

# REPUBLIC OF KENYA



## CENTRAL RIFT VALLEY WATER WORKS DEVELOPMENT AGENCY

**CONSULTANCY SERVICES FOR PREPARATION OF TENDER DOCUMENTS FOR DESIGN & BUILD WORKS AND SUPERVISION OF NANDI HILLS, KILGORIS AND LOLGORIAN WATER SUPPLY AND SANITATION PROJECTS**

**NANDI HILLS WATER SUPPLY AND SANITATION PROJECT**

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT**

**STUDY REPORT**

**JUNE 2020**

**CLIENT**

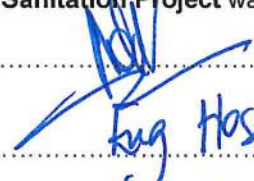
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I hereby certify that the particulars given in this report are correct and true to the best of my knowledge.

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# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

## STUDY REPORT

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## ACRONYMS

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ADD	Average Daily Demand
AfDB	African Development Bank
BOD	Biological Oxygen Demand
BoQ	Bill of Quantities
CBO's	Community Based Organizations
CFU	Composite Filtration Unit
COD	Chemical Oxygen Demand
CRVWDA	Central Rift Valley Water Works Development Agency
DI	Ductile Iron
DN	Nominal Diameter
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Co-ordination Act
ESIA	Environmental & Social Impact Assessment
ESMP	Environmental & Social Management Plan
GHG	Green House Gases
GI	Galvanized Iron
GoK	Government of Kenya
HDPE	High Density Poly Ethylene
HIV/AIDS	Human Immuno-Deficiency Virus
hr	hour
KES	Kenya Shillings
KFS	Kenya Forest Service
km	kilometre
KNBS	Kenya National Bureau of Standards
lcpd	Litres per capita daily
LVB	Lake Victoria Basin
m <sup>2</sup>	Square metre
m <sup>3</sup>	cubic metre
MDGs	Millennium Development Goals
mg/l	milligrams/litre
mm	Millimetre
MWI	Ministry of Water and Irrigation
NEMA	National Environmental Management Authority
OD	Outside Diameter
OS	Operational Safeguards
OSHA	Occupational Safety and Health Act
PAP	Project Affected Persons
PE	Polyethylene
RC	Reinforced Concrete
SS	Suspended Solids
TS	Total Solids
uPVC	Unplasticised Poly Vinyl Chloride
WATSAN	Water and Sanitation
WIBA	Work Injury Benefits Act
WRA	Water Resources Authority
WTP	Water Treatment Plant

# EXECUTIVE SUMMARY

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## PROJECT BACKGROUND

The Government of Kenya (GoK) has received financing from the African Development Bank (AfDB) under the Kenya Sustainable Water Supply and Sanitation Programme for augmentation of water supply facilities in the three towns of Nandi Hills, Kilgoris and Lolgorian. Under the above Programme, Central Rift Valley Water Works Development Agency (CRVWDA) (formerly Rift Valley Water Services Board) on behalf of Lake Victoria South Water Works Development Agency (LVSWWDA) (formerly Lake Victoria South Water Services Board) commissioned GIBB Africa Ltd in September 2017 to carry out **Consultancy Services for Preparation of Tender Documents for Design and Build Works and Supervision of Nandi Hills, Kilgoris and Lolgorian Water Supply and Sanitation Projects**. The consultancy services have been broken down into two phases as follows:

Phase 1: Preparation of conceptual design and design and build tender documents; and  
Phase 2: Review of designs to be prepared by the design and build contractor and supervision of the Works.

As part of Phase 1 services, the Consultant was to carry out supplementary studies and update the existing Environmental and Social Impact Assessment (ESIA) and Resettlement Action Plan (RAP) study reports to take into account proposed changes in the project and support the Client to obtain renewed environmental licence for the project as appropriate. This ESIA Report covers the proposed Nandi Hills Water Supply and Sanitation project. The project does not have an ESIA license from the original study conducted in 2016 by CAS Consultants Ltd; hence this report will constitute the first submission to the National Environment Management Authority (NEMA) for licensing.

This report covers the proposed rehabilitation and expansion of the existing Taito water supply system; the proposed new intake along Mokong River; the new treatment system that will be developed on land belonging to Kenya Forest Service (KFS); raw and treated water rising mains, water storage reservoirs as well as the associated distribution infrastructure. The assessment is based on the final detailed design.

## PROJECT DESCRIPTION AND JUSTIFICATION

The project's objectives are to deliver a supply of potable water complying with the World Health Organization's 2006 Guidelines for Drinking Water Quality and Kenya Drinking Water Quality Standards KS-1996.

The current intake for Nandi Hills is at Taito stream. From the current operating scenario at the water source and treatment Plant, 480m<sup>3</sup>/day is yielded. This is insufficient to meet the current water demand within Nandi Hills township of about 1,600m<sup>3</sup>/day. In addition, the water only undergoes full treatment during rainy seasons. In dry seasons, the water is only disinfected by chlorination at the treated water pump sump. There is therefore an urgent need to rehabilitate and expand the treatment facilities and the pumping system to increase the throughput and also ensure that water undergoes full treatment all the time regardless of the season.

To alleviate the water shortage in the town and its environs, consideration has been made for initial, future and ultimate planning period needs. The current project is based on a projected population of up to the year 2040. The following water sources have been considered:

- Taito Stream for initial and short term (Rehabilitation of the existing infrastructures);
- Mokong River for future demand.

The GPS locations of the facilities to be augmented as well new construction are shown in the table below;

Point and status	X-Coordinates	Y-Coordinates
Mokong Intake ( <i>new construction</i> )	740,846.89	15,756.39
Mokong Treatment Plant ( <i>new construction</i> )	740,445.28	15,454.26
Taito Intake ( <i>to be rehabilitated</i> )	743,203.59	12,455.58
Taito Treatment Plant ( <i>to be rehabilitated</i> )	743,157.07	12,406.04

The proposed intervention is to abstract from Taito Stream a maximum of 528 m<sup>3</sup>/day of raw water for full water treatment works throughput of 480 m<sup>3</sup>/day, assuming 10% loss through the Treatment Plant and other station uses. Studies show that 2,530 m<sup>3</sup>/day of water can sustainably be abstracted from Mokong River up to the year 2040 under different climatic conditions.

The proposed rehabilitation works at Taito water supply system including:

- Desilting and construction of silt traps upstream of the impoundment and protect against the erosion up stream of Taito on the main road to Kapsabet-Nandi Hills town;
- Laying of a new steel DN 100 raw water main pipe of length 25m from the intake chamber to the existing 25 m<sup>3</sup> sump;
- Installation of 3 no. submersible pumps in an existing 25m<sup>3</sup> masonry sump. The provisional capacity of each pump is 26.4 m<sup>3</sup>/hr against a head of 4.1m. The pumps are capable of handling solid particles. The pumps shall operate on shifts bases each working for 8 hours to deliver water to the Composite Filtration unit;
- Laying of a new steel DN 100 raw water main pipe of length 135m from the Sump to CFU and from CFU to Clear Water Tank;
- The proposal is to rehabilitate and upgrade the existing Taito Water Treatment Plant with a throughput of 480 m<sup>3</sup>/day comprising of a Composite Filtration Unit (CFU) with a capacity of 25 m<sup>3</sup>/hr., 50 m<sup>3</sup> clear water tank, 25 m<sup>3</sup> backwash tank and associated pipework and chemical mixing shed and dosing system;
- Construction of a new clear water pump station with 60 KVA standby generator room to be located near the Clear water tank (50 m<sup>3</sup>) including all associated works; and
- Installation of 2no. centrifugal pumps to meet the production capacity while operating as one duty and one standby. The pumps will be sized to deliver water to the existing tanks (50 m<sup>3</sup> for Nandi Bears Club and the 135 m<sup>3</sup> and 50 m<sup>3</sup>) located side-by-side along Kabikweni Road. The provisional capacity of each pump is 24m<sup>3</sup>/hr against a head of 140m.

Proposed New Works include:

- New water intake weir (15m long and 2.5m high) on Mokong river;
- Raw Water gravity main from the intake to the proposed Mokong treatment plant designed to convey a flow of 2530 m<sup>3</sup>/hr considering 20 hours operation and made of HDPE pipe;
- New water treatment plant for Mokong River (2300m<sup>3</sup>/day) with the following the following components;
  - ✓ 2 No inlets
  - ✓ 2 No Flocculation basins
  - ✓ 2 No Sedimentation basins
  - ✓ 2 No mono media rapid sand filter units
  - ✓ 2 No Sludge treatment lagoons
  - ✓ 1 No 75m<sup>3</sup> elevated pressed steel tank for backwash water.
  - ✓ 1 No 200m<sup>3</sup> masonry clear water tank.
- Two pumps, one to be a duty pump and one to be standby, each with a capacity of 115m<sup>3</sup>/hr against 225 m head. The pumps are sized to deliver water to a proposed 1,000m<sup>3</sup> RC tank at Kosojoywo Secondary school;
- Rising mains designed to transmit water from the proposed Mokong WTP to the

proposed high-level tank at Kosoiywo Secondary school at a distance of 1750m and altitude of 2130 masl;

- Gravity transmission main designed to transmit water from the proposed 1000m<sup>3</sup> reinforced concrete tank at Kosoiywo Secondary school to 500m<sup>3</sup> masonry tank next to existing 135m<sup>3</sup> and 50m<sup>3</sup> on Kiboweni Road. OD 315 HDPE pipe of length 4,400m;
- A new booster pump station with 10 kVA standby generator room to be located at the 500 m<sup>3</sup> reinforced concrete water storage tank, as its sump, for boosting water to the 200 m<sup>3</sup> reinforced concrete water storage ground tank at Ketbarak;
- 2 No. centrifugal pumps to meet the production capacity while operating as one duty and one standby. The provisional capacity of each pump is 8m<sup>3</sup>/hr against a head of 70m;
- Laying of DN 50 PN 16, cement lined steel clear water main pipe of length 770m from proposed 500m<sup>3</sup> RC tank next to the existing 135m<sup>3</sup> and 50m<sup>3</sup> located next to Nandi Bears Club to a proposed 200m<sup>3</sup> RC tank at Ketbarak at a distance of 1265m and altitude of 2139masl;
- Storage tanks including:
  - ✓ 1000m<sup>3</sup> reinforced concrete tank at Kosoiywo Secondary School;
  - ✓ 500m<sup>3</sup> reinforced concrete tank next to existing 135 m<sup>3</sup> and 50 m<sup>3</sup> near Nandi Bears Club; and
  - ✓ 200m<sup>3</sup> masonry tank at Ketbarak.
- Distribution system consisting of the following:

Pipe Diameter(mm)	Pipe Length(m)	Pipe Material
DN 150 (OD 180)	6,790	HDPE
DN 125 (OD 140)	7,610	HDPE
DN 110 (OD 125)	7,880	HDPE

- The Consultant has proposed for the design and construction of four (4) No. water kiosks which will include water connection;
- In addition, construction of 3 No. ablation blocks at various locations within the Nandi hills town is proposed.

The above are to be implemented over a period of 24 months with a defects' notification period of 12 months, and will cost approximately KES. 666,175,493.00 exclusive of duties and taxes.

## STUDY BASIS AND APPROACH

Environmental management in Kenya is guided by the Environmental Management and Coordination Act (EMCA), 1999, its Amendments of 2015 and associated regulations. This study has also made relevant references to the African Development Bank's Integrated Safeguards System (ISS) and other international environmental treaties to which Kenya is signatory. According to the revised Second Schedule of the Environmental and Coordination Management (Amended) Act, 2015, this project has been categorised under the Medium-Risk category (*Section (3) (b) and (c) water resources and infrastructure*). It is therefore a requirement as per the Environmental (Impact Assessment and Audit) (amendment) regulations 2019 that such projects undergo an ESIA Study culminating in a Project Report for submission to and approval by NEMA.

In order to meet the study objectives, the study team carried out desktop studies, site investigations and, public consultations relevant to project. Key reference documents included ESIA studies conducted alongside the feasibility design stage in 2016 and the updated project designs. This assessment is based on the final detailed design completed in 2019.

## BASELINE ENVIRONMENTAL CONDITIONS

The climate is determined by the equatorial low-pressure belt known as the Inter Tropical Convergence Zone (ITCZ) and it is situated between two pressure belts produced in the north and south hemispheres. Nandi Hills experiences a bi-modal type of rainfall pattern with

average annual rainfall of between 1482mm. Long rains occur between March and August with the highest rainfall being recorded in April and July. The short rains fall between September and November. The dry season occurs from January to March.

Nandi Hills experiences a cool and wet climate for the greater part of the year with mean temperatures of 18.3 degrees Celsius. The highest temperature is 25 degrees Celsius in February while the lowest is 10 degrees Celsius in August.

Water sampling and analysis of the Taito and Mokong rivers showed to a large extent that the water sources are within the NEMA, KEBS, and WHO limits of water quality for domestic use. However, Mokong River gave presence of *E. coli* (4/100ml), a bacteria which in some forms can release toxins that cause abdominal pains, diarrhoea and fever in humans if consumed through contaminated food or fouled water. Therefore, disinfection of the Mokong river water at the proposed water treatment plant kill the pathogen before the water is distributed to the users is necessary.

According to the Nandi Hills County Integrated Development Plan (2018-2022), the population for Nandi Hills urban area was projected as 8,929 in the year 2017, representing about 3.9% of the total population, implying that majority of the population reside in the rural areas. Nandi Hills has been growing at an average rate of 3.80% p.a. from 1979 to 2009. As per 2019 Census, Nandi Hills in Nandi East Sub-County recorded a total population of 119,173 people with 29,253 households. The population density is low with most people being concentrated in the developed area (old town), *Mchanganyiko* area, and areas of Chebarus immediately bordering the old town. There are pockets on the tea estates.

Nandi Hills division where the study area is located had a population of 6,907 people with 2,228 households as per the 2019 national population and housing census. The project area covers four (4) sub-locations of Nandi Hills, Kapng'etuny, Tururo and Kipsamoo.

## **STAKEHOLDERS CONSULTATIONS AND FEEDBACK**

Initial stakeholders' consultation in the project area was conducted in 2016 by CAS Consultants Ltd. based on preliminary design. Additional consultations have been undertaken during the current design review and update studies and the key issues of interest included the following:

- The project is highly welcome due to current potable water shortage and rationing in the area;
- Need to incorporate management of riparian reserve by discouraging planting of eucalyptus trees;
- Employment opportunities for locals;
- Need for more community water distribution points including areas along the transmission line;
- Compensations of any affected land. For pipe laying routes the community is willing to provide way, they didn't see this as an issue to block them from accessing clean water; and
- Need to continuously sensitize stakeholders on the project progress.

## **PROJECT IMPACTS**

The project will involve rehabilitation of the existing Taito water treatment plant infrastructure and construction of a new water treatment plant for the new proposed abstraction point at Mokong River. The new proposed abstraction from Mokong River is a good supplementary option since, based on hydrological analysis, the water that can be abstracted from Taito Stream cannot sustainably yield the desired volume to meet the projected demand. This will lead to increase of the volume of water to be supplied to the town as well the proposed additional distribution channels.

The positive impacts identified in the project implementation are

- Solving the persistent water shortage challenge and non-availability of safe drinking water in Nandi Hills town and its environs;
- Creation of employment and other economic opportunities in the project area;
- Improved public health;
- Improved access to water; and
- Women empowerment through reduced time spent looking for water.

For the environmental impacts identified, adequate mitigation measures have been proposed in order to alleviate the expected negative impacts and to make the project environmentally and socially acceptable. An ESMP has been prepared, and it includes: the mitigation plan; the monitoring and enforcement requirements; and the responsible persons/organizations.

A summary ESMP of the water project is as presented in the table below:

Environmental and social impact	Mitigation measures	Cost (KES)
<b>Construction Phase</b>		
Loss of productive land and assets	<ul style="list-style-type: none"> <li>• An Abbreviated RAP study shall be undertaken prior to commencement of the project in order to compensate the project affected persons.</li> </ul>	Cost Abbreviated RAP implementation
Soil erosion and disposal of excavated soil	<ul style="list-style-type: none"> <li>• In perusing the zero-waste policy, excavated soil will be used in the proposed project sites for development of impounding structures, re-spreading in areas to be landscaped to enhance aesthetics along the wayleave area and the development of access roads; and</li> <li>• Works program should be in line with Nandi Hills weather pattern so as to avoid such works during rainy seasons;</li> </ul>	No additional costs to the BoQ
Soil and river water contamination	<ul style="list-style-type: none"> <li>• Plan emergency response measures in case of accidental spills of hydrocarbons, cement and any foreign materials;</li> <li>• Maintenance of construction equipment to be done on designated purpose-built surfaces;</li> <li>• Placing of sand bags along drainage channels and the river bank to prevent siltation of the river;</li> <li>• Any on site/camp storage areas for fuels, oils or other liquid chemicals would be sited away from surface water drains, and on impermeable base.</li> </ul>	<p><b>42,000</b> <i>(for 1.2m high sand bags along 200m of the Mokong River bank)</i></p> <p>Mitigation measures to be included in contractor's contract document</p>
Loss of flora and habitat for avifauna	<ul style="list-style-type: none"> <li>• Construction zone limits should be identified and physically marked, to avoid or minimize unnecessary damage of existing vegetation</li> <li>• Where clearance of vegetation is unavoidable, incorporate landscaping with local tree species and plants approved by KFS.</li> </ul>	<p><b>21,000</b> <i>(Landscaping at 15,900/- per ha for ~ 1.3 ha to be cleared of vegetation)</i></p>
Noise and vibrations pollution	<ul style="list-style-type: none"> <li>• Noise levels at the construction site boundary should be kept within acceptable limits of 60 dB(A) during the day and 35 dB(A) during the night as stipulated in the EMCA (Noise &amp; Excessive Vibration Pollution) (Control) Regulations, 2009;</li> <li>• Workers to use ear plugs for noisy operations;</li> <li>• Regular maintenance of equipment; and</li> <li>• Noisy operation to be scheduled outside school learning hours.</li> </ul>	<p><b>50,000</b> <i>(Ear muffs for approx. 50 workers)</i></p> <p>Mitigation guidelines to be included in the contractor's contract document</p>
Air pollution by dust and greenhouse gases	<ul style="list-style-type: none"> <li>• Stabilize unpaved access roads, parking areas and staging areas at construction sites by soil compacting, and regular sprinkling of water to reduce on dust;</li> <li>• Minimizing number of motorised vehicles in use and number of trips through a traffic management plan;</li> </ul>	<p><b>3,000</b> per day <i>(for sprinkling water from a 5,000 L water bowser to reduce dust)</i></p>

	<ul style="list-style-type: none"> <li>Construction vehicles should adhere to speed limits within construction roads to prevent raising dust.</li> </ul>	
Spread of HIV / AIDS and STI related diseases	<ul style="list-style-type: none"> <li>Awareness campaigns on HIV/AIDS and STIs;</li> <li>Provision of condoms to the workforce; and</li> <li>As much as possible, unskilled labour to be recruited from the project area.</li> </ul>	No additional cost (4,000,000 as per BoQ, Bill No. 1)
Waste disposal	<ul style="list-style-type: none"> <li>Contractor to put in place well labelled solid waste segregation bins and ensure final disposal of the waste stream at designated dump sites</li> <li>Provision of appropriate sanitation facilities for use by workers.</li> <li>Sale of waste such as cartons and cement bags to waste paper recyclers.</li> </ul>	<b>130,000</b> (5 garbage bins of 1100 L capacity) <b>600,000</b> (10 High Density Polyethelene portable toilets @ 60,000) + 20,000 p.m. for exhauster services
Occupational and public health and safety	<ul style="list-style-type: none"> <li>Contractor to implement requirements of Occupational Safety and Health Act 2007 including provision of personal protective equipment (PPE), and carrying out frequent toolbox talks and safety trainings for workers.</li> </ul>	<b>1,824,000</b>
Security	<ul style="list-style-type: none"> <li>The project site should be enclosed using suitable walls with 24-hour security guards to beef-up security and to control movement in and out of the site.</li> </ul>	No additional cost (captured in BoQ)
Shortage in water supply due to construction works	<ul style="list-style-type: none"> <li>Provision of an alternative access to portable water for the community during construction of the pipeline and treatment plant; and</li> <li>Awareness should be carried out early in advance to inform the people on the major rehabilitation or decommissioning period and its anticipated impacts.</li> </ul>	-
Employment	<ul style="list-style-type: none"> <li>The contractor should as much as possible hire the local unskilled labour</li> <li>At end of construction phase, the contractor should notify the employees in advance on the project closure date and adequately compensate them;</li> <li>Dismissal procedures to be compliant with Employment Act, 2007;</li> </ul>	Mitigation guidelines to be included in the contractor's contract document
Noise and air pollution from decommissioning of the contractor's camp	<ul style="list-style-type: none"> <li>Schedule noisy activities during the day time period;</li> <li>Use silencers on machines where possible;</li> <li>Maintenance of machinery so as to reduce noise;</li> <li>Practice dust management techniques, including watering down during drier period;</li> <li>Set up dust barriers/ screens at strategic locations;</li> <li>Provide and enforce the appropriate use of PPE against dust.</li> <li>Further follow ups should be done.</li> </ul>	As a per decommissioning plan to be independently prepared by the contractor and agreed by the client and supervising consultant
<b>Operation Phase</b>		
Contamination of water source	<ul style="list-style-type: none"> <li>Continuous monitoring of water treatment effluent to ensure adherence to the EMCA (Water Quality) Regulations, 2006 and EMCA (Waste Management) Regulations, 2006;</li> <li>Notification of downstream community in case of unprecedented overflow of wastes from water treatment sludge lagoons. A communication protocol should be developed for this.</li> </ul>	<ul style="list-style-type: none"> <li><b>800,000</b> per year (for quarterly water sampling and analysis of the source river water)</li> </ul>
Noise pollution	<ul style="list-style-type: none"> <li>Suitable mounting is done at the installation stage incorporating noise and vibration abatement; and</li> <li>Generators to be equipped with standard noise attenuation features including silencers or lagging materials or specially designed acoustic enclosures;</li> </ul>	No additional cost
Occupational safety and health risks	<ul style="list-style-type: none"> <li>Provision of appropriate personal protective equipment (PPEs) for the operation &amp; maintenance</li> </ul>	<b>144,000</b> yearly (supposing 7 staff

from. exposure to chemicals and electricity hazards	<p>staff including safety glasses, hard hats, safety shoes, insulating (rubber) gloves with leather protectors, insulating sleeves, and flame-resistant clothing.</p> <ul style="list-style-type: none"> <li>• Scheduled staff training on handling of hazardous chemicals, tool box talks, and general health and safety training as per Occupational Safety &amp; Health Act, 2007</li> </ul>	<i>i.e. operations, maintenance, supervision, clerical, laboratory, yard work)</i>
Air pollution from operation of generators	<ul style="list-style-type: none"> <li>• Regular inspection and maintenance of installed generators according to manufacturer's specifications.</li> <li>• Regular servicing of generators</li> </ul>	No additional cost

All the recommendations/ mitigations mentioned in the study should be financed and incorporated in the construction and supervision contracts as applicable. Strict controls and supervision of the contractor will ensure compliance with required mitigation measures.

The monitoring plan for the implementation of the ESMP revolves around three fronts, namely:

- Physical environment
  - Noise and air quality of the project sites;
  - Surface water quality at intakes and receiving waters;
  - Solid and liquid waste management;
- Biological environment
  - Rehabilitation of work sites (landscaping);
- Social-economic environment
  - Implementation of the abbreviated Resettlement Action Plan;
  - Occupational and community health and safety; and
  - Efficiency at water treatment works once operational.

The proponents, CRVWDA and LVSWDA are staffed by environmental experts who will oversee the mainstreaming environmental and social sustainability of the project, supervising ESMP implementation by the contractor and responsible for monitoring during project's operation. For closer supervision of the construction ESMP, the supervision consultant shall also be required to have an environmentalist to oversee ESMP implementation by the contractor and periodically report to the CRVWDA.

