentives to influence positive behaviour towards environment*. Implementation of the ESMP will help to ensure that the proposed development will be sustainable.
5. *To ensure that the true and total costs of environmental use and abuse are borne by the user, i.e. the 'polluter pays' principle*. All mitigation measures in the ESMP must be costed by the contractor and financial and compliance audits must be conducted on a regular basis to ensure that the required management actions have been taken. Ongoing monitoring will be required to ensure that national and best practice goals and targets are being met.
6. *To empower women to play a key role in natural resource use and management activities*. Women are critical members of society when it comes to consultation, and they will also be key beneficiaries of this project. Awareness raising around

road safety, unsafe sex, HIV/AIDS, water-borne diseases, hygiene and sanitation need to focus on women and children.

7. *To cooperate in good faith with other countries in the Southern Africa Development Community (SADC) region, in Africa, and with international organisations and agencies to achieve optimal use of trans-boundary shared natural resources and effective prevention or abatement of trans-boundary environmental impacts*.

2.2.2 Gender and Development Policy 2003

Gender and Development Policy 2003, (as reviewed in 2016) is an instrument designed to establish and sustain support systems to encourage equal participation of women and girls, and men and boys in development. The policy aims to facilitate regular gender training and awareness creation at all places of work to ensure that planning and managerial procedures, programme design and implementation processes respond to the principles of gender equity and equality.

2.2.3 Lesotho Water and Sanitation Policy (LWSP) (2007)

The Policy aims to promote equity in provision, use, management and access to potable water supply and sanitation services. The policy will inform activities relating to provision of portable and construction water supply during LEMOFI implementation.

2.2.4 Lesotho Electricity Corporation Safety, Health, Environment and Quality (SHEQ) Management System

Guides the formulation of project specific SHEQ Plans by consultants and contractors working in electricity projects. The System will guide the formulation of project specific SHEQ Plans by consultants and contractors working in LEMOFI project during the construction phase since LEMOFI uses LEC infrastructure.

2.2.5 Lesotho Communications Policy 2008

Lesotho Communications Policy (2008) established an updated institutional framework for the integrated regulation of the telecommunications broadcasting and postal sectors. The policy seeks to address the challenges of access to fixed wireless and Internet services in Lesotho.

The aim of the Lesotho Communications Policy of 2008 was to provide the basis for a new Communications Act, (passed in 2012). The 2008 policy also adopts safeguards to prevent anti-competitive practices by entities with significant market power; adopts competitively neutral, transparent and non-discriminatory universal service criteria; makes licensing criteria publicly available; and adopts transparent procedures to facilitate agreements that allow for cost-based interconnection costs.

2.2.6 National HIV and AIDS Strategic Plan

The multi-sectoral **National HIV and AIDS Strategic Plan** for the five-year period from 2011/12 to 2017/18 provides the national response to the HIV and AIDS epidemic in Lesotho and provides interventions around four thematic areas of HIV prevention: treatment care and support, impact [mitigation, response coordination and management. However, there are several key challenges in Lesotho fight against HIV, including difficulties in changing behaviour, the stigma associated with the disease and the number of migrant workers moving in and out of the country.

2.2.7 Lesotho Environmental Impact Assessment Guidelines 2010

Lesotho Environmental Impact Assessment Guidelines of February 2010 make provision for facilitation to participation in and compliance with Lesotho's environmental impact assessment requirements mainly by project developers. They are designed to help to integrate environmental concerns and economic development from the earliest stages of project development as required in Environmental Act 2008. They are applicable to all types of projects, whether initiated by the public sector or the private sector, for which

EIA is or may be required. Sectoral guidelines (specific guidelines for special types of projects or industries such as urban infrastructure, dams, roads, communication or mining) have been complied to support the Department of Environment in their reviewing and decision-making.

2.3 International Obligations

Lesotho is a signatory to several international conventions which have been assimilated into national legislation. The following have relevance to the project:

2.3.1The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989)

One of the underlying principles of the Convention is that "States should take necessary measures to ensure that the management of hazardous wastes and other wastes including their trans-boundary movement and disposal is consistent with the protection of human health and the environment whatever the place of disposal". The Convention places obligations on member States to minimise and control the generation and movement of hazardous wastes between states. It also provides a list of wastes which are subject to trans-boundary movement and classified as hazardous wastes including: waste mineral oils unfit for their originally intended use; waste oils/water, hydrocarbons/water mixtures, emulsions.

Relevance to the project: Any waste oils and other hazardous wastes generated by the Project to be exported to South Africa for disposal or recycling would be subject to the Convention.

2.3.2 Convention on Biological Diversity (1992)

The objectives of this Convention are to conserve biological diversity, the sustainable use of its components and ensure reasonable sharing of the benefits arising out of the

utilisation of genetic resources. The Convention also requires States to develop and maintain necessary legislation for the protection of threatened species and adopt appropriate measures for the recovery and rehabilitation of threatened species.

Relevance to the project: The proposed mitigation measures in the ESIA/ESMP for protected and threatened species should conform to the provisions of this Convention.

2.3.3 Protocol to Prevent Suppression and Punish Trafficking in Persons, Especially Women and Children, 2003

This protocol is intended to prevent and combat human trafficking crime and facilitate international cooperation against it. It emphasizes the need for an appropriate balance between crime control measures and measures to support or protect victims of trafficking.

Relevance to the project: Its importance in the ESMP is to bring awareness to the Contractor that crime described as trafficking are dangerous to a human being especially girls and women.

2.3.4 Revised African Convention on Conservation of Nature and Natural Resources, 2004

This protocol desires the achievement of ecologically rational, economically sound and socially acceptable development interventions.

Relevance to the project: The proposed mitigation measures in the ESMP for protected and threatened species should conform to the provisions of this Convention.

2.3.5 International Labour Organisation Convention, 1998

Sets out basic principles and labour rights at work, based on international best practice.

Relevance to the project: Where there are gaps in the Labour Code this convention will guide the labour issues.

2.3.6 Convention on the Rights of the Child; 1990

Ensure that employment policies include prohibitions on the employment of children under the age of 18.

Relevance to the project: The Convention prohibits the use of Child labour hence there will be no children employed during the construction of the project.

2.3.7 African Development Bank Integrated Safeguards System - 2023

The proposed project is being developed with the support of the African Development Bank. Therefore, all environmental and social assessments carried out under this assignment are in accordance with relevant Environmental and Social Operational Safeguards (OS).

The LEMOFI project has been assigned a **Category 2** by the African Development Bank in line with the guidelines within the Bank's ESAP. The following E&S OSs are triggered:

- **OS 1: Assessment and Management of Environmental and Social Risks and Impacts** – the LEMOFI activities have potential to generate some environmental and social impacts to identified receptors within its area of influence which if not well managed can lead to disruption of ecosystem services for the community.
- **OS 2: Labour and Working Conditions** – during construction general and skilled labourers will be engaged.

- **OS 3: Resources Efficiency and Pollution Prevention and Management** – has been triggered since during construction hazardous materials (e.g. fuels) will be used hence the importance of applying the Mitigation Hierarchy.
- **OS 4: Community Health, Safety, and Security** – the LEMOFI activities occur in towns and villages hence traffic and other hazards are introduced and require mitigation.
- **OS 6: Habitat and Biodiversity Conservation, and Sustainable Management of Living Natural Resources** – even though there will be minimal excavation, rehabilitation and landscaping will be required.
- **OS10: Stakeholder Engagement and Information Disclosure -** LEMOFI recognizes that meaningful stakeholder engagement is essential for responsible infrastructure development. In alignment with AfDB's Operational Safeguard 10, the project has adopted a systematic and inclusive stakeholder engagement process throughout the Environmental and Social Impact Assessment (ESIA) cycle.

2.3.8 International Standards

2.3.8.1 International Finance Corporation (IFC) Performance Standards (2012)

The IFC is a financial services provider which has set out to ensure that their clients act responsibly toward the environment by providing environmental, health and safety guidelines, which their clients must follow and apply before lending of finance, may take place.

- **Performance Standard 1 – Assessment and Management of Environmental and Social Risks and Impacts** establishes the importance of:

(i) Integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects.

(ii) Effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and

(iii) The client's management of environmental and social performance throughout the life of the project.

- **Performance Standard 6 – Biodiversity Conservation** of the IFC reflects the objectives of the Convention on Biological Diversity which seeks to conserve biological diversity and promote use of renewable natural resources in a sustainable manner. The objectives as set out in Performance Standard 6 are:

(i) To protect and conserve biodiversity.

(ii) To maintain the benefits of ecosystem services; and

(iii) To promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities.

- **Performance Standard 2 – Labour and Working Conditions** promotes fair labour and procurement practices, management of influx of people into Project area looking for employment and management of workforce health and safety.

- **Performance Standard 4 – Community Health, Safety and Security** promotes structural safety of the Project infrastructure, Fire Safety, Traffic Safety, Transport of Hazardous Materials. Disease Prevention and Emergency Preparedness and Response.

- **Performance Standard 8 – Cultural Heritage** promotes management of cultural heritage aspects.

2.3.8.2 FIDIC HIV/ AIDS Guidelines 2021

FIDIC Policy on HIV/AIDS in the construction sector recommends the following at construction sites:

- Raising awareness about HIV/AIDS.

- Increased understanding about the disease, through dissemination of information and by generating discussion.
- Ensuring that construction workers have access to condoms.
- HIV counselling, testing and referral services.
- Sexually Transmitted Infection (STI) diagnosis and treatment; and
- Monitoring of outcomes.

These strategies are designed to build an HIV resilient workforce as well as HIV resilient communities associated with the communities that are able to draw on their own capacity to prevent further transmission of HIV, minimize the impact of the HIV/AIDS epidemic, and talk about HIV/AIDS. FIDIC also recommends provision of clauses addressing HIV/AIDS in construction contracts. The communities affected by the project are to be included in the HIV and AIDS awareness, counselling and all related activities.

In addition to the policy provision the Department of Environment facilitated a UN sponsored workshop of environmentalists on mainstreaming HIV/AIDS and gender in the preparation of EIAs on 31st October to 2nd November 2012. This initiative was in recognition by the GOL that HIV/AIDS is a pandemic and that project construction sites are vulnerable locations. It was also conducted in observance of the Maseru Declaration & Commitment to AIDS in the SADC region (2003). The workshop's resolution was that HIV/AIDS must be incorporated in the future preparation of EIAs.

2.3.8.3 Environmental, Health and Safety Guidelines (EHS Guidelines) 2007

The EHS Guidelines are technical reference documents with general and industry-specific examples of good international industry practice. A set of eight Guidance Notes, corresponding to each Performance Standard, and an additional Interpretation Note on Financial Intermediaries offer guidance on the requirements contained in the Performance Standards, including reference materials, and on good sustainability practices to help clients improve project performance.

2.3.9 Potential Permits Required

The permits that may be required for construction and operation of this project are summarised in **Table 3**.

Table 3 Required Environmental Permits and/or Licenses

Act/ Regulations	Permit/ Licence	Implementing agent	Relevance to the project
Section 47 of the Environment Act	Noise permit	Department of Environment	A noise permit may be required if the construction noise levels (i.e., blasting activities) are likely to be in excess of the noise emission standards.
Section 76 of the Environment Act	Waste license	Department of Environment	The Contractor may require a license to store, handle and transport hazardous waste.
Water Act, No. 15 of 2008	Water Use Permits	Department of Water Affairs	The activities that are applicable to this project require a Water Use Permit include: taking water from a watercourse storing water.
Sections 65–67 of the Environment Act	Consent	Department of Environment	Will be relevant to the removal of endangered or protected plants if any are found on sites to be cleared for construction.
National Heritage Resources Act, 2011	Consent	Ministry of Tourism, Environment and Culture	Permission / consent is required for any destruction or damage to any historical monuments.
Roads Act No. 24 of 1969	Permit Wayleave	Ministry of Public Works and Transport	A permit/wayleave will be required where the operational servitude of the fibre will be constructed along the road servitude

Act/ Regulations	Permit/ Licence	Implementing agent	Relevance to the project
			as well as construction servitude overlapping with road servitude.

2.4 Administrative framework for EIA in Lesotho

The legislative requirements for an Environmental Study conducted according to Section 21 of the Environmental Act of 2008 are provided in **Table 4**, with reference to the relevant section of this report.

Table 4 Summary of how this report satisfies the Legislative requirements of Section 21 Environmental Act 2008

Subsection of the Environmental Act (2008	Description	Reference in report
5(a)	A detailed description of the proposed project or activity and of activities it is likely to generate	Chapter 2
5(b)	A description of the potentially affected environment including specific information necessary for identifying and assessing the environmental effects of the proposed project or activity	Chapter 5
5(c)	A description of the technology, method and processes that shall be used in the implementation of the project or activities and the main alternatives and reasons for declining to use those alternatives	Chapter 3 Chapter 8

Subsection of the Environmental Act (2008	Description	Reference in report
5(e)	Environmental impacts of the proposed activity or project including the direct, indirect, cumulative, short term or long-term effects on the environment of the project	Chapter 9
5(f)	An identification and description of measures proposed for eliminating, minimising or mitigating the anticipated adverse effects of the project or activity on the environment	Chapter 10
5(h)	A brief description of how the information provided for in this section has been generated	Chapter 3
5(i)	An indication of gaps in knowledge and uncertainties which were encountered in completing the required information	Chapter 3
5(j)	The social, economic and cultural effects the project is likely to have on people and society	Chapter 9
5(k)	The irreversible and irretrievable commitment of resources which will be involved by the project if the implemented in the manner proposed by the developer	Chapter 8
5(l)	A comprehensive mitigation plan	Chapter 10
5(m)	any other matters that the Minister may prescribe	Chapter 5, 6 & 7

2.5 Institutional Arrangements

The proposed LEMOFI project will require coordination involving a number of national lead and regulatory agencies assisted by the district level sectoral Departments. The

Table 5 below presents a profile of relevant institutions for the implementation of the LEMOFI.

Table 5 Relevant Institutions for the Proposed LEMOFI Project

No.	Institution	Mandate
National Level		
1.	Ministry of Energy (MOE)	Implementing Agency and responsible for overall coordination and policy guidance
2.	Ministry of Environment and Forestry (MOEF) – Department of Environment (DOE)	Responsible for coordination, monitoring and supervision of environmental management activities. Issuance of ESIA guidelines and regulations. Reviews and approves ESIAs and issue Environmental Licence or Record of Decision.
3.	Ministry of Health (MOH)	Responsible for Health standards and Hygiene
4.	Lesotho Communication Authority (LCA)	Regulator of Telecommunication
5.	Lesotho Electricity Company (LEC)	Custodian of the powerlines used for LEMOFI
6.	Lesotho Electricity Company Communication (LECC)	LEMOFI Project Implementing Unit (PIU)
District Level		
1.	District Administrator (DA)	Administrative decentralisation and integration at the district level is coordinated by the District Administrator who represents the interests of Central Government in the District

2.	District Council Secretary (DCS)	Coordinating and monitoring all developments projects within the district
Community Level		
1.	Community Councils (CC)	Responsible for community organization and mobilization at village level
2.	Chiefs	Responsible for community organization and mobilization at village level

2.6 Gap Analysis

Table 6 African Development Bank Safeguards, Legal and thrir identified Gaps

Safeguard	Area of Focus	National Legal Provision	AfDB OS Requirement	Identified Gap	Recommended Action
OS1: Environmental and Social Assessment	Integrated environmental & social assessment	Environmental Act No. 10 of 2008 mandates EIA but with limited social impact emphasis	Requires integrated ESIA with equal weight on social, environmental, and climate risk considerations	Social impacts (e.g., vulnerable groups, gender, informal sector) are not deeply assessed under national EIA system	Ensure ESIA includes full social analysis, stakeholder mapping, and socio-economic baseline, per AfDB template
OS2: Involuntary Resettlement, Land Acquisition	Physical/economic displacement	Land Act (2010) allows compensation but lacks livelihood restoration requirements	Requires livelihood restoration, replacement cost compensation, and resettlement planning	National law does not mandate Livelihood Restoration Plans (LRPs)	Prepare a Resettlement Action Plan (RAP) or Livelihood Restoration Plan if economic displacement is identified

OS3: Biodiversity and Ecosystem Services	Habitat protection, species conservation	Environment Act requires protection of listed species and EIA for sensitive areas	Emphasizes critical habitat assessment, ecosystem services, and no-net-loss objectives	Ecosystem services rarely evaluated; limited guidance on cumulative biodiversity impacts	Include ecosystem services and biodiversity impact analysis, especially in semi-natural urban fringes
OS4: Community Health, Safety and Security	Public health & safety in development	Occupational safety covered under Occupational Safety and Health Act 2024; community safety not explicit	Includes risks from infrastructure works (traffic, vibration, noise), labour influx, and emergency preparedness	National law does not fully cover community-level health & safety risks from infrastructure	Develop and implement Community Health, Safety, and Security Plan, including safety signage, awareness campaigns
OS5: Labour Conditions	Working conditions, grievance mechanisms	Labour Act 2024 defines labour rights; limited guidance on	Requires grievance redress, fair treatment, OHS, and oversight of	No explicit mandate for worker grievance systems or	Include Labour Management Procedures (LMP) with GRM and

		contractors/subcontractors	labour standards along supply chain	contractor compliance oversight	contractor obligations in ESMP
OS10: Stakeholder Engagement & Information Disclosure	Public participation in EIA	Public review of ESIA is required under the Environment Act	Requires early, ongoing, inclusive engagement, and public disclosure prior to project appraisal	Stakeholder engagement often limited to one-off consultations during EIA	Develop and implement Stakeholder Engagement Plan (SEP) with continuous engagement strategy and public disclosure tracking

3.0 ESIA METHODOLOGY

This section describes the methods that have been used to study the physical, biological and socio-economic baseline conditions and further assess and predict the significance of impacts resulting from the proposed LEMOFI Project.

3.1 Overall Process

The Environmental and Social Impact Assessment (ESIA) for the Lesotho Metropolitan Fiber Infrastructure Expansion Project (LEMOFI) was undertaken in accordance with both national environmental legislation and relevant international environmental and social safeguards frameworks.

At the national level, the ESIA process strictly adhered to the provisions of the Lesotho Environment Act No. 10 of 2008, which mandates that all major infrastructure projects undergo environmental screening and assessment prior to implementation. This Act outlines requirements for the identification, prediction, and evaluation of potential environmental and social impacts, and mandates stakeholder consultations and the development of mitigation measures through Environmental and Social Management Plans (ESMPs).

In addition to complying with national legislation, the ESIA process was guided by international best practices, particularly the Environmental and Social Safeguards Standards of the African Development Bank (AfDB), as the LEMOFI project is anticipated to receive financing and/or technical support from the AfDB and other development partners. The ESIA thus aligned with AfDB's Integrated Safeguards System (ISS), including its five operational safeguards covering environmental and social assessment, labor and working conditions, pollution prevention and control, biodiversity, and involuntary resettlement.

The ESIA applied standard and accepted methodologies to gather and document baseline environmental and social conditions. This included: summary

- Literature Review: Analysis of existing documents including the Design Review Report, Lesotho Bureau of Statistics (BoS) Statistical Abstracts, the National Strategic Development Plan II (NSDP II), and scientific literature covering local fauna, flora, topography, hydrology, and geology.
- Field Surveys and Observations: Site visits and environmental field assessments were conducted to gather primary data on biophysical and socio-economic conditions in the project-affected areas.
- Stakeholder Engagement: Public consultations were undertaken in line with both the Environmental Act (2008) and AfDB standards, ensuring inclusive participation of local communities, government entities, private sector stakeholders, and civil society. This ensured transparency, the identification of stakeholder concerns, and the incorporation of community input into the project design and mitigation planning.
- Impact Assessment and Mitigation Planning: Environmental and social risks were identified, categorized, and assessed in accordance with AfDB's risk classification system. Mitigation measures and monitoring plans were developed to address potential adverse impacts.

The ESIA thus provides a comprehensive framework to ensure the environmental and social sustainability of the LEMOFI project, in full compliance with the legal and policy framework of Lesotho, while also meeting the expectations of international development partners.

3.1.2 Environmental Management Systems

While the LEMOFI project does not require formal ISO 14001 certification, adopting the framework reinforces the project's commitment to environmental sustainability, regulatory compliance, and responsible infrastructure development.

The Environmental and Social Management Plan (ESMP) developed as part of the ESIA reflects the core elements of ISO 14001, including:

- Environmental policy commitments;
- Impact mitigation measures;
- Monitoring and evaluation procedures;
- Roles and responsibilities for implementation;
- Reporting and documentation protocols

3.2 Terms of Reference

The Terms of Reference call for the Consultant to carry out the development of **Environmental and Social Impact Assessment (ESIA) Report and Environmental and Social Management Plan** (**ESMP**) to cover the follow aspects:

a. Impact Identification - A comprehensive assessment of potential environmental and social impacts, including effects on communities, ecosystems, and cultural heritage, as well as potential benefits of expanding fibre distribution networks.

b. Stakeholder Engagement - A summary of feedback from stakeholders, including government entities, local communities, businesses, and civil society organizations, highlighting key social and environmental concerns.

c. Mitigation Strategies - Proposed measures to address identified impacts and ensure regulatory compliance, including environmental protections, social programs, and community engagement initiatives.

3.3 Impact Assessment Methodology

The focus is to identify and evaluate the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

- **Direct**: Direct impacts occur through direct interaction of an activity with an environmental, social, or economic component.
- **Indirect**: Indirect impacts on the environment are these which are not a direct result of the project, often produced away from or as a result of a complex impact pathway. The indirect impacts are also known as secondary or even third level impacts.
- **Cumulative**: Cumulative impact consists of an impact that is created as a result of the combination of the project evaluated in the ESIA together with other projects causing related impacts. These impacts occur when the incremental impact of the project is combined with the cumulative effects of other past, present and reasonably foreseeable future projects.

Impact Qualification

The identified impacts of the proposed project will be qualified using four criteria as follows:

- Positive or negative
- Short-term – The impact will continue for between 1 month to 2 years
- Long-term – The impact will continue for 3 -15 years
- Reversible or irreversible
- Direct or indirect

Impact Rating

The qualification scale of 0, 1, 3, and 5 will be used to evaluate impacts in order to determine their significance. The criterial and weighing scale used for evaluating significance are:

- Legal/regulatory requirements (L)

- Risk factor (R)
- Frequency of occurrence of impact (F)
- Importance of impact on an affected environmental component (I)
- Public perception/interest (P)

3.3.1 Social Impact Assessment Model

The ***International Association for Impact Assessment*** (2003) states that Social Impact Assessment includes the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by these interventions. Its primary purpose is to bring about a more sustainable and equitable biophysical and human environment.

For the purpose of this ESIA, the following Social Impact Assessment categories were investigated:

- Health and social well-being
- Quality of the living environment
- Economic impacts and material well-being
- Cultural impacts
- Family and community impacts; and
- Institutional, legal, political and equity impacts.

Relevant criteria for selecting significant social impacts included the following:

- Probability of the event occurring
- Number of people that will be affected
- Duration of the impact
- Value of the benefits or costs to the impacted group
- Extent to which identified social impacts are reversible or can be mitigated

- Likelihood that an identified impact will lead to secondary or cumulative impacts
- Relevance for present and future policy decisions
- Uncertainty over possible effects; and
- Presence or absence of controversy over the issue.

3.3.2 Social Research Design

Social research was conducted as an essential part of the social impact assessment. The research had the following purposes:

- To establish a baseline description for the project area and the broader area
- To explore attitudes of the population in the project area about the Project
- To explore needs and challenges the area in terms of social issues
- To gain an understanding of the social landscape
- To identify and gain an understanding of potential social impacts and ways to manage and mitigate these potential impacts.

3.4 Impact Mitigation

Mitigation Approach

The Mitigation Hierarchy (**Figure 1**) has been applied when proposing prevention, compensation and mitigation measures within the accompanying ESMP:

- **Avoid / Prevent:** Avoidance or prevention refers to the consideration of options in project location, siting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services, and people. This is referred to as 'the best option', but it is acknowledged that avoidance or prevention is not always possible.

- **Minimise:** Minimisation refers to the consideration of alternatives in the project location, siting, scale, layout, technology and phasing that would minimise impacts on biodiversity, ecosystem services and people. As defined in IFC PS1; "acceptable options to minimise will vary and include abate, rectify, repair, and/or restore impacts, as appropriate".

- **Rehabilitate / Restore:** Rehabilitation refers to the consideration of the rehabilitation of areas where impacts are unavoidable, and measures are provided to return impacted areas to a near-natural state or an agreed land use.

- **Offset:** Offsetting refers to the consideration of measures over and above rehabilitation to compensate for the residual negative effects on biodiversity ecosystem services and people, after every effort has been made to minimise and then rehabilitate impacts.

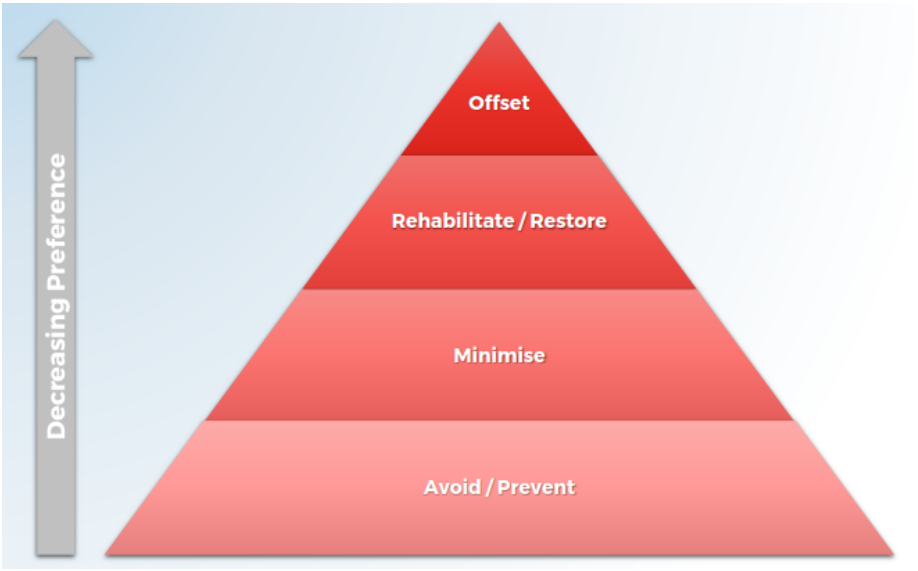


***Figure 1* Impact Assessment Mitigation Hierarchy**

3.5 Public Consultation

The Environmental Act (2008) of Lesotho views the management of the environment as a collective responsibility and therefore requires that all interested parties and stakeholders be consulted. Thus, public consultation is a key legal requirement in the conduct of ESIA's and project briefs in Lesotho. The main purpose is to ensure that as many people as possible who are concerned with or affected by a proposed development are consulted, and their views are recorded. Further, it is important to ensure that, wherever possible, these views are considered in the final design and operation procedures of the project.

The public consultation covered a range of study components. However, the key objectives of the consultation process were:

- Informing stakeholders of the project.
- Ascertaining issues of concern, according to those consulted, regarding the proposed project (including their suggestions on how to mitigate potential negative impacts).
- Identifying potential negative and positive impacts, which may result from the proposed project.
- Identifying sites of cultural and historical significance to the local community; and
- Identifying requirements/expectations from government departments/ministries regarding the implementation of the project.

3.5.1 Sensitisation Consultation and Stakeholder Identification

Introductory Letters were provided by the Principal Secretary, Ministry of Energy for use during stakeholders' engagements for sensitise of the local authorities. This included the briefing of the District Administration Offices, District Council Offices, Principal Chief's offices and Area Chiefs on the proposed project. Consultation mechanisms included: telephone discussions and office meetings. Also, community gatherings were held in Maseru, Mokhotlong, Thaba Tseka, Mafeteng, Mohale's Hoek, Leribe and Butha Buthe.

The stakeholders' engagements conducted from 16th December 2024 to 20th January 2025

3.6 Environmental and Social Management Plan

The purpose of the Environmental and Social Management Plan (ESMP) is to provide a framework within which the environmental and social risks and liabilities identified during the ESIA process are managed for the lifecycle of the Project. The plan also outlines implementation and monitoring costs associated with the activities planned and an audit plan to measure compliance.

During implementation, the Contractor is responsible to ensure that all the requirements stipulated in the ESMP are written into the specifications for contractor(s). The ESMP will therefore be used by the appointed contractor as a legal guideline for environmental best practice and will form part of the contract. The ESMP is detailed in a separate document**.**

3.7 Environmental and Social Impact Assessment Report

The Environmental and Social Impact Assessment (ESIA) report is one of the last steps in the process. The report is a compilation of the all the assessments (including specialists' findings), consultations and recommendations. The ESIA needs to include enough information about the impacts and risk of the project on the biophysical and social environment in order to evaluate the relative merits of the proposed development.

Based on the information provided in the ESIA report, the Department of Environment (DoE) will issue a record of decision (of approval or rejection) which will determine whether the project can proceed to the construction phase or not.

3.8 ESIA Phase Public Disclosure

Under the Lesotho Environment Act No. 10 of 2008, disclosure is a mandatory component of the Environmental and Social Impact Assessment (ESIA) process. The Act requires that ESIA reports for proposed projects be made available to the public and relevant stakeholders during the review process to ensure public participation and transparency and to allow affected communities to understand potential project impacts of the proposed project. This will help provide an opportunity for feedback and concerns to be incorporated into final project planning. This inclusive decision-making is crucial in strethining environmental governance.

Specifically, Section 26 of the Act mandates the submission and public review of the ESIA before approval is granted by the Department of Environment

3.8.1 AfDB Integrated Safeguards System (ISS) Requirements

According to the AfDB Integrated Safeguards System (ISS), particularly Operational Safeguard 1: Environmental and Social Assessment, disclosure is not just a procedural step—it is a fundamental right of stakeholders. The ISS requires that The ESIA and its associated Environmental and Social Management Plan (ESMP) be disclosed in a timely, accessible, and understandable manner. Disclosure must occur prior to appraisal and project approval, ensuring that stakeholder views can influence project design and mitigation strategies

Documents must be made available in Sesotho language and in locations accessible to project-affected persons. A summary of stakeholder feedback and how it influenced the final ESIA must be included in the report.

Public consultation is to continue throughout the ESIA process to ensure that:

- Legislative requirements and international operational policy requirements are met
- Stakeholder concerns are addressed in the assessment

- Inform local communities about potential impacts; and
- Receive verification from communities on suggested mitigation measures.

Once, the ESIA has been completed there will be disclosed through public announcements in the newspapers and radio stations. The general public will access the ESIA Report on the LECC and AfDB websites.

3.9 Limitations

Construction Camps and Laydown Areas

Information on location and size of construction camps as well as laydown areas was not available to properly assess the impacts.

Number of Labourers to be Employed

The number of labours to be employed was not clear; whether they will be provided with accommodation or not. Hence impacts of accommodation camps has considered worst case scenario.

Lack of Primary Social data for Project Specific Areas

Little primary social data for the specific project areas is available and, in few cases, where secondary data was found it was outdated. The only available census data was 2015 hence was deemed appropriate for the socio-economic baseline.

3.10 Assumptions

There are specific activities associated with the LEMOFI for which there is simply not enough information available at present to properly assess the impacts hence worst-case scenarios have been predicted.

a) Locality of laydown areas – the number and locality of the laydown areas associated with the construction phase of the LEMOFI project is not known at this

time. It is anticipated that a relatively small laydown area will be constructed within the already existing Electricity Substations where feasible. The bulk of such materials will most likely be stored at the contractor's central storage yard.

4.0 ANALYSIS OF ALTERNATIVES

Lesotho's development efforts are currently constrained by limited telecommunications coverage, aging electricity infrastructure, and inadequate digital connectivity in rural and peri-urban areas. These challenges have hindered access to essential services such as healthcare, education, public administration, and economic participation, especially for communities located in remote regions. Existing infrastructure lacks the capacity to meet rising demand, and many regions remain unconnected to modern networks that support e-governance, smart utilities, and inclusive digital services.

The Lesotho Electricity and Optical Fibre Infrastructure (LEMOFI) Project is proposed to address these gaps by expanding the national backbone for electricity distribution and broadband connectivity. By integrating fibre optic cables with electricity infrastructure, the project aims to deliver reliable and affordable communication and energy services to both urban and rural populations.

Key anticipated benefits include:

- Enhanced access to digital services for schools, health centres, and government offices.
- Affordable data prices for end-users.
- Support for start-up Network Service Providers and Unified Licensees.
- Job creation for local communities during implementation.
- Improved service delivery and smart monitoring for utilities like LEC.
- Support for national broadcasting and digital migration efforts.

However, given that the proposed infrastructure will traverse sensitive ecological zones. Careful consideration of environmental and social impact alternatives is necessary. The following section explores different development scenarios and assesses their implications, ensuring the LEMOFI Project is both impactful and sustainable.

As part of the planning process, the analysis of project alternatives is important for the resource's allocation and sustainability of the project. This chapter describes alternatives that were examined in the course of developing the proposed project and identifies other alternatives, which would achieve the same objectives, including the "without project" option.

4.1 Alternatives to the Project Design

4.1.1Recommendation ITU-T L.151 Installation of Optical Ground Wire Cable OPGW

Recommendation ITU-T L.151 refers to the installation of optical fibre ground wire cable. It deals with the factors that should be considered in determining the characteristics of this type of cable, the apparatus that should be used, the precautions that should be taken in handling the reels, and the method that should be used to string the cable and joint it. OPGW Recommendation L.151 has been updated in 2020 to align with IEC OPGW activities - [IEC 60794-4-10] IEC 60794-4-10:2014 Optical fibre cables – Part 4-10: Family specification – Optical ground wires (OPGW) along electrical power lines. LEMOFI network must be fully compliant with L.151 and IEC 60794-4-10] IEC 60794-4-10:2014 Optical fibre cables – Part 4-10.

4.1.2 Recommendation ITU-T L.26 Optical Fibre Cables for Aerial Applications

Recommendation ITU-T L.26 was last updated in 2015 and describes characteristics, construction and test methods of optical fibre cables for aerial application (including lashed cables) but does not apply to optical ground wire (OPGW) cables or metal armour self-supporting (MASS) cables. First, the characteristics affecting the satisfactory performance of optical fibre cables are described. Then, the methods of examining whether the cables have these required characteristics are described. The conditions required may differ according to the installation environment. Therefore, detailed

conditions of experiments need to be agreed upon between a user and a supplier on the basis of the environment where the cable is used. LEMOFI network must be fully compliant with L.26.

4.1.3 Optical Fibres, Cables and Passive Components and ITU-T Recommendations

LEMOFI Cable design should be determined to suit the LEMOFI OPGW/ADSS FTTx network architecture adopted.

Cables as described in [ITU-T L.100] to [ITU-T L.102] and [ITU-T L.107] to [ITU-T L.111] could be used for outside plant (OSP) cabling in the feeder and distribution network; cables as described in [ITU-T L.105] could be used for drop network; cable as described in [ITU-T L.111] could be used for home/building network; cables as described in [ITU-T L.103] and [ITU-T L.104] could be used as jumpers for short distance connection between passive components.

Optical fibre connectors as described in [ITU-T L.402] and [ITU-T L.404] could be used for termination of user cables in fibre to the x (FTTx) and similar applications. Passive node hardware and housings, with fibre organizers / fibre management systems, are used to protect and manage fibre joints/connections and passive components.

Sealed closures for outdoor environments should comply with [ITU-T L.201]; optical distribution frames for CO environments should comply with [ITU-T L.202]; outdoor optical cross-connect cabinets should comply with [ITU-T L.206]; fibre distribution boxes should comply with [ITU-T L.208]; housing to keep both active and passive elements in a single box should comply with [ITU-T L.209]; optical wall outlets and extender boxes used in the users' premise should comply with [ITU-T L.210]. Other passive optical plant hardware and housings should have specific environmental constraints, see [ITU-T L.200].

A line diagram of the optical fibres, cables and passive components along with their relevant ITU-T Recommendations is shown in **Figure 2**.

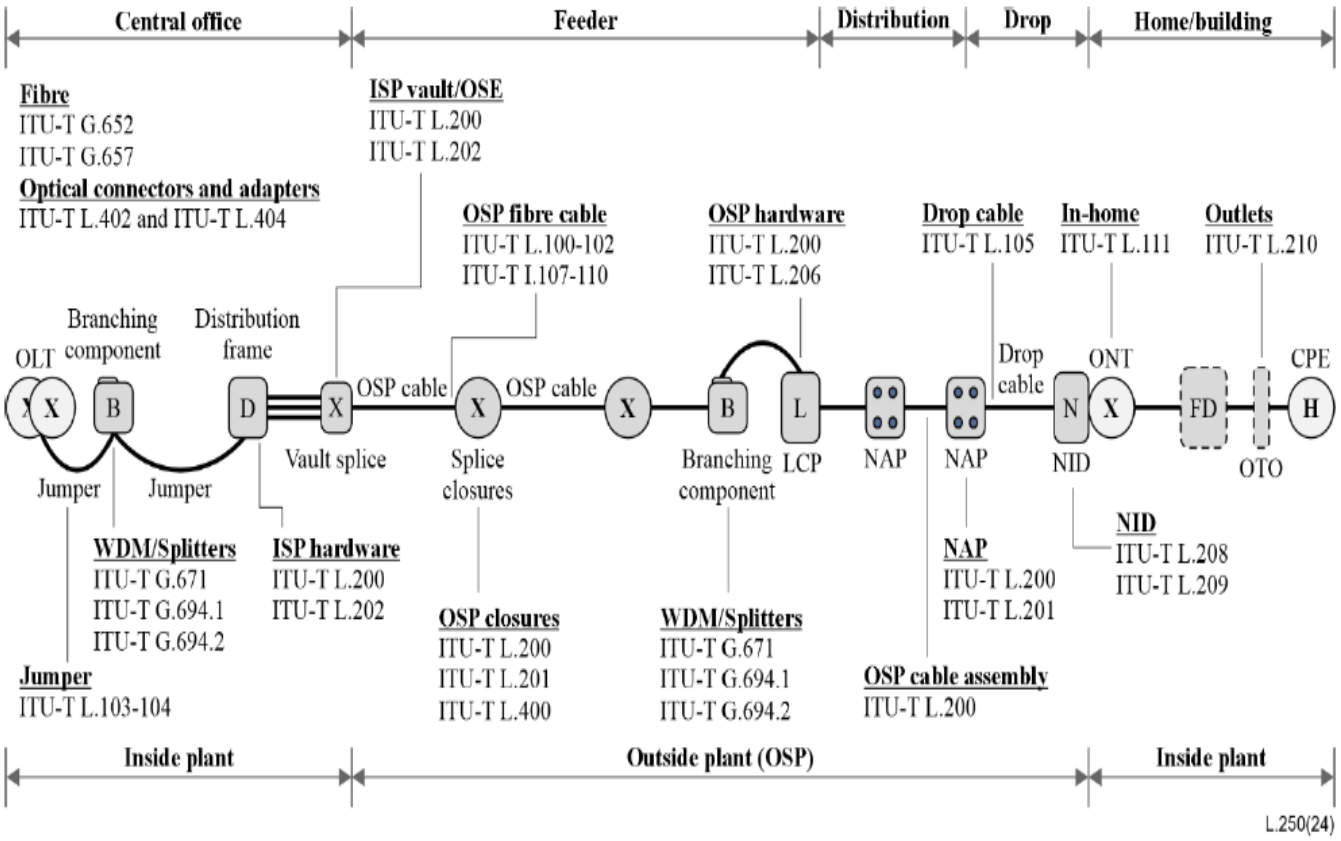


Figure 2 A line diagram of the optical fibres, cables and passive components

4.1.4 LEMOFI Network Compliant with ITU-T G.984.4 G-PON: ONT Management and Control Interface Specification OMCI

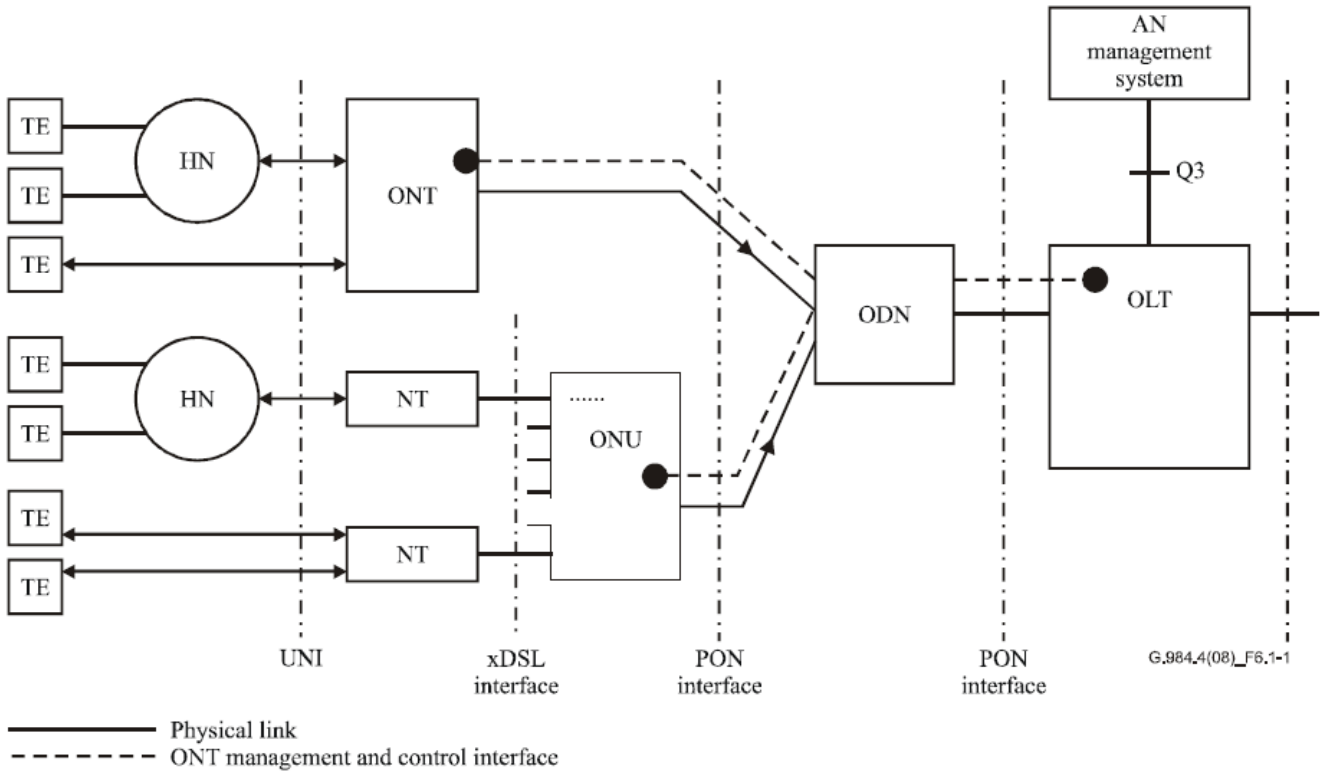


Figure 3 Recommendation ITU-T G.984.4 Gigabit-capable Passive Optical Networks (G-PON): ONT management and control interface specification – Reference Model

LECC LEMOFI must be fully compliant with G.984.4 where the Optical network termination Management and Control Interface OMCI specification addresses the ONT configuration management, fault management and performance management for the LEMOFI G-PON system operation. The focus of this OMCI specification is on Fibre to the home (FTTH) and Fibre to the business (FTTBusiness) ONTs; however, support for optical network units (ONUs) is addressed as well. This Recommendation defines a protocol necessary to support the capabilities identified for these ONTs. It also allows optional components and future extensions – see https://www.itu.int/rec/T-REC-G.984.4/en

4.1.5 LEMOFI Management Layer Points of Interconnect National and International Interconnect

LEMOFI Points of interconnect are at internet exchange points (Lesotho Internet Exchange Point locally) where most of local ISPs are hosted.

With the proposed deployment of nationwide LEMOFI ring and distribution networks, LEC substations and LEC Offices will be interconnect points – LCA, LECC New Europa, House No. 286, LEC Mabote Transmission and Distribution Substation.

4.2 Environmental and Social Alternatives

The below alternatives were concindered in relation to the social footprint:

Full Greenfield Development refers to the construction of entirely new infrastructure—such as electricity lines, substations, or related facilities—on previously undeveloped land where no existing utility corridors (like roads, pipelines, or power lines) are currently present. Greenfield literally means starting from "green fields"—natural, untouched land—without the constraints or benefits of existing infrastructure

Development via Existing Utility Corridors refers to constructing or upgrading infrastructure (e.g. electricity lines, substations) along routes that are already used for public or utility purposes. These corridors have already been disturbed or developed, which minimizes the need for new land acquisition and helps reduce environmental and social impacts.

Hybrid Development, also called Selective Greenfield + Existing Corridors refers to a combined approach where Most of the infrastructure (like transmission lines or substations) is built along existing utility corridors to minimize disruption. New development (Greenfield) is selectively applied only in underserved or critical areas where no existing infrastructure exists but service is urgently needed (e.g. remote schools, health centers, or rural communities).

Table 7 Below illustrates the implications and recommendations of each model:

Alternative	Implications	Social Footprint	Conclusion
Alternative B: Full Greenfield Development	High displacement risk (resettlement, land acquisition) - Livelihood disruption due to loss of agricultural land - Cultural disruption (sacred sites, cemeteries) - High potential for community resistance and project delays	**High negative impact** - Disruption of land rights and social fabric - Major instability without strong compensation and resettlement measures	**Not recommended** High social cost unless unavoidable and rigorously managed with safeguards
Alternative C: Development via Existing Utility Corridors	Minimal land acquisition required - Lower risk of displacement - Higher community acceptance - Accessible local employment - Improved access to rural services	**Significantly positive** - Preserves social structures - Reduces potential for conflict	**Highly recommended** Low social risk, strong positive impact—ideal for community-sensitive projects
Alternative D: Hybrid Development (Selective Greenfield + Existing Corridors)	Balanced use of existing and new routes - Moderate land acquisition, with community consultation - Local jobs and skills development - Supports vulnerable groups - Requires strong stakeholder engagement to avoid social exclusion	**Mostly positive** - Minimizes disruption - Enables equitable, targeted benefits	**Best option** Recommended with Social Management Plan and community benefit programs

Alternative D (Hybrid Development) is recommended for its balanced social impact. It aligns national development with community protection, promotes inclusive economic participation, and minimizes harmful disruptions. But it should be taken into concideration that this model should be supported by a robust Social Management Plan (SMP), Livelihood Restoration Plan (LRP) for new development areas, and Stakeholder Engagement Plan (SEP) to ensure transparency and benefit-sharing.

4.2.1 Recruitment of Labour

The Kingdom of Lesotho Labour Act 2024 stipulates that where local expertise exists, it should be utilized and sourcing out of any expertise should be based on non-availability locally. Possible ways of recruiting workforce are outlined in **Table 8** below.

Table 8 Altrnatives for Recruiting Workers

OPTIONS	COMMENTS
1. *Sourcing unskilled labour from within the surrounding communities*	***Positive aspects:*** • This option helps bring down accommodation costs that the Contractor would otherwise have to incur as labourers would continue living in their homes and not have to rent or squat for accommodation. • The rationale behind this option is that sourcing of labour from within the surrounding communities helps minimize otherwise possible social disruptions caused by the inflow of jobseekers. • Skill retention within the local communities
	Negative aspects: • Basotho from other parts of the country may complain that they have not been fairly treated.
2. *Employing Basotho irrespective of their district of origin*	***Positive aspects:*** • This would comply completely with the Labour Act 2024.
	Negative aspects: • In this option, people are considered for employment irrespective of where they come from. Therefore, possibility of influx of people into the area depending on where the hiring takes place becomes an anticipated problem. This can lead to temporary overcrowding and possibly squatter camps, accompanied by crime and the spread of disease, particularly HIV/AIDS.
3. *Employing a mixture of locals and expatriates*	***Positive aspects:*** • This option recognizes that all expertise required by the contractor will not necessarily be available within the country. Therefore, sourcing of skills not available locally then becomes a consideration.
	Negative aspects:

	• Importation of skills tends to impact on the socio-cultural norms of the host community and can also be disruptive because of unorthodox sexual activities, which can promote prostitution and associated social challenges. • No skill retention by local communities.
Recommendation: *Option 1 seems to be the better alternative, as implications of imported labour outlined above would be avoided thus averting associated social problems. Option 3 becomes appropriate for acquiring technical skills that are not available locally. Hence, a mixture of Option 1 and 3 can be used during the implementation of this Project.*	

4.2.2 Solid Waste Management

Options for the management of solid waste are analysed below in **Table 9** below:

Table 9 Possible Options for Solid Waste Management

OPTIONS	COMMENTS
1. *Burning of litter on site*	***Positive aspects:*** • This does not have serious financial burdens on the contractor.
	Negative aspects*:* • This option can increase the chances of fire hazards. • Some of the litter like bottles and tins still need to be transported to a dumping site since they cannot easily be decomposed by fire. • Emission of gases that contribute to respiratory problems and air pollution. • Residual ash still needs to be disposed-off.
2. *Refuse collection by the municipal authority/local companies*	***Positive aspects:*** •This option is regarded as convenient because the contractor will not have to deal with the time-consuming waste disposal activities.
	Negative aspects: •The Contractor may have to make their own arrangements to transport the waste hence, this comes at a cost.
	Positive aspects:

3. *Recycling of some of the waste material*	•Some of the waste like plastics, bottles or tins can be recycled as income generating activity. However, this would require communities to be mobilized.
	Negative aspects: • This option is time consuming as it requires separation of waste into recyclable, reusable and non-recyclable. However, individuals can be encouraged to sort the waste before disposing of it. • It also requires additional containers (and thus increases the initial cost for the Contractor) for segregation of the different recyclable waste streams.
4. *Existing Waste Disposal Site*	***Positive aspects:*** • The disposal site would be more convenient for the Contractor in terms of time and costs spent on the waste transportation.
	Negative aspects: • The Contractor would have to set aside funds for management of the disposal facility to assist the community councils with better management options. • This will require management and monitoring from the Contractor.
Recommendation: *Option 2 and 3 seems to be the practical options that can be used by the Contractor. However, where disposal is necessary Option 4 is also viable. Therefore, the Contractor must consider Options 1and 2 before considering 4.*	

Based on the assessment above, burning or burying of litter should be prohibited on site and arrangements be made for transporting such waste.

4.2.3 Ablution facilities

In any project, sanitation facilities are necessary to protect the surrounding environment from pollution and to improve public health. Therefore, the Contractor will ensure that the workforce make use of the toilets provided. During the full-scale production, sewage management could be done in a number of ways. Some of the options considered here are outlined in **Table 10**.

Table 10 Possible Options for Ablution Facilities

OPTION	COMMENTS
1. *Construction of water-borne toilets*	***Positive aspects:*** • The first option could be construction of toilets which might not be cost effective as in this case since all project areas are not yet reticulated with water-borne sewerage system/lines.
	Negative aspects: • The other option could be provision of a septic tank with a water treatment system.
2. *Chemical Toilets*	***Positive aspects:*** • Chemical toilets collect human excreta in a holding tank and uses chemicals to minimize odours. They do not require a connection to a water supply and are used in a variety of situation • Though more expensive than a standard permanent outdoor latrine, portable toilets have several significant benefits mostly related to their portability; as they are self-contained, they can be placed almost anywhere. Portable toilets can be hauled in the back of vehicles and some corporations manufacture special trucks for this purpose.
	Negative aspects: • Because portable toilets are not connected to plumbed network, they keep the waste inside the reservoir; this can lead to a sewage smell if the portable toilet is not cleaned properly or is overused. They may also be seen as an eyesore in most communities, some of which prohibit the use of a portable toilet. • Another disadvantage is that regular portable toilets are not wheelchair accessible, meaning that disabled people that use wheelchairs may find using portable toilets difficult or impossible. However, most modern companies offer wheelchair accessible portable toilets upon request.
3. *Erecting temporary VIP latrines*	***Positive aspects:*** • They are cheap to erect and do not require much of waste management activities.

	Negative aspects: • They pose pollution to groundwater. • Since they do not use water, they cannot be emptied easily. • When not airtight, their levels are affected by the water table levels.
Recommendation *Option 2 can be considered for workers along the road reserve where fibre is being installed as it would be impossible for them to access ablutions while working and option 1 will be used in camps where there is no reliable water supply.*	

4.2.4 Sources of water

The project will require water for drinking by the workforce and for various construction activities. Here the following options are being considered (**Table 11**).

Table 11 Water Supply Options for Construction and Drinking

OPTION	COMMENTS
1. *Abstraction of River water*	***Positive aspects:*** • Water will be readily available on site • The expenses incurred are once-off.
	Negative aspects: • The water quality does not conform to the required water standards (Drinking water standards), thus would require treatment • This would also require additional studies on the ESIA for the impacts of building water structures in the river and the associated impacts and this requires more time and resources • The construction company cannot use more water than stipulated in the abstraction license (Water Permit) issued by the Department of Water Affairs and this includes dry seasons where the river discharger is low, and the proponent should follow the Water Act 2008.
	Positive aspects: • The supply is relatively reliable

2. Use of Domestic Water supply from WASCO	• One assumption is that, since the water is used for human consumption, it has no microbial contaminations • Use of metered water which helps the Contractor to know quantity used • Conforms to water drinking standards.
	***Negative aspects**:* • Payment of standing charges. • The Contractor has to connect the project sites • Use of potable water for construction purposes, the water is cleaned for potable supply and not for construction.
3. Use of Domestic water Supply from DRWS water systems, Boreholes or natural springs	***Positive aspects:*** • The supply is relatively reliable • Very safe for drinking • Very cheap
	Negative aspects: • Routine water testing for microbial contamination • Require water use permit
***Recommendation**: All three options must be considered for drinking water. For construction river abstraction or natural water sources will be used.*	

4.2.5 Energy

The project requires electricity for the construction phase and operation phase. The electricity supply has to be reliable and functional. (**Table 12**).

Table 12 Energy Option for Production Activities

OPTIONS	COMMENTS
Option 1: *Use of solar power*	***Positive aspects:*** • Solar power is considered to be renewable and environmentally friendly • Once connected, there will be no bills to pay

	• It has a life span of about 25 years, though batteries have a life span of about 10 years.
	Negative aspects: • It is not reliable as it depends on sunlight to keep working • It will require acquisition of more land to lay the panels • It brings in an extended scope for the project which means more studies and resources.
Option 2: *Use of diesel generators on site*	***Positive aspects:*** • The Contractor does not pay any bills except to buy their own diesel • These generators are moveable and can be carried from one site to another • There is no need for permanent structures on site.
	Negative aspects: • These generators are very expensive • The cost of buying fuel is mostly high and with recent problems in Europe, diesel could be hard to find in the near future • It generates noise which will create more conflicts with the local communities.
Option 3: *Connecting to LEC power lines*	***Positive aspects:*** • LEC generally provides reliable power supply • When the correct amperage is connected, there is no problems of overloads • LEC has customer support to its clients in cases of problems incurred.
	Negative aspects: • This electricity comes at costs for connections and for consumption • All sites will have to be connected to the national grid.
Recommendation: *Option 3 is most preferred as the electricity supplied here is reliable and this reduces idle times. Option 1 could be considered for light electrical requirements and option 2 can be considered as a back-up when LEC power is down. It is recommended that all three (3) options be used during construction.*	

4.2.6 Storage of Construction Material

There will be a need for storage facility of construction material during the establishment of the camp site and the actual Construction phase and the following options have been considered (**Table 13**):

Table 13 Storage for Construction Material (night Storage)

OPTIONS	COMMENTS
1. *Hiring of space for storing the construction material*	***Positive aspects:*** • The material will be in the vicinity of site. • In this way, property owners will also benefit from the project through income that they will earn from renting out space for storing the construction material.
	Negative aspects: • The contractor will have to incur additional costs of renting/hiring storage facilities from property owners in the vicinity of the project site. • The contractor may also need to acquire more labour for guarding the equipment. • Higher number of required sites due to isolated grid expansion. • Increased land clearance and construction of access roads. • Greater visual, noise, and light pollution.
2. *Constructing own storage facility within the project site*	***Positive aspects****:* • This affords the contractor an opportunity to construct a facility that would meet their needs. • Material readily available on site.
	Negative aspects*:* • Constructing such a facility may also require a substantial amount of money. • Disturbance of pristine habitats and fragmentation of wildlife corridors. • Water flow alteration in wetlands. • Erosion risk on highland slopes and disruption of sensitive vegetation
Recommendation*: Based on the facts surrounding each of the identified options, and also the sensitivity of the project in terms of security, construction of own storage (option 1) seems to be the best option.*	

4.2.7 Housing for the Workforce

Since most of the labourers will be hired locally, most of them will be living in their own homes. But for other people with specialized skills not living in the project areas, there might be a need to either rent house units locally or use park-homes[1] or construct own housing facilities and the following options have been considered (**Table 14**):

Table 14 Housing for the Workforce

OPTIONS	COMMENTS
1. *Use of park home on site*	***Positive aspects**:* • Use of park homes will be convenient as the contractor may not have to deal with acquisition of building permit. • The local authorities may not have to deal with issues of such structures beyond the operation phase. • Land in its present status would be returned to the owners for use after the construction phase.
	Negative aspects: • This would definitely be costly although cost/benefit analysis may need to be undertaken before a decision is made. • Other associated costs will be incurred for ensuring that other associated facilities are put in place.
2. *Hiring of space for accommodation from the communities*	***Positive aspects:*** • In this way, property owners will also benefit from the project through income that they will earn from renting out space for accommodation. • Less area would be required for the operation activities thereby reducing compensation payments and loss of land by the local communities.
	Negative aspects: • The Contractor will incur costs of renting accommodation from property owners in the vicinity of the project site.

[1] Park homes are mobile units used as temporary housing for a certain period.

	• Presence of the workforce in the village may result in unbecoming tendencies where relationships may develop which may eventually lead to further spread of HIV and AIDS.
3. *Constructing own accommodation facilities.*	***Positive aspects**:* • This affords the Contractor an opportunity to construct a facility that would meet their needs.
	***Negative aspects**:* • Constructing such a facility may also require a substantial amount of money.
***Recommendation**: Based on the facts surrounding each of the identified options, option 1 (park homes on site) seems to be the most viable option, as they impose less destruction to the environment and would be very convenient to the proponent for decommissioning phase.*	

4.3 "Without Project"/ No Action Alternative

Under the NO-GO alternative, no development would be allowed on the proposed project area and therefore, there would neither be benefits from the project nor significant negative environmental and social impacts. Under the proposed development improvements, the proposed development would create temporary employment for contractors and workers. Also, the development will result in improved access to internet. The "no-go" alternative is not a preferred option, even though, from the bio-physical perspective, this alternative will be beneficial in the sense that any potential negative impacts associated with the project implementation will be avoided.

Socio – economical negative impacts if the LEMOFI project is not implemented:

- Compromised economic growth of the country due to unreliable access to internet
- Unreliable internet access

Environmental Impact:

- **Positive**: Avoids any disturbance to sensitive habitats, ecosystems, or land use patterns.

- **Negative**: Fails to support national environmental goals of smart energy use (smart metering), resulting in continued inefficient electricity distribution and unmonitored emissions.

However, the Do-Nothing/Without Project Option must not be adopted since benefits are more that negative impacts.

4.4 Project Implementation Alternative

The project implementation alternative is the preferred option the following benefits would result:

- Reliable Internet Access
- More people having access to reliable internet
- Increased economic activity within the country as more service providers can emerge in the industry due to adequate infrastructure
- More internet service providers will give rise to competition and the possibility of cheaper internet billing
- Temporary employment of general labourers

5.0 PROJECT DESCRIPTION

This section presents the description of the proposed LEMOFI Project.

The project will consist of a detailed design of Maseru Metropolitan Distribution network and ten (10) district Points- of- Presence (PoPs) including fibre optic distribution network in all major towns.

5.1 Project Purpose

The purpose of this project is to build an open-access communications network spanning all districts of Lesotho. This will break down existing financial, technical, and temporal barriers to entry into Lesotho's communications industry thus enabling even small network services providers to participate in the country's communications industry actively and equally. The increased competition in the market will help to reduce data costs to end users and increase residential fixed-line connectivity and provide affordable access to broadband services for small to medium enterprises (SMEs).

The LEMOFI is aligned to ***National Strategic Development Plan II (NSDP II)*** of the Kingdom of Lesotho and directly addresses **Intermediate Outcome 3.4** objectives:

- Objective 1 (improve ICT access and use)
    - Facilitate build-out and sharing of strategic ICT infrastructure.
    - Facilitate conducive environment to attract more market players to encourage competition in ICT market.
    - Invest in extension of LEC's optical fibre network to strategic areas to promote competition in retail internet access services.
    - Improve penetration, price, and quality performance of Fixed Broadband (FBB) market.
- Objective 4 (improve digital economy uptake)
    - Stimulate demand to drive broadband up-take.

- Promote ICT literacy and lifelong learning of citizens through e-learning and awareness programmes and reduce digital divide.
- Establish data centres or hubs to attract data locally and internationally.

The LEMOFI is also aligned to ***Prime Minister's Inaugural Speech*** where he emphasised the need to develop a shared broadband infrastructure company within the country. Therefore, LECC seeks to position itself as the ideal candidate to address this need.

Finaly the LEMOFI is aligned to ***ICT Policy for Lesotho,*** Objectives and strategies of **ICT Policy Subsection 3.4.1** are as follows:

❖ **ICT Policy for Lesotho objectives:**

- Speeding-up the provision of appropriate, affordable, cost-effective and equitable access to ICT services throughout the country.
- Facilitate wide access to ICT services over diverse platforms such as telecommunications networks, radio, television and the Internet.
- Support and facilitate the growth of entrepreneurs in the provision of ICT services.

❖ **ICT Policy for Lesotho strategies:**

- Promote the take up of communications services throughout the country.
- Encourage competition in the provision of ICT delivery networks and services in order to multiply the sources of information and to lower access costs to consumers.
- Encourage public private partnerships in the provision of community-based ICT services and initiatives.

5.2 Project Location

The following are the district and target areas/constituencies for the LEMOFI Fibre Network:

- **Year 1: Berea:** Teyateyaneng. **Leribe:** Maputsoe (Including Nyenye). **Mafeteng:** Mafeteng. **Maseru:** Highway- Central-IEMS. **Maseru:** Maseru Industrial. **Maseru:** Parliament - Maseru Mall. **Maseru:** A2 - Lekhaloaneng - Matala
- **Year 2: Leribe:** Hlotse. **Butha Buthe:** Botha Bothe. **Mohale's Hoek:** Mohale's Hoek. **Mokhotlong:** Mokhotlong Town. **Thaba Tseka:** Thaba Tseka. **Maseru:** Thetsane Industrial
- **Year 3: Maseru:** Old Europa – Downtown. **Maseru:** Tikoe Industrial. **Quthing:** Quthing – Moyeni. **Qacha's Nek:** Qacha's Nek Town.

A location Map (**Figure 4**) has been presented to show the location and specific areas' Ring and Distribution Network Maps have been presented in **Figures 5 - 22**.



