ENVIRONMENTAL IMPACT AND SOCIAL ASSESSMENT STUDY FOR THE PROPOSED SHARTUKA SUGAR MILL ON PLOT NO. TRANSMARA/SHARTUKA/921, NAROK COUNTY

Geo. Ref. Coordinates: latitudes 00.56'28" S and longitude 34057'53" E.

PROPONENT: **SHARTUKA SUGAR MILLS LIMITED**
P. O. Box 333 - 40700
NAROK

AUGUST 2022

This Report has been prepared in accordance with the requirements of the Environmental (Impact Assessment and Audit) Amendment Regulations, 2019, pursuant to the Environmental Management and Coordination Amendment) Act (EMCA) 2015

SUBMISSION OF DOCUMENTATION

This Environmental Assessment Report was prepared in accordance with the EMCA 2015 and the Environmental Impact Assessment and Audit Amendment Regulations, 2019 for the proposed development of a sugar milling plant with a crushing capacity of 1500tcd in Shartuka Location, Narok County. We, the undersigned confirm that the contents of this report are an accurate and truthful representation of all findings relating to the project.

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PROPONENT

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ACKNOWLEDGEMENT

The EIA/Audit Experts are very grateful to Shartuka Sugar Mills Limited, Narok County for commissioning us to conduct this Environmental and Social Impact Assessment. We further acknowledge the support of the Deputy County Commissioner (DCC), Assistant County Commissioner (ACC), area chiefs, opinion leaders and anyone either direct or indirect, from the various parties who assisted the EIA/EA experts' team towards the successful completion of this report.

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NON TECHNICAL SUMMARY

This study constitutes the Environmental and Social Impact Assessment for the proposed sugar milling plant with a crushing capacity of 1500 tcd (tonnes cane crushed per day) on plot no: Transmara/Shartuka/921, Shartuka Location, Transmara W est Sub-County, and Narok County for Shartuka Sugar Mills Limited. Specifically on GPS coordinates latitudes 00.56'28" S and longitude 34057'53" E.

In today's competitive market, efficiency on every front is crucial for survival. The prosperity of local citizens is directly linked to the prosperity of this unique rural industry. The economic scale of operation i.e .sizing of the factory and the implementation of advanced and modern technology is a must. The whole process of development of this project is capital intensive and will be implemented in phases.

Shartuka Sugar Mills Limited is determined to support Kenya in addressing the recurrent sugar production deficit in the country, and it's planning to develop a sugar milling plant by installing equipment/machinery geared towards sugar and allied products production. The construction phase will employ over 60 skilled and unskilled labourers. Completion is estimated at a cost of USD 8,232,000.00. The project proposes to construct and install equipment and machinery to be installed will include;

- Offices (Administration, Agriculture, way scale, security
- Sugar Go down
- Boiling House (pan supply tanks, P.T. Hooper, Seed Cry, vacuum pans, Vacuum Cry
- Evaporation House (Evaporation bodies, Juice heaters, Juice Limer)
- Clarification House (Clarifier, Flash tank, Mud mixer, Lime Slaker,
- Sugar House
- Power House (Alternator, turbine)
- Spray pond
- Molasses Tanks
- Water reservoir tank (1,875,000ltrs)
- Effluent Treatment Plant
- Fuel filling station

The operational phase of the project will involve the production of sugar with bagasse and molasses being produced as by-products. Other by-products will include filter mud and boiler ash. The main inputs will be sugarcane, raw water, bagasse and electricity. The decommissioning phase will consider restoring the site to its nearest original status if necessary. This environmental and social impact assessment and public participation activities will provide input to the final design (as part of an interactive process of design and environmental/public assessment which is required by GoK in order to obtain an optimally environmentally acceptable and cost-effective design). The final design will incorporate mitigation measures to address potential adverse impacts and significant public concerns. Mitigative measures within the final design will include machinery installation details, operations and management plans.

This Environmental Assessment study was undertaken pursuant to the requirements stipulated by the National Environmental Management Authority (NEMA) under the Environmental Management and Coordination Act (1999) (amended 2015) that requires all proposed development projects listed under Schedule II of the EMCA, to undergo an Environmental and Social Impact Assessment Study to determine the potential adverse impacts of a project and thereby devising appropriate mitigation measures. The study assesses the impacts of the proposed development and proposes mitigation measures as well as an Environmental Management Plan (EMP). It was carried out through desk research, field visits, and consultations. The team conducted extensive literature review including information sourced from the internet and local communities in relation to the proposed project. During field investigations, information on physical, ecological and socio-economic aspects of the project area and its environs were determined.

This study analyzed the potential adverse impacts of the project in terms of the possible effect to the environment and on the interested and affected parties. The study looked at the different stages of the development, namely;

- Project design;
- Project construction and equipment installation phase;
- Project operational phase involving use of the premises; and
- Project decommissioning phase.

The study examines the project in terms of the components it entails and the services the project will avail the end users and those to which its use will impact on. It has also considered the natural aesthetics and scenic beauty of the property while also maintaining the environmental quality and supporting investment value. To identify, predict, and analyze the various impacts that may emanate from the project, various study methods and tools were incorporated. These included checklists, matrices, expert opinions and observations.

An in-depth analysis of public concerns from the interested and affected parties was undertaken and views incorporated in the development of the Environmental Management Plan. This involved discussions and dialogue with the neighbours adjacent to the project site and lead agencies relevant to the installation of machinery. The baseline data collection was primarily investigated through desktop studies and sites visits, photographic capture, direct interviews and public meetings with the interested and affected stakeholders. What was found to be of significant environmental concern for investigation was;

- Incessant noise and dust levels during the construction, machinery installation and operation phase;
- The potential air, visual, water and soil contamination during the construction, machinery installation and operation phase
- Pressure on existing water resources during the construction, machinery installation and operation phase
- health and safety hazards during the construction, machinery installation and operation phase

However the above potentially adverse impacts identified are expected to occur during the construction and operation phases but will be ameliorated through the proposed mitigation measures. The positive impacts identified include the creation of short and long-term employment across the board.

The impact matrix below highlights the summary of the impacts anticipated.

Impact matrix

ENVIRONMENTAL IMPACT	**IMPACT TYPE**								**MITIGATION**	
	Positive		**Negative**							
	Significant	Not Significant	Significant	Not Significant	Short Term	Long Term	Irreversible	Cumulative	No mitigation required	Mitigation required
CONSTRUCTION/MATERIAL INSTALLATION PHASE IMPACTS										
Soil erosion-Land degradation				x	x					x
Accumulation of solid waste storage & disposal – Waste management			x		x					x
Construction works noise – Auditory nuisance			x		x					x
Dusting – Air quality degradation			x		x					x
Equipment/vehicle maintenance – Spillage/noise/visual impacts				x	x					x
Fire outbreak – Environmental disaster			x		x					x
Construction works induced traffic – traffic congestion			X		x					x
Const. works water demand – supply depletion			x		x			x		x
Loss of terrestrial habitat & biodiversity – Degradation of bio-diversity				x	x					x
Solid waste accumulation – Environmental degradation			x		x			x		x
Materials stockpiling & storage –contamination				x	x			x		x
Impervious surfacing & paving – increased run off.			x			x				x
Sewage & litter – public health & contamination			x		x					x
Fuel & chemical spills – Soils & water contamination				x	x					x

Roadside vending – unsightliness & littering				x	x			x		x
Visual amenities - Unsightliness				x	x					x
Emergency situations – Lack of response				x	x					x
Employment	x				x			x	x	
Improved growth of economy	x					x		x	x	
Improved land value	x					x		x	x	
OPERATION PHASE IMPACTS										
	Positive		**Negative**							
	Significant	Not Significant	Significant	Not Significant	Short Term	Long Term	Irreversible	Cumulative	No mitigation required	Mitigation required
Increased infrastructural pressure – water abstraction			x			x		x		x
Pollution - Accidental Oil Spills				x		x		x		x
Pollution – Environmental degradation				x		x		x		x
Pollution – Alterations of soil property				x		x				x
Pollution – bagasse, filter cake			x			x				x
Pollution – Water contamination(effluent)			x			x				x
Pollution – Air pollution & noise levels			x			x				x
Increased traffic – unnecessary congestion				x		x				x
Drain blockages – Back flooding				x		x				x
Vector and rodents breeding – Increased vulnerability to diseases				x		x		x		x
Electricity consumption – pressure on supply			x			x				x
Social amenities – Cultural interference				x						x
Natural/Manmade disasters – Environmental degradation			x		x					x
Increase in sugar production capacity	x					x			x	
Employment opportunities	x					x		x	x	

Improvement in efficient factory processes	x					x			x	
Optimal use of land	x					x			x	
DECOMMISSIONING PHASE IMPACTS										
	Positive		**Negative**							
	Significant	Not Significant	Significant	Not Significant	Short Term	Long Term	Irreversible	Cumulative	No mitigation required	Mitigation required
Solid Waste generation			x		x					x
Dust			x		x					x
Noise & vibration			x		x					x
Rehabilitation	x					x			x	
Employment opportunities	x				x				x	

Recommendations to mitigate resultant negative impacts have been put forward. These include proper management of by-products and both solid and liquid waste. An Environmental Management Plan (EMP) has been developed outlining the areas of impact and proposing measures to manage them sustainably.

Overall, the project is environmentally feasible and sound with minimal potential negative impacts, which can be minimized through incorporation of corrective, rehabilitation, and instituting of appropriate mitigation measures.

Acronyms

ACC	Assistant County Commissioner
BDL	Below Detection Limit
BQ	Bills of Quantities
CO	Carbon monoxide
CV	Control Valve
CVP	Continuous Vacuum Pan
DCC	Deputy County Commissioner
EAR	Environmental Assessment Report
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management Plan
FCV	Feed Control Valve
FFE	Falling Film Evaporator
GA	General Arrangement
GOK	Government of Kenya
GRPF	Grooved Roller Pressure Feeder.
HP	High Pressure
KFS	Kenya Forest Service
kV	Kilo Volts
LVBC	Lake Victoria Basin Commission
LVSWR	Lake Victoria South Water Resources Management
NEMA	National Environmental Management Authority
NET	National Environmental Tribunal
NETF	National Environmental Trust Fund

NO_X	Nitrogen oxides
SO_X	Sulphur oxides
SPM	Suspended Particulate Matter
TCD	Tons Crushed per Day
WRA	Water Resources Authority

CHAPTER ONE: INTRODUCTION AND SCOPE OF STUDY

1.0 Introduction

This study constitutes the Environmental and Social Impact Assessment for the proposed sugar milling plant with a crushing capacity of 1500 tcd (tonnes cane crushed per day) on plot no: Transmara/Shartuka/921, Shartuka Location, Transmara West Sub-County, and Narok County for Shartuka Sugar Mills Limited. Specifically on GPS coordinates latitudes 00.56'28" S and longitude 34057'53" E.

Shartuka Sugar Mills Limited is determined to support Kenya in addressing the recurrent sugar production deficit in the country, and it's develop a milling that with a capacity of 1500 total cane crushed per day by construting and installing equipment/machinery and allied infrustructure towards this.

The average farm size under small scale in Narok County is 6.1 Hectares and that of large scale is 26.3 Hectares with barley, tea, sugarcane and wheat being grown as the major cash crops. There has been sub-division of land into uneconomic units in some parts of the county while some large scale farms remain unutilized. Hence, there is a real possibility that well-planned and managed cash crop farming could employ several people and increase household incomes in the area. It is in this context that Shartuka Sugar Mills Limited has proposed to put up a sugarcane processing plant to support the production activities in Shartuka Location, Kilgoris Central Constituency, Narok County.

The operational phase of the project will ensure that the plant provides a long-term supply of high-quality sugar into the local, national and regional markets and alleviate the problem of overstaying of sugar cane in the farms. Main inputs will be sugarcane, water, bagasse and electricity. By-products will include bagasse, molasses, filter mud and boiler ash. The decommissioning phase will consider restoring the site to its nearest original status if necessary. The full environmental impact assessment and public participation activities will provide input to the final design (as part of an interactive process of design and environmental/public assessment which is required by GOK in order to obtain an optimally environmentally acceptable and cost-effective design).

The final design will incorporate mitigation measures to address potential adverse impacts and significant public concerns. Mitigative measures within the final design will include construction details and operations and management plans.

1.1 Background and Rationale of the EIA

To comply with the requirements of the Environmental Management and Co-ordination Act (EMCA) of 2015 and the Environmental Impact Assessment and Audit (Amendment) Regulations, 2019, the project owner has commissioned us to prepare an Environmental and Social Impact Assessment (EIA) Project Report. The environmental study was commissioned on 1st June, 2022. To initiate the public consultation process, standard public consultation forms were issued to the immediate neighbours, clients, staff of the proposed sites, and consultations were made with key lead agencies.

1.2 Scope

As a requirement by the Environmental Management and Coordination Act (1999), Amended 2015, of Kenya, a project proponent is required to undertake an Environmental & Social Impact Assessment study before undertaking any project highlighted in Schedule 2 of the Act. This study undertakes to fulfil this requirement. This study is necessary at the planning stages of the undertaking to ensure that significant impacts on the environment are taken into consideration during the design, construction, operation, and decommissioning of the facility. Screening of the activities of the project focussed on identifying the project's significant environmental impacts. These included the sensitivity of the area, public health and safety; the possibility of uncertain unique or unknown risks; the possibility of having individually insignificant but cumulatively significant impacts; proposals for solid and liquid waste disposal, etc. Scoping also focussed on identifying the key issues of environmental concern encompassing the significance of policy, legal, technical, economic and social impacts of the project.

1.3. Terms of Reference (NEMA/TOR/5/2/462)

The Terms of Reference for this assessment are based on the Environmental Impact Assessment and Audit Regulations dated June 2003 (amended 2019). These were submitted to and approved by NEMA.

1.4 Methodology

After preliminary visits to the proposed site, the following were carried out in the preparation of this document:

i) Observations, discussions with stakeholders and lead agencies

ii) Documentary review of the nature of the proposed project;

iii) Policy and legal frameworks, social and environmental setting of the area;

iv) Checklists were prepared to identify possible environmental and human safety issues, photography, etc;

v) Review of the project designs and implementation plans and comprehensive discussions with the project proponent;

vi) Report writing

CHAPTER TWO: PROJECT DESCRIPTION

2.0 Project Location

This report covers the preparation of a project-specific Environmental and Social Impact Assessment (EIA) for the proposed construction of sugar milling plant with a crushing capacity from 1500tcd (tonnes cane crushed per day) on plot no: Transmara/Shartuka/921, Shartuka, Transmara West, Narok County. It sits on a total area of about 9.7H.

Source: Google earth maps, 2022

2.1 Project Objectives

Shartuka Sugar Mills Limited is a registered company incorporated under the Companies Act (Cap. 486) to run a sugar milling plant at Shartuka location, in Kilgoris Central, Narok County.It proposes to develop a sugar milling plant that will provide a long-term supply of high-quality sugar to the local, national and regional markets. The company's main operation will be the development of sugar cane mainly from contracted and private farmers and aims to become the premier producer of the finest sugar and allied products whilst continually striving to achieve long-term sustainable growth and profitability.

2.2. Project Implementation

The project will be implemented in four phases: design, construction & equipment installation, operation and decommissioning.

2.2.1. Design Phase

This phase is the concept of the planned development and the designing of a structure which was envisaged to be functional and to take care of every environmental concern such as liquid and solid wastes and security.

The process has been neatly designed to achieve the lowest steam and power consumption, targeted crushing rate, maximum extraction and optimum boiling house efficiencies for a hassle free continuous operation. The main parameters that forms the basis for the design philosophy are: -

1.	Normal Crushing Capacity	1500 TCD @ 24 Hrs. basis
2.	Pol % Cane	Average 13%
3.	Fibre % Cane	Average 18%
4.	Extraneous Matter	Fresh, Clean, Mature cane harvested manually and having extraneous matter not more than 2% by weight.
5.	Instrumentation Voltage	230 V ± 10% AC
	Phase	Single Phase ; 50Hz AC
6.	Filed transmitter	24 V DC
7.	Cooling Water Quality	At temperature of 32°C or ambient temperature whichever is lesser.

Table 1: Dumping Grate Boiler

FUEL	
Fuel for Load carrying	100% MCR – Bagasse
FUEL SIZE AT NLET	
Bagasse	Milled (Free from foreign materials)
FUEL SIZE AT LAST MILL	
Bagasse	Milled (Free from materials)

Table 2: Fuel analysis (% by weight as fired basis)

Ultimate Analysis	Bagasse
Moisture	50.00
Ash	01.25
Carbon	23.50
Hydrogen	03.25
Nitrogen	00.00
Sulphur	00.00
Oxygen	22.40
GCV (Kcal/kg)	2272

Table 3: Data Utility

Cooling water Temperature	°C	32
Quality	-------	Filtered water
Noise level		
For individual rotating equipment only.	dB(A)	85 at 1.0 m distance from the equipment outer surface except boiler feed pump will be 110 bd(A) at 1 m distance from the equipment outer surface
For individual safety valves and start up vent with silencers		110 db(A) at 3 m distance
Surface temperature of thermal insulation		20°C differential temperature with respect to ambient temperature with wind velocity of 1 m/s (Except for refractory covered surface & surfaces exposed to direct sunlight)
Electrostatic Precipitator (ESP) Outlet dust concentration	mg/Nm^3	< 50

2.2.2. The Construction and equipment installation Phase

This phase will be based on the building standards, code and all other relevant regulations applicable in Kenya. All the proposed works will follow standard environmental guidelines, health and safety measures.

2.2.2.1.Construction & Equipment installation Activities

i. Construction activities

This will have to be undertaken to provide support and shelter for the equipment to be installed. The construction of the building walls, foundation, floor pavement, and drainage system, among other component of the project will involve minimal masonry works and related activities. General masonry and related activities will include concrete mixing, plastering, slab

construction, construction of foundation and curing of fresh concrete surfaces. These activities are known to be labour intensive hence may be supplemented by machinery such as concrete mixers.

