The Republic of South Sudan

Ministry of Information, Communication Technology and Postal Services (MICT&PS)

Eastern Africa Regional Digital Integration Project (P176181)

ELECTRONIC WASTE (E-WASTE) MANAGEMENT PLAN

(Final)

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OVERVIEW

The South Sudan, EA-RDIP will support the Government of the Republic of South Sudan (GoRSS) to establish digital connectivity and integrate with the regional digital market. The project has four components as briefly described below:

- Component 1. Connectivity Market Development and Integration. This component will provide support to develop terrestrial cross-border connectivity and expand the backbone and last mile connectivity to rural and remote communities.
- Component 2. Data Market Development and Integration. This component will provide support to the integration and development of data market, to enable secure exchange, storage and processing of data across borders to support regional deployment and access to data-driven services and innovation
- Component 3. Online Market Development and Integration. It will provide support to the integration and development of the online market, through targeted support for e-services.
- Component 4. Project Management. It will provide Technical assistance and capacity support for project preparation and implementation for the key implementing agency i.e., the Ministry of Information, Communications, Technology and Postal Services (MICT&PS) within GoSS.

The project's environmental and social risk rating is substantial considering the potential environmental, social, health and safety risks and impacts which could result from the implementation of activities under Components 1, 2, and 3. The potential EHS risks and impacts include alteration of terrestrial and aquatic habitats (due to broadband connectivity infrastructure deployment); construction and electronic wastes; localized greenhouse gas emissions; and occupational health and safety issues. A range of social risks may occur including i) physical and/ or economic displacement because of land take for fixed line components, access road and other fixed infrastructure under Component 1 and data centers under Component 2. (ii) adverse impacts to land used by traditional local communities depending on siting of infrastructure. Differential impacts may be experienced by vulnerable groups.

INTRODUCTION

The Ministry of Information, Communications, Technology and Postal Services (MICT&PS) within the Government of the Republic of South Sudan (GoSS) commits to manage environmental and social risks and impacts of the project throughout the project life cycle in a systematic manner, proportionate to the nature and scale of the project and to the potential risks and impacts. The generation of waste is one of those risks that must be considered during the preplanning and implementation phases of the project. Waste management planning for the project should be conducted early as possible to identify sound management practices and procedures within legal and environmental frameworks. Possible waste streams that may be generated during project implementation may include solid wastes, hazardous wastes, and electronic wastes, etc. However, the focus of this plan is on electronic wastes or E-wastes. An E-Waste Management Plan (EWMP) is used to describe the waste management related issues within the Electrical and Electronic Equipment (EEE) industry sector and specify the best way to address these issues, giving specific actions, targets, and timeframes. This E-waste management plan should be implemented throughout the project's lifecycle to protect the environment, biodiversity, and habitats, safeguard the health of the local communities, and comply with the World Bank Environment, Safety and Health Guidelines (ESHG), Environmental and Social Standards (ESS), South Sudan legislations and regulations, and Good International Industry Practice (GIIP).

CONSIDERATIONS ON E-WASTE MANAGEMENT

An E-Waste Management Plan (EWMP) is used to describe the waste management related issues within the Electrical and Electronic Equipment (EEE) industry sector and specify the best way to address these issues, giving specific actions, targets and timeframes. The aspects related to the generation and management of all types of waste must be considered from the very beginning, during the predesign, contracting, construction, and operational phases. In all cases, provisions shall be taken to minimize waste production and to provide proper management to reduce the impacts that these may have on the environment.

The EWMP based on ESS1 and ESS3, shall establish responsibilities in relation to the risks and impacts throughout all project phases, and it shall be implemented consistently with the requirements spelled out in the ESMF to avoid affectation to stakeholders and livelihood, biodiversity and habitats nearby and surroundings of the project sites and activities.

E-waste definition and general considerations

E-waste is a term used to cover items of all types of electrical and electronic equipment (EEE) and its parts that have been discarded by the owner as waste without the intention of reuse. Although e-waste is a general term, it is considered to cover TVs, computers, mobile phones, white goods (fridges, washing machines, dryers, etc.), home entertainment and stereo systems, toys, toasters, kettles – almost any household or home business item with circuitry or electrical components with power or battery supply. E-waste contains materials that, if mishandled, can be hazardous to human health and the environment, but, most importantly, also materials that are valuable and scarce.

E-waste volumes are growing exponentially simply because of the market demand. The proper treatment of e-waste avoids negative impacts and yields many benefits. E-waste, if not properly treated, can have negative impacts, both on human health and on the environment. However, sustainable treatment of e-waste avoids these negative impacts.

The appropriate handling of e-waste can both prevent serious health and environmental damage and also recover valuable materials, especially for common metals and precious metals. The recycling chain for e-waste is classified into three main subsequent steps: i) collection; ii) sorting/dismantling and pre-processing (including sorting, dismantling and mechanical treatment); and, iii) end processing. All three steps should operate and interact in a holistic manner to achieve the overall recycling objectives.

The main objectives of sustainable e-waste recycling are: i) Treat the hazardous fractions in an environmentally sound manner; ii) Maximize the recovery of valuable materials; iii) Create eco-efficient and sustainable business; and iv) Consider social impact and local context.

Electronic products to be procured under the project

Electronic products to be procured under the project include laptops, printers, photocopy machines and other electronic accessories, as well as all materials for the fibre optic cables. The exact quantity/number of the electronic equipment to be procured is not known at this stage.

Toxicity and radioactive nature of E-waste to human, water, soil, and animals

Electrical and electronic equipment contain different hazardous materials, which are harmful to human health and the environment if not disposed of carefully. While some naturally occurring substances are harmless in nature, their use in the manufacture of electronic equipment often results in compounds, which are hazardous (e.g., chromium becomes chromium VI). Lead, mercury, cadmium, and polybrominated flame retardants are found in electronic equipment and are all persistent, bio-accumulative toxins (PBTs). They can create environmental and health risks when computers are manufactured, incinerated, landfilled, or melted during recycling. PBTs, in particular, are a dangerous class of chemicals that have longevity in the environment and bioaccumulate in living tissues. PBTs are harmful to human health and the environment and have been associated with cancer, nerve damage and reproductive disorders. Table 1 depicts a selection of the most common toxic substances in E-waste**.**

Table 1 Toxic Substances in E-waste

Substance	**Occurrence in E-waste**
Halogenated compounds	
PCB (polychlorinated biphenyls)	Condensers, Transformers
TBBA (tetrabromo-bisphenol-A) PBB (polybrominated biphenyls) PBDE (polybrominated diphenyl ethers)	Fire retardants for plastics (thermoplastic components, cable insulation) TBBA is presently the most widely used flame retardant in printed circuit boards
Chlorofluorocarbon (CFC)	Cooling unit, Insulation foam
PVC (polyvinyl chloride)	Cable insulation
Heavy metals and other metals:	
Arsenic	Small quantities in the form of gallium arsenide within light emitting diodes
Barium	Getters in cathode ray tubes (CRTs)
Beryllium	Power supply boxes which contain silicon-controlled rectifiers and x-ray lenses
Cadmium	Rechargeable computer batteries, fluorescent layer (CRT screens), printer inks and toners, photocopying-machines (printer drums)
Chromium VI	Data tapes, floppy-disks
Lead	CRT screens, batteries, printed wiring boards, television sets, PC monitors, light bulbs, lamps
Lithium	Li-batteries
Mercury	Fluorescent lamps that provide backlighting in LCDs, in some alkaline batteries and mercury wetted switches
Nickel	Rechargeable NiCd-batteries or NiMH-batteries, electron gun in CRT
Rare Earth elements (Yttrium, Europium)	Fluorescent layer (CRT-screen)
Selenium	Older photocopying-machines (photo drums)
Zinc sulphide	Interior of CRT screens, mixed with rare earth metals

Arsenic

Arsenic is a poisonous semi-metallic element, which is present in dust and soluble substances. Chronic exposure to arsenic can lead to various diseases of the skin and decrease nerve conduction velocity. Chronic exposure to arsenic can also cause lung cancer and can often be fatal.

