APPENDICES

APPENDIX 1.1: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN FOR THE SOLAR PV PARK AND POWERLINE

1 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN FOR GARNETON NORTH SOLAR PV PLANT

The Environmental Management Plan (ESMP) is a tool designed to ensure the implementation of mitigation measures and monitoring by outlining roles and responsibilities of key stakeholders in respect to environmental management. The ESMP seeks to address all the possible negative environmental impacts at the various project phases. Environmental management and monitoring is carried out in all stages of the project (Construction and Operational). The document forms part of the Environmental Project Brief for the Garneton North Solar PV Project and also form part of the Contractors working brief for site management. The Contractor and Site Manager will be responsible for implementing the ESMP.

Total cost of ESMP implementation is estimated at USD 600,000.

1.1 Key Environmental and Social Aspects

- Vegetation clearing activities
  Site clearing activities have potential to cause loss of vegetation, increased erosion in the project area and disturbance to animal and vegetation habitats. Removal of trees also has adverse impacts on climatic conditions since the trees are critical in absorbing carbon from the atmosphere.
  Site clearing activities should be restricted to only areas marked for the construction of requisite project infrastructure. The project developer must consider offsetting the cleared trees by planting some trees within the project area in collaboration with the Kitwe District Forestry Department.

- Dust from access roads
  Dust is expected during the site clearing, excavation works and haulage of materials such as aggregates to the project site. If not mitigated, dust can cause a nuisance to nearby communities and adversely affects the employees' health.

  Dust should be controlled by periodically sprinkling water on dusty areas and restricting vehicle speeds to less than 40km per hour when driving along dusty areas.

- Exhaust fumes from operating equipment and vehicles
  Exhaust fumes contain greenhouse gases which not only cause adverse impacts on the climate systems but cause air pollution. Mostly equipment and vehicles which are not routinely serviced produce more exhaust fumes compared to equipment and vehicles which follow a routine service program. Therefore, exhaust fumes should be reduced by ensuring that equipment and vehicles are serviced each time they are due for service.

- Excavation works
  Excavation works disturb the ground and hence make the soil prone to erosion by both wind and water, especially if steep slopes are not properly stabilized. Excavations also contribute to generation of dust and noise if earth moving equipment is used.

  Impacts from excavation works can be reduced by restricting excavations to areas marked for construction of requisite project infrastructure and procuring borrowed materials from suppliers who have already existing borrow pits.

- Unauthorized access to the project site

Unauthorized access to the project site, especially during the construction phase, can expose members of the community to health and safety risks. The construction site will be fenced off and signs warning unauthorized people to stay away from the site will be posted around the site. Nearby communities must be sensitized about the commencement construction work and the dangers of unauthorized access to the site.

- Recruitment of employees
  The construction phase will require both skilled and unskilled labour. Employing employees expose them to occupational health and safety risks such as potential injuries and occupational related diseases due to exposure to substances that may cause ill health. Among the hazards include lifting loads, working on heights, noise, dust and operating heavy equipment.

  Occupational health and safety considerations should be evaluated right from the recruitment phase. Employees should undergo appropriate medical examinations as provided for by the labour laws and should be registered with the Workers Compensation Control Board. Furthermore, employees should be given appropriate access to safe and clean drinking water, eating areas and an appropriate period of rest during a shift.

- Haulage of materials
  Haulage of materials has potential to pose dangers to community health and safety due to potential traffic accidents and dust generation when passing through dusty sections of the access roads.

  Mitigating these impacts require sensitizing members of the community on road safety, installing appropriate road safety furniture such as speed humps and speed limit signs. Drivers must also be oriented in safe driving practices and only competent drivers must be allowed to drive company vehicles and operate company equipment.

- Storage of fuels and oils
  Storage of fuels and lubricants such as diesel and oil increases the risk of soil, surface and ground water contamination due to leaks and fire outbreaks. These materials must be stored in secured premises with impermeable surfaces and appropriate bund walls. Dispensing of these fuels and lubricants must be controlled to mitigate the risk of spills. Firefighting equipment such as fire extinguishers must be installed nearby. Also spill cleaning materials such as sand or other appropriate absorbent material must be stored close by.

- Cleaning solar panels
  Cleaning solar panels using water has potential to generate storm water which if not managed well may contaminate surface water. Also, the use of chemicals to clean solar panels can cause soil and water contamination. The cleaning of solar panels, especially in the dry season, will need to be handled properly to mitigate the risk of soil and water contamination. Grass will need to be planted within the solar farm to control erosion and reduce the risk of water from cleaning operations running off to the nearby surface water bodies.

- Generation of hazardous waste
  Hazardous waste generation is expected during the construction and operation phase of the project. Examples of such waste include sanitary waste, used oil, damaged solar panels and other types of electronic waste. This waste should be properly managed using a competent and licensed waste management company. Appropriate cleaner production techniques will need to be deployed to reduce the amount of waste generated in the first place. Such measures should include measures targeted at increasing the efficient use of raw materials for the project.

- Gender Based Violence
  The National Gender Policy, 2014 acknowledges that violence against women is one of the factors that exacerbates poverty among women. The policy further notes that poverty affects women and children more compared to men. Gender based violence exist within the project area as confirmed by interviews with the nearest health centre and Zambia Police Service. Key informants have observed that women are more likely to report cases of gender-based violence compared to the men because of the shame that comes along with the news that the man was bitten by a woman.

  Among the drivers for gender-based violence identified is delinquent behavior such alcohol abuse, extramarital affairs and failure to perform one defined role at home. The inability for men to provide food at home and other household necessities causes women to think that the men have misused resources for other delinquent activities and the feeling of inadequacy that results also causes men to become violent. The fear of the abusing spouse being locked up by police and the overdependence of women on men for economic support causes victims' gender-based violence not to report such to the police.

  Men who are too possessive may not want their spouses to work and insistence on working by the spouse may increase gender-based violence. Such men fear that when the spouse become economically independent from them, they will no longer have control over them and may find better men. For couples who experience gender-based violence because of the economic pressure they experience, the available job opportunities have potential to either reduce or stop gender-based violence between them.

  Therefore, improving the project outcome on gender-based violence calls for community sensitizations on gender-based violence, helping victims of gender-based violence to have the courage to report such cases, supporting survivor centered initiatives on gender-based violence through the company's Corporate Social Responsibility Program.

1.2 Roles and responsibilities

InnoVent will be accountable for managing the environmental and social risks associated with the project. However, management of the environmental and social risks associated with the construction and operation phase will be the responsibility of the EPC and Operations and Maintenance (O&M) contractor respectively. Innovent will provide the needed oversight to ensure that the EPC and O&M contractors are managing the environmental and social risks effectively and that they adhere to the InnoVent environmental and social policy. InnoVent will employ an Environmental and Social Officer who will be responsible for ensuring that the EPC and O&M contractors are effectively implementing the agreed upon environmental and social mitigation and enhancement measures in the environmental and social management plan. The Environmental and Social Officer will report all environmental and social issues to the project site manager who will ensure that needed resources are made available for the management of the identified environmental and social issues and that significant issues requiring the intervention of management are brought to the attention of management.

Both the EPC and O&M contractors are required to comply with the Innovent – CEC Garneton North Limited E&S policy and the African Development Bank Operational Safeguards and International Finance Corporation Environmental and Social Standards as guided by the E&S Policy. The contractors will each employ a person responsible for the daily environmental, safety and occupational health and safety issues. The site managers for the contractors will have the overall responsibility for ensuring that the site environmental and social risks are effectively managed and appropriate resources are allocated by top management for effective execution of the environmental and social management tasks. Figure 1-1 below shows the organogram for managing the environmental and social risks for the project. The organograms for Innovent and EPC contractors are also shown as figure 1-2 and figure 1-3 respectively. The organogram for the O&M contractor is not yet known as the contractor has not been appointed yet. However, Innovent will ensure that the O&M contractor show clearly the organogram the position responsible for daily management of environmental and social issues and that top management has the overall responsibility for ensuring sound environmental and social performance of the project site.

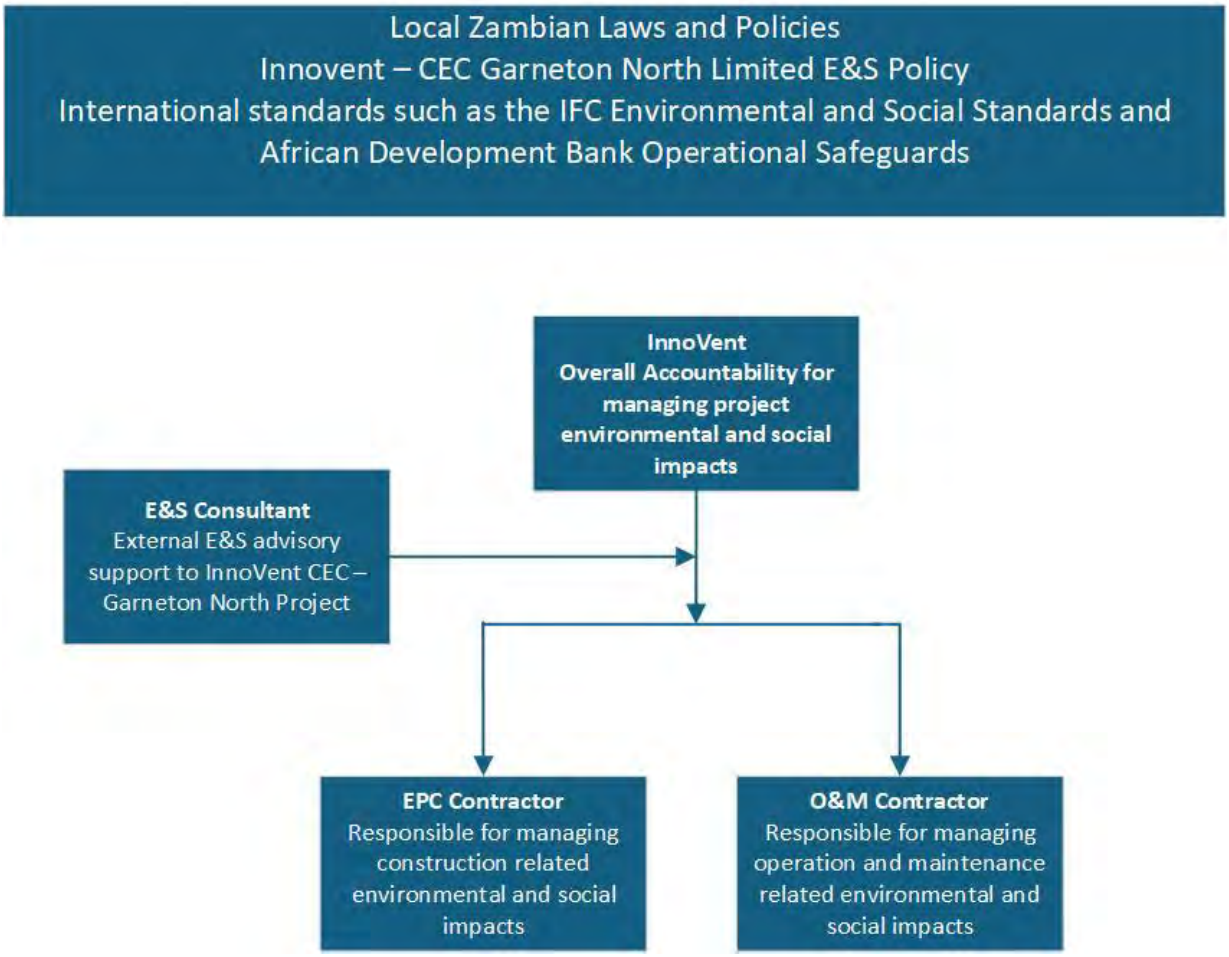

Figure 1-1: Project Structure for Managing Environmental and Social Risks

The organization structure for InnoVent has been made to respond to the demands associated with the construction and operations phase of the project. However, InnoVent has ensured that the structure has the a position to handle environmental and social issues and provide the needed oversight on contractors to ensure that they effectively manage the environmental and social risks associated with their activities. Figure 1-2 and Figure 1-3 shows the proposed organogram during the construction and operarion phases respectively. Figure 1-4 shows the organogram for the EPC Contractor.

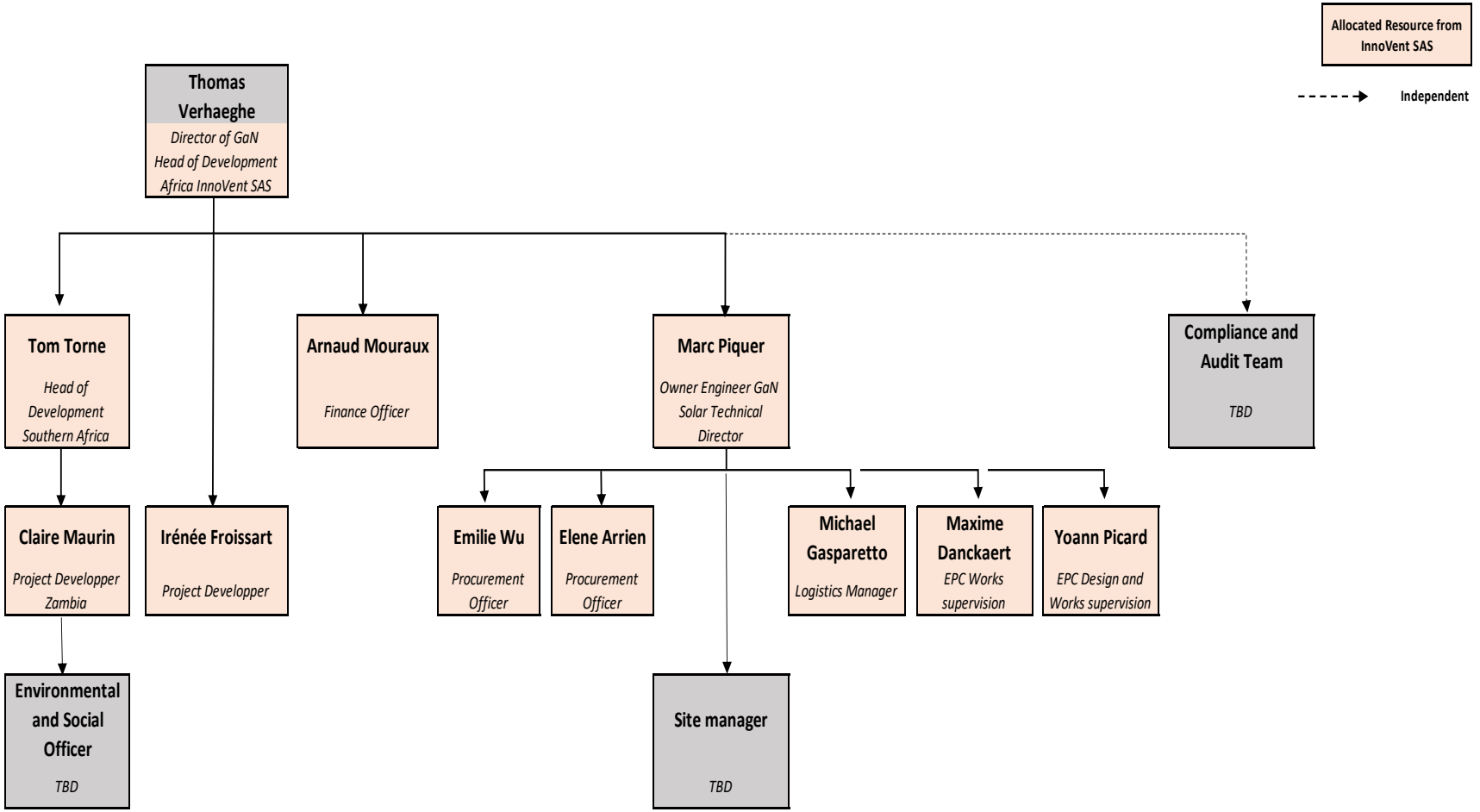

Figure 1-2: InnoVent Organogram During Construction Phase

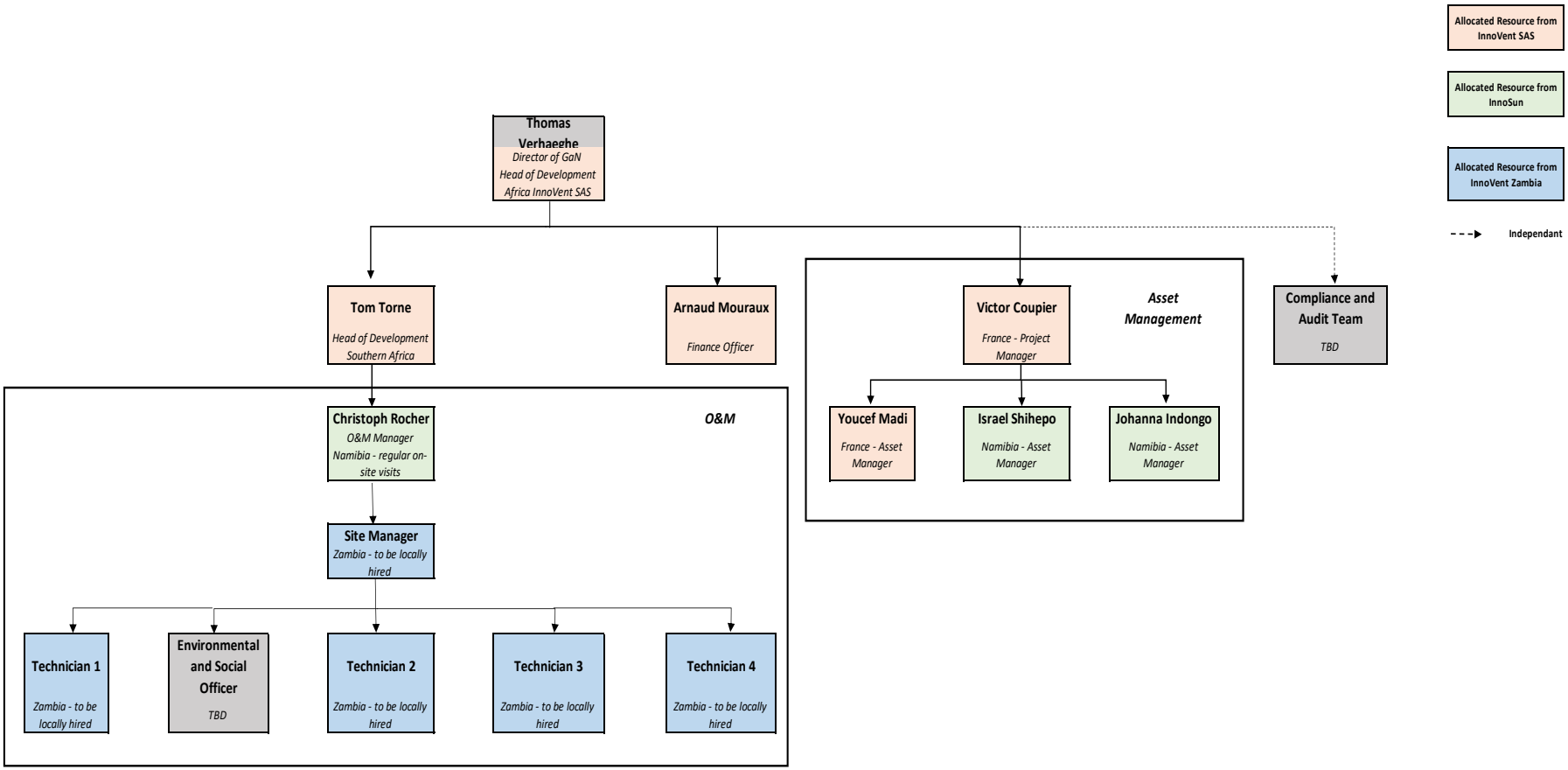

Figure 1-3: InnoVent Organogram During Operation Phase

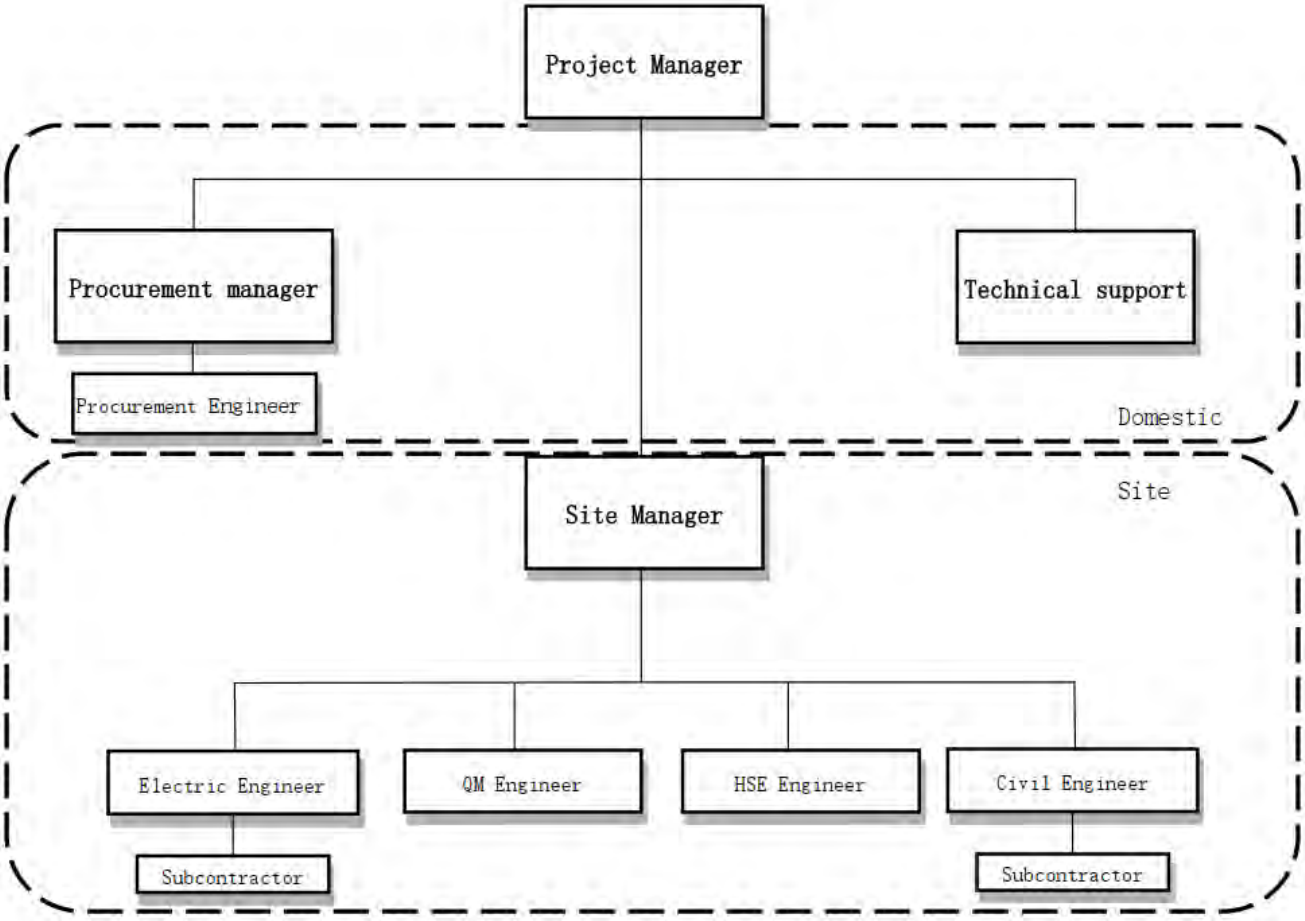

Figure 1-4: Organogram for O&M Contractor

Table 1: Environmental and Social Management Plan (ESMP) - Construction Phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator (Target)**	**Frequency and Monitoring Action**	**Time frame**	**Responsible Person**	**Cost (Us$)**	**Best Practice Guidance (Legal /Project Proponent/ IFC)**
Air Quality									
C1	Site clearing, levelling and construction of internal access roads and other construction works.	Dust generated can affect workers' health and safety on site and sensitive receptors in nearby settlements and private farms	• Dust generation on unpaved access roads and work areas should be controlled by application of water as need arises. • Appropriate speed limits should be set to minimise dust generation from vehicles moving on unpaved site access roads. • The workers should be trained on handling construction materials and debris to reduce fugitive dust emissions. • Construction workers at risk of being exposed to significant dust emissions should be provided with adequate personal protective equipment (PPE).	No visible dust plumes along access roads and construction sites. Reduced fugitive dust emissions along areas accessed by sensitive receptors and Reduced risks to health and safety of personnel and other sensitive receptors. Construction workers provided with approved dust protection devises.	Daily visual monitoring of dust emissions along access roads and during earthworks and construction activities. Daily safety checklist	Pre and during Construction phase	EPC Contractor HSE Engineer	1000	World Bank General EHS Guidelines: Occupational Health and Safety; Occupational Health and Safety Act 2010 of the Laws of Zambia; IFC PS 2 - Labour and Working Conditions.
	Use of diesel propelled generator during the construction phase	Emission of exhaust fumes	The generator will be kept in good state of repair and will mostly be used only when doing heavy duty works and at night.	Air monitoring results within the prescribed ZEMA limits	Routine monitoring	Construction phase	EPC Contractor HSE Engineer	1000	Environmental Management Act No. 12 of 2011, The Environmental Management (Licensing) Regulations, 2013

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C2	Operation of construction equipment and machinery and transportation of solar plant components	Exhaust emissions from the construction equipment and machinery	• Construction equipment and vehicles used for transportation of plant equipment should be adequately maintained and inspected to minimise exhaust emissions	Well maintained vehicles used during construction and transportation of plant equipment. Reduced risks to health of personnel due to exposure to exhaust emissions. Record of vehicle maintenance.	Daily visual monitoring of exhaust emissions during earthworks and other construction activities. Vehicle maintenance records.	During Construction phase	Site Manager	1000	World Bank General EHS Guidelines: Occupational Health and Safety; Occupational Health and Safety Act 2010 of the Laws of Zambia; IFC PS 2 - Labour and Working Conditions.
Archaeology and cultural heritage									
C3	Construction activities leading to exposure, unearthing or removal of unknown subterranean and chance surface archaeological finds.	Potential damage to archaeological finds that may be exposed or unearthed (below ground archaeological deposits) during construction works	• A 'chance find' procedure will be developed and implemented to address and protect cultural heritage features that may be discovered during the construction and operation phases of the project. • Construction activities in the immediate vicinity of the discovery shall be stopped if any archaeological or ancient prehistoric materials are chance found during construction works.	• Preservation of any discovered artifacts on site.	• At least one site inspection immediately after chance find. • Creating awareness among personnel on site about chance find procedures should they encounter archaeological or prehistoric materials. Quarterly during	Construction and Operation phase	EPC Contractor HSE Engineer	1000	IFC Performance Standard 8: Cultural Heritage; National Heritage and Conservation Act, CAP 173 of the Laws of Zambia.

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			• In an event that archaeological or ancient prehistoric materials are discovered, Regional offices of the National Heritage Conservation Commission (NHCC) should be contacted for professional advice and rescue excavations.		construction and operation phases.				
C4	Construction and operations of the project.	Loss of irreplaceable heritage material (cultural and natural heritage resources) in the Project area	• In an event that irreplaceable heritage material is found, an Information Centre should be constructed in consultation with NHCC to exhibit the cultural and natural heritage, storylines and exhibition for education, research, adventure and posterity within or outside Project Area. Collection and display / exhibition of heritage artifacts and fossils.	Preservation of any discovered artifacts on site	Maintenance of an information centre where any discovered artifacts will be preserved. Construction of information centre at occurrence and frequency of maintenance of centre to be done annually.	Construction and Operation phase	EPC Contractor HSE Engineer	1000	IFC Performance Standard 8: Cultural Heritage; National Heritage and Conservation Act, CAP 173 of the Laws of Zambia.
Biodiversity									

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C5	Clearing of areas for installation of the scaling solar infrastructure may impact on the existing modified habitat.	Loss of vegetation (tree species) and natural habitats for small mammals, birds and insects.	• Clearing of vegetation should only be confined to areas where the solar infrastructure will be installed to minimise loss of vegetation and wildlife habitats. • The construction workers should be provided with guides and extents of areas to be cleared and site clearing works should be monitored. • Burrowing animals likely to be noted on site during the construction and operation phases of the project will be removed from the site and the burrows filled.	No clearing of vegetation beyond the confines of the project footprint.	Daily visual inspection of clearing activities during the construction phase.	Construction phase	EPC Contractor HSE Engineer	1000	IFC Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources; Zambian Forest Act, 1973.
Community, Health Safety and Security									
C6	Construction and operation of the solar PV plant.	Risk of accidents involving members of the public through unauthorised access to the project site.	• The project site should be enclosed within a security perimeter and no unauthorized persons should be allowed access to the site. • Caution signs should also be placed around the site to prevent occurrence of	Zero accidents or injuries on site involving members of the general public.	Security surveillance and community engagement to sensitize affected members of the community on their health, safety and security. Daily for security surveillance and	Construction and Operation phase.	Environmental and Social Officer	10,000	World Bank EHS Guidelines: Community Health and Safety; IFC PS 4: Community Health Safety and Security; Occupational Health and Safety Act, No. 36 of

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			accidents and injuries. • The community should be sensitized on the dangers of trespassing on the project site so as to avoid potential accidents that might arise from unauthorized access to the site. • Reasonable steps should be taken in the provision of security and establish appropriate conduct towards workers and affected communities.		patrol. Community engagement - quarterly				2010 of the Laws of Zambia.
C7	Lack of or inadequate good water supply and sanitation facilities on site.	Risk of water borne diseases due to lack of potable water and sanitation facilities	• Safe and clean water and good sanitation facilities should be provided to construction workers to prevent an outbreak of waterborne diseases among them which can also affect the surrounding communities.	Zero occurrence of water borne diseases among the workers.	Safe and clean drinking water provided on site daily. Operable sanitation facilities provided on site.		Site Manager	10,000	IFC Performance Standard 4: Community Health, Safety and Security; Public Health Act, Cap 295
Landscape and Visual Amenity									
C8	Clearing of vegetation and installation of	Visual intrusion and disruption of the aesthetics.	• Low visual reflective solar modules with anti-reflective coating (ARC)	Visual intrusion and disruption to aesthetics	Annual monitoring of existing	Construction phase	Site Manager	10,000	-

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	solar PV modules.		that reduces reflectance from the solar PV modules should be used; • Low level solar module mount design system (2 - 3 meters) that will not disrupt the aesthetic view of the project /surrounding areas should be used on site: • A perimeter buffer of trees and grass vegetation (where possible) along the project site boundaries and streamlines should be left to screen sensitive viewing areas. • General cleanliness and good housekeeping at the site should be promoted at all times.	reduced.	vegetation screening at the site and ensuring that it is appropriately maintained without providing shades onto the Solar PV modules and daily visual inspection of cleanliness and housekeeping.				
Noise and vibration									
C9	Construction activities on (site clearance and levelling, internal roads construction), transportation of the plant components to site.	Potential noise disturbance from heavy equipment, may affect workers on site.	• Regular maintenance on all equipment, vehicles and machinery should be performed to minimise noise; • Provision of adequate PPE such as ear plugs to site workers likely to be exposed to high noise	Zero noise disturbance complaints received. Reduced risk to health and safety of personnel due to exposure to high noise levels. Compliance with IFC Noise Level	Noise monitoring during the construction using a portable noise level meter to demonstrate compliance. Daily safety checklist to ensure workers	Construction Phase	EPC Contractor HSE Engineer	60,000	World Bank General EHS Guidelines: Occupational Health and Safety; Occupational Health and Safety Act 2010 of the Laws of Zambia;

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			levels. • Appropriate transportation routes should be selected.	Guidelines for industrial receptors. Workers at risk of being exposed to occasional high noise levels provided with approved ear protection devises.	have approved PPE.				IFC PS 2 - Labour and Working Conditions.
Occupation Health and Safety									
C10	Occupational health and safety of workers working on site.	Reduced occupational health and safety among workers	• A Health and Safety Policy shall be developed and implemented by the contractor to guide construction and operations of the facility. • All construction activities should be conducted in accordance with provisions of the local legislation and international best practices (General EHS Guidelines: Occupational Health and Safety); • Safety rules should be enforced and	Risks of preventable accidents that can potentially result in injuries and/or fatalities substantially reduced.	Daily risks identification and implementation of management measures conducted prior to commencement works.	Construction and Operation Phase	EPC Contractor HSE Engineer	1000	World Bank EHS Guidelines: Occupational Health and Safety; IFC PS 4: Community Health Safety and Security; IFC PS1; IFC PS 2; IFC PS 5; Occupational Health and Safety Act, No. 36 of 2010 of the Laws of Zambia.

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			complied with by workers, contractors and those coming to site: • Personal Protective Clothing (PPE) should be issued and used as required by the various classes of the workers on project site; • Barrier tapes and caution signs should be erected in all potential hazardous areas to prevent injury or loss of life among construction workers; • No unauthorized person should be allowed on site including workers without appropriate PPE						
C11	Construction works at the project site	Safety risk to workers and equipment caused by slippery ground during wet months.	• Resuming work immediately after rains should be avoided. Work risk analysis should be undertaken before resuming. Blast should be applied on road networks.	Safe working procedures for wet slippery surfaces developed and implemented.	Permit to resume works to be implemented after a storm event and work risk analysis records. Frequency: As and when required.	Construction and Operation Phase	EPC Contractor HSE Engineer	1000	World Bank EHS Guidelines: Occupational Health and Safety; Occupational Health and Safety Act 2010 of the Laws of Zambia; IFC PS 2 - Labour and Working Conditions.
Socio-economic									

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C12	Employment opportunities at the project site arising from construction works.	Influx of population of job seekers on site posing health and security risks and leading to unplanned housing /structures and commercial activities around the project area.	• Enforcement of relevant by-laws laid down by the respective Local authorities with the help of CEC to prevent mushrooming of unplanned structures and activities.	Development of any unplanned structures and / or activities within the project site and immediate surroundings prevented.	Quarterly Security surveillance and Community Engagement to sensitize on matters relating to development of unplanned structures and activities.	Construction and Operation Phase	Site Manager	5000	IFC PS 4: Community Health Safety and Security; Urban and Regional Planning Act, 2015
C13	Construction sites have been known to promote risky sexual behaviour	Risky sexual behaviour among the population Leading to escalation of new STIs including HIV/AIDS in the local population and among the workforce.	• Developing an HIV/AIDS Policy by the Developer to be adhered to during the construction and operation phases of the project. • Sensitization programs on preventing the spread of STIs and HIV/AIDS for project workers including contractors and suppliers. • Provision of condoms (including Female Condoms) in places where they can be easily accessed such as toilets. • Education programs on fighting stigma of those infected with HIV/AIDS	HIV/AIDS Policy developed and implemented; Sensitisation / Education programmes on HIV/AIDS conducted for contractors and suppliers; Accessibility to condoms.	Record of sensitisation / education programmes undertaken including the number of people sensitised / trained on STI and HIV/AIDS. Frequency: Bi-annually	Construction phase	EPC Contractor HSE Engineer / Environmental and Social Officer	5000	IFC Performance Standard 4: on Community Health, Safety and Security. Public Health Act, Cap 295.

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C14	Construction of the Solar PV plant	Capacity building and technology transfer to local contractors, skilled manpower and unskilled workers.	• Local contractors, skilled specialists and unskilled workers should be used to benefit from technology and skills transfer during construction and operation of the solar plant. • Appropriate training should be provided to all local contractors, skilled manpower and unskilled workers to enhance expected project benefits	Skills transferred to local expert.	Bi-annual skills training for locals with assistance from local learning and construction institutions. Number of local people trained.	Construction phase	Site Manager	5000	IFC Performance Standard 2: Labour and Working Conditions.
C15	Construction of the Solar PV plant	Employment opportunities created forboth skilled and non-skilled labour and. multiplier opportunities for employment in support sectors.	• The contractor, where possible, should employ members of the local communities and local experts to maximize on the benefits of employment opportunities. The jobs for which local people qualify (including non-technical and technical) will be as much as possible be offered to the local people. • Priority of employment will be given to the project affected people	Increased employment opportunities leveraged to the local community	Record of employment, annual reports on Solar Plant Operators. Frequency: Bi-annually.	Construction and operation phase	Site Manager	5000	IFC Performance Standard 2 - Labour and Working Conditions; Zambian Employment (Amendment) Act No. 15 of 2015.