The construction phase will employ over 60 skilled and unskilled laborers. Completion is estimated at a cost of Kenya Shillings Two Billion. The project proposes to construct and install equipment and machinery to be installed will include;

1.	Juice Extraction Plant	ULKA two roller mills of size 24" x 48" in Combination
2.	Process House Plant	Boiling House suitable to handle juice of 1500 TCD
3.	Steam Generation Plant/Boiling House	Boiler of capacity 32 TPH at 32 kg/cm2 (g), 380°C±10°C will be provided with all associated Equipment (Pan supply tanks, P.T. Hooper, Seed Cry, vacuum pans, Vacuum Cry)
4.	Power Generation Plant	Backpressure type Turbine to generate 3 MW power provided with all associated equipment.
5.	Effluent Treatment Plant	Mechanical component for Effluent treatment plant provided of suitable capacity for sugar plant.
6.	Clarification House	Clarifier, Flash tank, Mud mixer, Lime Slaker,
7.	Evaporation House	Evaporation bodies, Juice heaters, Juice Limer
8.	Sugar Go down	
9.	Spray pond	
10.	Molasses Tanks	
11.	Fuel filling station	
12.	Water reservoir tank	1,875,000ltrs
13.	Workshop	
14.	Offices	Administration, Agriculture, way scale, security

ii. Roofing and sheet metal works

Roofing activities will include laying of iron sheets, and structural steel to the roof and fastening the roofing materials to the roof.

iii. Electrical Works

Electrical work during both construction and operation will involve installation of electrical gadgets and appliances including electrical cables, lighting apparatus, sockets etc.

Table 4: Designs and codes for power generator plant

Pressure part design (for Tube, Pipes and Drums)	ASME /IBR 1950
Boiler integral and external piping	ASME /IBR 1950
Other auxiliaries and non-pressure parts including Air heater	Indian Standard
Structural design and material including stack	Indian standard
Pressure parts material selection (for Tube, Pipes and Drums)	ASTM
Performance testing of the Boiler (Efficiency) 2008 by Indian heat loss method	ASME PTC 4.0
Pipe fitting and flanges	ANSI – B 16.5, B16.11, B16.9
Code for general construction in steel	I.S. 800
Criteria of Earth quake structures	I.S. 1893 – 2002I.S. 875 part 3
Turbine Generator	IEC / ASME PTC 6 / DIN 1943
Gear Box	AGMA / eq.
Instrument	ISA
Electrical	IEC / IS / IEEE
EOT Crane	IS: 3177 / IS: 807
Other Auxiliaries	Vendor Standard / Relevant Indian standard

2.2.2.2.Equipment and specifications

2.2.2.2.1. Cane Weighbridge - Two Nos. (Factory Scope)

Weighbridge will be electronic load cell type with automatic computerized weight recording with printing facility. The computerized system will be included with accounting, up to date crushing status report generation, fast access and analysis, to DCS based supervisory station, relevant software for report generation, including identification of customer/farmer, field,

transporters/ trailer or tractor No., cane variety, plant cane/ ratoon, etc. will be tailored to customer requirements.

2.2.2.2.2. Cane Handling And Feeding

The crane will be of 3 motion, 5 MT S.W.L. electrically operated overhead unloading crane conforming to class IV IS: specifications and capable of 20 lifts per hour. In each lift, grab will lift at least 2.5 tonnes of cane. The crane will be complete with its accessories, gantry columns, attendant platform along the length of the gantry on sides, 2 Nos. staircases, motors etc. it will be heavy duty type and suitable for continuous outdoor working.

All operations will be electrically controlled from the operator's cabin. The crane gantry span will be 20 meters. The crane gantry will be 40 meters in length with gantry columns 10mtrs apart for initial capacity. The crane bridge will be of box type construction made of IS: 2062 or equivalent. The gantry columns should have 'L' shape contraction but the 4 nos., end columns should have double L construction at 90 deg. The end columns should be provided with tie beams on each end.

2.2.2.2.3. Instrumentation And Automation In Juice Extraction Plant

a. Auto Cane Feed Control System:

The signals available from the sensors and field instruments of all the preparatory devices will be given to the PLC SCADA System for control & monitoring purpose through junction box and signal converters.

b. Auto Mill Imbibition Water Flow Control System:

The load of the penultimate mill drive is sensed or alternatively based on the percentage of raw juice flow, the Imbibition water flow is controlled either by control valve placed on the Imbibition water flow pipeline or VFD installed for Imbibition water pump.

c. Mill Speed Control System:

The speed of the mill roller will be controlled either by mill load or Donnelley chute level of that mill. The individual system will be provided for each mill.

d. Planetary Gear Box Lubrication Oil Pump Control System:

Each gear box will be supplied with individual PLC system for force feed lubrication system. Control panel for this individual system will be hooked-up with the master. PLC/SCADA system provided for complete mill house plant to monitor and control all required parameters.

e. Juice Flow Stabilization:

It is very important to maintain a constant juice flow rate going to the boiling house without fluctuations. Hence by throttling the control valve installed on the return pipeline to raw juice tank, the juice flow rate is maintained at desired rate set by the operator. Floating Juice Flow Rate set point concept will be adopted for very low level & very high level of juice in the raw juice tank to prevent dry run of juice pump & overflowing of the raw juice respectively. Juice flow meter will be purchaser in scope.

This independent PLC based system for complete mill house plant will be interfaced with the plant master control system by Ethernet gate-away.

2.2.2.2.4. Milling Plant:

Milling plant will consist of four nos. two roller Ulka CMR mill of size 24” x 48” with foot mounted 200 kW drive. Center distance in-between mills will be not less than 8 Mtr. Mill will consist of five rollers, one top CI roller and one bottom CI roller comprising the mill rollers and 3 Nos. Toothed Roller Feeders (TRF). Swinging Top roller is the free floating roller pivoted at one end and hydraulic loading is provided at other end.

2.2.2.2.5. Imbibition Equipment And Mixed Juice Pump:

a. Rotary Juice Screen:

Continuous juice screening is effected on a Welded wedge type screen fitted on acylindrical drum mounted in horizontal position with appropriate slope non- drive end. Unlike in case of stationary parabolic screen the entire screening area provided in the rotary screen is fully utilized and hence maximum screening efficiency is achieved. The dynamic movement of screen allows utilization of smaller size wedge bar opening for removal of even the smallest bagacillo particle from mill juice. The diameter, the length of the screen, the speed of the rotating screen and its inclination are such designed that the projectile formed by the solids

remaining on the screen facilitates complete drainage of juice. The direction of rotation of screen is such decided that maximum juice is removed in the first 30% section of the screen and the balance de-watering takes place in the remaining 70% of screening area. As a standard accessory, special design feature of cleaning the screen by application of hot water through flat cone nozzles ensures clean screen surface throughout the operation period.

b. Juice Tanks and Pumps:

The juice from mill No. 3 and 4 will be collected in individual cylindrical whirler tank with conical bottom of 750 mm dia. and 1100 mm height made of 6 mm thick 4 mm thick SS409 connected to mill juice trough through 4 thk SS409 gutter. The juice from mill No. 2 and 1 will be collected from individual mill juice trough to SS409M gutters outside the mill and then connected to individual cylindrical whirler tank with conical bottom of 50 HL capacity. All whirler tanks will be interconnected with gutter and flap at top level.

The juice from whirler tanks of mill number 3 and 4 will be pumped through individual chokeless pump capable of pumping 40m3 per hour of juice having minimum 50% solids at 10 metres head to imbibition juice distribution trough through a suitable surplus feedback device installed above the level of gangway at the mills to ensure steady and uniform rate of imbibition.

The juice from Mill No.1 and 2 will be collected in individual tank and be pumped through separate chokeless pump with full bore discharge and each capable of pumping 80 m3 per hour of juice having minimum 50% solids at 12 metres head to rotary screen. All the above pumps will be designed to operate at about 960 rpm. The screened juice will be collected in a 6 mm thick Aluminium/ 4 thk SS409M cylindrical tank / column of 50 HL capacity. Two strained juice pumps (one as stand by) each of 80 m3/hr capacity and 55 mtr head will be provided for pumping the screened juice.

c. Hot water meter:

One Orifice type flow meter indicating integrating and recording type suitable to measure upto 40 m3/Hr. at 100ºC. The water will be discharged in a closed receiving tank of suitable capacity fitted with two imbibition water pumps each of 30 m3/hour capacity and 50m. Head (one as

standby) capable of handling water upto 100 deg. C. The imbibition water will be applied before the last mill through gunmetal chokeless type nozzles.

2.2.2.2.6. Bagasse Elevator And Conveyor

One steel rake type bagasse elevator of all steel construction of 1000 mm width and suitable length (inclination not to exceed 45º with the horizontal) and driven by TEFC, IE2 electric motor of 22.5 kW / 1440 RPM with enclosed planetary gearbox having 2.0 service factor chain and sprocket to give a linear speed of 25 meters / minute will be provided. It will have two strands of chains of 150 mm pitch. The breaking strength of chains will be minimum 40,000 kg.

2.2.2.2.7. Mill House Crane

One three motion electrically operated overhead mill house travelling crane conforming to class II IS specifications having one grab of 15 tonnes SWL capacity & with box type design. The crane rail centre distance will be to suit the mill house building span and length of travel for Mill House Crane will cover fibrizer to Bagasse elevator.

2.2.2.2.8. Clarification Plant:

a. Juice Weighing Scale:

Mass flow meter for juice 100 T/hr. capacity will be provided. Also one cylindrical tank of suitable capacity, 2 nos. raw juice pumps and check Weighment arrangement will be provided. Mass flow meter will be connected to PLC for display as well as large size LED display of flow will be provided. Accuracy of juice weighed ± 0.1% based on the average of six weighment.

b. Juice heaters: 7 Nos.

The body will be constructed from 10 mm thick MS shell. Tube plates and cover plates will be provided with suitable stiffeners. Each vertical tubular juice heater will be provided with easy opening device for cover plates. Two sets of double beet valve having common housing for necessary interchangeable connection of heating raw and defecated juice will be provided. Exhaust steam connections will be provided to the manifold of each juice heater through 250

mm valve. Vapour line from 1st body/ 2nd body will be connected to the manifolds of juice heaters through a 300 mm valve.

c. Juice Limer:

One continuous juice limer unit of 90 HL capacity designed for a desired crushing rate with 112% juice, retention time not less than 7 minutes and working height of juice column above the gas distribution not less than 2 m will consist of a reaction tank, a correction tank, one cylindrical receiving tank of 90 H.L. capacity two centrifugal pumps each of 90 m^3/hour capacity. (one as stand-by), a 60 m head capable of pumping juice through two juice heaters in series, to the flash tank of the clarifier. The speed of stirrer will be around 16RPM.

d. Clarifier :

One Rapi Dorr 444 of 22 Ft. Dia. & 80 HL clear juice column complete set with 2 Nos. x 90 m^3/hr. & 40 mtr head clear juice pumps, piping. The continuous clarifier with complete with MS flash tank, clear juice and mud withdrawal gravity boxes with sleeves, telescope pipes, O-rings and squeezers, complete drive mechanism & mud and clear juice piping, one clear juice tank/column with two clear juice pump (1+1 stand by) will be provided.

e. Vacuum Filter:

Rotary mud vacuum filter 20’ Long and 10’ diameter will be installed at operating level of 7 meters from factory floor level, will be complete with 5 mm thick AISI 304 drum, 8 mm thick AISI 304 heads with mild steel structural reinforcement, cast iron trunnions, AISI 304 internal piping and decking, AISI 304 screens, mild steel trough, agitator, two numbers vales, one on each side consisting of bronze/stainless steel valve body, bronze wear plates, wash assembly scrapper, variable speed drum drive and constant speed agitator drive.

2.2.2.2.9. Evaporation And Boiling Plant:

The Evaporator sets will be complete with fitting for satisfactory operation including continuous syrup sampler, pressure gauges, Temperature gages vacuum gages, inter connecting piping, with valves and Bleeding of vapour from 1-2-bodies. Vapour piping will be made of 8 mm thick MS. with suitable columns site glasses grit catches, drains and equalization connection if necessary and with individual’s condensate pumps for each body. First body condensate will be feed to boiler feed water tank, and other have connections to hot water tank.

The bodies will have vapour space height not less than 4 meters. The minimum thickness for calandria and body will be 10 mm bottom Saucer 12 mm and tube plate thickness 25 mm. The tube plates will be supported by stay bolts. The Domes of the bodies will have poly-baffle type SS save-alls of suitable designs.

a. Molasses Storage /Pan Supply Tanks: 15 Nos.

Molasses storage rectangular tanks of 100 HL Capacity each to store syrup. Molasses melt at pan floor. The tank will be made of 6 mm thick MS plate. Molasses storage tanks will be provided with steam heating coils with necessary valves, non- return valves, draining arrangement, pipes, gutters, valves etc. The washout connection of each tank will be connected by a pipe to the juice receiving tank with suitable valve. Supporting steel structure for Pans will be provided.

b. Vacuum Pans: 4 Nos.

Total four low head batch pans of 40 T. (120 m² H.S.) capacity each. Two for `A' massecuite & one each for `B & C' massecuite. Pans of 40 tons capacity complete in all respects. Each pan will be of low head design with the central flow rapid boiling type. Each vacuum pan will have heating surface to volume ratio not less than 6. The tubes will be of SS tubes will be SS304 quality of 16 SWG thk and 102 mm outside diameter. The pitch of the tube will be such that the ligament will not be less than 16 mm.

c. Seed Crystallizer & Vacuum Crystallizers

2 Nos. Seed Crystallizers of 20 MT capacity each one for B seed & one for dry seed. 3 Nos. Vacuum Crystallizers of 45 MT capacity for A, B & C massecuite each. Vacuum crystallizers of 45 tons capacity. The crystallizer will be fitted with stirrer. The speed of the stirrer will be about 60 RPH. These crystallizers will be installed on pan floor. Necessary inter connection pipelines between these crystallizers and the pans will be provided.

d. Spray Ponds

One table top design spray pond will be provided having 140 nos. of Nozzles (cluster of 5 nozzles) with branch pipes. The injection water collected in a header pipe of suitable size will be connected to the main header of spray Pond will be carbon steel construction of minimum Techno-commercial offer for supply of 1500 TCD Sugar Plant – Shartuka Sugarmill 42 10 mm

thickness. The branch piping will be PVC/MS with support of RCC pillars (By Purchaser) the nozzles will be of thermo Engg. Plastic with S.S. insert at the throat of nozzles and arranged on branch piping with cluster nozzle arrangement. The cooling system for the water will be so designed that at least a drop of 10- 12°C or within 7°C of wet bulb temperature, whichever is less should be achieved

2.2.2.2.10 Water conservative recirculation system:

Necessary arrangement be provided for recirculation of cooling water from Power Turbine, Mill bearings, enclosed mill drive gear boxes, crystallizers & air compressor etc. All equipment like RCC constructed underground collection tank of suitable capacity, 2 Nos. pumping sets (one as standby), piping, valves etc. be installed at suitable location. This water shall be pumped to raw water reservoir through spray nozzles installed on the reservoir itself to achieve atmospheric cooling.

2.2.2.2.11. Effluent Treatment Plant

During processing, the water effluent from the plant, mainly consisting of bagacillo and floor washings, which are rich in BOD, will be taken to modern effluent treatment plant to reduce level of biological oxygen demand (B.O.D) to less than 30ppm and remove suspended matter. The effluent treatment process is described below:

a. Bar Screen

A bar screen is a mechanical filter used to remove large objects, such as rags and plastics, from wastewater. It is part of the primary filtration flow and typically is the first, or preliminary, level of filtration, being installed at the influent to a wastewater treatment plant. They typically consist of a series of vertical steel bars spaced between 10-20 mm apart.

b. Clariflocculator

Clariflocculator is a combination of flocculation and clarification in a single tank. In the Clariflocculator, the water enters the flocculator, where the flocculating paddles enhance flocculation of the feed solids. As heavy particles settle to the bottom, the liquid flows radially upward in the clarifier zone.

c. Aeration Tank

Aeration tank where air (or oxygen) is injected in the mixed liquor. Settling tank to allow the biological flocs (the sludge blanket) to settle, thus separating the biological sludge from the clear treated water.

d. Secondary Clarifier

Secondary clarifiers is to separate biological floc from the treated liquid waste stream. Secondary clarifiers are most often discussed in conjunction with suspended growth biological wastewater treatment systems.

e. Multi Grade Filter

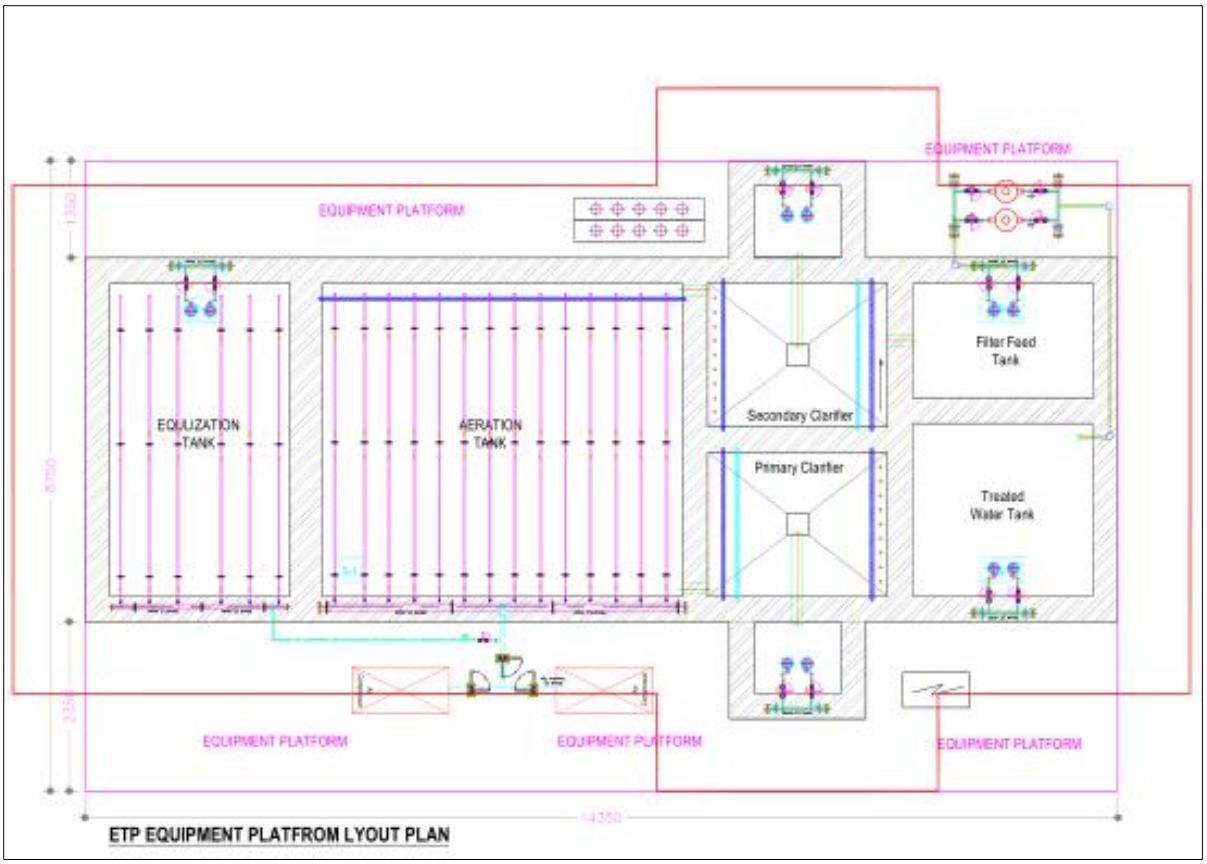
The multi grade filter helps reduce the slipped Total Suspended Solids and turbidity from the Secondary Clarifier. The MGF needs a backwash every day for the duration of 15-30 minutes from the treated water to remove the suspended solids. The limiting condition for MGF is TSS < 20 ppm and Turbidity < 20 NTU.