Barium

Barium is a metallic element that is used in sparkplugs, fluorescent lamps and "getters" in vacuum tubes. Being highly unstable in the pure form, it forms poisonous oxides when in contact with air. Short-term exposure to barium could lead to brain swelling, muscle weakness, damage to the heart, low blood potassium, cardiac arrhythmias, respiratory failure, gastrointestinal dysfunction, paralysis, muscle twitching, and elevated blood pressure, liver, and spleen. Animal studies reveal increased blood pressure and changes in the heart from ingesting barium over a long period of time.

Beryllium

Beryllium has recently been classified as a human carcinogen because exposure to it can cause lung cancer. The primary health concern is inhalation of beryllium dust, fume, or mist. Workers who are constantly exposed to beryllium, even in small amounts, and who become sensitized to it can develop what is known as Chronic Beryllium Disease (beryllicosis), a disease that primarily affects the lungs. Beryllium can also affect organs such as the liver, kidneys, heart, nervous system, and the lymphatic system, may develop beryllium sensitization or chronic beryllium disease. Exposure to beryllium also causes a form of skin disease that is characterized by poor wound healing and wart-like bumps. Studies have shown that people can still develop beryllium diseases even many years following the last exposure.

Brominated flame retardants (BFRs)
The 3 main types of BFRS used in electronic and electrical appliances are Polybrominated biphenyl (PBB), Polybrominated diphenyl ether (PBDE), and Tetrabromobisphenol - A (TBBPA). Flame-retardants make materials, especially plastics and textiles, more flame resistant. They have been found in indoor dust and air through migration and evaporation from plastics. Combustion of halogenated case material and printed wiring boards at lower temperatures releases toxic emissions including dioxins, which can lead to severe hormonal disorders. Major electronics manufacturers have begun to phase out brominated flame-retardants because of their toxicity.

Cadmium
Cadmium components may have serious impacts on the kidneys. Cadmium is adsorbed through respiration but is also taken up with food. Due to the long half-life in the body, cadmium can easily be accumulated in amounts that cause symptoms of poisoning. Cadmium shows a danger of cumulative effects in the environment due to its acute and chronic toxicity. Acute exposure to cadmium fumes causes flu-like symptoms of weakness, fever, headache, chills, sweating and muscular pain. The primary health risks of long-term exposure are lung cancer and kidney damage. Cadmium also is believed to cause pulmonary emphysema, possibly reproductive damage, and bone disease (osteomalacia and osteoporosis).

CFCs (Chlorofluorocarbons)
Chlorofluorocarbons are compounds composed of carbon, fluorine, chlorine, and sometimes hydrogen. Used mainly in cooling units and insulation foam, they have been phased out because when released into the atmosphere, they accumulate in the stratosphere and have a deleterious effect on the ozone layer. This results in increased incidence of skin cancer in humans and in genetic damage in many organisms.

Chromium
Chromium and its oxides are widely used because of their high conductivity and anti-corrosive properties. While some forms of chromium are nontoxic, Chromium (VI) is easily absorbed in the human body and can produce various toxic effects within cells. Most chromium (VI) compounds are irritating to eyes, skin, and mucous membranes. Chronic exposure to chromium (VI) compounds can cause permanent eye injury, unless properly treated, human carcinogens, impacts on neonates, reproductive and endocrine functions. Chromium VI may also cause DNA damage.

Dioxins
Dioxins and furans are a family of chemicals comprising 75 different types of dioxin compounds and 135 related compounds known as furans. Dioxins is taken to mean the family of compounds comprising polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Dioxins have never been intentionally manufactured but form as unwanted by-products in the manufacture of substances like some pesticides as well as during combustion. Dioxins are known to be highly toxic to animals and humans because they bio-accumulate in the body and can lead to malformations of the foetus, decreased reproduction and growth rates and cause impairment of the

immune system among other things. The best-known and most toxic dioxin is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).

Lead
Lead is the fifth most widely used metal after iron, aluminium, copper, and zinc. It is commonly used in the electrical and electronics industry in solder, lead-acid batteries, electronic components, cable sheathing, in the glass of CRTs etc. Short-term exposure to high levels of lead can cause vomiting, diarrhoea, convulsions, coma or even death. Other symptoms are appetite loss, abdominal pain, constipation, fatigue, sleeplessness, irritability, and headache. Continued excessive exposure, as in an industrial setting, can affect the kidneys. It is particularly dangerous for young children because it can damage nervous connections and cause blood and brain disorders.

Mercury
Mercury is one of the most toxic yet widely used metals in the production of electrical and electronic applications. It is a toxic heavy metal that bio-accumulates causing brain and liver damage if ingested or inhaled. In electronics and electrical appliances, mercury is highly concentrated in batteries, some switches and thermostats, and fluorescent lamps.

Polychlorinated biphenyls (PCBs)
Polychlorinated biphenyls (PCBs) are a class of organic compounds use in a variety of applications, including dielectric fluids for capacitors and transformers, heat transfer fluids and as additives in adhesives and plastics. PCBs have been shown to cause cancer in animals. PCBs have also been shown to cause a number of serious non-cancer health effects in animals, including effects on the immune system, reproductive system, nervous system, endocrine system, and other health effects. PCBs are persistent contaminants in the environment. Due to the high lipid solubility and slow metabolism rate of these chemicals, PCBs accumulate in the fat-rich tissues of almost all organisms (bioaccumulation). Nonetheless, PCBs may not be relevant for this project.

Polyvinyl chloride (PVC)
Polyvinyl chloride (PVC) is the most widely used plastic, used in everyday electronics and appliances, household items, pipes, upholstery etc. PVC is hazardous because it contains up to 56 percent chlorine which when burned produces large quantities of hydrogen chloride gas, which combines with water to form hydrochloric acid and is dangerous because when inhaled, leads to respiratory problems.

Selenium
Exposure to high concentrations of selenium compounds cause selenosis. The major signs of selenosis are hair loss; nail brittleness, and neurological abnormalities (such as numbness and other odd sensations in the extremities).

Toxic substances likely to be present in the electronic products supported by the project
Considering electronic products to be supported by the project include laptops, printers, photocopy machines and other electronic accessories. Hence, common toxic substances likely to be associated with such electronic products might include PBDE (polybrominated diphenyl ethers), TBBPA (tetrabromo-bisphenol-A), cadmium, chromium, beryllium, lead, lithium, nickel, mercury, selenium, zinc, yttrium, brominated flame retardants, halogenated flame retardants, tin, polyvinyl chloride (PVC) and phthalates, etc.

