MINISTRY OF EDUCATION

STATE DEPARTMENT OF UNIVERSITY EDUCATION AND RESEARCH (SDUER)

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED CONSTRUCTION OF THE PROPOSED CENTRE OF EXCELLENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING AT MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY, MERU COUNTY

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Declaration

This ESIA study Report was done in accordance to the requirements of the Environmental (Impact Assessment and Audit) Regulations, 2003, pursuant to The Environmental Management and Coordination Act, (EMCA) 1999 Rev. 2015 and acceptable international standards.

LEAD EXPERT:

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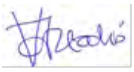
Signature:  **Date:** 27/11/2024

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Abbreviations And Acronyms

AIDS	Acquired Immune Deficiency Syndrome
AoI	Area of Influence
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CoEs	Centres of Excellence
CoE EEE	Centre of Excellence in Electrical and Electronic Engineering
CBET	Competency-Based Education and Training
DOSH	Directorate of Occupational Safety and Health
E&S	Environment and Social
EA	Environmental Audits
EIAs	Environmental Impact Assessments
EMCA	Environmental Management and Coordination Act
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FGD	Focus Group Discussion
GoK	Government of Kenya
HIV	Human Immunodeficiency Virus
IUCN	International Union for Conservation of Nature
MDGs	Millennium Development Goals
MoE	Ministry of Education
MUST	Meru University of Science and Technology
NECC	National Environmental Complaints Committee
NEMA	National Environment Management Authority
NET	National Environmental Tribunal
NGEC	National Gender and Equality Commission
OP	Operational Policies
OSHA	Occupational Safety and Health Act
PPE	Personal Protective Equipment
PS	Performance Standards
SDGs	Sustainable Development Goals
SDUER	State Department of University Education and Research
TOR	Terms of Reference
WRA	Water Resource Authority

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EXECUTIVE SUMMARY

i) PROJECT OVERVIEW

In 2016, Africa Development Bank (AfDB) supported Higher Education Science & Technology (HEST) Phase I initiative and provided selected nascent institutions of higher learning in Kenya with critical laboratory equipment. Meru University of Science and Technology (MUST) was one of the benefiting institutions. As a follow-up to Phase I, the Government plans to undertake Phase II of the project. Phase II will take Phase I support a notch higher and create Centres of Excellence (CoEs) with strong linkage to industry and initiatives to support the implementation of Competency-Based Education and Training (CBET). MUST has been selected to be a beneficiary of this second phase of the project. The project activities includes; the construction of a Modern Building housing: offices, lecture rooms and equipped laboratories/workshops, at Meru University of Science and Technology. The overall goal is to increase access to quality technical and skills development for value chains progress and employability. This will be achieved by investing in skills development infrastructure, which will facilitate the building of a highly skilled labour force to support the value chain and as a result, enhancing youth employability. In line with the Bank´s Environmental and Social Safeguards requirements, an Environmental and Social Impact Assessment (ESIA) must be conducted and the related reports approved and disclosed both by the Bank and the Government, it is based on this, as well as the bank's commitment to environmental conservation that the client intends to undertake an ESIA for the proposed works.

Prior to the commencement of activity implementation at the proposed project sites, there is a need to conduct an environmental and social impact assessments (ESIA) study to identify any adverse environmental and social impacts associated with the project construction/rehabilitation and propose mitigation measures to address those challenges. To achieve this, the Ministry of Education, in collaboration with AfDB has engaged a consultant to conduct an environmental and social impact assessment prior to the approvals of the Project Execution. Based on the outcomes of the environmental and social impact assessment, the assignment will develop an environmental and social management plan in compliance with the government regulations that will meet the African Development Bank's Environmental and Social Safeguards Policy requirements. The aim is to develop mitigation measures that will address any adverse environmental and social impacts the project activities may bring about, including the cost implications of implementing those

mitigation measures, develop a monitoring timeframe, and assign responsibilities to implement the measures.

The rationale for preparing this ESIA is essentially to evaluate the project's potential environmental and social risks and impacts of its implementation. The process of the ESIA will examine ways of improving project site selection, planning, design, and implementation; it's also to prevent, minimize, mitigate, or compensate for adverse environmental impacts, and to enhance positive impacts throughout project implementation. The ESIA document will serve the following purposes:

i) Provide guidance to implementers to ensure the environment assessment process is carried out in compliance with national legislation and AfDB safeguards policies.
ii) Provide an environmental and social screening process to allow for identification, assessment and mitigation of potential impacts by proposed works at the time the detailed aspects are known.
iii) Used as a reference document for assessing the potential environmental and social impacts of investment alternatives.
iv) Serve as guidelines for the development of sub-project/site-specific Environmental Social Management Plans (ESMPs), due diligence reports, environmental audits, among others.

ESIA Specific Objectives

i) Establishing clear procedures and methodologies for the environmental and social assessment, review, approval and implementation of subprojects to be financed under this project
ii) Identification of specific roles and responsibilities, and outlining the necessary reporting procedures for managing and monitoring environmental and social risks related to subprojects,
iii) Establishing project funding required to implement the ESMP requirements and
iv) Providing lessons learned for application to future project.

Project Goal and objectives

In this second phase of the project, MUST is proposing a Centre of Excellence in Electrical and Electronic Engineering (CoE EEE). The proposed CoE aims to address the challenges of the

limited technological capabilities and the need to enhance advanced research facilities in Kenya's institutions of higher learning. This centre is projected to be a world-class high technology research facility and a center of excellence to cater for research needs at the national, regional and international levels. The CoE aims to provide the highest quality of training to students in multi-disciplinary practical education and theory related to Electrical and Mechatronics Engineering leading to professional careers in the country, the region, and beyond. The centre graduates will have necessary knowledge and skills for contemporary areas of electrical and mechatronics engineering that they will use to solve national priority issues such as food security, climate adaptation, green energy, universal health care and affordable housing for overall economic development. Summary of proposed activities include

- Competence based Skill development in both undergraduate and graduate level
- Improvement in research and development
- To provide opportunities for Masters and Doctoral programmes
- Collaboration with Industry for applicable research and product development
- Enhancing research competence of faculty and knowledge sharing in thematic areas, both within the country and abroad

Components and main activities in this report

This project development activities may be categorized into Three (3) phases of: a) design, mobilization and construction phase b) operational phase, and c) decommissioning phase. The mobilization and construction phase will take place subsequently to the issuing of Environmental Impact Assessment Certificate, building/construction permits and once a construction contract with a suitable contractor is signed. The mobilization and construction phase will involve different activities as summarized including: i) site clearance, earthworks and construction of campsite ii) installation of temporary security fence at the camp sites, site office and storage facilities iv)acquisition of materials from a reliable sources and storage; iii) testing of the construction materials; iv)acquisition of other permits such as water use permits; v) confirmation of data and accuracy of topographical survey; vi) mobilization of labour force, equipment and plant for construction works; vii)transportation of equipment, workers, materials and storage; viii)Abstraction and transportation of water to the construction site; ix) collection, storage, transportation, treatment and disposal of wastes generated from construction activities; xi) Actual

construction works; xii)movement of heavy equipment and machines xiii)Occupational health and safety management;

In the project operation phase: Buildings and the state of the art equipment, offices, laboratories, workshops and training facilities well as the roads, parking yards and walkways will start to operate to serve the intended purposes. The activities that are expected to be executed during operational phase include: Transportation, experiments, generation of ideas, training, workshop activities, student's activities and mobility in the corridor among others.

Due to consistent use of the facility/buildings during operational phase there will be a routine housekeeping and maintenance as a result of wear and tear of the infrastructure that will affect its quality. Therefore, the Buildings will require maintenance throughout the project life. Among others, the maintenance works will include: i) Repainting of building ii) Repairing cracks on the structures iii) Routine maintenance of the building among others. Therefore, institution management will have to set aside funds to supported facilities, for operation and maintenance this includes cleaning and repair, payment of water and electricity bills and buying necessary items for cleaning (e.g. detergent, disinfectant, gloves, hand wash soap etc.).

The project will obtain the construction materials (aggregates and borrow materials) by applying for the permit from relevant government departments. The management of waste generated (both solid and liquid waste) with the proposed projects will use the existing system during operation phase of the project. Collected storm water will be directed to the existing drainage patterns of the areas. Other important concerns include Air pollution: gaseous, dusts and particulates, increased pressure on utilities/services, traffic, public safety risks and noise generation.

Methodology: The methodology used is commensurate with the Environment Regulations, in Kenya. The assessment followed a structured methodology, including:

- Environmental screening to determine the necessity of an environmental impact assessment under schedule 2 of EMCA CAP 387.
- Submission of Terms of Reference to NEMA headquarters for approval.
- Environmental scoping to identify key environmental issues.
- Desktop studies, interviews, and physical inspections of the site and surrounding areas.
- ESIA Public participation and Reporting.

Project Alternative

The consideration of alternatives or options to a project proposal, which will achieve the project's objectives is a requirement of many ESIA systems. It lies at the heart of the ESIA process and methodology. During the scoping process, alternatives to a proposal can be generated or refined, either directly or by reference to the key issues identified. A comparison of alternatives will help to determine the best method of achieving project objectives while minimizing environmental impacts or, more creatively, indicate the most environmentally friendly or best practicable environmental option.

***1. The 'No Action Alternative'*:** environmentally speaking, not carrying out the development ("No Project Alternative") may be the best option, as the area would remain a relatively undisturbed area providing a habitat for the varied flora and fauna presently observed. Although this area will continue to be impacted, though minimally, by anthropogenic and natural factors but from a socio-economic perspective the "no action" alternative may not be the best alternative as the numerous benefits to be gained from the development both locally and nationally would not be realized and the resources in the area would continue to be underutilized.

2 Alternative Site: this option involves pursuing the proposal but on a different site meaning its impacts that are relevant to the proposed site or occur due it will be avoided. The avoidance of these *in-situ* and *ex-situ* regional impacts would be the main benefit of this option but there will also be other impacts specific to the alternative site and due to specifications of the proposed project, a different site away from the current sites, would also increase logistic costs. Alternative sites are also not readily available since availability of land is limited. Additionally, the selected sites are in government land and therefore no need to compensate the land owners as well as developing a relocation action plan.

3. Alternative Schedule: this option entails carrying out the proposal at a later time thereby offsetting its impacts to that time. Only benefit is if there are improvements in baseline conditions and technologies that may be involved with the proposal. However, in this case, there are no guaranteed and it may only lead delays in development, therefore carrying out the proposed project with mitigation would be a preferred option due to this uncertainty. In addition, carrying out the proposed project at later time may lead to more operational and logistic costs due to increasing inflation and standards of living.

4. Alternative Design: This option curtails undertaking the project but with different infrastructural designs that encompass: buildings, roads, power, water and sewerage etc. The project design will be achieved by considering the options available that would ensure cost-effectiveness and avoid or reduce environmental and social impacts as much as possible. Additionally, several of the other possible designs may result in higher building densities and less internal transport/path optimization. This would mean the project would use more energy and resources as compared to the preferred project option.

Recommended Alternative: After analysis of alternatives, taking into account environmental and social impacts including views from Stakeholders it was recommended, that the current sites selected were optimal in terms of minimizing environmental and social impacts from the project. As such there were no better alternatives, additionally the selected sites were in government/ institutional land and therefore no need to compensate the land owners as well as developing a relocation action plan.

ii) PROJECT SITE AND MAJOR ENVIRONMENTAL AND SOCIAL STAKES

Meru University of Science and Technology is a public university in Tigania West sub-county Meru county, Kenya. It is 15 kilometres northeast of Meru Town, along the Meru-Makutano-Maua Highway. The proposed site is located within the university compound on a 1-acre piece of land, next to the engineering complex, main campus.

This ESIA report has identified both positive and negative impacts of the proposed project to the environment and community. The potential negative impacts identified include land degradation, pollution, increased water and energy demands, and pressure on social amenities. Mitigation measures proposed to address these negative impacts include landscaping, dust control measures, provision of Personal Protective Equipment (PPE) for workers, strategic management of solid and liquid wastes, and the development of an Environmental and Social Management Plan (ESMP) The rest of the mitigation measures to address the potential negative impacts, during the construction, operation and decommissioning phases of the project, for overall environmental and social sustainability are elaborated in the chapter 7 of this report.

iii) INSTITUTIONAL AND LEGAL FRAMEWORK FOR IMPLEMENTATION OF THE PROJECT

The project falls under the **Medium Risk Category** as defined in the **Amended Second Schedule of the Environmental Management and Coordination Act (EMCA), Legal Notice No. 31 of 2019**. As such, it is mandatory for the project to undergo an **Environmental Impact Assessment (EIA)** to evaluate potential impacts and to propose appropriate mitigation measures. The purpose of this Environmental and Social Impact Assessment (ESIA) is to ensure that all environmental and social considerations are accounted for, minimizing adverse effects during both construction and operational phases.

Legislative, Policy and Institutional Framework

The Environmental and Social Impact Assessment (ESIA) has been carried out in compliance with the requirements set forth in Section 58 of the Environmental Legislation, the Environment Management and Coordination Act (EMCA) 1999, along with its subsidiary legislation. This includes the Environmental Impact Assessment and Auditing Regulations (EIA/EA) of 2003, and the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019. This section provides an overview of the relevant legislative, policy, and institutional frameworks that govern the project's environmental, health, safety, and land use considerations.

The framework is essential for ensuring that the project adheres to the regulatory requirements, minimizes environmental and social risks, and promotes sustainable development throughout its lifecycle. Pertinent regulations, standards and regulatory bodies governing environmental quality, health and safety, protection of fauna and flora species, environment, economic activities, siting and land use control as relevant to the site and its immediate environs was evaluated and reported. A legal register listing all legislation, legal instruments relevant to the site has been prepared, indicating applicability to the site. In addition, permits and licenses that are required to be obtained during construction and operation has been provided. The ESIA was undertaken within the reference framework of the following standards and regulations: applicable National Environmental Management, Occupational Health and Safety, Public Health and Labour laws and regulations among others.

Roles and Responsibilities of the project Implementation Entity (PIE)

- **Coordination and Oversight**:
  - Ensure the project aligns with the overarching goals and objectives.
  - Coordinate activities among stakeholders, implementing agencies, and contractors.
- **Project Management**:
  - Manage the project lifecycle, including planning, execution, monitoring, and closure.
  - Develop detailed project plans, schedules, and budgets.
- **Financial Management**:
  - Oversee funding and financial allocations.
  - Ensure compliance with procurement guidelines and financial reporting standards.
- **Compliance**:
  - Ensure adherence to legal, regulatory, and contractual obligations.
  - Monitor environmental, social, and safety standards.
- **Reporting**:
  - Submit progress reports to funding bodies, regulatory agencies, and stakeholders.
  - Conduct project evaluations and audits.

Roles of Implementing Agencies

- **Execution of Project Components**:
  - Manage on-the-ground implementation of assigned tasks.
  - Ensure resources (materials, labor, and equipment) are effectively utilized.
- **Technical Expertise**:
  - Provide specialized knowledge and skills required for specific project areas.
  - Develop technical designs, specifications, and methodologies.
- **Monitoring and Reporting**:
  - Track progress and submit periodic updates to the PIE.
  - Identify risks and recommend mitigation measures.
- **Stakeholder Engagement**:
  - Collaborate with local communities, governments, and other stakeholders.
  - Address grievances and concerns related to the project.

iv) PROJECT IMPACTS

The proposed project is anticipated to bring several positive impacts, including enhancement of the country's research sector, employment opportunities, economic gains, improved services, efficient land use, and development of social amenities. However, potential negative impacts such as land degradation, pollution, increased water and energy demands, and pressure on social amenities were also identified.

Mitigation measures proposed to address these negative impacts include landscaping, dust control measures, provision of Personal Protective Equipment (PPE) for workers, strategic management of solid and liquid wastes, and the development of an Environmental and Social Management Plan (ESMP). The ESMP will outline procedures for hazardous material handling, emergency response protocols, and initiatives to involve vulnerable groups in the project.

The following are some of the key anticipated negative impacts of this project.

- **Soil Erosion & Slope instability**: The activities involved in the construction phase of the project may have a major negative short-term impact on soil.
- **Waste disposal**: Liquid and solid waste will be generated in the course of construction. The wastes range from general to hazardous categories. This impact is short term. However, the disposal mechanism of the wastes can have long term consequences.
- **Air pollution**: Emissions mainly associated with combustion of fuel from the construction vehicles and equipment. These emissions may be in the form of oxides of nitrogen as well as volatile organic carbons. Similar to other combustion processes, emissions from vehicles include CO, NOx, SO_2, and VOCs.
- **Particulate Matter**: The most common pollutant involved in fugitive emissions is dust or Particulate Matter (PM). This is released during certain operations, such as transport and open storage of solid materials, and from exposed soil surfaces, including unpaved roads. At the project site, particulate matter will high at storage areas, access road
- **Flora and fauna**: During construction, there will be localized disturbance of flora and fauna especially during excavations. The impact on ground cover will be restricted to the initial construction period, after which the ground cover is expected to be restored.

- **Noise and vibration**: The site preparation and construction phases of the project will result to negative impact to the ambient noise and vibration in the project area. However, this for temporary period restricted to construction phase only, the cumulative impact of the construction activities occurring simultaneously may increase the noise and vibration levels in the area significantly.
- **Occupational Health and safety:** Use of heavy machinery and various activities for construction may pose safety hazards to the workers and the community. Vehicular movements can cause accidents especially in dense settlement areas resulting in injuries and probably death.

v) CONSULTATIONS

Stakeholder engagement is a fundamental component of the Environmental and Social Impact Assessment (ESIA) process for the proposed centre of excellence in electrical and electronic engineering (CoE EE) project in Meru University of science and technology. The following groups were engaged during this stage

- The Local Community: Residents within the project vicinity whose daily lives may be indirectly impacted by project activities.
- Neighbors: Individuals residing in close proximity to the project site, whose concerns may arise due to construction or operational activities.
- Local Businesses: Commercial entities operating in the project area, whose operations may be tangentially impacted by project activities.

Taking into account the geographical scope of the university, we conducted a comprehensive focus group discussion. Additionally, representatives from diverse demographics such as men, women, youth, and people with disabilities from all these locations were actively engaged in the discussion. Questionnaires were distributed in the university and in surrounding neighborhoods to collect additional views from the community and other stakeholders. Some of the main stakeholders input included the following

1. Job Creation: Stakeholders highlight the potential for CoE to generate employment opportunities, thereby contributing to economic growth and reducing unemployment rates in the region.

2. Improved Livelihoods: They emphasized the positive impact of the CoE on enhancing the quality of life for local residents by giving them employment, generating income for better education, healthcare, and other essential services.
3. Urbanization: Stakeholders recognize the CoE as a catalyst for urban development, promoting infrastructure growth, and attracting investments in the surrounding areas.
4. Borrowing of Technology: They acknowledge the opportunity for knowledge transfer and technological advancement through collaboration with global partners, fostering innovation and competitiveness.
5. Hazardous Waste Management: Stakeholders express apprehension regarding the effective management of hazardous waste generated by the CoE, highlighting potential environmental risks and health hazards if not properly addressed.
6. Solid Waste Management: Concerns were raised about the adequacy of waste management systems to handle the increased volume of solid waste resulting from the CoE operations, emphasizing the importance of sustainable waste disposal methods.

The outcomes of the stakeholder engagement process for the CoE project can be summarized as follows:

- Increased Awareness: Enhanced stakeholder awareness and understanding of the CoE project, its objectives, and potential environmental and social impacts.
- Stakeholder Engagement: Active participation and engagement of stakeholders in the ESIA process, including the provision of valuable feedback, concerns, and recommendations. ***Filled questionnaires and meeting minutes are appended in this report***
- Improved Project Design: Integration of stakeholder input and considerations into the project design, mitigation measures, and management plans to address identified concerns and optimize project outcomes.
- Enhanced Trust and Collaboration: Building of trust, credibility, and collaborative relationships between project proponents, stakeholders, and affected communities through transparent and inclusive engagement practices.
- Compliance and Accountability: Demonstration of commitment to regulatory compliance, corporate social responsibility, and sustainable development principles through transparent and accountable public participation processes.

vi) ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

The following are the main environmental impacts and the proposed mitigation measures

- Soil Erosion & Slope instability:
    i. Wherever required, retaining walls should be constructed to eliminate the chances of soil erosion especially in steep slope area.
    ii. Soil excavated should be utilized for backfilling and the remaining soil being spread evenly and compacted to the extent possible.

- Waste disposal
    i. Providing waste collection bins at designated points on site for purposes of waste segregation
    ii. All solid waste should be collected at a central location at each site and will be stored temporarily until removal to an appropriately permitted disposal site. The approved disposal sites are available and the contractor will choose the nearest disposal site.
    iii. No dumping within the surrounding area is to be permitted unless at designated disposal sites. Where potentially hazardous substances are being disposed off, a chain of custody document should be kept with the environmental register as proof of final disposal.

- Air pollution
    i. Emissions from the construction vehicles should comply with national or international standards.
    ii. Regardless of the size or type of vehicle, operators should implement the manufacturer recommended engine maintenance plans;
    iii. Machines must not be left idling for unnecessary periods of time; this will save fuel and reduce emissions.

- Particulate Matter
    i. Use of dust control methods, such as covers, water suppression, or increased moisture content for open materials storage piles, or controls;

ii. Ensure that all material (sand and aggregate) stockpiled on the site to be used in construction activities are regularly sprayed to reduce the effects of wind whipping.

iii. Ensure that all trucks carrying aggregate and sand are covered during delivery to the site.

iv. Care must be taken in the unloading construction materials (aggregate, sand and cement) to prevent spillage. If a spill occurs, this should be cleaned up as soon as possible thereafter.

- Flora and fauna
  - **i.** Landscaping should be done after construction phase

- Noise and vibration
  - i. Construction activities should be restricted times where lectures are not ongoing.
  - ii. Construction activities should be undertaken through the use of small mechanical devices e.g., tractors and manual labour, as much as practically possible.
  - iii. Where possible low noise producing (silenced) machinery and instruments should be employed to reduce the impact of noise on the existing residents and workers.
  - iv. Contractors should ensure that noise level in project area should not exceed the permissible limits

- Occupational Health and safety
  - i. Ensuring that the drivers and machine operators hired to work on the site are qualified.
  - ii. Workers on site must be provided with appropriate PPE.
  - iii. There should be safety policy clearly displayed on the site.
  - iv. Machines should be properly maintained.
  - v. A first aid kit should be provided and a trained first aider should always be on site.
  - vi. Proper scheduling of activities to avoid workers being overworked.
  - vii. No worker should be allowed on site while under the influence of alcohol or other inebriating substances.

Environmental Monitoring Matrix

Here is the Environmental Monitoring Matrix that will be used for this project.

Table 1: Environmental Monitoring Matrix

Code	Parameter to Monitor	Sampling Methods/Approach	Cost Estimate	Responsibility	Reporting
EM-01	**Noise Levels**	**Sound level meters** to measure noise at various points around the project and university.	KSh 200,000 per year	Contractor (during construction), Health and Safety Officer	Monthly noise level reports. Immediate reports if noise exceeds permissible limits.
EM-02	**Soil Erosion and Stability**	**Visual inspection** after heavy rains; **Erosion pins** or sedimentation traps to measure erosion rates. Soil samples for nutrient and chemical analysis.	Ksh. 200,000 per year	Site Supervisor, Environmental Officer	Quarterly reports, including recommendations for erosion control.
EM-03	**Vegetation Cover and Flora**	**Field surveys** using random sampling plots. Photo documentation and inventory of species diversity and abundance. Monitoring of any rehabilitated or landscaped areas.	Ksh. 250,000 per year	Environmental Officer, Biodiversity Consultant	Annual biodiversity reports; vegetation recovery progress updates to the Forestry Department.
EM-04	**Wildlife (Fauna Monitoring)**	**Direct observation** and **camera traps** to monitor species presence, behavior, and movement. Track any signs of disturbance or habitat fragmentation.	Ksh.200,000 per year	Biodiversity Consultant, Wildlife Officer	Bi-annual wildlife monitoring reports to NEMA and the local wildlife authority.
EM-05	**Solid Waste Management**	**Regular inspections** of waste collection, storage, and disposal areas. Track volume and type of waste generated.	Khs. 150,000 per year	Waste Management Officer, Contractor	Monthly waste tracking reports; annual waste audit.
EM-06	**Hazardous Waste** (e.g., oils, solvents)	**Inventory and tracking** of hazardous materials, including storage and disposal logs. Sample analysis of any spills or leaks.	Khs. 150,000 per year	Environmental Officer, Health and Safety Officer	Incident reports for any spills; annual hazardous waste summary to the local authority.
EM-07	**Greenhouse Gas Emissions (GHG)**	**Emission factor calculations** based on fuel consumption data, machinery use, and power consumption. Use of emission	Khs. 200,000 per year	Environmental Officer, Energy Consultant	Annual GHG emission report to NEMA and relevant climate change authority.

		monitoring equipment for direct measurement where applicable.			
EM-8	**Health and Safety Compliance**	**On-site inspections** and safety audits to monitor compliance with occupational health and safety standards. Incident and accident logging.	Khs. 200,000 per year	Health and Safety Officer, External Safety Auditor	Monthly safety compliance reports; incident investigation reports when required.
EM-9	**Landscape and Visual Impact**	**Photo documentation** from fixed vantage points to monitor changes in visual impact. Record progress of rehabilitation and landscaping activities.	Khs. 100,000 per year	Environmental Officer, Landscape Architect	Bi-annual visual impact assessment reports.
EM-10	**Socio-economic Impacts**	**Household surveys** and **community consultations** to gauge local perceptions, socio-economic benefits, and any negative impacts.	Khs. 200,000 per year	Social Impact Consultant, Community Liaison Officer	Annual social impact assessment report with recommendations for community engagement.

Risk Management Matrix

Table 2: Risk Management Matrix

Code	Event	Risk Nature/Description	Risk Level	Prevention Measure	Preparedness/Management Action	Alert Notification Officer	Supervision
RM-01	**Air Pollution from Dust**	Dust generated during excavation, transportation of materials, and construction activities.	High	Use dust suppressants like water spraying, limit earthworks during dry/windy conditions, install dust barriers.	Regular dust monitoring, adjust suppression measures as needed.	Environmental Officer	Site Supervisor
RM-02	**Noise Pollution**	High noise levels from heavy	Medium	Use noise barriers, limit	Implement noise monitoring; provide PPE to workers.	Health and Safety Officer	Project Manager

		machinery, construction activities, and transport.		construction to daytime, maintain machinery.			
RM-03	**Soil Erosion**	Increased soil erosion due to land clearing, excavation, and site preparation.	Medium	Implement erosion control measures such as terracing, mulching, and retaining walls.	Conduct regular site inspections, especially after rainfall; stabilize exposed soil.	Environmental Officer	Site Supervisor
RM-04	**Chemical Spills and Hazardous Material Handling**	Accidental spills of fuels, oils, and hazardous materials during storage and use.	High	Secure storage areas, secondary containment, regular inspections.	Immediate containment of spills, use spill kits; report to authorities if needed.	Health and Safety Officer	Site Supervisor
RM-05	**Fire Hazards**	Fire risks due to machinery, electrical faults, or storage of flammable materials.	High	Install fire extinguishers, implement smoking restrictions, conduct fire safety training.	Emergency fire response plan; conduct regular fire drills.	Health and Safety Officer	Project Manager
RM-06	**Worker Injuries and Accidents**	Risk of injury from machinery operation, falls, or manual handling.	High	Provide appropriate PPE, safety training, and equipment maintenance.	On-site first aid stations, emergency response plan; immediate medical assistance in case of accidents.	Health and Safety Officer	Safety Auditor
RM-07	**Community Health Risks**	Dust, noise, and construction activities impacting local community health.	Medium	Install noise barriers, regular communication with local communities, use low-	Conduct health assessments, set up complaint mechanisms; adjust operations based on community feedback.	Community Liaison Officer	Project Manager

				emission equipment.			
RM-08	**Biodiversity Loss**	Loss or disturbance of wildlife and plant species due to land clearing.	Medium	Conduct pre-construction ecological surveys, limit clearing to non-sensitive areas, create buffer zones.	Implement habitat restoration; monitor species during and post-construction.	Biodiversity Consultant	Environmental Officer
RM-09	**Equipment and Machinery Failure**	Breakdowns of heavy machinery causing delays and safety risks.	Medium	Regular maintenance, use of high-quality equipment, conduct inspections.	Have backup equipment available; quick repair and replacement.	Mechanical Supervisor	Maintenance Engineer
RM-10	**Unauthorized Access and Vandalism**	Trespassing, theft, or vandalism at the construction site.	Low	Install fencing, employ security personnel, CCTV monitoring.	Quick reporting of incidents; increase security patrols if necessary.	Security Officer	Site Supervisor
RM-11	**Legal Non-compliance**	Failure to meet environmental or safety regulations leading to fines or work stoppages.	High	Ensure proper permits and approvals, conduct regular compliance audits.	Immediate rectification of non-compliance; coordinate with authorities.	Compliance Officer	Project Manager
RM-12	**Solid Waste Mismanagement**	Improper disposal of construction waste leading to pollution and regulatory fines.	Medium	Implement a waste management plan, segregate waste, use licensed waste handlers.	Regular inspections of waste storage areas; adjust disposal methods as needed.	Waste Management Officer	Environmental Officer

RM-13	**Supply Chain Delays**	Disruptions in material supply leading to construction delays.	Medium	Diversify suppliers, maintain buffer stock, regular supplier assessments.	Implement contingency plans; adjust schedules if delays occur.	Procurement Officer	Project Manager

Environmental and Social Management Plan (ESMP) Matrix

Table 3: Environmental and Social Management Plan (ESMP) Matrix

Code	Impacts	Mitigation Measures	Deadline for Completion	Cost Estimate	Key Performance Indicator (KPI)	Implementation Responsibility	Monitoring/Oversight
ESMP-01	**Air Pollution (Dust and Emissions)**	Use of water sprays for dust control, proper maintenance of machinery to reduce emissions, install dust screens.	Throughout construction phase	Ksh. 200,000	Reduced visible dust; Air quality meets regulatory standards (PM2.5, PM10).	Contractor	Environmental Officer
ESMP-02	**Noise Pollution**	Limit construction activities to daytime hours; use of noise barriers; regular equipment maintenance.	Throughout construction phase	Ksh. 200,000	Noise levels do not exceed 85 dB at site boundaries; Community complaints minimized.	Site Supervisor	Health and Safety Officer
ESMP-03	**Soil Erosion**	Use of terracing, grass cover, and retaining walls in high-risk areas;	Before and during rainy seasons	Ksh. 200,000	No visible signs of severe erosion; stable slopes maintained.	Contractor, Landscaping Team	Site Supervisor, Environmental Officer

		restrict clearing to dry conditions.					
ESMP-04	**Loss of Vegetation**	Conduct pre-construction vegetation surveys; transplant or replace significant trees; landscape with native species.	Before and after construction phase	Ksh. 250,000	Vegetation cover restored; survival rate of transplanted species ≥80%.	Contractor, Biodiversity Consultant	Environmental Officer
ESMP-05	**Waste Generation (Solid Waste)**	Implement a waste management plan; segregation of recyclables, use licensed waste handlers, ensure proper disposal.	Throughout project lifecycle	Ksh. 200,000	90% of construction waste handled according to the waste management plan; zero illegal dumping incidents.	Waste Management Officer	Environmental Officer
ESMP-06	**Health and Safety Risks for Workers**	Conduct safety training, enforce use of PPE, establish emergency procedures.	Prior to and during construction	Ksh. 250,000	Zero lost-time injuries; >95% PPE compliance among workers.	Health and Safety Officer	Project Manager, Safety Auditor
ESMP-07	**Biodiversity Impacts (Fauna Disturbance)**	Set aside buffer zones, minimize construction during breeding seasons, use wildlife corridors.	Before and during sensitive periods	Ksh. 200,000	No significant wildlife casualties; fauna monitoring shows normal patterns.	Biodiversity Consultant	Environmental Officer, Local Wildlife Authority
ESMP-08	**Soil Contamination**	Use of non-toxic construction materials; restrict heavy machinery	Before and after construction	Ksh. 200,000	Soil contaminant levels below regulatory limits; no adverse	Contractor	Environmental Officer, Agricultural Extension Officer

		in sensitive areas; conduct soil testing.			impact detected in soil samples.		
ESMP-09	**Visual Impact (Aesthetic Changes)**	Use of natural materials for construction, implement landscaping plans, maintain vegetation cover.	During and after construction	Ksh. 250,000	Project integrates with surrounding landscape; positive feedback from visual impact assessments.	Landscape Architect	Environmental Officer, Local Planning Authority
ESMP-10	**Energy Use and Efficiency**	Implement energy-saving technologies, monitor energy consumption, use renewable energy where possible.	Throughout construction and operation	Ksh. 300,000	Energy consumption reduced by 20% compared to baseline; renewable energy contribution ≥10%.	Energy Consultant	Project Manager, Environmental Officer
ESMP-11	**Public Health Impacts**	Implement pest control measures, control dust and emissions, manage noise levels.	Throughout project lifecycle	Ksh. 200,000	No major health incidents reported; community health assessments show no significant adverse effects.	Health and Safety Officer	Public Health Officer, Project Manager

Social Impacts Management

Table 4: Social Impacts Management

Anticipated Environmental and Social Impacts	**Proposed Monitoring and Implementation including performance indicators**	**Monitoring Indicators**	***Responsible Institutions***	***Cost estimate (Kshs)***
Construction work force Increased communicable diseases such as HIV/AIDS, STD	• Conduct education and awareness creation campaigns on the spread and transmission of STDs and HIV/AIDS for construction workers and local communities living close to the construction camp sites. • Implement interventions on sexual and reproductive health including providing information regarding transmission and safer sex practices • Develop and implement HIV/AIDS awareness and prevention program. Develop mechanism which will allow employees to get information on HIV/AIDS alleviation programs.	• No of sensitization sessions • Trends in diseases	Project Management Unit Contractor AfDB	100,000
Risk of Gender Based Violence	• Integrate measures for prevention and handling Gender Based Violence (GBV) and Sexual Exploitation and Abuse (SEA) in the contractor's environmental and social management plan (C-ESMP). • Record and report every Gender Based Violence (GBV)-related incident and take appropriate actions • Develop an induction programme, including a Code of Conduct, for all workers directly related to this project. A copy of the Code of Conduct should be presented to all workers and signed by each workers • Provide means for women workers and other community members to report abuse in the work place	• Cases of GBV reported and solved	Project Management Unit Contractor AfDB	200,000

	• Conduct monthly community leader's engagement meeting to discuss incidents related to violence against girls and women involving project workers			
Potential Changes to social fabric	• Undertake broader community engagement before the commencement and during implementation of the project • Preference to locals for employment opportunities • Implement awareness campaign on the impact of labor influx	• Level of cohesion	• Contractor PMT	100,000
Vulnerable Members of Community	• Employ more community women in skilled and clerical positions • Ensure fairness in allocation of stalls for the tourist markets	•	• Contractor • PMT	200,000

Environmental and Social Management Plan (ESMP) implementation indicators

1. **Grievance Redress Mechanism (GRM) Accessibility and Responsiveness**
    - Number of grievances reported and resolved within the stipulated time frame.
    - Percentage of stakeholders aware of the GRM.
    - Stakeholder satisfaction with the grievance resolution process.
2. **Compliance with Environmental Standards**
    - Percentage of project activities complying with environmental safeguards and regulations.
3. **Community Health and Safety Measures**
    - Frequency and severity of incidents affecting community health and safety.
    - Effectiveness of implemented safety measures (e.g., reduced accident rates).
4. **Stakeholder Engagement and Communication**
    - Number of stakeholder consultations and participation activities held.
    - Level of stakeholder satisfaction with the engagement process.
5. **Capacity Building and Training**
    - Number of training sessions conducted for project staff and local stakeholders on ESMP-related topics.
    - Percentage of participants demonstrating improved knowledge or skills post-training.