f. Activated Carbon Filter

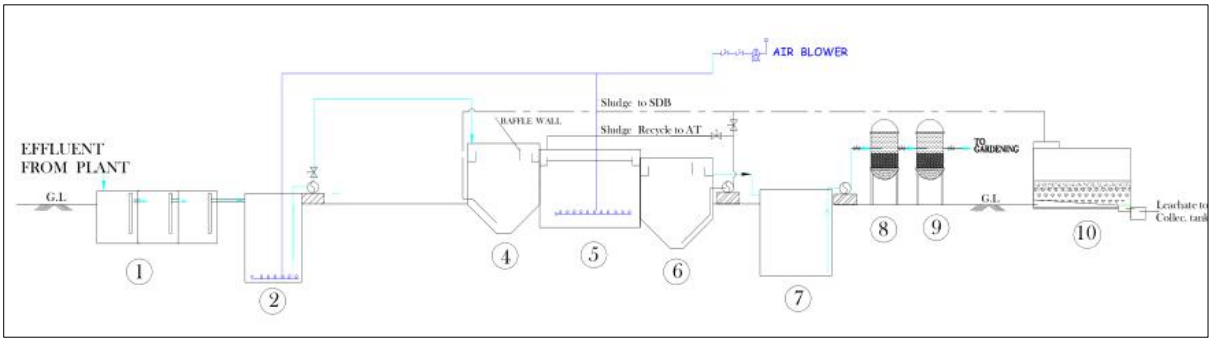
The main purpose of Activated Carbon is to reduce the color, and chlorine. The iodine value for the activated carbon will be 450.

g. Ultra-Filtration

UF is a low pressure (5 - 150 psig) process for separating larger size solutes from aqueous solutions by means of a semi-permeable membrane. Retains oils, particulate matter, bacteria and suspended solids large macromolecules and proteins passes most surfactants, water, acid and alkaline compounds Pore sizes ranging from 0.005 – 0.1 micron; 1K – 500K MWCO Permeate is clear (non-turbid) solution void of suspended solids. Most UF products for industrial applications are designed for cross flow or dead end separation, where a feed stream is introduced into the membrane element under pressure and passed over the membrane surface in a controlled flow path. A portion of the feed passes through the membrane and is called permeate. The rejected materials are flushed away in a stream called the concentrate. Crossflow membrane filtration uses a high cross flow rate to enhance permeate passage and reduce membrane fouling.

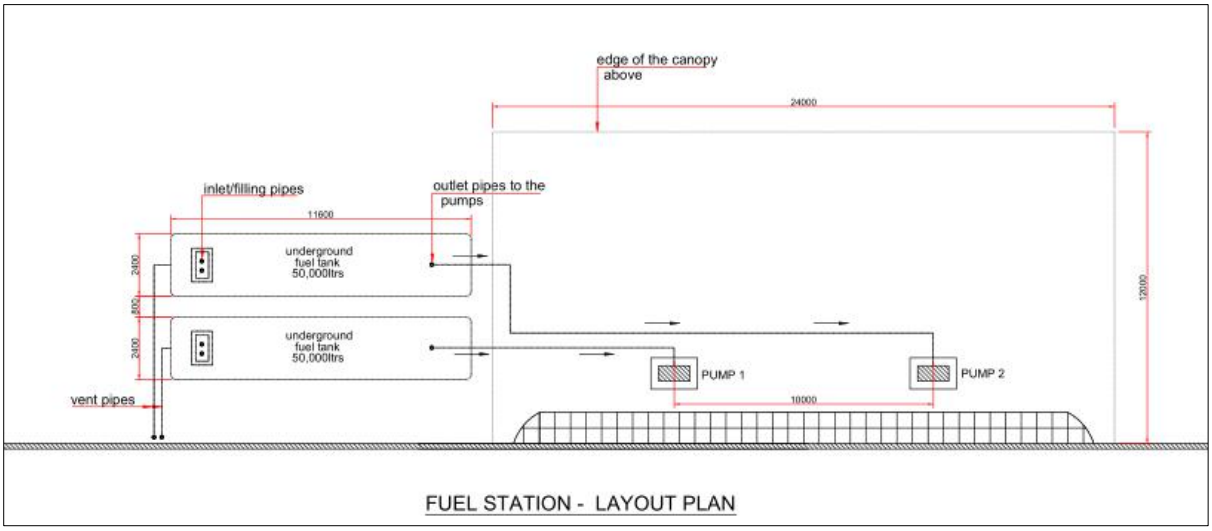


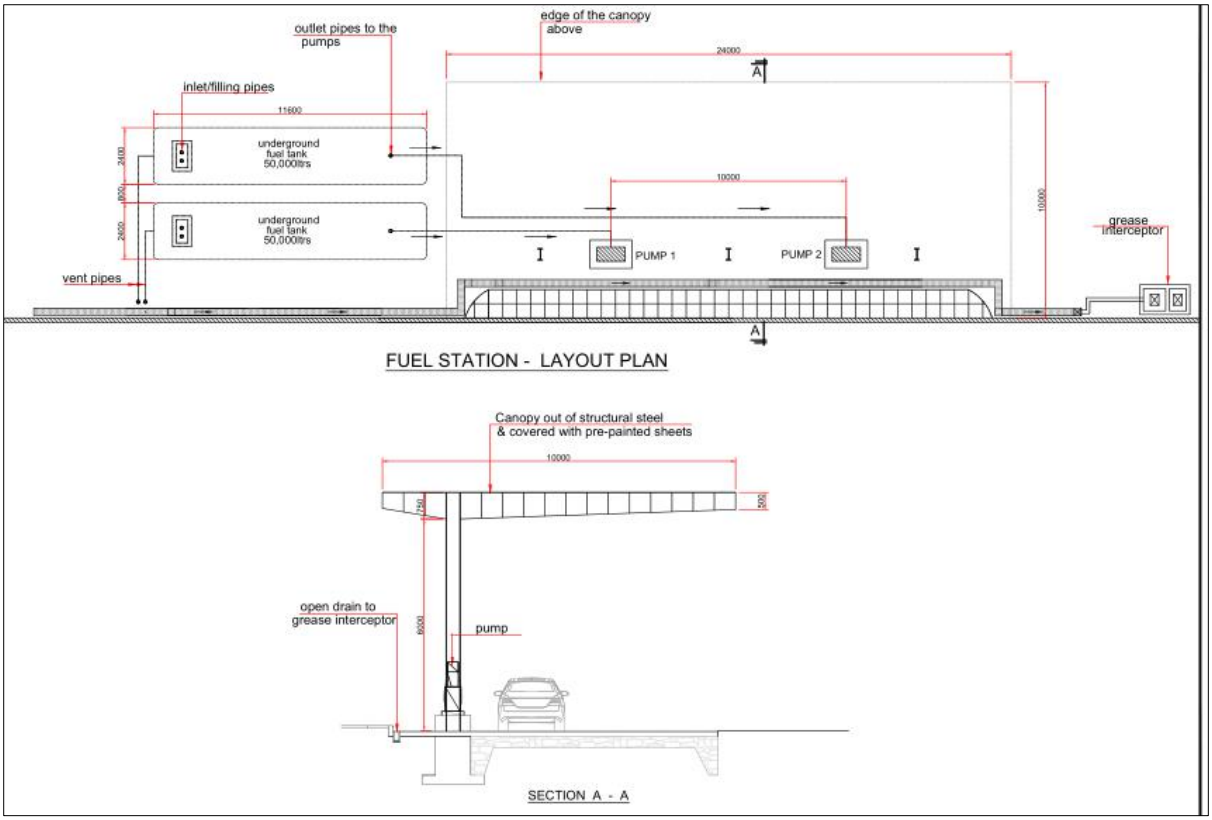
Typical Effluent Treatment Scheme



10	SLUDGE DRYING BEDS (3 NOS.)
9	ACTIVATED CARBON FILTER
8	PRESSUE SAND FILTER
7	TREATED STORAGE TANK
6	SECONDARY CLARIFIER
5	AERATION TANK
4	PRIMARY CLARIFIER
2	COLLECTION CUM EQUALIZATION TANK
1	OIL TRAP

2.2.2.2.12. Fueling Point





2.2.3. Operation Phase. (The Sugar making process Description)

The project proposes to construction of sugar milling plant with a crushing capacity of 1500 tcd (tonnes cane crushed per day) on plot no: Transmara/Shartuka/921, Shartuka, Kilgoris Central, and Narok County. It sits on a total area of about 9.7H. The factory's operation will be the production of sugar cane mainly from contracted and private farmers; and processing sugar from harvested sugar cane. The proposed crushing capacity will be about 1500 tons of sugarcane per day, the operation project's operational phase will ensure that the plant provides a long-term supply of high-quality sugar into the local, national and regional markets and alleviate the problem of sugar cane overstaying in the farms. The main inputs will be sugarcane, water, bagasse and electricity. By-products will include bagasse, molasses, filter mud and boiler ash. The decommissioning phase will consider restoring the site to its nearest original status if necessary. The proposed infrastructure and activities in the factory will include the following: -

2.2.3.1. Cane Yard

The yard will consist of a weighbridge and overhead gantry. The cane preparation equipment will consist of a cane carrier, a cane kicker to regulate feed cane knives and a fibrizer.

2.2.3.2. Milling

The extraction line will consist of roller milling tandem using a hydro-pneumatic pressure regulating system. The milling tandem will be driven by four AC electric motors with planetary-type speed reducers. Auxiliary equipment will include a mill house crane. The mixed juice will be passed through a rotary juice screen before being pumped to the screened juice tank.

2.2.3.3. Clarification

The pumping of juice to the clarification station will be done through automatic flow control to ensure a uniform flow rate. Primary heating of juice will be done prior to liming and sulphitation. Before final heating, both liming and sulphitation will be done to the juice with proper control of pH. Control of liming will be automated. Finally, heated juice will be pumped through the flask tank to the clarifier for settling out mud and production of clear juice. The mud from the clarifier is de-sweetened in a rotary vacuum filter, with filtrate being returned to the screened juice tank, and mud removed and used as fertilizer on the fields.

2.2.3.4. Evaporati

The clear juice from the clarifier will be heated and then evaporated to form a syrup. The evaporated set will consist of a quintuple effect. Exhaust steam from the turbine and boiler through a pressure-reducing station will be used as the heating medium for the first effect. Exhaust steam will be used in sequence so that the vapor leaving the first vessel will be used in the next vessel heat and so on; so that boiling will take place at reduced temperatures giving the advantage of minimizing destruction of sucrose, and for general steam company. Syrup, which consists of a concentrated clear juice will then be withdrawn from the last vessel and pumped to concentrated clear sugar juice will then be withdrawn from last vessel and pumped to Sulphitation vessel to reduce color before pumping it to the Boiling House section of crystallization.

2.2.3.5. Boiling house (crystallization)

Batch vacuum pans will be used to boil syrup into A-massecuite while automatic continuous pans will be used to boil B- and C- massecuite. From the pans, A- & B- massecuite will flow under gravity to air cooled crystallizers. Vertical continuous crystallizer will be used for C-massecuite.

2.2.3.6. Crystal separation

A-sugar will be separated from A-molasses by Batch type Centrifugal machines. The centrifugal machines will be fully automated with a 1250kg/charge capacity, complete the accessories and drive. B&C sugars will be separated from B& C molasses with continuous centrifugal machines. The centrifugal will be of vertical type and have a total capacity to cure all the massecuites produced. The molasses produced will be pumped to the molasses storage tank.

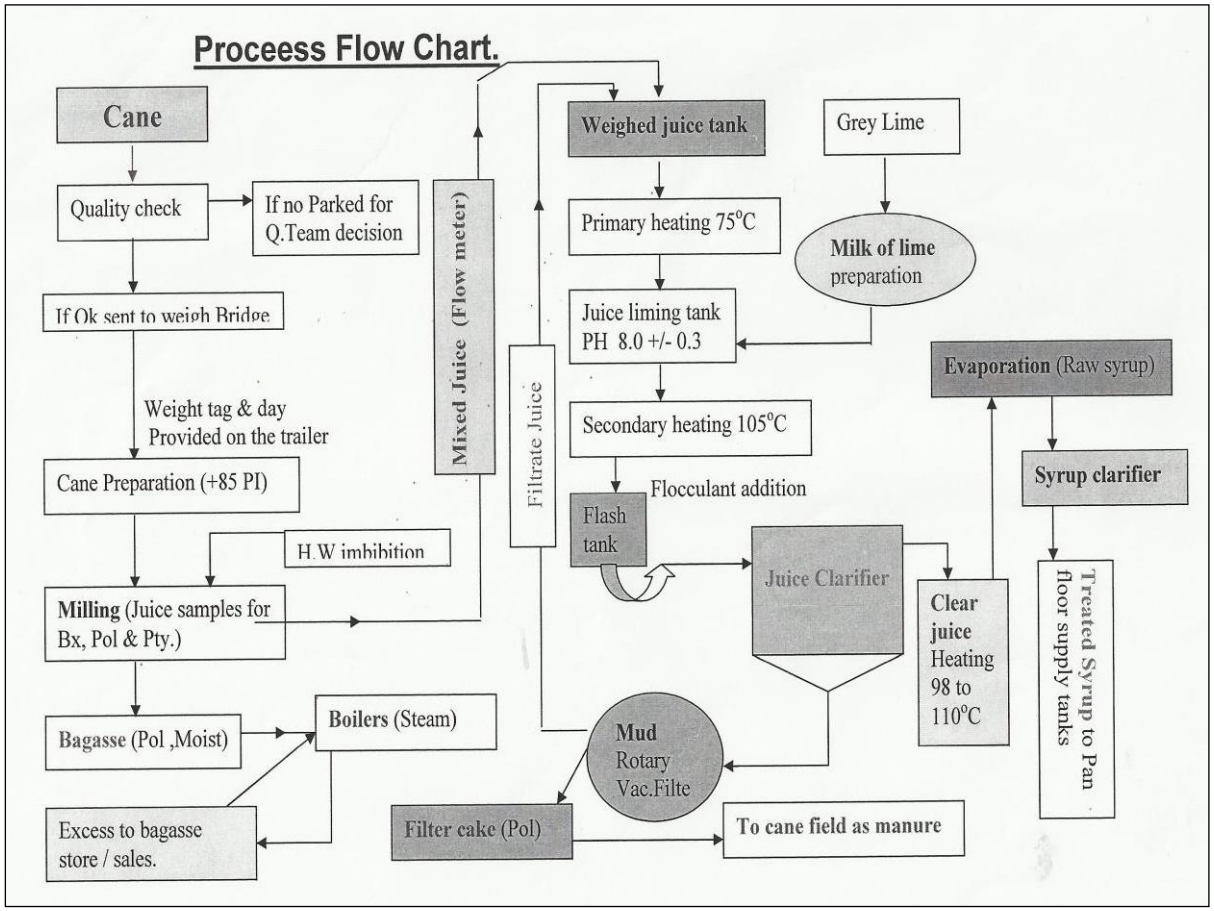
2.2.3.7. Drying and bagging

Hot air will be blown into the sugar drier and the sugar leaving the batch centrifugal to dry it. Drying will occur in multi-tray dryer with a hot air blowing arrangement. Big sugar lumps will be separated in last section of the tray. The sugar will then be cooled, sieved and conveyed to silos before packaging for sale.

2.2.3.8. Maintenance

The milling process will normally run for ten months per year, with monthly shutdowns of approximately 24 hours for servicing, cleaning/maintenance. These activities will include cleaning of heat exchangers, lubrication repairs and general cleaning.

The sugar-making process used at the existing plant has been summarized in the flow chart below:



Flow chart showing the process flow chart

2.3. Decommissioning Phase

At the end of the construction phase, all the equipment and waste materials from the construction/equipment installation will be removed from the site. The materials that can be reused will be separated and used for other construction work and others disposed of appropriately. The areas not intended for parking of vehicles will be landscaped and planted with beautiful vegetation to improve the aesthetics of the surrounding.

CHAPTER THREE: BASELINE INFORMATION

3.0 Project Location

Herein, the location of the area and characteristics of the proposed site and its neighborhood in terms of; Climate: hydrology and meteorology, Soils, Geology, Vegetation Type(s) within the project area, Current land use of the project site and adjacent properties; have been discussed.

3.1 Position and Size

Narok county lies between latitudes 0° 50´ and 1° 50´ South and longitude 35º28´ and 36º25´ East. It borders the Republic of Tanzania to the South, Kisii, Migori, Nyamira and Bomet counties to the West, Nakuru County to the North and Kajiado County to the East. The county headquarters is at Narok Town. The county covers an area of 17,933.1 Km2 representing 3.1 per cent of the total area in Kenya and hence the eleventh largest county in the country.

Location of Narok County

Source: Kenya Bureau of statistics, 2013

3.2.Climate: hydrology and meteorology

The climatic condition of Narok County is strongly influenced by the altitude and physical features. The county has four agro-climatic zones namely: humid, sub-humid, semi-humid to arid and semi-arid. Two-thirds of the county is classified as semi-arid (Narok DEAP2009-2013). Temperatures range from 20^0C (January- March) to 10^0C (June- September) with an average of 18^0C. Rainfalls amounts are influenced by the passage of intertropical convergence zones giving rise to bi-modal rainfall pattern. Long rains are experienced between the months of February and June while the short rains are experienced between August and November. Rainfall ranges from 2,500 mm in wet season to 500 mm during the dry season. The March to June season receives high intensity rainfalls that support growth of vegetation which is food for wild animals. This climatic characteristic has been influencing the migration of wildebeest into Kenya from Serengeti in June in search of vegetative food and return migration to Serengeti in November after the vegetation diminishes. The seasons are also important to farmers in planning for planting and harvesting.