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			or their relatives						
C16	Construction of the solar PV plant	Project contribution to the local and national economy through its multiplier effect	• Procurement of services and locally produced raw materials from local contractors and local companies should be done during the construction phase, where possible, to maximise on the benefits.	Increased participation of the local entrepreneurs and companies in the provision of services.	Annual reports on CEC / Solar Plant Operators	Construction and operation phase	Procurement Manager	1000	IFC Performance Standard 2: on Labour and Working Conditions.
Land and Soil									
C17	Site clearing and movement of construction equipment on unpaved surfaces.	Fugitive dust generation impacting on the health of workers and the environment.	• Unpaved surfaces should be maintained through application of water, capping and grading to minimise fugitive dust generation. • Water bowsers should be used to spray water on unpaved access road surfaces to suppress fugitive dust emissions during construction phase.	No visible fugitive dust plumes originating from the unpaved surfaces.	Daily visual inspections of all unpaved areas during construction phase and weekly during operation phase.	Prior to construction phase	EPC Contractor HSE Engineer	Covered in the total project Cost	IFC Performance Standard 3: Resource efficiency and pollution prevention.

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C18	Construction works and operation of the solar plant on site.	Damage to solar support structures and foundations due to soil erosion on site.	• An effective storm water drainage network should be constructed to channel increased surface runoff to designated catchment areas. An effective drainage network will minimise soil erosion over exposed surface and will minimise the risk of erosion of the support structures and foundations. It will also reduce the risk of flooding the project site.	Effective storm water drainage network constructed.	Check construction and effectiveness of all drainages structures on site. Frequency: weekly during construction and bi-annually thereafter.	Construction and Operation phase	Project Development Manager	1000	World Bank Group General EHS Guidelines: Construction and Decommissioning
C19	Site clearing and construction activities	Irregular soil profile causing foundation construction challenges and unstable foundations.	• Detailed mapping of subsurface will be carried to assess risks of soil movement (ground subsidence) prior to installation of Solar PV infrastructure. Detailed specific geotechnical investigations for design should be undertaken.	Detailed specific geotechnical investigations for design undertaken. Approved site layout and construction drawings used.	Quarterly monitoring of structures for stability in accordance with plant specifications.	Operation phase	Site Manager	15000	
Traffic and road infrastructure									
C20	Haulage vehicles carrying materials to site have a potential to increase traffic and decrease road	Reduced safety on public access roads and onsite due to increase in vehicle traffic (potential increase	• Developing and implementing a site specific Traffic Management Plan for transportation purposes	Zero incidence of any road related accidents with the project site. Workers trained on road safety.	Undertaking weekly traffic surveillance inspections and road condition surveys. Record	Construction phase	EPC Contractor HSE Manager	15000	World Bank General EHS Guidelines: Community Health and Safety; IFC PS 4:

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	safety especially on access routes	in traffic-related accidents and injuries)	during construction that the transportation service provider will adhere to. • Enhancing traffic safety management within the economic zone; • Ensuring that only licensed operators and drivers use equipment and vehicles accessing the project site. • Putting up appropriate signage (road markings, road traffic signs) including speed limits and applying speed control structures; • Road safety training for workers and other stakeholders within the zone. • Separating site access routes for construction vehicles and pedestrians. • Bulk storage of materials on site to lessen constant vehicular traffic.		of inspections and number of workers trained in road safety.				Community Health Safety and Security; Road and Traffic Control Act, Cap 464 of the Laws of Zambia.

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			• Employing speed calming devices. • Induction of drivers on safe conduct of vehicles on construction sites. • Providing reflective vests and coveralls for workers of site.						
Water Resources									
C21	Clearing of vegetation and construction works at the project site.	Risk of erosion of solar PV support structures and foundations arising from increase in surface runoff during the rainy season or storm rainfall being more than infiltration into the ground.	• Storm water drainage system should be properly designed and constructed to convey surface runoff away from the project area into a catchment area, which will hold runoff and allow it to slowly infiltrate the ground. • The drainage system should also be designed and constructed to avoid erosion of support structures and foundations.	Effective drainage system constructed and risks of erosion of Solar PV structures and foundations and their potential damage minimized at the project site by controlling surface runoff.	Weekly inspection of storm water drainage network during construction and operation phases to ensure their structural integrity and capacity to convey surface runoff. At least once before and after the start of the rain season during operation phase.	Construction and Operation phases	Site Manager	30,000	World Bank Group General EHS Guidelines: Construction and Decommissioning; IFC Performance Standard 3.
C22	Storage of fuels and oils during construction phase of the project.	Potential groundwater contamination arising from potential spillage of fuels and oils	• Appropriate procedure for storage and handling of fuels and oils should be adopted to avoid spillages of fuels and oils onto the ground.	Spillages of oils and fuels minimised. Appropriate secondary containment constructed.	Weekly inspection of storage areas	Construction Phase / Operation Phase	EPC Contractor HSE Engineer	5000	World Bank Group General EHS Guidelines for Hazardous Material Management; IFC Performance

Table 1: Environmental and Social Management Plan (ESMP) - Construction Phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator (Target)**	**Frequency and Monitoring Action**	**Time frame**	**Responsible Person**	**Cost (Us$)**	**Best Practice Guidance (Legal /Project Proponent/ IFC)**
			These include the following: • Fuel tanks must be bunded to contain possible spills and to prevent the infiltration of fuel into the ground; • The fuel tanks used for the storage of fuel must be designed and installed in accordance with relevant Oil Industry standards; • The tanks must be constructed to conform to the requirements of all relevant legislation, which includes the Environmental Management (Licensing) Regulations, 2013; use of all generators on site must include the use of drip trays. • Secondary containment structures, made of impervious and chemically inert material and capable of containing the larger of 110 percent of the largest storage vessel	Potential groundwater contamination prevented.					Standard 3; Zambian Environmental Management (Licensing) Regulations, 2013.

Table 1: Environmental and Social Management Plan (ESMP) - Construction Phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator (Target)**	**Frequency and Monitoring Action**	**Time frame**	**Responsible Person**	**Cost (Us$)**	**Best Practice Guidance (Legal /Project Proponent/ IFC)**
			should be constructed for storage of fuels, oils and other hazardous substances. All products (fuels, oils) shall be stored in a bund area that can carry 10% more than the product's capacity. • Handling, storage and disposal of hazardous substances (used transformer oils) should be carried out in accordance with the World Bank General Environmental Health and Safety Guidelines (Hazardous Materials Management) and the applicable Zambian Environmental Management (Licensing) Regulations, 2013. • Dedicated secured storage areas for fuels, oils and other hazardous materials should be provided as part of the design. All fuel stored on site will be above ground level and the storage areas shall be secured. The storage						

Table 1: Environmental and Social Management Plan (ESMP) - Construction Phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator (Target)**	**Frequency and Monitoring Action**	**Time frame**	**Responsible Person**	**Cost (Us$)**	**Best Practice Guidance (Legal /Project Proponent/ IFC)**
			areas and containers shall be clearly marked and labelled for the content stored within. Material Safety Data Sheets (MSDS) Hazard list and First Aid treatment notices shall be prominently displayed. Drip trays, a thin concrete slab or a facility with PVC lining shall be in place to prevent soil and water pollution. • Training on handling, storage and disposal of hazardous waste should be provided as part of the overall environmental management of the site. Only trained personnel shall be allowed to work and handle the chemicals. • All hazardous wastes shall be accumulated and temporarily stored on-site for final transportation to CEC main plant where there is a designated storage site for hazardous materials.						

Table 2: Environmental and Social Management Plan - Operational phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator / Target**	**Frequency and Monitoring Action**	**Time Frame**	**Responsible Person**	**Cost**	**Best Practice Guidance (Legal /Project Proponent / IFC)**
Air Quality									
OP1	Regular operational works on site with the potential to generate dust.	Exposure of workers to dust potentially posing health effects to them.	• Operators at risk of being exposed to significant dust emissions will be provided with adequate personal protective equipment (PPE).	Reduced risk to health and safety of personnel due to exposure to high dust levels. All workers provided with approved dust protection devises.	Daily safety checklist to ensure workers have approved PPE. Frequency: as and when potential dust generating activities are being done.	Construction phase	Environmental and Social Officer	20,000	World Bank General EHS Guidelines: Occupational Health and Safety; Occupational Health and Safety Act 2010 of the Laws of Zambia; IFC PS 2 - Labour and Working Conditions.
Noise and Vibrations									
OP2	Operations of the solar plant (electricity production) including clearing of vegetation from under and around the solar modules.	Noise disturbance arising from the operation of solar plant potentially affecting workers on site.	• Operations workers likely to be exposed to high noise levels will be provided with adequate PPE such as ear plugs.	All workers at risk of being exposed to occasional high levels of noise provided with approved ear protection devises.	Monitoring noise levels to ascertain level of noise generated by inverters and to check compliance with IFC Noise Levels Guidelines for industrial receptors. Frequency: at commissioning and daily during operation.	Operation phase	Environmental and Social Officer	30,000	World Bank General EHS Guidelines; IFC PS 4 - Community Health, Safety and Security; Occupational Health and Safety Act 2010 of the Laws of Zambia; IFC PS 2 - Labour and Working Conditions.

Table 2: Environmental and Social Management Plan - Operational phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator / Target**	**Frequency and Monitoring Action**	**Time Frame**	**Responsible Person**	**Cost**	**Best Practice Guidance (Legal /Project Proponent / IFC)**
Community Health, Safety and Security									
OP3	Operations of the Solar PV plant and transmission line	Risks of electric shock, thermal burn, exposure to EMF and several other hazards through unauthorised personnel trespassing the site.	• Security fence should be installed around the entire facility to control access and keep out unauthorized personnel. • Warning signs should be installed around the site and along the power line to warn the public about high voltage and potential electrocution	Installation of fence to appropriate safety and security standard.	Daily inspection of the premises and installed fencing around the project site.	Operation phase	Site Manager	50,000	World Bank EHS Guidelines: Community Health and safety (General site Hazards); IFC PS 4: Community Health Safety and Security.
OP4	Operation of the Solar PV plant and transmission line	Risk of accidents involving members of the public through unauthorised access to the project site and vandalism of the transmission line.	• The project site should be enclosed within a security perimeter and no unauthorized persons should be allowed access to the site. • Caution signs should also be placed around the site to prevent occurrence of accidents. • The community should be sensitized on the dangers of trespassing at the project site so as to avoid potential accidents that might arise from unauthorized access to site due to possible electrocution. Danger signs should also be pasted along	Zero accidents on site involving members of the general public.	Security surveillance and community engagement to sensitize affected members of the community on their health, safety and security. Frequency: Daily for security surveillance and patrol. Community engagement – quarterly.	Operation phase	Site Manager	50,000	World Bank EHS Guidelines: Community Health and Safety; IFC PS 4: Community Health Safety and Security; Occupational Health and Safety Act, No. 36 of 2010 of the Laws of Zambia.

Table 2: Environmental and Social Management Plan - Operational phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator / Target**	**Frequency and Monitoring Action**	**Time Frame**	**Responsible Person**	**Cost**	**Best Practice Guidance (Legal /Project Proponent / IFC)**
			the power line • Reasonable steps should be taken in the provision of security and in particular the use of force and establish appropriate conduct towards workers and affected communities. • A grievance mechanism should be put in place for the Affected Communities to express concerns about the security arrangements and acts of security personnel.						
OP5	Lack of or inadequate good water supply and sanitation facilities on site.	Risk of water borne diseases due to lack of potable water and sanitation facilities	• Safe and clean water and good sanitation facilities should be provided to workers to prevent an outbreak of waterborne diseases among them which can also affect the surroundingcommunities.	Zero occurrence of water borne diseases among the workers.	Safe and clean drinking water provided on site daily. Operable sanitation facilities provided on site.	Operation phase	Site Manager	60,000	IFC Performance Standard 4: Community Health, Safety and Security; Public Health Act, Cap 295
Landscape and Visual Amenity									
OP6	Installation of solar PV modules.	Visual intrusion and disruption of the aesthetics.	• Use of low visual reflective solar modules with anti-reflective coating (ARC) that reduces reflectance from the solar PV modules; • Use of low level solar module mount design system (2 - 3 metres) that	Visual intrusion and disruption to aesthetics reduced.	Annually monitoring existing vegetation screening at the site and ensuring that it is appropriately	Operation phase	Site Manager	10,000	-

Table 2: Environmental and Social Management Plan - Operational phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator / Target**	**Frequency and Monitoring Action**	**Time Frame**	**Responsible Person**	**Cost**	**Best Practice Guidance (Legal /Project Proponent / IFC)**
			will not disrupt the aesthetic view of the project /surrounding areas: • Maintaining a perimeter buffer of trees and grass vegetation along the boundaries to screen sensitive viewing areas in the vicinity of the site.		maintained without providing shades onto the Solar PV modules				
Noise and vibration									
OP7	Operations of the solar plant (electricity production) including clearing of vegetation from under and around the solar modules.	Noise disturbance arising from the operation of solar plant potentially affecting workers on site.	• Operations workers likely to be exposed to high noise levels will be provided with adequate PPE such as ear plugs.	All workers at risk of being exposed to occasional high levels of noise provided with approved ear protection devises.	Monitoring noise levels to ascertain level of noise generated by inverters and to check compliance with IFC Noise Levels Guidelines for industrial receptors. Frequency: at commissionin g and daily during operation phase.	Operation phase	Site Manager	20,000	World Bank General EHS Guidelines; IFC PS 4 - Community Health, Safety and Security; Occupational Health and Safety Act 2010 of the Laws of Zambia; IFC PS 2 - Labour and Working Conditions.

Table 2: Environmental and Social Management Plan - Operational phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator / Target**	**Frequency and Monitoring Action**	**Time Frame**	**Responsible Person**	**Cost**	**Best Practice Guidance (Legal /Project Proponent / IFC)**
Occupation Health and Safety									
OP8	Occupational health and safety of workers working on site.	Reduced occupational health and safety among workers	• A Health and Safety Policy shall be established to guide operations of the facility. • All opertion activities should be conducted in accordance with provisions of the local legislation and international best practices (General EHS Guidelines: Occupational Health and Safety); • Safety rules should be enforced and complied with by workers, contractors and those coming to site; • Personal Protective Clothing (PPE) should be issued and used as required	Risks of preventable accidents that can potentially result in injuries and/or fatalities substantially reduced.	Daily risks identification and implementation of management measures conducted prior to commencement of works.	Operation phase	Site Manager	1000	World Bank EHS Guidelines: Occupational Health and Safety; IFC PS 4: Community Health Safety and Security; IFC PS1; IFC PS 2; IFC PS 5; Occupational Health and Safety Act, No. 36 of 2010 of the Laws of Zambia.

Table 2: Environmental and Social Management Plan - Operational phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator / Target**	**Frequency and Monitoring Action**	**Time Frame**	**Responsible Person**	**Cost**	**Best Practice Guidance (Legal /Project Proponent / IFC)**
			by the various including workers without appropriate PPE classes of the workers on project site; • Barrier tapes and caution signs should be erected in all potential hazardous areas to prevent injury or loss of life among workers; • No unauthorized person should be allowed on site						
OP9	Occupational Health and Safety	Risks to workers health and safety during the operation and maintenance activities of the project as they are exposed to electromagnetic fields.	• Regular measurement of electrical and magnetic radiation levels and taking appropriate measures when exposure exceeds acceptable levels. • Only trained and certified workers should be allowed to install, maintain or repair electrical equipment.	Maintaining exposure levels within the statutory and best practice limits.	Certified and approved monitoring protocols to be carried out for all electrical and magnetic radiation. Approved and authorised work permits to qualified competent persons only. Frequency: as per operations and monitoring guidelines.	Operation phase	Site Manager	10,000	World Bank General EHS Guidelines: Occupational Health and Safety; World Bank EHS Guidelines for Electric Power Transmission and Distribution; Occupational Health and Safety Act 2010 of the Laws of Zambia; Electricity Act CAP 433 of the Laws of Zambia.
OP10	Employment opportunities at the project site arising from construction	Influx of population of job seekers on site posing health and	• Enforcement of relevant by-laws laid down by the Local authority with the help of CEC to prevent	Development of any unplanned structures and / or activities within the project	Security surveillance and Community Engagement to	Construction and Operation phase	CEC / Local authorities	10,000	IFC PS 4: Community Health Safety and Security; Urban and Regional Planning Act, 2015

Table 2: Environmental and Social Management Plan - Operational phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator / Target**	**Frequency and Monitoring Action**	**Time Frame**	**Responsible Person**	**Cost**	**Best Practice Guidance (Legal /Project Proponent / IFC)**
	works.	security risks and leading to unplanned housing / structures and commercial activities around the project area.	mushrooming of unplanned structures and activities.	site and immediate surroundings prevented.	sensitize on matters relating to development of unplanned structures and activities. Frequency: Daily for security surveillance and quarterly for Community Engagement				
OP11	Operations of the Solar Plant	Risky sexual behaviour among the population local leading to Escalation of new STIs including HIV/AIDS in the local population and among the workforce.	• Developing an HIV/AIDS Policy by the Developer to be adhered to during operation phase of the project. • Sensitization programs on preventing the spread of STIs and HIV/AIDS for project workers including contractors and suppliers. • Provision of condoms (including Female Condoms) in places where they can be easily accessed such as toilets. • Education programs on fighting stigma of those infected with HIV/AIDS	HIV/AIDS Policy developed and implemented; Sensitisation / Education programmes on HIV/AIDS conducted for contractors and suppliers; Accessibility to condoms.	Bi-annually monitoring records of sensitisation / education programmes undertaken including the number of people sensitised / trained on STI and HIV/AIDS.	Operation phase	Environmental and Social Officer	10,000	IFC Performance Standard 4: on Community Health, Safety and Security. Public Health Act, Cap 295.

Table 2: Environmental and Social Management Plan - Operational phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator / Target**	**Frequency and Monitoring Action**	**Time Frame**	**Responsible Person**	**Cost**	**Best Practice Guidance (Legal /Project Proponent / IFC)**
Soils and geology									
OP12	Operation of the solar plant on site.	Damage to solar support structures and foundations due to soil erosion on site.	• An effective storm water drainage network should be maintained to channel increased surface runoff to designated catchment areas. An effective drainage network will minimise soil erosion over exposed surface and will minimise the risk of erosion of the support structures and foundations. It will also reduce the risk of flooding the project site.	No damage to solar support structures arising from soil erosion. Effective storm water drainage network maintained.	Bi-annual monitoring of effectiveness of all drainage structures at the project site.	Construction / Operation phases	Site Manager	10,000	World Bank Group General EHS Guidelines: Construction and Decommissioning
OP13	Operations of the solar power plant.	Risk / threat to electrical equipment due to potential flooding / poor drainage at the project site.	• An effective storm water drainage network should be constructed in and around the project area to avoid flooding. • Conduits for electrical installations should be appropriately constructed to avoid flooding them.	No flooding of the project site and no damage to electrical installations experienced.	Bi-annual monitoring of storm water drainage system and electrical installations.	Operation phase	Site Manager	10,000	World Bank Group General EHS Guidelines: Construction and Decommissioning ; IFC Performance Standard 3;
Water Resources									

Table 2: Environmental and Social Management Plan - Operational phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator / Target**	**Frequency and Monitoring Action**	**Time Frame**	**Responsible Person**	**Cost**	**Best Practice Guidance (Legal /Project Proponent / IFC)**
OP14	Operation of the Solar PV plant at the project site.	Risk of erosion of solar PV support structures and foundations arising from increase in surface runoff during the rainy season or storm rainfall being more than infiltration into the ground.	• Storm water drainage system should be inspected regularly to ensure that the system conveys surface runoff away from the project area into a catchment area, which will hold runoff and allow it to slowly infiltrate the ground. • The drainage system should also be designed and constructed to avoid erosion of support structures and foundations.	No damage of Solar PV structures and foundations arising from erosional process on site. Storm water drainage system inspected and maintained.	Bi-annual inspection (before and after start of rain season) of storm water drainage network operation phases to ensure their structural stability and capacity to convey surface runoff.	Construction and Operation phase	Site Manager	10,000	World Bank Group General EHS Guidelines: Construction and Decommissioning ; IFC Performance Standard 3;
OP15	Conversion of the existing vegetation cover to bare or impervious surface at the project site	Flood risks arising from increased surface runoff and reduced infiltration into the groundwater regime with potential to cause damage to solar plant infrastructure (especially electrical equipment) mounted on or close to ground level.	Storm water drainage system should be properly designed and constructed to convey surface runoff away from the project area into a catchment area that will hold runoff and allow it to slowly infiltrate into the ground. This will also contribute to recharging of the groundwater aquifer. • Where appropriate, upstands should be erected for installation of electrical equipment to avoid flooding.	Effective drainage system constructed and risks of flooding of the project site that can cause damage to electrical equipment minimised.	Inspection of storm water drainage network during construction and operation phases to ensure their structural integrity and capacity to convey surface runoff. Frequency: Before and after the start of the rain season.	Construction and Operation phase	Site Manager	10,000	World Bank Group General EHS Guidelines: Construction and Decommissioning; IFC Performance Standard 3;

Table 2: Environmental and Social Management Plan - Operational phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator / Target**	**Frequency and Monitoring Action**	**Time Frame**	**Responsible Person**	**Cost**	**Best Practice Guidance (Legal /Project Proponent / IFC)**
OP16	Storage and handling of fuels and oils on site during operations phase.	Potential groundwater contamination onsite arising from spillage of fuels and oils onto the ground during operations phase.	• Handling, storage and disposal of hazardous substances (used transformer oils and others) should be carried out in accordance with the World Bank General Environmental Health and Safety Guidelines, Zambian Environmental Management (Licensing) Regulations, 2013 including Material Safety Data sheets (MSDS). • Appropriate designed bunded storage areas with impervious lining should be constructed and maintained. • Separate storage areas should be provided for all hazardous substances / products and they must be labelled with proper identification of its hazardous properties. These will then be collected and transported to a hazardous storage facility at CEC main plant in Kitwe. • Training on handling, storage and disposal of hazardous waste should be provided to relevant	• No contamination of groundwater arising from spillage of fuels and oils. • Fuel and oil storage areas provided with appropriate protective lining and labelling. • Training provided to personnel involved in handling, storage and disposal of hazardous materials • Materials; Record of training	• Weekly (and as and when material is received and dispatched) inspection of storage areas to monitor or ensure their integrity. • Weekly inspections and update of materials Storage bays and inventory	Operation phase	Site Manager	5000	World Bank Group General EHS Guidelines for Hazardous Material Management; IFC Performance Standard 3; Zambian Environmental Management (Licensing) Regulations, 2013.

Table 2: Environmental and Social Management Plan - Operational phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator / Target**	**Frequency and Monitoring Action**	**Time Frame**	**Responsible Person**	**Cost**	**Best Practice Guidance (Legal /Project Proponent / IFC)**
			workers on site as part of the overall environmental management of the site.	schedules for trained personnel. • Record inspection of fuels and oils storage areas including other hazardous wastes on site.					
OP17	Storage and handling of fuels and oils including handling of hazardous waste on site during operational phase.	Potential contamination of groundwater from spillage of fuels, oils and solid wastes	• Uncontrolled dumping or littering of any waste within the project area and areas adjacent to the project site should be avoided. • Uncontrolled dumping of any toxic or hazardous waste, including used oils from transformers should be avoided. • Solid wastes will be temporarily stored / accumulated on-site and later collected and disposed of at approved landfill sites • Specific dumping locations for litter and any other waste should be provided on site	No groundwater contamination arising from storage and handling fuels and oils including hazardous waste.	Weekly inspection of dumping sites within the site to ensure correct labelling and usage.	Operation phase	Environmental and Social Officer	10,000	World Bank Group General EHS Guidelines for Hazardous Material Management; IFC Performance Standard 3; Zambian Environmental Management (Licensing) Regulations, 2013.

Table 2: Environmental and Social Management Plan - Operational phase									
Ref	**Aspect / Issue**	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator / Target**	**Frequency and Monitoring Action**	**Time Frame**	**Responsible Person**	**Cost**	**Best Practice Guidance (Legal /Project Proponent / IFC)**
			with adequate protective lining. • Collection, storage and removal of all toxic and hazardous waste should be documented and handled by competent staff.						
OP18	Conversion of the existing vegetation cover to bare or impervious surface at the project site.	Reduced recharge of groundwater aquifer.	• Storm water drainage system should be properly designed and constructed to convey clean surface runoff away from the project area into a catchment area from where runoff will be held and allowed to slowly filter into the ground. This will also contribute to recharging of the groundwater aquifer.	Storm Water Management Plan with detailed site layout and functionality developed and implemented	Bi-annual inspection of the storm water system (Inspection to be carried put (before and during the rainy season).	Operation phase	Site Manager	5000	World Bank Group General EHS Guidelines: Construction and Decommissioning; IFC Performance Standard 3;

Table 3: Environmental and Social Management Plan during Decommissioning Phase (all the aspects and mitigation measures similar to construction phase)								
Aspect / Issue	**Potential Impact / Risk**	**Mitigation Measures**	**Performance Indicator / Target**	**Frequency and Monitoring Action**	**Time Frame**	**Responsible Person**	**Cost**	**Best Practice Guidance (Legal /Project Proponent / IFC)**
Air Quality								

Demolition of site buildings at decommissioning and restoration of the site.	Potential health effects on workers involved in demolition of site buildings and removal of site infrastructure arising from dust generation.	• Workers who will be involved in carrying out decommissioning works should be provided with adequate PPE such as dust masks.	Dust emissions reduced and reduced risk to health of personnel due to exposure to high dust levels during decommissioning of the solar plant. All workers provided with approved dust protection devises.	Daily safety checklists to ensure workers have approved PPE.	Decommissioning phase	EPC Contractor HSE Engineer	2,000	World Bank General EHS Guidelines: Occupational Health and Safety; Occupational Health and Safety Act 2010 of the Laws of Zambia; IFC PS 2 – Labour and Working Conditions.
Noise and vibration								
Removal from site of used solar modules, demolition of site buildings and restoration of the site.	Noise disturbance associated with decommissioning activities may potentially affect workers on site.	• Workers likely to be exposed to high noise levels should be provided with adequate PPE such as ear plugs. Decommissioning works should be done during day time to reduce on exposing the surrounding community to any potential noise disturbance.	Noise levels not exceeding IFC Noise Levels Guidelines for industrial receptors. All workers at risk of being exposed to high levels of noise provided with approved ear protection devises.	Daily safety checklists during decommissioning works.	Decommissioning phase	EPC Contractor HSE Engineer	5,000	World Bank General EHS Guidelines: Construction and Decommissioning; IFC PS 4 – Community Health, Safety and Security; Occupational Health and Safety Act 2010 of the Laws of Zambia; IFC PS 2 – Labour and Working Conditions.

2 Site Specific Waste Management Plan Land Preparation / Construction Phase

The project site may in the past have been susceptible to illegal dumping of domestic and industrial (mining sludge) wastes. These will require complete removal and transportation to offsite landfill sites prior to preparation / construction activities.

A chance find procedure will be followed prior to removal of any such materials, this will include the following steps:

- Suspend preparation / construction works upon encountering or excavating such waste materials.
- Inform the regulators (Local Authorities and ZEMA) about what has been found.
- Seclude the hazardous materials;
- Undertake assessment of coverage or extent of hazardous waste materials;
- Undertake an assessment of possible soil contamination by such materials;
- Apply remediation if such materials are proved to have contaminated the soil or immediate surroundings;
- Collect and transport materials to offsite approved dumpsites for non-hazardous materials;
- Collect and transport all hazardous materials to a hazard waste accumulation facility located at the CEC main plant within Kitwe.

3 Solid Waste / Used Containers (Garbage and Inert Materials)

CEC and InnoVent shall apply the following principles in handling of general garbage (wood, plastics, paper, and food wastes):

- Segregate components such as wood, plastic and paper, for recycling or reuse.
- Reduce packaging wastes such as paper and plastic by the use of bulk handling systems.
- Dispose all wastes at local approved dumpsites.

4 Sanitary Waste

Appropriate mobile septic tanks shall be provided during installation/pre-construction and construction phases. Sewage during the pre-construction, construction and operation phases

shall be treated with residual chlorine level of 0.8-2.0 mg/l before disposal at appropriate sites.

In order to manage the waste generated on site, the following guideline and principle will be applied:

5 Waste Handling Guidelines

Wastes handling and disposal procedures shall be well defined at source and a waste inventory register kept. The general information required, as a minimum, for adequate definition of wastes include:

- Waste stream identification;
- Proper waste categorization;
- Waste segregation;
- Appropriate handling and disposal practice; and
- Recommended Management practices.

6 Waste Minimization Guidelines

The four principles of waste minimization process; recycle, reduce, reuse and recovery shall be adopted as applicable, to ensure reduction to the possible extent, of the volume or relative toxicity of liquid or solid wastes.

7 Waste Segregation Guidelines

All wastes to be generated from the project shall be segregated at source, into clearly designated bins at strategic locations. Colour codes or clear labeling shall be used to differentiate the different waste bins.

8 Waste Disposal Guidelines

All debris, spoilt materials, rubbish and other waste, shall be cleared from the site during construction and disposed off accordingly at local designated dump/landfill sites for such wastes.

All wastes in transit shall be tracked by waste consignment note. The waste consignment note records shall be kept and would include as a minimum the following information:

- Date of dispatch;
- Description of waste;
- Waste quantity/container type;

- Designated disposal site and method;
- Consignee /driver name and means of transportation; and
- Confirmation of actual disposal (time and date).

9 Operation Phase

The proposed solar power generation project is not expected to generate significant quantity of waste, nevertheless, adequate waste management guideline and disposal facility have been integrated into the implementation of the proposed project. The principle of waste reduction, recycling, recovery and re-using shall be practiced. All wastes, which cannot be reused, will be managed and disposed off in accordance with the local regulatory standards.

Chemicals used during substation maintenance such as transformer oil, lubricants, etc. shall be stored and handled appropriately to minimize spills or leaks. Adequate hazardous materials handling programme shall be put in place to avoid poor handling and disposal and to reduce incidence of surface run-off and soil contamination where chemicals are spilled. Workers handling hazardous materials shall be trained about proper storage and handling techniques and shall be made to study and understand the MSDS accompanying each chemical.

No fueling and maintenance of vehicles shall be done on-site and all fixed equipment which uses fuel or oil shall be placed far enough from natural surface water bodies, i.e. at least 50m away. All potential sources of leaks from operation and maintenance of fixed equipments shall be blocked through regular maintenance and inspection. Adequate maintenance of drainage systems shall be carried out to prevent any overflow.

Oil and other hazardous materials shall be stored in an area with secondary containment; spill clean-up materials shall be located at appropriate locations. Solid waste shall be segregated or sorted and stored separated. Hazardous wastes shall be disposed of by a government approved licensed third-party contractor.

Permanent sewer disposal facilities utilizing septic tanks and soak aways will be constructed on site. these will be located far enough from any nearby surface water body (i.e. at least 50m away) and will be checked and emptied regularly or as required.

APPENDIX 1.2: IMPACT ASSESSMENT METHODOLOGY

1.0 Method of Assessing Impact Significance

The identification and assessment of environmental impacts is a multi-faceted process, using a combination of quantitative and qualitative descriptions and evaluations. It involves applying scientific measurements and professional judgement to determine the significance of environmental impacts associated with the proposed project. The process involves consideration of, *inter alia*: the purpose and need for the project; views and concerns of I&APs; social and political norms, and general public interest.

1.1 Identification and Description of Impacts

Identified impacts will be described in terms of the nature of the impact, compliance with legislation and accepted standards, receptor sensitivity and the significance of the predicted environmental change (before and after mitigation). Mitigation measures may be existing measures or additional measures that were identified through the impact assessment and associated specialist input. The impact rating system considers the confidence level that can be placed on the successful implementation of mitigation.

1.2 Evaluation of Impacts and Mitigation Measures

1.2.1 Introduction

All impacts identified for the project were subjected to a standard convention for assessing the significance of impacts, a summary of which is provided below.

In assigning significance ratings to potential impacts before and after mitigation the approach presented below is to be followed.

1. **Determine the impact consequence rating:** This is a function of the "intensity", "duration" and "extent" of the impact (see Section 0). The consequence ratings for combinations of these three criteria are given in Section 0.

2. **Determine impact significance rating:** The significance of an impact is a function of the consequence of the impact occurring and the probability of occurrence (see Section 0). Significance is determined using the table in Section 1.2.4.

3. **Modify significance rating (if necessary):** Significance ratings are based on largely professional judgement and transparent defined criteria. In some instances, therefore, whilst the significance rating of potential impacts might be "low", the importance of these impacts to local communities or individuals might be extremely high. The importance/value which interested and affected parties attach to impacts will be highlighted, and recommendations should be made as to ways of avoiding or minimising these perceived negative impacts through project design, selection of appropriate alternatives and / or management.

4. **Determine degree of confidence of the significance assessment:** Once the significance of the impact has been determined, the degree of confidence in the assessment will be qualified (see Section 0). Confidence in the prediction is associated with any uncertainties, for example, where information is insufficient to assess the impact.

1.2.2 Criteria for Impact Assessment

The criteria for impact assessment are provided below.

Criteria	Rating	Description
Criteria for ranking of the INTENSITY (SEVERITY) of environmental impacts	**ZERO TO VERY LOW**	Negligible change, disturbance or nuisance. The impact affects the environment in such a way that natural functions and processes are not affected. People / communities are able to adapt with relative ease and maintain pre-impact livelihoods.
	LOW	Minor (Slight) change, disturbance or nuisance. The impact on the environment is not detectable or there is no perceptible change to people's livelihood.
	MEDIUM	Moderate change, disturbance or discomfort. Where the affected environment is altered, but natural functions and processes continue, albeit in a modified way. People/communities are able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support.
	HIGH	Prominent change, disturbance or degradation. Where natural functions or processes are altered to the extent that they will temporarily or permanently cease. Affected people/communities will not be able to adapt to changes or continue to maintain-pre impact livelihoods.
Criteria for ranking the DURATION of impacts	**SHORT TERM**	< 5 years.
	MEDIUM TERM	5 to < 15 years.
	LONG TERM	> 15 years, but where the impact will eventually cease either because of natural processes or by human intervention.
	PERMANENT	Where mitigation either by natural processes or by human intervention will not occur in such a way or in such time span that the impact can be considered transient.
Criteria for ranking the EXTENT / SPATIAL SCALE of impacts	**LOCAL**	Impact is confined to project or study area or part thereof, e.g. limited to the area of interest and its immediate surroundings.
	REGIONAL	Impact is confined to the region, e.g. coast, basin, catchment, municipal region, etc.
	NATIONAL	Impact is confined to the country as a whole, e.g. South Africa, etc.
	INTERNATIONAL	Impact extends beyond the national scale.
Criteria for determining the PROBABILITY of impacts	**IMPROBABLE**	Where the possibility of the impact to materialise is very low either because of design or historic experience, i.e. ≤30% chance of occurring.