Figure 4 LEMOFI Project Location

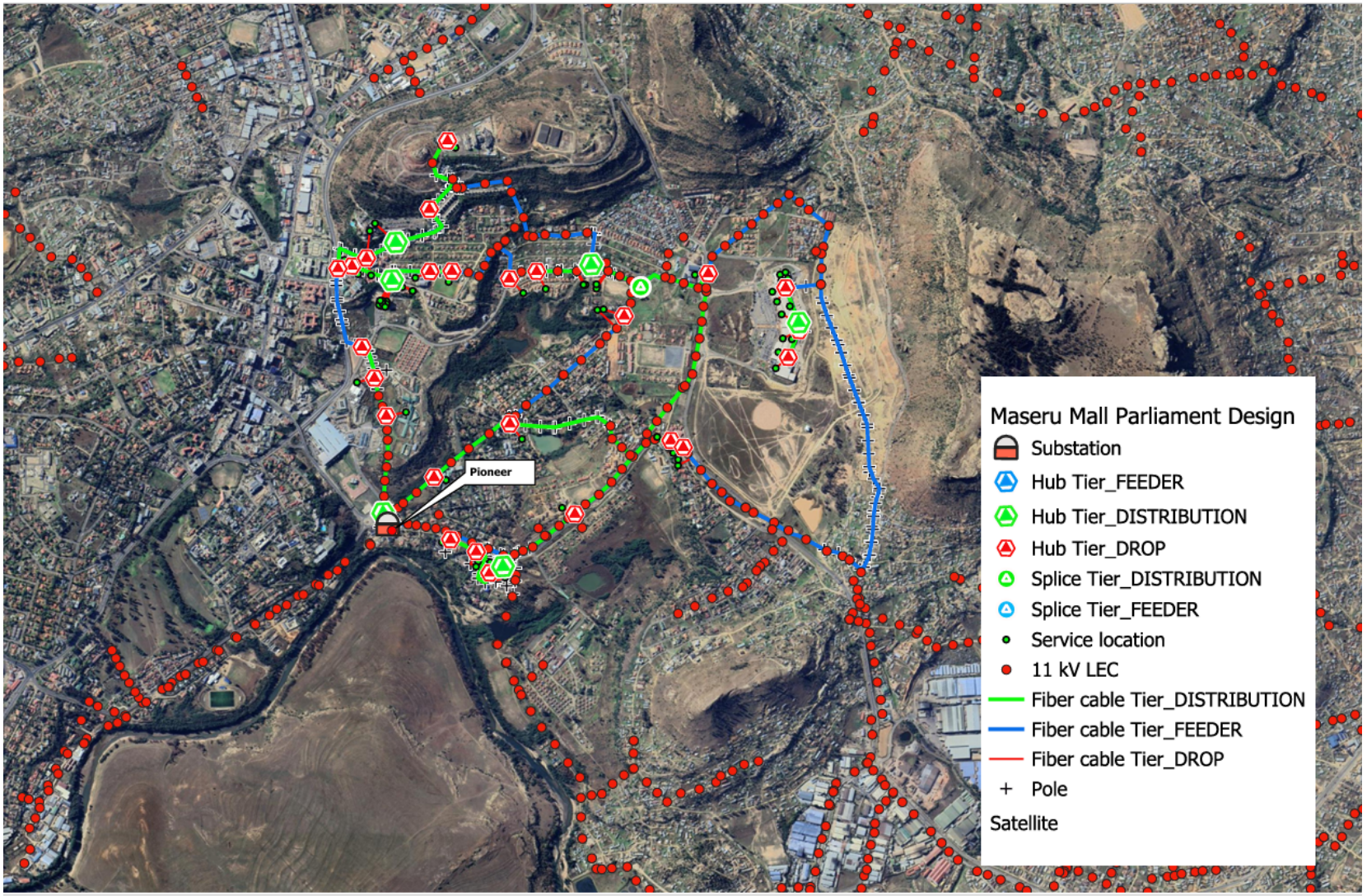


Figure 5 Parliament and Maseru Mall Ring Distribution Layout

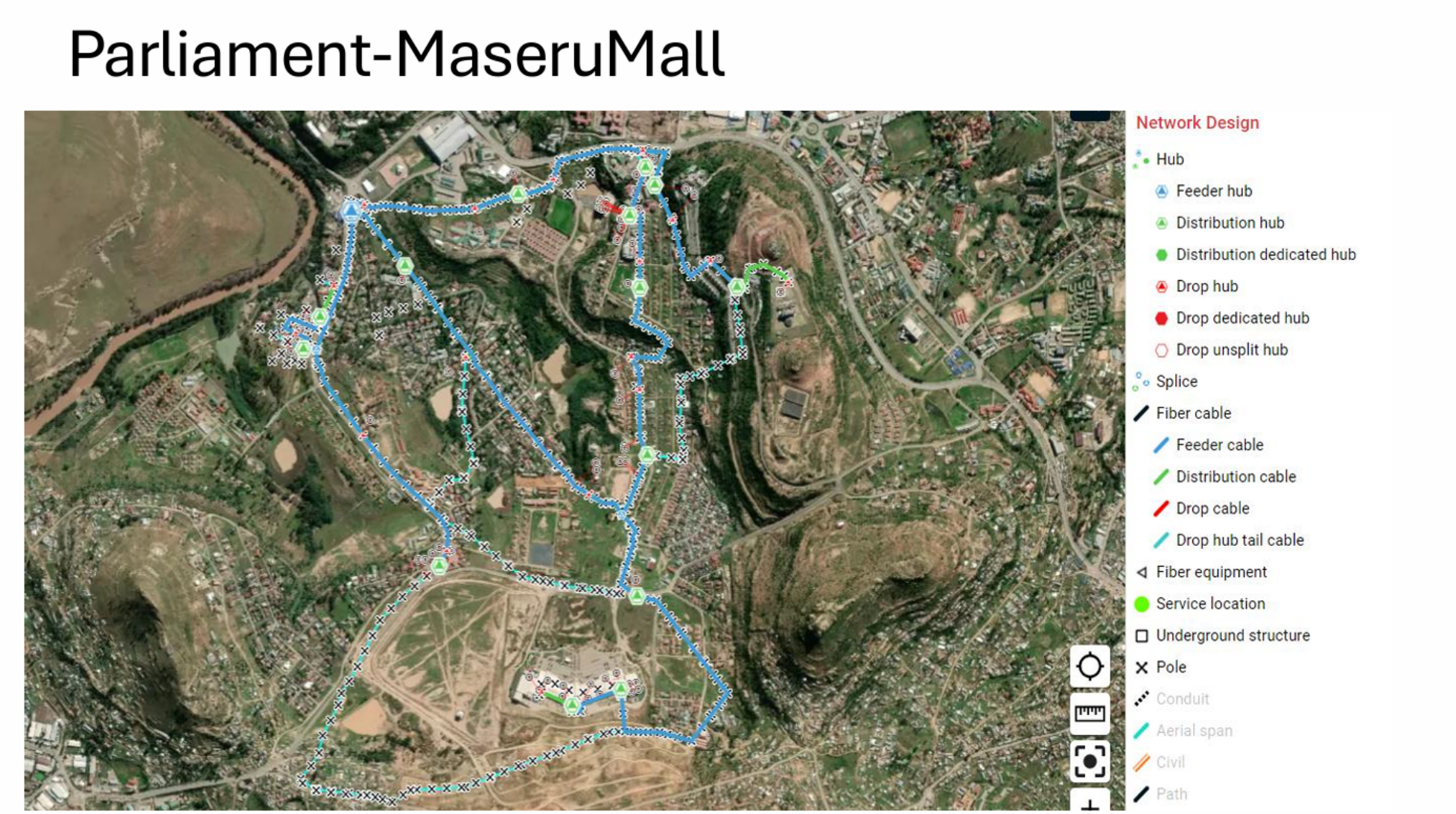


Figure 6 Parliament and Maseru Mall Design Layout

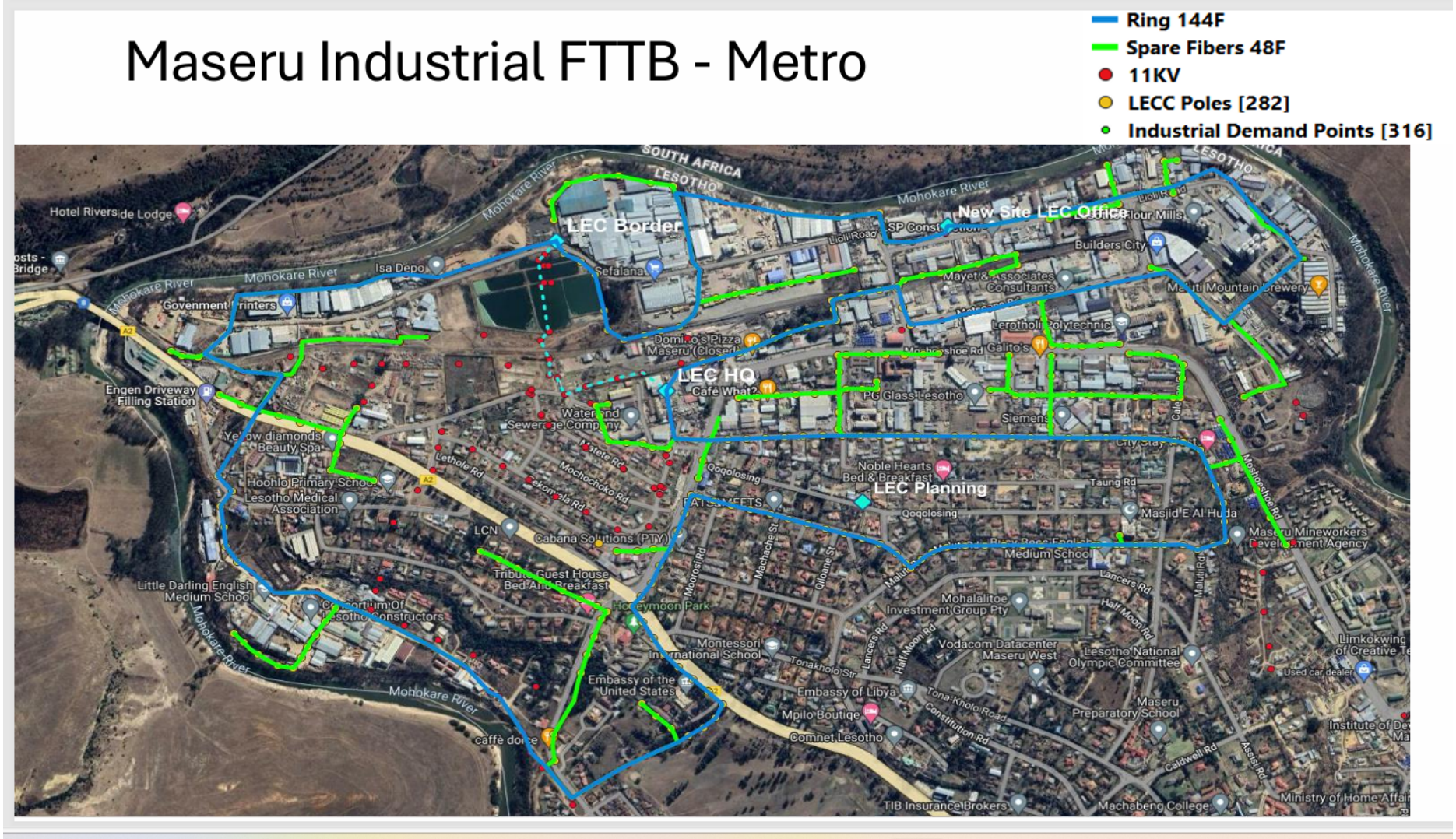


Figure 7 Maseru Industrial FTTB - Metro Ring and Distribution Design Layout

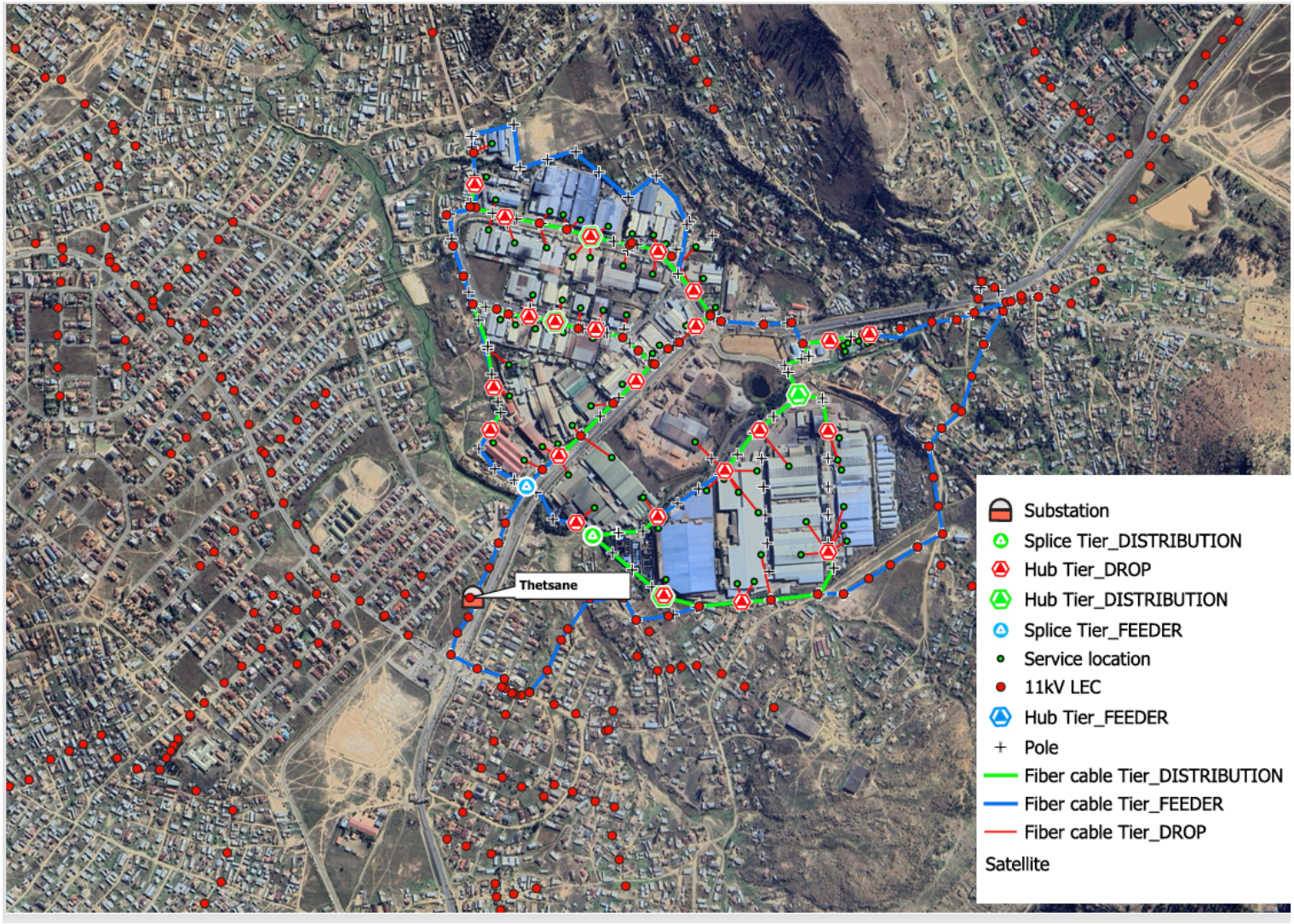


Figure 8 Thetsane Industrial Ring and Distribution Layout



Figure 9 Tikoe Maseru Industrial Ring and Distribution Design Layout

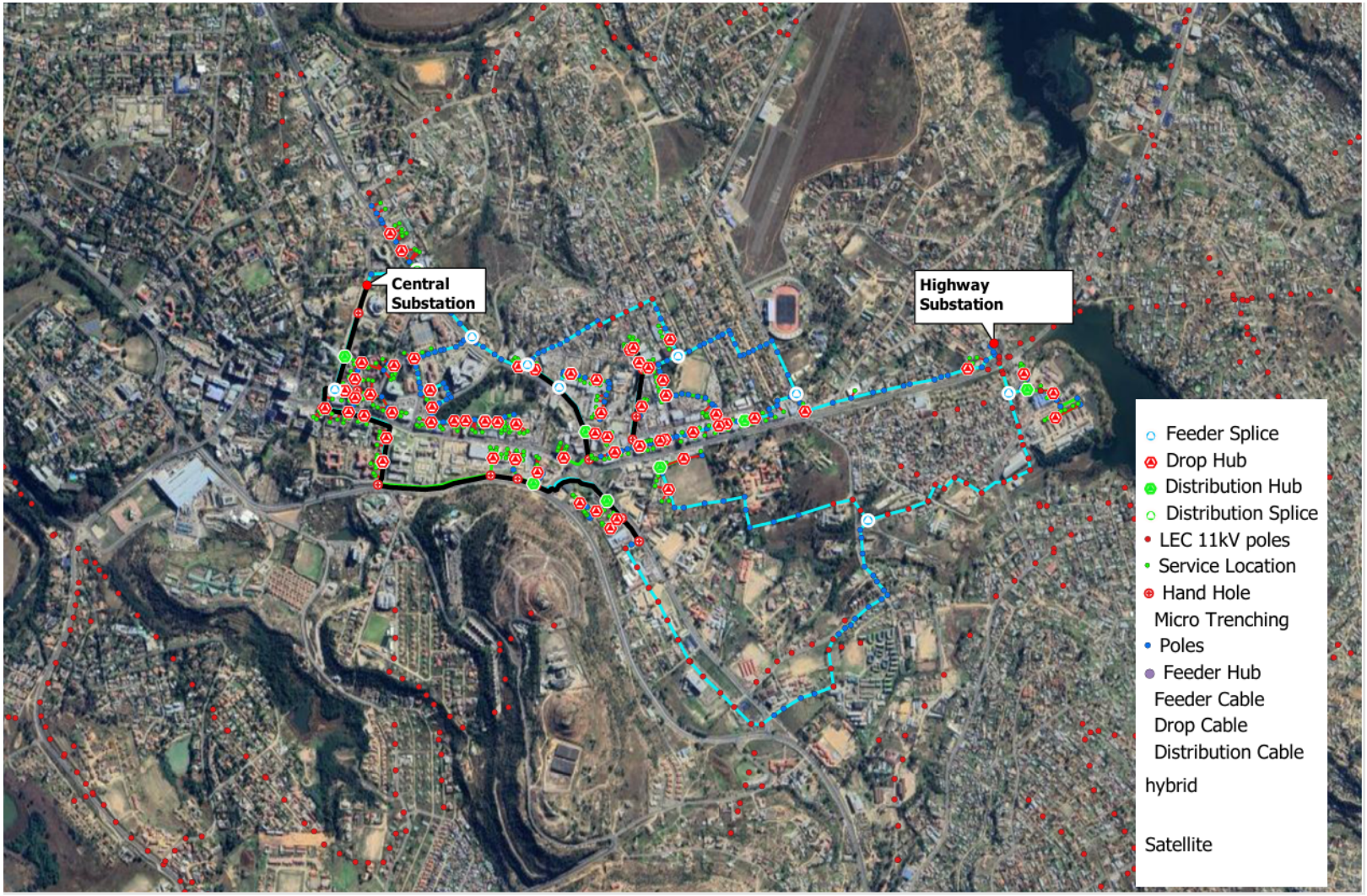


Figure 10 Highway - Central - EIMS Ring and Distribution Design Layout

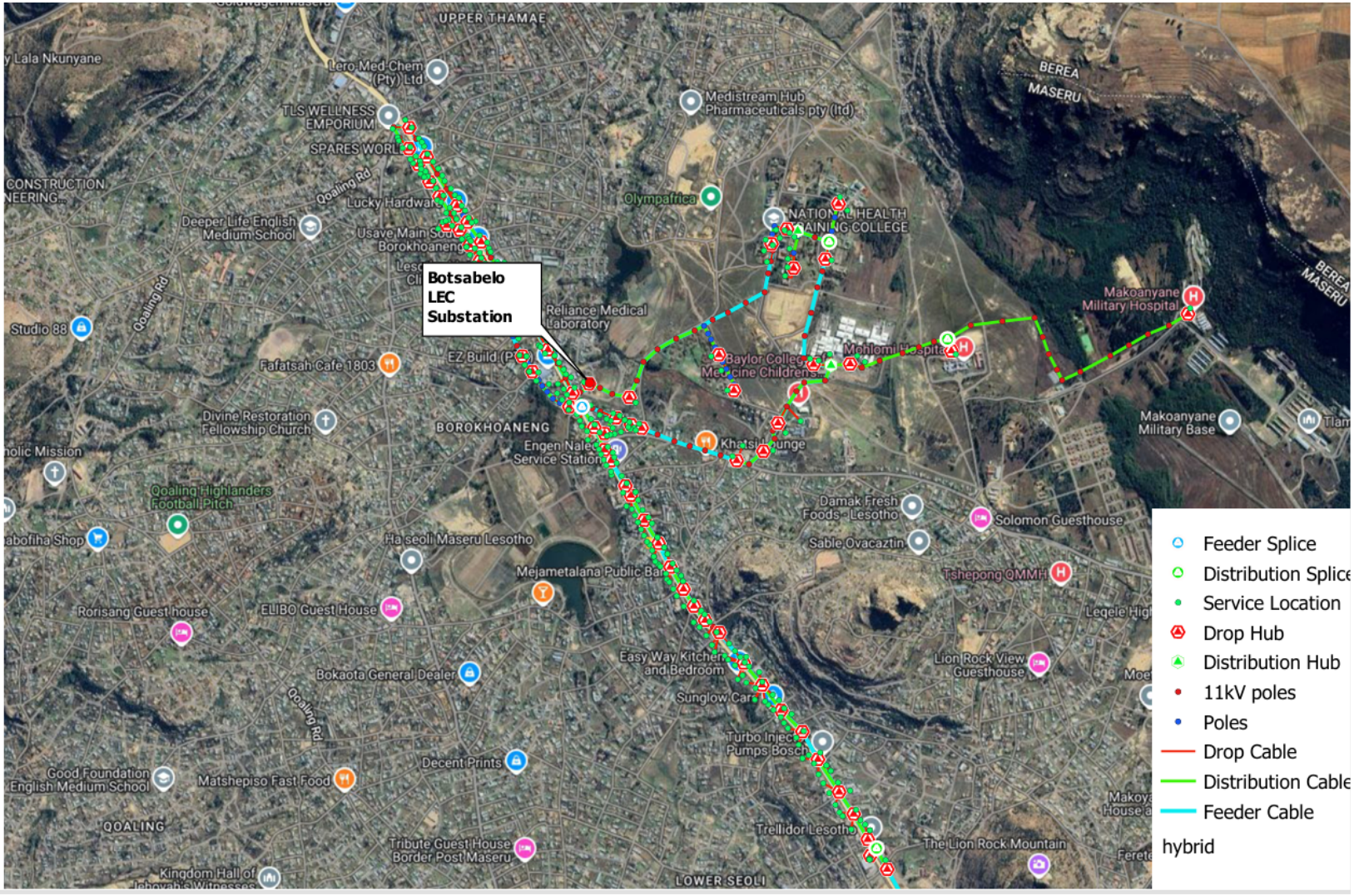


Figure 11 A2 FTTB Lekhaloaneng – Matala Distribution Layout

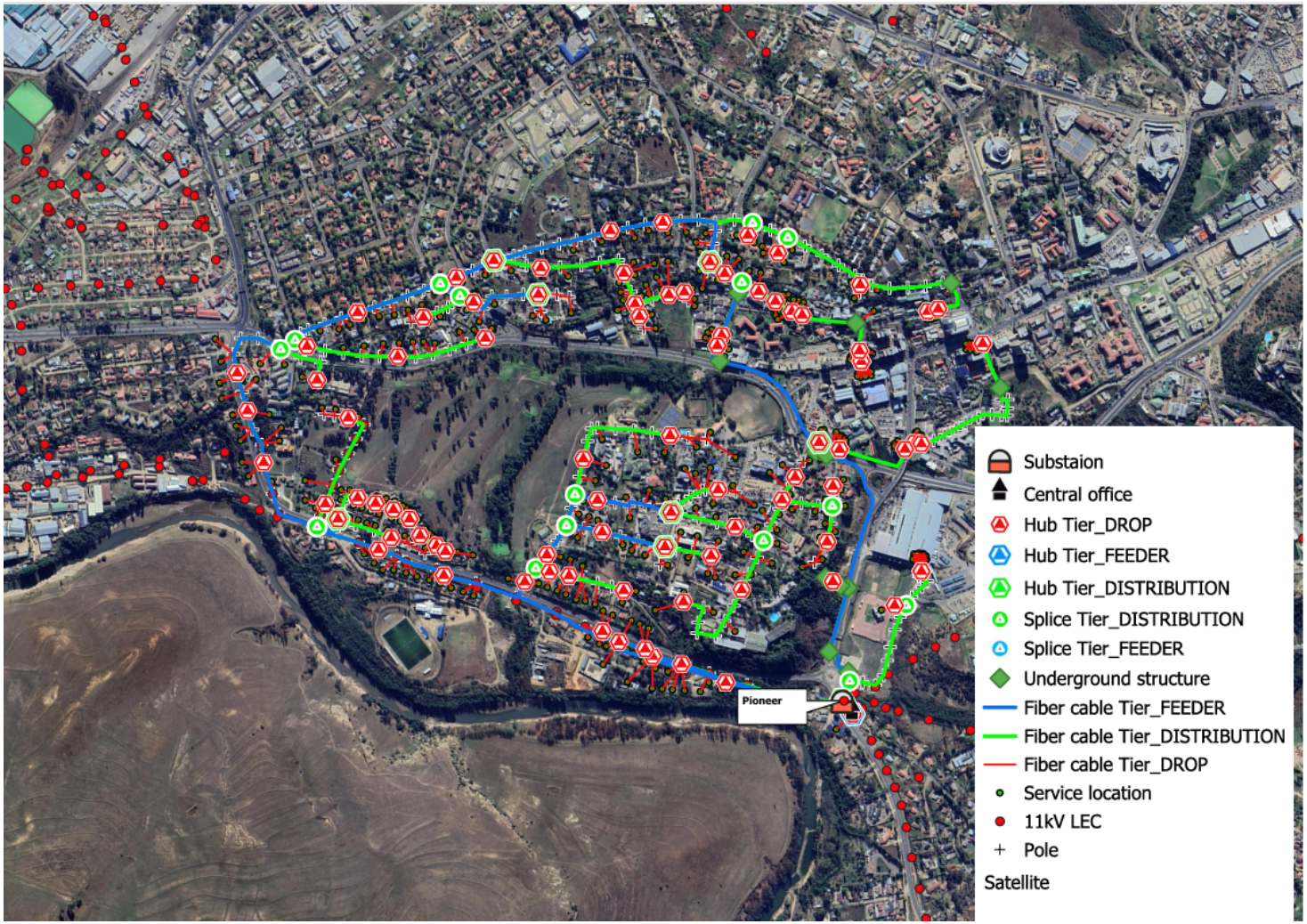


Figure 12 Old Europa - Downtown FTTB Ring and Distribution Layout

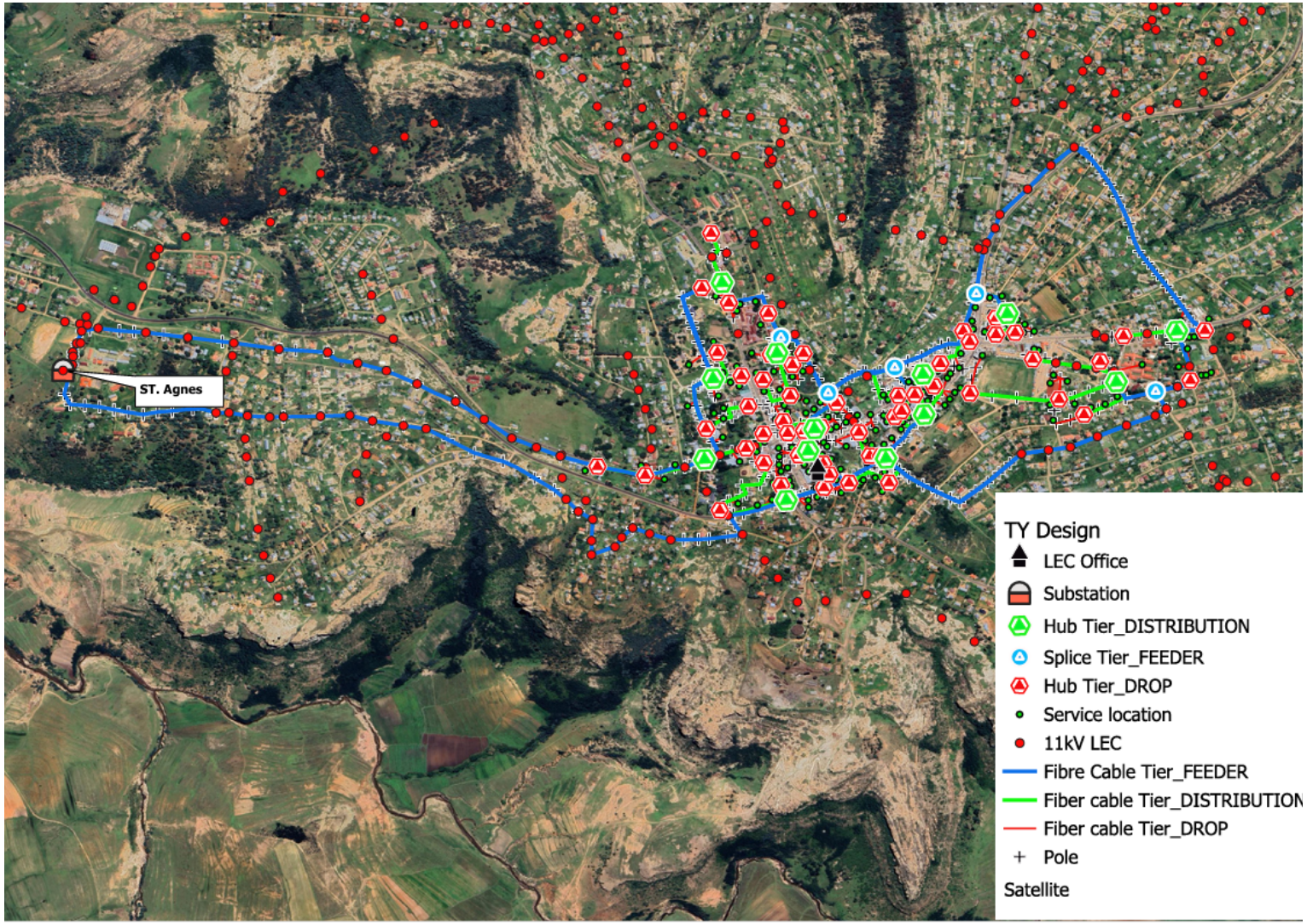


Figure 13 Teyateyaneng Berea TY CBD FTTB Ring Layout

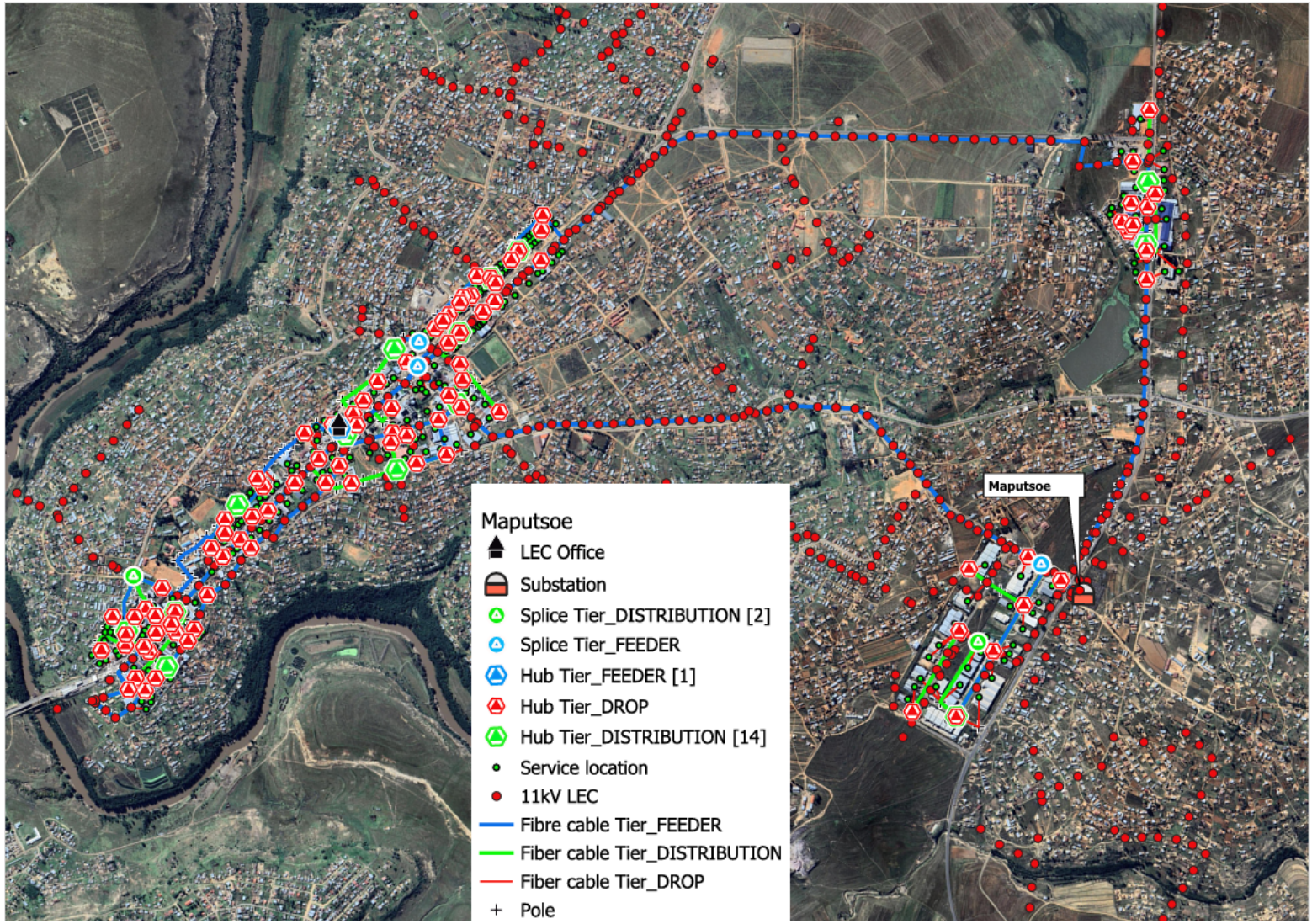


Figure 14Maputsoe CBD Design Layout

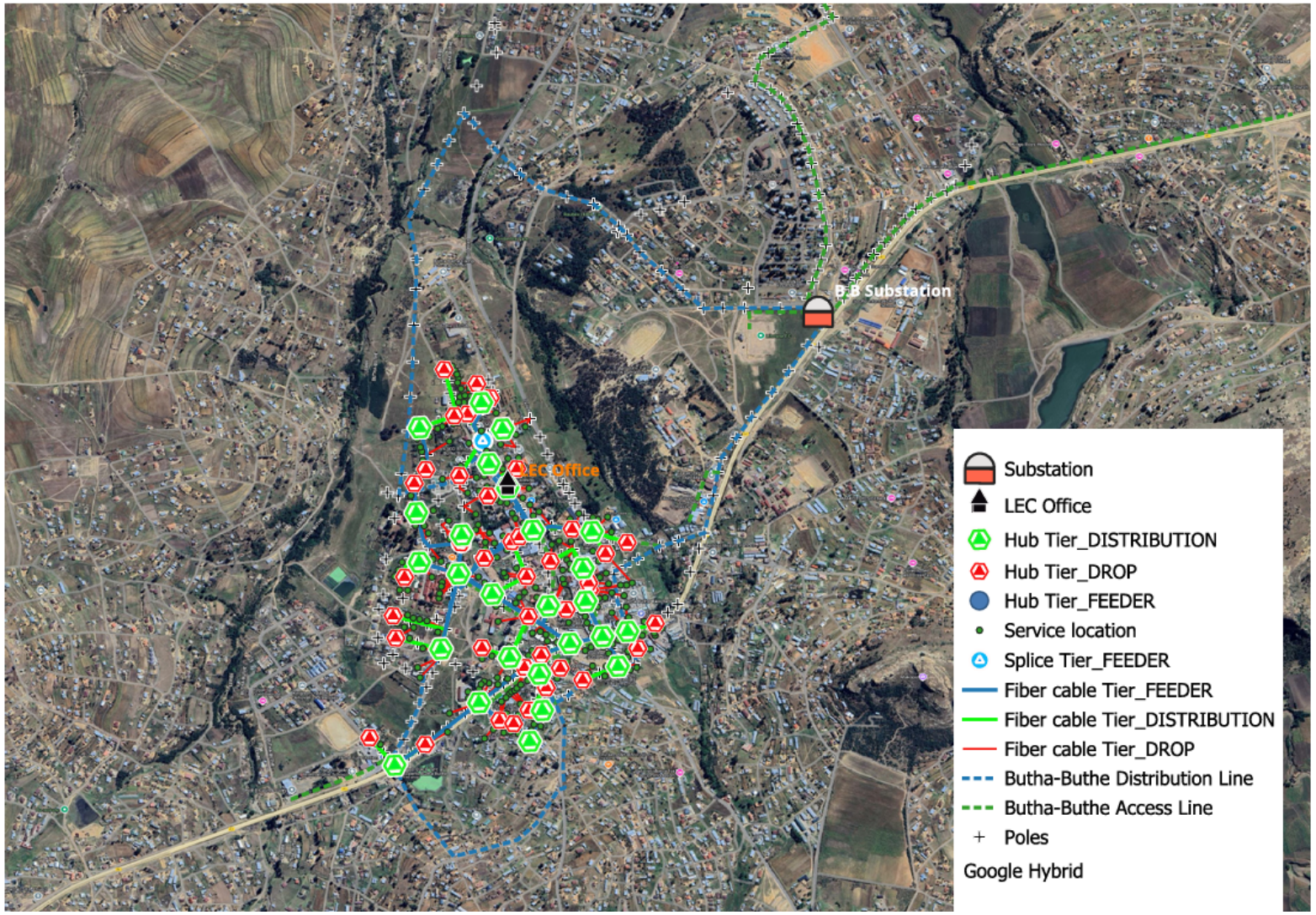


Figure 15 Butha Buthe Metro Ring and Distribution Layout

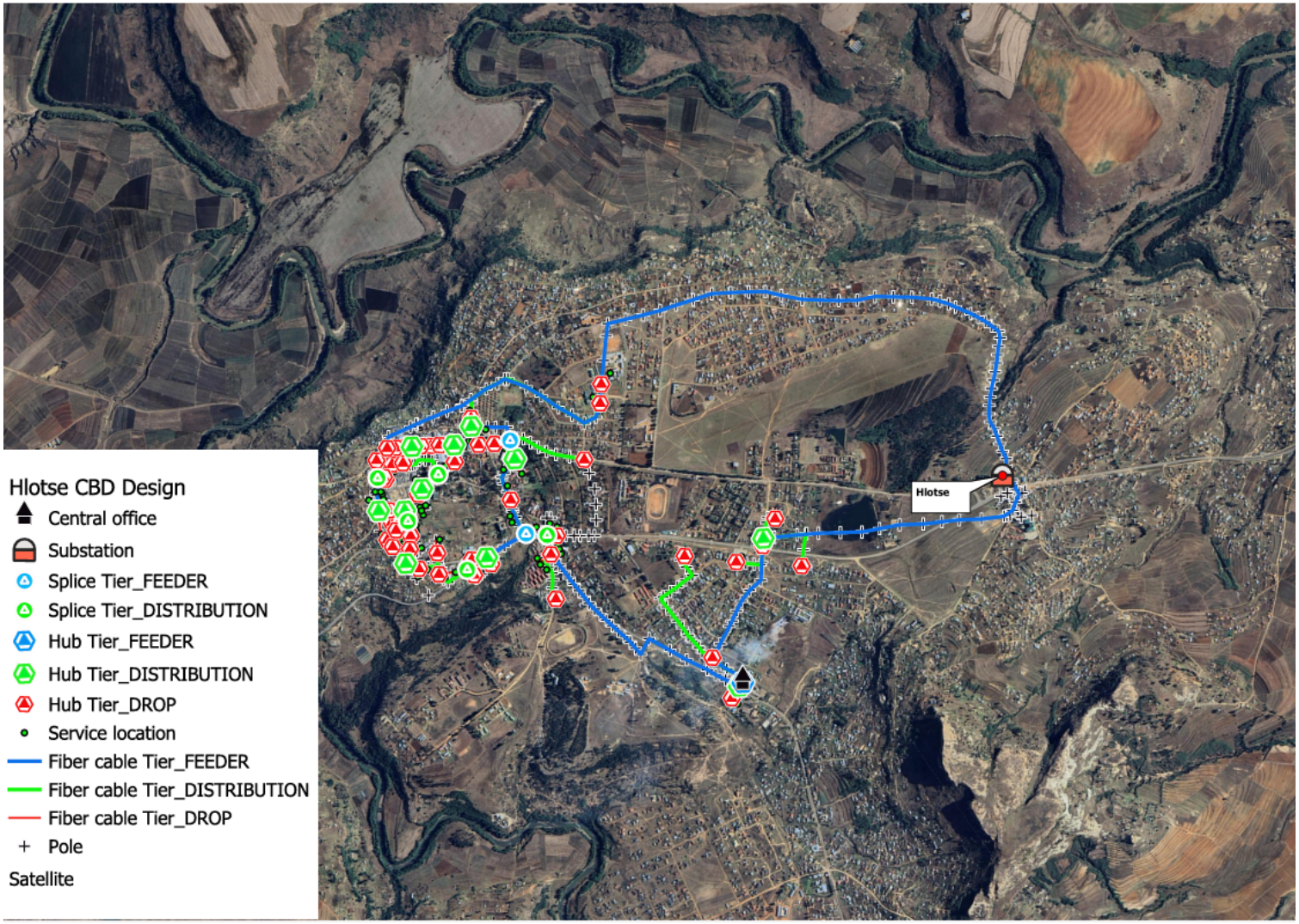


Figure 16 Hlotse Metro Ring and Distribution Layout

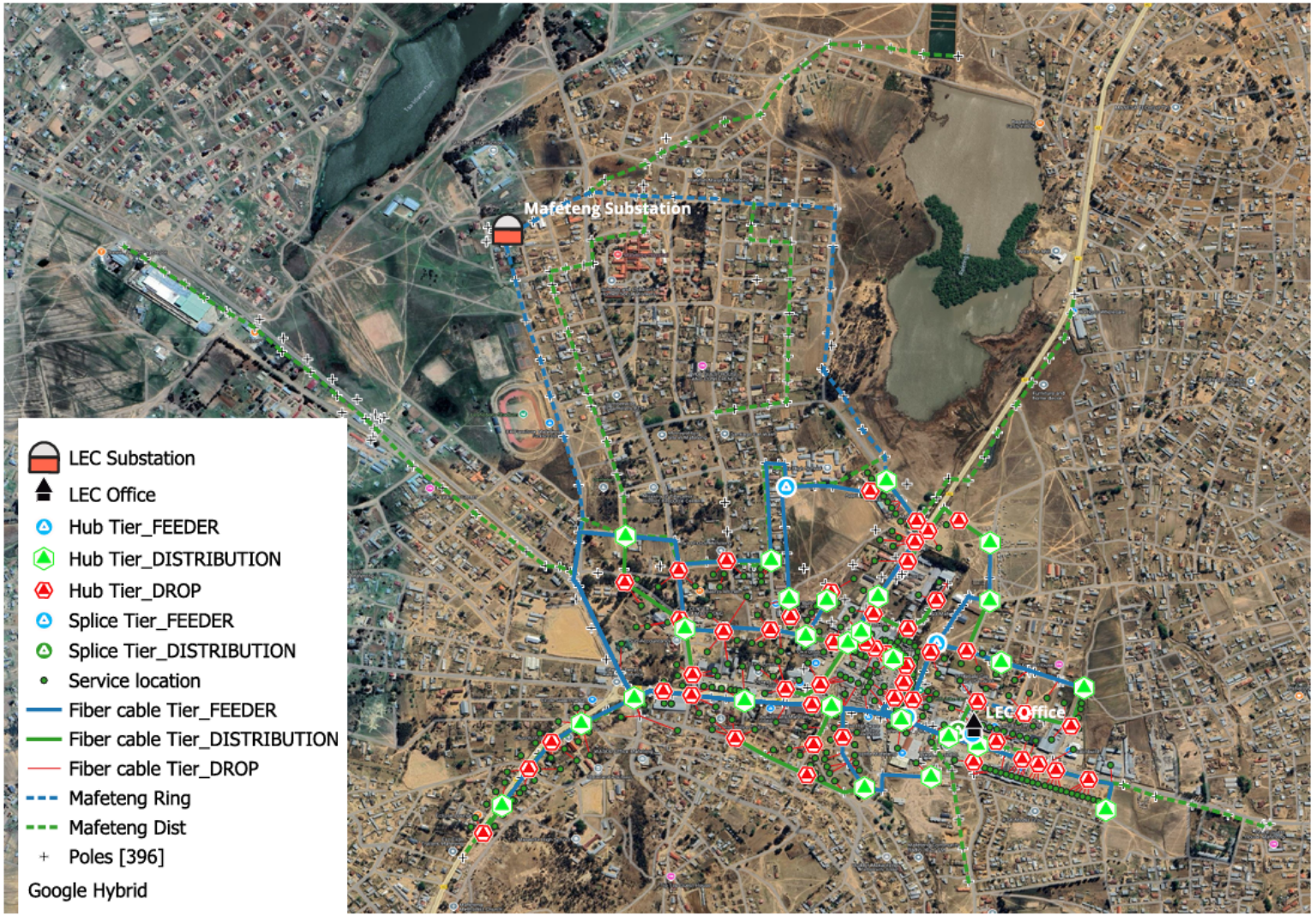


Figure 17 Mafeteng CBD FTTB Ring and Distribution Layout

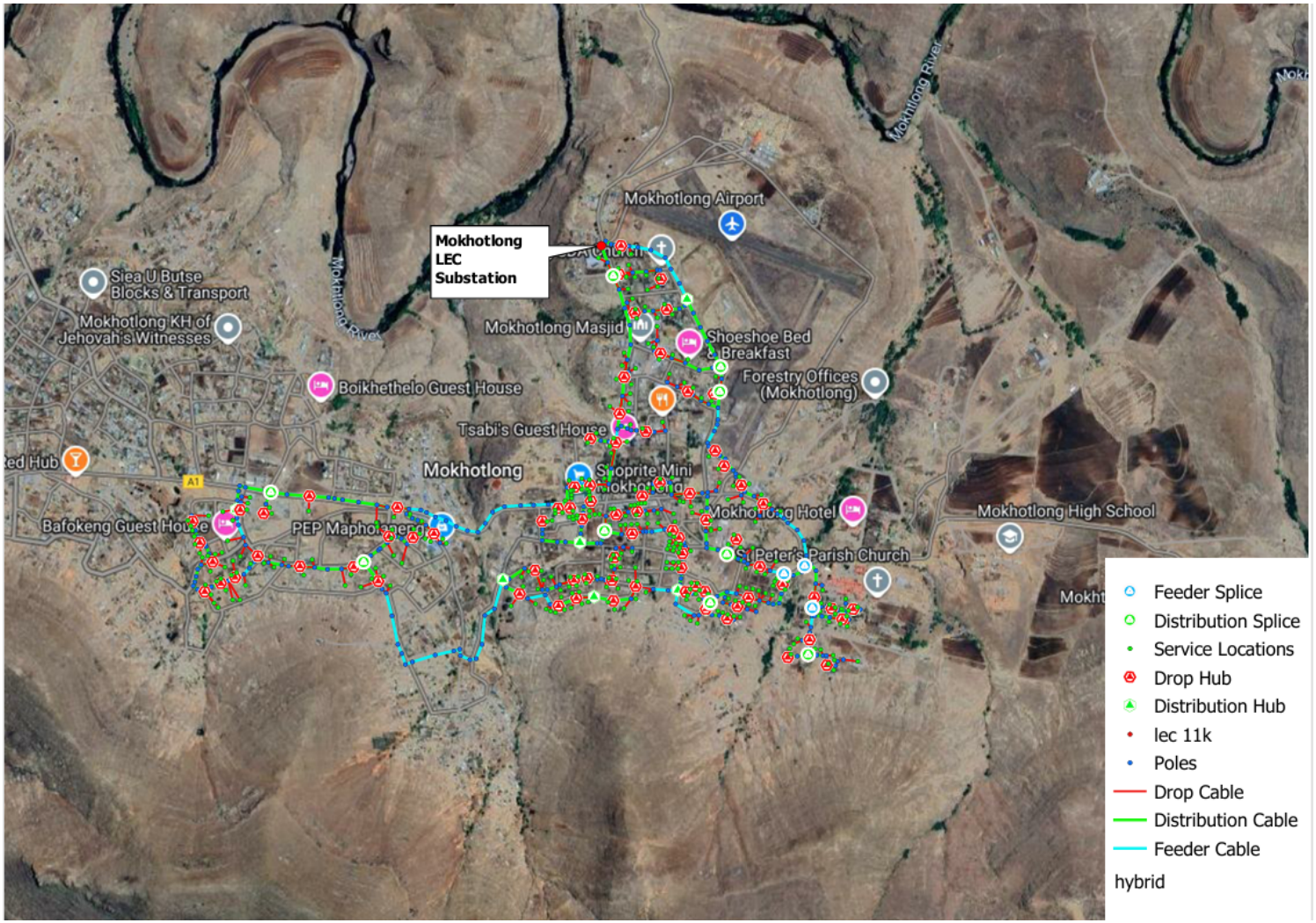


Figure 18 Mokhotlong CBD FTTB Ring and Distribution Layout

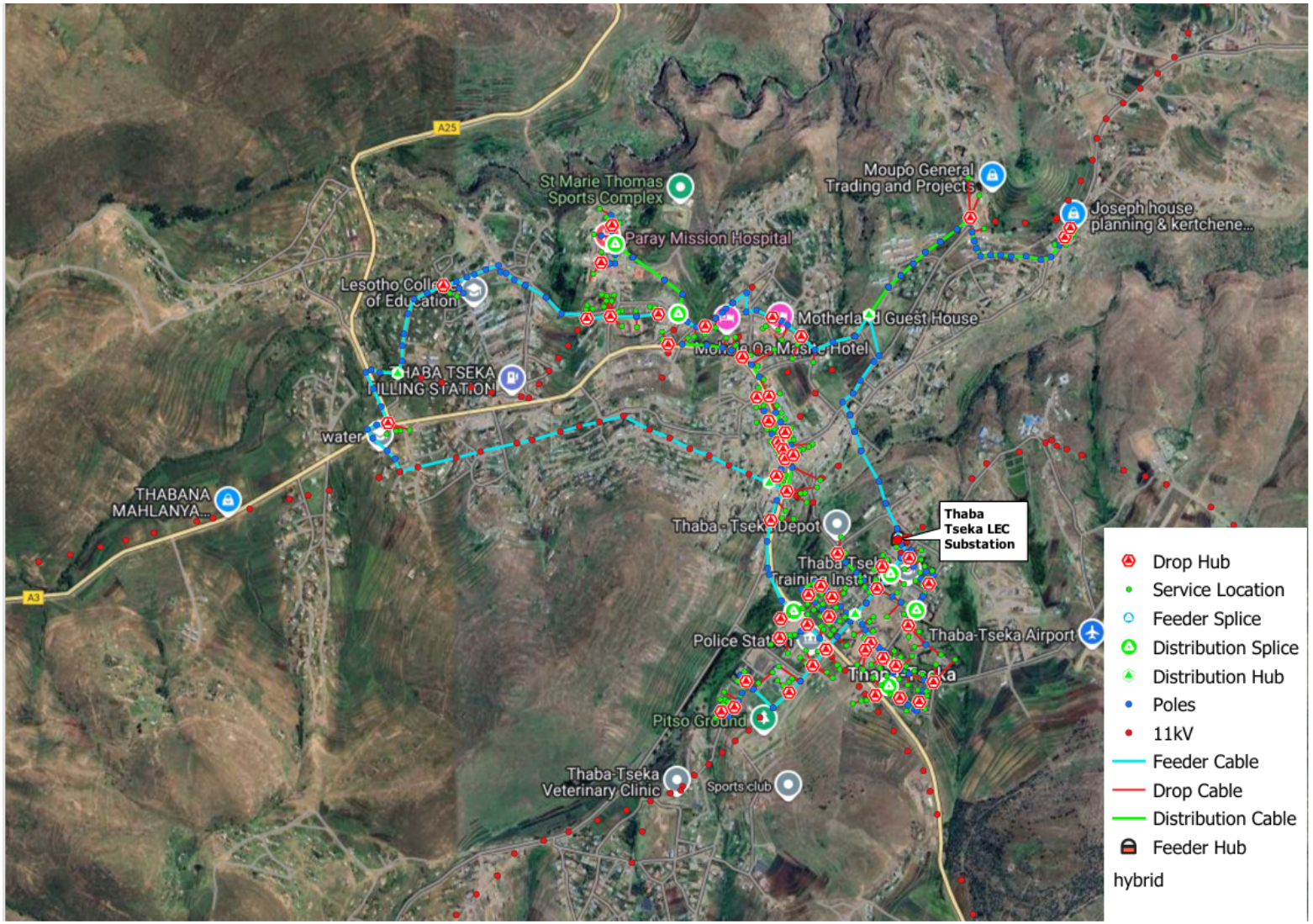


Figure 19 Thaba Tseka CBD FTTB Ring and Distribution Layout

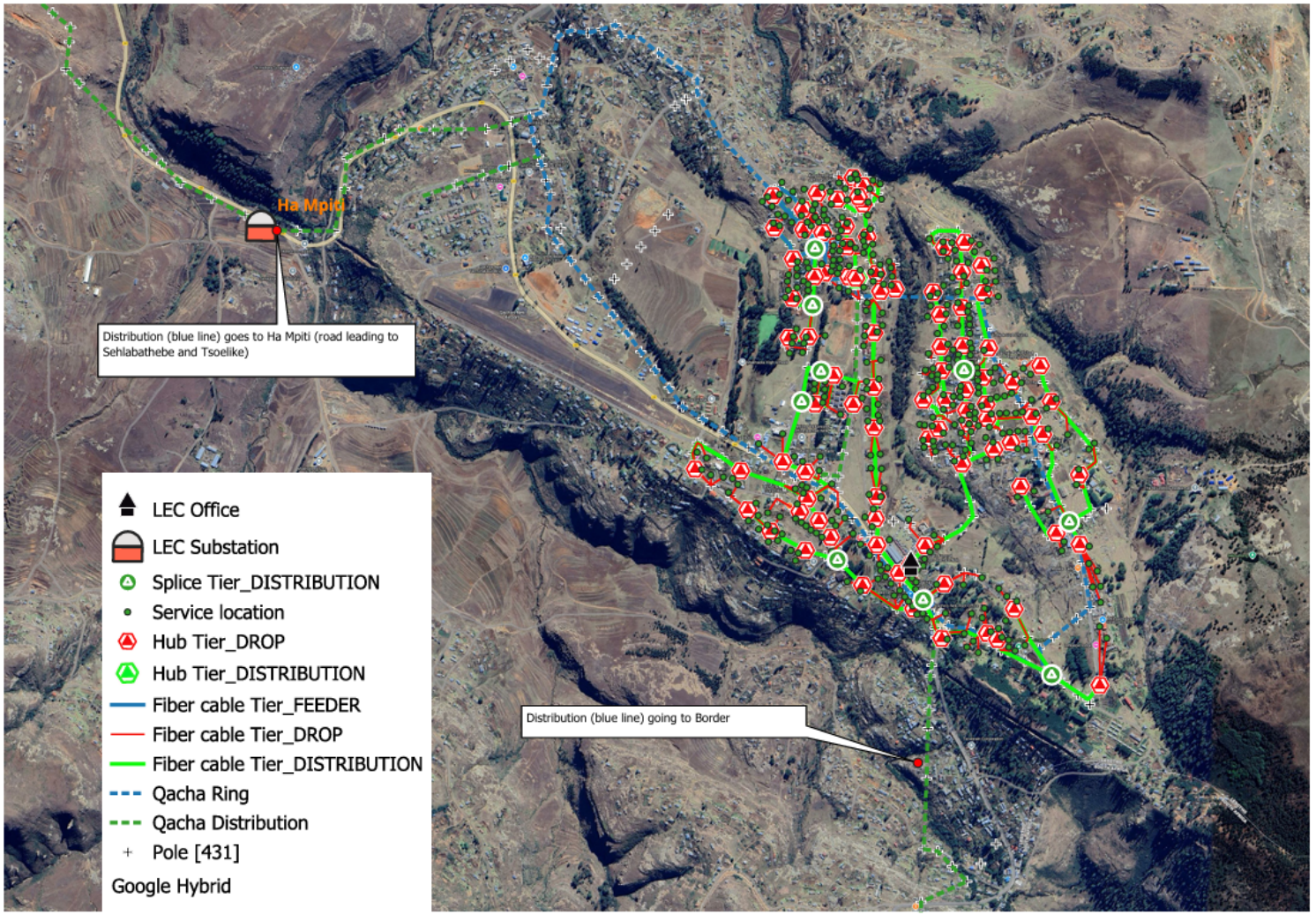


Figure 20 Qhacha's Nek CBD FTTB Ring and Distribution Layout

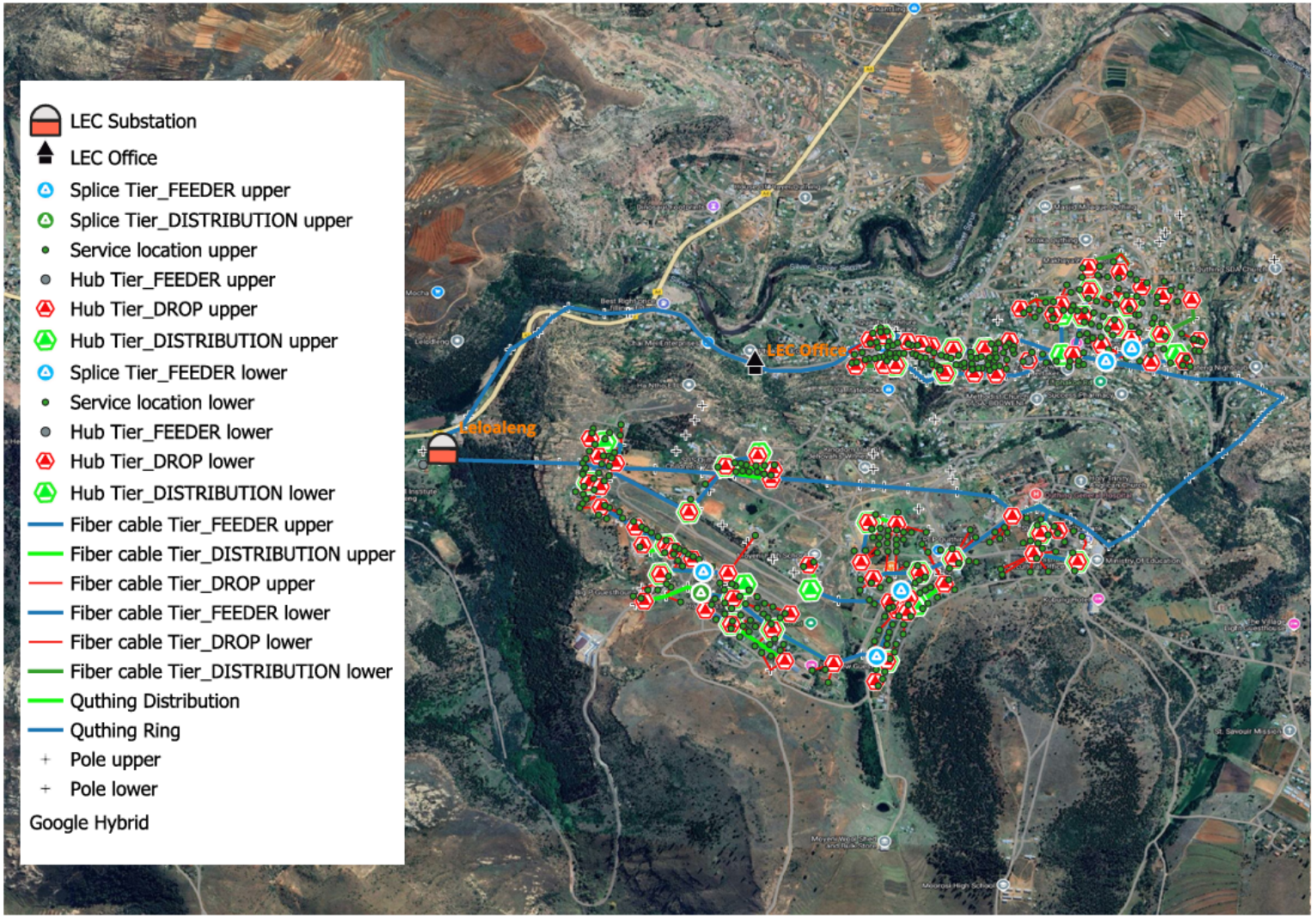


Figure 21 Quthing CBD FTTB Ring and Distribution Layout

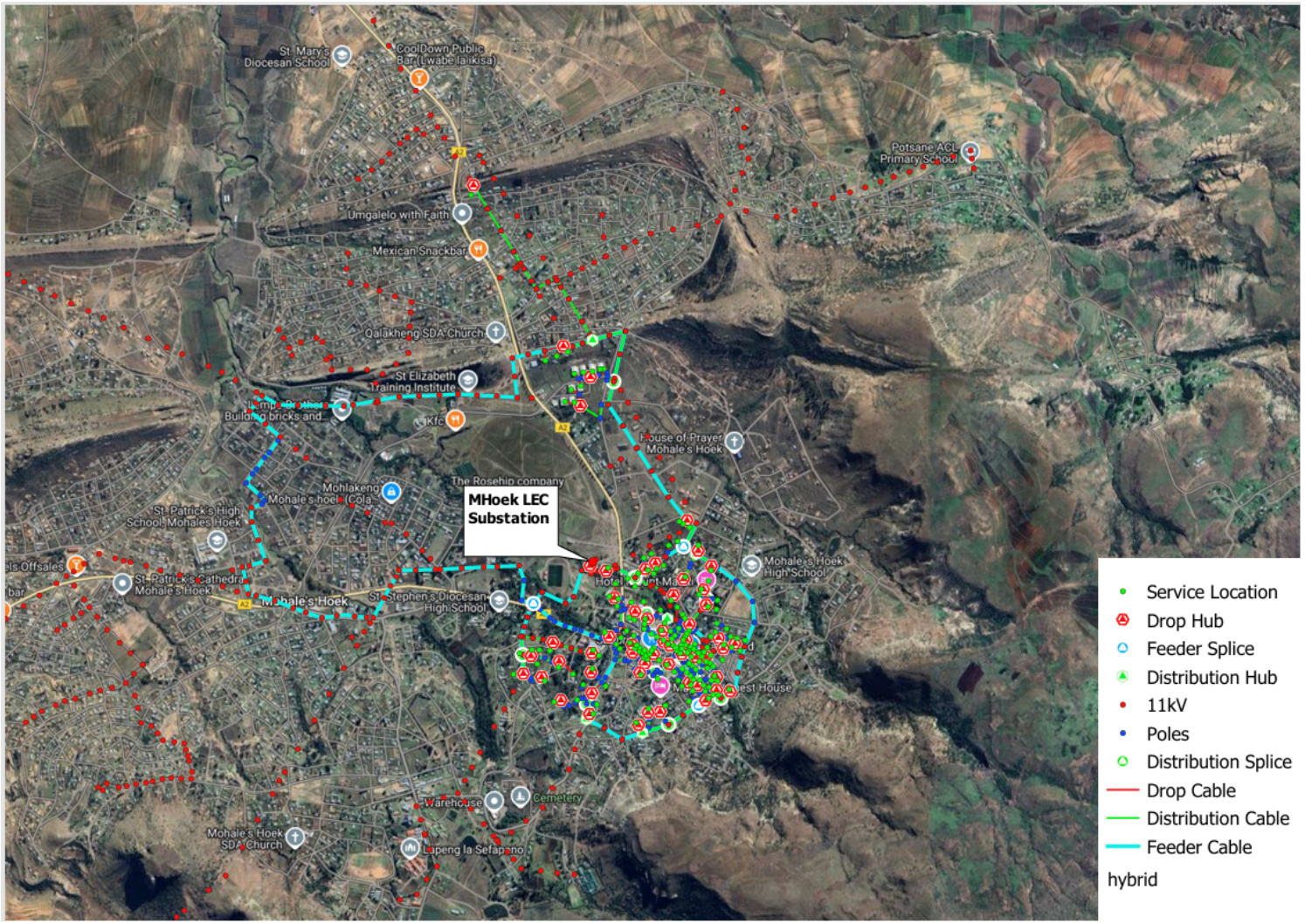


Figure 22 Mohale's Hoek CBD FTTB Ring and Distribution Layout

5.3 Current Infrastructure

5.3.1 Lesotho Electricity Company Communication

5.3.1.1.Open Standards Based Layered Architecture

The Consultant has during the recent years undertaken a detailed international standards and best practices assessment and analysis of the top Telecommunications Networks Operators (Telco's) worldwide and concluded that the majority have moved towards an Open Standards Based Layered Architecture which is depicted in **Figure 23**. The different layers are defined as follows:

- **Layer 1 or the Physical Layer is the Optical Fibre Cable Network and in the Case of LEMOFI that would be the physical LEC OPGW network and the LECC ADSS network.** Layer 1/2 is also includes all the LEMOFI passive infrastructure i.e. **Installation Accessories:** Galvanized Hoop Clamps (with Nuts and Bolts), Steel Banding Strips (Fit in 19.1mm buckle), Banding Strip Buckles (19.1mm), Bolt Pigtail M12 X 280mm, Termination - Dead End Thimble Type for ADSS, Termination - Dielectric Suspension Clamp (with Rubber Insert), Termination - Fiberlign Suspension Tie (Tangent for Short Span ADSS), Stay Rod Assembly with Baseplates - for all Poles that require stays, 4-arm slack storage for fibre slack loops (600mm), Splice Enclosure - Feeder Tier, Splice Enclosure - Feeder Tier, Fibre Distribution Hub (FDH) - with Splitters Fitted, Splitters 1:2 – Connectorized, Splitters 1:4 – Connectorized, Splitters 1:8 – Connectorized, Splitters 1:16 – Connectorized, Splitters 1:32 – Connectorized, Fibre Access Hub (FAT)- with Splitters Fitted, Fibre Patch Panel – Unloaded, Midcouplers for Fibre Patch Panels, Fibre Pigtails for Patch Panels, Brush Panels, Patch Leads, Manholes.