In addition, other institutions responsible for monitoring the ESMP implementation will include the National Environment Authority (NEMA), Nandi County Government, Water Resources Authority (WRA) and Kenya Forest Service (KFS), and any other stakeholder groups.

## CONCLUSION AND RECOMMENDATIONS

Access to water still remains a challenge to the area residents as well as the residents from other surrounding locations where the water distribution network did not reach. The area residents who are within the project zone of impact yet are not beneficiaries requested for additional distribution networks. In response to community requests, provision of water abstraction points for the community is proposed. The final location for these community water points will be decided upon by the contractor in consultation with the community members during detailed design stage.

The development of the proposed water supply project for Nandi Hills town and its environs is necessary as its implementation will significantly improve access to clean water by the beneficiaries. This will lead to overall improved level of sanitation and health as a result of reduced occurrence of water and sanitation related diseases. All the identified impacts can readily be mitigated through implementation of the proposed ESMP. It is therefore recommended that:

- The augmentation of the existing water supply for Nandi Hills project be granted a NEMA construction licence to commence;
- While the current conceptual design of pipeline alignment has optimised use of public road reserves as feasible, in case private land or property is affected during detailed



design and construction of the rising mains, an Abbreviated Resettlement Action Plan is recommended to ensure that any project affected person is compensated for the associated loss;

- A monitoring programme should be adhered to during construction and operation phases.

The following is further recommended:

- Apply standard best practice site sediment control procedures to minimise sediment in site drainage waters returning to the river;
- Conduct quarterly monitoring of the water quality of effluent from WTP site to confirm compliance with water quality regulations;
- There should be a multidisciplinary approach to addressing the re-forestation and phasing out the planting of blue gum trees along the river banks. This should be a joint effort between KFS, WRA, NEMA, Nandi County government and the Community through the WRUAs registered with WRA; and
- Engage the public in awareness campaigns for the protection and conservation of the catchment and riparian areas.

# 1 INTRODUCTION

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## 1.1 Background

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The Government of Kenya (GoK) has received financing from the African Development Bank (AfDB) under the Kenya Sustainable Water Supply and Sanitation Programme for augmentation of water facilities in the three towns of Nandi Hills, Kilgoris and Lolgorian.

Under the above Programme, Central Rift Valley Water Works Development Agency (CRVWDA) (formerly Rift Valley Water Services Board) on behalf of Lake Victoria South Water Works Development Agency (LVSWWDA) (formerly Lake Victoria South Water Services Board) commissioned GIBB Africa Ltd in September 2017 to carry out **Consultancy Services for Preparation of Tender Documents for Design and Build Works and Supervision of Nandi Hills, Kilgoris and Lolgorian Water Supply and Sanitation Projects.**

The consultancy services have been broken down into two phases as follows:

- Phase 1: Preparation of conceptual design and design and build tender documents;
- Phase 2: Review of designs to be prepared by the design and build contractor and supervision of the Works.

The above tasks will be achieved through carrying out the following activities:

- Collection of updated demographic data, existing study reports, designs and future development plans by the relevant authorities, and carry out assessment of the adequacy of existing study reports to identify any areas for improvement. In addition, assess water supply infrastructure, in consultation with relevant stakeholders, to capture any operational peculiarities and physical infrastructure deficiencies prior to proposing improvements and augmentation measures;
- Based on the review of the previous documents and designs for the towns of Nandi Hills, Kilgoris and Lolgorian and the Consultants own conceptual designs, define performance specifications for the proposed Works in each project town;
- On the basis of the performance specifications, prepare conceptual designs of the proposed water supply facilities together with the construction cost estimates;
- Carry out supplementary studies and update the existing ESIA and RAP reports to take into account proposed changes in the project and support the Client to obtain renewed environmental licence for the project as appropriate;
- Preparation of tender documents for the recruitment of the contractor who will execute the work based on the FIDIC Yellow Book (Conditions of Contract for Plant and Design-Build) and assist the Client in the Contractor selection process, including evaluation of received tenders and contract negotiation;
- Review survey and engineering designs carried out by the Contractor for acceptance before construction; and
- Supervision of construction of the Works in the three towns to be carried out by the contractors, including implementation of ESMP, contract management, review and validation of the Contractor's payment requests and provision of services during the Defects Notification Period.

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## 1.2 Project Objectives

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The service objectives are to deliver a supply of potable water complying with the World Health Organization's 2006 Guidelines for Drinking Water Quality and Kenya Drinking Water Quality Standards KS-1996 as follows:

- Water supply 24 hours per day, seven days per week;
  - Water supply at a minimum pressure of 15m in all areas;
  - Water supply at a minimum pressure of 10m and a maximum of 25m at communal water points; and
  - Water treatment to meet WHO guidelines.
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### 1.3 Scope of this Report

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GIBB was tasked to review and update ESIA report for the project as stated in Section 1.1 of this report. Following review of the ESIA report, the following key findings were made:

- The new intake along Mokong River will feed into a new treatment system that will be developed on land belonging to Kenya Forestry Services; and
- The Raw Water Rising main and the treated water rising main will also pass through new alignments hence need for an ESIA study update for the same.

Considering the above, the existing ESIA report has been updated to incorporate the new project components. According to the revised Second Schedule of the Environmental and Coordination Management (Amended) Act, 2015, this project has been categorised under the high-risk category. It is therefore a requirement by NEMA that such projects undergo an ESIA Study culminating in a Study Report as per the Environmental (Impact Assessment and Audit) (Amendment) regulations 2019.

This report covers the proposed rehabilitation and expansion of the existing Taito water supply system; the proposed new intake along Mokong River; the new treatment system that will be developed on land belonging to Kenya Forestry Services; raw and treated water rising mains, Water storage reservoirs as well as the associated distribution infrastructure. The assessment is based on the final detailed design (2019), which is an updated from the assessment that was done using the conceptual design.

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### 1.4 Project Location

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The project location of Nandi Hills town and its environs is found in the administrative boundary of Nandi Hills Division, Nandi Hills Sub County, Nandi County and covers an area of about 5km<sup>2</sup>. It is approximately 17km South of Kapsabet Town and approximately 64km South West of Eldoret Town. It is traversed by the main highway from Eldoret to Kisumu and Kisii via Chemilil that bypasses Kapsabet Town at Namgoi. Nandi County is a major tea growing area being mainly dominated by the Nandi Tea Estates, a company that has operated in the area for well over one century, and small and medium scale tea holders owned by local farmers. Historically, it developed as a service centre for the tea growing population for the larger Nandi Hills area and the tea estates.

Nandi County is located in the North Rift region of Kenya and covers an area of about 2,884.4km<sup>2</sup>. It borders Kakamega County to the west, Uasin Gishu County to the north east, Kericho County to the south east, Kisumu County to the south and Vihiga County to the south west.

Geographically, the unique jug-shaped structure of Nandi County is bound by the Equator to the south and extends northwards to latitude 0034"N. The Western boundary extends to Longitude 34045"E, while the Eastern boundary reaches Longitude 35025"E. The geographic coordinates of Nandi Hills, Kenya are: 0°06'01.0"N, 35°10'35.0"E Nandi Hills lies on an elevation of approximately 2,047 metres above sea level.

The location of the project area is presented in Figures 1-1 below and the location of Nandi

County in Kenya is presented in Figure 1-2.

Figure 1-1: Location of Nandi Hills in Nandi County

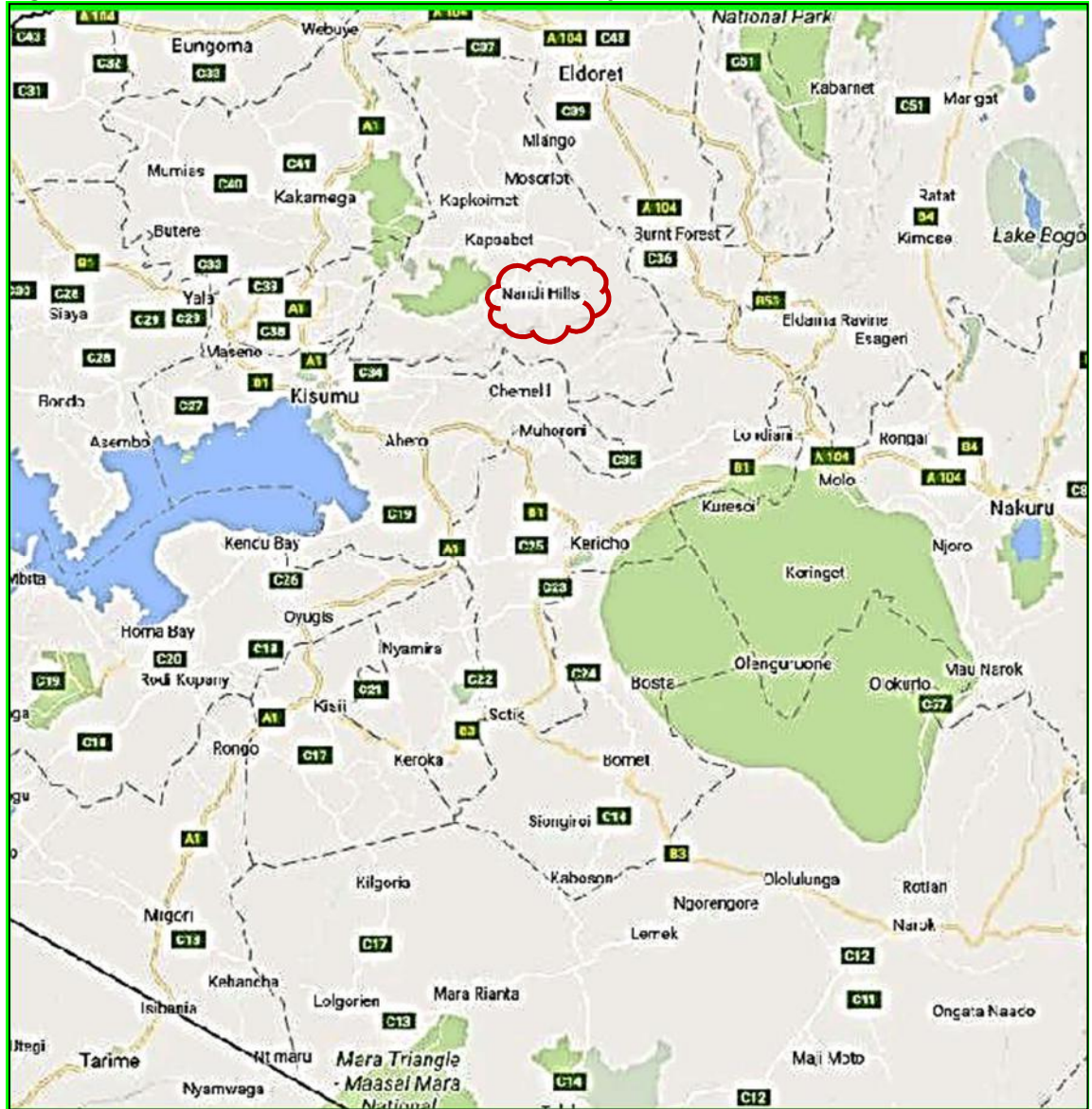


Figure 1-2: Map of Kenya showing location of Nandi County



Source: Kenya National Bureau of Statistics, 2013

The new main facilities to be constructed are located in the coordinates shown below:

Main Facilities	GPS Coordinates	
	East	North
Intake at Mokong River	35.158945	0.140563
Water Treatment Plant next to KFS offices	35.160007	0.138728

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## 1.5 Project Justification

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### 1.5.1 Existing Water Treatment Plant

From field inspections by the design engineers, it was noted that the water was not undergoing full treatment but only disinfection by chlorination at the treated water pump sump. The Engineers were informed that water flows by gravity through the raw water mains to the treatment works into the treated water pump sump where it is chlorinated before pumping to the distribution storage, without passing through the treatment unit. This is normally carried out during the dry season when the water has low turbidity.

During the rainy season water is pumped via the raw water suction main directly from the Taito reservoir to the Conventional Filtration Unit (CFU) for full treatment as this is the period when the sediment load is high. Low lift pump for raw water pumping is carried out in alternation with the high lift pump for the rising main depending on the period of filling the 50m<sup>3</sup> clear water tank.

During the dry season water pumping schedule is from 4am to 10 am in the morning and from 4pm to 9pm in the evening, which totals to 11 hours per day. From this raw water pumping regime, an average of 480m<sup>3</sup> of raw water is delivered to the town and its environs per day during the dry season. However, during the rainy season, pumping into the town and its environs would depend on the frequency of filling the 50 m<sup>3</sup> clear water tank. With the 17 m<sup>3</sup>/hr raw water pump and allowing for treatment losses of about 10%, the Plant throughput would be 15 m<sup>3</sup>/hr, which would take about 4 hours to fill up the 50m<sup>3</sup> clear water tank. This translates to filling the tank six times in a day, before the high lift pumps are operated to feed the distribution reservoirs, thus delivering an average of 240m<sup>3</sup> of treated water into the town.

There is need to rehabilitate and expand the treatment facilities and the pumping system to increase the throughput and also ensure that water undergoes full treatment at all times regardless of the season.

### 1.5.2 Rehabilitation for Existing Water Supply System

The existing water supply system is facing a number of challenges that have been identified as follows:

- Some of the infrastructure facilities are dilapidated and the whole system has inadequate capacity to meet the current and future water demand;
- The existing water source is inadequate;
- There exist consumer connections on the rising main that affect the pumping system. The working point for a fixed speed pump would shift from its optimal point to non-efficient working points due to variations in demand in the distribution system and therefore result in power wastage. Pumping to a reservoir ensures that this scenario does not occur as the pump would be working to a constant head and therefore flow.
- Poor repairs on the old rising main, e.g. replacement of sections of the GS pipeline with low pressure rated uPVC pipes, leading to frequent bursts;
- Siltation problem at Taito intake which is mainly caused by poor protection of the catchment area;
- Pump house that requires rehabilitation; and
- The available storage in the system is inadequate. Therefore, additional storage reservoirs would be required for the current planning period.

In view of the above, the existing water treatment and supply systems require rehabilitation and expansion since they are unable to meet the current water demand. From the above operating scenario at the water source and treatment Plant, delivery of 480m<sup>3</sup>/day is insufficient to meet the current water demand of about 1,600m<sup>3</sup>/day within the Nandi Hills township.

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## 1.6 Objectives of the ESIA Study

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The ESIA study will be carried out to deliver on the following broad objectives:

- To disseminate information on the project to the key stakeholders and the general public;
  - To identify and assess all potential significant environmental and social impacts of the water supply and sanitation project and recommend appropriate mitigation and enhancement measures;
  - Ensure compliance of the project with applicable national and international environmental standards and regulations as well as AfDB requirements; and
  - Prepare an Environmental and Social Impact Assessment Study Report for submission to NEMA for review in as far as approval of the project is concerned.
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## 1.7 Study Methodology

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In order to meet the study objectives, the study team carried out desktop studies, site visit and, public consultations relevant to project. These activities were as follows:

### 1.7.1 Desktop study

For the sake of preparation of a comprehensive report, the Environmental team has reviewed various specialised study reports prepared under this project. The Reports include the following:

- Final Pre-feasibility/Identification Report, dated September 2015, prepared by WEMA Consult (T) Ltd for the USAID;
- Layout map showing the present water supply and distribution pipework, including that installed in 2016;
- The 2009 and 2019 Kenya Population and Housing Census Report from Kenya National Bureau of Statistics;
- Environmental and Social Impact Assessment Project Report for Rehabilitation and Augmentation Nandi Hills Water Supply, prepared by CAS Consultants Ltd., dated May 2016;
- Nandi County Integrated Development Plan (2013 – 2017 and 2018 – 2022), prepared by the County Government of Nandi;
- Revised conceptual design report for Nandi Hills, prepared by GIBB Africa, July 2018;
- Site layout plans;
- Detailed design report for Nandi Hills water supply and sanitation project, prepared by GIBB Africa, December 2019; and
- Various legal documents pertinent to the project including the Environmental Management and Coordination Act (EMCA) 1999, (Amendment) Act, 2015, and the Water Act, 2016.

### 1.7.2 Field Study

A reconnaissance field visit to the project area was carried out on 15 November 2017. The field visit was led by the District Water Officer who briefed the Consultant on the status of the water supply system. A field study was conducted from 4 June 2018 to 14 June 2018 to collect primary baseline information and evaluate the types, mode of action and magnitude of the specific projected effects and impacts, both favourable and detrimental to the physical, biological and socio-economic environment.

The study tools applied during the field study were:

- Transect walks;
- Key informant interviews;
- Water sampling and analysis;
- Public meetings.

**(a) Transect walks**

During the visit a site walk survey of the project area was undertaken by the project team and involved the following:

- Participatory transect walks with key informants from the project area;
- Site observations including photographs to record and document existing site conditions.

Based on the site visit and discussions held with the project team, observations relevant to the project and which could influence the ESIA were identified.

**(b) Key Informant Interviews**

Key Informant Interviews (KII's) were undertaken with County and Sub County government agencies and other institutions in the project area from Nandi County as well as the constituent sub County of Nandi Hills. The KII's were undertaken to assist in identifying baseline conditions and in analysis of potential impacts to the community and institutions in the project area.

The agenda for all these meetings was to;

- Present the proposed project design to the stakeholders;
- Obtain views from the stakeholders on their concerns on environmental and socio-economic impacts of the proposed project;
- Discuss the role of each stakeholder on the proposed project.

**(c) Water Sampling and Analysis**

Water sampling and analysis was coordinated by the water Resources Authority (WRA) through collection of grab samples from the rivers at selected points. Water parameters analyses based on NEMA, KEBS and WHO quality standards for domestic water were:

- PH
- Colour (Mg/Pt/l)
- Turbidity (N.T.U)
- Conductivity (25°C) ( $\mu\text{S/cm}$ )
- Calcium (mg/l)
- Magnesium (mg/l)
- Total hardness (mgCaCO<sub>3</sub>/l)
- Total Alkalinity (mgCaCO<sub>3</sub>/l)
- Chloride (mg/l)
- Fluoride (mg/l)
- Nitrate (mgNO<sub>3</sub>/l)
- Nitrite (mgNO<sub>2</sub>/l)
- Orthophosphates (mg/l)
- Total Dissolved Solids (mg/l)
- Ammonium (mg/l)
- Sulphates (mg/l)
- Iron (mg/l)
- Manganese (mg/l)



- Total coliforms (No./100 ml)
- E. coli (No./100 ml)
- Bilharzia (No./100 ml)

**(d) Public Meetings**

The main purpose of the public meetings undertaken during the Environment and Social Impact Assessment study was to document the perceived Environmental and Social impacts to the project area and general attitude on the project based on the proposed project components.

The methodology used for undertaking the public meetings was:

- A reconnaissance survey of the general project area and site-specific location of the proposed project to identify the primary stakeholders to be consulted within the primary project zone of influence;
- Establishing contacts with the local area Chief and his assistants in order to establish dates and venue for public meetings;
- Hold a public meeting with the members of the community within the project area of influence.

Public meetings were held with the following primary stakeholders:

- Host community residents of Kosoiywo, Kipsebwo and Nandi Hills Location where the proposed new abstraction point for Mokong River, WTP as well as the water storage reservoir will be situated.
- Residents of Kaplelmet location where the new water storage reservoir for Taito Stream is situated. These residents are also beneficiaries of the proposed project.
- Residents from locations surrounding Kaplelmet location where the distribution network is located.

Further to public meetings held in 2016, additional meetings were held in 2018 at Kipsebwo Polytechnic in Kipsebwo Location as well as George Mutai Educational Centre in Kaplelmet Location. This was in order to explain the project and its effects to community as well as to obtain the views of the community on the proposed project.

## 1.8 Structure of the Report

This report has been prepared under the following sections and chapters:

**Executive**

**Summary:** This section presents a brief of the water and sanitation project, summary of the significant findings, expected environmental and social impacts, and recommendations and conclusions from public participation and stakeholder consultations.

**Chapter 1: Introduction:** This chapter gives description of the project background, Project objectives, scope of the report, project location, project justification, objectives of the ESIA Study, study methodology and the structure of the report.

**Chapter 2: Project Description:** This chapter gives a description of the status of the project in the project cycle, specifically during construction, operation and decommissioning.

**Chapter 3 Policy, Legal, and Regulatory Framework:** This chapter outlines the

overview of legislative framework, regulatory, international guidelines and conventions relevant to this project.

Chapter 4: **Description of the Baseline Environment:** This chapter gives description of the environmental setting of proposed project and surrounding areas, e.g., climate, soils, geology, hydrogeology, flora, fauna, land use, human populations, socio-economic and cultural heritage.

Chapter 5: **Assessment of Project Alternatives:** This chapter gives a description of the project details, alternative options, designs and implementation strategies.

Chapter 6: **Public Consultation and Disclosure:** This chapter gives description of the objectives, methods used and summary of results of the public consultation activities.

Chapter 7: **Assessment of Environmental and social impacts and mitigation measures:** This chapter presents the analysis of beneficial and adverse impacts of the project on the biophysical and human (social, cultural and economic) environments. The analysis covers anticipated impacts during the construction, operation phases and decommissioning phases and also describes the enhancement and mitigation measures proposed to enhance benefits or prevent, minimize, mitigate or compensate for adverse impacts.

Chapter 8: **Environmental and Social Management and Monitoring Plan:** This chapter presents the preliminary Environmental and Social Management and Monitoring Plan prepared for the project.

Chapter 9: **Conclusion and Recommendations:** The conclusion briefly presents the environmental and social acceptability of the project, taking into account the impacts and measures identified during the assessment process.

**Appendices:** This section presents supplementary documents to the report.

## 2 PROJECT DESCRIPTION

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### 2.1 Existing Water Supply System

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#### 2.1.1 Background

Nandi Hills Water Supply was under NYANAS Water Company and currently Kapsabet/Nandi Hills Water Supply Company. The scheme was constructed in 1948. The Scheme is responsible for the overall operation and management of water supply in Nandi Hills which comprises of four (4) sub locations namely Nandi Hills, Kapng'etuny, Tururo, and Kipsamoo.

Water sources in the area are surface and ground water. But currently Nandi Hills Water supply mainly depends on Surface water (Taito Dam). Raw water flows to a sump well of 50 m<sup>3</sup> through 75 mm GS pipe, and is then pumped to the treatment works by a 17 m<sup>3</sup>/hour pump set through a 100 mm rising main of GS pipe. The treatment works comprises of Mixing Chamber- Flocculation –Sedimentation and Filtration with the production capacity of 25m<sup>3</sup>/hour. The treatment plant it works for only 12 hrs per day. Water from conventional treatment plant then flows by gravity to clear water tank of 50 m<sup>3</sup>. From the clear water tank, water is pumped through a 100 mm GS pipe to four storage tanks (135 m<sup>3</sup>, two tanks 50m<sup>3</sup> and 25m<sup>3</sup>) for distribution to consumers. The existing distribution line ranges from 20 – 75 mm of about 6.7 km.

#### 2.1.2 Surface Water Sources

As per the Final Detailed Design Report (2019), the current water source for the Nandi Hills is Taito Stream, where a weir was constructed in 1948, creating the small Taito reservoir impoundment (see Figure 2-1 below).

**Figure 2-1: Existing Taito dam**



According to the Final Detailed Design Report (2019), the total water volume that Taito reservoir can hold stands at 7,500 m<sup>3</sup>.