Roles of Project Implementation Entity (PIE)

- **Oversight and Strategic Guidance:** Ensure ESMP compliance across the project lifecycle and address escalated issues.
- **Policy and Legal Compliance:** Ensure alignment of project activities with national and international environmental and social regulations.
- **Stakeholder Engagement:** Facilitate high-level engagement with stakeholders, including government agencies, donors, and affected communities.

Roles of Project Implementation Unit (PIU)

- **ESMP Implementation Coordination:** Oversee day-to-day execution of ESMP mitigation, monitoring, and reporting activities.

- **Monitoring and Evaluation:** Conduct regular inspections and audits to ensure ESMP compliance.
- **Capacity Building:** Provide training for staff, contractors, and stakeholders on ESMP measures and standards.
- **Grievance Redress Mechanism (GRM):** Manage an accessible and transparent grievance process for affected parties.
- **Reporting:** Prepare and submit environmental and social compliance reports to the PIE and relevant authorities.

Coordination Mechanisms

- **Periodic Meetings:** Regular coordination between PIE, PIU, contractors, and other stakeholders.
- **Information Sharing:** Use of shared platforms for data and report dissemination.
- **GRM Linkage:** Clear communication channels for grievance handling and resolution tracking.

Estimated overall budget for the implementation of all environmental and social measures

Below is an itemized budget matrix for the implementation of environmental and social measures

Table 5: Implementation of environmental and social measures budget

Item	Description	Estimated Cost (KES)
1. Environmental Mitigation Measures		
- Pollution Control	Measures to prevent air, water, and soil pollution during construction and operation phases.	2,000,000
- Waste Management	Proper disposal and recycling of construction and operational waste.	1,000,000
- Biodiversity Conservation	Activities to protect local flora and fauna, including habitat restoration.	1,000,000
2. Social Mitigation Measures		
- Community Health and Safety	Programs to ensure the health and safety of local communities.	2,000,000
- Stakeholder Engagement	Continuous engagement with stakeholders, including public consultations.	1,000,000
- Grievance Redress Mechanism (GRM)	Establishment and operation of a system for addressing public grievances.	1,000,000
3. Capacity Building and Training		

- Training for Project Staff	Workshops and courses on ESMP implementation for project personnel.	2,000,000
- Community Training Programs	Educating local communities on environmental and social aspects of the project.	500,000
4. Monitoring and Audits		
- Environmental Audits	Regular audits to ensure compliance with environmental standards.	1,000,000
- Social Audits	Assessments to ensure social measures are effectively implemented.	500,000
- Reporting and Documentation	Preparation and dissemination of regular reports on ESMP implementation.	700,000
5. Contingency Fund		
- Unforeseen Environmental/Social Issues	Reserve funds for unexpected issues requiring immediate action.	1,000,000
Total Estimated Budget		13,700,000

1. INTRODUCTION

1.1. Project Background

The idea of establishing a University dates back many years to the early 1960s when the Njuri Ncheke (Council of elders of the Meru people) conceived an idea of establishing an institution of higher education in Meru. In 2008, the Government of Kenya converted Meru College of Technology (MECOTECH) into a University and named it Meru University College of Science and Technology (MUCST). It was established through Legal Notice No. 103 of 18th July 2008 as a constituent college of Jomo Kenyatta University of Agriculture and Technology (JKUAT). Meru University of Science and Technology (MUST) was established as a full-fledged University following the Award of Charter on 1st March, 2013

The Government of Kenya though the African Development Bank aims to enhance the quality and relevance in Higher Education, Science and Technology project. The specific objective of the project is to improve quality and relevance in the target faculties of science, technology and innovation in line with Kenya's Vision 2030 priorities for Education and Training. On the other hand, the Ministry of Education has the mandate of spearheading the transformation of Kenya into a knowledge economy. The mandate consists of two main strategic thrusts: The Science, Technology and Innovation (ST&I) and the human resource development. The Mission of the Ministry emphasizes on the promotion of quality and relevant education and integration of science and technology into the production system of the economy.

To successfully achieve this Mission the Ministry needs to construct centres of excellence in various universities including Meru University of science and technology. This project is a flagship project in the Kenya Vision 2030 Medium Term Plans. This is aimed at value addition by addressing the limited technological capabilities and the need to enhance advanced research facilities access to Kenyan science and technology institutions. These centres of excellencies will further contribute to the development of the country's economy, generate knowledge, employment, and access to new markets so that the advantage arising from the high educational attainment can become an effective factor of competitiveness, developing initiatives that make possible

business activities based on knowledge. The CoE is also projected to be a world class high technology research facility to cater for research needs at the national, regional and international levels.

According to the provisions of the Environmental Management and Coordination Act (EMCA, 1999), a project of such magnitude should be subjected to Environmental Impact Assessment (EIA).

1.2. Project financier

This project will be financed by the African Development Bank (AfDB) through the ministry of education. This is in line with its mission to promote education, skills development, and innovation in Africa.

1.3. ESIA Objectives

The objective of the centre of excellence in electrical and electronic engineering at MUST is to provide the highest quality of training to students in multi-disciplinary practical education and theory related to Electrical and Mechatronics Engineering leading to professional careers in the country, the region, and beyond. The centre graduates will have necessary knowledge and skills for contemporary areas of electrical and mechatronics engineering that they will use to solve national priority issues such as food security, climate adaptation, green energy, universal health care and affordable housing for overall economic development.

The aim of ESIA is to evaluate the effects/impacts of proposed development in relation to the general environmental aspects i.e. physical, biological, and social-economic environments. Generally, it seeks to influence the protection and co-existence of the development with the surroundings as well as the compatibility of the proposed development to the area. Eventually, the ESIA will guarantee and augment sustainable environmental management during implementation as well as operation of the project.

The main objective is that prior to the commencement of activity implementation at the proposed project sites, there is a need to conduct an ESIA study to identify any adverse environmental and social impacts associated with the project construction/rehabilitation and propose mitigation measures to address those challenges. To achieve this, AfDB in collaboration with the Ministry of Education has engaged an Individual Environmental and Social Safeguards Consultant to conduct environmental and social impact assessment prior to the approvals of the Project activities. The specific objectives of the ESIA are to:

a) describe the nature of construction to be undertaken;
b) verify compliance with environmental laws, policies and regulations as well as industry best practice and standards;
c) identify and analyze alternatives to the envisaged project;
d) Identify, analyze and propose mitigation measures for positive and negative impacts and enhancement measures for positive impacts to be undertaken during and after the implementation of the project including; recommending cost effective measures to be used to mitigate against the anticipated negative impacts;
e) seek the views of affected persons;
f) Identification of specific roles and responsibilities, and outlining the necessary reporting procedures for managing and monitoring environmental and social risks related to subprojects,
g) Establishing project funding required to implement the ESMP requirements and
h) Providing lessons learned for application to future projects.
i) Prepare an Environmental and Social Management Plan (ESMP) report compliant with the Environment Assessment Regulations and in line with the Bank Environmental and Social Safeguards Requirements.

Based on the outcomes of the environmental and social impact assessment, the assignment will develop an environmental and social management plan in compliance with the African Development Bank's Environmental and Social Safeguards Policy requirements. The aim is to develop mitigation measures that will address any adverse environmental and social impacts the project activities may bring about, including the cost implications of implementing those

mitigation measures, develop a monitoring timeframe and assign responsibilities to implement the measures.

1.4. Terms of Reference for the ESIA

The ESIA included the necessary specialist studies to determine the environmental impacts relating to the biophysical and socio-economic aspects and to determine the issues or concerns from the relevant authorities and interested and/or affected parties. The appropriate measures to ensure co-existence of the proposed development with other social and economic activities in the area are provided as part of ESMP. The consultant on behalf of the proponent conducted the study by incorporating the following terms of reference inter alia:

- The objectives of the project,
- A description of the location of the proposed project,
- The technology, procedures and processes used, in the implementation of the project,
- The materials used in the construction and implementation of the project,
- The products, by-products and waste generated by the project,
- A concise description of the national and county environmental legislative and regulatory framework, baseline information and any other relevant information related to the project
- To recommend a specific environmentally sound and affordable waste management system,
- Hold public participation forums
- The environmental impacts analysis of the project including direct, indirect, cumulative, irreversible, short-term and long-term impacts anticipated, social analysis, economic analysis and cultural analysis;
- Integration of climate change vulnerability assessment, adaptation and mitigation actions;
- Analysis of alternatives including project site, design, technologies and processes and reasons for preferring the proposed site, design, technologies and processes;
- An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment; including the cost, time frame and responsibility to implement the measures;
- Provision of an action plan for the prevention of foreseeable accidents, occupational

diseases and management of hazardous activities in the course of carrying out activities of the project;

- Identification of gaps in knowledge and uncertainties which were encountered in compiling the information.

1.5. Responsibility and Undertaking

The proponent had the responsibility to provide information required by the Consultant which included: site plan(s) showing roads, service lines, buildings layout and the actual sizes of the sites, details of raw materials, proposed process outline and anticipated by-products, future development plans, operation permits and conditions, land-ownership documents and site history, and estimated investment costs. The output from the consultants includes the following:

- An Environmental and Social Impact Assessment report comprising of an executive summary, assessment approach, baseline conditions, anticipated impacts and proposed mitigation measures
- An Environmental and Social Management Plan outline, which also forms part of the report recommendations.

1.6. Methodology

The methodology used for preparation of this ESIA report is stated in the steps below:

i. Screening of the project. This step was applied to determine whether an ESIA was required and what level of assessment was necessary. Issues considered included the physical location, sensitive receptors in close proximity to the site and the nature of anticipated impacts. It was concluded that the proposed project falls within the category of projects under the second schedule of EMCA CAP 387 that requires an Environmental Impact Assessment to be carried out before implementation,

ii. A scoping exercise that identified the key issues to be addressed in the assessment. The scoping process helped narrow down to the most critical issues requiring attention during the assessment. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects. The site history and the facilities in close proximity to the site were considered during this stage,

iii. Document review on the nature of the proposed activities, policy and legal framework, environmental setting of the area and other available relevant data/information,
iv. Public participation and discussions with the local community, proponent and the project team regarding the proposed project. The Communities surrounding the project site were interviewed and they expressed their views towards the upcoming project. In addition to that, questionnaires were administered to solicit for more details and views from the surrounding facilities and businesses. Meetings were also held in adjacent estates to collect residents' views.
v. Physical evaluation of the project site and the surrounding areas using a pre-prepared checklist with specific focus on environmental and human safety issues that are likely to be affected.
vi. Reviewing the proposed project designs and implementation plan/schedules with a view to suggesting suitable alternatives,
vii. Developing an EMP outline with responsibilities, schedules, indicators and time frames among other aspects,
viii. A comprehensive report including issues as listed in the Environmental (Impact Assessment) Regulations 2003.

1.7. Constraints and Limitations

This report presents information that is generally consistent with the data and information gathered through various sources and approaches mentioned above. The findings and issues presented from the stakeholder and community engagement program are representative of the general views and perceptions of some selected people and stakeholders. As such, they may not cover the specific issues for some unique situations or some individuals affected by the project.

The validity of the secondary data used in this report should be viewed with reference to the data source publication dates. It is therefore necessary to view such information with reference to the time reference and the limitations specific to the publication.

1.8. ESIA Report Structure

- Chapter one presents the introduction on the background information of the proposed project,

its development objectives and the proposed project implementation arrangements.

- Chapter two presents the project description, in which there is a description of the location and relevant components of the project and their activities.
- Chapter three presents the baseline information relevant to environmental characteristics, which gives details concerning the Bio-physical environment, socio-economic and Gender equality and Gender Based Violence issues at the project area
- Chapter four illustrates policy, legal and administrative framework, which are the relevant National policies, acts and AFDB standards applicable to construction projects.
- Chapter five describes the positive and negative environmental impact of the project that are likely to be generated from the different phases (the planning and designing, construction, operation and maintenance and the demobilization phases).
- Chapter six presents the analysis of the project alternatives
- Chapter seven presents the consultation exercise at the project area detailing the list of stakeholders consulted and the issues raised.
- Chapter eight presents the mitigation measure for the potential negative impact of the project.
- Chapter nine presents the summary and conclusions of the study.
- Appendices, this section presents some key primary information collected during the study as attached at the end of this report.

2. PROJECT DESCRIPTION

The Proposed Centre of Excellence (CoE) in Electrical and Electronic Engineering is an ambitious initiative aimed at fostering cutting-edge research and innovation in electrical, electronic and mechatronic engineering. The envisioned facility is structured to accommodate various divisions, each dedicated to specific areas of research and development. It will be situated within a two-floored building that will serve as a hub for interdisciplinary collaboration, academic exchange, and technological advancement. The CoE development shall comprise the construction of the following laboratories and workshops:

1. Renewable Energy & smart grid laboratory
2. Power system switchgear and protection laboratory
3. Electrical Machines & Power system laboratory
4. Measurement, Instrumentation & Control laboratory
5. High Voltage laboratory
6. Electronics laboratory
7. Telecommunication laboratory
8. Communication and transmission laboratory
9. Mechatronics laboratory

Renewable Energy & smart grid laboratory

A reliable and sustainable power grid is key to enabling increased use of renewable energies, but variability and uncertainty in renewable generation, especially wind power, have seriously challenged the operation of power grids and future planning for integrating renewable resources. The lab will be comprised of synchronous generators, solar panels, and smart grid equipment for micro grid analysis and control purposes. The laboratory is intended to provide infrastructure for R&D, demonstration, verification and testing over a wide range of Smart Grid use cases.

It will be equipped with the following equipment among others: Solar training kits, Solar Array Simulator, Solar System Analyzer (Photovoltaic I-V Curve Tester), Advanced Wind Energy Trainer with Simulator, Smart grid trainer kit, Wind, solar energy trainers, Solar photovoltaic

panels, Hybrid converters, Lithium-Ion Batteries, Solar Hydrogen Education Kit, Solar Installation, Micro Wind Turbine, Digital UPS trainer among others.

Power system switch gear and protection Lab

The Switchgear and Protection Lab will be equipped with modern facilities to give the students real-life exposure of power system protection. The lab will be equipped with the following equipment among others: Transformer Protection Simulator, Generator Protection Simulator, Feeder Protection Simulator, Ac Motor Protection Simulator, OCB (Oil Circuit Breaker) Test Kits, Vacuum Circuit Breaker (VCB)Test Kits

Electrical Machines and power systems Lab

The objective of Electrical Machines Laboratory is to impart deep understanding of all types of DC Machines, AC Machines (such as Induction and Synchronous Motors, Transformers, DC Generator and Alternators). The experiments to be performed by the students will be designed such as to make them understand about the theory and working of all these machines. The laboratory will also be used for research activities in area of machines and to carry out the project work assigned by faculty from time to time.

The laboratory will be equipped with Power System Transmission line trainer, Transformer Trainer, Distribution Trainer, Regulated Power Supply Units, Digital Multimeters, Digital function generators, Digital Storage Oscilloscopes, Computer-Aided System of Electric Measurements and Laboratory Tests Provided with Control Software, Three-Phase Asynchronous Cage Motor, Three-Phase Asynchronous Wound-Rotor Motor, Asynchronous Single-Phase Motor with Starting Capacitor, Three-Phase Synchronous Motor / Generator with Asynchronous Starting, Universal AC /DC Motor, Direct-Current Motor / Generator with Separate / Compound / Series Excitation, Electrodynamometer – Dc Dynamometer, Measurement Unit of Torque, Speed, Mechanical Power, Single-Phase Transformer with 50%,86.6% tapings, Three-Phase Transformer Mod. P-14/EV, Magnetic Powder Brake & Electronic Control, Shunt Field Rheostat Generator, Shunt Field Rheostat Motor , Series Field Rheostat Motor, D.C. Starting Rheostat Rotor Starting Stator Starting, Variable Resistive Load, Variable Inductive Load, Variable Capacitive Load, Three-Phase Motor Drive, Experimental Flywheel, Special and Micro machines, Electrical Machine drives Trainer, Machine design equipment, DC motor starting and control system, Tong

tester(Clamp meter), Energy Meter(5-10A,240V), Digital Contact Type Tachometers, 1- Ø Autotransformers, Direct-Current Motor /Generator With Separate / Compound Excitation Mod. P-1/EV, Double Busbar Extension Leybold 745 654, AC single phase split phase induction motors, AC single phase capacitor-start-capacitor-run induction motors, AC three phase induction machines, Data Acquisition and Control Interface (9063-00) - LabVolt

Measurement, Instrumentation & Control Lab

The aim of this laboratory is to impart the practical knowledge about various process control techniques used in modern process industries. It will also help the students understand and practice the modeling, simulation, and implementation of a physical dynamical system by a linear time invariant ordinary differential equation.

This laboratory will be equipped with Breakdown test machines, Digital Tachometer, Sensors and transducers, PLCs, Microcontrollers, Control engineering trainers, DC Position Control Kits, AC Position Control Kits, AC Servomotor Study Kit, Analog Compensation Design Kit, Magnetic Levitation Kit, stepper Motor Study Kit, DC motor control unit, AC motor control unit, AC Servo Motor Speed Control Trainer, DC Servo Motor Speed Control Trainer, Synchro Transmitter & Receiver kits, LVDT Trainers, Temperature Measurement Trainers, Schering Bridge with Digital Null Detector & Oscillator, Anderson bridge, Kelvin double bridge, Portable Power Factor Meter Single Phase, Crompton DC Potentiometer, Single phase inductive load, 1 HP Black Three Phase Inductive Load Bank, 415 V, Three phase capacitive load

High Voltage Lab

The laboratory will focus on high voltage research, evaluation, and education. This will be designed to meet the evaluation needs of the industry and provides the necessary environment for academic research in high voltage engineering. The lab will be equipped with High Voltage Technology Trainer, Power systems trainer, Power Quality Analyzer, 200kv, 300kv, 400kv, 600kv, 800kv, 1200kv High Voltage Lightning Impulse Voltage Generator Lab Testing Equipment, High voltage kit (generation of AC, DC and impulse voltages), AC Hipot Tester(Testing Transformer), Megger 5kV DC Dielectric Test Set, Megger Transformer Oil Test Set, Insulation Test set, Schering Bridge, Tan delta and capacitance measuring equipment and High Voltage DC Transmission Line Trainer

Electronics Lab

This laboratory's aim is to impart practical knowledge of power electronic components and their applications. It will be equipped with the Power Electronics Training Workbench, Integrated Circuits, IoT Trainer Kit, 1 Phase SCR Modules, Digital 3 Phase HV Thyristor Control Trainer, For Laboratory, Model: XPO-HVDC, Single Phase Cycloconverter, SCR DC Motor Speed Controller By chopper training kit, SCR Forced Commutation Trainers, SCR Series Inverter Trainers, SCR Parallel Inverter Trainers, D.C. Step Down Mosfet Chopper Trainer Kit, DC-DC Buck Converters, DC-DC Buck -Boost converter Power Supply Module, UPS Trainers Kit, Microprocessor Trainer Kits 8085, 8086, 8051, Microcontroller Trainer Kits 8085, 8086, 8051, PCB etching machine, PCB making machines, Etching machines, Digital Design Lab with Solderless Breadboard & Power Supply, Pick and place machine for Surface Mount Devices (SMD) PCB components, Logic gates, Capacitance box, Inductance box, Regulated Power Supply unit, Cathode Ray Oscilloscope, Encoder And Decoder Kit, Multiplexer And Demultiplexer Kit, Single phase Fully controlled Bridge converter, Board Plotter PCB Machine ProtoMat S-42, Variable AC power supply and Smart Energy meter

Telecommunication lab

This Lab will deal with three important aspects of telecommunications: fixed site antennas, radio wave propagation, and small antennas proximate to the body. Antennas are the essential communication link. Antennas for cellular phones and all types of wireless devices link us to everyone and everything. Antennas provide the vital links to and from everything out there. The future of antennas reaches the stars.- antennas. Television, which now is considered one of the most basic amenities, is one of the strongest medium of mass communication. Radar is used greatly in defense. It is very important for an electronics and communication engineer to understand the basics behind these technologies. This Lab will introduce field of TV & RADAR, right from beginning to latest trend so that they can contribute to the development, procurement, manufacture, and application of TV & RADAR system. - TV and radar. This Laboratory will be equipped with Radar Trainer (Mod. M702-E/EV), Radio/Transmitter AM/SSB/FM/RADIO CONTROL MCM24/EV Kit with Accessories, Satellite Communications Trainer (Mod. MW-AS/EV), Cellular Communications Trainer, ISDN Trainer, TV systems Trainer, Optical communications

trainer (MCM40/EV), Short range wireless communications, Optical Spectrum Analyzer, Fiber Fusion Splicing Machine Signal Fire A1-9, ED-AMP ,Erbium Doped Fiber Amplifier, Advanced Fiber Optic Communication Trainer and OTDR Units

Communication and transmission lab

This Laboratory will be used to understand the principles of analog and digital communication engineering. The lab wiil be equipped with various modulation and demodulation training boards for AM, FM, SSB, DSP, ASK, FSK, PSK, Delta, adaptive delta, TDM-PCM techniques and sufficient number of CROs, function generator and DSOs. - communication systems

This Lab will introduce the basic concepts and techniques for processing signals. Additionally, Lab will provide the learners fairly comprehensive coverage of the basic principles and practical aspects of modern digital circuits and systems. - signals

The Communication networks and transmission line serves as the backbone in integrating the circuit components in a microwave device. Thus, the understanding of the electromagnetic wave propagation in free space and transmission lines are very critical in designing a communication system. This Lab will introduce students to the concept of transmission lines, which forms the basis for understanding RF and microwave technology. Students will understand the need for transmission lines and also the complexities involved in dealing with high-frequency systems. - Communication networks and transmission line. The lab will be equipped with Communication & Networks Trainer, Analogue communications trainer, Acoustics training equipment, Digital communications trainer, Network Analyzer, Spectrum Analyzer, Transmission Lines and Antennas (Mod. LA/EV), Antenna Measuring System (Mod. ANT-M/EV), Microwave Trainer (MW-B-C/EV), Frequency Counter, Rigol DSG815 1.5GHz RF Signal Generator and SWR Meter

Mechatronics lab

The objective of this lab is to provide skills and knowledge to design, construct, and analyze mechatronic systems. The lab will cater for the need to provide multi-domain knowledge and system level integration which is expected to be the key role for a mechatronics engineers. The laboratory will hold sophisticated equipment which will be used for conducting academic courses as well as research for faculty and students. The availability of most advanced hardware as well as software tools in the laboratory will help train our students practically in all the four modules.

This lab will be equipped with basic pneumatic trainer kits with manual and electrical controls, hydraulic trainer kits, hydraulics and pneumatics systems simulation software, microcontroller kits with stepper motor and drive circuit sets, Mechatronics System, Motor control training system, Thermal Process Control System, Analytical Process Control System, Hydraulic and pneumatic training system, TPX00031 SENSOR KITARDUINO, PLC (programmable logic controller) trainer kits, DCS Trainer Kit, Programmable systems Simulator, Basic 3-Floor Lift, Process Control Multivariable System, Pieces Distribution Module, Swivel Arm Module, Pieces Thickness Measurement Module, Linear Storage Module, Rotary Arm Module, Drilling Station Module, Conveyor Module, Conveyor and Multiple Selection Module, 6-Axis Robotic Arm, Arduino Trainer Panel, pneumatic trainer kits with manual and electrical controls, hydraulic trainer kits, hydraulics and pneumatics systems simulation software.

2.1. Scope of project

The government policy on all new development projects requires that an environmental impact assessment be carried out at the design stage of the proposed undertaking to ensure that significant impacts on the environment are taken into consideration during the construction, operation and decommissioning of the facility. The scope of this ESIA, therefore, covered:

- The baseline environmental conditions of the project area,
- Description of the proposed project,
- Provisions of the environmental laws pertinent to the project,
- Identification and discussion of any adverse negative impacts to the environment anticipated from the proposed project,
- Appropriate mitigation measures,
- Provision of an environmental management plan outline.

The scope of the assessment covered the project site, area in close proximity to the proposed site, construction & operation works and the utilities under the project. The output of this work was a comprehensive ESIA report for the purposes of applying for an ESIA license.

2.2. Ground Floor:

The ground floor will serve as the main entrance and reception area, providing a welcoming

environment for visitors and guests. Additionally, it will feature a business center to facilitate administrative tasks, a security office to ensure the safety and security of the premises. The floor will house four laboratories with their associated equipment as shown below;

1. Renewable Energy & smart grid laboratory
    - ✓ Solar training kit - To teach and demonstrate the principles and applications of solar energy
    - ✓ Solar Array Simulator - To emulate the electrical characteristics of a solar photovoltaic (PV) array. This allows for the testing and development of solar power systems without the need for actual sunlight or physical solar panels
    - ✓ Solar System Analyzer (Photovoltaic I-V Curve Tester) - For evaluating, monitoring, and optimizing the performance of solar photovoltaic (PV) systems.
    - ✓ Advanced Wind Energy Trainer with Simulator – For education, training, research teach the principles and practical aspects of wind energy technology. It combines hardware and software to simulate the behavior of wind turbines and wind power systems, providing a comprehensive learning experience
    - ✓ Smart grid trainer kit - For education, training and research the principles and applications of smart grid technology. It provides a comprehensive and realistic experience, preparing users for real-world applications and contributing to the advancement of modern, efficient, and sustainable grid systems
    - ✓ **Hybrid Converters**: These are used to study and experiment with hybrid power conversion systems that combine different technologies, such as AC and DC converters. Students learn about the operation, efficiency, and control of systems that integrate multiple types of power converters.
    - ✓ **Lithium-Ion Batteries**: Used for studying the characteristics, charging, discharging, and management of lithium-ion batteries. Students learn about battery technology, including performance, safety, and applications in various systems.
    - ✓ **Solar Hydrogen Education Kit**: Provides hands-on experience with solar-powered hydrogen generation systems. Students learn about renewable energy technologies, including the conversion of solar energy into hydrogen through electrolysis and its potential applications.

- ✓ **Micro Wind Turbine**: Demonstrates the principles of wind energy conversion on a small scale. Students study wind turbine design, efficiency, and energy generation, exploring how wind power can be harnessed for various applications.

2. Power system switchgear and protection laboratory
    1. Circuit Breaker Trainer – For education, training, research and provision of hands-on learning experiences on the principles, operation, and maintenance of circuit breakers.
    2. Protection Relay Test Set - A Protection Relay Test Set is used to teach students the principles and operation of protection relays in electrical systems. It allows for the testing, calibration, and verification of relay functionality under various fault conditions, ensuring they respond accurately to protect electrical equipment.
    3. Generator Protection Simulator - The Generator Protection Simulator is a training tool that simulates the operation and protection of generators. It helps students understand how to protect generators from faults such as overcurrent, overvoltage, and underfrequency, and to learn the setup and testing of protection schemes.
    4. AC Motor Protection Simulator - An AC Motor Protection Simulator is designed to demonstrate the protection mechanisms for AC motors. It provides practical training on how to protect motors from conditions like overloads, short circuits, and phase failures, and how to set up and test
    5. Protection Relay Test Set: Used to test and calibrate protection relays, which are critical for ensuring the safety and reliability of electrical systems. Students learn how to verify and adjust relay settings to protect electrical circuits from faults.
    6. Generator Protection Simulator: Simulates various fault conditions and scenarios for generator protection systems. It helps students understand how to configure and test protective devices for generators and how to respond to different operational challenges.
    7. AC Motor Protection Simulator: Provides a platform for students to study the protection mechanisms of AC motors. It allows for the simulation of faults and protection strategies, helping students learn how to protect motors from issues like overloads, short circuits, and phase failures.

8. Power Transmission Line Trainer: Offers practical training on the design, operation, and protection of power transmission lines. Students can explore concepts such as line losses, voltage drops, and line protection in a controlled environment.
9. Power Factor Correction Control Trainer: Teaches students about power factor correction methods and devices. It helps in understanding how to improve the efficiency of electrical systems by adjusting the power factor and minimizing losses.
10. Protection Relays for High- and Low-voltage Network: Provides hands-on experience with protection relays used in both high- and low-voltage networks. Students learn about the differences in protection strategies and settings required for different voltage levels.
11. Panel for Studying and Testing Distribution Systems (Neutral Point Connection): Allows students to study and test the behavior of electrical distribution systems with various neutral point connections. It helps in understanding the implications of different grounding methods on system stability and safety.
12. The ETI PI-6000 Mobile Circuit Breaker Test Set: Used for testing and calibrating circuit breakers in various settings. It provides students with the skills needed to ensure circuit breakers function correctly and meet safety standards.
13. Vacuum Circuit Breaker (VCB) Test Kits: Designed for testing the performance and reliability of vacuum circuit breakers. Students learn how to assess the operation of these breakers and troubleshoot potential issues.
14. Real-Time Power Grid Simulator: Simulates the operation of a power grid in real-time, allowing students to experiment with grid management, fault analysis, and stability. It provides an interactive platform for understanding complex grid dynamics and operational strategies.

3. Electrical Machines & Power system laboratory
   - ✓ **Power System Transmission Line Trainer**: Helps students understand the principles of power transmission, including line losses, voltage drops, and load

distribution. It provides hands-on experience with real-world transmission line scenarios.

- ✓ **Transformer Trainer**: Used for demonstrating and studying the operation, characteristics, and testing of transformers. Students learn about transformer design, efficiency, and various testing methods.
- ✓ **Distribution Trainer**: Provides practical experience with electrical distribution systems. It allows students to study and test various components of distribution networks, including transformers, circuit breakers, and protection systems.
- ✓ **Regulated Power Supply Units**: Supply a stable and adjustable voltage or current for testing and powering electrical circuits and devices. Essential for experiments requiring precise power control.
- ✓ **Digital Multimeters**: Measure electrical properties such as voltage, current, and resistance. They are essential for diagnosing and troubleshooting electrical circuits and devices.
- ✓ **Digital Function Generators**: Produce various waveforms (sine, square, triangle) for testing and analyzing electronic circuits. Useful for signal generation in experiments and circuit testing.
- ✓ **Digital Storage Oscilloscopes**: Capture and display electrical signals in real time. They are used to observe waveform characteristics and analyze signal behavior in electronic circuits.
- ✓ **Computer-Aided System of Electric Measurements and Laboratory Tests Provided with Control Software**: Integrates computer software with measurement hardware for automated data collection, analysis, and control of experiments.
- ✓ **Three-Phase Asynchronous Cage Motor**: Demonstrates the operation of a standard three-phase induction motor, used to study motor performance, efficiency, and starting characteristics.
- ✓ **Three-Phase Asynchronous Wound-Rotor Motor**: Used to study the behavior and control of wound-rotor induction motors, including rotor resistance variation and its effects on motor performance.