Criteria	Rating	Description
	POSSIBLE	Where there is a distinct possibility that the impact would occur, i.e. > 30 to ≤ 60% chance of occurring.
	PROBABLE	Where it is most likely that the impact would occur, i.e. > 60 to ≤ 80% chance of occurring.
	DEFINITE	Where the impact would occur regardless of any prevention measures, i.e. > 80% chance of occurring.
Criteria for determining the DEGREE OF CONFIDENCE of the assessment	**LOW**	≤ 35% sure of impact prediction.
	MEDIUM	> 35% and ≤ 70% sure of impact prediction.
	HIGH	> 70% sure of impact prediction.
Criteria for the DEGREE TO WHICH IMPACT CAN BE MITIGATED - the degree to which an impact can be reduced / enhanced	**NONE**	No change in impact after mitigation.
	VERY LOW	Where the significance rating stays the same, but where mitigation will reduce the intensity of the impact.
	LOW	Where the significance rating drops by one level, after mitigation.
	MEDIUM	Where the significance rating drops by two to three levels, after mitigation.
	HIGH	Where the significance rating drops by more than three levels, after mitigation.
Criteria for LOSS OF RESOURCES - the degree to which a resource is permanently affected by the activity, i.e. the degree to which a resource is irreplaceable	**LOW**	Where the activity results in a loss of a particular resource but where the natural, cultural and social functions and processes are not affected.
	MEDIUM	Where the loss of a resource occurs, but natural, cultural and social functions and processes continue, albeit in a modified way.
	HIGH	Where the activity results in an irreplaceable loss of a resource.

1.2.3 Determining Consequence

Consequence attempts to evaluate the importance of a particular impact, and in doing so incorporates extent, duration and intensity. The ratings and description for determining consequence are provided below.

Rating	Description
VERY HIGH	Impacts could be EITHER: of ***high intensity*** at a ***regional level*** and endure in the ***long term***; OR of ***high intensity*** at a ***national level*** in the ***medium term***; OR of ***medium intensity*** at a ***national level*** in the ***long term.***
HIGH	Impacts could be EITHER: of ***high intensity*** at a ***regional level*** and endure in the ***medium term***; OR of ***high intensity*** at a ***national level*** in the ***short term***; OR of ***medium intensity*** at a ***national level*** in the ***medium term;*** OR of ***low intensity*** at a ***national level*** in the ***long term***; OR of ***high intensity*** at a ***local level*** in the ***long term***; OR of ***medium intensity*** at a ***regional level*** in the ***long term.***
MEDIUM	Impacts could be EITHER: of ***high intensity*** at a ***local level*** and endure in the ***medium term***; OR of ***medium intensity*** at a ***regional level*** in the ***medium term***; OR of ***high intensity*** at a ***regional level*** in the ***short term***; OR of ***medium intensity*** at a ***national level*** in the ***short term***; OR of ***medium intensity*** at a ***local level*** in the ***long term***; OR of ***low intensity*** at a ***national level*** in the ***medium term;*** OR of ***low intensity*** at a ***regional level*** in the ***long term.***
LOW	Impacts could be EITHER of ***low intensity*** at a ***regional level*** and endure in the ***medium term***; OR of ***low intensity*** at a ***national level*** in the ***short term***; OR of ***high intensity*** at a ***local level*** and endure in the ***short term***; OR of ***medium intensity*** at a ***regional level*** in the ***short term***; OR of ***low intensity*** at a ***local level*** in the ***long term***;

Rating	Description
	OR of ***medium intensity*** at a ***local level*** and endure in the ***medium term.***
VERY LOW	Impacts could be EITHER of ***low intensity*** at a ***local level*** and endure in the ***medium term***; OR of ***low intensity*** at a ***regional level*** and endure in the ***short term***; OR of ***low to medium intensity*** at a ***local level*** and endure in the ***short term.*** OR **Zero to very low intensity** with any combination of extent and duration.

1.2.4 Determining Significance

The consequence rating is considered together with the probability of occurrence in order to determine the overall significance using the table below.

		PROBABILITY			
		IMPROBABLE	POSSIBLE	PROBABLE	DEFINITE
CONSEQUENCE	VERY LOW	INSIGNIFICANT	INSIGNIFICANT	VERY LOW	VERY LOW
	LOW	VERY LOW	VERY LOW	LOW	LOW
	MEDIUM	LOW	LOW	MEDIUM	MEDIUM
	HIGH	MEDIUM	MEDIUM	HIGH	HIGH
	VERY HIGH	HIGH	HIGH	VERY HIGH	VERY HIGH

In certain cases it may not be possible to determine the significance of an impact. In these instances, the significance is **UNKNOWN**.

APPENDIX 1.3: ENVIRONMENTAL MONITORING PLAN

ENVIRONMENTAL MONITORING PLAN FOR GARNETON NORTH SOLAR PV PLANT

Key monitoring requirements have been identified through the ESIA process to monitor the environmental and social performance of the Project. The overall objectives of monitoring are to:

- Ensure regulatory requirements are met;
- Verify predictions made in the ESIA by obtaining real time measurements;
- Verify that mitigation measures are effective; and
- Provide early warning of potential unplanned for or unmitigated impacts.

Monitoring will be carried out by the Project team and Contractor(s) pursuant to their contractual obligations to undertake inspections, monitoring and reporting. The following four types of inspections and monitoring will be employed:

- **Inspections** planned and conducted on a regular basis to ensure that mitigation measures and commitments are properly maintained and implemented, and that specific management procedures are being followed (*e.g.* practices on temporary waste storage and transport).
- **Receptor monitoring** undertaken to verify predictions made in the ESIA and to confirm that the activities at the site are not resulting in unacceptable impacts on the environment and assessing disturbance to affected communities through a grievance mechanism).
- **Compliance monitoring** involving periodic sampling or continuous recording of specific environmental quality indicators to ensure compliance of emissions with Project standards (e.g. air quality and noise monitoring).
- **Auditing** to assess compliance of the Project activities with both regulatory and site management system requirements.

The results of the inspection and monitoring activities will be reported to the Senior Manager-HSES and Risk on a monthlyy basis, or as required.

Table 1: Environmental Monitoring Plan for selected Environmental and Social Aspects

Aspect, Potential impact/issue	ESIA Ref.	Specific Actions	Responsible Person for ensuring commitment implementation	Means of verification that commitment has been met (KPI)	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Reporting Requirements	Budget for Monitoring Cost (US$)
Biophysical Impacts								
Air Quality Management								
Ambient Air Quality	6.2.1.1	Monitoring of ambient PM10, SO_2 and NO_X levels at pre-defined receptor locations to establish conformance to the ambient air quality guidelines.	Project Manager	Results of air quality samples	Every 3 months, during construction	Senior Manager-HSES and Risk	HSE Audit Report	6000
Soils Management								
Soil Erosion and Contamination	6.2.1.3 and ESMP	Monitoring of silt traps where high volumes of runoff enter the Mwambashi stream and Sand sales water reservoir. The Total Suspended Solids is likely to vary over a season based on the amount of rainfall and runoff.	Technical Manager Project Manager	HSE Manager report, Visual inspection	Monthly	Senior Manager-HSES and Risk	HSE Manager audit report	1500
		Monitoring of erosion in the vicinity of access roads and other hard-standing surfaces will be conducted before and after the rainy season to ensure erosion sites can be identified early and remedied.		Monitoring report	Monthly			1500

Aspect, Potential impact/issue	ESIA Ref.	Specific Actions	Responsible Person for ensuring commitment implementation	Means of verification that commitment has been met (KPI)	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Reporting Requirements	Budget for Monitoring Cost (US$)
Ecological Management								
Monitoring of riverline vegetation and aquatic life in Mwambashi stream	6.2.2.2	• Visual inspections to ensure that vegetation along the streamlines remain undisturbed as per Developers environmental commitment.	Project Manager	Monitoring records	Every 3 months	Senior Manager-HSES and Risk	HSE Manager audit report	3000
		• Monitoring of known fish species in the Mwambashi stream by the Department of Fisheries (DOF) to take place. Results of monitoring during construction periods by the Project Ecologist to be made available to DOF, and results from DOF to be requested in return.			Every 6 months			2000
Introduction of Invasive Aquatic Plant Species through	6.2.2.2	Development and implementation of an Invasive Species Management Plan, which will incorporate a monitoring programme and resource requirements.	Project Manager	Recorded training	Every 6 months	Senior Manager-HSES and Risk	Record of training	1000

Aspect, Potential impact/issue	ESIA Ref.	Specific Actions	Responsible Person for ensuring commitment implementation	Means of verification that commitment has been met (KPI)	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Reporting Requirements	Budget for Monitoring Cost (US$)
Flooding of streamlines								
Introduction of Invasive Aquatic Plant Species through Flooding of streamlines.	6.2.2.1 and ESMP	Vegetative wastes of invasive species of plants, e.g. Tithonia diversiforlia will be collected and disposed at a local approved landfill site	Project Manager	Records of waste disposal	Logs to be audited every 3 months throughout construction	Senior Manager-HSES and Risk	HSE Manager audit report	1000
Surface Water Quality	ESMP	Water quality needs to be monitored on a regular basis in order to highlight potential issues during the operational phase. The main variables include: Nitrogen, Phosphorus, turbidity, pH, electrical conductivity, suspended solids and DO. It is also recommended that water quality monitoring include the analyses of lead, zinc and methyl- mercury. Monitoring points should be located upstream of the Mwambashi stream, within the stretch falling within the project land and downstream.	Project Manager	Water quality tests	Every 6 month	Senior Manager-HSES and Risk	HSE Manager audit report	6000

Aspect, Potential impact/issue	ESIA Ref.	Specific Actions	Responsible Person for ensuring commitment implementation	Means of verification that commitment has been met (KPI)	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Reporting Requirements	Budget for Monitoring Cost (US$)
Socio-economic Impacts								
Over-arching Plans and Programmes								
Discussion Points	-	In case CSR activities will be established they will be monitored on same basis as mitigation programmes/activities.	Project Manager	Corporate Social Responsibility Strategy		Senior Manager-HSES and Risk	Updated Corporate Social Responsibility Strategy	1000
Visual and aesthetics	6.2.3.1	Implement the Stakeholder Engagement Plan (SEP) monitoring as part of project implementation.	Project Manager	Stakeholder Engagement Plan, Documented community communications	Every 3 months	Senior Manager-HSES and Risk	Updated SEP	1000
Management of Malaria	6.2.3.5 and 6.2.3.6	Monitor the incidence of malaria using available data, most notably the number of workforce cases that occur.	Project Manager	Collection of data	monthly	Senior Manager-HSES and Risk	HSE Manager audit report	1000
Management of Employment Creation	6.1.1	Record the number and provenance of persons employed on site	Project Manager	Records of employees	Throughout Monthly during construction and operation	Senior Manager-HSES and Risk	HSE Manager audit report	1000

Aspect, Potential impact/issue	ESIA Ref.	Specific Actions	Responsible Person for ensuring commitment implementation	Means of verification that commitment has been met (KPI)	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Reporting Requirements	Budget for Monitoring Cost (US$)
Livelihood restoration and livelihood restoration programs	6.2.3.3	Monitor the implementation of all livelihood restoration activities as stated in the Livelihood Restoration Plan	Project Manager	Monitoring and evaluation reports	Quarterly, (every 3 months)	Senior Manager-HSES and Risk	HSE Manager audit report	3000

APPENDIX 2.3: PROPOSED FOOTPATHS

Appendix 2-3: Rerouted Trail Options for Garneton North for engagement with affected persons.

Figure A2-1: Garneton North Site Boundary with existing points of access for neighboring land users.

White: Garneton North site boundary
SG: School Gate on Eastern edge of site boundary
FG: Farm Gate on Eastern edge of site boundary

Figure A2-2: Option 1 for rerouting access routes.

Red: 900m around Southern edge of site for farm access
Green: 1010m along Easter edge of site traveling North
Orange: 120m to connect green route to existing access route. See Figure A2-4 for detail

Figure A2-3: Option 2 for rerouting access routes, creating perimeter around entire site.

Red: 900m around Southern edge of site for farm access
Yellow: 1160m along Eastern edge of the site to connect FG and SG
Green: 1010m along Easter edge of site traveling North from SG
Blue: 340m to connect green route to existing access route around Northern site edge. See Figure A2-4 for detail

Figure A2-4: Northern Route Options 1 & 2 Detail.

Orange: Option 1: 120m to connect green route to existing access route.

Blue: Option 2: 340m to connect green route to existing access route around Northern site edge.

APPENDIX 3: WASTE MANAGEMENT PROCEDURE

	COPPERBELT ENERGY CORPORATION STANDARD OPERATING PROCEDURE			
Title:	**WATSE MANAGEMENT PROCEDURE**			
Procedure No.:	**CEC/CQQ/QA/004**	**Issue No. 8.0**	**Date: 29.11.2022**	**Status: Issued**

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Approved by: _____ Senior Manager – HSES and Risk	Date: 29.11.2022

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1.0 Purpose

This procedure provides information and guidelines on managing waste at CEC to ensure compliance to legal requirements, company policies, local concerns to achieve continual improvement in environmental management performance. It also provides the information on separation and storage of waste according to type, characteristics, and disposal.

2.0 Scope

This procedure applies to all CEC facilities and sites.

3.0 Definitions

Within the context of this procedure, the following definitions shall apply:

Term	Definition
Waste	garbage, refuse, sludge's, and other discarded substances resulting from industrial and commercial operations and from domestic and community activities

Pollution	The presence in the environment of one or more contaminants in such quantities and for such duration and under such conditions that may cause discomfort or to endanger the health; safety and welfare of persons, or which may cause injury or damage to flora and fauna, or which may interfere unreasonably with the normal enjoyment of life or use of proper or conduct of business;
Hazardous Waste	Waste, which is poisonous, corrosive, irritant, explosive, inflammable, toxic or harmful to human, animal, plant, or the environment
Collection	The act of removing waste, or materials, which have been separated for the purpose of recycling, from a storage point;
Disposal	The storing, handling, processing, treatment and utilization and final location of waste to avoid undesired effects on the environment;
Licence	A licence to operate a waste disposal site or plant issued under this part

Disposal Site	Means the approved land where waste disposal facilities are physically located.
Storage	The interim containment of waste after generation and prior to collection form ultimate recovery or disposal;
Environment	Land, water, air and other external influences and conditions that affect the development and life of all organisms including human beings
Clinical Waste	This is waste from medical establishments like clinics and hospitals e.g., pharmaceutical waste, syringes, and body tissues;
Industrial Waste	This is waste, which comes from industries but does not include hazardous waste. This waste is in most cases is homogeneous and is easier to handle and manage e.g., mine waste such as waste rock and tailings, metals, chemical
Municipal Solid Waste	This is waste, which includes trading commercial and domestic waste e.g., packaging, perishables, kitchen waste and paper waste.

Approved by: _____ Senior Manager – HSES and Risk	Date: 29.11.2022

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4.0 Procedure

4.1 Waste management at CEC

Waste generated at CEC is classified as hazardous and non-hazardous and management of these two streams of waste have been detailed below.

4.1.1 Hazardous Waste

Due to the inherent risks associated with the generation and handling of hazardous wastes, extreme care must be taken and maintained when handling, packaging, transporting, and disposing of these waste types. The following are the minimum requirements:

- There shall be dedicated hazardous waste storage area, which will be protected from other elements.
- The total amount of waste generated across CEC facilities shall not exceed 0.99 Tonnes per year at any given site and 500Tonnes at CSS.
- The storage area shall have an impervious surface and must contain any spillage. The containment can be achieved by provision of a bund wall, a sump, an inward sloping floor or tray. In each case the volume of the containment facility should be at least 110% of the largest holding vessel in the enclosure.
- Incompatible hazardous wastes will not be stored in proximity of each other, to an extent that the mixing of their vapours or because of an accidental spill will not result in a new major risk or a more dangerous hazard.
- All loading and offloading of the storage bins will take place within the containment area. Where this is not possible, appropriate measures will be taken to prevent spillage. The loading and offloading of the bins should be carried out in such a manner that under normal working conditions spillage will not occur.
- Bins for storing hazardous waste will be kept closed at all times.
- Access into hazardous waste storage areas will be restricted to authorised persons for purposes of loading and offloading of waste bins, inspections, and equipment maintenance.
- No hazardous liquid waste will be discharged into a storm water drain or a sewer system unless it has been prior to being discharged, appropriately treated to render the product non-hazardous to both people and the environment.

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- Hazardous waste containers must not be transported by hand unless the container is designed for that purpose and there is no risk of the waste spilling in transit under normal handling conditions.
- Hazardous waste spills shall be immediately reported to the responsible line supervisor. The supervisor will arrange for the immediate containment of the spill, its recovery or treatment in situ and clean-up of the spill site. The supervisor will also report the incident to system control and HSES and Risk as appropriate considering its extent and significance. Non-hazardous waste (e.g., clothing), which has been contaminated with a hazardous substance, will be treated as hazardous.
- Waste transportation off site will be conducted in a manner which will protect people and the environment i.e., the vehicles used must be roadworthy and fitted with appropriate hazard warning sign / symbol.
- The transportation operation must be licensed with the local authority in any given town where CEC operates.
- The waste must only be disposed of at a site licensed for such waste type or agreed with the regulators in case of an interim storage site.
- Storage of Hazardous waste at the Hazardous Storage Shelter shall be relevant as long as the ZEMA limit is not exceeded.
- Disposal of hazardous waste shall be done in accordance with the prescribed regulations but shall only be done when it is economically feasible to do so, without exceeding the ZEMA annual limits.

4.1.2 Waste oil

There are mainly two different types of waste oil generated at CEC namely transformer oil and engine oil. Transformer oil shall be taken to the oil tank farm for regeneration. In a situation where the properties cannot be improved, the waste transformer oil is taken to the stores yard for onward collection by a licensed third party. The engine oil once generated is taken to the stores for onward collection by a licensed third party.

4.1.3 Oil Contaminated Waste.

The oil contaminated waste generated at CEC include oil filters, mutton cloth and used oil spill absorbents. The oil filters once generated shall be drained off completely and sold as scrap metal.
The contaminated mutton cloth shall be soaked with a biodegradable degreaser and thereafter can either be re-used or disposed of as non-hazardous waste. The used oil absorbents shall be taken to the bioremediation farm for treatment thereafter be used by horticulture as manure.

4.1.4 Fluorescent Tubes

The fluorescent tubes shall be crushed using a fluorescent tube crusher and then kept in interim storage facility awaiting final disposal to be approved by the Zambia Environmental Management Agency.

4.1.5 Clinical Waste

Clinical waste will be placed in biohazard bags at the Plant site Clinic. The bags will be sealed on site prior to being transported to the incinerator at Progress Medical Centre for high temperature burning in the incinerator. In respect of sharps, these may be placed in appropriate primary containers before being placed in biohazard bags to ensure that they do not puncture the biohazard bags.

4.1.6 Batteries

The used batteries generated are taken to stores where they are sold to licenced third parties.

4.1.7 Refrigeration Equipment

Fridges and freezers contain gases such as chloro-fluorocarbons (CFCs) and hydro chlorofluorocarbons (HCFCs). Both CFCs and HCFCs are greenhouse gases, which when emitted into the atmosphere contribute to climatic change It is recommended that prior to disposal of the equipment, maintenance staff should:

- Ensure that the gas is removed and contained in the refrigerant cylinders.

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- Ensure that the oil is removed from compressors to prevent spillage.
- Ensure that refrigerant cylinders are emptied completely, and valves left open to prevent pressure build up inside which can result into cylinder explosion causing injury.

4.1.8 Electronic Waste

To reduce harm to mankind and the environment and to monitor and account for the decommissioned electrical and electronic equipment, such as printer cartridges, computers, laptops, meters, telecommunication equipment, generated by the Company; it shall be the responsibility of all employees in charge to adopt and implement the following:

Ensure all Electronic waste is properly packed in plastic bags where in preparation for storage at the main stores.

- Avoid throwing E-waste in waste bins.
- In the case of Cartridges and Copiers, caution must be taken to avoid spillage or discharge of Copier ink or powder.
- The Supervisor Horticulture shall then plan to have the E-waste collected and deposited / stored at the main stores. This waste shall be treated as hazardous waste and disposed of with other hazardous waste.
- The Supervisor Horticulture shall maintain monthly records of the quantities of E-waste collected during the month. This data shall be used to compile statistics on waste management for inclusion in the environmental monthly reports.
- All other forms of E-waste that include or are similar in form to all of the following: Laptops, Printers, Monitors, CPUs, Top Cage Electrical relays, Telecoms, and metering devices once generated shall be quantified and taken to stores for temporal storage awaiting final disposal.

4.1.9 Asbestos Waste

- All asbestos waste and used disposable PPE must be disposed of in accordance with the requirements of the Hazardous waste regulations.

- During and on completion of the Asbestos Contaminated Material works, these shall be double bagged/wrapped as it is produced. Bags shall be sealed, labelled, and cleaned prior to removal from the sealed off enclosure.

- Bags containing asbestos waste shall be transported along an agreed route for immediate removal from site, or safe storage within a lockable container located in an agreed position on site.

- Where practicable, large pieces of rigid materials must not be broken or cut for disposal in plastic sacks. They should be double wrapped intact in sheet plastics or other suitable material or placed in a sealed container.

- All asbestos waste shall be disposed of strictly at a site licensed to receive it in accordance with the Environmental Management Act No. 12 of 2011. Permanent records must be updated when asbestos has been removed.

- Asbestos stored shall only be transported with the authorisation of HSES & Risk department.

4.1.10 Expired chemicals

These are chemicals that are unused during their period of usefulness. When these chemicals exceed their shelf life without being consumed, they are disposed of at an incinerator. This disposal is approved by ZEMA.

4.1.11 Silica Gel

Silica gel is used in transformers to absorb moisture. After it has lived its usefulness, the silica gel is changed and disposed of as hazardous waste.

4.1.12 Solar modules

These modules are generated from CEC solar PV plants. During the life of the solar plant, some solar modules may be generated due to damage or other causes that makes them obsolete. The disposal of the modules will be done through ZEMA-licenced dealer.

4.2 Non-Hazardous Waste

4.2.1 Paper Waste

Paper Waste generated shall be kept separate from other waste types. Once the collection bins are full, they shall be transported to the Records Centre where arrangements will be made with Zambezi Paper Mills for final disposal.

It is the responsibility of each paper waste generator to ensure that confidential papers are shredded prior to being placed in bags for disposal.

4.2.3 Scrap Metal

Scrap Metals and machining waste are disposed of through registered scrap metal dealers. It is the responsibility of all employees to follow guidelines provided in the Procurement and Supply procedure (P&S/016) when confronted with this type of waste. For further clarification, employees should contact the Warehouse Supervisor or the Environmental Personnel on 244317/342.

4.2.4 Municipal Waste

Municipal waste generated at CEC includes garden waste, wooden pallets, kitchen waste and any other non-hazardous waste. All municipal generated other than garden waste and wooden pallets shall be placed in the designated waste bins and once filled up, shall be disposed of at the licensed dumpsites.

The garden waste is treated to form compost manure that is used within CEC. The wooden pallets are stored and are used as a source of energy.

4.2.5 Plastics

The waste plastics shall be put in separate waste bins and once filled up, shall be taken to the plastic recycling facilities.

4.2.6 Tyres

The used tyres once generated are taken to stores where they are sold to employees, while they are still in a condition that they can be reused.

4.2.7 Construction Waste

Construction waste generation shall be quantified and segregated according to type. The waste that can be salvaged and be re-used shall be separated and kept for use and whereas that which cannot be re-used within CEC is surrendered to the supply chain department for sale as scrap. Only minimal waste shall be taken to the dumpsite.

4.3 Waste Segregation

All the wastes generated shall be separated at the point of generation to ensure that contamination of non-hazardous waste by hazardous waste does not occur. Source segregation allows for waste reuse / recycling either on site or off site, thereby minimizing wastes requiring final disposal and double handling of waste.

4.4 Record Keeping

All departments shall maintain a record of the types and quantities of the waste being generated and shall be submitted to HSES and Risk department for inclusion in the Environmental monthly report.

5.0 Responsibilities and Distribution

5.1 Responsibility

Waste generated at CEC is disposed of using licensed waste disposal facilities. Responsibilities for waste disposal are as follows:

a. Civil and Mechanical Maintenance:

This function is responsible for collection of waste from waste storage sites and for disposal of non-hazardous waste. Disposal of this type of waste is done using licensed trucks that are suitable for this purpose. Domestic waste is disposed of at licensed landfills located in all CEC's operation areas. The new Ichimpe dumpsite in Kitwe, Mushi dumpsite in Luanshya, Helen dumpsite in Chingola and TD11 in Mufulira.

If an employee detects a non-compliant issue likely to cause breach of legislation, pollution, or hazard, shall inform the Civil Engineer on phone number 244138 and the Environmental /Safety Personnel on 244218/244205/244317/244342.

b. Supply Chain Management:

This function is responsible for disposal of waste oils, scrap metals, Batteries, tyres, and E-waste and building materials.

c. Progress Medical Centre is currently servicing CEC Plant Clinic and is responsible for disposal of clinical waste produced at the CEC Plant Site Clinic located at the Central Switching Station.

d. Employees: It is the responsibility of all employees to ensure that waste is disposed of as stipulated above.

e. The Environmental and Social Advisor: Responsible for developing, maintaining, and issuing this procedure. This procedure and its revisions are to be authorized for issue by the Senior Manager HSES and Risk. A copy of this procedure will be posted on the CEC Intranet in the Company Procedures Database and will also be issued when need arises.

6.0 References

Approved by: _____ Senior Manager – HSES and Risk	Date: 29.11.2022

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Reference	Description
CEC/CQQ/QA/001	Developing, Issuing and Maintaining Procedures (CEC intranet)
CEC/IMS/QA/001	Integrated Management Manual
CEC/ESM/QA/007	Waste management standard
The Environmental Management Act No. 12 of 2011	The Zambia Environmental Management Regulations
Solid Waste Regulation and Management No. 20 of 2018	Ministry of Local Government

7.0 Related Documents

Reference	Description
CEC/CQE/QA/005	Soil Clean up Guidelines and Bioremediation
CEC/CQE/QA/006	Management of Hazardous Chemical Substance

8.0 Review

This procedure will be reviewed every after two years or when need arises.

9.0 Record of Amendment

Date	Revision	Revision Changed (Yes/No)	Indicate sections amended	Summary description of Amendment
March 2004	1.0		N/A	First Issue
April 2005	2.0	No	All	Procedure numbering system
October 2007	3.0	No	All	Formatting
June 2011	4.0	No	All	Formatting
April 2015	5.0	Yes	All	Format and entire contents revised
Oct 2018	6.0	Yes	All	Entire document reviewed, and typos corrected.
July 2020	7.0	Yes	All	Included electronic and asbestos on hazardous waste. Typos were also corrected.
November 2022	8.0	Yes	All	Whole document reviewed, typos corrected, and format/font corrected.

Approved by: _____ Senior Manager – HSES and Risk	Date: 29.11.2022

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10.0 Appendices

i) Appendix 1 – Document Management Record

Appendix 1 – Document Management Record

Document Title:	WASTE MANAGEMENT PROCEDURE
Document ID:	CEC/CQE/QA/004
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Issue	Date	Notes/changes	Originator	Authorised for Use
1.0	March 2004	First Issue	F Kasongo	V Nyirenda
2.0	April 2005	Procedure numbering system	C Chabuka	V C Nyirenda
3.0	October 2007	No Change	F Kasongo	V C Nyirenda
4.0	June 2011	Nil	F Kasongo	C Chabuka
5.0	May 2015	Format	Rhoda N. Mumba	Caroline Sinkamba
6.0	October 2018	Typos corrected.	Bupe C. Lunda	Caroline Sinkamba
7.0	July 2020	Included Electronic Waste and asbestos on Hazardous waste. Typos were also corrected.	Rhoda N Mumba	Caroline Sinkamba
8.0	November 2022	Typos and fonts corrected	Bupe Chama	C Sinkamba

Approved by: _____ Senior Manager – HSES and Risk	Date: 29.11.2022

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APPENDIX 4.1: WATER TEST RESULTS

SCHOOL OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT
ENVIRONMENTAL ENGINEERING LABORATORY

P.O Box 32379, Lusaka

PHYSICAL/CHEMICAL EXAMINATION OF WATER

REFERENCE : EEL2405010
Attn : Crownbit
Lusaka
Sampled by : Client
Receipt date : 08.05.2024
Report date : 10.05.2024

Laboratory Results

Parameter	**Borehole 1**	**Kayombo**	**Mwambashi**	**ZABS** Standards
pH	6.81	6.52	7.24	6.5- 8.0
Turbidity (NTU)	2.77	0.25	0.27	5.0
Conductivity (µs/cm)	432	67	750	1,500
Total Dissolved Solids (mg/l)	217	34	375	1,000
Total Suspended Solids (mg/l)	<1.0	<1.0	<1.0	-
Total hardness (as mg $CaCO_3$/l)	224	32	352	500
Calcium hardness (as mg $CaCO_3$/l)	136	16	152	500
Alkalinity (as mg $CaCO_3$/l)	220	24	344	500
Iron (mg/l)	<0.0001	<0.0001	<0.0001	0.30
Ammonia (as NH_4-Nmg/l)	<0.0001	<0.0001	<0.0001	1.50
Sulphates (mg/l)	100.90	3.4763	165.54	400
Chlorides (mg/l)	18.0	18.0	26.0	250
Nitrites (as NO_2–N mg/l)	<0.0001	<0.0001	<0.0001	1.0
Nitrates (as NO_3–N mg/l)	<0.0001	<0.0001	<0.0001	10.0
Acidity (as mg $CaCO_3$/l)	Nil	Nil	Nil	500
Total phosphates (mg/l)	<0.0001	<0.0001	<0.0001	5.0
Magnesium (mg/l)	21.12	3.84	48.0	150
Calcium (mg/l)	54.4	6.4	60.8	200
Fluorides (mg/l)	0.58	0.12	0.67	1.50
Potassium (mg/l)	3.84	3.56	5.48	-
Sodium (mg/l)	11.88	12.32	17.16	200
Manganese (mg/l)	<0.01	<0.01	<0.01	0.1
Bacteriological Results				
Total coliforms (#/100ml)	**92**	0	**TNTC**	0
Feacal coliforms (#/100ml)	**60**	0	**TNTC**	0

Tests carried out in conformity with " Standard Methods for the Examination of water and Wastewater APHA, 1998".

NOTE: TNTC-Too numerous to count

Comment: On the day of sampling the bacteriological quality of the water was bad except at Kayombo, the water needs to be treated before drinking i.e. Boiled, chlorinated, UV etc.
The chemical tests were within the ZABS standards for drinking water.

Tested by: D. Mkandawire..... Checked & Approved by: D. Mkandawire .....
Chief Engineer Chief Engineer

UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
10 MAY 2024
CIVIL AND ENVIRONMENTAL
ENGINEERING LABORATORY

APPENDIX 4.2: HYDROLOGICAL STUDY REPORT

Hydrological, Geological And

Hydrogeological – Draft Report

CEC Solar Sites _ Garneton Area, Kitwe

May 2024

1.0. GEOLOGICAL SETTING

1.1. Regional Geology

The tectonic history of Zambia and Congo Copperbelt is dominated by the late Precambrian Lufilian Orogeny. N-S crustal shortening developed and essentially E-W set of folds distorted by and wedged between bastion like forelands of the Kibaran Massif in the north-west and the Luapula Massif in the north –east. The effect of this distortion has been to produce an accurate pattern of folds bulging northwards into the gap between two stable forelands. It is this pattern that the rocks of the Katanga System have accommodated themselves according to the local Basement palaeotography and their position relative to the forelands.

In Zambia the Lufilian structural feature in the Kafue Anticline. It is the erosion of this anticline and the consequent exposure of the subsidiary flanking folds that accounts for the present location of the Copperbelt Mines. Figure 1 shows the general geology of the Copperbelt and surrounding areas.

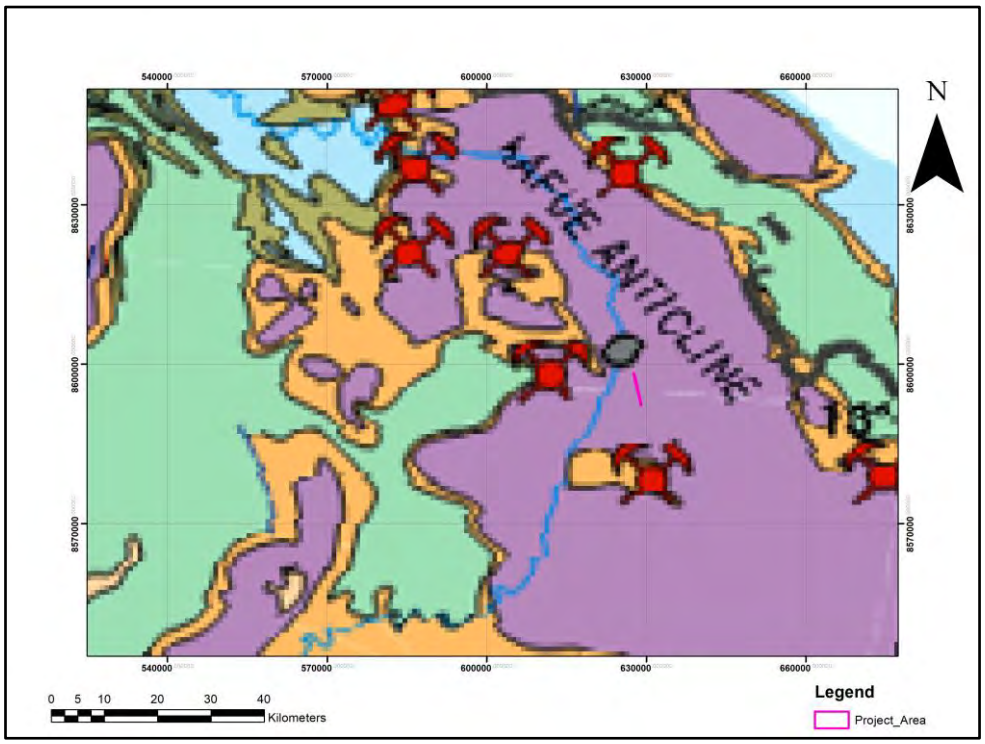


Figure 1: Generalised Regional Geology of the Copperbelt.

1.2. Local Geology

The project site is underlain by an even grained, foliated granite, belonging to the Lufubu Group, of the Basement complex. The granites are younger and have intruded the older rocks that is schists, quartzites and gneisses. Further north and south, outside the project area are schists also belonging to the same Basement Complex. There are no outcrops within the project area, as well

as in the immediate surrounding areas. Figure 2 below shows the location of the project site on the geological map.

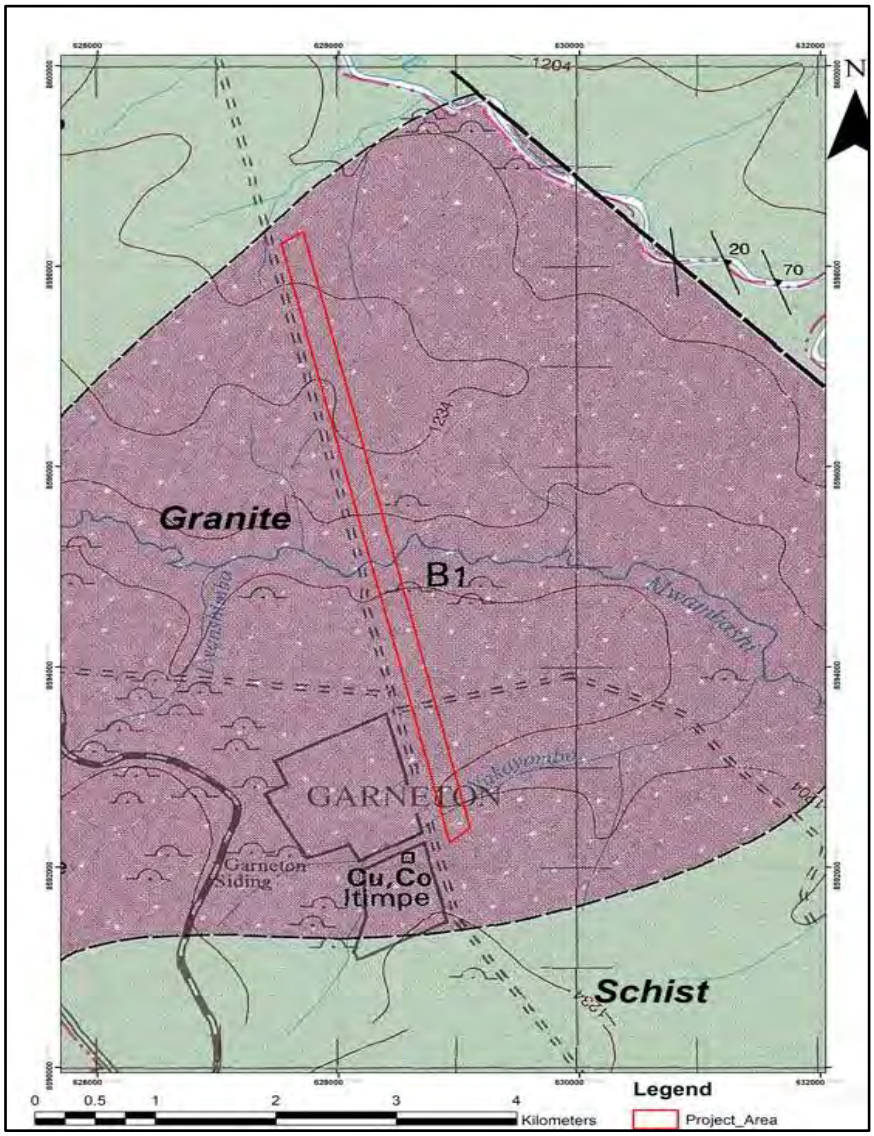


Figure 2: Local geology of the project site.