LECC adopts an Open Access Business Model and offers Dark Fibre Services to customers:

- **Long-Term Dark Fibre Service** This service, we provide to businesses which are interested in a long-term business

commitment and comes as an indefeasible right of use (IRU) service which gives the subscriber the right to use a pair of fibre (for a purchase segment) for 10 to 15 years. The service is charged per kilometre and paid in advance for the total period. Additionally, maintenance is paid annually starting from second year of the service. The targeted audience is network providers who are interested in expanding or protecting own network.

- **Short-Term Dark Fibre Service -** The short-term leased fibre is provided to businesses that are not interested in long-term relationship or will only manage paying month-on-month for the service rendered. The service is purchased contracts ranging from one year to five years for specific segments of interest. The targeted audience is network providers who are interested in expanding or protecting own network**.**

- **Layer 2 is when the passive fibre network is lit by installing active optical fibre cable equipment:** In the case of LEMOFI the active equipment is the Gigabit Passive Optical Network GPON and Optical Network Unit ONU / Optical Network Termination (ONT) equipment. This is the LEMOFI Ring and Distribution Network that LECC plans to deploy and the offer Open Access FTTx Services to ETL, VCL, Comnet, Leo, Jenny Lesotho.

- **Layer 2/3 consists of the Optical Transport Network OTN, Ethernet Swichess and Router Network.** LECC have deployed the Ethernet Switches and Routers at the LECC HQ site in New Europa, House No. 286, LCA Lesotho Internet Exchange Point (LIXP) and Mabote Substation.

The End-to-End E2E Management Layer consists of the International Interconnect the QoS/QoE requirements, Security (DMZ Security Layer), OSS/BSS and other ITS Systems, FCAPS, NMS Network Management Systems and EMS Element Management Systems.

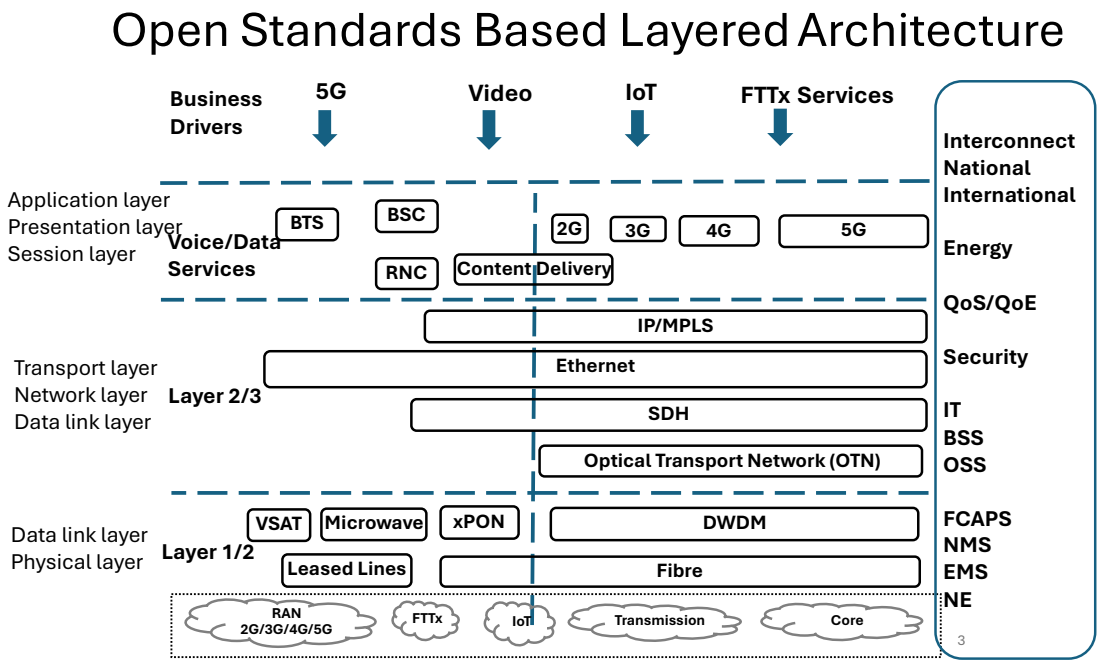


Figure 23Open Standard Based Layered Architecture

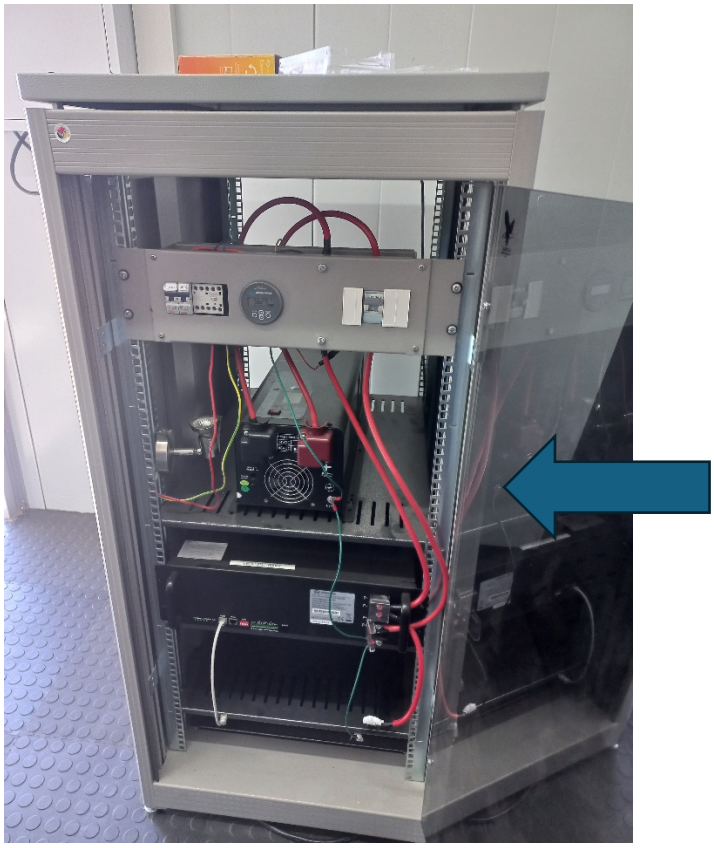
5.4 Project Components

The process of implementing the project for each of the identified sites (**Table 14**) involves the following activities:

- **Construction of Points of Presence (POP)**
  - Components of POP: Outdoor Cabinet, Plinth, Switch, Optical Line Terminals, Environment Monitoring System, Electrical Distribution, Rectifier, Battery (as illustrated in **Picture 1**, **2 ,3, 4 and 5**)



Picture 1: Points of Presence (POPs) in an Outdoor Cabinet at Ha Foso LEMOFI Station



Picture 2: Points of Presence (POPs) Batteries at LECC Offices



Picture 3: Points of Presence (POPs) at LECC Offices



Picture 4: Fibre on Already existing LEC Pole



Picture 5: Fibre on Already existing LEC Pole

- **Construction of Fibre Distribution Network**
    - Components of Distribution Network: Backhaul Fibre, feeder fibre, poles, micro ducts, distribution fibre, 1:2 splitters, 1:4 splitters, 1:8 splitters, drop cable, fibre distribution terminals, fibre access terminals

Table 14 Quantity of Project Construction Components for Identified Sites

Activity	Description
1. Construction of ring and distribution networks (Highway – Central – IEMS)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **6.859km** Estimated Ring Trenched Cable length: **3.06km** Estimated Distribution Aerial Cable length: **6.192km** Estimated Distribution Trenched Cable length: **1.053km** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **26 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **210 Poles** Manhole: **0**

2. Construction of ring and distribution networks (Parliament-MSU Mall)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **9.159km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **7.761km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **7 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **11 Poles** Manhole: **0**
3. Construction of ring and distribution networks (Old Europa - Downtown)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **5.080km** Estimated Ring Trenched Cable length: **1.459km** Estimated Distribution Aerial Cable length: **11.102km** Estimated Distribution Trenched Cable length: 1.705**km** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **50 Poles** Manhole: **2**
4. Construction of ring and distribution networks (A2-Lekhaloaneng Matala)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **7.258km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length:**12.032km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **61 Poles** Manhole: **0**
5. Construction of ring and distribution networks (Thetsane-Tikoe)	Number of PoPs: **Two** Estimated Ring Aerial Cable length: **12.160km** Estimated Ring Trenched Cable length: **N/A**

	Estimated Distribution Aerial Cable length: **13.112km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **51 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **87 Poles** Manhole: **0**
6. Construction of ring and distribution networks (Maseru Industrial)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **12.234km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **13.389km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **8 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles** Manhole: **0**
7. Construction of ring and distribution networks (Teyateyaneng)	Number of PoPs: **Two** Estimated Ring Aerial Cable length: **9.749km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **11.138km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **89 Poles** Manhole: **0**
8. Construction of ring and distribution networks (Mafeteng)	Number of PoPs: **Two** Estimated Ring Aerial Cable length: **9.056km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length:**31.434km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes**

	SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **11 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles** Manhole: **0**
9. Construction of ring and distribution networks (Maputsoe)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **12.144km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **17.977km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **0 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **0 Poles** Manhole: **0**
10. Construction of ring and distribution networks (Hlotse)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **11.682km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **10.336km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **46 Poles** Manhole: **0**
11. Construction of ring and distribution networks (Butha Buthe)	Number of PoPs: **One** Estimated Ring Aerial Cable length:**7.480km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **16.463km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **46 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **115 Poles**

	Manhole: **0**
12. Construction of ring and distribution networks (Mohale's Hoek)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **7.699km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **12.025km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **0 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **4 Poles** Manhole: **0**
13. Construction of ring and distribution networks (Lower & Upper Moyeni)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **7.449km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **6.203km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **0 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **4 Poles** Manhole: **0**
14. Construction of ring and distribution networks (Mokhotlong)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **7.225km** Estimated Ring Trenched Cable length: **N/A** Estimated Distribution Aerial Cable length: **9.70km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **20 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **284 Poles** Manhole: **0**
15. Construction of ring and distribution networks (Thaba Tseka)	Number of PoPs: **One** Estimated Ring Aerial Cable length: **6.758km** Estimated Ring Trenched Cable length: **N/A**

	Estimated Distribution Aerial Cable length: **7.983km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **10 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **47 Poles** Manhole: **0**
16. Construction of ring and distribution networks (Qacha's Nek)	Number of PoPs: **One** Estimated ring aerial cable length: **6.842km** Estimated ring trenched cable length: **N/A** Estimated Distribution Aerial Cable length: **12.512km** Estimated Distribution Trenched Cable length: **N/A** Use of LEC's 11kV lines: **Yes** SABS Poles of Length 9 meters (Treated – creosole and 140mm – 160 mm or greater): **0 Poles** SABS Poles of Length 7 meters (Treated – creosole and 140mm – 160 mm or greater): **8 Poles** Manhole: **0**

5.5 Project Activities

The project activities will cover the following areas:

- **Pre – Construction Activities Include**
  - Acquiring Right of Way
  - Site preparation (Land and Vegetation clearing) which will be minimal for digging poles.
  - Mobilisation (Transport) to the sites (Equipment, personnel and construction modules)
  - Provision of Energy for construction
- **Construction Activities Include**
  - Micro trenching of Fibre route which will be in Maseru only and cover 8,000 meters. The micro trenches are 3cm width and 30cm depth (Illustrated in

Picture 6). The micro trenching will be done between the yellow line of the road and the pavement (**Picture 7**).



Picture 6: Micro Trenching



Picture 7: Micro Trenching Area in Maseru CBD

- Laying and hanging of Fibre cables – most of the fibre will be on already existing LEC poles and additional poles will be added to accommodate distribution fibre.
- Installation of various equipment, power generation equipment, e.g. PoPs and Substation.
- Civils works
- Activities relating to the construction of Data centres (electrical/ mechanical) as illustrated in Picture 8.



Picture 8: LEMOFI Substation Ha Foso

- Commissioning of Fibre
- Demobilization

- **Operational Activities Include**
  - Operation of the Fibre Network
  - Maintenance or inspection of the Fibre Cable
  - Maintenance of data center and access system locations

5.6 Benefits of the Project

In an effort to enhance national connectivity and support socio-economic development, this project aims to establish a robust and inclusive telecommunications infrastructure

across the country. By extending network services and improving digital accessibility, the initiative will serve as a foundational platform for start-up Network Service Providers, bolster existing service delivery, and expand coverage to underserved areas. The resulting network will not only offer affordable data services to the public but also empower key sectors such as health, education, governance, and broadcasting. Additionally, the project promises to boost economic growth through job creation, support smart infrastructure monitoring, and ensure long-term operational sustainability for the Lesotho Electricity and Communications Company (LECC).

The project will result in the following benefits:

- Platform for start-up Network Service Providers
- Extended network infrastructure to Unified Licensees and Network Service Providers
- Affordable prices of data to the end users
- Increase fibre Optic network coverage.
- Offer infrastructure for protection (service redundancy) of existing government offices and business connections.
- Once the network is in place, the government will be able to affordably connect health centres, schools, local and central government offices, and other key strategic points.
- Extended coverage to new sites
- Signal distribution links for Lesotho National Broadcasting Services (LNBS) high-sites and increased capacity for quality broadcasting to support digital migration initiatives.
- Job creation for Basotho during the implementation stage
- Opportunities for LEC to monitor smaller sub-stations and be able to introduce smart metering.
- Offer LECC's operational sustainability

NB. The Designs are attached as **Annexure 10**

6.0 STAKEHOLDERS ENGAGEMENTS

The objectives of the undertaking the stakeholder engagement process includes:

- **Ensuring understanding:** An open, inclusive and transparent process of culturally appropriate engagement and communication was undertaken to ensure that stakeholders were well informed about the Project.
- **Building relationships:** Through supporting open dialogue, engagements helped to establish and maintain a productive relationship between the Environment and Social Specialist and stakeholders.
- **Ensuring compliance:** The process is designed to ensure compliance with both local regulatory requirements and international best practice.

6.1 Approach

The methodology for undertaking the stakeholder's engagement involved the following activities:

- Stakeholder consultations planning
  - Review of project documentation and identification of gaps in information for public participation report,
  - Identification of stakeholders as Directly Affected Parties, Interested Parties, Traditional Leaders, Community Councillors and Regulatory Authorities,
  - Mapping and Profiling of stakeholders to categorisation,
- Stakeholder consultations: public gatherings (Lipitso) and interviews as well as meetings with stakeholders,

6.2 Key Engagement Risks

Table 15 presents a summary of the risks that may occur during the Stakeholder Engagement Process and proposed remedial actions to be taken should these risks manifest.

Table 15 Identified Engagement Risks and Remedial Action Taken

Risk	Remedial Action
Lack of community understanding and Misinformation about the Project	• ES specialist tailored the key messages as necessary to ensure that messages are understood. This included the translation of Project messages into Sesotho. • Meetings included feedback from the communities to ensure the messages are understood.
Low participation or unwillingness to participate in community meetings	• ES specialist undertook the meetings as community gatherings to facilitate participation.

6.3 Local Authorities

The first step in the stakeholders' engagements was sensitisation of the respective Local authorities, as part of the local governance (Illustrated in **Table 16**).

Table 16 Dates for Sensitization meetings with the Local Authorities

Official Engaged	Position	Venue	Date
MOKHOTLONG DISTRICT			
Mr. Khau Maseru	**District Administrator** Planning Manager	Mokhotlong	12th December 2024
Mr. Boipuso Moleko	**District Council Secretary**	Mokhotlong	12th December 2024
Chief Mathealira	**Principal Chief**	Mokhotlong	12th December 2024

Ms. Malehloa Khoarai	**Chief Secretary**		
Ms. Nthabiseng Tekane	**Mokhotlong Urban Council – Town Clerk**	Mokhotlong	12th December 2024
THABA TSEKA DISTRICT			
Mr. Tlali Mphafi	**District Administrator**	Thaba Tseka	13th December 2024
Mr. Lenka Letlatsa	**District Council Secretary**	Thaba Tseka	13th December 2024
Chief Ntaote	**Principal Chief**	Thaba Tseka	13th December 2024
Mr Tšabela Tlali	**Thaba Tseka Urban Council – Town Clerk**	Thaba Tseka	13th December 2024
Chief Samonyane Ntaote	**Chief – Thabong**	Thaba Tseka	13th December 2024
BOTHA BOTHE DISTRICT			
Mr. Tsepa Machaba	**District Administrator**	Botha Bothe	19th December 2024
Mrs 'Mathulisi Mathusi	**District Council Secretary** Accountant	Botha Bothe	19th December 2024
Chief Retšelisitsoe Mopeli	**Principal Chief**	Botha Bothe	19th December 2024
Senate Nkuebe	**Secretary**		
Mr. Nchaka	**Botha Bothe Urban Council – Town Clerk**	Botha Bothe	19th December 2024
Chief Chonela	**Chief of Ha Belo**	Ha Belo – Botha Bothe	19th December 2024
BEREA DISTRICT			
Mr. Phahlane Makoko	**District Administrator**	Berea	7th January 2025

Mr. Paseka Letela	**District Council Secretary**	Berea	7th January 2025
Chief Sempe Khabasheane Masupha	**Principal Chief**	Mamathe	7th January 2025
Mrs. 'Mamolete Khothatso	**Berea Urban Council – Town Clerk**	Berea	7th January 2025
LERIBE DISTRICT			
Mr. Letsema Khalanyane	**District Administrator**	Hlotse	6th January 2025
Mr. Tšolo Thabana	**District Council Secretary**	Hlotse	6th January 2025
Chief Joel Molapo	**Principal Chief**	Leribe	6th January 2025
Chief Pontšo Mathealira Seeiso	**Principal Chief**	Tsikoane, Peka le Kolobere	6th January 2025
Mr. Molalle	**Hlotse Urban Council – Town Clerk**	Hlotse	6th January 2025
Ms. Mothontši Lekau	**Maputsoe Urban Council – Town Clerk**	Maputsoe	6th January 2025
Chief Mantsoe	**Chief of Ha Tlai-Tlai**	Ha Tlai-Tlai	6th January 2025
MAFETENG DISTRICT			
Mr. Tsamaiso Tlolotlolo	**District Administrator**	Mafeteng	8th January 2025
Mr. Paseka Letele	**District Council Secretary**	Mafeteng	8th January 2025
Chief Lerotholi Leshoboro Seeiso	**Principal Chief**	Likhoele	8th January 2025
Mr. Monyetsane	**Mafeteng Urban Council**	Mafeteng	8th January 2025
Chief Tebello Sello	**Chief - Matheneng**	Matheneng	8th January 2025

MOHALE'S HOEK DISTRICT			
Mrs. 'Malebohang Lebele	**District Administrator**	Mohale's Hoek	9th January 2025
Mr. Thabo Mothe	**District Council Secretary**	Mohale's Hoek	9th January 2025
Mrs. 'Malehlohonolo Khemeso	**Mohale's Hoek Urban Council** Accountant	Mohale's Hoek	9th January 2025
Chief – Qalakheng	Chief Leteketa	Qalakheng	9th January 2025
QUTHING DISTRICT			
Mr. Bonang Tlali	**District Administrator**	Quthing	9th January 2025
Libuseng Matsenela	**District Council Secretary** Secretary	Quthing	9th January 2025
Ms. 'Majobo Lejaha	**Quthing Urban Council**	Quthing	10th January 2025
Chief Seeiso Nkuebe	**Principal Chief**	Quthing	10th January 2025
QACHA'S NEK DISTRICT			
Mr. Habofanoe pheko	**District Administrator**	Qacha's Nek	10th January 2025
'Manepo Makatjane	**District Council Secretary** Administrator	Qacha's Nek	10th January 2025
Mr. Realeboha Motlatsi	**Qacha's Nek Urban Council**	Qacha's Nek	10th January 2025
Chief M. Makhaola	**Principal Chief**	Qacha's Nek	10th January 2025
MASERU DISTRICT			
Mr. Tšepo Lethobane	**District Administrator**	Maseru	14th January 2025

Administrator – Ms Mphanya	**District Council Secretary**	Maseru	14th January 2025
Mr. Motlalepula Sepipi	**Maseru City Council – Mayor**	Maseru	14th January 2025
Chief Moeketsi Hlatsi Mothobi	**Chief – Majoe - a – Litšoene**	Maseru	14th January 2025
Chief Maama	**Chief – Ha Maama**	Roma	14th January 2025

6.4 Local Communities Engagements

Following the meetings with the Local Authorities, the ES Specialist and the Chiefs collaborated to set up the dates for holding the public gatherings (Lipitso) for respective communities under the project's scope. The public gathering for few villages were held on the dates indicated on **Table 17**. The public gatherings Attendance Registers are attached in the **Annexure 7** and Pictures as **Annexure 8**.

Table 17 Public Gathering Information

Communities Involved	**Place**	**Date**	**Time**	**Total Number of Participants**	**Gender of Participants**	
					Females	**Males**
Ntlholohetsane - Mokhotlong	Pitso ground	20th December 2024	07:00am	6	1	5
Thabong – Thaba Tseka	Pitso ground	21st December 2024	07:00am	15	6	9

Communities Involved	Place	Date	Time	Total Number of Participants	Gender of Participants	
					Females	Males
Ha Tlai-Tlai - Leribe	Chiefs' Place	5th January 2025	09:00am	10	4	6
Ha Maama - Roma	Chiefs' Place	11th January 2025	08:30am	9	6	3
Majoe - a – Litšoene - Maseru	Pitso ground	11th January 2025	02:30pm	7	4	3
Ha Belo – Botha Bothe	Chiefs' Place	15th January 2025	07:00am	24	18	6
Qalakheng – Mohale's Hoek	Pitso ground	18th January 2025	08:30am	12	5	7
Matheneng - Mafeteng	Chiefs' Place	19th January 2025	08:30am	20	8	12

6.5 Limitations

The engagements were carried out during the festive season and community members were not in the mood for attending community gatherings but preparing for the Christmas celebrations and the engagements continued in January when they were busy preparing for the new year (looking for schools for their children, moving back to workplaces) hence few numbers participated in the community engagements.

6.6 Outcome of Engagements

The intent of the engagements was to inform the stakeholders about the project. During these engagements, the stakeholders were given an opportunity to raise concerns and expectations related to the project. The engagements were structured as follows:

- Welcome and introduction of the Consultant team
- Non-technical presentation of the proposed Project
- Question and answer session
- Photographs of the engagements where possible
- Completion of the attendance register

6.6.1 Key Findings

The project stakeholders responded positively to the proposed development and expressed that they would remain so as long as mitigation and mending up measures are developed and implemented simultaneously with the project. The following issues were raised as indicated in **Table 18** below.

Table 18 Key Concerns of Stakeholders

Stakeholder groups	Key Concerns	Communication Methods
Project Communities	- The government must subsidise access to internet for the households and schools as now education is through internet. - Recruitment of Casual Labourers - Sub-standard workmanship. - Destruction of already existing Powerlines - Management of Borrow Pits - Compensation of affected Properties - Grievance Redress Mechanism	- Public Gatherings

Stakeholder groups	Key Concerns	Communication Methods
Local Authorities	- Compensation of affected properties - Engagement of local labour - Grievance Redress Mechanism - Continuous stakeholders' engagement throughout the project implementation - Free internet for government offices e.g. Courts, hospitals, offices of chiefs, community councils etc.	- Meetings
Government Departments	- Policy guidance	- Meetings

6.6.2 Uptake of the Proposed Project by the Communities

All issues and concerns raised at the meetings have been captured and summary of Communities issues are shown in **Table 19**.

Table 19 Issues Covered During Public Gatherings

Area	Questions/Concerns	Answers
Ntlholohetsane - Mokhotlong	1. How is general labour recruitment going to be handled?	1. The general labourers are going to be recruited using the already existing engagement methods that the Community of Ntlholohetsane and local structures are using to recruit general labourers.
	2. How are the grievances going to be handled?	2. LECC will disclose the GRM to follow before commencement of the Project. However, all the grievances will be recorded by the Project Team and will be handled by relevant parties.
	3. Are the affected properties going to be compensated?	3. All affected properties will be registered and valuated and compensation will be issued by the LECC.
Qalakheng – Mohales' Hoek	1. The community was very happy to hear about the project and they said they are going to support the project since internet is going to help them have reliable WhatsApp.	Noted
	2. General labour recruitment	2. The community suggested that all general Labourers recruitment be done through the

Area	Questions/Concerns	Answers
		office of the Chief and the Councillor to avoid political influence.
Thabong – Thaba Tseka	1. How is casual labour recruitment going to be handled?	1. There are already existing employment methods that the community use to hire casual labourers for other projects, those methods will be followed.
	2. Will the contractor impart any skills to some members of the community to attend to any requirements of the works once he leaves site.	2. Given the scope of work, this is going to be a huge project that will require expertise and manpower for the project to completed on time. Therefore, skills transfer will be done by the Contractor
Ha Tlai-Tali - Leribe	1.How are the disputes going to be handled between the Contractor and the Community?	1. LECC will disclose the GRM before commencement of the project. Again, the disputes are going to be handled by the Client and the Engineer.
	2. How is casual labour recruitment going to be handled?	2. There are already existing employment methods that the community use to hire casual labourers for other projects, those methods will be followed.

Area	Questions/Concerns	Answers
Ha Belo – Botha Bothe	1. Will there be blasting?	1. Blasting is not anticipated.
	2. Access to internet will improve communication hence, we welcome the project, and we will support it.	Noted
Ha Maama - Roma	1. Community pleaded that the contractor should give first preference to the elderly for camp establishment to enable them to make a living out of leasing their sites.	Noted
	2. Community complained that the government has a tendency of making promises that it is not willing to fulfil and takes too long to implement. As a result they don't believe that this project will see light of the day.	2. The project has secured funding already from the AfDB hence it will be implemented once the studies have been completed.
	3.Will the general labourers qualify for severance at the end of the project?	3. The Labourers will be paid as per the Labour Act 2024 and its guidelines.
Majoe -a-litšoene - Maseru	1. What will happen to individual properties if damaged by the Contractor?	1. All damaged properties will be repaired by the contractor.
	2. How is casual labour recruitment going to be handled?	2. There are already existing employment methods that the community use to hire casual

Area	Questions/Concerns	Answers
		labourers for other projects, those methods will be followed.
	3. Site management and clean-up efforts should be done by the contractor during the construction phase. The project should not pollute the project area.	3.The Construction Supervision Engineer will ensure that the Contractors do not pollute the Environment where pollution is caused the Contractor will rehabilitate to the satisfaction of the Construction Supervision Engineer.
Matheneng - Mafeteng	1. Who will be staying at the proposed labour camps?	1. Probably skilled labourers from outside the project area.
	2. The project seems to cover a huge area will there be more than one contractor?	2. the modalities of project implementation are not yet in place hence that can be clarified at a later stage.
	3.What is going to happen if the Contractor leaves the project site without paying casual labourers?	3. There is money that is called retention that the Client holds for a period of a year after construction. This money will not be released until all social and environmental issues have been addressed.

In general, the following observation and recommendations were made by the communities:

- Communities expressed their scepticism about the proposed project given that experience has taught them that engagements are done but implementation of projects never happens or take too long to happen. Hence, many previous consultations of previous similar projects which never took off.

- Communities requested that they be given regular feedback about the project.

- On property that will be affected by the project, communities wanted to know whether they will be compensated. Communities were sceptical about compensations, making reference to a previous project which did not compensate them for loss and damage of some of their properties.

- Communities suggested that for local unskilled labour, similar approaches for local development projects such as Water and Soil Conservation, should be followed whereby people register at the local chief's offices and recruitment is done on a first come first serve basis. They complained about Councillors who they said have the tendency of recruiting their friends and relatives.

- On the recruitment of skilled labour too communities said that first preference should be given to people of the area where construction is taking place. They claimed that they too are skilled.

- Inclusiveness in recruitment was raised. Villagers where construction is taking place, should be the ones engaged to work there. When the construction moves to the next village, villagers concerned would be ones to work in such

an area. Likewise, recruitment by gender and age range needs to be considered.

6.6.3 Local Authorities Uptake

The local authorities mentioned that projects of this nature are really beneficial when they take place and they believe they are going to improve on service provision as communication is now easier using online platforms. Therefore, all most all the government office still do not have reliable access to internet hence definitely this project once implemented will contribute significantly to service delivery. They are going to support it.

7.0 GRIEVANCE REDRESS MECHANISM

The GRM is grounded in several national laws that uphold transparency, community participation, and the right to redress:

- Environment Act (2008): Requires that affected parties have the right to raise concerns and receive responses regarding environmental impacts.
- Land Act (2010): Supports community participation in land use decisions and access to dispute resolution mechanisms, especially where land is temporarily disturbed.
- Labour Code Order (1992): Provides a legal basis for resolving workplace disputes and protecting workers' rights, particularly during construction activities.
- Local Government Act (1997): Empowers local councils to mediate and resolve community grievances in development contexts.

These frameworks collectively ensure that the GRM reflects local governance structures and cultural norms around dispute resolution.

7.1 Grievance Redress Mechanism

Grievances may take the form of specific complaints for actual damages or injury, general concerns about project activities, incidents and impacts, or perceived impacts. Therefore, the grievance may either be negative or positive. The African Development Bank (AfDB) The IFC standards require Grievance Mechanisms to provide a structured way of receiving and resolving grievances. Complaints should be addressed promptly using an understandable and transparent process that is culturally appropriate and readily acceptable to all segments of affected communities and is at no cost and without retribution. The mechanism should be appropriate to the scale of impacts and risks presented by a project and beneficial for both the company and stakeholders. The mechanism must not impede access to other judicial or administrative remedies.

Therefore, the Grievance Redress Mechanism (GRM) is an effective tool for early identification, assessment, and resolution of complaints on projects.

The GRM will ensure that community members or any other stakeholders are able to raise their concerns regarding project-related activities, including the application of relevant social and environmental safeguards and mitigation measures. The GRM, once fully functional, will help to safeguard Project funds and reputation in that it gives LECC as the Project Implementing Unit (PIU) a method of effectively collecting and responding to key stakeholders' inquiries, suggestions (positive or/and negative), concerns, and complaints that, if left unresolved, may result in the derailment of the whole project (**Figure 24 illustrates**).

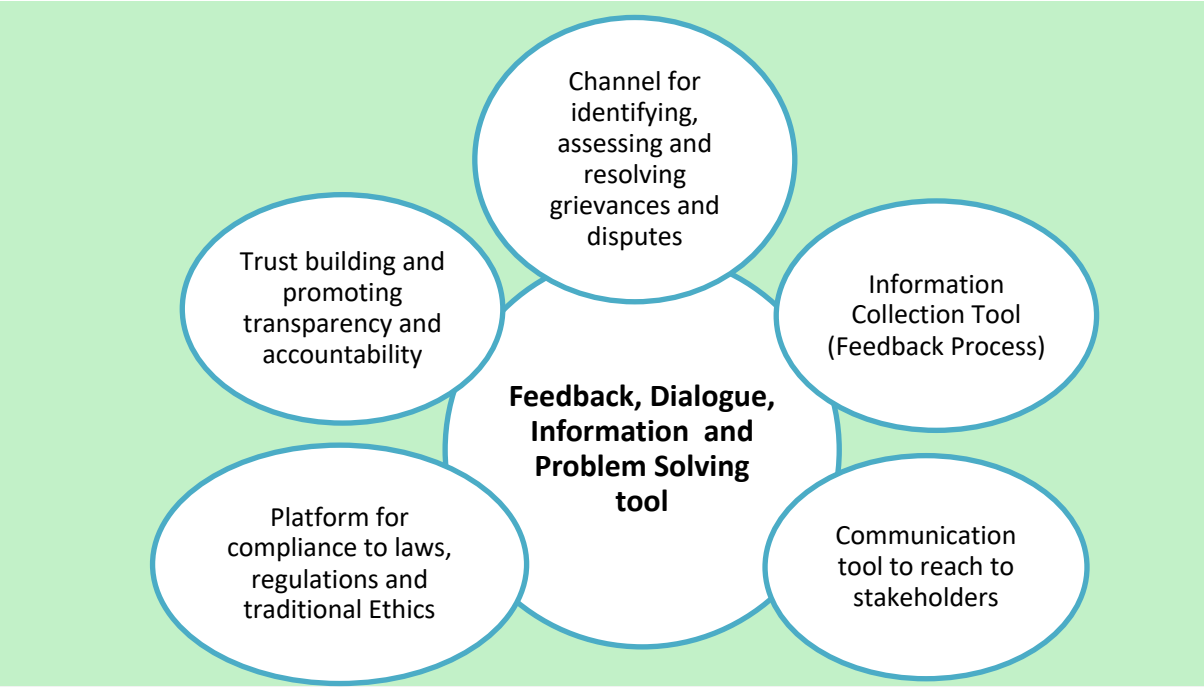


***Figure 24* Purpose and Objectives of GRM**

The GRM has the following specific objectives:

a. To be responsive to the needs of the beneficiaries by providing a channel for feedback and resolving grievances and disputes at the various levels (local, district) in the project area.
b. To provide an opportunity to the aggrieved party and the project implementers to resolve disputes in a short time before they escalate to big problems.
c. To collect information that can be used to improve project performance and mitigate project risks.
d. To facilitate effective communication between the project and the affected parties.
e. To enhance the project's legitimacy among stakeholders by promoting transparency and accountability and deterring fraud and corruption.
f. To provide a platform to ensure compliance with the provisions of the laws, regulations, and cultural and traditional rules in the project areas.

7.1.1 Potential Grievances

The LECC will be proactive in addressing grievances by ensuring that there is adequate stakeholder participation and consultation during the project processes. Based on the understanding of the project area and the stakeholders, an indicative list of the types of grievances have been identified for the project, as can be seen below:

- Unfair award of tenders and contracts
- Delay in commencement of sub-project activities
- Delay in payments of Contractors and Consultants
- Delay in disbursement of Project funds
- Long procurement procedures
- Delay in procuring Project implementing resources
- Delay in implementing construction phase of the Project
- Concerns over the impact on local cultures and customs

- Delay in commencement of the compensations process
- Delay in establishing community project implementing committees
- Labour recruitment issues
- No continuous Stakeholders Engagements
- Labour Issue from project and sub-project employees e.g. Non-payment of salaries
- Sexual Exploitation and Abuse (SEA) & Sexual Harassment (SH)
- Gender Based Violence (GBV) and issues.

7.1.2 Types of Remedies Available Under the GRM

The GRM provides for categories of remedies for the grievances, and these include:

- **Acknowledgement of Responsibility and Apology**

In some cases, such as in the event that the GRM determine that the LECC failed to undertake its obligations (e.g. failure to provide feedback to community on project related issues or grievance) and the impact on the Aggrieved Party is minimal. The LECC shall acknowledge the problem and offer a written apology to the Aggrieved Party.

- **Clarification and Provision of Factual Information**

In cases where it is determined that the complaint was based on lack of information or incorrect information on the part of Aggrieved Party, the LECC shall respond by providing the correct and factual information that should remedy the grievance.

In instances where incorrect information may lead to harm, there is need to assess damage occasioned to the aggrieved party because of incorrect information or otherwise is imperative and so is subsequent compensation.

- **Modification of Conduct/Actions that caused Grievances**

There are specific actions by the project or its Consultants /Contractors that could be well intended but may result in individuals or community declaring a grievance. In the event that such actions can be remedied by changing the actions/conduct, the LECC shall reverse or change such an action.

- **Legal Recourse**

If the project is unable to solve a complaint, it may be appropriate to enable complaints to have recourse to external experts. The Project team will be familiar with the judicial and administrative channels for dispute resolution available in Lesotho and will not impede access to this mechanism. E.g. in cases of sexual harassment or similar complaints, such will be referred to the relevant authorities.

7.1.3 Implementation Steps for the GRM

The GRM has been designed to provide a timely, responsive and effective system of resolving community, stakeholders or individual's grievances in the areas the project is implementing activities. It is a process (**Figure 25 - 26**) starting at the community level (e.g. Community Liaison Officer), through the district administration (e.g. District Councils) to the National level (e.g. LECC, Ministry of Energy (MoE) as illustrated in **Table 20**. It is a multi-stage process that ensures that all stakeholders from the community level structures to the National office are involved in finding solutions to the grievances raised by the communities the project is targeting.

All Project Affected Persons (PAPs) will be informed of their rights to raise grievances pertaining to the LECC. GRM procedures will be put in place to ensure that grievances are

recorded and considered fairly and appropriately. The LECC will publicly disclose the GRM.

The LECC will generally seek to resolve complaints within 30 days. Therefore, the maximum resolution period will not normally exceed 30 days.

Step 1: Identifying Focal Points

The LECC Safeguards Officer will be in charge of GRM. GRM will have multiple focal points to receive and register grievances. This GRM is designed to give the aggrieved parties access to seek redress to their perceived or actual grievance using this mechanism or other existing mechanisms such as the National legal system (i.e. local Courts, magistrate courts, High court and Supreme Court), Ombudsman Office. The LECC safeguards Officer will have the overall responsibility for tracking and following up on issues and complaints raised.

At **Community Level**, the project grievance redress structure will be linked and interface to the existing traditional authority structure as this already provides for resolving conflicts in the communities. This will ensure accessibility to the GRM as the traditional structures are close to the people. The Focal Point at community level will be the GRM Community Representative, Community Council Secretary, Chief, LECC Safeguards Officer.

The LECC will implement a training and disclosure program to inform and teach Focal Points, community members and other stakeholders how to handle grievances and why the GRM is important to the Project's success. This disclosure and training will include information about interacting with beneficiaries about grievances, the LECC's internal policies and procedures in relation to grievance redress. The disclosure and training will be conducted in English and Sesotho.

Table 20 Project Team Roles and Responsibilities in GRM Implementation

	Role	Responsibility
1.	**Project Manager - LECC**	Accountable for the implementation of the Grievance Redress Mechanism (GRM).
2.	**LECC Environment and Social Safeguards Officer**	Raise awareness in the communities (Project Area) on GRM. Train Focal Points on the implementation of the GRM. Responsible for the overall implementation of the grievance mechanism. Overall responsibility for tracking and following up on issues and complaints raised Ensure Feedback is provided to the AP by the Focal Points. Support the resolution of Complaints; and liaison with Focal Points and the Complainant (AP).
3.	**LECC Environment and Social Safeguards Officer**	Responsible serving as the main point of contact with the Complainant (AP). This includes receiving and reporting Complaints, maintaining the Complaints Log. Dissemination of the Feedback to the AP.
4.	**Ministry of Energy** • **GRM Committee** • **LECC**	Responsible for investigating and resolving Complaints. This includes conducting investigations, proposing resolutions, implementing corrective actions and coordinating with the complainant.

5.	**Local Community Structures** • **District Councils representatives** • **Community Councils representatives**	Responsible for collating grievances from the project affected communities in line with project reporting protocols. The LECC Safeguards Officer shall collect these complaints from the Community Council Secretary. While the community will lodge the compliant through their area chief and or Community Councillor.

Step 2: Registration of Grievances

A register of grievances which will be held by the LECC Safeguards Officer, GRM Community Representative (GCR), Community Council Secretary (CCS) and Chiefs Offices. The Aggrieved Party (AP) will register their grievances on this register and to register the grievance, the AP will provide information to the LECC Safeguards Officer, GCR, Community Council Secretary, and/or Chief to be captured in the Grievances Registration Form (**Annexures 2 and 3**). The LECC will also accept complaints from the APs submitted through verbal, email, phone, WhatsApp, meeting or letter to the offices of the LECC, in English and Sesotho. The LECC Safeguards Officer will transcribe these submissions. Receipt of grievances shall be acknowledged as soon as possible, by letter or by verbal means.

When a complaint is made verbally to the LECC, the LECC will acknowledge its receipt in a communication that outlines the grievance process; provides contact details and, if possible, the name of the person who is responsible for handling the grievance; and note how long it is likely to take to resolve the grievance. Complainants will receive periodic updates (every two weeks) on the status of their grievances. This GRM has established clearly defined schedules for acknowledgment and follow-up activities. And to enhance accountability, these schedules will be disclosed widely to various stakeholders, including communities, civil society, and the media.

Step 3: Assessment and Investigation

Assessment and investigation involves gathering information about the grievance to determine its validity and resolving the grievance. The merit of grievances should be judged objectively against clearly defined standards. Grievances that are straight forward (such as queries and suggestions) will be resolved quickly by contacting the complainant.

Having received and registered a complaint, the next step in the complaint-handling process is for the focal points to establish the eligibility of the complaint received. The LECC Safeguards Officer, GCR, CCS or/and Chiefs, once a complaint or grievance is registered, shall within 5 days assess the registered complaint or grievances to determine its validity. The following criteria can be used to assess and verify eligibility:

- The complainant is affected by the project
- The complaint has a direct relationship to the project
- The issues raised in the complaint fall within the scope of the issues that the GRM is mandated to address.

Having completed the complaint assessment, a response can be formulated on how to proceed with the complaint. This response should be communicated to the complainant. The response should include the following elements:

- Acceptance or rejection of the complaint
- Reasons for acceptance or rejection
- Next steps – where to forward the complaint; and
- If accepted, further documents and evidence required for investigation e.g. field investigations.

Once the registered grievance or complaint has been determined as falling within the scope of this GRM, the LECC or/and Ministry of Energy (GRM Team) shall investigate the complaint. Investigation of the complaint may include the following:

- On site visit and verification
- Focus Group discussions and interviews with key informers
- Review of secondary records (books, reports, public records); and
- Consultations with local government and traditional authorities.

The LECC and/or Ministry of Energy (GRM Team) will ensure that investigators are neutral and do not have any stake in the outcome of the investigation. At the end of the field investigation, LECC and/or Ministry of Energy (GRM Team) shall compile a Grievance Investigation Report (GIR) using a standard template (**Annexures 4 and 5**) on the outcomes of the investigations and the specific recommendation to resolve the grievance or complaint.

Step 4: Recommendations and Implementation of Remedies

After the investigations, the focal point will inform the AP of the outcome of the investigations and the recommended remedies if any. The AP shall be provided with written response clearly outlining the course of action the LECC and/or Ministry of Energy (GRM Team) shall undertake to redress the grievances and the specific terminal date by which the recommended remedies shall be completed. Potential actions will include responding to a query or comment, providing users with a status update, or referring the grievance to another level of the system for further action.

The LECC or/and Ministry of Energy (GRM Team) will then ask the Complainant to sign the Registration Form (**Annexures 2 or 3**). If the Complainant agrees to sign, the Complaint is closed out as resolved. If the Complainant refuses to sign, or has failed to sign within the timeframe allowed, the Complaint is referred to the Ombudsman.

Step 5: Referral to Ombudsman

The LECC or/and Ministry of Energy (GRM Team) will seek to reach a resolution with the Complainant that is satisfactory to both sides. In the likely event that the AP is not satisfied with the recommended remedy. The LECC or/and Ministry of Energy (GRM Team) shall forward the copy of Grievance Registration Form (GRF) and the Grievances Investigation Report (GIR) as well as the resolution to the Ombudsman.

The Ombudsman will review the case and determines if further reasonable action is possible. If no reasonable action is possible, the Ombudsman will authorise the close out of the complaint. A close out letter will be sent to the Complainant explaining the Ombudsman's position within 30 working days.

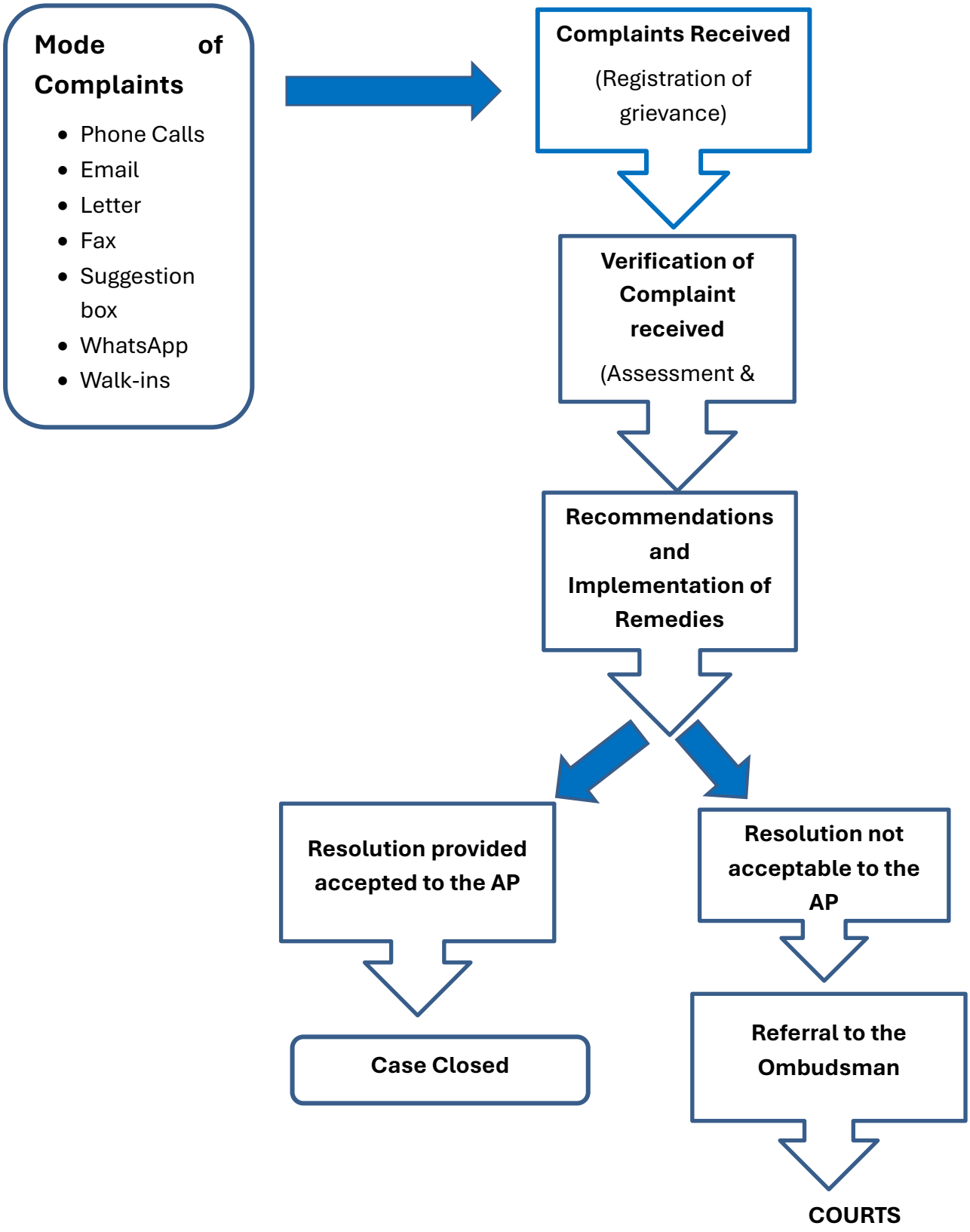


Figure 25 Grievance Flow in GRM

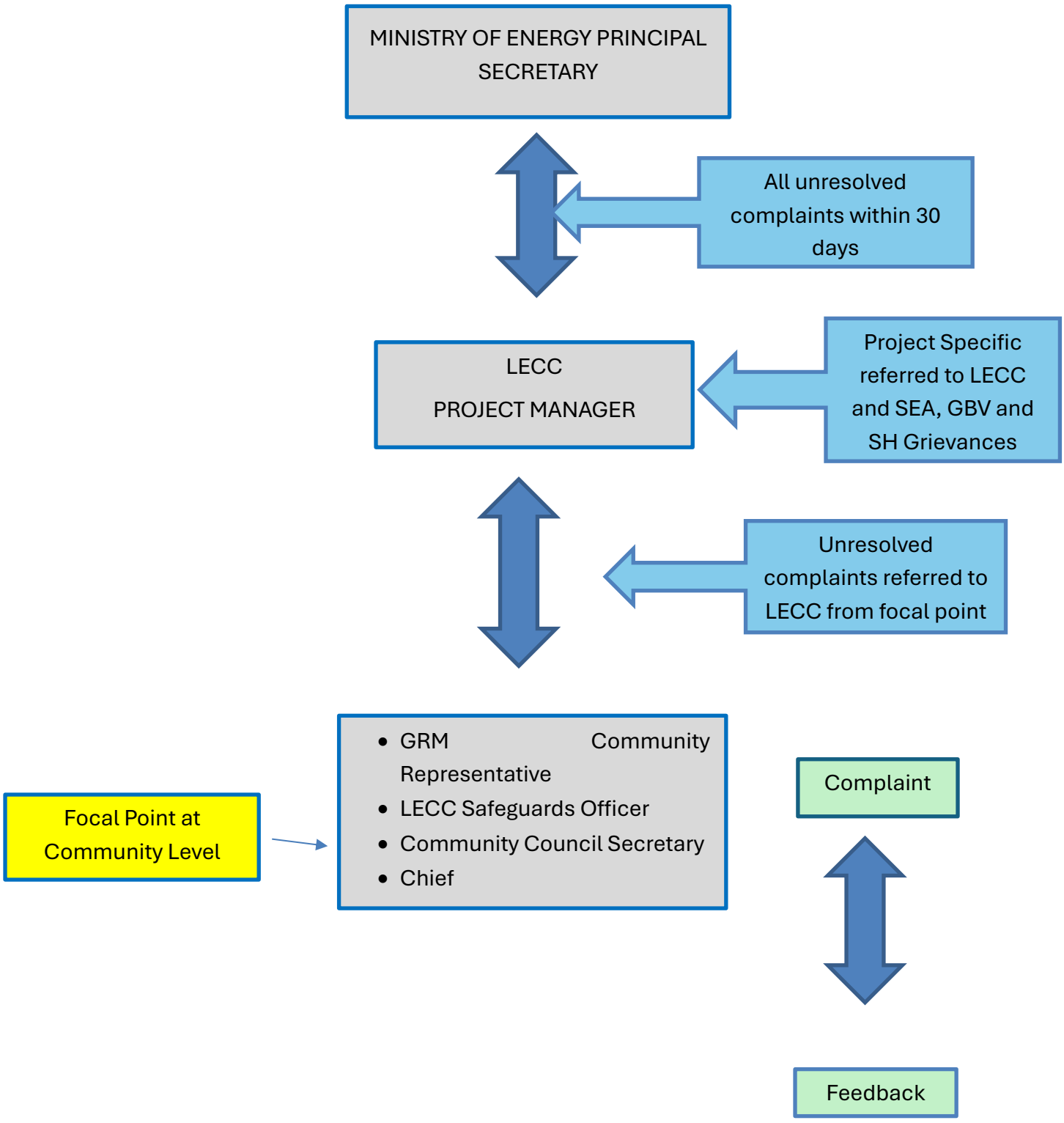


Figure 26 Institutional Grievance Flow in GRM

7.2 General GRM and the GBV/SEA/SH-Specific GRM

To ensure effective handling of complaints and uphold social safeguards, two distinct Grievance Redress Mechanisms (GRMs) shall be established during the construction phase of the **LEMOFI Project**:

Table 21 shows the General GRM and the GBV/SEA/SH-Specific GRM

GRM Type	Purpose	Key Features
General Project GRM	To address LEMOFI project-related grievances, including issues such as noise, dust, traffic disruption, access concerns, employment, and contractor conduct.	- Transparent and accessible to all affected stakeholders - Multiple submission channels (e.g., in-person, phone, written, online) - Timely resolution and feedback mechanism - Regular monitoring and reporting
GBV/SEA/SH-Specific GRM	A separate, confidential channel dedicated to handling **Gender-Based Violence (GBV)**, **Sexual Exploitation and Abuse (SEA)**, and **Sexual Harassment (SH)** complaints.	- Survivor-centred, safe, and confidential - Staffed by trained personnel (preferably gender-balanced) - Referral pathways to support services (medical, psychosocial, legal) - Non-retaliation and protection of complainants - Culturally sensitive and inclusive of vulnerable groups

8.0 BASELINE DATA (BIO-PHYSICAL AND SOCIO-ECONOMIC)

This chapter provides information on the physical, biological and social elements of the environment within the Project scope. The environments described in this section entail the entire physical and social influence area of the Project.

8.1Biophysical Environment

8.1.1 Climate

The climate of Lesotho is described as continental and temperate with four distinct seasons dominated by warm wet summers, and cool dry winters (**Figure 27**). Lesotho enjoys an average of 310 sunshine days per year, with the summeraverage being 24 sunny days per month. Floods and droughts are a common occurrence, with high intensity rainfall producing flash floods that contribute to erosion and high sediment loads in the rivers (NES, 1999). According to the Lesotho Meteorological Services (LMS) (2013), the country's climate is influenced by its location in the Karoo Basin, with altitudes ranging from about 1,400m to 3,480m above sea level.

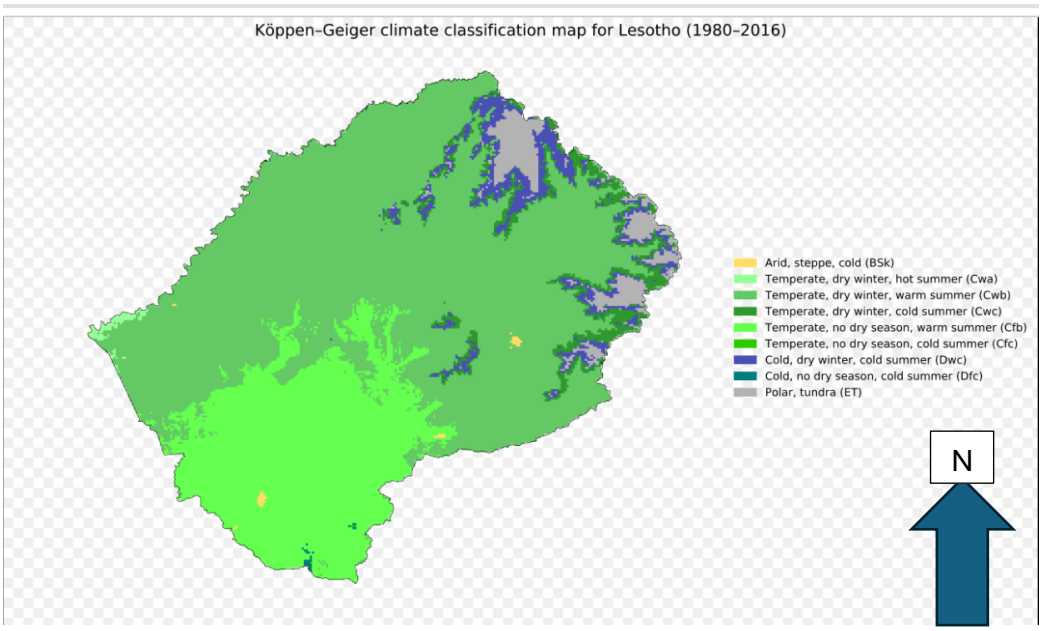


Figure 27 Climate Classification Map of Lesotho

8.1.2 Topography

Lesotho is divided into four topographical regions, namely the Highlands (>2,200 masml), Foothills (1,800-2,200 masml), Lowlands (1.400-1,800 masml) and the Senqu River Valley as shown in **Figure 28**.

Highlands (>2,200 masml),

- **Eastern Lesotho** (e.g., Mokhotlong, Thaba-Tseka, Qacha's Nek)
- **Altitude**: 2,000 to 3,400 meters above sea level
- **Features**: Steep mountains, narrow valleys, and rugged terrain
- **Implications**:
    - Challenging for cable trenching and tower construction
    - Susceptibility to soil erosion and landslides
    - Difficult access requiring off-road logistics

Foothills (1,800-2,200 masml)

- Transitional zone between the lowlands and highlands
- Slope: Moderate to steep gradients
- Located mainly in central Lesotho
- Easier to navigate than highlands but still requires slope stabilization and erosion control

Lowlands (1.400-1,800 masml)

- **Western Lesotho** (e.g., Maseru, Mafeteng, Mohale's Hoek)
- **Altitude**: 1,400–1,800 meters
- **Topography**: Relatively flat to gently rolling plains
- **Implications**:
    - Most suitable for infrastructure placement
    - Easier access for vehicles and machinery
    - Lower construction costs and environmental disruption

Senqu River Valley

- Drakensberg Mountains (e.g., Mokhotlong, Thaba-Tseka, Qacha's Nek and parts of Quthing)
- **Altitude**: 1400 meters in the valley floor to over 3,000 meters along surrounding mountain ridges)
- **Features**: Steep escarpments, Deep-cut riverbeds, Rugged highland slopes, Narrow floodplains in certain sections
- **Implications**:
    - increases difficulty of trenching and pole erection; may require cable suspension systems
    - Requires durable, elevated infrastructure such as aerial spans or riverbed boring
    - Construction equipment access may be limited; may require temporary roads or aerial support

- Infrastructure must include slope stabilization and erosion control measures

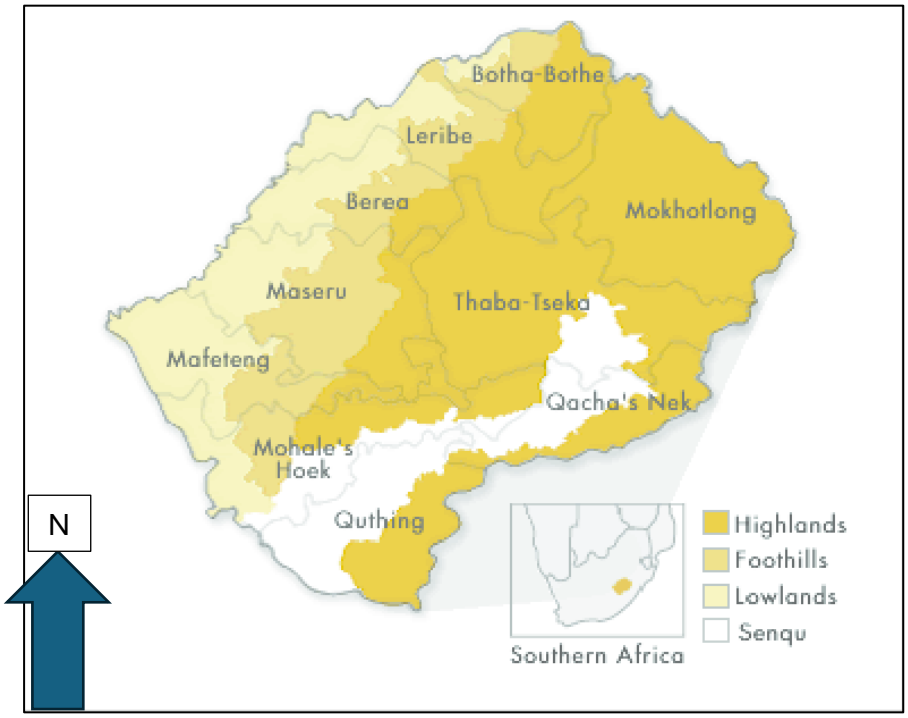


Figure 28 Topographic Regions of Lesotho

8.1.3 Geology

The geology of Lesotho forms layers that lie more or less horizontal. The geological formations layers are as follows; the Stormberg group, Beautfort group, and Drakensburg group (**Figure 29** and **Table 22**). The Beautfort group consists of Burgersdorp. The Stormberg formation consists of four layers: Molteno, Elliot, Clarence and Lesotho Formation. Lesotho formation is the youngest formation of lava flows formed during the Jurassic period with a thickness of about 1 400 m. Below it, is the Clarence formation which are sediments of yellowish fine grains of a thickness of about 91 m. Beneath the Clarence formation is Elliot then Molteno formations. Elliot formation is made up of red and purple mudstones and shales and fine-grained feldspathic sandstones and have

coarse grits at the base. The Molteno formation comprises of several bands of coarse sandstone interleaved with shales which are typically grey and blue in colour.

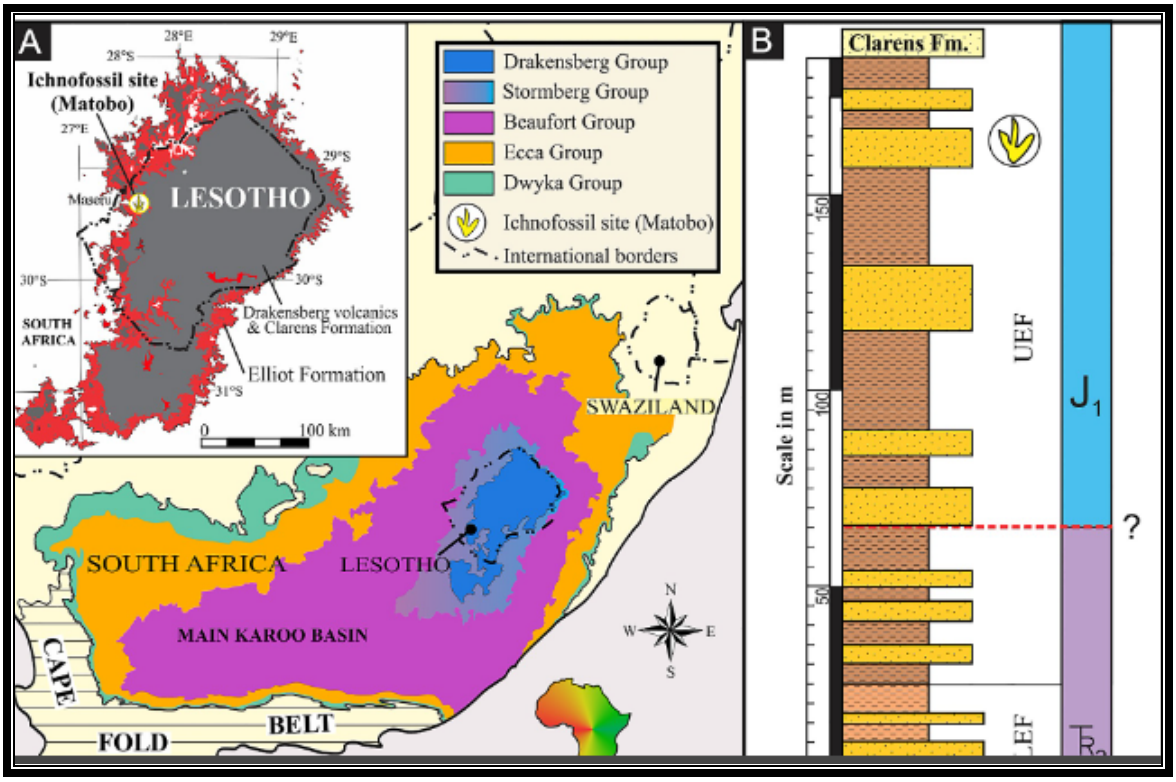


Figure 29 Geology of Lesotho

Table 22 Stratigraphy of Lesotho

Age	Group	Formation	Lithology
Quaternary and Tertiary		Alluvium, colluvium and residual deposits	Clays, silts and gravels
Middle Jurassic to Permian	Drakensberg	Lesotho	Basaltic lava with subordinate tuff and lenses of sandstone near the base
	Stormberg	Clarens	Sandstone and siltstone

	Beaufort	Elliot	Mudstones and shales with subordinate feldspathic sandstone
		Molteno	Sandstones, grits, mudstones, shales and coals
		Burgersdorp	Mudstones and siltstones, sandstone intercalation common
Early Tertiary to Late Cretaceous	Intrusive Rocks	Dykes and sills	Basalt, dolerite and gabbro
		Clusters of pipes and dykes at depth	Kimberlite

8.1.4 Soils

Baseline information on the soils of Lesotho is required in terms of their related use for structural materials as well as for the determination of land capability. The kind of soil properties that are important for an engineering project of this nature are aspects such as permeability, shear strength, compressibility, shrink-swell potential, compaction characteristics, organic matter, corrosivity, soil acidity or alkalinity, particle-size distribution, soil drainage, water holding capacity, hydraulic conductivity as well as depth to rock.

Eleven (11) benchmark soil series were described and analysed as representing the most important agricultural soils in Lesotho (**Table 24**). The geomorphological units of Lesotho and associated soils are related and were partly modified by Schmitz and Rooyani (1987) as shown in **Table 23** and **Figure 30** below.