- ✓ **Asynchronous Single-Phase Motor with Starting Capacitor**: Provides insights into single-phase motor operation and the role of starting capacitors in improving starting torque.
- ✓ **Three-Phase Synchronous Motor / Generator with Asynchronous Starting**: Demonstrates the operation of a synchronous motor and its transition from asynchronous starting to synchronous operation.
- ✓ **Universal AC/DC Motor**: Allows students to study motors that can operate on both AC and DC power sources, providing a broad understanding of motor principles and characteristics.
- ✓ **Direct-Current Motor / Generator with Separate / Compound / Series Excitation**: Used to explore different excitation methods in DC motors and generators, including series, compound, and separate excitation.
- ✓ **Electrodynamometer – DC Dynamometer**: Measures the torque and power output of DC motors and generators. It is used for performance testing and analysis.
- ✓ **Measurement Unit of Torque, Speed, Mechanical Power**: Measures and analyzes torque, speed, and mechanical power in motors and generators, aiding in performance evaluation.
- ✓ **Single-Phase Transformer with 50%, 86.6% Tapings**: Provides a range of voltage outputs for studying transformer operation and load characteristics.
- ✓ **Three-Phase Transformer Mod. P-14/EV**: Demonstrates three-phase transformer operation and is used for experiments related to three-phase systems and transformer testing.
- ✓ **Magnetic Powder Brake & Electronic Control**: Used to study braking and control systems in motors, allowing for the simulation of different load conditions.
- ✓ **Shunt Field Rheostat Generator**: Adjusts the field current in a generator to control its output voltage and performance.
- ✓ **Shunt Field Rheostat Motor**: Controls the field current in a shunt-wound motor, affecting its speed and torque characteristics.
- ✓ **Series Field Rheostat Motor**: Adjusts the field current in a series-wound motor to control its performance characteristics.

- ✓ **D.C. Starting Rheostat Rotor Starting Stator Starting**: Used to control the starting conditions of DC motors, including rotor and stator resistances.
- ✓ **Variable Resistive Load**: Provides adjustable resistive loads for testing and analyzing electrical circuits and power systems.
- ✓ **Variable Inductive Load**: Allows students to study the effects of varying inductive loads on electrical circuits and systems.
- ✓ **Variable Capacitive Load**: Provides adjustable capacitive loads for experiments related to capacitors and their impact on circuit behavior.
- ✓ **Three-Phase Motor Drive**: Used to study the control and operation of three-phase motors, including speed control and performance analysis.
- ✓ **Experimental Flywheel**: Demonstrates the effects of rotational inertia and angular momentum in mechanical systems, often used in conjunction with motors and generators.
- ✓ **Special and Micro Machines**: Include various specialized or miniature machines for studying specific principles and applications in electrical and mechanical engineering.
- ✓ **Electrical Machine Drives Trainer**: Provides hands-on training with electrical machine drives, including control techniques and performance analysis.
- ✓ **Machine Design Equipment**: Includes tools and equipment for studying and designing electrical machines, focusing on design principles and practical implementation.
- ✓ **DC Motor Starting and Control System**: Allows students to experiment with different starting and control methods for DC motors, including speed regulation and torque control.
- ✓ **Tong Tester (Clamp Meter)**: Measures current without disconnecting the circuit, useful for diagnosing electrical systems and measuring current in various applications.
- ✓ **Energy Meter (5-10A, 240V)**: Measures electrical energy consumption in circuits, helping students understand energy usage and efficiency.
- ✓ **Digital Contact Type Tachometers**: Measures rotational speed in mechanical systems, useful for analyzing motor performance and speed characteristics.

- ✓ **Autotransformers**: Provide variable voltage output for testing and experiments, allowing students to study voltage regulation and transformer principles.
- ✓ **Direct-Current Motor / Generator with Separate / Compound Excitation Mod. P-1/EV**: Used for studying DC motors and generators with various excitation methods, including separate and compound excitation.
- ✓ **Double Busbar Extension Leybold 745 654**: Expands the capabilities of a busbar system for experimenting with electrical distribution and switching.
- ✓ **AC Single Phase Split Phase Induction Motors**: Demonstrates the operation of split-phase induction motors, including starting and performance characteristics.
- ✓ **AC Single Phase Capacitor-Start-Capacitor-Run Induction Motors**: Provides insights into motors with both starting and running capacitors, used for various applications.
- ✓ **AC Three Phase Induction Machines**: Used for studying the operation, performance, and control of three-phase induction motors.
- ✓ **Data Acquisition and Control Interface (9063-00) – LabVolt**: Interfaces with laboratory equipment to collect and analyze data, providing a platform for automated experiments and control.

4. High Voltage laboratory

- ✓ **High Voltage Technology Trainer**: Provides hands-on experience with high voltage concepts, including generation, measurement, and safety. Students learn about the design and operation of high voltage systems and equipment.
- ✓ **Power Systems Trainer**: Offers practical training on various aspects of power systems, including generation, transmission, and distribution. It allows students to study and simulate real-world power system scenarios and components.
- ✓ **Power Quality Analyzer**: Measures and analyzes power quality parameters such as voltage sags, harmonics, and power factor. Helps students understand and troubleshoot issues related to power quality in electrical systems.
- ✓ **High Voltage Lightning Impulse Voltage Generator Lab Testing Equipment**: Simulates lightning strikes to test the insulation strength and response of electrical equipment. Used for testing equipment to ensure it can withstand high voltage surges.

- ✓ **High Voltage Kit (Generation of AC, DC, and Impulse Voltages)**: Provides the ability to generate and measure high voltage AC, DC, and impulse signals for testing and experimentation. Helps students study the effects of different high voltage types on electrical components.
- ✓ **AC Hipot Tester (Testing Transformer)**: Tests the dielectric strength of transformers by applying high voltage AC. Ensures that transformers can handle electrical stresses without failure.
- ✓ **Megger 5kV DC Dielectric Test Set**: Measures the insulation resistance of electrical equipment and cables using high voltage DC. Helps students assess the quality and safety of insulation materials.
- ✓ **Megger Transformer Oil Test Set**: Analyzes the dielectric strength and condition of transformer oil. Used to evaluate the health and performance of transformers.
- ✓ **Insulation Test Set**: Measures insulation resistance of electrical systems and components. Helps in assessing the effectiveness of insulation and predicting potential failures.
- ✓ **Schering Bridge, Tan Delta, and Capacitance Measuring Equipment**: Used to measure insulation capacitance and dissipation factor (tan delta) of electrical equipment. Provides insights into insulation quality and performance.
- ✓ **High Voltage DC Transmission Line Trainer**: Simulates high voltage DC transmission systems, allowing students to study the operation, control, and effects of high voltage DC transmission. Helps in understanding the principles and challenges of HVDC systems.

2.3. First Floor:

The first floor will accommodate offices for administrative staff, four lecture rooms. Furthermore, the floor will accommodate four laboratories as highlighted below:

1. Measurement, Instrumentation & Control laboratory

- **Breakdown Test Machine**: Tests the dielectric strength of insulating materials by applying high voltage until breakdown occurs. Used to assess insulation quality and safety.
- **Digital Tachometer**: Measures the rotational speed of motors and shafts. Helps students understand speed measurement and control in various mechanical and electrical systems.

- **Sensors and Transducers**: Converts physical quantities (such as temperature, pressure, or displacement) into electrical signals. Used for practical training on sensor technology and data acquisition.
- **PLC (Programmable Logic Controller)**: A versatile controller used in automation and control systems. Students learn programming, troubleshooting, and the integration of PLCs in industrial processes.
- **Microcontrollers**: Small computing devices used for embedded system applications. Students learn programming and interfacing of microcontrollers for various automation and control tasks.
- **Control Engineering Trainers**: Provide hands-on experience with control systems, including feedback loops, PID control, and system stability. Used for practical training in control engineering concepts.
- **DC Position Control Kits**: Used to study and experiment with position control in DC motors. Helps students understand position feedback, control algorithms, and practical implementation of position control systems.
- **AC Position Control Kits**: Similar to DC position control kits but for AC motors. Students learn about position control strategies for AC motors, including feedback mechanisms and control systems.
- **AC Servomotor Study Kit**: Allows students to study the operation and control of AC servomotors, including their use in precision control applications and performance characteristics.
- **Analog Compensation Design Kit**: Used for designing and testing analog compensators for control systems. Students learn about compensation techniques to improve system performance and stability.
- **Magnetic Levitation Kit**: Demonstrates principles of magnetic levitation and control. Helps students understand electromagnetic forces and their application in levitation systems.
- **Stepper Motor Study Kit**: Provides hands-on experience with stepper motors, including their control, operation, and applications in precision positioning systems.
- **DC Motor Control Unit**: Used for controlling the speed and direction of DC motors. Students learn about various control methods and their effects on motor performance.

- **AC Motor Control Unit**: Similar to DC motor control units but for AC motors. Provides practical experience with AC motor control techniques, including speed and torque regulation.
- **AC Servo Motor Speed Control Trainer**: Allows students to study and experiment with speed control in AC servomotors. Includes hands-on practice with speed regulation and control systems.
- **DC Servo Motor Speed Control Trainer**: Similar to the AC servo motor speed control trainer but for DC servomotors. Students learn about speed control techniques and their application in DC servomotors.
- **Synchro Transmitter & Receiver Kits**: Used to study synchro systems, which are used for position and angle measurement in control systems. Students learn about the operation and application of synchros.
- **LVDT (Linear Variable Differential Transformer) Trainers**: Demonstrates the principles of LVDTs for measuring linear displacement. Helps students understand how LVDTs convert mechanical movement into electrical signals.
- **Temperature Measurement Trainers**: Provides practical experience with various temperature measurement techniques and sensors, including thermocouples and RTDs.
- **Schering Bridge with Digital Null Detector & Oscillator**: Used to measure insulation resistance and capacitance with high accuracy. Helps students understand the operation of bridges for electrical measurements.
- **Anderson Bridge**: Measures the capacitance and dissipation factor of capacitors. Used in precision measurement of electrical components.
- **Kelvin Double Bridge**: Measures low resistance values with high accuracy. Used to study the effects of contact resistance and improve measurement precision.
- **Portable Power Factor Meter Single Phase**: Measures the power factor of single-phase electrical systems. Helps students understand power factor correction and its impact on system efficiency.
- **Crompton DC Potentiometer**: Used for precise voltage measurements and calibrations. Students learn about the principles of potentiometry and its applications in electrical measurements.

- **Single Phase Inductive Load**: Provides inductive loads for testing and experimenting with single-phase electrical circuits. Helps students study the effects of inductance on circuit behavior.
- **1 HP Black Three Phase Inductive Load Bank, 415 V**: Simulates inductive loads for three-phase systems. Allows students to study the performance and behavior of three-phase circuits under different load conditions.
- **Three Phase Capacitive Load**: Provides capacitive loads for testing and experimentation in three-phase electrical systems. Helps students understand the effects of capacitance on system performance

2. Electronics laboratory

- ✓ **Power Electronics Training Workbench**: Provides a comprehensive platform for studying power electronics concepts and circuits. Includes various components and instruments for hands-on experiments with power electronic devices and systems.
- ✓ **Integrated Circuits**: Used for studying the functionality and applications of various ICs in electronic circuits. Helps students understand IC design, operation, and integration into larger systems.
- ✓ **IoT Trainer Kit**: Provides hands-on experience with Internet of Things (IoT) technologies. Students learn about IoT devices, sensors, communication protocols, and data processing.
- ✓ **1 Phase SCR Modules**: Used for experiments with Silicon Controlled Rectifiers (SCRs) in single-phase circuits. Helps students understand SCR operation, triggering, and applications in power control.
- ✓ **Digital 3 Phase HV Thyristor Control Trainer, Model: XPO-HVDC**: Provides training on high-voltage thyristor control for three-phase systems. Students learn about the operation, control, and applications of thyristors in high-voltage DC systems.
- ✓ **Single Phase Cycloconverter**: Demonstrates the principles of cycloconversion, where AC power is converted to a different frequency AC power. Useful for studying frequency control and AC-to-AC conversion.

- ✓ **SCR DC Motor Speed Controller by Chopper Training Kit**: Allows students to experiment with DC motor speed control using SCR-based chopper circuits. Helps in understanding speed regulation and control strategies.
- ✓ **SCR Forced Commutation Trainers**: Provides training on forced commutation techniques used to turn off SCRs in power electronic circuits. Useful for studying commutation methods and their effects on circuit operation.
- ✓ **SCR Series Inverter Trainers**: Demonstrates the operation of series inverters using SCRs. Students learn about inverter circuits, operation, and their applications in power conversion.
- ✓ **SCR Parallel Inverter Trainers**: Provides hands-on experience with parallel inverters using SCRs. Helps students understand parallel inverter circuits and their applications in power systems.
- ✓ **D.C. Step Down MOSFET Chopper Trainer Kit**: Used to study DC-DC conversion using MOSFET-based chopper circuits. Allows students to explore step-down (buck) conversion and control techniques.
- ✓ **DC-DC Buck Converters**: Demonstrates the operation of buck converters for stepping down DC voltage. Students learn about switching regulators and efficiency in power conversion.
- ✓ **DC-DC Buck-Boost Converter Power Supply Module**: Provides both step-up and step-down DC-DC conversion. Helps students understand buck-boost converters and their applications in varying voltage levels.
- ✓ **UPS Trainers Kit**: Simulates Uninterruptible Power Supply (UPS) systems. Students learn about UPS operation, battery management, and power backup solutions.
- ✓ **Microprocessor Trainer Kits 8085, 8086, 8051**: Provides hands-on experience with microprocessors and microcontrollers. Students learn programming, interfacing, and application development using 8085, 8086, and 8051 microprocessors.
- ✓ **PCB Etching Machine, PCB Making Machines, Etching Machine**: Used for designing and fabricating printed circuit boards (PCBs). Students learn about PCB manufacturing processes, including etching and assembly.

- ✓ **Digital Design Lab with Solderless Breadboard & Power Supply**: Provides a platform for experimenting with digital circuit design using a solderless breadboard and a power supply. Helps students prototype and test digital circuits.
- ✓ **Pick and Place Machine for Surface Mount Devices (SMD) PCB Components**: Automates the placement of SMD components on PCBs. Students learn about automated assembly processes and component handling.
- ✓ **Logic Gates**: Fundamental building blocks of digital circuits. Used for studying and experimenting with basic digital logic operations and circuit design.
- ✓ **Capacitance Box**: Contains various capacitors for testing and experimentation. Helps students study the effects of capacitance in circuits and components.
- ✓ **Inductance Box**: Contains various inductors for testing and experimentation. Used to study the effects of inductance in electrical circuits.
- ✓ **Regulated Power Supply Unit**: Provides a stable and adjustable voltage or current for powering and testing electronic circuits and devices.
- ✓ **Cathode Ray Oscilloscope (CRO)**: Displays and analyzes electrical signals in real time. Used for observing waveform characteristics and troubleshooting circuits.
- ✓ **Encoder and Decoder Kit**: Demonstrates the principles of digital encoding and decoding. Students learn about data representation, transmission, and error correction.
- ✓ **Multiplexer and Demultiplexer Kit**: Provides hands-on experience with multiplexing and demultiplexing techniques. Students study how to combine and separate multiple signals in digital systems.
- ✓ **Single Phase Fully Controlled Bridge Converter**: Demonstrates a fully controlled bridge converter circuit for single-phase systems. Helps students understand phase control and power conversion.
- ✓ **Board Plotter PCB Machine ProtoMat S-42**: Used for creating PCB prototypes. Students learn about PCB design and fabrication, including routing and plotting.
- ✓ **Variable AC Power Supply**: Provides adjustable AC voltage for testing and experimentation. Useful for studying the behavior of AC circuits under varying voltage conditions.

- ✓ **Smart Energy Meter**: Measures and monitors electrical energy consumption. Students learn about energy metering, efficiency, and smart grid technologies.

3. **Telecommunication laboratory**
   - ✓ **Radar Trainer (Mod. M702-E/EV)**: Provides hands-on experience with radar systems, including radar signal processing, detection, and tracking. Students learn about radar principles, operation, and applications.
   - ✓ **Radio/Transmitter AM/SSB/FM/Radio Control MCM24/EV Kit with Accessories**: Covers various types of radio transmission, including AM (Amplitude Modulation), SSB (Single Sideband), and FM (Frequency Modulation). Students learn about radio communication, modulation techniques, and transmitter design.
   - ✓ **Satellite Communications Trainer (Mod. MW-AS/EV)**: Simulates satellite communication systems. Students study satellite link budgets, signal modulation, and satellite-based communication techniques.
   - ✓ **Cellular Communications Trainer**: Provides practical experience with cellular network technologies. Students learn about cellular network architecture, signal transmission, and cellular system operation.
   - ✓ **ISDN Trainer**: Demonstrates Integrated Services Digital Network (ISDN) technology, including digital telephony and data services. Students learn about ISDN signaling, channel types, and network integration.
   - ✓ **TV Systems Trainer**: Covers various aspects of television systems, including signal generation, transmission, and reception. Students study analog and digital TV technologies, including signal processing and broadcasting.
   - ✓ **Optical Communications Trainer (MCM40/EV)**: Provides hands-on experience with optical fiber communication systems. Students learn about fiber optics, signal transmission, and optical network components.
   - ✓ **Short Range Wireless Communications**: Demonstrates short-range wireless technologies, such as Bluetooth or Zigbee. Students learn about wireless communication protocols, range considerations, and practical applications.

- ✓ **Optical Spectrum Analyzer**: Measures and analyzes the optical spectrum of signals. Used to study wavelength distribution and spectral properties in optical communication systems.
- ✓ **Fiber Fusion Splicing Machine Signal Fire A1-9**: Used for splicing optical fibers by fusing them together. Helps students understand the process of fiber optic splicing and its importance in maintaining signal integrity.
- ✓ **ED-AMP, Erbium Doped Fiber Amplifier**: Amplifies optical signals in fiber optic communication systems using erbium-doped fiber. Students learn about optical amplification, signal boosting, and amplifier design.
- ✓ **Advanced Fiber Optic Communication Trainer**: Provides in-depth training on fiber optic communication systems, including components, signal transmission, and network design. Helps students understand advanced topics in optical communications.
- ✓ **OTDR Unit (Optical Time Domain Reflectometer)**: Measures the characteristics of optical fibers, including length, attenuation, and faults. Used to test and troubleshoot fiber optic networks.

4. Communication and transmission laboratory

- ✓ **Communication & Networks Trainer**: Provides a comprehensive platform for studying communication systems and networking technologies. Students learn about different communication protocols, network configurations, and troubleshooting techniques.
- ✓ **Analogue Communications Trainer**: Focuses on analog communication techniques, including amplitude modulation (AM), frequency modulation (FM), and signal processing. Helps students understand traditional analog communication methods.
- ✓ **Acoustics Training Equipment**: Demonstrates principles of sound and acoustics, including sound propagation, measurement, and acoustical engineering. Useful for studying acoustic properties, sound waves, and their applications in various fields.

- ✓ **Digital Communications Trainer**: Covers digital communication techniques such as pulse modulation, digital encoding, and decoding. Students gain hands-on experience with digital signal processing and communication systems.
- ✓ **Network Analyzer**: Measures and analyzes network parameters such as impedance, reflection, and transmission characteristics. Used to study network performance and diagnose issues in communication networks.
- ✓ **Spectrum Analyzer**: Measures the amplitude of signals across a range of frequencies. Helps students analyze the frequency spectrum, identify signal components, and troubleshoot issues in communication systems.
- ✓ **Transmission Lines and Antennas (Mod. LA/EV)**: Provides practical training on transmission lines and antenna systems. Students learn about signal transmission, impedance matching, and antenna design.
- ✓ **Antenna Measuring System (Mod. ANT-M/EV)**: Measures antenna characteristics, including gain, radiation pattern, and impedance. Helps students understand antenna performance and optimization.
- ✓ **Microwave Trainer (MW-B-C/EV)**: Focuses on microwave communication systems, including generation, propagation, and measurement of microwave signals. Provides hands-on experience with microwave components and systems.
- ✓ **Frequency Counter**: Measures the frequency of electrical signals. Used to accurately determine the frequency of oscillators and signal sources in communication systems.
- ✓ **Rigol DSG815 1.5GHz RF Signal Generator**: Generates RF (radio frequency) signals up to 1.5 GHz. Useful for testing and calibrating communication systems and components.
- ✓ **SWR Meter (Standing Wave Ratio Meter)**: Measures the standing wave ratio in transmission lines. Helps students understand impedance matching and power transmission efficiency in antenna systems.

2.4. Second Floor:

The second floor will feature conference hall, centre library dedicated to intellectual exchange and scholarly pursuits, featuring a library stocked with reference materials and scholarly works,

lecturer's offices, boardroom, drawing rooms, cafeteria and mechatronics laboratories. The list of equipment in this laboratory will include the following;

- ✓ **Mechatronics System**: Integrates mechanical engineering, electronics, and computer control. Provides hands-on experience with automated systems, robotics, and control technologies, helping students understand the interplay between mechanical and electronic systems.
- ✓ **Motor Control Training System**: Focuses on the principles and techniques of controlling electric motors. Includes components for studying speed control, direction control, and various motor types (AC, DC, stepper).
- ✓ **Thermal Process Control System**: Provides practical training in controlling and monitoring thermal processes. Students learn about temperature measurement, control strategies, and thermal system dynamics.
- ✓ **Analytical Process Control System**: Focuses on process control in analytical applications, such as chemical or material processing. Students gain experience with process variables, control loops, and instrumentation used in analytical settings.
- ✓ **Hydraulic and Pneumatic Training System**: Covers the principles and applications of hydraulic and pneumatic systems. Includes components and circuits for studying fluid power, pressure control, and actuator operation.
- ✓ **TPX00031 SENSOR KITARDUINO**: Provides a set of sensors and components compatible with Arduino for experimentation and learning. Students use this kit to explore various sensor technologies and their integration with microcontrollers.
- ✓ **PLC (Programmable Logic Controller) Trainer Kits**: Offers hands-on experience with PLC programming and applications. Students learn to design, program, and troubleshoot PLC-based control systems.
- ✓ **DCS Trainer Kit (Distributed Control System)**: Simulates DCS environments used in industrial automation. Students learn about distributed control, system architecture, and process management.
- ✓ **Programmable Systems Simulator**: Allows students to simulate and program various automated systems. Useful for practicing system design and control strategies in a virtual environment.

- ✓ **Basic 3-Floor Lift**: A model of a basic elevator system used to study lift control, automation, and mechanical components. Helps students understand elevator operation and control systems.
- ✓ **Process Control Multivariable System**: Provides training on controlling processes with multiple variables. Students learn to manage complex process dynamics and control strategies involving multiple inputs and outputs.
- ✓ **Pieces Distribution Module**: Simulates the distribution of items in a production or assembly line. Useful for studying sorting, routing, and distribution processes.
- ✓ **Swivel Arm Module**: A module used for studying robotic arm movements and control. Students learn about the mechanics and control of swiveling arms in automation systems.
- ✓ **Pieces Thickness Measurement Module**: Measures the thickness of objects in a production line. Helps students understand measurement techniques and quality control in manufacturing processes.
- ✓ **Linear Storage Module**: Simulates linear storage systems used in logistics and material handling. Students learn about storage solutions and inventory management.
- ✓ **Rotary Arm Module**: Provides hands-on experience with rotary motion systems. Students study the control and application of rotating arms in automation and manufacturing.
- ✓ **Drilling Station Module**: Simulates a drilling operation in a production environment. Students learn about automation, control, and the integration of drilling processes.
- ✓ **Conveyor Module**: Demonstrates conveyor belt systems used in material handling and manufacturing. Students learn about conveyor operation, control, and integration into production lines.
- ✓ **Conveyor and Multiple Selection Module**: Combines conveyor systems with selection mechanisms for sorting and routing items. Provides experience with complex material handling systems.
- ✓ **6-Axis Robotic Arm**: Provides a versatile platform for studying robotic manipulation, automation, and control. Students learn about kinematics, dynamics, and programming of multi-axis robots.
- ✓ **Arduino Trainer Panel**: A hands-on training panel for learning about Arduino microcontrollers and electronics. Includes various components and sensors for experimentation and project development.

- ✓ **Pneumatic Trainer Kits with Manual and Electrical Controls**: Offers hands-on training with pneumatic systems, including manual and automated control methods. Students learn about pneumatics principles, circuit design, and control strategies.
- ✓ **Hydraulic Trainer Kits**: Provides practical experience with hydraulic systems, including components, circuits, and control. Students learn about fluid dynamics, pressure control, and hydraulic system design.
- ✓ **Hydraulics and Pneumatics Systems Simulation Software**: Software for simulating hydraulic and pneumatic systems. Allows students to design, test, and analyze fluid power systems in a virtual environment.

2.5. Proposed project activities during construction

Project Implementation activities are as described in the table below:

Table 6: Project activities During Construction

S/N	ACTIVITY	DESCRIPTION
1.	**Site Preparation:**	✓ Clearing and leveling of the construction site. ✓ Excavation of trenches for utilities and foundations. ✓ Installation of temporary fencing and access roads
2.	**Foundation Construction:**	✓ Pouring of concrete foundations for the laboratory building and associated structures. ✓ Installation of underground utilities, including water, sewer, and electrical systems. ✓ Placement of steel reinforcement bars (rebar) and formwork for foundation structures.
3.	**Structural Erection:**	✓ Erection of steel framework for the laboratory building and support structures. ✓ Installation of precast concrete panels for exterior walls. ✓ Assembly of roof trusses and installation of roofing materials. ✓ Construction of interior structural elements, such as columns, beams, and floor slabs.

4.	**Interior Fit-Out:**	✓ Installation of interior partitions, doors, and windows. ✓ Electrical wiring and installation of lighting fixtures. ✓ Plumbing installation, including fixtures and fittings. ✓ HVAC (heating, ventilation, and air conditioning) system installation. ✓ Finishing work, such as painting, flooring, and ceiling installation. ✓ Installation of laboratory equipment, benches, and furniture.
5.	**Materials, Equipment, and Machinery:**	✓ Materials: Concrete, steel, glass, wood, insulation materials, plumbing fixtures, electrical components, HVAC systems, laboratory equipment, etc. ✓ Equipment and Machinery: Excavators, bulldozers, cranes, concrete mixers, scaffolding, welding equipment, drilling machines, HVAC systems, laboratory instruments, etc.
6.	**Additional Considerations:**	✓ Environmental and social impact mitigation measures, such as dust control, noise management, and waste management, should be implemented throughout the construction process. ✓ Health and safety protocols should be strictly followed to ensure the well-being of workers and surrounding communities. ✓ Regular monitoring and reporting of construction progress, compliance with regulations, and environmental and social performance should be conducted.

2.6. Description of Project's operational activities

Table 7: Project Operational Activities

Operational Activity	Description
Research Conduct	• Scientists, researchers, and technicians utilize the laboratory's specialized equipment and facilities to conduct experiments and

	studies in various fields in electrical, electronic and mechatronic engineering. • Experimental setups are designed and executed • The laboratory serves as a hub for interdisciplinary research, fostering collaborations among engineers from different disciplines to address complex scientific questions and challenges.
Data Collection and Analysis	• Advanced instrumentation are used to collect data from experiments. • Data analysis techniques, including statistical analysis, computational modeling, and simulation, are employed to interpret experimental results, extract meaningful insights, and validate theoretical models.
Instrumentation and Facility Maintenance	• Ongoing maintenance and calibration of laboratory equipment and instruments are essential to ensure accurate and reliable experimental outcomes. • Skilled technicians and engineers are responsible for the upkeep, repair, and upgrade of scientific instruments, as well as the overall maintenance of the laboratory facility.
Collaborative Research Projects	• The laboratory collaborates with academic institutions, research organizations, industry partners, and government agencies on collaborative research projects. • Joint research initiatives may involve sharing resources, expertise, and data to address scientific and technological challenges and achieve common research goals.
Training and Education	• The laboratory provides training programs, workshops, and seminars to educate scientists, students, and professionals on advanced research techniques, experimental methodologies, and scientific discoveries. • Educational outreach activities, including tours, lectures, and public engagement events, are organized to promote scientific literacy and

	awareness of electrical, electronics, mechatronics and related fields.
Publication and Dissemination	• Findings from research conducted at the laboratory are documented in scientific papers, journals, and conference proceedings. • Research outcomes are disseminated through publications, presentations, and collaborations with the scientific community, contributing to the advancement of knowledge and innovation in electrical engineering and related disciplines.
Regulatory Compliance and Safety	• The laboratory adheres to regulatory requirements and safety protocols to ensure the well-being of personnel, protect the environment, and prevent accidents or incidents. • Compliance with local, national, and international regulations governing the operation of scientific research facilities is essential to maintain operational integrity and public trust.
Landscaping	• The site will be landscaped after construction, using existing and locally available plant species where applicable in order to improve the aesthetic value of the proposed project location.
General Cleaning	• This will involve regular washing and cleaning of the Facility spaces, common areas, pavements and other public areas.
General Repairs and Maintenance	• The facilities will be repaired and maintained regularly during the operational phase of the project. Such activities will include repair of building walls and floors, repairs and maintenance of electrical gadgets and equipment, repairs of leaking water pipes, painting and replacement of worn-out materials among others

2.7. Description of the Project's Decommissioning Activities

Decommissioning is an important phase in the project cycle and comes last to wind up the operational activities of a particular project. It refers to the final disposal of the project and associated materials at the expiry of the project lifespan. If such a stage is reached, the proponent needs to remove all materials resulting from the demolition/ decommissioning from the site. The following should be undertaken to restore the environment:

Table 8: Project Decommissioning Activities

Decommissioning Activity	**Description**
Facility Shutdown	The decommissioning process begins with the orderly shutdown of the CoE facility, including the cessation of research activities, equipment deactivation, and the removal of hazardous materials. Shutdown procedures are conducted in accordance with established protocols and safety guidelines to minimize risks to personnel and the environment.
Equipment Removal and Disposal	Specialized equipment, machinery, and scientific instruments within the facility are systematically dismantled, disconnected, and removed from the premises. Equipment removal is carried out by qualified personnel using appropriate tools and techniques. Disposal of equipment may involve recycling, repurposing, or environmentally responsible disposal methods to minimize waste generation and environmental impact.
Decontamination	Decontamination procedures are implemented to mitigate potential hazards associated with chemical, biological, radiological, and other contaminants present within the facility. Surfaces, equipment, and infrastructure are cleaned, treated, or removed as necessary to reduce contamination levels to acceptable standards and ensure safe handling during decommissioning activities.
Structural Demolition	Structural demolition involves the dismantling and demolition of buildings, laboratories, and other facilities within the NPSRL site. Demolition activities are carried out using heavy machinery, such as excavators, bulldozers, and cranes, under the supervision of qualified personnel to ensure safety and compliance with regulatory requirements. Debris and waste materials generated during demolition are segregated, removed, and disposed of responsibly.

Environmental Remediation	Environmental remediation measures are implemented to address any contamination or environmental impacts resulting from the operation of the CoE facility. Soil and groundwater remediation, air quality monitoring, and ecological restoration efforts may be undertaken to restore the site to its original or an acceptable condition in compliance with regulatory standards.
Waste Management	Waste management practices are employed to handle, transport, and dispose of hazardous and non-hazardous waste materials generated during decommissioning activities. Waste streams are characterized, segregated, and treated accordingly to minimize environmental risks and ensure compliance with waste disposal regulations.
Site Restoration	Site restoration involves the rehabilitation and reclamation of the decommissioned CoE site to its pre-existing or an alternative land use condition. Restoration efforts may include landscaping, soil stabilization, infrastructure removal, and site grading to prepare the site for future development, conservation, or reuse in alignment with regulatory requirements and stakeholder preferences.

3. BASELINE INFORMATION

3.1. Meru University of Science and Technology

Meru University of Science and Technology (MUST) is a public university in in Meru County, 15 kilometres northeast of Meru Town, along the Meru-Makutano-Maua Highway. In 2008, Meru College of Technology (MECOTECH) was upgraded to Meru University College of Science and Technology (MUCST) through Legal Notice No. 103 of 18th July 2008 to become a constituent college of Jomo Kenyatta University of Agriculture and Technology (JKUAT). MUCST was launched by President Mwai Kibaki in 2010, followed by chartering of the University in March 2013 thereby becoming a full-fledged university. This marked a great milestone for MUST to become a world class university of excellence. Since inception, there has been a phenomenal increase in the student population to reach 11,500 in 2023.

3.2. Population, Health and Education

University Population: MUST has over 10,000 students and employs a significant number of academic and non-academic staff. The region boasts numerous primary and secondary schools, providing a steady inflow of students to the university. The area is served by healthcare facilities such as the Meru Level 5 Hospital and smaller clinics, ensuring access to medical services for residents and the university community. The surrounding population relies on subsistence farming, focusing on crops like maize, beans, and miraa (khat), along with livestock rearing. Small-scale businesses, particularly those related to agriculture and retail, are common.

3.3. Economic Impact

MUST has a direct economic influence on the region through employment, student spending, and community engagement in research and development. It also serves as an innovation hub for addressing regional socio-economic challenges. This socio-economic context aligns well with the proposed construction project, ensuring community integration and sustainability.

3.4. Project Location

The proposed project will be located on a 1-acre piece of land, next to the engineering complex, Meru university of science and Technology, main campus. GPS Coordinates of the location are as follows

X	Y
0.134106	37.709586

The soil type within the site is mainly dark brown clay loam soil. There were no structures on site as at scoping.