Other surface water sources in Nandi Hills that could be exploited for increased water supply to the town and its environs, as identified in the Preliminary Design Report include the following:

- Taito Stream, which has a catchment of about 0.25km<sup>2</sup> with a minimum river flow of 691.2m<sup>3</sup>/day and a maximum of 1,793 m<sup>3</sup>/day;

- For Mokong River, the Consultant carried out the hydrological analysis and found out that with the catchment of 26km<sup>2</sup>, the river has a minimum flow of 4,320m<sup>3</sup>/day and a maximum of 8,355m<sup>3</sup>/day;
- Mogobich River, which has a catchment of about 17km<sup>2</sup> with a minimum river flow of 1,215.62m<sup>3</sup>/day and a maximum of 3,062 m<sup>3</sup>/d;
- Kibabet Stream, which has a catchment of about 23km<sup>2</sup> with a minimum river flow of 1,644.66m<sup>3</sup>/day and a maximum of 4,140m<sup>3</sup>/day; and
- Kapsombeiwa River, which has a catchment of about 24km<sup>2</sup> with a minimum river flow of 1,716.16m<sup>3</sup>/day and a maximum of 4,320 m<sup>3</sup>/day

### 2.1.3 Existing Water Treatment Facilities

The existing Water Treatment Plant comprises of the following units:

- Pump building housing both raw and treated water pumps. The reported raw pump capacity is 17m<sup>3</sup>/hr while the treated water pump has a capacity of 40m<sup>3</sup>/hr. Both pumps have no standby pumps.
- 1 No. composite filtration unit with a capacity of 25 m<sup>3</sup>/hr;
- Chemical mixing and dosing unit, for alum dosing;
- 1 No. 50 m<sup>3</sup>-treated water tank (concrete);
- Treated water pump sump;
- 1 no. 25 m<sup>3</sup> backwash tank;
- Station pipework as follows:
  - DN 100 mm GS raw water suction from the reservoir
  - DN 100 mm GS treated water pipe from the CFU to the treated water tank and thence to the treated water pump sump
  - DN 150 and DN 75 mm raw water gravity pipes from the reservoir to the treated water pump sump.

### 2.1.4 Existing Pumping to distribution reservoirs

The existing pumping facilities include the following:

- One treated water pump of 40-m<sup>3</sup>/hr capacity that is located within the pump building at the Water Treatment Plant;
- DN 100 mm GS delivery main constructed with the original works in 1948;
- DN 100 mm GS delivery main constructed in 2013 branching off the old main just after the treatment works compound;

From the above operating scenario at the water source and treatment Plant, an average of 480m<sup>3</sup> is insufficient to meet the current water demand of about 1,600m<sup>3</sup>/day within the Nandi Hills.

The original design of 1948 was for pumping water from the treatment works through a DN100 GS pipe to a 20 m<sup>3</sup> reservoir for serving the Government quarters. However, the pumping regime changed in 2013 when the new DN100 mm rising main was installed for delivering water to the new 135 m<sup>3</sup> and 50 m<sup>3</sup> located on Kabikwen Road. The new main was branched off the old main just after the treatment works compound near the backwash tank. The two mains were interconnected on Koitalel Samoei Road, next to Kaptumo Bus Station, by extending the old pipeline from the 20 m<sup>3</sup> reservoir.

Treated water is pumped from the treatment Plant through the two DN 100 mm GS rising mains to the two distribution storage reservoirs (135 m<sup>3</sup> and 50 m<sup>3</sup>) that were constructed in 2013 before gravitating into town. In addition, water is delivered to the old 20m<sup>3</sup> tank and a 50m<sup>3</sup> tank, located along the rising main on Kabikwen Road, that was understand to be dedicated water supply to Nandi Bears Hotel.

However, the operator indicated that there were individual connections on the rising mains within the town, which would not be appropriate as the pump is of constant head and cannot cope with varying demand, and therefore pressure reduces along the mains. This scenario

needs to be rationalized to ensure that the system operates optimally by either providing a variable speed pump or feeding the whole system from distribution storage tanks by providing dedicated mains that feed storage reservoirs before distribution.

### **2.1.5 Existing Distribution Storage**

Nandi Hills main reservoir storage consists of two side-by-side ground tanks located on Kabikwen Road, some 170 m from the junction with Nandi Bears Road, constructed in 2013. The two tanks are interconnected so they share a common water level with a total volume of 185 m<sup>3</sup> when full (1no. concrete tank of 135 m<sup>3</sup> and 1 no. masonry tank of 50 m<sup>3</sup>). These tanks serve the town as well as Mogoivet Centre along Nandi Hills-Kimwani Road, through a water kiosk.

The tanks are in good condition and at an elevation that feeds the distribution system by gravity. However, the compound is not secured through fencing.

Some of the consumers are connected to the rising mains within the town, however, when the demand from these consumers is low, the tanks would fill up.

A 50m<sup>3</sup> tank, located along the rising main before the above two tanks is dedicated to supply water to Nandi Bears Hotel. This is a masonry ground tank that receives water from the treatment works through a branch pipe from the DN100 rising main. The tank is in good condition. However, the compound is also not secured through fencing.

A 20m<sup>3</sup> tank is located in the middle of the town that was constructed in 1948 to serve the Government quarters. This is a masonry ground tank that receives water from the treatment works through a branch pipe off the DN100 rising main. The tank is dilapidated and has visible cracks.

### **2.1.6 Existing distribution Network**

The distribution system consists of an estimated 9.3 km of uPVC pipelines from 50mm to 75mm in diameter serving mainly residential, commercial and institutional developments.

The distribution system is fed from reservoirs and direct pumping as some of the consumers are connected to the rising mains.

The settled area of the town is about 2.95 km<sup>2</sup> and the existing network covers an area of about 0.6km<sup>2</sup>, which is about 20% of the total settled area. The proposed design is meant to ensure that the distribution network is extended to cover the unserved areas when planning for network improvements.

Kapsabet-Nandi Water and Sewerage Company is responsible for the overall operation and management of the water supply in Nandi Hills Town and its environs.

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## **2.2 Existing Sanitation Facilities**

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As per the Ministry of Water and Irrigation (MWI) Preliminary Design Report (2016) and as confirmed by the design engineers during the preliminary field visits, Nandi Hills township has no existing water borne sewerage system. The town relies mainly on pit latrines for disposal of human waste. The quality of the pit latrines varies from one family to the other due to economic status of the individual family.

According to the USAID Pre- Feasibility Report (2015), about 60 per cent of the Nandi County households use pit latrines while 40 per cent use flush toilets connected to septic tanks, mostly in the urban centres. Inadequate access to water for flushing toilets has kept the use of pit latrines as the preferred option in the County. The faecal sludge exhausted from the septic tanks is transported to Kapsabet Wastewater Treatment Plant.

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## 2.3 Population Projections

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In order to carry out an assessment of the water demand in Nandi Hills, the Consultant obtained the population for the Town as presented in Table 3 of the 2009 Kenya Population and Housing Census Report (Population Distribution by Sex in Urban Centres and Status of Centre, which is broken down into core-urban and peri-urban. The population figures have been projected to the year 2040, which is the planning horizon for the current project, as presented in Table 2-1 below.

**Table 2-1: Population projections for Nandi Hills**

Type of Settlement	2009 (census)	Current 2017	Initial Year 2020	Year 2025	Future Year 2030	Year 2035	Ultimate Year 2040
Core-Urban	6,968	8,965	9,853	11,534	13,501	15,804	18,500
Peri-Urban	3,152	4,055	4,457	5,217	6,107	7,149	8,369
<b>Total</b>	10,120	13,020	14,310	16,751	19,608	22,953	26,869

*Source: Final Design Report, 2019*

The population projections presented above formed the basis for domestic water demand projections for the design of the proposed project.

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## 2.4 Water Demand Projections

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The Final Design Report of 2019 presents the criteria for water demand assessment and projection as presented in the following sections.

### 2.4.1 Domestic consumer categorisation and level of service

#### (a) Domestic consumer categorisation

- **For urban areas**
  - High and Medium Class Housing
  - Low Class Housing
- **For rural areas**
  - High Potential
  - Medium Potential
  - Low Potential

#### (b) Level of service

The Ministry of Water and Irrigation Practice Manual for Water Supply Services in Kenya, 2005, has suggested service type as indicated in Table 2-2 below. It however notes that local factors may warrant deviation from the figures in the table and if the designed supply is an extension or completion of an existing supply, then the distribution of individual connections (IC) and non-individual connection users (NC) is estimated after monitoring of the existing situation.

**Table 2-2: Service type**

Service area	% of IC			% of NC		
	Initial	Future	Ultimate	Initial	Future	Ultimate
<b>Urban Areas</b>						
High and Medium Class Housing	100	100	100	0	0	0
Low Class Housing	10	30	50	90	70	50
<b>Rural Areas</b>						
High Potential	20	40	80	80	60	20
Medium Potential	10	20	40	90	80	60
Low Potential	5	10	20	95	90	80

Source: Final Design Report, 2019

## 2.4.2 Consumption rates

The report notes that consumption rates adopted were those recommended in the Ministry of Water and Irrigation Practice Manual for Water Supply Services in Kenya, 2005, with slight changes to take into account the economic conditions within the area. The recommended water consumption rates by housing classification from the Manual are as presented in Table 2-3 below.

**Table 2-3: Recommended water consumption rates by housing classification**

CONSUMER CATEGORY	WATER CONSUMPTION RATES						
	UNIT	DOMESTIC IN RURAL AREAS			DOMESTIC IN URBAN AREAS		
		High potential	Medium potential	Low potential	High Class Housing	Medium Class Housing	Low Class Housing
People with individual connections	l/head/ day	60	50	40	250	150	75
People without connections	l/head/ day	20	15	10	-	-	20
Livestock unit	l/head/ day	50					
Boarding schools	l/head/ day	50					
Day school with WC	l/head/ day	25					
Day school without WC	l/head/ day	5					
Hospitals Regional	l/bed/ day	400 + 20 litres per outpatient per day (minimum total of 5000 l/day)					
District hospital	l/bed/ day	200 + 20 litres per outpatient per day (minimum total of 5000 l/day)					
Other hospital	l/bed/ day	100 + 20 litres per outpatient per day (minimum total of 5000 l/day)					
Dispensary and Health Centre	l/day	5,000					
High class hotel	l/bed/ day	600					
Medium class hotel	l/bed/ day	300					
Low class hotel	l/bed/ day	50					
Administrative offices	l/head/day	25					
Bars	l/day	500					
Shops	l/day	100					
Unspecified industry	l/ha/day	20,000					

For the current assignment, the water demand projections based on the revised population projections for Nandi Hills presented in Table 2-1 above and the new design horizon up to the year 2040.

The updated water demand projections are presented in Tables 2-4 to 2-6 below.

**Table 2-4: Domestic water demand projections**

Housing Category	Per capita demand	Projected population				Projected domestic water demand			
		Current (2017)	Initial (2020)	Future (2030)	Ultimate (2040)	Current (2017)	Initial (2020)	Future (2030)	Ultimate (2040)
High and Medium Class	150 lpcd	7,812	8,586	11,765	16,121	1,172	1,288	1,765	2,418
Low Class (IC)	75 lpcd	521	572	2,353	5,374	39	43	176	403
Low Class (NC)	20 lpcd	4,687	5,152	5,490	5,374	94	103	110	107
<b>Total</b>		<b>13,020</b>	<b>14,310</b>	<b>19,608</b>	<b>26,869</b>	<b>1,305</b>	<b>1,434</b>	<b>2,051</b>	<b>2,928</b>

Source: Final Design Report, 2019

**Table 2-5: Non-domestic water demand**

Sector	Water Demand			
	Current 2017	Initial, 2020	Future 2030	Ultimate 2040
Institutional	175	192	262	359
Commercial	90	99	135	185
Livestock	30	30	30	30
<b>Total</b>	<b>295</b>	<b>321</b>	<b>427</b>	<b>574</b>

Source: Final Design Report, 2019

**Table 2-6: Total water demand**

Design Demand	Total water Demand, m <sup>3</sup> /day			
	Current Year 2017	Initial Year 2020	Future Year 2030	Ultimate Year 2040
Domestic Water Demand	1,305	1,434	2,051	2,928
Institutional Water demand	175	192	262	359
Commercial Water demand	90	99	135	185
Livestock Water demand	30	30	30	30
<b>Total Water Demand, m<sup>3</sup>/day</b>	<b>1,600</b>	<b>1,755</b>	<b>2,478</b>	<b>3,502</b>

Source: Final Design Report, 2019

## 2.5 Proposed Project Components

In order to meet the above current and projected demand, the following are proposed.

### 2.5.1 Water sources

The following water sources have been proposed;

- Taito Stream for initial and short term (Rehabilitation for the existing structures);
- Mokong river for future demand;

The proposed project plans to abstract 528 m<sup>3</sup>/day and 2530 m<sup>3</sup>/day from Taito and Mokong respectively.



The following sections describe details of the sources to be considered for development in order to alleviate the water supply shortage. Consideration was made for initial, future and ultimate period needs.

**(a) Taito Stream Source**

As per the Design Report, Taito stream is considered as one of the potential and current sources of water supply for Nandi Hills. The existing intake includes an impoundment with a capacity of about 7,500m<sup>3</sup>. According to the report, the stream has a dry flow of about 691.2m<sup>3</sup>/day and a maximum flow of 1,793m<sup>3</sup>/day with the average flow being 1,242m<sup>3</sup>/day. The proposed intervention is to abstract a maximum of 528 m<sup>3</sup>/day of raw water for full water treatment works throughput of 480 m<sup>3</sup>/day, assuming 10% loss through the treatment Plant and other station uses

**(b) Mokong River source**

In the analysis of the Mokong River flow, the Consultant obtained the data from the following sources:

- Average monthly and streamflow data at RGS 1FD02 (1991-2010) from National Water Master Plan prepared by Nippon Koei for JICA , 2013.
- Stream flow data for RGS 1FD02 (1986-2015) from WRA, though with missing data for some days, months and years.

JICA stream flow data for the 20 years period (1991-2010) was used by the Consultant to analyse the potential of Mokong River serving as a water supply source for Nandi Hills. The analysis involved daily, seasonal and monthly stream flow fluctuation. The results of the analysis are presented in Table 2-7 below.

**Table 2-7: Summary of Mokong river flow analysis**

Statistic	Flow (m <sup>3</sup> /s)	Flow (m <sup>3</sup> /day)	% Exceedance
Minimum	0.0505	4,365.6	98
Maximum	0.0967	8,354.9	2.5
Average	0.0607	5,241.0	50

Source: Final Design Report, 2019

The results show that 2,530 m<sup>3</sup>/day of water can sustainably be abstracted from Mokong river up to the year 2040 under different climatic conditions. The minimum flow at 98% exceedance for Mokong River is 4,365 m<sup>3</sup>/day against a proposed abstraction of 2,530 m<sup>3</sup>/day while the maximum daily flow at 2.5% is 8,354 m<sup>3</sup>/day and the average flow is 5,241.02 m<sup>3</sup>/day at 50 % exceedance.

The proposed abstraction is about 58% 30%, 48% of the minimum, maximum and average flows respectively is shown in the Table 2-8 below.

**Table 2-8: Proposed abstraction from Mokong river as a percentage of Maximum, average and Minimum flows**

Statistic	Flow (m <sup>3</sup> /day)	Proposed abstraction (m <sup>3</sup> /day)	Abstraction %
Minimum	4,365.62	2,530	58
Maximum	8,354.88	2,530	30.
Average	5,241.02	2,530	48.

Source: Final Design Report, 2019

From the analysis, the Consultant proposed to abstract 2,530m<sup>3</sup>/day being 58% of the minimum flow of raw water and full water treatment works throughput of 2,300 m<sup>3</sup>/day, assuming 10% loss through the treatment Plant and other station uses.

A suitable intake works site was identified upstream of Kimondi Bridge (See Plate 2-1 below). The treatment works site was identified downstream of the intake works to allow raw water flow by gravity.

**Plate 2-1: Proposed intake site on Mokong River**



## 2.5.2 Rehabilitation of Taito River Water Supply System

### Raw water system

- Desilting and construction of silt traps upstream of the impoundment and protect against the erosion up stream of Taito on the main road to Kapsabet - Nandi Hills town
- Laying of a new steel DN 100 raw water main pipe of length 25m from the intake chamber to the existing 25 m<sup>3</sup> sump
- Installation of 3 no. submersible pumps in an existing 25m<sup>3</sup> masonry sump. The provisional capacity of each pump is 26.4 m<sup>3</sup>/hr against a head of 4.1 m. The pumps are capable of handling solid particles. The pumps shall operate on shifts bases each working for 8 hours to deliver water to the Composite Filtration unit.
- Laying of a new steel DN 100 raw water main pipe of length 135m from the Sump to CFU and from CFU to Clear Water Tank

### Water Treatment Plant

The proposal is to rehabilitate and upgrade the existing Taito Water Treatment Plant with a throughput of 480 m<sup>3</sup>/day comprising of a Composite Filtration Unit (CFU) with a capacity of 25 m<sup>3</sup>/hr., 50 m<sup>3</sup> clear water tank, 25 m<sup>3</sup> backwash tank and associated pipework and chemical mixing shed and dosing system.

### Clear Water Pump house

Construction of a new clear water pump station with 60 KVA standby generator room to be located near the Clear water tank (50 m<sup>3</sup>), including all associated works.

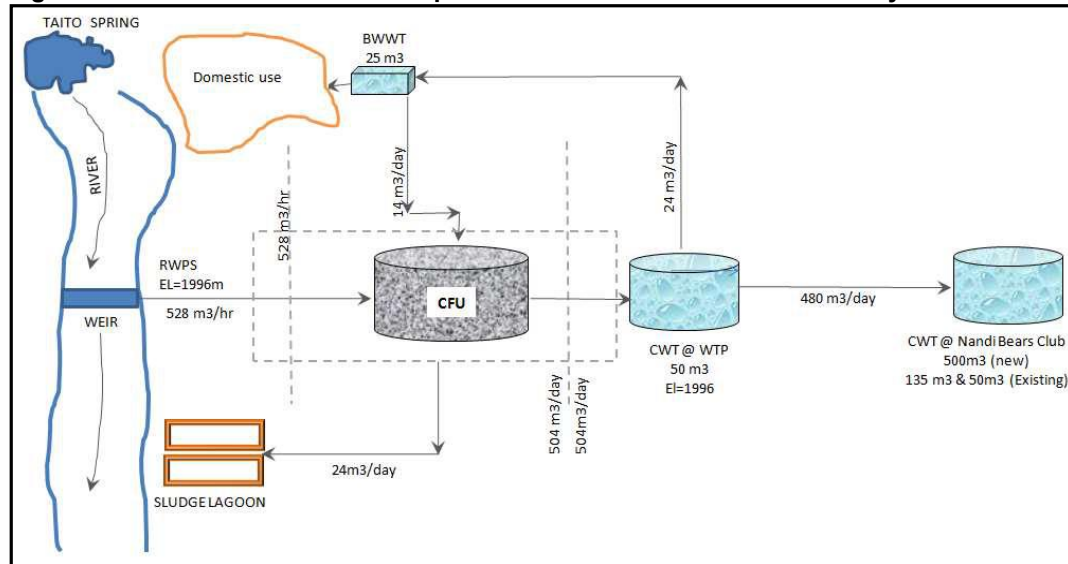
### Clear Water Pumps

Installation of 2 No. centrifugal pumps to meet the production capacity while operating as one duty and one standby. The pumps will be sized to deliver water to the existing tanks (50 m<sup>3</sup> for Nandi Bears Club and the 135 m<sup>3</sup> and 50 m<sup>3</sup>) located side-by-side along Kabikweni Road. The provisional capacity of each pump is 24m<sup>3</sup>/hr against a head of 140m.

The work shall include provision of control panels complete for the pumps with associated electrical and mechanical equipment.

Schematic presentation of the above works is presented in Figure 2-2.

**Figure 2-2: Rehabilitated and expanded Taito River Water Treatment System**



Source: Final Design Report, 2019

### 2.5.3 Mokong River Water Supply System

#### (a) Raw water intake

A new concrete intake weir was designed on River Mokong to meet the following:

Flood discharge $Q_{100}$	=351 m <sup>3</sup> ./hr
Intake design discharge	=105 m <sup>3</sup> /hr
Bed width	=15m
Weir length	=12m
Weir height	=2.5 m
Free board	=0.5m

The intake weir was considered with the following features:

- Weir across the river.
- Collection chamber to act also as a sedimentation tank.
- Drain pipe designed with a steep gradient in order to attain high tractive force so that the deposited sediments easily discharge into the natural course.
- Distribution box provided with side spillway to discharge the excess water back to the river during high flows.
- A short spillway chute to guide back the spill water to the river without eroding the banks. The box will also be provided with two outlet pipes and gate/slucice valves to control flow to the treatment plant.

#### (b) Raw Water Delivery

Raw water pipes length to the raw water sump	=60 m
Diameter of HDPE pipe	= 250mm
Raw water pipes length from the raw water sump to TP	=130 m
Diameter of Steel pipe	=200
Frictional losses in raw water rising mains	= 0.8 m
Static head	= 11.7m
Residual head	= 12.5m
Losses due to fittings	= 4m
Total Head	= 16.5m

**(c) Raw water pumps**

Pumps have been sized to pump raw water from the intake sump to the water treatment works, operating on 2 duty + 1 standby basis. The capacity of the raw water pumps has been proposed based on throughput of 2,300 m<sup>3</sup>/day plus Plant losses and station use, which is 2,530m<sup>3</sup>/day. Each pump is therefore rated at 115 m<sup>3</sup>/hr. and 17m head to be installed submersible in the intake sump, complete with associated pipework and electrical controls.

**(d) Mokong Water Treatment Plant (WTP)**

The Water Treatment Plant has been sited next to Kenya Forestry Service offices along Nandi Hills – Kapsabet road near the Mokong river where the intake water source is located.

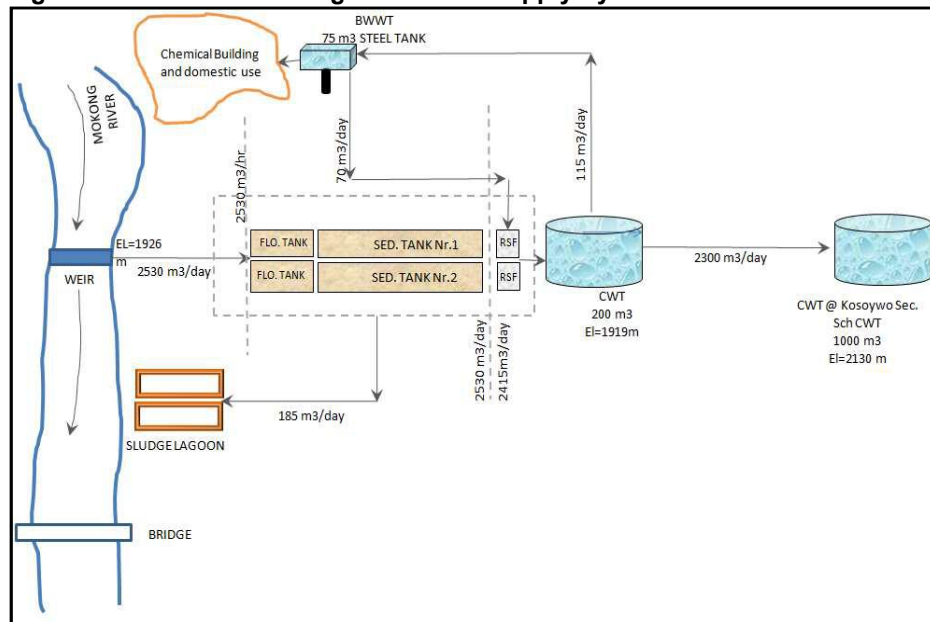
The site is accessible through an all-weather asphalt road that connects Kapsabet and Nandi Hills at coordinates Region 36 N, Longitude 0740423.90 E UTM, Latitude 0015460.96N UTM, Altitude 1920 m. The treatment plant shall be designed for throughput capacity of 2300 m<sup>3</sup>/day.

The treatment works will consist of a conventional treatment and will be designing to have two units such that each will be operated independently. The plant is expected to comprise the following:

- 2 No inlets
- 2 No Flocculation basins
- 2 No Sedimentation basins
- 2 No mono media rapid sand filter units
- 2 No Sludge treatment lagoons
- 1 No 75m<sup>3</sup> elevated pressed steel tank for backwash water.
- 1 No 200m<sup>3</sup> masonry clear water tank.

The new Mokong River water supply system with simple mass balance is as presented in Figure 2-3.

**Figure 2-3: New Mokong river Water Supply System**



Source: Final Design Report, 2019

**(e) Water Treatment Process**

The treatment plant is designed for a capacity 2530m<sup>3</sup>/day of raw water with a throughput of 2300 m<sup>3</sup>/day. The Filter can also operate at 30% overloading with no anticipated problems. However, this shall be confirmed after carrying out Jar Test and chlorine reaction/absorption tests.