Table 23 Geomorphological Units and Associated Soil Series (Schmitz & Rooyani, 1987)

Geology	Geomorphological Unit	Associated Soil Series
Lesotho Formation	Step & middle slopes	Popa & Matšana
	Accumulation glacis	Fusi & Thabana
	Planation surface	Machache, Nkau, Sefikeng, Tumo, Matšaba, Seforong, Ralebese, Matela
	Alluvial deposits	Phechela, Khabo, Sofonia, Maseru dark
Clarens Formation	Structural Plateau	Matela, Berea, Ntsi, Qalaheng, Thoteng, Theko
	High Structural plateau	Lekhalong, Tšenola, Sani
Burgersdorp, Molteno & Elliot Formations	Accumulation glacis	Maliehe, Bosiu, Majara, Moshoeshoe, Tsiki, Sephula, Tšakholo, Maseru
	Planation surface	Leribe, Matela, Qalo, Hololo, Rama
	Alluvial deposits; high terrace	Matšaba, Seforong, Ralebese, Kubu, Khabo
	Alluvial deposits; middle terrace	Khabo, Kubu, Bela, Phechela, Maseru, Maseru dark
	Alluvial deposits; low terrace and flood plain	Caledon, Sofonia, Kolonyama, Phechela
	Dolerite dykes & sills	Ralebese

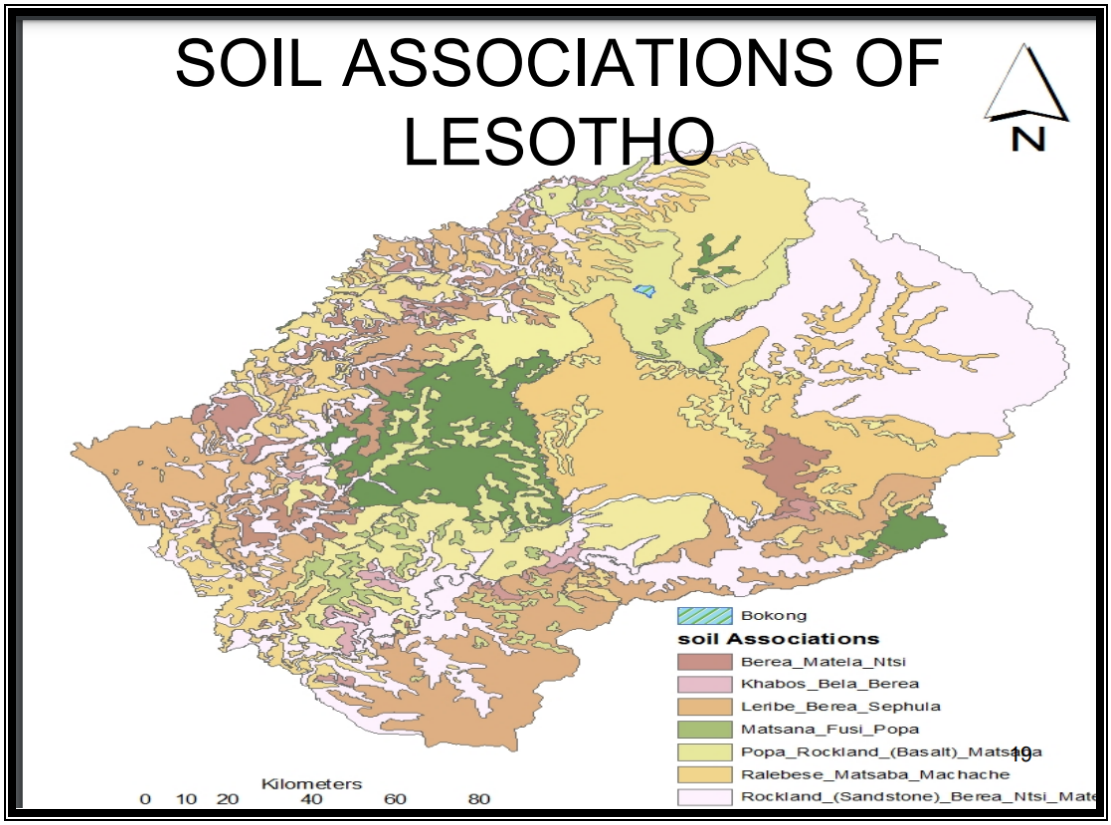


Figure 30 Map of Lesotho Soil Association

Table 24 ***Benchmark Soils of Lesotho***

Benchmark Soil and Binomial	Fertility	Profile Description	Settings	Erodibility
Fusi	High	Clay loam, gravelly clay and clay Well drained	Setting at heads of drains and on moderately steep and steep slopes.	Low resistance to erosion.
Caledon/Sofonia	Ranges between low and high. .	Loamy sand and sandy loam mostly in the surface Range from excessively drained and low water holding capacity to well drained	Continuous deposition of alluvial materials	High vulnerability to erosion
Thabana	High	Clay loam and clay dominant Well drained	On sloping land	Prone to erosion
Phechela	High	Heavy clay with high shrink swell dominant Slow infiltration and very slow permeability rates	The soils occupy depression and are very heavy.	Prone to erosion

Popa	High	Gravelly loam and gravelly clay loam Well drained	Mainly on steep slopes and the soils are very shallow.	Prone to erosion.
Matsana	Moderate	Moderately deep gravelly loam Well drained	The soils are mainly on steep slopes and dominated by unconsolidated basalt saprolite material.	Very vulnerable to erosion.
Berea	Low	Berea Series is a fine loamy, friable soil that is easily drained.	Soils occur on smooth side slopes underlain by sandstone.	Prone to erosion.
Khabos (Bonheim Form)	High	Black, friable, weakly structured, sandy clay loam surface layer. The upper layer is very dark gray, firm strongly structured clay loam Well drained moderately permeable soils	Not extensive & are locally distributed along major streams and rivers in the western lowlands.	Moderate resistance to erosion.

Leribe (Hutton Form)	Low	Dark, reddish-brown, weakly structured, friable, loam. Well-drained permeable soils	These soils occur on smooth, convex ridge tops and side slopes of ancient terraces and erosional surfaces. These soils are extensive and widely distributed throughout the western lowlands	Low to moderate resistance to erosion.
Maseru Form	Low	This form has poor topsoil with shallow layer of fine clay. Poor drainage	Soils occur in depressions and other strongly concave areas or on flats that receive water from adjacent areas	Low resistance to erosion.
Sephula (Estcourt Form)	Medium	Brown, friable, weakly structured, dark yellowish-brown and greyish-brown, friable, massive, very fine. sandy loam.	Soils commonly at the heads of drains, around slight depressions, and at the base of slopes. **Dongas are commonly associated with Sephula soils**	Low resistance to erosion.

		Moderate well to poorly drained		
Tumo (Hutton Form)	Low	This series has a dark, reddish-brown, friable, weakly structured. The upper layers are dark reddish-brown, friable, moderately structured, clay and clay loam. Well drained	Tumo soils are on smooth ancient erosional surfaces underlain by basalt bedrock. The soils are widely distributed throughout the western foothills but are not extensive	Moderate resistance to erosion.
Fusi (Inhoek Form)	High	Friable, moderate structured, black, clay. Well-drained soils	Occur at the base of slopes and at heads of drains. Widely distributed in foothills and lower mountains.	Moderate resistance to erosion.
Bosiu	Medium	The upper horizon is about 50cm and the lower horizon ranges from 50cm to 200cm	Weathered product of shale, sandstone and siltstone residuum	Low resistance to erosion

Machahe (Shortland Form)	Medium	Friable, weakly structured, dark reddish-brown, clay.	These soils occupy gently sloping crests and side slopes of gentle land rises underlain by basalt bedrock.	Moderate resistance to erosion
Qalaheng (Clovelly Form)	Low	Dark, yellowish-brown, friable, weakly structured, very fine sandy loam. Well-drained	Soils are on smooth hilltops and side slopes underlain by sandstone.	Moderate resistance to erosion.
Rama (Bainsvlei Form)	Low	Friable, structureless, yellowish red, very fine sandy loam. Well drained	Rama soils are smooth ridge tops and side slopes of ancient terraces and erosional surfaces.	Moderate resistance to erosion.
Matela (Hutton Form)	Low	Friable, weakly structured, loamy fine sand. Well drained	Matela soils are on smooth ridge tops and side slopes of ancient erosional surfaces.	Moderate to high resistance to erosion
Thabana (Arcadia Form)	High	Black, friable, moderately structured, silty clay.	Thabana soils are in the heads of drains, along drainage ways, on	High to erosion.

		Well drained	foot slopes and toe slopes and concave areas of side slopes. These soils can also be recognised by the wide cracks that develop in the surface layer.	
Sefikeng (Hutton Form)	Low	Friable, moderately structured, dark reddish-brown, clay loam. well drained	Sefikeng soils are on erosional surfaces underlain by basalt parent material.	High resistance to erosion.

8.1.5 Erosion Potential

Lesotho has the highest erosion hazard of any single country in southern and central Africa (Chakela, et. al 1989). An Erosion Hazard Map has been produced for Lesotho that defines the main danger areas for erosion and the principal processes contributing to this hazard. The sub-factors that were considered in producing this map included slope, soil erodibility, rainfall erosivity and cover. It was noted that slope and rainfall are the dominant factors that contribute to the erosion hazard in Lesotho. The erosion hazard map for Lesotho gives values in Erosion Hazard Units (EHU) as indicated in **Table 26**. The following scale was adopted and an erosion hazard map produced (**Figure 31**)

Table 26 Erosion Hazard Unit (EHU)

Level of erosion hazard		**EHU**
4	Medium	51 – 100
5	High	101 – 250
6		251 – 500
7	Very High	501 – 1000
8		1000+

Figure 31 shows a very high erosion hazard in the foothills and mountain areas and this is explained in terms of the steep slopes, high total quantities of rain, poor lithosols and only average vegetation cover. The intensively gullied border Lowlands, shows the lowest erosion hazard in Lesotho. Nevertheless, on an international scale, the erosion hazard for this area is still high. The Lowlands have suffered years of mismanagement, which accounts for the past history of severe soil erosion. Shallow slopes and low rainfall counteract the high erodibility of the soil.

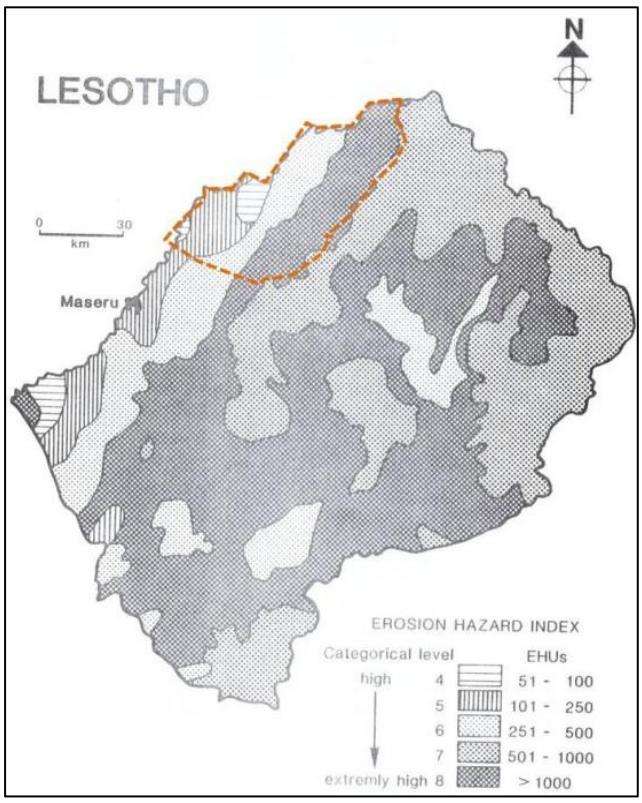


Figure 31Erosion Hazard Map of Lesotho (Chakela,et al, 1989

8.1.6 Biodiversity

8.1.6.1 Vegetation

Lesotho is situated in the grassland biome. This biome is centrally located in southern Africa, andadjoins all except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the grassland biome include:

- Seasonal precipitation; and
- The minimum temperatures in winter (Mucina & Rutherford, 2006).

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often

abundant. Frosts, fire and grazing maintain the grass dominance and prevent the establishmentof trees. The vegetation types of Lesotho include the following (**Figure 32**):

- Basotho Montane Shrubland
- Eastern Free State Clay Grassland
- Eastern Free State Sandy Grassland
- Lesotho Highland Basalt Grassland
- Senqu montane Shrubland
- Western Lesotho Basalt Shrubland; and
- Zastron Moist Grassland.

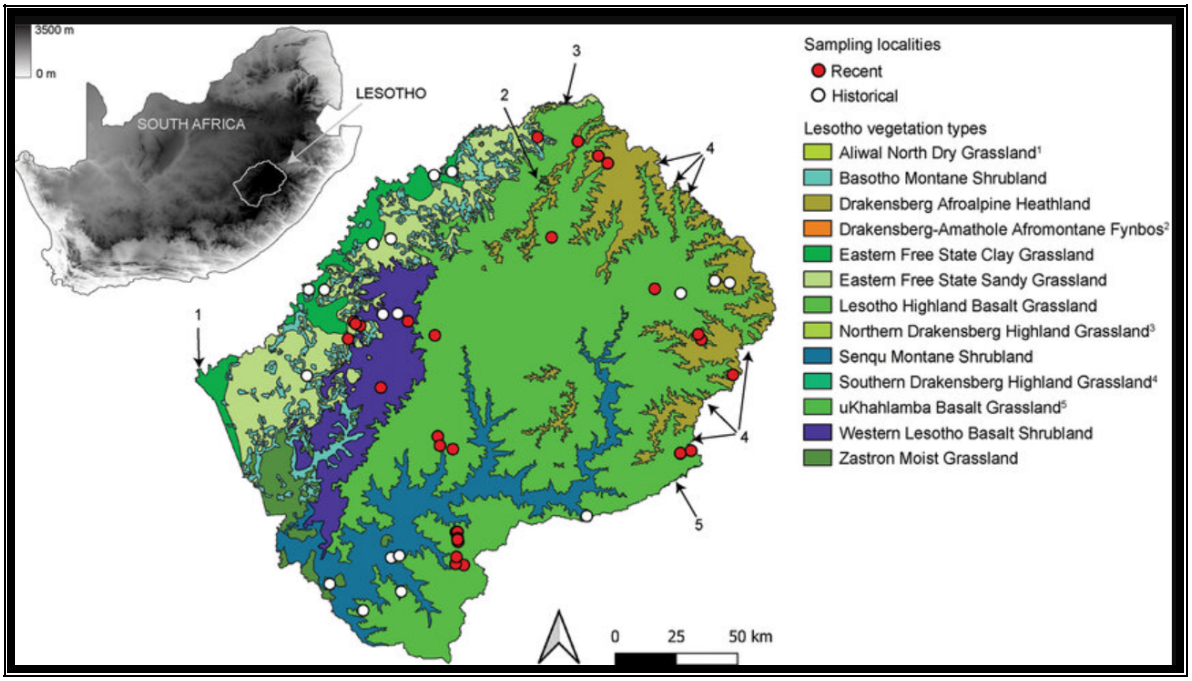


Figure 32 Lesotho Vegetation Types

8.1.6.2 Alien and Invasive Plants

K Kobisi 2017, lists 65 invasive plant species in Lesotho, of which 51 are terrestrial species and 14 are aquatic species. The International Union for the Conservation of Nature (IUCN) defines alien invasive species as "*animals, plants or other organisms introduced by man into places out of their natural range of distribution, where they*

become established and disperse, generating a negative impact on the local ecosystem andspecies."

The rangelands of Lesotho have been degraded to levels of non-recovery through overgrazing due in part to overstocking. Overgrazing of the rangelands has led to decrease in diversity of species and invasion of non-palatable species. With the degradation of the rangelands, there is an accompanying invasion of the Karoo species like *Chrysocoma*. Although the extent of *Chrysocoma* invasion has not been quantified, these shrubs are now being observed in areas where they were not previously known to occur. Although *Chrysocoma* provides ground cover against rain induced soil erosion, it is an indicator of deterioration of the rangelands, loss of useful biological components and a sign of increasing desert-like conditions. In essence, Lesotho is progressively becoming a desert.

Other alien species with some economic and habitat importance are the *Xanthium* species; *Xanthium stromarium&X. spinosum* (**Figure 33**). These are weedy species of both rangelands and cultivated fields causing millions of Maloti in production losses. These weeds have strong burrs on their seeds which cling to wool and mohair rendering it useless. The infected crops, wool and mohair lose in productivity and market value.



Figure 33 Xanthium spinosum

8.1.6.3 Riverine system

The vegetation along the shores of the rivers are composed of mainly sedges and rushes. Typical grass-like species and herbs found near water and damp places are Scirpus sp, Juncus sp, Cyperus sp, Plantago sp, Schoenoplectus sp, Imperata cylindrica, Miscanthus sorghum, Persicaria, polygonum sp, Anagallis sp, Verbena sp, Bromus sp, Schisostylis coccinea, Poa sp, Homeria sp and Moraea sp. The grass-like species are mainly used for handicrafts.

The riparian vegetation is mostly modified with a number of exotic species being present, i.e. Salix sp., Populis sp., etc. (**Figure 34**).



Figure 34 Riparian Vegetation in Lesotho

8.1.6.4 Plantations

This is composed mainly of Pine, Acacia, dealbata and Poplar trees. All these are exotic introduced species. The acacia and poplar trees have invaded extensive areas of formerly indigenous thickets (**Figure 35**).



Figure 35Typical Tree Plantations in Lesotho

8.1.7 Fauna

8.1.7.1 Mammals

Poor land management, rapid population growth, excessive exploitation, and disturbance by humans have significantly affected the biological resources of Lesotho and have led to highly modified ecosystems. All large mammals have disappeared from Lesotho due to over-hunting and habitat loss leaving only five species of large mammals, but these are limited to mountain areas.

Some of the large mammals known to occur in the mountain areas are Eland (*Taurotragus oryx*), Southern Reedbuck (*Redunca arundinum*), Mountain Reedbuck (*Redunca fulvorufula*), Grey Rhebok (*Pelea capreolus*), Black Wildebeest (*Connochaetes gnou*) and Oribi (*Ourebia ourebi*). Natal Red Rock Hare (*Pronolagus crassicudatus*) is near-endemic and does occur in eastern Lesotho (Avenant, 2007).

8.1.7.2 Avifauna

Some 340 bird species have been recorded in Lesotho over the last 100 years. Although not a species-rich country, the mountains of Lesotho, and the Drakensberg escarpment and foothills of South Africa form an internationally important biogeographic province, and Lesotho is well endowed with many endemic and near-endemic taxa. It also supports 10 globally threatened and near-threatened bird species. Lesotho holds nearly 12% of the world population of Gyps coprotheres (VU), comprising some 600 breeding pairs. Geronticus calvus (VU) is also fairly common in the highlands, and Lesotho supports globally significant numbers of this species. A tiny population of Anthus chloris (VU) is found in Sehlabathebe National Park, but this is estimated not to exceed 50 individuals. Falco naumanni (VU) and F. amurensis are common in the lowlands during the austral summer and roost in hundreds in large trees in urban centres (Keith Barnes, 1998).

Four species of restricted range occur in Lesotho. Three of these—Anthus hoeschi (NT), Chaetops aurantius (NT) and Serinus symonsi (NT)—have the majority (60–80%) of their global ranges in Lesotho, and together they define the Lesotho highlands Endemic Bird Area (EBA). Lesotho also supports species from three biome-restricted assemblages: the Afrotropical Highlands (A07), Zambezian (A10) and Namib–Karoo (A12) biomes. The three remaining species of global conservation (Keith Barnes, 1998).

8.1.7.3 Herpetofauna

Three endemic frog species occur in fast-flowing streams at high altitudes in Lesotho, namely Maluti River Frog (*Amietia vertebralis*), Phofung River Frog (*Amietia hymenopus*) and Natal Cascade Frog (*Hadromophryne natalensis*). Ambrose (2006) lists 45 reptiles

for Lesotho, of which one species is now considered extinct in the country (Southern African Python *Python natalensis*). Bates and Haacke, 2003, documented 23 amphibian species for Lesotho, many of which are confined to the western lowlands

The only herpetofauna protected under the Historical Monuments, Relics, Fauna and Flora Act (Act No. 41 of 1967) are monitor lizards (*Varanus* species) and chelonians (tortoises and terrapins).

8.1.7.4 Protected Areas

Sehlabathebe, Lesotho's only national park, is situated on the eastern border of the country in Qacha's Nek and lies adjacent to South Africa's uKhahlamba–Drakensberg Park (IBA ZA064) to the west of Himeville, Underberg and Kokstad.

In addition to Sehlabathebe, there is Tšehlanyane Nature Reserve, Bokong Nature Reserve, and Letšeng la Letsie. **Table 25** below summarises the conservation priority areas and protected areas of Lesotho.

Table 25 Protected Area of Lesotho

Name	Size	IUCN Class
Sehlabathebe National Park	6475 ha	II
Tsehlanyane Nature Reserve	5300 ha	II
Bokong Nature Reserve	1972 ha	II
Letšeng la Letsie (Ramsar site)	434 ha	VI
Range Management Areas (total)	~185,684 ha	VI
Mokhotlong/Sanqebethu Range Management Area (RMA)	52 000 ha	VI

8.2 Socio-Cultural Environment

8.2.1 Demographic Profile

Lesotho's socio-economic and cultural landscape is shaped by a predominantly rural population engaged in subsistence agriculture, informal trade, livestock rearing, and seasonal labor. Livelihoods remain vulnerable due to limited infrastructure, climate challenges, and a lack of diversification. Access to digital technologies, including internet and telecommunications, remains low—particularly in remote and mountainous areas—hindering access to education, market information, and government services. Women and youth play vital but often underrecognized roles in the economy: women are central to household management and small-scale trading, while youth form the backbone of informal enterprises and labor markets. However, both groups face barriers to opportunity due to limited access to infrastructure, capital, and digital resources. The proposed LEMOFI project, by expanding electricity and ICT infrastructure, offers a transformative opportunity to bridge these gaps—empowering communities, boosting local economies, and enhancing digital inclusion. Improved access to power and internet will not only support existing livelihoods but also open new pathways for innovation, job creation, and social equity, particularly for women and youth.

According to the national Census, in 2016 Lesotho had a total *de jure* population of 2,003,962, representing a population growth rate of 7.0% from 2006 (BoS, 2016). According to Bureau of Statistics (2016), male population accounted for 982, 133 which is 48.9% while the female population had about 1,025,068 constituting 51.1% of the entire Lesotho population.

Population aged less than 15 years has increased from 34.1 to 37.8% from 2006 to 2016 while population aged 65 and above has increased from 5.7 to 6.1% from 2006 to 2016. The average household size has declined from 4.4 in 2006 to 3.7 persons in 2016.

Fertility

The 2016 Population and House Census (PHC) Age Specific Fertility Rates (ASFR) indicates that most females were giving birth at the age of 25 to 29 years and female of childbearing ages decrease with an increase in age. Therefore, the age pattern of fertility in Lesotho has not changed over years. In 1976 census, the Total Fertility Rate was estimated at 5.4 children per woman and it declined to 3.2 children per woman in the 2026 census hence, a decline of 2 children from 1976. According to the PHC, the overall fertility had declined.

Mortality

Mortality refers to the occurrence of deaths in a population over a period of time. There is a decline from 94 deaths in 2006 to 53 children dying per 1000 births in 2016. Urban settlements have the least infant mortality rate at approximately 50.9 children than peri-urban and rural settlements. Infants, child and under-five born to mothers residing in the rural settlements tend to experience higher mortality rate than those mothers who reside in the urban and in the peri-urban (BoS, 2016).

Orphanhood

An orphan is defined as a child who has lost either one of the biological parents or both of them through death and that child must be aged 0 to 17 years of age. The population aged 0 to 17 years has been estimated at 765,614 and out of that, 210,712 were orphans (BoS, 2016).

Youth

According to the Ministry of Gender, Youth, Sports and Recreation, youth are persons aged 15 to 35 years. In 2016 census, youth were 794,940 accounting for 39.6% of the Lesotho total population. Males were 403,000 which is 50.7 % of the total youth while female youth constitute 49.3% (BoS, 2016)

Youth in Lesotho represent a growing demographic but are Underemployed or unemployed, especially in rural areas where they often engaged in informal, low-paying jobs. There is Limited in access to skills training, ICT, and capital for youth

entrepreneurship. The intervention of the LEMOFI proposed project will bridge the gap and make available internet and power that will enable youth entrepreneurship in areas such as mobile services, IT support, and digital media. Internet and power will enable access to online education and vocational training which will upskill youth for the evolving job market. LEMOFI can support innovation hubs and co-working spaces powered by renewable electricity in district centres promoting sustainability development.

Elderly

These are people aged 60 years and above and age group 60-64 constituted the largest proportion of the elderly population. There is a higher proportion of males at age 60-74 years than that of females of the same age. However, there is a higher proportion of elderly females at older ages relative to males (BoS 2016).

Elderly people in Lesotho play a crucial though often overlooked the role in the economy, especially in rural settings. Many older adults Are custodians of agricultural knowledge and traditional practices. They Serve as primary caregivers to grandchildren, often in skip-generation households. They are engaged in subsistence farming and informal trade and rely heavily on government pensions, which support entire households. Despite their contributions, older adults face challenges such as limited physical mobility, lack of access to digital tools and modern communication platforms and exclusion from development programs that prioritize youth or working-age populations. The LEMOFI proposed project will provide reliable electricity and ICT can improve elderly access to telehealth services, reducing the need for travel. Ease availability of Social protection programs (e.g., mobile pension payments). The proposed project will avail Community centers powered by LEMOFI infrastructure can serve as learning and engagement hubs for the elderly.

Migration

It is the movement of people from one geographic area to another. The least number of people estimated at 2.0 % moved into Mokhotlong while 3.4% moved out of Qacha's Nek.

On average, Maseru gained more people at 22.5% while Mafeteng lost most people at about 8.0%.

Urbanization

The total number of 636,729 out of the total population that was estimated in 2016 census was Basotho who were residing in urban areas. The total population residing in urban areas accounted for 31.7%.

Employed Population

The 2016 PHC results show that employed population aged 10 years and above comprised of 38.8% of females and 61.2% males.

Unemployed Population

The 2016 PHC results show that unemployed population aged 10 years and above comprised of 34.2% of females and 65.8% males.

Community Livelihood

Land is of primary importance to sustain livelihoods in Lesotho. Agriculture is an important livelihood activity for household subsistence. The main farming crops found in Lesotho are maize and sorghum, wheat, beans and peas (in order of priority) while animal husbandry. In other words, the most common means of livelihood in the country is subsistence farming and formal employment.

Land Tenure Systems

The traditional system of land tenure in Lesotho is such that the king holds the land in trust for the Basotho nation, while individuals hold user rights. There are various modes of acquiring land by household members, these include: allocation by a chief, inherit piece of land from parents or extended family members, bought landfrom somebody else or chief, acquiring land through a private developer etc. Lesotho's land tenure system recognises three types of title: leasehold, Form C and license. Some households occupy land without the appropriate title in place, i.e., through the traditional/ customary tenure

system under which the land was allocated to citizens through chiefs and headmen on behalf of the King. Leasehold acts as a check on private subdivision and allocation of land. Under the leasehold system, the leaseholder has the right to use and enjoy the property for the agreed period. A leaseholder may lease out their land under a sub-lease agreement. In practice the leasehold of land is inherited by the family of the leaseholder; in effect, the land is never returned tothe state unless it has become apparent that it has been abandoned. Forms of leasehold comprise of:

- Residential leases for a period of 90 years;
- Commercial and industrial leases for periods of 30 and 60 years;
- Agricultural leases for periods of 10-90 years;
- Others, including religious, educational and charitable leases for periods of 90 years.

Leasehold agreements are registered at the office of the Land Administration Authority (LAA). The Land Act entitles the leaseholder to transfer the title, sub-lease, or use their land as collateral for accessing credit from financial institutions; the title can also be passed on via inheritance to a named family member. Owners of leases for a primary place of residence are exempt from paying ground rent; however, those who have a lease ona second property or for commercial, industrial or agricultural land are required to pay annual ground rent to theLAA.

On the other hand, Form C was abolished by the Land Act (No. 17) of 1979, however, to date people in the ruralareas are still issued with the Form C as proof of land tenure; it refers to land that is allotted by the chief. All forms issued before the 1979 Land Act remained valid. Form Cs and title deeds can be converted into leases.

A license is a land tenure system used for agricultural land within the urban areas. The tenure's right is called a license, and the land right is neither transferable, subject to inheritance nor negotiable. Licenses are held undercustomary law.

The 2026 PHC indicates that 12% has Lease, 41% Form C, 4% Title Deed, 27% other and 12% nothing.

Religion

Christianity is the most widely practiced religion in the project area, so Basotho are predominantly a Christiansociety though there are few who follow the Muslim religion. The main Christian denominations found are the Apostolic Faith Mission, Roman Catholic, Lesotho Evangelical and Anglican. Furthermore, most Basotho, perhaps like in any other African country also follow their traditional belief systems, like appeasing their ancestors 'balimu' in Sesotho.

8.2.2. Vulnerability and Marginalisation

Most of the population living at the project area are vulnerable people due to unemployment, lack of income earning opportunities, harsh conditions for generating a reliable source of food throughout the year, and poor educational standard level or illiteracy. This is as a result of inadequate social infrastructure and services. Theolder male population (56 and above) are the most poorly educated, perhaps due to the need to drop out of school early in order to participate in domestic and subsistence activities.

Within this already vulnerable population, groups of people are considered more vulnerable. These include households that do not 'own' land or do not have the ability to farm (e.g., older persons and people with disability; and households that are headed by children or older persons who have been left to care for young children due to parental absence or incapacity. In the project AoI, the broad categories of people who should be considered to have some level of vulnerability include: women; older persons; youth; herders; orphaned children; and people with disability or chronically ill persons.

Lesotho is also susceptible to human trafficking. As a result of poverty, young girls and women are often promised lucrative jobs on the other side of the border, only to find that they are going to be subjected to forcedlabour and sex trafficking. The government is

trying to curb the problem by requiring documents from both parents for children under 18 years to be able to cross the border. Lesotho's stance on human trafficking has been assessed by the US Department of State's Office to Monitor and Combat Trafficking in Persons, and Lesotho is deemed not to be taking adequate steps to discourage or control human trafficking within, through and beyond its borders (https://www.state.gov/j/tip/rls/tiprpt/countries/2024/271226.htm).

Basotho children are commonly subjected to domestic servitude and forced labour in animal herding. Women and children (mostly from rural areas) are coerced into leaving Lesotho in pursuit of income earning opportunities in urban areas (both inside and outside the country). These are often not real opportunities; or areassociated with poor working and living conditions.

8.2.3 Services and Infrastructure

Almost all essential services are available throughout the country. Services that are commonly found include: large businesses, banks, cooperatives, small shops / kiosks, day care centres/pre-schools, primary and high schools, churches, hospitals, clinics, government offices. Local courts, electricity, and water supply and telecoms infrastructure. Notably, communication via cellular phones is common throughout the country.

The LEMOFI project will enable improved service delivery as well as improved communication once implemented.

8.2.4 Community Structure

Rural population settlement patterns are characterised by scattered villages, small sized villages, and large extended family units. Urban settlements comprise large rapidly growing towns with a degree of industrialization. The majority of households' heads in rural areas often build their homesteads and others inherit them from their parents and

build some additional structures on their parents' sites, more especially the first born sons who normally according to the customary law inherit their late father's estates. On the other hand, in urban areas the household heads often build or buy their households structures. Furthermore, a reasonable number of residents in urban areas stay in public or privately rented buildings or take care of someone else's property.

The types of housing units commonly found in the Lesotho are traditional huts for most of the population in rural areas and the modern structures in urban and peri-urban areas or a mixture of traditional and modern structures. In urban areas there are also Malaene (rental flats) and informal structures.

These dwellings can easily be connected with distribution fibre without damage as the structures are solid.

8.2.5 HIV / AIDS

Radio and public gatherings are the leading means through which the community receives health education. In some cases, the public received HIV and AIDS messages in churches and by reading IEC material. HIV testing,counselling, and treatment services are offered at health centres, mobile clinics and New Start/ PSI Tents. Mostof these services are local and within a range of 3-7km walking distance.

The previous studies conducted by Ministry of Health (2015), U.S. President's Emergency Plan for AIDS Relief(PEPFAR) (2016) & World Health Organisation (WHO) (2014) quoted in UN Lesotho Country Analysis Report(2017) revealed that in Lesotho HIV/AIDS is a burden to the health sector and is one of the factors that have contributed to the slow economic growth and social progress in Lesotho. AIDS has become the leading cause for morbidity and mortality in Lesotho. Twenty five percent of adults aged 15-49 years old in Lesotho are infected with HIV and is one of the highest prevalence rates in the world. The prevalence of HIV is significantly higher among women (29.7%) than men (18.6%), with women aged 35-39 years old having the highest prevalence of 46%. Of particular concern

is HIV prevalence among vulnerable and risk populations. Theprevalence is reported at 72% among sex workers, 43% in factory workers, 33% in men who have sex with men,and 31% among prison inmates. It has also been found out that prevalence is higher in urban areas than in rural areas. The key drivers that significantly contribute to new infections in the general population include multiple and concurrent sexual partners, low and inconsistent use of condoms, low rates of medical male circumcision, mother to child transmission, and gender-based violence.

With the high prevalence of HIV/AIDS in the country, it is very important that during implementation the LEMOFI Project incorporates HIV/AIDS awareness for labourers as well as Project communities.

8.2.6 Cultural and Historical Resources

During the survey (local interviews) undertaken, several people were interviewed in order to understand their appreciation of cultural heritage. There were positive responses to cultural heritage assets as follows:

Musical Instruments

Lesiba and ‘Mamokhorong are the only instruments currently still played by herders, though they are quickly being replaced by modern electronic instruments. Both are played by herders while herding livestock, althoughthere are very few episodes of this lately. ‘Mamokhorong is played by herders mostly and is still highly fashionable amongst young herders.

These instruments are described below:

- ***Lesiba*** is a mouth bow. A stringed-wind instrument with a quill attached to a long string. Its historical origin can be traced to the San who converted their hunting bows to musical instruments.

- ***Mamokhorong*** is a sinew string 'violin' developed in Lesotho. There are modern versions of it, which make use of tin cans in place of a calabash and a piece of wire in place of sinew.

Most herders throughout the country may be seen carrying either pre-recorded music players (Blue tooth speaker, tape players,disc-players etc.) or cell phones. The indication is that modern technology has a strong influence on musical composition trends.

The Songs

Rural communities are dominated by initiation practices. The ceremonial songs for initiates have gained access into the current media and in shops, taverns and hand-held gadgets. Initially this seemed to be male dominated, but lately women have joined the practice.

- ***Mokhibo*** is one traditional women's dance that is still highly popular in the proposed project area.
- ***Mokorotlo*** performed largely by men, is actively sung at local ceremonies.
- ***Mangae***, sung mainly by teenage boys as part of going through initiation.
- ***Pitiki,*** performed by married women during childbirth ceremony.

The urban areas listen more to modern western music for example Hip hop, Jazz and House.

Oral History

Embedded story telling in the evenings (Litšomo – traditional fictional stories), has mostly declined, although this still takes place in a very few households. There are also riddles (Lilotho - puzzles) that lately feature mostly through media intervention (radio), as practice in the household has declined. Again, as in the case of original music

instruments, people have gained access to electricity and therefore television and radio have replaced the useof evening family time. Overall, oral history is depreciating.

Language

There are two official languages in Lesotho: Sesotho and English however, the are also minor languages: Sephuthi, Sethepu, Xhosa and dialects mixing Afrikaans with any of these (*Fanakaloko*) due primarily to community members employment in South African mining activities which are predominantly men. It is explained that this mining language is typically used to seclude others fromunderstanding discussions.

Another area of seclusion is the new economic hardship experiences of drug dealers' language and symbolism,which takes various forms, but the most visual is hanging of pairs of shoes on telephone and electricity lines especially in urban areas.

Arts and Crafts Skills

The community has indicated that they have the following cultural skills, which they still practice:

- Livestock rearing
- Weaving grass sun hats – Tšetše; Molia-nyeoe
- Thatching ropes – Lithapo
- Weaving of grass mats – Meseme with the special Nguni type called Leqasa
- Traditional beer brewing although the strainers are not weaved any more due to scarcity of natural resources. Instead, the mealie bags from modern industry have replaced traditional ones
- Hut making and plastering (*ho lila*); and,
- Grass thatching.

Games

Lesokoana (stick used to stir porridge), is still actively played especially in the dry periods by young girls. The main purpose of Lesokoana is a rainmaking ritual. Herders actively practice Ho kalla – stick fighting, which is also done by initiates. These games are mostly common in the rural areas of Lesotho however, recently initiation has become common in the urban and peri-urban hence normalising stick fighting throughout the country.

Cultural Practices

The following cultural practices were recorded to be still active, in almost all community groups within theproject area:

- ***Mekete ea Balimo***: a thanksgiving ceremony for one's ancestors
- ***Lebollo*****:** the initiation or coming of age of both boys and girls, which prepares them for adulthood
- ***Thapo*****:** following a death in a family, the rest of the family would observe a month-long mourning periodwhile the mother and wife who have lost either a husband or a child must observe an extended mourning period and wear distinct clothing, normally black; and,
- ***Ho beha lejoe*****:** this is unveiling of a tombstone, in a solemn ceremony of relatives joined by locals.

9.0 ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

9.1 Introduction

The key objective of the Environment and Social Impact Assessment (ESIA) is to predict changes both negative (adverse) and positive (beneficial) in the ecological and socio-economic environment resulting from a proposed project as well as recommended mitigation measures to minimise, eliminate or offset those aspects that adversely impact on the environment.

This chapter presents an assessment of the anticipated impacts of the LEMOFI Project on the physical, biological, and socio-economic/cultural environment. The purpose of this Environmental and Social Impact Assessment (ESIA) is to identify, evaluate, and propose mitigation measures for the potential impacts resulting from the construction and operation of the project infrastructure, including fibre optic networks, electrical transmission systems, and associated facilities.

The assessment draws upon the detailed project design, layout, and phasing outlined in Chapter 6, *Project Description*, and is informed by the environmental and social baseline conditions presented in Chapter 9. Impacts have been evaluated across all project phases—planning, construction, operation, and decommissioning—based on how project activities are likely to interact with the receiving environment, which includes sensitive habitats, protected areas, rural communities, and socio-economic systems.

By systematically analyzing these interactions, the ESIA provides a foundation for ensuring that environmental integrity and community wellbeing are safeguarded throughout the project lifecycle. It also ensures alignment with national regulations and international best practices on sustainability and impact mitigation.

9.2 Impact Assessment Methodology

The overall intent of the ESIA study is to identify and characterise all the associated and potential impacts that will be caused by the proposed project. The ISO 14001 has been selected for evaluation of impacts for this ESIA. The ISO 14001 method is simple to apply, provides a high level of detail, and relies on limited data.

9.3 Environmental Impact Indicators

The environmental impact indicators are observable parameters that will indicate deviation, which can be used to monitor the various environmental components as illustrated in **Table 26** below.

Table 26 Environmental Components and Potential Impacts Indicators

No.	Environmental Components	Indicators
1.	Air Quality and Noise	❖ SPM, No_x, SO_2, CO, VOCs, NH_3, H_2S ❖ Noise
2.	Soil	❖ PH ❖ TOC
3.	Surface Water Quality	❖ Dissolved and Suspended solids ❖ Turbidity ❖ PH ❖ BOD ❖ COD ❖ Toxicity ❖ Pb, Cd, As, Ni, Fe, Hg, Mg Coliform
4.	Groundwater Quality	❖ Dissolved and Suspended solids ❖ Turbidity ❖ PH ❖ BOD

		❖ COD ❖ Toxicity ❖ Pb, Cd, As, Ni, Fe, Hg, Mg ❖ Coliform
5.	Socio-economic and Health	❖ Needs and concerns of the host communities/third Party concerns ❖ opportunities for employment ❖ Income level ❖ Health risks ❖ Waste streams, handling, treatment and disposal ❖ Access to transport ❖ Opportunities for contracting and procurement ❖ Respect for labour rights and human rights

9.4 Impact Identification and Evaluation

The ESIA has adopted the following steps for identification and evaluation of impacts:

- Impact identification
- Impact qualification
- Impact rating
- Impact description

9.4.1 Impact Identification

Impact identification accounts for the potential and associated biophysical, social and health impacts making sure that both adverse and beneficial significant and insignificant impacts are accounted for. The anticipated impacts were determined based on the interaction between project activities and environmental sensitivities. The identified potential impacts during the different phase of the proposed project are listed in **Table 27** below.

Table 27 Identified Proposed Project Impacts

Impacts	Phases of the Project	
	Construction	Operation
Acceleration of erosion	√	
Alteration of local topography	√	
Alteration of soil profile	√	
Blockage of drainage pattern	√	
Blockage of roads	√	
Change in land use	√	
Change in water quality	√	√
Contamination of groundwater	√	√
Contamination of surface water	√	√
Contamination of soil	√	√
Damage to communication cables	√	
Exposure to heat and light	√	
Impairment of air	√	√
Improved telecommunication		√
Improved livelihood	√	√
Increased demand for social infrastructure	√	√
Increased surface water turbidity	√	
Increase in incidence of STIs and HIV	√	
Increase in income	√	√
Increase in price of locally sources material	√	
Increase in social vices	√	√
Increase in opportunity for business and employment	√	√
The influx of migrant workers and camp-followers	√	√
Land utilised for temporary camps	√	
Legal issues	√	√
Loss of land	√	√
Loss of employment/income	√	
Noise and vibration nuisance	√	

Road accidents	√	√
Worksite accidents	√	√

9.4.2 Impact Qualification

The identified impacts of the proposed project were qualified using four criteria as follows:

- Positive or negative
- Short-term or long-term
- Reversible or irreversible
- Direct or indirect

Definitions

- Positive Impacts – Impacts which enhance the quality of the environment.
- Negative Impacts – Impacts that adversely affect the biophysical, health and social environments.
- Short term – a period less than three months
- Long term – any period greater than three months
- Reversible – the environment can revert to previous conditions
- Irreversible – the environment remains permanent when activity causing impact is terminated

9.4.3 Impact Rating

The qualification scale of 0, 1, 3, and 5 were used to evaluate impacts in order to determine their significance. The ratings are adopted from the International Organisation for Standardization (ISO) 14001 – Environmental Management System Approach. The criterial and weighing scale used for evaluating significance are:

- Legal/regulatory requirements (L)
- Risk factor (R)
- Frequency of occurrence of impact (F)
- Importance of impact on an affected environmental component (I)
- Public perception/interest (P)

9.4.3.1 Legal/Regulatory Requirements (L)

The regulatory requirements were identified based on national laws, guidelines and standards. Relating to the proposed project activity. The regulatory requirements respond to whether legislation to be complied with or permit to be obtained. The scoring is as follows:

0 = There is no legal/ regulatory requirement
3 = There is a legal/regulatory requirement
5 = There is a legal/regulatory requirement and permit required

9.4.3.2 Risk (R)

This uses a matrix based on the interaction of the probability of occurrence of the impact (**Table 28**) against consequence (**Table 29**). The matrix (**Figure 36**) is referred to as the Risk Assessment Matrix (RAM). Five probability categories interacted against four groups of consequences. The resultant outcomes were given scores with colour-coding. High risk categories are red; intermediate risk are yellow and low risk are green. Therefore, risk categorization is as follows:

- 1 = Low risk (Green)
- 3 = intermediate risk (Yellow)
- 5 = High risk (Red)

9.4.3.3 Frequency of Impact (F)

The frequency of impact refers to the number of occurrences of impact. The criteria for rating the frequency of impacts are outlined in **Table 30**.

9.4.3.4 Importance of Affected Environmental Component and Impact (I)

The importance of the affected environmental components was determined using information on experiences on the impact of already existing facilities in the proposed project area. The rating of the importance of impact is summarised in **Table 31**.

Table 28 Probability of Occurrence

Probability Category	Definition
A	Possibility of Repeated incidents
B	Possibility of Isolated Incidents
C	Possibility of Occurring Sometime
D	Not Likely to Occur
E	Practically Impossible

Table 29 Consequence

Consequence Category	Considerations			
	Safety/Health	**Public Disruption**	**Environmental Aspects**	**Financial Implications**
I	Fatalities / Serious Impact on Public	Large Community	Major / Extended Duration / Full-Scale Response	High
II	Serious Injury to Personnel / Limited Impact on Public	Small Community	Serious / Significant Resources Commitment	Medium

II	Medical Treatment for Personnel / No Impact on Public	Minor	Moderate / Limited Response of Short Duration	Low
IV	Minor Impact on Personnel	Minimal to None	Minor / Little or No Response Needed	None

	A	B	C	B	E
I					
II					
III					
IV					

Figure 36 Risk Matrix

9.4.3.5 Public Perception (P)

The opinions among the project stakeholders were used to determine the public perception of the potential impacts and the criteria applied are as summarised in **Table 32**.

The combination of the five impact rating weights formed the basis for judging the level of significance of each impact. A matrix displaying the combination based on the ISO 1 4001 tool.

The final ratings of the identified impacts are presented in **Tables 34 - 37** below. In this study, low, medium and highly significant negative impacts were judged to require mitigation, and all positive impacts required enhancement.

Table 30 Frequency Rating and Criteria

Frequency	Rating	Criteria

Low	1	Rare, not likely to happen within the project lifespan
Medium	3	Likely to happen ≥ 5 years
High	5	Very likely to happen throughout the project lifespan

Table 31 Importance Criteria

Importance	Rating	Criteria
Low	1	• Imperceptible outcome • Insignificant Alteration in value, function, or service of impacted resources • Within compliance, no controls required
Medium	3	• Negative outcome • Measurable reduction or disruption in value, function, or service of impacted resources • Potential for non-compliance
High	5	• Highly undesirable outcome e.g. impairment of endangered species and protected habitat • Detrimental, extended animal behavioural change (breeding, spawning, moulting) • Major reduction or disruption in value, function, or service of impacted valued ecosystem resources • Impact during an environmentally sensitive period • Continuous non-compliance with existing statutes.

Table 32 Public Perception Criteria

Public Perception	Rating	Criteria
Low	1	• No risk to human health, acute and/or chronic • No possibility of life endangerment for residents, associated communities

		• A minor reduction in social, cultural, economic values • The unlikely adverse perception among the population
Medium	3	• The limited incremental risk to human health, acute and/or chronic • Unlikely life endangerment for residents • Some reduction in social, cultural, economic value • Possibility of adverse perception among the population • Potential for non-compliance
High	5	• The elevated incremental risk to human health, acute and/or chronic • Possibility of life endangerment for residents • Major reduction in social, cultural, economic value • Continuous non-compliance with statutes • Any major public concern among the project communities

Table 33 Impact Value and Rating Colour Code

Impact Value	Cut Off Values	Impact Rating
L + R + F + I + P	<8	Low
L + R + F + I + P	≥8 but <15	Medium
L + R + F + I + P	≥15	High
F + I	>6	
P	=5	
Positive		Positive

Table 34 Potential and Associated Impacts of the Proposed Project - Pre-Construction Phase

Key: L = Legal/Regulatory, R = Risk, F = Frequency, I = Importance, P = Public Interest/perception

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
Pre – Construction	Land Acquisition	Loss of land		√	√		√	√	√		3	1	1	1	1	7	2	L
		Change in land use		√	√			√	√		3	1	1	1	1	7	2	L
		Legal issues		√	√			√	√		3	1	1	1	1	7	2	L
	Mobilisation (Transport) to the site (equipment, personnel and construction modules)	Road Traffic accidents		√	√		√	√	√		3	3	1	1	1	9	2	M
		Noise nuisance		√	√		√		√		3	3	1	1	1	9	2	M
		Impairment of air quality		√	√		√		√		3	1	1	1	1	7	2	L
		Loss of biodiversity		√	√		√	√	√		3	1	1	1	1	7	2	L
	Energy consumption (provision of energy for pre-construction activities)	Impairment of air quality		√	√		√		√		3	1	1	1	1	7	2	L
		Noise and vibration nuisance		√	√		√		√		3	3	1	1	1	9	2	M
		Increased opportunity for business and employment	√		√		√		√		-	-	-	-	-	-	-	P

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
		Contamination of soil by waste oil		√	√		√		√		3	1	1	1	1	7	2	L
	Site preparation – land clearing and removal of vegetation	Acceleration of erosion		√	√		√		√		3	1	1	1	1	7	2	L
		Alteration of topography		√	√		√		√		3	1	1	1	1	7	2	L
		Blockage of drainage pattern		√	√		√		√		3	1	1	1	1	7	2	L
		Contamination of soil by run-offs		√	√	√	√		√		3	1	1	1	1	7	2	L
		Impairment of air quality		√	√	√	√		√		3	1	1	1	1	7	2	L
		Noise and vibration nuisance		√		√		√	√	√	3	3	3	3	3	15	6	M
		Worksite accidents		√		√		√	√	√	3	3	3	3	3	15	6	M
		Security/artificial light at night		√	√		√		√		0	1	3	1	1	6	4	L
		Habitat alteration		√	√			√		√	3	1	1	1	1	7	2	L

Table 35 Potential and Associated Impacts of the Proposed Project - Construction Phase

Key: L = Legal/Regulatory, R = Risk, F = Frequency, I = Importance, P = Public Interest/perception

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
Construction	Transport activities during construction	Road traffic accidents		√	√		√		√		3	3	3	3	3	15	6	M
		Noise nuisance from heavy vehicles		√	√		√		√		3	3	3	1	3	13	4	M
		Impairment of air quality – emission from heavy vehicles		√	√		√		√		3	1	1	1	1	7	2	L
	Trenching of Fibre route and laying of Fibre cables and pole holes	Loss of vegetation cover with possible impact on biodiversity loss		√	√	√	√	√	√		3	1	1	1	1	7	2	L
		Impairment of air quality		√	√		√		√		3	1	1	1	1	7	2	L
		Waste generation from excavated materials		√	√		√		√		3	1	1	1	1	7	2	L
		Contamination due to oil spills from		√	√			√	√		3	1	1	1	1	6	8	L

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
		equipment and machinery																
	Construction of poles and installation of various equipment, power generation equipment of data center and access system	Waste management – aesthetics and general waste nuisance.		√	√		√		√		3	1	3	1	1	9	2	L
		Impairment of air quality		√	√	√	√		√		3	1	1	1	1	7	2	L
		Noise and vibration nuisance		√		√		√	√	√	3	1	3	1	1	9	2	L
		Road/worksite accidents		√		√		√	√	√	3	3	3	3	3	15	6	M
		Slowing traffic fluidity due to construction vehicles		√	√		√		√		5	1	1	3	1	11	4	M
	Water utilization for construction	Changes in surface water hydrology		√	√		√		√		0	1	1	1	1	4	2	L
	Backfilling of micro trenches and pole holes	Surface water pollution			√	√		√		√	3	1	1	1	1	7	2	L
		Alteration of hydrological patterns resulting in temporary			√	√		√		√	3	1	1	1	1	7	2	L

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
		or permanent flooding, soil erosion, and destruction of biodiversity.																
		Habitat alteration		√	√		√		√		3	1	1	1	1	7	2	L
		Worksite accidents			√	√		√		√	3	3	3	3	1	15	6	M
		Increased in communicable diseases (including STDs and HIV/AIDS		√	√		√		√		5	1	1	3	1	11	4	M
	Site demobilisation	Road Traffic Accidents		√	√			√		√	3	3	2	3	3	14	5	M

Table 36 Potential and Associated Impacts of the Proposed Project - Operation Phase

Key: L = Legal/Regulatory, R = Risk, F = Frequency, I = Importance, P = Public Interest/perception

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
Operation/ Maintenance	Operation and maintenance or inspection of the Fibre Network, maintenance of data center and access system locations	Soil / groundwater contamination due to fuel and oil spill		√	√			√		√	3	1	1	1	1	7	2	L
		Air emission during Maintenance / servicing of production equipment and ancillaries		√	√	√	√		√		3	1	1	1	1	7	2	L
		Noise and vibrations nuisance from generating set		√	√			√		√	3	1	1	1	1	7	2	L
		Road accidents due to transportation activities during data center operation and maintenance Fibre		√	√			√		√	3	1	1	1	1	7	2	L

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
		Stealing and vandalism of fibre cables		√	√			√		√	3	5	5	5	5	23	10	H
		Generation of waste during operation		√	√			√		√	3	1	1	1	1	7	2	L
		The threat of Naturally Occurring Radioactive Material (NORM) to the environment		√	√			√		√	3	3	3	3	3	15	6	M
		Thermal effects due to exposure to the EMF experienced by residents located around the data centre		√	√	√	√		√		3	1	1	3	1	9	4	M
		Public Perceptions and fears		√	√	√	√		√		3	1	1	3	1	9	4	M
		Worksite related accidents		√	√			√		√	3	1	1	1	1	7	2	L
		Hazardous waste generation		√	√			√		√	3	1	1	1	1	7	2	L

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
		Improvement of network services	√		√		√		√		-	-	-	-	-	-	-	P
	Transportation activities during operation	Road traffic accidents		√	√		√		√		3	1	1	1	1	7	2	L
	Recruitment of personnel from the surrounding communities	Employment generation: Personnel will be recruited from the communities. This employment will cause an increase in the earnings of the project communities.	√		√		√		√		-	-	-	-	-	-	-	P

Table 37 Potential and Associated Impacts of the Proposed Project - Decommissioning

Key: L = Legal/Regulatory, R = Risk, F = Frequency, I = Importance, P = Public Interest/perception

Project Phase	Project Activity	Description of Impact	Impact Qualification								Impact Quantification							Impact Rating
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	
Decommissioning	Decommissioning and Evacuation	Interference with road transportation		√	√		√		√		3	3	3	1	3	13	4	M
		Noise and vibrations nuisance		√	√		√		√		3	1	1	1	1	7	2	L
		Contamination of ground and/or surface water		√	√	√	√		√		3	1	1	1	1	7	2	L
		Contamination of soil		√	√	√	√		√		3	1	1	1	1	7	2	L
		The threat of Naturally Occurring Radioactive Material (NORM) to the environment		√	√			√		√	5	1	5	5	1	25	10	M
		Poor disposal of waste		√	√	√	√		√		3	1	3	3	1	11	6	M
		Loss of Jobs		√	√	√	√		√		3	1	3	3	1	11	6	M
		Injury/fatalities in workforce		√	√	√	√		√		3	1	3	3	1	11	6	M

		Agitation of project communities due to loss of employment		√	√	√	√		√		3	1	3	3	1	11	6	M

10.0 MITIGATION MEASURES

This chapter provides mitigation measures against identified impacts to ensure the environment al sustainability of the proposed project. The impact identification and evaluation indicated that components of the biophysical, health and social environments will be impacted both positively and negatively. Several measures are hereby proposed to mitigate the impacts of the facility to an acceptable residual impact level.

The health, social and environment (HSE) design and operation objectives of the project are to implement all cost-effective measures to reduce the risks and impacts of routine or major hazards including accidents. Thus, the steps taken in the HSE process for the proposed project include the following:

- Design based standards and regulations
- Improved operation based on qualitative risk assessment

  Best international practice

Selection and Application of Mitigation Measures

Mitigation measures for the LEMOFI project were selected based on technical feasibility, regulatory compliance, and alignment with industry best practices. These measures aim to reduce adverse impacts and enhance positive outcomes across environmental, occupational, and community health and safety domains. They are to be implemented throughout the project's lifecycle to ensure sustainable and responsible project execution.

10.1 Criteria for Selection of Mitigation Measures

Selection of mitigation measures for the identified impact is based on the following consideration:

- Engineering design of the Fibre

- The practicability of the measures
- Regulatory requirements
- Industry and international best practices

10.2 Mitigation Measures

Mitigation Measures are actions taken to minimise negative impacts, while also enhance positive ones. Mitigation measures are often implemented continuously throughout the project's life span. These measures aim to improve the environmental sustainability of the proposed project. Mitigation measures are recommended for the project identified impacts on:

- Environment
- Occupational health and safety
- Community health and safety

The comprehensive mitigation measures for the project phases are presented in **Tables 38 - 41** below.

Table 38 Mitigation Measures of the Proposed Project Activities - Pre-Construction

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Land Acquisition	• Loss of Land • Change in land use • Legal issues	L	This impact is negative and reversible, the probability of the impact arising is also low because there are already existing sites for construction. However, the LECC will ensure: • Continuous consultation and engagements with project communities and other stakeholders shall be maintained to forestall unrest in line with LECC's grievance redress mechanism (GRM). • Proper land acquisition procedures must be followed where there is need for land acquisition.	L
Mobilisation (Transport) to the site (equipment, personnel and construction materials)	• Road Traffic accidents	M	To prevent road accidents, the LECC will ensure: • Vehicles are inspected before mobilisation and an inspection certificate must be issued. • The use of PPE at sites; daily tool box talks and carry out job hazard analysis • Speed breakers at sections traversing communities • Conformance with national road traffic laws • All safety incidents will be reported and investigated. Corrective actions will be implemented.	L
	Noise nuisance	M	The LECC will ensure:	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Regular maintenance of vehicles • Vehicles are turned off when not in use	
	Impairment of air quality	L	The LECC will ensure: • Nose masks and earmuffs are worn by site workers during excavation • Water shall be sprayed on construction sites to reduce dust levels • Regular maintenance of backup generators • Generators are switched off when not in use	L
	Loss of Biodiversity	L	• Implement good housekeeping practice on site • Storing and handling of the hazardous waste following approved Waste Management Plan (WMP) • Limiting land clearing • Avoid erodible areas	L
Energy consumption (provision of energy for pre-construction activities	Impairment of air quality	L	• Regular maintenance of backup generators • Generators are switched off when not in use	L
	Noise and Vibration Nuisance	M	• Generators are fitted with effective silencers • Regular maintenance of generators • Noise barriers are erected	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Generators are switched off when not in use	
	Contamination of soil	L	• Soil disturbance will be kept to the minimum required for operation and safety • Oil spill containment will be provided to prevent an oil spill from getting to the soil • Implement good housekeeping practice on site • Storing and handling hazardous waste following approval of the WMP.	L
Site preparation – land clearing, removal of vegetation	Acceleration of erosion	L	• Stabilise soil within the camp site mechanically using compactors to reduce erosion potential • Avoid erodible areas	L
	Alteration of local topography	L	• Re-grading of the sites • Restoring top soil • Restoring the original profile of the topography and the soil • Strictly regulating heavy equipment traffic	L
	Blockage of drainages	L	• Regular cleaning of drainages	L
	Contamination of soil	L	• Soil disturbance will be kept to the minimum • Oil spill containment will be provided to reduce soil contamination	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Store and handle hazardous waste following approval of the WMP • Place filtration berms and sediment barriers • Prohibiting refueling near waterways	
	Impairment of air quality	L	• Only inspected and approved equipment is used • Equipment engines are turned off when in use • Construction of soundproofing walls around stationary power generation	L
	Noise and Vibration nuisance	M	• Equipment must be fitted with effective silencers • There will be regular maintenance of equipment • Vibration containment be made for equipment which is likely to cause vibrations • PPE will be used at all times	L
	Worksite accidents	M	• Workers and visitors use appropriate PPE • Use of warning signs • Non-consumption of alcoholic beverages on work site • Well stocked First aid kit will always be available within the site	L
	Habitat Alteration	L	• Contain oil spills	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Minimise destruction or modification of the vegetation cover by restoring vegetation at the end of the work	

Table 39 Mitigation Measures of the Proposed Project Activities - Construction Phase

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Operation and maintenance or inspection of the optic fibre and associated infrastructure	Noise and vibration nuisance from generators	M	• Regular maintenance of generators • Generators are switched off when not required • Use of renewable energy e.g. solar	L
	Impairment of air quality emissions from trucks and equipment	L	The LECC will ensure: • Maintenance of engines and exhaust gas check • Nose masks and earmuffs are worn by site workers during excavation • Use of loading and unloading equipment that minimises the height of fuel drop to the stockpile to reduce the generation of fugitive dust • Regular maintenance of backup generators • Generators are switched off when not in use	L
Trenching of Optic Fibre and laying of Fibre cables	Loss of vegetation cover with possible impact on biodiversity loss	L	• Place filtration berms and sediment barriers • Contain oil spills • Minimise destruction or modification of the vegetation cover by restoring vegetation at the end of the work	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	Noise and Vibration Nuisance	M	• Generators are fitted with effective silencers • Regular maintenance of generators • Noise barriers are erected • Generators are switched off when not in use	L
	Impairment of air quality	L	• Maintenance of engines and exhaust gas check • Nose masks and earmuffs are worn by site workers during excavation • Use of loading and unloading equipment that minimises the height of fuel drop to the stockpile to reduce the generation of fugitive dust • Regular maintenance of backup generators • Generators are switched off when not in use • Dust suppression	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	Contamination due to oil spills from equipment and machinery	L	• Oil spill containment • Regular maintenance of equipment • Soil disturbance will be kept to the minimum required for operation and safety • Oil spill containment will be provided to prevent an oil spill from getting to the soil • Implement good housekeeping practice on site • Storing and handling hazardous waste following approval of the WMP.	L
	Waste generation from excavated materials	L	• All other waste generated including environmentally deleterious materials generated by construction activities will be disposed of appropriately at designated disposal sites • Generation of all waste is minimised as much as practically possible • Unsuitable excavated materials shall be systematically carried away from areas prone to erosion • Reuse waste material wherever possible and use designated disposal sites	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Used oil and lubricants will be recovered and reused or removed from site to an approved disposal facility in South Africa • Oil waste, debris, and/or other waste materials must not be burned • All the construction camps and facilities will be dismantled and removed from the site unless otherwise desired by the local authorities or communities • The site will be restored to a condition in no way inferior to the condition prior to the commencement of activities • Safety measures must be followed while disposing waste • Prepare waste management plan (WMP)	
Construction of poles and installation of various equipment, power generation equipment	Waste Management • Potential effects will be of aesthetics and nuisance of waste such as scrap metals, paper, wood, optic fibre cables etc.	M	• All other waste generated including environmentally deleterious materials generated by construction activities will be disposed of appropriately at designated disposal sites • Generation of all waste is minimised as much as practically possible • Unsuitable excavated materials will be systematically carried away from areas prone to erosion	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Reuse waste materials wherever possible and use designated areas for disposal • Used oil and lubricants will be recovered and reused or removed from site to an approved disposal facility in South Africa • Oil waste, debris, and/or other waste materials must not be burned • Safety measures must be followed while disposing waste • Prepare waste management plan (WMP)	
	Impairment of air quality	L	• Only inspected and approved equipment is used • Equipment engines are turned off when in use • Construction of soundproofing walls around stationary power generation • Regular maintenance of engines and equipment • Nose masks are worn by all workers during excavations	L
	Noise and Vibration nuisance	M	• Equipment must be fitted with effective silencers • There will be regular maintenance of equipment • Vibration containment be made for equipment which is likely to cause vibrations • PPE will be used at all times	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Monitoring the air quality at least three times a day	
	Road/Worksite accidents	M	• Vehicles are inspected on a daily basis before commencement of works • Workers and visitors use appropriate PPE • Use of warning signs • Non-consumption of alcoholic beverages on work site • A well-stocked First aid kit will always be available within the site • Flag personnel will be deployed to guide traffic where necessary • Informatory and warning signages provided will be retro-reflective for visibility in the night • All vehicles will be parked in designated parking areas • Speed breakers at sections transversing communities	L
	Presence of transport vehicles and site machinery could restrict traffic fluidity and lead to quarrelling with Contractor	M	• Installing retro-reflective mobile signage in the work areas, especially at night and speed limit signs in dangerous areas • Restoring access for local residents, which had been restricted by the works • Ensuring compliance with local customs and traditions	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Backfilling	Surface water may be polluted due to increased erosion, runoff from a construction site, and contamination by oil spills from equipment and machinery	L	• Soil disturbance will be kept to the minimum required for operation and safety to reduce erosion • Oil spill containment shall be provided to reduce oil spill from getting to the soil and surface • There will be regular maintenance of the equipment and machinery • Mechanically stabilizing the soil to reduce the potential for erosion • Avoid excavation/trenching and burial in the steeply sloped ground and avoiding the creation of great breaks • Limiting activities in erodible soil • After work, levelling the disturbed soil and revegetation to control erosion	L
	Waste Management Potential effects will be of aesthetics and nuisance of waste shall mainly come from discarded packaging materials such as scrap metals, empty plastic containers, poor disposal methods can lead to	M	• Toilets must be available on site • The site remains clean, well maintained, and free of hazards, with the thoughtful location of litter bins • Proposal disposal of solid waste from construction activities and camps • Storage of lubricants, fuels and other hydrocarbons in self-contained enclosures	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	environmental problems due to their non-biodegradable nature. Most of the packaging wastes are expected to be reused.		• Sanitation facilities to avoid the release of wastewater and sewage to the environment • Reuse waste materials wherever possible and use designated disposal sites • Minimum wastes are generated • Used oil and lubricants will be recovered and reused or removed from site in full compliance with national regulatory frameworks • Oil waste, debris and/or other waste materials will not be burned • Safety measures are followed while disposing of wastes	
	Alteration of hydrological patterns resulting in soil erosion and destruction of biodiversity	L	• Mechanically stabilizing the soil to reduce the potential for erosion • Avoiding excavation and burial in the steeply sloped ground and avoiding the creation of great breaks • Limiting activities in erodible soil • At the completion of the work, levelling the disturbed soil and quickly revegetation to control soil erosion	L
	Habitat alteration	L	• Implement good housekeeping practice on site	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Store and handle hazardous waste following approved WMP • Use of appropriate PPE • Backfilling must be followed by mechanical compaction to retain the original level • Re-vegetation with indigenous plants	
	Worksite accidents	M	• Workers and visitors use proper PPE • Use of warning signs • Non-consumption of alcoholic beverages on work site • First aid kill will always be well stocked and available	L
	Increase in communicable disease (including HIV/AIDS and STDs	M	• Inductions will be given to workers on communicable diseases • As much as possible provide psychological support to persons living with HIV/AIDS • Condoms to be provided in work areas	L
Site demobilisation	Road traffic accidents	M	• Enforcement of the use of PPE • Daily tool box talks • Job hazard analysis is carried out • Prepare and implement Traffic Management Plan	L

Table 40 Mitigation Measures of the Proposed Project Activities - Operation/Maintenance Phase

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Operation and maintenance or inspection of the Fibre Network, maintenance of data center and access system locations	Noise and vibration nuisance	L	• Regular maintenance of backup generators • Vehicles are turned off when not in use • Noise barriers are erected	L
	Emissions during maintenance/servicing of production equipment and ancillaries	L	• Maintenance of engines and exhaust gas check • Regular maintenance of backup generators • Generators are switched off when not in use • Use of solar for backup	L
	Contamination due to oil spills from equipment and machinery	L	• Oil spill containment • Regular maintenance of equipment • Implement good housekeeping practice on site • Storing and handling hazardous waste following approval of the WMP.	L
	Road Traffic accidents	L	• Vehicles are inspected on regular basis • Ensure that drivers obey traffic rules • All vehicles to be parked at assigned areas • Informatory and warning signages will be retro-reflective for visibility during the night • Engage flag personnel when necessary to direct traffic	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
	Soil/groundwater contamination due to fuel, oil, paints and coating as a result of spillage	L	• Containment of spills • Implement management controls (Procedures, inspections, communication and trainings) • Paints and solvents will be stored on an impervious ground and the area will be constructed as a spill tray to avoid the spread of accidental spills	L
	Major accidents related to fires and explosions	L	• Define fire zones and equip them with firefighting equipment • Use of engineering controls (automatic alarms) • Installation of smoke detectors • Safe ventilation for storage of volatile materials shall be provided	L
	Worksite accidents	M	• Vehicles are inspected on daily basis before commencement of works • Use of warning signs • Non-consumption of alcoholic beverages on work site • Well stocked First aid kit will always be available within the site • Flag personnel will be deployed to guide traffic where necessary	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Informatory and warning signages provided will be retro-reflective for visibility in the night • All vehicles will be parked in designated parking areas	
	Threat of Naturally Occurring Radioactive Material (NORM) to the environment (Soil, water and air)	M	• Regular maintenance or servicing of production equipment • Regular NORM monitoring to detect material and equipment with NORM • Carrying out personal dosimetry for external radiation exposure to confirm that exposures fall into range expected from external radiation surveillance monitoring • Measuring airborne radioactive dust during maintenance activities to check that the assumptions upon which respirator selections were made are accurate – or if respirators are needed • Sampling and analysis of waste streams to confirm that they remain within regulatory limits • Materials used in NORM control procedures, e.g. gloves, disposable overalls will be disposed with hazardous waste	L
	Thermal effects due to exposure to EMF	M	• Prepare and implement an EMF safety program	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Training of workers in the identification of occupational EMF levels and hazards • Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained personnel	
	Waste Management Potential effects will be of aesthetics and nuisance of waste shall mainly come from discarded packaging materials such as scrap metals, empty plastic containers, poor disposal methods can lead to environmental problems due to their non-biodegradable nature. Most of the packaging wastes are expected to be reused.	L	• Toilets must be available on site • The site remains clean, well maintained, and free of hazards, with the thoughtful location of litter bins • Proposal disposal of solid waste to appropriate waste disposal facility • Storage of lubricants, fuels and other hydrocarbons in self-contained enclosures • Sanitation facilities to avoid the release of wastewater and sewage to the environment • Reuse waste materials wherever possible and use designated disposal sites • Minimum wastes are generated	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Used oil and lubricants will be recovered and reused or removed from site in full compliance with national regulatory frameworks • Oil waste, debris and/or other waste materials will not be burned • Safety measures are followed while disposing of wastes	
	Stealing and Vandalization of fibre cables	H	• Daily security reports shall be reviewed • Engage security for fibre protection • A liaison to foster a partnership with community to guarantee security for the project is established and sustained	L
	Hazardous waste	L	• Good housekeeping will be instituted and maintained • Hazardous waste will be collected, stored and disposed off at an approved disposal site • Proper PPE must be used for personnel handling hazardous waste	L

Table 41 Mitigation Measures of the Proposed Project Activities - Decommissioning

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
Demolition and Evacuation	Noise and vibration nuisance	L	• Regular maintenance of generators and vehicles • Vehicles and generators are turned off when not in use • Noise barriers are erected	L
	Impairment of air quality	L	• Maintenance of engines and exhaust gas check • Regular maintenance of generators and vehicles • Generators and vehicles are switched off when not in use • Use of solar for backup • Use of nose masks • Dust suppression,	L
	Road Traffic accidents	M	• Vehicles are inspected on regular basis • Ensure that drivers obey traffic rules • All vehicles to be parked at assigned areas • Informatory and warning signages will be retro-reflective for visibility during the night • Engage flag personnel when necessary to direct traffic	L
	Soil/groundwater contamination due to fuel, oil, paints and coating as a result of spillage	L	• Soil disturbance must be kept to the minimum for operation and safety • Containment of spills	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Implement management controls (Procedures, inspections, communication and trainings) • Cleanup in compliance to the specifications • Hazardous material/waste will be stored on an impervious ground and the area will be constructed as a spill tray to avoid the spread of accidental spills • Restore the affected area to a condition in no wat inferior to the condition prior to the commencement of the works.	
	Injury/fatalities in workforce/communities	M	• Vehicles are inspected on daily basis before commencement of works • Use of warning signs • Non-consumption of alcoholic beverages on work site • Well stocked First aid kit will always be available within the site • Flag personnel will be deployed to guide traffic where necessary • Informatory and warning signages provided will be retro-reflective for visibility in the night • All vehicles will be parked in designated parking areas • Ensure safety awareness training for the workforce	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Emergency preparedness plan shall be in place and implemented	
	Poor Waste Management	M	• None of the wastes generated are disposed of into any water body or open land • Keep all waste consignment, treatment and disposal • The site remains clean, well maintained, and free of hazards, with the thoughtful location of litter bins • Proposal disposal of solid waste to appropriate waste disposal facility • Storage of lubricants, fuels and other hydrocarbons in self-contained enclosures • Sanitation facilities to avoid the release of wastewater and sewage to the environment • Reuse waste materials wherever possible and use designated disposal sites • Minimum wastes are generated • Used oil and lubricants will be recovered and reused or removed from site in full compliance with national regulatory frameworks	L

Project Activity	Description of Impacts	Rating before Mitigation	Mitigation/Control Measures	Rating after Mitigation
			• Oil waste, debris and/or other waste materials will not be burned • Safety measures are followed while disposing of wastes	
	Hazardous waste	M	• Good housekeeping will be instituted and maintained • Hazardous waste will be collected, stored and disposed off at an approved disposal site • Proper PPE must be used for personnel handling hazardous waste	L
	Loss of job	M	• Give enough notice as per the Labour Act 2024 • Counsel workers being retrenched	L
	Agitation due to employment issues and loss of direct benefits as project communities	M	• Continuous engagements with workers and project communities including local authorities	L

10.3 Summary of Residual Impacts after Mitigation

Residual effects can be considered as those that remain significant following the application of mitigation measures, although they are likely to have reduced in magnitude as a result of the mitigation measures implemented.