3.5. Neighbours

The proposed site is located next to the Engineering complex, as indicated on Figure below.

Figure 1: Engineering complex

Figure 2: Engineering workshops

3.6. Topography, Geology and Climate of MUST and its environs

MUST is located in Nchiru, in Meru County, Kenya, on the eastern slopes of Mount Kenya. The topography and geology of Nchiru, like much of Meru County, are influenced by its proximity to this significant mountain. The university is situated on the eastern slopes of Mount Kenya, which has varying elevations. The region ranges from mid-altitude areas to higher elevations closer to the mountain. The terrain is characterized by rolling hills, valleys, and ridges. It is generally rugged due to its mountainous nature. The geology of Nchiru is largely shaped by past volcanic activity from Mount Kenya. The region features volcanic rocks, primarily basalts and phonolites.

Meru University is situated in an area with varied elevation, ranging from approximately 4,511 to 5,807 feet above sea level. The topography includes rolling hills and valleys, typical of Meru County, which influence drainage and accessibility. The university is dominated by the two great massifs of Mount Kenya and the Nyambene Ranges both of which lend striking diversity to the physical landscape. These two elevations affect not just the physiography, but also the entire environmental potential of the area. At its highest point on Mt. Kenya which is also the highest point in the country, the county rises to 5199m. The land then slopes gently from west to east, finally reaching an altitude of 335m, near the Tana River. This tremendous range of altitude gives

the county a more diverse climate, as well as a very wide range of agroecological zones. The Nyambene range, elongated south-west to north-east rises sharply above the surrounding plateau. Summit elevation is to the south where the peak, Itiene, reaches 2514m. The slopes of the Nyambene are steeper than those of Mt. Kenya but the crests are much lower with very little land above 1829m. On the eastern side of the range, rivers have cut deep valleys on the bedrock.

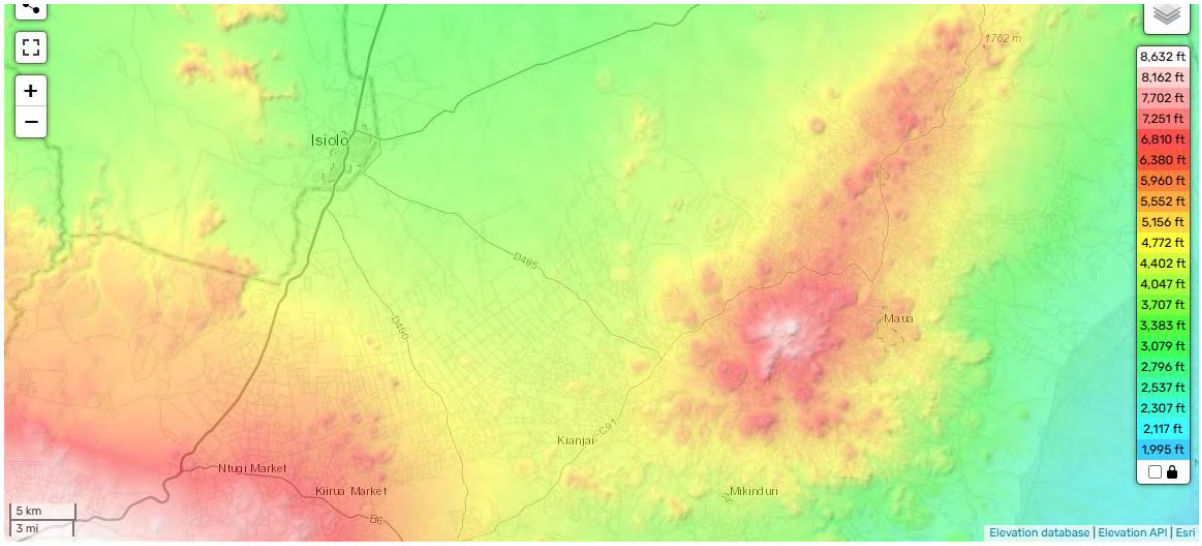


Figure 3: Topographical map of the area

3.6.1. Hydrology

The Mt. Kenya is an important water catchment zone in Kenya. Many rivers have numerous tributaries joining them from the mountain as they flow downstream. Though no streams or rivers affected by the proposed project, the surface runoff from the slopes of Mt. Kenya flows along the side drains.

3.6.2. Climate and meteorology

MUST and Nchiru at large experiences a climate influenced by its elevation and proximity to the equator. Nchiru has a tropical highland climate due to its elevation on the eastern slopes of Mount Kenya. The region typically ranges between 20°C to 28°C. The annual rainfall varies from 1,000 mm to 1,800 mm depending on specific location and elevation. The humidity is generally high due to the frequent rainfall and the dense vegetation of the area.The climate in the area is generally characterized by two rainy seasons -from April to May, and

October to November

The region experiences moderate winds, often influenced by the mountain's topography. Winds are generally stronger during the transition periods between rainy and dry seasons. Frequent cloud cover, especially during the rainy seasons. The area often experiences mist and fog in the mornings and evenings due to the high humidity and elevation.

3.6.3. Surface and Ground Water Hydrology

The surface and ground water hydrology of Nchiru in Meru County is influenced by its location on the eastern slopes of Mount Kenya. Flow rates in rivers and streams can vary significantly between the rainy and dry seasons, with higher flows during the rainy seasons (March to May and October to December) and lower flows during the dry seasons. The area features small wetlands that play a crucial role in maintaining the ecological balance, supporting diverse flora and fauna, and acting as natural water filtration systems. The geology of the region, with its volcanic rocks and ash deposits, supports aquifers that store groundwater. These aquifers are typically found in the porous volcanic rock formations. The slopes of Mount Kenya act as major recharge zones for both surface and groundwater. Rainwater infiltrates the soil and recharges the aquifers, ensuring a steady supply of groundwater.

3.6.4. Flora and Fauna in MUST and Nchiru at large

Nchiru in Meru County, Kenya, boasts a rich diversity of flora and fauna, influenced by its location on the eastern slopes of Mount Kenya. The flora in Nchiru is varied due to the range of elevations and climatic conditions, from high-altitude forests to lower-altitude grasslands and agricultural lands. The montane forests found here are characterized by a mix of indigenous tree species such as African olive, East African camphorwood, and African cedar. Maize, beans, potatoes, and vegetables like cabbages, carrots, and kale are commonly cultivated. Avocado, mango, banana, and citrus trees are prevalent in farms and homesteads.

Mount Kenya ecosystem constitutes an important reservoir for biodiversity with identified 880 plant species, subspecies and varieties belonging to 479 genera in 146 families below the 3200 m altitude. There are at least 11 endemic species of higher plants and more than 150 species that are near endemic.

The fauna in the university is diverse, supported by the varied habitats ranging from forests to grasslands. The region is home to elephants, buffalos, and occasionally, leopards, especially in areas closer to the forest reserves of Mount Kenya. Monkeys, such as the colobus monkey and vervet monkey, are common in forested areas. Birds like the secretary bird, weaver birds, and hornbills are found in the grasslands and agricultural areas.

Mammals

Genetta tigrina stuhlmanni Matschie.

Jackal. Thos sp

Colobus polykomos kikuyuensis Lonnberg. Cercop.~thecus mitis kolbi Neumann, "Blue" or Sykes'

Monkey (Guenon).

Bush-baby. *Galago crassicaudatus subsp*

Shrews. *Crocidura allex alpine*

Porcupine. *Hystrix galeata subsp*

Squirrels. *Heliosciurus keniae (Neumann)*

Hare. *Lepus'sp*

Thicketrat. *Grammonys (formerly Thamnomys) gigas (Dollman)*

Rufous-nosedrat. *Oenomys hypoxanthus bacchante (Thomas)*

Climbingvlrood- MoUSE. *Rattus (Hylomyscus) denniae denniae*

Harvey's duiker. *Cephalophus harveyi harveyi*

Bushbuck. *Tragelaphus scriptus delamerei Pocock*

The Birds

Lammergeyer. *Gypaetus barbatus.*

Shelley's francolin. *Francolinus shelleyi theresae Meinertzhagen*

Lammergeyer. *Gypaetus barbatus*

Red-headed parrot. *Poicephalus gulielmi massaicus*

Mackinder's owl. *Bubo capensis mackinderi Sharpe*

White-starred bush-RoBIN. *PogonocichLa steHata guttifer*

Overall, the flora and fauna around the university are diverse and ecologically significant, supported by the region's favorable climate and varied topography. Conservation efforts are essential to preserve this rich biodiversity amidst increasing human activities.

Figure 4: Visible vegetation at university entrance and compound

3.6.5. Socio-Economic activities in and around the university

The socio-economic landscape in and around Meru University of Science and Technology (MUST) reflects a blend of academic, agricultural, and community influences. MUST attracts students from across Kenya and beyond, contributing to the local economy through their daily spending and housing needs. The presence of the university fosters educational development and skills enhancement among students and staff. The university's research activities contribute to local technological and scientific advancements, potentially impacting agriculture, health, and engineering sectors.

The demand for goods and services from students and university employees supports local businesses such as shops, restaurants, and accommodation providers. The entrepreneurial spirit among students leading to new businesses and innovations that contribute to the local economy. Additionally, Small and medium enterprises (SMEs) benefit from the university's presence, providing products and services to the campus community.

Meru County is known for its agricultural activities, including tea, coffee, and horticulture. The university's research and outreach programs may support local farmers and promote sustainable practices. Agriculture remains a significant part of the local economy, with many residents engaged in farming as their primary source of income.

Finally, Meru County is the Leading County that produces Miraa (Khat) for export and hence boosting the economic national grid. It's the leading county in Horticulture production

3.6.6. Infrastructure

Wastewater Reticulation and Recycling System

The management of wastewater reticulation and recycling systems at Meru University of Science and Technology (MUST) involves several key components aimed at efficiently handling and reusing wastewater. Here's an overview of how such a system is structured and implemented:

- **Pipes and Channels**: A network of pipes and channels collects wastewater from various sources such as hostels, laboratories, and administrative buildings.
- **Pump Stations**: Located at strategic points to transport wastewater to treatment facilities
- **Screening**: Removes large debris and solids from wastewater.
- **Sedimentation**: Allows larger particles to settle out of the wastewater.
- **Biological Treatment**: Uses microorganisms to degrade organic matter.
- **Aeration Tanks**: Provides oxygen to support microbial activity that breaks down organic pollutants.

Water source

Due to poor rainfall patterns and lack of Permanent River, water supply has been the greatest challenge on campus, which has since been addressed by piping water from the forest and erecting a Mega Water Reservoir on Campus.

3.6.7. The geology and soils

The geology and soils of the project area is majorly influenced by the larger Mount Kenya conditions. The Mount Kenya Series consists of volcanic rocks erupted from Mount Kenya and its satellite volcanoes presumably during the Pliocene. It includes the Ithanguni Tracytes and Tuffs on the northeastern slopes, small areas of olivine basalts on the area, a large region with phonolites, porphyrites and keynotes on the western side of the mountain. Widespread indications of solifluction, U-shaped valleys and moraines are found on all flanks of the mountain, evidence of extensive former glaciation.

Two periods of glaciation can be distinguished (Nilsson 1935, 1940), an older less widespread one (Baker, 1967) and a younger glaciation, the moraines of which are found downwards to about 3400 m.a.s.l.

The soil is dark reddish with agillic B-horizon, including:

- Acrisols with topsoil of about 20-40cm thick of dark clay loam, over a 1.2-1.5m thick layer of reddish brown day of weathering rock.
- Nitosols formed from a mighty horizon of dark reddish friable clay, partly covered with dark reddish brown clay up to 1.2 m thick over weathering rock.
- Phaezems with 30-40 cm dark reddish brown, humic, silty clay loam over dull reddish brown clay.
- Luvisols of dark reddish brown clay up to 1.2 m thick over weathering rock.

Figure 5: Geological map of Meru University

4. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

4.1. Introduction

This chapter includes a summary of the laws, regulations and institutional setup relevant to environmental and social management in Kenya. A review of the most pertinent regulations and standards governing health and safety has been included. This section also includes a review of environmental quality standards relevant to the proposed project. Kenya has in place a wide range of policy, institutional and legislative framework to address the major causes of environmental degradation and negative impacts on ecosystems emanating from economic development programmes.

It is a legal obligation within the Laws of Kenya that a development of such magnitude adheres to certain legal parameters. This section therefore describes the Policy, Legal, and Institutional framework pertaining to the proposed commercial centre. The policy, legal and institutional frameworks have been put in place to ensure that development projects adhere to environmental conservation at all times. As development activities have the potential to damage the environment, it is a challenge today to ensure that development efforts are sustainable.

The proposed development will change the landscape and among the environmental changes to be observed include exposure and compaction of the soils, loss of vegetation, waste generation etc. It is these issues amongst others that legislation sets to address. Through recognizing the importance of environmental conservation in all development endeavours, the Kenyan government put in place a wide range of policy, institutional and legislative frameworks to guide developments in Kenya in the process of minimizing environmental degradation.

4.1.1. The Constitution of Kenya, 2010

The Constitution of Kenya is the country's supreme legislation and has Environmental provisions in Chapter Four, under 'Rights and Fundamental Freedoms', Chapter Five, under 'Environment and Natural Resources', and Chapter Ten, under 'Judicial Authority and Legal System'. The

Fourth Schedule also includes environmental provisions under 'Distribution of functions between National and County Governments' and the Fifth Schedule titled 'Legislation to be enacted by Parliament'. Environmental rights and freedoms are presented in Article 42 of the new constitution, which states:

Every person has the right to a clean and healthy environment, which includes the right –

- To have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and
- To have obligations relating to the environment fulfilled under Article 70.

Part II (Environment and Natural Resources), (I) the State clearly undertakes to carry out the following:

- Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits
- Work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;
- Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;
- Encourage public participation in the management, protection and conservation of the environment;
- Protect genetic resources and biological diversity;
- Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
- Eliminate processes and activities that are likely to endanger the environment; and
- Utilize the environment and natural resources for the benefit of the people of Kenya.

(II) "Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

Chapter 5 on land and environment emphasizes on the following:

- Land use and management shall by law benefit local communities;
- Community land is protected from encroachment by state;
- Rivers, forests and water bodies shall be protected by law;
- Equitable access to land; and
- County Governments will manage land in trust of the people in accordance with the constitution.

The project should observe the above stated conditions in as far as environmental protection is concerned. For instance, in the protection of the rights of every Kenyan to a clean environment and the right of Project Affected Persons (PAPs) especially during the construction phase of the project.

4.1.2. Environment Management and Coordination (Amendment) Act, 2015

The Environment Management and Coordination (Amendment) Act, 2015 provides the main legal and institutional framework under which the environment in general is to be managed. EMCA is implemented by the guiding principle that every person has a right to a clean and healthy environment and can seek redress through the High court if this right has been, is likely to be or is being contravened.

EMCA 1999 being the principle Act, Section 58 having been amended as section 43 of the amended Act, makes it a mandatory requirement for an EIA study to be carried out by proponents intending to implement projects specified in the Second Schedule of the Act. Such projects have a potential of causing significant impacts on the environment. Similarly, section 68 of the same Act requires operators of existing projects or undertakings to carry out Environmental Audits (EA) in order to determine the level of conformance with statements made during the EIA study. The proponent is required to submit the EIA and EA reports to NEMA for review and necessary action.

This project has been categorized under High-Risk Projects in the Second Schedule of

the Environmental Management and Coordination (Amendment) Act 2015, which requires for the project to be subjected to an ESIA study prior to its implementation.

4.1.3. Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2016

The EIA and Audit Regulations state in Regulation 3 that "the regulations should apply to all policies, plans, programmes, projects and activities specified in Part IV, Part V and the Second Schedule of the Environment Management and Coordination (Amended) Act, 2015. Part II of the Regulations indicates the procedures to be taken during preparation, submission and approval of the full ESIA study report.

This project has been listed under High- R i s k Projects in the Second Schedule of the Environmental Management and Coordination (Amendment) Act 2015, as one of the projects that should undergo an Environmental and Social Impact Assessment.

4.1.4. Environmental Management and Co-ordination (Water Quality) Regulations, 2006)

This regulation was published in the Kenya Gazette Supplement No. 68, Legislative Supplement No. 36, and Legal Notice No. 120 of 29 September, 2006. The regulation provides for sustainable management of water resources including prevention of water pollution and protection of water sources (lakes, rivers, streams, springs, wells and other water sources). It is an offence under Regulation No. 4 (2), for any person to throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution. Regulation No. 11 further makes it an offence for any person to discharge or apply any poison, toxic, noxious or obstructing matter, radioactive waste or other pollutants or permit the dumping or discharge of such matter into the aquatic environment unless such discharge, poison, toxic, noxious or obstructing matter, radioactive waste or pollutant complies with the standards for effluent discharge into the environment.

From preliminary site assessment, the contractor will have to adhere to these regulations

so as not to carry out any activity that will cause pollution to the natural water courses.

4.1.5. Environmental Management and Co-ordination (Waste Management) Regulations, 2006

This regulation was published in the Kenya Gazette Supplement No. 69, Legislative Supplement No. 37, and Legal Notice No. 121 of 29th September, 2006. The regulations provide details on management (handling, storage, transportation, treatment and disposal) of various waste streams including:

- Domestic waste;
- Industrial waste;
- Hazardous and toxic waste;
- Pesticides and toxic substances;
- Biomedical wastes; and
- Radioactive waste.

Regulation No. 4 (1) makes it an offence for any person to dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.

Regulation 5 (1) provides categories of cleaner production methods that should be adopted by waste generators in order to minimize the amount of waste generated and they include:

i) Improvement of production process through
   - Conserving raw materials and energy;
   - Eliminating the use of toxic raw materials and wastes; and
   - Reducing toxic emissions and wastes.

(ii) Monitoring the product cycle from beginning to end by

   - Identifying and eliminating potential negative impacts of the product;
   - Enabling the recovery and re-use of the product where possible, Reclamation and recycling; and
   - Incorporating environmental concerns in the design and disposal of a product.

Regulation 6 requires waste generators to segregate waste by separating hazardous waste from non-hazardous waste for appropriate disposal.

Regulation 15 prohibits any industry from discharging or disposing of any untreated waste in any state into the environment.

Regulation 17 (1) makes it an offence for any person to engage in any activity likely to generate any hazardous waste without valid Environmental Impact Assessment license issued by NEMA.

The proposed project, during construction phase will generate wastes such as soil debris, cement bags, plastic containers, waste oil among other hazardous products such as bitumen containers which will need to be disposed as per the guidelines in the regulations. The proponent shall comply with these regulations throughout project implementation.

4.1.6. Environmental Management and Coordination Act (Noise and Excessive Vibration

Pollution) (Control) Regulations, 2009

These regulations were published as legal Notice No. 61 being a subsidiary legislation to the Environmental Management and Co-ordination Act, 1999. The regulations provide information on the following:

i. Prohibition of excessive noise and vibration beyond defined thresholds;
ii. Provisions relating to noise from certain sources;
iii. Provisions relating to licensing procedures for certain activities with a potential of emitting excessive noise and/or vibrations; and
iv. Noise and excessive vibrations mapping.

According to regulation 3 (1), no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the

comfort, repose, health or safety of others and the environment. Regulation 4 prohibits any person to: (a) make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or (b) cause to be made excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source.

Regulation 5 further makes it an offence for any person to make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property.

Regulation 12 (1) makes it an offence for any person to operate a motor vehicle which- (a) produces any loud and unusual sound; and (b) exceeds 84 dB(A) when accelerating. According to sub-regulation 2 of this regulation, no person shall at any time sound the horn or other warning device of a vehicle except when necessary to prevent an accident or an incident.

Regulation 13 (1) provides that except for the purposes specified in sub-regulation (2) there under, no person shall operate construction equipment (including but not limited to any pile driver, steam shovel, pneumatic hammer, derrick or steam or electric hoist) or perform any outside construction or repair work so as to emit noise in excess of the permissible levels as set out in the Second Schedule to this regulation.

Regulation 19 (1) prohibits any person to carry out activities relating to fireworks, demolitions, firing ranges or specific heavy industry without a valid permit issued by the Authority. According to sub-regulation 4, such permit shall be valid for a period not exceeding three months.

The excessive noise and vibrations during construction are likely to be produced from haulage of materials from the source (batching site, quarrying) to construction areas, blasting, piling earthworks among others. The contractor /sub-contractor for civil works will be required to ensure compliance with the above regulations in order to promote a healthy and safe working environment throughout the construction phase. This shall include regular

inspection and maintenance of equipment and prohibition of unnecessary hooting of vehicles. During operation, noise may be emitted by standby power generators and some lab equipment.

4.1.7. Environmental Management and Coordination (Air Quality) Regulations, 2014

These Regulations cover air quality standards that are requisite to protect human health and allow an adequate margin of safety. These Regulations specify priority air pollutants, mobile and stationary sources as well as stipulates emission standards.

The emissions generated from construction activities (such as burning waste on site and vehicle and equipment combustion engines) have the potential of polluting the immediate atmospheric environment. Earthworks and bulk delivery of construction material, if not managed well may result in generation of a lot of dust.

Some of the lab processes are likely to generate fumes and particulate matter that will cause air pollution. Thus, need for strict adherence to these regulations and standards

4.1.8. The Sustainable Waste Management Act of 2022

The Act outlines comprehensive objectives and principles aimed at promoting sustainable waste management practices in Kenya. It emphasizes promoting a clean and healthy environment, reducing pollution, and creating an enabling environment for employment in the green economy. The Act also establishes general principles such as the polluter pays principle and extended producer responsibility, aiming to shift the focus towards waste reduction and resource conservation. Furthermore, it mandates the establishment of regulatory bodies like the Waste Management Council and the Authority to oversee waste management efforts and develop relevant policies and regulations.

Relevance to the CoE Project:

The provisions of the Act are highly relevant to the CoE in electrical and electronic project as they provide a structured framework for managing waste generated during research activities.

By aligning with the Act's objectives, the CoE can ensure sustainable waste management practices within its facilities. For instance, adhering to the polluter pays principle, CoE would be responsible for managing and disposing of waste generated by its research activities, thereby minimizing its environmental impact. Furthermore, the Act's emphasis on collaboration and coordination between government entities and private sector stakeholders offers opportunities for CoE to engage in partnerships and knowledge-sharing initiatives, enhancing its waste management capabilities. Overall, by complying with the Act's provisions, the CoE can contribute to Kenya's broader goals of promoting environmental sustainability and fostering a green economy.

4.1.9. Science, Technology and Innovation Act (2013)

This is an Act of parliaments that provides for the registration and licensing of research within the Country. Part IV of the Act stipulates that "Any person undertaking or intending to undertake research in science and technology in the country, or who accesses, handles, or transfers any material or technology or moves it within, from or into the country, shall apply to the Commission for the grant of a license in accordance with this Act". Part V of the same Act provides for registration of research Institutions in Kenya.

Since the CoE shall be operating under this Act, it is imperative that the Proponent follows the stipulations of this Act to the latter to ensure their operations are legal.

4.1.10. Public Health Act (Cap. 242)

This is an Act of Parliament that makes provision for securing and maintaining health. Section 115 of this Act prohibits causing nuisance or other condition liable to be injurious or dangerous to health. Section 118 provides a list of nuisances which includes any noxious matter or waste water, flowing or discharged from any premises, wherever situated, into any public street, or into the gutter or side channel of any watercourse, irrigation channel or bed thereof not approved for the reception of such discharge.

4.1.11. The Public Health (Drainage and Latrine) Rules

Rule 85 provides that every owner or occupier of every workshop, workplace or other premises where persons are employed shall provide proper and sufficient latrines for use by employees. Rule 87 requires every contractor, builder or other person employing workmen for the demolition, construction, reconstruction or alteration of any building or other work in any way connected with building to provide in an approved position sufficient and convenient temporary latrine for use by such workmen. Rule 91 provides that no person shall construct a latrine in connection with a building other than a water closet or a urinal, where any part of the site of such building is within 200 feet of a sewer belonging to the local authority which is at a suitable level, and where there is sufficient water supply.

This Act is applicable to the project since the contractor for civil works will be required to provide toilets for use by workers and visitors to the site during construction phase of the proposed project. The contractor will also be required to ensure that waste from the site is properly managed so as not to cause nuisance to public health.

4.1.12. County Governments Act, 2012

The County Governments Act of 2012 repealed the Local Government Act. Section 114 of this Act, sub sections (1) and (2) require that a project of national significance in a County be preceded by mandatory public hearings for approval. Part VIII Section 91(g) of the Act provide for the establishment of citizen forums for public participation. It states that the county needs to integrate these mechanisms into its planning, budget and implementation calendar. The county also needs to provide clear guidelines to ensure timelines in engagement, stakeholder mapping, notice periods, notification strategies, communication, management of public forums or meetings, recording deliberations, reporting, feedback mechanisms are made aware to the citizens, and government officials should be enabled to implement them. In addition, Section 115, sub section (1) Public participation in the county planning processes shall be mandatory and be facilitated through the mechanism stated under this section.

The Act further states in Section 108 under County Integrated Development Plan,(2) (b) requires each County Integrated Development Plan to at least identify (as informed by the strategies and

programmes set out in the plan);

- Any investment initiatives in the County;
- Any development initiatives in the County, including infrastructure, physical, social, economic and institutional development;
- All known projects, plans and programs to be implemented within the County by any organ of state; and
- The key performance indicators set by the County

Public participation in the County will be encouraged throughout the study.

4.1.13. Urban Areas and Cities (Amendment) Act, 2019

This is an Act of parliament that came into operation after the repeal of the Local Government Act (Cap. 265).The Amendment Act makes revisions to the principal act, Urban Areas and Cities Act, 2011. The first schedule of the amendment act puts the criteria for classifying cities and urban areas and by service. A city is an area with a population at least 500,000, a Municipality is where population is at least 250,000, and a town is classified as an area with a population of at least 10,000.

The principal Act requires that every city and municipality established under the Act to operate within the framework of integrated development planning which will be the basis for the preparation of environmental management plans; overall delivery of service including provision of water, electricity, health, telecommunications and solid waste management. It adds that a city or urban area integrated development plan shall be aligned to the development plans and strategies of the county governments.

The management of a city and municipality shall be vested in the county government and administered on its behalf by a board. The board is expected to, among other functions, exercise control over land use, land sub-division, land development and zoning by public and private sectors for any purpose including; agriculture, industry, commerce, markets, employment centers, residential, recreational parks, entertainment, passenger transport freight and the transit stations within framework of spatial and master plans for the city and municipality.

The proposed project during design, construction and operation phases should be in line with the regulations of this Act. The proponent should liaise with the County for their approval of the development, and coordinate with the county governments

4.1.14. The Traffic Act, Cap 403

This Act empowers police officers to stop and remove from the road vehicles producing noxious emissions or to charge owners in a court of law. Under the traffic rules every motor vehicle shall be constructed, maintained and used such that no avoidable smoke or visible vapour is emitted.

This Act specifies that motor vehicles use proper fuel. The traffic Regulations promulgated under the Act specifies that every vehicle is required to be well constructed, maintained and used so as not to emit any smoke or visible vapour. The vehicles to be used during the construction of the fuel tanks should be serviced and be in good condition so that they do not emit any hazardous emissions.

In as much as all vehicles emit pollutants to the air through the vehicular engines, the situation is aggravated by use of adulterated petroleum products or un-roadworthy vehicles. The traffic act requires that the vehicles shall only use fuel specified in the vehicles license. The Traffic Act prohibits the operation of motor vehicles that emit fumes that pollute the air and cause visibility problems. The Act has not specified the standard measures or definition of what constitutes black fume or visibility problem. In addition, it does not address specific pollutants that are particularly harmful, such as lead and carbon monoxides

The contractor should ensure that his construction vehicles abide by the traffic rules such as having valid insurance, are properly maintained, and ensure only licensed drivers operate the machines.

4.1.15. Physical Planning Act, 1996

This is the main Act that governs land planning and all proposed developments must be approved by the respective local authority and certificate of compliance issued accordingly. Under the Act, the Director of Physical Planning advises the Commissioner of Lands on land alienation issues

that fall under Government Lands Act.

The Director also advises the Commissioner of Lands and local authorities on land use, sub-division and or amalgamation of land; prepares regional and local physical development plans. At the County level, this is yet to be aligned to conform to the County Government structure and the new constitution of Kenya.

The director is required to publish the regional physical development plan and also notify the local authority within whose jurisdiction the plan is to be affected. Section 36 states that if in connection with a development application a local authority is of the opinion that proposals for industrial location, dumping sites, sewerage treatment, quarries or any other development activity will have injurious impact on the environment, the applicant shall be required to submit together with the application an Environmental Impact Assessment report.

Section 30(1) requires a developer in any local authority to be granted development permission by the respective local authority, failure to which heavy fines will ensue; and the land registrar shall decline to register such a document. No sub-division of private land shall take place within a local authority unless the sub-division is in accordance with the requirements of an approved local physical development plan.

The proponent will be required to submit the plans (designs) to the County Physical Planning Officers in charge of Machakos County for approval prior to implementation of the project. Any temporary structures erected by the appointed contractor will also require county approval.

4.1.16. Employment Act, 2007

This is an Act of parliament that applies to all employees employed by any employer under a contract of service. This Act repeals the Employment Act (Cap 226). The Act highlights on the following:

- Employment relationship;
- Protection of wages;
- Rights and duties in employment such as:

- Basic minimum conditions of employment in terms of contracts and agreements;
- Hours of work
- Entitlement to leave including sick leave
- Provision of medical attention
- Provision of clean drinking water

Employment of children in the following forms is prohibited in the following sections of the Act:

53. (1) notwithstanding any provision of any written law, no person shall employ a child in any activity which constitutes worst form of child labour.

56. (1) No person shall employ a child who has not attained the age of thirteen years whether gainfully or otherwise in any undertaking.(2) A child of between thirteen years of age and sixteen years of age may be employed to perform light work which is:

(a) Not likely to be harmful to the child's health or development; and

(b) Not such as to prejudice the child's attendance at school, his participation in vocational orientation or training programmes approved by Minister for labour or his capacity to benefit from the instructions received.

The proponent and the contractor will need to adhere to all the requirements of this Act during the construction phase of the project.

4.1.17. Work Injury Benefits Act (WIBA)

It is an Act of Parliament to provide for compensation to workmen for injuries suffered in the course of their employment. It outlines the following:

- Employer's liability for compensation for death or incapacity resulting from accident;
- Compensation in fatal cases;
- Compensation in case of permanent partial incapacity;
- Compensation in case of temporary incapacity;
- Persons entitled to compensation and methods of calculating the earnings;
- No compensation shall be payable under this Act in respect of any incapacity or death resulting from a deliberate self-injury; and

- Notice of an accident, causing injury to a workman, of such a nature as would entitle him for compensation shall be given in the prescribed form to the director.

The contractor will need to abide by all the provisions of WIBA in managing hazardous environment and according injured persons their dues in terms of shouldering the medical expenses or compensation of the families should there be loss of life.

4.1.18. Occupational Safety and Health Act, 2007

This is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. It applies to all workplaces where any person is at work, whether temporarily or permanently. The purpose of this Act is to:

- Secure the safety, health and welfare of persons at work; and
- Protect persons other than persons at work against safety and health arising out of, or in connection with the activities of persons at work.

The scope of OSHA 2007 has been expanded to cover all workplaces including offices, schools, academic institutions, factories and plantations. It establishes codes of practices to be approved and issued by the DOSHS for practical guidance of the various provisions of the Act.

The contractor and the proponent will be required to comply with all the provisions of the Act throughout the project cycle such as registration of construction site as a workplace, management of hazards, forming health and safety committees and reporting all the accidents and near misses.

4.1.19. HIV/AIDS Prevention and Control Act, 2006

This law requires HIVAIDs education in the work place. Road construction works by their nature increase risks of HIV/AIDS spread between workers, especially those in camps, and host communities.

The proponent is expected to explicitly incorporate as part of Contractor's requirements, provision of HIV/AIDs education and awareness during the construction phase of this Project.

4.1.20. Energy Act, 2006

Energy Act makes provisions that shall apply to every person or body of persons importing, exporting, generating, transmitting, distributing, supplying, using electrical energy, importing, exporting, transporting refining, storing and selling petroleum or petroleum products, producing, transporting, distributing and supplying of other forms of energy, and to all works or apparatus for any or all of these purposes".

This Act also creates the Energy Regulatory Commission whose functions and powers include issuance of licenses, permits and exemptions for electric power and petroleum undertakings, review and approval of the electric power tariffs, imposition and collection of penalties and fines for non- compliance in the energy sector, investigation and resolution of conflicts, formulation of regulations and enforcement of standards in the Energy Sector, formulation and co- ordination of a disaster preparedness plan for the energy sector, ensuring fair play and competition within the Energy sector

4.1.21. The Penal Code (Cap. 63)

Section 191 of the Penal Code makes it an offence for any person or institution that voluntarily corrupts, or foils water for public springs or reservoirs rendering it less fit for its ordinary use. Similarly, section 192 prohibits making the atmosphere in any place noxious to health of persons/institution in dwellings or business premises in the neighborhood or those passing along a public way.

The Contractor and proponent will be required to ensure strict adherence to the Environmental Management Plan throughout the Project cycle in order to mitigate any possible negative impact associated with dust, noise, and effluent discharge.