Benefits from Sustainable E-Waste Management Practices

Sustainable management practices, i.e., recycling operations, also considerably contribute to reducing greenhouse gas emissions. Primary production of metals that are part of the E-waste usually is large contributors to greenhouse gas emissions, i.e., mining, concentrating, smelting and refining, especially of precious and special metals have a significant carbon dioxide (CO_2) impact due to the low concentration of these metals in the ores and often difficult mining conditions. But “mining” of old phones, servers, or old computers to recover the contained metals – if done in an environmentally sound or correct manner – needs only a fraction of energy compared to mining ores in nature. Recycling of E-Waste equipment reduces the amount of land that has to be set aside specifically as landfill zones which in turn can be used for far more productive and socially beneficial usages such as low-income housing, more farming, or renewable energy power supplies. Recycling means that less money and energy has to be expended for the mining of the various minerals, which are consumed during the manufacturing process for the production of E-Waste equipment.

The environmental footprint of a phone, a computer, and other electronic devices could be significantly reduced if treated in environmentally sound managed recycling operations, which prevent hazardous emissions and ensure that a large part of the contained metals is finally recovered for a new life. This E-Waste Management plan does not include or mandates for the establishment of an E-Waste recycling infrastructure, but points in the direction that; building a sustainable recycling infrastructure creates jobs and contributes to capacity building. The sustainable collection, sorting, manual dismantling, and pre-processing of e-waste could create a significant number of jobs in the countries that would develop this activity.

E-WASTE MANAGEMENT PLAN (EWMP)

E-Waste Management During the Implementation Phase

This Electrical Waste Management Plan (EWMP) will be implemented throughout the project’s lifecycle and will follow and comply with the ESS1 and ESS3 of the Environmental and Social Framework of the World Bank. The plan is required to be adopted during the project implementation period when project-financed electrical equipment (computers, printers, servers, cables, etc.), and backup generators, among others, are replaced, irreparable or at their end of life. This plan must also comply with existing South Sudanese legislation and regulations, WB ESHG, and Good International Industrial Practice (GIIP).

Material Recycling Process

The material recycling processes of waste computers can be split into three steps: 1) dismantling or disassembling process, 2) pre-processing (mechanical process), and 3) recovery and refining process. Although this plan illustrates the resourceful recycling process of waste computers, the methodology of recycling for other electronic equipment of information and communication technology is almost similar.

Dismantling Process

Dismantling is the systematic removal of components, parts, a group of parts or a sub-assembly from waste electronic equipment. The dismantling process is performed with simple tools such as screwdrivers, air drivers, hammers, tongs, and conveyors to separate the materials and components into different categories (i.e., plastics, iron, steel, copper, printed circuit boards, etc.). Disassembling of waste computers makes the recycling process easy and efficient. Disassembling process breakdowns the computers into small components and materials, which makes the packing, shipping, pre-processing and refining process easy and efficient. Although the manual disassembling process is not economically feasible in developed countries because of the unavailability of workers and high wages, it is still viable in developing countries and many parts of the world.

Computer Case

Generally, the computer cases are disassembled manually to separate the main body (iron, aluminium, or plastic), power supplies, copper wires, cooling fans, CD drives, floppy disk drives, hard drives, memory modules, PCI cards, motherboards (PCBs), CPUs, etc.

Cathode Ray Tube (CRT) Monitors

The CRT unit is mainly composed of different kinds of glass: panel glass, made of strontium/barium oxides in front of the monitor; funnel glass, leaded glass that covers the CRT unit; neck glass, highly leaded glass that covers the electron gun; and front glass, highly leaded glass that results from welding the funnel glass to the panel glass. Aside from the glass, the CRT unit contains a ferrous shadow mask and an electron gun. Waste CRT monitors cause a substantial portion of the regional and global electronic waste stream. CRT monitors possess nominal or negative scrap value as they contain leaded glass; therefore, CRT monitors are difficult and expensive to recycle. As a result, CRT monitors are usually transferred to be dismantled manually and discarded in safety regions of environmental protection.

Liquid Crystal Display (LCD) Monitors

Disassembled components of LCD monitors of waste computers are classified in printed circuit boards (PCBs), cold cathode fluorescent (CCFL) tubes, LCD panel glasses, metals, speakers, plastics, and others. The plastics and metals can be recycled by existing technology, transferring them to a plastic recovery facility. CCFL tubes usually contain small amounts of mercury, requiring special treatment. Therefore, CCFL tubes must be disassembled from the LCD module. This type of tube should be transferred to heavy metal (i.e., mercury) recovery facility after disassembling, which yields no scrap value. The LCD panel glasses consist of a number of layers, which typically consist of 25 or more components. These include glass, foil, and liquid crystal compounds. The LCD panel glasses denote an environmental risk, and it is necessary to be disassembled them from waste LCD monitors.

Polychlorinated Biphenyl (PCBs)

PCB is an essential constituent of all electronic and electrical equipment that contains various metals such as copper (Cu), iron (Fe), lead (Pb), zinc (Zn), gold (Au), silver (Ag), palladium (Pd), platinum (Pt). The substrate of the PCBs is a thermoplastic material and epoxy resin with contents of flame retardants, which are not so easy to recycle. Most of the disassembled PCBs, excluding power boards, contain gold coatings, gold plated connectors, pins, small, medium, and large size IC chips, capacitors, slots, resistance, solder, Integrated Graphics Processor (IGP), Ball Grid Array (BGA) IC chips, and metal films. Typically, six types of PCBs can be categorized after dismantling waste computers and monitors. Type 1 is a PCB of HDD drive, Type 2 is a memory module, Type 3 is a PCI card, Type 4 is a PCB of an LCD monitor, Type 5 is the motherboard, and Type 6 is a lower grade PCB or power board. The value of each scrap PCB is different and depends on the size and number of IC chips, small capacitors, gold pins, gold plated connectors, and area of gold plates.

Identification of Scrap Metals

Different types of scrap metal are extracted from waste computers, such as copper, aluminium, copper, magnesium, zinc, etc. Since the market value of these scrap metals is different, they should be separated at the time of the dismantling process. The scrap metals mined from waste computers can be separated into two categories by magnet test: ferrous and non-ferrous metals. Non-ferrous metals are typically more valuable than ferrous metals. Once the magnet test is finished, additional scratch tests could be executed to distinguish the non-ferrous metal (i.e., aluminium, copper, stainless steel, etc.).

Pre-processing

Pre-processing or mechanical processing is an integrated part of e-waste recycling by shredding into small pieces using crushers and grinders. However, the incineration and pyrolysis process of e-wastes are also considered mechanical processing. Metals and non-metals are separated during this stage using separation techniques such as screening, magnetic, eddy current and density separation techniques. Although this mechanical process makes the e-waste recycling faster and reduces workers' demand, the unselective blending of plastic materials and different types of metal may reduce the recovery rate of metals, especially precious metals and rare metals. Various pre-processing techniques include shredding and separation processes, thermal treatment, pyrolysis, incineration, pulverizing, compressing, etc.