Overall, with the provision of the proposed mitigation measures outline in tables 30 to 33, the positive impacts of the project will considerably outweigh the negative impacts. The public as a whole will benefit from the completion of the project. Once the mitigation measures outlined are implemented, the residual impact of construction and operation on the different elements identified will not be significant.

An overall mitigation measure is to undertake a Job Hazard Analysis, to enable each worker to assess the risk associated with the job and work safety using procedural guidelines in handling equipment and the fatalities.

10.3.1 Community Unrest

Widespread youth restiveness is common in the project area. However, issues about employment if not well managed would likely elicit community unrest.

Mitigation

The Client through Supervision Engineer shall maintain and maintain channels of communication with the project communities during all phases of the project. Also, the contractors will engage general labourers from local communities where feasible.

From the foregoing, the impact rating should drop from high to medium, since it is impossible to eliminate all sources of community disagreements in a project such as this.

10.3.2 Influx of People and Increase in Social Vices

The influx of labour and camp followers of diverse characters is anticipated, this will result in an increase in social vices such as stealing, drug abuse, alcoholism and sexual promiscuity.

Mitigation

The Client will carry out sustained awareness raising campaigns amongst the workforce and also enforce an alcohol and drug policy. Access control will be maintained at worksites. The rating after mitigation will reduce from medium to low and not eliminated since behaviour change is a difficult process.

10.4 Enhancing Positive Impacts

10.4.1 Job Creation

The project is expected to create job opportunities during the different phases. There will be opportunities for skilled and unskilled employment. It is also expected that the engaged unskilled project community members that will be engaged during implementation will also acquire some on job skills which they can use for their own future development after completion of the project.

To enhance job creation opportunities throughout the project phases, the client will ensure that unskilled labourers are sourced from the project communities.

10.4.2 Business Opportunities

Engagement of local population as unskilled labourers means that more people will earn money to spend within and outside the project area hence, improvement in both local and national businesses. To enhance business growth, the contractors will be advised to source materials from project business where feasible.

10.4.3 Greenhouse Gas Emissions

Fibre: A Greener Internet Solution

Fibre is not only best internet technology with regard to speed and reliability, but also environmentally friendly. Fibre has minimal ecological impact, reduces waste, consumes minimal energy thus helps in decreasing greenhouse gas emissions.

In addition, greenhouse gases can be reduced through telecommuting. This requires both download and upload speeds to be at a sufficient rate. Copper upload and download speeds are often inadequate hence fibre offers symmetrical speeds resulting in quick uploading and downloading.

Fibre reduces the demand for Copper

DSL and cable internet use copper wire to transmit data. Copper mining is harmful to the environment and dangerous, producing hazardous chemical and toxic by-products. On the other hand, Fibre utilises fibreglass which is made from quartz. Quartz occurs naturally as sand and rocks. Finally, the production and disposal of copper wire has more negative environmental impact footprint that production and disposal of quartz.

Energy Consumption

Fibre uses up to twelve times less energy than copper by transmitting data using light. Furthermore, the energy consumed by copper and cable networks creates heat, which must be kept cool on the backend to prevent overheating. Cooling is accomplished with air conditioners, which consume a lot of electricity. By consuming less energy, fibre networks stay cooler hence no need for a cooling system

10.5 Biodiversity Mitigation Hierarchy and Relevant Bank Operational Safeguards

In accordance with best international practices and the relevant Bank Operational Safeguards, particularly OS 3: Biodiversity and Ecosystem Services, this project adopts the biodiversity mitigation hierarchy as a guiding framework for managing potential biodiversity-related impacts. The mitigation hierarchy comprises four sequential steps: Avoid, Minimize, Restore, and Offset.

1. Avoidance
   - Priority is given to avoiding biodiversity impacts wherever possible through careful site selection, project design, and timing of activities.
   - Critical habitats, protected areas, and ecosystems with high conservation value have been identified early in the planning phase to steer project components away from sensitive areas.
   - For instance, infrastructure siting was adjusted to avoid indigenous forests and riparian habitats supporting endangered species.
2. Minimization
   - Where avoidance is not feasible, the project will minimize impacts through the adoption of environmentally-sensitive construction practices.
   - Measures include restricted working corridors, reduced vegetation clearance, erosion control, and timing construction to avoid breeding seasons for key species.
3. Restoration

- Restoration of disturbed habitats will be undertaken immediately after construction, especially in temporarily impacted areas such as construction camps, access roads, and laydown areas.
- Native species will be used for replanting, and soil stabilization will be implemented to prevent further degradation.

4. Offset

- In cases where residual impacts remain significant after avoidance, minimization, and restoration efforts, biodiversity offsets will be considered.
- These will follow a measurable, additional, and long-term conservation gain approach aligned with OS 3 requirements.
- Offset programs will be developed in consultation with stakeholders and relevant conservation authorities, with a preference for in-kind, locally relevant solutions.

Compliance with Bank Operational Safeguard (OS 3)

This mitigation approach complies with OS 3 of the Bank, which mandates:

- The protection of biodiversity and maintenance of ecosystem services.
- The application of the mitigation hierarchy to biodiversity and ecosystem impacts.
- Specific attention to critical habitats, ensuring that development in such areas only proceeds if no other viable alternatives exist, and if measures are in place to achieve a net gain of biodiversity.
- The engagement of stakeholders in biodiversity management planning.

11.0 CAPACITY ASSESSMENT OF THE PUBLIC ENTITIES IN CHARGE OF ESIA ENFORCEMENT AND OVERSIGHT

11.1 Institutional Responsibilities for ESIA Monitoring and ESMP Implementation

Effective implementation of the Environmental and Social Impact Assessment (ESIA) and the associated Environmental and Social Management Plans (ESMPs) for the LEMOFI project requires the active involvement of institutions at the national, district, local, and project levels. This section outlines the institutional arrangements, roles, and responsibilities of key stakeholders involved in ensuring environmental and social compliance throughout the project lifecycle.

The analysis includes an assessment of the capacity of implementation entities to manage environmental and social safeguards, and details the specific roles of ministries, government agencies, departments, and traditional authorities in:

A clear understanding of these institutional responsibilities is critical to ensure accountability, streamline coordination, and promote sustainable development outcomes. The section further highlights existing strengths and gaps in institutional capacity, providing a basis for proposed capacity-building and coordination mechanisms necessary for successful ESMP implementation and long-term monitoring.

11.1.1 Department of Environment

The Department of Environment (DoE), on behalf of the Minister (Ministry of Environment and Forestry), plays a lead role in the implementation of the national environmental policies, legislation and regulations. Their role is to ensure that the proposed project is implemented in a sustainable manner, in compliance to the relevant environmental legislation. DoE will be responsible for approving the ESIA and ESMP.

The Department of Environment has the capacity to approve the ESIA and ESMP produced for LEMOFI.

11.1.2 Lesotho Electricity Company Communications (LECC)

The LECC will be responsible for the overall procurement issues and preparation of the safeguard's instruments ensuring that the project is screened; stakeholders' engagements are done, ESIA and ESMP are

prepared, cleared and disclosed prior to approval through appointment of a permananent Environmental and Social Safeguards Specialist. Therefore, the role of LECC includes:

- Executing project activities in line with environmental and social standards;
- Reviewing and monitoring the ESIA and ESMP implementation;
- Conducting compliance audits and preparing regular performance reports;
- Addressing any emerging environmental or social issues in coordination with affected communities; and
- Implementing of the Grievance Redress Mechanism.

Currently, LECC has no Environment and Social Management Policies hence will require to prepare safegurads policies and engage a safeguards specialist.

11.1.3 Local Government

At the district level the local government is headed by the District Administrator (DA) and has the following management Levels:

- District Council Secretary (DCS) – at district level
- Urban Council (UC) – at town level
- Community Council (CC) – at village Level
- Community Council Memebers – from each electoral devision in the district.

The responsibility of the local government includes but not limited to:

- Control of natural resources and environmental protection
- Land Allocation
- Markets and the promotion of economic developments
- Management of parks, reacreation and cultural areas
- Management of streets and public places

The local government is adequately capacitated to manage the implementation of the LEMOFI as well as the associated environmental and Social Safeguards Documents.

11.1.4 Traditional Leaders

Traditional leadership in Lesotho is through chietainship, which is hereditary. The leadership is hierarchical consisting of the King (King Letsie III), Principal Chiefs, Area Chiefs and Village Chiefs. During project implementation the project team will be working directly with Village Chiefs. In addition to their civil and traditional responsibilities the Village Chiefs oversee general labour recruitment process inorder to maintain law and order as well as adjudication during disputes.

Also, all community engagements appointments are requested from the Village Chiefs thus all communication to the communities must be through the village chiefs.

The Tradiditional leaders have adequate capacity to assist the LEMOFI project during implementation in issues of community enagements, grievance redress and engagement of general labourers.

12.0 CONCLUSION AND RECOMMENDATIONS

12.1 Background Information

The project ESIA study shows that with the application of the recommendations built into the environmental and social management plan (ESMP), construction and operations of the project will be carried out with minimal impacts on the environment.

12.2 Conclusion

The goal of the ESIA process was to get to a position where the Project does not have any major residual impacts on the environment therefore, following the application of mitigation measures, the residual negative impacts became short-term, mostly localised, and reversible of low significance. There are no moderate and high negative residual impacts associated with this project.

Even though the proposed mitigation measures cannot sufficiently reduce probability of these impacts, implementation of the ESMP mitigation measures will be able to manage them.

The project therefore can be categorised as a **Category 2** because of coverage of the project (Country wide) not the residual impacts since all residual impacts are of low significance.

12.3 Recommendations

LECC Should engage a permanent Environmental and Social Safeguards Officer to insure the implementation of the Environment and Social Management Plan; Grievance Redress Mechanism (GRM) and continuous engagements with the stakeholders.

The Environmental and Social Management Plan (ESMP) should be used as an on-site reference document during all phases of this project. Monitoring/Auditing should take place in order to determine compliance with the ESMP. Parties responsible for transgression of the ESMP should be held responsible for any rehabilitation that may need to be undertaken. Parties responsible for environmental degradation through irresponsible behaviour/negligence should receive penalties as per PART XV-OFFENCES of the Environment Act 2008 of the Kingdom of Lesotho.

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14.ANNEXURES

ANNEXURE 1

PUBLIC NOTICE

PUBLIC NOTICE

Design and Construction of Metropolitan and District Telecommunications Points-of-Presence (PoPs) and Fibre Optic Distribution Network.

The government has realised that new and smaller Network Service Providers (NSPs) and Reseller Internet Service Providers (ISPs) have had difficulties in entering and succeeding in Lesotho's telecommunications market which is currently dominated by Unified Licensees (providers of mobile and fixed network services – voice and data).

LEC's existing fibre infrastructure runs on long distance electricity transmission lines which do not typically run within business and residential areas. To bring these services closer to users, it is necessary to deploy fibre distribution networks in ten districts of the country within business and residential areas.

Therefore, the GoL, Through Lesotho Electricity Company Communication (LECC) intends to Construct Metropolitan and District Telecommunications Points-of-Presence (PoPs) and Fibre Optic Distribution Network throughout Lesotho. The proposed works may result in positive and negative impacts during construction. The Project is preparing an Environmental and Social Impact Assessment (ESIA) to address the anticipated impacts of the Project on behalf of LECC).

The public is invited to raise their concerns or make inputs addressed to the Project at the following contacts, on or before 30th January 2025.

Nthame Monare (Ms)
Email: nmonare3@gmail.com
Moblie: 59816344

ANNEXURE 2

GRIEVANCE REGISTRATION FORM

This form is for the use to record any complaints, grievances, issues, comments, requests, suggestions or compliments they have with regard to the implementation of the project.

Name of Project _____

Date: _____ **Grievance Number:** _____

Name of Complainant: _____ **Cell:** _____

Village: _____**Area Chief:** _____

Community Council: _____**District:** _____

Grievance Description: _____

_____

_____

_____ (Use extra page if needed)

If a Complaint is of such a nature that it poses potential harm, injury or danger to an employee or any member of the public, **Contact Project Engineer; Tel.** _____

Signature of Complainant: _____

Recording Officer: _____ **Date** _____

Signature of Recording Officer _____

ANNEXURE 3

GRIEVANCE REGISTRATION FORM – SESOTHO VERSION

_____

Foromo ena e sebelisoa ho ngolisa litletlebo ka nako ea tšebetso ea morero

Lebitso la Morero _____

Letsatsi: _____**Nomoro ea Tletlebo:** _____

Lebitso la Motletlebi: _____**Nomoro ea Mohala:** _____

Motse: _____**Morena oa Motse:** _____

Lekhotla la Mathomo: _____**Setereke:** _____

Tlhaloso ea Tletlebo: _____

_____

_____

_____ (Sebelisa leqephe le leng ha ho hlokahala)

Haeba tletlebo e ka baka likotsi ho morero kapa mosebetsi oa morero kapa ho Sechaba ka kakaretso, **Tsebisa Mookameli oa Morero (Project Engineer); Tel.** _____

Motekeno oa Motletlebi: _____

Ofisiri e ngola tletlebo: _____**Letsatsi** _____

Motekeno oa Ofisiri e ngolang tletlebo _____

ANNEXURE 4

GRIEVANCE INVESTIGATION REPORT

PARTICULARS OF THE GRIEVANCE			
Name of Complainant:			
Grievance Number:			
Summary or Grievance Description:			
Grievance location (District, Community Council, Electoral Division, Village):			
TYPE OF INVESTIGATION CONDUCTED			
Field or Site Visit: Yes. ( ) No. ( )	Desk Review: Yes. ( ) No. ( )	Date Conducted:	
Key people consulted/interviewed:			
Narration of the investigation taken:			
Summary of the findings:			

Recommendations:	
Responsible/Investigation Officer Name:	
Signature:	
Designation:	
Date:	
District:	

ANNEXURE 5

GRIEVANCE INVESTIGATION REPORT – SESOTHO VERSION

LINTLHA TSA TLETLEBO			
Lebitso la Motletlebi:			
Nomoro ea tletlebo:			
Kakaretso e hlakile ea tletlebo:			
Sebaka sa tletlebo (Setereke, Lekhotla la Mathomo, Setsi (Electoral Division), Motse):			
MOFUTA OA LIPATLISISO TSE ENTSOENG			
Ketelo ea Sebaka: Ee. ( ) Chee. ( )	Tlhatlhobo ea litokomane tse teng: Ee. ( ) Chee. ( )	Letsatsi:	
Batho ba botsitsoeng ka ketsahalo:			
Tlhaloso ea Ketsahalo:			
Kakaretso ea Liphuputso:			

Likhothaletso:	
Ofisiri e entse lipatlisiso:	
Motekeno:	
Boemo Mosebetsing:	
Letsatsi:	
Setereke:	

ANNEXURE 6

CHANCE FIND PROCEDURES

1.1 PURPOSE

Areas of the proposed development activity are subject to heritage survey and assessment at the planning stage. These surveys are based on surface indications alone, and it is therefore possible that sites or items of heritage significance will be found in the course of development work. The procedure set out here covers the reporting and management of such finds.

1.2 SCOPE

The “chance finds” procedure covers the actions to be taken from the discovery of a heritage site or item to its investigation and assessment by a trained archaeologist or other appropriately qualified person.

1.3 COMPLIANCE

The “chance finds” procedure is intended to ensure compliance with relevant provisions of the following Acts:

ACT	PROVISION	REFERENCE
Environment Act, 2008 (Act No. 10 of 2008)	Provides for protection of Natural Heritage Sites	Act No. 10 of 2008 -71(i)
The Historical Monuments, Relics, Fauna and Flora, 1967 (Act No. 41 of 1967)	Provide for the preservation and protection of natural and historical monuments, relics. antiques, fauna and flora and for connected matters,	Act No. 41 of 1967

1.4 RESPONSIBILITY

Environmental Control Officer: To provide training to the contractor on the procedure and to advice of any chance find on site.

Project Engineer: To exercise due caution if archaeological remains are found

Contractor: To secure site and advise management timeously

Archaeologist: To inspect, identify, advice management, and recover remains

1.5 PROCEDURE

MITIGATION/MONITORING ACTION	RESPONSIBILITY	SCHEDULE
Should a heritage site or archaeological site be uncovered or discovered during the construction phase of the project, the "change find" procedure should be applied. The details of this procedure are highlighted below:		
• If operating machinery or equipment: stop work • Identify the site with flag tape • Determine GPS position if possible • Report findings to foreman	Operator or reporting person	
• Report findings, site location and actions taken to superintendent • Cease any works in immediate vicinity	Foreman	
• Visit site and determine whether work can proceed without damage to findings • Determine and mark exclusion boundary • Site location and details to be documented for field confirmation by archaeologist	Environmental control Officer	
• Inspect site and confirm addition to project Documentation • Advise the Ministry of Environment and Forestry - Department of Environment and request written permission to remove findings from work area • Recovery, packaging and labelling of findings for transfer to National Museum	Environmental control Officer	
• Should human remains be found, the following actions will be required: - Apply the chance find procedure as described above. - Schedule a field inspection with an archaeologist to confirm that remains are human.	Environmental control Officer	

- Advise and liaise with the Department of Environment and Police on necessary exhumation procedures - Remains will be recovered and removed following the exhumation procedures		

ANNEXURE 7

PUBLIC GATHERINGS ATTENDANCE REGISTERS

ATTENDANCE LIST OF HA BELO – BOTHA BOTHE PUBLIC GATHERING

No.	Name	Surname	Gender	Village
1	‘Manceto	Koaqatsa	Female	Ha Belo
2	‘Matjelele	Matasa	Female	Ha Belo
3	‘Mateboho	Machenene	Female	Ha Belo
4	‘Mamosia	Mbele	Female	Ha Belo
5	‘Mambabalele	Lesiamo	Female	Ha Belo
6	Makala	Goli	Male	Ha Belo
7	‘Mamamello	Tjekoa	Female	Ha Belo
8	Hlonephewe	Mbela	Male	Ha Belo
9	‘Matsepiso	Lesiamo	Female	Ha Belo
10	Mabaki	Mofokeng	Male	Ha Belo
11	‘Malerato	Koebu	Female	Ha Belo
12	‘Malineo	Nnonya	Female	Ha Belo
13	‘Mamosa	Ndlayela	Female	Ha Belo
14	‘Mampela	Mbela	Female	Ha Belo
15	Tomakase	Thocha	Male	Ha Belo
16	‘Mamoratoe	Tlhabaki	Female	Ha Belo
17	‘Mathethiwe	Nqozo	Female	Ha Belo
18	Itumeleng	Nzimande	Female	Ha Belo
19	‘Malekhooa	Moneuoa	Female	Ha Belo
20	Tsietso	Chitja	Male	Ha Belo
21	‘Makoashane	Qindi	Female	Ha Belo
22	‘Makhubuli	Lekarapa	Female	Ha Belo
23	Seqelo	Chetane	Male	Ha Belo
24	Malefetsane	Goli	Male	Ha Belo
25	Tjabolane	Pita	Male	Ha Belo

ATTENDANCE LIST OF THABONG – THABA TSEKA PUBLIC GATHERING

No.	Name	Surname	Gender	Village
1.	'Maphoka	Taele	Female	Thabong
2.	'Machakale	Ralibuseng	Female	Thabong
3.	'Marorisang	Lekhanya	Female	Thabong
4.	'Mamoseme	Moseme	Female	Thabong
5.	Lerato	Matete	Female	Thabong
6.	Napo	Moshoeshoe	Male	Thabong
7.	Thabo	Mokuoane	Male	Thabong
8.	Tiisetso	Letooane	Female	Thabong
9.	Tlali	Phomane	Male	Thabong
10.	Mosiuoa	Mpela	Male	Thabong
11.	Motenelapi	Taele	Male	Thabong
12.	Khothatso	Mofammere	Male	Thabong
13.	Lebina	Lebina	Male	Thabong
14.	Tlalinyane	Nkhahle	Male	Thabong
15.	Rethabile	Rantja	Male	Thabong

ATTENDANCE LIST OF HA MAAMA – ROMA PUBLIC GATHERING

No.	Name	Surname	Gender	Village
1.	Lisemelo	Lesenyeho	Female	Ha Maama
2.	Mohau	Ratšiu	Male	Ha Maama
3.	‘Masebetoane	Kobeli	Female	Ha Maama
4.	Moeketsi	Khalechane	Male	Ha Maama
5.	Mpho	Sekonyela	Male	Ha Maama
6.	‘Matumo	Majoro	Female	Ha Maama
7.	‘Maliketso	Bulane	Female	Ha Maama
8.	Mathibeli	Ramaliehe	Male	Ha Maama
9.	‘Mashadrack	Lebelo	Female	Ha Maama

ATTENDANCE LIST OF QALAKHENG – MOHALE'S HOEK PUBLIC GATHERING

No.	Name	Surname	Gender	Village
1.	Nthuseng	Mokupi	Female	Qalakheng
2.	'Maphinda	Mokhele	Female	Qalakheng
3.	Rakuba	Masenyetse	Male	Qalakheng
4.	Tšeliso	Nthama	Male	Qalakheng
5.	Bokang	Mohale	Male	Qalakheng
6.	'Manteboheleng	Lipholo	Female	Qalakheng
7.	Nthabiseng	Dingane	Female	Qalakheng
8.	Molefi	Nkakole	Male	Qalakheng
9.	Molaoa	Molaoa	Male	Qalakheng
10.	Moeketsi	Kholorine	Male	Qalakheng
11.	'Manthabiseng	Pata	Female	Qalakheng
12.	Tlhoriso Josiase	Brown	Male	Qalakheng

ATTENDANCE LIST OF MAJOE-A-LITŠOENE – MASERU PUBLIC GATHERING

No.	Name	Surname	Gender	Village
1.	Thapelo	Molebatsi	Female	Majoe-a-Litšoene
2.	‘Mampoi	Lenkoe	Female	Majoe-a-Litšoene
3.	Dintle	Leboela	Female	Majoe-a-Litšoene
4.	Albert	Nthako	Male	Majoe-a-Litšoene
5.	‘Mampho	Khoachele	Female	Majoe-a-Litšoene
6.	‘Maitumeleng	Tsunyane	Female	Majoe-a-Litšoene
7.	Moorosi Samuel	Khotle	Male	Majoe-a-Litšoene

ATTENDANCE LIST OF MATHENENG – MAFETENG PUBLIC GATHERING

No.	Name	Surname	Gender	Village
1.	Benedict	Noosi	Male	Matheneng
2.	Mpho	Bofelo	Female	Matheneng
3.	Neo Phakiso	Lebona	Male	Matheneng
4.	Thabang Alexander	Sefali	Male	Matheneng
5.	Masilo Johannes	Moqeti	Male	Matheneng
6.	'Mamokete Marianna	Molise	Female	Matheneng
7.	Lefu	Ramahali	Male	Matheneng
8.	Bosco	Matobo	Male	Matheneng
9.	Molefi	Seutloali	Male	Matheneng
10.	Augustine	Ramabusa	Male	Matheneng
11.	Edith	Letuka	Male	Matheneng
12.	'Makoena	Mokhachane	Female	Matheneng
13.	Itsokolele	Matsoakeletsa	Male	Matheneng
14.	'Mamochai	Ngoae	Female	Matheneng
15.	'Makamohelo	Mphomela	Female	Matheneng
16.	Molefi	Hashatsi	Male	Matheneng
17.	Liepollo	Sefika	Female	Matheneng
18.	'Mathato	Mathaba	Female	Matheneng
19.	Paulina	Moabi	Female	Matheneng
20.	Relebohile	Kalaka	Female	Matheneng

ATTENDANCE LIST OF HA TLAI-TLAI – LERIBE PUBLIC GATHERING

No.	Name	Surname	Gender	Village
1.	Puseletso	Khoeli	Female	Ha Tlai-Tlai
2.	Tšotleho	Qethisi	Male	Ha Tlai-Tlai
3.	Hlalefang	Sekamane	Male	Ha Tlai-Tlai
4.	Ntemana	Lekoekoe	Female	Ha Tlai-Tlai
5.	Realehoha	Mapefane	Male	Ha Tlai-Tlai
6.	‘Mamotšelisi	Polisa	Female	Ha Tlai-Tlai
7.	Teboho	Mothepu	Male	Ha Tlai-Tlai
8.	Tanki	Khalane	Male	Ha Tlai-Tlai
G.	‘Maccambe	Seaba	Female	Ha Tlai-Tlai
10.	Selbi	Mofokeng	Male	Ha Tlai-Tlai

ATTENDANCE LIST OF NTLHOLOETSANE – MOKHOTLONG PUBLIC GATHERING

No.	Name	Surname	Gender	Village
1.	Moholi	Ramoholi	Male	Ntlholohetsane
2.	Botšepehi	Morojele	Female	Ntlholohetsane
3.	Tebello	Letsema	Female	Ntlholohetsane
4.	Lereko	Phatela	Male	Ntlholohetsane
5.	Seobi	Lefoka	Male	Ntlholohetsane
6.	‘Mateboho	Seeiso	Female	Ntlholohetsane

ANNEXURE 8

STAKEHOLDER'S ENGAGEMENTS PHOTOS



Photo 1: Stakeholder's Engagement at Qalakheng – Mohale's Hoek



Photo 2: Stakeholder's Engagement at Thaba Tseka - Thabong





Photo 3: Stakeholder's Engagement at Ha Belo – Botha Bothe



Photo 4: Stakeholder's Engagement Mafeteng - Matheneng



Photo 5: Stakeholder's Engagement Ha Tlai-Tlai – Leribe

ANNEXURE 9

STAKEHOLDERS' ENGAGEMENT MINUTES

STAKEHOLDERS ENGAGEMENT MEETING AT NTLHOLOHETSANE - MOKHOTLONG

Venue: Pitso ground

Date: 20th December 2024

Time: 07:00am

Present: Attendance register attached

1. Meeting Proceedings

The area Chief welcomed the Consultant (Ms Nthame Monare) and requested her to do the introductions. The Consultant did the introductions, then requested the community members to allow her to take pictures and attendance register. The community granted permission to take pictures and attendance register. Also, the community provided a member to assist with writing of the attendance register. The consultant then proceeded with the engagements by giving a background on the LEMOFI Project and further providing an outline of the anticipated environmental and social impacts of the project and how they are going to be mitigated. She further introduced the Grievance Redress Mechanism (GRM) proposed for the project and the role of the Communities in making this project a success.

2. Discussions

The floor was opened for the community to comment and/or seek clarification relating to the project.
Table below presents, the questions, concerns and comments by the community regarding the project.

	COMMUNITY ISSUES	RESPONSES PROVIDED TO THE COMMUNITIES
1.	Community was interested to know how general labourer and semi-skilled will be recruited.	General Labourer will be recruited using the already established at Ntlholohetsane but semi-skilled will have to apply whenever there are vacancies during the implementation of the Project. Therefore, Skilled and Semi-skilled labour will be engaged directly by the Project Contractors while the general labourers will be engaged through already existing community structures.
2.	Will people with experience on certain jobs be employed without proper qualifications? E.g. there are people who are electricians but lack the relevant qualification.	The Contractors will be made aware of such situations so that he may address those during implementation.

	COMMUNITY ISSUES	RESPONSES PROVIDED TO THE COMMUNITIES
3.	The community wanted to know how grievances will be handled during project implementation.	The Consultant will propose a Grievance Redress Mechanism (GRM) to LECC. Upon approval of the GRM, LECC will disclose it to the communities before project commencement.
4.	The communities were keen to know when they should expect the project to start and for how long.	Currently, the Client (LECC) is preparing documents to enable engagements of contractors hence commencement date is not known as yet.
5.	The community wanted to know if there will be compensation for affected properties.	All affected properties will be registered and valuated and compensation will be issued by the LECC. However, it is anticipated that there wont be any affected property during implementation of the project.

3.0 Closing Remarks

The Consultant thanked all for their coming and contributions. She also encouraged them to keep attending similar expected future meetings so that they are all updated about any developments regarding the project.

Chief

The Chief thanked the Consultant on affording them, the opportunity to hear about the project and also, for providing clarity on questions. He further, thanked the consultant on being on time since it has now become a norm for people to arrive late when they have called 'Pitsos'.

The meeting was then adjourned after singing the National anthem.

STAKEHOLDERS ENGAGEMENT MEETING AT QALAKHENG – MOHALE'S HOEK

Venue: Pitso ground

Date: 18th January 2025

Time: 08:30am

Present: Attendance register attached

1. Meeting Proceedings

The area Chief welcomed the Consultant (Ms Nthame Monare) and requested her to do the introductions. Before the Consultant gave a background on the LEMOFI Project, she requested a volunteer to assist with attendance register. The consultant explained that the register was proof that the engagement was done not for future general labour recruitment. The Consultant then, gave an outline of the anticipated environmental and social impacts of the project and how they are going to be mitigated. She further introduced the Grievance Redress Mechanism (GRM) proposed for the project and the role of the Communities in making this project a success.

2. Discussions

The floor was opened for the community to comment and/or seek clarification relating to the project.
Table below presents, the questions, concerns and comments by the community regarding the project.

	COMMUNITY ISSUES	RESPONSES PROVIDED TO THE COMMUNITIES
1.	The community was very happy to hear about the project and they said they are going to support the project since internet is going to help them have reliable WhatsApp.	Noted
2.	Community was interested to know how general labourer will be recruited.	The community will advise LECC consultants on how to proceed during the construction phase. That means the contractors will follow already existing general labour recruitment procedures.

3.0 Closing Remarks

Consultant

The Consultant thanked all for their coming and contributions. She also encouraged them to keep attending similar expected future meetings so that they are all updated about any developments regarding the project.

Chief

The Chief thanked the Consultant and mentioned that these kind of projects after completion of so-called studies disappear for good. He hopes this one will be different as there is high unemployment and also internet is part of their daily communication as the community since they have opened a WhatsApp group to enable smooth communication.

STAKEHOLDERS ENGAGEMENT MEETING AT THABONG – THABA TSEKA

Venue: Pitso ground

Date: 21st December 2024

Time: 07:00am

Present: Attendance register attached

1. Meeting Proceedings

The area Chief welcomed the Consultant (Ms Nthame Monare) and requested the community to listen very carefully in order to be able to ask questions later. He informed the Consultant that His subjects are very humble and respectful hence cannot provide any troubles during the consultation. The Chief then requested the consultant to make introductions and proceed with the business of the day. The Consultant did the introductions, then requested the community members to allow her to take pictures and attendance register. The community granted permission to take pictures and attendance register. Also, the community provided a member to assist with writing of the attendance register. The consultant then proceeded with the engagements by giving a background on the LEMOFI Project and further providing an outline of the anticipated environmental and social impacts of the project and how they are going to be mitigated. She further introduced the Grievance Redress Mechanism (GRM) proposed for the project and the role of the Communities in making this project a success.

2. Discussions

The floor was opened for the community to comment and/or seek clarification relating to the project.
Table below presents, the questions, concerns and comments by the community regarding the project.

	COMMUNITY ISSUES	RESPONSES PROVIDED TO THE COMMUNITIES
1.	How is casual labour recruitment going to be handled?	There are already existing employment methods that the community use to hire casual labourers for other projects, those methods will be followed.
2.	Will the contractor impart any skills to some members of the community to attend to any requirements of the works once he leaves site.	Given the scope of work, this is going to be a huge project that will require expertise and manpower for the project to completed on time. Therefore, skills transfer will be done by the Contractor

3.0 Closing Remarks

The Consultant thanked all for their coming and contributions. She also encouraged them to keep attending similar expected future meetings so that they are all updated about any developments regarding the project.

Chief

The Chief thanked very attendee and requested the community to close the meeting with the National Anthem.

STAKEHOLDERS ENGAGEMENT MEETING AT MATHENENG – MAFETENG

Venue: Pitso ground

Date: 19th January 2025

Time: 08:30am

Present: Attendance register attached

1. Meeting Proceedings

The area Chief requested the community to open the meeting with a prayer then welcomed the Consultant (Ms Nthame Monare) and introduced her to the community. He then allowed the Consultant to proceed with the information dissemination. However, before the Consultant gave a background on the LEMOFI Project, she requested a volunteer to assist with attendance register as this was proof that the engagement has occurred. The Consultant then, gave an outline of the anticipated environmental and social impacts of the project and how they are going to be mitigated. She further introduced the Grievance Redress Mechanism (GRM) proposed for the project and the role of the Communities in making this project a success.

2. Discussions

The floor was opened for the community to comment and/or seek clarification relating to the project.
Table below presents, the questions, concerns and comments by the community regarding the project.

	COMMUNITY ISSUES	RESPONSES PROVIDED TO THE COMMUNITIES
1.	Who will be staying at the proposed labour camps?	Probably skilled labourers from outside the project area.
2.	The project seems to cover a huge area will there be more than one contractor?	The modalities of project implementation are not yet in place hence that can be clarified at a later stage.
3.	What is going to happen if the Contractor leaves the project site without paying casual labourers?	There is money that is called retention that the Client holds for a period of a year after construction. This money will not be released until all social and environmental issues have been addressed.

3.0 Closing Remarks

Consultant

The Consultant thanked the community and informed them that the discussions that took place will form part of the ESIA report that she is compiling.

Chief

The thanked the Community and the Consultant and requested the Community to sing the National Anthem in order to close the meeting.

STAKEHOLDERS ENGAGEMENT MEETING AT HA BELO – BOTHA BOTHE

Venue: Chief's Place

Date: 15th January 2025

Time: 07:00am

Present: Attendance register attached

1. Meeting Proceedings

On Behalf of the Chief, the Community Councillor welcomed the Consultant (Ms Nthame Monare) and introduced her to the Community. He let Ms Monare to proceed with the presentation. Before the Consultant gave a background on the LEMOFI Project, she requested a volunteer to assist with attendance register. The consultant explained that the register was proof that the engagement was done not for future general labour recruitment. The Consultant then, gave an outline of the anticipated environmental and social impacts of the project and how they are going to be mitigated. She further introduced the Grievance Redress Mechanism (GRM) proposed for the project and the role of the Communities in making this project a success.

2. Discussions

The floor was opened for the community to comment and/or seek clarification relating to the project.
Table below presents, the questions, concerns and comments by the community regarding the project.

	COMMUNITY ISSUES	RESPONSES PROVIDED TO THE COMMUNITIES
1.	Will there be blasting?	Blasting is not anticipated.
2.	Access to internet will improve communication hence, we welcome the project, and we will support it.	Noted

3.0 Closing Remarks

Consultant

The Consultant thanked everybody who took time to participate in this gathering. She mentioned that the Project is coming, and people should get ready, not only for engagement as general labourers but also for using the infrastructure when completed.

Chief

The Chief thanked the Consultant for coming to inform them about the project and thanked the Community Councillor for arranging the gathering.

STAKEHOLDERS ENGAGEMENT MEETING AT MAJOE – A -LITŠOENE: MASERU

Venue: Pitso ground

Date: 11th January 2025

Time: 02:30pm

Present: Attendance register attached

1. Meeting Proceedings

The Chief's assistant requested the community to open the proceedings with a prayer. Then welcomed everybody including the Consultant (Ms Nthame Monare). He requested the Consultant to do the introductions. The Consultant did the introductions, then requested the community members to allow her to take pictures and attendance register. The community granted permission for attendance register and not for taking pictures. The community provided a member to assist with writing of the attendance register. The consultant then proceeded with the engagements by giving a background on the LEMOFI Project and further providing an outline of the anticipated environmental and social impacts of the project and how they are going to be mitigated. She further introduced the Grievance Redress Mechanism (GRM) proposed for the project and the role of the Communities in making this project a success.

2. Discussions

The floor was opened for the community to comment and/or seek clarification relating to the project.
Table below presents, the questions, concerns and comments by the community regarding the project.

	COMMUNITY ISSUES	RESPONSES PROVIDED TO THE COMMUNITIES
1.	What will happen to individual properties if damaged by the Contractor?	All damaged properties will be repaired by the contractor.
2.	How is casual labour recruitment going to be handled?	There are already existing employment methods that the community use to hire casual labourers for other projects, those methods will be followed.
3.	Site management and clean-up efforts should be done by the contractor during the construction phase. The project should not pollute the project area.	The Construction Supervision Engineer will ensure that the Contractors do not pollute the Environment where pollution is caused the Contractor will rehabilitate to the satisfaction of the Construction Supervision Engineer.

3.0 Closing Remarks

The Consultant thanked all for their coming and contributions.

Chief's Assistant

The Chief's assistant thanked the Consultant on affording them, the opportunity to hear about the project and also, for providing clarity on questions. The meeting was then adjourned after singing the National anthem.

STAKEHOLDERS ENGAGEMENT MEETING AT HA MAAMA - ROMA

Venue: Chief's Place

Date: 19th January 2025

Time: 08:30am

Present: Attendance register attached

1. Meeting Proceedings

The Chief opened the meeting with a Basotho prayer then welcomed the Consultant (Ms Nthame Monare) and introduced her to the community. He then allowed the Consultant to proceed with addressing the gathering. However, before the Consultant gave a background on the LEMOFI Project, she requested a volunteer to assist with attendance register as this was proof that the engagement has occurred. The Consultant then, gave an outline of the anticipated environmental and social impacts of the project and how they are going to be mitigated. She further introduced the Grievance Redress Mechanism (GRM) proposed for the project and the role of the Communities in making this project a success.

2. Discussions

The floor was opened for the community to comment and/or seek clarification relating to the project.
Table below presents, the questions, concerns and comments by the community regarding the project.

	COMMUNITY ISSUES	RESPONSES PROVIDED TO THE COMMUNITIES
1.	1. Community pleaded that the contractor should give first preference to the elderly for camp establishment to enable them to make a living out of leasing their sites.	Noted
2.	Community complained that the government has a tendency of making promises that it is not willing to fulfil and takes too long to implement. As a result they don't believe that this project will see light of the day.	The project has secured funding already from the AfDB hence it will be implemented once the studies have been completed.
3.	Will the general labourers qualify for severance at the end of the project?	The Labourers will be paid as per the Labour Act 2024 and its guidelines.

3.0 Closing Remarks

Consultant

The Consultant thanked the community and informed them that the discussions that took place will form part of the ESIA report that she is compiling.

Chief

The thanked the Community and the Consultant. He mentioned that the world is moving to social media platforms very quickly as a result the community is also forced to do so. Therefore, expansion of network services will be very beneficial and appreciated if it can be fast tracked to enable the community to benefit. He mentioned that there are schools in Roma (Primaries to University) hence the need for the project to proceed as soon as possible. The Chief then requested the Community to sing the National Anthem in order to close the meeting.

STAKEHOLDERS ENGAGEMENT MEETING AT HA TLAI TLAI - LERIBE

Venue: Chief's Place

Date: 05th January 2025

Time: 09:00am

Present: Attendance register attached

1. Meeting Proceedings

The area Chief welcomed the Consultant (Ms Nthame Monare) and requested her to do the introductions. The Consultant did the introductions, then requested the community members to allow her to take pictures and attendance register. The community granted permission to take pictures and attendance register. Also, the community provided a member to assist with writing of the attendance register. The consultant then proceeded with the engagements by giving a background on the LEMOFI Project and further providing an outline of the anticipated environmental and social impacts of the project and how they are going to be mitigated. She further introduced the Grievance Redress Mechanism (GRM) proposed for the project and the role of the Communities in making this project a success.

2. Discussions

The floor was opened for the community to comment and/or seek clarification relating to the project.
Table below presents, the questions, concerns and comments by the community regarding the project.

	COMMUNITY ISSUES	RESPONSES PROVIDED TO THE COMMUNITIES
1.	How are the disputes going to be handled between the Contractor and the Community?	LECC will disclose the GRM before commencement of the project. Again, the disputes are going to be handled by the Client and the Engineer.
2.	How is casual labour recruitment going to be handled?	There are already existing employment methods that the community use to hire casual labourers for other projects, those methods will be followed.

3.0 Closing Remarks

The Consultant thanked all for their coming and contributions made.

Chief

The Chief thanked the Consultant on affording them, the opportunity to hear about the project and also, for providing clarity on questions. He further, mentioned that the grievances and general labour recruitment if not handled properly destroy implementation of project. Therefore, the Consultant must ensure that the developer is well aware of the issues during implementation to avoid community riots. He also requested that during implementation his office must be provided with free internet to enable him to deliver services to the community as they are now communicating with WhatsApp to send urgent messages.

The meeting was then adjourned after singing the National anthem.

ANNEXURE 10

PROJECT DESIGN REVIEW REPORT

Feasibility Study Lesotho Metropolitan Fiber Distribution Network (LEMOFI) - LEMOFI Design Review Report

Lead Telecommunications Infrastructure Consultant: Paul Inglesby

Date: 3 February 2025

1. CONTENTS

1. Contents 2
2. Executive Summary 4
3. Introduction 9
3.1 Government Ambition 9
3.2 Background Information 10
3.3 Scope and Objectives 10
3.4 Methodolgy 10
4. Current Infrastructure 11
4.1 LECC 11
4.2 LEC 24
4.3 ETL 25
4.4 VCL 25
4.5 Comnet 26
4.6 Leo 28
4.7 Jenny Lesotho 29
5. Review of any additional telecommunications or infrastructure assets that could support broader network expansion and integration 30
5.1 SpaceX's Starlink 30
5.2 Econet Telecoms LESOTHO ETL Infrastructure Assets 30
5.3 Vodacom Lesotho VCL Infrastructure Assets 31
6. Regulatory and Legal Framework Analysis Review 31
6.1 Telecommunications laws, regulations, and compliance requirements impacting the project 31
7. Gaps and Areas for Improvement 32
7.1 Identification of coverage gaps 32
7.2 Coverage Gaps in towns and residential areas and recommedations for extending lemofi33

7.3 Mapping of the gaps onto the LEMOFI roll-out plan..... 39
8. Technological Recommendations - technological advancements and best practices..... 40
8.1 ITU-T FTTx standards and best practices..... 41
8.2 ITU-T GPON, XG-PON, XGS-PON, XG-PON Combo, XGS-PON combo standards technology roadmap compliance 41
8.3 LECC pizza box OLT must support all FTTx applications..... 41
8.4 ITU-T Study Group 15 GSuppl. 74 Network Slicing in a Passive Optical Network..... 41
8.5 Network Management System OLT Slicing Configuration..... 41
8.6 Independent QoS configuration for different users and services..... 41
8.7 Digitalized ODN Management System..... 41
8.8 End to End Management for all FTTx applications..... 41
8.9 Telecommunications infrastructure provider Operations Support Systems (OSS) key features 41
8.10 Telecommunications infrastructure provider Business Support Systems (BSS) key features 42
8.11 TM Forum TMF standards for Building the future of OSS/BSS: The TMF Agile OSS toolkit.. 42
8.12 Network engineering, supply, delivery, installation and commissioning of the LEMOFI network 42
8.13 Recommendation ITU-T L.151 Installation of optical ground wire cable OPGW..... 43
8.14 Recommendation ITU-T L.26 Optical fibre cables for aerial applications..... 43
8.15 [IEC 60794-4-20] IEC 60794-4-20 (2012), Optical fibre cables – Part 4-20: Aerial optical cables along electrical power lines 43
8.16 Specification for ADSS (All Dielectric Self Supported) optical cables,..... 43
9. Conclusion..... 44
10. APPENDIX 1 Reference Documentation..... 45
11. APPENDIX 2 Definitions, Acronyms and Abbreviations..... 50
11.1 Definitions..... 50
11.2 Acronyms and Abbreviations..... 53
12. Appendix 3: International Standards and Best Practices Compliance..... 57

2. EXECUTIVE SUMMARY

The Government of Lesotho has recognized the challenges faced by new and smaller entrants in the telecommunications market, which is predominantly dominated by Mobile Network Operators (MNOs) Econet Telecoms Lesotho ETL and Vodacom Lesotho VCL. The high costs associated with building the necessary fibre infrastructure have proven to be prohibitively expensive for smaller players, thus hindering the establishment of healthy competition. This absence of competition has led to consistently high data and fixed broadband prices in Lesotho, ultimately depriving majority of the citizens of Lesotho of the advantages of widespread and affordable broadband access.

The **Lesotho Metropolitan Fiber Infrastructure Expansion Project (LEMOFI)** plan, build and operational technical capabilities are based on the inter district long-haul, constituencies within the district's transmission connectivity provided by Lesotho Electricity Company LEC. LEC uses Optical Ground Wire (OPGW) fibre technology to connect the LEC distant substations (usually on 88kV and 132kV lines, rarely on 33kV) whereas for connecting substations within a district metro area like Maseru, All Dielectric Self-Supporting fibre (ADSS) is more commonly used (on 33kV lines). ADSS is also exclusively used for pole attachments by attaching third-party fibre to LEC's 11 kV poles.

Unfortunately, LEC's fibre infrastructure does not extend into towns nor residential areas. **LEMOFI's** strategic objective is to address these infrastructure coverage gaps by establishing the essential fibre ring and distribution networks within towns and metropolitan areas and connecting them to the nationwide LEC OPGW/ADSS network.

The LEMOFI Design Review Report considers the current infrastructure, the regulation environment, broadband technologies coverage gap analysis, and technological considerations. The following is an executive summary of findings and recommendations.

CURRENT INFRASTRUCTURE: The Current Infrastructure technical assessment and analysis was undertaken on the Lesotho Electricity Company Communications LECC existing and **Lesotho Metropolitan Fiber Infrastructure Expansion Project (LEMOFI)** planned network design and specifications.

The Technical Design Review included Econet Telecoms Network ETL, Vodacom Lesotho VCL, Comnet, Leo and Jenny Lesotho fibre networks and mobile cellular 4G/5G, copper based Digital Subscriber Line DSL technologies, Point-to-Point PTP Wireless and Satellite Technologies broadband network technologies.

The LEMOFI Ring and Distribution Network was mapped onto the Open Standards Based Layered Architecture and benchmarked with international standards and best practices. The technology domains reviewed included the LEMOFI network

- Fibre and Passive Infrastructure
- Gigabit Passive Optical Network GPON, XGS-PON 10 Gbps symmetric passive optical network (X=10, S=symmetric) Optical Line Terminal OLT and Optical Network Unit ONU / Optical Network Termination ONT active equipment
- Ethernet, Internet Protocol IP/ Multiprotocol Label Switching MPLS Core Network
- Interconnect to other networks, Energy Efficiency initiatives proposed for LEMOFI, Quality of Services QoS / Quality of Experience QoE measures, Master Service Agreements and Service-Level Agreements and Security technical capabilities.
- Operations Support Systems OSS, Business Support Systems BSS and other Information Technology IT Systems
- Faults, Configuration, Accounting, Performance and Security FCAPS, Network Management Systems NMS, Element Management Systems EMS and Network Elements NE

Finding 1 National Broadband Connectivity Plan - Strategic interventions ICT 1 in the Lesotho's National Digital Transformation Strategy: Agenda 2030 page 25: No mapping of the Government of Lesotho broadband infrastructure to identify connectivity gaps exists. No National Broadband Connectivity Plan exists.

Recommendation 1: Map the broadband infrastructure (and supporting infrastructure) to identify connectivity gaps (coverage, infrastructure gaps, usage, quality, resilience, etc.) and develop a National Broadband Connectivity Plan to bridge the gaps. Special focus should be on ensuring rural broadband expansion with a differentiated set of regulations (such as different spectrum prices, licenses, fiscal regimes, subsidizing shared

infrastructures, etc.), expansion of a national backbone network, and connectivity for key public service institutions (such as schools, health centers, local administrations, post offices, and police stations).

Finding 2 Feasibility Study to optimize the value of public entities and assets - - Strategic interventions ICT 2 in the Lesotho's National Digital Transformation Strategy: Agenda 2030 page 26: No feasibility study has been undertaken on public entities and assets and strategic plan developed to optimize these assets.

Recommendation 2: Conduct a feasibility analysis and delineate the strategy for optimizing the value of public entities/assets (such as LECC, WIOCC, data centers) to enhance broadband and electricity accessibility and improve connectivity with special emphasis on rural areas, where gaps in access to electricity and broadband are most prevalent.

Finding 3 Duplication of LEC/LECC Pole Infrastructure: the proposed LEMOFI network fibre, pole, and optical distribution network ODN passive infrastructure is in accordance with the standards and best practices. It is more cost effective to deploy an All-Dielectric Self Supporting (ADSS) cable on Pole Infrastructure than buried duct and micro duct underground infrastructure. However, the proposed LECC LEMOFI network pole infrastructure does not share all the LEC pole infrastructure in the last mile network. The Pole outside the consumers house or the Enterprise building which feeds the electricity which is connect back to the LEC switch cannot be shared with LECCC. LECC is required to provide its own Pole Infrastructure. LEC and LECC have not reached an agreement to share the existing LEC pole infrastructure that connects the customer to the LEC electricity grid network.

Recommendation 3: LEC and LECC need to resolve the sharing of the LEC access and last mile pole network infrastructure and identify where it is feasible to share existing pole infrastructure and reduce costs. The current Nationwide Network Costing Model indicates a Total Cost of 2 148 001,59 LSL for Pole Infrastructure in the 18 x Target Areas Ring and Distribution Network target areas which can be reduced after agreement between LEC and LECC regarding sharing of Pole Infrastructure.

Finding 4 Competitive GPON/XGS-PON Technology: LECC will not have a competitive technology advantage over Econet Telecoms Lesotho ETL from an active equipment technology perspective. ETL have deployed GPON active equipment in the Lesotho FTTx market since 2013 and in 2025 ETL will be deploying XGS-PON technology.

Recommendation 4: LECC needs to consider the deployment of XGS-PON technology where XGS-PON is a 10 Gbps symmetric passive optical network (X=10, S=symmetric). Recommend that LECC investigates the new Passive Optical Network PON technology which efficiently merges GPON and XGS-PON resulting in huge cost and capability benefits in accordance with ITU-T Study Group 15 G.9807 Recommendations https://www.itu.int/en/ITU-T/studygroups/2022-2024/15/Documents/flyers/Flyer_ITU-T_G9807r1.pdf

Finding 5 OLT and ONU/ONT Interoperability: Optical Line Terminal OLT connects to the Optical Distribution Network ODN and the Optical Network Unit ONU Optical Network Terminations ONT on the customers premises. LECC OLT and ONU deployed for the LECC FTTH Ha Foso project and planned for the LEMOFI network are BDCOM products which does lock LECC into a single vendor for all FTTH/FTTB services.

Recommendation 5: Singles vendor lock-in for OLT and ONU/ONT network elements is not recommended for the longer term and hence the request for LECC to provide interoperability test results for BDCOM GPON OLT with at least 3 suppliers of GPON ONU's. Recommend that LECC adopts the ITU-T recommendations for interoperability test procedures as well as Broadband Forum new standard which de-couples the ONU, OLT, and ONU management and control interface OMCI stacks, avoiding OLT vendor lock-in and the management cycle of

optical modems being tied to a specific vendor's OLT or their software release cycles. This encourages competition between vendors with operators having increased freedom to choose from other ONU vendors and introduce more end-user devices into their network. Reference G.Sup46 : G-PON interoperability test plan between optical line terminations and optical network units https://www.itu.int/rec/T-REC-G.Sup46-200905- I/en. Broadband Forum BBF-247 is part of the global widely accepted industry standards that ensures multi- vendor interoperability, it is a critical program that delivers choice and flexibility for service providers and broadband consumers. – see https://www.broadband-forum.org/testing-and-certification-programs/bbf-247- gpon-onu-certification

Finding 6 Energy Efficiency: Energy efficiency is a very important consideration for the information and communication technology (ICT) sector, contributing around 2 to 2.5 per cent of global greenhouse gas (GHG) emissions, ICTs are also a part of the solution because they have the potential to assist in reducing emissions from

other sectors of the economy. Currently there is no Energy Efficiency Strategic Plan and energy efficiency metrics/key performance indicators (KPIs), measurement methodologies and energy management solutions for the LEMOFI network.

Recommendation 6: Recommend LECC prepares an Energy Efficiency strategic plan for the LEMOFI network in accordance with International Standards and Best Practices - https://www.itu.int/en/ITU- T/climatechange/resources/Pages/Energy-efficient.aspx and include associated costs as a line item in the Nationwide Network Costing Model.

ITU-T L.1310 "Energy efficiency metrics and measurement for TLC equipment" Metrics and measurement methods defined for broadband wireline/wireless equipment and small networking devices. https://www.itu.int/rec/T-REC-L.1310/en

Finding 7 Quality of Services QoS / Quality of Experience QoE: Currently there is no Quality of Services QoS / Quality of Experience Strategic Plan and QoS/QoE metrics/key performance indicators (KPIs), measurement methodologies and QoS/QoE management solutions for the LEMOFI network.. Quality of Service (QoS) is defined as the collective effect of service performance, which determines the degree of satisfaction of a user of the service and Quality of Experience (QoE) is defined as the degree of delight or annoyance of the user of an application. The LEMOFI QoS/ QoE Strategic Plan forms an important part of the LEMOFI SLA Agreement.

Recommendation 7: Recommend LECC prepares an QoS / QoE strategic plan for the LEMOFI network in accordance with International Standards and Best Practices and includes associated costs as line items in the Nationwide Network Costing Model. QoS/QoE international standards and best practices in accordance with ITU- T Study Group 12 https://www.itu.int/en/ITU-T/about/groups/Pages/sg12.aspx compliance is recommended and documented in the LECC LEMOFI Technology Standards Strategy and LEMOFI Technology Network Master Plan.

The LEMOFI Technology Network Master Plan enables the LECC project teams to understand the LEMOFI strategic roadmap for technology adoption and integration, including the LEMOFI current assessment and the identification of future needs and costs.

Findings 8 Security: Security Firewalls network element NE components and costs are not included in the LEMOFI Ring and Distribution network design and the Nationwide Network Costing Model. LEMOFI Security Strategic Plan and measurement methods, metrics/KPI and reference values have not been compiled.

Recommendation 8: Recommend that the LEMOFI network must be fully compliant with ITU-T Study Group 17 https://www.itu.int/en/ITU-T/studygroups/2025-2028/17/Pages/default.aspx . The demilitarized DMZ Security Layer needs to be clearly defined from a LEMOFI Technology Standards Strategy and LEMOFI Technology Network Master Plan perspective. The Security Network Elements need to be a line item in the LEMOFI Nationwide Network Costing Model.

Findings 9 Operations Support Systems OSS, Business Support Systems BSS, Information Technology IT Systems: The OSS/BSS and other IT Systems shared indicate that LECC is still finalizing plans for the OSS/BSS stack. The OSS/BSS stack network elements and costs during the LEMOFI 3-year capital spend are not included in the Nationwide Network Costing Model. Billing Systems are included as a cost item in the No.2 Nationwide Network Detailed Proposal draft - October 2023 which is dated in 2023.

Recommendation 9: All of OSS/BSS stack LEMOFI network components need to be included in the Nationwide Network Costing Model dated 2025 and costs clearly indicated. Recommend LECC build the future LEMOFI OSS/BSS stack based on TM Forum The Agile OSS toolkit which provides a range of assets to support architects and other members of the IT community in realizing OSS/BSS solutions based on the latest IT practices which support current and anticipated future requirements of Digital Service Providers – see https://www.tmforum.org/resources/toolkit/agile-ossbss-toolkit/

Findings 10 Faults, Configuration, Accounting, Performance and Security FCAPS, Network Management Systems NMS, Element Management Systems EMS and Network Elements NE All the network elements and software systems are not listed as line items in the 3-year Nationwide Network Costing Model. The LECC LEMOFI network is locked-into BDCOM for OLT ONU NE network elements, EMS and NMS functionality and LEMOFI FCAPS technical capabilities are unclear.

Recommendation 10: All FCAPS, NMS, EMS, NE LEMOFI network components need to be included in the Nationwide Network Costing Model as line items and costs clearly indicated. Recommend compliance with the ITU-T - M series: Telecommunication management, including Telecommunications Management Network TMN

and network maintenance https://www.itu.int/rec/T-REC-M.3000-200002-I M.3000 : Overview of TMN Recommendations

Finding 11 Maintenance and Support, SLA Agreements: LECC currently does not have a Master Maintenance and Support and Service-Level Agreements SLA in place and the associated costs over the 3 years deployment of the LEMOFI Ring and Distribution Network are not reflected in the Nationwide Costing Model.

Recommendation 11: Recommend that LECC develops the SLA agreement in accordance with ITU-T M. 3342 Guidelines for the definition of SLA representation template - https://www.itu.int/rec/T-REC-M.3342-200607-I/en

Findings 12 ISO 9001:2015 Documentation – Quality Management System (QMS): LECC documentation is not in accordance with ISO 9001:2015 Quality management systems QMS standards and best practices.

Recommendation 12: LECC requests for an end user license from the Government of Lesotho ISO 9001:2015 QMS master agreement. Reference for ISO 9001:2015 https://www.iso.org/standard/62085.html

Findings 13 Infrastructure assets that could support broader network expansion: Econet Telecoms Lesotho ETL has the dominant deployment of narrowband wireless (2G/3G) and broadband wireline (DSL) and wireless (4G/5G) technologies in Lesotho i.e. Narrowband 2G supporting 0.1 Mbps download speeds, narrowband 3G networks supporting 8 Mbps, 4G broadband mobile networks supporting 60 Mbps and next generation 5G networks the average download speeds are between 50 Mbps and 2 Gbps,

SpaceX Starlink https://www.starlink.com/ will be a threat to ETL wireless mobile network as Starlink offers download speeds ranging from 50 Mbps to 250 Mbps and the Lesotho Communications Authority LCA is considering license approval for Starlink in Lesotho. The terms and conditions of the Starlink license are confidential whilst still in the approval phase.

The dominant FTTx Operator in Lesotho is ETL who has Fibre (Long Haul, Regional, Metro, Backhaul) and FTTH FTTB Network Coverage in 32 (thirty-two) of the 80 (eighty) constituencies within the 10 districts in Lesotho i.e. 40% (forty percent) of the constituencies within the 10 districts have FTTH/FTTB coverage.