1.3. Structure

Regionally, the Copperbelt occupies the south-east end of the 800 km-long Lufillian arc, which extends from Angola through Kolwezi, Jadotville and Lubumbashi in the Democratic Republic of Congo and into Zambia and the Copperbelt. The general trend is NW-SE. The pre-Katangan basement is exposed in the core of the Kafue anticline, which follows the course of the Kafue River. It comprises granites, granitic gneisses, schists, quartzites and metabasic rocks. The oldest rocks are believed to be schists, quartzites and gneisses that are referred to the Lufubu Group (Mendelsohn, 1961, p. 18).

The foliation in the granitic gneisses is mainly parallel to the schistosity in the surrounding schists. There are migmatitic zones in mica schists, with thin veins of fine-grained granitic material intruded along the foliation, or along older zones of weakness. In thin sections, this intrusive granite shows granoblastic textures.

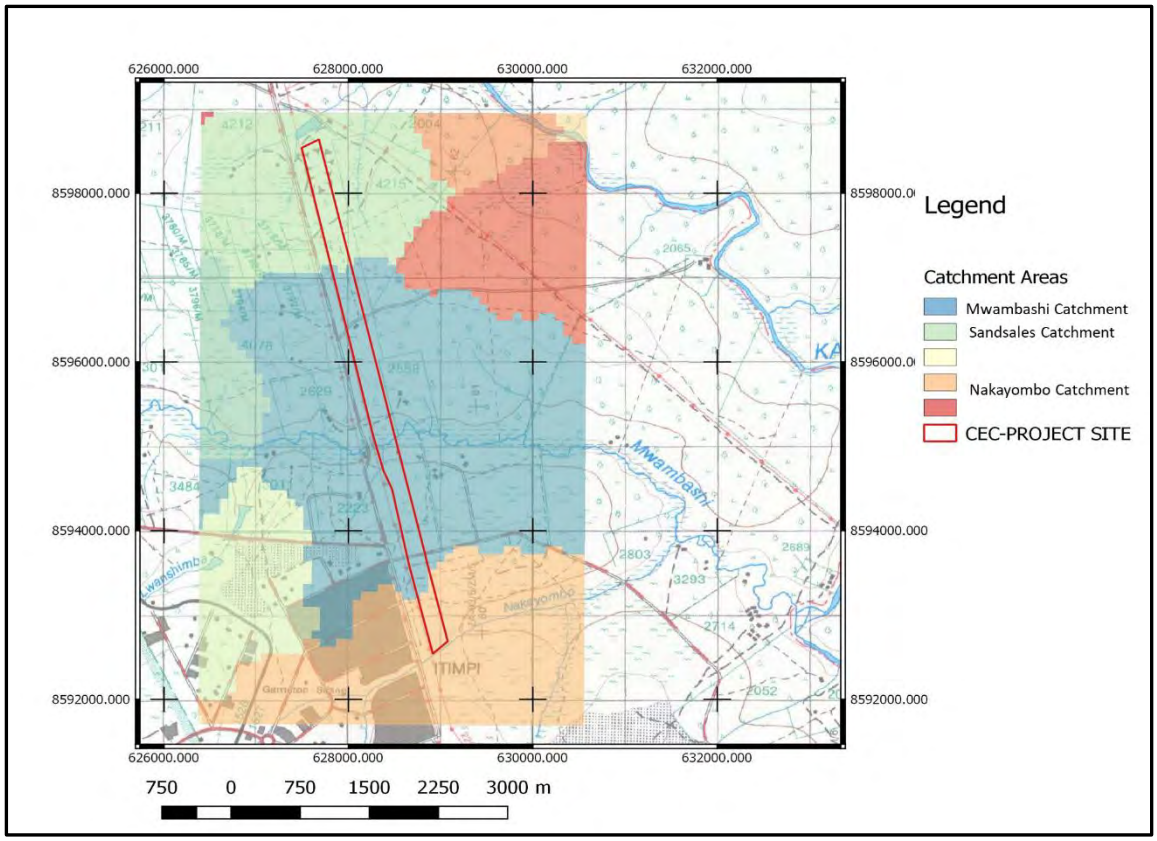
The project site is mainly sitting on an even grained foliated granite, which is generally not highly fractured, with no major zones of weakness and pathways for groundwater movement and occurrence. A major fault striking NW-SE is located approximately 2 to 5 km west of the project site, into the Kafue River which flows NNW-SSW. The Kafue River is structurally controlled.

2.0. HYDROLOGY

2.1. Drainage and Catchment

The Copperbelt lies within the catchment of the Kafue River and its tributaries. The Kafue passes about 4 km to the east of the project area. Mwambashi River passes the project area draining east into the Kafue River. To the south of the project area, which marks as boundary is the Nakayombo stream, which drains into Mwambashi River eventually into Kafue River. There is a spring which is located about 750m southwest of the project site. The water from this spring drains into Mwambashi River.

The project area has three catchment areas. The main one is the Mwambashi Catchment, with an estimated area of 16km$^{2.}$ To the south of the project area, at the headwaters of Nakayombo stream is the Nakayombo catchment, with an area of 6km^2 and to the north is the "Sand-sales" Catchment with an area of 9km^2. Figure 3 shows the location of the catchment areas located at the project site.



3.0. HYDROGEOLOGICAL ASSESSMENT

Boreholes within a radius of 3km were plotted on the borehole location map as shown in figure 4, Specific hydrogeological consideration was given to these boreholes because they were closer to the project site that is nine (9) boreholes were less than 200m away and only one (1) borehole (BH1) was further away, about 1.6km southwest of the project site.

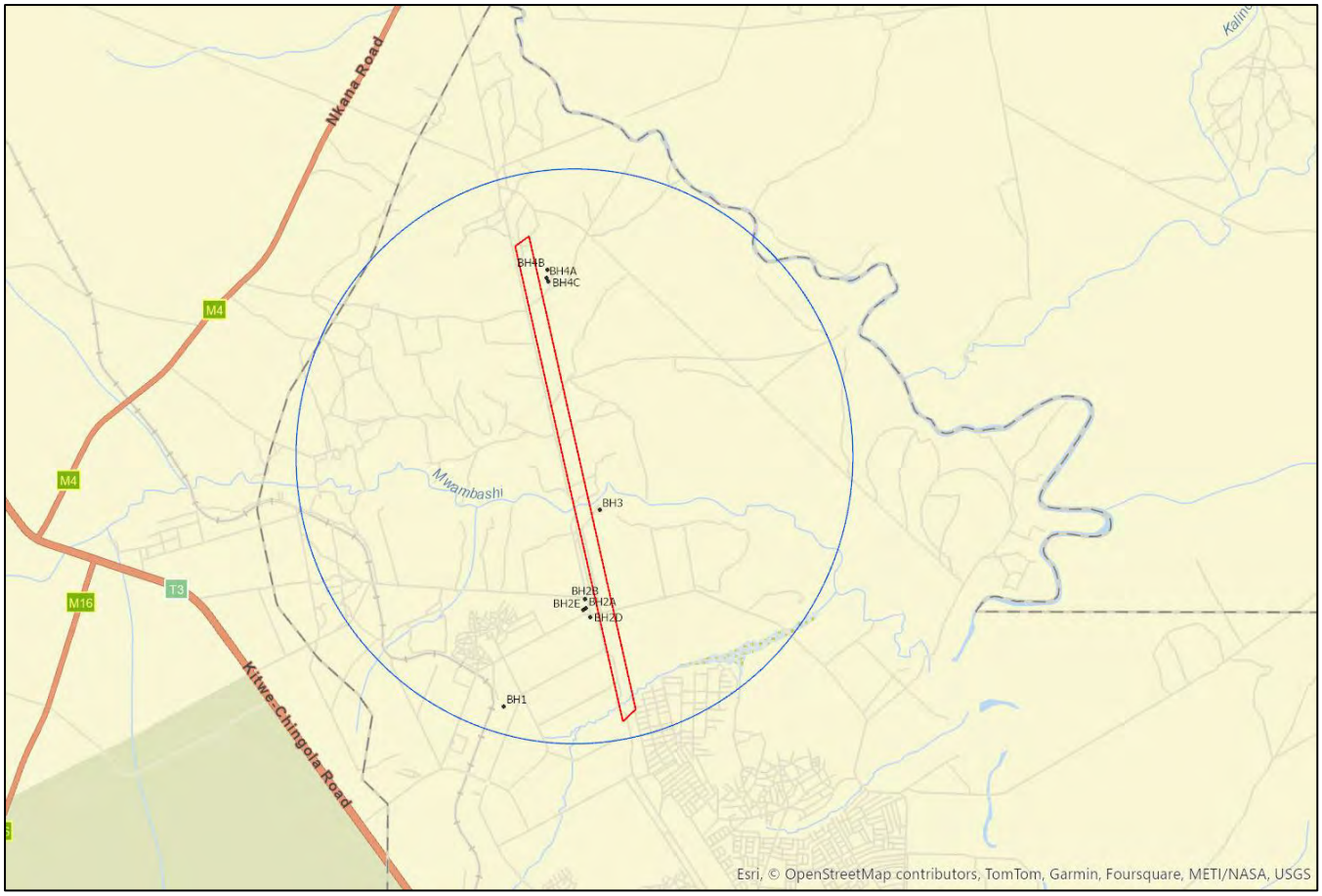


Figure 4: Location of drilled boreholes within the buffer zone

The borehole data was used to assess the depth to water bearing zones (1st water Strike), borehole yield, depth of weathering, at the site, water quality, depth to static water level, soil profile and weathering/ fracturing pattern of the rock underlying the rock at the site. The assessment is crucial in assessing the impact on groundwater resources as a result of the planned construction of the Solar Plant at the site.

A total of 10 boreholes were gathered with data on borehole yields, general water strikes and the depth. A further four (4) were identified which are located 14km south of the project area and falls within the same geological and hydrogeological environment. The depth of some boreholes were not known in relation to the location of each borehole, for they were drilled some years back. Data from drilling company was collected and used though the drilling reports were not comprehensive. However, data available was used and increased the level of confidence in the hydrogeological assessment of the project site. The table below show the details of the boreholes that were identified.

TABLE 1: Details of the identified boreholes.

BH	UTM-X	UTM-Y	DEPTH (mbgl)	WATER STRIKE	STATIC WATER LEVEL	APPROX. YIELD	DISTANCE FROM PROJECT SITE
BH1	627372	8592433	54	12-30	-	0.5	1.6km
BH2A	628442	8593663	50	12-30		0.5	196m
BH2B	628431	8593782	56	12-30	5	1.5	188m
BH2C	628464	8293530	50	12-30	-	0.5	202m
BH2D	628498	8593552	60	12-30	-	0.5	169m
BH2E	628409	8593641	65	12-30	-	0.5	232m
BH3	628620	8594904	-	12-30	.-	0.5	62m
BH4A	627930	8597822	80	12-30	-	0.5	58m
BH4B	627945	8597927	70	12-30	8	0.5	95m
BH4C	627956	8597778	-	12-30	-	0.5	75m
GW_TD03	629579	8577363	65	44	-	1.5	14km
GW_TD18	629318	8576630	60	38	-	1	14km
GW_TD19	628448	8576926	60	9	-	1	14km
GW_TD20	628907	8578152	65	25	-	1.5	14km

3.1. Drilling Depth

The average drilling depth is 58.5mbgl with the median of 56mbgl, at the buffer zone area. The median data indicates that most boreholes are drilled deeper than 56mbgl. This indicates that the area has a shallow weathered zone and fractured rock with shallow depth to fresh rock. The maximum drilled depth is 80mbgl and minimum being 50mbgl.

3.2. Depth to Water Bearing zones

From the drilling information, most of the water bearing zones (1st Water Strike) are encountered between 12m and 30mbgl in the buffer zone. The aquifers are very shallow owing to the nature of the geology. During hot seasons most of the boreholes in the area experience reduced water levels, in some instances go dry, until rain reason after the recharge takes place.

3.3. Depth to Water Level

The ground water-levels in the buffer zone is 6mbgl on average. This is because of the nature of the aquifers which are shallow. This observed in **BH2B** and **BH4B** which had no pumps. The water levels fluctuate with seasonal recharge. The water levels are generally high during the wet season, and extremely low during hot season.

3.5. Borehole Yield.

Most of the boreholes in the buffer zone are less than 2l/s. This is attributed mainly to the nature of geology, for aquifers associated with granite have low yields. From figure 5, the project area lies in low yield zone according to the hydrogeological map.

4.0. Water Quality

From the water quality analysis conducted on the three water samples collected that is one sample from the borehole, and two samples from the two rivers namely Nakayombo and Mwambashi Rivers reviewed that samples collected and analysed met both the physical and chemical parameters as prescribed by Zambia Bureau of Standards (ZABS) guidelines. In terms of bacteriological quality, the water from the borehole and Mwambashi River was bad, as such requires treatment before drinking. The Chemical, Physical and bacteriological analysis results of the water samples collected are shown in Appendix A.

4.0. Site hydrogeological Characterisation.

Based on the boreholes that have been drilled within the radius of 200m of the site, the depth to groundwater at the site is between 12m and 30m and the groundwater level is on average 9mbgl. The depth to groundwater (water table) of 12m to 30m from the excavation during construction minimises any possible risk to groundwater pollution.

The aquifers within the project site and the generally the surrounding areas has limited potential hence, very low borehole yields. Most of the boreholes have less than 2l/s.

Structural analysis at the site shows the site is located within a non-fractured environment and lack of significant and regional fractures within the vicinity of the site minimises the risk of groundwater contamination.

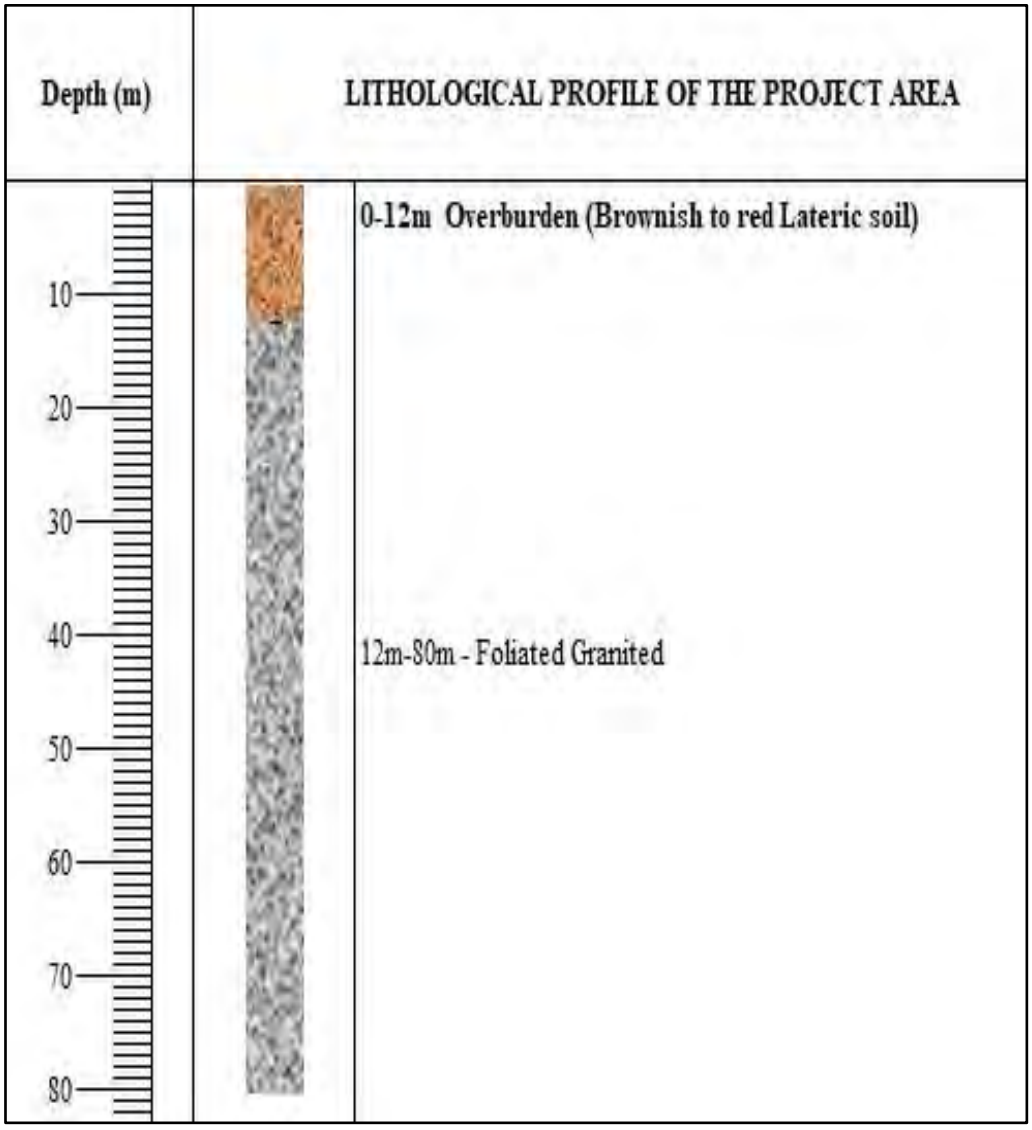


Fig 6: Lithological profile at the project site.

Potential Risks

The tower systems may need a lot of water for cooling, which is a concern in arid settings, as an increase in water demand may strain available water resources. The only reliable sources of water at the project site are mostly surface water from Mwambashi and Nakayombo Rivers. Groundwater is another source of water for the project site, though the aquifers at the project and surrounding areas has limited potential that is low yielding boreholes (<2l/s).

- Chemical spills from the facilities which may result in the contamination of groundwater or the ground surface.

Mitigation Measures

To ensure maximum protection of the groundwater resource from contamination, the following recommendations are made:

- The use of efficient and advanced cooling system of the solar plant.
- Drilling of monitoring boreholes within and around the project site.
- Groundwater level and groundwater quality monitoring and sampling is recommended, in order to have an effective water management at the project site. This can be carried out on a regular basis and the sampling rate can be increased to monthly in the event that possible pollution is detected.
- Detailed structural mapping within the vicinity of the site and high precision GPS of existing and planned boreholes is recommended to get elevation data to determine groundwater flow directions in relation to the river system.

References

GRESP, 2013, The Development of a Groundwater Information and Management Programme for the Lusaka Groundwater System, Key Findings and Recommendations, Lusaka-Zambia.

MENDELSOHN, F. 1961 (editor). The geology of the Northern Rhodesian Copperbelt. Macdonald: London.

APPENDICES

APPENDIX A: Water Quality Analysis Results.

SCHOOL OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT
ENVIRONMENTAL ENGINEERING LABORATORY

P.O Box 32379, Lusaka

PHYSICAL/CHEMICAL EXAMINATION OF WATER

REFERENCE : EEL2405010
Attn : Crownbit
Lusaka
Sampled by : Client
Receipt date : 08.05.2024
Report date : 10.05.2024

Laboratory Results

Parameter	Borehole 1	Kayombo	Mwamhashi	ZABS Standards
pH	6.81	6.52	7.24	6.5- 8.0
Turbidity (NTU)	2.77	0.25	0.27	5.0
Conductivity (µs/cm)	432	67	750	1,500
Total Dissolved Solids (mg/l)	217	34	375	1,000
Total Suspended Solids (mg/l)	<1.0	<1.0	<1.0	-
Total hardness (as mg $CaCO_3$/l)	224	32	352	500
Calcium hardness (as mg $CaCO_3$/l)	136	16	152	500
Alkalinity (as mg $CaCO_3$/l)	220	24	344	500
Iron (mg/l)	<0.0001	<0.0001	<0.0001	0.30
Ammonia (as NH_4-Nmg/l)	<0.0001	<0.0001	<0.0001	1.50
Sulphates (mg/l)	100.90	3.4763	165.54	400
Chlorides (mg/l)	18.0	18.0	26.0	250
Nitrites (as NO_2 –N mg/l)	<0.0001	<0.0001	<0.0001	1.0
Nitrates (as NO_3 –N mg/l)	<0.0001	<0.0001	<0.0001	10.0
Acidity (as mg $CaCO_3$/l)	Nil	Nil	Nil	500
Total phosphates (mg/l)	<0.0001	<0.0001	<0.0001	5.0
Magnesium (mg/l)	21.12	3.84	48.0	150
Calcium (mg/l)	54.4	6.4	60.8	200
Fluorides (mg/l)	0.58	0.12	0.67	1.50
Potassium (mg/l)	3.84	3.56	5.48	-
Sodium (mg/l)	11.88	12.32	17.16	200
Manganese (mg/l)	<0.01	<0.01	<0.01	0.1
Bacteriological Results				
Total coliforms (#/100ml)	**92**	0	**TNTC**	0
Fecal coliforms (#/100ml)	**60**	0	**TNTC**	0

Tests carried out in conformity with " Standard Methods for the Examination of water and Wastewater APHA, 1998".

NOTE: TNTC-Too numerous to count

Comment: On the day of sampling the bacteriological quality of the water was bad except at Kayombo, the water needs to be treated before drinking i.e. Boiled, chlorinated, UV etc. The chemical tests were within the ZABS standards for drinking water.

Tested by: D. Mkandawire ..... Checked & Approved by: D. Mkandawire .....
Chief Engineer Chief Engineer

10 MAY 2024

APPENDIX 5: SOIL SURVEY REPORT

REPUBLIC OF ZAMBIA

Ministry of Agriculture

Zambia Agricultural Research Institute

Soil Survey Report

Proposed Solar Energy project

Ganatone area

Kitwe District

Copperbelt Province

ZARI Soils Research, May 2024

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1.0 SUMMARY

The baseline soil data collection of the proposed Energy stock pile in TWE district was conducted on 3 and 4th may 2024, with the purpose of describing the inherent soil quality to support general land use and more specifically its vulnerability to construction of a **S**olar power project. Other alternative potential land uses were evaluated covering a wider potentially affected area. This exercise was necessitated as part of the biophysical data collection of the area to constitute an environmental project brief prior to the setting up of the project according to the requirements of the Zambia Environmental Management Act. This was a follow up assessment to the evaluation which was conducted in 2018. Most of the factors had not yet changed.

The chemical content of the soils will be compared to the critical minimum both for the health of the soil for agriculture and others as the samples were submitted to the laboratory for analysis of especially heavy metals as the major wastes coming from solar panels and other accessories.

Generally the soils are fairly stable on the site and are suited for traffic movement, building construction and roads subject to surface stabilization by quarry gravel, crushed stones and concrete to reduce subsidence, water and wind erosion. Solar products are known to contain appreciable levels of heavy metal and chemical contaminants, therefore it is recommended to avoid wastes which may find their way in the environment.

2.0 INTRODUCTION

The baseline soil data collection of the site was conducted with the purpose of describing the inherent soil quality to support general land use and more specifically its vulnerability to setting up of a **S**olar energy project.

Other alternative potential land uses were evaluated covering a wider potentially affected area. This exercise was necessitated as part of the biophysical data collection of the area to constitute a full scale environmental Impact assessment prior to the setting up of the project according to the requirements of the Zambia Environmental Management Act.

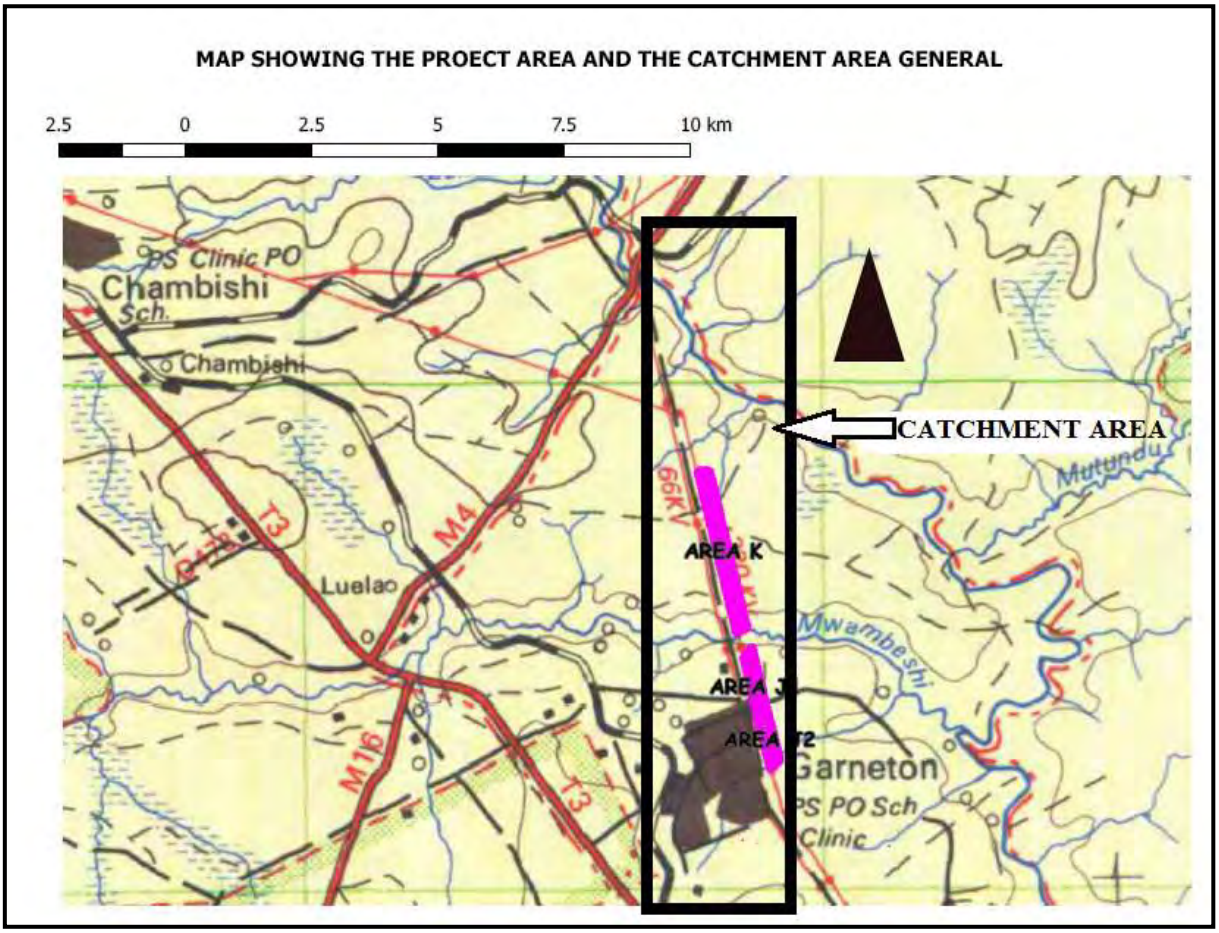
The specific objectives of the study included conducting an inventory of the soil and associated land resources of the project area and to establish the suitability potentials of the area for other uses. This was achieved by carrying out descriptions of soils, outline their

classification, assess the land use patterns around the site and provide other relevant data and information on the environmental status of the soils and other land resources in the area and the related land degradation hazards and recommendations for soil and land husbandry management to enhance environmental conservation measures to help mitigate resources degradation and depletion.

2.1 Location

The project is located in Ganatone area along the 60 Kv power line from Ganatone compound are up to the near the current Solar plant in itimpi. The assessment was done between UTM 629251 and 85911232 and 627757 and 8597987 covering about 5 Km. The figure below shows the geographic location of the proposed.

Figure 1: Location of the project site



2.2 Methodology

The execution of the task involved a number of techniques of data collection to come up with interpretive information to be used by project management and stakeholders, professionals, researchers, local authorities for sustainable utilization.

Literature review on soils, ecology, geology, vegetation, Topography, climate, land use and other studies previously conducted in the region around the study area were done so as to provide information for planning of detailed field investigations. Satellite imagery and topographical and other maps were used to study the survey area. Most importantly the assessment earlier analyzed in 2019.

A base map was thus created to act as a guide line in the field.

Soil investigations were conducted on site using the standard soil auger to examine soil properties and characteristics to a depth at least 120 cm from the surface, and recorded accordingly along with the surrounding environmental conditions and prevailing land use.

Data observed included soil depth, soil texture, colour, land slope, topographical position, surrounding land use, and geology.

Three soil samples were collected for laboratory analyses to test for soil capacity to release and host to most fertility parameters. The soil was analysed for pH, Soil Organic Carbon and a number of heavy metals as byproducts of Solar panels and accessories. Chemical data was used to confirm soil classification and correlated land capability class. Similarly micronutrients in the soils are required in very small quantities normally not exceeding 100 ppm. However as an indicator of an ideal agricultural soil devoid of contamination from heavy metals, the data was compared to the F.A.O limits for Agricultural soils which are used in Zambia as a matter of compliance to international norms. For each of the parameters exceedance of the limits may lead to toxicity in the soils and may lead to poor crop performance and sometimes total crop failure may be experienced.

Valuable information about the area was also obtained from the local people about the area in general.

3. BIOPHYICAL LAND FEATURES

3.1 CLIMATE

The Ganatone project site is located in a high rainfall area, where the mean annual rainfall is 1309 mm, specifically the area falls in zone 24-c and some of it's characteristics are listed in the table below. The table presents rainfall data for the Kafironda weather station on the Copperbelt. The data also shows that the area receives most of its rainfall in the months of November to March, with the months of May to September being effectively dry.

The table presents mean monthly maximum and minimum temperature, humidity, wind, sunshine hours, radiation and open pan evaporation data for the Kafironda station.

The number of sunshine hours is of great importance to the project being heavily reliant on solar energy and according to the data it is brighter for most parts of the day throughout the year except in a few months.

TABLE 1: Climatic summary- (30 year period averages) Kafironda Agro-meteorology station

Month	Rain (mm)	No of Rain days	Mean RH (%)	Mean Temp (°c)	Mean Max Temp (°c)	Max temp. (°c)	Mean Min Temp (°c)	Min temp. (°c)	Mean Ground Min Temp °c)	No. Of Frost Days
JAN	269.2	19	81	22.7	27.7	30.5	17.7	14.6	17.4	0
FEB	135.8	11	76	23.2	29.5	32.8	16.9	13.4	16.5	0
MAR	153.7	7	74	23.1	29.7	32	16.6	13	15.9	0
APR	20.6	4	69	21.1	29.6	32.2	12.5	8.9	12	0
MAY	0	0	62	17.9	29	30.8	6.9	1.9	6	0
JUN	0	0	59	15.9	27.9	29.6	3.9	0.5	1.3	8
JUL	5.8	1	58	15.5	26.8	29.4	4.1	0	2.8	2
AUG	0	0	49	18.3	30.3	32.7	6.4	2	4.9	0
SEP	2.9	1	48	21.1	32.1	36.1	10.1	4.7	7.8	0
OCT	tr	0	46	23.3	33.9	35.7	12.8	8.5	11.4	0
NOV	85.8	12	62	24.7	32.5	36.2	16.9	11.8	15.9	0
DEC	365.8	19	77	23	29	31.6	17	12.5	17	0

Climatic data obtained from Kafironda Agro metrological station based at Mufulira Research Station (approximately 100 kilometres from the area) from a 30-year period 1960 to 1990 were referred to (Dept. Met, 1970, 1990). The full onset of the rains is mid November but there is usually some rains in October with annual rainfall of 1200 to 1400mm. The plant-growing period calculated at 70% probability is 120 to 140 days. Drought occurrence is rare,

but about 5-10 days can be dry per growing season. Frost usually occurs in the cold season (June -July) in about 10 to 15 days. Mean maximum temperatures are higher in October (33.9°C) and lowest in July (26°C). The annual mean maximum temperature is (28.8°C). The mean minimum temperatures are lowest in June (3.9°C) and highest in October (17.5°C). Calculated annual pan evaporation based on 5 year record ranged between 2300-2500mm. (Veldamp, et al. 1984).

3.2 Geology

During the baseline data collection, the main geological features noted comprised of the 'Undifferentiated Sandstones, especially weakly cemented sandstones of quartz type. There also mineral rich ironstones and Calcareous beds, limestone, which have given rise to reddish clay soils; the geology greatly influence the resultant soil types and properties. The main geological features are summarised as below.

TABLE 2: MAJOR GEOLOGICAL FORMATIONS OF THE LAND

Map Unit	Main geological features
WQS	White quartzitic gravels and stone spread on the surface over a large area
ERO	Extensive rock outcrops extended over one meter above ground
LGSS	latelitic gravels in the subsoil from 20cm below the surface
IQ	Iron and quartzitic rock parent material

3.3 Topography

As this area is a narrow strip below the same land use (power line) they have the same geological formation and the general configuration of the land is same throughout. Topography is influenced by the streams in the north and south of area K, JI and J2 and the power line. The area is mainly gently sloping with steep land being located in the northern and southern tips of the area towards the two streams in the respective directions. Three levels of topography can be distinguished in the area as indicated in the mapping units. The geology of the area is closely related to the soil types occurring in the area. The more resistant quartzitic rock types have given rise to shallow and stoney soils while the iron and manganese parent material is found in clayey, slightly deep soils. The main topographical features are summarised as below.

TABLE 3: MAJOR TOPOGRAPHICAL SUMMRIES OF THE LAND

Map Unit	Topography
1	Very slopy land especially towards the stream greater than 10 %
3	Gently sloping land 0 - 5 % slope
2	Slopy land 5 - 10%

During the baseline data collection, the main geological features noted comprised of the 'Undifferentiated Sandstones, especially weakly cemented sandstones of quartz type. There also mineral rich ironstones and Calcareous beds, limestone, which have given rise to reddish clay soils; the geology greatly influence the resultant soil types and properties.

3.4 Land Use

The site has experienced a number of industrial establishments in its neighbourhood and as such over the decades the area has seen mushrooming residential settlements around the area as people from all over the country to provide labour to the industries.