Although pre-processing is essential for disassembled scrap materials from waste computers, all the processes (i.e., shredding, incineration, pulverizing, compressing, etc.) are not obligatory for each and every type of scrap material. Actual process selection of a pre-processing technique usually depends on material characteristics, scrap value, transportation, recovery, and refinery facilities. It is still a big challenge to select actual pre-processing for each and every material to enhance the value of e-waste scraps.

Recovery and Refining Process

Selection of further recovery and refinery process of disassembled scraps is also a big task in the recycling business. Each type of scrap should be sent to a specialized recovery facility to yield maximum recovery efficiency. The final destination (recovery facility) should be selected on the basis of the metal composition of the scraps. The concentration of precious metals and base metals should be measured for each type of PCB. The higher-grade PCBs (containing a comparatively higher amount of precious metals) should be shipped to a recovery facility which specializes in the hydrometallurgical recovery of precious metals. Meanwhile, the lower-grade PCBs (containing a very lower amount of precious metals) should be transferred to a pyrometallurgical recovery facility.

Objectives of the EWMP

The aim should be to achieve and maintain an integrated e-waste management plan that is effective and efficient to ensure the generated e-waste is not indiscriminately disposed to the detriment of human health and the environment. In general terms, this EWMP will be:

(i) to assess the activities involved for the proposed project and determine the type, nature, and estimated volumes of waste to be generated;
(ii) to identify any potential environmental impacts from the generation of waste at the project sites;
(iii) to recommend appropriate waste handling, storage, transport, treatment, and disposal measures in accordance with the current legislative requirements, WB ESHG, and GIIP;

- (iv) to strengthen capacity building and raise awareness to communities and firms on e-waste management risks and impacts.

Legal framework

The legal framework will legally support the bases of the EWMP in each one of the project implementation locations, and this will be based in the local legislature, regulations, resolutions, norms, international treaties, and other legally binding instruments that apply to the project nature.

The Transitional Constitution of the Republic of South Sudan, 2011 includes numerous provisions relating to the biophysical and social environment. Article 41 (1) provides that the people of South Sudan shall have a right to a clean and healthy environment and (2) that every person shall be obliged to protect the environment and (3) that future generations shall have the right to inherit an environment protected for the benefit of present and future generations. E-waste is one of the most indelible sources of pollution of the environment that should be mitigated.

The Wildlife Conservation and National Parks Act at Section 5 of the Act recognizes that wildlife constitutes an important national natural wealth and is part of the heritage of South Sudan and therefore needs to be conserved, protected and utilized for the benefit and enjoyment of all its people. This should be protected from e-waste.

The Public Health (Water and Sanitation) Act (2008) emphasizes the prevention of pollution of air and water and also encourages improvement in sanitation. Key provisions include the protection of the sanitation of the environment and encompasses measures to address the pollution of water and air.

Institutional Framework

This includes the institutions involved in the project administration, management, and operations. These will be identified, and their roles and responsibilities will be defined during the project phases (pre-construction, construction, operation, and closure). During the entire project cycle, the PIU will in line with ESS 4 (on Community Health and Safety), implement measures and actions to control the safety of deliveries of hazardous materials, and of storage, transportation and disposal of hazardous materials and wastes, and will implement measures to avoid or control com- munity exposure to such hazardous material including e-waste. ESS 1 on Assessment and Management of Environmental and Social Risks and Impacts clarifies the responsibilities of the borrower for wastes such as e-waste generated from projects (if not properly sorted, treated and managed) and the hazards thereto. This ESS illustrates the various ES instruments that will be prepared to address the issues of ES risks and impacts. With regard to ESS3 Resource Efficiency and Pollution Prevention and Management, the project is likely to generate a significant amount of e-waste. These may affect the local communities and the environment. In line with the guidance of this ESS this EWMP has been prepared.

Environmental Social Standards (ESS)

Transboundary Environmental Assessment Guidelines for shared ecosystems in East Africa require the project to prepare the project brief which must provide the possible products and by-products, including wastes generated by the project (2.1 (b) (vi)). The Guidelines also require a project to indicate waste and effluent production (if any) during operation of the project and how these will be managed (2.2.2 (a) (v). The project will follow these Guidelines and national legislation, WB ESS, WB ESHG, and GIIP for the management of e-waste. The project will avoid the disposal of E-waste by reuse, recycle, and recover. Where e-waste cannot be reused, recycled, or recovered then the project will treat, destroy, or dispose of e-waste in accordance with ESS 1 and ESS 3, and the guidelines prescribed by the National or Local Authorities. That is, when hazardous waste management is conducted by third parties, the project will use NEMC license hazardous waste contractors and all E-waste will be disposed of in hazardous waste landfill or licensed disposal facilities in accordance with the Environmental Management Regulations.

WB ESHG

The WBG EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP) and are referred to in the World Bank's Environmental and Social Framework and in IFC's Performance Standards. The EHS Guidelines contain the performance levels and measures that are normally acceptable to the World Bank Group, and that are generally considered to be achievable in new facilities at reasonable costs by existing technology. The World Bank Group requires borrowers/clients to apply the relevant levels or measures of the EHS Guidelines. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects will be required to achieve whichever is more stringent.

The WBG EHS guidelines defines hazardous waste as one sharing the properties of hazardous materials (e.g., ignitability, corrosivity, reactivity or toxicity, etc.,) among other physical, chemical, or biological characteristics that may pose potential health risks. Hazardous waste in terms of this document are ones that are also classified as "hazardous' by local regulations. The EHS guidelines define the practices required from facilities that generate and store waste which include avoidance and minimization, and where waste generation cannot be avoided but has been minimized, recovering, reusing waste and where this cannot be implemented, reusing, treating, and destroying and disposing of it in an environmentally sound manner. Understanding potential impacts and risks associated with the management of any generated hazardous wastes during its complete lifecycle. There is also provision in the EHS guideline that, ensuring the contractors handling treating and disposing hazardous waste should be reputable and legitimate enterprises licensed by relevant regulatory authority and following good international industry practice for the management of hazardous waste. In addition to general waste management measures on waste prevention, reuse, recycling, treatment, disposal, storage, transportation, and monitoring. The contractor should also handle the hazardous management in compliance with applicable local and international regulation. The WB EHS guidelines also requires monitoring records for hazardous waste collected, stored, or shipped. (See annex A on the WBG EHS guidelines on waste management).

GIIP

GIIP promotes the use of an obligation on distributors to offer to consumers a take-back system where e-waste items can be disposed of free of charge. There are two types of take-back systems, and distributors of EEE items must offer one of these schemes to their customers. Examples include free in-store take-back scheme where distributors accept e-waste items from customers purchasing equivalent new items. Distributors take-back scheme where consumers can dispose of WEEE items free of charge at designated collection facilities. E-waste generators should manage and dispose of e-waste responsibly in ways already mentioned in the preceding paragraphs. In addition, when purchasing a new electrical item arrange with the retailer to collect the old one. Businesses and other users (i.e. schools, hospitals, and government agencies) of electrical and electronic goods (EEE) must ensure that all separately collected e-waste is treated and recycled.