The full treatment works comprises of:

- Flushing (dropping) chemical mixing inlet structure;
- Maze hydraulic mixing flocculation basin,
- Chemical aided sedimentation basins;
- Rapid sand filters;
- Clear water/chlorine contact tank.

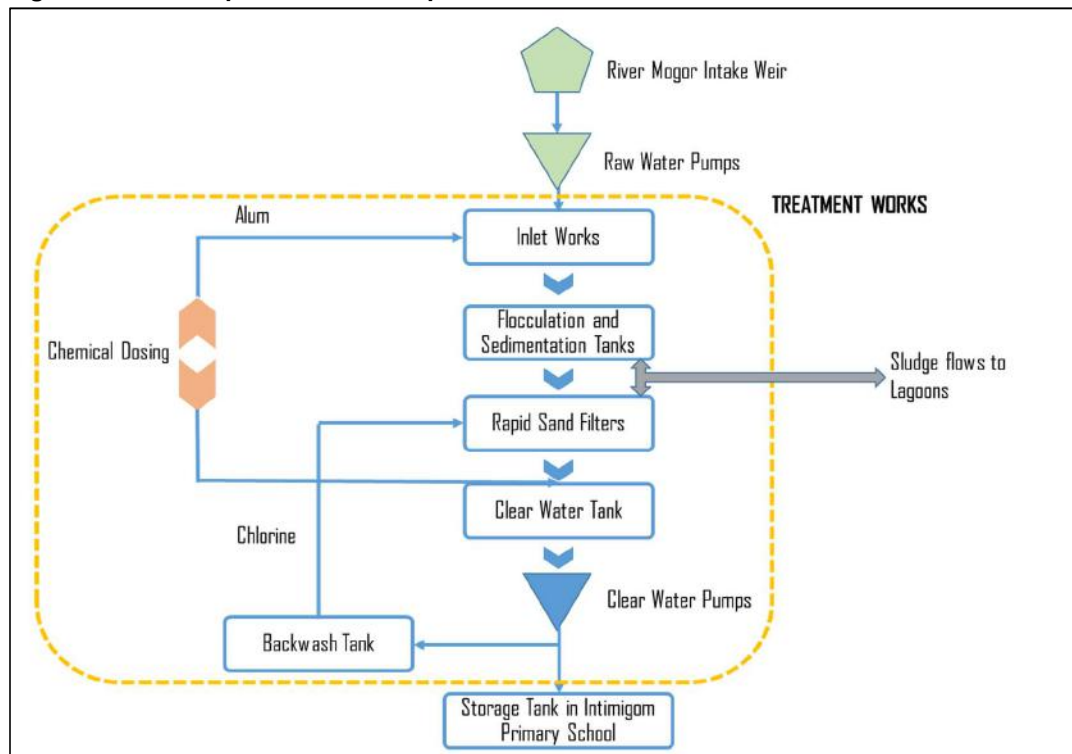
The following chemicals have been proposed to be used and the treatment process flow diagram is presented in

**Figure 2-4:**

- Aluminium sulphate for coagulation,
- Chlorine solution for disinfection
- Soda ash for pH correction.

The water treatment plant is designed to have two parallel independent of flocculation, sedimentation units and three Rapid Sand Filter Beds capable of providing 30% overloading. The design has been based on the standard design water treatment plant done by Ministry of Water and Irrigation of Kenya.

**Figure 2-4: Proposed treatment processes**



### Clear Water Pump house

The water from the clear water tank at the treatment shall be lifted into 1000 m<sup>3</sup> storage tank located Kosoiywo Secondary school through DN200 still pipe. Thus, a clear water pump station has to be provided which can house at least two pumps and 320 kVA standby generator room to be located at treatment works next to clear water tank. The pump house has been designed to house 2no. centrifugal pumps to meet the production capacity while operating as one duty and one standby. The provisional capacity of each pump is 115m<sup>3</sup>/hr against a head of 225m.

The location coordinates of key project infrastructure are presented in the Table 2-9

**Table 2-9: Coordinates of key infrastructure locations**

Point	X-Coordinates	Y-Coordinates
Mokong Intake	740,846.89	15,756.39
Mokong TP	740,445.28	15,454.26
Taito Intake	743,203.59	12,455.58
Taito TP	743,157.07	12,406.04

#### **2.5.4 Operation and maintenance building**

An operation and maintenance building to house the chemical mixing and dosing units, the operation and maintenance staff, the water testing laboratory and the water treatment chemical stores is proposed. The proposed building will be a one storey building with a plinth area of 250m<sup>2</sup>. The building is storied to enable use of the first floor for chemical dosing by gravity.

#### **2.5.5 Transmission and Distribution**

##### **(a) Taito river water supply system**

###### Clear water pump station

Two pumps have been proposed. One to be a duty pump and one to be standby, each with a capacity of 24m<sup>3</sup>/hr against 110 m. The pumps were sized to deliver water to the existing tanks (50 m<sup>3</sup> for Nandi Bears Club and the 135 m<sup>3</sup> and 50 m<sup>3</sup> side-by-side tanks) located on Kiboweni Road.

###### Taito Clear Water Rising Main

The steel rising mains were sized as follows:

Assumed pumping hrs	=20hrs
Daily demand	= 480 m <sup>3</sup> /day
Design Flow	= 24 m <sup>3</sup> /hr
Approximate length of line	= 1800 m
Pipe material	= Cement lined Steel
Pipe size	= DN 100,
Pipe class	= PN 16

##### **(b) Mokong river water supply system**

###### Clear water pump station

Two pumps have been proposed. One to be a duty pump and one to be standby, each with a capacity of 115m<sup>3</sup>/hr against 210 m. The pumps are sized to deliver water to the proposed 1,000m<sup>3</sup> RC tank at Kosoiywo Secondary school.

Mokong Rising mains

The rising mains was designed to transmit water from the proposed Mokong WTP to the proposed high-level tank at Kosoiywo Secondary school at 2130masl. The rising mains was sized as follows:

Assumed pumping hours	=20hrs
Daily demand	= 2,300 m <sup>3</sup> /day
Design flow	= 115.0 m <sup>3</sup> /hr
Length of line	= 1,600 m
Static head	= 215m
Pipe material	= Cement lined steel
Pipe size	= DN 200,
Pipe class	= PN 25

Gravity transmission mains

The gravity transmission main is designed to transmit water from the proposed 1000m<sup>3</sup> reinforced concrete tank at Kosoiywo Secondary school to 500m<sup>3</sup> masonry tank next to existing 135m<sup>3</sup> and 50m<sup>3</sup> on Kiboweni Road. OD 315 HDPE pipe of length 4,400m has been proposed.

The proposed gravity mains from Kosoiywo Secondary school to Nandi Hills shall be sized to meet the following subject to confirmation by the Contractor:

Daily demand	= 2,300 m <sup>3</sup> /day
Approximate length of line	= 4400m
Pipe material	= HDPE
Maximum Static head	= 135m
Optimal pipe size	= DN 200
Pipe class	= PN 16

**2.5.6 Lifting pump station to Ketbarak reservoir**

Lifting Pump house

A new booster pump station with 5.5 kW standard pumping capacity to be located at the 500 m<sup>3</sup> reinforced concrete water storage tank site for boosting water to the 200 m<sup>3</sup> reinforced concrete water storage ground tank at Ketbarak that will distribute water to the higher western parts of the town around Ketbarak and Samoei University.

Booster pump rising main to Ketbarak reservoir

The rising main from Nandi Bears Club storage site to Ketparak 200 m<sup>3</sup> clear water tank was sized and provided as follows:

Design Flow	= 250 m <sup>3</sup> /day (2.9l/s)
Length of line	= 1265 m
Pipe material	= Steel fusion bonded epoxy coated
Hazen-Williams friction factor, C	= 130
Pipe size	= DN 100 mm
Frictional head loss	= 3.27 m
Pipes pressure rating	= PN 16

## **2.5.7 Distribution System**

### **(a) Storage reservoirs**

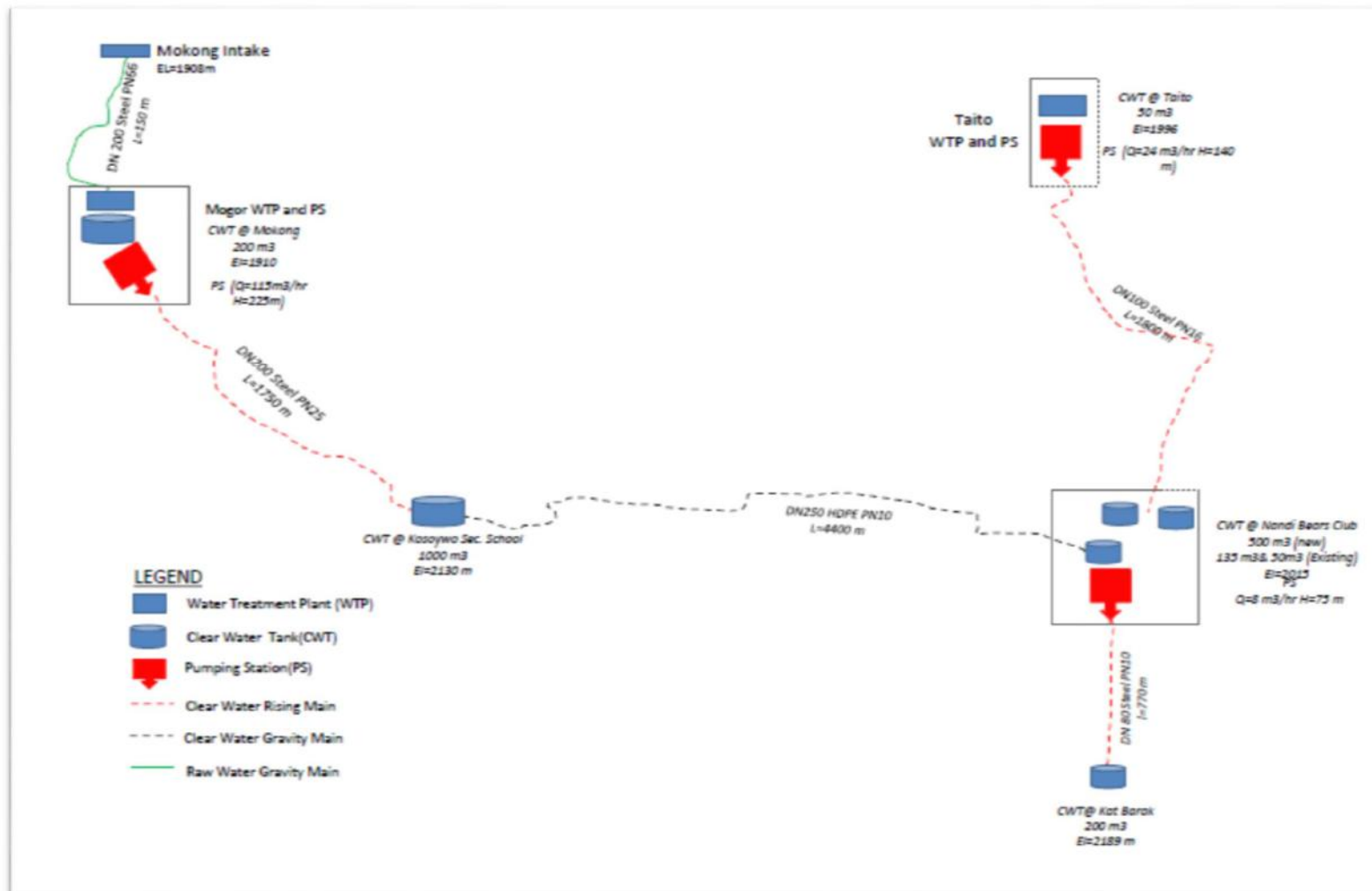
The following storage tanks are proposed:

- 1000m<sup>3</sup> Reinforced Concrete tank at Kosoiywo Secondary School;
- 500m<sup>3</sup> Reinforced Concrete tank next to existing 135 m<sup>3</sup> & 50 m<sup>3</sup> Near Nandi bears Club;
- 200m<sup>3</sup> Reinforced Concrete tank at Ketbarak.

The general schematic arrangement for the proposed development of these sources is presented in figure below.



Figure 2-5: Schematic arrangement for the proposed works



Source: Final Design Report, 2019

**(b) Distribution pipelines**

The settled area of Nandi Hills is about 1.7 km<sup>2</sup> and the existing network covers an area of 0.7 km<sup>2</sup>, which is about 41%. The existing water distribution network within the project area comprises approximately 6.7 km of mostly uPVC pipes (Ranging from 20 to 75mm, which are small).

The new distribution network consists of:

- Main distribution pipes, secondary and tertiary branching.
- Accessories that facilitate operation and maintenance such as air valves, washout valves, sectional valves.
- Communal water kiosks for collection of water by the residents.

**Table 2-10** below presents the pipe diameters, length and materials for the proposed distribution system.

**Table 2-10: Distribution pipeline system**

Pipe dia (mm)	Pipe material	Total length (m)
OD 280	HDPE	550
OD 225	HDPE	960
OD 163	HDPE	850
OD 110	HDPE	2,220
OD 90	HDPE	5,830
OD 63	HDPE	14,140
<b>Total length</b>		<b>24,550</b>

**(c) Water kiosks**

To serve the communities construction of 4 No. water kiosks is proposed. The location of which will be defined during the implementation after consultation with local communities and the Client

**2.5.8 Sanitation**

Construction of three (3 No) ablution blocks at various locations within the Nandi hills is proposed. The exact location will be determined during implementation of the project after consultation with the stakeholders. The site selection will take into consideration population density and accessibility.

The ablution blocks will be connected with water supply and will be connected to appropriately sized septic tanks.

The ablution blocks shall be designed in accordance with environmentally sustainable design principles. Long term maintenance problems will also be considered, as this is where significant costs are associated. The facility will be audited frequently to assess wear and maintenance requirements. When wear is evident, maintenance should be provided to avoid equipment failure.

Detailed layouts of the proposed infrastructure are presented in Appendix I.

**2.5.9 Construction Equipment**

The main construction equipment to be deployed are expected to include the following in varying numbers.

- Excavators
  - Tipper trucks
  - Lorries
  - Vibrating roller
  - Grader,
  - De-watering pumps
  - Concrete mixers
  - Concrete dumpers
  - Air compressors
  - Wheel loaders
  - Bulldozers
  - Water bowser and
  - 50 KW diesel generators
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## **2.6 Project Cost and Implementation Period**

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The total project implementation cost is estimated at **KES. 666,175,493**. The project will be implemented over an estimated period of 24 months.

## **3 POLICY LEGAL AND REGULATORY FRAMEWORK**

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### **3.1 General Overview**

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Regulation 18 (1) (b) of the Environmental (Impact Assessment and Audit) Regulations, 2003 requires an environmental impact assessment report to, among others; include a concise description of national environmental legislative and regulatory framework. This Chapter presents a review of the current policy, legal and regulatory framework applicable to environmental management of the proposed water supply project for Nandi Hills.

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### **3.2 Policy Framework**

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#### **3.2.1 National Environmental Policy, 2014**

The National Environmental Policy is an outcome of the Sessional Paper No. 10 of 2014. The overall goal of the policy is better quality of life for present and future generations through sustainable management and use of the environment and natural resources. One of the objectives of the policy is to promote and support research and capacity development as well use of innovative environmental management tools such as Environmental Impact Assessments (EIAs) and Environmental Audits that is necessary to ensure environmental quality and resource productivity on long term basis.

The policy among other important objectives calls for promotion of domestication, coordination and maximization of benefits from Strategic Multilateral Environmental Agreements (MEAs). The policy further calls for integration of environmental concerns into development policies, plans and activities.

The National Environmental Policy proposes a broad range of measures and actions responding to key environmental issues and challenges. It seeks to provide the framework for an integrated approach to planning and sustainable management of natural resources in the country. It recognises the various vulnerable ecosystems and proposes various policy measures not only to mainstream sound environmental management practices in all sectors of society throughout the country but also recommends strong institutional and governance measures to support the achievement of the desired objectives and goal.

#### **Relevance**

The policy requires that projects such as this one, which are likely to have significant environmental and social impacts should be undertaken with sound environmental management plan.

#### **3.2.2 National Land Policy, 2009**

In section 3.2, land policy is linked to constitutional reforms. Regulation of property rights is vested in the government by the constitution with powers to regulate how private land is used in order to protect the public interest.

Section 3.6, under land issues requiring special intervention, asserts that “Land rights of minority communities shall be protected through a law to be passed specifically to secure their rights as individuals and groups and recognition of their resource management systems to ensure sustainability.” It further states, “Land rights of vulnerable groups (namely subsistence farmers, pastoralists, hunters and gatherers, agricultural labourers, unskilled workers, unemployed youth, persons with disabilities, persons living with HIV and AIDS, orphans, slum and street dwellers and the aged.) shall be addressed by creating a system for identifying,

monitoring and assessment, resettling them, facilitating their participation in decision making over land and land based resources, and protecting their land rights”.

The policy in section 3.4.3.4 promotes Environmental Management and Audit as land management tools and encourages public participation in the process.

### **Relevance**

Land acquisition is required for the laying of the newly proposed rising mains as well as the location where the new storage tank will be situated. the proposed route for the rising mains is along an existing road but verification must first be done to ascertain that no private land will be affected. In the case that private land is affected, the proponent will be required to adhere to the principles in the land policy and follow the rightful procedure in the acquisition of these lands. This includes compensating the respective ascertained owners of the land parcels.

### **3.2.3 Kenya’s Vision 2030**

Kenya Vision 2030 is the current national development blueprint for the period from 2008 to 2030. It was developed following on the successful implementation of the Economic Recovery Strategy of Wealth and Employment Creation which saw the country’s economy back on the path to rapid growth since 2002.

The Vision 2030 is based on 3 key pillars; Economic Pillar, Social Pillar, and Political Pillar. The economic, social and political pillars of Kenya Vision 2030 are anchored on the following foundations: macroeconomic stability; continuity in governance reforms; enhanced equity and wealth creation opportunities for the poor; infrastructure; energy; science, technology and innovation, land reform; human resources development; security and public-sector reforms.

The objective of the vision 2030 is to “transform Kenya into a middle-income country with a consistent annual growth of 10% by the year 2030”. One of these aims is to make Kenya to be a nation that has a clean, secure and sustainable environment by 2030. This will be achieved through promoting environmental conservation for better support the economic pillar flagship projects.

### **Relevance**

Kenya’s transformation in to a middle-income country will be achieved by bringing and improving basic infrastructure and services namely: water and sanitation facilities, roads, street lights, storm water drains and footpaths among others. This project aims at improving water supply to Nandi Hills.

### **3.2.4 The National Biodiversity Strategy, 2007**

The overall objective of the National Biodiversity Strategy and Action Plan (NBSAP) is to address the national and international undertakings elaborated in Article 6 of the Convention on Biological Diversity (CBD). It is a national framework of action to ensure that the present rate of biodiversity loss is reversed and the present levels of biological resources are maintained at sustainable levels for posterity.

The general objectives of the strategy are to conserve Kenya’s biodiversity to sustainably use its components; to fairly and equitably share the benefits arising from the utilization of biological resources among the stakeholders; and to enhance technical and scientific cooperation nationally and internationally, including the exchange of information in support of biological conservation.

### **Relevance**

Activities during the construction of the new water treatment plant, rising mains and distribution lines are bound to impact negatively on the flora around the area. As such, during construction, the contractor will be required to reinstatement of the environment to its original

state. This will be in order to reverse the loss of biodiversity or to maintain the levels of biological resources at sustainable levels for posterity.

### **3.2.5 Sustainable Development Goals (SDGs)**

The SDGs provide a framework for the entire international community to work together towards a common end making sure that human development reaches everyone, everywhere. If these goals are achieved, world poverty will be cut by half, tens of millions of lives will be saved, and billions more people will have the opportunity to benefit from the global economy.

Up to 2015, the development agenda was centred on the Millennium Development Goals (MDGs), which were officially established following the Millennium Summit of the United Nations in 2000. The MDGs were supposed to be achieved by 2015, so a further process was needed to agree and develop development goals from 2015-2030. Discussion on the post-2015 framework for international development began well in advance. On 19 July 2014, the UN General Assembly's Open Working Group on Sustainable Development Goals (SDGs) forwarded a proposal for the SDGs to the Assembly.

The proposal contained 17 goals with 169 targets covering a broad range of sustainable development issues. Goal number 6 in the SDGs ensures availability and sustainable management of water and sanitation for all". Some of the targets of this goal include

- Achieving universal and equitable access to safe and affordable drinking water for all by 2030;
- Protection and restoration of water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes by 2020;
- expanding international cooperation and capacity-building support to developing countries in water and sanitation related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies; and
- Support and strengthen the participation of local communities in improving water and sanitation management.

#### **Relevance**

The proposed project aims at achieving some of the mentioned targets for the SDG goal no 6. In the long run, this moves the country towards the goal of ensuring availability and sustainable management of water and sanitation for all is addressed through this proposed water supply project.

The SDG goal number 6 on ensuring healthy lives and promoting the well-being for all at all ages and access to water and sanitation for all can be achieved by this project through reduction of sanitation related diseases which will increase life expectancy and reduce some of the common killers associated with child and maternal mortality.

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### 3.3 Legal Framework

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#### 3.3.1 The Constitution of Kenya

Article 42 of Bill of Rights of the Kenyan Constitution provides that every Kenyan has a right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislation and other measures.

Under Chapter 5 (Land and Environment), Part I is devoted to land. It requires that land be used and managed in 'a manner that is equitable, efficient, productive and sustainable, and in accordance with the following principles:

- Equitable access to land;
- Security of land rights;
- Sustainable and productive management of land resources;
- Transparent and cost-effective administration of land; and
- Sound conservation and protection of ecological sensitive areas.

In Part II of Chapter 5 of the Constitution (Environment and Natural Resources), (I) the State clearly undertakes to carry out the following:

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

According to Article 69 (2) "Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

Chapter 5 on Land and Environment emphasizes on the following:

- Land use and management shall by law benefit local communities
- Community land is protected from encroachment by State.
- Law shall protect Rivers, forests and water bodies.
- Equitable access to land.
- All lawful land rights are secured; only someone who has stolen land needs to worry.
- County governments will manage land in trust of the people in accordance with the Proposed Constitution.

#### Relevance

The constitution of Kenya provides for sound management and sustainable development of all of Kenya's projects, both public and private investments. It also calls for the duty given to the

project proponent, in this case CRVWWDA is to cooperate with State organs and other persons to protect and conserve the environment as mentioned in Part II.

### **3.3.2 The Environmental Management and Coordination Act (EMCA)**

The EMCA 1999 and The Environmental management and Co-ordination (Amendment) Act, 2015 provide the main legal and institutional framework under which the environment in general is to be managed. EMCA is implemented by the guiding principle that every person has a right to a clean and healthy environment and can seek redress through the High Court if this right has been, is likely to be or is being contravened.

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

#### **Relevance**

This project has been categorised under Medium Risk Projects in the Second Schedule of the Environmental Management and Coordination (Amendment) Act 2015, which requires for the project to be subjected to an ESIA prior to its implementation.

The following regulations under EMCA are also relevant to the proposed project;

#### **(a) Environmental (Impact Assessment and Audit Regulations) 2003 and (Amendment) Regulations, 2016**

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

#### **Relevance**

This report has been compiled in compliance with the above regulations. LSWSB will also be expected to carry out Environmental audit of the project during the construction stage and annually thereafter the completion of the project. The project is expected to get clearance from NEMA before commencement.

#### **(b) The Environmental Management and Co-ordination (Water Quality) Regulations, 2006.**

The Regulations provides for sustainable management of water resources including prevention of water pollution and protection of water sources (lakes, rivers, streams, springs, wells and other water sources). It is an offence under Regulation No. 4 (2), for any person to throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution.

Regulation No. 11 further makes it an offence for any person to discharge or apply any poison, toxic, noxious or obstructing matter, radioactive waste or other pollutants or permit the dumping or discharge of such matter into the aquatic environment unless such discharge, poison, toxic, noxious or obstructing matter, radioactive waste or pollutant complies with the standards for effluent discharge into the environment.