3.2.1. Climate change – Projected temperature and rainfall changes in Narok County:

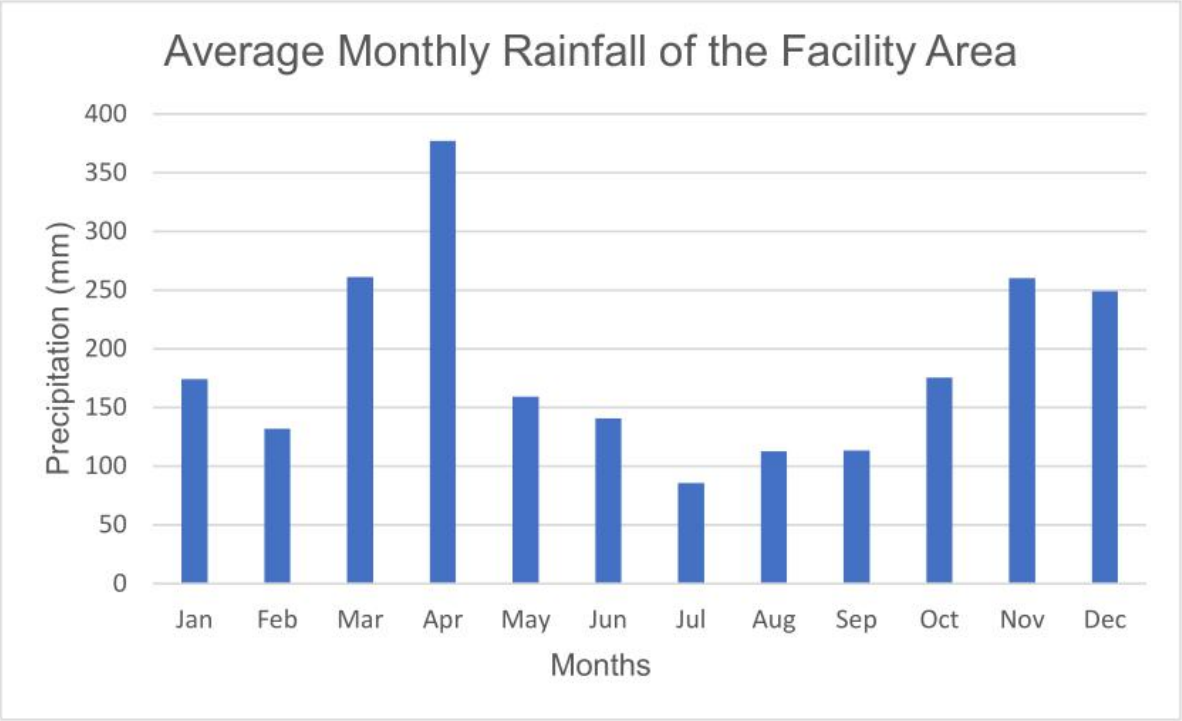
Pastoralists, agro-pastoralist and agriculturalists in Narok County will be among the most vulnerable due to the impacts of climate change. Increasing climate variability (changes in duration, seasonality and increase in temperature) and extreme events (droughts and floods) will affect livestock and agriculture production, incomes, and food security of these communities in the County. It is projected that temperatures in Africa are likely to increase more rapidly than the other parts of the world, which might surpass 2°C by midway of the 21st century and 4°C by the close of the 21st century (Niang et al., 2014; World Bank 2013). Recent national studies by Ogutu et al., (2016) indicate striking temperature rises in the ASALs of Kenya with annual average maximum temperature increases between 0.7 to 1.9 °C between 1960 and 2013. The mean annual minimum temperature rose from 0.6°C to 1.7°C between the same periods displaying a more country wide warming. In Narok the maximum average temperature increased by 1.75°C and minimum average temperature by 1.48°C between 1960 and 2013 (Said et al., 2018).

Further projections on rainfall and temperature by 2030s indicate Narok County is among the few counties in Kenya that will observe slight increase in rainfall for both long March- April-May (MAM) and short rains October-November-December (OND) but with increasing dry

spell for the months of June-July-August-September (JJAS). Agricultural and livestock production is likely to be affected in the near-term, as warming shifts the climatic conditions that are conducive to current agricultural production. The area of land suitable for agriculture, length of growing seasons and yield potential are expected to shrink-- particularly along the margins of semi-arid and arid areas. These changes in temperature and rainfall will have a huge impact in the planning for crop and livestock production in the county in the next 10 years and beyond.

3.2.2. Rainfall

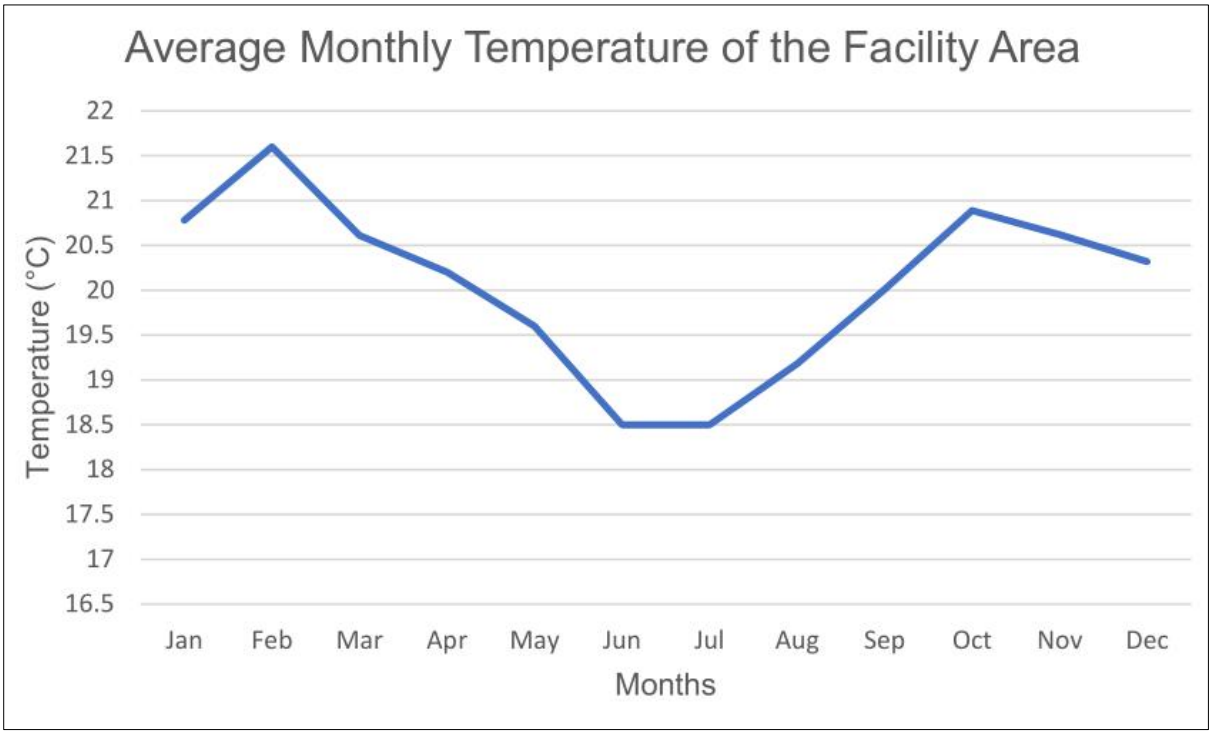
Rainfall pattern is very important in air pollution assessments as it represents an effective removal mechanism for atmospheric pollutants and suppresses dust generation. An analysis of monthly precipitation rates for the period 2019-2021 is presented in Figure 6 below. The mean annual precipitation rate for the Kilgoris region is 164 mm with the highest amount of rainfall of 288 mm recorded in the month of April.



Modelled Area Rainfall Intensity for the Year 2019-2021

3.2.3. Temperature

An analysis of the mean temperatures is presented in Figure 7 below. The hottest month was February with a mean temperature of 24.6ºC.



Modelled area temperature intencity for the year 2019 - 2021

3.3.Ecological Conditions

The county has a robust ecological system that residents depend on for agriculture, tourism, water and many other benefits. The county's ecological conditions are influenced by the soil type, altitude, vegetation, rainfall pattern and human activities. The two dominant vegetation types in the county include forest land in the Mau area and grasslands and shrubs in the lowland areas of Suswa, in Narok North, Osupuko and Loita divisions in Narok South as well as the Mara sections in Transmara. Grasslands are suitable for livestock rearing and wildlife survival. A major threat to the vegetation cover is the destruction caused by human activities including grazing, charcoal burning, extraction of wood fuel and cutting down of trees without replacement resulting in adverse ecological effects.

The main drainage systems are Lake Victoria South catchment basin and Ewaso Nyiro South drainage area. Rivers in these basins include Mara, Mogor that traverse the county from Mau region through to Kenya-border and into Tanzania draining into Lake Victoria and River Ewaso Ng'iro rising from the Mau Escarpment, draining into Lake Natron respectively. However, due to continuous deforestation over a couple of years, the volume of water in the rivers has been decreasing. To address this challenge, the county has introduced programs to construct water

reservoirs, water pans, dams, shallow wells and, boreholes especially in the lowlands and denser settlements of urban and market centres of Narok town, Kilgoris, Lolgorian, E/Enkare and Ololulung'a to provide water for domestic and livestock use.

Maasai Mara Game reserve is home to the country's highest wildlife density and as such is Africa's premium wildlife destination. The reserve is home to a variety of wildlife including Wildebeests, Gazelles, Zebras, Warthogs, Hyenas, Giraffes, Elephants, Lions, Leopards and Elands. With increasing human encroachment activities to the reserve, cases of human-wildlife conflict have been on the rise and thus threatening sustainability of the reserve and the tourism sector at large.

3.4.Physical & Topographic features

The county lies within the Great Rift Valley, and is serviced by several rivers, flowing from highlands through arid and undulating landscapes. It is home to numerous volcanic landforms with areas of prominent geothermal activities. The highland areas of Mau escarpments, rising to an altitude of 3,100m above sea level provide fertile ground for farming and source major rivers like Mara and Ewaso Nyiro with Mara River being the single major river that passes through Maasai Mara Game Reserve and ultimately draining into Lake Victoria.

Narok County is home to the world-renowned Maasai Mara Game Reserve which is considered Kenya's jewel when it comes to wildlife. The reserve sitting on 1,510 km2 hosts 25% of Kenya's big cats and has one of the highest wildlife densities in Africa. It is characteristised by Savannah plains and woody shrubs which provide and ideal home for the 95 species of mammals, amphibians and reptiles and over 400 bird species found in the park and its environs. Over 300,000 tourists visit the park each year with the peak season for the park coinciding with the Great Wildebeest Migration that occurs between July and September of every year.

In the addition to high agricultural potential in the highlands and tourism economic activities in the lowlands, the county is endowed with numerous natural resources. Exploration of geothermal power in Suswa area has shown positive prospects, in Talek harnessing of solar power is ongoing. Wind power is used in pumping water from boreholes in the Mara area and adjacent areas. Other resources found in the county include vast deposits of sand in Suswa and Naikarra wards, pockets of gold deposits in Transmara constituency.

3.4.1. Soils and Geology

Soil sampling was done on in accordance to the USEPA protocol on Field Sediment Sampling. The soil samples were collected from the 2 predetermined locations i.e. near the dispensary and at the proposed fuel area. Subsurface samples were collected from the ground at a depth of 0.1 meter directly using a manual soil-sampling auger. The samples were placed in zip bags and then cooled by ice packs in a cool box at a temperature of 4° C and transported to the laboratory for analysis using standard approved methodologies.

3.4.1.1.Dutch Target Values and Intervention Values Soil Remediation

It is worth noting that Kenya is yet to formulate standards for soil contamination. The Dutch values were developed by the Dutch Ministry of Housing, Spatial Planning and the Environment (VROM). Dutch Standards are environmental pollutant reference values (i.e., concentrations in environmental medium) used in environmental remediation, investigation and cleanup. The intervention values and the accompanying target values for soil/sediment are given in the table 5 below.

Table 5: Standard Chemical Compound Values Based on Dutch standard

	SOIL/SEDIMENT	
	Soil/Sediment (mg/kg dry weight)	
	Target values Standard soil	**Intervention values Standard soil**
Metals		
Arsenic	29	56
Antimony	3	15
Barium	160	625
Cadmium	0.8	12
Chromium	100	380
Cobalt	9	240
Copper	36	190
Mercury	0.3	10
Lead	85	530
molybdenum	3	200
Nickel	35	210
Zink	140	720
Beryllium	1.1	30
Selenium	0.7	100
Vanadium	42	250
Thalium	1	15
Silver	-	15
Tin	-	900

Table 6: Standard Chemical Compound Values Based on Dutch standard

Parameter	***Results***				***Soil/Sediment*** **(mg/kg dry weight)**	
					Target values	**Intervention values**
					Standard soil	**Standard soil**
	Sample 5	**Sample 6**	**Sample 7**	**Sample 8**		
Parameter						
Arsenic	0.55	0.39	0.28	0.31	29	56
Cadmium	< 0.20	< 0.20	< 0.20	< 0.20	0.8	12
Chromium	5.0	20.7	24.0	23.7	100	380
Lead	2.11	1.58	0.69	1.92	85	530
molybdenum	0.52	0.21	0.22	0.35	3	200
Nickel	22.8	30.2	42.4	24.9	35	210
Zink	0.80	0.92	0.88	0.92	140	720
Phoshorus	59.4	64.3	70.7	80.2	20.0	100.0
Calcium	222.8	197.3	220.6	210.8	8710	12200
Iron	38.5	35.2	38.8	34.2	30.0	300
Boron	0.66	0.83	1.06	1.07	0.80	2.00

Discussion and Conclusions

The analysis results have indicated that the soil quality with reference to the measured parameters values of were found to be within the target values. The heavy metals were within the guideline values in accordance to the Standard Chemical Compound Values Based on Dutch standard.

3.4.2. Vegetation Type(s) within the project area

Generally, Shartuka area is significant for agricultural cultivation and several legume fodders are found here in crop-livestock systems. It is also the most resettled by human. The major grasses are *Hyperenia* and *Cymbopogon, Themeeda triandra, Panicum maximum, Seteria Sphacelata, Sporobolus pyramidalis, Bracharia brizantha* (Congo signal), *Bricharia siluta, Chloris gayana* (Rhodes grass) and *Cynodon dactylon* (Star grass). The proposed project site is currently under maize crop.

Common vegetation on and around the project site

3.4.3. Water sources and access (distance to the nearest water points by sub-county)

There is an estimated 1,684 water sources in the county among them dams, rivers, water pans, springs and boreholes which are community and private owned. In the whole county only an estimated 8.6 % of households were benefitting from piped water (KNBS 2009). In 2017, about 1,600 households were estimated to have roof catchments systems for harvesting rain water. The average distance people travel in search of water is approximately 2Km in wet seasons. The distance increases to 10 Km during the dry seasons. The areas with the longest distance to

the water points are in rural areas where only 7,760 households accessed tap water mainly from protected springs and boreholes. Low flows in rivers and springs have continued to be recorded in the county mainly due to water sources and catchments degradation. Water used in the project area is mainly drawn from River Romosha.

Pictures of River Romosha which is adjacent to the project site

3.4.3.1.Water Sampling

The sampling of the water was done according to the following procedures based on methods defined in the ISO 5667: Water sampling was done on 3rd – 4rd July 2022; water sample was collected from a borehole within a private residence. The sample was collected by use of a sampling bottle, preserved in cool boxes, and transported to the laboratory for analysis using standard approved methodologies. Sample analysis was done by KENAS and NEMA accredited laboratory. Summary of analysis results are presented in tables 7 :

Table 7: Quality Standards for Sources of Domestic Water

PARAMETER	***RESULTS***		***EMCA (Water Quality), Regulations 2006 First schedule (Environment) Guide Value (max allowable)***
	SAMPLE 1	**SAMPLE 2, DOWN STREAM**	
pH	6.87	6.99	6.5– 8.5
Suspended solids	22.0	661	< 1200
Nitrate-NO3	9.06	10.12	10 (mg/L)
Ammonia –NH3	0.22	0.19	0.5 (mg/L)
Nitrite –NO2	0.018	0.020	3 (mg/L)
Total Dissolved Solids	525	611	1200 (mg/L)
Fluoride	0.92	0.99	1.5 (mg/L)
Arsenic	<0.007	<0.007	0.01 (mg/L)
Cadmium	<0.002	<0.002	0.01 (mg/L)
Lead	<0.009	<0.009	0.05 (mg/L)
Selenium	<0.02	<0.02	0.01 (mg/L)
Copper	<0.01	<0.01	0.05 (mg/L)
Zinc	<0.01	0.01	1.5 (mg/L)
Oil & Grease	ND	ND	NR

Discussion and conclusions

The water analysis results indicated that Nitrate was high for sample 2. All other parameters tested were within the acceptable limits for both samples as stipulated in the EMCA (Water Quality Regulation), 2006 Legal Notice 120 of for Quality Standards for Sources of Domestic Water (First schedule). These results could have been influenced by seasonality i.e rainy and dry seasons.

3.4.4. Ambient air

The measurements for air were done as per the Kenyan (NEMA) Air Quality Regulations and WB/IFC Guidelines with specific parameters being SO2, NO2 and Total Suspended Particulate Matters (TSP, PM10, and PM2.5) undertaken to establish ambient air gases at two locations along the proposed project boundaries adjacent to key receptors.

Sampling of Particulate matter was done using portable air quality monitor for ambient environmental monitoring. The monitor allows for real-time data collection by attaching the Interchangeable cartridge sensor head for (PM10 and PM2.5.) to the monitor base. The sensor head features active fan sampling which ensures a representative sample is taken and therefore increases measurement accuracy. Sampling was done using passive sampling tubes diffusive sampler, for the gaseous pollutants of concern (SO2, NOx and VOCs).

3.4.4.1.NO_2 Description:

Acrylic tube fitted with coloured and white thermoplastic rubber caps. The colored cap contains the absorbent. The concentrations of Nitrite ions and hence NO2 chemically adsorbed are quantitatively determined by UV/ Visible Spectrophotometry with reference to a calibration curve derived from the analysis of standard nitrite solutions (UKAS Accredited Methods).

Measurement Results

The concentrations of measured at the monitoring location for a period of 24 hours are reported. The results of the survey and some interpretations thereof presented in Table 8.

Table 8: Results of Nitrogen Dioxide

No	*Location*	*GPS LOCATION*	*Concentration µg/m³*	*EMCA (Air Quality) Regulations, 2014 (µg/m³)*
1	SPI 1- Location 1 Shartuka Community setlement Location	-0.939508, 34.959348	21.15 µg/m^3	80 µg/m^3
2	SPI 2- Location 2 Romosha River side area	-0.942169, 34.965974	19.12 µg/m^3	80 µg/m^3
3	SPI 3- Location 3 Water spring along the proposed site	-0.942169, 965974	19.51 µg/m^3	80 µg/m^3
4	SPI 4- Location 4 The lower side of watr distribution	-9.40871, 34.966177	21.62 µg/m^3	80 µg/m^3

The results indicate that the Level of Nitrogen Dioxide averaged at 19.12 µg/m3 to 23.12 µg/m3 which were within the ambient air quality tolerable limits provided by the EMCA (Air

Quality) Regulations, 2014 set at 80 µg/m3 for rural residential and other areas. The source of the Nitrogen Dioxide was attributed to emissions from the motorist and vehicular movement along the access road adjacent to site.