LEMOFI 18 X Ring and Distribution Network Coverage is planned to be deployed in the constituencies within the districts where ETL already has Fibre, FTTH, FTTB Services deployed.

VCL have not deployed any FTTH networks in Lesotho which aligns with the VCL strategy of the large-scale deployment of Fixed Wireless Access FWA technology integrated with 4G LTE and/or 5G when budget is available. VCL have deployed FTTB in only 2 of the 80 constituencies i.e 2.5% whereas ETL is 40% of the constituencies covered by FTTx services.

Internet Service Providers ISP Comnet and Leo have deployed small fibre networks in Maseru. Comnet has deployed a Fibre to the Tower network to connect all Comnet's Towers in Maseru and Leo has deployed a Fibre to the Business network in Central Maseru. Jenny Lesotho has plans d to deploy fibre networks but will lease if more cost effective from ETL, LECC or VCL.

With one dominant Wholesaler (ETL), one new entrant LECC and 5 x ISP's ETL, VCL, Comnet, Leo and Jenny Lesotho, the current wholesale carrier's carrier and ISP retail services business model in Lesotho is not conducive for aggressive competition and driving down the price per Meg for the Enterprise and Consumer market.

Recommendation 13: Recommended that LECC needs to approach LCA to facilitate LECC/ETL FTTx network sharing business opportunities in the 32 constituencies where ETL have FTTx services.

Recommend that LECC approach VCL management and Vodacom Group with the view of a LECC/VCL FTTx Strategic Partnership for the LEMOFI Network. LECC provide the wholesale LEMOFI FTTx network infrastructure and VCL ISP provides the FTTx services.

Recommend that VCL commits to payment of a percentage of the LEMOFI Network Project costs of LSL155,847,106 or USD8,424,168 and share revenues with LECC based on the % investment VCL does commit. LECC/VCL then compete aggressively with ETL in all constituencies within the districts.

Recommend LCA considers approving more ISP licenses in the Lesotho market.

REGULATORY ANALYSIS AND REVIEW: Analysis and review was undertaken of the telecommunications laws, regulations, and compliance requirements impacting the LEMOFI project that was shared by Lesotho Communications Authority (LCA). The following are the findings and recommendations:

Finding 1 DRAFT – LCA – ADMINISTRATIVE – RULES – 2024 PUBLIC CONSULTATION FINAL: The most important

clause impacting the LEMOFI project is the following - **Requirement to give access and share infrastructure -**

Reference Clause 28. (1) The Authority may require a licensee to share its communications infrastructure, and the licensee shall allow other licensees to use the infrastructure- On a first come first served basis; On a cost-based pricing structure and on non-discriminatory terms and conditions. Provided that- The infrastructure can be shared without adverse effects to the owner of the infrastructure; and requiring other licensees to replicate the infrastructure, would impede competition and growth of the sector. The Authority designates, without being exhaustive, the following communications infrastructure as infrastructure that shall always be shared – Communications sites, towers or masts (mobile, broadcasting, telemetry and two-way radio); Poles; - FTTH network Poles are not shared today the Ha Foso village in Berea District, Lesotho. Ducts: ETL do not share duct infrastructure in the Maseru Metro network resulting in LECC deploying Poles and Duct infrastructure, VCL are planning a Maseru Metro Fibre Network, Comnet have a fibre to the tower network and Leo have deployed a 48- core fibre network in Maseru. Maseru currently has four FTTx Network Operators

Recommendations 1: LECC to request meeting with LCA and ETL to discuss when LCA plans to enforce the sharing of FTTx infrastructure in the 10 Lesotho districts, and particularly the 18 target areas for the LEMOFI project. The No.2 Nationwide Network Detailed Proposal draft - October 2023, and Nationwide Network Costing Model would need to be reviewed and costs of leasing fibre from ETL compared with LECC self-building the LEMOFI fibre network.

Finding 2 Starlink: The terms and conditions of the Starlink license is of critical importance for ETL, VCL, LECC, Comnet, Leo and Jenny Lesotho to read and study to determine what impact Starlink will have on the competitive environment in the telecommunications market in Lesotho. Reference https://www.lena.gov.ls/starlink-to-hit- lesotho-next-year/ The decision to award the license is still pending with various Minister's.

Recommendation 2: Recommend that the Government of Lesotho should work closely with Starlink in the rural areas in Lesotho to provide broadband services to the underserviced areas.

Recommend that Government of Lesotho MICSTI/LECC works with LCA and Starlink to provide broadband services to Government buildings, hospitals, clinics, community centres, schools, healthcare centres, residential homes in the rural areas in Lesotho.

Recommend that the LECC LEMOFI Fibre Network should not be deployed in those constituencies/communities within the districts where it is more cost effective to deploy Starlink. In those rural areas where the LEMOFI Fibre Network is approved for deployment but may take 2-3 years

for deployment then Starlink connectivity should be considered to be deployed until the LEMOFI Fibre Network is operational.

GAPS AND AREAS FOR IMPROVEMENT: LECC, ETL and VCL were requested to complete a District Constituencies Communities Technology Coverage Matrix for the 80 Constituencies within the 10 districts and the 129 communities within the 10 districts. The following are findings and recommendations based on the results of the survey:

Finding 1 Constituencies within the Districts with No Fibre, FTTH, FTTB: The following is the list of the 51 constituencies within the districts where in 2025 there is no deployment of Fibre, Fibre to the Business FTTB, Fibre to the Home FTTH services

Berea District - Bela-Bela, Khafung, Makhoroana-Lube, Malimong, Mosalemane, Tšoana-Makhulo.

Butha-Buthe District – Hololo, Mechachane, Motete, Qalo.

Leribe District – Kolonyama, Mahobong, Maliba-Matšo, Matlakeng, Mphosong, Peka, Pela-Tšoeu, Thaba-Phatšoa,

Tsikoane.

Mafeteng District - Thaba-Phechela, Phoqoane, Matelile, Maliepetsane, Thabana-Morena, Qalabane.

Maseru District - Koro-Koro, Machache, Majoe-a-Litšoene, Makhaleng, Maletsunyane, Matsieng, Rothe, Thaba- Bosiu, Thaba-Putsoa.

Mohale's Hoek District – Hloahloeng, Mekaling, Mpharane, Phamong, Taung

Mokhotlong District – Bobatsi, Malingoaneng, Senqu

Qacha's Nek District – Lebakeng, Tsoelike

Quthing District – Sempe, Mount Moorosi, Qhoali

Thaba-Tseka District – Mantšonyane, Mashai, Semena, Thaba-Moea

Recommendation 1: Recommend that all the service providers including Starlink meet with Lesotho Communications Authority LCA to agree that DRAFT – LCA – ADMINISTRATIVE – RULES – 2024 PUBLIC CONSULTATION FINAL will be enforced. Sharing of requirements to give access and share infrastructure - Reference Clause 28 will be enforced by LCA. The service providers need to agree on which of the above 51

constituencies within the 10 districts they will Plan, Build and Operate based on an Open Access Fibre Network Business Model.

Finding 2 LEMOFI Target Constituencies within the Districts: The following are the district and target areas/constituencies for the LEMOFI Fibre Network:

Year 1: Berea: Teyateyaneng. **Leribe:** Maputsoe (Including Nyenye). **Mafeteng:** Mafeteng. **Maseru:** Highway-Central-IEMS. **Maseru:** Maseru Industrial. **Maseru:** Parliament - Maseru Mall. **Maseru:** A2 - Lekhaloaneng - Matala **Year 2: Leribe:** Hlotse. **Butha Buthe:** Botha Bothe. **Mohale's Hoek:** Mohale's Hoek. **Mokhotlong:** Mokhotlong Town. **Thaba Tseka:** Thaba Tseka. **Maseru:** Thetsane Industrial

Year 3: Maseru: Old Europa – Downtown. **Maseru:** Tikoe Industrial. **Quthing:** Quthing – Moyeni. **Qacha's Nek:** Qacha's Nek Town.

The LEMOFI Fibre Network Year 1 to Year 3 districts constituencies will not provide FTTH/FTTB Services to any of the 51 constituencies who have been identified as currently having no FTTH/FTTB Services

Recommendation 2: Recommend that the current LEMOFI Nationwide Network Costing 150125 and No.2 Nationwide Network Detailed Proposal draft - October 2023 (dated 2023) be updated to include a selection of the HIGH DEMAND areas from the Preliminary Market Analysis Report **Berea District:** Bela-Bela, **Butha-Buthe District** Hololo, **Leribe District** Mahobong, **Mafeteng District** Matelile, **Maseru District:** Rothe, **Mohale's Hoek District** Taung , **Mokhotlong District** Bobatsi, **Qacha's Nek District** Lebakeng, **Quthing District** Sempe, **Thaba-Tseka District** Semena

Recommend that all Government of Lesotho building, offices, state owned hospital, healthcare clinics, schools are all transferred from existing ETL connectivity onto the LEMOFI Network and included in the revised LECC LEMOFI Fibre Network Business Plan..

Recommend that information is shared covering the name of entity, GoL Department, physical address, GPS Coordinates in order to include as revenue income for the LEMOFI network. If this recommendation is not implemented, then the LEMOFI business plan will be in a HIGH RISK status as far as any future Return On Investment ROI is concerned.

TECHNOLOGY RECOMMENDATIONS: Technology recommendations and suggestions were provided for incorporating recent technological advancements and best practices, such as FTTH and FTTB models, and the use of OPGW and ADSS fibre.

Finding 1 FTTH, FTTB, OPGW, ADSS.international standards and best practices: Current LEMOFI network design review indicates some further work is required with respect to the compliance with key FTTx Network Operators international standards and best practices.

Recommendation 1: OPGW, Pole Infrastructure and ADSS cable technology have not changed during recent years.

Recommend that LEMOFI plan, build and operate network comply with the applicable ITU-T, IEEE, IEC standards highlighted in this document. The Passive Optical Distribution Network ODN technology has encountered minor enhancements and links have been shared. Recommend that LEMOFI consider the deployment of the ITU-T based roadmap for active equipment Optical Line Terminal OLT and Optical Network Unit (ONU) and Optical Network Termination (ONT). The key competitive technology differentiator is in the Management Layer in particular the Energy Efficiency, Quality of Service / Quality of Experience, Security, Operations Support Systems, Business Support Systems, Faults, Configuration, Accounting, Performance, Security technology domains.

Recommend LECC ensure that they have the capacity and capabilities to plan, build and operate the all the technology domains which will provide LECC with a competitive technology advantage.

3. INTRODUCTION

3.1 GOVERNMENT AMBITION

The Government of the Kingdom of Lesotho is committed to advancing its telecommunications sector by fostering innovation and expanding affordable broadband access for all citizens. With a focus on enhancing competition and driving digital inclusion, the Government aims to make broadband services more accessible and affordable for both urban and suburban populations. To achieve this, the Government is working to extend fiber networks by leveraging existing infrastructure and developing new fiber networks to support wider connectivity, ultimately promoting economic growth and social development.

3.2 BACKGROUND INFORMATION

The Government of the Kingdom of Lesotho is committed to fostering a competitive telecommunications sector and expanding broadband access across the nation. However, the sector is currently dominated by Mobile Network Operators (MNOs), and the high costs associated with building new infrastructure have hindered smaller entrants from establishing a foothold. This lack of competition has led to high data and broadband prices, preventing many citizens from accessing affordable broadband and participating fully in the 4th Industrial Revolution.

To address these gaps, the **Lesotho Metropolitan Fiber Infrastructure Expansion Project (LEMOFI)** project should focus on developing comprehensive fiber distribution networks within towns and metropolitan areas to enhance access and promote competition. The design should account for existing fiber coverage from Econet, Vodacom, and the Lesotho Electricity Company (LEC), whose network primarily follows long-distance transmission lines.

Additionally, it should consider other local ISPs with smaller or expanding fiber deployments to ensure a more integrated infrastructure.

3.3 SCOPE AND OBJECTIVES

The primary objective of this Design Review Report is to determine:

Technical Feasibility: To review existing designs and specifications for the national fibre network, focusing on infrastructure that expands coverage into urban and suburban areas, with the objective of proposing an optimized network design and architecture, including technology options and infrastructure requirements.

Regulatory and Legal Framework impact: regulatory telecommunications laws, and compliance requirements impacting the LEMOFI project.

FTTx network coverage gaps: Identification of coverage gaps, particularly in towns and residential areas, and recommendations for extending the network into these areas.

Recent technological advancements and best practices - FTTH and FTTB models, and the use of OPGW and ADSS fibre and associated technology compliant with international standards and best practices.

3.4 METHODOLGY

The methodology used to undertake this assignment is outlined below.

Step 1 – Consultation and fact finding

Key stakeholders in Lesotho were visited for in-person meetings and detailed technical meetings were held with LECC with follow-up online meetings:

- seek input and contribution for the Lesotho Metropolitan Fiber Infrastructure Expansion Project (LEMOFI) project strategic objectives, technical and business requirement
- gather background information such as previous reports, LEMOFI technical design and specifications, compliance to international standards and best practices information, OPGW, ADSS, Fibre, FTTH, FTTB, 5G, 4G, DSL, Satellite, 2G,3G technology coverage maps, costings, market demand data.
- establish an understanding of connectivity and affordability, challenges.

Step 2 – Analysis

This step is an analysis of the information received in Step 1 and:

- assessed the technical design of the LEMOFI network and highlighted areas of international standards and best practices compliance.
- developed Open Standards Based Layered Architecture and mapping of the LEMOFI network onto the international standards and best practices compliant architecture
- requested further technical supporting information in the LEMOFI network technology domains
- compiled a District Constituencies, Communities Technology Coverage Matrix and requested LECC, ETL, VCL to complete
- Identified the Fibre, FTTH, FTTB technology coverage gaps in the 80 constituencies within the 10 districts in Lesotho
- Identified the 4G/5G technology coverage gaps in the 80 constituencies within the 10 districts in Lesotho
- Identified the DSL technology coverage gaps in the 80 constituencies within the 10 districts in Lesotho
- Identified the 2G/3G technology coverage gaps in the 80 constituencies within the 10 districts in Lesotho
- Identified the Satellite technology coverage gaps in the 80 constituencies within the 10 districts in Lesotho

Step 3 – Reporting

The purpose of this step was to report on:

- the technical feasibility of the LEMOFI project and offer recommendations regarding international standards and best practices
- regulatory telecommunications laws, and compliance requirements impacting the LEMOFI project
- current fibre services providers coverage gaps, particularly in towns and residential areas, and provide recommendations for extending the network into these areas.
- incorporating recent technological advancements and best practices, such as FTTH and FTTB models, and the use of OPGW and ADSS fibre.

The remainder of this report is structured as follows:

- **Section 4** is a detailed technical assessment of the current infrastructure technical designs and technical specifications for the national fiber network, considering not only LEC and LECC's dark fiber networks and LEC's pole infrastructure, but also the fiber infrastructure deployed by other service providers and utilities, Econet Telecoms Lesotho, Vodacom Lesotho, Comnet, and Jenny Lesotho. The current technical design review includes a review of any additional telecommunications or infrastructure assets that could support broader network expansion and integration.
- **Section 5** is an analysis of the regulatory and legal framework and review of the telecommunications laws, regulations, and compliance requirements impacting the project.
- **Section 6** identifies coverage gaps, particularly in towns and residential areas, and provides recommendations for extending the network into these areas.
- **Section 7** offers technological recommendations based on international standards and best practices for further deployment in the LEMOFI Ring and Distribution Network
- **Section 8** provides concluding commentary

4. CURRENT INFRASTRUCTURE

4.1 LECC

4.1.1 OPEN STANDARDS BASED LAYERED ARCHITECTURE

The Consultant has undertaken detailed international standards and best practices assessment and analysis of the top Telecommunications Networks Operators (Telco's) worldwide and concluded that the majority have moved towards Open Standards Based Layered Architecture which is depicted in Figure 1. The different layers are defined as follows:

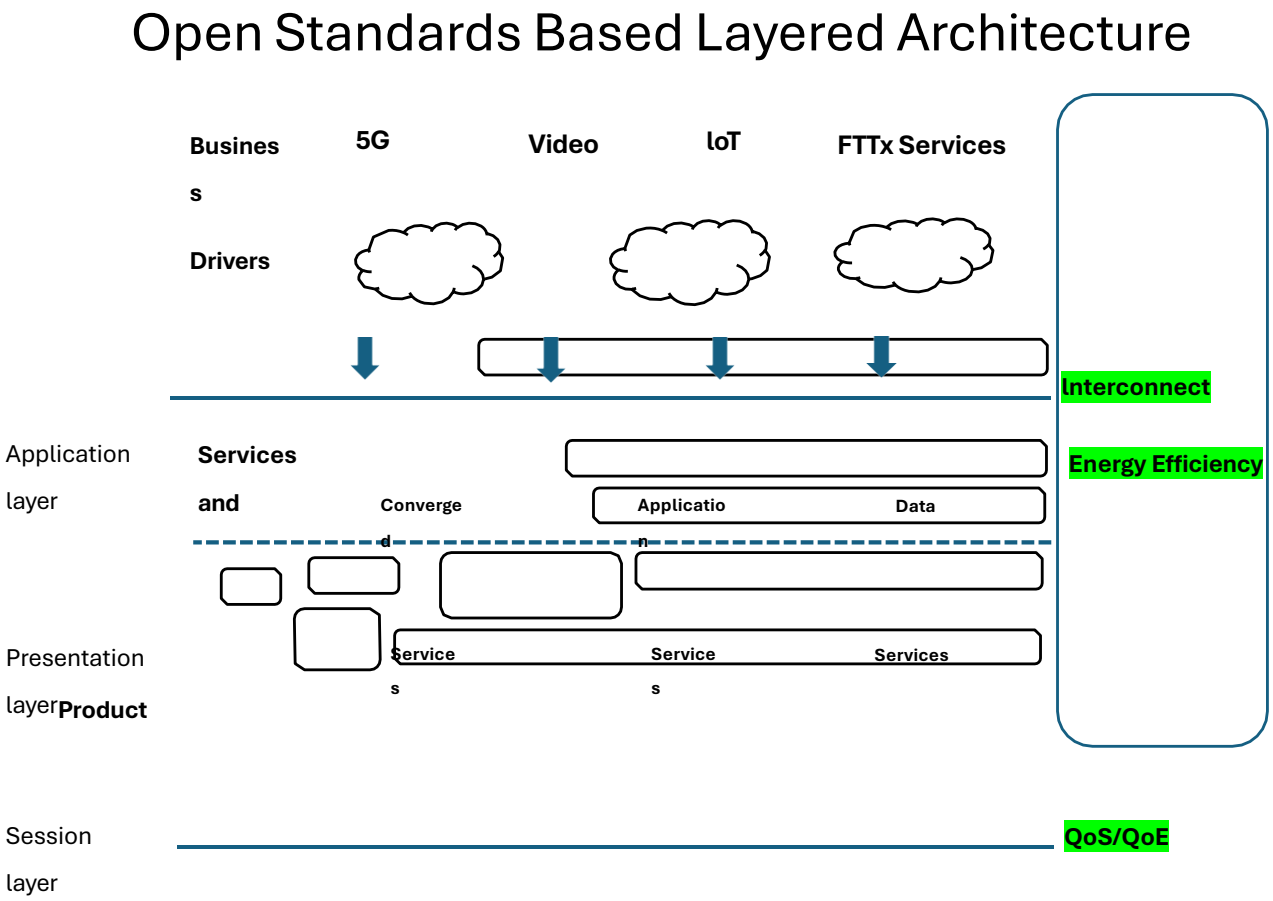
Layer 1 or the Physical Layer is the Optical Fibre Cable Network and in the Case of LEMOFI that would be the physical LEC OPGW network and the LECC ADSS network. Layer 1/2 is also includes all the LEMOFI passive infrastructure i.e. **Installation Accessories:** Galvanized Hoop Clamps (with Nuts and Bolts), Steel Banding Strips (Fit in 19.1mm buckle), Banding Strip Buckles (19.1mm), Bolt Pigtail M12 X 280mm, Termination - Dead End Thimble Type for ADSS, Termination - Dielectric Suspension Clamp (with Rubber Insert), Termination - Fiberlign Suspension Tie (Tangent for Short Span ADSS), Stay Rod Assembly with Baseplates - for all Poles that require stays, 4-arm slack storage for fibre slack loops (600mm), Splice Enclosure - Feeder Tier, Splice Enclosure - Feeder Tier, Fibre Distribution Hub (FDH) - with Splitters Fitted, Splitters 1:2 – Connectorized, Splitters 1:4 – Connectorized, Splitters 1:8 – Connectorized, Splitters 1:16 – Connectorized, Splitters 1:32 – Connectorized, Fibre Access Hub (FAT)- with Splitters Fitted, Fibre Patch Panel – Unloaded, Midcouplers for Fibre Patch Panels, Fibre Pigtails for Patch Panels, Brush Panels, Patch Leads, Manholes.

Layer 1 LECC Dark Fibre: LECC adopts an Open Access Business Model and offers Dark Fibre Services to customers - **Long-Term Dark Fibre Service** This service is provided to businesses which are interested in a long- term business commitment and comes as an indefeasible right of use (IRU) service which gives the subscriber the right to use a pair of fibre (for a purchase segment) for 10 to 15 years. The service is charged per kilometre and paid in advance for the total period. Additionally, maintenance is paid annually starting from the second year of the service. The target audience is network providers who are interested in expanding or protecting own network. **Short-Term Dark Fibre Service -** The short-term leased fibre is provided to businesses that are not interested in long-term relationships or will only manage to pay month-on-month for the service rendered. The service is purchased contracts ranging from one year to five years for specific segments of interest. The target audience is network providers who are interested in expanding or protecting their own network**.**

Layer 2 is when the passive fibre network is lit by installing active optical fibre cable equipment: In the case of LEMOFI the active equipment is the Gigabit Passive Optical Network GPON and Optical Network Unit ONU / Optical Network Termination (ONT) equipment. This is the LEMOFI Ring and Distribution Network that LECC plans to deploy and the offer Open Access FTTx Services to ETL, VCL, Comnet, Leo, Jenny Lesotho.

Layer 2/3 consists of the Optical Transport Network OTN, Ethernet Switches and Router Network. LECC have deployed the Ethernet Switches and Routers at the LECC HQ site in New Europa, House No. 286, LCA Lesotho Internet Exchange Point (LIXP) and Mabote Substation.

The End-to-End E2E Management Layer consists of the International Interconnect the QoS/QoE requirements, Security (DMZ Security Layer), OSS/BSS and other ITS Systems, FCAPS, NMS Network Management Systems and EMS Element Management Systems.



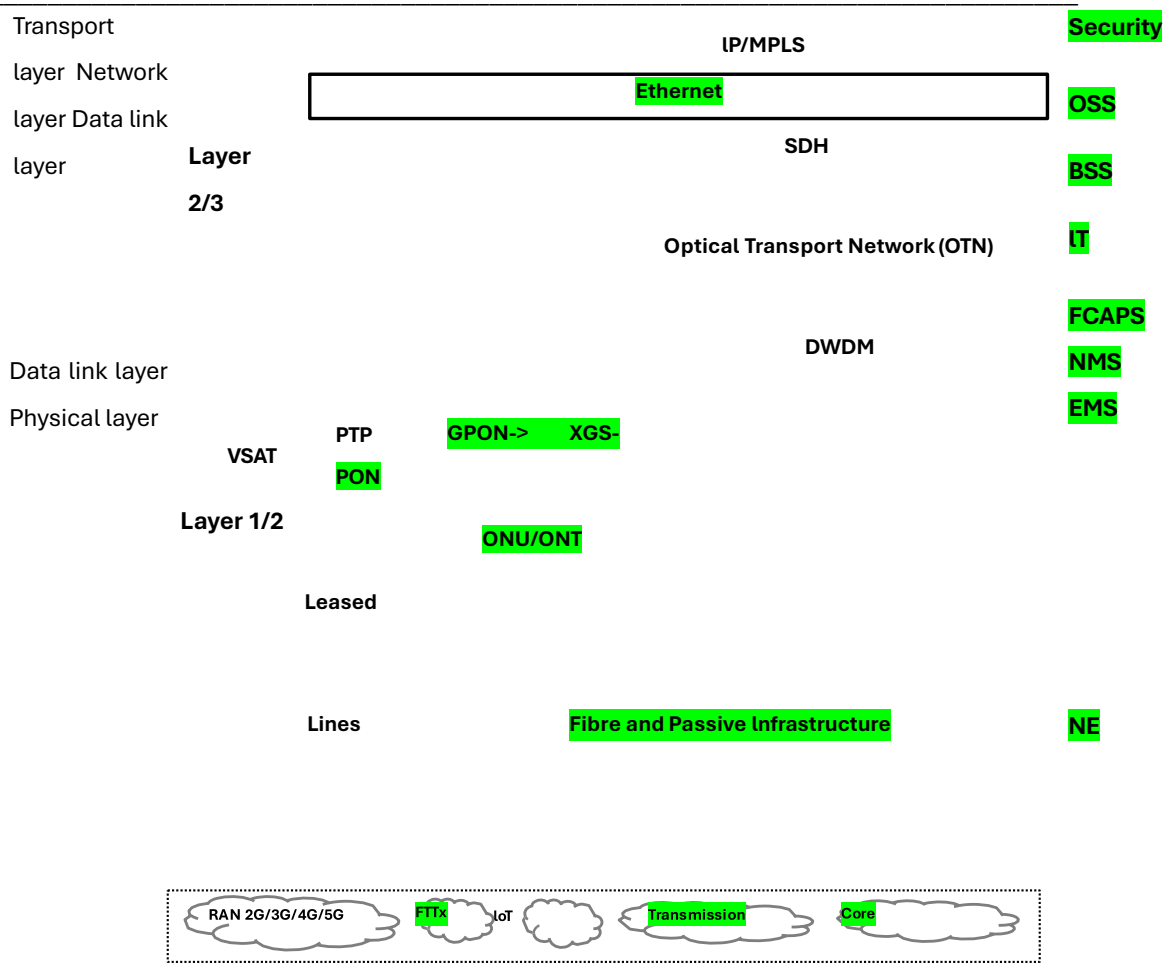


Figure 1

With reference to Figure 1 Open Standards Based Layered Architecture, Technical Design Review an analysis and assessment is undertaken on the green highlighted network elements and benchmark with respect to the following technology domains:

Physical Layer 1 Fibre-to-the-x technology domain where x could be H = Home, B= Business or Building, T= Tower, GoLB=Government of Lesotho Building, H=HealthCare Centre/Clinic, S=School, H=Hospital, R = Room. Reference ITU-T Study Group 15 - Networks, Technologies and Infrastructures for Transport, Access and Home - https://www.itu.int/en/ITU-T/about/groups/Pages/sg15.aspx

Layer 1 Fibre and passive Infrastructure OPGW technology domain - all the passive infrastructure, installation accessories. International Electrotechnical Commission IEC IEC 60794-4-10

IEC 60794-4-10:2014 Optical fibre cables - Part 4-10: Family specification - Optical ground wires (OPGW) along electrical power lines IEC 60794-4-10:2014 which is a family specification, covers cable construction, test methods and optical, mechanical,

environmental and electrical performance requirements for OPGW (optical ground wire) which is used for the protection of electrical power lines against atmospheric discharges or short-circuits and, at the same time, as a high bandwidth transport media for communications-and-control optical signals. The corresponding environmental declaration may be built according to IEC TR 62839-1. This second edition cancels and replaces the first edition published in 2006 and constitutes a technical revision. This edition includes the following significant technical

changes with respect to the previous edition: - galloping test (9.7) has been added to the type tests list; - update of definitions clause; - maximum installation tension (MIT) defined and used in the sheave test description; - definition of characterization of OPGW's mechanical behavior in order to provide information useful for electrical power transmission lines designers; - improved definition of lightning test parameters and conditions to improve reproducibility among different laboratories. Keywords: OPGW (optical ground wire), protection of electrical power lines, atmospheric discharges. https://webstore.iec.ch/en/publication/3505#:~:text=IEC%2060794-4-10%3A2014%20which%20is%20a%20family%20specification%2C%20covers,electrical%20power%20lines

%20against%20atmospheric%20discharges%20or%20s

Layer 1 Fibre and passive infrastructure ADSS cable technology domains - IEC 60794-4-20 IEC 60794-4- 20:2018 Optical fibre cables - Part 4-20: Sectional specification - Aerial optical cables along electrical power lines - Family specification for ADSS (all dielectric self-supported) optical cables IEC 60794-4- 20:2018 covers optical telecommunication cables, commonly with single-mode fibres used primarily in overhead power lines applications. The cables can also be used in other overhead utility networks, such as for telephony or TV services. Requirements of the sectional specification IEC 60794-4 for aerial optical cables along electrical power lines are applicable to cables covered by this document. This document covers the construction, mechanical, electrical, and optical performance, installation guidelines, acceptance criteria, test requirements, environmental considerations, and accessories compatibility for an all dielectric, self-supporting fibre optic (ADSS) cable. This document provides construction and performance requirements that ensure, within the guidelines of this document, that the required mechanical integrity of the cable components as well as optical fibre mechanical reliability and transmission parameters are maintained. The ADSS cable consists of single mode optical fibres contained in one or more protective dielectric fibre optic units surrounded by or attached to suitable dielectric strength members and sheaths. The cable does not contain metallic components. An ADSS cable is designed to meet the optical and mechanical requirements under different installation, operating and environmental conditions and loadings, as described in Annex B. This document excludes any "lashed" or "wrapped" OPAC cables included in IEC 60794-4. Figure 8 aerial cables are also excluded; they are specified in IEC 60794-3-20. This second

edition cancels and replaces the first edition published in 2012 and constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition: - this document has been streamlined by cross-referencing IEC 60794-1-1,

- IEC 60794-4 (all parts) and IEC 60794-1-2; - reference to the MICE table has been deleted; - the example of test method for particular environment in Annex C has been deleted; - creep test method has been updated in Annex E. Keywords: optical telecommunication cables, single-mode fibres used primarily in overhead power lines - https://webstore.iec.ch/en/publication/26507

Layer 1/2 Active Equipment technology domain – GPON-> XGS-PON, and ONU/ONT, ITU-T Study Group 15 - Networks, Technologies and Infrastructures for Transport, Access and Home - https://www.itu.int/en/ITU-T/about/groups/Pages/sg15.aspx

Layer 2 Transmission Network technology domains - Reference ITU-T Study Group 15 - Networks, Technologies and Infrastructures for Transport, Access and Home - https://www.itu.int/en/ITU-T/about/groups/Pages/sg15.aspx

Layer 2/3 Core Network Ethernet Switches/Routers technology domains - Fast Ethernet switches (FS) - 10/100 Mbps (standard IEEE 802.3u). Gigabit network switches (GS or JGS) - 10/100/1000 Mbps (standard IEEE 802.3-2008). Ten-gigabit network switches (GSS) - 10/100/1000/10000 Mbps (standard IEEE 802.3a) - https://ieeexplore.ieee.org/document/8457469?denied= . https://www.ietf.org/archive/id/draft-ietf- bess-v4-v6-pe-all-safi-02.html . Ethernet Switches/Routers – IEEE and IETF technical specifications SG13 - Future networks and emerging network technologies https://www.itu.int/en/ITU-T/studygroups/2025-2028/13/Pages/default.aspx

The End-to-End Management Layer:

Interconnect National and International - https://www.itu.int/en/ITU-D/Regulatory- Market/Documents/Events2020/RED-AFR/Ses3-1_Interconnection-peering-Hilda.pdf

Energy Efficiency technology domain - https://www.itu.int/en/ITU-T/climatechange/resources/Pages/Energy-efficient.aspx

Quality of Services/ Quality of Experience QoS/QoE - https://www.itu.int/en/ITU- T/studygroups/2022-2024/12/Pages/default.aspx

Security – ITU-T Study Group 17 https://www.itu.int/en/ITU-T/studygroups/2025-2028/17/Pages/default.aspx

IT, Business Support System, Operation Support System, BSS, OSS: Telemanagement Forum - This snapshot of a Communication Service Provider Transformation Guide for Cloudification of BSS/OSS is a collection of experiences and practices from several service providers and vendors targeting the transformation of monolithic BSS and OSS systems to Cloud. Typically, such transformations are conducted in 'waves' based on different criteria defined by the CSP strategy like value to the company, momentum, impact on the organization, cost. As part of this strategy, there are advantages in having a systematic checklist based approach across all waves and considering a constant evaluation of the needs and criteria https://www.tmforum.org/resources/best-practice-suite/ig1221-bss-oss-cloudification-guide- suite/

FCAPS, NMS, EMS, NE TU-T Study Group 2 - Operational aspects of service provision and telecommunications management - https://www.itu.int/en/itu-t/about/groups/pages/sg02.aspx

4.1.2 LECC LEMOFI HIGH-LEVEL NETWORK ARCHITECTURE

LECC shared the LECC LEMOFI High=Level Network Architecture and datasheets of the core devices indicate that the specific devices deployed include Arista 7280SR3-40YC6), Juniper (MX 104), and BDCOM (S5828), but the demilitarized DMZ Security Layer is not clearly indicated in the network diagram.

LECC technical product data sheets for all network elements in the Core and Edge POPS received and studied without any further clarifications

APPENDIX 3 International Standards and Best Practices Compliance is recommended for all the Layers of the LECC LEMOFI network in particular the Management Layer as well as the international standards and best practice compliance listed in this document.

Interconnect for National / International traffic is not shown in the LECC LEMOFI Network Architecture Diagram.

Energy Efficiencies for the LEMOFI network need to be documented in accordance with International Standards and Best Practices - https://www.itu.int/en/ITU-T/climatechange/resources/Pages/Energy-efficient.aspx.

QoS/QoE international standards and best practices in accordance with ITU-T Study Group https://www.itu.int/en/ITU-T/about/groups/Pages/sg12.aspx compliance is recommended and documented in the LECC LEMOFI Technology Standards Strategy and LEMOFI Technology Network Master Plan – The LEMOFI Technology Network Master Plan enables the LECC project teams to understand the LEMOFI strategic roadmap for technology adoption and integration, including the LEMOFI current assessment and the identification of future needs and costs.

No Security Network Elements (NE's) plans have been shared with the Consultant and it is recommended that the LEMOFI network must be fully compliant with ITU-T Study Group 17 https://www.itu.int/en/ITU- T/studygroups/2025-2028/17/Pages/default.aspx . The demilitarized DMZ Security Layer needs to be clearly defined from a LEMOFI Technology Standards Strategy and LEMOFI Technology Network Master Plan perspective.

Operations Support Systems OSS/Business Support System BSS and Information Technology IT Systems Layer information to be shared with the Consultant.

Fault, Configuration, Accounting, Performance and Security FCAPS, Network Management Systems NMS, Element Management Systems EMS and Network Elements NE information to be shared with the Consultant.

The following section covers the Physical Layer 1 fibres and the passive infrastructure that is all part of the Optical Distribution Network ODN. The ODN is all the passive infrastructure that connects the Optical Line Terminal OLT with the Optical Network Unit (ONU) and Optical Line Terminal (OLT).

4.1.3 OPTICAL FIBRES, CABLES AND PASSIVE COMPONENTS

LEMOFI Cable design should be determined to suit the LEMOFI OPGW/ADSS FTTx network architecture adopted.

Cables as described in [ITU-T L.100] to [ITU-T L.102] and [ITU-T L.107] to [ITU-T L.111] could be used for outside plant (OSP) cabling in the feeder and distribution network; cables as described in [ITU-T L.105] could be used for drop network; cable as described in [ITU-T L.111] could be used for home/building network; cables as described in [ITU-T L.103] and [ITU-T L.104] could be used as jumpers for short distance connection between passive components. The Step-by-Step Process to download the relevant ITU-T Study Group 15 L-Series of Recommendations is as follows: **Step 1:** Go to https://www.itu.int/en/publications/ITU-T/Pages/default.aspx.

Step 2: Go to https://www.itu.int/rec/T-REC-L/e **Step: 3** Go to https://www.itu.int/rec/T-REC-L.102/en to download L.102 : Optical fibre cables for aerial application.

Optical fibre connectors as described in [ITU-T L.402] and [ITU-T L.404] could be used for termination of user cables in fibre to the x (FTTx) and similar applications. Passive node hardware and housing, with fibre organizers / fibre management systems, are used to protect and manage fibre joints/connections and passive components.

Sealed closures for outdoor environments should comply with [ITU-T L.201]; optical distribution frames for CO environments should comply with [ITU-T L.202]; outdoor optical cross-connect cabinets should comply with [ITU- T L.206]; fibre distribution boxes should comply with [ITU-T L.208]; housing to keep both active and passive elements in a single box should comply with [ITU-T L.209];

optical wall outlets and extender boxes used in the users' premise should comply with [ITU-T L.210]. Other passive optical plant hardware and housings should have specific environmental constraints, see [ITU-T L.200].

A line diagram of the optical fibres, cables and passive components along with their relevant ITU-T Recommendations is shown in Figure 2.

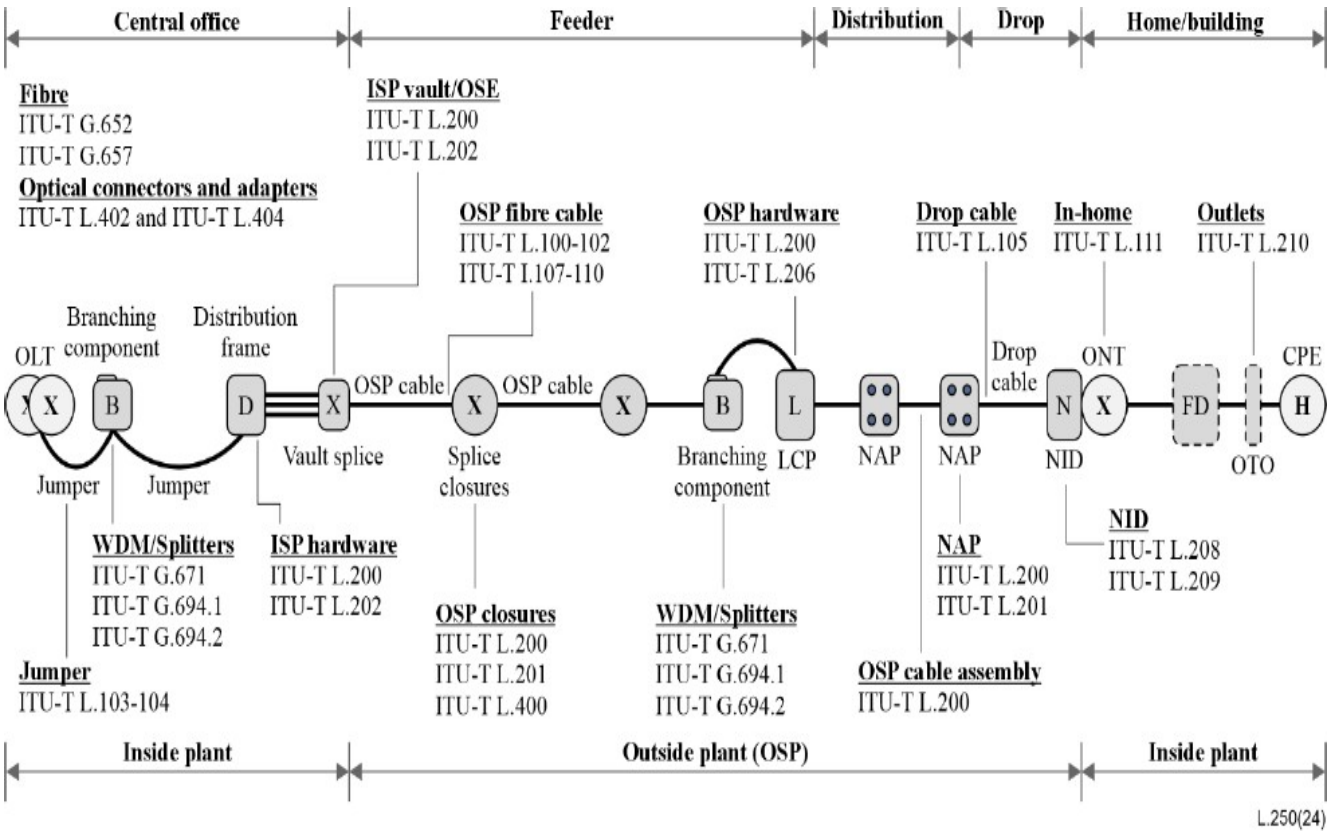


Figure 2

Recommended that LEMOFI Optical Distribution Network ODN I is fully compliant with the L – Series of ITU-T Recommendations - Environment and ICTs, climate change, e-waste, energy efficiency; construction, installation and protection of cables and other elements of outside plant - https://www.itu.int/rec/T-REC-L/en

Recommend that LEMOFI Optical Distribution Network ODN is fully compliant with ITU-T L.250 Topologies for optical access network - https://www.itu.int/rec/T-REC-L.250/en

Passive network infrastructure quotations: LECC have obtained passive infrastructure quotations from the Pinnacle Group company VH Fibre / Prysmian Group. Recommendation is to investigate alternative companies' quotations i.e. Cable Feeder Systems who now represent Prymian,, Dartcom

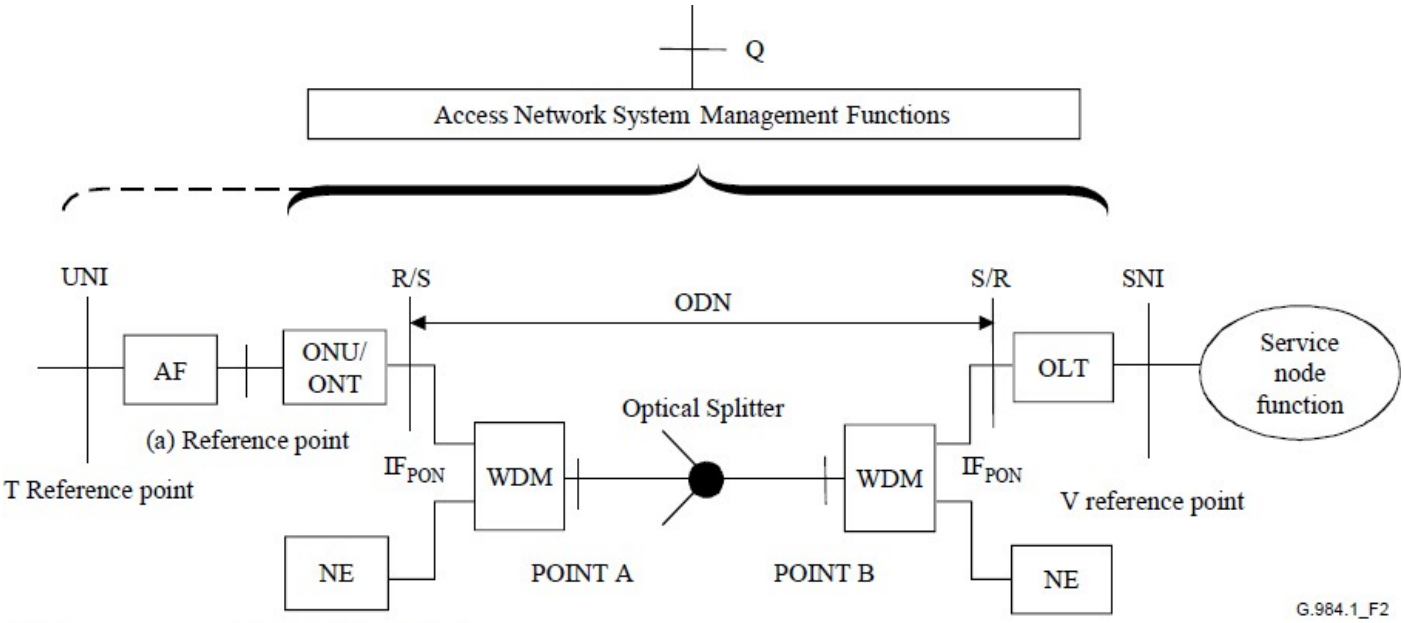
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Shared technical specifications for the CPS 42U Outdoor Cabinet with AirCon Door, Cabinet and Accessories CPS, Envicool AC AIRCON EC15HDNC1J (2021) (1), 100m-msa-technical-data-sheet YOA Cables and 75m-ssa-technical- data-sheet – short span YOA CABLES. All studied and approved for deployment in the LEMOFI network.

Technical specifications for Cabinet and HVAC technical issues received and studied. The HVAC technical fan issue has been resolved by using door mounted air conditioning units for outdoor cabinets. The 42U outdoor and air conditioning unit datasheets have been provided.

The following section covers Layer 1/2 reference configuration for Optical Line Terminal (OLT), Optical Distribution Network (ODN) and the Optical Network Unit (ONU) and Optical Line Terminal (OLT)

4.1.4 ITU-T G.984.1 GPON GENERAL CHARACTERISTICS REFERENCE CONFIGURATION FOR GPON



ONU	Optical Network Unit
ONT	Optical Network Terminal
ODN	Optical Distribution Network
OLT	Optical Line Termination
WDM	Wavelength Division Multiplex Module (If WDM is not used, this function is not necessary.)
NE	Network Element which uses the different wavelength from the OLT and the ONU
AF	Adaptation Function (Sometimes, it may be included in the ONU.)
SNI	Service Node Interface
UNI	User Network Interface
S	Point on the optical fibre just after the OLT (Downstream)/ONU (Upstream) optical connection point (i.e., optical connector or optical splice)
R	Point on the optical fibre just before the ONU (Downstream)/OLT (Upstream) optical connection point (i.e., optical connector or optical splice)
(a) Reference point	If AF is included in the ONU, this point is not necessary.
POINT A/B	If WDM is not used, these points are not necessary.

NOTE – Whether or not the AF is an operating object of the Q interface depends on the service.

Figure 3

Recommendation 984.1 addresses the general characteristics of gigabit-capable passive optical network (GPON) systems to guide and motivate the physical layer and the transmission convergence layer specifications. The general characteristics include examples of services, user-network interfaces (UNIs) and service node interfaces (SNIs) that are requested by network operators.

GPON systems are characterized, in general, by an optical line termination (OLT) system and an optical network unit (ONU) or optical network termination (ONT) with a passive optical distribution network (ODN) interconnecting them. There is, in general, a one-to-many relationship between the OLT and the ONU/ONTs, respectively.

Recommended ITU-T G. 984 Series Recommendation compliance for the LEMOFI Gigabit-capable passive optical networks (GPON) Reference Configurations and High-Level Architecture Schematics - see https://www.itu.int/rec/T-REC-G.984.1 and Figure 2.

Recommend that LEMOFI G.984.1 compliance test results are shared with the Consultant.

The following section covers Layer 1/2 Optical Distribution Network ODN which connects the Optical Line Terminal OLT with different suppliers Optical Network Units/ Optical Line Terminal OLT.

4.1.5 GENERIC PHYSICAL CONFIGURATION OF THE OPTICAL DISTRIBUTION NETWORK (ODN)

Generic physical configuration of the optical distribution network ODN – compliant with G984.2

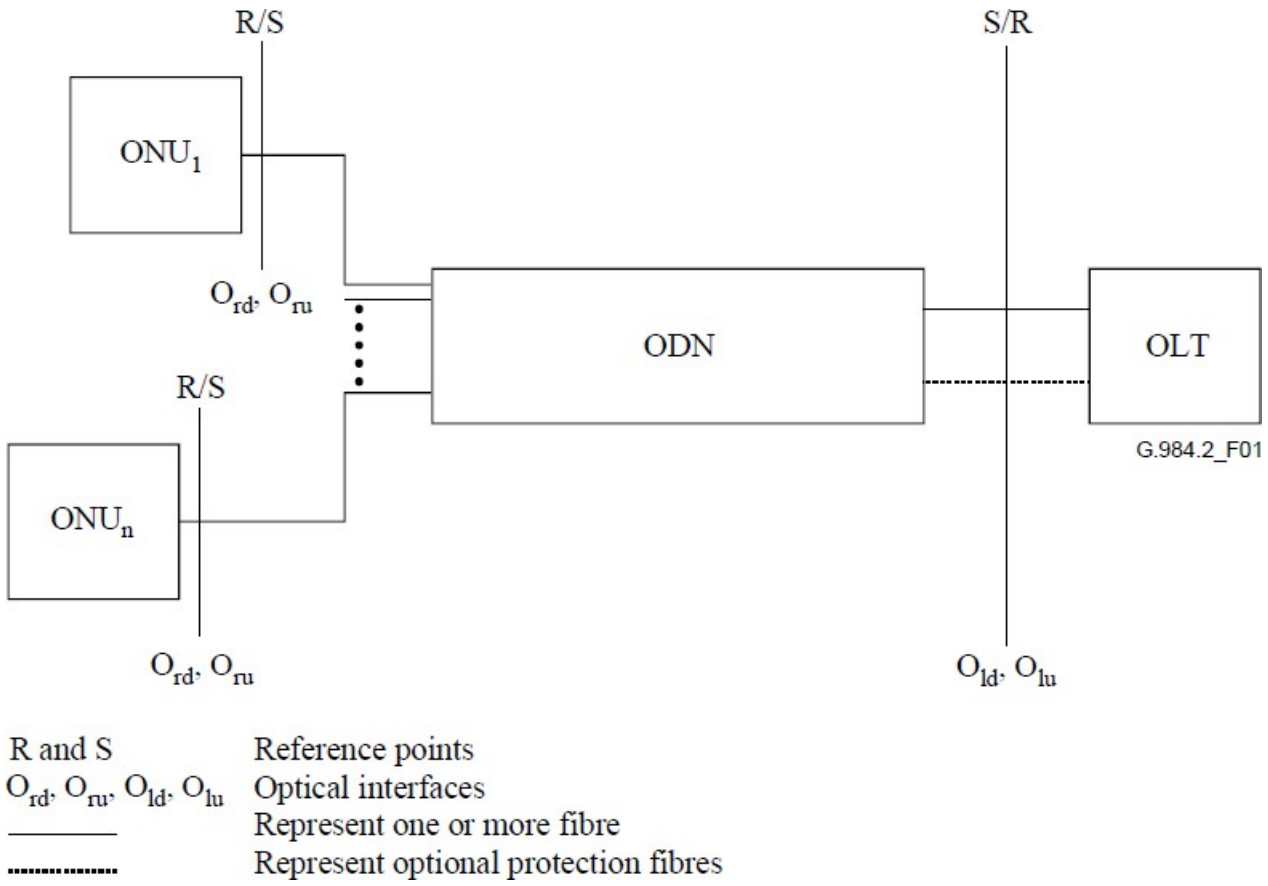


Figure 4

This Recommendation describes flexible access networks using optical fibre technology. The focus is primarily on a network supporting services with bandwidth requirements ranging from that of voice to gigabit-per-second data services. Also included are distributive services.

This Recommendation describes characteristics of the physical media dependent (PMD) layer of an optical access network (OAN) with the capability of transporting various services between the user-network interface (UNI) and the service node interface (SNI).

The OAN should enable LECC as the LEMOFI network operator to provide a flexible upgrade to meet future customer requirements in the optical distribution network (ODN). The ODN is based on a point-to-multipoint tree and branch option.

Recommend that LEMOFI G.984.2 compliance test results are shared.

The following section covers the Layer 1/2 Optical Distribution Network ODN passive infrastructure.

4.1.6 ITU-T G.984.4 G-PON: ONT MANAGEMENT AND CONTROL INTERFACE SPECIFICATION OMCI

Recommendation ITU-T G.984.4 Gigabit-capable Passive Optical Networks (G-PON): ONT management and control interface specification – Reference Model

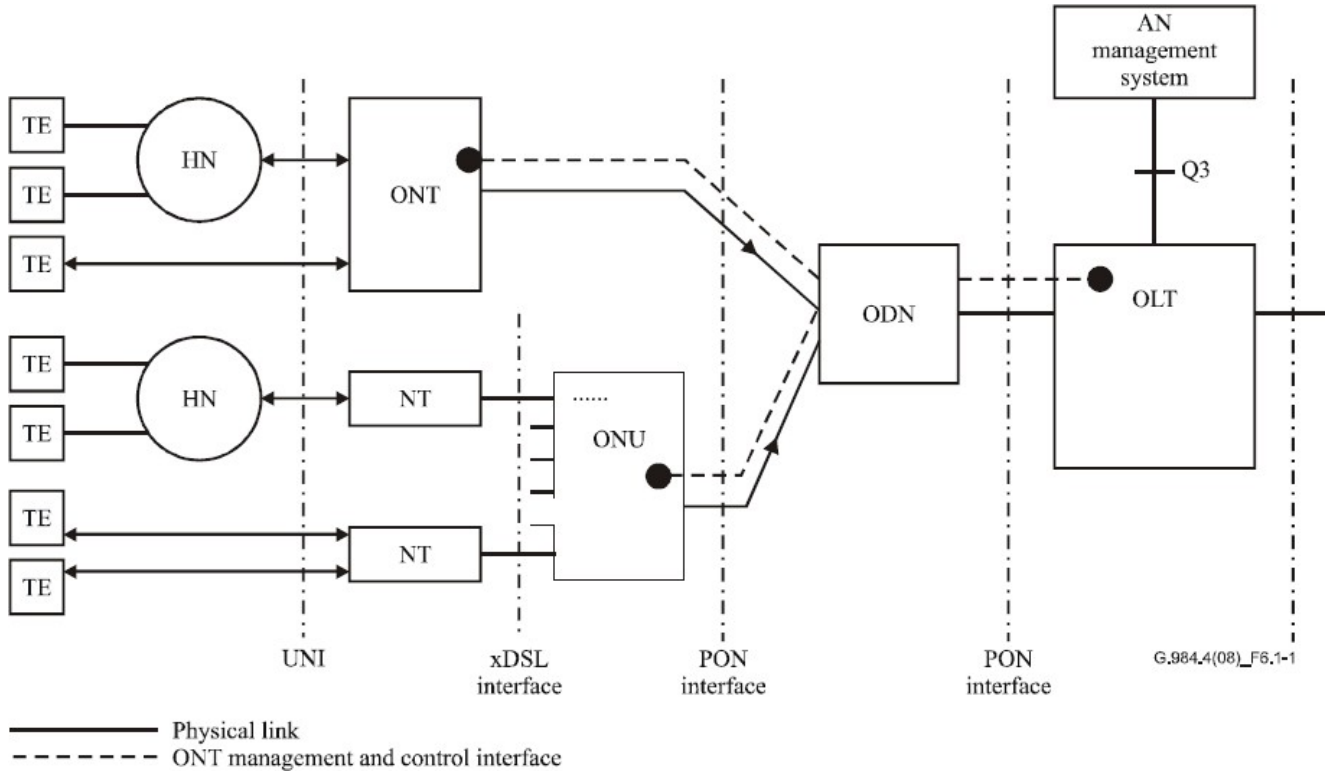


Figure 5

LECC LEMOFI must be fully compliant with G.984.4 where the Optical network termination Management and Control Interface OMCI specification addresses the ONT configuration management, fault management and performance management for the LEMOFI G-PON system operation. The focus of this OMCI specification is on Fibre to the home (FTTH) and Fibre to the business (FTTBusiness) ONTs; however, support for optical network units (ONUs) is addressed as well. This Recommendation defines a protocol necessary to support the capabilities identified for these ONTs. It also allows optional components and future extensions – see https://www.itu.int/rec/T-REC-G.984.4/en

Recommend that G.984.4 compliance test results are shared with the Consultant.

With reference to Figure 1 the LEMOFI Technical Design Review of network elements NE is completed, and the following sections cover the Management Layer Interconnect National and International, Energy, QoS/QoE, Security, IT/OSS/BSS and FCAPS/NMS/EMS/NE layers.

4.1.7 INTERCONNECT

LEMOFI Points of interconnect are at internet exchange points (Lesotho Internet Exchange Point locally) where most of local ISPs are hosted.

With the proposed deployment of nationwide LEMOFI ring and distribution networks, LEC substations and LEC Offices will be interconnect points – LCA, LECC New Europa, House No. 286, LEC Mabote Transmission and Distribution Substation.

4.1.8 ENERGY EFFICIENCY

Network enhancements to improve energy efficiency is a critical criteria included as part of the Technical Design of the LEMOFI network.

Energy efficiency (EE) is the relation between useful output and energy/power consumption [ITU-T L.1330] - L.1310 : Energy efficiency metrics and measurement methods for telecommunication equipment https://www.itu.int/rec/T-REC-L.1310/en

Taking into consideration that Lesotho has energy supply and energy price challenges, the energy efficiency management on the LEMOFI communications network is of great importance.

The LEMOFI Network Design strategic objective is to significantly reduce the power consumption of the LEMOFI communications network and thus promote the development of more FTTx communications networks and communications users in Lesotho.

4.1.9 QUALITY OF SERVICES QOS / QUALITY OF EXPERIENCE QOE

Recommend LEMOFI compliance to ITU-T SG12 - Pperformance, quality of service (QoS) and quality of experience (QoE) defines the requirements for QoS/QoE - https://www.itu.int/en/ITU-T/studygroups/2022- 2024/12/Pages/default.aspx Recommendations ITU-T P.10/G.100, G.100.1, G.191, G.192, P.800.1, P.800.2, G.1000

4.1.10 SECURITY

Security threats to telecommunication, and information and communication technologies (ICTs) and infrastructure remain increasingly complex. Efforts over the years to secure the infrastructure have been somewhat fragmented and reactionary, and so far, have not produced the desired level of protection against threats in a timely manner. The economic impact of such attacks and threats has been huge, resulting in several financial and organizational losses to governments and entities. Intensive, continuous and focused efforts are essential to combat these threats.

Recommend that LEMOFI Security is based on ITU-T Study Group 17 he https://www.itu.int/en/ITU-T/about/groups/2025-2028/Pages/sg17.aspx X-Series of Recommendations - https://www.itu.int/rec/T-REC-X/e

4.1.11 OPERATIONS SUPPORT SYSTEMS OSS, BILLING SUPPORT SYSTEMS BSS, INFORMATION TECHNOLOGY IT SYSTEMS

Recommend that LECC clarifies if LECC has the capacity and capabilities to provide service provision from OLT to the ONT/ONU, customer router, CPE.

OSS/BSS stack does require further work via a RFx (Request for Proposal, Request for Quotation) process where the LEMOFI OSS/BSS Layer technical requirements and costs need to be resolved.

The Consultant studied the OSS/BSS documents that were shared as part of reference documents and there is sufficient OSS/BSS content to prepare an RFP or RFQ.

Compliance with Telemanagement Forum OSS of the Future is recommended – see https://www.tmforum.org/resources/whitepapers/oss-of-the-future/

4.1.12 FAULT, CONFIGURATION, ACCOUNTING, PERFORMANCE, SECURITY (FCAPS), NETWORK AND ELEMENT MANAGEMENT SYSTEMS (NMS/EMS), NETWORK ELEMENTS (NE)

List of systems and technical descriptions. Confirm receipt of Network Monitoring and Management Tools spreadsheet a list of all management tools that LECC uses which covers the FCAPS clarifications. All the systems are not scalable for high volumes of FTTH and FTTB customers but will be fine for the first 3 years and the 4500 subscribers that LECC have planned for the 18 areas in the districts.

EMS, NMS, FCAPS Documentation: Confirm receipt of step-by-step process for fault detection and repairs. Recommend that the LECC technical team compile the work procedures, guidelines, and policies for the LEMOFI GPON technology, roadmap to XGS PON technology, overview of the ODN LEMOFI technology and components, optical budget calculations, planning guidelines for the FTTx solutions, management of FTTx network and monitoring of ODN, OLT to ONU.

LECC OLT and ONU/ONT fault management and control. A schematic has been shared that details LECC's fault management and control for ONU/ONTs and OLTs.

LEMOFI compliance with the ITU-T M-Series of Recommendations – see Telecommunication management, including TMN and network maintenance recommendation as follows:

M.3342 Guidelines for the definition of SLA representation templates

M.3343 Requirements and analysis for NGN trouble administration across B2B and C2B interfaces

M.3344 Requirements and analysis for NGN appointment management across the business-to-business and customer-to-business interfaces

M.3345 Principles for self-service management

M.3347 Requirements for the NGN service activation across the interface between the network management system and the element management system

M.3348 Requirements of the NMS-EMS management interface for NGN service platforms

The following section covers the Management Layer Maintenance and Support Master Agreement that will need to define how LEMOFI Network will be maintained and supported once deployed

4.1.13 NETWORK MAINTENANCE AND SUPPORT MASTER AGREEMENT AND SLA AGREEMENT

SLA agreement that LECC has with the service providers. LECC has so far only deployed an open access FTTH network at Ha-Foso. The current SLA document is formulated for FTTH services between LECC and LECC clients (ISPs).

Note that LECC do comply with ITU-T SLA recommendations. LECC must compile with a typical Open Access Wholesale Carrier Services SLA agreement for the different services – see ITU-T Recommendation M.3342 Guidelines for the definition of SLA representation template - https://www.itu.int/rec/T-REC-M.3342-200607-I/en

The tripartite agreement between LEC, LECC and a client that stipulates some levels of services was shared with the Consultant – see references 1.1 to 1.28, however the SLA template is not compliant with ITU-T M.3342.

The Consultant noted that LECC uses the recommended ITU-T G.650.3 for conducting the fibre pair handover between LEC and LECC which incorporates OTDR and OLTS tests.

No specific LEMOFI Network Maintenance and Support and SLA Agreement was shared with the Consultant to review.

The following sections cover the Consultant observations and recommendations during the visit to the LECC FTTH deployment in Ha Foso, Berea District.

4.1.14 LECC HA FOSO SUBSTATION/SWITCH DESIGN

The LECC Ha Foso substation/Switch does not have any SCADA supervisory and monitoring capabilities. LECC Sales and Marketing need to investigate that the LEC monitoring services can be provided by LECC POP which is installed next to the LEC switch.

The Ha Foso FTTH network design from the LECC POP is all overhead with duplicate pole infrastructure installed by LEC, LECC and ETL. The Regulator LCA needs to enforce the sharing of network pole infrastructure as well as allocating FTTH residential wholesale open access services to a specific wholesale service provider.

In the case of Ha Foso either ETL or LECC should have been registered by LCA to provide the wholesale FTTH infrastructure in Ha Foso. ETL would then be one of the ISP's that would provide the FTTH services to the Ha Foso residential subscribers.

4.1.15 LEC, LECC AND ETL SHARING OF POLE NETWORK INFRASTRUCTURE

No alignment between LECC and ETL on sharing network infrastructure. LCA needs to enforce an Open Access based business model.

LCA needs to enforce the networking sharing rules so that wholesalers open up access to FTTx Services to enable all retailers to compete in the FTTB/FTTH market in Lesotho.

There is no LEC/LECC pole infrastructure sharing in the LECC 18 ring and distribution networks LEMOFI proposal. LEC and LECC need to work on internal Department of Energy policies and work procedures to enable the sharing of pole infrastructure in the 18 x Ring and Distributions Networks.

The following section covers the technical capabilities of the BDCOM GPON and ONU and how the LEMOFI passive infrastructure costs can be driven down.

4.1.16 BDCOM OLT STANDALONE AND lNTEROPERABlLlTY WlTH MULTlPLE ONU'S TECHNlCAL CAPABlLlTlES

Concern regarding the BDCOM technical capabilities. Recommend that BDCOM technical compliance reports are shared with the relevant ITU-T GPON recommendations and interoperability tests results of tests between BDCOM GPON OLT and ONU's from minimum 3 x ONU suppliers.

FTTH market today is all about driving down the cost of the ONU'S/ONT's and this is exactly what one of the

biggest FTTH operators in Africa recently achieved via an RFP process, then an e-auction and finally pricing for

technically compliant ONT's at below 30USD. LECC OLT from BDCOM needs to interoperate with other suppliers,

ONU's not only BDCOM.

OLT to ODN TO ONU/ONT interoperability tests. – LECC OLT and ONU in service currently for the FTTH Ha Foso project are BDCOM products which does restrict LECC to a single vendor for all FTTH services. This is not recommended for the longer-term and hence the request to provide interoperability test results for BDCOM OLT with at least 3 suppliers of ONU's. ITU-T recommendations for interoperability test procedures as well as Broadband Forum new standard which de-couples the ONU, OLT, and OMCI stacks, avoiding OLT vendor lock-in and the management cycle of optical modems being tied to a specific vendor's OLT or their software release cycles. This encourages competition between vendors with operators having increased freedom to choose from other ONU vendors and introduce more end-user devices into their network.

It is recommended that the LECC technical team need to consider Gigabit Passive Optical Network (GPON) LEMOFI passive elements and the active elements that all form part of the LEMOFI network. This includes Optical Line Terminals (OLTs), optical modules, and Optical Network Units (ONUs). The interoperability of the LEMOFI GPON Network is the ability of two active elements, an OLT and a ONU, to work together to bring the intended service and provide Quality of Service (QoS) to the end-user.