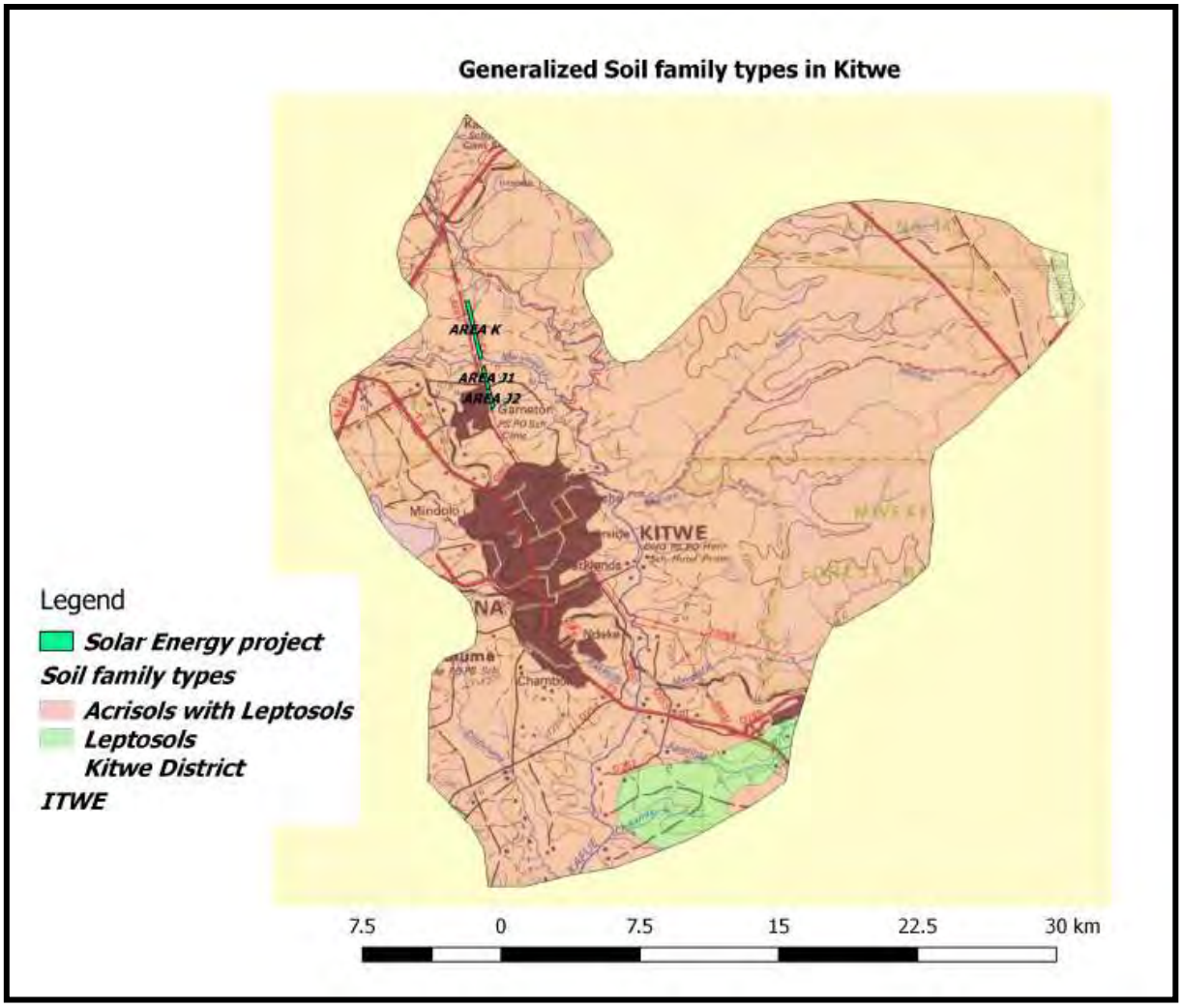
The main land use of the area is that of illegal small scale field gardens along the power line in the north of the site. Like area K, Areas J1 and J2 have mainly been use three main land utilisation types which included the area under natural forest although this has been rampantly deforested and secondary vegetation has sprung over the last few years. Other areas have been used as damp site especially in J2 where there is rampant damping of industrial and domestic waste including Copper tails.

Other areas are used for subsistence production of crops by the local people although the land is marginal in terms of its capability to agricultural production mainly due to high presence of gravelly surfaces and while the sandy riverline areas have been used for quarrying of sand for construction around the townships in Mufulira, Ganatone itself and Chambishi

4. Soils

The area is composed of one type of soil in terms of classification. According to the generalized soil map of Zambia (1990) by the Zambia Agricultural research institute, the area is comprised of well drained deep to very deep yellowish red to strong brown, friable, fine loamy to clayey soils having a clear clay increase with depth (chromi haplic) with inclusions (20%) of moderately well drained to, imperfectly drained deep to moderately shallow, gravelly clayey soils ACRISOLS: with gleyl-haplic Acrisols, partly skeletic phaseq; dystric LEPTOSOLS.

Figure 2: Generalized Soil family types in



4.2 Actual soi1 type on site

4.2.1 Current status of the soils

Four main soil subgroups were identified in the two areas and are mainly differentiated based on the location, topographical and hydrological factors.

Map Unit	Brief description of soils
U1	Shallow stoney soils with stones or gravels on the surface and within the profile
U2	Deep, sandy clay soils: In areas with dense vegetation, there has an accumulation of organic matter in the top soils.
U3	Moderately deep soils with gravels below the surface in most cases from as high as 20cm to 100cm. They are marginally suitable to any meaningful agricultural alternative

U4	Imperfectly drained, deep, dark grayish brown sand soils with compacted gravelly sub soils at 100cm; These soils are structureless, on the surface and are located near dambo or plain areas where they have silty material deposited by water. Some places had compacted sub soils mainly due to accumulation of clay minerals. They are water logged in the rainy season when the soils become saturated with water and thus support grassland regrowth

4.3 Textures: mainly sand clay loam textures in the top soil were common on the site in a few places sandy loam textures were noted mainly due to the movement of sandy top soils to the eastern parts where active sheet deposition of Colluvial material was observed. The sub soils have higher clay with common sandy clay textures from 15 to 20 centimeters, the clay increases with depth.

4.4 **Soil Structure***:* the top soil is weakly structured and loose, the sub soil is usually sub angular in structure and easily breaks into finer crumbs, physical sorting of particles and movement of loose top soil has led to compacting of the top soil in some areas within the site. Natural hard pans have formed in these areas.

4.5 Soil Consistence*:* these soils on the top are loose and weak when dry becoming strong to hard in the sub soil under very dry conditions, but they are fragile when moist and easy to work, an increase in the moisture conditions to wet status the soils are very sticky and makes workability and movement difficult.

4.6 **Biological activity, permeability and porosity***:* A very high porosity was observed in the top 50 cm of these soils, termite and other insect activity had contributed also to the porosity with abundant macro pores, The soils are highly permeable in the top 30cm and moderately permeable in the deeper layer forming a reservoir of moisture.

4.7 Effective soil growing depth*:* Most of the area is shallow to deep (60 cm in depth), these present marginal to low potential for cropping if the area were to be considered for production.

4.8 Soil fertility

The results *a*re yet to come out

5. Environmental Sensitivity

The major source of the environmental impact on soils of the area during and after the construction is mainly related to the massive movement of construction materials and earth during construction, Buildings and quarrying, etc. runoff is likely to the lower land scape.

Generally the soils fairly stable on the site and are suited for traffic movement, building construction and roads subject to surface stabilization by quarry gravel, crushed stones and concrete to reduce subsidence, water and wind erosion.

The use of the land must be accompanied with adequate measures to curb soil contamination with foreign materials and reduce movement of the particles and other substances to the lower land. Mass movement erosion is possible in the area.

5.1 Threats and opportunities

5.1.1 Threats

The main threats to the stability of the landscape (Soils, vegetation, landuse, Water, socio and economic factors) is mainly related to the physical nature of the soils, land form, Climatic factors and socio settings, but in summary the following threats to the land scape are foreseen.

- The major source of the environmental impact on soils of the area during and after the construction is mainly related to the soil and land degradation as influenced by massive movement of construction materials and earth during construction, building and increased quarrying, etc.

- There is likely to be clearing of sites; this would lead to bare exposing the surrounding areas to accelerated erosion and increased run off. This is essentially because of;

- The changes to the top soil characteristics are likely to increase run off to the lower areas and may also increase sedimentation in the streams.

- Increased traffic to the project area would result in dust and noise pollution to the surrounding areas. Traffic is also likely to increase pressure on the roads and drainage networks of the area there by increasing degradation of the land.

- In order to increase exposure of the site to longer sunshine hours there may be an attempt to cut down some trees.

- In terms of alternative land use, permanent cultivation of annual crops is not attainable and would require management inputs that are usually not economically viable.

5.2 Opportunities

Owing to the climatic and physical setup of the sites, the areas lend themselves well to the development of solar power generation plant.

- Generally the soils are fairly stable on the site and are suited for traffic movement, building construction and roads subject to surface stabilization by quarry dust, crushed stones and concrete to reduce subsidence, water and wind erosion.

- Natural vegetation growth is possible which will eventually lead to more stable soils as long as there are appropriate measures such as fire management.

- The area experiences sufficient sun shine hours which are cardinal for the project through- out the year other than in a few months like in Winter when the hours reduce.

- Diversification or pursuing alternative livelihoods is possible, including securing employment in the project site and in nearby towns, starting small businesses, establishing vegetable gardens where conservation agriculture techniques can be applied would improve the people's livelihood which in turn will reduce the pressure for natural resources like forestry through charcoal burning.

APPENDIX 6: BIODIVERSITY REPORT

BIODIVERSITY STUDY
FOR

THE PROPOSED CONSTRUCTION OF
A SOLAR PV PARK UNDER THE GET FIT ZAMBIA SOLAR PV (GARNETON SOUTH)
BY
COPPERBELT ENERGY CORPORATION PLC. (CEC)

KITWE COPPERBELT PROVINCE

Report Prepared By

JACOB TEMBO

June 2024

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LIST OF ACRONYMS

BS	Biodiversity Study
BBOP	Business and Biodiversity Offsets Program
CBD	Convention on Biological Diversity
CEC	Copperbelt Energy Corporation
CIEEM	Chartered Institute of Ecology and Environmental Management
CITES	Convention on International Trade in Endangered Specie
EIA	Environmental Impact Assessment
EIS	Environmental Impact Study
EMA	Environmental Management Act
EMP	Environmental Management Plan
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
NNL	No Net Loss
NPI	Net Positive Impact
DNPW	Department of National Parks and Wildlife
ZEMA	Zambia Environmental Management Agency

1.0 INTRODUCTION

Copperbelt Energy Corporation Plc. (CEC) plans to construct a Solar PV park under the GET FiT Zambia solar PV initiative. The proposed location for the project is Kitwe District, with the proposed area named as Garneton South near the CEC and ZESCO power lines. Garneton South site sits on a 52 Hectares piece of land and will be connected to the High voltage grid through an 8.1km 33kV power transmission line which will run from the Solar farm to Zesco Mwambashi Substation along Kalulushi road.

The development will be designed and constructed to CEC's exacting standards that meet the local and international demands and fully conform to the IFC Performance Standards and Environment Health and Safety (EHS) Guidelines.

The proposed project falls under The EIA Regulations, SI No. 28 of 1997 and is listed under the first schedule (Regulation 3(2)) "Projects which require Project Briefs. CEC commissioned an independent Environmental Consultant to undertake a full Environmental Impact Assessment of the project and prepare the EPB to be submitted to ZEMA. The Consultant conducted a biodiversity survey of the project area as part of the baseline condition of the proposed site in accordance with the International Finance Corporation (IFC) Performance Standard 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources) as the proposed project is located in natural habitat (IFC/PS6 paragraph 5).

Thus this report provides a description of the biodiversity features of the project area such that key biodiversity features requiring special consideration can be identified for the purposes of later impact assessment and the identification and design of mitigations that will protect these key biodiversity features. The biodiversity survey results will subsequently be fed into the full EPB.

The structure of this report has been adopted from Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines for preparation of ecological report writing.

1.1 Brief Description of the Site and Access

The project site covers a portion of 52 Ha located in garneton area; Kitwe district of Copperbelt province. It is located just after Nakayombo stream near the mine waste dump site.

Some of the GPS coordinates for the site are shown below.

AREA K (WGS_1984_UTM_Zone_35S)

AREA J_1

LATITUDE	LONGITUDE	NORTHING	EASTING
-12.711447	28.18343957	8594481.899	628488.752
-12.7120601	28.18279704	8594414.408	628418.674
-12.7218834	28.18517725	8593326.720	628672.183
-12.7214552	28.18690739	8593373.227	628860.261
-12.7103221	28.18415307	8594605.962	628566.793
AREA J_2			
-12.7217248	28.18696677	8593343.380	628866.573
-12.730289	28.18908005	8592395.083	629091.707
-12.7316732	28.18754407	8592242.744	628924.232
-12.7221113	28.185228	8593301.483	628677.579

1.2 Brief Project Description

The project involves the construction and operation of a 20MWac solar PV power plant. Key project components include PV modules and mounting structures, underground direct current (DC) and alternating current (AC) cables, transmission lines, inverter stations, substation(s) (site substation(s)), stores and office building(s), access road and internal access tracks, perimeter security fence and security

1.3 Objectives of the Study

i) To identify and describe all potentially significant ecological effects associated with the proposed development
ii) To set out the mitigation measures required to ensure compliance with nature conservation legislation and to address any potentially significant ecological effects
iii) To identify how mitigation measures will/could be secured
iv) To provide an assessment of the significance of any residual effects
v) To identify appropriate enhancement measures
vi) To set out the requirements for post-construction monitoring

2.0 POLICY AND INSTITUTIONAL FRAMEWORK

The development of legislation dealing with natural resources management dates back to the colonial era. The formulation of laws followed a sector approach as pieces of legislation were formulated to deal with forests, wildlife, land, water, fisheries, and many other natural resources separately. Given the poor coordination, the promulgation of these laws brought about duplication and gaps. The first attempt to coordinate various laws was done under the auspices of the National Conservation Strategy (NCS) of 1985. The NCS aimed to ensure the sustainable use of renewable natural resources and to maintain biological diversity and essential process and life-support systems. The NCS recommended key environmental issues and prescribed policy, legislative and institutional measures to address these issues. The strategy put in place processes such as community management of natural resources and decentralization, capacity building of key institutions, legislative reforms and the establishment of institutions such as the Environmental Council of Zambia, now the Zambia Environmental Management Agency (ZEMA).

2.1 National framework

This chapter provides a brief summary of the Zambian legislation and international conventions pertaining to ecological/biodiversity management from which this report draws its strength and authority. CEC will ensure that the provisions of all these pieces of legislation and policies are strictly adhered during all phases of the project.

2.1.1 The Forests Act No. 4 of 2015

Part VI section 49 (1) subsection (a) and (b) provides for major forest produce on state Land and customary areas to be conserved for the use and benefit of the local community in the areas.

Relevance: The project will involve cutting down of trees in the project area.

Compliance: the trees in the project site will be cleared for the purposes of developing the project and CEC will ensure that indiscriminate cutting of trees is avoided.

2.1.2 Zambia Wildlife Act No. 14 of 2015

The act provides among other things for the establishment, control and management National Parks, Bird and wildlife sanctuaries and for the conservation and enhancement of Wildlife eco-systems, biological diversity and objects of aesthetic, pre-historical, geological, archaeological and scientific interests in National Parks.

PART IX section 75-82 provides for the following;

i) Self-defence

ii) Defence of property

iii) Game or protected animal killed through accident or error

iv) Wounding of game animal or protected animal

v) Wounding of dangerous animal

vi) Cruelty to wild animals

vii) Possession of maimed wild animal

viii) Molesting or provoking game animal or protected animal

Relevance: The project is located within a natural habitat and different animals were mentioned to exist within the site by the locals hence the Act is relevant.

Compliance: CEC will ensure that no animal is injured and if animals are found will be reported to departments of National Parks and wildlife.

2.2 International Agreements and Conventions

2.2.1 Convention on International Trade in Endangered Species (CITES)

The Convention on International Trade in Endangered Species of Wild Fauna and Flora, also known as the Washington Convention is a multilateral treaty to protect endangered plants and animals. It was drafted as a result of a resolution adopted in 1963 at a meeting of members of the International Union for Conservation of Nature (IUCN). The convention was opened for signature in 1973 and CITES entered into force on 1 July 1975. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species in the wild, and it accords varying degrees of protection to more than 35,000 species of animals and plants.

2.2.2 Convention on Biological Diversity

The Convention on Biological Diversity (CBD), known informally as the Biodiversity Convention, is a multilateral treaty. The Convention has three main goals including: the conservation of biological diversity (or biodiversity); the sustainable use of its components; and the fair and equitable sharing of benefits arising from genetic resources. In other words, its objective is to develop national strategies for the conservation and sustainable use of biological diversity. It is often seen as the key document regarding sustainable development. The Convention was opened for signature at the Earth Summit in Rio de Janeiro on 5 June 1992 and

entered into force on 29 December 1993. At the 2010 10th Conference of Parties (COP) to the Convention on Biological Diversity in October in Nagoya, Japan, the Nagoya Protocol was adopted

2.3 IFC Performance Standards

The following IFC Performance Standards are applicable to this BS:

2.3.1 Performance Standard 1 (Assessment and Management of Environmental and Social Risk and Impacts)

IFC Performance Standard (PS) 1 aims to identify and assess environmental (including biodiversity) and social risks and impacts of any given project. The project must adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimise, and where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment. PS1 promotes improved environmental and social performance of clients through the effective use of management systems. Furthermore, the standard promotes and provides a means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

2.3.2 Performance Standard 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources)

IFC PS6 has the greatest relevance to this BS. PS6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living and natural resources are fundamental to sustainable development. This standard covers the following aspects that are relevant to this BS:

- To protect and conserve biodiversity;
- To maintain the benefits from ecosystem services; and
- To sustainably manage living natural resources.

3.0 METHODOLOGY

This chapter describes the methodology used to assess the biodiversity of the proposed site which enabled the researcher to meet the objectives of the study.

3.1 Scope of the Study

When coming up with the scope of the biodiversity assessment several consultations were made which included interviews with the developers and the main consultant. Project design and scoping reports all formed the basis for scope formulation. Further, familiarization tours to the site were made to appreciate the site before the actual study was commissioned. The study was conducted between 1st and 5th May 2024 and covered the entire 52 ha of the proposed project site. The study looked at the following features;

i) Vegetation types and plant communities that occur on and around the site.
ii) Habitat associations and conservation status of the identified species of both flora and fauna
iii) Sensitive plant communities (exotic/alien) and/or habitats where disturbance should be avoided or minimized.
iv) Species and species group (Mammals, Birds, Reptiles, Amphibians, Invertebrates and Fish)
v) Areas of high biodiversity on the site including Rare/Endangered Species in the Project area.
vi) Species of special concern, including sensitive, endemic and protected species.

3.2 Desk Study

Desk study was conducted in April 2024. Resources books, journals, publications internet and other ecological reports that have been conducted in the region were reviewed and referenced appropriately. Interviews with nearby local communities were also conducted.

3.3 Field Survey

Field surveys were conducted within the 52 hectares proposed project site between 1st and 5th May 2024 by Mr. Jacob Tembo assisted by a local tour guide[1].

3.3.1 Terrestrial Biodiversity

3.3.1.1 Flora

The following methods were employed during the study;

i) 5 circular plots of 10m radius were created within the project area
ii) In each plot geographical coordinates were taken from the center of the plot.

[1] Jacob Tembo has a Bachelor of Science degree in Ecology (BSc) and a Master of Science degree in Environmental Management.

iii) The vegetation and tree inventory of each plot was Identified and described

iv) Areas of high biodiversity including rare or endangered species within the plot were identified and recorded

v) Any species of special concern, including sensitive, endemic and protected species were identified and recorded

3.3.1.2 Fauna

The following methods were employed during the assessment:-

i) Walking along the main roads observing and recording the variety of fauna observed

ii) Interviews with local inhabitants of the project area about the Terrestrial fauna found in project area.

3.3.2 Aquatic Biodiversity

3.3.2.1 Aquatic Flora

Aquatic flora was sampled using the systematic method. Random circular plots were created with 10m radius on banks of Mwambashi stream. At each of the plot, flora occurring in the wider riparian zone and on the water surface and edges was observed. Plants occurring in the aquatic areas were identified across a range of growth forms, including aquatic macrophytes (emergent, surface and sub-surface) species. Care was taken to focus plant identification and description of habitats to aquatic species only as stipulated in the scope of work. The choice of the plots was mainly determined by accessibility.

3.3.2.2 Aquatic Fauna

The following methods were employed to collect data on the aquatic fauna of the project area:-

i) Site walk over along the banks of the stream identifying and recording different types of aquatic fauna spotted in the stream.

ii) Interviews with local fishermen on the dominant fish species in the streams, methods employed, types of nets used, any interesting fish species caught and other aquatic fauna caught or spotted apart from fish

iii) Interviews with local inhabitants of the project area about the aquatic fauna found in and on the banks of the stream.

3.4 Study Limitations

The major limitations were:-

- It was not possible to determine seasonal variations in the species activities as only one site visit during one season was carried out.

4.0 BASELINE BIODIVERSITY CONDITION

4.1 Site Description and Proximity to other Conservation areas

The project site covers a portion of 52 Ha located in garneton area; Kitwe district of Copperbelt province. It is located just after Mwambashi stream near the CEC and ZESCO power lines covering. The site is not located within IUCN protected area and could be categorized as modified due to significant cutting down of trees and land cleared for agricultural purposes.

The immediate west of the site is CEC power lines and further west is a gravel access road. The north-western part of the site about 100m is a stream called Kanakankoko. The southern part of the site Nakayombo stream about 50m. The eastern side is mixed both modified and natural habitat. Generally the site slopes both on the NW side and southern side. There are no important sites within 10km radius.

4.2 Results

4.2.1 Types of Habitat

High level mapping of broad habitat structure classes based on density of vegetation using 2022 remote sensing imagery (Table 1) shows that there are four (4) types of habitats or vegetation cover within the project site; secondary Miombo woodland, shrubland, grassland and old fallow crop fields.

Table 1: Habitat/vegetation coverage within the site

No	Habitat/vegetation type	Area (km2)	% Coverage
1	Secondary Miombo woodland	0.16	31.82
2	Shrubs	0.06	11.36
3	Grassland	0.25	47.73
4	Old fallow crop fields	0.05	9.09
Total		0.71	100.00

The dominant land cover is grassland covering about 47% of the total area representing 0.25 km^2 of the total area. Some of the very old fallow fields were also categorized under this class.

Figure 1: Grassland cover on the project site

Secondary miombo woodland is the second dominant land cover with 32% representing 0.16km² of the total area. Mostly it concentrated on the northern side of the site just after Nakayombo road. The dominant tree species observed were Marquesia *macroura, Brachystegia boehmii, Brachystegia floribunda, Maprounea africana, Mimusops zeyheri, Bauhinia petersiana, Isoberlinia angolensis and Erythrophleum africanum.*

Figure 2: Mature tree on the project site

Shrubland is the third dominant land cover with about 11% representing 0.05km² of the total project site. This land cover was dominated by secondary vegetation of trees. Most of these trees were very small with average diameter of less than 5cm and height of 2-3m. The dominant trees include; *Dichrostachys cinerea, Uapaca kirkiana, Diplorhynchus condylocarpon and Parinari curatellifolia.* This land cover is also characterised by an evergreen perennial flowering plants in the subfamily *Bambusoideae* of the grass family *Poaceae* (Bamboo). This land cover was rather denser than sparse as the trees were seen growing close to each other without any distinctive strata. The ground was covered by patches of plant and grass species mixed with some herbs.

Figure 4: Some bamboo species characterising the shrubland

The fourth land cover was the old fallow crop fields covering about 10% representing 0.04km² of the total project area. This was characterized by grass and late pioneer herbaceous plants growing in association with some small plants and weeds. These fields became fallow after the illegal encroachers who practiced seasonal agriculture on the project land were displaced in 2020. The dominant grass species was *Hyperrhenia rufa* which covers most of this land cover. Other notable grass species include; *Dactylocterium aegyptiun*, *Cynodon dactylon, Digitaria termata, Eleusine indica, Setaria sp. Eragrostis sp, and Bidens Schmperi.* The figure below shows the common grass species found in this land cover.

Figure 5: Common Grass species growing in association with plants species

4.2.2 Species Richness, Evenness and Diversity

Species richness is the number of different species represented in an ecological community, landscape or region. Species richness is simply a count of species, and it does not take into account the abundances of the species or their relative abundance distributions. Evenness is a measure of the relative abundance of the different species making up the richness of an area.

Determination of species richness, evenness and diversity helps in understanding the productivity and biodiversity of an area this is important in impact assessment and formulation of mitigation measures of a project where forest clearing is present. Diversity is usually proportional to the stability of the ecosystem: the greater the diversity the greater the stability (Naffield, 2008). The most stable communities have large numbers of species which are fairly evenly distributed in good-sized populations. Pollution often reduces diversity by favouring a few dominant species. Diversity is therefore a factor in successful conservation management. The table below shows the species richness, evenness and diversity where trees will be cleared. Species diversity was calculated using Simpson index. **Simpson's Index of Diversity 1- D** value ranges between 0 and 1, where:

- High scores (close to 1) indicate high diversity.
- Low scores (close to 0) indicate low diversity.

The index represents the probability that two individuals randomly selected from a sample will belong to different species.

$$D = 1 - \frac{\Sigma n(n-1)}{N(N-1)}$$

where N = the total number of organisms of all species and n = the total number of organisms of a particular species from which Simpson's Diversity Index, 1 – D, is found.

Table 2: Species Richness, Evenness and Diversity

Habitat	Species Richness	Species Evenness	Simpson Index (1-D)
Plot 1	7	0.24	0.803
Plot 2	6	0.18	0.831
Plot 3	Grassland/bamboo	Grassland/Bamboo	Grassland/Bamboo
Plot 4	Grassland	Grassland	Grassland

Habitat	Species Richness	Species Evenness	Simpson Index (1-D)
Plot 5	*Tithonia sp*	*Tithonia sp*	*Tithonia sp*
Average	6.5	0.21	0.817

From table 3 above, plot 1 had the highest species richness, evenness and species diversity compared to plot 2. This entails that the above plot is very productive and have higher biodiversity than the other plot. On average, species richness, evenness and diversity is 6.5, 0.21 and 0.817 respectively. Therefore, the diversity of the area could be considered high as the value of the diversity index is closer to one.

4.2.3 Terrestrial Fauna

Mammals

No mammals were spotted during the period of study period, however, some locals interviewed reviewed that some mammals are occasionary seen, these included, Rabbits (*Lepus kapensis*) some rodents. No physical evidence of the mammals was observed in the study area such as droppings, footprints.

Birds (Avifauna)

The notable species of birds as observed and interviews from the locals include; *Egretta spp, Lybiustorquatus (*Black-collard Barbet), *Mirafra rufocinnamomea* (Flappet Lark), *Hirundo rustica* (European Swallow,) Swallow (*Hirundo dimidiate),* Swallow (*Hirundo daurica)*, Swallow (*Hirundo smithii)*, *Oriolus larvatus* (Black-headed Oriole), *Corvus albus* (Pied Crow), *Turdoides jardineii* (Arrow-marked Babbler) and *Cossypha heuglini (*Heuglin's Robin-Chat). The figure below shows evidence of some bird species.

Insects (Lepidoptera)

Difference types of insects were observed in the project area these include, termites, butterflies, ants, etc. Table 11 highlight types of butterflies observed.

Table 3: List of Identified Species of Butterflies Observed

No.	Species	Common name
1	*Belenois gidica*	Brown veined white
2	*Eurema brigitta brigatta*	Broad-bordered Grass yellow

3	*Mylothris agathina agtathina*
4	*Acraea induna mv*

Source: field data

Reptiles

Few reptiles were observed during the site walk over. These included the lizards, Geckos, Chameleons and skinks. Some common snakes such as black mambas are reported to be present in the area though none were observed during the course of the survey.

4.2.3 Aquatic Species in the Project Area

Aquatic Flora

Aquatic flora was observed in both Nakayombo and Kanakankoko streams, however, in Kanakankoko stream only mature trees were observed along the banks and access to the river habitat was difficult. In Nakayombo stream some water lilies (Nymphaea sp) were observed and other notable aquatic flora which include; *Cyperus papyrus, Phragmites mauritianus and Typha capensis,*.

Aquatic Fauna

Fish/ Ichthyology

The dominant fish species in the project area as reported by the local fishermen during the field visit included the following; *Labeobarbus polylepis, Clarias stapperssi, Barbus fasciolatus, Barbus multineatus, Pseudocrealabrus philander, Tilapia sp. B. lineomaculatus*, *Synodontis macrostigma*, *Serranochromis macrocephalus*, *Barbus miolepis. (Mormyrus longirostris)*, *(vittatus)*, barbel (*Schilbe intermedius,* butter barbel (*Schilbe mystus*. The fishermen use gill nets, hand nets and fish hooks as methods to catch fish species.

All the fish species highlighted by the fishermen were common to the project area and other river systems in Zambia.

4.4 Identification of Rare, threatened or Endangered Species in the Project Area

In the project area no threatened, rare or endangered species for both fauna and flora species were registered or are known to exist on the study site.

Species of commercial importance

The study area had exotic tree species that that could be exploited for commercial purposes

Species with potential to become nuisance, vectors or dangerous

No species with potential to become nuisance, vectors or dangerous were registered at the time of the study, however, the presence of black mambas has been reported.

4.7 Description of the Proposed Development

The project involves the construction and operation of a 20MWac solar PV power plant. Key project components include PV modules and mounting structures, underground direct current (DC) and alternating current (AC) cables, transmission lines, inverter stations, substation(s) (site substation(s)), stores and office building(s), access road and internal access tracks, perimeter security fence and security. During construction the following activities will be undertaken.

- Excavation of cable trenches;
- Ramming or drilling of the mounting structure frames;
- Installation of the modules onto the frames;
- Installation of measuring equipment;
- Laying of cables between the module rows to the inverter stations;
- Optionally laying of gravel or aggregate from nearby quarries placed in the rows between PV arrays for enhanced reflection onto the panels, assisting in vegetation control and drainage;
- Construction of inverter station foundations and installation of inverter stations;
- • Construction of site substation foundations and installation of site substation plant and equipment;
- Construction of office and welfare facilities;
- Testing and commissioning;
- Removal of equipment and demobilisation of construction team; and
- Construction of the transmission line.

5.0 BIODIVERSITY IMPACTS AND MITIGATION MEASURES

Impacts on biodiversity can often adversely affect the delivery of ecosystem services. This chapter discusses the major potential impacts on biodiversity features identified in section 4.0 (Vegetation, Mammals, Birds and Reptiles) from the project, and details the major mitigation actions that will be undertaken and how the project developer can sustainably manage and mitigate impacts on biodiversity and ecosystem services throughout the project's lifecycle.

All the impacts identified were as a result of constructing a 20MWac solar PV power plant. Key project components include PV modules and mounting structures, underground direct current (DC) and alternating current (AC) cables. The likelihood, consequence and risk of each impact were assessed.

The risks and impacts identification process considered direct and indirect project related impacts on biodiversity and ecosystem services and identified any significant residual impacts. This process also considered relevant threats to biodiversity especially focusing on habitat loss, degradation and fragmentation, invasive alien species, overexploitation, nutrient loading, and pollution (IFC/PS6 2012) see appendix I

5.1 Major Potential Biodiversity Impacts

The Major potential impacts for all the biodiversity features identified are listed below;

- Direct habitat loss due to vegetation clearance
- Indirect habitat loss of aquatic animals due to pollution of water resources
- indirect mortality of aquatic species due to pollution of water resources

5.1.1 Impacts During Preparatory and Construction Phases

The key impacts during the construction phase are associated with:

- Direct Loss and Degradation of Habitat – through development of infrastructure and possible increased human influx.
- Loss of faunal and floral Species
- Direct mortality (from collisions with and electrocution by vehicles and power lines)
- Cumulative Impacts associated with the Loss of Habitats and faunal Species – associated with the Project and other construction activities in the greater Project Area.

5.1.2 Impacts during Operations Phase

During operations the key impacts are associated with:

- Fragmentation (reduced connectivity) of animal populations
- Direct mortality (from collisions with and electrocution by vehicles and power lines)
- Cumulative Impacts to Proposed Conservation Areas– through development of modern construction activities.
- Cumulative Impacts associated with the loss of habitats and faunal Species

5.2 Mitigation Measures

5.2.1 Mitigation Measures during Construction

Avoid the Loss of Habitats and indigenous vegetation

Disturbances resulting from activities are expected (viz. Excavations, equipment laydown areas, temporary storage, parking for trucks, importing heavy equipment and may also include other activities). In this regard, the following will be undertaken:

- Natural drainage lines will not be disrupted significantly and development of borrow pits will be located as far away from any of the fringe habitats as possible to avoid drainage disturbances to the vegetation in the area.
- Vegetation clearing will be limited; only areas earmarked for infrastructure development will be cleared.

Containment of Construction Activities and Avoiding Footprint Creep

Construction activities will be contained within a reasonable minimum area through a planning and disciplined approach that accounts for the following considerations to avoid undesirable "footprint creep":

- The reasonable minimum area required for the construction activity will be determined in advance and clearly demarcated on the ground. These areas will consider equipment laydown areas, vehicle parking and turning space.
- Construction teams will be made aware of the demarcations prior to initiating construction works, and follow-up checks are to be done to ensure that the construction areas are not being exceeded.
- Toilet facilities and rest areas will be provided for construction teams to avoid the need for them to venture beyond the demarcated area in search of such necessities.

Integrate Biodiversity Importance into Induction Programmes

The importance of the natural environment and the local biodiversity will be incorporated into Induction Programmes for all of the workers and contractors working in the Project Area.

These components of the induction programmes will be regularly updated and improved, and will include the following topics:

- Awareness of the biodiversity that exists in the Project Area and surrounds and the impacts caused during the construction and operational phases of the Project.
- Outline the individual responsibilities to reduce impacts to the environment.
- Present the company procedures on land clearance and waste disposal.
- Vehicle speed limits and the reasons for them.
- Highlight the responsible people on any biodiversity related issues that may arise.

Implement an Internal Biodiversity Protection Statement

A Biodiversity Protection Statement to conserve plants and animals will be developed, and made applicable to all staff, contractors and other personnel associated with the Project. The following activities will be prohibited by CEC staff and contractors within and surrounding the Project Area, both during and outside of work hours:

- Any forms of hunting of wildlife or fishing or blank firing of guns.
- The intentional killing of any animals including snakes, lizards, birds or other animals. Awareness of the Animal Rescue Plan will be promoted as a means of addressing the presence of animals at risk or presenting a risk to the implementation of activities.
- Purchase, sale or transport of any live animals, bush meat or other local wild animal products from local communities or passing traders.
- Collection of any animals or animal products for consumption, medicinal or other use.
- Sellers of wildlife would not to be allowed on project site premises. Such people will be reported to local authorities or appropriate wildlife agencies such as NPWP.
- Purchase or transport of fuel wood from or for surrounding communities.
- Contamination or disposal of waste anywhere other than at designated disposal points.

The above information will be included within the site induction processes so that all workers are aware of these prohibitions. It will also be included in internal and external reporting documentation.

Maintain an Inventory of Floral and Faunal Species

The IFC standards require that developments demonstrate there is no net loss of biodiversity values as a result of their activities. This can in part be achieved through maintaining a structured register of species that demonstrates the continued presence of a diversity of species

within the site and the surrounding area about 200m from the boundary of the proposed site. A detailed inventory and photo library of plant and animal species present within and around the project concessions will be kept by the Environmental Department.

A biennial record will be kept of as many species as possible observed within and around the Project Area, with updates to cover all seasons and include migratory species. A record of species known to occur will never be complete, but will gradually become increasingly comprehensive. Data will be formally updated on an annual basis to assess progress, which can be measured by the growth in the number known to occur within and around the site.

Implement an Animal Rescue Plan

An animal rescue procedure will be developed and implemented for the safe translocation of any faunal species found to be at risk from operations or posing a threat to project activities. The animal rescue procedure will include the following aspects:

- Selected staff will be professionally trained and equipped to handle venomous snakes, with particular emphasis on species likely to be encountered in and around the Project Area, and a schedule maintained whereby a trained snake handler is on call during operational hours.