3.4.4.2.SO2 Description

Fluorinated ethylene polymer tube fitted with purple and white thermoplastic rubber caps. The colored cap contains the absorbent. A one-micron porosity filter is fitted to prevent the ingress of particulates loaded with Sulphur i.e., diesel fumes. The concentrations of sulphate ions chemically adsorbed are quantitatively determined by Ion Chromatography with reference to a calibration curve derived from the analysis of standard sulphate solutions (U.K.A.S. Accredited Methods).

Measurement Results

Sulphur Dioxide (SO2) is produced when fuels containing sulphur are burned. The concentrations of Sulphur Dioxide (SO2) measured at the monitoring location for a period of 24hrs are reported. The results of the survey and some interpretation thereof are presented in Table 9.

Table 9: Results of Sulphur Dioxide

No	***Location***	***GPS LOCATION***	***Concentration µg/m^3***	***EMCA (Air Quality) Regulations, 2014 (µg/m^3)***
1	SPI 1- Location 1 Shartuka Community settlement Location	-0.939508, 34.959348	2.53	80 µg/m^3
2	SPI 2- Location 2 Romosha River side area	-0.942169, 34.965974	< 2.27	80 µg/m^3
3	SPI 3- Location 3 Water spring along the proposed site	-0.942169, 965974	< 2.19	80 µg/m^3

The results indicate that the Level of Sulphur Dioxide (SO2) averaged at 2.53 µg/m3 near the settlement area of Shatuka and this was within the set limits provided by the EMCA (Air Quality) Regulations, 2014 set at 80 µg/m3. At the River Ramosha area, the Level of Sulphur Dioxide (SO2) averaged at <2.27 µg/m3 this was below the Limit of Reporting (LOR) hence

within the guideline values. The source of the Sulphur Dioxide are attributed to the vehicular movement along the adjacent road and a fuel station in the area.

3.4.5. Land ownership categories/ classification

Land ownership in Narok can be categorized into three main categories namely; community land, trust land and private land. Community land refers the proportion of land held communally and registered as a group ranch. Due to population growth, this type of land ownership is rapidly diminishing. Group members are championing the subdivision of these group ranches resulting into individual land ownership – free hold titles. The areas, which are under communal land ownership, are parts of Loita and Olokurto wards.

Trust land is held by the county government on behalf of the people of Narok. This type of land is mainly in urban centres, forest reserve and in Maasai Mara game reserve. Private land is emerging as a result of disbandment of group ranches and community land. In urban centres, private ownership is in the form of lease hold titles while in the rural areas, people have freehold titles. Private land ownership has led to the land owners leasing out their land to investors. This is mainly happening in the wheat producing areas and within the Mara ecosystem. The proposed project site is owed absolutely by Shartuka Sugar Mills Company.

3.4.5.1.Mean holding size

The average land holding size in the county is approximately 16 acres. This is not uniform throughout the county. There are individuals who own thousands of acres, especially in the wheat producing areas. Land within the conservancies which is owned by members of the conservancies has bigger acreages. This is basically because these areas are conservation zones.

3.4.5.2.Type and size of land

Land in the county can be classified into four broad categories based on land use. These are: Urban land, Conservancies, Maasai Mara Game reserve and Arable. Urban land is spread across several urban areas in six sub-counties including; Narok Town, Kilgoris Town, Lolgorian, Nairegie Enkare, Ololulunga. The approximately area under urban land use is about is about 178.17km2

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Conservancies are found mainly around Maasai Mara ecosystem. These conservancies serve as dispersal and migratory corridors for wildlife from the Maasai Mara game Reserve. In total there is more than 352, 000 hectares of land under conservancies in the county, comprising more than ten conservancies. Among the biggest conservancies are Pardamat, Mara North, Mara Naboisho and Siana conservancies. Maasai Mara Game reserve on other hand accounts to approximately 1,510KM2. The game reserve is home to the big five: elephants, buffaloes, rhinos, lions and cheetahs.The arable land where most agricultural activity take place is approximately 8,495.5km2

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This land is mainly in Mau region, Narok North areas, Nairege enkare in Narok East, bigger part of Emurrua Dikirr sub-county and Narok South and pockets of land in Northern part of Narok West sub-county.

3.4.5.3.Average farm sizes

The average farm size under small scale is 6.1 Hectares and that of large scale is 26.3 Hectares with barley, tea, sugarcane and wheat being grown as the major cash crops. There has been sub-division of land into uneconomic units in some parts of the county while some large scale farms remain unutilized. The proposed project site is approximately 9.7Ha

3.4.6. Demographic Patterns:

Kilgoris is a town in Narok County, Kenya. The town has a population of 70,475 (2019 census). Kilgoris is one of two major urban centres in Narok County; the other being Narok town.

CHAPTER FOUR: ENVIRONMENTAL LEGISLATIVE AND REGULATORY FRAMEWORK

4.0 Introduction

The implementation of this project is guided and governed by a number of laws and policies of the country and region. These determine the nature of the project in terms of siting, height of the structure as well as use to which it will be put. The government has long been concerned with environmental conservation and protection of human health. It has therefore; put in place all the frameworks necessary for the legislative and regulatory controls of environmental management. EMCA, 2015 was amended to comprehensively address environmental issues which were being governed differently by the various sectoral acts in place.

4.1 Policy framework

4.1.2. Environmental Policy

The Kenya Government's environmental policy aims at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy include:

- Optimal use of natural land and water resources in improving the quality of the human environment;
- Sustainable use of natural resources to meet the needs of the present generation while preserving their ability to meet the needs of future generations;
- Integrate environmental conservation and economic activities into the process of sustainable development;
- Meet national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating the effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

4.1.3. The Sugar Policy

The Sugar policy as established is in line with the national objectives of the national food policy, which are; self-sufficiency, food security, employment creation, income generation, foreign exchange earnings, stemming rural-urban migration, poverty alleviation and overall economic growth. Sugar plays a vital role in providing livelihoods, earning national revenues and incomes, and creating employment and foreign exchange savings. It is an industry valued at approximately Kshs. 15 billion, providing over 500,000 direct and indirect jobs and

supporting the livelihoods of over 6 million people. The Sugar sub-sector is a major enterprise in the Western and Nyanza and potential exists in the Eastern and Coastal belts. Further improvement of this vital industry will help alleviate unemployment through backward and forward linkages.

4.1.4. The Kenya Vision 2030 and the "Big Four" Blueprint

The Kenya Vision 2030 is the national long-term development policy that aims to transform Kenya into a newly industrialized, middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment.

The Big Four is an economic blueprint that was developed by the government to foster economic development and provide a solution to the various socio-economic problems facing Kenyans. The four items that are intended for delivery include Food Security and Nutrition, Universal Health Care, Affordable Housing and enhancing the Local Manufacturing industry. Shartuka Sugar Mills Limited will explicitly play a big role in the realization of two of the pillars namely food security and local manufacture as soon as it starts its operations in Narok County.

4.1.5. Sustainable Development Goals (SDGs)

MDGs are eight internationally-agreed goals for socio-economic development that emphasize the following: elimination of extreme poverty and hunger; universal primary education; gender equality; reduction in child mortality; improvement in maternal health; lower HIV/AIDS and major disease incidence; environmental sustainability; and better partnerships with international development partners. The facility has an opportunity to contribute towards the local achievement of some of these goals via employment opportunities creation, corporate support to community initiatives and contribution towards achieving environmental sustainability goals.

4.2. Institutional and Regulatory Framework

Some of the key institutions to be involved include; the National Environment Management Authority (NEMA), the County Government of Narok, the National Construction Authority (NCA), the Water Resources Authority (WRA), National Sugar Board (NSB), Agriculture Fisheries and Food Authority (AFFA) among others.

Table 10: Legislative Framework

Principal Legislation	Requirements	Action
The Constitution of Kenya, 2010	**Article 42** of the Constitution states that every person has the right to a clean and healthy environment, which includes the right: a) 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 b) to have obligations relating to the environment fulfilled under **Article 70**. **Article 69(2)** states that 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. **Article 70 (1)** states that If a person alleges that a right to a clean and healthy environment recognized and protected under **Article** 42 has been, is being or is likely to be, denied, violated, infringed or threatened, the person may apply to a court for redress in addition to any other legal remedies that are available in respect to the same matter.	Commission an Environmental & Social Impact Assessment (ESIA) study for all new projects By commissioning of Environmental Audit (E.A) during project operations
The Environment Management and Coordination Act	**Ensure environmental protection during project implementation.** • Environmental Impact Assessment EIA) • Environmental Audit and Monitoring, Environmental Quality standards and issuance of environmental protection orders	Commission an Environmental & Social Impact Assessment

(EMCA)-1999 (rev.2015)	• Generation of sector related regulations • Environmental Management and Coordination (Environmental Impact Assessment and Audit) Regulations, 2003 • Waste Management Regulations – 2006 • Water Quality Regulations – 2006 • Wetlands, River Banks, Lake Shores and Sea Shore Management Regulations – 2009 Air Quality Regulations – 2014	(ESIA) study for all new projects Commissioning an Environmental Audit (E.A) for on-going projects
The Environmental Impact Assessment and Audit Regulations, Amendment Regulations, 2019	**Regulation 11 (1)** states that an environmental impact assessment study shall be conducted in accordance with terms of reference developed during the scoping exercise by the proponent and approved by the Authority. **Regulation 13 (2)** states that every environmental impact assessment study shall be carried out by a lead expert qualified in accordance with the criteria of listing of experts specified in the Fourth Schedule to these Regulations. **Regulation 24** on EIA licensing states that environmental Impact License shall be issued after the authority approves the study report under regulations 23, and shall be issued in form and accompanied by the prescribed fee.	Commission an Environmental & Social Impact Assessment (ESIA) study for all new projects Commissioning an Environmental Audit (E.A) for on-going projects

The Customs and Excise Act	Section 90. (1), states that, No person shall manufacture excisable goods unless he is licensed by the Commissioner to manufacture them. Section 91. (1), states that, Subject to this Act, the Commissioner may on application grant a licence to a person to manufacture excisable goods; and the Commissioner may, without assigning any reason, refuse to grant the application.	KRA registration
Standards Act Chapter 496	Section 9 (2), states that, where a Kenya Standard has been declared under subsection (1), the Minister, on the advice of the Council, shall, by order in the Gazette, prescribe a date after which no person shall manufacture or sell any commodity, method or procedure to which the relevant specification or code of practice relates unless it complies with that specification or code of practice. (3) Where, after the publication of an order under section 9. Section 10 (2), states that, any person intends to manufacture any commodity to which that order refers after the date specified therein he shall notify the Bureau in the prescribed form of his intention and the Bureau, if it is satisfied that he is capable of manufacturing the commodity in accordance with the relevant Kenya Standard, shall issue him with a permit to use the standardization mark referred to in paragraph (a) of subsection (1).	The proponent should seek a permits from KEBS to use the standardization mark as per this act.
Kenya Sugar Act, 2001 (rev.2012)	Part Iii – Licensing And Registration, 14. Requirement of licence to operate mill states that (1) No person shall operate a sugar mill or a jaggery mill unless he is a holder of a current licence issued by the Board for that purpose.	Acquire a license from the Kenya Sugar Board

	The Act is the primary legal framework governing the structure, operations and relationships of stakeholders in the sugar industry and provides for: a) Establishment, powers and functions of the Kenya Sugar Board, which is the industry regulator; b) Licensing and registration of sugar mills; c) Financial provisions – the Sugar Development Levy; d) Quality, health and safety; e) Offences and penalties; f) Sugar industry agreements; g) Rights of growers; h) Establishment and Constitution of the Sugar Arbitration Tribunal	
Agriculture, Fisheries and Food Authority Act, 2013	Control over soil conservation, land preservation and land development are mainly controlled within this Act, and many of the provisions can be generally applied beyond those lands suitable for agriculture	Acquire a license from the Kenya Sugar Board
County Governments Act, 2012	A county government may on receipt of an application under this Act grant a business permit to allow the conduct of a business or trade, including a profession or occupation within its area. Also provides for other easements required for such a project.	Acquire a license from the County Government of Narok
Air Quality Regulations, 2014	Requires the plant to install sampling portholes and carry out continuous emission monitoring systems in the emission duct. Stack emission measurements are to be submitted to NEMA.	Periodic analysis and stack emission tests

Solid Waste Management Regulations, 2006	This subsidiary legislation creates rules to govern the handling, transportation, treatment and disposal of various wastes. It defines wastes broadly into industrial, biomedical, hazardous and toxic and stipulates the various ways of handling these waste streams. **Regulation 4 (1)** demands that no person shall dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle. **Regulation 4 (2)** states that a waste generator shall collect, segregate and dispose such waste in the manner provided for under these Regulations. **Regulation 5(1)** states that a waste generator shall minimize the waste generated by adopting the following cleaner production methods:	Acquire waste transportation license from NEMA Keep waste tracking documents
Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009	Section 14 of the regulations states: Duty of land owners users and occupiers. (1) Every owner, occupier or user of land which is adjacent or contiguous to a wetland shall, with advice from the Authority, have a duty to prevent the degradation or destruction of the wetland, and shall maintain the ecological and other functions of the wetland.	Undertake E.I.A. before undertaking any development near a water source
Water Quality Regulations, 2006	These regulations apply to drinking water, water used for industrial purposes, agriculture purposes, fisheries and wildlife and water used for any other purpose. The objective of the water quality regulations is to prevent water pollution by prescribing threshold levels of various elements that are permissible in effluent water. Provides the permissible limits for wastewater discharge to environment i.e. water body, sewer and land. It is thus the benchmark for adoption of wastewater treatment technologies and best practice to avoid water pollution. It also creates riparian zones along rivers and streams alongside providing for the daily monitoring of effluent discharge both in terms of quality and	-Acquire effluent discharge license for filling station -Acquire effluent discharge license for (effluent treatment plant) ETP

	quantity to the environment. The regulations provides for the sound and integrated management of waste across the sectors in Kenya. The First Schedule of the regulations gives quality standards for sources of domestic water. The Third Schedule of the regulations gives standards for effluent discharge into the environment.	-Install a water meter to measure the amount of water waste water released from the factory on daily basis Carry out quarterly analysis of the composition of the effluent through a NEMA registered laboratory -Continuously monitor the discharge as per the regulations
The Water Act, 2002 (rev.2016)	Part II, section 18, of the Water Act, provides for national monitoring and information systems on water resources. Following on this, sub-section 3 allows the Water Resources Management Authority to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a facility operator and the information thereof furnished to the authority. Section 73 of the Act allows a person with license (licensee) to supply water to make regulations for purposes of protecting against degradation of water sources. Section 75 and sub-section 1 allows the licensee to construct and maintain drains, sewers	-undertake E.I.A. before drilling of boreholes -obtain WRA water extraction permits before drilling of bore holes or water abstraction from nearby rivers and streams

	and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing pollution of water sources within his/her jurisdiction.	
Occupational Health and Safety Act, 2007	This act was signed into law in October 2007 to repeal and replace the Factories and Other Places of Work Act Cap 514. It came into force on December 20, 2007. The Act makes provision for safety and health of workers in all workplaces in Kenya. All rules made under the previous Act remain in force under the new Act. The Act requires developers to notify the Director of Occupational Health and Safety of their intended development before commencement. The act also sets minimum standards that are to be maintained in such workplaces to safeguard health, safety and welfare of workers. These are all aimed at elimination of hazards from workplaces. The act further requires all workplaces to display the abstract of the act for all workers to read and remind themselves on how to protect themselves from hazards. The Act also makes it mandatory for occupiers or employers to provide personal protective equipment and all practicable means to prevent injury to health of workers who are exposed to any potentially harmful substances or conditions.	-notify the Director of Occupational Health and Safety of any intended development -registrar factory as a workplace and obtain a certificate
Food Drugs and chemicals substances Act (Cap 254)	The Food, Drugs and Chemical Substances Act (CAP 254) whose purpose is to make provisions for the prevention of adulteration of food, drugs and chemical substances. This Act (which has been invoked for the consumption of genetically modified food), requires that food, drugs, cosmetics, devices and chemical substances should not be sold if they are unwholesome, poisonous, or adulterated. It further prohibits deceptive	The plant should be inspected by the public health officer and issued with a Food Drugs and chemicals substances license.

	labelling. The statute also gives powers to authorized officers to inspect and examine any premises for evidence of contravention of the provisions of the law.	
Noise and Excessive Vibration Pollution) (Control) Regulations, 2009	**Regulation 3(1)** states that except as otherwise provided in these Regulations, 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 (1)** states that except as otherwise provided in these Regulations, no person shall- (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 4(2) states that any person who contravenes the provisions of this Regulation commits an offence.	Obtain noise and excessive vibrations permit for all noisy activities (where relevant)
The Malaria Prevention Act (Cap. 246)	Section 5 on Drainage System states that no occupations at the construction phase that shall obstruct flow of water into or out of any drainage. The contractor shall be required to maintain drainage system within the area of the project for removal of water from any land around the project to prevent larvae breeding.	Maintain drainage systems within the factory and prevent ponding of water within the factory compound
The Physical Planning Act, 2012	The Act gives provision for the development of local physical development plans for guiding and co-coordinating development of infrastructure facilities and services within the area of authority of the County government, and for specific control of the use and	Seek approval from the Narok County physical planning department

	development of land. It gives counties power to prohibit and control the use of land, building, and subdivision of land, in the interest of proper and orderly development of its area. It also allows them to approve all development applications and grant development permissions as well as to ensure the proper execution and implications of approved Physical Development Plans.	
The Land Registration Act, No.5 of 2012	An Act of Parliament to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes The Act has repealed the following land related laws: i. The Indian Transfer of Property Act 1882 ii. The Government Lands Act, (Cap 280) iii. The Registration of Titles Act, (Cap 281) iv. The Land Titles Act, (Chapter 282) v. The Registered Land Act, (Cap. 300) **Section 26** of the Act states that Certificate of title to be held as conclusive evidence of proprietorship, except: a) on the ground of fraud or misrepresentation to which the person is proved to be a party; or b) Where the certificate of title has been acquired illegally, un-procedurally or through a corrupt scheme.	-verifying the land ownership status before acquiring any private land -provide proof of land ownership for lands of proposed projects (title deed available)

Public Health Act, 2012	An Act of Parliament to make provision for securing maintaining health. The act makes it the duty of every local authority (in the capacity of "health" authority) to take all lawful, necessary and reasonably practicable measures to safeguard and promote public health (s.13). Part IX of the act deals with sanitation and housing, and is of most significance for the control of polluting discharges. S.116 imposes a duty on every local authority to maintain its district in a clean and sanitary condition, to prevent nuisances and prosecute those responsible for nuisances. Nuisances include drains and sewers for the discharge of pollutants into watercourses and lakes.	-undertake public health inspections for the factory -get public health approvals for all new developments
Wildlife (Conservation and Management) Act Cap 376 of 1976, 1989 & Bill, 2013 (GoK, 2013)	Section 30 of part VI: Prevention of adverse effects on the environment, including the seepage of toxic waste into streams, rivers, lakes and wetlands.	
The Employment Act, 2007	An Act of Parliament to repeal the Employment Act, declare and define the fundamental rights of employees, to provide basic conditions of employment of employees, to regulate employment of children, and to provide for matters connected with the foregoing.	