LECCE technical team need to first take a look at the standards set by the ITU including ITU G.984.x (GPON), G.987.x (XG-PON), G.9807.x (XGS-PON), and G.989.x (NG-PON2), and G.988 (OMCI). Benchmarking with international standards and best practices the most common interoperability issues include: **The Physical Layer:** Burst definition (defined by the OLT). Rogue ONU (ONU drifting). Alien ONU. **Service Configuration.** OMCI (ONT Management Control Interface). NETCONF/YANG (TR-355 encompasses YANG Modules for FTTdp Management, allowing operators to configure and control fiber-fed nodes in the periphery of the access network using advanced software-based techniques, enabling interoperability for FTTdp management). Configuration languages are usually complex and offer many services and configuration options and are therefore prone to configuration issues. **QoS (Quality of Service):** Packet delivery. Latency. Throughput.

LECC LEMOFI Interoperability should be considered for the long-term perspective. LECC needs to consider the core network from a viewpoint of managing LECC assets, whereas the vendor is looking more from a business opportunities perspective. LECC must reduce the cost of equipment, ensure security as LECC secures the equipment supply of different brands and products, reduces the validation time and integration cycle, and facilitates the equipment, network and services evolution for the future.

The recommended interoperability standards compliance for the LEMOFI Network include the following:

G.984.1	Gigabit-capable passive optical networks (GPON): General characteristics
G.984.2	Gigabit-capable Passive Optical Networks (G-PON): Physical Media Dependent (PMD) layer specification
G.984.3	Gigabit-capable passive optical networks (G-PON): Transmission convergence layer

G.984.4 Gigabit-capable passive optical networks (G-PON): ONT management and control interface specification

G.Imp.984.4 Implementers' Guide for Recommendation ITU-T G.984.4

G.988 ONU management and control interface (OMCI) specification

Broadband Forum BBF-247 is part of the global widely accepted industry standards that ensures multi-vendor interoperability, it is a critical program that delivers choice and flexibility for service providers and broadband consumers. A cornerstone of The Broadband Forum BBF.247 is to publish open standards, certification and test plans that give the ability to choose from differing network equipment (OLTs) and the fiber termination device inside the users building (ONUs). Enabling the fiber broadband deployments and future fiber service upgrades realize true multi-vendor flexibility. Securing the growth of fiber broadband, irrespective of supply chain challenges and ever evolving needs for service differentiation – see .https://www.broadband-forum.org/testing- and-certification-programs/bbf-247-gpon-onu-certification

Broadband Forum BBF Interoperability and Test Fiber Access Networks Work Area: Interoperability project stream is dedicated to PON system interoperability of telecom services over multi-vendor and multi-carrier inter- connections. The Interoperability project stream has also added OLT NETCONF management interoperability between OLT NETCONF server interfaces and third-party NETCONF clients such as an SDN controller.

Interoperability and test project is responsible for creating test cases documents for vendor certification and conformance. Both vendors and operators benefit from these documents as they describe agreed-upon use cases to support. Being able to exchange information between devices and management applications is crucial for the modern economy. https://wiki.broadband-forum.org/display/BBF/Fiber+Access+Networks

The following section shares information of 2024 FTTH FTTB projects in South Africa GON to XGS-PON and beyond roadmap, Nigeria, Uganda, Ghana, Ivory Coast FTTH/FTTB, Botswana Villages and Tower Company TowerCo in Nigeria wholesale ISP projects

4.1.17 BENCHMARKING WITH AFRICAN FTTX NETWORKS (INVITATION TO TENDER ITT)

Botswana FNO Fibre Network Operator 5 villages around Gaborone remote XGS – PON FTTx tender is applicable for the Lesotho LEMOFI network. To deploy FTTx XGS-PON network to Business Centres,

Government offices, and other strategic sites including towers within the target areas. Share with the LECC team to assist in investigating alternative OLT ODN ONU/ONT network architectures.

Nigeria, Ghana, Uganda, Côte d'Ivoire Mobile Network Operators MNO calls for the supply, delivery, installation, testing and commissioning of the FTTH(x) Active equipment xPON (OLT + ONT), together with the passive components, including ODN, ODF, Enclosures, FDT, FAT, Splitters, ATB & Cabling (Distribution, Feeder & Drop).

Largest Wholesale Open Access Fibre Network Operator FNO in Africa's RFI investigating FTTP (FTTPremise) fibre access (which includes FTTHome, FTTBusiness and FTTBaseStation (for mobile backhaul)) network equipment for the Inside Plant and network terminating equipment. This includes: GPON, XGS-PON, 50G-PON. Optical Line Terminals (OLTs) line cards and chassis. Uplink cards and associated SFP/SFP+/QSFP, OLT SFPs/SFP+. ONTs/ONUs and SFP ONUs. Associated licences. Active Ethernet (AE) and Next-generation (NG) AE (10G, 25G, 50G). Optical Line Terminals (OLTs) line cards and chassis. Uplink cards and associated SFP/SFP+/QSFP, OLT SFPs/SFP+.

ONTs/ONUs and SFP ONUs. Associated licences. All applicable standards must be referenced as supporting evidence of standards compliance. Optical Distribution Network (ODN) or Outside Plant equipment is out of scope for this RFI.

One of the largest independent Owners, Operators, and Developers of shared Telecommunications Infrastructure in the World who provide mission-critical Telecommunications Infrastructure to our Customers, most of who are leading Mobile Network Operators (MNOs) and who in turn provide Wireless voice and data services to their end Users. The purpose of the RFQ is to solicit competitive Commercial Proposals for Supply of Optical Line Terminal (OLT). The business model is such that the TowerCo will provide all the open access wholesale capacity and resell this capacity to the ISP in the various African countries. The TowerCo is only requesting the supply, delivery install and commission of OLT equipment which needs to interoperate with all the ISP's ONU/ONT's in the market i.e.

Nokia / Model: G-0425-C. ZTE / Model: F670L V9. TP-LINK / Model: XZ000-G7. TP-LINK / Model: XC220-G3V.

Vantiva / Model: FGA225CSKB. Sagemcom / Model: Fast 5655v2. FiberHome /Model: AN5506-04-FAT. Sagemcom

/ Model: Fast 5657. ZTE /Model: F680 V9.0. Sagemcom / Model: Fast 5670. Kaon / Model: PG2447. Technicolor

/Model: FGA2232. Blu-Castle /Model: BC-UM221E. ZTE / Model: F6600P. Zyxel / Model: PX5511. Concern has been noted that currently the LECC BDCOM OLT only interoperates with the BDCOM ONU/OLT which effectively locks LECC into BDCOM for all LEMOFI OLT and ONU supply which is not an appropriate strategy to adopt.

4.1.18 PRELIMINARY FINANCIAL ANALYSIS FOR THE LEMOFI RING AND DISTRIBUTION NETWORKS

Detailed assessment and analysis of the Y1 Mafeteng CBD FTTB – ME, Y1 Highway-Central-IEMS, Y2 Mokhotlong CBD FTTB-Metro E, Y2 Mohale's Hoek CBD FTTB - ME and Y3 Old Europa - Downtown FTTB. The technical team clarified all concerns noted by the Consultant except for the duplications in LEC and LECC pole infrastructure and the fact that a key metric which is not included in the Design and Costing information is LECC Ring and Distribution Network Offices/Home Passed vs Offices/Homes Connected. The technical team mentioned that this is part of the Business Development Managers responsibility and will be covered as part of the Market Analysis Report

Nationwide Network Costing 150125 updated and detailed costing and financial analysis will be completed together with the Market Study Report

GPON, EPON, 10GEPON, and XGPON cost comparison: A comparison was made between the technologies and the estimated costs for deployment at that location. This document was later used to draft a business case for the deployment of the fibre in that location. The conclusion was to use GPON when all assessments were made, primarily because of technical reasons. In agreement that for years 1 to 3 GPON is the appropriate technology for deployment in the LEMOFI network, but the selected GPON technology needs to be a seamless upgrade to XGS- PON purely with card replacement on the 1U pizza box unit.

LECC LEMOFI Ring and Distribution Network is planned to cover the 18 constituencies within the 10 districts OPGW and ADSS technology and network infrastructure is deployed in most of the LEMOFI target areas except for the following constituencies: Thaba-Tseka, Motimposo (no OPGW), Majoe-a-Litšoene (no OPGW), Maama (NO OPGW)

4.2 LEC

4.2.1 LEC-VCL - POLE ATTACHMENT AGREEMENT

Pole Attachment Agreement between LEC, LECC and Customer VCL example clauses relevant to the LEMOFI network: LEC owns, operates and maintains an electricity distribution system in Lesotho comprising roughly 1,720± km of existing electricity distribution lines and 18,000± distribution poles

LEC has the right to authorize ETL, VCL, on a non-exclusive basis, to install, operate, maintain, modify, replace and remove their telecommunications attachments on LEC's poles, and to perform related work

LEC has an indefeasible right of use of one dark fiber pair in each fiber optic cable installed by ETL, VCL, on LEC's poles for so long as such attachment remains on LEC's poles.

LEC's permitted use of such dark fiber will be limited to internal communications to support its electricity businesses, including, without limitation, remote meter reading, monitoring, measurement and control of the electricity distribution grid, and monitoring and control of electricity apparatus to control the load on the electricity distribution grid. LEC will not use such dark fiber to provide public telecommunications services.

LEC and LECC reserve all rights to install, operate or commercialize, or to authorize third parties to install, operate or commercialize, telecommunications attachments on any pole, including those on which ETL, VCL has requested or installed attachments, whether or not such other activities by LEC, LECC or third parties may compete with ETL VCL existing or proposed activities

ETL/VCL may not install any attachment, or otherwise perform any work, on any pole unless LECC has issued to Customer a written permit (a "permit") to attach to the poles comprising the relevant distribution line segment. A permit grants ETL/VCL a non-exclusive license to install attachments on the pole or poles comprising the designated distribution line segment.

4.2.2 LEC/LECC OPGW FIBRE REQUIREMENTS

LEC had predominantly deployed 12 core (12F) OPGW fibre optic cables between their substations. At the time of deployment of the OPGW, the fibre optic cables were envisioned for exclusive use by LEC for their systems being SCADA and use for protection of the power lines between these substations.

SCADA applications use a fibre pair while another fibre pair is used for protection of each power line through use of relays. In some instances where there are two feeder power lines between the substations, such as between Pioneer Substation and Thetsane Substation, each power line is protected using a fibre pair.

For more recent OPGW fibre optic cable deployments between substations, 24F or 48F fibre optic cables are used. This approach has ensured that sufficient fibre for LEC and LECC is available. LECC uses the fibre optic cable for its network and leases out some of these fibre pairs in the form of dark fibre to its clients.

4.3 ETL

4.3.1 EXISTING NETWORK DESIGN AND SPECIFICATIONS OBSERVATIONS AND RECOMMENDATIONS

ETL shared fibre network information and completed the District Constituencies and Communities Technologies Coverage Matrix.

ETL are concerned regarding the duplication of LECC/ETL FTTH infrastructure deployments in the fiber-to-the-home network at Ha Foso (in Berea district). LCA needs to enforce **Requirement to give access and share infrastructure Reference Clause 28.**

ETL 5G roll-out plan in every Lesotho town, however service tariffs and the cost of devices are high which results in affordability challenges.

ETL will roll out a modernized LTE network whilst the 5G challenges are addressed. ETL will lease OPGW broadband capacity where there are gaps.

ETL requested clarification on whether some form of subsidization will be possible for broadband connectivity. There is an affordability challenge outside of the main towns in the districts urban, peri-urban areas.

ETL have deployed GPON networks since 2013 and in 2025 will deploy XGS-PON in compliance with ITU-T GPON, 10GPON, 50GPON standards.

4.4 VCL

4.4.1 EXISTING NETWORK DESIGN AND SPECIFICATIONS OBSERVATIONS AND RECOMMENDATIONS

VCL shared fibre network information and completed the District Constituencies Technologies Coverage Matrix.

Technology investment priority is 5G and Fixed Wireless Access FWA technologies. Business plan show that an integrated FWA 5G technology roll-out is far more cost effective than FTTx networks.

End user devices costs and tariff affordability are the primary challenges

Vodacom Group have had a discussion with Starlink, and the parent company Vodafone is working with AST SpaceMobile to develop the first space-based mobile network to connect directly to consumer 4G and 5G smartphones without specialised hardware.

5G capacity is available in some Lesotho towns but there are no devices and not many customers connected.

VCL are a customer of LECC for OPGW 240 kilometers fibers and some 2000 x Poles Infrastructure attachments. VCL prefer to use their own fiber cables.

Dark fibres and wholesale bandwidth capacity need to be based on an Open Access business model. LCA needs to enforce access and network sharing rules.

VCL has a much smaller fiber footprint compared to ETL. VCL have chosen to invest in 5G networks and less in fiber networks.

Investment in 5G networks provides quicker returns than fiber networks.

VCL key vendors are Nokia for Circuit Switch CS Voice Network and Huawei for Packet Switch PS Data Networks.

4.5 COMNET

4.5.1 EXISTING NETWORK DESIGN AND SPECIFICATIONS OBSERVATIONS AND RECOMMENDATIONS

Comnet have a contract with the Government of Lesotho GoL for the provision of the Managed Services on the optical fiber cable link from Maseru to Mohale's Hoek. 10 Year IRU and still have 5-years of contract to complete. Comnet do install, commission, maintain and support the GoL Maseru to Mohale's Hoek fibre network.

LECC would be able to work with Comnet on future LECC ring and distribution network managed field services as well as FTTB and FTTH installations.

Comnet business has grown over the last 8 years, and Comnet are able to compete directly with ETL and VCL ISP businesses. One of the main contributing factors is that Comnet now have their own upstream international bandwidth connectivity from WIOCC. Comnet has provided its own international upstream wholesale capability which enables Comnet to offer on par ISP products and services.

Comnet network infrastructure is primarily in Maseru Fixed Wireless Access FWA technology, however Comnet have during the last 2 years invested in fibre technology and have connect all the Comnet Towers with fiber.

Comnet lease fiber from ETL and LECC when their customers require fiber connectivity services in the other districts.

Currently Comnet do offer Fiber Connectivity Products to the Enterprise FTTB and Consumer FTTH. Monthly costs per Meg Tariffs have dropped from over R500 per meg in 2016 to below R200 meg in 2024.

ETL is the dominant partner of choice for Comnet due to the coverage that ETL has in all the Lesotho districts and constituencies.

LECC second largest Dark Fiber customer is Comnet Lesotho ~ 122 km

Comnet have a small permanent skilled employee head count and growth in semi-skilled and unskilled labour is managed based on business demand. LECC would need to do a due diligence on Comnet Managed FTTx install, commission, maintain and support services capabilities.

Comnet are in favour of the sharing of network infrastructure and will rather lease it from ETL, VCL, LECC if it is more cost effective than self-provide.

Comnet competitive advantages is that they offer ICT engineering services which goes deeper into the customer LAN network – printers, laptops, customer LAN services.

Comnet had 5 x Towers in Maseru in 2016 and the network has now grown to 30 x Towers all will be connected via Comnets self-provided physical layer fiber infrastructure – passive from CFS and the active equipment Ekinops, MikroTik

IP Telephony: An IP telephone system uses packet-switched Voice over IP (VoIP), or Internet telephony, to transmit telephone calls over the Internet as opposed to the circuit-switched telephony used by the traditional Public Switched Telephone Network (PSTN). Our rates will slash your international telephone calls up to 30%!

IT Consultancy: Comnet Lesotho is staffed by professionals who are devoted to addressing your business needs and solving your business problems. We consult to determine requirements and configure solutions that are specifically designed to address identified challenges.

Internet Service Provider: We provide high speed, reliable and cost-effective wireless and satellite connectivity for your business and home.

Premium Web and Email Hosting: Linux hosting for PHP developed and normal HTML or DHTML websites and Windows hosting for ASP, ASP.Net developed Websites. E-mails are hosted at customers' own domain and are available to be accessed online. We also offer domain registration for.co.ls and .com domain names.

Website Development: We develop basic information websites, database driven sites, Dynamic Websites, Intranets and also perform maintenance and revamps to existing websites. These are developed using various Web tools and server scripting languages with Joomla being the most frequently deployed.

Cloud storage: Clients can store their media and documents on our safe and secure digital facility called Hive. Hive is a digital platform for all media, music, photos and documents.

Technical Maintenance and Repairs: Network Implementation - Network Design. Designing infrastructure models Designing Security models. Mapping out potential network growth. Planning integration of legacy systems. Installation of brand new networks. Current network re-design and assessment. Subnet and network segmentation. Disaster recovery planning and implementation. **Fire suppression** - Server room design and implementation. Network analyzation and certification. Fibre and Copper wiring. DMZ planning and implementation. **Network Upgrades -** Upgrading of network backbones. Subnet expansion and analysis. WAN bandwidth upgrades. Server room enhancements. **Network Installation -** Installation of Brand new Networks. Re- designing of existing

networks. Installation of wired and wireless networks. Coordination of office IT infrastructure relocation. Server room setup and maintenance**. Network Support -** Networked computer troubleshooting.

Router and other WAN device troubleshooting. Firewall maintenance and security updates

Comnet Fibre to the Tower: Fibre POP's at MPOP, LCA, MBR Towe, Celeb Tower, HQ- Tower, Red Cross Tower LFM – Tower, MNET Tower, Thetsane Tower, Tsolo Wasco Tower, Maswoe Tower.

Fibre Team 2 x: Fibre Engineer, 1 x Fibre Route Planner, 1 x Fiber Deployment Project Manager, 8 x Technicians, 1 x Quality Manager

Internet Connectivity Services: We do not resell services from VCL, ETL, or LECC. All our upstream suppliers are non-local.

Current MNO/FNO Wholesale and ISP Retail Model: The current model is not ideal, as MNOs are wholesaling and retailing internet services simultaneously. This creates a scenario where suppliers are also competitors within the same market.

Improvements to the Wholesale/Retail Model: To encourage competition among ISPs across Lesotho's provinces and districts, wholesalers should focus on leasing infrastructure and internet services to ISPs without directly competing with them.

Interest in FTTH/FTTB Services: We are interested in offering FTTH and FTTB services, provided that the pricing structure is reasonable.

Installation, Commissioning, Maintenance, and Support Capabilities: Yes, we have the necessary experience and expertise, including commissioning the Ministry of Communications' IRU OPGW connectivity.

24/7/365 Customer Care System: Yes, we operate a comprehensive system using Odoo for ERP and Splinx for ISP management.

Service Provisioning and Control Capabilities: Yes, we have full FTTH/FTTB service provisioning and control capabilities.

Government of Lesotho Fibre Contracts: We hold a 10-year IRU fibre contract with the Ministry of Communications, which extends until 2027, with a capacity of 100 Gbps.

FTTH and FTTB Business Revenue: Our FTTH and FTTB services contribute approximately 25% to our business revenue.

Fibre Active Equipment and Passive Infrastructure Partners: We work with Ekinops, Cisco, and Mikrotik for active and passive fibre infrastructure solutions.

Engineering Capabilities: We have a skilled engineering team capable of handling all technical aspects of fibre network deployment, maintenance, and support

4.6 LEO

4.6.1 EXISTING NETWORK DESIGN AND SPECIFICATIONS OBSERVATIONS AND RECOMMENDATIONS

Leo Pty. Ltd, a registered company in Lesotho, is an entrenched, traditional full-service ISP, offering wireless, fiber and dedicated internet access. Also, web-site, mail and nameserver hosting.

Leo provides services to a long-established base of customers. Customers include amongst others, home / residential users, small business, large multinational textile factories, NGO's, foreign owned diamond mines, insurance companies, various government ministries and the Royal Palace.

The company has licensed frequencies in the 5 Ghz band and has built an extensive wireless distribution network covering the Maseru CBD, the residential suburbs and a little further, as far as Moshoeshoe I International Airport.

In 2019/20 has seen the installation of several kilometers of fiber-optic cable reaching to the international gateway at the Lesotho border and the Local IXP at the LCA building.

Leo looks to provide an end-to-end, one-stop service, in which the company can provide for the customer's complete requirement. Typically, this might include the supply of notebooks, workstations, gateways and servers; the design construction and commissioning of network infrastructure; domain name registration, mail service, internet connectivity and VOIP service.

Leo can provide a full-service maintenance plan, including same-day service and off-site back-up amongst many other aspects of a widely configurable offering. Leo is engaged in a" remote hand and eyes" contract for the maintenance of a microwave distribution network.

Leo offers a wide range of PC hardware as well as peripherals, consumables, service and repair.

Leo is a very much smaller version of Comnet and is basically a small family business and very sensitive to pricing. LECC pricing for Dark Fiber is far higher than Fixed Wireless Access which according to Leo can be 10 times the price of FWA in greenfield scenarios. LECC must investigate FTTB and FTTH pricing in greenfield ares versus the cost of FWA.

Leo feels that pricing is the stumbling block for all broadband communications development in Lesotho. If the GoL is going to deploy the fiber, then it must be open access at an affordable price for all the ISP's. Leo only operates in Lesotho with furthest client at the Airport 25km away.

Leo have installed a 48 core fiber from the Lesotho border international gateway to LCA, Lesotho Internet Exchange Point (LIXP) to Christie House to The Alliance Building and to Leo offices.

Leo provides Data Centre international connectivity for Alliance Building clients and Christie House clients.

Leo is busy with the feasibility of extending the fiber network to Pioneer Mall Shopping Complex, GoL building, Letseng Diamonds House, Cnr Kingsway & Old School Road, Maseru, SA Government Building.

Leo is sensitive to fiber pricing which has always been a problem in Lesotho with ETL the dominant player and setting the fibre pricing levels in the Lesotho market.

The fiber services pricing in the Lesotho market has driven Leo to self-providing a 48-fiber core from WIOCC gateway at the Lesotho border. WIOCC is an award-winning, pan-African supplier of carrier-grade, international connectivity. In committing over US$500 million to building Africa's first, truly open access, hyperscale, integrated core digital network infrastructure, and are supporting cloud operators, content providers, internet service providers, fixed and mobile telcos to expand their reach and generate new business opportunities across Africa.

Leo also has back-up international connectivity via AFR-IX telecom, an infrastructure and licensed Telecommunication Operator that delivers Data, MPLS, SDN and advanced Managed solutions to Corporates and Telecommunication Operators in Africa.

4.7 JENNY LESOTHO

4.7.1 EXISTING NETWORK DESIGN AND SPECIFICATIONS OBSERVATIONS AND RECOMMENDATIONS

Jenny Lesotho was awarded a license by Lesotho Communications Authority in July 2023 and the goal is to connect all areas within Lesotho with high speed Internet.

Jenny Lesotho is part of the Jenny Africa group. Other countries include: Botswana, Eswatini, Mozambique, South Africa and Zambia.

Jenny Internet has developed custom management systems for wireless and Internet services; that is the core of the ability to provide network services to customers.

Jenny system provides monitoring and provisioning services on heterogeneous networks allowing which can scale to provide excellent support.

Jenny Lesotho deploy Mikrotik, Ubiquiti, Radwin and Mimosa products in the network and there is no fibre deployed by Jenny Lesotho.

Jenny Lesotho products and services include Fibre via Wireless, Wireless Business Internet, Wireless Home Internet and WIFI as a Service. Jenny Lesotho is basically a Wireless Internet Service Provider WISP with no experience in fibre networks.

The Consultant did have an online call with the Jenny Lesotho Account Manager Teboho Matlole and Jenny Lesotho is interested in the LEMOFI project and how it will enable the company to provide fibre based services in the Lesotho districts.

Jenny Lesotho who started operations in July 2023 do not currently have any fibre networks.

Plans are in place to lease rather than self-build as long as the fibre services pricing is acceptable and on par with the Point-to-Point PTP network that Jenny Lesotho are deploying in Maseru.

Jenny Lesotho are very keen to work with LECC to identify which of the Ring and Distribution Networks will be of

interest for subscribers on Jenny's network.

5. REVIEW OF ANY ADDITIONAL TELECOMMUNICATIONS OR INFRASTRUCTURE ASSETS THAT COULD SUPPORT BROADER NETWORK EXPANSION AND INTEGRATION.

5.1 SPACEX'S STARLINK

Lesotho Communication Authority LCA is planning to provide a license for Starlink to start operating in Lesotho early 2025.

SpaceX's Starlink boasts substantially faster speeds, lower latency, and better prices than the legacy satellite broadband services that are legally approved in South Africa.

Starlink has been a game-changer for households and small businesses in rural areas who previously had to fork out for an expensive or lower-performance satellite service, or fixed-LTE services that often go down during load- shedding.

One of the major factors that makes Starlink so attractive is its impressive speed, made possible by its low-earth orbit (LEO) satellite fleet operating around 550km above Earth.

While download and upload speeds can vary greatly depending on the dish's view of the sky, tests in South Africa

generally recorded 100Mbps downloads and around 20Mbps uploads.

In addition, the current latency varies from as low as 100ms to around 300ms. This is expected to improve as Starlink brings more ground stations with Internet backhaul online close to South Africa.

In comparison, conventional geostationary (GEO) satellite networks like those run by Eutelsat and Hughes rely on satellites 35,000km away, with much less bandwidth and higher latency. Entry-level uncapped packages on these networks offered by ISPs like Vox and Morclick start with download speeds of 5Mbps and 10Mbps for R700 and R999 per month, respectively.

In addition to being much slower than Starlink, the conventional geostationary (GEO) satellite networks packages come with stringent fair usage policies (FUPs) that significantly slow down speeds once a user consumes a certain amount of data in a month.

Upfront kit cost for Starlink are R10,000–R14,999 whereas for GEO satellite networks it is R999–R2,500. Monthly price for Starlink is R700 (40 USD) –R1,299 and R700–R2,629 for GEO satellite networks

Recommend that LECC undertake an in-depth detailed assessment and analysis of the Starlink technology and network and determine the impact on the LECC LEMOFI business plan.

5.2 ECONET TELECOMS LESOTHO ETL INFRASTRUCTURE ASSETS

ETL has made a significant investment in the roll-out of 4G, 5G and PTP backhaul microwave systems and Fixed Wireless Access FWA systems in all the districts and constituencies which does enable ETL to provide cost effective broadband connectivity services to the large enterprise, SME and consumer market.

Results show (further details in the Preliminary Market Analysis Report) that ETL is the dominant FTTx market player in Lesotho and has covered 40% of the constituencies within the 10 districts in Lesotho with fibre long haul, fibre backhaul and both FTTB and FTTH. ETL is the exclusive supplier of Fibre to the Government of Lesotho offices in all the 10 districts withing Lesotho and the constituencies and communities within the districts.

ETL has invested in the following broadband assets and can provide broadband products and services to the Enterprise, Small Medium Enterprise and Consumer Market:

FTTx GPON technology since 2013 and currently has a footprint 32 (thirty-two) of the 80 (eighty) constituencies, 32 (thirty-two) of the 80 (eighty) constituencies i.e. 40% (forty percent)

16 (sixteen) of the constituencies have fibre deployed in the constituency area but no FTTH or FTTB which shows that 60% of the Lesotho constituencies have fibre technology deployments.

The ETL Fibre and FTTH and FTTB technology coverage results show that there is a requirement for further fibre and Fibre-to-the-Home FTTH and Fibre-to-the-Building FTTB technology deployments. ETL have installed ITU-T G.984 Series of GPON standards since 2013 and have plans to install ITU-T G. 9807 series of standards.

ETL 2G and 3G network covers all the 80 Lesotho constituencies – 100% Coverage with 2G and 3G technology

ETL 4G Broadband Network covers 80-19= 61 of the 80 Lesotho constituencies - 76% coverage of 4G technology

ETL 5G Broadband Network covers 23 of the 80 Lesotho constituencies – 29% coverage of 5G technology. **ETL Copper and DSL technology** covers 35 of the 80 Lesotho constituencies – 44% coverage of copper and DSL technology.

5.3 VODACOM LESOTHO VCL INFRASTRUCTURE ASSETS

VCL have had CAPEX/OPEX challenges in recent years from holding companies Vodacom Group and Vodafone Group.

VCL continues to provide cost effective broadband connectivity services to the large enterprise, SME and consumer market, but majority is via wireless technologies 4G integrated with Fixed Wireless Access, limited deployment of 5G New Radio NR base stations.

Results show (further details in the Preliminary Market Analysis Report) that VCL has covered 40% of the constituencies in the 10 districts in Lesotho with Fixed Wireless Access FWA and 4G and only 5 x 5G base stations deployed in a few constituencies within the 10 districts.

However, Vodacom Lesotho does have plans to deploy over 900 kilometers of fibre during the next 5 years pending budget approval.

6. REGULATORY AND LEGAL FRAMEWORK ANALYSIS REVIEW

6.1 TELECOMMUNICATIONS LAWS, REGULATIONS, AND COMPLIANCE REQUIREMENTS IMPACTING THE PROJECT

6.1.1 APPLICATION REQUIREMENTS FOR NETWORK INFRASTRUCTURE, NETWORK SERVICES

AND/OR A UNIFIED LICENSE

The Consultants observations of the Lesotho telecommunications – ICT market is that there are currently 2 x Unified License operators ETL and VCL and 5 x network infrastructure operators ETL, VCL, LECC, Comnet, Leo and Jenny Lesotho. The 5 x ISP's that can sell LECC wholesale carrier services are ETL, VCL, Comnet, Leo and Jenny Lesotho.

The market dynamics is such that competition is not very aggressive. Recommendation is to allocate a Unified License to LECC who have the right to have a LECC wholesale business unit and an ISP business unit as per ETL and VCL, alternatively the recommend option indicated in previous section.

6.1.2 DRAFT – LCA – ADMINISTRATIVE – RULES – 2024 PUBLIC CONSULTATION FINAL

The most important clause impacting the LEMOFI project is the following highlighted clauses: **Requirement to give access and share infrastructure - Reference Clause 28.** (1) The Authority may require a licensee to share its communications infrastructure, and the licensee shall allow other licensees to use the infrastructure- On a first come first served basis; On a cost-based pricing structure and On non-discriminatory terms and conditions.

Provided that- The infrastructure can be shared without adverse effects to the owner of the infrastructure; and Requiring other licensees to replicate the infrastructure, would impede competition and growth of the sector.

The Authority designates, without being exhaustive, the following communications infrastructure as infrastructure that shall always be shared – Communications sites, towers or masts (mobile, broadcasting, telemetry and two-way radio); **Poles;** - FTTH network Poles are not shared today the Ha Foso village in Berea District, Lesotho. **Ducts;** ETL do not share duct infrastructure in the Maseru Metro network resulting in LECC

deploying Poles and Duct infrastructure, VCL are planning a Maseru Metro Fibre Network, Comnet have a fibre to the tower network and Leo have deployed a 48 core fibre network in Maseru. Equipment rooms; Counters at post offices and postal agencies; Volumes in transport; and Post Office Boxes.

Access and infrastructure sharing shall be provided by all dominant licensees in the relevant market to all requesting licensees on terms that are non-discriminatory, fair and reasonable.

Requests for access or infrastructure sharing that are made to dominant licenses shall be notified to the Authority by the dominant licensee within three (3) days of the request being made, with a copy of the request received by the dominant licensee; and

The Authority shall create and maintain a register of access requests for the purpose of monitoring the compliance by dominant licensees with the applicable time periods for responding to requests, and which may be inspected by any person during the working hours of the Authority at the Authority's office or on the Authority's website at any time.

Access and infrastructure sharing agreements shall be deposited with the Authority.

Recommend that LCA needs to enforce Clause 28 which will have a major impact on the LEMOFI project. If ETL operated an Open Access business model, then it could well be more cost effective for LECC to lease fibre from ETL as opposed to building their own Ring and Distribution Networks

6.1.3 SPACEX'S STARLINK LICENSE

LECC will need to do a detailed analysis of what the impact of SpaceX's Starlink license will have on the LEMOFI

project.

The terms and conditions of the Starlink license is of critical importance for ETL, VCL, LECC, Comnet, Leo and Jenny Lesotho to read and study to determine what impact Starlink will have on the competitive environment in the telecommunications market in Lesotho.

The Consultant did request further Starlink information from LCA, but as the decision to award the license is still

with various Minister's the information was regarded as restricted and highly confidential.

7. GAPS AND AREAS FOR IMPROVEMENT

7.1 IDENTIFICATION OF COVERAGE GAPS

7.1.1 LECC

The ETL Constituencies within a District Technology Coverage matrix is attached.

LECC LEMOFI Ring and Distribution Network is planned to cover the 18 constituencies within the 10 districts OPGW and ADSS technology and network infrastructure is deployed in most of the LEMOFI target areas except for the following constituencies: Thaba-Tseka, Motimposo (no OPGW), Majoe-a-Litšoene (no OPGW), Maama (NO OPGW)

LECC has no deployment of 2G, 3G, 4G, 5G, Point to Point Microwave, Fixed Wireless Access FWA to building and Homes, and no Satellite Communications technology deployments.

7.1.2 ETL

The ETL Constituencies within a District Technology Coverage matrix is attached.

ETL has Fibre and FTTH FTTB Network Coverage in 32 (thirty-two) of the 80 (eighty) constituencies i.e. 40% (forty percent) of the 80 Constituencies.

16 (sixteen) of the constituencies have fibre deployed in the constituency area by no FTTH or FTTB which shows that 60% of the Lesotho constituencies have fibre technology deployments.

The ETL Fibre and FTTH and FTTB technology coverage results show that there is a requirement for further fibre and Fibre-to-the-Home FTTH and Fibre-to-the-Building FTTB technology deployments.

ETL have installed ITU-T G.984 Series of GPON standards since 2013 and have plans to install ITU-T G. 9807 series of standards.

ETL 2G and 3G network covers all the 80 Lesotho constituencies – 100% Coverage with 2G and 3G technology ETL 4G Broadband Network covers 80-19= 61 of the 80 Lesotho constituencies - 76% coverage of 4G technology ETL 5G Broadband Network covers 23 of the 80 Lesotho constituencies – 29% coverage of 5G technology.

ETL Copper and DSL technology covers 35 of the 80 Lesotho constituencies – 44% coverage of copper and DSL technology. ETL do have plans to reduce the percentage of copper and DSL technology due to the theft of copper.

ETL Point to Point technology covers 69 of the 80 Lesotho constituencies - 86% coverage of Point to Point Fixed Wireless Access technology

ETL has no Point to Multipoint PTMP and Satellite based technologies deployed in Lesotho.

ETL has less than 30% of the Lesotho constituencies covered by 5G Broadband Wireless technologies and only 40% fibre and FTTH and FTTB technologies. The LEMOFI project will enable fibre and FTTH and FTTB technology coverage to increase in the constituencies.

Recommend LEC/LECC/ETL/VCL discuss FTTx network sharing business opportunities.

LCA to enforce requirements to give access and share infrastructure - Reference Clause 28

7.1.3 VCL

The ETL Constituencies within a District Technology Coverage matrix is attached.

VCL have not deployed any FTTH networks in Lesotho which aligns with the VCL strategy of the large-scale deployment of FWA technology.

VCL have deployed FTTB in only 2 of the 80 constituencies 2.5%.

VCL have however deployed fibre in 23 of the 80 constituencies 29% of which 2 are FTTB but no FTTH. Majority of the applications is tower backhaul where VCL install their own ADSS cables on the LEC/LECC pole infrastructure. LEC have the right to access 1 pair of fibres and LECC do not have any rights in place.

VCL have not deployed any FTTH networks in Lesotho which aligns with the VCL strategy of the large-scale deployment of FWA technology integrated with 4G and 5G.

7.2 COVERAGE GAPS IN TOWNS AND RESIDENTIAL AREAS AND RECOMMEDATIONS FOR EXTENDING LEMOFI

Recommendations for the extension of the LEMOFI Ring and Distribution Network into the constituencies within the districts is depicted in attached “Identification of Coverage GAPS-Observations & Recommendations

worksheet” spreadsheet as follows:

Constituencies by district	**Observations and Recommendations**
Berea District	
Bela-Bela	**GAP 1-** No FTTx (FTTH FTTB) Deployed. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy

Constituencies by district	Observations and Recommendations
Khafung	**GAP 2-** No FTTx (FTTH FTTB) Deployed. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy
Khubetsoana	All have fibre. ETL have deployed FTTx. LECC/ETL/VCL to discuss FTTx network sharing business opportunties. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Mabote	All have FIBRE. ETL have deployed FTTx. Mabote Constituency nor Community is included as one of the 18 X LEMOFI projects in Berea Destirct.
Makhoroana-Lube	**GAP 3 -** No FTTx Deployed. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy
Malimong	**GAP 4-** No FTTx (FTTH FTTB) Deployed. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy
Mokhethoaneng	NO OPGW - FTTH and FTTB deployment by ETL. ETL and LECC Fibre. LECC ADSS. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Mosalemane	**GAP 5 -** No FTTx (FTTH FTTB) Deployed. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy
Teya-Teyaneng	POTENTIAL DUPLICATION OF FTTH and FTTB INFRASTRUCTURE. Investigate FTTx network sharing opportunties LEMOFI Year 1 project 302 customers Teyateyaneng. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Thuathe	ETL have Fibre, FTTH and FTTB. NO OPGW or ADSS
Tšoana-Makhulo	**GAP 6 -** No FTTx (FTTH FTTB) Deployed. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL infrastructure sharing busines opportuntiy
Butha-Buthe District	
Butha-Buthe	POTENTIAL DUPLICATION OF FTTH and FTTB INFRASTRUCTURE. LEC/LECC Fibre, OPGW and ADSS. Investigate FTTx network sharing opportunities LEC/LECC/ETL. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Hololo	**GAP 7 -** LEC/LECCfibre and OPGW. No FTTH/FTTB. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL infrastructure sharing busines opportuntiy. LCA to enforce

	Requirement to give access and share infrastructure - Reference Clause 28
Mechachane	**GAP 8-** LEC/LECCfibre and OPGW. No FTTH/FTTB. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Motete	**GAP 9 -** LEC/LECCfibre and OPGW. No FTTH/FTTB. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Qalo	**GAP 10 -** ETL Fibre no FTTH/FFTB, OPGW, ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL infrastructure sharing busines opportuntiy
Leribe District	
Hlotse	POTENTIAL DUPLICATION OF FTTH and FTTB INFRASTRUCTURE. LEC/LECC Fibre, OPGW and ADSS. LEC/LECC/ETL to investigate FTTx network sharing opportunties. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Kolonyama	**GAP 11 -** ETL Fibre no FTTH/FFTB, OPGW, ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy
Leribe	POTENTIAL DUPLICATION OF FTTH and FTTB INFRASTRUCTURE. LEC/LECC Fibre, OPGW and ADSS. LEC/LECC/ETL to investigate FTTx network sharing opportunties. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Mahobong	**GAP 12 -** No FTTx LEC/LECC OPGW, no ADSS.NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy
Maliba-Matšo	**GAP 13 -** No FTTx LEC/LECC OPGW, no ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy

Constituencies by district	Observations and Recommendations
Maputsoe	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. LEC/LECC Fibre, OPGW. No ADSS. LEC/LECC/ETL to investigate FTTx network sharing opportunties. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Matlakeng	**GAP 14 -** ETL Fibre no FTTH/FFTB, OPGW, ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy
Moselinyane	ETL has FTTH FTTB installed. LEC/LECC/ETL to investigate potential FTTx network sharing business opportunties
Mphosong	**GAP 15 -** LEC/LECC has Fibre and OPGW deployed. LEC/LECC/ETL/VCL to investigate potential FTTx network sharing business opportunties
Peka	**GAP 16 -** ETL Fibre no FTTH/FFTB, OPGW, ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy
Pela-Tšoeu	**GAP 17 -** LECC Fibre no FTTH/FFTB, OPGW, but ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy
Thaba-Phatšoa	**GAP 18 -** ETL Fibre no FTTH/FFTB, OPGW, ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy
Tsikoane	**GAP 19 -** ETL Fibre no FTTH/FFTB, OPGW, ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy
Mafeteng District	
Thaba-Phechela	**GAP 20 -** ETL Fibre no FTTH/FFTB, OPGW, ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy
Phoqoane	**GAP 21 -** ETL Fibre no FTTH/FFTB, OPGW, ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx infrastructure sharing busines opportuntiy
Matelile	**GAP 22** - No FTTH/FFTB, OPGW, ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx network infrastructure sharing busines opportuntiy
Maliepetsane	**GAP 23** - No FTTH/FFTB, OPGW, ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx network infrastructure sharing busines opportuntiy
Thabana-Morena	**GAP 24** - No FTTH/FFTB, OPGW, ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx network infrastructure sharing busines opportuntiy

Qalabane	**GAP 25** - All have deployed Fibre. No FTTH/FFTB, OPGW, ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL FTTx network infrastructure sharing busines opportuntiy
Mafeteng	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. LEC/LECC Fibre, OPGW.LEC/LECC/ETL to investigate FTTx network sharing opportunties. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Maseru District	
Abia	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. LEC/LECC Fibre, OPGW.LEC/LECC/ETL/VCL to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Koro-Koro	**GAP 26** - All have deployed Fibre. No FTTH/FFTB, OPGW. No ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL/Comnet/Leo/Jenny Lesotho FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Likotsi	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE.All have Fibre. LEC/LECC Fibre, OPGW, No ADSS.LEC/LECC/VCL/ETL/Comnet/Leo/Jenny Lesotho to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Lithabaneng	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE.All have Fibre. LEC/LECC Fibre, OPGW, ADSS.LEC/LECC/VCL/ETL/Comnet/Leo/Jenny Lesotho to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28

Constituencies by district	Observations and Recommendations
Lithoteng	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE.All have Fibre. LEC/LECC Fibre, ADSS, No OPGW. LEC/LECC/VCL/ETL/Comnet/Leo/Jenny Lesotho to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Maama	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE.All have Fibre. LEC/LECC Fibre, OPGW, ADSS.LEC/LECC/VCL/ETL/Comnet/Leo/Jenny Lesotho to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Machache	**GAP 27** - All have deployed Fibre. No FTTH/FFTB, No OPGW. LECC ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL/Comnet/Leo/Jenny Lesotho FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Majoe-a-Litšoene	**GAP 28** - All have deployed Fibre. No FTTH/FFTB, No OPGW. LECC ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL/Comnet/Leo/Jenny Lesotho FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Makhaleng	**GAP 29** - NO FIBRE. No FTTH/FFTB, No OPGW. No LECC ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL/Comnet/Leo/Jenny Lesotho FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Maletsunyane	**GAP 30** - ETL FIBRE. No FTTH/FFTB, No LEC/LECC OPGW. No LECC ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL/Comnet/Leo/Jenny Lesotho FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Maseru	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. All have Fibre. ETL, LECC FTTH/FTTB. VCL possible RFx if business plan approved. LEC/LECC OPGW and ADSS. LEC, LECC, VCL, ETL, Comnet, Leo, Jenny Lesotho to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28

Matala	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. All have Fibre. ETL, LECC FTTH/FTTB. No OPGW. LECC ADSS. LEC, LECC, VCL, ETL, Comnet, Leo, Jenny Lesotho to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Matsieng	**GAP 31** - LECC, ETL FIBRE. No FTTH/FFTB, No LEC/LECC OPGW. LECC ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL/Comnet/Leo/Jenny Lesotho FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Motimposo	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. All have Fibre. ETL, LECC FTTH/FTTB. No OPGW. LECC ADSS. LEC, LECC, VCL, ETL, Comnet, Leo, Jenny Lesotho to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Qeme	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. All have Fibre. ETL, LECC FTTH/FTTB. No OPGW. LECC ADSS. LEC, LECC, VCL, ETL, Comnet, Leo, Jenny Lesotho to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Qoaling	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. ETL and VCL Fibre. VCL, LECC FTTH, LECC FTTB. No OPGW. LECC ADSS. LEC, LECC, VCL, ETL, Comnet, Leo, Jenny Lesotho to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Rothe	**GAP 32** - Only ETL FIBRE. No FTTH/FFTB, No LEC/LECC OPGW nor ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL/Comnet/Leo/Jenny Lesotho FTTx network

Constituencies by district	Observations and Recommendations
	infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Stadium Area	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. All have Fibre. ETL, LECC FTTH/FTTB. LEC/LECC OPGW and ADSS. LEC, LECC, VCL, ETL, Comnet, Leo, Jenny Lesotho to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Thaba-Bosiu	**GAP 33** - Only ETL FIBRE. No FTTH/FFTB, No LEC/LECC OPGW nor ADSS. NO FTTx BROADBAND. Potential LEC/LECC/VCL/ETL/Comnet/Leo/Jenny Lesotho FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Thaba-Putsoa	**GAP 34** - LECC, ETL, VCL FIBRE. No FTTH/FFTB, No LEC/LECC OPGW. No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL, Comnet, Leo, Jenny Lesotho FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Thetsane	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. All have Fibre. All have FTTH. ETL, LECC FTTB. LEC/LECC OPGW and ADSS. LEC, LECC, VCL, ETL, Comnet, Leo, Jenny Lesotho to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Tsolo	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. ETL, VCL Fibre. ETL, LECC FTTH, FTTB. No OPGW. LECC ADSS. LEC, LECC, VCL, ETL, Comnet, Leo, Jenny Lesotho to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Mohale's Hoek District	
Hloahloeng	**GAP 35** - NO FIBRE. No FTTH/FFTB, No OPGW. No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28

Mekaling	**GAP 36** - Only ETL FIBRE. No FTTH/FFTB, No LEC/LECC OPGW nor ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Mohale's Hoek	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. LECC, ETL, VCL Fibre. ETL FTTH, FTTB. LEC/LECC OPGW. LECC ADSS. LEC, LECC, VCL, ETL to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Mpharane	**GAP 37** - NO FIBRE. No FTTH/FFTB, No OPGW. No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Phamong	**GAP 38** - NO FIBRE. No FTTH/FFTB, No OPGW. No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Taung	**GAP 39** - Only ETL FIBRE. No FTTH/FFTB, No OPGW. No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Mokhotlong District	
Bobatsi	**GAP 40** - NO FIBRE. No FTTH/FFTB, No OPGW. No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Malingoaneng	**GAP 41** - NO FIBRE. No FTTH/FFTB, LEC/LECC OPGW.No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines

Constituencies by district	Observations and Recommendations
	opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Mokhotlong	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. LECC, ETL, VCL Fibre. ETL and LECC FTTH, FTTB. LEC/LECC OPGW. LECC ADSS. LEC, LECC, VCL, ETL to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Senqu	**GAP 42** - NO FIBRE. No FTTH/FFTB, LEC/LECC OPGW.No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Qacha's Nek District	
Lebakeng	**GAP 43** - NO FIBRE. No FTTH/FFTB, LEC/LECC OPGW.No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Qacha's Nek	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. ETL Fibre. ETL and LECC FTTH, FTTB. No OPGW. LECC ADSS. LEC, LECC, VCL, ETL to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Tsoelike	**GAP 44** - NO FIBRE. No FTTH/FFTB, LEC/LECC OPGW.No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Quthing District	
Moyeni	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. LECC, ETL, VCL Fibre. ETL and LECC FTTH, FTTB. LEC/LECC OPGW and LECC ADSS. LEC, LECC, VCL, ETL to investigate FTTx network sharing business opportunties.LCA to enforce Requirement to give access and

	share infrastructure - Reference Clause 28
Sempe	**GAP 45** - NO FIBRE. No FTTH/FFTB, LEC/LECC OPGW.No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Mount Moorosi	**GAP 46** - ETL FIBRE. No FTTH/FFTB, LEC/LECC OPGW.No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Qhoali	**GAP 47** - NO FIBRE. No FTTH/FFTB, LEC/LECC OPGW.No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Thaba-Tseka District	
Mantšonyane	**GAP 48** - ETL FIBRE. No FTTH/FFTB, LEC/LECC OPGW.No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Mashai	**GAP 49** - NO FIBRE. No FTTH/FFTB, LEC/LECC OPGW.No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28

Constituencies by district	Observations and Recommendations
Semena	**GAP 50** - NO FIBRE. No FTTH/FFTB, LEC/LECC OPGW.No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Thaba-Moea	**GAP 51** - NO FIBRE. No FTTH/FFTB, LEC/LECC OPGW.No LECC ADSS. NO FTTx BROADBAND. Potential LEC, LECC, VCL, ETL FTTx network infrastructure sharing busines opportuntiy. LCA to enforce Requirement to give access and share infrastructure - Reference Clause 28
Thaba-Tseka	POTENTIAL DUPLICATION OF FTTx INFRASTRUCTURE. LECC, ETL, Fibre and FTTH, FTTB. LEC/LECC OPGW and LECC ADSS. LEC, LECC, VCL, ETL to investigate FTTx network sharing business opportunities' to enforce Requirement to give access and share infrastructure - Reference Clause 28

7.3 MAPPING OF THE GAPS ONTO THE LEMOFI ROLL-OUT PLAN

District	Target Area	District	Deployment Months	Projected Customers	No of POPS	Identified GAPS in the constituencies within a district - No Fibre, FTTH, FTTB Services
Year 1						
Berea	Teyateyaneng	Berea	6	302	2	Bela-Bela, Khafung, Makhoroana-Lube, Malimong, Mosalemane, Tšoana-Makhulo
Leribe	Maputsoe (Including Nyenye)	Leribe	7	355	1	Kolonyama, Mahobong, Maliba-Matšo, Matlakeng, Mphosong, Peka, Pela-Tšoeu, Thaba-Phatšoa, Tsikoane

Mafeteng	Mafeteng	Mafeteng	5	310	2	Thaba-Phechela, Phoqoane, Matelile, Maliepetsane, Thabana-Morena, Qalabane
Maseru	Highway-Central-IEMS	Maseru	6	334	1	Koro-Koro, Machache, Majoe-a-Litšoene, Makhaleng, Maletsunyane, Matsieng, Rothe, Thaba-Bosiu, Thaba-Putsoa
Maseru	Maseru Industrial	Maseru	3	316	1	Koro-Koro, Machache, Majoe-a-Litšoene, Makhaleng, Maletsunyane, Matsieng, Rothe, Thaba-Bosiu, Thaba-Putsoa
Maseru	Parliament - Maseru Mall	Maseru	4	79	1	Koro-Koro, Machache, Majoe-a-Litšoene, Makhaleng, Maletsunyane, Matsieng, Rothe, Thaba-Bosiu, Thaba-Putsoa

District	Target Area	District	Deployment Months	Projected Customers	No of POPS	Identified GAPS in the constituencies within a district - No Fibre, FTTH, FTTB Services
Maseru	A2 - Lekhaloaneng - Matala	Maseru	7	401	1	Koro-Koro, Machache, Majoe-a-Litšoene, Makhaleng, Maletsunyane, Matsieng, Rothe, Thaba-Bosiu, Thaba-Putsoa
Year 2						
Leribe	Hlotse	Leribe	6	219	1	Kolonyama, Mahobong, Maliba-Matšo, Matlakeng, Mphosong, Peka, Pela-Tšoeu, Thaba-Phatšoa, Tsikoane
Butha Buthe	Botha Bothe	Butha Buthe	5	284	1	Hololo, Mechachane, Motete, Qalo
Mohale's Hoek	Mohale's Hoek	Mohale's Hoek	6	200	1	Hloahloeng, Mekaling, Mpharane, Phamong, Taung
Mokhotlong	Mokhotlong Town	Mokhotlong	6	330	1	Bobatsi, Malingoaneng, Senqu
Thaba Tseka	Thaba Tseka	Thaba Tseka	7	250	1	Mantšonyane, Mashai, Semena, Thaba-Moea
Maseru	Thetsane Industrial	Maseru	5	219	2	Koro-Koro, Machache, Majoe-a-Litšoene, Makhaleng, Maletsunyane, Matsieng, Rothe, Thaba-Bosiu, Thaba-Putsoa
Year 3						

Maseru	Old Europa - Downtown	Maseru	4	445		Koro-Koro, Machache, Majoe-a-Litšoene, Makhaleng, Maletsunyane, Matsieng, Rothe, Thaba-Bosiu, Thaba-Putsoa
Maseru	Tikoe Industrial	Maseru	5	236		Koro-Koro, Machache, Majoe-a-Litšoene, Makhaleng, Maletsunyane, Matsieng, Rothe, Thaba-Bosiu, Thaba-Putsoa
Quthing	Quthing - Moyeni	Quthing	5	144	1	Sempe, Mount Moorosi, Qhoali
Qacha's Nek	Qacha's Nek Town	Qacha's Nek	6	133	1	Lebakeng, Tsoelike
TOTAL				**4557**	**18**	

None of the LEMOFI target areas will provide FTTx Services ro the constituencies where currently there is no FTTx technology deployed.

8. TECHNOLOGICAL RECOMMENDATIONS - TECHNOLOGICAL ADVANCEMENTS AND BEST PRACTICES

The following are FTTx technology international standards and best practices recommendations:

8.1 ITU-T FTTX STANDARDS AND BEST PRACTICES:

LECC FTTx network must comply with ITU-T G.984 Series of GPON recommendations and have a roadmap path defined for ITU-T G.9807 XGS-PON standards which will enable the expansion of LECC existing network, for integrating data, voice & video services and be the primary source of Internet bandwidth for Corporate, Institutions, Government Bodies, retail users and individual customers.

8.2 ITU-T GPON, XG-PON, XGS-PON, XG-PON COMBO, XGS-PON COMBO STANDARDS TECHNOLOGY ROADMAP COMPLIANCE

The LECC OLT must support an all-in-one service card, ie one service card should be able to access the following services at the same time: GPON, XG-PON, XGS-PON, XG-PON Combo, XGS-PON combo with different optical modules. Smooth upgrades only by replacing the optical module, with no need to replace the card and modify the ODN.

8.3 LECC PIZZA BOX OLT MUST SUPPORT ALL FTTX APPLICATIONS

The LECC 1U pizza box subrack OLTs should provide GPON, 10G PON (including XG-PON and XGS-PON), 50GPON, P2P 10GE/GE access, supporting the various FTTx applications deployments on FTTH, Fiber To The Desktop FTTD, FTTB, Fiber to the tower (FTTT), FTTR, or Fiber-to-the-Room, and FTTC networks. This makes it applicable to home access, enterprise access, mobile backhaul, and Wi-Fi hotspot backhaul scenarios to aggregate all services on one fiber network.

8.4 ITU-T STUDY GROUP 15 GSUPPL. 74 NETWORK SLICING IN A PASSIVE OPTICAL NETWORK

The LECC OLT device should support network slicing to divide a physical network into multiple logical networks for multiple purposes. Different slices can meet differentiated SLAs (achieving application-level bandwidth and latency commitment), isolation, security, and independent operation requirements

8.5 NETWORK MANAGEMENT SYSTEM OLT SLICING CONFIGURATION

The LECC active OLT, ONU/ONT equipment & NMS must support OLT slicing configuration, at least 8 different types of slice profiles should be possible.

8.6 INDEPENDENT QOS CONFIGURATION FOR DIFFERENT USERS AND

SERVICES

Each slice must support an independent QoS configuration for different users and services, while the link bandwidth and latency can be specified for each slice.

8.7 DIGITALIZED ODN MANAGEMENT SYSTEM

LECC should deploy a Digitalized ODN management system to manage the digitalized ODN network. The Optical Distribution Network (ODN) solution should make ODN passive resources visible and manageable during network construction and service provisioning, improving resource data accuracy. This solution consists of the Management Platform and smartphone/remote device application. The Consultant will share information regarding a FTTx Field Services Solution solution which has been deployed in some African countries.

8.8 END TO END MANAGEMENT FOR ALL FTTX APPLICATIONS

The LEMOFI network needs to evolve to a Next Generation System and this includes enhanced analysis capability from all FTTx applications to access the OLT and ODN and to perform end-to-end network monitoring for the OLT, ODN, and ONU/ONT.

8.9 TELECOMMUNICATIONS INFRASTRUCTURE PROVIDER OPERATIONS SUPPORT SYSTEMS (OSS) KEY FEATURES

Operations Support Systems (OSS) helps providers monitor, analyze and manage telecom networks. OSS includes the network infrastructure and software used to control the network. OSS enables telecom operators to remotely oversee technical and operations activities, including: **Real-time network watchdog:** OSS provides constant network monitoring, identifying issues and sending instant alerts. This allows for swift intervention, resolution and proactive maintenance planning to prevent future problems. **Strategic network planning:** OSS analyzes data like traffic patterns and network usage. This helps predict future needs and identify areas prone to congestion, ensuring your network stays ahead of the curve. **Configuration control center:** OSS tracks network configurations,

maintains a history of changes and allows for rollbacks if needed. This ensures optimal performance and minimizes the risk of configuration errors.**Rapid fault detection and resolution:** Quickly identifying and fixing network issues is crucial for minimizing downtime. OSS acts as your network's diagnostic tool, pinpointing problems for swift resolution. **Service quality assurance:** OSS constantly monitors performance metrics like latency, jitter and packet loss. This information helps guarantee service quality meets agreed-upon service level agreements (SLAs**). Network inventory management:** Maintaining an accurate record of network resources - towers, cables, equipment - is essential. OSS keeps track of everything, allowing for optimal resource allocation and future capacity planning. **Seamless service provisioning:** OSS automates service order processing, allocating resources, configuring equipment and activating services for your customers. Advanced systems even offer self- service portals for online ordering and activation.

8.10 TELECOMMUNICATIONS INFRASTRUCTURE PROVIDER BUSINESS SUPPORT SYSTEMS (BSS) KEY FEATURES

Business Support Systems (BSS) refers to software that manages and streamlines interactions with customers to deliver positive customer experiences. BSS enables CSPs to automate, simplify and speed up customer-facing business activities, including: **Effortless billing:** BSS automates billing, generating accurate and timely bills based on usage. It handles everything from rating and payment processing to revenue reporting, saving you time and effort. **Fast and accurate service delivery:** From sign-up to activation, BSS manages customer orders efficiently. Automated validation and provisioning ensure services are delivered quickly and accurately, minimizing errors and frustration. **Flexible service options:** A robust BSS allows easy management of your product catalog. You can create bundles, customize services and offer various pricing models to cater to diverse customer needs**. Smart subscription management:** BSS acts as a central hub for subscriptions. Customers can easily modify or renew plans, while usage data is tracked for accurate billing and valuable insights. These insights help you tailor bundles and offers to different customer segments**. Personalized marketing:** BSS collects valuable customer data on usage, preferences and demographics. Leverage this data to segment customers and deliver targeted promotions and campaigns with services they'll love. **Enhanced customer relationships:** BSS integrates with CRM systems, providing detailed customer information like service usage and support tickets. This empowers marketers to personalize communications, address churn potential and recommend relevant services for upselling or cross- selling. **Proactive customer care:** BSS automates helpful

notifications for customers. They can receive payment reminders and be kept informed about scheduled maintenance, minimizing service disruptions and improving overall experience.

8.11 TM FORUM TMF STANDARDS FOR BUILDING THE FUTURE OF OSS/BSS: THE TMF AGILE OSS TOOLKIT

Recommend that LECC Technical Teams study and adopt all the TM Forum TMF standards for Building the future of OSS/BSS: The TMF Agile OSS toolkit

TMF provides a range of assets to support architects and other members of the IT community in realizing OSS/BSS solutions based on the latest IT practices which support current and anticipated future requirements of Digital Service Providers. The TM Forum has released a complete blueprint for a platform for managing a multi-vendor Hybrid / NFV infrastructure as part of its Agile OSS toolkit. The blueprint brings together multiple elements into one set of tools in the TMF070 suite of documents. The suite includes key practical assets such as Open APIs, information models, best practices and deployment guides. Together these provide the standard interface required for multi vendor hybrid deployments. It should be noted that even at the first release this blueprint goes beyond the very basic management capabilities typically deployed with NFV today, and includes items such as: **Resource function activation and configuration. Inventory Management. Catalog Management. Assurance.**

Together these key capabilities begin to unlock the latent potential of the new technology in a standardised interoperable way, and allows realisation of the long-awaited business benefits.

8.12 NETWORK ENGINEERING, SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF THE LEMOFI NETWORK

LECC has completed the deployment a FTTH network in Ha Foso and the following is a typical process which is recommended that LECC adopts for the engineering, supply, delivery, installation and commissioning of the LEMOFI networks with the contractors:

- Supply and Installation of GPON Optical Line terminal (OLT) Equipment.
- Supply and deploy of Optical Network Units (ONU) at user premises.
- Configuration and Provisioning of the GPON network infrastructure equipment.

- Rigorous testing of the GPON network to verify performance, stability, and adherence to specifications ITU-T G984 series of recommendations.
- Verification of both downstream and upstream data rates.
- Resolution of any issues identified during testing.
- Supply testing tools for the operation of the network.
- Comprehensive documentation of the LECC GPON network architecture, configuration, and setup.
- Provide detailed technical literature in support of the installed systems, to ensure effective and efficient operation, configuration management and maintenance of the system and key components.
- Design and develop an effective Design document for LECC GPON network specifically to Active Equipment taking into consideration current and next generation technologies and features. LECC GPON G.984 Series of ITU-T Recommendation roadmap to ITU-T G.9807 XGS-PON series of Recommendations.
- Supply all requisite hardware for the proper and full execution of the planned LECC GPON network. Detailed Bill of Material, Bill of Quantities and Budgetary Costing for each District and Target Area
- Confirm License costs necessary for the system to deliver required services.
- Arrange for training of LECC and Contractor personnel on the system; its planning and dimensioning, configuration, operation and maintenance, and its various key components by the technical specialists and suppliers.
- Compile the detailed configuration drawings (low & high-level) in support of the installation. This has to be signed-off prior to solution deployment.
- Prepare the Final Design documents after negotiation and contract signature
- Confirm recommended system critical operating and maintenance spares.
- Compile the Provisional Acceptance Tests (PAC) templates.

8.13 RECOMMENDATION ITU-T L.151 INSTALLATION OF OPTICAL GROUND WIRE CABLE OPGW

Recommendation ITU-T L.151 refers to the installation of optical fibre ground wire cable. It deals with the factors that should be considered in determining the characteristics of this type of cable, the apparatus that should be used, the precautions that should be taken in handling the reels, and the method that should be used to string the cable and joint it. OPGW Recommendation L.151 has been updated in 2020 to align with IEC OPGW activities - [IEC 60794-4-10] IEC 60794-4-10:2014 Optical fibre cables – Part 4-10: Family specification – Optical ground wires (OPGW) along electrical power

lines. LEMOFI network must be fully compliant with L.151 and IEC 60794-4-10] IEC 60794-4-10:2014 Optical fibre cables – Part 4-10.

8.14 RECOMMENDATION ITU-T L.26 OPTICAL FIBRE CABLES FOR AERIAL APPLICATIONS

Recommendation ITU-T L.26 was last updated in 2015 and describes characteristics, construction and test methods of optical fibre cables for aerial application (including lashed cables), but does not apply to optical ground wire (OPGW) cables or metal armour self-supporting (MASS) cables. First, the characteristics affecting the satisfactory performance of optical fibre cables are described. Then, the methods of examining whether the cables have these required characteristics are described. The conditions required may differ according to the installation environment. Therefore, detailed conditions of experiments need to be agreed upon between a user and a supplier on the basis of the environment where the cable is used. LEMOFI network must be fully compliant with L.26.

8.15 [IEC 60794-4-20] IEC 60794-4-20 (2012), OPTICAL FIBRE CABLES – PART 4-20: AERIAL OPTICAL CABLES ALONG ELECTRICAL POWER LINES

LEMOFI network must be fully compliant with all the IEC, IEEE All-Dielectric Self-Supporting (ADSS) Fiber Optic technical specifications

8.16 SPECIFICATION FOR ADSS (ALL DIELECTRIC SELF SUPPORTED) OPTICAL CABLES,

LEMOFI network must be fully compliant with all the IEC, IEEE All-Dielectric Self-Supporting (ADSS) Fiber Optic technical specifications - [IEEE 1222] IEEE 1222 (2011), IEEE Standard for Testing and Performance for All- Dielectric Self-Supporting (ADSS) Fiber Optic Cable for Use on Electric Utility Power Lines:

9. CONCLUSION

The Government of Lesotho should proceed with the plan, build and operations of the Lesotho Metropolitan Fiber Infrastructure Expansion Project (LEMOFI) Fibre Network. The following are the various scenario options which is recommended that the Government of Lesotho considers:

1. **Scenario 1 LEMOFI approved as per existing proposed business model:** Approve the LEMOFI business model as is and request approval from Government of Lesotho and Bank for funding approval. Project Total Cost: LSL155,847,106 or USD8,424,168. Compete with ETL and VCL as a Wholesale Carrier Open Access FTTx Operator. HIGH RISK with low market share and long period before return on investment ROI. All three Fibre Network Operators in Lesotho ETL, VCL and LECC will be targeting the high earning Enterprise, Government Sector, Small Medium Enterprise and Consumer Market. ETL as the existing dominant FTTx operator will retain full control of the pricing per Meg.
2. **Scenario 2 Open access network sharing business model ETL, LEC and LECC LEMOFI strategic alliance:** LCA and Government of Lesotho stakeholders LEC, LECC, MICSTI, meet with ETL to discuss potential LECC sharing of ETL FTTx network infrastructure in all the constituencies within the districts where ETL has deployed a Fibre Network. LCA to enforce requirements to give access and share infrastructure rules- Reference Clause 28. MEDIUM RISK and ETL can charge high wholesale FTTx prices, which does not enable LECC to be competitive in the FTTx market. Recommend that all Government of Lesotho current ETL FTTx Services are moved onto the LECC LEMOFI Fibre Network to reduce to LOW RISK.
3. **Scenario 3 Open access network sharing business model VCL, LEC and LECC LEMOFI strategic alliance:** LEC/LECC/VCL consortium is formed after discussion at senior level with Vodacom Lesotho, Vodacom Group, Vodafone Group and Government of Lesotho to agree on the strategic alliance. MEDIUM RISK and LECC will not be competing with its primary customers. To achieve a LOW RISK status then the Government of Lesotho must transfer all Government of Lesotho Buildings, Schools, Hospitals, HealthCare Centres, Clinics FTTx connectivity services onto the LECC LEMOFI Network. ETL will still be dominant, but only in the initial phase of the alliance.
4. **Scenario 4 Open access network sharing business model for ETL, VCL, LEC, LECC LEMOFi strategic alliance:** LCA enforces the sharing of FTTx network infrastructure and ETL, VCL and LECC independently provide FTTx Services to the Enterprise, SME and Consumer market. MEDIUM RISK as ETL has the dominant FTTx coverage in 36 of the 80 constituencies within the districts and will have control of the per Meg pricing.