Develop and Implement Awareness Programmes Focused on Biodiversity

Awareness and appreciation of the local ecology among people generates tremendous support for the conservation of biodiversity. Various biodiversity-related activities will be highlighted in this document, which include the development of a register of species, the need for an animal rescue plan and offsetting and ecological monitoring programmes. Awareness of these activities will be raised among staff and contractors. The following suggestions are presented, but awareness programmes need not be restricted to these:

- Where possible, opportunities will be explored for involvement of staff, contractors and associated personnel to widen the appreciation and enthusiasm for the conservation of the biodiversity in and around the Project Area.
- Staff and contractors will be encouraged to report interesting wildlife sightings and observations, which are to be incorporated into the species register and recognition for worthwhile wildlife observations will be publicized accordingly.
- An acceptance of hyenas and vultures will be promoted due to their importance in the local ecosystem.
- Additional means of generating pride will be explored.

Proactive Dissemination of Information

MoH will consolidate information that demonstrates the compatibility of their activities with conservation and present the steps taken to avoid ecological impacts and promote cultural harmony. Such information will be proactively released through appropriate channels to avoid the development of negative perceptions against project activities within a proposed conservation area.

5.2.2 Mitigation Measures Proposed for Consideration during Operation

Implement an Internal Biodiversity Protection Statement

A Biodiversity Protection Statement to conserve plants and animals will be developed, and made applicable to all staff and other personnel associated with the Project. The following activities will be prohibited by CEC staff and contractors within and surrounding the Project Area, both during and outside of work hours:

- Any forms of hunting of wildlife or fishing or blank firing of guns.
- The intentional killing of any animals including snakes, lizards, birds or other animals. Awareness of the Animal Rescue Plan will be promoted as a means of addressing the presence of animals at risk or presenting a risk to the implementation of activities.
- Purchase, sale or transport of any live animals, bush meat or other local wild animal products from local communities or passing traders.
- Collection of any animals or animal products for consumption, medicinal or other use.
- Purchase or transport of fuel wood from or for surrounding communities.
- Contamination or disposal of waste into aquatic environments.

Maintain an Inventory of Floral and Faunal Species

The IFC standards require that developments demonstrate there is no net loss of biodiversity values as a result of their activities. This can in part be achieved through maintaining a structured register of species that demonstrates the continued presence of a diversity of species in the area associated with the project and vicinity.

A detailed inventory and photo library of plant and animal species present within and around the project concessions will be kept by the Environmental Department. The species within this inventory will be classified into taxonomic groups and families, Red Data status using the IUCN Red List of Threatened Species and their perceived threat status within the area.

A biennial record will be kept of as many species as possible observed within and around the Project Area, with updates to cover all seasons and include migratory species. A record of species known to occur will never be complete, but will gradually become increasingly

comprehensive. Such activities can involve a broad spectrum of staff within the Environmental Department and volunteers within the other departments of the company.

Data will be formerly updated on an annual basis to assess progress, which can be measured by the growth in the number known to occur within and around the concessions, and increases in the proportion of species that in the non-risk categories described in 7.

Implement an Animal Rescue Plan

An animal rescue procedure will be developed and implemented for the safe translocation of any faunal species found to be at risk from operations or posing a threat to project activities. The animal rescue procedure will include the following aspects:

- Selected staff will be professionally trained and equipped to handle venomous snakes, with particular emphasis on species likely to be encountered in and around the Project Area, and a schedule maintained whereby a trained snake handler is on call during operational hours.
- Selected staff, preferably with some medical background, will be trained and equipped with sedative drugs to safely subdue and translocate aggressive mammals.
- Safe areas of similar habitat type will be identified where animals rescued from areas of risk can be released without harm to operations, surrounding communities, neighboring operators or harm to that animal.

5.3 Significance of Residual Effects

Residual impacts are those impacts that remain following the implementation of the mitigation measures. Three main residual impacts were identified for this biodiversity study; Habitat loss and Vegetation clearing.

Despite measures that will be implemented to reduce habitat loss through vegetation clearing, habitat for various faunal species will be lost.

The site has mainly 4 vegetation types which include; Secondary miombo woodland, grassland, crop field and shrubland. Cropfield predominates in the area. Residual effects are habitat loss and vegetation clearing.

5.4 Compensation

In order to achieve no net loss (NNL) on biodiversity features with residual impacts, biodiversity tree replanting programme is proposed. The goal of tree replanting is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure and ecosystem function and people's use and cultural values associated with biodiversity.

5.5 Assessments of the Impacts

Table 4: Impact Assessment of Habitat Loss due to Vegetation Clearance

Type of Impact	**Negative and Direct**							
Impact Criteria	**Pre-construction**		**Construction**		**Operation**		**Decommissioning**	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Intensity/Severity	High	Low	Moderate	Low	Low	Low	NA	NA
Geographic Extent	Regional	Local	Regional	Local	Local	Local	NA	NA
Duration	Long Term	Short Term	Medium term	Short term	Short term	Short term	NA	NA
Consequence	High	Low	Moderate	Low	Low	Low	NA	NA
Probability	Definite	Probable	Possible	Probable	Unlikely	Unlikely	NA	NA
Significance	High	Moderate	Low	Negligible	Negligible	Negligible	NA	NA

Table 5: Impact Assessment of Indirect Mortality and Habitat Loss of Aquatic Species due to water pollution

Type of Impact	**Negative and Indirect**							
Impact Criteria	**Pre-construction**		**Construction**		**Operation**		**Decommissioning**	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Intensity/Severity	Moderate	Low	Moderate	Low	Low	Low	Moderate	Low
Geographic Extent	Regional	Local	Regional	Local	Local	Local	Local	Local
Duration	Long Term	Short Term	Medium term	Short term	Short term	Short term	Short term	Short term
Consequence	High	Low	Moderate	Low	Low	Low	Moderate	Low
Probability	Possible	Probable	Probable	Unlikely	Unlikely	Unlikely	Probable	Unlikely
Significance	High	Moderate	Low	Negligible	Negligible	Negligible	Low	Negligible

6.0 CONCLUSION

The biodiversity study was conducted and prepared following relevant national and international legislation and planning policies. Further, the report complies with relevant national development plans, policies and statutory obligations which require the sustainable use of living natural resources and achieving no net loss on biodiversity.

Commitments and delivery of recommended mitigation measures shall be secured through planning, acquiring of various licences and permits from relevant authorities. The securing of the mitigation measures will result in reduction of impacts on biodiversity.

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Refining Estimates of Bird Collision and Electrocution Mortality at Power Lines in the United StatesScott R. Loss, 1 , * , ¤ Tom Will, 2 and Peter P. Marra 1

Effects Of An Exotic Plant And Habitat Disturbance Onpollinator Visitation And Reproduction In A Boreal Forest Herbørjanotl and Department of Ecology and Natural Resource Management, The Norwegian University of Life Sciences, P.O. Box 5003, Norway

Alien plant invasion and their impact on indigenous species diversity at global scale: A review

Measuring the Effects of Invasive Plants on Ecosystem Services: Challenges and Prospects

APPENDIX I: POTENTIAL IMPACTS

1.1 Direct habitat loss due to vegetation clearance and invasive species

Habitat loss and degradation are the primary drivers of the decline and extinction of wildlife populations in terrestrial ecosystems (WWF, 2014). Habitat supporting many biodiversity features will be lost under the project's direct infrastructure footprint.

Most significant impacts will be on plants/trees, which cannot move. Miombo is known to be the dominant tree species in the project area. The other rare plants are not known to occur under planned infrastructure. Impacts are also expected on the largely resident species and, to a lesser extent, migrant birds. Impacts on other priority species are not expected to be significant because they are not likely to use the area substantially or are largely passage migrants that only fly through the area.

These risk assessments and mitigation plans assume that the project will follow standard best practice for minimisation and restoration of construction (including construction camps, access roads, borrow pits and temporary parking areas) and operation footprints.

1.2 Indirect Mortality and habitat loss of aquatic animals due to water pollution

Pre-construction Phase

Runoff from site preparation activities could result in an increase in turbidity and organic load of surrounding water bodies. This will adversely affect the water quality and aquatic organisms.

Construction Phase

Alteration of soil structure during construction could lead to erosion and subsequent siltation in the surface water bodies at the downstream area. Changes in surface hydrology can in turn adversely affect conditions that maintain healthy biological resources especially the epifauna. Accidental spillage of hazardous materials, improper disposal of solid, liquid and hazardous wastes and contaminated surface runoffs from both the site and the construction personnel living quarters can also impact the aquatic environment. Site preparation and construction activities will occur over a limited time and in a localized manner.

Operational Phase

There would be minimal discharge from the quarterly cleaning of the PV modules. Wastewater would be routed to a pond from where they would be reused. Accidental leakage of transformer oil can occur during transmission line and substation operation, which would cause contamination of nearby surface-water bodies such as the Mwambashi and sandsale streams.

Decommissioning Phase

Runoff from decommissioning activities could result in an increase in turbidity and organic load of surrounding water bodies. This will adversely affect the water quality and aquatic organisms.

ANNEX II: COMMON WOOD TREE SPECIES

Table 6: Common Wood Trees found within the Site and the Local Names

No.	Local name	Scientific name
1.	Mufungo	*Anisophylusboehmii*
2.	Musamba	*Bracchystegia sp*
3.	Mtobo	*Isoberlinia angolensis*
4.	Msuku	*Uapaca kikiana*
5.	Mupundu	*Parinari curatellifolia*
6.	Mtondo	*Julbenardia paniculata*
7.	Kafulamume	*Maprounea africana*
8.	Mchenja	*Mimusops zeyheri*
9.	Katenge	*Dichrostachys cinerea*
10.	Mlombwa	*Pterocarpus angolensis*
11.	Nsengu	*Bamboo grass*
12.	Kaimbi	*Erythrophleum africanum*
13.	Msangati	*Pseudolachnostylis maprouneifolia*
14.	Museshi	*Marquesia macroura*
15.	Mtombolya	-
16.	Mupondo	*Bauhunia petersiana*

APPENDIX 7: LIVELIHOOD RESTORATION PLAN

APPENDIX 8: AGRICULURAL SURVEY REPORT

REPUBLIC OF ZAMBIA
MINISTRY OF AGRICULTURE
OFFICE OF THE DISTRICT AGRICULTURAL COORDINATOR
P.O BOX 21916
KITWE

29th April 2019

The Chief Projects Officer
COPPERBELT ENERGY CORPORATION PLC
Kitwe

RE: ASSESSMENT OF FARMER FIELDS ON THE PROPOSED SOLAR PV POWER PROJECT IN GARNETON

Find enclosed herewith the above stated Assessment report as requested by your office.

Yours in national service,

Raphael Muyaule (Dr.)
District Agricultural Coordinator
KITWE

MINISTRY OF AGRICULTURE

DEPARTMENT OF AGRICULTURE

KITWE DISTRICT

ASSESSMENT REPORT ON FARMER FIELDS ON PROPOSED SOLAR PV POWER PROJECT IN GARNERTON KITWE DISTRICT

Compiled by

Francis Katongo

April **2019**

1.0 INTRODUCTION

This report reflects findings gathered during field visit to the project sites (both North and South)
The assessment team comprised of One Environmental Consultant Officer MR. FLOYD CHIPATELA, the Chairman from the farming Community, MR. SILAS LUNGU and an officer from the District Agricultural Coordinator's Office. The exercise was to verify what is on the ground of the farmer fields during the assessment exercise in Garnerton Camp.
The Assessment report was compiled by Messrs Francis Katongo a staff at Ministry of Agriculture, based at Kitwe.
The Assessment was conducted in two phases; namely the north part and the south part of Garnertone Camp following the wayleaf of the power lines. The estimated value of Agricultural productivity loss for all affected households (beneficiaries) amounts to K28770

2.0 METHODOLOGY

The assessment was carried out using standard practical methods i.e. valuation of agricultural production per unit area and crop gross margins. The affected fields were measured in the presence of most affected farmers and verified by the community chairperson. The crop yields were estimated based on the information given by the farmers and physical observation/assessment of the fields to determine production per hectare. The yield was multiplied by the number of hectares and the current market price for all affected crops to determine the expected revenue loss.

A. HECTARAGE

Every affected field plot on the wayleaf of the power lines was measured using Global Positioning System (GPS) to determine the area in hectares (ha).

B. FRUIT TREES

The value of fruit trees was based on a 10 years period with each tree estimated to give an income as shown below:

I. MANGO

Information collected from farmers indicate that the prevailing price of Mango fruits is K20 per 20Kg bucket. The average yield is about 300Kg of fruit per tree per year (season). This gives an average estimate K300 per tree per season.

II. GUAVA

The current price for guavas is K30 per 25Kg bag. The assumption is that a guava tree yields about 400Kg of fruits per year, giving an average cost of K480 per tree per season.

C. VEGETABLES

Pumpkin Leaves: A 50Kg bag is sold at K50 as prevailing price
Okra: A 50Kg bag is sold at K150
Sweet potato vines: A 50Kg bag is sold at K40

D. EXPECTED REVENUE LOSS FROM CROP FARMING

The crops found at the time of the assessment where Maize, Groundnuts, Sweet potatoes, Beans, Mbambara nuts and Cassava. Farmers had grown Okra, Sweet potato vines and Pumpkin leaves. The expected loss of income from all crops grown by the affected farmers is calculated per individual farmer as the tables show. The market value for maize grain is based on the official flow price as announced by Zambia's Food Reserve Agency for the 2019/2020 market season. The other crops grown on the Project land are not purchased by FRA, as such their market values were obtained from the farmers.

E. LAND VALUE

The value of land could not be calculated because the affected farmers do not own land.

FINDINGS

NAME OF FARMER	NRC	PHONE No.	CROP	SIZE OF FIELD (Ha)	YIELD (ton/ha)	EXPECTED PRODUCTION (No. X 50Kg)	COST OF CROP (K)	PERIOD OF COST (yr)	VALUE OF CROP (K)
KAULU YOTAM	486315 /67/1	0968877004	EGGPLANT	0.02	4.0	1	150	1	150
			CASSAVA	0.01	1.92				***
			PUMPKIN LEAVES	0.01	3.0	0.5	50	1	25
			MAIZE	0.20	2.44	6	110	1	660
			OKRA	0.01	4.0	0.5	150	1	150
PILESI MUBYANA	395814 /67/1	0972889650	MAIZE	0.22	2.44	6.5	110	1	715
BWALYA ALICE			MAIZE	0.16	2.44	5	110	1	550
SAPUTO VIOLET		0966534265	MAIZE	0.07	2.44	2.5	110	1	275
CHIPULU MARGARET	184427 /44/1	0962490735	MANGO TREE(S) (1)	1	300Kg /tree	1	300	1	300
NYAMBOJI ELISA	128404 /23/1	0965834909	CASSAVA	0.06	1.92	2	120	1	240
KABWE DIGASHOME	160875 /43/1	0964440609	MAIZE	0.24	2.44	7	110	1	770
			G/NUT	0.01	0.62	0.5	70	1	35
			MANGO TREES (1)	1	300kg /tree	1	300	1	300

NAME OF FARMER	NRC	PHONE No.	CROP	SIZE OF FIELD (Ha)	YIELD (ton/ha)	EXPECTED PRODUCTION (No. X 50Kg)	COST OF CROP (K)	PERIOD OF COST (yr)	VALUE OF CROP (K)
TEMBO ELIZABETH	304183 /52/1	0977361261	MAIZE	0.32	2.44	9.5	110	1	1045
			MANGO TREES (4)	1	300kg /tree	4	300	1	1200
			GUAVA TREE (1)	1	400kg/ tree	1	480	1	480
KAMPAMBA MEYA	248801 /64/1	0969730062	MAIZE	0.16	2.44	5	110	1	550
			G/NUT	0.10	0.62	2	70	1	140
CHINGUNGU DOROPHINA	259310 /67/1	0965121978	MAIZE	0.18	2.44	5.5	110	1	605
			SWEET POTATO	0.01	3.16	1	90	1	90
			G/NUT	0.1	0.62	2	70	1	140
			MANGO TREES (8)	1	300kg /tree	8	300	1	2400
KAYOMBO JOSEPHINE	242108 /67/1	0968087418	MAIZE	0.015	2.44	1	110	1	110
			G/NUT	0.03	0.62	0.5	70	1	35
TITIMA FLORENCE		0961945006	MAIZE	0.18	2.44	5.5	110	1	605
MUBANGA EMMANUEL	103488 /34/1	0950724246	MAIZE	0.35	2.44	10	110	1	1100
			G/NUY	0.18	0.62	2	70	1	140

NAME OF FARMER	NRC	PHONE No.	CROP	SIZE OF FIELD (Ha)	YIELD (ton/ha)	EXPECTED PRODUCTION (No. X 50Kg)	COST OF CROP (K)	PERIOD OF COST (yr)	VALUE OF CROP (K)
			MBAMBARA NUT	0.01	0.26	0.5	70	1	35
			BEANS	0.01	0.71	0.5	100	1	50
SAMUTU YVONNIE	361386 /65/1		MAIZE	0.21	2.44	6	110	1	660
			G/NUT	0.02	0.62	0.5	70	1	35
			BEANS	0.03	0.71	0.5	100	1	50
SAMUTU KELVIN	194748 /65/1	0964205430	MAIZE	0.16	2.44	5	110	1	550
			SWEET POTATO	0.08	3.16	5	90	1	450
MUMBA KINGFORD	130122 /45/1		MAIZE	0.25	2.44	7	110	1	770
			G/NUT	0.2	0.62	3	70	1	210
MBAKA ROSE		0966650935	MAIZE	0.01	2.44	1	110	1	110
			G/NUT	0.01	0.62	0.5	70	1	35
SALACHI BEAUTY	130785 /25/1	0962759433	MAIZE	0.25	2.44	7	110	1	770
			MANGO TREES (3)	1	300kg /tree	3	300	1	900

NAME OF FARMER	NRC	PHONE No.	CROP	SIZE OF FIELD (Ha)	YIELD (ton/ha)	EXPECTED PRODUCTION (No. X 50Kg)	COST OF CROP (K)	PERIOD OF COST (yr)	VALUE OF CROP (K)
SIMWALE MARY			MAIZE	0.1	2.44	3	110	1	330
KASONGO JANET	375073 /67/1	0964123901	MAIZE	0.55	2.44	16	110	1	1760
			SWEET POTATO	0.2	3.16	12	90	1	1080
			MBAMBARA NUT	0.03	0.26	0,5	70	1	35
			MANGO TREES (5)	1	300kg /tree	5	300	1	1500
BUPE MUSE		0962472134	MAIZE	0.18	2.44	5.5	110	1	605
			MANGO TREES (8)	1	300kg /tree	8	300	1	2400
KASONGO BEATRICE	395814 /67/1	0962472134	MAIZE	0.12	2.44	3.5	110	1	385
MWANSA EVALYN	129895 /67/1	0962472134	MAIZE	0.15	2.44	4	110	1	440
SAMOYO OSCAR	568515 /67/1	0964875888	G/NUT	0.01	0.62	0.5	70	1	35
SAKUWAHA ELIZABETH	472888 /67/1	0960153440	G/NUT	0.01	0.62	0.5	70	1	35
KAPOSA MATHEWS	181407 /35/1	0964462727	MAIZE	0.05	2.44	2	110	1	220
			G/NUT	0.06	0.62	0,5	70	1	35

NAME OF FARMER	NRC	PHONE No.	CROP	SIZE OF FIELD (Ha)	YIELD (ton/ha)	EXPECTED PRODUCTION (No. X 50Kg)	COST OF CROP (K)	PERIOD OF COST (yr)	VALUE OF CROP (K)

NOTE: *……..The Cassava plant is about 5 months old. Harvesting of the crop may take next 17 months.**

CHALLENGES

A. Some identified farmers did not show up during field verification
B. The exercise was being done when farmers were harvesting/harvested the crop.

CONCLUSION

Farmer fields were verified and the cost of each crop was calculated.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

APPENDIX 9.1: RDA CLEARANCE LETTER

ROAD DEVELOPMENT AGENCY

The Regional Manager - Copperbelt Region Plot 4084, Mosi-O-Tunya Road, Tel/Fax: 212 650497
P.O. Box 71517 Ndola Copperbelt Province

In reply please quote No.:
RDA/10/2/5

November 21, 2018

The Chief Projects Officer
Copperbelt Energy Corporation PLC
P.O Box 20819
Kitwe

RE: APPLICATION FOR TRANSMISSION LINE ROUTE ACCESS RELATED TO THE GET FiT (ZAMBIA) SOLAR PROJECTS TENDER.

Reference is made to your letter dated November 12, 2018, and referenced CEC/VCW/206/2018 in which you requested for a budgetary quote and letter of comfort for the purpose of the tender for the Global Energy Transfer programme in Ganerton area, Kitwe.

We write to inform you that should your consortium be the successful bidder for the above mentioned tender, the Road Development Agency will be glad to grant you consent to use part of the road reserve to construct approximately 8km of 33kV power evacuation line subject to the provisions of the Public Roads Act No. 12 of 2002 and upon payment of the processing fees hereby attached for your ease of reference.

We wish you luck in your tender and remain available for any clarifications you may require.

Yours faithfully,
ROAD DEVELOPMENT AGENCY- COPPERBELT REGION

Eng. Joseph M. Himululi
REGIONAL MANAGER

ROAD DEVELOPMENT AGENCY

Internal Memo

PROCESSING FEES FOR ROAD INFRINGEMENT

Further to the Public Roads Act No 12 of 2002 Sections 5, 22, 33, 35 and 56, we wish to notify the general public that those wishing to infringe a Public Road by carrying out activities such as access to the public road, erecting a sign, cutting a road, erecting an advertising sign e.t.c in respect of Inter-territorial, territorial main roads and district roads must obtain application form No. RDA/D1 from the Finance Office of the Road Development Agency Headquarters or Regional Manager of the Province upon payment of the respective processing fees stated below.

Item No.	Type of Infringement	Within 20 km radius from town center	Over 20km but within 50Km from town center	Over 50 km from town center
1	Cutting a road for various purposes	K 7,500.00	K 7,500.00	K 7,500.00
2	Boring of road for various purposes	K5,000.00	K5,000.00	K5,000.00
3	Erecting advertising Sign	K 3,000.00	K 3,000.00	K 3,000.00
4	Access	K 7,500.00	K7,500.00	K 7,500.00
5	Others	Charges extrapolated from above depending on nature and magnitude		

For urban and rural roads, the application forms are available at the respective Local Road Authorities offices.

RDA: Good Roads for sustainable development.

Director Maintenance
Road Development Agency

FORM No. RDA/D 1

REPUBLIC OF ZAMBIA

ROAD DEVELOPMENT AGENCY

APPLICATION TO INFRINGE A PROCLAIMED ROAD

(Sections 5,22,33, 35 and 56 of the Public Roads ACT NO 12, 2002)

NB: Kindly fill in this application in block letters and forward it to the Director & CEO of the Road Development Agency with copy to the Regional Engineer where road or bridge is located.

The Director, Road Development Agency Headquarters

Sir,

1. I hereby apply to infringe a proclaimed road by: (indicate the appropriate item with an X)

(a) ☐ Laying a cable under the road surface;

(b) ☐ Laying a pipeline;

(c) ☐ Laying a pipeline through an existing bridge/culvert;

(d) ☐ Laying a cable through an existing bridge/culvert;

(e) ☐ Constructing a furrow, canal or ditch (pipelines) across or under such proclaimed road;

(f) ☐ Erecting a building or structure;

(g) ☐ Erecting an advertising sign;

(h) ☐ Erecting any other sign;

(i) ☐ Erecting a fence;

(j) ☐ Access to the proclaimed road

(k) ☐ Other (Specify

2. Further details in respect of the application are:

2.1	**Details of Applicant**	
(a)	First and surname of applicant:	
(b)	Postal address :	
(c)	Telephone Number:	
(d)	Fax Number:	
(e)	Name of Company/Farm:	
(f)	Location/ Plot Number	
(g)	Principal business (if applicable)	
2.2	**Details of Road/ bridge to be infringed upon:**	
(a)	Name of road /bridge:	
	Road designation number:	
(b)	Status of road (Trunk, Main, District):	
(c)	District:	
(d)	Province:	
(e)	Start date and period:	

3. Attached please find a sketch map to indicate where the road is to be infringed. In the case of cables through the culvert/bridge a plan is also attached to indicate the envisaged way of anchoring.

4. Attached please find a sketch of proposed advertisement sign.

5. I undertake to strictly adhere to the provisions of Public Roads No. 12 of 2002 and to further specifications that you shall provide.

6. I also agree to pay to the Road Development Agency a processing charge stated overleaf.

7. I agree also to pay for the full reinstatement of road resulting from any damage caused directly or indirectly by ourselves as per assessment that will be made by Road Development Agency.

....

Signature of Applicant Date

Copy: Regional Manager

_____Region

APPENDIX 9.2: ZEMA COMFIRMATION OF EPB

ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY

Head Office
Corner of Church & Suez Roads
P.O. Box 35131
Lusaka, Zambia
Tel: +260- 211-254130/254023/254059
Fax:+260-211-254164/256658

Northern Regional Office
Jacaranda Road
P.O. Box 71302
Ndola, Zambia
Tel: +260-212-621048/610407
Fax: +260-212-610246

Livingstone Office
Plot No. 555
Junction Obote / Nehru Roads
P.O. Box 60195
Livingstone, Zambia
Tel / Fax:+260-213-321297

Chirundu Border Office
Lusaka Road
P.O. Box CRU31
Chirundu, Zambia
Tel/Fax: +260-211-515261

In reply please quote

No: ZEMA/FAC/102/12/8/C/14

February 6, 2019

The Managing Director
Copperbelt Energy Corporation
P.O. Box 20819
KITWE

Dear Sir,

RE: ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED TWO 20MW SOLAR PARKS UNDER THE GETFIT ZAMBIA PROJECT

The above matter refers.

We confirm receipt of your letter dated 24th January, 2019, in which Copperbelt Energy Corporation ("CEC") sought guidance on the level of environmental impact assessment for the two 20MW solar power generation projects in Kitwe.

We have since reviewed your correspondence and wish to advise you to proceed to compile and submit separate environmental project briefs for the two proposed projects.

Additionally, we advise you to identify and consult stakeholders such as but not limited to the following:

1. Energy Regulation Board;
2. Zesco Limited;
3. Kitwe City Council; and
4. ZAFFICO.

Yours faithfully,

Fredrick Muyano
Manager Operations-North
For/Director General
ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY

APPENDIX 9.3: ZEMA DECISION LETTER

ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY

Head Office
Corner of Church & Suez Roads
P.O Box 35131
Lusaka, Zambia
Tel: +260-211-254023/254059

All Correspondence to be addressed to The Director General

info@zema.org.zm www.zema.org.zm

In reply please quote

ZEMA/EA/EPB/6901

May 28, 2020

The Director
Innovent - CEC Garneton North Solar Limited
C/o Copperbelt Energy Corporation Plc
P.O. Box 20819
23rd Avenue, Nkana East
KITWE

COPPERBELT ENERGY CORPORATION PLC
RECEIVED BY Gladys Kunda
DATE 17.06.20
CORPORATE OFFICE LUSAKA

Dear Sir/Madam,

RE: DECISION LETTER IN RESPECT OF THE ENVIRONMENTAL PROJECT BRIEF FOR THE PROPOSED 20MWac SOLAR PV PARK AT GARNETON NORTH SITE IN KITWE DISTRICT, COPPERBELT PROVINCE BY INNOVENT – CEC GARNETON NORTH SOLAR LIMITED

Reference is made to the above captioned Environmental Project Brief ("EPB") submitted to Zambia Environmental Management Agency ("ZEMA") on **March 4, 2020** for consideration in accordance with the requirements of the Environmental Management Act No. 12 of 2011 as read together with the Environmental Impact Assessment Regulations, Statutory Instrument No. 28 of 1997.

ZEMA has since reviewed the EPB and based on the information provided by yourselves and taking into account written and verbal comments from interested and affected parties as well as our site verification inspection findings; the said EPB has been **approved** with conditions.

You are advised to fully acquaint yourselves with the conditions herein and to ensure compliance thereof.

Yours faithfully,

Simon Mulenga Mwansa
Acting Director General
ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY

Cc: The Town Clerk – Kitwe City Council, **KITWE**
The Managing Director – ZESCO, **LUSAKA**
The Director General – Energy Regulation Board, **LUSAKA**
The Chief Executive Officer – Road Transport & Safety Agency, **LUSAKA**
The Manager – ZEMA, Northern Region, **NDOLA**

Zambia Environmental Management Agency
DECISION LETTER

1.0 PROJECT BACKGROUND

1.1 PROJECT TITLE:

Construction of 20MWac Solar PV Park at Garneton North Site in Kitwe District, Copperbelt Province by Innovent – CEC Garneton North Solar Limited.

1.2 PROJECT PROPONENT:

Innovent - CEC Garneton North Solar Limited
C/o Copperbelt Energy Corporation Plc
P.O. Box 20819
23rd Avenue, Nkana East
KITWE

Contact Person's Details

Name:	Caroline M. Sinkamba
Designation:	Senior Manager - SHE
Address:	Copperbelt Energy Corporation Plc, P.O. Box 20819, 23rd Avenue, Nkana East, **KITWE**
Phone No:	+260 960 632 602/+ 260 212 244 285
Email address:	sinkambac@cec.com.zm

1.3 PROJECT LOCATION:

The project site is located in Garneton area in Kitwe District, Copperbelt Province. It is located within the servitude land parcel for CEC's 220kV Kitwe – Mufulira main power transmission line way leave. The site is located about 23km north-east of Kitwe Central Business District (CBD).

	Coordinates	
Location Point	**Latitude**	**Longitude**
K1-A	12°67'76.99"S	28° 17'43.63"E
K1-B	12°67'66.26"S	28° 17'59.24"E
K1-Z1	12°70'05.23"S	28° 18'17.89"E
K1-Z2	12°70'11.99"S	28° 18'01.34"E

ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY
28 MAY 2020
DIRECTOR GENERAL'S OFFICE
P.O. BOX 35131, LUSAKA

Zambia Environmental Management Agency
DECISION LETTER

1.4 DATE OF SUBMISSION BY PROPONENT:

March 4, 2020

1.5 DATE OF CONSIDERATION BY THE AGENCY:

May 28, 2020

2.0 DETAILS OF THE PROJECT:

Innovent - CEC Garneton North Solar Limited intends to install a 20 MWac Solar PV plant in Garneton area of Kitwe District, Copperbelt Province. The Garneton North Solar PV Project will involve the construction and operation of a 20 MWac Solar PV Power Plant with installed ancillary facilities. Key project components will include:

i. PV modules and tracking mounting structures;
ii. Underground direct current (DC) and alternating current (AC) cables;
iii. Transmission lines;
iv. Inverter stations;
v. Substations;
vi. Stores and office buildings;
vii. Internal access tracks; and
viii. Perimeter security fence and security rooms.

Electricity generated from the Garneton North Solar PV park will be evacuated via a 33-kV combine power evacuation route.

The size of the project site is approximately 56ha.

3.0 DECISION BY THE AGENCY:

3.1 The project is **approved** subject to conditions listed below.

3.1.1 Innovent - CEC Garneton North Solar Zambia Limited shall implement the project and all environmental management commitments as stated in the Environmental Project Brief (EPB) **with changes** as may be made by Zambia Environmental Management Agency (ZEMA) and any other conditions that may be issued thereafter.

ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY
28 MAY 2020
DIRECTOR GENERAL'S OFFICE

Zambia Environmental Management Agency
DECISION LETTER

3.1.2 The approval is for the Construction of the 20MWac Solar PV Park at Garneton North Site in Kitwe District, Copperbelt Province by Innovent – CEC Garneton North Solar Limited. Therefore, without an appropriate and written authorisation, Innovent - CEC Garneton North Solar Zambia Limited shall not conduct or carry out activities that can impact negatively on the environment and are not part of the approved project.

3.1.3 Innovent - CEC Garneton North Solar Zambia Limited shall ensure that solid waste and any other unwanted materials generated as a result of preparation, construction and operation works are collected and disposed of at a licensed dumpsite.

3.1.4 Electronic and other forms of hazardous waste shall be identified, collected and disposed of appropriately at an authorised disposal site by an authorised or licensed person.

3.1.5 Where appropriate and safe, Innovent – CEC Garneton North Solar Limited shall ensure that there are access roads in selected points passing through the project site to allow access for the communities in the eastern and western sides of the project site.

3.1.6 Innovent – CEC Garneton North Solar Limited shall be monitoring electromagnetic radiation and shall put in place appropriate measures to ensure that the radiation levels are kept within acceptable limits.

3.1.7 Prior to commencement of the project, Innovent – CEC Garneton North Solar Limited shall **compensate all Project Affected Persons** (PAPs).

3.1.8 The project and related activities shall be implemented in such a way that public and private property, health and livelihoods shall not be affected negatively, endangered, damaged, harmed or lost. Where it is determined that the health of people, property or livelihood is endangered, harmed, affected negatively, damaged or lost as a result of the project and/or related activities, Innovent - CEC Garneton North Solar Zambia Limited shall be liable for the payment or settlement of the appropriate compensation and other forms of relief or replacement.

3.1.9 Innovent - CEC Garneton North Solar Zambia Limited shall consult and comply with the requirements and specifications of the Energy Regulation Board, Forestry Department, Local authorities, Road Development Agency, Road Transport and Safety Agency and other mandated authorities.

3.1.10 Innovent - CEC Garneton North Solar Zambia Limited shall preserve flora and fauna habitats in areas of the project site that will not be used for the project and related activities.

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Zambia Environmental Management Agency
DECISION LETTER

3.1.11 All radioactive materials or materials containing radioactive substances shall be handled and disposed of appropriately.

3.1.12 Innovent - CEC Garneton North Solar Zambia Limited shall put in place effective measures for management of waste to be generated from the project and related activities.

3.1.13 Innovent - CEC Garneton North Solar Zambia Limited shall ensure that all hazardous waste is managed or disposed of appropriately by duly licensed persons.

3.1.14 Innovent - CEC Garneton North Solar Zambia Limited shall integrate drainage and erosion control measures in the development and operation of the project.

3.1.15 Innovent - CEC Garneton North Solar Zambia Limited shall not conduct open air burning without appropriate and written authorisation.

3.1.16 Innovent - CEC Garneton North Solar Zambia Limited shall put in place measures or install and operate appropriate and effective facilities for monitoring, preventing and controlling land degradation, soil contamination, air pollution, and pollution of surface water and groundwater.

3.1.17 Noise levels from project activities shall be monitored and shall be controlled within appropriate limits.

3.1.18 Innovent - CEC Garneton North Solar Zambia Limited shall put in place an appropriate Emergency Preparedness and Response Plan, and shall submit the same to ZEMA within three months following this approval or within three months of project commencement.

3.1.19 Innovent - CEC Garneton North Solar Zambia Limited shall ensure that all incidents with potential to pollute the environment and/or harm human beings are reported to ZEMA immediately.

3.1.20 Innovent - CEC Garneton North Solar Zambia Limited shall protect water resources including dambos/wetlands from contamination and pollution.

3.1.21 Innovent - CEC Garneton North Solar Zambia Limited shall collect, decontaminate and dispose of all contaminated waste in an environmentally sound and acceptable manner.

3.1.22 Innovent - CEC Garneton North Solar Zambia Limited shall put in place appropriate measures to suppress dust.

ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY
28 MAY 2020
DIRECTOR GENERAL'S OFFICE
P.O. BOX 50613, LUSAKA

3.1.23 Innovent - CEC Garneton North Solar Zambia Limited shall obtain appropriate Licences and/or permits from Zambia Environmental Management Agency and comply in full with Environmental Management (Licensing) Regulations, 2013 and the Environmental Management Act, 2011.

3.1.24 At decommissioning and closure, Innovent - CEC Garneton North Solar Zambia Limited shall prepare and submit an appropriate Decommissioning and Closure Plan and Report outlining implementation of all environmental management commitments presented in the EPB for consideration by ZEMA.