<u>Diagnostics and Characteristics</u>

Feasibility analyses must be performed in order to determine the level of involvement and processes needed to implement the EWMP and to what extent. For example, if the generation of e-waste is identified to be very small, maybe the most feasible option will be to store it in an appropriate environmental site until there is a larger volume of E-waste to be properly processed following the guidelines of the EWMP. If the amount of e-waste is large, then it will be feasible to proceed with the later phases of the business of recycling. In all cases this analysis will include an environmental screening assessment to understand the potential negative impacts of the EWMP implementation, in this process the following must be evaluated: i) Possible environmental and social impacts; ii) Evaluation of the environmental and social impacts; iii) Measurements for E-waste management during construction and operational phase of the project; iv) Arrangements for permits for final disposal of the different types of waste that the plan entitles; and, v) Implementation time table or chronogram.

Potential Environmental, social, and health impacts that could arise from the generation of E-waste

Social Impacts: Extraction of copper and gold from e-waste can be extremely harmful if not done properly – the works are often performed by women and children.

Health impacts: According to the WHO, E-waste-connected health risks may result from direct contact with harmful materials such as lead, cadmium, chromium, brominated flame retardants or polychlorinated biphenyls (PCBs), from inhalation of toxic fumes, as well as from accumulation of chemicals in soil, water and food.

Toxins from E-Waste can end up in our food. Hazardous substances from e-waste stay absorbed in the ground for a long time. Farming on land contaminated with toxins from e-waste can create unsafe conditions for food. If e-waste ends up in the ocean and leaches chemicals into shellfish, molluscs, fish, or other marine animals, those toxins can also be passed on to humans. Chemicals that are embedded in seafood will remain once they are caught and cooked and will eventually end up in our bodies.

E-Waste can pollute drinking water if improperly disposed. When disposed of improperly, toxins from e-waste mixes with ponds, lakes, and groundwater. Communities that directly depend on these sources of water then consume it unknowingly. These heavy metals are hazardous for all forms of living beings.

- Lead may cause neurotoxicity, high blood pressure, and muscle pains, and learning disabilities among children. Barium oxide can cause severe skin irritation and ingestion is harmful, and chronic exposure may lead to damage of Central Nervous System (CNS), spleen, liver, kidney or bone marrow.
- Gold is extracted from E-waste either by burning the gold containing components at high temperatures, or using leaching chemicals like cyanide solution. Burning releases toxic gases and disposal of cyanide solution or other leaching chemicals into the drain or on land pollutes water and soil.
- Mostly the above mentioned hazardous chemicals and toxic metals are persistent toxic substances (PTSs), which are released in the environment and can enter the food webs. Several PTSs are known to be endocrine disrupters, posing adverse health effects such as reproductive disorders, developmental deformities, and cancer in both humans and wildlife.
- Dioxins, released from burning of E-waste are known carcinogens, which accumulate in the human body and may cause changes in the immune system, glucose metabolism and reproductive problems.
- Inhalation of cadmium fumes or particles can be life threatening. Cadmium exposure may cause kidney damage. The International Agency for Research on Cancer (IARC) has classified cadmium as a human carcinogen (group I) on the basis of sufficient evidence in both humans and experimental animals.
- Acute mercury exposure may give rise to lung damage. Chronic poisoning is characterized by neurological and psychological symptoms, such as tremor, changes in personality, restlessness, anxiety, sleep disturbance and depression.
- High mercury exposure results in permanent nervous system and kidney damage. It has also been possible to detect proteinuria at relatively low levels of occupational exposure. Metallic mercury is an allergen, which may cause contact eczema.
- The symptoms of acute lead poisoning are headache, irritability, abdominal pain and various symptoms related to the nervous system. People who have been exposed to lead for a long time may suffer from memory deterioration, prolonged reaction time and reduced ability to

understand. Acute exposure to lead is known to cause proximal renal tubular damage. Long-term lead exposure may also give rise to kidney damage.

- Inorganic arsenic is acutely toxic and intake of large quantities leads to gastro intestinal symptoms, severe disturbances of the cardiovascular and central nervous systems, and eventually death. Populations exposed to arsenic via drinking water show excess risk of mortality from lung, bladder and kidney cancer, the risk increasing with increasing exposure. There is also an increased risk of skin cancer. Studies on various populations exposed to arsenic by inhalation, such as smelter workers, pesticide manufacturers and miners in many different countries consistently demonstrate an excess lung cancer.
- Beryllium can cause sensitization, lung and skin disease in a significant percentage of exposed workers. Calcium chromate, chromium trioxide, lead chromate, strontium chromate, and zinc chromate are known human carcinogens. An increase in the incidence of lung cancer has been observed among workers in industries that produce chromate and manufacture pigments containing chromate.
- Exposure to relatively high concentrations of antimony (9 mg/m3 of air) for a longer period of time can cause irritation of the eyes, skin and lungs. As the exposure continues more serious health effects may occur, such as lung diseases, heart problems, diarrhea, severe vomiting and stomach ulcers.

Environmental impacts: The impact of the e-waste on the environment includes the following:

- Air Pollution: Burning of wires (to extract the copper underneath the rubber insulation) releases hydrocarbons into the atmosphere.
- Water Pollution: When disposed of improperly, toxins from e-waste seeps with ponds, lakes, and groundwater.
- Soil Pollution: The waste-products of recycling (along with leftover e-waste) is dumped into fields or other large landfill sites. From here, chemicals leach into the ground and are absorbed by plants from the soil. These metals not only destroy the plants, but also are then consumed by other living beings, leading to a poisonous food chain.

The risk on marine life from e-waste is well pronounced. Some electronics end up being dumped into waterways, whether accidentally or on purpose. Once there, electronic components start to break down and the toxins inside the devices can seep out into the environment. These polluting chemicals or heavy metals, like lead, travel through water and contaminate or poison marine life.

When electronics are not properly recycled, much of the precious metals and resources that were used to produce the device are lost to landfills. This creates further demand for newly mined materials. Thus, mining for metals used to produce new phones is causing habitat loss. Mining operations often clear-cut forests and use explosives to blast into the ground. Mining can also leak toxic by-products into nearby rivers and nearby soil. This disturbs the natural ecosystem and leads to habitat loss for the species living in the area. Overall, habitat destruction results in the mass migration or starvation of animal species living in the area and is the number one cause of extinction of animal species worldwide. For example, the habitat destruction stemming from the aggressive mining of cobalt is driving gorillas to extinction in the Congo. (Cobalt is a metal used in mobile phones and other electronics).

E-Waste Mitigation Measures and Management Plan

This E-Waste Management Plan contains proposed mitigation measures through which all e-waste can be managed in accordance with the national legislation, WB ESF, WB ESHG, and GIIP. The mitigation measures or guidelines have been designed in order to avoid, minimize, and reduce negative environmental and social impacts at the project level. The mitigation measures are presented in Table 3 in a descriptive format.

Procurement of electronic items of a high quality and from reputable retailers/sources

The first mitigation measure is to ensure that all electronic devices are procured from retailers and sources that are credible, that all devices will have a clear date of manufacture and warranty and the item is of a high quality. This will avoid procurement of poor quality, refurbished, or used second hand electronic devices with a shorter life cycle that leads to a rapid generation of E-waste. All items should be purchased where applicable, with protective covers and insurance. If possible, retailers or source of electronic items should be engaged where a repair, renewal, recycling or take back scheme option is offered. If the retailer or source does not offer some or all of these options, then the project is to locate legally licensed facilities that do repair or recycle electronic items. If such options do not exist, then disposal in licensed disposal facilities for hazardous wastes should follow the Environmental Management Regulations as prescribed by the National or Local Authorities.