4.2. Institutional Framework

4.2.1. National Environment Management Authority (NEMA)

NEMA is a semi-autonomous agency under the Ministry of Environment, established to exercise general supervision and co-ordinate over all matters relating to the environment and to be the principal instrument of the government in the implementation of all policies relating to the environment. The Director General appointed by the president heads NEMA. The objective and purpose for which NEMA is established is to exercise general supervision and co-ordinate over all matters relating to the environment and to be the principal instrument of the government in the implementation of all policies relating to the environment.

The Authority shall:

- Co-ordinate the various environmental management activities being undertaken by the lead agencies and promote the integration of environmental considerations into development policies, plan, programs and projects with a view to ensuring the proper management and rational utilization of the environmental resources on a sustainable yield basis for the improvement of the quality of human life in Kenya.
- Take stock of the natural resources in Kenya and their utilization and conservation, with the relevant lead agencies.
- Examine land use patterns to determine their impact on the quality and quantity of the natural resources.
- Carry out surveys, which will assist in the proper management and conservation of the environment.
- Advise the government on legislative and other measures for the management of the environment or the implementation of relevant international conservation treaties and agreements in the field of environment as the case may be.
- Advise the government on regional and international environmental convention treaties and agreements to which Kenya should be a party and follow up the implementation of such agreements where Kenya is a party.
- Undertake and co-ordinate research, investigation and surveys in the field of environment and collect and disseminate information about the findings of such research,

investigation or survey.

- Mobilize and monitor the use of financial and human resources for environmental management.
- Identify projects and programmes or types of projects and programmes, plans and policies for which environmental audit or environmental monitoring must be conducted under EMCA.
- Initiate and evolve procedures and safeguards for the prevention of accidents, which may cause environmental degradation and evolve remedial measures where accidents occur.
- Monitor and assess activities, including activities being carried out by relevant lead agencies in order to ensure that the environment is not degraded by such activities, environmental management objectives are adhered to and adequate early warning on impeding environmental emergencies is given.
- Undertake, in co-operation with relevant lead agencies programmes intended to enhance environmental education and public awareness about the need for sound environmental management as well as for enlisting public support and encouraging the effort made by other entities in that regard.
- Publish and disseminate manuals, codes or guidelines relating to environmental management and prevention or abatement of environmental degradation.
- Render advice and technical support, where possible to entities engaged in natural resources management and environmental protection so as to enable them to carry out their responsibilities satisfactorily.
- Prepare and issue an annual report on the state of the environment in Kenya and in this regard may direct any lead agency to prepare and submit to it a report on the state of the sector of the environment under the administration of that lead agency and,
- Perform such other functions as government may assign to the Authority or as are incidental or conducive to the exercise by the authority of any or all of the functions provided under EMCACAP 387.

4.3. EMCA, Cap 387 Administrative Framework

4.3.1. National Environmental Tribunal

The National Environment Tribunal (NET) created under Section 125 of EMCA Cap 387 has the following functions:

- To hear and determine appeals from NEMA's decisions and other actions relating to issuance, revocation or denial of (EIA) licenses or amount of money to be paid under the Act and imposition of restoration orders;
- To give direction to NEMA on any matter of complex nature referred to it by the Director General; and

If the proponent disagrees with NEMA decisions in exercising the above-mentioned functions, then they may lodge a case at the NET to seek to overturn the decision. Should this avenue not lead to a favourable ruling from the NET, an appeal may be lodged in the Environment and Land Court.

4.3.2. National Environmental Complaints Committee

The National Environmental Complaints Committee performs the following functions:

- Investigate any allegations or complaints against any person or against the authority in relation to the condition of the environment in Kenya and on its own motion, any suspected case of environmental degradation and to make a report of its findings together with its recommendations thereon to the Cabinet Secretary.
- Prepare and submit to the Cabinet Secretary periodic reports of its activities which shall form part of the annual report on the state of the environment under section 9 (3) and
- To undertake public interest litigation on behalf of the citizens in environmental matters.

This committee will act as a safeguard for members of the public who feel aggrieved by actions taken under the proposed project, and can exercise their constitutional rights to launch a complaint should they have exhausted all other grievance redress mechanisms available to them.

4.3.3. National Environment Action Plan Committee

The Authority is responsible for the development of a 6-year National Environment Action plan and shall ensure that it has undertaken public participation before the adoption of the plan. The National Environment Action Plan shall:

- Contain analysis of the Natural Resources of Kenya with an indication as to any pattern of change in their distribution and quantity over time.
- Contain analytical profile of the various uses and value of the natural resources incorporating
- Considerations of intergenerational and intra-generational equity.

4.3.4. County Environment Committees

Governors shall by notice in the gazette constitute a County Environment Committee that shall be responsible for the proper management of the environment within the County for which it is appointed. They should also perform such additional functions as prescribed by the Act or as may, from time to time be assigned by the Governor by notice in the gazette. The decisions of these committees are legal and it is an offence not to implement them.

4.3.5. National Environment Restoration Fund

The objective of the Restoration Fund shall be to serve as supplementary insurance for the mitigation of environmental degradation where the perpetrator is not identifiable or where exceptional circumstances require the Authority to intervene towards the control or mitigation of environmental degradation.

4.3.6. National Environment Trust Fund

The trust fund is vested in NEMA and subject to EMCA Cap 387. A board of five trustees appointed by the Cabinet Secretary administers it. These funds may be received from donations, endowments, grants and gifts from whatever source or sums of money or from monies designated by NEMA for this fund

4.4. Administrative and Institutional Framework

There are several institutional arrangements responsible for development control in different sectors. In this project, some of the institutions whose mandates fall within the assignment include:

4.4.1. National Environmental Management Authority (NEMA)

Established under EMCA, 1999, NEMA acts as the lead agency in regulating development in relations to conservation, utilization, and management of environmental resources in the country. The objects and purpose of the NEMA are stipulated in Section 9(1) of EMCA, 1999 that charges the Authority with the responsibility of general supervision and co-ordination of all matters relating to the environment and representation of government in the implementation of all policies and regulations relating to the environment.

Relevance to the Project

NEMA is responsible for conditional issuance of Environmental Impact Assessment license. Besides, the authority has the responsibility to follow up on project development to ensure compliance to conditions set out in the license, and it has the power to revoke EIA license upon when convinced that project component violates the provisions of the license.

4.4.2. County Government of Meru

Constituted under the First Schedule of the CoK, 2010, the County Government Meru is responsible for initiating local and development projects within its jurisdiction. Some of the roles of the County government include the provision of county planning needs in the development arena; provision of health services; and provision of water and sanitation service. Similarly, Meru County government is responsible for development control in the local sub-counties, regulation of housing development through control and supervision measures; and maintenance of an inspectorate department for regulation and supervision of all development projects in the county.

Relevance to the Project

Local Governance: As the local government authority in the area, the County Government plays a role in regulatory oversight, land use planning, and environmental management within Meru

County, which may indirectly impact CoE activities.

Community Engagement: The County Government facilitates engagement with local communities to ensure their participation in and benefit from CoE initiatives. It may also address any social or environmental concerns raised by community members.

Promotion of Innovation and Development: The County Government may support initiatives aimed at promoting innovation, entrepreneurship, and economic development within the county, including those associated with CoE research and innovation activities.

4.4.3. Ministry of Health

This is the agency charged with the responsibility of ensuring adequate health and sanitation programs in the country on behalf of the national government. In the water and sanitation services, the ministry is responsibility for supervising the development of health and sanitation policies for effective management of wastes. The ministry is also responsible for provision of community health service, promotion of healthy behaviors, reproductive health campaigns, and ensuring food hygiene among other functions.

Relevance to the Project

The county government institutions in collaboration with, the ministry provide relevant advice on the location of water and sewerage treatment systems in the county. Consulting the national government before implementation of the project gives the project proponent a preamble of the expected systems of water and sewerage services provision in the county.

4.4.4. Ministry of Labour and Social Security Services

As a government agency, this ministry seeks to enforce labor laws, maintain industrial peace, industrial training and promote safety and health of employees. The Ministry also has a responsibility to develop and coordinate implementation of policies and strategies for human resource development, micro, and small enterprise sector and productivity improvement.

Relevance to the Project

The ministry is responsible for implementation and enforcement of occupational, health, labor,

and social service policies in the country.

Proponent's compliances to the safety, social security, and welfare of the persons employed in the project implementation will be supervised by the ministry of labor and social security services.

The department of occupational health and safety, the ministry will supervise the occupational health and safety policies set out by contractors the ensure conformity with the country's demands and expectations.

4.4.5. Water Resource Authority

This is an institution established under the Water Act 2002 as the principle authority of the government on all matters related to water utilization, resources, management and distribution. Part II, section 18, of the Water Act 2002 provides for national monitoring and information system on water resources. Additionally, sub-section 3 allows the Water Resources Authority (WRA) to demand from any person or institution, specified information, documents, samples or materials on water resources.

Relevance to the project

The proponent and all the allied stakeholders to the project shall ensure proper water use, management and conservation. In the event of borehole drilling WRA shall be consulted by the project hydro geologists for the purpose of attaining permits for borehole sinking. Besides, specific records may require to be kept by a facility operator and the information thereof furnished to the Authority.

4.5. The African Development Bank's (AfDB) Integrated Safeguards System (ISS)

The African Development Bank's (AfDB) Integrated Safeguards System (ISS) is a key policy framework for ensuring that construction and development projects funded by the bank are socially inclusive, environmentally sustainable, and compliant with international best practices. For the construction of the Centre of Excellence project at Meru University of Science and Technology, the following key safeguards are applicable:

1. **Operational Safeguards (OS):**

- **OS1:** Environmental and Social Assessment. This safeguard ensures that potential environmental and social impacts are identified, assessed, and mitigated during the project's lifecycle.
- **OS2:** Involuntary Resettlement. It ensures that any displacement of people is minimized and mitigated, with fair compensation and support for affected communities.
- **OS3:** Biodiversity and Ecosystem Services. It focuses on protecting natural habitats and biodiversity, ensuring sustainable use of ecosystem services.
- **OS4:** Pollution Prevention and Hazardous Materials. This emphasizes the need for projects to control pollution, manage hazardous materials responsibly, and adopt sustainable resource use.
- **OS5:** Labour Conditions and Health and Safety. It ensures fair treatment of workers, adherence to labor laws, and the provision of safe working environments.

2. **Climate and Resilience Considerations:** Projects are assessed for their contribution to climate change adaptation and mitigation, promoting the use of green technologies and energy-efficient designs
3. **Community Engagement and Grievance Mechanisms:** ISS policies emphasize the importance of stakeholder engagement, transparency, and grievance redress mechanisms to address concerns from affected communities during project implementation.

4.6. Other International conventions that Kenya is a signatory to are relevant to this project

For the Centre of Excellence construction project at Meru University of Science and Technology, several international conventions that Kenya is a signatory to are relevant. These conventions address environmental protection, labor rights, health and safety, and sustainable development, aligning with both the AfDB Integrated Safeguards System and Kenya's commitments. Key conventions include:

Environmental Protection and Biodiversity

1. **Convention on Biological Diversity (CBD), 1992**. This aims to conserve biodiversity, promote sustainable use of natural resources, and share benefits equitably. It ensures protection of local biodiversity and habitats during construction.
2. **United Nations Framework Convention on Climate Change (UNFCCC), 1992**. This focuses on mitigating climate change impacts and promoting sustainable practices. It encourages energy-efficient designs and green building technologies.
3. **Ramsar Convention on Wetlands, 1971**. This Protects wetlands of international importance, particularly for waterfowl habitats. This is relevant if the project area impacts local wetland ecosystems.

Labor Rights and Safety

International Labour Organization (ILO) Conventions. This ensures compliance with labor rights and safe working conditions on-site.

4. Kenya is party to multiple ILO conventions, including:
    - **C87:** Freedom of Association and Protection of the Right to Organise (1948).
    - **C98:** Right to Organise and Collective Bargaining (1949).
    - **C138:** Minimum Age for Employment (1973).
    - **C182:** Elimination of the Worst Forms of Child Labour (1999).

Health and Human Rights

5. **Stockholm Convention on Persistent Organic Pollutants (POPs), 2001**. This regulates chemicals harmful to human health and the environment tosafe handling and disposal of hazardous materials during construction.
6. **Universal Declaration of Human Rights (UDHR), 1948**. This guides principles for safeguarding community rights and preventing displacement.

Sustainable Development

7. **Agenda 21 (United Nations Conference on Environment and Development, 1992)**. This focuses on integrating environmental and developmental goals. It encourages sustainable land use and community participation.
8. **Paris Agreement (2015)**. It builds on the UNFCCC to enhance climate resilience and sustainable development.

Regional Conventions

9. **African Convention on the Conservation of Nature and Natural Resources, 1968 (revised 2003)** that promotes conservation and sustainable management of natural resources. It aligns with sustainable construction practices.

5. IMPACT ASSESSMENT

5.1. Potential Environmental Impacts

A summary of the potential impacts on the socio-economic and biophysical environment is given below. Impacts are assessed in terms of their magnitude (size) and significance (importance). Actions necessary to mitigate potential impacts are given. Impacts' monitoring requirements are summarized in a section of this report.

Construction Phase

5.1.1. Potential Effect to Air Quality

Vehicular/equipment engine exhaust emissions are a potential source of impacts to air quality, though they will be minor and temporary during construction. Air quality impacts will be temporary during construction. The project will generate moderately significant vehicle trips to the area. Vehicular and equipment exhaust emissions during project operations will, thus, have a minor incremental/cumulative impact locally and regionally.

Particulate matter (dust particles) would be generated by grading, excavation and the movement of construction vehicles. It is not possible to accurately estimate the particulate concentration that might occur at the site because it is dependent on meteorological conditions and soil moisture. But all the same, mitigation measures need to be put into place. Proposed mitigation measures include:

- Vehicle speeds in the construction area will be limited to minimize dust in the area.
- Discourage idling of vehicles i.e. vehicle and equipment engines will be turned off when not in direct use to reduce exhaust emissions.
- Regular maintenance of construction plant and equipment
- The management will sensitize the employees on sound environmental management.
- Provide Personal Protective Equipment (PPPE) such as nose masks to the workers on site
- The construction contractor will water the site with exposed soil surfaces twice each day during dry weather.

5.1.2. Increased Water Demand

Given the substantial water requirements of the proposed development, prudent water management practices are essential to mitigate potential strain on the existing water supply in the area. The project's significant water consumption necessitates careful consideration and implementation of the following mitigation measures:

- Utilize water supplied to the site efficiently, minimizing wastage wherever possible.
- Promote water reuse and recycling throughout both the construction and operational phases to reduce overall water demand.
- Install water-conserving taps equipped with automatic shut-off mechanisms during the operational phase to encourage water conservation.
- Advocate for the implementation of effective water management systems to optimize water usage within the project site.

5.1.3. Potential Effects due to Increased Power Demand

It is expected that there will be high power consumption especially during occupation phase. The proposed development will be connected to the existing power line and this might strain this resource. However, the contractor, construction workers and the eventual office operators will be encouraged to conserve energy and to use energy conserving appliances as much as possible. Energy conservation involves proper use of electrical appliances, lighting systems and other electrical gadgets utilized for different purposes. Thus, the proposed mitigation measures are as stated below:

- All electrical appliances should be switched off when not in use.
- Put off all lights when not in use.
- Use energy conserving electric lamps for general lighting.
- Utilize natural light inside buildings to avoid using electricity for lighting during the day.
- Explore the use of solar energy
- Create awareness among workers by use of stickers on the need to conserve energy

5.1.4. Potential Impacts due to Effluent Generation

Effluent generation and its management is another challenge related to implementation of the proposed project. It is common for developers to begin construction of projects without planning on how effluent will be disposed appropriately; hence waste water (raw sewage) is either channeled to a river, or disposed carelessly. Some are poorly constructed, are of inadequate capacity, make use of low-quality structural materials which leads to leakage of sewage to the underground water hence posing a dangerous health risk to the living organism including man. However, the proposed project deviates from this norm and hence, has integrated effective waste water handling system in to its designs. It is also recommended that:

- All liquid wastes to be disposed of properly
- Construction of the drainage system to be under the supervision of the structural engineer
- Proper maintenance of the effluent treatment by the project management.
- Provide mobile toilets to construction workforce

5.1.5. Potential Impacts in Relation to Occupational Health and Safety

The immediate neighbours and workforce involved would be more subjected to these environmental hazards such as falling debris or materials, dust, vehicle accidents, falling from high areas, open pits etc. Food for the construction workforce is usually provided by mobile individuals who usually operate without licenses. This can compromise health of the workers especially if foodstuffs are prepared in unhygienic conditions. To ameliorate against the above, the proposed mitigation measures include:

- All workers should be provided with full protective gear. These include working boots, overalls, helmets, goggles, earmuffs, masks and gloves.
- Construction crew at the site will be sensitized on social issues such as drugs, alcohol and diseases.
- A first aid kit should be provided within the site. This should be fully equipped at all times and should be managed by qualified person.
- The contractor should have workmen's compensation cover. It should comply with workmen's compensation Act, as well as ordinances, Regulations and Union Agreements.
- Adequate sanitary facilities should be provided and standard cleanliness maintained.

- Food handlers preparing food for the workers at the site should be controlled and monitored to ensure that food is hygienically prepared.
- Construction sites should be well scaffolded with netting to take care of falling materials
- Control the speed of vehicles in and around the project site

5.1.6. Impacts in Relation to Surface Drainage

Good drainage system is used to prevent land near human settlement from becoming saturated with water which collects or accumulate/flood after a downpour or from other sources. Poor drainage causes dampness to building structures as well as water stagnation. Dampness is influenced by poor drainage, in the presence of warmth and darkness, breeding grounds for malaria and other diseases can be directly traced to it. Hence, proper drainage of the general property/premise comes in handy to enhance effective flow of the much-anticipated surface run-off emanating from the roof catchments and other newly pave areas within the site. To prevent bad effects of poor drainage, the following mitigation measures are proposed for this project:

- During construction, the design of the drainage system should ensure that surface flow is drained suitably into the public drains provided to control flooding within the site.
- Drainage channels should be installed in all areas that generate or receive surface water such as drive ways and along the building block-edges of the roofs.
- Channels should be covered by approved materials to prevent occurrence of accidents and entry of dirt that would compromise flow of run-off.
- Drainage channels should ensure safe disposal of run-off/surface water and should be self-cleaning.
- Paving of the side walkways, driveways and other open area should be done using pervious materials to encourage recharge and thus reducing water run-off volume.

5.1.7. Potential Impacts due to Solid Waste Generations

Solid waste will be generated both during construction and operation phases of the project. This will include metal cuttings, rejected materials, excavated materials, paper bags, empty cartons, broken glass among other materials from a construction site. Solid wastes if not well managed have a potential of causing disease outbreaks due to the creation of suitable breeding conditions

from various pathogens. To avoid occurrence of such effects, recommended mitigation measures include:

- The contractor or the proponent should work hand in hand with the private refuse handlers and the council to facilitate proper waste management and disposal from the site. The resulting debris will be collected, transported and disposed off at suitably NEMA approved dumpsites.
- It is recommended that land excavation and construction waste be recycled or reused to ensure materials that should be disposed off as waste are diverted for productive use. In this regard the proponent is committed to ensuring that construction materials left over at the end of construction should be recovered for refurbishing and use in other projects. Such measures should involve the sale or donation of such recyclable/reusable materials to construction companies, local community and residents.
- Any disposal should be by a NEMA licensed person/company at a NEMA approved site

5.1.8. Potential Impacts of Climate Change

Climate change presents various potential impacts on the project, which could affect its operational efficiency, infrastructure, and surrounding environment. These impacts include but are not limited to:

- **Increased Temperature Extremes:** Rising temperatures may lead to heat stress in personnel and affect the performance of equipment and infrastructure.
- **Changes in Precipitation Patterns:** Alterations in precipitation patterns may result in changes in water availability, affecting water supply for the project's operations.
- **Extreme Weather Events:** Increased frequency and intensity of extreme weather events, such as storms and floods, pose risks to project infrastructure, safety, and operations.

Mitigation and Adaptation Measures

To enhance the project's resilience to climate change and minimize its potential adverse impacts, the following mitigation and adaptation measures are recommended:

i. Infrastructure Design and Planning

- **Climate-Resilient Design:** Incorporate climate-resilient design principles into project

infrastructure, such as buildings, roads, and drainage systems, to withstand temperature extremes, heavy rainfall, and flooding.

- **Elevation and Flood Protection:** Elevate critical infrastructure above projected flood levels and implement flood protection measures to reduce vulnerability to inundation.

ii. **Water Management**

- **Water Conservation:** Implement water conservation measures, such as rainwater harvesting and efficient irrigation systems, to mitigate the effects of changing precipitation patterns and ensure sustainable water use.
- **Diversification of Water Sources:** Explore alternative water sources, including groundwater and recycled water, to reduce reliance on surface water sources vulnerable to climate variability.

iii. Energy Efficiency and Renewable Energy

- **Energy Efficiency Measures:** Improve energy efficiency in project operations and facilities to reduce greenhouse gas emissions and minimize the project's carbon footprint.
- **Integration of Renewable Energy:** Integrate renewable energy sources, such as solar and wind power, into the project's energy supply to reduce dependence on fossil fuels and enhance energy security.

iv. Monitoring and Adaptive Management

- **Climate Monitoring:** Establish a climate monitoring system to track key climate variables, such as temperature, rainfall, and sea level, and incorporate climate projections into project planning and decision-making processes.
- **Adaptive Management:** Adopt an adaptive management approach to continually assess and adjust project operations and strategies in response to changing climate conditions and emerging risks.

5.1.9. Potential Loss of Biodiversity

The proposed centre of excellence in electrical and electronic engineering project entails the clearance of vegetation, including the grass and thorny shrubs, to make way for construction

activities. This vegetation serves as a habitat for various organisms, necessitating careful consideration to minimize adverse effects.

Mitigation Measures:

- Implementation of landscaped gardens to mitigate habitat loss.
- Creation of artificial soil hills for tree planting, blending the project seamlessly with the natural landscape.
- Establishment of extensive vegetation cover across open areas to compensate for cleared vegetation.
- During the decommissioning phase, rehabilitation efforts will be prioritized, including the removal of any debris or materials obstructing the restoration of natural biodiversity.

5.1.9.1. Potential Noise Pollution

Activities related to the project implementation can lead to noise, which is the unwanted/undesirable sound that can affect job performance, safety and health, of especially those residing around the project site. This can lead to psychologically related effects of noise that include annoyance and disruption of concentration. Physical effects may include loss of hearing, pain, nausea and interference with communications if the exposure is severe. The proposed project is expected to generate noise during construction period. Since the proposed site is located within an already developed area, there should be a clear guideline on the working hours whereby construction work should be carried out strictly during the day. Other proposed mitigation measures include:

- Construction works should be carried out only during the specified time of 0800-1700hrs.
- Machineries should be maintained regularly to reduce noise resulting from friction.
- There should not be unnecessary horning of the involved machinery
- Provision of bill boards at the construction site notifying of the construction activity and timings
- Sensitize drivers of construction machinery on effects of noise.
- Billboards will be suitably erected on the start of the project to psychologically prepare the people in the vicinity.
- Workers in the vicinity of high-level noise to wear safety and protective gear.
- Provide barriers such as walls around site boundaries to provide some buffer against noise

propagation.

- The proponent should comply with **The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.**

5.2. Social Impact Assessment

Social Impact Assessment (SIA) for the centre of excellence in electrical and electronic engineering (CoE EE) project in Meru university of science and technology (MUST) encompasses a comprehensive examination of the project's potential social implications. This assessment delves into the effects on communities, social structures, and cultural heritage. It aims to understand how the project may influence local livelihoods, socio-economic dynamics, and community well-being.

Key components of the SIA include:

- Community Engagement: Rigorous engagement with local communities to gather insights, concerns, and aspirations regarding the project. This ensures that community perspectives are integrated into decision-making processes.
- Socio-Economic Analysis: Thorough analysis of the project's potential socio-economic impacts, including employment opportunities, income generation, and local business development. This analysis helps identify both positive and negative effects on livelihoods and economic activities.
- Cultural Heritage Preservation: Assessment of the project's impact on cultural heritage sites, traditions, and practices. Measures will be proposed to mitigate adverse effects and preserve cultural integrity.
- Social Inclusion and Equity: Examination of how the project may impact marginalized or vulnerable groups, ensuring that their needs and rights are addressed. Strategies for promoting social inclusion and equity will be incorporated into project planning and implementation.
- Community Resilience and Capacity Building: Evaluation of community resilience and capacity to adapt to changes induced by the project. Capacity-building initiatives will be developed to enhance local skills, knowledge, and resources for sustainable development.

Through comprehensive SIA, the NPSRL project aims to proactively identify and address social concerns, promote community participation, and foster positive socio-economic development in

the project area.

5.2.1. Potential Increased Run Off

Construction works and paved roads could result in additional run off through creation of impervious areas and compaction of soils. Impervious areas and compacted soils generally have higher runoff coefficients than natural areas and increased flood peaks are a common occurrence in developed areas. Increased runoff from paved grounds and expansive roofs causing extreme flooding and overflows of drainage system shall be mitigated via the following:

- Surface runoff and roof water shall be harvested and stored in an underground reservoir for reuse or shall be directly channeled to storm water drains.
- A storm water management plan that minimizes impervious area infiltration by use of recharge area and use of detention and /or retention with graduated outlet control structures will be designed.

The following is a summary of construction phase potential negative impacts:

- Stress on infrastructure as a result of increased population/vehicle traffic,
- Possible soil erosion,
- Possible surface and ground water hydrology changes and water quality degradation,
- Solid waste generation,
- Noise pollution,
- Dust emissions,
- Generation of exhaust emissions,
- Increased water demand,
- Increased energy consumption,
- Increased use of building materials,
- Likely accidents and diseases.

To ameliorate against the potential negative effects, the following is a summary of proposed mitigation measures:

- Use scaffold netting during construction phase to reduce the spread of dust, debris and

other particles to neighboring areas.

- Awareness creation and education of the project communities regarding HIV/AIDS and other diseases.
- The contractor to ensure that all machines are well tuned and maintained to reduce amount of exhaust emission
- All materials will be ordered as per need to avoid over piling on site which leads to destruction of materials and unnecessary obstruction.
- The construction will be done in design that will allow for natural ventilation and lighting as well as both vertical and horizontal ventilation. The incorporation of natural ventilation and lighting will contribute to the reduction of the amount of energy consumed in artificial ventilation and lighting.
- Landscaping and greening of the buildings will be a contribution to the ongoing beautification and greening of our urban centers, a factor that will subsequently be beneficial to carbon sequestration.
- To save on water, the construction could also incorporate water saving designs such as waterless urinals, self-timing taps and low volume water closets. Water harvesting from the roof will be implemented to provide water for cleaning, landscaping and use in the toilets. Roof water harvesting will also lead to the reduction of the amount of runoff within the area hence controlling the flooding that afflicts it during the rain seasons.
- Emergency escape routes will also be incorporated during this stage
- To safeguard against accidental falls, all balconies and staircases will be fitted with metal rails and grills.
- Waste handling cubicles will also be constructed during this stage.
- To protect the health of workers on the site, they should be provided with protective gears and the contractor ensures that they make full use of them. Workers should not be forced or allowed to lift heavy loads.
- All materials on site should not be piled to heights that are prone to accidental falls.
- First Aid kits and emergency numbers should be conspicuously displayed. This means that someone trained in administering first aid should be present at the construction site all the time of the work.
- An insurance cover by the contractor should be acquired to compensate for any

unforeseen medical emergencies and injuries or destructions

- Provisions should be included during the construction period to allow for greening of public places.
- Provisions for disabled friendly toilets with support bars in them should be implemented during the construction period to avoid unnecessary modifications later during the life of the project.
- To ensure that neighbours are not disturbed by the reflection from the glass that will be part of the walling materials, only the north and southern sides of the buildings will be fitted with glass. This is because the two sides do not receive direct sunshine.

On the other hand, the anticipated positive impacts include:

- Creation of alternative employment opportunities,
- Improving growth of the economy hence improved living standards,
- Provision of market for supply of construction materials and other services and
- Provision of the much-needed scientific research facilities

Operation Stage

Operation phase negative impacts include: increased water use as a result of increased occupation, run-off from new impervious areas, solid waste and hazardous waste generation, air pollution and occupational health and safety risks.

Table 9: Operational Phase Impacts and Mitigation

Impact	**Mitigation**
High Energy Consumption	✓ Identify those pieces of equipment and processes that can be shut down when not required. Undertake batch processes when constant operation is not necessary.
	✓ **Respond to ambient conditions:** Manually adjust temperature and humidity controls on equipment where appropriate in response to demand due to seasonal ambient temperature and humidity loads.
	✓ **Select lower-power settings for overnight:** Certain instruments can be operated on a reduced setting overnight to save energy.
	✓ **Switch off instruments when not in use:** Switch off all equipment when not in use, where appropriate. Do not leave in standby mode. A lot of instruments can be switched off immediately after use.

	✓ **Ensure freezers are operating at full capacity:** Freezers operate at their most efficient when fully loaded. Ensure they are used to their full capacity, and always have the minimum possible number of refrigerators and freezers in the laboratory.
	✓ **Organize freezers carefully:** Improving the organization of your freezer can drastically reduce the amount of time the door needs to be open, and therefore energy consumed. Freezers can be organized efficiently using an indexed rack system. Freezer inventory management software can also be purchased to help manage samples contained in the freezer, providing an inventory of all contents as well as helping with sample labeling, tracking and management.
	✓ **Use fume hoods wisely:** Chemical fume hoods and biological safety cabinets are some of the most energy intensive pieces of equipment in the lab. Fume hoods and safety cabinets are essential and irreplaceable laboratory tools. However, the simple action of closing the sash whenever possible can dramatically reduce the amount of energy consumed by the fume hood.
	✓ **Remote fume hood communication:** Fume hoods can now be operated and managed remotely using software. This provides laboratory managers and safety officer's access to real-time status information and remote management capabilities, allowing them to easily adjust the settings of the fume hood for maximum energy conservation.
	✓ **Switch off when not in use:** Always turn off the blower and turn on the U.V. light when a fume hood or biological safety cabinet is not in use.
	✓ **Improved fume hood filtration system:** Installing an advanced fume hood filtration system allows for efficient handling of a wide range of chemicals, including acids, bases and solvents, without increasing energy consumption. Modular filtration columns allow the system to be adapted to handle multidisciplinary chemistry and to constantly adjust to the changing needs of a laboratory.
	✓ **Sash position detection system:** A sash position detection system, which adjusts the fume hood's blower speed to the height of the sash opening, can prevent situations in which the fan is left permanently on maximum. Some detectors can be remotely managed and monitored using software for optimum security.
Waste Production	✓ **Recycle:** Labs tend to order vast amounts of supplies, all of which come packed in enormous amounts of protective material. These

	materials should be recycled.
	✓ **Packaging:** Order materials that are packaged in recyclable materials.
	✓ **Recycling scheme:** Introduce a recycling scheme using color-coded boxes or bins to separate different materials.
	✓ **Choose reusable options:** Although recycling is important, a better way to reduce the environmental impact of the lab is to reuse equipment and accessories where possible. For example, it is possible to purchase pipette tip refill systems that enable the same rack to be refilled and reused repeatedly. This dramatically minimizes waste and a lab's environmental impact.
	✓ **Avoid disposables:** Where possible, avoid use of disposable and single-use items for nonsterile activities.
	✓ **Use glass:** Always purchase glass or other reusable and washable laboratory ware where possible
Increased water demand & use	✓ **Increase recovery for laboratory water:** Much of the water that is used in a laboratory can be collected and reused. Employ laboratory water systems to those that are less wasteful or that recycle water.
	✓ **Don't let the tap run:** When rinsing or washing, be sure to run the tap only when water is needed.
	✓ **Use less distilled water:** The distillation process involves heating water to its boiling point and then cooling the vapor back to liquid. This process is incredibly water and energy intensive, as well as expensive. When washing equipment, use tap water for the initial wash and distilled water for the rinse.
	✓ **Use environmentally friendly lab washers:** Some lab washers are much more environmentally benign than others in terms of their water and energy requirements. Always choose the most efficient lab washer.
	✓ **Use centralized lab washers:** Consider using centralized wash programs as opposed to bench-side washers positioned under the counter. Under appropriate circumstances, centralized lab washers can be far more efficient
Hazardous/Chemical waste	✓ **Use chemicals responsibly:** Chemical waste should be collected in plastic bottles or containers according to type. Avoid the mixing of potentially reactive chemicals. Dispose of chemical waste according to the waste management regulation 2006.
	✓ **Radioactive waste:** Radioactive liquids should be collected and stored until below exposure limits for disposal. Dispose of

	radioactive waste according to the waste management regulations.
	✓ **Biological waste:** Autoclave liquid media to inactivate harmful agents, and neutralize with bleach to inactivate harmful agents. Biological waste is more easily disposed of when completely neutralized.
	✓ **Use less hazardous and less toxic chemicals where possible:** If a choice of reagent or solvent is possible, always choose the least toxic alternative.
	✓ **Store, use, and dispose of chemicals responsibly:** Always store and use chemicals in containers or spill trays. Never pour chemicals into the sink or allow chemicals to leak into drains.
	✓ **Reduce solvent usage:** Always use the minimum quantities of solvent possible for a given analysis or reaction. Conduct micro-scale experiments where possible.
	✓ **Use a solvent recycler:** Investing in a dedicated solvent recycler can be an effective way to reduce costs and minimize environmental impact. Using a recycler, solvents can be restored to their original purity. The most common applications of solvent recycling include: HPLC solvents, GPC solvents, Freon solvents, as well as general lab solvent recycling.
Runoff	✓ To reduce the amount of run-off, roof water harvesting will be instituted ✓ All run off from paved areas should be directed to a well-constructed drainage system ✓ Water harvested from the roof to be utilized for purposes of cleaning and washing of the buildings and cars.
Sewage	✓ To manage sewage, it is recommended that the proponent installs waste water treatment system or connects to the MUST Treatment Plant.
Non-hazardous Solid waste	✓ Proponent to hire services of a NEMA licensed waste collector to ensure proper waste disposal
Occupational hazards	✓ Fire hydrants and extinguishers should be tested from time to time to ensure their functionality. All the property occupants should be subjected to regular Fire drills to be conducted by a licensed and reputable institution. ✓ Occupational Health and Safety audits should be conducted periodically to ensure the safety of the occupants and point out areas of improvement. ✓ Provision of protective gear for staff
Climate Change	✓ **Extreme Weather Events**: Increased frequency and intensity of

impacts	extreme weather events such as storms, floods, and heatwaves could pose risks to the infrastructure of the NPSRL. Mitigation measures may include: • Designing buildings to withstand extreme weather conditions through resilient construction techniques. • Implementing proper drainage systems to manage stormwater runoff and reduce flood risks. • Installing backup power systems to ensure continuous operation during power outages caused by extreme weather.
	✓ **Water Scarcity:** Climate change may lead to changes in precipitation patterns, resulting in water scarcity or drought conditions. Mitigation measures involve: • Implementing water conservation measures such as rainwater harvesting and efficient water use practices. • Investing in water-efficient technologies and systems for laboratory operations. • Recycling and reusing water wherever possible to minimize consumption.
	✓ **Rising Temperatures:** Increasing temperatures could impact indoor comfort levels and energy consumption within the CoE buildings. Mitigation measures may include: • Designing buildings with energy-efficient features such as proper insulation, shading, and natural ventilation to reduce reliance on mechanical cooling systems. • Installing energy-efficient HVAC systems and equipment to minimize energy consumption. • Incorporating green roof systems or cool roof materials to mitigate the urban heat island effect and reduce indoor temperatures.
	✓ **Impacts on Ecosystems:** Climate change can affect local ecosystems and biodiversity, potentially impacting research activities conducted within the CoE. Mitigation measures should involve: • Implementing biodiversity conservation measures such as preserving natural habitats and creating green spaces within the project site. • Conducting ecological assessments to understand the potential impacts of the project on local flora and fauna. • Implementing sustainable land management practices to minimize habitat disturbance and promote ecosystem

	resilience.
	✓ **Carbon Footprint:** The construction and operation of the CoE could contribute to greenhouse gas emissions, exacerbating climate change. Mitigation measures may include: • Adopting green building principles and practices to minimize carbon emissions during construction and operation. • Incorporating renewable energy sources such as solar panels or wind turbines to reduce reliance on fossil fuels for energy. • Implementing carbon offset strategies such as tree planting initiatives or supporting renewable energy projects to mitigate the project's carbon footprint.