Recommendation is that either Scenario 2 or Scenario 3 is approved for implementation by the Government of Lesotho. Scenario 3 would be first choice if the Vodafone/Vodacom Group do show a definite expression of interest to invest in the VCL, LEC and LECC LEMOFI consortium.

Lesotho Communications Authority LCA should approve the SpaceX Starlink licence as it will be a complementary technology to Fibre, FTTH, FTTB, 5G technologies. The Government of Lesotho MICSTI and LECC to form a close working relationship with Starlink to identify the rural area priorities for broadband connectivity as documented in the Preliminary Market Analysis Report.

All the LEMOFI technology recommendations highlighted in the Design Review Report should be actioned.

END OF DOCUMENT

10. APPENDIX 1 REFERENCE DOCUMENTATION

APPENDIX 1 provides a list of all the reference documentation requested by the Consulatnt and forwarded by Lesotho Electricity Company Communications LECC, Econet Telecoms Lesotho ETL, Vodacom Lesotho VCL, Comnet, Leo, Jenny Lesotho, Lesotho Communication Authority LCA, and Ministry of Information, Communications, Science, Technology, and Innovation (MICSTI).

ID	Reference Document Title	Description
1	**Lesotho Electricity Company Communications LECC**	
1.1	National Digital Policy 2024	A comprehensive framework to enable Lesotho to harness digital technologies to drive economic growth, enhance inclusivity, improve public services, promote social and environmental sustainability, and enhance global competitiveness through initiatives to foster digital entrepreneurship, bridge the digital divide, digitise government services, address societal challenges, and engage in digital diplomacy.
1.2	National Strategic Development Plan II 2018/19 to 2022/23	A blueprint for the transformation of Lesotho's economy for job creation and inclusive growth. It builds on the achievements and lessons learned from the implementation of the first National Strategic Development Plan.
1.3	Concept Note - LEC Communications (Pty) Ltd	Design and Construction of Metropolitan and District Telecommunications Points-of-Presence (PoPs) and Fibre Optic Distribution Network. The project will consist of a detailed design of Maseru Metropolitan Distribution network and ten (10) district Points- of- Presence (PoPs) including fibre optic distribution network in all major towns. The project will be constructed in either or both Metro— Ethernet and Gigabit Passive Optical Network (GPON).

1.4	No.2 Nationwide Network Detailed Proposal draft - October 2023	Design and Construction of Metropolitan and District Telecommunications Points-of-Presence (PoPs) and Fibre Optic Distribution Network. Project Total Cost: LSL155,847,106 or USD8,424,168. LEC's fibre infrastructure does not extend into towns nor residential areas. The proposed project hopes to address these infrastructure coverage gaps by establishing the essential fibre distribution networks within towns and metropolitan areas.
1.5	Design and Costing zipped file	National Network Costing spreadsheet and all 18 LEMOFI project target ares with Ring and Distribution Network costing and pdf maps
1.6	Network Management & Monitoring Tools	Zabbix, ElastiFlow, Greylog, Netbox, OTRS, Odoo, EXFO FastReporter, BDCOM NMS, Netping, Ookla Server, Configuration Backup Server
1.7	Cover Document	SLA Agreement. OLT-ONU/ONT Interoperability. High Level Schematic of LECC Network Core and PE Specifications. Interconnect Points. EMS and NMS architecture and technical capabilities. OSS/BSS and IT System Layer Architecture. FCAPS technical capabilities. Roadmap to 3-5years (ITU-T XGPON and XGSPON).
1.8	District Constituencies Communities Technologies Coverage Matrix LECC Currently	The OPGW, ADSS, Fibre, FTTH, FTTB technology coverage matrix existing in the constituencies within the districts
1.9	District Constituencies Communities Technologies Coverage Matrix LECC Planned	The OPGW, ADSS, Fibre, FTTH, FTTB technology coverage matrix planned in the constituencies within the districts
1.10	1. Matala Phase II Cost Comparison LECC vs LEC Pole Infrastructure	Options (GPON vs 10G-EPON)

ID	Reference Document Title	Description
1.11	Cover Page 2	Understanding of OPGW generation, transmission, sub-station, switching box power architecture. SLA between LEC and LECC. Why is LEC running out of Fibre. What test spec does LEC/LECC comply with when LEC handover the OPGW fibre pair and/or ADSS pair for LECC to use. Documentation for GPON, EPON, 10GEPON, and XGPON comparison. Cabinet and HVAC technical issues. LECC OLT and ONU/ONT fault management and control. LECC FTTx Fault Management of the Physical Network. Demarcation zone.
1.12	75m-ssa-technical-data-sheet	YOA ADSS Cable. Short Span ADSS cable with 12-144 fibres for self-support aerial installations
1.13	100m-msa-technical-data-sheet	YOA Middle Span ADSS cable with 12-144 fibres for self-support aerial installations
1.14	Envicool AC AIRCON EC15HDNC1J (2021) (1)	Outdoor Cabinet Air Conditioner. Envicool EC Series Air ConditionerEnvicool is a professional thermal control solutions provider for outdoor cabinets.Envicool has accumulated rich technological experience and lots of applicationin this field. The EC series air conditioner is the result of Envicool technologyapplied in AC powered outdoor cabinets. The cooling range is 400W~ 5000W.
1.15	Cabinet and Accessories CPS	Intelligent outdoor integrated cabinet.
1.16	SOP - FTTx Network Design Guidelines - LECC	SOP Title: LECC FTTx Network Design Guidelines. The purpose of this SOP is to outline the procedure pertaining to the Design of FTTx Network by LEC Communications. Resources 1.Geographical Information System Software (QGIS). 2. FOND Planner (Biarri Networks) FTTH Design Software
1.17	VCL IRU contract	Dark Fibre ITU Agreement LEC LECC VCL 2015.
1.18	LEC-VCL - pole attachment agreement - FINAL SIGNED - 20150922	LEC owns, operates and maintains an electricity distribution system in Lesotho comprising roughly 1,720± km of existing electricity distribution lines and 18,000± distribution poles. Customer owns and operates a national mobile telecommunications network in Lesotho. Customer has requested authorization from LEC to attach Customer's own telecommunications lines and equipment to LEC's distribution poles, and LEC is willing to grant such authorization on and subject to the terms and conditions in this Agreement. LECC represents and supports LEC in connection with the provision of

		passive telecommunications infrastructure.
1.19	LEC Power Architecture - High Level	HT - High Tension Power Line. HV - High Voltage Power Line. MV - Medium Voltage Power Line LV - Low Voltage. Generation / Supply sites Muela Hydro Power Station Maputsoe S/S Mabote S/S ESKOM/ SAPP
1.20	20220509_SS_LEC Comm_GPon_02_cd	Huawei GPON quote from Mustek. 2022
1.21	SDA10-48100(EN)-3U440	SDA10-48100 Lithium-ion battery system for telecom SOTHO
1.22	S5800 Series - Switch	BDCOM S5800 Series is a new generation of full-10GE TOR switches, oriented for high-performance computing, data center and high-end campuses. The S5800 Series adopts our most advanced hardware architecture designs. S5800 Series (1U height) supports up to 2.56Tbps. switching capacity and 48 10GE ports + 2 40GE ports + 4 100G ports or 72 10GE ports.
1.23	Netping User Guide	UniPing server solution v3/SMS and UniPing server solution v3 are devices for monitoring the operation environment of equipment in a server room. A device helps to remotely track: temperature; humidity; access control to a room, to closets and

ID	Reference Document Title	Description
		servers; presence of smoke; water leakage; presence of 220V; presence of motion in a room; presence of shocks and vibrations
1.24	MX104 Datasheet - Core Router	Juniper Networks® SDN-ready MX104 3D Universal Edge Router is Juniper's response to a shift in metro network architecture where the aggregation layer is assuming responsibility for the service provider edge. The MX104 simplifies metro architectures by eliminating unnecessary layers, dramatically reducing CapEx and OpEx. Based on the architectural simplification and cost reduction, service providers and enterprises can adopt the new "Edge Anywhere" paradigm enabled by MX104.
1.25	GP3600 Series - OLT BDCOM	BDCOM GP3600 Series complies with ITU-T G.984/G.988 and meets requirements about GPON OLT in Network Access Technical Requirements. It fully supports CTC2.0, automatic discovery and cooperation with ONUs of different manufacturers. BDCOM GP3600 Series supports the Asymmetric uplink 1.25Gbps/ downlink 2.5Gbps PON transmission rate, efficient bandwidth usage and Ethernet services, helping carriers to provide reliable services to their users.
1.26	GP1702-1G - ONT BDCOM	BDCOM GP1702-1G is a new generation smart ONT for integrated multi-service broadband access networks. GP1702-1G, involving multiple models, supports common enterprise broadband access service, POE service and outdoor widetemperature.
1.27	DPS 850B-48-3 CellD 40 - Delta Rectifier	DPS 850B-48-3 19IN (CellD 40) belongs to Delta CellD product series. This high efficient and extreme compact system is an optimal solution for spacecritical applications. The system includes up to three high efficiency rectifiers, AC and DC connections, battery connection and either Delta PSC 3 or CSU 502 controller. In addition to advanced supervision, short depth and

		easy installation are the success factors of the system. Delta is known for quality and product reliability – in this solution that has been combined to optimize the total cost of ownership.
1.28	7280R3-Data-Sheet	The Arista 7280R3 Series of #xed systems, including the 7280R3 and the 7280R3K, are key components of the Arista 7000 Series portfolio of data center switches. The Arista 7280R3 Series are purpose built 25G, 100G and 400G systems built for the highest performance environments, and to meet the needs of the largest scale data centers and service providers They deliver scalable L2 and L3 resources and high density with advanced features for network monitoring, precision timing and network virtualization to deliver scalable and deterministic network performance while simplifying designs and reducing OpEx. The 7280R3 capabilities address the requirements for modern networking and rich multi-media content delivery

ID	Reference Document Title	Description
		requiring a lossless forwarding solution in a compact and energy e"cient form factor.
2	**Econet Telecoms Lesotho ETL**	
2.1	District Constituencies Communities Technology Coverage Matrix	2G, 3G, 4G, 5G, Copper DSL, PTP, FIBRE, FTTH, FTTB, Satellite technology coverage matrix for constituencies within the districts and communities within the districts
2.2	ETL Coverage 19122024	2G & 3G Coverage, LTE Coverage, and 5G Coverage
3	**Vodacom Lesotho VCL**	
3.1	District Constituencies Communities Technology Coverage Matrix	2G, 3G, 4G, 5G, Copper DSL, PTP, FIBRE, FTTH, FTTB, Satellite technology coverage matrix for constituencies within the districts and communities within the districts
3.2	FIBER FOOTPRINT PLAN - FEB 2024 V6 FIBER NETWORK PLAN	TX Network | CURRENT FIBER FOOTPRINT. TX Network | NEW BACKHAUL FIBER PLAN: Entire Network
3.3	Annexure 2_VDC Les_Fibre OSP ISP Specification_ver1.0	VODACOM LESOTHO Fibre OSP and ISP Construction High Level Specification
4	**Comnet, Leo, Jenny Lesotho**	
4.1	District Constituencies Communities Technology Coverage Matrix	2G, 3G, 4G, 5G, Copper DSL, PTP, FIBRE, FTTH, FTTB, Satellite technology coverage matrix for constituencies within the districts and communities within the districts. Comnet did not complete as Comnet do not have any FTTH or FTTB in any of the Districts except Maseru.
4.2	Company Profiles and Fibre Network Infrastructure Data	Received the Company Profiles and Fibre Network Infrastructure Data from Comnet, Leo and Jenny Lesotho
5	**Lesotho**	

	Communication Authority LCA	
5.1	APPLICATION REQUIREMENTS FOR NETWORK INFRASTRUCTURE(1)	A completed application form, and an application letter containing a brief motivation on a need for a required service - network infrastructure
5.2	APPLICATION REQUIREMENTS FOR NETWORK SERVICES	A completed application form, and an application letter containing a brief motivation on a need for a required service - network services
5.3	APPLICATION REQUIREMENTS FOR UNIFIED LICENCE	Unified Licence is a full-service licence that consists of fixed and mobile services. The licence authorizes the holder to provide all forms of electronic communications networks and services within Lesotho. The holder of Unified Licence qualifies for numbering and spectrum resources required for provision of telecommunication services. The Applicable fees are as follows:

ID	Reference Document Title	Description
		a) Non-refundable application fee of M220, 000.00. b) Initial Fee of M11, 000,000.00, payable when the application is successful but before the licence can be issued.
5.4	Communications Act 2012	The Communications Act, 2012 Part II (4) provides the general duties of the Authority as, but not limited to: 01. To efficiently manage universal access to communication services to ensure that communications services are available to Basotho in under served and unserved areas; 02. To facilitate infrastructure sharing by operators to foster universal access; 03. To enhance tariff regulation on operators classified as dominant licensees; 04. To introduce an element of self regulation in the broadcasting services; 05. To introduce competition regulation safeguards by dominant licensee (s); 06. To enhance consumer protection by ensuring that the Authority monitors quality of services introduce efficient methods and practices which would meet rendered; 07. To facilitate the introduction of a converged regulatory regime for the provision of communication service parameters; 08. To integrate the regulation of telecommunications, broadcasting and postal services to international standards.

5.5	Ministry of Communications, Science and Technology Lesotho Communications Policy 2008	The Government of Lesotho hereby adopts this Communications Policy, which establishes the framework for regulation of the telecommunications, broadcasting, and postal sectors. The Policy will provide the foundation for the adoption of new legislation, the Communications Act of 2008, which will replace the Lesotho Telecommunications Authority Act No. 5 2000, as amended (LTA Act), and the Post Office Act of 1979. The Policy builds on the foundation established by the Lesotho Telecommunications Policy of 1999 and the ICT Policy for Lesotho, adopted in 2005. The Policy recognises that the telecommunications, broadcasting, and postal sectors are at different stages of development and reform. For instance, while the 1999 Telecommunications Policy began the process of restructuring the Lesotho Telecommunications Corporation, the state broadcaster and post office have not been restructured. While the Policy draws on International best practice, it is designed to reflect Lesotho's unique conditions. Lesotho is a developing country with a small population and limited resources. Outside of Maseru, population density is low. The country's mountainous terrain, and the fact that it is surrounded on all sides by another country, present additional challenges. Recognizing these conditions, the Policy seeks to adopt a concrete and achievable regulatory framework for the sector.
5.6	DRAFT-LCA-ADMINISTRATIVE-RULES-2024_public-consultation-final	Citation and commencement: 1. These rules may be cited as Lesotho Communications Authority (Administrative) Rules, 2025 and shall come into operation on the date of publication in the Gazette. Interpretation 2. In these rules, words shall have meaning assigned in the Act and unless the context otherwise requires – "Act" means the Communications Act, 2012;

ID	Reference Document Title	Description
6	**Ministry of Information, Communications, Science, Technology, and Innovation (MICSTI)**	
6.1	Lesotho National Digital Transformation Strategy 2024-2030 MICSTI	Lesotho's National Digital Transformation Strategy: Agenda 2030
6.2	Broadband and Shared Infrastructure Policy & Implementation Plan_0.1	This Broadband and Shared Infrastructure Policy (hereinafter, the "Policy") has been developed as an output under the Project titled "The Development of Policy Frameworks (Broadband and Shared Infrastructure Policy; Data Management Policy; Artificial Intelligence Policy) for Digital Governance and Digital Enabling Environment in Lesotho" (hereinafter, the "Project") implemented by Norway Registers Development AS (NRD) for the United Nations Development Cooperation Programme (UNDP) and the Ministry of Information, Communications, Science, Technology and Innovation (MICSTI) of Lesotho.

11. APPENDIX 2 DEFINITIONS, ACRONYMS AND ABBREVIATIONS

APPENDIX 2 covers Definitions, Acronyms and Abbreviations

11.1 DEFINITIONS

Term	Definition
optical access network (OAN):	The OAN is the set of access links sharing the same network-side interfaces and supported by optical access transmission systems. The OAN may include a number of ODNs connected to the same OLT.
optical distribution network (ODN) [ITU-T G.989]:	A point-to-multipoint optical fibre infrastructure. A simple ODN is entirely passive and is represented by a single-rooted point-to-multipoint tree of optical fibres with splitters, combiners, filters, and possibly other passive optical components. A composite ODN consists of two or more passive segments interconnected by active devices, each of the segments being either an optical trunk line segment or an

	optical distribution segment. A Passive optical distribution segment is a simple ODN itself. Two ODNs with distinct roots can share a common subtree.
optical line termination (OLT):	A device that terminates the common (root) endpoint of an ODN, implements a PON protocol, such as that defined by [ITU-T G.984], and adapts PON PDUs for uplink communications over the provider service interface. The OLT provides management and maintenance functions for the subtended ODN and ONUs.
optical network terminal (ONT)	Terminates the optical network at customer premises. It includes an electro-optical converter. The ONT and customer premises equipment (CPE) may be integrated.
optical network unit (ONU):	A generic term denoting a device that terminates any one of the distributed (leaf) endpoints of an ODN, implements a PON protocol, and adapts PON PDUs to subscriber service interfaces. In some contexts, an ONU implies a multiple-subscriber device
customer premises equipment (CPE)	This is any active device, e.g., set-top-box, that provides the end-user with certain services (high-speed data, TV, telephony, etc.). The optical network terminal (ONT) and CPE may be integrated.
activation:	A set of distributed procedures executed by the optical line termination (OLT) and the optical network units (ONUs) that allows an inactive ONU to join or resume operations on the passive optical network (PON). The activation process includes three phases: parameter learning, serial number acquisition and ranging.

Term	Definition
bandwidth allocation:	An upstream transmission opportunity granted by the optical line termination (OLT) for the duration of the specified time interval to the specified traffic-bearing entity within an optical network unit (ONU).
C/M-plane:	A plane of the gigabit-capable passive optical network (G-PON) protocol suite that handles control and management information in a G-PON system. Data on optical network unit management and control interface (OMCI) is transferred through this plane
ONU management and control interface (OMCI) [ITU-T G.989]:	ONU management and control interface (OMCI) [ITU-T G.989]: An operation and management channel between the OLT and an ONU that is message-based and employs an extendable management information base.
dynamic bandwidth assignment (DBA):	A process by which the optical line termination (OLT) distributes the upstream passive optical network (PON) capacity between the traffic-bearing entities within optical network units (ONUs), based on the dynamic indication of their activity status and their configured traffic contracts.
gigabit-capable passive optical network (G-PON):	A variant of the passive optical network (PON) access technology supporting transmission rates in excess of 1 Gbit/s and based on the G.984-series of ITU-T Recommendations.
physical layer OAM (PLOAM):	A message-based operation and management channel between the optical line termination (OLT) and the optical network units (ONUs) that supports the PON TC-layer management functions, including ONU activation, ONU management and control channel (OMCC) establishment, encryption configuration, key management and alarm signalling
downstream:	Downstream is a traffic flow from OLT to ONT
upstream:	The upstream is a traffic flow from ONT to OLT.
access network (AN) [ITU-T G.902]:	An implementation comprising those entities (such as cable plant, transmission facilities, etc.) which provide the required transport bearer capabilities for the provision of telecommunications services between a service node interface (SNI) and each of the associated user-network interfaces (UNI).
user-network interface (UNI) [b-ITU-T I.112]:	The interface between the terminal equipment and a network termination at which interface the access protocols apply
service node interface (SNI) [ITU-T G.902]:	An interface which provides access to a service node.

10-gigabit-capable passive optical network (XG-PON):	A passive optical network (PON) system supporting nominal line rate of 10 Gbit/s in the downstream direction and 2.5 Gbit/s in the 8 Rec. ITU-T G.9807.1 (02/2023) upstream direction, and implementing the suite of protocols specified in the ITU-T G.987 series of Recommendations. NOTE – Both a 10/2.5G and 10/10G definition was originally envisioned, but only the 10/2.5G was defined, XG-PON is the realization of NG-PON1. The 10/10G option is defined under the XGS-PON recommendations.
optical path loss:	The reduction in the optical power of light having traversed the optical distribution network (ODN) expressed as a ratio in decibel units. NOTE – This loss may be caused by the fibre, connectors, splices, splitters, wavelength couplers, attenuators, and other passive optical components.
optical ground wire (OPGW):	Metallic optical cable that has the dual performance functions of a ground wire with telecommunication capabilities. NOTE – The fibres of an OPGW are usually embedded loosely in protective buffer tubes. To fulfil mechanical and electrical requirements; an armouring of one or more layers with aluminium, aluminium alloy, and aluminium clad steel, galvanized steel or a mixture of them is helically stranded.

Term	Definition
demilitarized zone DMZ	Demilitarized Zones (DMZs) [Adapted from NIST SP 800-82 Rev.2] Perimeter network segment that is logically located between internal and external networks. Its purpose is to enforce the internal network's Information Assurance Policy for external information exchange and shield the internal networks from outside attacks.
Ethernet ring:	A collection of Ethernet ring nodes forming a closed physical loop whereby each Ethernet ring node is connected to two adjacent Ethernet ring nodes via a duplex communications facility.
Ethernet ring node:	A network element that implements at least the following functionality: a) One Ethernet connection function (ETH_C) with a dedicated Ethernet flow forwarding function (ETH_FF) for forwarding ring automatic protection switching (R- APS) control traffic. b) Two ring ports, including ETHDi/ETH adaptation function at the ring maintenance entity group level (MEL). c) Ethernet ring protection (ERP) control process controlling the blocking and unblocking of traffic over the ring ports.
energy	The capacity for doing work.
energy efficiency rating:	energy efficiency rating: Functional unit divided by the energy used. NOTE – For more details on energy efficiency for telecommunication equipment, see [b-ITU-T L.1315].
Fixed Wireless Access FWA	Fixed wireless access, or FWA, is a type of 5G or 4G LTE wireless technology that enables fixed broadband access using radio frequencies instead of cables. FWA can be used to connect homes and businesses to the internet.
Point to Point Radio PTP	Radio PTP technology refers to Radio Point-to-Point technology. You might we wondering that what actually radio PTP is? The answer is radio PTP is nothing but a part of telecommunication and networking.
Point to Multipoint Radio PMTP	The only difference between PTMP (Point to Multipoint) form of communications and PTP form of communication is, in case of PTMP, multiple receivers can receive a signal from the signal transistor, and in case of radio PTP, there is a communication between single pair of transmitter and receiver.
Point to Point Wireless	Point to point wireless is the ideal alternative for business communication between two buildings or sites where wired connection is either impossible, costly or impractical. Point to point Ethernet bridge link facilitates a wireless data connection between two or more networks or buildings across distances up to 100 Kilometres

	and at speeds up to 1Gbps.
Last Mile	The last mile is the final leg of the network that connects the local points of presence to individual homes, businesses, or end-user devices. This is often considered the most critical and challenging part of the network due to the varying distances, diverse user needs, and potential obstacles that can affect data delivery quality. The goal of the last mile is to provide reliable, high-speed connectivity directly to the end-users.
Access	An access network, also referred to as the last mile, is the final link in the network chain that connects end-users to the core and regional networks. It offers a direct connection to the network operators' point of presence (PoP). Its primary function is to provide internet or network access to individual users or devices, such as computers, phones and Internet of Things (IoT) devices. This type of network often uses a different transmission technology and infrastructure to the regional or the core networks. Access networks can use a variety of technologies to provide connectivity, with both wired and wireless connections forming part of the infrastructure. Wired connections include cable modems, DSL and fibre-optic cables, while wireless connections include WiFi, cellular networks, microwave or satellite. The choice of technology used depends on factors such as location, bandwidth requirements and the number of users
Regional (Districts) Networks	A regional network is one that connects different geographical regions, such as cities or provinces, disticts to each other. These networks are designed to facilitate communication and data transfer between different areas and are typically used by

Term	Definition
	telecommunications companies to provide services to end-users. Regional networks also provide the infrastructure for businesses to communicate and collaborate from different locations. The regional networks act as a bridge between core networks and access networks. From a technological perspective, these do not differ much from the core network. However, they do not provide any network interconnection between different network operators; regional networks are just connection lines. One of the most important features of regional networks is their scalability and flexibility. As demand for data increases, regional networks can be expanded to accommodate more users and devices. What's more, regional networks can be customised to meet the specific requirements of enterprises and businesses, such as providing dedicated connections between multiple geographical locations. This scalability and flexibility make regional networks an important component of modern network architecture.
Core Networks	Core networks connect continents, countries and major national network nodes. These are high-speed, high-capacity networks that serve as the core infrastructure for businesses. The primary function of a core network is to facilitate data transmission between different regional networks and access networks. Core networks provide the data exchange between the network operators (network interconnection), ensuring that every host is reachable. The infrastructure consists of routers, switches and other networking equipment that helps direct data to its destination. Core networks are responsible for routing data across vast distances, so they commonly use high-speed fibre-optic cables. This ensures speeds of several gigabits per second (Gbps), as well as a low latency connection with the smallest possible delay. One of the most significant features of core networks is their high level of security and reliability. They are designed to be redundant, which means that if one connection fails, data traffic can be rerouted through another connection. In addition, core networks use advanced security measures, such as firewalls, to protect against cyber attacks and data breaches.
functional unit (based on [ISO 14040]):	A performance representation of the system under analysis.
idle mode:	The state of a network element not handling any user data traffic, but ready to do so. NOTE – It is not zero traffic, as service and protocol supporting traffic are present.

low power (sleep) mode:	For small networking equipment, this means a state that happens after the device detects no user activity for a certain period of time and reduces energy consumption. NOTE – For this state, no user-facing local area network (LAN) ports are connected; the Wi-Fi is active but no clients are connected. The wide area network (WAN) port may be inactive. The device will reactivate on detecting a connection from a user port or device.
non-drop rate (NDR) throughput:	observed system throughput at which no packet drops are recorded.
small networking device:	A networking device with fixed hardware configuration, designed for home/domestic or small office use, with fewer than 12 ports. NOTE – This device can have wireless functionality implemented. Wireless functionality is not considered a port.
system throughput:	The sum of throughput on all system ports in the egress direction (bit/s). Example: Maximum throughput for 1 Gb Ethernet is 1 Gbit/s.
useful output:	The useful work carried out by the equipment, e.g., delivered bits or output energy from wireless equipment.

11.2 ACRONYMS AND ABBREVIATIONS

Abbreviations and acronyms
AC Alternating Current
ADSL2+ Asymmetric Digital Subscriber Line 2 Transceiver Extended Bandwidth
AMP Amplifier

Abbreviations and acronyms
AP Access Point
APS Automatic Protection Switching
ATM Asynchronous Transfer Mode
BEP Building Entry Point
BPR Blocked Port Reference
BSC Base Station Controller
BTS Base Transceiver Station
CCM Continuity Check Message
CDMA Code Division Multiple Access
CI Characteristic Information
CII Common Interworking Indicators
CO Central Office
CO-PS Connection-Oriented Packet Switched
CoS Class of Service
CP Connection Point
CPE Customer Premises Equipment
CPU Central Processing Unit
C-RAN Centralized Radio Access Network
CW Control Word
CWDM Coarse Wavelength Division Multiplexing
DC Direct Current
DMUX Demultiplexer
DSL Digital Subscriber Line
DSLAM Digital Subscriber Line Access Multiplexer
DWDM Dense Wavelength Division Multiplexing
EDGE Enhanced Data for GSM Evolution
EER Energy Efficiency Rating
E-LAN Ethernet LAN
EPL Ethernet Private Line
ERP Ethernet Ring Protection
ETH Ethernet layer network
ETH Ethernet MAC layer network
ETHDi Ethernet MAC layer network Diagnostic function within MIP

ETY Ethernet physical layer network
EUT Equipment Under Test
EVPL Ethernet Virtual Private Line
FCAPS Fault, Configuration, Accounting, Performance, Security
FD Floor Distributor
FDB Fibre Distribution Box
FDB Filtering Database
FF Flow Forwarding
FTTH Fibre To The Home
FTTR Fibre To The Room
FTTx Fibre to the x (where "x" indicates the final location on the user side of any one of a variety of optical fibre architectures, e.g., FTTH, FTTB, FTTC)
GEPON Gigabit Ethernet Passive Optical Network
GFP Generic Framing Procedure
GPON Gigabit Passive Optical Network
GSM Global System for Mobile Communications

Abbreviations and acronyms
HSPA High Speed Packet Access
ID Identification
IF Interface
IMIX Internet MIX Traffic
IP Internet Protocol
ISP Internet Service Provider
KPI Key Performance Indicator
LAN Local Area Network
LC Link Connection
LCP Local Convergence Point
L-LSP Label-Only-Inferred PSC LSP
LSE Label Stack Entry
LSP Label Switched Path
LTE Long Term Evolution
MAC Media Access Control
MAC Media Access Control
MCC Management Communication Channel
MDU Multi-Dwelling Unit
ME Maintenance Entity
MEG Maintenance Entity Group
MEL Maintenance Entity group Level
MEP Maintenance entity group End Point
MI Management Information
MIP Maintenance entity group Intermediate Point
MPLS Multiprotocol Label Switching
MPLS Multiprotocol Label Switching
MPLS-TP Multi-Protocol Label Switching – Transport Profile
MS Manual Switch
MSAN Multiservice Access Node
MUX Multiplexer
NAP Network Access Point
NC Network Connection
NDR Non-Drop Rate

NE Network Element
NG-PON2 Next Generation Passive Optical Network 2
NID Network Interface Device
NMS Network Management System
NNI Network-Network Interface
NR New Radio
NSP Native Service Processing
OADM Optical Add-Drop Multiplexer
OAM Operation, Administration and Maintenance
OC Optical Carrier
ODF Optical Distribution Frame
ODU Optical channel Data Unit
OLT Optical Line Terminal
OLT Optical Line Termination
OMCC Optical Network Unit Management and Control Channel
OMCI Optical Network Unit Management and Control Interface

Abbreviations and acronyms
ONT Optical Network Terminal
ONT Optical Network Termination
ONU Optical Network Unit
OPGW Optical Ground Wire
OPM Optical Power Meter
OSI Open Systems Interconnection
OSP Outside Plant
OSS Operations Support System
OTDR Optical Time Domain Reflectometer
OTH Optical Transport Hierarchy
OTN Optical Transport Network
OTO Optical Telecommunication Outlet
OTU Optical Transport Unit
OXC Optical Cross Connect
p2mp point-to-multipoint
p2p point-to-point
P2P Point-to-Point
PDU Protocol Data Unit
PF Power Factor
PON Passive Optical Network
PONIF Passive Optical Network Interface
POTS Plain Old Telephone Service
PSU Power Supply Unit
PW Pseudowire
R-APS Ring APS
RB RPL Blocked
RBS Radio Base Station
RF Radio Frequency
RFU Radio Frequency Unit
RNC Radio Network Controller
ROADM Reconfigurable Optical Add-Drop Multiplexer
RPL Ring Protection Link
RTS Rated Tensile Strength

SCC Signalling Communication Channel
SDH Synchronous Digital Hierarchy
SDH VC Synchronous Digital Hierarchy Virtual Circuit
SF Signal Fail
SN Subnetwork
SNC Subnetwork Connection
SNC/S SNCP with Sublayer monitoring
SNCP Subnetwork Connection Protection
SNI Service Node Interface
SONET Synchronous Optical Network
STM Synchronous Transport Module
STP Spanning Tree Protocol
SW Switch
TC Traffic Class
TCM Tandem Connection Monitoring
TCP Termination Connection Point

Abbreviations and acronyms
TDM Time Division Multiplexing
TEER Telecommunications Energy Efficiency Ratio
TLV Type, Length and Value
Tx Transmit
UE User Equipment
UMTS Universal Mobile Telecommunication System
UNI User Network Interface
UNI User Network Interface
UUT Unit Under Test
VC Virtual Container
VDSL2 Very high bit rate Digital Subscriber Line
VID VLAN Identifier
VLAN Virtual Local Area Network
VPLS Virtual Private Local Area Network Service
WAN Wide Area Network
WCDMA Wideband Code Division Multiple Access
WDM Wavelength Division Multiplexing

12. APPENDIX 3: INTERNATIONAL STANDARDS AND BEST PRACTICES COMPLIANCE

APPENDIX 3 is a list and description of International Standards and Best Practices which is recommended that the LEMOFI technical team read and study and share reports on compliance capabilities.

International Standards and Best Practises Compliance	Description

Supplement 46 to ITU-T G-series Recommendations G- PON interoperability test plan between optical line terminations and optical network units https://www.itu.int/en/publications/ITU-T/Pages/default.aspx https://www.itu.int/rec/T-REC-G/e https://www.itu.int/rec/T-REC-G.Sup46/en https://www.itu.int/rec/T-REC-G.Sup46-200905-I/en	Supplement 46 to ITU-T G-series Recommendations defines a test plan whose purpose is to verify interoperability between a G-PON OLT and ONU. Emphasis is placed on test cases that address the G- PON physical layer (ITU-T G.984.2), the TC layer (ITU- T G.984.3) and low-level components of the management layer (ITU-T G.984.4). Service layer test cases are out of scope for this supplement. Interoperability testing is conducted by or on behalf of four interests: the OLT vendor, the ONU vendor, one or more network operators who are potential customers, and possibly a third-party testing lab.
Recommendation ITU-T G.984.1 Gigabit-capable passive optical networks (GPON): General characteristics https://www.itu.int/rec/T-REC-G.984.1-200803-I/en	This Recommendation addresses the general characteristics of gigabit-capable passive optical network (GPON) systems in order to guide and motivate the physical layer and the transmission convergence layer specifications. The general characteristics include examples of services, user-network interfaces (UNIs) and service node interfaces (SNIs) that are requested by network operators. Also, this Recommendation shows the principle deployment configuration. As much as possible, this Recommendation maintains characteristics from [ITU-T G.982] and ITU-T G.983.x- series Recommendations. This is to promote backward-compatibility with existing optical

International Standards and Best Practises Compliance	Description
	distribution networks (ODNs) that complies with those Recommendations. PON systems are characterized, in general, by an optical line termination (OLT) system and an optical network unit (ONU) or optical network termination (ONT) with a passive optical distribution network (ODN) interconnecting them. There is, in general, a one-to-many relationship between the OLT and the ONU/ONTs, respectively.
Recommendation ITU-T G.984.2 Gigabit-capable passive optical networks (GPON): Physical media dependent (PMD) layer specification https://www.itu.int/rec/T-REC-G.984.2-201908-I/en	Recommendation ITU-T G.984.2 describes a flexible optical fibre access network capable of supporting the bandwidth requirements of business and residential services, and covers systems with nominal line rates of 1 244.160 Mbit/s and 2 488.320 Mbit/s in the downstream direction and 155.520 Mbit/s, 622.080 Mbit/s, 1 244.160 Mbit/s and 2 488.320 Mbit/s in the upstream direction. Both symmetrical and asymmetrical (upstream/downstream) gigabit-capable passive optical network (GPON) systems are described. This Recommendation proposes the physical layer requirements and specifications for the physical media dependent (PMD) layer. The transmission convergence (TC) layer and ranging protocol for GPON systems are described in Recommendation ITU-T G.984.3. This Recommendation describes a system that represents an evolutionary development from the system described in ITU-T G.983.1. To the greatest extent possible, this Recommendation maintains the requirements of ITU-T G.983.1 to ensure maximal continuity with existing systems and optical fibre infrastructure. In addition, it describes

	several enhanced optical budgets (B+, C+, and D) to extend that capability. The necessary parameters are defined to support optical layer supervision.
Recommendation ITU-T G.984.3 Gigabit-capable passive optical networks (G-PON): Transmission convergence layer specification https://www.itu.int/rec/T-REC-G.984.3-201401-I/en	Recommendation ITU-T G.984.3 describes the transmission convergence layer for gigabit-capable passive optical networks – a family of flexible access networks capable of providing a range of broadband and narrow-band services, operating at the rates of 2.48832 Gbit/s downstream and 1.24416 or 2.48832 Gbit/s upstream. This Recommendation includes the specifications of the following: • gigabit PON transmission convergence (GTC) layer framing; • upstream time division multiple access mechanism; • physical layer operation, administration and maintenance (OAM) messaging channel; • principles and signalling mechanism of the upstream dynamic bandwidth assignment; • optical network unit (ONU) activation method;

	• forward error correction; • security.

International Standards and Best Practises Compliance	Description
	This Recommendation forms an integral part of the G.984-series of ITU-T Recommendations that, together, specify a single coherent set of access transmission systems. Amendment 1 provides necessary extensions to support Class D ODN.
Recommendation ITU-T G.984.4 Gigabit-capable Passive Optical Networks (G-PON): ONT management and control interface specification https://www.itu.int/rec/T-REC-G.984.4-200802-I/en	Recommendation ITU-T G.984.4 provides the optical network termination (ONT) management and control interface (OMCI) specification for gigabit-capable passive optical network (G-PON) systems as defined in Recommendations ITU-T G.984.2 and G.984.3. Firstly, it specifies the managed entities of a protocol-independent management information base (MIB) that models the exchange of information between the optical line termination (OLT) and the optical network termination (ONT). In addition, it covers the ONT management and control channel, protocol and detailed messages. This revised version incorporates the material from Amendment 1 (2005), Amendment 2 (2006), and Amendment 3 (2006). In addition to the purely editorial collection work, this revision endeavours to remove all references to the optional ATM transport capabilities of G-PON, since all modern systems do not support it.

Recommendation ITU-T G.9807.1 10-Gigabit-capable symmetric passive optical network (XGS-PON) https://www.itu.int/rec/T-REC-G.9807.1/en	Recommendation ITU-T G.9807.1 describes a 10-Gigabit-capable symmetric passive optical network (XGS-PON) system in an optical access network for residential, business, mobile backhaul and other applications. This system operates over a point-to- multipoint optical access infrastructure at the nominal data rate of 10 Gbit/s both in the downstream and the upstream directions. This Recommendation contains the common definitions, acronyms, abbreviations, conventions, general requirements, physical media dependent layer requirements, and transmission convergence layer requirements of the XGS-PON system. This revision adds an annex specifying out of band noise limits on XGS-PON optical network units (ONUs) to reduce the impact on other systems coexisting on the same optical distribution network (ODN).
Recommendation ITU-T L.312: Optical fibre cable maintenance support, monitoring and testing system for optical fibre cable networks carrying high total optical power https://www.itu.int/rec/T-REC-L.312/en	This Recommendation describes the functional requirements of optical fibre cable maintenance systems for optical fibre cables carrying high total optical power. It applies to test equipment, optical switches for selecting fibre under test, test access modules for connecting test equipment to the communication line, testing optical fibre cords and optical connecting devices that are part of the maintenance system. It also considers safety procedures and guidelines for the maintenance of

International Standards and Best Practises Compliance	Description
	outside optical fibre plants carrying high total optical power
Recommendation ITU-T L.250 Topologies for optical access network https://www.itu.int/rec/T-REC-L.250/en	This Recommendation defines optical single-mode fibre access network architectures and provides information on planning new deployments and upgrading existing networks. Moreover, this Recommendation considers optical transmission performance and optical safety which depends on the architecture design of an optical access network. This Recommendation covers: – definitions and general features of fibre level and cable level architectures that have been used to meet different system objectives; – convergence architectures for upgrading the performance of the optical access network; – physical components within the network architectures; – optical safety requirements; – installation issues.
Recommendation ITU-T L.151 Installation of optical ground wire cable https://www.itu.int/rec/T-REC-L.151/en	Recommendation ITU-T L.151 refers to the installation of optical fibre ground wire cable. It deals with the factors that should be considered in determining the characteristics of this type of cable, the apparatus that should be used, the precautions that should be taken in handling the reels, and the method that should be used to string the cable and joint it.

Recommendation ITU-T L.26 Optical fibre cables for aerial application https://www.itu.int/rec/T-REC-L.26/en	Recommendation ITU-T L.26 describes characteristics, construction and test methods of optical fibre cables for aerial application (including lashed cables), but does not apply to optical ground wire (OPGW) cables or metal armour self-supporting (MASS) cables. First, the characteristics affecting the satisfactory performance of optical fibre cables are described. Then, the methods of examining whether the cables have these required characteristics are described. The conditions required may differ according to the installation environment. Therefore, detailed conditions of experiments need to be agreed upon between a user and a supplier on the basis of the environment where the cable is used.

International Standards and Best Practises Compliance	Description
Telemanagement Forum TMF The OSS of the Future Please sign up as a TMF guest member https://www.tmforum.org/resources/whitepapers/oss- of-the-future/	As the multi-trillion dollar communications industry looks forward to the fifth generation of mobile technology, seizing the range of growth opportunities attached to 5G demands more than just technology transformation – it demands a "fifth generation" business. This requires a holistic business transformation, encompassing new approaches to strategy and innovation; customer centricity; digital business operations and agility; and the ability to engage in new, multi-sided and platform-based business models. IT systems, typically referred to as Operations Support Systems (OSS/BSS) hold the key to monetizing these new opportunities at scale, but transformation of these systems is not easy – they run the existing business, and often represent long-term capital investments. As more service providers grapple with the challenges of overhauling their OSS/BSS systems, it is clear that a new and radical approach is needed if CTIOs are to meet their Total Cost of Ownership (TCO) and agility goals. A new generation of systems is needed, embracing state of the art IT technology such as Service Oriented Architectures (SOA) and microservice based approaches, open source, virtualization and cloud architectures.
Recommendation ITU-T M.3348 Requirements of the NMS-EMS management interface for NGN service platforms https://www.itu.int/rec/T-REC-M.3348/en	Recommendation ITU-T M.3348 describes the requirements of the NMS-EMS management interface for NGN service platforms. The requirements are provided using the TMN interface specification methodology described in

	Recommendation ITU-T M.3020.
Supplement 13 to ITU-T X-series Recommendations ITU-T X.1051 – Supplement on information security management users' guide for Recommendation ITU-T X.1051 X.Sup13 : ITU-T X.1051 - Supplement on information security management users' guide for Recommendation ITU-T X.1051	Supplement 13 to ITU-T X-series Recommendations provides interpretable guidance for users of Recommendation ITU-T X.1051 with additional explanations and implementation guidance for each clause and control specified in Recommendation ITU- T X.1051. This Supplement is intended to assist telecommunications organizations in the implementation of information security controls based on Recommendation ITU-T X.1051.
National Institute of Standards and Technology NIST Special Publication 1 NIST SP 800-82r3 ipd Guide to Operational Technology (OT) 3 Security https://csrc.nist.gov/pubs/sp/800/82/r3/final	This document provides guidance for establishing secure operational technology (OT) while addressing OT's unique performance, reliability, and safety requirements. OT encompasses a broad range of programmable systems and devices that interact with the physical environment (or manage devices that interact with the physical environment). These systems and devices detect or cause a direct change through monitoring and/or control of devices, processes, and events. Examples include industrial

International Standards and Best Practises Compliance	Description
	control systems (ICS), building automation systems, transportation systems, physical access control systems, physical environment monitoring systems, and physical environment measurement systems. The document provides an overview of OT and typical system topologies, identifies typical threats and vulnerabilities for these systems, and recommends security countermeasures to mitigate the associated risks.
https://www.iso.org/ics/35.100/x/	35.100.01 Open systems interconnection in general 35.100.05 Multilayer applications Including International Standardized Profiles 35.100.10 Physical layer 35.100.20 Data link layer 35.100.30 Network layer 35.100.40 Transport layer 35.100.50 Session layer 35.100.60 Presentation layer 35.100.70 Application layer
Recommendation ITU-T G.8032/Y.1344 Ethernet ring protection switching https://www.itu.int/rec/T-REC-Y.1344/en	Recommendation ITU-T G.8032/Y.1344 defines the automatic protection switching (APS) protocol and protection switching mechanisms for Ethernet layer network (ETH) ring topologies. Included are details pertaining to Ethernet ring protection characteristics, architectures and the ring APS (R-APS) protocol. This revision updates references, removes items formerly considered for further study and incorporates terms formerly defined in Recommendation ITU-T G.8001/Y.1354 (2016).

Recommendation ITU-T G.8110.1/Y.1370.1 Architecture of the Multi-Protocol Label Switching transport profile layer network https://www.itu.int/rec/T-REC-Y.1370/en	Recommendation ITU-T G.8110.1/Y.1370.1 provides functional components, based on Recommendation ITU-T G.805, that allow the Multi-Protocol Label Switching Transport Profile (MPLS-TP) to be modelled in a way that is consistent with the description of other transport technologies defined by the ITU-T, (e.g., the synchronous digital hierarchy (SDH) and the optical transport network (OTN)), to simplify integration with other transport technologies. This Recommendation provides a representation of the MPLS-TP technology using the methodologies that have been used for other transport technologies (e.g., SDH, OTN and Ethernet). NOTE – This ITU-T Recommendation is intended to be aligned with the IETF MPLS RFCs normatively referenced by this Recommendation. In this Recommendation the architecture of MPLS-TP forwarding, operation, administration and maintenance (OAM), and network survivability is modelled from a network- level viewpoint. The description of the control plane and management plane aspects of MPLS-TP is outside the scope of this Recommendation. The functional components described in this

International Standards and Best Practises Compliance	Description
	Recommendation also support the architecture for point-to-multipoint (p2mp) MPLS-TP label switched paths (LSPs), in compliance with IETF RFC 5331 and IETF RFC 5332.
Recommendation ITU-T L.1310 Energy efficiency metrics and measurement methods for telecommunication equipment https://www.itu.int/rec/T-REC-L.1310/en	Recommendation ITU-T L.1310 specifies the energy efficiency metrics test procedures, methodologies and measurement profiles required to assess the energy efficiency of telecommunication equipment. Energy efficiency metrics and measurement methods are defined for telecommunication network equipment and small networking equipment. These metrics allow for the comparison of equipment within the same class, i.e., equipment using the same technologies.

Quality of service regulation manual	In this digital, globally connected world where all functions and aspects of life are being transferred to communication networks and services, citizens everywhere rely on ICTs to conduct their everyday socio-economic activities. Telecommunication networks are interconnected on a national, regional, and global basis, and the quality of telecommunication services applied in one network or one country influences the end-to-end quality of that service, so the quality cannot be considered only at national or regional level, but also needs to be considered globally. Ensuring quality of service (QoS) in this ever-changing environment is increasingly critical. A harmonized and common approach to regulating QoS would enable greater quality prospects irrespective of the locations of the consumer and service provider. Southern African Development Community countries: Quality of service regulation and enforcement Refer to section 10.7 as follows: 10.7.1 Botswana. 10.7.2 Malawi. 10.7.3 Mauritius. 10.7.4 Mozambique. 10.7.5 Namibia. 10.7.6 South Africa. 10.7.7 Swaziland. 10.7.8 Zimbabwe. 10.7.9 Southern African Development Community countries recommendations on quality-of-service regulation

International Standards and Best Practises Compliance	Description
ITU-T Study Group 12 - Performance, QoS and QoE - https://www.itu.int/en/ITU-T/about/groups/Pages/sg12.aspx	ITU-T Study Group 12 is the expert group responsible for the development of international standards (ITU- T Recommendations) on performance, quality of service (QoS) and quality of experience (QoE). This work spans the full spectrum of terminals, networks and services, ranging from speech over fixed circuit- switched networks to multimedia applications over mobile and packet-based networks. The evolution from circuit-switched to packet-based networks has introduced new challenges to the assessment of QoS/QoE, in large part stemming from the emergence of new multimedia services and applications. SG12 standards thus work to achieve the end-to-end performance levels required to support adequate QoS in an IP environment characterized by a wide array of user applications.

END OF APPENDIXES

ANNEXURE 11

TERMS OF REFERENCE

TERMS OF REFERENCE …

[ICT Operations Division (PITD.2)

Industrial and Trade Department (PITD)
CCIA Abidjan Plateau

REQUEST FOR EXPRESSIONS OF INTEREST (**INDIVIDUAL CONSULTANTS**)

1. Lead Telecommunications Infrastructure Consultant
2. Environmental and Social Safeguards Specialist

COUNTRY: Kingdom of Lesotho

Feasibility Study Lesotho Metropolitan Fiber Distribution Network

Background: The Government of the Kingdom of Lesotho is committed to advancing its telecommunications sector by fostering innovation and expanding affordable broadband access for all citizens. With a focus on enhancing competition and driving digital inclusion, the Government aims to make broadband services more accessible and affordable for both urban and suburban populations. To achieve this, the Government is working to extend fiber networks by leveraging existing infrastructure and developing new fiber networks to support wider connectivity, ultimately promoting economic growth and social development.

Overview: In recognition of the immense potential for growth and development in Lesotho's digital landscape, the African Development Bank (AfDB), the premier pan-African development institution, is working closely with the Government of Lesotho through its ICT Operations division (PITD.2). The Bank has been at the forefront of Africa's digital transformation, partnering with governments and stakeholders to enhance connectivity, build resilient digital infrastructures, and promote inclusive access to digital services across the continent.

As part of this collaborative effort, the AfDB is supporting the Government of the Kingdom of Lesotho in conducting a feasibility study for the **Lesotho Metropolitan Fiber Infrastructure Expansion Project (LEMOFI)**. This Feasibility Study, funded by the KOAFEC Trust Fund, will examine the technical, financial, regulatory, and environmental dimensions of deploying a comprehensive fiber distribution network in key urban and suburban areas in Lesotho.

Request for Expression of Interest: The African Development Bank (AfDB) invites qualified Individual Consultants to express their interest in one of two roles for the LEMOFI project:

1. **Lead Telecommunications Infrastructure Consultant**
2. **Environmental and Social Safeguards Specialist**

These consultants will collaborate closely to ensure a comprehensive analysis of the project, covering all aspects of the infrastructure expansion while ensuring environmental and social safeguards are fully addressed.

Duration and Commencement: The assignment is expected to last **two (2) months**, with a tentative start date of **November 26, 2024**.

Remuneration: The proposed remuneration will be competitive and aligned with the African Development Bank's established remuneration scale for short-term consultants. It will be based on the candidate's financial proposal, requisite qualifications, and experience, and finalized through contract negotiations.

Eligibility and Selection Process: The eligibility criteria, the establishment of a shortlist, and the selection procedure will be in conformity with the AfDB's **Rules and Procedures for the Acquisition of Consulting Services** funded by the Administrative or Capital Expenditure Budget. Please note that expressing interest does not imply any obligation on the part of the AfDB to include the consultant in the shortlist.

Submission Requirements: Interested consultants are invited to submit the following:

- *A detailed CV outlining relevant qualifications and experience.*
- *References to similar assignments, demonstrating the ability to perform the assignment.*
- *Evidence of experience with international donor agencies and similar consulting projects.*

The Terms of Reference (ToR), which outline the detailed scope of work and specific services required from the consultants, are attached in the annex for further reference.

Evaluation Criteria: The selection of consultants will be based on the following criteria:

- *General qualifications and suitability for the task:* *30%*
- *Experience with similar assignments as outlined in the ToR:* *40%*
- *Experience with international donor agencies:* *15%*
- *Knowledge of the region (Lesotho)* *10%*
- *Language proficiency:* 5%

Only candidates scoring 70 points or more will be considered for the assignment. Candidates will be ranked, and the highest-ranked candidate will be selected for the assignment, provided the fee rate is within the project budget.

Submission : All expressions of interest, including the required documentation, must be submitted by **11th October 2024 at 9 PM**.UTC.

Submissions should include the subject line: *"REoI – Lesotho Metropolitan Fiber Infrastructure Expansion – [Role Title]".*

emailed to Mr. Thierno M. DIARRA, IT Solutions Architect, Email: t.diarra@afdb.org , CC: n.williams@afdb.org :

Annex 1 : Terms of Reference : FEASIBILITY STUDY: NATIONAL FIBER DISTRIBUTION NETWORK IN LESOTHO'S MAJOR TOWNS AND CITIES

Background

The Government of the Kingdom of Lesotho is committed to fostering a competitive telecommunications sector and expanding broadband access across the nation. However, the sector is currently dominated by Mobile Network Operators (MNOs), and the high costs associated with building new infrastructure have hindered smaller entrants from establishing a foothold. This lack of competition has led to high data and broadband prices, preventing many citizens from accessing affordable broadband and participating fully in the 4th Industrial Revolution.

To address these gaps, this project aims to support the development of a comprehensive fibre distribution networks within towns and metropolitan areas, enhancing access and driving competition. The project's design must also consider the existing fibre coverage from entities like Econet and Vodacom, in addition to the Lesotho Electricity Company's (LEC) fibre network which currently primarily follows long-distance transmission lines.

Objectives

The primary objectives of this consultancy are:

- **Technical Feasibility:** To review existing designs and specifications for the national fibre network, focusing on infrastructure that expands coverage into urban and suburban areas, with the objective of proposing an optimized network design and architecture, including technology options and infrastructure requirements.

- **The Regulatory and Legal Framework analysis:** identify relevant telecommunications laws, regulations, and compliance requirements impacting the project, and to assess the need for permits, licenses, and adherence to environmental and safety standards and their associated impacts on project cost and timeline, proposing strategies to navigate challenges and recommending modifications to facilitate successful implementation.

- **Market Analysis:** To prepare a comprehensive market analysis that evaluates demand, competitive dynamics, and business opportunities for Mobile Network Operators, Network Service Providers, and Resale Internet Service Providers.

- **Financial Analysis:** to comprehensively evaluate the project's financial viability, providing the project estimated Initial costs for network design, equipment, and infrastructure, civil Works, Operational Expenditures, Revenue Projections, financial and economic returns, risks and sensitivity analysis.

- **Risk Assessment:** analyse how changes in key assumptions, could impact technical, financial and operational outcomes. Also including different scenarios—best-case, worst-case, and most likely—to understand potential financial performance under various conditions. Additionally, contingency planning for identified risks and develop strategies to mitigate them.

- **Environmental and Social Impact Assessment:** To conduct an Environmental and Social Impact Assessment (ESIA) to evaluate the project's potential impact on Lesotho's urban environments and communities and to propose mitigation strategies, compliance measures, and monitoring plans to ensure ongoing environmental and social sustainability throughout the project's lifecycle

Scope of Work

1. **Technical Feasibility Review - Network Design and Architecture:**

    a. Assess the current designs and technical specifications for the network, including existing LEC and LECC infrastructure, that of other market players such as VODACOM, ECONET and other projects in progress.

    b. Identify gaps, strengths, and areas for improvement to extend coverage into towns and residential areas.

    c. Engage with the required stakeholders to optimize the use of existing infrastructure, ensuring network maintainability and minimizing the frequency and impact of outages during project implementation and maintenance activities.

    d. Assess existing project plans and make recommendations on rollout plan, considering phasing and prioritization for different urban and suburban areas based on market demand and infrastructure availability

    e. Make recommendations for updates or revisions based on technological advancements, best practices, and cost-effectiveness.

    f. Work with the identified stakeholders to develop preliminary draft tender documents.

2. **Regulatory and Legal Framework Analysis:**

    a. Identify all relevant telecommunications laws, regulations, and compliance requirements impacting the project, including environmental and safety standards at the national and local levels.

    b. Assess the need for permits, licenses, and approvals at each stage of the project (planning, construction, operation) from relevant authorities. Estimate the associated costs and timelines for obtaining these approvals.

    c. Analyse the potential impact of regulatory requirements on project cost and timeline. Develop strategies to navigate potential challenges and recommend modifications to existing regulations, if necessary, to facilitate smooth project implementation. This could involve stakeholder engagement with regulatory bodies to advocate for streamlined procedures.

    d. Develop a compliance plan outlining the specific actions and procedures required to ensure adherence to all regulatory requirements throughout the project lifecycle.

3. **Market Analysis:**

a. Conduct a comprehensive market study, analysing demand for fibre network services across Lesotho.

b. Conduct surveys and interviews with businesses, government entities, and residential users to understand their current and projected needs for fibre network services.

c. Explore the use of alternative technologies such as 5G to address residential demand.

d. Segment the demand into various categories, such as residential, commercial, industrial, and institutional users, to identify specific needs and trends in each segment.

e. Analyse demographic and economic trends to project future demand for fibre services over the next 5 to 10 years.

f. Examine competitive dynamics, pricing strategies, and opportunities for smaller entrants.

g. Identify potential business models and strategies to incentivize competition and sustainable operations.

4. Financial Analysis:

a. Estimate the initial project costs for network design, equipment (including fiber optic cables, network termination points, etc.), infrastructure development (civil works for trenching or pole installations), and operational expenditures (maintenance, staffing, etc.).

b. Develop detailed financial models that project potential revenue streams from different user segments (MNOs, ISPs, RISPs, residential users, etc.) based on the market analysis findings (Section 2). Consider different pricing models and service packages.

c. Assess the financial and economic returns on investment (ROI) for the project under various scenarios, considering potential risks like delays or changes in market demand.

d. Conduct sensitivity analysis to evaluate how the project's financial performance might be impacted by fluctuations in key variables (e.g., construction costs, subscriber numbers, bandwidth pricing).

5. Risk Assessment:

a. Conduct sensitivity analysis to evaluate how changes in key assumptions will impact technical, operational and financial outcomes.

b. Conduct scenario analysis to consider best-case, worst-case, and most likely scenarios to gauge potential project performance.

c. Develop contingency plans for the identified risks with strategies to mitigate them.

6. Environmental and Social Impact Assessment:

a. Conduct a thorough ESIA, identifying potential impacts on communities, ecosystems, and cultural heritage.

b. Collaborate with LEC to develop mitigation strategies to minimize the impact of potential electricity outages within major towns and metro centers during network construction and maintenance.

c. Conduct thorough stakeholder engagement throughout the ESIA process, gathering feedback on potential social and environmental concerns from communities and businesses in target areas.

d. Develop an Environmental and Social Management Plan with a robust costed mitigation plan to address identified impacts, outlines specific actions to minimize them, and ensures compliance with regulatory requirements.

e. Establish a monitoring plan to track the project's environmental and social impacts throughout its lifecycle, allowing for adjustments to mitigation strategies if necessary.

Deliverables

1. **Design Review Report:**

   a. Current Infrastructure - An assessment of the existing designs and specifications for the national fibre network, incorporating LEC and LECC's dark fibre networks and LEC's pole infrastructure.

   b. Regulatory and Legal Framework Analysis reviewing the telecommunications laws, regulations, and compliance requirements impacting the project

   c. Gaps and Areas for Improvement - Identification of coverage gaps, particularly in towns and residential areas, and recommendations for extending the network into these areas.

   d. Technological Recommendations - Suggestions for incorporating recent technological advancements and best practices, such as FTTH and FTTB models, and the use of OPGW and ADSS fibre.

2. **Market Analysis Report:**

   a. Demand Analysis - A detailed report on current and projected demand for fibre services across various user segments, including residential, commercial, industrial, and institutional users, with demographic and economic analyses to support growth projections.

   b. Competitive Landscape - An assessment of the competitive dynamics in the telecommunications sector, including major players, market share, and business models, as well as a SWOT analysis for each player.

   c. Pricing Strategies - An evaluation of current pricing models, alternative business models, and strategies for sustainable operations, particularly for new entrants and smaller players.

3. **Environmental and Social Impact Assessment Report and Environmental and Social Management Plan:**

a. Impact Identification - A comprehensive assessment of potential environmental and social impacts, including effects on communities, ecosystems, and cultural heritage, as well as potential benefits of expanding fibre distribution networks.

b. Stakeholder Engagement - A summary of feedback from stakeholders, including government entities, local communities, businesses, and civil society organizations, highlighting key social and environmental concerns.

c. Mitigation Strategies - Proposed measures to address identified impacts and ensure regulatory compliance, including environmental protections, social programs, and community engagement initiatives.

4. Final Report:

a. Comprehensive Overview - A complete report integrating the findings and recommendations from the Technical Design Review, Regulatory compliance, Market Analysis, Financial Analysis and ESIA and ESMP reports, providing a holistic view of the project's feasibility and strategic direction.

b. Implementation Roadmap - A detailed roadmap outlining the steps needed to implement the project's recommendations, including timelines, resources, and key milestones.

c. Strategic Recommendations - Actionable insights for advancing Lesotho's fibre network, including strategies for expanding coverage, promoting competition, and ensuring sustainable operations.

5. Presentation and Communication:

a. Stakeholder Presentation - A presentation summarizing key findings and recommendations, tailored to various stakeholders, including policymakers, investors, and technical experts, to facilitate understanding and decision-making.

b. Regular Updates - Periodic updates to the project's supervising entity, detailing progress, challenges, and next steps.

Duration and Commencement Date

Project Duration: 2 months

Commencement Date: Tentative 01 October 2024

Payment Schedule: Linked to Deliverables

Timeline and Milestones:

Schedule (from Contract Signature)	**Deliverables**	**Payment (%)**
Contract Signature	Signed Contract	0%

1 Week	Inception Report (Detailed Project Plan)	0%
4 Weeks	**Design Review Report:** **Preliminary Market Analysis Report** **Draft Environmental and Social Impact Assessment Report**	20%
6 Weeks	Validation Workshops and Draft Final Report	40%
8 Weeks	Final Study Submission Final Report Market Analysis Report Environmental and Social Impact assessment Environmental and Social Management Plan	30%

Qualifications for the Consultant

The Interested consultants must have competency to perform the services (brochures, description of similar assignments, experience in similar conditions, availability of appropriate skills among staff, etc.).

The key staff for the assignment should include at a minimum the following skills-mix:

1. **Lead Telecommunications Infrastructure Consultant(Team Leader)**	Tasks The team leader will be responsible for the overall management of the deliverables under supervision of LECC. They are expected to perform the following responsibilities: Technical Analysis Regulatory and Legal Framework Analysis Market Analysis Financial and Economic Analysis
	Qualifications • Master's degree in telecommunications engineering, business administration, or a related field (preferred). • Minimum of 10 years of experience in telecommunications infrastructure projects.

	• Proven experience leading multi-disciplinary teams on complex infrastructure projects in developing countries. • Strong foundation in telecommunications, with specific knowledge of fibre network infrastructure, design, and implementation, including extensive knowledge in the various aerial and underground fibre deployment technologies and methods. • Familiarity with recent advancements and emerging technologies in the fibre network industry, including fibre-to-the-home (FTTH) and fibre-to-the-business (FTTB) models. Must also understand 5G technologies in the context of residential uncapped internet services. • Proven experience in conducting market studies, including demand analysis, competitive landscape assessments, and pricing strategy evaluations within the telecommunications or technology sectors. • Strong Experience in developing sustainable business models and strategies, including market entry, competitive positioning, and partnerships within the telecommunications industry. • Understanding of telecommunications regulations and competition policies, including licensing requirements, compliance standards, and anti-competitive practices, particularly in the Lesotho context or similar markets. • Knowledge of financial modelling and economic analysis for infrastructure projects. • Experience working with international development institutions (AfDB, WB, EU) on infrastructure projects in Africa. • Proven ability to manage stakeholder engagement with government agencies, regulatory bodies, communities, and private sector entities. • Fluency in English
2. Environmental and Social Safeguards Specialist	Tasks : The E&S Specialist will lead the Environmental and Social Impact Assessment (ESIA) for the project and will **Prepare the ESIA report and Environmental and Social Management Plan (ESMP)** in a format that meets the requirements of international development institutions like AfDB, WB, and EU.
	Qualifications • Master's degree in environmental science, social sciences, development studies, or a closely related field (preferred). Minimum of 5 years of experience conducting Environmental and Social Impact Assessments (ESIAs) for infrastructure projects in developing countries. • Proven experience in applying international safeguard policies of development institutions like AfDB, WB, and EU.

	• Understanding of Lesotho's environmental and social context, including relevant laws and regulations. • Proficiency in conducting stakeholder consultations and social baseline assessments. • Experience working with telecommunications infrastructure projects (Desirable). • Fluency in English and Sesotho (highly desirable).

ANNEXURE 12

PROJECT AREA PHOTOS



Picture 1: Mohale's Hoek Town



Picture 2: Mafeteng Town



Picture 3: Maseru Metropolitan



Picture 4: Maputsoe Town