## Relevance

During the construction, operation and maintenance phases of the project, there may be waste water and other liquid waste generated from oil spills, machine cleaning and vehicles among other sources. Rivers Mokong and Taito are the primary receptor for such waste due to run off, the contractor should therefore comply to all the requirements of this regulation. During the site visit, it was also observed that there were tea plantations around the proposed extraction points at the river including along the riparian. When the crops are sprayed with chemicals and fertilisers, these end up in the river as surface runoff. Proof of this is the eutrophication that was observed in Taito stream.

These regulations must be observed and implemented by the responsible authority in order to ensure that the quality of water to be abstracted is up to standard for human consumption.

### (c) **The Environmental Management and Co-ordination (Waste Management) Regulations, 2006**

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

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

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

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

- i. Improvement of production process through
  - Conserving raw materials and energy;
  - Eliminating the use of toxic raw materials and wastes; and
  - Reducing toxic emissions and wastes.
- ii. Monitoring the product cycle from beginning to end by
  - Identifying and eliminating potential negative impacts of the product;
  - Enabling the recovery and re-use of the product where possible, and
  - Reclamation and recycling; and
  - Incorporating environmental concerns in the design and disposal of a product.

Regulation 6 requires waste generators to segregate waste by separating hazardous waste from non-hazardous waste for appropriate disposal. Regulation 15 prohibits any industry from discharging or disposing of any untreated waste in any state into the environment. Regulation 17 (1) makes it an offence for any person to engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment license issued by NEMA.

### **Relevance**

The proposed project, during construction phase will generate wastes such as soil debris, cement bags, plastic containers, vehicles spare parts, stripped off vegetation and any other waste which will need to be disposed as per the guidelines in the regulations.

#### **(d) The Environmental Management and Coordination Act (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009**

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

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

According to regulation 3 (1), no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

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

### **Relevance**

Noise and vibrations are expected during the construction phase of the project when the boreholes are being drilled as well as when the excavation is on-going. The contractor /sub-contractor for civil works will be required to ensure compliance with the above regulations in order to promote a healthy and safe working environment throughout the construction phase. This shall include regular inspection and maintenance of equipment and prohibition of unnecessary hooting of vehicles.

#### **(e) Environmental Management and Coordination (Air Quality) Regulations, 2014**

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

### **Relevance**

The emissions generated from construction activities (such as running vehicle and equipment engines) have the potential of polluting the immediate atmospheric environment. Vegetation clearing, earthworks and bulk delivery of construction material, if unmanaged may result in generation of dust. Thus, need for strict adherence to these Regulations and standards therein in preventing possible pollutants and managing sources.

### **3.3.3 Water Act, 2016**

The Water Act No. 43 of 2016 was assented to on 20th September 2016 and repealed the Water Act 2002. The enactment of this law aimed at aligning national water management and water services provision with the requirements of the Constitution of Kenya 2010 particularly on the clauses devolving water and sanitation services to the county governments.

The Water Act 2016 provides for the management, conservation, use and control of water resources and for acquisition and regulation of rights to use water; to provide for the regulation and management of water supply and sewerage services.

Section 11. (l) states the establishment of the Water Resources Authority (WRA) whose function in section 12 (d) include; to receive water permit applications for water abstraction, water use and recharge and determine, issue, vary water permits; and enforce the conditions of those permits.

Section 143 of the Act makes it an offence an offence to obstruct, interfere with, divert or obstruct water from any watercourse or any water resource, or negligently allow any such obstruction, interference, diversion or abstraction. It also prohibits anyone to throw or convey or cause or permit to be thrown or conveyed, any rubbish, dirt, refuse, effluent, trade waste or other offensive or unwholesome matter or thing into or near to water resource in such a manner as to cause, or be likely to cause, pollution of the water resource.

According to the Water Resources management Rules (2007), Fifth schedule Part A Water use activities that require approval by authority (d) Diversion of a water course, ANY PERSON shall obtain approval from the Authority to undertake the activity: In addition Part II-approval, authorisation and permits (2) no water works approval, authorization and permit shall be issued or renewed for the purposes of supplying water for domestic, public, commercial or industrial use within the limits of supply of a water service provider without the applicant having received consent of the licensed water service provider for the area.

### **Relevance**

The Nandi Hills water supply and sanitation project will abstract water from River Mokong and Taito stream. Before abstraction of water, there must be approval, authorization and issuance of a permit. The proponent shall therefore apply for an abstraction permit from WRA in line with this law.

In accordance to WRA water allocation guidelines, for streams and rivers, the Reserve Quantity shall not be less than the flow value that is exceeded 95% of the time as measured by a naturalised flow duration curve at any point along the water course.

### **3.3.4 The Lands Act, 2012 No. 6 of 2012**

Part II Section 8 provides guidelines on management of public land by National Land Commission (NLC) on behalf of both National and County Governments. This law in Section 8(b) stipulates that the Commission shall evaluate all parcels of public land based on land capability classification, land resources mapping consideration, overall potential for use, and resource evaluation data for land use planning.

Section 8(d) stipulates that the Commission may require the land to be used for specified purposes subject to such conditions, covenants, encumbrances or reservations as are specified in the relevant order or other instrument. In managing public land, the Commission is further required in Section 10(1) to prescribe guidelines for the management of public land by all public agencies, statutory bodies and state corporations in actual occupation or use.

In these guidelines, management priorities and operational principles for the management of public land resources for identified uses shall be stated. This in essence means that the Commission shall take appropriate action to maintain public land. As well the Commission shall identify ecologically sensitive areas that are within public lands and demarcate or take any other justified action on those areas and act to prevent environmental degradation and climate change.

Section 9 (d) it states that community land may be converted to either private or public land in accordance with the law relating to community land enacted pursuant to Article 63(5) of the Constitution. (3) Any substantial transaction involving the conversion of public land to private land shall require approval by the National Assembly or county assembly as the case may be.

Section 110 (1) of the Act provides that land may be acquired compulsorily if the Commission certifies, in writing, that the land is required for public purposes or in the public interest as related to and necessary for fulfilment of the stated public purpose.

In such an acquisition, this Act, in section 111(1) provides that just compensation shall be paid promptly in full to all persons whose interests in the land have been determined. The procedure for land acquisition is laid out in Part VIII of the Act.

#### **Relevance**

This part of the law seeks to preserve and direct management of fragile public land held by the various public bodies for sustainable development. CRVWSB and the contractor will therefore be required to ensure protection of any sensitive habitats and endangered species that have been identified.

### **3.3.5 Climate Change Act, 2016**

This is an Act of Parliament to provide for a regulatory framework for enhanced response to climate change, to provide for mechanism and measures to achieve low carbon climate development, and for connected purposes.

One of the main goals of this act is to enhance energy conservation, efficiency and use of renewable energy in industrial, commercial, transport, domestic and other uses;

#### **Relevance**

During construction, the vehicles and machines to be used may contribute to additional GHG emissions.

### **3.3.6 The Public Health Act (Cap. 242)**

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

#### **The Public Health (Drainage and Latrine) Rules**

Rule 85 provides that every owner or occupier of every workshop, workplace or other premises where persons are employed shall provide proper and sufficient latrines for use by employees.

Rule 87 requires every contractor, builder or other person employing workmen for the demolition, construction, reconstruction or alteration of any building or other work in any way connected with building to provide in approved position sufficient and convenient temporary latrines for use by such workmen.

Rule 91 provides that no person shall construct a latrine in connection with a building other than a water closet or a urinal, where any part of the site of such building is within 200 feet of a sewer belonging to the local authority which is at a suitable level, and where there is sufficient water supply.

#### **Relevance**

The contractor for civil works will be required to construct toilets for use by workers and visitors to the site during the construction phase of the proposed project. Sufficient latrines will

also be required should there be any staff quarters within the site. During operation, the project is expected not to cause any public nuisance to the public.

### **3.3.7 The County Governments Act, 2012**

The County Governments Act of 2012 repealed the Local Government Act.

Section 110 (2) provides for a spatial development framework for the county that indicates;

- Where public and private land development and infrastructure investment should take place;
- Desired patterns of land use within the county,
- address the spatial construction or reconstruction of the county;
- Sets out basic guidelines for a land use management system in the county taking into account any guidelines, regulations or laws as provided under Article 67 (2) of the Constitution;
- contains a strategic assessment of the environmental impact of the spatial development framework;
- Identify programs and projects for the development of land within the county

Section 114 of this act, sub sections (1) and (2) require that a project of national significance in a County be preceded by mandatory public hearings for approval. In addition, Section 115, sub section (1) Public participation in the county planning processes shall be mandatory and be facilitated through the mechanism stated under this section.

#### **Relevance**

The proposed development should be in line with the county spatial development framework in section 110 (2) as well as allow for public participation prior to implementation. This ESIA provides a platform for public participation. CRVWWDA should work in liaison with County Government of Nandi to ensure compliance with land use requirements within the County.

### **3.3.8 Physical Planning Act, 2019**

This is the main Act that governs land planning and all proposed developments must be approved by the respective local authority and certificate of compliance issued accordingly.

Under the Act, the director of physical planning advises the commissioner of lands on land alienation issues that fall under Lands Act. The director also advises the commissioner of lands and local authorities on land use, sub-division and or amalgamation of land; prepares regional and local physical development plans.

At the County level, the Act has established the County Physical and Land Use Planning Consultative Forum chaired by the County Executive Committee Member responsible for matters related to physical and land use planning. One of the major functions of the consultative forum is to determine development applications for change of user or sub-division of land that could have significant impact on adjacent land and or breach registered conditions in a given title deed; and also, industrial location which could have negative impact on the environment and adjoining land.

#### **Relevance**

CRVWWDA will be required to discuss its development plans with the Nandi County Physical Planning Officers and seek the requisite approvals. For control of future development around the site, the County government shall enforce this law to ensure compatible land uses only are allowed near the water works.

Similarly, any temporary contractor's facilities like camps will require development approval from the Nandi County government.

### 3.3.9 Urban Areas and Cities (Amendment) Act, 2019

This is an Act of Parliament that gives effect to article 184 of the Constitution, to provide for:

- the classification, governance and management of Urban Areas and Cities;
- the criteria of establishing urban areas; and
- the principle of governance and participation of residents and the related purposes.

Section V of the Act on Integrated Development Planning requires that every city and municipality established under this act shall operate within the framework of integrated development planning.

The second schedule of the Act outlines the rights and participation by residents in affairs of their city or Urban areas.

#### Relevance

As water supply is a problem in the project area, the project through this ESIA study collected views of the residents and incorporate them in the designs where feasible, to solve the water shortage problem.

### 3.3.10 Employment Act

This is an Act of parliament that applies to all employees employed by any employer under a contract of service. The Act came in operation in June 2008. Employment of children in the following forms is prohibited in the following sections of the Act:

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

56. (1) *No person shall employ a child who has not attained the age of thirteen years whether gainfully or otherwise in any undertaking.*

(2) *A child of between thirteen years of age and sixteen years of age may be employed to perform light work which is*

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

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

#### Relevance

CRVWVDA and the contractor will need to understand all the requirements of the Act during employment such as ensuring that employees are of the right age, entitlement to leave, protection from discrimination and sexual harassment among others.

### 3.3.11 Work Injury Benefits Act (WIBA)

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

- Employer's liability for compensation for death or incapacity resulting from accident;
- Compensation in fatal cases;
- Compensation in case of permanent partial incapacity;
- Compensation in case of temporary incapacity;
- Persons entitled to compensation and methods of calculating the earnings;
- No compensation shall be payable under this Act in respect of any incapacity or death resulting from a deliberate self-injury; and
- Notice of an accident, causing injury to a workman, of such a nature as would entitle him for compensation shall be given in the prescribed form to the director.

## **Relevance**

The contractor and CRVWWDA will be required to comply with all the provisions of the Act throughout the project cycle such as management of hazards, forming health and safety committees and reporting all the accidents and near misses. They will also be required to accord injured persons their dues in terms of shouldering the medical expenses or compensation of the families should there be loss of life.

### **3.3.12 The Occupational Safety and Health Act, 2007**

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

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

Section 44. (1) Before any person occupies or uses any premises as a workplace, he shall apply for the registration of the premises.

Section 95. Every occupier shall provide and maintain so as to be readily accessible, a first-aid box or cupboard of the prescribed standard.

The Occupational Safety and Health Act 2007 (OSHA 2007) Kenya Gazette Supplement No. 111 (Acts No.15) dated October 26, 2007 revokes the Factories and Other Places of Work Cap.514.

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

## **Relevance**

The contractor and CRVWWDA will be required to comply with all the provisions of the Act throughout the project cycle such as registering the construction site as place of work, management of hazards, forming health and safety committees and reporting all the accidents and near misses and provision of First-Aid kits as necessary.

### **3.3.13 Environment and Land Court Act, 2012**

The Court is established under section 4 of the Environment and Land Court Act No. 19 of 2011. It has the jurisdiction to hear any other dispute relating to environment and land. The jurisdiction of the court is provided under section 13 of the Act. The Court has original and appellate jurisdiction to hear and determine all disputes in accordance with Article 162(2)(b) of the Constitution and with the provisions of the Act or any other written law relating to environment and land. The court is also empowered to hear cases relating to public, private and community land and contracts, choses in action or other instruments granting any enforceable interests in land.

## **Relevance**

In matters relating to land and environmental disputes that may arise between and the local community or county government during requisite private land acquisition and environmental management for the development of local material sites. The court has powers to deal with such disputes relating to land administration and management. Nonetheless, alternative grievance resolution mechanisms are also encouraged.

### **3.3.14 Wildlife Conservation and Management Act, 2013**

The act established the Kenya Wildlife Service (KWS). The main objective of this service is to ensure that wildlife is managed and conserved so as to yield to the Nation in general and to individual areas in particular, optimum returns in terms of cultural, aesthetic and scientific gains as well as such economic gains as are incidental to proper wildlife management and conservation

#### **Relevance**

Contractor shall be responsible for conserving the indigenous flora within the project area. They shall ensure when the land modified but not needed for permanent works is reinstated back to its original condition as far as feasible, the indigenous trees are replanted for their conservation.

### **3.3.15 Forest Conservation and Management Act, 2016**

Various legislative forest reforms have taken place over the years that culminated in the repeal of the Forest Act 385, the enactment of the Forest Act, 2005 which established the Kenya Forest Service as a Semi-Autonomous State Corporation in 2007, and the now newly formed Forest Conservation and Management Act, 2016 (FCM Act, 2016).

The main purpose of the Act is to give effect to Article 69 of the Constitution of Kenya with regard to forest resources; provides for the development and sustainable management, including conservation and rational utilization of all forest resources for the socio-economic development of the country and other connected purposes.

#### **Relevance**

The water intake site is abounding with different tree species which should be protected and not be cut down beyond the project site boundaries as guided by this Act. Works to be undertaken on land under KFS management shall also be required to seek approval in line with this Act.

### **3.3.16 The Penal Code, Cap 63**

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

In addition, section 193 Any person who makes loud noises or offensive or unwholesome smells in a place so as to annoy any considerable number of persons in the exercise of their common rights commits an offence and is liable to be punished as for a common nuisance.

#### **Relevance**

The contractor and proponent will be required to ensure strict adherence to the Environmental Management Plan throughout the project cycle in order to mitigate any possible negative impact associated with dust, noise, and effluent discharge that might likely affect the public.

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## **3.4 Regulatory Framework**

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In 2001, the Government established the administrative structures to implement the Environmental Management and Co-ordination Act 1999. The main administrative structures are described in the following sections.



### **3.4.1 County Environment Committee**

The County Environment Committee is responsible for environmental management at the County level through preparation of County environment action plans for consideration and adoption by the respective County Assemblies.

#### **Relevance**

CRVWWDA should ensure that the project abides by the set County environment action plan for Nandi County.

### **3.4.2 County Government of Nandi**

The Fourth Schedule of the Constitution of Kenya 2010 Part 2 (3) provides for devolved environmental functions to be undertaken by the County Governments and includes; control of air pollution, noise pollution, and other public nuisances.

In addition to development approvals, the county government has some jurisdiction of environmental management including waste management, drainage, noise permit issuance, and enforcing public health act.

### **3.4.3 The National Environment Management Authority**

The responsibility of the National Environment Management Authority (NEMA) is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment.

In addition to NEMA, the Act provides for the establishment and enforcement of environmental quality standards to be set by the Cabinet Secretary in consultation with the Authority, which will govern the discharge, limits to the environment by the proposed project.

#### **Relevance**

NEMA must approve the project before implementation and also participates in subsequent stages of construction environmental management and annual audits review.

### **3.4.4 Water Resource Authority (WRA)**

WRA is responsible for regulation of water resources issues such as water allocation, source protection and conservation, water quality management and pollution control and international waters. Its roles and responsibilities are as follows:

- Planning, management, protection and conservation of water resources;
- Planning, allocation, apportionment, assessment and monitoring of water resources;
- Issuance of water permits;
- Water rights and enforcement of permit conditions;
- Regulation of conservation and abstraction structures;
- Catchment's and water quality management;
- Regulation and control of water use; and
- Coordination of the Integrated Water Resource Management (IWRM) Plan.

#### **Relevance**

The contractor will be required to consult WRA for the best source of water for construction. They will also be required to apply for a permit to abstract water as well as adhere to the rules and regulations stipulated by WRA.

The WRA is responsible for protection, conservation and management of the riparian areas. It is their mandate to ensure that there are WRUAs in place to actively manage the water resource. They are also required to ensure quality management of the water that comes in as surface runoff from the tea farms surrounding the water abstraction points.

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### 3.5 International Guidelines

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The African Development Bank's environmental policy framework is strongly anchored in the concept of sustainable development. This concept defines sustainability as *"development that meets the needs of the present without compromising the needs of the future"*.

The AfDB's Operational Safeguards (OS) include:

**OS 1: Environmental and Social Assessment.** This OS governs the process of determining a project's environmental and social category and the resulting Environmental and Social Assessment requirements. The requirements cover the scope of application, categorization, use of Strategic Environmental and Social Assessment (SESA) and Environmental and Social Impact Assessment (ESIA) where appropriate, Environmental and Social Management Plans, climate-change vulnerability, public consultation, community impacts, treatment of vulnerable groups, including indigenous peoples, and grievance procedures.

#### Relevance

Implementation of the project is required to take place within AfDB policy framework on the best practices when it comes to ensuring that the project does not destabilize the riverine aquatic ecosystem, affect downstream users or degrade the environment.

**OS 2: Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation.** This OS consolidates the Bank policy on involuntary resettlement and incorporates a number of refinements designed to improve their operational effectiveness. In particular, the OS embraces comprehensive and forward-looking notions of livelihood and assets, to account for their social and cultural dimensions, as well as their economic ones. It also adopts a progressive understanding of community and common property that emphasizes the crucial need to maintain social cohesion, community structures and the social inter-linkages that common property provides.

#### Relevance

Although the project is proposed to be done along an existing road reserve as well as the riparian land, acquisition of private land for construction of the rising mains may be triggered. The private land along the riparian land may also be temporarily acquired during construction. In the case that this is triggered, the acquisition should be done on a willing buyer and willing seller basis. As such, the OS 2 should be applied through consulting affected persons to ensure that they receive a commensurate compensation to package of their loss of land and other assets therein that will restore their livelihood and living standards, income earning capacity and production levels.

**OS 3: Biodiversity, renewable resources and Ecosystem Services.** This OS translates the policy commitments in the Bank policy on integrated water resources management into operational requirements and also reflects the objectives of the Convention on Biological Diversity to preserve biological diversity and promote the sustainable use of natural resources. It reflects the importance of biodiversity in the African continent and the value to the population of key ecosystems. Its content has benefited from recent joint work among the MDBs to improve their approach to assessing how the potential impacts of projects on different types of habitats can be avoided, minimized or offset.

## Relevance

During the construction phase of the project, the contractor will be forced to clear vegetation in order to excavate. The location of the treatment plant is within land belonging to KFS. The vegetation in the project area is mainly indigenous and should be conserved. Precaution is thus required in line with this standard to ensure biodiversity is preserved.

**OS 4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource Efficiency.** This OS covers the range of key pollution, waste and hazardous materials impacts for which there are agreed international conventions as well as comprehensive industry-specific standards that are followed by other MDBs and financial institutions that have adopted the Equator Principles. It also introduces a GHG emission threshold for projects to trigger a detailed analysis of feasible reduction or offset measures and reporting on emission levels. Borrowers or clients are required to consider measures to improve resource efficiency.

## Relevance

The contractor will be required to observe the above convention in all its operations throughout the project cycle in reducing emission of Greenhouse Gasses and proper management of the in treatment of the effluent before being released into the environment.

**OS 5: Labour Conditions, Health and Safety.** This OS aligns the Bank requirements for its borrowers or clients with the range of ILO conventions concerning workers' conditions, rights - and protection from abuse or exploitation. It covers working conditions, workers' organizations, avoidance of child or forced labour and occupational health and safety.

## Relevance

The contractor will need to abide by all the provisions of the standard in maintaining safe working environment for the employees, in addition to this, the contractor will have to establish as health and safety policy to be approved the DOSHS that will guide the construction activities.

## 4 DESCRIPTION OF THE BASELINE ENVIRONMENT

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### 4.1 Physical Environment

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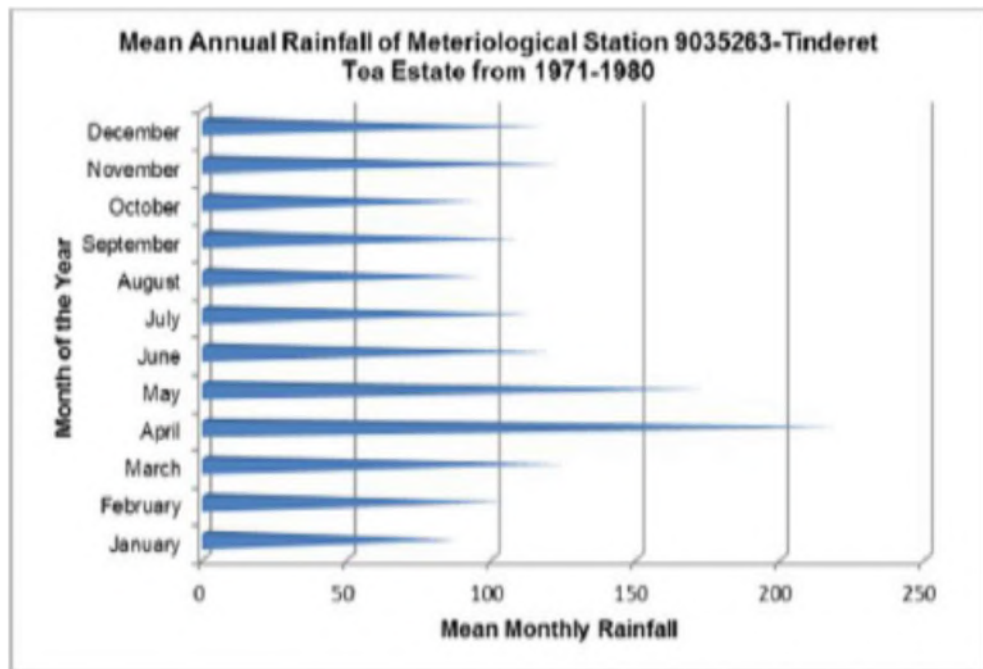
#### 4.1.1 Climate

The climate is determined by the equatorial low-pressure belt known as the Inter Tropical Convergence Zone (ITCZ) and it is situated between two pressure belts produced in the north and south hemispheres. According to the exaltations of the pressure system following the earth position in relation to the sun, the weather associated with the (ITCZ) will produce one rainy season in the tropics, and two rainy seasons under the equator

##### (a) Rainfall

Nandi Hills experiences a bi-modal type of rainfall pattern with average annual rainfall of 1482mm. Long rains occur between March and August with the highest rainfall being recorded in April and July. The short rains fall between September and November. The dry season occurs from January to March. Figure 4-1 shows the mean annual rainfall figures as captured in Tinderet Tea Estates.