CHAPTER FIVE: ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.0.Impact description & mitigation

This chapter presents an assessment of environmental impacts from the planned project design and activities, and proposes mitigation and management measures to prevent and control these impacts.

The environmental impact assessment and analysis was done using a number of methods and tools. While identifying impacts, a checklist was used. This indicated all possible impacts that would accrue from implementation of this project.

5.1. Legal and regulatory compliance

The national laws and regulations relevant to the development and their relevance to the process project have been discussed.

5.2. Construction and Equipment installation

Key aspects to be considered during construction are:

- Procurement of construction materials.
- Installation of services and interiors of the building;
- Use of heavy and light machinery.
- Energy utilisation, major energy consuming activities include:
    - Lighting;
    - Excavation;
    - Transportation;
    - Hauling and hoisting of materials;
- Mixing raw materials;
- Waste handling trucking and disposal;
- Testing and commissioning of the development.
- Energy sources for these activities include grid electricity and diesel or petrol fuel for machinery/vehicles.
- Water utilisation, including use for the following activities:
    - Washing of machinery and equipment;
    - Preparing of mixtures, including water based emulsion paints;
    - Concrete works, including curing;
    - General cleaning;
    - Landscaping;
    - Controlling dust on site;
    - Domestic utilisation (sanitary facilities).
- Construction waste will include the following:
    - Timber from used formwork;
    - Paints, lubricants and petroleum wastes;
    - Containers, cement paper bags and other packaging materials;
    - Metal, glass, plastic containers and other unwanted materials.
- Socio-economic effects;
    - Labour;

- Security;
- Transport.
- Archaeological findings and aesthetics.

Table 11: Summarises the anticipated impacts and recommended mitigation measures during the construction and equipment installation stage.

Activity	Anticipated Impact	Recommended Mitigation Measures

Procurement of construction materials:	Natural resource depletion if not rationally done through activities such as quarrying, mining, timber logging.	• The tender documents should specify required standards and certification for procurement of all materials and appliances;
		• All construction materials should be from approved sources; for example, hardstone for building should be obtained from bona fide commercial quarries;
		• As far as possible, environmentally friendly and sustainable materials should be used. Materials not to be used for the construction of the buildings include:
		  • High alumina cement;
		  • Wood wool slab in permanent formwork to concrete;
		  • Calcium silicate bricks or tiles;
		  • Asbestos in any form;
		  • Asbestos substitutes or any naturally occurring or man-made mineral fibres;
		  • Lead, lead paint or any other materials containing lead which may be inhaled, ingested or absorbed;
		  Vermiculite, unless it is established as being fibre-free;
		  Any products containing cadmium that are regarded as being injurious substances;

		• Any other substances regarded as being deleterious building materials which are not in accordance with statutory requirements or with current accepted good building practice at the time of specification or construction. • The Project Manager should ensure that the Contractors are instructed in the use of all materials that may have negative environmental (including health) effects; • If any material or substance is used that is at any point in the future deemed to be deleterious to health, then it must be replaced with an acceptable alternative.
Building works:	Health and safety risk from accident and incidents; Noise and dust.	• Adhere to safety regulations outlined in the Local Government Adoptive by-laws, Building Order 1968 (Building Code) and the Building Operations and Works of Engineering • The Project Manager should ensure strict safety management through close attention to design, work procedures, materials and equipment; • Schedule noisy construction • Develop a site safety action plan detailing safety equipment to be used, emergency procedures, restrictions on site, frequency and personnel responsible for safety inspections and controls; • All workmen should be provided with personal protective equipment (e.g. nose masks, ear muffs, helmets, overalls, industrial boots, etc);

		• There should be regular site reporting on health, safety and environment (HSE) issues by an appointed HSE representative, daily site inspections should be done to ensure safe work practises are adhered to; • All injuries that occur on site must be recorded in the accident registers and corrective actions for their prevention be instigated as appropriate; • Statistical records on accidents and incidents should be collated and analysed on a monthly basis and forwarded to the Project Manager and / or displayed on the notice boards; • Site personnel should be encouraged to report "near-miss incidents" in order to avoid potential problems and increase safety awareness.
Energy utilisation:	Energy consumption.	• Develop an energy management plan; • Construction machinery and vehicles should be maintained and used in accordance with manufacturer's specifications, to maximise efficiency and lower use of energy, e.g. drivers of construction vehicles should be instructed not to leave them idling for extended periods; • Construction workers should be sensitised on the importance of energy management.
Water utilisation:	Water consumption; Hygiene and sanitation challenges.	• Monitor water consumption and utilisation; • Sensitise construction workers on the importance of proper water management; • All wastewater should be drained into approved drainage facilities.

Waste production:	Littering, soil and surface water pollution potential.	• The tender documents should specify the proper disposal of waste during construction and should also ensure that the Contractor leaves the site in a clean and safe condition on completion of the Works; • The Contractor should be required to restore and landscape all areas to the satisfaction of the Project Manager; • All solid waste generated during construction should be collected, stored, and taken away for disposal; • There should be controlled use of raw materials; • Procedures for handling of special wastes, such as waste fuel oil, should be specified; • Comply with guidelines on solid waste disposal and Waste Management Regulations 2006.
Influx of construction workers into the area:	Proliferation of informal kiosks in the area; Increase in transport demand.	• Develop a catering program on site for construction staff; • Provide transportation for the workforce to and from the site.
Construction traffic:	Disruption of local traffic; Potential for accidents.	• The Contractor should plan itineraries for site traffic.
Archaeological findings:	Destruction of natural heritage/loss of archaeological findings.	• In the event of an archaeological finding, the Contractor should secure the location 'as is' and immediately call the National Museums of Kenya's Archaeology Section.

5.3. Operation Stage

The key environmental issues during commissioning and operation are as follows:

- Water supply and consumption;
- Energy consumption and management;
- Effluent Management
- Solid waste, bagasse, filter cake and boiler ash management;
- Stack emissions
- Property management;
- Transport & security;
- Health and safety;
- Noise.

5.3.1. Operational Phase Negative Impacts

5.3.1.1. Increased pressure on infrastructure – Stressed up service provision

The additional facility will lead to increased pressure on existing infrastructure such as roads, water abstracted from river Romosha, etc due to the increased number of users. In turn, this may directly translate into increased use of facilities and services.

Recommended Mitigation Measures

i. Relevant authorities such as the Kenya Power and Lighting, and WRA should be informed of the capacity of the development
ii. The proponent will install water-conserving automatic taps and toilets, as well as energy-saving electrical fittings to optimize the use of public resources.
iii. Water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff.
iv. Occupants of the facility should be sensitized to use water efficiently.

5.3.1.2. Pollution – Environmental Degradation

Possible pollution may impact on alteration of soil structure by contaminations from introduced materials, bagasse, molasses, boiler ash, filter mud, waste water contamination, air pollution as well as noise levels from various sources within the premise.

a. Solid waste generation/by-products (bagasse, filter cake, boiler ash)

Once the proposed project is completed and operational, they are expected to generate a large amount of solid waste on a daily basis whose composition will be dominated by organic waste. These solid waste, if not disposed properly can cause the following impact on environment:

- Ground water contamination by bagasse leachate generated by non-scientific dumping
- Surface water contamination by the run off from the dumping site
- Bad odour, Pests, rodents and windblown litter in and around the collection site
- Generation of inflammable gases (e.g. Methane)

Impacts may also result from improper sitting, inadequate design and poor operation of waste disposal facilities.

Recommended Mitigation Measures

i. Clearly designate and construct an appropriate waste collection facility or provide covered refuse skips; (Filter cake and boiler ash dumping and composting sites are available)
ii. NEMA licensed waste transport vehicles have been provided
iii. Maintain a proper waste tracking document
iv. Bagasse is used as a source of fuel in the boilers. However, the bagasse holding shades appear not to be adequate to hold additional bagasse. A larger shade may be needed.
v. Ensure adequate fire warning, response and management systems are installed.
vi. Provide well-structured engineering solutions to leachate and surface runoff.

b. Wastewater management

There will be an increase in effluent due to the increase in cane crushing capacity. The EMCA Water Quality Regulations of 2006 require all facilities that discharge any effluent to the environment to obtain an Effluent Discharge license and to continuously monitor the discharge. The fourth schedule of the Water quality regulations gives a guide on the quality parameters which should be monitored for different types of effluents. The parameters which should be monitored for Sugar Industry effluent include the following: Biochemical Oxygen Demand (BOD), Total suspended solids (TSS), pH, Fecal Coliforms /Ecoli, Chemical Oxygen Demand (COD), Colour/Dye/Pigment, Organic Nitrogen as N, Flow, Copper, Zinc and Surfactants.

Recommendations (ETP)

- Apply for an effluent discharge license from NEMA on time
- Install a water meter to measure the amount of waste water released from the factory on a daily basis
- Carry out an analysis of the composition of the effluent through a NEMA registered laboratory
- Continuously monitor the discharge as per the regulations
- The company to construct drainages throughout the factory to direct storm waters to the river after lab testing and treatment if necessary

c. Air pollution levels

Vehicular emissions from vehicles and stack emissions will be the major air pollution sources from the Project.

Recommended Mitigation Measures

- Regularly monitor stack emission
- Invest in bagasse drying mechanism along the delivery line
- Exhaust gas recirculation
- Selective non-catalystic/catalystic reduction
- Installation of wet scrubbers and thermal oxidizers
- Avoid overloading the bagasse for efficient burning
- use the correct fuel to air ratio by proper adjustment of air and fuel ratios
- Avoid carbon build-up in the boiler and furnace tubes and maintain the boiler and furnace settings in good condition

5.3.1.3. Increased traffic flow – Unnecessary congestion

An increase in the number of vehicles within the area is anticipated which may lead to congestion and pose a threat to accidental occurrences.

Recommended Mitigation Measures

i. In case of heavy traffic, an attendant should be employed to direct vehicles during peak periods.

5.3.1.4. Drain blockages – Back flooding

Poor surface drain management or large amounts of effluents may lead to blockage of drains which in turn could result in flooding and unsanitary conditions within the neighborhood. Blocked drains produce a bad odour and are a threat to general health, hence are environmentally unfriendly.

Recommended Mitigation Measures

i. The proponent should ensure that there are adequate means of handling the large quantities of sewage generated at the facility.
ii. It will also be important to ensure that septic pipes are not blocked or damaged since such occurrences can lead to the release of the effluent, resulting in land and water contamination.
iii. Such blockages or damages will be fixed expeditiously

5.3.1.5. Vector and rodents breeding grounds – Vulnerability to diseases

If the project does not have well-designed storm water drains, the rainwater may end up stagnating or intruding neighbouring facilities and hence creating conducive breeding areas for mosquitoes and other water-based vectors leading to human diseases like malaria. Poor solid waste management practices may also lead to breeding grounds for pests such as rats and other scavenging animals.

Recommended Mitigation Measures

i. The design of the construction should ensure that no space for stagnant water will be retained.
ii. A well maintained trash collection point should be set aside.
iii. The proponent should put in place efficient storm water and waste management systems that will prevent the accumulation of rain water and uncontrolled waste, as well as an efficient collection system and off-site disposal.
iv. Proper monitoring of the premise should be effected for maintenance of health and hygiene.

5.3.1.6. Electricity consumption – pressure on supply

The project shall consume large amount of electricity due to activities that will take place once the project is complete. Since electric energy in Kenya is generated mainly through natural resources, namely water and geothermal resources, increased use of electricity have adverse impacts on these natural resources base and their sustainability.

Recommended mitigation measures:

i. Maximize the contribution of daylight to reduce use of artificial lighting in the buildings;
ii. Select the most efficient lighting system design and minimum lighting level appropriate for the required application;
iii. Install energy saving appliances;
iv. Select the most effective lighting controls for optimal operating efficiency and minimum energy wastage.
v. The project design should consider use of solar energy for water heating.
vi. Monitor energy consumption to establish trend;
vii. Maintain records;
viii. Develop an energy management plan.

5.3.1.7. Water supply and consumption

Table 12: The issues and recommended mitigation measures are:

Issue	Recommended mitigation measure
Water consumption:	• Monitor water consumption • Install internal water meters.
Rainwater harvesting	• Incorporate rainwater harvesting measures.
Estimated water demand:	• Manage consumption rigorously.
Water conservation.	• Installing plumbing fittings, appliances and devices to optimise water use efficiency; • Recycling of wastewater to reduce water consumption.

5.4. Decommissioning

Decommissioning is the process of shutting down an operational facility in a manner that leaves the area in a safe and stable condition that is consistent with the surrounding physical and social environment. The Contractor will ensure that:

- The process of closure occurs in an orderly, cost effective and timely manner with the allocation of adequate resources;
- The anticipated cost of decommissioning is adequately provided for in the project costs.

The Contractor will be expected to:

- Carry out consultations with stakeholders
- Develop the action plan for demolition including the assigning of roles for the demolition crew;
- Isolate power at the main switch and remove cables up to that point;
- Dismantle, remove and dispose of construction camp equipment and structures in an appropriate environmentally friendly manner;
- Request utility service providers to disconnect the power, water and telephones as may be appropriate;
- Reinstate the land to its natural condition by filling excavations and planting suitable saplings.

The Contractor must obtain a Certificate of Satisfactory Decommissioning from the relevant Authorities. In the unlikely event that the facilities is closed down decommissioning would comprise the reduction of all buildings and facilities to a safe condition and the restoration of the land to its original condition. The following will be done:

- Notification of intent to all relevant regulatory agencies;
- Liaise with project Consultants including architects, engineers, and environmentalists to ascertain guidelines, anticipated de-commissioning impacts and mitigation measures.

5.4.1. Decommissioning phase Negative Impacts

During the decommissioning phase, another comprehensive EIA study based on the intended new use of the site will be conducted. Decommissioning may involve one of the following options: facing out operations and evacuating the premise without carrying out any other plans; change of use of the facility; demolition of the property to restore it to the current or better status.

5.4.1.1. Solid Waste Generation

Demolition of the facilities and related infrastructure will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphate and ammonia which may be released as a result of leaching of demolition waste, are known to lead to degradation of groundwater quality.

5.4.1.2. Dust

Large quantities of dust will be generated during demolition works. This will affect demolition staff as well as the neighbouring residents.

5.4.1.3. Noise and Vibration

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas. This will be as a result of the noise and vibration that will be experienced as a result of demolishing the proposed project.

Table 13: Summary of impacts and their proposed mitigation measures

Proposed project stage	Potential impact	Proposed mitigation
Pre-construction/equipment installation stage	Introduction of improper seeds to the sugar farmers	Use of short maturing sugar varieties which will enable the farmers to be able to meet their financial needs through short maturity period. Sugar varieties exist in Sudan which matures at 14 months. Other countries with short maturing varieties include; Pakistan 10-12 months, Java (Indonesia) 12-15 months, Mauritius 14-20 months, Philippines 11-14 months, Cuba 12-15 months and India 10-12 months
	Improper land preparation	Shartuka Sugar Mills Limited through their designated office will sensitize the farmers on the standards of land preparation and methods of soil conservation so as to sustain the productivity of the soil over the long term
	Use of improper inputs	Shartuka Sugar Mills Limited through their designated office will sensitize farmers on the need of applying all the inputs they are given so as to get higher yields instead of diverting the farm inputs to other uses
	Conflicts with other sugar millers	Shartuka Sugar Mills Limited will carefully identify and contract their sugar farmers in collaboration with the local administration in order to avoid conflicts with other existing millers in the catchment area such as Transmara Sugar Company
	Noise and vibration pollution	• Switching off machines while not in use.

Construction/equipment installation stage		• Restrict working hours to periods which are not associated to human disturbances especially the recommended working hours 8.00 am – 5.00pm • Provide workers with ear masks. • Regular servicing of working machines
	Material and equipment Transport	• As far as possible, transport of construction materials should be scheduled for off-peak traffic hours. • Appropriate traffic warning signs, informing road users of a construction site entrance ahead and instructing them to reduce speed, should be placed along the main road in the vicinity of the entrance to the site during the construction period. • Flagmen should be employed to control traffic and assist construction vehicles as they enter and exit the project site. • Issue notices/advisories of pending traffic inconveniences and solicit tolerance by local residents before the commencement of construction works.

	• Assign traffic regulators to places during periods of chronic or potential traffic congestions. • Set relatively low speed limit within the site. • Encourage transport vehicle owner to insure their vehicles on regular basis. • Discourage parking near the entrance or exit routes.
Material and equipment stockpiling & storage	• The stockpiling of construction materials should be properly controlled and managed. Fine-grained materials (sand, marl, etc.) should be stockpiled away from any surface drainage channels and features. • Low berms should be placed around the piles of sand and marl and/or tarpaulin used to cover open piles of these materials to prevent them from being washed away during rainfall. • Safe storage areas should be identified and retaining structures put in place prior to the arrival and placement of material and equipment • Materials and equipment to be delivered on site in installments.
Soil Erosion	• Stage site clearance works so as to minimize the area of exposed soil at any given time.

	• Re-cover exposed soils with grass and other ground cover as soon as possible. • Temporarily bund exposed soil and redirect flows from heavy runoff areas that threaten to erode or result in substantial turbid surface runoff to adjacent drainage waters. • Monitor areas of exposed soil during periods of heavy rainfall throughout the construction phase of the project to ensure that any incidents of erosion are quickly controlled. • Leveling of the project site to reduce run-off velocity and increase infiltration of storm water into the soil, therefore avoid compaction where possible.
Workers safety and health	• Provide workers with reflective garments. • Regular servicing of working machines. • Train workers on manual handling techniques. • Deploy an expert to lead first aid administration. • Provision of adequate safety garments and enforce on their usage.