5.2.2. Hazardous Waste Management

5.2.2.1. Introduction

This section outlines the strategies and measures to manage hazardous waste generated during the construction, operation, and decommissioning phases of the CoE project in MUST. The plan aims to ensure the safe storage, transport, and disposal of hazardous waste to protect human health and the environment.

5.2.2.2. Identification of Hazardous Waste

Hazardous waste generated by the CoE project may include chemicals, solvents, contaminated materials, and laboratory equipment containing toxic or hazardous substances. A comprehensive waste identification and classification system will be implemented to accurately categorize and label hazardous waste streams.

5.2.2.3. Storage of Hazardous Waste

Storage Facilities*:* - Designated storage areas for hazardous waste will be established within the CoE facility. - Storage facilities will be constructed to meet regulatory standards and equipped with appropriate containment measures to prevent leaks and spills.

Segregation and Labeling: - Hazardous waste will be segregated based on compatibility and chemical properties to prevent reactions. - Clearly labeled containers with information on waste

composition, hazards, and handling instructions will be used for storage.

Security and Access Control: - Access to hazardous waste storage areas will be restricted to authorized personnel only. - Security measures such as locks, alarms, and surveillance cameras will be installed to prevent unauthorized access.

Inventory and Monitoring: - A detailed inventory of hazardous waste stored on-site will be maintained, including quantity, type, and storage location. Regular inspections and monitoring will be conducted to ensure compliance with storage requirements and detect any leaks or spills.

5.2.2.4. Transportation of Hazardous Waste

Transportation Procedures: - Hazardous waste will be transported by NEMA licensed and authorized waste management contractors using specialized vehicles equipped with containment measures. Transport routes will be planned to minimize exposure to populated areas and sensitive environmental receptors. Tracking documents to be availed waste transportation.

Packaging and Labeling: - Hazardous waste containers will be securely packaged and labeled according to regulatory requirements for transportation. Adequate cushioning and secondary containment will be provided to prevent breakage or leakage during transit.

Emergency Response Preparedness: - Drivers and transport personnel will be trained in emergency response procedures and equipped with spill containment kits and personal protective equipment (PPE). Communication protocols with emergency services and waste management authorities will be established for prompt response to accidents or incidents.

5.2.2.5. Disposal of Hazardous Waste

Licensed Disposal Facilities: - Hazardous waste will be disposed of at licensed and authorized disposal facilities in compliance with national and local regulations. Facilities with appropriate treatment and disposal technologies will be selected based on waste characteristics and environmental considerations.

Documentation and Record-Keeping: - Records of hazardous waste disposal transactions,

including waste manifests and certificates of disposal, will be maintained for regulatory compliance and auditing purposes. Documentation will include details such as waste composition, quantity, disposal date, and destination facility.

Closure and Rehabilitation: - Upon completion of the CoE project, closure and rehabilitation measures will be implemented to restore any disturbed areas and mitigate any residual environmental impacts from hazardous waste management activities.

5.2.2.6. Training and Awareness

Training Programs: - Personnel involved in hazardous waste management activities will receive training on waste handling, storage, transportation, and disposal procedures. Training will emphasize the importance of compliance with regulatory requirements and best practices for environmental protection.

Public Awareness: - Awareness campaigns will be conducted to inform project stakeholders, including employees, contractors, and the local community, about hazardous waste management practices and their role in environmental stewardship.

5.2.2.7. Compliance Monitoring and Reporting

Monitoring Activities: - Regular monitoring and inspections will be conducted to assess compliance with hazardous waste management procedures and regulatory requirements.- Monitoring parameters may include waste storage conditions, transportation practices, and disposal site compliance.

Reporting Mechanisms: - Incident reporting procedures will be established to document and investigate any spills, leaks, or non-compliance events related to hazardous waste management. - Reports will be submitted to relevant regulatory authorities as required by law.

5.2.2.8. Emergency Response and Contingency Planning

Emergency Response Plan: - An emergency response plan will be developed to address potential accidents, spills, or releases of hazardous waste during storage, transportation, or disposal. - The plan will outline procedures for containment, cleanup, and notification of relevant authorities and

stakeholders.

Contingency Measures: - Contingency measures, such as backup storage containment systems and emergency response equipment, will be in place to mitigate the impacts of hazardous waste incidents.

5.2.2.9. Decommissioning Phase

Decommissioning phase impacts include loss of direct and indirect employment, demolition waste, noise pollution, dust and exhaust emissions, and occupational health and safety hazards.

6. ANALYSIS OF PROJECT ALTERNATIVES

6.1. Introduction

This chapter analyses the project alternative in terms of site and non-implementation. The purpose of including alternatives in the EIA is to identify and evaluate alternate actions that accomplish similar goals and promote sustainable development. Alternatives should be economically feasible with minimal adverse environmental impacts and time delays. Diverse alternatives to the proposed action must be included in the EIA. Alternatives may include both design and location options. In most case, the EIA process often occurs too late in the decision-making process to consider a full range of alternatives. This can undermine EIA goals to encourage more environmentally sound and publicly acceptable solutions. Allowing new alternatives and objectives to evolve in relation to environmental conditions and public preferences may be a solution to most of the environmental and socio-economic problems associated with the implementation of new projects.

6.2. No-Action Alternative

The 'no-action' alternative, which serves as a baseline for comparative analysis, must be included where the environmental impact of taking the proposed action is too high compared to the impact of not taking the proposed action. The No project alternative option in respect to the proposed project implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. Under No project option, the proponent's proposal would not receive necessary approval from Authorities. The proposed construction would not be implemented. This option would however, involve several losses both to the proponent and the community as a whole. The No Project Alternative option is the least preferred from the socio-economic and partly environmental perspective due to the following factors:

- The economic status of Kenyans would remain unchanged
- The local skills would remain underutilized (in terms of labor provision)
- The proposed CoE will not have a research facility as stipulated in its master plan

6.3. Site Relocation Option

Relocation of the proposed project of constructing labs is one of the alternatives in ensuring the environmental status of the area is not affected. But it is quite clear that as per the current situation, the proposed project cannot be relocated. The reason behind this is only a part of a larger development at MUST, hence getting an alternative site would not only beat its purpose, but also be a very expensive venture.

6.4. Waste Water/Sewage Management Alternatives

The following available technologies can be alternatives to be considered:

1. **Constructed/Artificial Wetland**: Constructed wetlands mimic the natural processes of filtration and purification that occur in natural wetlands. In the context of the CoE project, a constructed wetland could serve as an eco-friendly and cost-effective method for treating effluent. By using plants and microorganisms, the wetland can remove contaminants from the wastewater through biological and physical processes. This option aligns with the project's emphasis on sustainable practices and could potentially provide additional ecological benefits such as habitat creation and biodiversity enhancement.

2. **Septic Tank and/or Bio-digesters**: Septic tanks are underground chambers that separate solids and liquids in wastewater, allowing anaerobic bacteria to break down organic matter. Bio-digesters, on the other hand, utilize aerobic bacteria to decompose organic waste. Both options offer decentralized treatment solutions suitable for the CoE project, particularly in areas where centralized wastewater treatment infrastructure may be impractical or costly. Implementing septic tanks and bio-digesters can help manage wastewater onsite, minimizing the need for extensive piping and reducing the environmental footprint of the facility.

3. **Stabilization Ponds/Lagoons**: Stabilization ponds, also known as lagoons, are shallow ponds designed to treat wastewater through natural processes such as sedimentation, biological degradation, and solar disinfection. In the context of the CoE project, stabilization ponds could serve as a relatively simple and low-cost treatment option, especially in regions with favorable climate conditions. These ponds can effectively reduce organic pollutants and

pathogens in the effluent, providing a reliable treatment solution with minimal energy requirements.

4. **Waste Treatment Plants such as Bio-box or the Vex-P System**: Advanced waste treatment plants like Bio-box or the Vex-P system utilize innovative technologies to treat wastewater efficiently and meet stringent discharge standards. These systems typically incorporate processes such as filtration, biological oxidation, and disinfection to remove contaminants from the effluent. While more complex and expensive compared to some other alternatives, waste treatment plants offer high treatment efficiency and are suitable for projects like the CoE where strict environmental regulations or water quality standards must be met. These systems can ensure that the treated effluent meets the required quality standards before discharge or reuse.

5. **The Moving Bed Biofilm Reactor (MBBR)**: This is an advanced wastewater treatment technology that utilizes a biological process to remove contaminants from wastewater. In an MBBR system, plastic carriers or media with a high surface area are suspended in aeration tanks, providing a substrate for the growth of microorganisms. These microorganisms form a biofilm on the surface of the carriers, where they metabolize organic matter and remove pollutants from the wastewater.

   One of the key advantages of MBBR technology is its compact design and high treatment efficiency. The biofilm process allows for a significant reduction in the footprint of the treatment plant compared to conventional systems, making it suitable for projects with limited space availability, such as the CoE EEE. Additionally, MBBR systems offer flexibility in operation and can adapt to varying wastewater loads and characteristics, providing reliable treatment performance under different conditions.

   Overall, the MBBR technology presents a viable option for effluent treatment at the CoE, offering efficient pollutant removal, compact footprint, and operational flexibility. By implementing MBBR systems, the project can achieve effective wastewater treatment while minimizing environmental impact and ensuring compliance with regulatory standards.

Note: The NPSRL shall connect to the MBBR wastewater treatment Plant within MUST

6.5. Design and technology alternatives

6.5.1. Alternatives to Achieving Green Building

The areas of concern may be categorized broadly as follows:

- Proper and efficient use of resources. These include power, water and other sources of energy
- Reducing waste and pollution
- Improving occupant health

Green building can take on various forms. From the basic housing level to the national level, efforts are being put to reduce reliance on the costly fossil fuels. Some of the methods that can be adopted in this include:

i. The Use of Renewable Energy

More buildings are powering up using solar panels. The availability of the technology and ease of setting up the panels have gone a long way in encouraging its adoption. Generation and use of wind power is also a viable source of energy. Waste (such as papers, plastics, and so forth) is also being used in an ingenious pilot project in areas to produce heat energy.

ii. Adoption of Water Harvesting, Treatment and Re-Use

Large development projects should to adopt water treatment and re-use to cut on costs. With demanding clientele who want green compounds all year round, this technology is quite handy. The used water is collected and treated in collection tanks placed within the project areas. This water is then re-used for irrigation of lawns and also in flushing toilets. Hence this calls for the adoption of sewage treatment systems.

In addition, water harvesting should also be taken more seriously. Methods include tanks and also water pans in areas having space. Trenches in gardens are also dug up with the sole intention of trapping run-off water. Hence, the proposed project should entail rain water harvesting without failure.

iii. The Use of Plants or Vegetation

Plants can be used as water towers to aid in replenishing ground water. Structures in hot areas are advised to adopt plants to keep the temperatures down.

iv. Adoption of Natural Lighting and Ventilation

Strategic building of windows and porches goes a long way in enhancing natural lighting. Sun roofs are also becoming a common feature in many modern buildings, allowing much sunlight into the rooms.

These are just some of the few methods that could be adopted in going green in building the proposed project.

6.6. Technological Alternatives

6.6.1. Equipment

These are some of the alternatives the proponent should consider in the purchase and use of equipment:

Energy-efficient equipment: The amount of electrical equipment in a laboratory far exceeds that in most commercial spaces. This represents a major source of energy consumption. Choosing energy-efficient freezers, refrigerators and other equipment should be a priority when attempting to reduce the environmental impact of the laboratory.

Redistribute equipment internally: Reallocating less well-used equipment from other areas of your facility into your lab can prevent the unnecessary purchase of brand-new equipment, and reduce the environmental impact of a laboratory.

Replace old or inefficient equipment: Holding onto old or outdated equipment can prove false cost savings. Modern laboratory equipment is designed with energy efficiency as a primary feature, and the running costs and energy consumption of modern equipment often far outweigh that of equivalent older models.

Reusable options: Although recycling is important, a better way to reduce the environmental

impact of the lab is to reuse equipment and accessories where possible. For example, it is possible to purchase pipette tip refill systems that enable the same rack to be refilled and reused repeatedly. This dramatically minimizes waste and a lab's environmental impact.

Avoid disposables: Where possible, avoid use of disposable and single-use items for non-sterile activities.

Glass: Always purchase glass or other reusable and washable laboratory ware where possible.

Environmentally friendly lab washers: Some lab washers are much more environmentally benign than others in terms of their water and energy requirements. Always choose the most efficient lab washer.

Centralized lab washers: Consider using centralized wash programs as opposed to bench-side washers positioned under the counter. Under appropriate circumstances, centralized lab washers can be far more efficient.

6.6.2. Chemicals

Less hazardous and less toxic chemicals

If a choice of reagent or solvent is possible, always choose the least toxic alternative. Using pre-prepared reagents can sometimes eliminate the need for certain toxic or hazardous chemicals.

7. STAKEHOLDER ENGAGEMENT

7.1. Introduction

Stakeholder engagement is a fundamental component of the Environmental and Social Impact Assessment (ESIA) process for the proposed centre of excellence in electrical and electronic engineering(CoE EE) project in Meru university of science and technology. This chapter outlines the objectives, methods, and outcomes of the public participation process undertaken to engage stakeholders and gather their input on the project's potential environmental and social impacts.

7.2. Objectives of stakeholder engagement

The primary objectives of stakeholder engagement in the ESIA process are as follows:

- To provide stakeholders with relevant information about the CoE project, including its purpose, scope, and potential environmental and social impacts.
- To solicit feedback, concerns, and suggestions from stakeholders regarding the project's
- design, construction, operation, and decommissioning phases.
- To promote transparency, inclusivity, and accountability in decision-making processes related to the CoE project.
- To enhance stakeholder understanding of environmental and social issues associated with the project and foster meaningful dialogue and collaboration among diverse stakeholder groups.

7.3. Methods of stakeholder engagement

The stakeholder engagement process for the CoE EEE project involved the following key methods:

- Stakeholder Identification: Identification of relevant stakeholders, including local communities, government agencies, non-governmental organizations (NGOs), academic institutions, and industry stakeholders.
- Stakeholder Engagement: Engagement with stakeholders through various communication channels, including public meetings, focus group discussions, online platforms, and written

submissions.

- Information Dissemination: Provision of project information, including project documents, reports, maps, and visual aids, to stakeholders through multiple channels, such reports and public notices.
- Consultation and Feedback: Facilitation of consultations and feedback mechanisms to gather stakeholder input, concerns, and suggestions on the project's environmental and social aspects.
- Collaboration and Partnerships: Collaboration with local authorities, community leaders, civil society organizations, and other stakeholders to facilitate meaningful engagement and foster partnerships for sustainable development.

7.4. Stakeholder Identification and Mapping

CoE EE at MUST stakeholders were identified and grouped as follows:

Group 1—High Impact and High Interest:

These pivotal stakeholders wield significant influence over the project's outcomes and are deeply invested in its progress. Close collaboration with them is imperative to mitigate potential risks and ensure project sustainability. They include:

- Proponent-The driving force behind the project, whose vision and resources are crucial for its success.
- Design Team- Responsible for translating conceptual ideas into actionable plans, ensuring alignment with project objectives.
- Investors- Financial backers whose support is fundamental for project execution and viability.
- Project Employees- Individuals directly involved in project implementation, whose expertise and dedication are vital for achieving milestones.

Group 2—Low Impact and High Interest:

While these stakeholders may not directly impact project outcomes, their engagement and satisfaction are important for maintaining positive relationships and managing reputational risks. They encompass:

- Community Groups/ Associations: Representatives of local communities whose support or opposition can influence public perception and project acceptance.
- Groups with Special Interests: Organizations or associations advocating for specific causes or interests relevant to the project's scope.
- Leaders: Figures of influence within communities whose endorsement or concerns can impact public sentiment and project acceptance.
- Politicians: Elected officials whose support or opposition can sway regulatory decisions and public opinion.

Group 3—Low Impact and Low Interest:

Although these stakeholders may have minimal influence and interest in the project, keeping them informed and monitoring their sentiments is essential to preempt any potential issues. This group comprises:

- The Local Community: Residents within the project vicinity whose daily lives may be indirectly impacted by project activities.
- Neighbors: Individuals residing in close proximity to the project site, whose concerns may arise due to construction or operational activities.
- Landowners: Property owners whose assets may be affected by project development or infrastructure changes.
- Local Businesses: Commercial entities operating in the project area, whose operations may be tangentially impacted by project activities.

Group 4—High Impact and Low Interest:

Despite their significant influence on project outcomes, these stakeholders may not be actively engaged or interested in project developments. However, providing them with necessary information is crucial to ensure compliance and regulatory adherence. This category includes:

- National Environment Management Authority: Regulatory body overseeing environmental compliance and permitting, whose approvals are essential for project progression.
- County Government Departments: Local governmental bodies responsible for regulatory oversight and permitting within the project's jurisdiction.

Table 10: Stakeholder engagement

Stakeholder	**Area Of Influence**	**Project Phase**	**Stakeholder Manager**	**Engagement Approach**	**Engagement Tools**	Frequency
National Environment Management Authority (NEMA)	Regulatory Compliance Environment Monitoring	ALL	Lead Expert	Consult and Report	Reports, Letters, Email	Very frequent
Proponent and design team	Project design and implementation	ALL	Lead Expert	Consult and inform	Meetings, Emails, Telephone, Reports.	Very frequent
Kenya Wildlife Service	Regulatory Compliance Approval of new developments	ALL	Lead Expert	Consult and inform	Meetings and Reports.	Very frequent
County Department of Planning	Regulatory Compliance Approval of new developments	Construction	Associate Experts	Consult	Information Boards/ Approval documents	Occasional
Local Leaders/Chief	Local Impacts and opportunities	ALL	Lead & Associate experts	Consult	Meeting & Interviews	Periodic
Community/Residents Groups	Social and communal impacts	ALL	Sociologist + Associate experts	Consult	Consultative Meetings	Periodic
Neighbours	Direct impacts of project Implementation	ALL	Sociologist + ESIA experts	Consult and inform	Meetings and Questionnaires	Frequent
Businesses and Institutions	Socioeconomic Impacts	ALL	ESIA experts	Consult and inform	Questionnaires Interviews	Lass Frequent

7.5. Focused Group Discussions

Taking into account the geographical scope of MUST, which we conducted a comprehensive focus group discussion. Additionally, representatives from diverse demographics such as men, women, youth, and people with disabilities from all these locations were actively engaged in the discussion. Furthermore, the focus group was honored to host a representative from the Njuri

Ncheke council of elders adding valuable insights and perspectives to the discourse.

Questionnaires

Questionnaires were distributed within Meru university of science and technology and in surrounding neighborhoods to collect additional views from the community and other stakeholders.

7.6. Key Stakeholder Input

Positive:

1. Job Creation: Stakeholders highlight the potential for CoE to generate employment opportunities, thereby contributing to economic growth and reducing unemployment rates in the region.
2. Improved Livelihoods: They emphasized the positive impact of the CoE on enhancing the quality of life for local residents by giving them employment, generating income for better education, healthcare, and other essential services.
3. Urbanization: Stakeholders recognize the CoE as a catalyst for urban development, promoting infrastructure growth, and attracting investments in the surrounding areas.
4. Borrowing of Technology: They acknowledge the opportunity for knowledge transfer and technological advancement through collaboration with global partners, fostering innovation and competitiveness.

Negative:

i. Hazardous Waste Management: Stakeholders express apprehension regarding the effective management of hazardous waste generated by the CoE, highlighting potential environmental risks and health hazards if not properly addressed.
ii. Solid Waste Management: Concerns are raised about the adequacy of waste management systems to handle the increased volume of solid waste resulting from the CoE operations, emphasizing the importance of sustainable waste disposal methods.

7.7. Outcomes of stakeholder engagement

The outcomes of the stakeholder engagement process for the CoE project are summarized as

follows:

- Increased Awareness: Enhanced stakeholder awareness and understanding of the CoE project, its objectives, and potential environmental and social impacts.
- Stakeholder Engagement: Active participation and engagement of stakeholders in the ESIA process, including the provision of valuable feedback, concerns, and recommendations. ***Filled questionnaires and meeting minutes are appended in this report***
- Improved Project Design: Integration of stakeholder input and considerations into the project design, mitigation measures, and management plans to address identified concerns and optimize project outcomes.

- Enhanced Trust and Collaboration: Building of trust, credibility, and collaborative relationships between project proponents, stakeholders, and affected communities through transparent and inclusive engagement practices.
- Compliance and Accountability: Demonstration of commitment to regulatory compliance, corporate social responsibility, and sustainable development principles through transparent and accountable public participation processes.

Here is a summarized table of consultations held for this proposed projects at Meru University of Science and Technology

Table 11: Summary of Stakeholder engagement table

Consultation Date	Venue	Number of Participants	Stakeholders Consulted
15 July 2024	Meru University Hall	35	University administration, faculty members, and students
22 July 2024	Tigania West Sub-County Office	50	Local government officials, community leaders, and representatives of nearby communities
29 July 2024	Meru Level 5 Hospital	20	Health sector stakeholders, environmental officers, and local NGOs
5 August 2024	University main Hall	40	Business representatives, small-scale traders, and agricultural stakeholders

12 August 2024	Online Consultation	25	Experts, donors, and international development partners

7.8. Conclusion

Stakeholder engagement is a vital aspect of the ESIA process for the CoE EE project, providing an opportunity for stakeholders to contribute to decision-making processes, voice their concerns, and shape the project's outcomes. By fostering open dialogue, collaboration, and transparency, the public participation process has strengthened stakeholder engagement, improved project understanding, and enhanced the overall sustainability and acceptability of the CoE project. Ongoing engagement with stakeholders will remain essential throughout the project lifecycle to ensure continued alignment with stakeholder interests, regulatory requirements, and best practices in environmental and social management.

8. ENVIRONMENTAL MITIGATION MEASURES AND ENVIRONMENTAL MANAGEMENT PLANS (EMP)

The tables below form the proposed EMP for the construction, operational and decommissioning phases of this project. In general, the Tables outline the potential safety, health and environmental risks associated with the project and detail all the necessary mitigation measures, as well as the persons responsible for their implementation and monitoring. **The EMP will be used as checklist in future environmental audits.**

8.1. Construction Phase

Table 12: Construction Phase EMP

Expected Negative Impacts	**Recommended Mitigation Measures**	**Responsible Party**	**Time Frame**	**Estimated Cost (Kshs.)**
High Demand of Raw materials	Source building materials from local suppliers who use environmentally friendly processes in their operations.	Resident Project Manager & Contractor	Throughout construction period	Part of the main budget
	-Source building materials from local suppliers who use environmentally friendly processes in their operations.			
	-Ensure accurate budgeting and estimation of actual construction material requirements to ensure that the least amount of material necessary is ordered.			
	-Ensure that damage or loss of materials at the construction site is kept minimal through proper storage.			
	-Use of some recycled/refurbished or salvaged materials to reduce the use of raw materials and divert material from landfills.			
	-Specify locations for trailers and equipment, and areas of the site which should be kept free of traffic, equipment, and storage.	Civil Engineer, Architect and Resident Project Manager	1 month	200,000
	-Designate access routes and parking within the site.			
	-Introduction of more vegetation (trees, shrubs and grass) on open spaces and their maintenance., especially at the front side of the development	Architect, Project Manager & Landscape specialist	Monthly to Annually	
	-Design and implement an appropriate landscaping program to help in re vegetation of part of the project area after construction. This is to complement the existing one due the disturbance by construction activities	Architect & Landscape specialist	During the beginning phase of the project	

Loss of biodiversity due to habitat disturbance	-Implement re vegetation and habitat restoration programs.	Landscape Architect & Biodiversity Expert	Throughout construction and operational phases	300,000
Increased storm water, runoff and soil erosion	-Roof water to be harvested and stored in underground reservoirs for use in cleaning and in the toilets. The tanks should have a capacity of at least 100, 000litres. To ensure the use of such water for the stated purposes, the building should be fitted with a dual water distribution system	The Civil Engineer, Mechanical Engineer and Resident Project Manager	During the beginning phase of the project	500,000
	-A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structure should be designed.	The Civil Engineer, Mechanical Engineer and Resident Project Manager	1 month	100,000
	-Apply soil erosion control measures such as leveling of the project site to reduce run-off velocity and increase infiltration of storm water into the soil.			50,000
	-Ensure that construction vehicles are restricted to existing roads to avoid soil compaction within and around the project site.		Throughout construction period	200,000
	-Ensure that any compacted areas are ripped to reduce run-off.		2 monthes	
	-Site excavation works to be planned such that a section is completed and rehabilitated before another section begins.	Resident Project Manager	Throughout construction period	
	-Construction of soil galleys on sloppy sections.			
	-Open drains all interconnected to be provided on site.	Civil Engineer	Throughout construction period	
	-Roof catchments to be used to collect the storm water for use			
Increased solid waste generation	-Use of an integrated solid waste management system i.e. through a hierarchy of options: reduction, sorting, re-use, recycling and proper disposal	Resident Project Manager & Contractor	Throughout construction period	200,000

	-Through accurate estimation of the sizes and quantities of materials required, order materials in the sizes and quantities they will be needed, rather than cutting them to size, or having large quantities of residual materials.	Resident Project Manager & Contractor	One-off	
	-Ensure that construction materials left over at the end of construction will be used in other projects rather than being disposed of.			
	-Ensure that damaged or wasted construction materials including cabinets, doors, plumbing and lighting fixtures, marbles and glass will be recovered for refurbishing and use in other projects			
	-Donate recyclable /reusable or residual materials to local community groups, institutions and individual local residents or home owners.			
	-Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time	Resident Project Manager & Contractor	Throughout construction period	
	-Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure.	Resident Project Manager & Contractor	One-off	
	-Purchase of perishable construction materials such as paints should be done incrementally to ensure reduced spoilage of unused materials	Resident Project Manager & Contractor; Mechanical Engineer & Contractor	Throughout construction period	
	-Use building materials that have minimal or no packaging to avoid the generation of excessive packaging waste			
	-Use construction materials containing recycled content when possible and in accordance with accepted standards.			