Awareness and Sensitization

Awareness and sensitization of project staff and contractors (as applicable) who will use or install the electronic devices on the proper disposal once they become damaged, irreparable or at their end of life is vital. The project office should include in the sensitization the usefulness and significance of E-waste recycling, and the need for returning back all electronic items procured by the project to a collection centre that should be established. Also, project staff should be aware and sensitize on the fact that cell phones and computers do hold sensitive data/information, which present security risks if not properly disposed, and this can lead to lawsuits.

Budget and Costs

In each phase of the project there must be a budget with associated costs of the development and implementation of EWMP. The budget must consider all management activities, as well as potential procurement of equipment, including personal protective equipment and collection, sorting, dismantling, temporary storage, transportation, and disposal of the e-waste as well as audit and training/capacity building of project staff and contractors. The budget will also include contingency expenditures. These budgets to be prepared in charts showing cost estimations categorized for each management activity presented must also include those contingency expenditures and expending charted chronograms. The budget by the PIU will be itemized and should include all financial considerations that are being adopted for the general implementation of all project activities.

Public Consultation Mechanism

The information provided to the project participants and workers, as well as to the communities and all other relevant stakeholders, must be early and culturally appropriate. Procedures must be established for solicitation, convening, and training to workers and affected communities. Amongst the potential topics to cover are labor ethics, responsibilities, and rights, sustainable daily issues and behavior, care for nature and biodiversity, environmental management. For information mechanisms to communities and workers the following must be considered: written information (press), radio, internet, social media, workshops, etc. The public consultation of project activities must be performed before project implementation, at the design level during the pre-construction phase. This activity is a requirement under ESS10 and demands the local stakeholder's active participation which shall be continuous throughout all the project phases. The result of the public consultations shall be included in the EWMP for all project activities.

Grievance Redress Mechanism (GRM)

The procedures for the GRM are based on the ESS10. This process will follow the format described in this ESMF. In general terms, the GRM will include actions such as registry and chart log of visits, complaints, observations, and comments of all interested parties.

Monitoring, Review and Reporting

The implementation of the EWMP will be managed by the MoICT&PS and PIU according to the implementation section of this ESMF. Monitoring, review and reporting activities must be performed throughout all phases of the project. It will be important to have control of all activities implemented as part of the Plan, by measuring their efficiency, effectiveness, and compliance. This will assist in preparing the evaluation to address improvement actions if so needed. This mechanism will include project supervision and reporting (daily logs, verification and technical, environmental and engineering reports (weekly, monthly, quarterly) as agreed. Some key information that must also be collected include data on i) Number of producers (importers) registered; ii) Percentage of registered producers / all producers; iii) Details of official e-waste collection points and recyclers participating; iv) Amount of waste collected and treated, quarterly reporting of output by material state (reuse, recycle), type (product, metal, plastic, other) and destination (smelter, incinerator, producer, landfill).

Adaptive Management Arrangements

These are defined as alternative managerial actions, different from what was originally planned. These managerial arrangements must be adopted due to unforeseen events during project implementation, which in turn generate a need for an adaptive management approach to address the new and unexpected situations. The EWMP shall be updated in the case an adaptive management arrangement is decided to be needed. All specific details and considerations shall be properly recorded in the Plan.

E-WASTE ENVIRONMENTAL HEALTH AND SAFETY GUIDELINES

Recommended Procedures for E-wastes Management Plan (EWMP)

General E-Waste Management

The following guidance applies to the management of non-hazardous and hazardous e-waste. Additional guidance specifically applicable to hazardous e-wastes is presented below. E-waste management should be addressed through an e-waste management system that addresses issues linked to e-waste, which include generation, waste management (reduction, reuse, recycling), transportation, disposal, and monitoring.

As part of the E-waste Management Plan, e-waste should be characterized according to composition, sources, types of e-waste, generation rates, and local legislation. Effective planning and implementation of e-waste management strategies should include: i) Revision of new e-waste sources during all project phases including planning, siting, and equipment upgrades, in order to identify e-waste generation, pollution prevention opportunities, and necessary treatment, storage, and disposal infrastructure; ii) Collection of data and information about the process and e-waste streams in existing facilities, including characterization of e-waste streams by type, quantity, and potential use/disposition; iii) Establishment of priorities based on a risk analysis that takes into account the potential Environmental Health and Safety (EHS) risks during the e-waste cycle and the availability of the infrastructure to manage the e-waste in an environmentally sound manner; iii) Definition of opportunities for source reduction, as well as for reuse and recycling; iv) Definition of procedures and operational controls for onsite storage; and, v) Definition of options/procedures/ operational controls for treatment and final disposal.

E-Waste Prevention Processes
This should be designed and operated to prevent, reduce or minimize, the quantity of e-waste generated and hazards associated with the e-waste generated in accordance with the following strategy: i) Substituting raw materials or parts with less hazardous or toxic materials, or with those where processing generates a lower e-waste volume; ii) Adopting and implementing good housekeeping and operating practices, including inventory control to reduce the amount of e-waste resulting from materials that are out-of-date, off-specification, contaminated, damaged, or are an excess to operational needs; and, iii) Reducing/minimizing hazardous e-waste generation by implementing stringent e-waste segregation to prevent the commingling of non-hazardous and hazardous e-waste from be managed.

Recycling and Reuse
In addition to the implementation of e-waste prevention strategies, the total amount of e-waste may be significantly reduced through the implementation of reuse and recycling plans, which should consider the following elements: i) Identification and reuse/recycling of products that can be reintroduced into the operational processes ii) Investigation of external markets for recycling by other industrial processing operations located in the neighbourhood or region of the facility (e.g., e-waste exchange); iii) Establishing reuse/recycling objectives and formal tracking of e-waste generation and recycling rates; and, iv) Providing training and incentives to employees in order to meet objectives.

Treatment and Disposal
If e-waste materials are still generated after the implementation of feasible e-waste prevention, reduction, reuse, recovery, and recycling measures; then, e-waste materials should be treated and disposed of following all measures to avoid potential impacts to human health and the environment. Selected management approaches should be consistent with the specifications of e-waste characteristics and local regulations, and may include one or more of the following: i) On-site or off-site chemical, or physical treatment of the e-waste material to render it non-hazardous prior to final disposal; ii) Treatment or disposal at permitted facilities specially designed to receive the e-waste; iii) Permitted and operated landfills or incinerators designed for the respective type of e-waste or other methods known to be effective in the safe, final disposal of e-waste materials.

Hazardous E-Waste Management
Hazardous e-waste refers to electric and electronic devices that contain toxic materials such as mercury, lead, arsenic, cadmium, or brominated flame retardants, etc., beyond threshold quantitiesor known to harm human health and the environment.

Hazardous e-waste should always be segregated from non-hazardous e-wastes. If the generation of hazardous e-waste cannot be prevented through the implementation of the above general e-waste management practices, its management should focus on the prevention of harm to health, safety, and the environment, according to the following additional principles: i) Understanding potential risks and impacts associated with the management of any generated hazardous e-waste during its complete life cycle; ii) Ensuring that contractors handling, treating, and disposing of hazardous e-waste are reputable and legitimate enterprises, licensed by the relevant regulatory agencies and following good international industry practice for the e-waste being handled; iii) Ensuring compliance with applicable local and international regulations, WB ESHG, and GIIP.