	• Discourage trespass. • Put signage on the ongoing activities
Construction debris and other rejected construction materials.	• Reduce wastes from the point of generation by purchasing high standard and recommended materials. • Instruct workers to avoid damage of working materials. • Contract NEMA registered garbage collector to collect waste on regular basis. • Embrace the 3R's concept (Reduce, Reuse and Recycle).
Dust generation and aerosol emission	• Sprinkle water to harness dust level. • Provide workers with nose masks.
Landscape and ecosystem change	• Once the project is completed any bare land will be re-vegetated with indigenous grass, shrubs and trees • Landscaping will be done to reduce any negative impacts • Only specified areas of construction will have vegetation cleared • protecting the existing individual trees as much as possible

	Water supply	• Provide adequate water storage reservoirs on the construction site to meet project needs during periods of high demand externally and refill the tanks during periods of low demand (e.g. late at night). • Engaging water supply tankers in case of total supply failure.
Operation Stage	Cane fires	• Shartuka Sugar Mills Limited will encourage green cane harvesting to avoid the negative environmental impacts associated with can harvesting through burning
	Cane spillage	• Shartuka Sugar Mills Limited in partnership with Kenya Sugar Board, Kenya Roads Board, KENHA, KURA, KERRA and the County Government of Narok will ensure the improvement of the road infrastructure within the cane growing area in order to reduce the level of cane spillage along the roads • Sensitization of sugarcane loaders so as to allow for proper sugarcane loading avoiding protruding cane which inconvenience other road users • The company should also institute measures of collecting all the spilled cane on the feeder roads

Water use	• A Sustainable Water Management System Plan should be developed in collaboration with WRA to minimize impact to natural systems by managing water use, avoiding over-abstraction in Romosha River or the groundwater aquifers, and minimizing impacts to other water users. • Shartuka Sugar Mills Limited should also consider the harvesting, tapping and utilization of rainwater as well as reuse, recycling and treatment of process water where feasible • Factory water use should be carefully monitored through the use of flow meters and timely identification and control of nay leakages • The factory will be operated at optimum capacity and with minimum stoppages because raw water consumption per ton of cane crushed increases when crushing lower than the optimum capacity and when hot water production is suspended during halts in operations (cleaning, restocking, and breakdowns).
Waste water	• Wherever possible, containment of water collected from areas with potential contaminants will be ensured. Such waste water should be reused.

- Oil interceptors and sediment traps should be installed and maintained to ensure any discharge to the environment carries a low sediment load.
- Storm water management canals and dams should be maintained and kept clean in order to ensure that the capacity of such systems is not compromised during the life of the operations
- Sensitization of the clients who buy molasses of the environmental effects of the product so as to prevent spillage of the same
- Apply for effluent discharge license from NEMA on time
- Install a water meter to measure the amount of water waste water released from the factory on daily basis
- Carry out an analysis of the composition of the effluent through a NEMA registered laboratory
- Continuously monitor the discharge as per the regulations
- The company to construct drainages throughout the factory to direct storm waters to the river after lab testing and treatment if necessary

Solid waste generation/by-products (bagasse, filter cake, boiler ash)	• Clearly designate and construct an appropriate waste collection facility or provide covered refuse skips; (Filter cake and boiler ash dumping and composting sites are available) • NEMA licensed waste transport vehicles have been provided • Maintain a proper waste tracking document • Bagasse is used as a source of fuel in the boilers. The factory has also applied for (EIA) a new environmentally designed bagasse holding area. It also has plans for a cogeneration plant which will use up all the bagasse produced. • Ensure adequate fire warning, response and management systems are installed. • Provide well-structured engineering solutions to leachate and surface runoff.
Air pollution levels	• Regularly monitor stack emission • Invest in bagasse drying mechanism along the delivery line • Exhaust gas recirculation

	• Selective non-catalystic/catalystic reduction • Installation of wet scrubbers and thermal oxidizers • Avoid overloading the bagasse for efficient burning • use the correct fuel to air ratio by proper adjustment of air and fuel ratios • Avoid carbon build-up in the boiler and furnace tubes and maintain the boiler and furnace settings in good condition
Drain blockages	• The proponent should ensure that there is adequate means of handling large quantities of sewage blockages as well as related emergency situations. • Proper monitoring at waste generation points should be established. A site management plan should be put in place.
Increased pressure on infrastructure	• The proponent should maintain close operations with service providers such as The Kenya Power and Lighting Company, WRA e.t.c. • Principles of Cleaner Production should be applied to ensure optimal system performance.
Fire outbreak.	• Install and regular maintenance of the firefighting equipment • Clearly labeling fire exit route.

		• Staff to be made clearly aware of fire hazards
	Vector breeding grounds	• Include an efficient storm water and waste management systems that will prevent the accumulation of rain water • All trenches and drains should be kept clear of all debris
Decommissioning stage	Loss and damage of properties during demolition activities	• Removal of properties that are not intended to be destroyed before the actual demolition process. • Proper supervision during demolition activities.
	Loss of employment opportunities	• A good phase out programme for employees should be put in place from the onset of the project
	Accidents to the demolishing team.	• Issue the workers with reflective garments. • Supervisors instruct the worker and ensure that no one is at risk by falling objects.
	Loss of environmental aesthetics beauty.	• Ensure complete collection and disposal of wastes after demolition. • Landscaping the affected areas. • Conduct a decommissioning audit.

CHAPTER SIX PROJECT ALTERNATIVES

6.0 The Proposed Alternatives

This section discusses the potential impacts (both positive and negative) and proposes alternatives to the execution of the project based on the information generated by the analysis of the environmental issues above.

6.1 Site alternative

Alternatives for siting the project may be limited to land ownership and the appropriateness of the area. The current location provides the most suitable place. The relocation option to a different site is an option totally unavailable to the project as the proponent already owns the land. The current location provides the most suitable place. The proposed site for the sugar mill is currently 20 acres but is projected to occupy 60 acres after further land acquisition by the Proponent. The site is without major development and is currently on small-scale maize plantation with most of it being bare. This alternative will have minimal impact on the physical environment and has considered the necessary measures to almost eliminate the identified issues. The project is also in line with the contemporary needs of the proponent.

Advantages:

- The property value appreciates.
- Investment made in the property will be productive. The proponent will have a potential source of income in long-term basis.
- Government earns revenue from fees, taxes, rent, rates and licenses.
- Employment opportunity for the workforce expands since the larger structure will require larger management services.
- Optimal economic and spatial land use
- Visual amenities will be improved.

6.2 Alternative Technologies

The design of the ETP has taken into account measures that can be implemented to minimise wastewater production through recycling, treatment and reuse. Its capacity shall be enhanced should it not be capable of handling larger amounts of effluent. No discharge of effluent shall

be made to the Romosha River before satisfactory treatment. Sewage arising from the workforce at the plant will also be discharged into septic tanks. Equipment for the development were preferred with reference to available capital, and function. The design of the facility was undertaken with a view to providing the most suitable, modern and practical facilities for the expected users.

6.3. Alternative Bagasse management

Bagasse is the residual material after extraction of juice from sugarcane. This bagasse through the conveyor is sent to steam generation unit. However, the bagasse generated is so voluminous that managing it requires serious interventions. The proponent shall have a robust bagasse waste management infrastructure that comprises of briquette processing plant side by side with the sugar milling plant to ensure excess bagasse that is not undergone complete combustion during boiler firing is turned into fuel briquette for the consumption by the local community in order to reduce chances of forming leachate especially during wet weather.

Bagasse Leachate is a low pH liquid which normally forms when rain water percolates through bagasse and washes some of the bagasse organic components. Shartuka Sugar Mill Ltd has considered each of several methods in the management of bagasse.

6.3.1. Transfer the bagasse heap to another location

Shartuka Sugar Mill Ltd explored the possibilities of shifting the bagasse from the factory grounds to another site to reduce the quantities of bagasse at the yard. However this will only worsen the situation since the large quantities of bagasse will form leachate in the near future.

6.3.2. Use of bagasse in co-generation of power and steam

Shartuka Sugar Mill Ltd will use fresh bagasse to produce about 3 MW of power at its station. However, the power station will only be able to utilise a fraction of the fresh bagasse daily out of the quantities produced from crushing of cane per day.

6.3.3. Reuse of bagasse in making of briquettes

Shartuka Sugar Mill Ltd has planned to introduce making of briquettes at the sugar mill once the mill commences operation. It will involve drying bagasse from 45% - 50% to the required 8% moisture content in order to make the briquettes.

6.3.4. Reuse of bagasse as soil conditioner

Bagasse could be a suitable soil conditioner if applied in thin layers and with pH adjustment, for example, using lime. Shartuka Sugar Mill Ltd shall work with farmers on application of the bagasse on land.

6.4. Alternative Equipment

Equipment for the development were preferred with reference to available capital, and function. The design of the facility was undertaken with a view to providing the most suitable, modern and practical facilities for the expected users.

6.5. "No Project" Alternatives

The No Project alternative would be a loss to the expected gap that would be filled by with the increase in sugar production at the sugar factory. The no project development alternative in respect to the proposed project implies that the status quo is maintained. Under the no project alternative, the proponent's proposal would not receive the necessary approval from NEMA. The proposed sugar factory would not be constructed and the expectations attached to the project would not be met. The no project construction alternative is the least preferred from the socio-economic perspective.

6.6. Preferred option

For this project, there are limited alternatives for the project site because the proponent already operates a sugar plant. Therefore, emphasis is now placed on the technological approaches that the proponent will adopt in constructing and managing the proposed development.

CHAPTER SEVEN: PUBLIC PARTICIPATION

7.0. Overview

The project proposes mainly serve the public and the local people. Therefore it is imperative that the beneficiaries are involved in the project feasibility, planning, implementation and operation stages. In view of these, the ESIA team adopted a participatory approach during the study noting that stakeholders' participation in Kenya is entrenched in the constitution, several legal instruments and international instruments to which Kenya is a party.

The consultants endeavoured to ensure that due consideration is given to public values, concerns and preferences when decisions are made. It encompasses the public actively sharing in the decisions that government and other agencies make in their search for solutions to issues of public interest. Effective public participation requires the availability of adequate information in public in puts.

7.1. Legal Requirement for Public Participation

7.1.1. The Constitution of Kenya

Public participation is entrenched in several articles across the Kenya constitution 2010. Article 6 provided for devolution and access to services. Responsibilities in major decision-making process have been bestowed to the public (in the bill of rights, articles 118, 174, 196 and 201). The constitution further in article 21 section 3 requires safeguarding the rights and interests of marginalized groups for equity in public service provision. This can be effectively achieved through the active involvement of such groups in decision- making process at all levels. Hence need to involve the local people in the project area in the studies, design and implementation of the proposed project facilities.

7.1.2. Environmental Management and Coordination Act, 1999 (amended 2015)

Section 17 of the Environmental (Impact Assessment and Audit) Regulations of 2003 requires that all ESIA studies incorporate consultation with the public during the entire study process. The aim of public consultation in the project was to ensure that all stakeholders' issues and concerns in the proposed facilities are identified and their opinion considered during the project planning, design, implementation, operation and decommissioning phase.

7.1.3. County Government Act 2012

Public participation is integral in Kenya's development process as set out in the decentralized system of governance. The county government Act which sets out the service delivery procedure of county governments, has recognized local people involvement in decision making as key to governance. The Act in part VIII stipulates the principles of citizen participation and in part IX it guarantees the citizens‟ right to public communication as well as access to information. To ensure that there is optimal participation, the Act provides for civic education in part X to build the capacity of local people. Therefore meaningful public consultation is significant during planning, implementing and operation of development projects hence the need for such consultations for the proposed development of Shartuka Sugar Mill Ltd project in Narok County.

7.1.4. International Convention (Aarhus Convention 1998)

The Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters entered into force in October 2001. The Convention grants the public rights regarding access to information, public participation and access to justice, in public decision-making processes on matters concerning the local, national and transboundary environment. It focuses on interactions between the public and public authorities.

7.2. Objectives of Public Consultations

Public participation is not a one-off event but a process throughout the project cycle that requires regular consultations. In regard to the preceding observation, the proposed project involved stakeholders' participation with the following objectives;

- Disseminate and inform the project stakeholders about the proposed project, its key components and activities, location and expected impacts with particular attention to potentially affected persons;
- Create awareness among the public and stakeholders on the need for the ESIA for the proposed project and its due process;
- To obtain information about the needs, concerns, comments, suggestions and priorities of the local people as well as their general reactions to proposed project activities;
- To obtain the cooperation and participation of the key stakeholders, affected persons and local communities in activities that were required to be undertaken for

designing, implementing and operating the proposed project or development of the project facilities;

- Create a sense of ownership, capacity build and ensure transparency in all activities related to the project including but not limited to designing, planning, implementing, environmental management, operation, monitoring and evaluation of the project by all key stakeholders; and
- To establish a clear communication channel, easily accessible and effective grievance procedure between the public, consultant team, the project proponent and the County government of Narok.

7.3. Stakeholders' Identification/Mapping

The public participation was an inclusive exercise that required proper planning and arrangements.

- The team ensured that the stakeholders identified are multi-sectorial touching on agriculture, lands, water, health, environment, county and national government. These stakeholders were consulted by use of a key stakeholders' meeting. To ensure that no major player is left out.

- The stakeholders are categorised into two groups of primary stakeholders and secondary stakeholders. Primary stakeholders are the beneficiaries of a development intervention or those directly affected (positively or negatively) by it. They included local populations (individuals and community-based organizations) in the project area, in particular, poor and marginalized groups who have traditionally been excluded from participating in development efforts. Secondary stakeholders are those who influence development intervention or are indirectly affected by it.

  They included the proponent, government and county line ministry and departments, implementing agencies, civil society, NGOs and CBOs. The consultation programme developed and implemented taking into account the various areas of influence.

- Prior to the public meetings/barazas, the sites have been visited to identify all the stakeholders and appropriate meeting venues. This also presented a platform to consult with the area leaders and the residents hence developing a good rapport. The ESIA team

established contacts to enable proper planning and invitation of the public for the consultative meetings. The means of communication used to invite the public were verbal through the area chiefs/village elders and posters. The team in liaison with the Assistant County Commissioner settled on appropriate venues and dates for public meetings. These consultative meetings were held on 10th July 2022. The ESIA team documented the minutes and list of attendance.

7.4. Consultation Process

Legal Notice of 101 of June 2003 requires that all environmental and social assessment processes in Kenya incorporate Public Consultation. This a requirement informed by an awareness that the development and implementation of projects can occasion diverse impacts on stakeholders who should consequently be informed appropriately following which they can make an informed decision about the proposed development. It is also important to ensure that all stakeholder interests are identified and incorporated in project development, implementation and operation and, against such background, the consultation was undertaken far and wide both within the project area and outside with the following objectives; -

1. To disclose the Study to both primary, secondary and other stakeholders;
2. To obtain the reaction/comments/concerns of all stakeholders so as to understand their perceived view of the proposed project and assess the extent to which their views need to be taken into account. This is important as it helps to ensure that important social issues are not overlooked and there is ownership from the communities in all the project areas;
3. Improve project design by incorporating their views, thereby, minimize conflicts and delays in implementation;
4. Increase long term project sustainability and ownership of the project;
5. Identify local leaders with whom further dialogue can be continued in subsequent stages of the project.

7.5. Tools used in stakeholder and public consultations

7.5.1. Reconnaissance Visit

The ESIA study process commenced with a reconnaissance visit to the project area. The consultants alongside the proponent's representatives visited the proposed project site for a reconnaissance survey on diverse dates. The goal of the visits have been to familiarize the team with the project site and assess the status of the construction site and the farms. The proponent

explained the origin and justification of the project as well as the planning activities that had so far taken place in relation to the proposed project.

7.5.2. Feasibility

A feasibility study of the project had already been done. The proponent also confirmed that they had already acquired the 20-acre piece of land in Shartuka location that was earmarked for the construction of the proposed cane milling factory. Piloting of cane development had also taken place. It showed that the cane varieties to be used could be harvested after 19-22 months from planting. The trial experiments also showed they could expect to harvest 42-46 tonnes of cane per acre. Further, it was mentioned that the research/experiments had shown that sugar cane can be produced under rain-fed conditions with no need for irrigation water.

The proposed milling plant will have a capacity of 1500 tonnes of cane per day (tcd). This capacity may be enhanced in future. It was also confirmed that there would be enough cane supply to support this capacity. The proponent had a full financial feasibility study for the project which showed a positive Net Present Value (NPV) in terms of financial performance.

7.5.3. License

Apart from a sugar cane production and milling licence from the Kenya Sugar Board, a NEMA licence is a requirement for such a venture. A comprehensive Environmental and Social Impact Assessment is hence necessary before a decision to issue a NEMA licence can be made. The proponent has authorized the consultants to prepare a Terms of Reference (TOR) for the consultancy assignment.

7.5.4. Meeting with NEMA County Director

The consultants and the proponent held a joint meeting with the NEMA County Director of Environment at Narok County. The purpose of the meeting was to appraise the office on the proposed project and to identify the broad environmental concerns. The Director also helped mobilize the key stakeholders in the county government for purposes of consultation and information.

7.5.5. Meeting with Deputy County Commissioner and area chiefs

The consultant's and proponents' team have also had a meeting with the Deputy County Commissioner in his office in to inform him about the project and seek his support in mobilizing the public during the public consultation forums. It was agreed that that the

consultant and proponent would hold three public consultation meetings. Each meeting in different locations of Romosha, Shartuka and Oltanki which boarder the proposed project site. Both Deputy County Commissioner and Assistant County Commissioner were receptive of the venture and asked the chiefs to spearhead the public mobilization

7.5.6. Socio-economic Survey

Socio-economic Survey (Household questionnaires) - This was based on structured questionnaires to gather information on socio-economic aspects of the communities in the study area. It was administered through face-to-face interviews at the household level. The survey was conducted on selected (sampled households). The sampling was confined to communities living around identified project sites and the neighbours that was affected by the project.

7.5.7. Key Stakeholder Meeting

Key Stakeholders' meeting will be held with technical representatives of the County's Environmental Committee to gather information and interrogate the technical and implementation schedule of the project with a view to identifying and tightening the gaps that might be a hindrance to the project. This will involve representative from ministries of planning, agriculture, water among others.

7.5.8. Public Consultation Meetings

PCMs – The Consultants in collaboration with the national government led by the Deputy County Commissioner (DCC), Assistant County Commissioner, Area Chief and the assistant chief carried out public participation on the proposed Shartuka Sugar Mill Limited project. The meetings was be held in three venues namely; Shartuka Chiefs office compound, AIC Oltanki Church and Romosha Community Centre targeting 3 locations within and neibouring the project project area. During the meetings, Shartuka Sugar Mill Limited representative and the consultants explained the salient features of the project including geographical scope, infrastructure, expected benefits that was cross-checked with the communities and environmental aspects. The community members was given an opportunity to air their views and bring out the issues that were of concern to them. The meetings addressed the following topics: Overview of the project; cane development; the sugar milling factory, possibility of domestic water supply; socio-economic aspects including anticipated project benefits; community participation in the project; natural resources including water, land and

environmental and social issues including likely negative impacts and the proposed mitigation measures.