	-Reuse packaging materials such as cartons, cement bags, empty metal and plastic containers to reduce waste at the site			
	-Dispose waste more responsibly by dumping at designated dumping sites or landfills only.			
	-Waste collection bins to be provided at designated points on site			
	-Contract a NEMA licensed private waste disposal company to transport and dispose the solid waste from site			
	-Running educational campaigns amongst residents/workers, e.g. through use of posters, to encourage reuse or recycling of the solid waste			
Dust emission	-Ensure strict enforcement of on-site speed limit regulations	Resident Project Manager & Contractor	Throughout construction period	100,000
	-Avoid excavation works in extremely dry weathers if/and when possible			
	-Sprinkle water on graded access routes when necessary to reduce dust generation by construction vehicles			
	-Personal Protective equipment to be worn			
Exhaust Emission	-Vehicle idling time shall be minimized	Resident Project Manager & Contractor	Throughout construction period	50,000
	-Alternatively fueled construction equipment shall be used where feasible; equipment shall be properly tuned and maintained			
	-Sensitize truck drivers to avoid unnecessary racing of vehicle engines at loading/offloading points and parking areas, and to switch off engines at these points			
Noise and Vibration	-Sensitize construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used.	Resident Project Manager & Contractor	Throughout construction period	50,000

	-Sensitize construction drivers to avoid gunning of vehicle engines or hooting			
	-Ensure that construction machinery are kept in good condition to reduce noise generation			
	-Ensure that all generators and heavy-duty equipment are insulated or placed in enclosures to minimize ambient noise levels.			
	-The noisy construction works will entirely be planned to be during day time when most of the neighbors will be at work.			
Increased energy consumption	-Ensure electrical equipment, appliances and lights are switched off when not being used	Resident Project Manager & Contractor	Throughout construction period	Part of the main budget
	-Install energy saving fluorescent tubes at all lighting points instead of bulbs which consume higher electric energy			
	-Ensure planning of transportation of materials to ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts			
	-Monitor energy use during construction and set targets for reduction of energy use.			
High Water Demand	-Harness rainwater for some uses such as general cleaning, in the toilets & gardening (roof catchment), hence the need for a dual water distribution system within the building	Mechanical Engineer, Proponent and Resident Project Manager	Throughout construction period	100,000
	-Promote recycling and reuse of water as much as possible (need for a dual water distribution system within the building)		Throughout construction period	
	-Install water conserving taps that turn-off automatically when water is not being used as well as low flush toilets and waterless urinals		One-off	

	-Install a discharge meter at water outlets to determine and monitor total water usage			
	-Promptly detect and repair water pipe and tank leaks		Throughout construction period	
	-Sensitize staff to conserve water by avoiding unnecessary toilet flushing etc.			
	-Ensuring taps are not running when not in use			
Generation of Wastewater	-Provision of means for handling sewage generated by construction workers	Mechanical Engineer & Resident Project Manager	One-off	Part of the main budget
	-Conduct regular checks for sewage pipe blockages or damages since such vices can lead to release of the effluent into the land and water bodies		Throughout construction period	
	-Monitor effluent quality regularly to ensure that the stipulated discharge rules and standards are not violated			
	-Recommended that the proponent connects to the waste water reticulation Plant in MUST	Proponent, contractor	One-off	3,000,000
Incidents, accidents and dangerous occurrences.	-Ensure that provisions for reporting incidents, ccidents and dangerous occurrences during construction using prescribed forms obtainable from the local Occupational Health and Safety Office (OHSO) are in place.	Resident Project Manager, Developer & Contractor & Site Safety Officer	Continuous	100,000
	-Enforcing adherence to safety procedures and preparing contingency plan for accident response in addition to safety education and training shall be emphasized.			
	-Ensure that the premises are insured as per statutory requirements (third party and workman's compensation)		Annually	
	-Develop, document and display prominently an appropriate SHE policy for construction works	Resident Project Manager, Developer & Contractor	One-off	
	-Provisions must be put in place for the formation of a Health and Safety Committee, in which the employer and the workers are represented			
	-Ensure that Suitable, efficient, clean, welllit			

	and adequate sanitary conveniences have been provided for construction workers			
	-Ensure that materials are stored or stacked in such manner as to ensure their stability and prevent any fall or collapse		Continuous	
	-Ensure that items are not stored/stacked against weak walls and partitions			
	-All floors, steps, stairs and passages of the premises must be of sound construction and properly maintained			
	-Securely fence or cover all openings in floors	Resident Project Manager & Contractor	One-off	
	-Ensure that construction workers are not locked up such that they would not escape in case of an emergency		Continuous	
	-All ladders used in construction works must be of good construction and sound material of adequate strength and be properly maintained	Resident Project Manager & Contractor	One-off	
	-Design suitable ocumented emergency preparedness and evacuation procedures to be used during any emergency. Such procedures must be tested at regular intervals	Resident Project Manager & Contractor	One-off for the design/ regularly for the documentation	
	-Ensure that adequate provisions are in place to immediately stop any operations where there is an imminent and serious danger to health and safety and to evacuate workers			
	Ensure that the most current emergency telephone numbers posters are prominently and strategically displayed within the construction site			
	-Provide measures to deal with emergencies and accidents including adequate first aid arrangements		Continuous	

Machinery/equipment safety	-Arrangements must be in place for the medical examination of all construction employees before, during and after termination of employment	Resident Project Manager, Developer & Contractor	Continuous	50,000
	-Ensure that machinery, equipment, personal protective equipment, appliances and hand One-off tools used in construction do comply with the prescribed safety and health standards and be appropriately installed maintained and safeguarded		One-off	
	-Ensure that equipment and work tasks are adapted to fit workers and their ability including protection against mental strain		Continuous	
	-All machines and other moving parts of equipment must be enclosed or guarded to protect all workers from injury		One-off	
	-Arrangements must be in place to train and supervise inexperienced workers regarding Construction machinery use and other procedures/ operations		Continuous	
	-Equipment such as fire extinguishers must be examined by a government authorized person. The equipment may only be used if a certificate of examination has been issued		Continuous	
	-Reports of such examinations must be presented in prescribed forms, signed by the examiner and attached to the general register		Continuous	
occupational health and safety risks during construction period and occupational phase	-Well stocked first aid box which is easily available and accessible should be provided within the premises	Resident Project Manager & Contractor/ proponent/ residents	One-off	100,000
	-Provision must be made for persons to be trained in first aid, with a certificate issued by a recognized body.			
	-Firefighting equipment such as fire extinguishers and hydrant systems should be provided at strategic locations such as stores			

	and construction areas.			
	-Regular inspection and servicing of the equipment must be undertaken by a reputable service provider and records of such inspections maintained		Every 3 Months	
	-Signs such as “NO SMOKING” must be prominently displayed within the facility, especially in parts where inflammable materials are stored		One-off	
	-Enough space must be provided within the premises to allow for adequate natural ventilation through circulation of fresh air			
	-There must be adequate provision for artificial or natural lighting in all parts the premises in which persons are working or passing			
	-Circuits must not be overloaded		Continuous	
	-Distribution board switches must be clearly marked to indicate respective circuits and pumps		One-off	
	-There should be no live exposed Connections		Continuous	
	-Electrical fittings near all potential sources of ignition should be flame proof		One-off	
	-All electrical equipment must be earthed			
	-Develop a suitable system for the safe collection, recycling and disposal of chemical wastes, obsolete chemicals and empty chemical containers to avoid their reuse for other purposes and to eliminate or minimize the risks to safety, health and environment			
	-Ensure that all chemicals used in construction are appropriately labeled or marked and that material safety data sheets containing essential information regarding			

	their identity, suppliers classification of hazards, safety precautions and emergency procedures are provided and are made available to employees and their representatives			
	-Keep a record of all hazardous chemicals used at the premises, cross-referenced to the appropriate chemical safety data sheets		Continuous	
	-There should be no eating or drinking in areas where chemicals are stored or used			
	-Provide workers in areas with elevated noise and vibration levels, with suitable ear protection equipment such as ear muffs		One-off	
	-Ensure that construction workers are provided with an adequate supply of wholesome drinking water which should be maintained at suitable and accessible points.			
	-Ensure that conveniently accessible, clean, orderly, adequate and suitable washing facilities are provided and maintained in within the site			
	-Provision for repairing and maintaining of hand tools must be in place			
	-Hand tools must be of appropriate size and shape for easy and safe use			
	-Height of equipment, controls or work surfaces should be positioned to reduce bending posture for standing workers			
Safety and Security	-Ensure general safety and security at all times by providing day and night security guards and adequate lighting within and around the construction site.	Resident Project Manager & Contractor	Continuous	10,000 per month

Oil Spills	A designated garage section of the site fitted with oil trapping equipment to be planned for changes. Such an area will be well protected from contaminating the soil			5,000 per month
Increased Food Supply/demand	-Construction workers will be given breaks to go for lunch	Resident Project Manager & Contractor	Continuous	50,000
	-Onsite canteen to supply food if possible			
Hazardous waste/material spills	-Hazardous substance control and emergency response plan that will include preparations for quick and safe cleanup of accidental spills.	The Mechanical Engineer, Resident Project Manager, Contractor & the Developer /The Mechanical Engineer	Continuous	Part of erosion control
	-Hazardous-materials handling procedures to reduce the potential for a spill during construction			
	-Identify areas where refueling and vehicle maintenance activities and storage of hazardous materials, if any, will be permitted			
Vector Borne and Water Borne Disease Incidence	-Complete refuse collection and handling service to be provided	Mechanical Engineer	Continuous	50,000
Possible Exposure of Workers to Diseases	-Shall be mitigated by occupational health and safety standards enforcement	Contractor & all foremen	Continuous	
Increased Pressure on Infrastructure	-Coordinate with other planning goals and objectives for region	Architect, Project Manager, Contactor and the Developer	Continuous	
	-Upgrade existing infrastructure and services, if and where feasible.			
Insecurity	-Appoint security personnel operating 24 hours	Security Officer, Resident Project Manager & Police	Continuous	Part of general safety
	-Body-search the workers on entry, to avoid getting weapons on site, and leaving site to ensure nothing is stolen.			
	-Ensure only authorized personnel get to the site			

Air Pollution	-Suitable wet suppression techniques need to be utilized in all exposed areas -All unnecessary traffic must be strictly limited on site; speed controls are to be enforced	The Contractor & Site Safety Officer	Continuous	Part of dust Control
Emergence of new environmental concern during the construction phase	-Due to the magnitude of the project, the Firm of experts shall carry out monitoring and evaluation. Moreso, an initial environmental audit will also be carried within a period of 12 months after commencement of the operations	Firm of Experts/ NEMA.	Continuous	240,000

8.2. Operational Phase EMP

The necessary objectives, activities, mitigation measures, and allocation of responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the operational phase of proposed Project are outlined in the table below.

Table 13: Operational Phase EMP

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Estimated Cost (KShs)
Solid waste generation	1.Use of an integrated solid waste management system i.e. through a hierarchy of options: 2. Source separation and reduction 3. Recycling 4. Composting and reuse 5 Incineration	Resident Project Manager & Contractor	Throughout construction period	20,000

	6. Sanitary land filling.			
	2. Provide color coded solid waste handling facilities such as rubbish bags and bins and skips		One-off	
	3.Ensure that solid wastes generated at the facility are regularly disposed of appropriately at authorized dumping sites		Continuous	
	4. Ensure that occupants of the facility manage their waste efficiently through recycling, reuse and proper disposal procedures.			
	5. Donate redundant but serviceable equipment to charities and institutions 6. Adhere to the provisions of 5.2.2 of this report to handle hazardous waste and hazardous waste EMP below			
Release of sewage into the environment	1. Provision of adequate and safe means of handling sewage generated at the project via connection to the MUST Water and Sewerage treatment plant	Resident Project Manager & Mechanical Engineer	One-off	10,000
	2. Conduct regular inspections for sewage pipe blockages or damages and fix appropriately		Continuous	
	3. Ensure regular monitoring of the sewage discharged from the project to ensure that the stipulated sewage/effluent discharge rules and standards are not violated			
	4. Apply for Effluent Discharge License in NEMA and comply with the license conditions			
High demand for	1. Switch off electrical equipment, appliances and lights when not being used	Resident Project	Continuous	500,000

Energy	2. Install occupation sensing lighting at various locations such as storage areas which are not in use all the time	Manager & Occupants of the facility		
	3. Install energy saving fluorescent tubes at all lighting points within the offices instead of bulbs which consume higher electric energy			
	4. Monitor energy use during the operation of the project and set targets for efficient energy use			
	5. Sensitize office occupants to use energy efficiently			
	6. Explore the possibility of using renewable sources of energy such as wind and solar energy			
	Manually adjust temperature and humidity controls on equipment where appropriate in response to demand due to seasonal ambient temperature and humidity loads.			
	Select lower-power settings for overnight			
	Ensure freezers are operating at full capacity			
	Use fume hoods wisely-Fume hoods and safety cabinets are essential and irreplaceable laboratory tools. However, the simple action of closing the sash whenever possible can dramatically reduce the amount of energy consumed by the fume hood.			
	Installing an advanced fume hood filtration system allows for efficient handling of a wide range of chemicals, including acids, bases and solvents, without increasing energy consumption.			
High water Demand	1. Promptly detect and repair water pipes and tank leaks	Resident Project Manager & Mechanical	Continuous	10,000 a month
	2. Facility operators to conserve water e.g. by avoiding unnecessary toilet flushing.			
	3. Ensure taps are not running when not in Use			

	4. Install water conserving taps that turn-off automatically when water is not being used	Engineer	One-off	
	5. Install a discharge meter at water outlets to determine and monitor total water usage			
	6. Create water conservation awareness among the office occupants		Continuous	
Occupational Health and Safety Accidents/ Incidents	Ensure provisions for reporting incidents, accidents, and dangerous occurrences during the operational phase using prescribed forms obtainable from the local Occupational Health and Safety Office (OHSO).	Resident Project Manager, Developer, Contractor, and Site Safety Officer.	Continuous.	500,000 pa
	Enforce adherence to safety procedures, prepare contingency plans for accident response, and emphasize safety education and training.			
	Ensure premises are insured as per statutory requirements for third party and workman's compensation annually.			
	Develop, document, and prominently display an appropriate Safety, Health, and Environment (SHE) policy for operational Works			
	Establish provisions for the formation of a Health and Safety Committee with representation from employers and workers			
	Ensure suitable, efficient, clean, well-lit, and adequate sanitary conveniences are provided for workers.			
	Ensure materials are stored or stacked in a manner ensuring stability and preventing falls or collapse.			
	Ensure all floors, steps, stairs, and passages are of sound construction and properly maintained.			

	Design suitable documented emergency preparedness and evacuation procedures, regularly testing such procedures.			
	Ensure provisions are in place to immediately stop operations where there is imminent and serious danger to health and safety and evacuate workers.			
	Display the most current emergency telephone numbers posters prominently within the Facility.			
	Provide measures to deal with emergencies and accidents, including adequate first aid arrangements.			
	Health and Safety Training: Provide comprehensive health and safety training to workers and contractors, covering hazard identification, risk assessment, use of personal protective equipment (PPE), and emergency procedures			
	Occupational Health Monitoring: Implement regular occupational health monitoring programs to assess and mitigate exposure risks, including air quality monitoring, noise monitoring, and ergonomic assessments.			
	Personal Protective Equipment (PPE): Ensure the availability and proper use of appropriate PPE, such as respiratory protection, hearing protection, and safety harnesses where needed.			
	Take all necessary measures to ensure health and safety of workers and the general public during operation of the project as stipulated in Factories and Other Places of Work Act Cap 514			
Impacts of climate Change	- Incorporate climate-resilient design principles into project infrastructure Elevate critical infrastructure above projected flood levels	Design team,		Part of

□ *Changes in Precipitation Patterns:* □ *Increased Temperature Extremes:* □ *Extreme Weather Events:*	- Implement water conservation measures, such as rainwater harvesting and efficient irrigation systems - Explore alternative water sources - Improve energy efficiency in project operations and facilities - Integrate renewable energy sources, such as solar and wind power, into the project's energy supply - Establish a climate monitoring system to track key climate variables	Project manager & contractor		design and construction costs
Increased Traffic	Slip roads should be constructed to ease getting and leaving the site- a proper traffic management plan should be developed		One off	
Increased general safety and security impacts	1. Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the premises. 2. Body-search the workers on entry, to avoid getting weapons on site, and leaving site to ensure nothing is stolen. 3. Ensure only authorized personnel get to the facility	Security Officer, Manager & Police	Continuous	
Increased Pressure on Infrastructure	1. Coordinate with other planning goals and objectives for region 2. Upgrade existing infrastructure and services, if and where feasible.	Architect, Project Manager, and the Developer	Continuous	100,000
Air Pollution	1. Install fume hoods within the labs	Site Safety Officer/ Residents project manager	Continuous	100, 000 pa
	2. Suitable wet suppression techniques need to be utilized in all exposed areas			
	3. All unnecessary traffic must be strictly limited on site speed controls are to be enforced			
	3. Use of unleaded fuel to be encouraged			

Emergence of new environmental concerns	1. Undertake an environmental audit within 12 months after operation commences as required by law	EIA Experts/ NEMA	Annually	240,000
	Undertake regular Safety drills Audits in line with the provisions of OSH Act, 2007	Safety Auditor, Project EHS officer	Annually	200,000

8.3. Decommissioning Phase

In addition to the mitigation measures provided in tables above, it is necessary to outline some basic mitigation measures that will be required to be undertaken once all operational activities of the project have ceased. The necessary objectives, mitigation measures, allocation of responsibilities, time frames and costs pertaining to prevention, minimization and monitoring of all potential impacts associated with the decommissioning and closure phase of the project are outlined in the following table.

Table 14: Demolition phase EMP

Recommended Mitigation Measures	**Responsible Party**	**Time Frame**
1. Demolition waste management		
1. All buildings, machinery, equipment, structures and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible	Contractor, Proponent	One-off
2. All foundations must be removed and recycled, reused or disposed of at a licensed disposal site		
3. Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the materials should be taken to a licensed waste disposal site		

4. Donate reusable demolition waste to charitable organizations, individuals and institutions		
2. Rehabilitation of project site		
1. Implement an appropriate re-vegetation program to restore the site to its original status	Contractor, Proponent	One-off
2. Consider use of indigenous plant species in re-vegetation		
3. Trees should be planted at suitable locations so as to interrupt slight lines (screen planting), between the adjacent area and the development.		

8.4. Environmental and Social Safeguards

This Section outlines the Environmental and Social Safeguards applicable to the CoE EE, in line with the World Bank Environmental and Social Standards

Environmental and Social Standard (ESS)	Description
ESS 1: Assessment and Management of Environmental and Social Risks and Impacts	- Conduct comprehensive Environmental and Social Impact Assessments (ESIA) for all project phases. - Develop and implement Environmental and Social Management Plans (ESMP) to manage identified risks and impacts. - Establish and maintain grievance mechanisms for affected stakeholders.
ESS 2: Labor and Working Conditions	- Ensure compliance with national labor laws and regulations. - Provide safe and healthy working conditions for project personnel. - Prevent discrimination, harassment, and child labor within the project workforce.
ESS 3: Resource Efficiency and Pollution Prevention	- Promote resource efficiency and pollution prevention measures. - Optimize resource utilization and minimize waste generation. - Implement pollution control technologies and practices to reduce environmental impacts.

ESS 4: Community Health and Safety	- Develop and implement community health and safety plans. - Provide adequate safety training and personal protective equipment. - Establish emergency response protocols and procedures.
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	- Identify and assess impacts on biodiversity and ecosystems. - Implement measures to avoid, minimize, and mitigate adverse impacts. - Develop biodiversity conservation and management plans.
ESS 7: Indigenous Peoples	- Respect and recognize the rights of indigenous peoples. - Conduct meaningful consultation and engagement with indigenous communities. - Obtain free, prior, and informed consent (FPIC) for project activities affecting indigenous lands and resources.
ESS 8: Cultural Heritage	- Identify and assess impacts on cultural heritage sites and artifacts, if any - Implement measures to avoid, minimize, and mitigate adverse impacts. - Develop cultural heritage management plans.
ESS 9: Financial Intermediaries	- Ensure compliance with environmental and social safeguards policies. - Conduct due diligence assessments for financial intermediaries. - Provide capacity building and technical assistance for risk management.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1. Monitoring Guidelines

Continuous observations and assessment is essential so that if unforeseen dangers are noticed, alternatives are sort for. Risk assessment of fire outbreaks, and others should not be ignored in the construction plan. Waste management within the project site should be strictly followed. Mitigation measures of storm water management are essential. Safety standards should constantly be maintained, in brief, monitoring guidelines could be based on the following parameters:

- Health and safety measures using such standards as the laid down regulatory framework
- Water demand, availability and use
- Waste management
- Examine the changing land use patterns including those for residential, ecological and economic purposes
- Accidents and risk assessment arising from the use of water, roads, electricity and or any other amenity

Environmental audits

Conduct a regular environmental and safety audit to ensure that all necessary environmental and safety measures are being undertaken and that existing practices are still valid.

Staff training

There is no point in conducting full environmental audits and installing sophisticated environmental measures unless all staff members are committed to reducing the environmental impact of the labs. Staff training is therefore essential so that all employees understand what the goals are and what is expected of them.

Environmental protocols

Ensure that formal systems and protocols for different procedures are drawn up where appropriate, that staff are made aware of them, and that they are readily accessible in the lab.

Meetings

Hold regular lab meetings to discuss environmental issues and check progress. As well as a practical way of improving compliance, these meetings emphasize the importance of this issue.

Courses

There are a number of courses available covering different environmental issues, particularly those pertaining to the laboratory. Staff should be sent on environmental training courses as appropriate.

9.2. Reporting

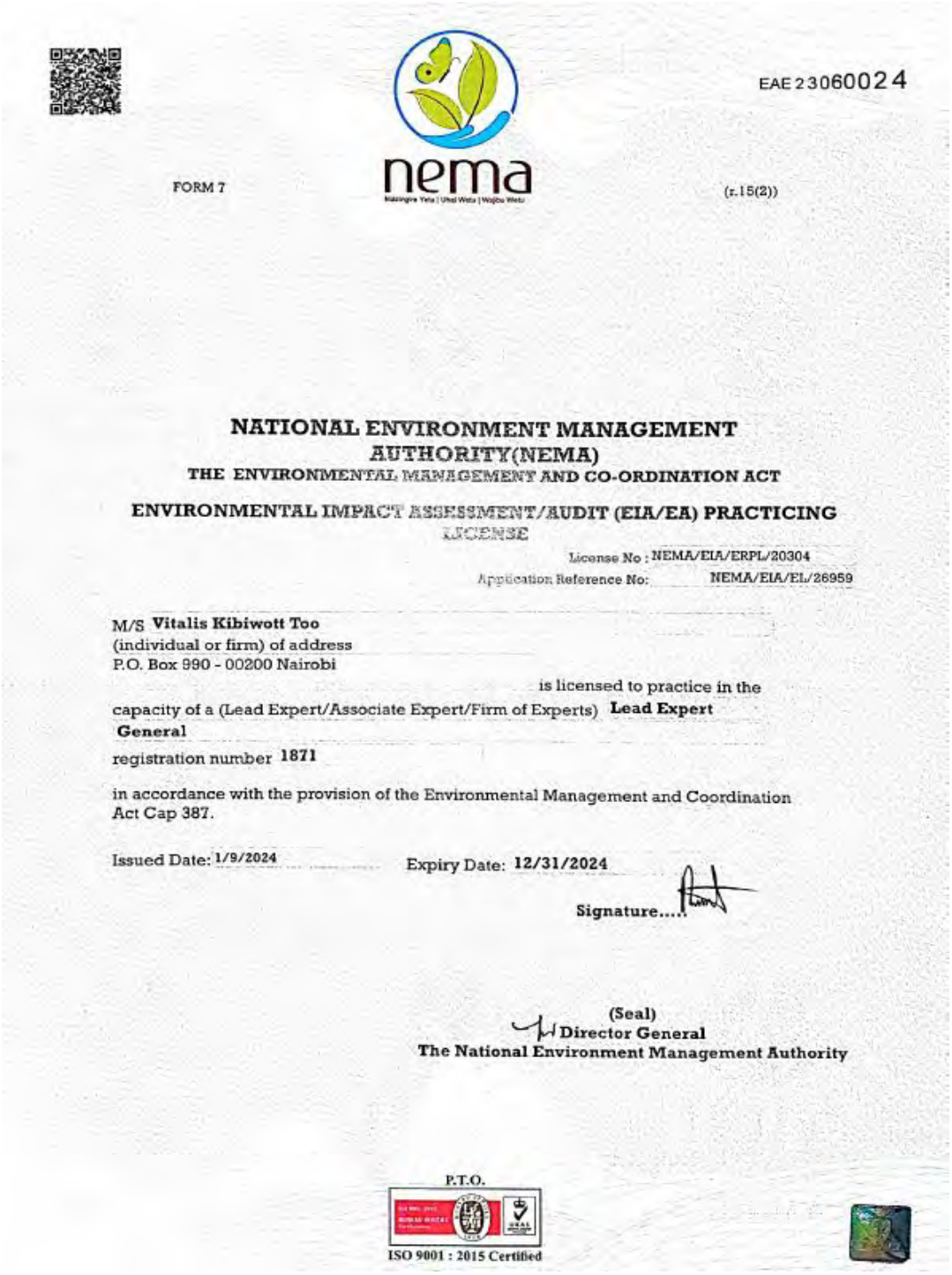
Constant reporting by the site contractor to the architect is necessary to ensure the project is executed as per the architectural drawings. The safety officer should always remain on site to report any safety concerns for urgent mitigation. He should also at all times enforce safety requirements as per the relevant legislations. The contractor must consult the architect to maintain a clear understanding of all the aspects of the project.

9.3. Conclusion and Recommendations

During the preparation of this report for the proposed development, it was observed and established that most of the predicted negative impacts during construction on the environment are rated medium-term with no significant effect. Operational impacts are significant and require close monitoring and strict adherence to EMP. The positive impacts are highly rated and will benefit all stakeholders at large. The project proponent has proposed to adhere to prudent implementation of the EMP; and is obtaining all necessary permits and licenses from the relevant authorities and have qualified and adequate personnel to do the project as proposed. The proponent has proposed adequate safety and health mitigation measures as part of the relevant statutory requirements.

APPENDICES

Firm license



EAE 23060024

FORM 7 (r.15(2))

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/20304

Application Reference No: NEMA/EIA/EL/26959

M/S **Vitalis Kibiwott Too**
(individual or firm) of address
P.O. Box 990 - 00200 Nairobi

is licensed to practice in the capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert General**

registration number **1871**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: 1/9/2024 Expiry Date: **12/31/2024**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001 : 2015 Certified

Title Deed

(T)

REPUBLIC OF KENYA

THE REGISTRATION OF TITLES ACT
(Chapter 281)

GRANT: NUMBER L.R. 103827

ANNUAL RENT: Kshs. 72/- (REVISABLE)

TERM: 99 years from 1.11.2006

KNOW ALL MEN BY THESE PRESENTS that THE PRESIDENT OF THE REPUBLIC OF KENYA hereby grants unto THE BOARD OF GOVERNORS, MERU COLLEGE OF TECHNOLOGY, a body corporate duly incorporated under the Education Act (Chapter 211) of the Laws of Kenya of MERU (Post Office Box Number 972)

[hereinafter called "the Grantee ") All that piece of land situate in North of Meru Municipality in NORTH MERU District containing by measurement two one five decimal seven (215.7)

hectares/~~acres~~ or thereabouts that is to say L.R. No. 27423

which said piece of land with the dimensions abuttals and boundaries thereof is delineated on the plan annexed hereto and more particularly on Land Survey Plan Number 268932 deposited in the Survey Records Office at Nairobi

TO HOLD

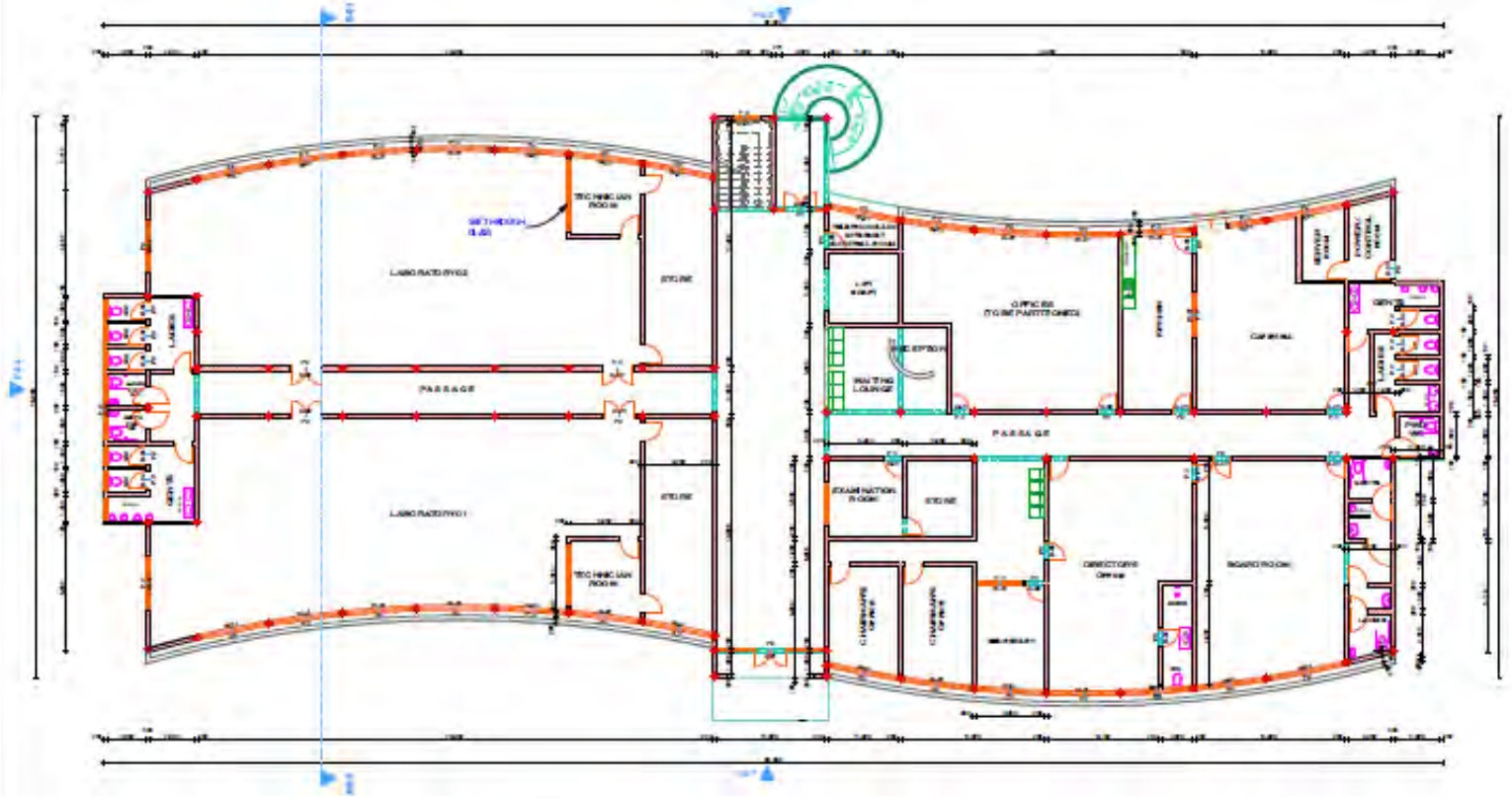
for the term of ninety nine (99) years from the

First day of November ~~One thousand nine hundred and~~ Two thousand and six SUBJECT to (a) the payment in advance on the first day of January in each year of the annual rent of shillings seventy two (Kshs. 72/-)(Revisable) w.e.f. 1.11.2006 (b) the provisions of the Government Lands Act (Chapter 280) and (c) the following Special Conditions (namely):—

[P.T.O.

Project Design

PROPOSED CONSTRUCTION OF ELECTRICAL ENGINEERING SCHOOL OF EXCELLENCE AT MERU UNIVERISTY OF SCIENCE AND TECHNOLOGY



GROUND FLOOR LAYOUT PLAN

NOTES

GENERAL NOTES :

1.All dimensions are in millimeters.

2.Only figured dimensions are to be read no scaling the drawing.

3.All levels and foundation depth to be determined and checked on site before any building work commences.

4.Any descripancies to be reported to the architect before any work commences.

5.All works to be in accordance with the standard specifications and notes.

6.D.P.C shall be in 2ply bituminous felt at least 150mm from GL.

MECHANICAL NOTES :

1. ANY SVP denotes man hole @ galley trap respectively .

2., permanent vents (PV) to be provided above every opening (doors and windows).

3.Mechanical work to MOH and local authority's regulations and specifications.

REVISIONS

PROPOSED CONSTRUCTION OF SCHOOL OF EXCELLENCE ELECTRICAL ENGINEERING AT MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY P.O BOX 972-60200, MERU

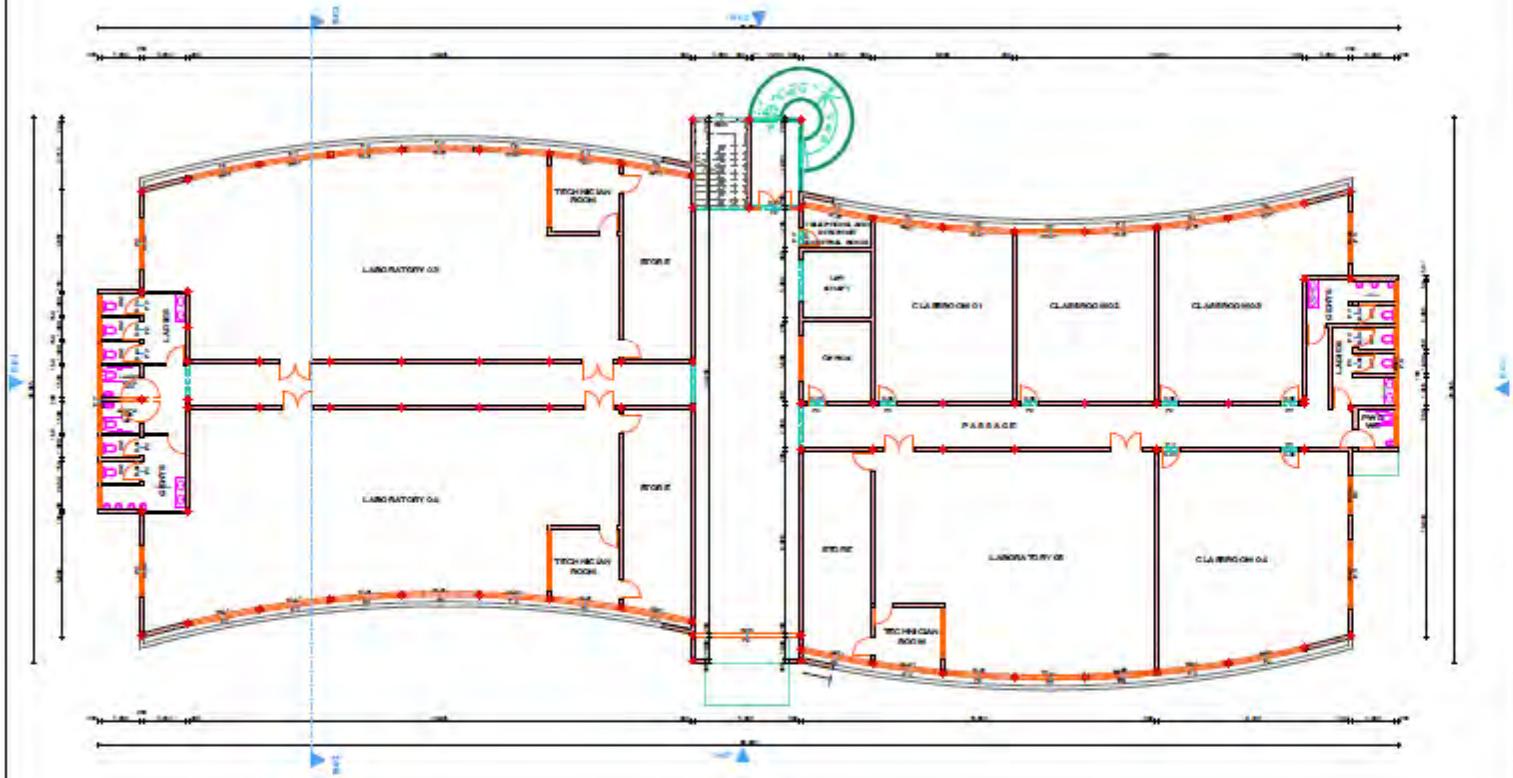
GROUND FLOOR LAYOUT PLAN

1:100

AUGUST 2024

1

PROPOSED CONSTRUCTION OF ELECTRICAL ENGINEERING SCHOOL OF EXCELLENCE AT MERU UNIVERISTY OF SCIENCE AND TECHNOLOGY



FIRST FLOOR LAYOUT PLAN

NOTES

GENERAL NOTES :

1.All dimensions are in millimeters

2.Only figured dimensions are to be read no scaling the drawing .

3.All levels and Foundation depth to be determined and checked on site before any building work commences.

4.Any descripancies to be reported to the architect before any work commences.

5.All works to be in accordance with the standard specifications and notes.

6.D.P.C shall be in 2ply bituminous felt at least 150mm from GL.

MECHANICAL NOTES :

1. MH EGF denotes man hole & gulley trap respectively .

2. permanent vents (PV) to be provided above every opening (doors and windows).

3.Mechanical work to MOH and local authority's regulations and specifications.