3.2 Innovent - CEC Garneton North Solar Zambia Limited **shall**:

3.2.1 As appropriate obtain and comply in full with any other relevant authorisations such as those stipulated in the following Acts of Parliament:

i. The Electricity Act, No. 11 of 2019;
ii. The Water Resources Management Act, No. 21 of 2011;
iii. The Forests Act No. 4 of 2015;
iv. The Energy Regulation Act, CAP 436 of the Laws of Zambia;
v. The Local Government Act, 2019;
vi. The Urban and Regional Planning Act No. 3 of 2015;
vii. The Workers' Compensation Act, CAP 271 of the Laws of Zambia;
viii. The Public Health Act, CAP 295 of the Laws of Zambia;
ix. The Roads and Road Traffic Act No. 11 of 2002; and
x. The Public Roads Act No. 12 of 2012.

3.2.2 Make available information on hygiene, malaria control, HIV/AIDS and other communicable and infectious diseases to employees.

3.2.3 Provide employees with appropriate fire-fighting equipment and train employees in fire-fighting and emergency response.

3.2.4 Report all objects or sites of archaeological, cultural or historical value to an appropriate institution such as the National Heritage Conservation Commission and ZEMA.

3.2.5 Provide employees with appropriate Personal Protective Equipment (PPE).

ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY
28 MAY 2020
DIRECTOR GENERAL'S OFFICE
P.O. BOX 35131, LUSAKA

Zambia Environmental Management Agency
DECISION LETTER

3.3 Innovent - CEC Garneton North Solar Zambia Limited shall comply with environmental standards and/or specific limits of particular pollutants as its responsibility. Thus, compliance with Zambia Environmental Management Agency recommended measures **does not absolve** Innovent - CEC Garneton North Solar Zambia Limited of its responsibility if such measures do not achieve compliance with environmental control standards.

3.4 Innovent - CEC Garneton North Solar Zambia Limited shall, in accordance with Section 15 of the Environmental Management Act, No. 12 of 2011, allow inspectors from ZEMA **unrestricted entry** to the project site at any reasonable time with or without making prior notice throughout the project cycle.

3.5 The implementation of the project shall commence **within three years** from the date of approval. Failure to commence implementation of the project within the stated period shall render the Decision Letter invalid and Innovent - CEC Garneton North Solar Zambia Limited shall be required to re-submit the EPB for consideration.

3.6 The Agency may suspend or cancel the Decision Letter **without notice** should Innovent - CEC Garneton North Solar Zambia Limited fail to comply with any condition of approval.

3.7 This Decision Letter may be amended on the volition of the Agency or otherwise should a situation arise that requires that an amendment be effected.

28/05/20

....

Date Simon Mulenga Mwansa
Acting Director General
ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY

28 MAY 2020
DIRECTOR GENERAL'S OFFICE
P.O. BOX 35131, LUSAKA

APPENDIX 9.4: ZESCO MINUTES ON POWER CONNECTION AGREEMENT

ZESCO
Powering the Nation

energy innovent

Subject: GETFiT Solar CEC-INNOVENT Shallow Grid Connection to ZESCO grid
Venue: CEC Lusaka Office Boardroom **Date: Wednesday, 10th & 11th October, 2019**
Time: 09:00hrs **Parties: CEC-INNOVENT and ZESCO**

1. Attendance:

Appendix II shows the summary of attendance.

2. Opening Remarks:

CEC-InnoVent welcomed the ZESCO delegation to the meeting.

3. Agenda:

The agenda was agreed as detailed below.

i) Introduction and Apologies
ii) Presentation by members of the study team on the key outcomes of the study
iii) Agreement on the interconnection option
  a) Specifications
  b) Metering point
iv) Grid code compliance issues
v) Way forward
  a) Identification of outstanding issues on the connection agreement that require closure
  b) Way forward on items under part 'a'

4. Introduction and Apologies:

Introductions were done as per attached attendance list of Appendix II.

5. Presentation by members of the study team on the key outcomes of the study:

The study team reported that 5 options were studied and were all technically viable. However, each had its own pros and cons from a budget, time, losses and reliability point of view. The summary of each of the options is presented in Appendix I;

The team that undertook the study and the site visits from both ZESCO and CEC informed the meeting that the team identified challenges that would arise in upgrading the single-busbar to double-busbar arrangement. Firstly, the substation has space constraints and secondly, the process would result in power supply interruptions during the upgrade. Thus, the upgrade would be costly.

A.T
C.M Ntumba

6. Agreement on interconnection option:

ZESCO kicked off this discussion by informing the meeting that options 3 and 4 which were 66kV should be discarded from further consideration on account of their higher cost of implementation compared to the initial proposed bid solution. Further, ZESCO informed the meeting that option 5 was ZESCO's preferred solution as it was similar to the approved connection solution of option 1 but that it had been further optimized.

CEC-InnoVent informed the meeting that with the separate plants as submitted in the bid the tariff for each plant was 4.90 cUSD/kWh but a conditional bid was given to GETFiT that in the event two plants were awarded a tariff of 4.80 cUSD/kWh would be offered considering the two plants were close and that a shared grid connection could be used. They further informed the meeting that Option 5 would require a change in scope compared to option 1. Firstly, there would be a need to change the conductor from Mwambashi S/S to the loop in loop out point and that if the heavy conductor Bison is used there could be a need to reinforce the structures or reconstruct them altogether. This alteration of reconducting an entire portion of existing ZESCO 33kV line was never considered at bid stage. Secondly, it was highlighted that conductors considered in the bid for the new lines to be built (connecting PV parks to ZESCO grid) was Wolf as opposed to Bison recommended in option 5 of the study.

ZESCO informed the meeting that they preferred more lines as the PPA is binding for 25years, a period in which changes in climate or other circumstances would expose ZESCO to pay for deemed energy beyond the excused grid unavailability hours i.e. 100 Daylight Hours per year. ZESCO also stated that having N-1 is a Grid Code requirement for a generation plant. CEC-InnoVent explained their understanding of the Grid Code requirement as only being applicable when the plant provides voltage support, which in essence is not the case in this context.

CEC-InnoVent informed the meeting that option 2 on wooden poles would be their preferred option as the option would enable CEC-InnoVent to meet the CAPEX as per conditional bid, that the solution will have less losses than the option approved with the bid for 2 separate plants (411kW losses less) which would be beneficial to ZESCO and that CEC-InnoVent were willing to commit a team to assist with periodical inspections of the line for the duration of the PPA. Should Option 2 on wooden poles be agreed on, CEC-InnoVent committed to order spares at implementation stage, which would be stocked at the PV plant and at Mwambashi S/S. ZESCO informed the meeting that a single line on wooden poles or concrete poles was not acceptable. ZESCO further highlighted that they have a vast and competent maintenance team and therefore did not require CEC-InnoVent to provide a team that would only undertake inspections. However, ZESCO agreed to work with Option 2 provided it was on steel monopoles.

The meeting concluded that two options were acceptable being Option 2 which is a single 33kV line from the combined solar PV plant transfer station (for both Garneton North and Garneton South solar PV parks) to Mwambashi S/S, provided it is supported on steel monopoles, utilizes silicone rubber insulators and Bison Conductor, and Option 5 constituting a single 33kV line to Mwambashi S/S and a loop in loop out connection onto the existing Mwambashi - Kafironda 33kV line provided the lines in this option are supported on wood, with silicone rubber insulators, utilizes Wolf conductor and the existing stretch from Mwambashi to the loop in point is reconducted from the existing Dog conductor to Wolf conductor. Further, CEC-InnoVent wished to confirm that in the case of a single line, a single busbar can also be implemented at the PV plant to which ZESCO agreed.

The meeting agreed to adjourn to Friday 11th October 2019 09:00hrs to allow CEC-InnoVent to further assess the two options that had been agreed upon and confirm that they would be within budget and timeframe proposed in the bidding process.

7. Agreement on interconnection option continued Friday, 11th October 2019:

After the meeting resumed, the two Parties agreed to implement Option 2 to connect the two CEC-InnoVent Solar PV plants, namely Gameton North and Gameton South solar PV plants to the existing grid i.e. a single 33kV line, single circuit, from the combined solar PV plant transfer station to Mwambashi S/S to be supported on steel monopoles, to utilize silicone rubber insulators and Bison Conductor, with only one busbar at each end of the 33kV line. ZESCO informed the meeting that the use of a single busbar and no bypass would be subject to an exemption being granted by the ERB following the initial guidance that the two parties agree on satisfactory level of reliability.

Further, the meeting clarified that as per GETFiT requirements the Shallow Grid Connection (SGC) will be transferred to ZESCO, and that ZESCO will therefore carry the maintenance over such assets once hand-over is effective.

CEC-InnoVent requested if 33kV switchgear can be installed with a fault rating less than 31.5kA (3s) considering the expected maximum fault level at Mwambashi is less than 15kA. ZESCO advised the meeting that there was no formal fault level analysis report provided yet, but ZESCO would consider the request and advise a position.

CEC-InnoVent also sought clarity from ZESCO on whether indoor switchgear can be used at the combined PV plant transfer station. ZESCO confirmed that it shouldn't be a problem and informed the meeting that they have similar indoor switchgear within their distribution network.

ZESCO requested that the combined PV plant transfer station design be done in such a way that it will be possible to extend in the future for connection of potential new circuits.

ZESCO confirmed enough space is available inside Mwambashi S/S to develop new 33kV feeder bay, without additional earthworks or extension of existing fence. Though, there will be a need to extend the existing 33kV busbar to connect feeder bay onto it.

ZESCO confirmed enough space inside Mwambashi S/S control room to accommodate control panel.

Due to other pending commitments for the ZESCO team and need for consultation on some clarifications and requests made by CEC-InnoVent, the meeting agreed that CEC-InnoVent would send the questions requiring confirmation via email and ZESCO would respond accordingly including agreeing on the metering points and property boundary, considering there are two SPVs with expected two independent PPAs as per GETFiT requirements.

8. Way forward:

The ZESCO team advised the meeting that further to the outstanding questions for clarifications, the team had also been tasked to close out issues in the Grid Connection Agreement (GCA) particularly that the connection option had been agreed on by both parties. The meeting agreed that all sections that were pending in the agreement of the connection solution must now be completed.

9. Action items:

	Description	Responsible	Due Date
1	Forward list of technical questions seeking clarification	CEC-InnoVent	11/10/2019
2	Fault level study – Determination whether less stringent fault level requirement would be acceptable for switchgear arrangements	ZESCO	15/10/2019
3	Answering list of technical questions sent by CEC-InnoVent	ZESCO	Week of 21/10/2019

A.O.

C.M

10. Signing:

CEC:	INNOVENT:	ZESCO:
Name: Cassius Chongo	**Name**: Alexandre Matton	**Name:** Kennedy Mwanza COLLINS MUMBA
Designation: Snr Manager Projects	**Designation:** Project Manager	**Designation:** Snr Manager Transmission South
Signature:	**Signature:**	**Signature:**
Date: 07-11-2019	**Date:** 07/11/2019	**Date:** 11/11/2019

Appendix I Summary of findings of study team:

Option	Voltage	Additional scope	Peak capacity losses	Comment
Option 1: *Looping in and looping out of the existing Mwambashi-Kafilonda 33kV line for Garneton North Solar PV plant and direct connection through a 33kV line to Mwambashi substation for Garneton South (As per GETFiT bid substation).*	33kV	No reinforcements were need for this option. The voltage at Garneton North could be regulated by use of transformer tap changers and reactive power from the PV plant	1453.09kW	As per CEC GETFIT bid.
Option 2: *Direct connection to Mwambashi with a single 33kV line from the combined switching station for both plants (Revised proposal by CEC-Innovent).*	33kV	No reinforcements are required to the existing network. Further, the study confirmed that single Bison conductor is sufficient to evacuate both plants to Mwambashi. However, there is no N-1 contingency for the 40MW solar plant.	1041.94kW	As per CEC request for optimised connection
Option 3: *Direct connection to Mwambashi with a single 66kV overhead line between Mwambashi .(As proposed by ZESCO).*	66kV	No reinforcements are needed to the existing network. However, a solution in which evacuation is being undertaken at 66kV will necessitate the construction of a 33kV to 66kV transformation station at the Solar PV plants, this scope was not included in the CEC-Innovent bid. Furthermore, there is no N-1 contingency for the 40MW solar plant.	561.56kW	As per ZESCO request for consideration

C.M Hamba

Option 4: Establish new switching station on Mwambashi – Chambishi East 66kV OHL + 1x66kV OHL to Solar PV plants	66kV	No reinforcements were required to the existing network. However, similar to option 3 a solution in which evacuation is being undertaken at 66kV will necessitate the construction of a 33kV to 66kV transformation station at the Solar PV plants, this scope was not included in the CEC-Innovent bid. Furthermore, there is no N-1 contingency for the 40MW solar plant.	330.42kW	As per ZESCO request for consideration
Option 5: Loop in loop out on existing Mwambashi – Kafironda 33kV and Direct connection to Mwambashi substation with a 33kV OHL from common Substation at the PV plants	33kV	It was noted if there was to be N-1 in the operation then the new line from the Combined Solar Plant substation to Mwambashi should be constructed with minimum conductor Bison and the stretch between Mwambashi and the Loop in Point should be reconducted with bison from the current Dog. This option does provide for N-1 contingency for evacuation.	686.74kW	As per ZESCO request for consideration

A.D

C.M
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Appendix II Summary of Attendance:

	NAME	ORGANIZATION	EMAIL ADDRESS	PHONE
1	Alexander Kampengele	ZESCO	akampengele@zesco.co.zm	0976768000
2	Justin Kamungoma	ZESCO	jkamungoma@zesco.co.zm	0979047701
3	Able Kaonga	ZESCO	abkaonga@zesco.co.zm	0977898936
4	Simon Mabeta	ZESCO	smabeta@zesco.co.zm	0955908089
5	Misozi Samboko	ZESCO	msamboko@zesco.co.zm	0976217482
6	Collins Mumba	ZESCO	collinsmumba@zesco.co.zm	
7	Cassius C. Chongo	CEC/InnoVent	chongoc@cec.com.zm	0966754851
8	Clement Hakatombo	CEC/InnoVent	hakatomboc@cec.com.zm	0966410448
9	Mwenya Kaliwile	CEC/InnoVent	kaliwilem@cec.com.zm	0966273645
10	Alexandre Matton	CEC/InnoVent	amatton@innosun.org	+264813749292
11	Alexis Croz	CEC/InnoVent	acroz@innovent.fr	+264812604539

APPENDIX 10.1: SOCIO-ECONOMIC SURVEY

Questionnaire serial number:

Questionnaire on vulnerability Assessment of owners of crop fields to be displaced from the Garneton Solar PV Project Sites in Kitwe, Zambia.

By

DH Engineering Consultants Limited

Enumeration Details

1.1 Date of enumeration 24 APRIL 2019

1.2 Name of enumerator MULENGA HEALCLIFF.

1.3 Date checked _____

1.4 Name of Field Supervisor _____

SECTION 1: FARMER IDENTIFICATION

Q1. Name of Respondent: Elizerbeth Sakuwaha.

Q2. Sex: M / F ✓ F

Q3. Age: 26

Q4. Level of education of Respondent:

1=None; 2 = Primary; (3)=Secondary; 4=Tertiary

Q5. In which part of Kitwe do you live? P12 gamestone.

Q6. What mode of transport do you normally use to get to your crop field.

(1) Footing ✓
2. Bicycle
3. Public transport
4. Personal car

SECTION 2 HOUSEHOLD DEMOGRAPHICS

Q1. Household head Sex [2] 1= Female (2)= Male	**Q2.** Marital status of the household head? [1] (1)= Married; 2 = Single; 3 = Divorced; 4 = Separated; 5=Widowed
Q3. Level of Education of household head? 1=None; 2 = Primary; (3)=Secondary; 4=Tertiary [3]	**Q4. Level of Education of spouse if applicable head?** 1=None; 2 = Primary; (3)=Secondary; 4=Tertiary; 5= Not applicable [3]
Q5. Household size [3]	**Q6.** Household members older than 18 years N/A
Q.7. What is the main occupation of the head of household? [5] 1 = Field crop production; 2 = Vegetable Production; 3 = Fishing; 4= Trading; 5 = Formal employment; 6 = Other (specify) Driver.	

SECTION 3: HOUSEHOLD ASSET OWNERSHIP

Tools/implements (TIMP)	Code	Tick	Quantity owned	Condition 1=Working 2= Not working
Q1. Physical Assets (Ox drawn Implements)				
1. Ox-drawn plough	IMPL1			
2. Ox drawn planter	IMPL2			
3. Cultivator	IMPL3			
4. Ridging plough	IMPL4			
5. Ox-cart	IMPL5			
Q2. Physical Assets (Livestock)				
6. Cattle	LVST1			
7. Goats	LVST2			
8. .Poultry	LVST3			
9. Pigs	LVST4			
10. Other specify	LVST5			

Q3. Other Physical Assets	Code	Tick	Quantity	Condition 1=Working 2= Not working
Bicycles	OPAST1	✓	1	1
Radios	OPAST2	✓	1	1
TV set	OPAST3	✓	1	1
Vehicle	OPAST4	X	X	X
Motorbike	OPAST5	X	X	X
Others (specify)	OPAST6	House.	1	Company house.

Financial Assets

Q1. Sources of income	Code	Tick	Estimated annual income (ZMK)
Petty trading (Specify)	Incm1		
Gardening activities/Off season farming	Incm2	✓	N/A
Chicken rearing	Incm3		
Goat rearing	Incm4		
Cattle rearing	Incm5		
Remittances from other sources	Incm6		
Sale of rain fed food crops (specify)	Incm7		
Other sources (specify)	Incm8		

SECTION 4: LAND OWNERSHIP

Q1. Are you aware that you have been cultivating on land that belongs to the Copperbelt Energy Corporation (CEC)? Yes....No...

Q2. If yes to question 1, when and how did you learn about this?

Q3. Who allocated this land to you or how did you acquire permission to cultivate this land inherited

Q4. For how long has the Respondent cultivated the piece of land in question? 1 year

Q5. If asked to vacate the land, how soon would you do that? after harvest.

Q6. Do you own any other land elsewhere? Yes.....No.

Q7. If yes to above, specify where?.....

Q8. What form of ownership?
1=Customary
2=Private (on title)
3=Other.....

N/A

SECTION 5: AGRICULTURAL PRACTICES

5.1. Crop production practices

Crops grown	Code	*Q14 Did interviewee grow the crops this season or not* ***0=No 1=Yes***	*Q15. Did farmer grow the crop in 2017/2018 Season* ***0=No 1=Yes***	*Q16. Did farmer grow the crop in 2016/2017 season*	*Q17 What is the land preparation method for this crop* ***1=hand hoeing 2= Ox drawn ploughing 3=Tractor ploughing 4= Planting basins 5= Ox drawn ripping 6= Ridging by hand***	*Q18 Weeding method for this crop* ***1= mechanical by hand hoe 2= mechanical by ox-drawn implement 3= weeding with chemicals***	*Q19 Month of planting in the season* ***1=October 2=November 3= December 4= January 5= February***
Maize	CRPG RO1	✓		X	✓	✓	✓
Sweet potato	CRPG RO2	✓		✓	✓	✓	✓
Irish potato	CRPG RO3						

groundnuts	CRPG RO4	✓		✓	✓	✓	✓
cassava	CRPG RO5						
Sorghum	CRPG RO6						
Millet	CRPG RO7						
cowpeas	CRPG RO8						
Other	CRPG RO9						

5.2: YIELDS

Crops grown	Code	*How much yield of each crop do you produce in a good season (Kgs)*
Maize	CRPG RO1	Home
Sweet potato	CRPG RO2	Home
Irish potato	CRPG RO3	
groundnuts	CRPG RO4	Home.
cassava	CRPG RO5	
Sorghum	CRPG RO6	
Millet	CRPG RO7	
cowpeas	CRPG RO8	
Other	CRPG RO9	

Crops grown	Code	*How much do you earn from the sale of your agricultural produce per season (ZMK)*
Maize	**CRPG RO1**	Home
Sweet potato	**CRPG RO2**	Home
Irish potato	**CRPG RO3**	
groundnuts	**CRPG RO4**	Home.
cassava	**CRPG RO5**	
Sorghum	**CRPG RO6**	
Millet	**CRPG RO7**	
cowpeas	**CRPG RO8**	
Other	**CRPG RO9**	

SECTION 6: WILLINGNESS TO ADOPT OTHER LIVELIHOODS

Q1. Do you consider subsistence farming / agriculture as your main source of livelihood?
(1)=Yes
2=No

Q1. If given a choice, would you still choose subsistence farming as your main source of livelihood?
1=Yes
(2)=No

Q2. If no, what other potential sources of livelihood do you plan to venture into?
1. Back to school (nursing).
2. Poultry business.
3. _____
4. _____

Q3. What has been the main hindrance for not adopting the above mentioned alternative livelihoods?
Lack of Money to start projects.
and. Sponsering school.

APPENDIX 10.2: SOCIO-ECONOMIC-DATA COLLECTION FORMS

DATA COLLECTION FORMS FOR SOCIO-ECONOMIC SURVEY OF PAPs ON GARNETON NORTH AND SOUTH SOLAR PV SITES

1	**Basic Information**										
	First Name	Last Name	NRC	Marital Status	Physical/Health Status (Normal, Chronically Ill, Disabled)	Illness Symptoms within the past 2 weeks (Yes/No)	Home Adress	Gender	Age (yrs)	Project Site	Family Size (Number of Household members)

2	**Income Stream Analysis**			
	Primary Source of Income/ Year (ZMW)	Secondary Source of Income/Year (ZMW)	Remitances Received/Year (ZMW)	Total Household Net Income/Year (ZMW)

3	**Household Expenditure**													
	Medical Expenses (ZMW)	Education (School Fees, PTA, Books, etc) (ZMW)	Rentals (ZMW)	Housing (own House-maintenance, Rates,etc) (ZMW)	Alcohol, Non-Alcoholic Beverages (ZMW)	Expenditure on Consumer Goods (Clothing, Footware) (ZMW)	Remitances in Cash or in Kind (Given to Church, Family etc) (ZMW)	Communication (Airtime) (ZMW)	Private or Public Transport (Including Transport to and from work, school) (ZMW)	Food (Breakfast) (ZMW)	Food (Lunch) (ZMW)	Food (Super) (ZMW)	Personal Services (Laundry, Entertainment, Hairdressing) (ZMW)	Total Expenditure (ZMW)

4	Physical Assets														
	Number of Houses	Number of Farms outside CEC Land	Plot (Residential, commercial)	Livestock (Goats, Cattle, Pigs etc)	Poultry (Chickens, Ducks, etc)	TV	Ra dio	Bicycle	Bed	Matress	Cell Phone	Hoe	Axe	Shovel	Brazier (Imbabula)

5	Accommodation							
	Amount for Rentals/Year (ZMW)	Source of Income for Rented Accomodation (Remitances, Salary, wages, etc)	Period of residence at rented Accomodation (Years)	Period of residence at own house (Years)	Mode of aquistaion of current accomodation (Purchased, built, gift, inheritance, other)	Building Materials used for House (Burnt Bricks, Concrete blocks, mud bricks, wood)	Roofing Material used for the House (Grass, iron sheets, clay tiles)	Portable Water Source (inbuilt, water well, borehole, tap stream, River)

6	Agricultural Produce Analysis													
	Size of Farm on Project Land (Ha)	Duration of cultivation on project Land (Yrs)	Mode of Access to Project Land (Rented, common access)	Continuation of farming once Farm is taken for the project (Use own Land, buy land, rent land, no plans yet)	Type of Crop 1 (Major Crop)	Type of Crop 2	Type of crop 3	Type of crop 4	Quantity of Major crop Harvested/ Annum (Kg-Major Crop)	Quantity of Harvest Sold/Annum (Kg-Major Crop)	Quantiy of Harvest reserved for Home Consumption/ Annum (Kg-Major Crop)	Type of staple food Consumed (Maize, Cassave, Millet, other)	Source of Staple food (Harvested, Purchased)	Quantity of Staple Food Reserved for family consumption (kg)

7	**Employment**				
	Employment Status of Household head (Working Formally, Retired, Running a Business)	Prefered job type at the Project Site (Maintaining lawns on Project Site, Cleaning Pannels, Bush clearing, digging of drainages, other manual jobs)	Reason for not Taking any job type (Already employed, Age, disability, not Interested, Other)	Number of Household members employed (Formally, running a business)	
8	**Grants and Government Assistance**				
	Number of Household member entitled benefiting from Government Social Cash Transfer Programme for Vulnerable People	Number of Household members who are Beneficiaries of Relief Food from Government, NGO or other institution	Number of Household members who are beneficiaries of Donor-sponsored Poverty Eradication programs	Number of Infants or children within the houseold on Government/NGO nutritional assistance	Number of Household beneficiaries of Any Other Government/NGO (e.g. FAWEZA)

Field Survey on Establishment of Nature, Approximant Number of Assets and Owners

		List of Coordinates								
Name	NRC No.	E	N	Total Size of Farm	Size of farm in project site	Type of crops	Home address	Gender	Age	Project site
Johnson Chingugu	112811/25/1			0.24 Ha	0.24 Ha	Maize		M		North
6/2/2019		628190.64	8595996.3							
		628194.68	8595977.4							
		628203.27	8595980.3							
		628207.68	8595971.4							
		628243.26	8595985.8							
		628226.66	8595918.6							
		628200.96	8595926.9							
Josephine Kayombo		628198.74	8595891.5	0.10 Ha	0.10 Ha	Maize		F	56	North
6/2/2019		628241.31	8595892.5							
		628240.02	8595869.4							
		628202.97	8595865.5							
Emmanuel Mubanga	103488/34/1	628128.72	8595825.1	0.33 Ha	0.27 Ha	Maize	IT 1247	M	72	North
6/2/2019		628110.95	8595832.4							
		628118.27	8595770.4							
		628091.96	8595763.5							
		628072.15	8595873.6							
Evon Samuntu		628063.02	8595872.8	0.16 Ha	0.11 Ha	Maize	IT 1247	F	38	North
6/2/2019		628117.35	8595878.5							
		628113.42	8595899.8							
		628047.52	8595901.4							
Beauty Saladi		628096.73	8596073.4	0.23 Ha	0.23 Ha	Maize	IT 1409	F	55	North
6/2/2019		628147.18	8596062.9							
		628144.22	8596129.7							
		628129.24	8596132							
Kabwe Digashome	160875/43/1	628424.79	8595213	0.34 Ha	0.34 Ha	Maize	KS 3437	M	65	North

6/2/2019		628360.67	8595200.9							
		628364.64	8595261.5							
		628415.76	8595256.3							
		628415.65	8595256.3							
		628293.73	8594879							
Cassava Field		628444.08	8595131	517 m2	517 m2					North
19/02/2019		628436.26	8595130.5							
		628431.3	8595187.3							
Eness Namulungu	219732/47/1	629028.27	8592296.3	0.88 Ha	0.67 Ha	Maize, Nuts, Sweet Potatoes	N 131439	F	33	South
19/02/2019		628999.61	8592273.3							
		628979.83	8592292.4							
		628962.76	8592288.2							
		628933.18	8592326.5							
		628956.49	8592341.5							
		628967.92	8592371.8							
		628956.71	8592389.7							
		628953.6	8592373.5							
		628949.85	8592362.7							
		628882.11	8592340.1							
		628875.39	8592366.3							
		628869.79	8592401							
		628881.55	8592432.1							
		628910.8	8592440.6							
Mukonko		628910.36	8592440.8	0.17 Ha	0.15 Ha	Maize,Nuts		F		South
19/02/2019		628882.53	8592432.8							
		628862.2	8592474							
		628855.94	8592483.8							
		628889.2	8592490.5							
Eunice Sailota Phiri	267739/52/1	628924.98	8592336	0.27 Ha	0.20 Ha	Maize,Nuts	7616	F	67	South
19/02/2019		628910.73	8592330.9							
		628941.26	8592240.9							
		628974.69	8592260.8							
Bana Mokonko		628939.95	8592238.3	0.36 Ha	0.1 Ha	Maize,Nuts		F		South
19/02/2019		628910.43	8592217.2							
		628876.2	8592282.6							
		628909.42	8592329.9							
Abiya		628779.62	8592986	0.20 Ha	0.20 Ha	Maize,Nuts		F		South
19/02/2019		628805.25	8592986.5							
		628819.64	8592974.5							

		628843.64	8592929.1							
		628820.03	8592918.7							
Shi Mbita		628851.48	8592909.6	0.11 Ha	0.11 Ha	Maize,Nuts		M		South
19/02/2019		628808.24	8592880.1							
		628841.52	8592868.8							
		628842.77	8592929.3							
Abraham Kambele		628842.77	8592929.3	0.21 Ha	0.21 Ha	Maize,Nuts	622 Twatasha	M	82	South
19/02/2019		628863.72	8592951							
		628843.31	8592998							
		628798.21	8592989.7							
		628824.32	8593002.5							
Elini Kapindula		628855.17	8592979.6	0.15 Ha	0.15 Ha	Maize	851 Rescos	FF	70	South
19/02/2019		628866.39	8592988.3							
		628846.2	8593037							
		628809.65	8593022.9							
Mary Taimo		628873.53	8592983.7	0.20 Ha	0.20 Ha	Maize,Nuts	331 Rescos	F	62	South
19/02/2019		628902.51	8593028.2							
		628902.12	8593038.1							
		628897.08	8593050.3							
		628847.07	8593037.4							
Royda Taimo		628805.16	8593038.2	198 m2	198 m2	Maize		F		South
19/02/2019		628808.01	8593044.2							
		628823.33	8593047							
		628831.2	8593034.5							
Bana Kasongo		628024.9	8596328.4	0.20 Ha	0.20 Ha	Maize, Nuts		F		North
19/02/2019		628017.8	8596341.4							
		628015.51	8596340.4							
		628088.49	8596341.3							
		628078.94	8596295.5							
Jane Kasongo		628085.13	8596294	0.40 Ha	0.40 Ha	Maize, Nuts		F		North
19/02/2019		628088.04	8596314.5							
		628118.67	8596314.2							
		628117.24	8596335.2							
		628142.23	8596337.1							
		628145.48	8596240.2							
		628101.76	8596250.2							

Oscar Samoyo	568515/67/1	627884.65	8597470.9	793 m2	793 m2	Maize, Nuts	PIZ	M	27	North
19/02/2019		627881.61	8597493.8							
		627863.8	8597494							
		627857.29	8597471							
		627861.14	8597458.6							
Elizabeth Sakwaya	472888/67/1	627807.1	8597371.3	783 m2	783 m2	Ground nuts	PIZ	F	25	North
19/02/2019		627794.31	8597377.8							
		627788.62	8597368.3							
		627773.98	8597372.9							
		627774.45	8597356.3							
		627780.31	8597355							
		627780.5	8597348.2							
		627787.33	8597345.9							
		627803.4	8597346.2							
Kaposa Mathews	181407/35/1	627770.65	8597548.2	0.20 Ha	0.20 Ha	Maize, Nuts	PIZ	M	27	North
19/02/2019		627774.78	8597549.5							
		627775.67	8597554.4							
		627786.79	8597563.8							
		627787.68	8597568.3							
		627785.1	8597573.4							
		627785.46	8597582							
		627775.46	8597603.3							
		627772.69	8597616.3							
		627795.48	8597636.5							
		627826.21	8597611.1							
Mary Simwale		628171.22	8596217.2	565 m2	565 m2	Maize, Nuts		F		North
19/02/2019		628169.5	8596219.8							
		628149.78	8596181.5							
		628149.78	8596181.5							
		628148.37	8596182							
		628143.42	8596168.9							
		628132.28	8596179.1							
		628109.13	8596150.5							
		628116.61	8596147.3							
		628123.25	8596151.3							
		628127.75	8596160.8							
		628134.46	8596157							
NOTE:										
ALL FARMS ABOVE 1000 SQUARE METERS ARE INDICATED IN HECTARES										
DATES INDICATED BELOW NAMES INDICATE DAY THE COORDINATE PICKING EXERCISE WAS CARRIED OUT IN PRECENSE OF THE FARM OWNER OR REPRESENTATIVE.										

APPENDIX 11: CERTIFICATE OF TITLE

5m H889 6/76

DR 10b

REPUBLIC OF ZAMBIA

CERTIFICATE OF TITLE

No.: 51827

Farm No. KITWE/LN-1000001141/2

LANDS REGISTER

Printed on: 29/11/20

Property number KITWE/LN_1000001141/2 Ernest Kapenda

PRELIMINARY REGISTRATION

ENTRY NO. 1 DATE OF DOC 28/11/2018 DATE OF REG 28/11/2018

Lessor THE PRESIDENT OF ZAMBIA

Lessee COPPERBELT ENERGY CORPORATION PLC

NATURE OF DOC STATE LEASE FOR 99 YEARS FROM 01/10/2018 WITH AREA SIZE 64.7414 HECTARES

AREA 64.7410 Ha

PRELIMINARY REGISTRATION

ENTRY NO. 2 DATE OF DOC 28/11/2018 DATE OF REG 28/11/2018

Title holder COPPERBELT ENERGY CORPORATION PLC

NATURE OF DOC Certificate of Title NO. CT_51827

AREA 64.7410 Ha

DR 1A

REPUBLIC OF ZAMBIA

No.: 51827

Registered No.: LN-1000001141/2/2

THE LANDS AND DEEDS REGISTRY ACT

(Section 45)

CERTIFICATE OF TITLE

THIS Certificate, dated the TWENTY-EIGHTH day of NOVEMBER two thousand and EIGHTEEN under the hand and seal of the Registrar of the Lands and Deeds Registry of Zambia WITNESSETH that COPPERBELT ENERGY CORPORATION PLC a Company incorporated in Zambia under the Companies Act Cap 388 of the Laws of Zambia and having its office registered at Kitwe is a tenant or lessee for the unexpired residue of a term of 99 years from the first day of October, 2018 (subject to such reservations, restrictions, incumbrances, liens, estates and interests as are notified by memorial underwritten or endorsed hereon) of and in ALL that piece of land in extent 64.7414 hectares more or less being Farm No. Kitwe/LN-1000001141/2 situate at Kitwe in the Copperbelt Province of Zambia which piece of land is more particulalry delineated and described on Diagram No. SR-1000003898 of 2018 except and reserved all minerals oils and precious stones whatsoever upon or under the said land.....

.....

Registrar

Memorials

Date of Document	Date of Registration	Registered No.		Cancellation
28/11/2018	28/11/2018	LN-1000001141 /2/2	Subject to the exceptions reservations restrictions restrictive covenants and conditions mentioned contained or referred to in a lease (a copy of which is attached hereto) made between The President of the Republic of Zambia of the one part and COPPERBELT ENERGY CORPORATION PLC of the other part.	