**Figure 4-1: Mean Annual Rainfall of Tinderet Tea Estate from 1971-1980**



##### (b) Temperature

Nandi Hills experiences a cool and wet climate for the year with mean temperatures of 18.3 degrees Celsius. The highest temperature is 25 degrees Celsius in February while the lowest is 10 degrees Celsius in August.

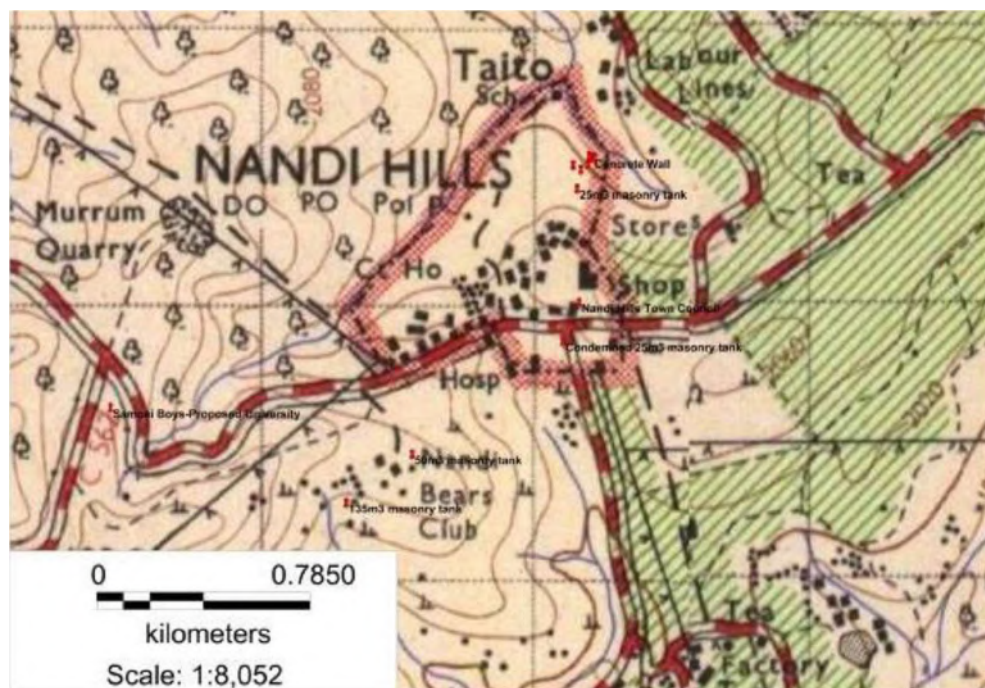
##### (c) Winds

The area has a moderate wind pattern. Winds are gentle and blow from north east to south west for most of the year with a peak in February.

### 4.1.2 Topography

Nandi Hills lies in an area characterized by undulating hills which are flat-topped ridges. This influences the direction and pattern of growth and means of communication within the town. It has an altitude of above 2000m above sea level. Several ravines e.g. Bondeni River drain the town. The ravines have perennial streams that carry large quantities of water during the rainy season.

Figure 4-2: Topographical map of Nandi Hills



### 4.1.3 Geology and Hydrogeology

The Geology of Nandi Hills is covered by Geological Report No. 63: -Geology of Kapsabet Plateau. Arising from above, Nandi Hills is covered by undifferentiated volcanic rocks, mainly metabasalts.

### 4.1.4 Hydrology

#### (a) General

The proposed improvement of Nandi Hills Water Supply situation was through seeking potential of abstracting water (1540 m<sup>3</sup>/day) from Mokong River for Water Supply. The second proposed approach was to extract 1242 m<sup>3</sup>/day from Taito dam from through rehabilitation and expansion of existing Taito Water Supply Scheme.

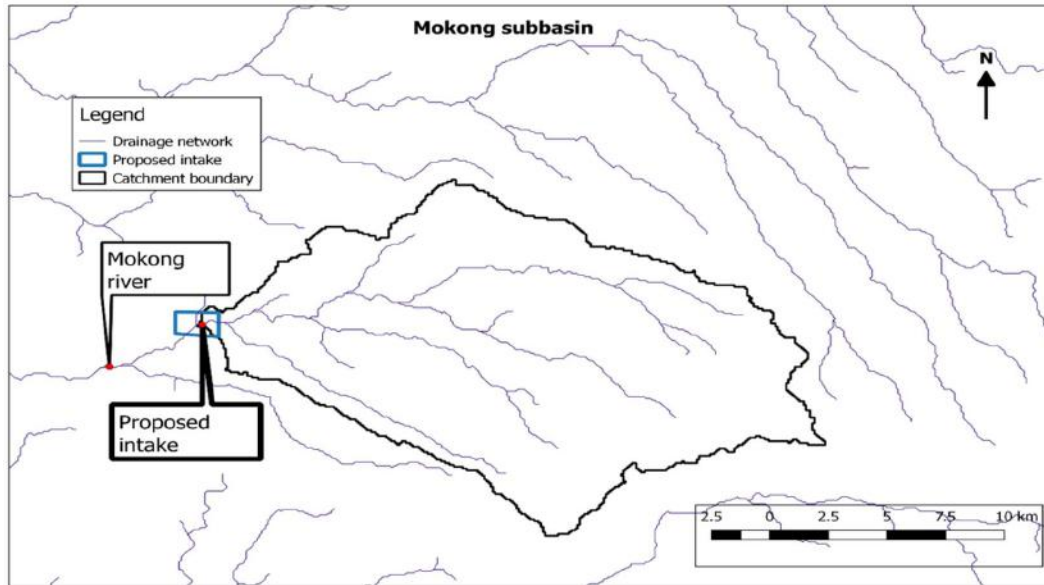
#### ***Mokong River***

Mokong river sub-basin is located in Nandi Hills and the network drains an area of about 260 sq.km commanded by the river gauging station ID 1FD 02. The source is in North Tinderet area where lot of tea farming is practiced. The preliminary report indicated that 2002.2 m<sup>3</sup>/day and 4004 m<sup>3</sup>/day is the average low flow in Mokong River and maximum flow respectively. Rainfall characteristics varies by year, season and by month. The catchment plays a key role on the river in terms of river morphology, sediment loading, flow regime and evapotranspiration. The spatial position of the sub-basin is shown in Figure 4-3 and the general characteristics are summarized in Table 4-1.

**Table 4-1: Summary of general characteristics of Mokong sub-basin**

Description	Characteristics/parameter
Catchment area	260 km <sup>2</sup>
General slope	0.029
Longest flow path	25.56 km
Time of concentration	5.9 hrs
Land-use/Land-cover	Forests, Peri-urban, cropped area, grasslands and farmlands

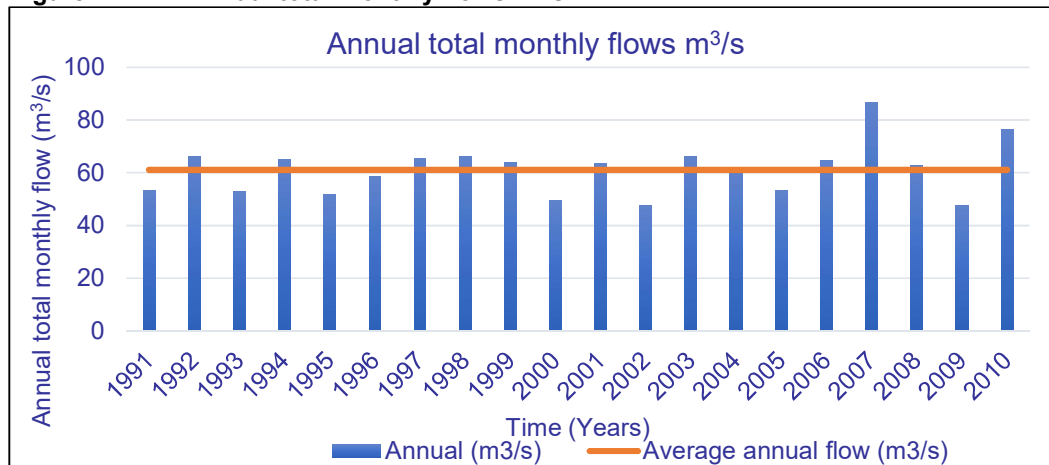
**Figure 4-3: Mokong sub-basin river network**



**(b) Stream flow**

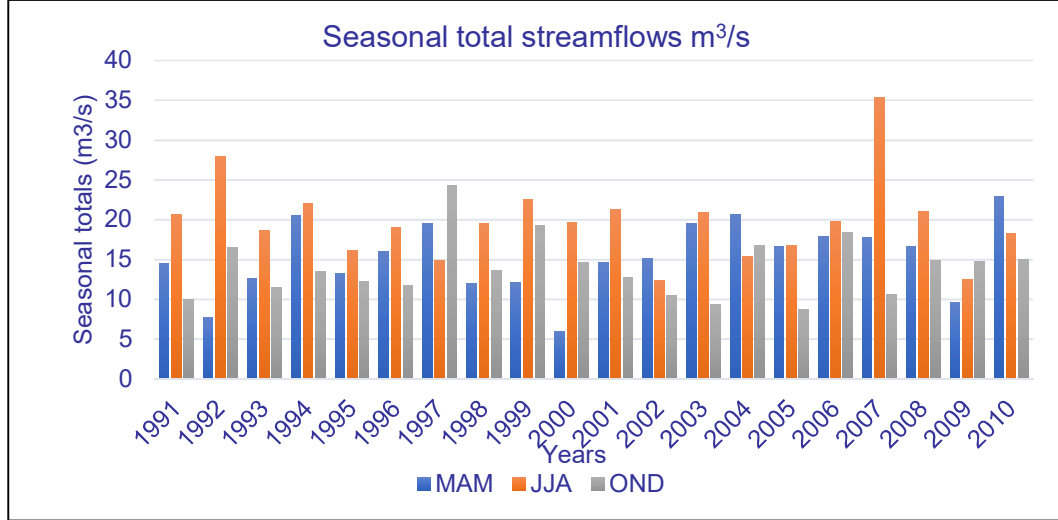
Project hydrological analysis has been based on Monthly stream flow data for period 1991-2010 and the extended period 2020-2040 obtained from National Water Master Plan Report by JICA (JICA & MOWI, 2013). The second stream flow record for the gauging station IFD 02 for the period 1986-2014 was collected from Water Resources Authority (WRA) though it had lot of monthly and annually missing data and finally was considered unreliable for analysis. From the analysis, the annual total monthly stream flows and total monthly stream flows were established as follows.

**Figure 4-4: Annual total monthly flows m<sup>3</sup>/s**



Annual total monthly flows show a temporal increment and most of the flows between 2001 and 2010 are above average. This indicates that the rainfall falling into the catchment is translating into runoff faster than the previous decade. Thus, the groundwater which is a water balance component may be at risk since the infiltration time is reducing and the rainfall-runoff lag time is also reducing significantly. To promote long-term groundwater availability and recharge, rehabilitation of previously pristine environment is recommended. The base flow contributes a good percentage into river flow during the dry period and thus enhancing infiltration will be a common good.

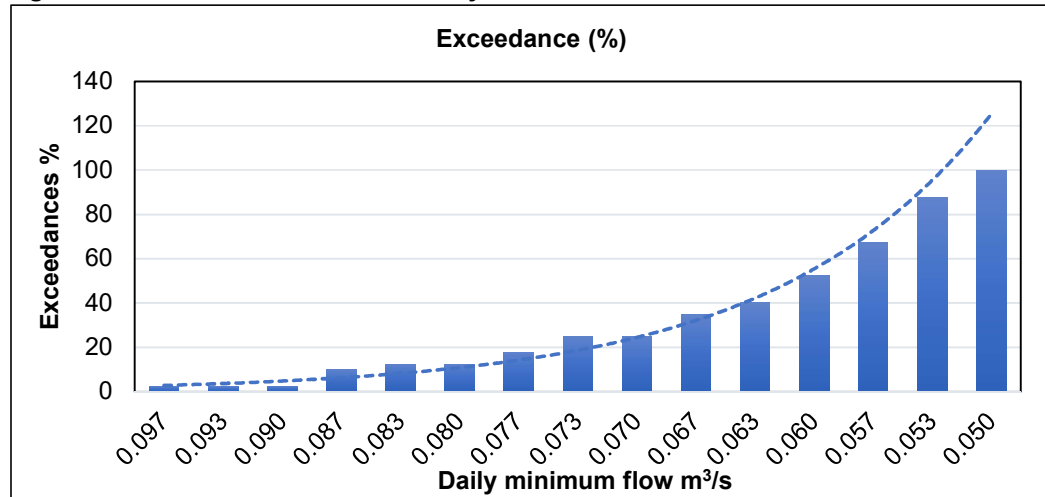
**Figure 4-5: Seasonal total stream flow m<sup>3</sup>/s**



The total stream flow for the month of June July and August is the high flow season while the October, November and December are the low flow season. In future, water can be stored by the start of March, April and May through JJA season and can significantly supply the demand during the recession period of October, November and December.

Results from analysis of minimum flows indicate that, 0.050 m<sup>3</sup>/s per day is available at 100 exceedances while 0.097 m<sup>3</sup>/s per day is available at 2.5% exceedance.

**Figure 4-6: Exceedances of the daily minimum flows**



The minimum daily flow of 0.05096 m<sup>3</sup>/s is exceeded at 96% while a maximum daily flow of 0.0967 m<sup>3</sup>/s is exceeded at 2.5%. The minimum flow at Q96 translates to 4402 m<sup>3</sup>/day and by encouraging more infiltration in the recharge zones, groundwater will also serve as a

sustainable water source to meet extra demands that may arise in the future. A Summary of minimum stream flow at different exceedances is shown in Tables 4-2.

**Table 4-2: Minimum stream flow characteristics**

Parameter	Flow (m <sup>3</sup> /s)	Flow (m <sup>3</sup> /day)
Q98	0.0505	4365.62
Q96	0.05096	4,402.94
<b>Q95</b>	<b>0.0512</b>	<b>4,423.68</b>
Q50	0.06066	5241.02
Q2.5	0.0967	8354.88

### **Taito Dam**

Taito dam is located about 0.5 km from Nandi hills . It was designed to carry 7500 m<sup>3</sup> of water but due to land-use/land-cover change activities in the neighbourhood areas, this capacity has reduced due to sedimentation. The source of Taito dam is a spring which sprouts from the groundwater. Sustainability of the groundwater depends on flow velocities of runoff, rate of infiltration and most importantly the land covers.

**Figure 4-7: Location of Taito dam**



Due to the lack of hydrological data for analysis of Taito stream, the sustainability of ground water was analysed based on land-use/land-cover changes from Landsat imagery and use of remote sensing to determine extent of conversion of pristine vegetation covers into agricultural land between 1995 and 2018. The results indicate that, there is intensification in agriculture in Taito area, a point which indicates that accelerated sediment loading into the Taito dam is inevitable if no proper measures are put in place. This occurrence reduces the percolation rates which eventually reduce amount of water flowing into the Taito dam.

### **(c) Water quality**

Water sampling and analysis through the Water Resources Authority (WRA) was conducted to obtain baseline conditions of Taito River and Mokong River. Authenticated analysis results are included in the appendix. Table 4-3 gives a summary of the river water analysis of Taito stream. The sampled river was within NEMA's water quality limits for domestic water sources, as well as KEBS and WHO standards. In addition, the water samples tested negative for Schistosomiasis (bilharziasis), a major parasitic disease responsible for bilharzia. From the water quality results, Taito stream is recommended as a water source for supply to the local population.



Biological analysis of Mokong River however revealed the presence of E. coli (4/100 ml), a bacterial pathogen that can cause serious disease, such as urinary tract infections, bacteraemia and meningitis. A limited number of enteropathogenic strains of E. coli can cause acute diarrhoea. Nevertheless, disinfection of the water source can inactivate the pathogen. Hence, it is recommended that disinfection through chlorination be applied prior to distribution of the drinking water to local population.

**Table 4-3: Water quality analysis of Taito stream**

Parameter	Unit	Results	NEMA standards	KEBS standards	WHO standards
PH	pH scale	7.0	6.5-8.5	6.5-8.5	6.5-8.5
Colour	Mg/Pt/l	0	-	15	15
Turbidity	N.T. U	2.28	-	5	5
Conductivity (25oC)	µS/cm	140	-	-	2500
Calcium	mg/l	13.8	-	150	100
Magnesium	mg/l	2.79	-	100	100
Total hardness	mgCaCO3/l	46	-	300	500
Total Alkalinity	mgCaCO3/l	72	-	-	500
Chloride	mg/l	10	-	250	250
Fluoride	mg/l	0.1	1.5	1.5	1.5
Nitrate	mgNO3/l	0.3	10	44	44
Nitrite	mgNO2/l	0	0.5	0.003	0.1
Orthosphates	mg/l	0.6	-	2	2
Total Dissolved Solids	mg/l	105	1200	1000	1500
Ammonium	mg/l	0	-	0	0
Sulphates	mg/l	10	-	400	450
Iron	mg/l	0.08	-	-	0.3
Manganese	mg/l	0	-	-	0.5
Total coliforms	No./100 ml	4	-		
E. coli	No./100 ml	0	Nil		
Bilharzia	No./100 ml	0	-		

#### 4.1.5 Physical Infrastructure

The County is served with tarmac roads from Eldoret through Nandi Hills to Kisumu and Kericho. Other tarmac roads in the District include Nandi Hills -Lessos, Kipsigak-Shamakhokho and Nandi Hills- Maraba. These roads enable the transportation of Agricultural produce from Nandi East to various Market destinations.

The major weakness that exists in the county include: poor state of the rural access roads, the lagged topography which does not favour mechanized agriculture and lack of modern housing facilities for workers. The rural access roads which serve the agricultural farm land of the District are in very poor state, making most of the perishable farm produce to go waste before they reach the market.

The County is served with a private airstrip at Kapchorua tea estate. It is the feeling of the locals that a public airstrip should established at Nandi Hills.

## 4.2 Biological Environment

### 4.2.1 Flora

The catchment area in general used to be highly vegetated with indigenous trees being a characteristic feature of the landscape. This has since changed with time. The trees have been cut down and used for charcoal production among other uses. On the other hand, the

land including the riparian has gradually been transformed into farmland leading to heavy siltation.

There are also tea plantations surrounding both the Mokong River and the Taito stream. Due to the close proximity to the rivers there is a very high likelihood of chemical contamination through surface runoff from these farms. At it is, The Taito Stream experiences high eutrophication as is made evident by the presence of algae on the water surface this has the potential to interfere with the quality of water being abstracted for consumption.

#### 4.2.2 Fauna

Due to developed human settlements and farming land uses, there are no wild fauna in the project area.

Dairy and beef cattle are the main form of livestock bred in the area. Others are poultry, goats, pigs, sheep, and bees. The main fishing activities are fish farming which are done mainly on individual fish farms or as a group activity. The main type of fish produced is African Cat Fish and Tilapia.

During the site visit, some locals were observed fishing on the Mokong River. It was reported that fishing on this river happens on a small scale for subsistence by some of the area locals. We also observed zero grazing of dairy cattle in Kosoiwo location.

Some of the site observations are captured in the photo log presented in Appendix II

### 4.3 Socio Economic Environment

#### 4.3.1 Administrative and political units

Nandi Hills Sub County is part of the larger Nandi County which is made up of six constituencies that double as sub- counties, and 11 Divisions, 30 wards and a total of 99 locations and 299 sub-locations. Nandi Hills Sub-County has a total of 34 locations and 105 sub-locations. Table 4-4 below shows the area and administrative units of Nandi Hills Sub-County within Nandi County.

**Table 4-4: Administrative unit and area (Km<sup>2</sup>)**

County	Sub-County/Constituency	Area (sq. km)	No. of Wards
Nandi	Mosop	601	7
	Chesumei	472	5
	Nandi Hills	432	4
	Emgwen	269	4
	Aldai	458	6
	Tinderet	553	4
<b>Total</b>		2,785	30

Source: Nandi County Integrated Development Plan (2018-2022)

### 4.3.2 Population

According to the Nandi Hills County Integrated Development Plan (2013-2017), the population for Nandi Hills urban area was projected as 8,929 in year 2017. It currently has a population of about 7,000 people. The Town has been growing at an average rate of 3.80% p.a. from 1979 to 2009. As per 2009 Census, Nandi Hills Sub-County recorded a total population of 122,459 people with 28,371 households. The population density is low with most people being mostly concentrated in the developed area (old town), Mchanganyiko area, and areas of Chebarus immediately bordering the old town. There are pockets on the tea estates.

In Nandi Hills division where the study area is located had a population of 12,754 people with household 3,660. The project area covers four (4) sub-locations of Nandi Hills, Kapng'etuny and Kipsamoo.

**Table 4-5: Population distribution of Nandi Hills**

<b>Core Urban</b>			
Male	Female	Total	Male/Female
3,484	3,484	6,968	1
<b>Peri-Urban</b>			
Male	Female	Total	Male/Female
1661	<b>1491</b>	<b>3,152</b>	<b>1.114017438</b>
<b>Rural Areas</b>			
Male	Female	Total	Male/Female
32,854	30,652	63,506	1.071838705
<b>Total</b>			
Male	Female	Total	Male/Female
37,999	35,627	73,626	1.066578718

Source: Nandi County Integrated Development Plan (2013-2017)

### 4.3.3 Employment and Other Sources of Income

The Labour Force (15 – 64 Years): This group of population accounts for 52.7percent of the total population standing at 418,823 persons in 2012 and is projected to reach 495,767 by the end of 2017. This implies the county has to create more employment opportunities to absorb those joining the labour force per year. Once the project commences it will be of great importance to ensure that skilled and unskilled opportunities from, locals be prioritized and an onion strategy be adopted in recruitment of the locals. There is a total of 296,249 self-employed people in the county according to the 2009 Kenya Population and Housing Census. Males form the large proportion of this where there is a total of 162,599 who are in involved in micro, small and medium enterprises.

### 4.3.4 Education and institutional facilities

Nandi Hills township as a whole has a number of education facilities which include 10 primary and 2 secondary schools. The project area has 3 primary schools and 1 secondary school. One primary school namely, Greenvale is privately run while the only secondary (Koitalel Arap Samoei) school is public. Each primary school currently runs an ECD unit in accordance with the Ministry of Education requirements. With respect to levels of education, 45% of the population have attained post-secondary education while 54% have either no education or have attained up-to primary level of education.

### 4.3.5 Health Care

The residents of Nandi Hills rely mainly on medical facilities in Nandi Hills District hospital. There are no other Health Care facilities within the near reach of the centre. Considering the current and envisaged population of the centre and the vastness of the township, the area needs two additional health centres and three dispensaries.

#### 4.3.6 Public health

The most common diseases are malaria, upper respiratory tract infections, skin diseases, and diarrhoea and urinary tract infections. The first three are common to all age groups while diarrhoea cases are commonly reported amongst children less than five years of age. The urinary tract infection is common among the age groups from 13 years and above. The period with the highest cases of outpatient cases is between March and October, which is the time when the area experiences heavy rains during which mosquitoes and other disease-causing agents thrive.

#### 4.3.7 Sanitation

As per Nandi Hills Township Local Physical Development Plan, the town relies mainly on pit latrines for disposal of human wastes. This poses a threat to the nearest rivers and the ground water sources. The quality of the Pit latrines varies from one family to the other due to economic status per family. The field visit revealed that most of the people adopt pit latrine because of lack of adequate water for flushing system. A total of 60 per cent of the County households use pit latrines in comparison to 40 per cent who use the flush toilets and mostly in the urban centres. There is no single solid waste disposal and management facility in the entire county which has led to non-conventional ways of waste disposal like dumping of garbage in rivers and streams and bush toilets. Access to piped water is limited to Towns where households are connected to the main water supply.

#### 4.3.8 Economic activity

The major economic activity in the district is tea farming, with large farms owned by multinational companies. The tea is mainly grown in Nandi Hills and Tindiret Divisions. In Lessos division, there is mixed farming which includes dairy farming and crop production mainly maize. There is also sugarcane farming in the lower sides of the Nandi Escarpment, cattle rearing and mixed crop farming. The Sub-County has a potential to produce a surplus of diverse crops such as horticulture, pyrethrum, fruits and potatoes owing to adequate reliable rainfall through the year.