An average person involved in e-waste management can recognize hazardous e-waste by looking for warning labels or markings on the device, such as a “crossed-out trash can symbol” or the word "danger." These labels are often found on electronic devices that contain hazardous materials, such as lead, mercury, or other toxic chemicals. In addition, hazardous e-waste may also be identified by the presence of certain materials or substances, such as batteries, toner or ink cartridges, and old television sets and computer monitors. These items may contain hazardous materials that can be harmful to human health and the environment if they are not handled and disposed of properly.

If a person is unsure whether a particular electronic device is hazardous e-waste, it can check the manufacturer's website or contact them directly to find out more about the materials used in the device and how to properly dispose of it. It can also consult your local waste management agency or environmental agency for guidance on e-waste disposal.

E-Waste Prevention Processes

This should be designed and operated to prevent, reduce, or minimize, the quantity of e-waste generated and hazards associated with the e-waste generated in accordance with the following strategy: i) Substituting raw materials or parts with less hazardous or toxic materials, or with those where processing generates a lower e-waste volume; ii) Adopting and implementing good housekeeping and operating practices, including inventory control to reduce the amount of e-waste resulting from materials that are out-of-date, off-specification, contaminated, damaged, or are an excess to operational needs; and iii) Reducing/minimizing hazardous e-waste generation by implementing stringent e-waste segregation to prevent the commingling of non-hazardous and hazardous e-waste from been managed.

Recycling and Reuse

In addition to the implementation of e-waste prevention strategies, the total amount of e-waste may be significantly reduced through the implementation of reuse and recycling plans, which should consider the following elements: i) Identification and reuse/recycling of products that can be reintroduced into the operational processes ii) Investigation of external markets for recycling by other industrial processing operations located in the neighborhood or region of the facility (e.g., e-waste exchange); iii) Establishing reuse/recycling objectives and formal tracking of e-waste generation and recycling rates; and iv) Providing training and incentives to employees in order to meet objectives.

Hazardous E-Waste Storage

Hazardous e-waste should be properly stored to prevent or control accidental releases to air, soil, and water resources in areas where: i) E-waste is stored in a manner that prevents the commingling or contact between incompatible e-waste and allows for inspection between containers to monitor leaks or spills. Examples include sufficient space between incompatible or physical separation such as walls or containment curbs; ii) Store in closed containers (some could be radioactive proofed), away from direct sunlight, wind and rain; iii) Secondary containment systems should be constructed with materials appropriate for the e-waste being contained and adequate to prevent loss to the environment; iv) Provision of readily available information on compatibility to employees, including labelling each container to identify its contents; v) Limiting access to hazardous e-waste storage areas to only employees who have received proper training; vi) Clearly identifying (labelling) and demarcating the area, including documentation of its location on a facility map or site plan; and, vii) Conducting periodic inspections of e-waste storage areas and documenting the findings.

Transportation of E-Waste

All e-waste containers designated for off-site shipment should be secured and labeled with the contents and associated hazards. This must be properly loaded and secured into transportation vehicles before leaving the site and must be accompanied by a shipping paper (i.e., manifest, record, etc.) that describes the load and its associated hazards, and which is consistent with the Transport of Hazardous Materials good practices and guidance.

When preparing for shipment the following should be implemented:

- Name and identification number of the material(s) composing the e-waste
- Physical state (i.e., solid, liquid, gaseous or a combination of one, or more, of these)
- Quantity (e.g., kilograms or liters, number of containers)
- Waste shipment tracking documentation to include, quantity and type, date dispatched, date transported, and date received, record of the originator, the receiver, and the transporter
- Method and date of storing, repacking, treating, or disposing at the facility, cross-referenced to specific manifest document numbers applicable to the e-waste.
- Location of each e-waste within the facility, and the quantity at each location.

Treatment and Disposal

If e-waste materials are still generated after the implementation of feasible e-waste prevention, reduction, reuse, recovery, and recycling measures; then, e-waste materials should be treated and disposed of following all measures to avoid potential impacts to human health and the environment. Selected management approaches should be consistent with the specifications of e-waste characteristics and local regulations, and may include one or more of the following: i) On-site or off-site chemical, or physical treatment of the e-waste material to render it non-hazardous prior to final disposal; ii) Treatment or disposal at permitted facilities specially designed to receive the e-waste; iii) Permitted and operated landfills or disposal facilities designed for the respective type of e-waste or other methods known to be effective in the safe, final disposal of e-waste materials.

Small Quantities of Hazardous E-waste

Hazardous e-waste materials are frequently generated in small quantities by many projects through a variety of activities such as equipment and building maintenance activities. Examples of these types of e-wastes include used batteries (such as nickel-cadmium or lead-acid); and lighting equipment, such as lamps or lamp ballasts, servers, computers, cables, etc. These types of e-waste should be managed, following the guidance provided in the above sections.

Special considerations for Monitoring Activities

Monitoring activities associated with the management of hazardous and non-hazardous e-waste should include: i) Regular visual inspection of all e-waste storage collection and storage areas for evidence of accidental releases and to verify that e-waste is properly labelled, and stored; ii) Inspection of loss or identification of cracks, corrosion, or damage to protective equipment, or floors; iii) Verification of locks, and other safety devices for easy operation (lubricating if required and employing the practice of keeping locks and safety equipment in standby position when the area is not occupied); iv) Checking the operability of emergency systems; v) Documenting results of testing for integrity, emissions, or monitoring stations; vi) Documenting any changes to the storage facility, and any significant changes in the quantity of materials in storage, vii) Regular audits of e-waste segregation and collection practices, viii) Tracking of e-waste generation trends by type and amount of e-waste generated, preferably by facility departments, ix) Characterizing e-waste at the beginning of generation of a new e-waste stream, and periodically documenting the characteristics and proper management of the e-waste, especially hazardous e-wastes; x) Keeping manifests or other records that document the amount of e-waste generated and its destination; xi) Periodic auditing of third party treatment, and disposal services including re-use and recycling facilities when significant quantities of hazardous e-wastes are managed by third parties. Whenever possible, audits should include site visits to the treatment storage and disposal location. In the event that e-waste (on-site storage and/or pre-treatment and disposal) is in direct contact with soil, additional procedures must be performed to ensure regular monitoring of soil quality.

Monitoring records for hazardous e-waste collected, stored, or shipped should include: i) Name and identification number of the material(s) composing the hazardous e-waste or Physical state; ii) Quantity (i.e., kilograms, number of containers); ii) E-waste shipment tracking documentation to include, quantity and type, date dispatched, date transported and date received, a record of the originator, the receiver and the transporter; iii) Method and date of storing, repacking, treating, or disposing at the facility, cross-referenced to specific manifest document numbers applicable to the hazardous e-waste o Location of each hazardous e-waste within the facility, and the quantity at each location.