PTO

Memorials

Date of Document	Date of Registration	Registered No.		Cancellation

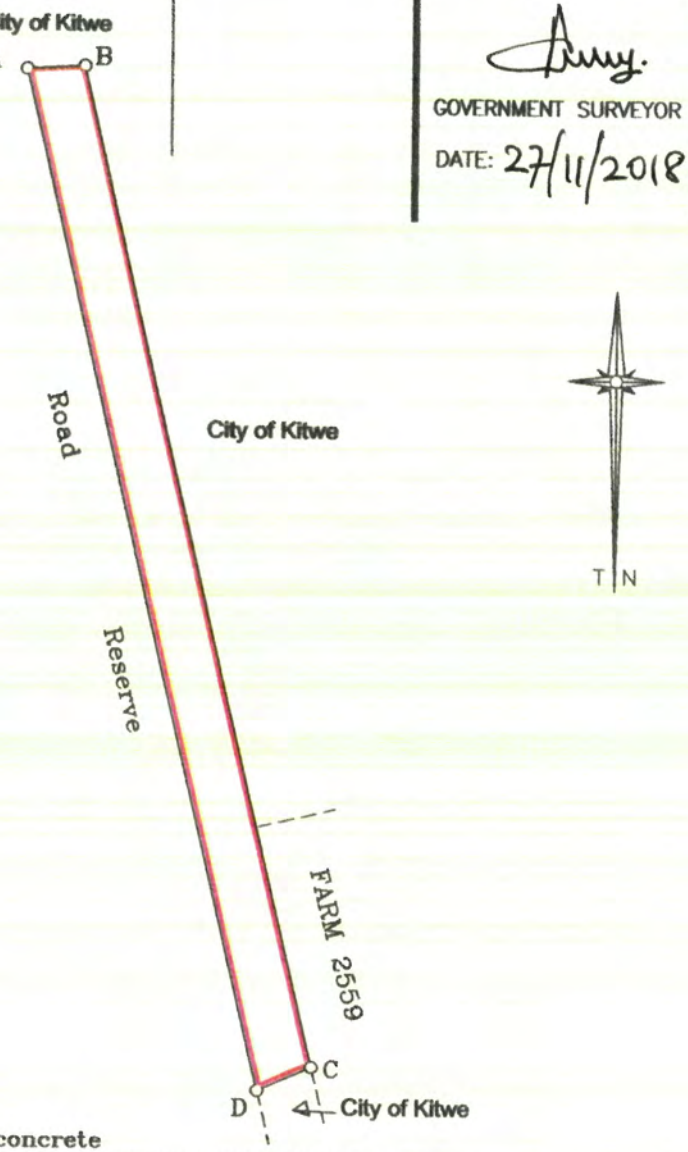
SIDES METRES		ANGLES OF DIRECTION	CO-ORDINATES SYSTEM	E METRES	N
AB	190.53	86.47.00			
BC	3413.47	166.56.13			
CD	191.57	245.26.03			
DA	3484.26	346.56.13			

DIAGRAM NUMBER
SR_1000003898/2018

APPROVED:

GOVERNMENT SURVEYOR

DATE: 27/11/2018



SCALE 1:25000

BEACON DESCRIPTION All are iron pegs in concrete

THE FIGURE A – B – C – D – A

REPRESENTS 64.7414 Hectares

OF LAND BEING Kitwe/LN_1000001141/2

SITUATED IN THE Copperbelt PROVINCE REPUBLIC OF ZAMBIA

SURVEYED IN November 2018

BY ME

LAND SURVEYOR

PARENT DIAGRAM No.:

SURVEY RECORDS No.: SR_1000000685/2018

S G FILE No.: S/34/LN_1000001141

PLAN No.: SR_1000000685/2018

MAP REFERENCE: 1228C3 & C4

LF/1
Stocked by Lands
10m M593 12/84 S&T

COT – 51827
Reg no LN-1000001141/2/2
DATED- 28/11/2018

REPUBLIC  **OF ZAMBIA**

Lease No LE-15709

Province COPPERBELT

FARM No. KITWE/ LN -1000001141/2

THIS LEASE MADE the 28 day of NOVEMBER

two thousand and 2018 BETWEEN HIS

EXCELLENCY THE PRESIDENT OF ZAMBIA(hereinafter called 'the President') of one part COPPERBELT ENERGY CORPORATION plc ACompany incorporated in Zambia having its office registered at Kitwe.

(Hereinafter called 'the Lessee' which expression where the context so admits includes Itself, its successors in title and assigns) of the other part

WITNESSETH as follows

1. In consideration of the sum of K 1,800,000.00 now paid by the Lessee to the President receipt whereof the President doth hereby acknowledge and of the rent hereinafter reserved and the covenants and condition herein after contained the President hereby demises unto the Lessee ALL THAT piece of land

In extent Six Four decimal point Seven Four One Four (64.7414) Hectres

More or less being Farm No. Kitwe /LN -10000011

situated in Kitwe

province of ZAMBIA which piece of land is more particularly delineated and described on

Diagram No. SR -10000[illegible]

attached to these presents

(hereinafter called 'the said land')TO HOLD unto the Lessee for terms of

Ninety - Nine (99) years from the first day of November

two thousand and Eighteen (herein called 'the said terms')

YIELDING AND PAYING therefor during the said term the rent as hereinafter provided.

EXCEPTING AND RESERVING out of the demise hereby made all minerals, mineral oils and precious stones whatsoever upon or under the said land.

2. The Lessee for ITSELF, ITS SUCCESSORS IN TITLE AND ASSIGNS

hereby covenant with the President as follows:

(1) To pay all such rates taxes assessment an imposition whatsoever as may hereafter become payable in respect of the said land according to the law

(2) To permit during the said term the President or any person or persons authorised by the President to enter on the said land at any reasonable time during the day for the purpose of inspection or to lay or have access to water mains drains sewer pipes telegraph or telephone wire and electric manis of all description whether the same or any of them be overhead or undergroun provided that just and fair compensation shall be paid by the President to the Lessee for any los or damage occasioned thereby.

(3) To pay on or before the execution of these presents the sum of K 589.40 being rent for the period from the date of commencement or the said to the thirty - firs day of December two thousand and Eighteen and thereafter yearly rent of K 589.40 on the thirty - first day December in each successive year in arrear free of all deductio

(4) within a period of twenty-four months from the date of the certificate of title to erect on the said land good and substantial buildings to the approval of the planning Authority and to the value as assessed by the local authority of not less than K....500,000.00.....and to complete the foundations thereof within twelve months from the date of the certificate of title.

(5) At all times during the said term well and sufficiently to repair, cleanse, uphold, maintain and keep any messuage or buildings which may be erected on the said land and all additions thereto and the wall fences, sewers drains and amendments and to execute at the lessee's own cost all such sanitary and other works as may from time to time be lawfully required by the local authority.

(6) Except with the prior written consent of the President not to assign sublet mortgage charge or any manner whatsoever encumber or part with possession of the said land or any part thereof or interest therein or concerning the same or attempt so to assign sublet mortgage charge encumber or part with possession of the said land.

(7) Except with the prior written consent of the President not to use the said land or the buildings thereon or to be erected thereon or any part thereof for any purpose other than for.....
COMMERCIAL purposes in accordance with the approved development plan or any amendment thereof and oFor which an application for Planning permission has been submitted to and approved by the Copperbelt Province Planning Authority

The President hereby covenants with the Lessee that the Lessee paying the rent of 589.40..... hereby reserved and observing and performing the several covenants and condition herein on the Lessee's part contained shall peaceably hold and enjoy the said land during the said term without any interruption by the President or any person lawfully claiming under the President.

PROVIDED ALWAYS and it is hereby mutually agreed as follows:

(1) If and whenever the rent hereby reserved or any party thereof shall be in arrear and unpaid for twenty-eight days after the same shall have become due (whether legally demanded or not) or if the Lessee shall at any time make default in the observance of any of the covenants and conditions herein contained on the Lessee's part to be performed or observed it shall be lawful for the President to re-entre upon the said land and hold the same as of his former estate as if this Lease had not been made but without prejudice to any right of action or remedy of the Lessor in respect of any prior breach non-performance non-observance of any of the lessee's covenants or conditions herein contained.

(2) The annual rent stated in sub-clause shall at the option of the President be subject to revision during the subsistence of the Lease or any extension thereof at such periods as the President might in his absolute discretion decide.

IN WITNESS WHEREOF.....HARRY CHIFINDA MWEWA SHAMENDE.....

.....ACTING CHIEF LANDS OFFICER FOR.....

Commissioner of Lands of the Government of Zambia for and on behalf of the President has hereunto set his hand and seal and....COPPERBELT ENERGY CORPORATION ...plc...has hereunto set his hand and seal.....

on the day and year first before written.

SIGNED SEALED and DELIVERED

by the said....HARRY CHIFINDA MWEWA SHAMENDE.....

.....

For and on behalf of the President of Zambia

in the presence of:

SEAL

Witness.....REBECCA NYONDO.....

Address: P .O. Box 30069/73799, NDOLA/LUSAKA/

Occupation: Civil Servant

SIGNED SEALED and DELIVERED

by the said....THE COMMON SEAL OF COPPERBELT ENERGY CORPORATION plc HAS HEREUNTO BEEN AFFIXED.....

in the presence of:

DIRECTOR Witness/////.....

Address/////.....

SECRETARY Occupation/////.....

APPENDIX 12: CULTURAL HERITAGE STANDARD

	COPPERBELT ENERGY CORPORATION ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM			
Title:	**CULTURE HERITAGE STANDARD**			
Procedure No.:	**CEC/EHSS/010**	Issue No. **1.0**	Date: **30.09.2016**	Status: **Issued**

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Approved by: _____ Senior Manager-Risk and HSES	Date: _____

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1. PURPOSE

The purpose of this Technical Standard is to establish the programme design, risk management controls and supporting information, to ensure the preservation and protection of cultural heritage by avoiding, reducing, and in some cases compensating the adverse impacts that projects might cause to cultural heritage. The procedure is aimed at providing a frame work for understanding and evaluation of the site before undertaking a project that may have an impact on culture heritage.

2. SCOPE

The guidance in this Standard is mandatory and applies to CEC operations and all its sites and projects (i.e. employees and contractors who are directly or indirectly involved in undertaking projects in green field areas). The Standard applies to all new projects and is applicable to the entire operation lifecycle (including project assessment and planning, evaluation, operation and closure). It also applies to cultural heritage regardless of whether or not it has been legally protected or previously disturbed.

3. DEFINITIONS

Definitions of key terms used in this document are shown in the following table.

Term	Definition
Chance Find	A previously unknown tangible cultural heritage resource encountered during any part of a project lifecycle. Most commonly these are archaeological sites found during construction or surface clearing.
Critical Cultural Heritage	Consists of (i) the internationally recognized heritage of communities who use, or have used within living memory the cultural heritage for long-standing cultural purposes; and (ii) legally protected cultural heritage areas, including those proposed by host governments for such designation.
Cultural Heritage	According to the National Heritage Conservation Commission Act Chapter 173 of the Laws of Zambia "Cultural Heritage" means • Any area of land which is of archaeological, traditional or historical interest or contains objects of such interest; • Any old building or group of buildings of historical or architectural interest; • Any relic, national monument or ancient heritage; • Any other object constructed by man, other than a relic, of aesthetic,

Term	Definition
	archaeological, historical or scientific value or interest; According IFC Performance Standard 8; "Culture Heritage" means. • Tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values; • Unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls; and • Certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.
Cultural Heritage Management Plan (CHMP)	A Cultural Heritage Management Plan (CHMP) is a comprehensive document that describes management measures, including reporting requirements that are in place in a project or facility to address the specific cultural heritage protection needs that have been identified according to the requirements of this Cultural Heritage Technical Standard. The CHMP will be a part of the project or facility's Environmental and Social Management Plan.
IFC (International Finance Corporation)	Member of the World Bank that finances and provides advice to private sector ventures and projects in developing countries.
Intangible cultural heritage	Intangible forms of cultural heritage include cultural resources, knowledge, innovations, and/or practices of indigenous or local communities embodying traditional lifestyles. These are of concern only if the project intends to use the cultural heritage – such as using cultural resources, knowledge, innovation and/or practices such as using traditional techniques or practices - for commercial development.
Lifecycle	The phases of a CEC project including assessment and planning, evaluation, operation and closure.
Stakeholders (cultural heritage)	In the context of cultural heritage, stakeholders may include: historical or traditional users and owners of heritage; indigenous peoples; traditional communities embodying traditional lifestyles; ministries of archaeology; culture or similar national or heritage institutions; national and local museums; cultural institutes and universities, and civil society concerned

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Term	Definition
	with the cultural heritage or historical preservation, areas of environmental of scientific or environmental interest, affected indigenous peoples, and religious groups for whom the cultural heritage is traditionally sacred.
Tangible cultural heritage	Tangible cultural heritage is a unique and non-renewable resource that possesses cultural, scientific, spiritual, or religious value and includes moveable or immovable objects, sites, structures, groups of structures, marked and unmarked grave sites, natural features, or landscapes that have archaeological, paleontological, historical, architectural, artistic, religious, aesthetic, or other cultural value. These also include natural features that embody cultural values, such as sacred groves, rocks, lakes, springs and waterfalls.
ZEMA (Zambian Environmental Agency)	Zambia Environmental Management Agency (ZEMA) is a Zambian independent environmental regulator and coordinating agency, established through an Act of Parliament that provides for integrated environmental management and the protection and conservation of the environment and the sustainable management and use of natural resources.
National Heritage Conservation Commission	National Heritage Conservation Commission (NHCC) is a Zambian independent coordinating agency, established through an Act of Parliament that provides (i) for the conservation of ancient, cultural and natural heritage, relics and other objects of aesthetic, historical, prehistorical, archaeological or scientific interest and; (ii) for the regulation of archaeological excavations and export of relics; and to provide for matters connected with or incidental to the foregoing.
CEC	Independent power transmission and quality electricity distribution company with interests in Zambia and sub-Saharan Africa, including optic fibre based telecommunications.

4. IMPLEMENTATION GUIDELINES

CEC and all its sites/projects are required to follow the requirements listed below with regards to the mechanisms for identifying, evaluating, preserving and protecting cultural heritage that may be impacted by a proposed CEC activity or operation.

4.1 General Principles

a) CEC and all its sites/projects shall create, implement and maintain arrangements to perform an international standard cultural heritage impact assessment (as part of a wider ESIA) for every potential new project and expansion of existing operations, and as part of business decision-making.

b) CEC and all its sites/projects shall strive at every stage from project screening through to execution to protect tangible and intangible cultural heritage from the potential adverse impacts of its activities and to support its preservation.

c) Project planning and engineering staff shall be fully consulted regarding all baseline assessments as their plans and knowledge regarding project design will provide critical input for the survey process.

d) Appropriate government agencies (i.e. The National Heritage Conservation Commission, ZEMA, etc.) shall be informed at the start of cultural heritage surveys in order to gain access to government heritage archives and to understand government protection standards, priorities and survey requirements. In some cases survey may require interviews with knowledgeable local people. In the case that project confidentiality is a concern, initial surveys can be done without consultation, recognizing that in no situation can invasive survey work, such as archaeological testing be performed without formal government permission.

e) Prior to commissioning a cultural heritage survey, CEC shall identify all formal permitting requirements that may exist and shall ensure that all necessary arrangements are put in place to obtain a permit and to ensure compliance with this permit.

f) CEC shall ensure that both the surveys and the individuals performing such studies meet any specific requirements imposed by the national heritage authority and any relevant international standards as may exist.

g) CEC shall ensure that brief training is provided to construction crews particularly supervisors on the chance finds procedure as outlined in this standard.

h) CEC Culture Heritage Standard shall meet the requirements of the IFC Performance Standards and the "National Heritage Conservation Commission Act Chapter 173" of the Laws of Zambia. These requirements are summarised as follows

- Performance Standard 1 – Assessment and Management of Social and Environmental Risks and Impacts. This Standard is also applicable in that it

requires an assessment of all the potential environmental impacts of a project and the minimisation and/or mitigation of these impacts.

- Performance Standard 8 – recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity. The Objectives are:
- To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- To promote the equitable sharing of benefits from the use of cultural heritage.
- The "National Heritage Conservation Commission Act Chapter 173" of the Laws of Zambia to seek:
- To provide for the conservation of ancient, cultural and natural heritage, relics and other objects of aesthetic, historical, prehistorical, archaeological or scientific interest;
- To provide for the regulation of archaeological excavations and export of relics; and to provide for matters connected with or incidental to the foregoing.

4.2 Culture Heritage Assessment

CEC will undertake cultural heritage assessment in order to protect cultural heritage in accordance with the National Heritage Conservation Commission Act and the Convention concerning the Protection of the World Cultural and Natural Heritage. This will be done during project design and execution. A phase of evaluation is considered important in assessing the significance of all possible cultural heritage sites. This will include field-based study, and documentation of the cultural heritage sites present in the project area. During these practices, where the risk and identification process determines that there is a chance of impacts to cultural heritage, CEC will have to engage professionals to assist in the identification and protection of cultural heritage.

4.3 Cultural Heritage Feasibility Study

It is good practice to identify any potential cultural heritage issues before the start of the ESIA where possible to identify any issues of significant concern such as project cost and design constraints that may present limitations for the ongoing feasibility of the project.

4.4 Desktop Study and Consultations

A desktop study shall be undertaken once the decision has been made that the project is feasible and will be undertaken to identify existing known and potential undiscovered cultural heritage.

a) CEC shall ensure that the desktop survey considers the following:

- Literature review – the extent will depend on the sensitivity of the cultural heritage associated with the project's area of influence that may be impacted. The review shall consider a variety of sources including national heritage archives, published journals, existing assessments and studies in the project site and its area of influence, web-based information, protected area management plans.
- Initial desktop analysis – includes consideration of existing spatial data and landscape mapping particularly for critical cultural heritage. The analysis shall consider satellite imagery or aerial photographs, topographical mapping, protected area maps.

b) CEC shall ensure the necessary arrangements for undertaking direct engagement with stakeholders including Affected Communities. This may involve the appointment of social and other specialists. As cultural heritage is not always documented or protected by law, this engagement may be critical for identifying it, documenting its presence and significance, assessing potential impacts to it, and exploring mitigation options. Stakeholder engagement shall be planned and managed in accordance with the Stakeholder Engagement Technical Standard.

c) CEC will need to consult the Affected Communities who use or have used the cultural heritage for long-standing cultural purposes. This will enable CEC to have knowledge of the importance of the cultural heritage and get the views of the affected communities on such cultural heritage. This consultation will involve

relevant stakeholders including the Zambia Environmental Management Agency, ZEMA, local authorities and the National Heritage Conservation Commission.

4.5 Community access

In the event that CEC's project site contains cultural heritage or prevents access to previously accessible cultural heritage sites being used by, or that have been used by, Affected Communities within living memory for long-standing cultural purposes, CEC shall allow continued access to the cultural site or will provide an alternative access route, subject to overriding health, safety, and security considerations.

4.6 Baseline Survey

a) A baseline cultural heritage survey shall be undertaken during the project screening phase for all new potential projects to collect data on current (i.e. pre-development) cultural heritage attributes as this information may determine whether or not a proposed project should go ahead to the planning and development phases.

b) The survey may involve multi-phased desktop and field investigations where follow-up work is required to the information provided by earlier phases of investigation.

c) The survey shall record sufficient details of tangible cultural heritage of all forms (e.g. archaeological sites, monuments etc.) and of all ages and cultural affiliations, recognising that differing cultural heritage types may have different stakeholders, e.g. scientific and traditional, national and local.

4.7 Risks and Impacts Identification Process

a) The risks and impacts identification process will adopt the same form as that for the overarching ESIA process and reference shall be made to the Conducting ESIAs to International Standards Technical Standard.

b) CEC shall strive to ensure at every stage from project screening through to execution that the potential impacts to cultural heritage are avoided.

c) Where avoidance is not possible, and because cultural heritage is non-renewable, CEC shall strive to adopt 'preservation-in-place' over removal.

d) The impact avoidance and reduction measures shall be included in the Cultural Heritage Management Plan and shall be reviewed and updated regularly as CEC progresses through the project phases.

e) The following cultural heritage risks and impacts shall be considered:

- Cultural heritage baseline conditions in the project's area of influence;
- An analysis of project alternatives in relation to the baseline conditions to determine potential impacts;
- Project-related short and long term, direct, indirect and residual impacts on the cultural heritage identified in the literature review and baseline studies;
- The range of relevant threats to cultural heritage;
- Proposed impact mitigation measures in accordance with the mitigation hierarchy as described in the Conducting ESIAs to International Standards Technical Standard.

f) The scoping of the risks and impacts identification process is a continuous process and is intended to be so that it can be changed to reflect the changing needs of the project and as a result of new information becoming available.

4.8 Cultural Heritage Management Plan

a) A Cultural Heritage Management Plan (CHMP) shall be prepared that details the impact management arrangements (where impact cannot be avoided), an action plan for implementing the protection and preservation arrangements and any necessary monitoring requirements.

b) The CHMP shall detail the arrangements for the periodic internal and external reporting (as required) of the impact management activities.

c) The CHMP shall be integrated into the Company or Project Environmental and Social Management Plan.

d) Compliance with the CHMP and the development of additional sub-plans and procedures shall be a project commitment of CEC, its contractors and their subcontractors.

e) Impact reduction measures shall be considered in the following order of priority:

i) changes to the project design;

ii) Introduction of special construction and operational procedures,

iii) preservation in place, and

iv) Compensatory mitigation measures (such as rehabilitation and restoration of cultural heritage if possible where disturbance has occurred).

f) Opportunities to promote and enhance the conservation of cultural heritage of a protected area shall be considered as appropriate.

g) CEC shall ensure that the CHMP contains suitable arrangements for dealing effectively with chance finds (refer to 5.3 below).

h) The action plan for the protection and preservation arrangements shall include the following:

- Definition of the agreed goal(s), objectives and targets;
- Costs of the various protection arrangements;
- Description of the required actions; completion indicators; responsibilities and accountabilities, and
- Monitoring timeframes and mechanisms.

i) The monitoring arrangements shall consider the following:

- Mechanisms for monitoring the effectiveness of management actions,
- Maintenance and monitoring of specific controls such as preservation activity, and
- Arrangements for adapting management and mitigation responses as necessary to accommodate changes.

j) The plan shall be a project specific and practical document that forms the basic guidance for implementing this Standard in the context of a particular project or operational unit that is owned or operated by CEC.

4.9 Chance Find

Cultural heritage that can be found by chance include archaeological material, human remains and large heritage structures.

In a case where during construction or operations where cultural heritage is expected to be found, CEC shall follow the described processes below.

4.10 Chance Find Involving an Archaeological Material and Human Remains

In the event that an artefact is discovered as a result of construction or operational activities, the following procedure will be followed:

- The chance find shall not be disturbed any further until an assessment by a competent Authority (NHCC) is made;
- All activities in the vicinity of the chance find/ site will cease immediately;
- The discovered chance find/ artefact/site will be delineated;
- Record the chance find location, and all remains are to be left in place;
- The area will be secured to prevent any further damage or loss of removable object;
- Report the chance find, artefact/ site to the Project Manager on site;
- The Project Manager will assess, record and photograph the chance find/artefact/site;
- The chance find, artefact/site will be reported to the Senior Manager-Risk and HSES;
- The chance find will then be reported to the National Heritage and Conservation Commission and or the Health Department of the local Authority by the Risk and Compliance Manager;
- In consultation with the NHCC and or Local Authority, an appropriate course of action to take will be determined;
- In consultation with the NHCC an appropriate on site temporal storage area will be identified allowing temporal storage of any artefacts or other archaeological material recovered;

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- In the case of human remains such as bones, in addition to the above the NHCC, the Health Authorities will be contacted and the guidelines for treatment of human remains will be adhered to. If skeletal remains are identified, the NHCC will be contacted to examine the remains.
- All Employees and Contractors on site will be required to avoid disturbing conservation areas identified by NHCC;

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- Documentation of the chance find/ artefacts will be completed with guidance from NHCC;
- Authorisation to resume works on the site where chance find artefacts were discovered would be given by the respective Authority upon completion of the required procedure.

4.11 Handling Large Heritage Structures

Should the chance find be deemed to be part of a structure or large deposit in the area, the following will take place:

- The Employees or contractor will notify the Project Manager of the discovery;
- The project manager will ensure photographs or video is taken of the discovery.
- The chance find will then be reported to the NHCC and photographs submitted for assessment.
- The historical importance/cultural value of the discovery will be determined by the NHCC and it will be a matter of discussion between CEC and the NHCC;
- The Senior Manager-Risk and HSES will complete a report on the findings in line with the NHCC, requirement;

4.12 Removal of Replicable Cultural Heritage

When CEC encounter tangible cultural heritage that is replicable and not critical, mitigation measures that favour avoidance will be implemented. Where avoidance is not feasible, the following will be implemented as follows:

- Minimize adverse impacts and implement restoration measures, in situ, that ensure maintenance of the value and functionality of the cultural heritage, including maintaining or restoring any ecosystem processes needed to support it;

- Where restoration in situ is not possible, restore the functionality of the cultural heritage, in a different location, including the ecosystem processes needed to

support it; The permanent removal of historical and archeological artifacts and structures is carried as described above;

- Only where minimization of adverse impacts and restoration to ensure maintenance of the value and functionality of the cultural heritage are demonstrably not feasible, and where the Affected Communities are using the tangible cultural heritage for long-standing cultural purposes, compensation for the loss of that tangible cultural heritage will be done.

4.13 Removal of Non-Replicable Cultural Heritage

The most efficient way of protecting culture heritage is by preservation in its place and removal can result in irreparable damage or destruction. CEC will therefore not remove nonreplicable culture heritage unless the following conditions are met:

- There are no technically or financially feasible alternatives to removal;
- The overall benefits of the project conclusively outweigh the anticipated cultural heritage loss from removal; and
- Any removal of cultural heritage is conducted using the best available technique.

4.14 Critical Cultural Heritage

Critical cultural heritage consists of two types namely the internationally recognized heritage of communities who use, or have used within living memory the cultural heritage for long-standing cultural purposes and legally protected cultural heritage areas, including those proposed by host governments for such designation.

CEC shall should not remove, significantly alter, or damage critical cultural heritage. In exceptional circumstances when impacts on critical cultural heritage are unavoidable, the Consultation and Participation as described in the Environmental Impact Assessment process shall be implemented and engagement of experts to assist in the assessment and protection of culture heritage will be done.

Legally protected cultural heritage areas are important for the protection and conservation of cultural heritage, and additional measures are needed for any projects that would be

permitted under the applicable sections of the National heritage conservation act. In the case where the proposed project is located within a legally protected area, CEC in addition to the requirements of the critical cultural heritage cited above will meet the following requirements:

- Comply with defined National heritage conservation act of 1994
- Consult the protected area sponsors and managers, local communities and other key stakeholders on the proposed project; and
- Implement additional programs, as appropriate,

4.15 Project's Use of Cultural Heritage

In the situation where a project proposes to use the cultural heritage, including knowledge, innovations, or practices of local communities for commercial purposes, CEC will inform these communities of

- Their rights under national heritage conservation act;
- The scope and nature of the proposed commercial development; and
- The potential consequences of such development.

CEC will not proceed with such commercialization unless it (i) enters into a process of consultation and participation as described by the EIA regulations and the results documented. The outcome of the consultation and participation process should also provide for fair and equitable sharing of benefits from commercialization of such knowledge, innovation, or practice, consistent with their customs and tradition.

5. ROLES AND RESPONSIBILITIES

CEC shall ensure that roles and responsibilities for implementing and complying with this Standard are allocated. Key responsibilities shall be included in job descriptions, procedures and/or other appropriate documentation.

6. COMPLIANCE AND PERFORMANCE

CEC shall ensure they comply with the requirements of this standard. Performance against meeting the requirements of this Standard shall be assessed periodically, documented and, where required, reported to CEC Group. The assessment of performance shall include setting and reporting on key performance indicators (KPIs) where these have been established. The evaluation of performance shall include, as a minimum, confirmation that:

- A cultural heritage assessment is undertaken as part of the overarching ESIA for all potential projects.
- A Cultural Heritage Management Plan is prepared and implemented for every project.
- Stakeholder engagement must be included as an essential component of the assessment and involves Affected Communities where they exist within the project area.
- The competence and credibility of all specialists (internal and external) that contribute to the cultural heritage assessments and impacts management must be able to present evidence (such as training, certification, etc.) to demonstrate this.
- The data and findings of the impact assessment and management plan must be disclosed formally either as standalone reports or within the ESIA disclosure report and in a manner and form that is accessible to all stakeholders.
- Clear and transparent evidence of the adoption of the mitigation hierarchy must be available to support the proposed impacts management arrangements.
- All management and monitoring arrangements must be actively maintained and implemented and documentary evidence kept to demonstrate this.

7. SUPPORTING INFORMATION

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Reference	Description
International Finance Corporation Performance Standards Guidance Notes	The IFC has published Guidance Notes to guide the implementation of the full range of performance standards. These are available on the website. The guidance is currently being updated and draft versions (V2) are available however these have not yet been finalised and formally published. http://www.ifc.org/ifcext/sustainability.nsf/Content/PerformanceStandards
National Heritage Conservation Commission Act, Cap 173	An Act to repeal and replace the Natural and Historical Monuments and Relics Act; to establish the National Heritage Conservation Commission; to define the functions and powers of the Commission; www.parliament.gov.zm/downloads/VOLUME 12.pdf http://www.zambialii.org/zm/legislation/consolidated-act/173
World Bank - Cultural Heritage Country Files	These are data files now in place with the World Bank. They contain valuable information for clients who are in the initial phases of project development and are concerned with possible heritage issues and constraints in the host country. The files contain existing, readily available technical and contact information, and a checklist of additional information that should be obtained.
World Heritage List (from the Convention Concerning the Protection of the World Cultural and Natural Heritage)	List forming part of the cultural and natural heritage which the World Heritage Committee considers as having outstanding universal value. http://whc.unesco.org/pg.cfm?cid=31

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8. REVIEW

This Technical Standard shall be periodically audited and reviewed to determine its accuracy and relevance with regard to legislation, education, training and technological changes. In all other circumstances, it shall be reviewed no later than two years since the previous review.

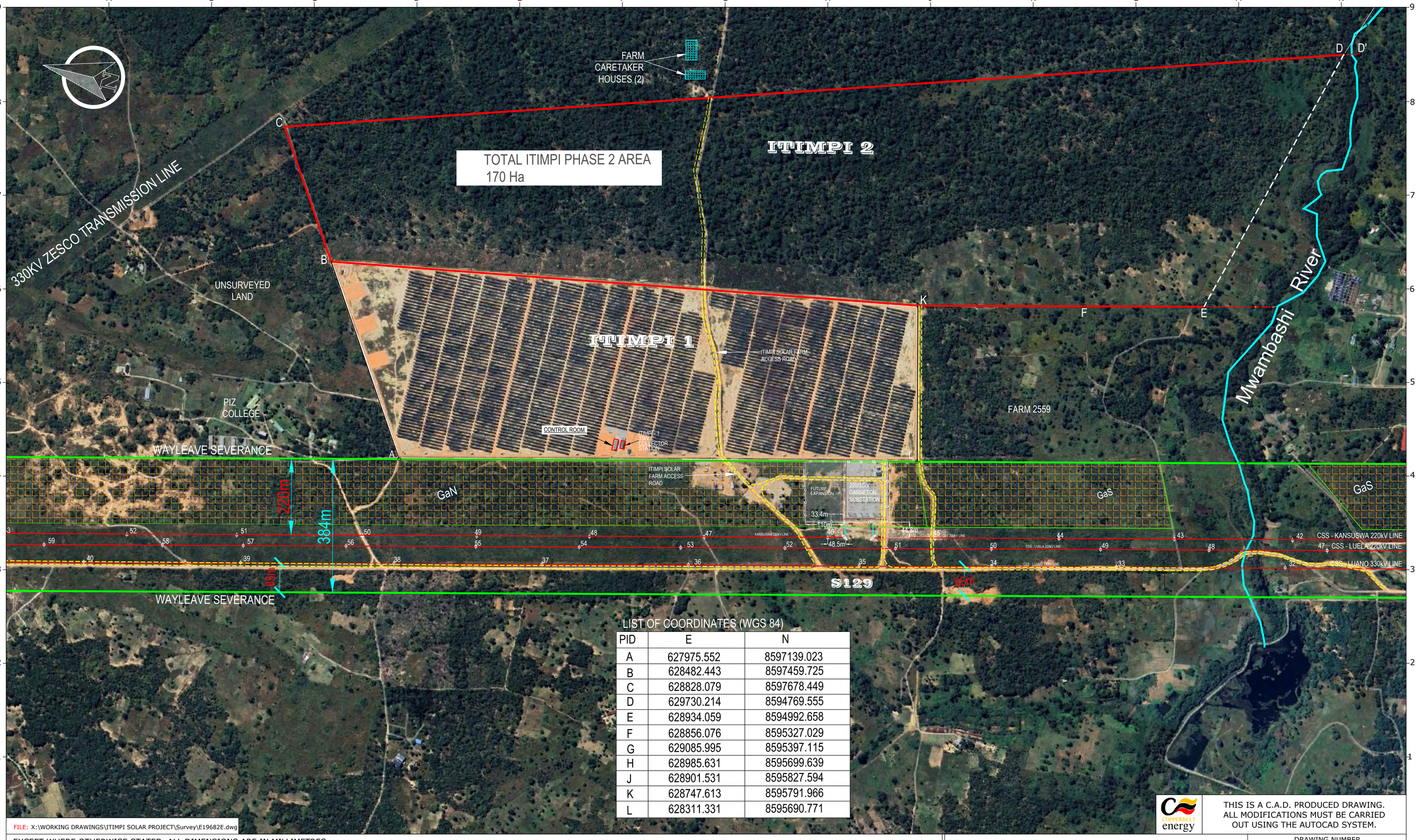
9. RELATED DOCUMENTATION

A summary of the references and supporting documents relevant to this document is provided in the following table.

Doc. Ref.	Document name

APPENDIX 13: SITE PLAN

E19682E



LIST OF COORDINATES (WGS 84)

PID	E	N
A	627975.552	8597139.023
B	628482.443	8597459.725
C	628828.079	8597678.449
D	629730.214	8594769.555
E	628934.059	8594992.658
F	628856.076	8595327.029
G	629085.995	8595397.115
H	628985.631	8595699.639
J	628901.531	8595827.594
K	628747.613	8595791.966
L	628311.331	8595690.771

FILE: X:\WORKING DRAWINGS\ITIMPI SOLAR PROJECT\Survey\E19682E.dwg

THIS IS A C.A.D. PRODUCED DRAWING. ALL MODIFICATIONS MUST BE CARRIED OUT USING THE AUTOCAD SYSTEM.

EXCEPT WHERE OTHERWISE STATED, ALL DIMENSIONS ARE IN MILLIMETRES

REFERENCES

DRAWING No.	TITLE

REV No.	DATE	REVISIONS	DRAWN	CHK'D	DESIGN APP'D	PROJ. APP'D
0	31.03.22	FIRST DRAWN	MM	PC	HF	VN
1	12.10.22	ADDING LILO LINES	MM	PC	RKM	RKM
2	08.11.22	SHIFTING 220/33kV SUBSTATION TO HIGH POINT	MCC	PC	RKM	RKM
3	22.11.23	ADDING ACCESS ROADS TO SUBSTATION	MM	PC	RKM	RKM
4	17.07.24	PERIMETER AND INSTALLATIONS	MM	PC	RKM	RKM

REV No.	DATE	REVISIONS	DRAWN	CHK'D	DESIGN APP'D	PROJ. APP'D

COPPERBELT ENERGY CORPORATION

SITE PLAN SHOWING
ITIMPI PROJECT SITE PROPOSED LINE ROUTES TO GARNETON SUBSTATION

DRAWING NUMBER

PROJECT No.	SUB PROJ	ESTIMATE	JOB	ITEM

PROJ / A / EST / JOB / ITEM - DWG

E19682E

REVISION No.4

NTS

APPENDIX 14: CERTITICATE OF INCORPORATION

Companies Form 7
Companies Registration No. **120180009889**
Serial No. **1089008**

Republic Of Zambia

CERTIFICATE OF INCORPORATION OF COMPANY LIMITED BY SHARES

(Section 10)

This is to certify that INNOVENT-CEC GARNETON NORTH SOLAR LIMITED is on and from the **23rd day of November 2018** incorporated as a COMPANY LIMITED BY SHARES.

Given under my hand and seal at Lusaka, Zambia, this **23rd day of November 2018**.

COMPANIES REGISTRATION & PATENTS AGENCY

P.C. Mwaba
Assistant Registrar of Companies

For further details relating to this business visit
http://www.pacra.org.zm

Companies Form 10
Companies Registration No. **120180009889**
Serial No. **1089008**

Republic Of Zambia

CERTIFICATE OF SHARE CAPITAL

(Section 10)

PACRA

This is to certify that INNOVENT-CEC GARNETON NORTH SOLAR LIMITED has the nominal capital of **K 15,000.00** divided into **15000** shares of **K 1.00** each.

Given under my hand and seal at Lusaka, Zambia, this **23rd day of November 2018.**

PATENTS & COMPANIES REGISTRATION AGENCY

P.C. Mwaba
Assistant Registrar of Companies

APPENDIX 15: DETAILS OF THE PROJECT AFFECTED PERSONS