The area under plantation agriculture accounts for approximately 50% of the entire township and about 90% of town's population depends directly and indirectly on agriculture. Subsistence farming is practiced mainly in Chebarus and *Mchanganyiko*. The main crops are maize, potatoes, vegetables alongside dairy farming. Small scale tea plantations also exist. The average farm size in Chebarus area is two hectares while in *Mchanganyiko* is one hectare. Average earnings from agriculture are approximately KES. 2,500 per month.

#### 4.3.9 Water Supply System

Nandi County also faces the challenge of inadequate clean and safe water. The level of the County's household access to potable water is still very low as compared to the UN standards which require that each person is entitled to between 20-50 liters of water a day. The county has only 33,932 of households with access to piped water and 3,765 with access to portable water; springs are the main source of water. This is despite the fact that the county is considered water rich with rainfall throughout the year and also many accessible streams.

This untreated water sources exposes people to the risk of contracting various water borne diseases. Most of the County populace depends on water sourced from rivers, shallow wells and roof catchments.

In order to ensure that quality water supply is brought closer to the community, there is need for construction of water dams and treatment plants to harness the waters available and reduce water related morbidity.

The design project undertook a baseline assessment on water supply and sanitation of the Lake Victoria basin. Nandi Hills is one of the areas within the basin. The situation shows that the improved water supply in the area only ranges between 39 – 54% (Figure 3). This was one of the reasons for the selection of Nandi Hills to be included in this project.

#### 4.3.10 Water Consumption and Level of Service

In Nandi County households with access to clean and safe water to drink are about 22% of the total number of households by using the piped water statistics. However, the county is termed as water endowed and this means that the county should invest in provision of piped water to the residents.

At present, the level of service is low, however it's expected that people will get better service in future due to governmental policy which lead to development in this side. Besides that, the water consumption is expected to increase with time due to development in standard of living of the people. The current average water consumption is estimated at 50 Lpcd. The summary of level of service, production capacity and Non-Revenue Water (NRW) is shown in Table 4-6 below.

**Table 4-6: Water Consumption and Level of Service, 2015**

Item	Nandi Hills Water Supply
Average Water Consumption, Lpcd	50
Production Capacity, m <sup>3</sup> /day	7,500
Average daily Production, m <sup>3</sup> /day	240

**Source:** NYANAS Water Company

## 5 ASSESSMENT OF ALTERNATIVES

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### 5.1 No Project Alternative

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This option will leave the town to be served by Taito Stream whose treatment plant is in a wanting state and needs rehabilitation. It also does not have the capacity of meeting the present water demand which stands at 1,600m<sup>3</sup>/day against the average supply of 480m<sup>3</sup>/day.

Without the project, the environmental situation will neither improve nor can we say that it will necessarily deteriorate. Development of the project on the other hand will improve water provision to the communities living within Nandi Hills town and its environs. The no-project option will however lead to the following (general) major negative and long-term impacts:

- The targeted populations (for water provision) will continue to face acute water shortage and rationing;
- Increased exposure to health risks (water borne diseases);
- Stagnating growth of the town and County at large;
- Environmental degradation; and
- There will be loss of productivity and reduced ability to create wealth.

This scenario is thus not acceptable on either social or environmental grounds.

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### 5.2 Alternative Intake Sources

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#### 5.2.1 Other intake sources

Assessment was conducted on the following potential alternative rivers for water sources:

- Mogobich River, which has a catchment of about 17km<sup>2</sup> with a minimum river flow of 1,215.62m<sup>3</sup>/day and a maximum of 3,062 m<sup>3</sup>/day. The River is located about 20km to the west of Nandi Hills Forest. The location of the river means longer transmission line besides pumping which raises the cost of every single litre at the tap significantly.
- Kibabet Stream, which has a catchment of about 23km<sup>2</sup> with a minimum river flow of 1,644.66m<sup>3</sup>/day and a maximum of 4,140m<sup>3</sup>/day. This river is far away from the town so it will have longer transmission lines and pumping raising the cost significantly.; and
- Kapsombeiwa River, which has a catchment of about 24km<sup>2</sup> with a minimum river flow of 1,716.16m<sup>3</sup>/day and a maximum of 4,320 m<sup>3</sup>/day.

In addition, these sources were found unable to meet the required minimum abstraction amount of 2000m<sup>3</sup>/day as compared to Mokong River which has a catchment of about 26km<sup>2</sup> with a minimum river flow of 4320m<sup>3</sup>/day and a maximum of 8355m<sup>3</sup>/day.

#### 5.2.2 Keben - Lessos Dam

The proposed Lessos-Keben dam was designed in 2014 by Agricom Consultants Ltd in association with Integrated Partnership Consultants Ltd for Lake Victoria North Water Works Development Agency (formerly Lake Victoria North Water Services Board). The dam water supply project is designed to serve over sixty per cent of residents of Nandi County mainly Nandi and Kapsabet towns including the surrounding neighborhoods and those along the distribution lines. However, in 5 March 2019, as reported by the Daily Nation Newspaper, Kenya's Parliament ordered the project including other 23 dam projects across the country be stopped until due diligence is done on their viability and how land owners will be compensated. The proposed Lessos-Keben Dam is situated in Northern Tinderet Forest, Eastern catchment of Mau Ranges in Nandi County. The dam is located on the Mogobich

River which is a tributary of Mokong River with an estimated catchment area of 14km<sup>2</sup>. The dam location Coordinates are (UTM 36N, Arc 1960); Easting :76058.78, Northing:14687.23 at an altitude of 2340m. The proposed dam is intended to supply water for irrigation for Lessos/Kebe area, Water supply in Kapsabet and Nandi Hills towns and 8 No Rural locations in Nandi County.

Water balance and availability using the Kebe-Lessos dam are represented in Table 5-1 below.

**Table 5-1: Water balance and availability using the Kebe-Lessos dam**

S/No	Description	Water Demand (Million Cubic Meters)		
		Year 2018 (initial)	Year 2028 (future)	Year 2038 (ultimate)
	<b>Dam Capacity</b>	<b>6.47</b>	<b>6.47</b>	<b>6.47</b>
1	Irrigation Water for 500 ha (1250) acres)	2.85	2.85	2.85
	<b>Available water after Irrigation phase 1</b>	<b>3.62</b>	<b>3.62</b>	<b>3.62</b>
2	Domestic Water Supply to Kapsabet Town	0.27	0.39	0.56
3	Domestic Water Supply to Nandi hills Town	0.13	0.19	0.27
4	Domestic Water Supply to 8 target rural locations (Communities)	0.41	0.59	0.86
	<b>Domestic Water Demand</b>	<b>0.81</b>	<b>1.17</b>	<b>1.69</b>
	<b>Surplus</b>	<b>2.81</b>	<b>2.45</b>	<b>1.93</b>

As per the 24 February 2020 news release of planned projects by Lake Victoria North Water Works Development Agency, the project is proposed to be procured under Finance Design and Build model. The process of procurement is at an advanced stage and the Commercial Contract is currently with the National Treasury at a cost of KES 7.7 Billion for approval of financing agreement.

The Kebe-Lessos dam water supply project shall supply 740m<sup>3</sup>/day that shall be available in 2021, which is only 1 year after our initial year of 2020. This cannot be relied on for the immediate needs of Nandi Hills town and its environs.

### 5.2.3 Groundwater

The Preliminary Design Report has noted that there are two existing boreholes located in the Tea Estate with an average yield of 10m<sup>3</sup>/hr each. However, the Final Detailed Design has not proposed groundwater development for water supply for Nandi Hills Town. Groundwater will therefore not be considered as an alternative water supply source during this study.

## 6 PUBLIC CONSULTATION AND DISCLOSURE

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### 6.1 General

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Public consultation is useful for gathering environmental data, understanding likely impacts, determining community and individual preferences, selecting project alternatives, and designing viable and sustainable mitigation plans.

The Constitution of Kenya (2010) makes Consultation and Public Participation (CPP) a central part of governance. CPP is also a mandatory procedure as stipulated by EMCA 1999 Section 58, on ESIA for achieving the fundamental principles of sustainable development.

Public consultation in the ESIA process is undertaken during the project design, implementation, and initial operation. The aim is to disseminate information to interested and affected parties (stakeholders), solicit their views, and consult on sensitive issues.

Inadequate public consultation can result in significant information gaps, which could mislead environmental planners undertaking an environmental assessment. Lack of attention to communication and consultation processes can generate individual, community, or regional opposition to a project. This can ultimately be a cause of substantial delays, increased costs, and unsatisfactory compromise solutions, which could have been avoided through earlier consultation.

Participation is a process through which different stakeholders influence and share their views regarding development initiatives and the decisions and resources that affect them.

#### 6.1.1 Objectives of the Public consultation program

The overall objective of the consultations process was to disseminate project information to the project effected people and members of the community and to provide a feedback mechanism from these stakeholders to inform the environmental and social assessment of the project with feedback to be incorporated in the overall project planning and management processes. The specific objectives of the consultations were to;

- Comply with EMCA's regulations on public consultation of primary and secondary stakeholders to obtain their views and concerns on expected impacts of the project both socially and environmentally;
- Provide clear and accurate information about the project to the public;
- Obtain the main concerns and perceptions of the population and their representatives regarding the project;
- Obtain opinions and suggestions directly from the affected communities on their preferred mitigation measures;
- To reduce conflict through the early identification of contentious issues; and
- Identify local leaders with whom further dialogue can be continued in subsequent stages of the project.

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### 6.2 Public Consultations and Feedback on Original Design

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Earlier in 2016, a public meeting had been held by the Preliminary Design Consultant (CAS Consultants Ltd) to inform the locals of the proposed project. The purpose for such a process was to identify the positive and negative impacts and subsequently promote and mitigate them respectively. It also helped in identifying any other miscellaneous issues which may bring conflicts in case project implementation proceeded as planned. Table -1 below shows the schedule of the public meetings that were held. Minutes and attendance list for the meetings are attached in Appendix III.



**Table 6-1: Public baraza schedule at preliminary design stage**

Date	Time	Venue
27/4/2016	11:00Hrs	Kosoiywo Market
27/4/2016	14:00Hrs	Kipsamo Primary School
28/4/2016	14:00Hrs	Kipsebwo Primary School

The following is the summary of views, comments, suggestions obtained and discussions had during public *barazas* consultations held:

#### **6.2.1 Shortage of water**

Community members reported that scarcity of water was a serious challenge in the area. They were optimistic that the need to improve the water supply through augmentation of existing water supplies in Nandi Hills town by rehabilitating and expanding the water supply system will complement the existing water sources and reduce traveling distances to water points. They requested that the capacity of the existing supply system be increased in order to meet their demand.

#### **6.2.2 Empowerment of women and children**

The community members informed the EIA team that women and children will be the greatest beneficiaries of the project as they are the ones tasked with the duty of fetching water. Consequently, time wasted in search for water will be used for other constructive activities. Additionally, the danger posed to women and children during the search for water will greatly reduce. They requested for water provision to be available for learning institutions: primary, secondary schools for most of them do not have water.

#### **6.2.3 Trunk pipe laying**

For pipe laying routes the community is willing to provide way, they didn't see this as an issue to block them from accessing clean potable water. However, land acquisition shall be taken for the water intake and rising main at Mokong River.

#### **6.2.4 Water Kiosks**

Because not all are able to pay for own access, people in informal settlements of Kisoywo settlement requested accessible water kiosks especially in the settlement and even markets.

#### **6.2.5 Employment opportunities**

This is a key benefit of any project that host communities can gain from a proposed project. They thus expressed the need for the proponent to observe the following with regard to employment. Those responsible for project implementation ensure that youth from the area are given priority in recruiting labour force. They were emphatic especially on the recruitment of manual labour. While recruiting employees during the operation phase there is need to consider local population skilled in various skills and adopt the onion recruitment strategy.

#### **6.2.6 Future information flow**

To avert unnecessary conflicts, there is need for prompt communication to all stakeholders. This could be through the use of the local administration and other such for a. Any information or clarification about stakeholders' position on project need to be promptly availed to any interested party.

### **6.2.7 Speed of Action**

The public requested that the time to undertake the project should be hastened because water deficit in the area is very high.

### **6.2.8 Implementation**

Given the immense benefits that the proposed project will produce, the community members urged the proponent to hasten so that the community can start benefitting from it. Those living in towns are especially very keen on the sanitation aspect.

### **6.2.9 Negative impacts**

The community also expressed concerns related to undesirable impacts from the proposal. These varied from location to location and were greatly a function of the socio-economic characteristics of the location.

### **6.2.10 Displacement and Disruption of Activities**

The concern is that laying transmission lines and tanks may displace some of the residents from their plots, businesses or lose crops. This would also affect their land activities such as farming crops and trees to create way for pipe laying. The EIA team explained that upon approval of final designs by LVSWWDA, Resettlement Action Plan shall be undertaken. However, the consultants also encouraged the community to allow distribution lines to run in their farms so as to ensure more penetration of piped water in the area.

### **6.2.11 Manual labour**

As much as is practically possible, machinery should not be used where manual labour can be used to increase employment opportunities for the community.

### **6.2.12 Awareness of the project**

From the respondents, project awareness was at 55%, depicting that the most respondents were not aware of the proposed project. CRVWWDA should undertake more sensitization in the community to gain more project support and ownership.

### **6.2.13 Project acceptance and support**

There was support for the proposed project. This was as a result of clear explanation of what is proposed and the way forward in the implementation process. The community understood that the project is feasible in all aspects. In addition, the project will spur growth in the area. The local administration indicated that it and the entire community would support the project as long as it promoted development in the area. The community has no objections for the project since there are similar projects in other parts of the country that have benefitted the residents. In addition, the fact that access to water and decent sanitation is aright enshrined in Constitution of Kenya increases support for the proposal. The community thus embraces the project which will go a long way in making this right a reality.

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## **6.3 Initial stakeholder engagement on original design**

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From the initial stakeholder consultations held in 2016, a summary of the comment from the different stakeholders were documented in table 6-2 below.

**Table 6-2: Summary of comments from stakeholder consultation**

No.	Name and Position	Comments
1.	Mr. Anthony Kiboi, Ag.- Managing Director Kapsabet Nandi Water & Sanitation Company	<ul style="list-style-type: none"> <li>The manager acknowledged that Nandi hills town is water deficient, the town has grown and still relies on colonial water supply system.</li> <li>The water supply in Nandi hills town is paid on a flat rate depending on the kind of consumers accessing the service</li> <li>The water users are willing to pay for improved service;</li> <li>There is need for sanitation service alongside provision of clean water.</li> </ul>
2.	Daniel Ruto Nandi Hills Sub county Administrator	<ul style="list-style-type: none"> <li>Nandi Hills town has an existing dam, Taito which needs rehabilitation to serve the people.</li> <li>Nandi Hills water supply system needs improved production</li> <li>Additional water from Mokong river is a good to supplement Taito dam</li> <li>Proposed project highly accepted and supported by all stakeholders and county government of Nandi.</li> </ul>
3.	Francis Mwaura and Leonard Sub-County Water Officer	<ul style="list-style-type: none"> <li>The Nandi Hills water supply system is below capacity and can't meet demand for the ever-increasing town population</li> <li>He proposed the water tanks to be located at Samoei High school so as to also serve the institution and gravitate the water to Kipsamoo, Kapngetuny and Kipsebwo locations.</li> </ul>
4.	Philemon Busienei - County Director of Water, Nandi.	<ul style="list-style-type: none"> <li>The officer was in support of the project;</li> <li>He had reservation on the elevation of Mokong river as it will require multi stage pumping;</li> <li>The water quality on Mokong is more turbid and the intake should have been further upstream so as to reduce the costs of pumping and treatment;</li> <li>Most of the household do direct river abstraction of water, with a few making the water safe.</li> <li>In terms of Sanitation, pit latrines are the majorly used with a few septic systems in Nandi Hills town and a small exhauster serving the town which he feel may be overwhelmed once there is more supply volumes in the area.</li> </ul>

Consultation records are attached as Appendix III of this report.

## 6.4 Stakeholders Engagement on Revised Design

Following revision and update of the preliminary design under the current consultancy services by GIBB Africa, additional stakeholder engagements were conducted in order to update the consultations held earlier.

### 6.4.1 Consultation with key stakeholders

The following stakeholders were identified to be key in the project. One on one interviews were conducted with them during the preliminary site visit as indicated in Table 6-3. Notes of the meetings held with them are attached as an Appendix to this report.

**Table 6-3: Stakeholders consulted during the site visits**

Stakeholder	Type		Date of Consultation
Primary Stakeholders	Project Proponent	Lake Victoria South Water Works Development Agency and Rift Valley Water Works Development Agency	Met earlier by project Engineers.
	Project Affected Persons	KFS. The proposed new treatment Plant is cited at KFS land.	5 June 2018
		George Mutahi Educational Centre	14 June 2018
		Nandi Hill Residents	
Secondary Stakeholders	Nandi County Government	Nandi County Executive Committee Member in charge of Lands, Environment and Natural Resources	20 February 2018
		Nandi County Environmental Director	20 February 2018
		Nandi County Physical Planning Officer	20 February 2018
	Kapsabet Nandi Water and Sewerage Company Ltd.	Managing Director	20 February 2018
		Technical Manager	20 February 2018
		Commercial Manager	20 February 2018
	NEMA County officer	Nandi County	20 February 2018
	Officer in Charge	Nandi Hills Water Treatment Plant	19 February 2018
	WRA	WRA Regional Office (In charge of the intake sources i.e. Taito Stream and Mokong River.)	6 June 2018
	Local Administration	DCC Nandi Hills Chiefs in charge of the following locations: <ul style="list-style-type: none"> <li>• Nandi Hills;</li> <li>• Kipsebwa;</li> <li>• Kosoiywo; and</li> <li>• Kaplelemet.</li> </ul>	5 June 2018

#### 6.4.2 Public meetings

Two public meetings were conducted in Kosoiywo and Kaplelemet locations in order to explain the project and its effects to community as well as to obtain the views of the community on the proposed project. The schedule of the meetings was as scheduled below.

Location	Date	Venue
Kosoiywo	12/06/2018	Kosoiywo Polytechnic
Kaplelemet	13/06/2018	George Mutai Educational Centre



These public meetings were scheduled in consultations with the local administration and the project proponent (CRVWDA LVWDA). The members of public targeted at this meeting were those who reside along the intake source, along the rising main lines and at the new proposed water storage tank. They were identified as those who would likely to be affected by the project especially in terms of land take.

Typically, the agenda for the consultations was:

- Presentation of the proposed project;
- Obtaining from the respondents their environmental and socio-economic concerns, and perceptions as well as suggestions/comments regarding the proposed project.

These public consultations were documented and the records of consultation are presented within this report. See Appendices II and IV. The records include the date and location of the consultation meetings, list of attendees and their contact addresses and finally summarized minutes. These records are supported by photographs. Notice for the meeting including the venue and the time were communicated to the public and other concerned parties two weeks prior to the meeting.

## 6.5 Issues Arising from The Stakeholder and Public Consultations

The issue response matrix in Table 6-4 below summarises the issues raised by various stakeholders and how they have been incorporated in the ESIA study and the Conceptual design development.

**Table 6-4: Issue Response Matrix**

Feedback	Incorporation into designs and ESIA report
Pollution of current Taito stream water intake from neighboring Nandi Tea Estate.	One of the roles and responsibilities of WRA is catchment and water quality management. From consultation held with them they assured the study team that they would engage the Tea Estate management in order to come up with a solution on how the pollutants from the estates can be prevented from getting into Taito Stream.

<b>Feedback</b>	<b>Incorporation into designs and ESIA report</b>
Need for water kiosks to be used by residents who are located away from the proposed distribution lines.	The design budget has provided for 4 No water Kiosks. The Contractor will work with the stakeholders in locating the sites for the water kiosks.
The current Mokong River Riparian has been encroached and a lot of Eucalyptus tree planting is ongoing around the riparian. These trees have been known to consume a lot of water and they threaten the quantities of water in the river/will lead to drying up of the river.	During the ESIA study, WRA officers were consulted and requested to work hand in hand with Kapsabet Nandi Water and Sewerage Company Ltd. in order to maintain the river riparian so that the water levels will not go down as a result of human activities along the Mokong River Riparian.
Need to plan for alternative sources of power to be used in the pump stations since the electricity bills are very high as compared to the water bill collections by Kapsabet Nandi Water and Sewerage Company Ltd.	The engineer's budget has factored in contingency which will be used for such items. The stakeholders were also for the idea of instead of providing generators, they can provide solar panels which are much cheaper and convenient in terms of maintenance.
Abstraction at the intakes (Taito stream and Mokong River) should not interfere with the water users downstream.	In consultation with WRA, the Engineers have allowed for 30% flow of the river at the intake sites so as not to interfere with water flow for use by downstream users.
Absence of sewerage system in the county may lead to pollution of the water supply infrastructure	The project has catered for ablution blocks as described in Section 2.5.5 of this report. In addition, recommendation will be made for Kapsabet Nandi Water and Sewerage Company Ltd to consider feasibility study for design and development of water borne sewer system.
Employment opportunities that will be attracted by the project should benefit the locals.	The locals shall be given first priority when it comes to employment opportunities. Only skilled labour shall be outsourced where need be.
Lack of security fence and walls around the water treatment and supply facilities.	The project rehabilitation process will include fencing and securing of the treatment plants and the tanks.

Additional consultations were done at the project report preparation phase of the project. Findings from the consultation with the WRA officer for Nandi Hills County are summarised below.

<b>Issue</b>	<b>Comments and responses to issues raised</b>
Proposed water abstraction project	There is no objection. This project will be the major abstractor
Maintenance of the riparian	Currently, the residents living along the river are planting of Eucalyptus along the riparian land. Riparian management is the responsibility of the WRA through the assistance of the WRUAs.

Issue	Comments and responses to issues raised
	<p>The WRUA is yet to be formed.</p> <p><b><u>Response</u></b></p> <p>WRUAs will take care of the eucalyptus issue after sensitization. Once functional, the WRUA members will sensitize the community on uprooting the eucalyptus and advised to plant the water friendly trees e.g. <i>Grevillea</i> after the sensitization, it is anticipated that the community will then remove the trees at their own volition.</p> <p>There is a high sedimentation load in the river due to encroachment on the riparian land for farming and horticulture. During the field study, it was observed that there were trees and tea bushes planted along the riparian.</p> <p><b><u>Response</u></b></p> <p>The WRUAs are also in charge of demarcating the riparian land (6 m away from the water source) as well as sensitizing the water users on the importance of conservation of the riparian.</p> <p>The riparian acts as a buffer between the cultivated land and the water source</p>
Ensuring acceptable Water Quality	<p>There are several tea farms around the area that may be discharging their waste into the Mokong river. The Tea farms belong to EPK their discharge is usually municipal waste. It's discharged into the river but on the lower side</p> <p>There is presence of residual fertilizers from tea farms surrounding the water treatment plant. These fluctuate depending on seasons but highest during planting season When the riparian is maintained, the chemicals washed off from the crops will seep into the ground before reaching the water.</p> <p><b><u>Recommendations</u></b></p> <p>Consider full chemical treatment due to presence of residual fertilizers. Ensure to apply the full water treatment: Flocculation, Sedimentation, Filtration, Chlorination</p> <p>Water quality should be monitored on quarterly basis to ensure that the standard for water consumption is maintained.</p>
Maintaining the water supply during low flow seasons	<p>The flow of Mokong fluctuates from season to season. This may lead to reduction of available water for abstraction and for use downstream.</p> <p><b><u>Recommendations</u></b></p> <p>Have some storage to capture and store excess water during flooding so that during low flow there is enough water to be supplied</p>
Lack of an existing WRUA	<p>There is no existing WRUA in the area. The members of the WRUAs are supposed to be the farmers along the riparian. After formation of the WRUA by the WRA, the members should be trained to carry out the management of the riparian on behalf of the WRA.</p> <p>Once formed, the WRUAs will enforce the rules. The WRA targeted to form WRUAs in the region but they faced resource and time constraints.</p>

Issue	Comments and responses to issues raised
	<p><b><u>Recommendations</u></b></p> <p>WRUAs should be formed in order to help manage the riparian</p>

Findings from the consultation with the KFS officer for Nandi Hills town are summarised below.