REVISIONS

PROPOSED CONSTRUCTION OF SCHOOL OF EXCELLENCE (ELECTRICAL ENGINEERING) AT MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY, P.O.BOX 972-60200, MERU

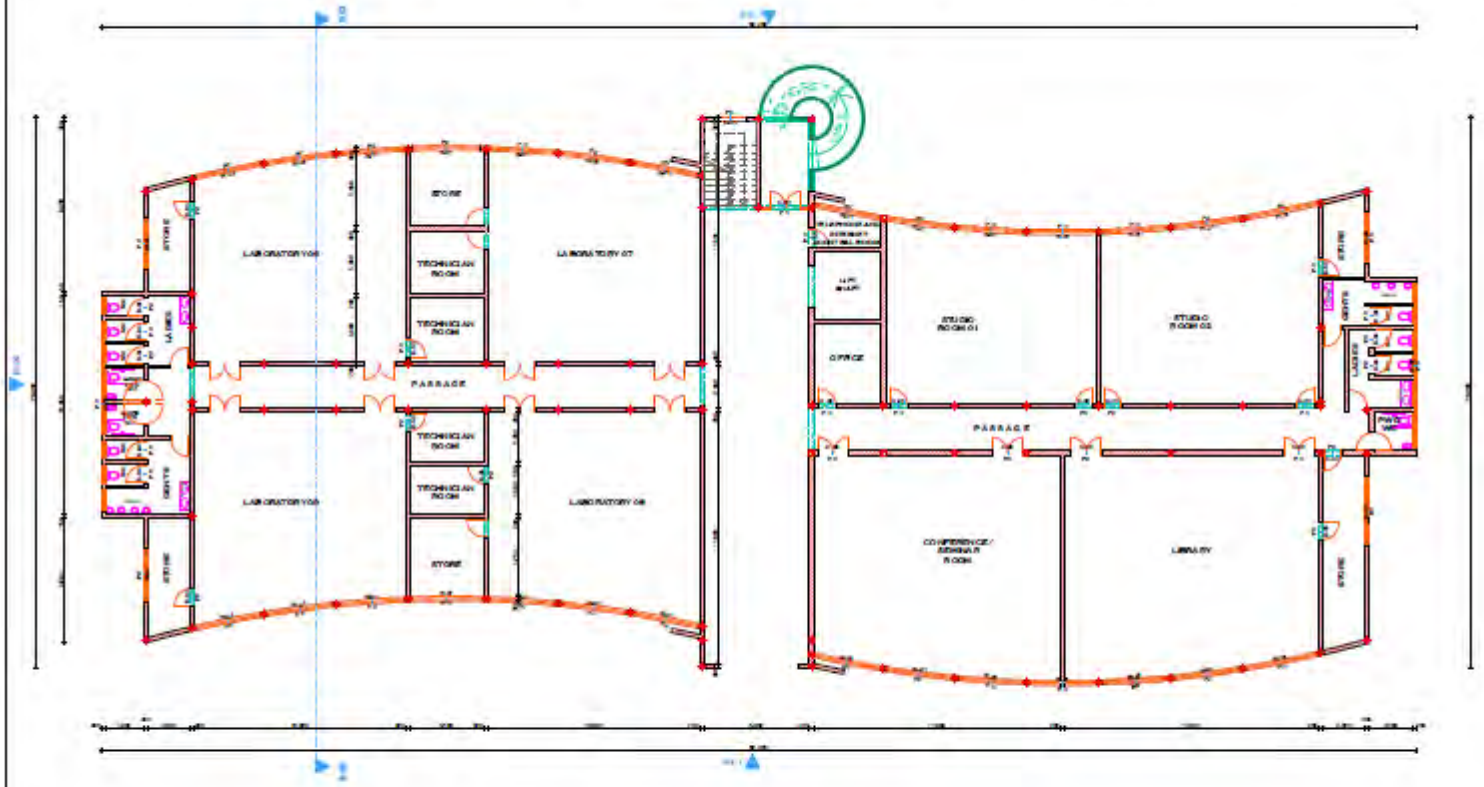
FIRST FLOOR LAYOUT PLAN

1:100

JANUARY 2024

2

PROPOSED CONSTRUCTION OF ELECTRICAL ENGINEERING SCHOOL OF EXCELLENCE AT MERU UNIVERISTY OF SCIENCE AND TECHNOLOGY



SECOND FLOOR LAYOUT PLAN

NOTES

GENERAL NOTES :

1.All dimensions are in millimeters

2.Only figured dimensions are to be read not scaling the drawing.

3.All levels and Foundation depth to be determined and checked on site before any building work commences.

4.Any descripancies to be reported to the architect before any work commences.

5.All works to be in accordance with the standard specifications and notes.

6.D.P.C shall be in 2ply bituminous felt at least 150mm from GL.

MECHANICAL NOTES :

1. WM G/T denotes wash hand basin and gulley trap respectively.

2. permanent vents (PV) to be provided above every opening (doors and windows).

3.Mechanical work to MOH and local authority's regulations and specifications.

REVISIONS

Project Title :
PROPOSED CONSTRUCTION OF SCHOOL OF ELECTRICAL ENGINEERING AT MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

Client :
MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY
P.O BOX 972-60200
MERU

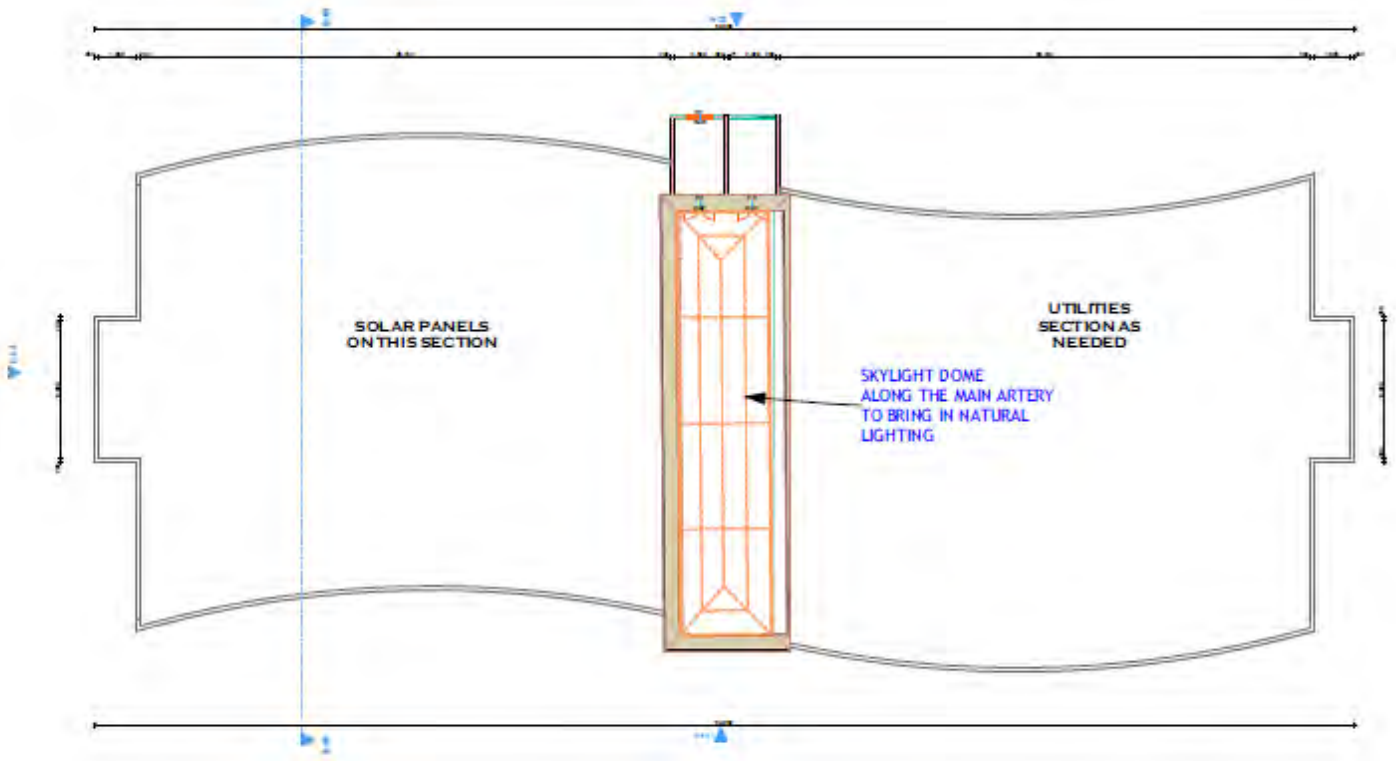
Drawing Title :
SECOND FLOOR LAYOUT PLAN

Ministry of Public Works, Kenya Public Works Office, Building Department, P.O. Box 30, Embu.

Scale: 1:100
Date: AUGUST 2024

Drawing No. 1

PROPOSED CONSTRUCTION OF ELECTRICAL ENGINEERING SCHOOL OF EXCELLENCE AT MERU UNIVERISTY OF SCIENCE AND TECHNOLOGY



ROOF LAYOUT PLAN

NOTES

GENERAL NOTES :

1.All dimensions are in millimeters

2.Only figured dimensions are to be read no scaling the drawing .

3.All levels and Foundation depth to be determined and checked on site before any building work commences.

4.Any descrepancies to be reported to the architect before any work commences.

5.All works to be in accordance with the standard specifications and notes.

6.D.P.C shall be in 2ply bituminous felt at least 150mm from GL.

MECHANICAL NOTES :

1., MH &GT denotes man hole & gulley trap respectively .

2., permanent vents (PV) to be provided above every opening (doors and windows).

3.Mechanical work to MOH and local authority's regulations and specifications.

REVISIONS

PROPOSED CONSTRUCTION OF SCHOOL OF EXCELLENCE ELECTRICAL ENGINEERING AT MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY, P.O BOX 972-60200, MERU

ROOF LAYOUT PLAN

1:100 AUGUST 2024

1


NOTES
GENERAL NOTES:
1.All dimensions are in millimeters.
2.Only figured dimensions are to be read no scaling the drawing.
3.All levels and Foundation depth to be determined and checked on site before any building work commences.
4.Any descrepancies to be reported to the architects before any work commences.
5.All works to be in accordance with the standard specifications and notes.
6.D.P.C shall be in 2ply bituminous felt at least 150mm from GL.
MECHANICAL NOTES:
1. All SVP, services must have G.gulley trap respectively .
2., permanent vents (PV) to be provided above every opening (doors and windows).
3.Mechanical work to MOH and local authority's regulations and specifications.
REVISIONS
ELEVATIONS

Bill of Quantities Attached Separately.

Estimate: KES 250,000,000

MINUTES ON THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) MEETING HELD AT MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY ON 5th AUGUST 2024, FOR THE PROPOSED CONSTRUCTION OF CENTRE OF EXCELLENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

Attendance list: As attached

AGENDA
1. Welcome and Introduction
2. Purpose of the meeting
3. Presentation: Project description
4. Presentation: Environmental and Social Impact Assessment
5. Discussion
6. Support for the project
7. Closing Remarks

MINUTE 01- 05/08/2024 -WELCOME AND INTRODUCTION

The meeting was called to order at 10.30am by the Environmental Expert who also asked Dr Lucas Mogaka to lead in a word of prayer. After the prayers, she welcomed all the attendants and thanked them for creating time for the meeting. This was followed by introductions of stakeholders present in the meeting.

MINUTE 02-05/08/2024 -ESIA: PURPOSE OF THE MEETING

The lead consultant informed the meeting and Regulation 17 of the Environmental (Impact Assessment and Audit Regulations, 2003-which was revised in 2016) and the Legal Notice Number 31 and 32 of 2019 requires a project proponent in consultation with the National Environment Management Authority (NEMA) to seek views/ opinions of the entities/ stakeholders/ communities and/or persons that might be directly/ indirectly affected by activities/operations of a proposed project/ action. The purpose of consultation and public participation was outlined as follows:

- Provide information regarding a proposed project, in this case the proposed CoE EEE, to the people likely to be affected, key stakeholders and interested persons
- Provide an overview of the ESIA and Public Participation Process (PPP) being followed for the proposed project
- Provide an opportunity for members of public, key stakeholders and Interested persons to seek clarity and provide input into the project;
- Record and document the comments raised and include them in the final report

MINUTE 03-05/08/2024 - PROJECT DESCRIPTION

In order to make the meeting attendants understand the project better and to lay ground for informed discussions, the EIA Expert made a brief description of the project by stating that there will be Construction of the a three-floored building, including. The CoE EEE will serve as a hub for interdisciplinary collaboration, academic exchange, and technological advancement. The ESIA expert outlined all the facilities that will be contained on every floor of the proposed project and gave handouts on the same.

MINUTE 04-05/08/2024 ESIA: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

The Lead ESIA Expert explained that ESIA is a systematic analysis of projects, policies, plans or programs to determine their actual and potential environmental impacts, the significance of such impacts and to propose measures to mitigate the negative ones. ESIA is mainly used at the level of specific developments and projects i.e. for specific and definable projects, in specific areas; hence each project must have its own ESIA report. The consultant also outlined various Laws, Regulations and Policies that apply in the carrying out of an ESIA such as the following: Environmental Policy Framework, Environmental Management and Coordination (Amended 2015) Act, 1999; and the Environmental Impact Assessment and Audit Regulations of 2003

MINUTE 05- 29/04/2024 -Discussion and Public Meeting Outcomes

- *Mr. Stephen Njogu expressed concern about solid waste disposal, particularly hazardous solid wastes, and inquired about the facility's waste management procedures. The Lead Expert responded, explaining that the university has a solid waste management system in place for general wastes. However, the proponent will have to engage NEMA licensed hazardous waste handlers to dispose of hazardous wastes safely.*
- *Mr. Moses Wambugu raised a question regarding the handling of toxic gases to mitigate air pollution. The Lead Expert explained that project shall implement engineering controls such as local exhaust ventilation (LEV) systems, fume hoods, and gas scrubbers to capture and remove toxic gases at the source before they can disperse into the laboratory air. Additionally, annual audits of labs will ensure their proper functioning, minimizing harm to human health.*
- *Adamson Kingori, a community member, recommended implementing laws and regulations to govern the lab's operations, ensuring the comfort and safety of the community and workers. He also recommended that HIV awareness should be created to as this development will bring high population in the nearby town. He added that there will be cases of insecurity, because not all people that will move to nearby towns will be employed in the city. She also emphasized that the proponent considers carrying out CSR activities for the neighboring communities.*
- *John expressed gratitude for the meeting's importance and emphasized the benefits the project would bring to the surrounding communities, both socially and economically. He highlighted the importance of strict enforcement by NEMA to address environmental pollution.*
- *The Environmental Lead Expert mentioned the Sustainable Waste Management Act, 2022 and its provisions on extended producer responsibility. Encouraging participants to report companies whose wastes are strewn within their communities to reduce environmental pollution.*
- *Wambugu, thanked the organizers for facilitating the meeting, highlighting the benefits of the proposed project for the surrounding communities and the nation at large. He emphasized the importance of local employment and revenue generation, urging the Ministry to ensure professional execution of the project.*
- *Attendees expressed full support for the project, recognizing its alignment with university's objectives and potential benefits for the region. They recommended adherence to government regulations and conditions.*

- *Stakeholders suggested that the contractor should engage with the communities directly to raise awareness about available job opportunities. This proactive approach will enable interested individuals to apply for the available positions, fostering a sense of inclusivity and stakeholder involvement within the community.*
- *Mr. Raphael expressed concern regarding their suggestions and whether they would be taken seriously. He also raised an issue with the existing liaison office, noting that many community members who applied for jobs through the office were not considered. He emphasized the importance of community employment. He suggested the establishment of a community liaison and a community liaison committee to oversee ongoing activities*

The overall conclusions from the public meeting led to determination of the following:

i. *There is general support for the entire project and that the proposed project is timely and the community is eager for the CoE to be operational;*

ii. *The proposed labs will provide opportunities for learning and research, not only in Kenya but also in the continent*

iii. *There is need for all construction works to be above board to ensure occupational, health and safety and too guaranteed to the workers and the community at large*

MINUTE 06-05/08/2024 ESIA: SUPPORT FOR THE PROJECT

All the members who were present at the meeting were in support of the proposed project

MINUTE 07-29/04/2024 ESIA: CLOSING REMARKS

Consultants thanked the participants for their active engagement in the meeting and informed them that their views and comments will be incorporated in the ESIA report. The participants signed the attendance sheet and requested to share all they have learned about the project with other community members.

The meeting ended at 1300hours with a word of prayer from one of the members

Lead expert stamp..... *Date*....05/08/2024.....

Witnessed by
Area assistant Chief
Name and stamp....JOSEPH MUREUKI*Sign*.....*Date*....10/9/2024

ASST. CHIEF
LAURI SUB LOCATION
NKOMO LOCATION

PUBLIC CONSULTATION FORM

The ministry of Education, state department of Higher Education and Research plans to establish a Centre of Excellence in Electrical and Electronic engineering in Meru university of science and Technology which falls within your vicinity. To adhere to the Environmental Management and Coordination Act(EMCA, 1999) and Environmental Impact Assessment and Audit Regulations (2003), the project proponent is conducting the environmental and social Impact Assessment (ESIA) for this endeavor.

ESIA evaluates potential environmental, social and economic impacts of a proposed project to aid decision making. Public and stakeholders' consultation is integral to this process, and we value your input as a neighbour to the project site. Your responses to the following questionnaire will greatly contribute to our understanding of community perspectives. Your information will be handled with utmost respect and confidentiality. Please provide objective feedback.

Name of neighbour/stakeholder... CAROLINE KAGWIRIA.....

Telephone... 0712273592 ..... ID Number.... 27989094 .....

Residential area..... KAITHE .....

1. Do you support the proposed development, which is within your neighbourhood?
   (a) Yes ✓ (b) No
2. Give reasons for your response in (1) above.....
   ..... Education and economic empowerment
3. What impact is likely to rise from the proposed project (Environmental, social, economic)
   ..... Scarce resorces eg water and .....
   ..... health facilities .....
4. Give any anticipated negative impact as a result of the proposed project
   ..... Rise of H.I.V .....
   .....
5. What are your suggested mitigation measures for the anticipated negative impacts?
   .....
   ..... Educating on H.I.V .....
   .....

Signature... CKKS ..... Date... 9/09/2024 .....

Thank you for your time and opinion

PUBLIC CONSULTATION FORM

The ministry of Education, state department of Higher Education and Research plans to establish a Centre of Excellence in Electrical and Electronic engineering in Meru university of science and Technology which falls within your vicinity. To adhere to the Environmental Management and Coordination Act(EMCA, 1999) and Environmental Impact Assessment and Audit Regulations (2003), the project proponent is conducting the environmental and social Impact Assessment (ESIA) for this endeavor.

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Name of neighbour/stakeholder..... Nduru Laban .....

Telephone..... 254723267707 .....ID Number..... 27922075 .....

Residential area..... Nduru .....

1. Do you support the proposed development, which is within your neighbourhood?

   (a) Yes ✓ (b) No

2. Give reasons for your response in (1) above..... It will give a good opportunity for innovations .....

3. What impact is likely to rise from the proposed project (Environmental, social, economic)

   ..... (1) New innovations .....

   ..... (2) Center for learning .....

4. Give any anticipated negative impact as a result of the proposed project

   ..... None though of .....

   .....

5. What are your suggested mitigation measures for the anticipated negative impacts?

   ..... Observation of set Commission .....

   ..... Procedures .....

   .....

   Signature..... .....Date..... 9-9-2024 .....

Thank you for your time and opinion

PUBLIC CONSULTATION FORM

The ministry of Education, state department of Higher Education and Research plans to establish a Centre of Excellence in Electrical and Electronic engineering in Meru university of science and Technology which falls within your vicinity. To adhere to the Environmental Management and Coordination Act(EMCA, 1999) and Environmental Impact Assessment and Audit Regulations (2003), the project proponent is conducting the environmental and social Impact Assessment (ESIA) for this endeavor.

ESIA evaluates potential environmental, social and economic impacts of a proposed project to aid decision making. Public and stakeholders' consultation is integral to this process, and we value your input as a neighbour to the project site. Your responses to the following questionnaire will greatly contribute to our understanding of community perspectives. Your information will be handled with utmost respect and confidentiality. Please provide objective feedback.

Name of neighbour/stakeholder.....Timothy Baru.....

Telephone.....0713481882-1.....ID Number.....26205493.....

Residential area.....

1. Do you support the proposed development, which is within your neighbourhood?
   (a) Yes (b) No
2. Give reasons for your response in (1) above.....It will Promote Research in Electrical and Electronic Engineering
3. What impact is likely to rise from the proposed project (Environmental, social, economic)
   .....Economic Impact.....
   .....
4. Give any anticipated negative impact as a result of the proposed project
   - Economic Impact - Funding
   .....
5. What are your suggested mitigation measures for the anticipated negative impacts?
   - Apply and engage in Research to Solicite funding
   .....

Signature.....Date..9/9/2024.....

Thank you for your time and opinion

PUBLIC CONSULTATION FORM

The ministry of Education, state department of Higher Education and Research plans to establish a Centre of Excellence in Electrical and Electronic engineering in Meru university of science and Technology which falls within your vicinity. To adhere to the Environmental Management and Coordination Act(EMCA, 1999) and Environmental Impact Assessment and Audit Regulations (2003), the project proponent is conducting the environmental and social Impact Assessment (ESIA) for this endeavor.

ESIA evaluates potential environmental, social and economic impacts of a proposed project to aid decision making. Public and stakeholders' consultation is integral to this process, and we value your input as a neighbour to the project site. Your responses to the following questionnaire will greatly contribute to our understanding of community perspectives. Your information will be handled with utmost respect and confidentiality. Please provide objective feedback.

Name of neighbour/stakeholder.....Job Mutuma.....

Telephone....0723606723.....ID Number....22896858.....

Residential area....Kitheka.....

1. Do you support the proposed development, which is within your neighbourhood?
   (a) Yes ✓ (b) No
2. Give reasons for your response in (1) above....the Centre of Excellence will be a boost to the economy of Nchiu.....
3. What impact is likely to rise from the proposed project (Environmental, social, economic)
   The high number of students that will be pursuing education in MUST/CoE will be a boost the areas' economy.
4. Give any anticipated negative impact as a result of the proposed project
   It may lead to overpopulation and scrambling for resources such as water and hostels.
5. What are your suggested mitigation measures for the anticipated negative impacts?
   later supply measures to be considered, and adequate hostels to be constructed within the vicinity.

Signature.....Date....06/09/2024....

Thank you for your time and opinion

PUBLIC CONSULTATION FORM

The ministry of Education, state department of Higher Education and Research plans to establish a Centre of Excellence in Electrical and Electronic engineering in Meru university of science and Technology which falls within your vicinity. To adhere to the Environmental Management and Coordination Act(EMCA, 1999) and Environmental Impact Assessment and Audit Regulations (2003), the project proponent is conducting the environmental and social Impact Assessment (ESIA) for this endeavor.

ESIA evaluates potential environmental, social and economic impacts of a proposed project to aid decision making. Public and stakeholders' consultation is integral to this process, and we value your input as a neighbour to the project site. Your responses to the following questionnaire will greatly contribute to our understanding of community perspectives. Your information will be handled with utmost respect and confidentiality. Please provide objective feedback.

Name of neighbour/stakeholder....KARIMI....JULIUS.....

Telephone....0717277636.....ID Number....27694889.....

Residential area.....NKOMO.....Ward.....

1. Do you support the proposed development, which is within your neighbourhood?
   (a) Yes (b) No
2. Give reasons for your response in (1) above....It...will...Create...Jobs...to.....
   neighbours....and....good...~~learning~~...learning...facilitators'.....
3. What impact is likely to rise from the proposed project (Environmental, social, economic)
   ..economic.....
   .....
4. Give any anticipated negative impact as a result of the proposed project
   .....
   .....N/A.....
5. What are your suggested mitigation measures for the anticipated negative impacts?
   .....
   .....N/A.....
   .....

Signature.....Date..26/09/2024.

Thank you for your time and opinion

PUBLIC CONSULTATION FORM

The ministry of Education, state department of Higher Education and Research plans to establish a Centre of Excellence in Electrical and Electronic engineering in Meru university of science and Technology which falls within your vicinity. To adhere to the Environmental Management and Coordination Act(EMCA, 1999) and Environmental Impact Assessment and Audit Regulations (2003), the project proponent is conducting the environmental and social Impact Assessment (ESIA) for this endeavor.

ESIA evaluates potential environmental, social and economic impacts of a proposed project to aid decision making. Public and stakeholders' consultation is integral to this process, and we value your input as a neighbour to the project site. Your responses to the following questionnaire will greatly contribute to our understanding of community perspectives. Your information will be handled with utmost respect and confidentiality. Please provide objective feedback.

Name of neighbour/stakeholder.....WILLIAM MUTWIRI.....

Telephone....0726277142.....ID Number.....22686862.....

Residential area.....MIATHENE.....

1. Do you support the proposed development, which is within your neighbourhood?
   (a) Yes (b) No
2. Give reasons for your response in (1) above.....
   .....
3. What impact is likely to rise from the proposed project (Environmental, social, economic)
   .....
   .....
4. Give any anticipated negative impact as a result of the proposed project
   .....
   .....
5. What are your suggested mitigation measures for the anticipated negative impacts?
   .....
   .....
   .....

Signature.....Date....9/9/2024.....

Thank you for your time and opinion

MERU UNIVERSITY OF SCIENCE & TECHNOLOGY

MEETING ATTENDANCE FORM

NAME OF THE MEETING: STAKEHOLDERS MEETING

CHAIRMAN/CONVENER: _____

DATE: 05/08/2024 VENUE _____ TIME: _____

S/NO.	NAME	DESIGNITION	SIGN
1			
2	LUCAS MOGATKA		
3	Socrates Or Mogere		
4	Ephrakim Wamalwa		
5	ANDERSON KIPROTICH		
6	MATHEON OTIENO		
7	ANDERSON KIPROTICH		
8	Nimrod Kipkemoi		
9	Adamson Kingori		
10	Daniel Orwenyo		
11	Michael Rabuogi		
12	KELVIN MWENDA KIAMBI		
13	Emmanuel Karanja		
14	Abdullahi Ged. Hassan		
15	RONO IAN		
16	FESTUS KIPKEMOI		
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20	Stephen Njogu		
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22	MOSES WAMBUGU		
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MERU UNIVERSITY OF SCIENCE & TECHNOLOGY
31 AUG 2023
P.O. BOX 972-60200 MERU
DEAN SCHOOL OF ENGINEERING & ARCHIT.

EIA240112703

nema

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT
ENVIRONMENTAL IMPACT ASSESSMENT LICENSE

License No: NEMA/EIA/PSL/35478

Applicaton Ref No: NEMA/EIA/PSR/54018

This is to certify that the Environmental Impact Assessment Project Report received from
MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

of
P.O BOX ,972-60200 MERU, KENYA

submitted to the National Environment Management Authority in accordance with the Environmental Impact Assessment & Audit Regulations, 2003 regarding the:
CONSTRUCTION OF THE CENTRE OF EXCELLENCE BUILDING

whose objective is to carry on
To construct a centre of excellence building

located at
Kianjai, Tigania west

has been reviewed and a license is hereby issued for the implementation of the project, subject to attached conditions.

Issue Date:
14/10/2024

Signature
(Seal)

Director-General
The National Environment Management Authority.

P.T.O.

ISO 9001 : 2015 Certified

1.0 General Conditions

1.1 The Project is for The **Proposed Construction Of The Centre Of Excellence At The Meru University Of Science And Technology Located At Kianjai Area, Nchiru ,Tigania West .**

1.2 The license shall be valid for 24 months (time within which the project shall commence) from the date hereof.

1.3 The Director General shall be notified of any transfer, variation or surrender of this license.

1.4 Without prejudice to the other conditions of this license, the proponent shall implement and maintain an environmental management system, organizational structure and allocate resources that are sufficient to achieve compliance with the requirements and conditions of this license.

1.5 The Authority shall take appropriate action against the proponent in the event of breach of any of the conditions stated herein or any contravention to the Environmental Management and Coordination Act, Cap 387 and regulations therein.

1.6 This license shall not be taken as statutory defence against charges of environmental degradation or pollution in respect of any manner of degradation/pollution not specified herein.

1.7 The proponent shall ensure that records on conditions of licenses/approval and project monitoring and evaluation shall be kept on the project site for inspection by NEMA's Environmental Inspectors.

1.8 The proponent shall submit an Environmental Audit report in the first year of occupation/operations/commissioning to confirm the efficacy and adequacy of the Environmental Management Plan.

1.9 The proponent shall comply with NEMA's improvement orders throughout the project cycle.

1.10 The proponent shall provide the final project accounts (final project costs) on completion of construction phase. This should be done prior to project commissioning/operation/occupation.

2.0 Construction Conditions

2.1 The proponent shall obtain all the requisite approval from the County Government of Meru, Ministry of Education and all other relevant authorities prior to commencement of construction works for the development.

2.2 In the event that the project site borders a river or a stream, the proponent pursuant to Regulation 6(c) of Water Quality Regulation 2006, shall protect the riparian reserve by ensuring that NO development activity is undertaken within the full width of the river or stream to a **minimum of six (6) meters and a maximum of 30 meters on the highest recorded flow level.**

2.3 The proponent shall put up a modern waste water treatment plant with a capacity to handle cumulative discharge from the entire development even during peak hours.

2.4 The proponent shall put up a project signboard as per the Ministry of Transport and Infrastructure standards indicating the NEMA license number among other information.

2.5 The proponent shall ensure strict adherence to the provisions of Environmental Management and Coordination (Noise and Excessive Vibrations Pollution Control) Regulations of 2009.

2.6 The proponent shall ensure strict adherence to the Occupational Safety and Health Act (OSHA), 2007 and safety of the learners at all times.

2.7 The proponent shall ensure that workers are provided with adequate personal protection equipment (PPE), sanitary facilities as well as adequate training.

2.8 The proponent/developer shall ensure that construction activities are undertaken during the day (and not at night) - between 0800 hrs and 1800 hrs; and on Saturdays between 0800 hrs to 1300 hrs. No work shall be undertaken on Sundays; and that transportation of construction materials to and from site are undertaken during weekdays and Saturdays only during the hours specified herein

2.9 The proponent shall ensure that the development adheres to zoning specifications issued for development of such a project within the jurisdiction of County Government of Meru with emphasis on approved land use for the area.

2.10 The proponent shall ensure strict adherence to the provisions of Environmental Management and Coordination (Air Quality) Regulations of 2014.

2.11 The proponent shall ensure strict adherence to the Environmental Management Plan developed throughout the project cycle.

2.12 The proponent shall ensure the construction works and materials meet the specifications and standards of the building code 1968 with regards to the public safety during construction and occupation of the building.

3.0 Operational Conditions

3.1 The proponent shall ensure that all excavated material and debris is collected, re-used and where need be, disposed of as per the Environmental Management and Coordination (Waste Management) Regulations of 2006.

3.2 The proponent shall obtain an effluent discharge license from NEMA within the first year of operation as per the requirements of the Environmental Management and Coordination (Water Quality) Regulations of 2006.

3.3 The proponent shall maintain a functional waste water treatment plant throughout the project life.

3.4 The proponent shall ensure that all waste water is disposed as per the standards set out in the Environmental Management and Coordination (Water Quality) Regulations of 2006.

3.5 The proponent shall ensure that rain water harvesting and storm water drains facilities are provided to supplement surface and ground water.

3.6 The proponent shall ensure that all equipment used are well maintained in accordance with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations of 2009.

3.7 The proponent shall ensure that all solid waste is handled in accordance with the Environmental Management and Coordination (Waste Management) Regulations of 2006.

3.8 The proponent shall provide adequate parking space for vehicles, adequate access routes for emergency situations.

3.9 The proponent shall ensure that all workers are well protected and trained as per the Occupational Safety and Health Act (OSHA) of 2007.

3.10 The proponent shall comply with the relevant principal laws, by-laws and guidelines issued for development of such a project within the jurisdiction of County Government of Meru, County Executive in charge of Environment, Ministry of Health, Water Resources Authority, Building codes of Kenya 2000, National Construction Authority, Kenya Forest Service; Kenya Wildlife Service, Min of Education and other relevant Authorities.

3.11 The proponent shall ensure that environmental protection facilities or measures to prevent pollution and ecological deterioration such as water and energy saving fixtures, integrated solid waste management system, landscaping, soil erosion controls, functional drainage systems, emergency response plan, utility relocation plan, traffic management plan, Air pollution control, crowd control mechanisms, waste water management plans are designed, constructed and employed simultaneously with the proposed project.

4.0 Notification Conditions

4.1 The proponent shall seek written approval from the Authority for any operational changes under this license.

4.2 The proponent shall ensure that the Authority is notified of any malfunction of any system within 12 hours on the NEMA hotline No. **020 6006041/0786101100** and mitigation measures put in place.

4.3 The proponent shall keep records of all pollution incidences and notify the Authority within 24 hours.

4.4 The proponent shall notify the Authority in writing of its intent to decommission the facility **three (3) months** in advance.

5.0 Decommissioning Conditions

5.1 The proponent shall ensure that a decommissioning plan is submitted to the Authority for approval at least three (3) months prior to decommissioning.

5.2 The proponent shall ensure that all pollutants and polluted material is contained and adequate mitigation measures provided during the phase

The above conditions will ensure environmentally sustainable development and must be complied with.