The Ministry of Information, Communications, Technology and Postal Services (MICT&PS) within GoRSS will monitor the implementation of this E-Waste management Plan in accordance with national law and E&S instruments agreed to. In the course of monitoring project implementation through Bank Missions the World Bank will also directly monitor the implementation of this EWMP and provide support in enhancing effective implementation Monitoring by the MICT&PS and the World Bank will be preceded by monitoring reports from the PIU indicating progress in implementation and any challenges encountered as appropriate.

Good International Industry Practices Relevant to the Project's E-waste Management Plan

(a) End-of-Life Management for ICT Equipment, ITU 2012: https://www.itu.int/dms_pub/itu-t/oth/4B/04/T4B0400000B0013PDFE.pdf
(b) Palestinian Hazardous Waste Management System, No. 6 2021: https://www.molg.pna.ps/uploads/files/%D9%86%D8%B8%D8%A7%D9%85%20%D8%A7%D8%AF%D8%A7%D8%B1%D8%A9%20%D8%A7%D9%84%D9%86%D9%81%D8%A7%D9%8A%D8%A7%D8%AA%20%D8%A7%D9%84%D8%AE%D8%B7%D8%B1%D8%A9%20%D8%B1%D9%82%D9%85%20(6)%20%D9%84%D8%B3%D9%86%D8%A9%202021_69e6eb5ebbae48b3b8e5e6b05fa95aa8.pdf
(c) Palestinian Cabinet Decree on Adopting the General Policy for the Disposal and Treatment of Electronic Waste – June, 2021 (02/113).
(d) Success Stories on E-waste Management, L Supplement.27, ITU 2016: https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-L.Sup27-201610- I!!PDF-E&type=items
(e) Environmental, Health, and Safety Guidelines for Telecommunications, IFC, the World Bank Group: https://www.ifc.org/wps/wcm/connect/25b87632-c01d-4a89-b149-21c1124730a4/Final%2B-%2BTelecommunications.pdf?MOD=AJPERES&CVID=nPtjCyb&id=132315234382 8
(f) Environmental, Health, and Safety (EHS) Guidelines GENERAL EHS GUIDELINES: ENVIRONMENTAL, WASTE MANAGEMENT:https://www.ifc.org/wps/wcm/connect/456bbb17-b961-45b3-b0a7-c1bd1c7163e0/1- 6%2BWaste%2BManagement.pdf?MOD=AJPERES&CVID=nPtgwEW
(g) Implementation Guidelines for E-waste Management Rules, CPCB India, 2016: https://cpcb.nic.in/displaypdf.php?id=aHdtZC9HVUlERUxJTkVTX0VXQVNURV9SVUxFU18yMDE2LnBkZg==

Monitoring roles and responsibilities

The goal of monitoring is to measure the success rate of the project, determine whether interventions have resulted in dealing with negative impacts, whether further interventions are needed, or monitoring is to be extended in some areas.

The PIU implementing the EARDIP-related activities of this project will be responsible for overall monitoring and evaluation of this E-Waste Management Plan. Monitoring must be performed throughout the project life cycle. The results of the monitoring reports will be submitted to the Bank. The PIU should also provide training and capacity building on e-waste management.

The Bank will provide supervision on compliance and commitments made in the E-Waste Management Plan. The Bank will further undertake monitoring during its scheduled project supervision missions. Specifically, for each year that the agreement is in effect, the PIU will be required to submit regular the monitoring reports to the Bank as part of its project progress reports and the Bank will review these reports and provide feedback.

Table 2 E-Waste Management/Disposal Plan

Issue: Procurement and Provision of Electronic Devices (computers, printers, servers, cables etc)			
Impact	**Mitigation**	**Monitoring**	**Responsibility**
Air Pollution through improper disposal Which leads to release of toxic, hazardous, and carcinogenic gaseous. **Human Health** Electrical and electronic equipment contain different hazardous materials, which are harmful to human health. For instance, bio-accumulative toxins (PBTs) are harmful to human health and have been associated with cancer, nerve damage and reproductive disorders. Chronic exposure to arsenic can cause lung cancer and can often be fatal. Also, exposure to barium can lead to brain swelling, muscle weakness, damage	Procure Electronic devices from credible manufactures to avoid purchasing second hand, refurbished or obsolete devices with a short shelf life or already categorized as E-Waste. If possible, select sources offering repair and take back schemes. Ensure insurance coverage and electronic physical protective devices are fitted. Reuse and recycle all E-waste where applicable and possible. Establish E-Waste collection points in all project sites, including collection bins/receptacles. Conduct awareness and sensitization targeting the users of the electronic devices to ensure that they engage in best	Warranty and take back schemes for Electronic Devices purchased. Credibility of manufacturers supplying the electronic devices Availability of E-waste receptacles in each project site. Number of awareness and training conducted for users of electronic devices on E-waste E-waste certificates of disposal using licensed hazardous waste contractors and licensed hazardous waste landfills/disposal facilities.	PIU

to the heart, liver, and spleen. **Pollution of water bodies** Electrical and electronic equipment contain different hazardous materials, which are harmful to human health and the environment including ground and surface water if not disposed of carefully.	practice for E-waste management.		
Pollution of land resources including landfills Electrical and electronic equipment contain different hazardous materials, which are harmful to human health and the environment including soil if not disposed of carefully.	Procure Electronic devices from credible manufactures to avoid purchasing second hand, refurbished or obsolete devices with a short shelf life or already categorized as E-Waste. If possible, select sources offering repair and take back schemes. Ensure insurance coverage and electronic physical protective devices are fitted. Reuse or Recycle all E-waste. Establish E-Waste Collection Centres in all project sites, including collection bins/receptacles. Use licensed hazardous waste contractors and	Warranty and take back schemes for Electronic Devices purchased. Credibility of manufacturers supplying the electronic devices. Availability of E-waste receptacles in each project site. Number of awareness and training conducted for users of electronic devices on E-waste E-waste certificates of disposal using licensed hazardous waste contractors and licensed hazardous waste landfills/disposal facilities.	PIU

	licensed hazardous waste landfill sites/disposal facilities. Create and maintain records of all E-waste items for disposal, securely store and prepare for shipment correctly. Conduct awareness and sensitization targeting the users of the electronic devices to ensure that they engage in best practice for E-waste management.		
Growth of informal E-waste disposal centres. Improper and indiscriminate disposal of E-waste is likely to lead to the exponential increase of informal waste disposal centers in communities near project sites which may further exacerbates the problem of E-waste.	Procure Electronic devices from credible manufactures to avoid purchasing second hand, refurbished or obsolete devices with a short shelf life or already categorized as E-Waste. If possible, select sources offering repair and take back schemes. Ensure insurance coverage and electronic physical protective devices are fitted. Reuse or Recycle all E-waste. Establish E-Waste Collection Centres in all project sites, including collection bins/receptacles. Use licensed hazardous waste	Warranty and take back schemes for Electronic Devices purchased. Credibility of manufacturers supplying the electronic devices. Availability of E-waste receptacles in each project site. Number of awareness and training conducted for users of electronic devices on E-waste. E-waste certificates of disposal using licensed hazardous waste contractors and licensed hazardous waste landfills/disposal facilities.	PIU

	contractors and licensed hazardous landfill sites/disposal facilities. Create and maintain records of all E-waste items for disposal, securely store and prepare for shipment correctly. Conduct awareness and sensitization targeting the users of the electronic devices to ensure that they engage in best practice for E-waste management.		