Public participation meetings

7.5.9. Kenya Gazette and Mass Media Public Notice

After the EIA report is finalized and submitted to NEMA, in line with EMCA, NEMA will prepare public notices to be advertised in the Kenya Gazette and the mass media (print media and radio) inviting public comments and views about the proposed development.

CHAPTER EIGHT: ENVIRONMENTAL MANAGEMENT PLAN

8.0 Introduction

The Environmental Management Plan involves the protection, conservation and sustainable use of the various elements of the environment. The EMP for the proposed project provides all the details of its activities, impacts, mitigation measures and expected costs during implementation and decommissioning phases of the project. This project bears the potential of a number of negative impacts on the environment. With proper environmental management procedures in place and adhered to then there should be minimal negative impact of concern emanating from it. Key areas that require mitigation measures include wastewater, solid wastes, maintaining good air quality, safety, and storm water management.

Table 14 below indicates measure for Environmental Management Plan

Table 14: Environmental Management Plan (EMP)

Environmental parameter	Impact	Mitigation measure	Responsible party	Cost (Ksh.)
CONSTRUCTION/EQUIPMENT INSTALLATION PHASE				
Extraction of raw material	▪ Landscape change ▪ Poor visual quality ▪ Depressions leading to human and fauna health impact ▪ Deforestation ▪ Natural resource depletion ▪ Water abstraction	▪ Source material from supplies that use environmentally friendly processes in their operation. ▪ Ensure accurate budgeting and estimation of actual construction material requirement to ensure that the least amount of material necessary is ordered. ▪ Ensure that damage or loss of material at construction site is kept minimal through proper storage. ▪ Use at least 5%-10% recycled, refurbished, or salvaged materials to reduce the use of raw material and divert material from land fill. ▪ WRA permit to be obtained if water abstraction is done ▪ The tender documents should specify required standards and certification for procurement of all materials and appliances; ▪ Steel scaffolding should be used in preference to timber and the Contractor should ensure that sufficient quantities of scaffolding are available for hire at the time of construction.	Proponent and contractor WRA NEMA	**As per BQ and agreement with contractor**

		▪ All construction materials should be from approved sources; for example, hard stone for building should be obtained from bona fide commercial quarries;		
Removal/clearing of vegetation	▪ Exposing ground to agents of soil erosion ▪ Lose of vegetation ▪ Loss of terrestrial habitat & biodiversity	▪ Proper demarcation and delineation of the project site to be affected by construction work ▪ Specify location for trucks and equipment, and areas of the site which should be kept free from traffic, equipment and storage. ▪ Designate access route within the site ▪ Design and implement an appropriate landscaping program to help in re-vegetation of part of the project site after construction ▪ Protecting the existing vegetation as much as possible ▪ Set a replanting and landscaping programme that focuses on increasing "green area"	Proponent and contractor KFS	**Per BQ**
Sewage and effluent	▪ Pollution	▪ Provide adequate sanitary facilities for workers, ▪ Provide solid waste receptacles and storage containers, particularly for the disposal of plastic bags boxes, so as not to block drainage system and to prevent littering of the site.	Proponent and contractor	**Per bq**
Movement of vehicle at the site	• Compaction of soil • Interference with soil structure leading to low water infiltration	• 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. • Ensure that construction vehicles are restricted to existing graded	Proponent and contractor	**50,000**

		roads to avoid soil compaction within the project site, • Ensure that any compacted areas are ripped to reduce run-off. • Storm water drainage lines be well constructed to reduce incidence of pounding and flooding		
Utilization of construction materials	• Generation of Construction waste leading to: ➢ Wastage of resources/ materials ➢ Health risk to the workers and environment ➢ Reduced aesthetic value of the site ➢ Production of leachate hence pollution of underground water and the soil ➢ blockage of drainage systems	• Through accurate estimation of 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. • Ensure that construction materials left over at the end of construction will be used in other projects rather than being disposed off. • Ensure that damaged or wasted materials including cabinet, doors, plumbing, and lighting fixtures, marble and glasses will be recovered for refurbishing and use in other projects • reducing the amount of construction waste generated over time • Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements • Purchase of perishable construction materials such as paints should be done incrementally to ensure reduced spoilage of unused materials • Use building materials that have minimal or no packaging to avoid the generation of excessive packaging waste • Dispose waste more responsibly by dumping at designated dumping	constructor and his workers	**Per bq**

	➢ Chocking water bodies	sites or landfills only; the use of a NEMA registered waste disposal company is encouraged.		
Dust emission from movement of transportation vehicles at the site and on the road,	• Air pollution • Causing breathing problems to the workers and the neighborhood • Blockage of fauna stomata	• Sprinkle water on graded access routes each day to reduce dust generation by construction vehicles • controlling the speed of vehicles on the site • watering open soil or storage sites • selecting transportation routes • provide worker with dust masks	Constructor and his workers	**50,000 pm**
Utilization of fossil fuel by fuel consuming machineries.	• Emission of carbon gas into the atmosphere leading to global warming • Exhaustion of fossil fuel resource • Air pollution • Can Lead to breathing problems	• Ensure proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done per vehicle or the number of vehicles on the road. • Sensitize truck drivers to avoid unnecessary racing of vehicle engines at adding/offloading points and parking areas, and to switch off or keep vehicle engines when not in use • Prompt servicing of vehicles engines • Use of unleaded and low sulphur fuel • Monitor energy use during construction and set target for reduction of energy use.	Contractor and Drivers	**per need**

Noise and vibration	Noise generation Hearing problem	• Sensitize construction drivers to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, schools, residential areas and hospitals • Sensitize construction vehicle drivers and machinery operators to switch of vehicle or machinery not being used. • Ensure that all heavy duty equipment are insulated or placed in enclosures to minimize ambient noise levels. • Measure to ensure that noise levels does not exceed 75dB(A) • Attenuation of any sound that may affect the inner ear by use of earplugs and earmuffs	Constructor and Workers	**Per need**
Water consumption	• Excessive use / misuse of water • Generation of excess waste water • Water pollution	• Prompt reuse and recycling of water as much as possible where necessary • Install a discharge meter at water outlet to monitor and determine total water usage. • Monitor water consumption and utilization; • Sensitize construction workers on the importance of proper water management; • All wastewater should be drained into approved drainage facilities.	Contractor and his workers	**Per BQ**
Approval of building plan	Positive : the building being in alignment with	Ensure that plans are approved by the county Government, Physical Planner and the local Occupational Health and Safety Office	The proponent	**Gazetted fee**

	the town/District Development Plan (DDP)			
Incident, accidents, and dangerous occurrences	To enable relevant authorities to monitor incidence occurrences and take necessary measure to minimize them.	Ensure that provisions for reporting incidents, accidents and dangerous occurrences during construction using prescribed forms obtainable from the local Occupational Health and Safety Office (OHSO) are in place.	Contractor and his workers	**Gazetted fee**
Safety, health and environment (SHE) policy	To give guidelines on how one is to protect himself within a given premises against any incident.	Develop, document and display prominently an appropriate SHE policy for construction works	Contractor	**150,000**
Personal protective gears	To protect against any infection or injuries while at work.	Suitable overalls, safety footwear, dust masks, gas masks, respirators, gloves, ear protection equipment etc should be made available and construction personnel must be trained on their use.	Contractor	**100,000**
Supply of clean water	Ensure good health as dirty/untreated water leads to water borne diseases.	Ensure that construction workers are provided with an adequate supply of wholesome drinking water which should be maintained at suitable and accessible points.	Contractor	**Per bq**

Storage of materials	Can cause accident, material wastage and spoilage, and reduced aesthetic value.	Ensure that materials are stored or stacked in such manner as to ensure their stability and prevent any fall or collapse	Contractor	**150,000**
First aid	To ensure that when any injury occur it can be taken care of before main treatment at a hospital or a dispensary.	• Well stocked first aid box which is easily available and Accessible should be provided within the premises • Provision must be made for persons to be trained in first aid, with a certificate issued by a recognized body.	Contractor	**100,000**
Safety and security	Destruction and stealing of materials on site.	• Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the construction site. • The Contractor should ensure strict safety management through close attention to design, work procedures, materials and equipment; • Develop a site safety action plan detailing safety equipment to be used, emergency procedures, restrictions on site, frequency and personnel responsible for safety inspections and controls; • All workmen should be provided with personal protective equipment (e.g. nose masks, ear muffs, helmets, overalls, industrial boots, etc); • There should be regular site reporting on health, safety and environment (HSE) issues by an appointed HSE representative, daily	Contractor	**100,000pm**

		site inspections should be done to ensure safe work practices are adhered to; • All injuries that occur on site must be recorded in the accident registers and corrective actions for their prevention be instigated as appropriate (Section 62 of the Factories and Other Places of Work Act); • Statistical records on accidents and incidents should be collated and analysed on a monthly basis and forwarded to the contractor and / or displayed on the notice boards; • Site personnel should be encouraged to report "near-miss incidents" in order to avoid potential problems and increase safety awareness.		
Fire Hazards	Destruction of property and lives	• Provide adequate number of appropriate firefighting equipment as well as fire exit options. • Ensure inspection and maintenance of fire equipment • A fire escape route and an emergency assembly point should be clearly indicated	Contractor and proponent	**200,000**
Construction traffic:	Disruption of local traffic; Potential for accidents.	• The Contractor should plan itineraries for site traffic. • Issue notices/advisories of pending traffic inconveniences and solicit tolerance by commuters before the commencement of construction works. • Assign traffic regulators to places during periods of chronic or	Contractor	**5,000**

		potential traffic congestions. • Prepare & provide appropriate signage & trained flag persons where the movement of heavy machinery and construction equipment may cross the main roads.		
Influx of construction workers into the area:	Proliferation of informal kiosks in the area; Increase in transport demand. Road side vending	• Develop a catering program on site for construction staff; • Provide transportation for the workforce to and from the site. • The contractor should identify, demarcate and fence a specific area within which specific number vendors will be allowed to operate. • The vendors should be instructed to maintain the area in a tidy fashion and litter bins should be provided with arrangements in place to have the contents of these emptied on a regular basis and disposed of appropriately.	Contractor	**Per need**
Energy utilization:	Energy consumption.	• Develop an energy management plan; • Construction machinery and vehicles should be maintained and used in accordance with manufacturer's specifications, to maximize efficiency and lower use of energy, e.g. drivers of construction vehicles should be instructed not to leave them idling for extended periods; • Construction workers should be sensitized on the importance of energy management.	Contractor	**150,000**

Ergonomic	Bad posture may lead to body structural disorder.	• 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	Contractor	**100,000**
OPERATIONAL PHASE				
Solid waste generation	Generation of general Solid wastes leading to pollution of water bodies, air impairment when decomposing hence odours, and reduction in aesthetic value of the compound.	• Provision of dirt bins/skips at strategic points of the compound • Disposal at the designated site, • Awareness creation among workers • Practice reuse and recycling methods as much as possible where applicable. • Display portraits like “Don’t Litter”, “Keep Environment Clean”	Proponent	**Waste collection as per rates**
	Bagasse, filter cake and boiler ash	• Clearly designate and construct an appropriate waste collection facility or provide covered refuse skips; • Maintain a proper waste tracking document • Bagasse is used as a source of fuel in the boilers. However, the bagasse holding shades appear not to be adequate to hold additional bagasse. A larger shade may be needed.		

		• Co-generation can be considered • Ensure adequate fire warning, response and management systems are installed. • Provide well-structured engineering solutions to leachate and surface runoff.		
Hazardous waste generation	Pollution of surface or ground water due to oil spillage	• Hazardous wastes, such as waste oils and grease to be collected in secure storage facilities on-site to prevent accidental release that may result in contaminated run-off and leaching. • storage areas for hazardous material to be cemented to provide an impervious surface and to prevent uncontrolled discharges to groundwater	Proponent	**Waste collection as per rates**
Air pollution	Unmonitored stack emissions	• Monitor stack emissions regularly • Ensure the emissions are within permissible limits • Install wet scrubbers • Use appropriate fuels in the boilers	Proponent	**100,000**
Accidents and injuries	machine safety (improper use and maintenance of machines)	• All plant, machinery and equipment should only be used for work which they are designed for and be operated by a competent person. • Insist on regular servicing of electrical fittings and appliances by qualified personnel. • Every machine intended to be driven by mechanical or any other type of power should be provided with an efficient starting and stopping	Proponent	-

		appliance, the control of which should be in such a position as to be readily and conveniently operated by the person operating the machine		
Occupational health and Safety	Accidents and injuries	• The premise must be kept clean, daily removal of accumulated dust from floors, free from effluvia arising from any drain, sanitary convenience or nuisance • The premise must not be overcrowded, there must be in each room 10 metres of space for each employee, not counting space 14 feet from the floor and a 9 feet floor-roof height. • The circulation of fresh air must secure adequate ventilation of workrooms. • There must be sufficient and suitable lighting in every part of the premise in which persons are working or passing. • There should also be sufficient and suitable sanitary conveniences separate for each sex, • Management should ensure provision of suitable protective clothing and appliances including where necessary, suitable gloves, footwear, goggles, gas masks, and head covering, and maintained for the use of workers in any process involving expose to wet or to any injurious or offensive substances	Proponent	**100,000**

		• Management should ensure training and supervision of inexperienced workers • An adequate supply of both quantity and quality of • Wholesome drinking water must be provided. • Maintenance of suitable washing facilities, accommodation for clothing not worn during working hours must be provided. • Provision of well-equipped First Aid kits and /or ready transport facilities to hospital.		
Use of sanitary room (toilets and urinal)	Generation of sewage (liquid waste), • Water pollution, • Air pollution (odour) • Reduced aesthetic value	• Incorporate grease traps • Conduct regular inspections for sewerage pipe blockages or damages and fix appropriately • Ensure regular monitoring of the sewage discharged • Reuse, recycle waste water where necessary • Ensure adequate water supply for flushing and to ensure the waste is carried to the sewerage system without causing blockage. • Ensure flashing toilet after use though Avoid unnecessary flushing • Apply for effluent discharge license	Proponent NEMA	**150,000**
Water Consumption	• Overutilization of water	• Monitor water consumption • Apply for water abstraction permits from WRA • Install internal water meters.	Proponent/Contractor WRA	**As per BQ**

		• Incorporate rainwater harvesting measures. • Installing plumbing fittings, appliances and devices to optimize water use efficiency; • Recycling of wastewater to reduce water consumption.		
Waste management	• Drain blockages	• The proponent should ensure that there is adequate means of handling large quantities of sewage blockages as well as related emergency situations. • Proper monitoring at waste generation points should be established.	Proponent/ Contractor	**As per BQ**
use of energy	• Overutilization of hydropower • Overloading hydropower grid	• Switch off electrical equipment, appliances and lights when not being used • Install energy saving fluorescent tubes at all lighting points within the facility instead of bulbs which consume higher electric energy • Sensitize occupants of the facility to use energy efficiently • Use of alternative sources of energy like solar for lighting • Plant trees within the compound and along the fence.	Proponent	-
Electricity use	Explosions/Fire outbreaks causing injuries and destruction of properties	• Regular maintenance of fire extinguishers • Proper electric connections. • Circuit must not be overloaded • Distribution boards switches must be clearly marked to indicate respective circuits • No live exposure connection	Proponent /Contractor	**As per BQ and need**

		• Electrical fittings near all potential sources of ignition should be flame proof		
Ventilation	Suffocation and lack of clean air may lead to discomfort of the occupants of the building.	• Enough space must be provided within the premises to allow for adequate natural ventilation through circulation of fresh air	Proponent Contractor	**As per BQ**
Vector/rodents breeding grounds	Diseases and infections	• Ensure that there is no space for unplanned stagnant water retained in the fields. • Recommended measures should be applied when dealing with rodents and food storage. • A monitoring programme should be put in place for controlling relative cases observed.	Proponent	**As per need**
Lighting	Lack of enough light in the room may lead to eye straining hence eye problems	There must be adequate provision for artificial and natural lighting in the building.	Proponent	**As per BQ**
DECOMMISSIONING PHASE				
Demolition activity	• Lead to accident from falling, and flying objects.	• Develop a decommissioning EIA	Proponent and the contractor	Develop BQ and

	• Generation of construction waste • Reduced aesthetic value of that place • Destruction of soil structure • Lead to soil erosion hence water pollution			project budget

CHAPTER EIGHT: CONCLUSIONS

This Project Report has been prepared to provide sufficient and relevant information on the proposed project to enable NEMA to establish whether activities of the project are likely to have significant adverse environmental impacts. Mitigation measures have been proposed for identified impacts in this report and an Environmental Management Plan (EMP) for the implementation of the proposed measures has been presented. The EMP presented in this report is a tool to be used by the Project Team during the construction, hand-over and operation periods.

To ensure implementation, mitigation measures should be reflected in the Conditions of Contract and Bills of Quantities. It is the responsibility of the Proponent to ensure these measures are incorporated into these two documents.

It is recommended that the available waste management systems must be monitored to ensure that they adequately handled.

In this respect the project can proceed on condition that the concerns are addressed the proposed mitigation measures are implemented and an ESIA license issued with the above conditions taken fully into account amongst any others.

References

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3. Agriculture, Fisheries and Food Authority Act, 2013

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7. Regulations, 2006. Government Printer, Nairobi. Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. Government Printer, Nairobi

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9. Kenya Gazette Supplement Acts Public Health Act (Cap. 242). Government Printer, Nairobi.

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11. Kenya Gazette Supplement Acts. Environmental Management and Coordination (Water Quality) Regulations, 2006. Government Printer, Nairobi.

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13. Kenya Gazette Supplement Number 69. Environmental Management and Coordination (Waste Management) Regulations, 2006. Government Printer, Nairobi.

14. Kenya Gazette Supplement Number 74. Environmental Management and Coordination (Fossil Fuel Emissions Control) Regulations, 2006. Government Printer, Nairobi.

15. Occupational Safety and Health Act, 2007

16. Sessional Paper No. 1 of 1999. Government Printer, Nairobi.

17. County Integrated Development Plan For Narok County, 2018 -2023

Annexure

1. Proof of land ownership
2. Certificate of registration
3. KRA Pin
4. Water/Air/Soil quality analysis results
5. Proof of Public Participation
6. Proposed plans/designs
7. Summary of bill of quantities