Issue	Stakeholder consulted	Comments and responses Issues raised
Permission to use land belonging to KFS.	Mr. Omondi Benedict Head watershed management KFS Headquarters in Kamae forest	<p>Since the proposed water treatment plant for water abstracted from Mokong river is on land belonging to KFS., there are some procedures to be followed before using the land.</p> <p><b><u>Recommendation</u></b></p> <ul style="list-style-type: none"> <li>The client is required to write a letter to KFS, through Ecosystem Conservator, to get authority to access the forest. The letter should be addressed to the Chief Conservator of the forest.</li> </ul>
The procedure of acquiring the permit	Head of Conservancy North Rift Chief Conservator of KFS	<p>The following is the procedure to follow in order to obtain a permit from KFS.</p> <ul style="list-style-type: none"> <li>The Chief conservator of KFS should attach his/her brief notes on the letter to talk about his/her views on how the proposed project will affect the forest.</li> <li>If abstracting water from the forest consent is required, including annual charge for way-leave and one-off payment for water easement.</li> </ul>
	Sub-County forest officer- Nandi East Sub-County	<p><b><u>Comments directed to the stakeholder. (Sub-County forest officer- Nandi East Sub-County)</u></b></p> <p>The officer should do the following:</p> <ul style="list-style-type: none"> <li>Write her comments on the project in regards to impacts on the forest. This is to be attached to the letter requesting for access.</li> <li>to give a detailed description of the area to be occupied or affected.</li> <li>The Ecosystem Conservator's office will then check the details of the project area affecting the forest. They will then compare the details against the KFS general orders and advice accordingly.</li> <li>Advice to be sent to head office who will then issue the instructions to the office on the ground.</li> </ul>
Comments on the proposed project in relation to the proposed site	KFS Officer:	<p>The site for the proposed water treatment plant for Mokong river floods during rains. Depending on the design, this might therefore affect the operation of the treatment plant</p> <p><i>The design has incorporated adequate provision for local site drainage.</i></p>



Issue	Stakeholder consulted	Comments and responses Issues raised
		Excavation during construction will lead to destruction of biodiversity. This is however temporary and reversible since the vegetation cover will come back naturally. Tree harvesting in the catchment in general is not done sustainably.  <b><u>Recommendation</u></b> <ul style="list-style-type: none"> <li>Open areas to be planted with bamboo and ornamental plants.</li> </ul>
Benefits of the project		<ul style="list-style-type: none"> <li>It will benefit the nursery – currently they want a generator to pump water to the nursery.</li> <li>The staff and officials will be beneficiaries of the water supply.</li> <li>Support for the project. It benefits the community.</li> </ul>

### 6.5.1 Feedback from additional public meetings

Additional comments obtained from the public meetings conducted during the report preparation phase. They have been summarised in the issue response matrix below.

**Table 6-5: Issue response matrix for the public meeting at Kipsebwo**

Topics/ Issue	Comments/ Questions/ Issues	Responses
Capacity of resources and distribution of water	<ul style="list-style-type: none"> <li>Residents from Kipsebwo village asked how they would get water since the distribution lines were not passing in their location. The residents requested that the design should consider inclusion of residents of Kipsebwo and its environs in the water distribution networks.</li> </ul>	Water will be directed from the rising mains to a water kiosk from where water will be sold to the members of the community.
Water scarcity	It was reported that Kosoiwo secondary and primary schools have 200 and 500 students respectively. With the water scarcity in the area, the school currently uses donkeys to transport water from the river and other available sources. This is very costly to the school.	
Promises and Delivery of the project	The women in the area need water since they are the ones who are most affected by the scarcity. Will this project be the same as the previous promises? In the past, promises have been made to the members of this community about supplying water to their community and yet they have never come to pass. They need clarification and assurance that the water will be delivered.	

Topics/ Issue	Comments/ Questions/ Issues	Responses
Compensation	The project should consider aspect of environment and the community members should be compensated in the case that they are their land is used during the project leading to their assets being affected.	The rising mains is proposed to pass along the designated road reserve. In case of land acquisition, the affected land owners will be compensated.
Location and security issues	Will there be a dam at the water abstraction point? If so, how secure is the surrounding community?  Kipsebwo has 3 schools& a polytechnic -they have a site for tank construction	There will be no dam and therefore the community is not under any occupational safety threat  Kipsewo primary has already been identified as the site where the storage tank will be situated.

**Table 6-6: Issue response matrix for the public meeting at Kaplelmet location**

Topics/Issue	Comments/ Questions/ Issues	Responses
Feasibility study and commencement of the project	<ul style="list-style-type: none"> <li>• When will the project start?</li> <li>• Have studies been conducted to establish the population it can serve?</li> <li>• Have you identified the schools that the project will benefit?</li> </ul>	Feasibility studies for the area, including population size and water demand, have been conducted. This formed the basis for the proposed project design as well as the proposed volumes of water to be abstracted.
Wayleave and Compensation	<ul style="list-style-type: none"> <li>• Will the distribution pipes pass through homes? Will there be compensation?</li> <li>• Will we be able to use our land after pipes have been laid or will there be restrictions?</li> <li>• What types of pipes are proposed? Plastic or others since the pipes can be affected if trees are planted on it (roots). Will there be compensation for the pipes?</li> <li>• In case of destruction of property, will they be compensated?</li> <li>• Will there be compensation where the water is abstracted from?</li> </ul>	Most of the pipes will be along existing roads. In case of land acquisition, the affected land owners will be compensated.
Distribution and access to water	<ul style="list-style-type: none"> <li>• Will there be another tank other than that in George Mutai?</li> </ul>	No. The design has proposed only one distribution tank at George Mutai Educational Centre.
	<ul style="list-style-type: none"> <li>• In Kipsamo, there is no dedicated tank for water distribution. The population is very large. There are schools and slums, eg, Samoei Center, Samoei Primary and Secondary schools, Kipsamo primary school, Slums (Kosoywa)</li> </ul> <p>The area residents proposed that that there be an additional tank and distribution lines.</p>	Distribution lines will serve Kipsamo and Samoei Secondary School and Centre.

Topics/Issue	Comments/ Questions/ Issues	Responses
	<ul style="list-style-type: none"> <li>• Keteng has a population of about 3000 people who rely on borehole water from Chemomi tea factory. There is a Health Centre, dispensary, shops, schools and 6 churches. They are using motorbikes and donkeys to fetch water from which is about 5-7 km way. Kinolowok also does not have water.</li> <li>• The area residents proposed that Keteng should also have a tank at Ketbarak. This will flow to Keteng.</li> </ul>	The final design has adopted Ketbarak as the reservoir area to avoid need for land acquisition at George Mutai memorial center.
	<ul style="list-style-type: none"> <li>• Will the people from Ketbarak get water? They are on the highest point therefore if water is supplied to a point lower than them they will miss out. Is it possible to pump the water to Ketbarak first then later distribute? The residents also proposed the alternative of boosting water from George Mutai to pump it to Ketbarak?</li> </ul>	
	<ul style="list-style-type: none"> <li>• For those who the pipe passes through their land, are they allowed to tap water before it gets to the storage tank?</li> </ul>	That is not allowed since it is illegal to divert water from the rising mains. However, there shall be community water points from where the water can be accessed by the members of the community.
Access to water	<ul style="list-style-type: none"> <li>• Kimolonik is a hardship area. There are other sources of water but there are no tanks or distribution pipes. Can you assist us to get water?</li> <li>• We rely on rain water or use donkeys to fetch water from the rivers. For a school, getting water requires about three trips to the river to fetch water. It is expensive on the school.</li> <li>• There was no mention of water supply to Keteng from the district hospital records, people from this location are leading in typhoid, amoeba etc. they rely on water from the boreholes.</li> </ul>	
Water costs	<ul style="list-style-type: none"> <li>• Who will bear the cost of the meter connection; the government or the consumers?</li> <li>• The connection there should not be too expensive that we may not be able to access.</li> </ul>	The consumers will bear the cost of connecting the water meters to their residents.
Opportunities,	<ul style="list-style-type: none"> <li>• During the project construction, will</li> </ul>	As much as practical, the

Topics/Issue	Comments/ Questions/ Issues	Responses
employment during implementation of project	<p>we be employed? What skills set will be required and will we get jobs to manage the water?</p> <p>The residents recommended that Employ the idle youth for casual work, security for the project tanks, maintaining the line, pump attendants, meter readers.</p>	contractor will be required to employ local area residents who are qualified.
Use of water	<ul style="list-style-type: none"> <li>Other than domestic use, can we use the water for irrigation, aquatic irrigation or horticulture?</li> </ul>	As long as the resident is paying for the water connection, the water use is not restricted.
Awareness creation and Environmental conservation	<ul style="list-style-type: none"> <li>Can AfDB assist the local community (CBOs) to get seedlings to protect the water springs or to take advantage of water springs?</li> </ul>	

## 6.6 Future Consultations

After collection of public views on the proposed water supply and sanitation development, the Proponent will be required to set the ground for future consultations with key stakeholders and the general public with respect to identification of location of the 3 No. ablution blocks and 4 No. water kiosks proposed in the town. The following methods could be used to gather information from and continuously engage the various community members and other stakeholder groups:

- Key Informant Interviews;
- Focus Group Discussions (FGDs);
- Public meetings (*barazas*); and
- Roundtable meetings.

CRVWWDA and LVSWWDA should maintain consultation records including attendance registers, signed minutes, sample photographs for meetings, mails etc.

### 6.6.1 Public availability of documents

Subject to the existing legal framework, relevant approved project reports and licensing documents should be made available (at designated public offices and the project website) for public inspection/access on request.

We propose that the ESIA report findings be disclosed to the public through the Nandi County NEMA office and the Deputy County Commissioners offices. Any comments raised by the public should be communicated to CRVWWDA /LVSWWDA through NEMA.

In addition, the ESMP to be publicized by NEMA upon completion of the ESIA studies, the final ESMP adopted for construction phase should also be made available to the public. Its availability should be publicized electronically through the Proponent and/or Contractor's website. Hard copies should be deposited at the contractor's camp site(s) and at the Deputy County Commissioners office for inspection.

### 6.6.2 Notification on forthcoming works

Prior to the commencement of construction, the Proponent and Contractor should mobilize and, in liaison with other stakeholders, facilitate consultation with the local community among

other stakeholders including project affected persons (PAPs) in addition to those already identified in this report.

The Proponent and Contractor should continuously consult adjacent property owners with respect to project activities affecting their properties/environment and mitigation measures and, where necessary, jointly fine tune the proposed ESMP actions.

### **6.6.3 Publicity signages**

Prior to the commencement of construction, the contractor should erect publicity signages detailing the nature of forthcoming water works at various strategic locations including the treatment works site, reservoir sites, and at intervals along the distribution lines. The Publicity signage should be as required and approved by the Ministry of Transport, Infrastructure Housing Urban Development and Public works as well as National Construction Authority (NCA), and the by-laws of Nandi County.

### **6.6.4 Localised notifications**

For any working front, the Proponent in conjunction with the contractor will post notifications of forthcoming works, especially the disruptive ones. In addition, localized notifications should be made for:

- Job opportunities available;
- Any traffic disruptions or controls or changes to abutting property access; and
- Any irregular/hazardous work practices such as excessively noisy works etc.

## 7 ASSESSMENT OF POTENTIAL IMPACTS AND MITIGATION MEASURES

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### 7.1 General

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The purpose of the Environmental and Social Impact Assessment (ESIA) of the project is to improve decision making and to ensure that the project progresses using a sustainable approach. The ESIA identifies ways of improving the project environmentally and socially by preventing, minimising, mitigating, or compensating for adverse impacts. These measures will help to avoid potentially costly remedial measures. In order to alleviate negative impacts emanating from the implementation of the project, relevant mitigation measures have also been proposed in this chapter.

The impacts are divided into three phases namely construction; operation and decommission phases. The impacts of construction phase are related to activities carried out during project construction and they directly affect the communities living in the area in which the project is undertaken. The operational phase impacts are related to the impacts of the operation of the water supply project. The closure and decommissioning phases impacts have also been anticipated and considered in this report.

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### 7.2 Positive Impacts during construction phase

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#### 7.2.1 Employment opportunities

The project is estimated to employ a large number of people working with the contractor several workers including casual labourers, masons, electricians and plumbers are expected to work on the site for a period that the project will last. Also, semi-skilled and unskilled labour and formal employees are also expected to obtain gainful employment during the period of construction.

During the construction phase, there will be job opportunities for both skilled and unskilled labour. The skilled workers will include:

- Engineers (Supervising Engineering team);
- Environmentalists;
- Civil works contractors;
- Contractor's staff (managerial, skilled and unskilled labour force)
- Administrators.
- Artisans;
- Suppliers of plant, machinery, materials and essential services; and
- Construction monitoring personnel from the various Government agencies.

Employment will lead to increased incomes for those employed. Creation of job opportunities will improve financial security hence improved living standards.

#### **Enhancement mitigation**

The client should coordinate with the appointed contractor to ensure that the local population is given priority (mainly for unskilled labour) when it comes to employment opportunities during the construction phase.

## 7.2.2 Injection of money into the local economy

A large sum of the Project money shall be released into the local economy due to the construction activities. It is envisaged that during construction a large number of downstream activities shall take place including but not limited to the following:

- Payments for skilled and unskilled labour;
- Purchases of construction materials; and
- Payments for local provisions including fuel, foods and accommodation

## 7.2.3 Cultural appreciation

During construction phase it is anticipated that few skilled personnel will be sourced from outside the project area of varied cultures. It is expected that there will be cultural exchange which will lead to adoption of new ways of life, such as: Changes in ways of clothing; Social Interactions between the new members and members of the community; and introduction of new beneficial ideas.

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## 7.3 Negative Impacts during Construction Phase

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### 7.3.1 Loss of productive land and assets

The augmentation of existing water supply in Nandi hills town involves rehabilitation of the existing Taito Water treatment plant as well as construction of a new water treatment plant a few meters from the abstraction point at Mokong River. It also involves laying of the rising mains pipes as well as construction of a water storage tank from which the additional water abstracted will be distributed to the beneficiaries. According to the design, the rehabilitated and expanded Taito water treatment plant will be located within the land belonging to Kapsabet Nandi Water and Sanitation Company. The proposed new water treatment plant for water abstracted from Mokong River will be located on a piece of public land belonging to Kenya Forestry Services (KFS). The major land requirement is as detailed below.

**Table 7-1: Maim project land requirements**

Project component	Land area to be acquired	Land owner
Intake site	2000 sq m	Private
Raw water main	n/a	Private
Treatment works	6000 sq. m	KFS
Kosoiywo Reservoir	1,200 sq. m	Kosoiywo Secondary school
Nandi Bears reservoir	2,600 sq. m	Nandi Hills Water Supply Company
Katibarak Reservoir	650 sq. m	Nandi Hills Water Supply Company
Ablution blocks (3 No.)	340 sq.m	Nandi County Government
Water Kiosks (4 No.)	20 sq.m	Sites to be determined

The proposed location for the proposed new storage tanks has already been identified. The land owners, on whose land the proposed new storage tanks are proposed to be situated, have been consulted by the client and are in agreement in as far as acquisition of that land is concerned. This was confirmed by the land owners during the field work.



The rising mains as well as the distribution lines are proposed to be laid along the existing road reserve thereby limiting the need for land acquisition. However, in the event that the project activities lead to destruction of personal property, restriction on use of land following the installation of the pipelines or new forthright acquisition of land, an abbreviated resettlement action plan (ARAP) will be carried out to ensure there is prompt compensation to the affected property owners.

#### **Mitigation measures**

- Implement the abbreviated Resettlement action Plan (ARAP) prior to commencement of any project works at the new intake and treatment sites for Mokong river.
- Institute and maintain an active grievance redress mechanism on site during the construction phase to ensure that any arising issues are promptly and amicably addressed e.g. property affected but not previously envisaged in the ARAP is timely compensated for as applicable.

#### **7.3.2 Soil-related impacts**

This impact is assessed to be of minor significance due to the relatively small area concerned, although it is a permanent and non-reversible impact.

All construction activities have some minor impacts on the soil. However, the impact is restricted locally to the trenches for the pipes, or the construction site of Intakes, Water Treatment Works, Reservoirs, etc. The impacts are:

- disturbance of the natural soil structure;
- mixing of layers; and
- compaction thus reducing the ecological function of soil in the respective areas.

However, most of the pipelines will be laid in areas having already disturbed soil structures and functions i.e. along unpaved roads within the town. The soil where pipes are being laid through farmland (e.g. Raw Water Main and Treated Water Main) will be slightly more affected. The trenches will be refilled after pipe laying; therefore, the impact is temporary and reversible.

#### **Disposal of excavated soil**

Due to excavation of the trenches some excess material will be left over which needs to be disposed off appropriately. However, the quantities will be relatively low (estimated to be only



about 1%) because most of the excavated material will be used for backfilling. If required, abandoned quarries, which are available in the Municipality, will be used for the disposal of excessive quantities of excavated/unwanted material. If the spoils are left uncovered during rainy seasons, they may be eroded into the water bodies as surface runoff.

### **Mitigation**

- The project shall therefore pursue the zero-waste policy on the management of excavated soils and debris.
- The excavated soil will not be disposed off site. Instead the soil will be used in the proposed project areas included the development of impounding structures, re-spreading in areas to be landscaped to enhance aesthetics along the wayleave area and the development of access roads; and
- The valuable top soil containing organic material, nutrients as well as seeds and the soil fauna should be excavated separately and piled in an appropriate manner for reuse. The top soil should be spread over the excavated area in order to improve the conditions for development of a vegetation cover thus accelerating the restoration process. This rule should be followed particularly in farmland areas which are supposed to be cultivated again after the construction works. In these areas, majority of the pipelines, where applicable, will be laid along the fences. Areas adjacent to the construction sites will not be disturbed and care will be taken to minimize the area of impairment by storage of construction material (gravel and sand) and pipes.
- Program of Works should be prepared in line with Nandi Hills weather pattern so as to avoid such works during rainy seasons.

### **Soil contamination**

Contamination of soil is more likely to happen during the construction phase. The sites where the construction machinery is stored/parked/serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Refuse and solid waste from construction and human activities can also contaminate the soil. Contamination of soil during construction might be a major long-term residual negative impact. Unwarranted disposal of construction spoil and debris will add to soil contamination. This contamination is likely to be carried over to water bodies in case of dumping being done near water body locations.

### **Mitigation**

- Plan emergency response measures in case of accidental oil spills;
- Maintenance of construction equipment shall be done only on designated purpose-built surfaces to avoid contamination of soil; and
- All spoils should be disposed off appropriately and the site shall be fully cleaned before handing over are among ways of minimizing soil contamination.

### **Soil erosion**

In sloping areas, where the pipes will be laid, there will be an increased risk of soil erosion, particularly during the rainy season, due to removal of vegetation. Kosoiywo primary school where the storage tank will be situated is the highest point in that location. Adequate consideration of these problems in such high-risk areas will be catered for in the Construction Schedule.

### **Mitigation**

- Putting up of sand bags along drainage channels and the river bank will trap soil particles before they end up into the river;
- Where possible, avoid unnecessary disturbance/excavations;
- Strictly implement the ESMP suggested for the project.

### 7.3.3 Impacts on water resources

As it is, river Mokong is highly turbid with heavy siltation through surface water runoff from the nearby farms. The catchment area in general used to be highly vegetated with indigenous trees being a characteristic feature of the landscape. This has since changed with time. The trees have been cut down and used for charcoal production. On the other hand, the land including the riparian has gradually been transformed into farmland leading to heavy siltation.

There are also tea plantations surrounding both the Mokong River and the Taito stream. Due to the close proximity to the rivers there is a very high likelihood of chemical contamination through surface runoff from these farms. At it is, The Taito Stream experiences high eutrophication as is made evident by the presence of algae on the water surface. This has the potential to interfere with the quality of water being abstracted for consumption.

There will be increased wastewater production from the construction site and this may cause pollution of the water resources. Water contamination with cement from the construction site can make it to be highly alkaline and toxic to fish, plants and animals living in watercourses. Cement particles entering a watercourse can clog fishes' gills and also destroy their spawning grounds

#### Mitigation

- Including checks on equipment condition (especially leaks of oils, fuel, hydraulics), refuelling protocols (at safe location away from water, availability of spill kits and knowledge of their use, and emergency spill procedures);
- Any on site/camp storage areas for fuels, oils or other liquid chemicals would be sited away from surface water drains. They must have an impermeable base and would not drain directly into the surface water drains. Where practicable, drainage from storage compounds would be passed through oil interceptors prior to discharge;
- Apply standard best practice site sediment control procedures to minimise sediment in site drainage waters returning to the river;
- Ensure all staff and workers are fully aware of the limits to the site for each activity, Standard Operating Procedures, and emergency procedures;
- Ensure that all construction equipment and vehicles are serviced off site at licensed garages or at purpose-built service bays; and
- Any contaminated soil should be handled properly as hazardous waste and removed from site for safe disposal.]
- Conduct quarterly monitoring of the water to determine whether there is contamination of the water source by surface runoff from the tea plantations;

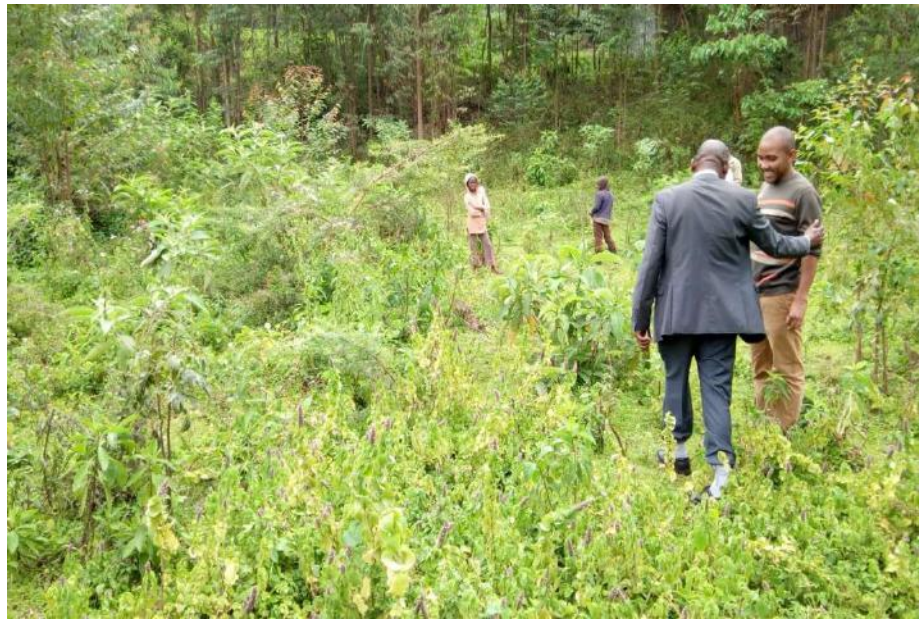
### 7.3.4 Impacts on flora and fauna

The sites of the new Nandi Hills Water Treatment Works and Storage Reservoirs will be affected due to construction of the Works. As much of the excavated material as possible will be used for restoration of the construction site by landscaping. This impact is assessed to be of minor significance due to the relatively small area concerned, although it is a permanent and no reversible impact.

At the water abstraction point for Mokong River, there is no existing clear passage way to access the site. The area is surrounded by tea plantations. Agricultural activities are on-going on the riparian land as well and therefore during construction of the weirs, there will be some damage done to the crops. The soil will therefore be exposed to the agents of erosion.

Construction of the WTP for the water abstracted from Mokong River will involve clearing of trees and natural vegetation found on the land belonging to KFS. The impact of this is not so significant as there will be natural revegetation once construction is done. The soil from this portion of land will potentially be washed off into the river due to its close proximity to Mokong River. The soil in this area is very susceptible to the loss because of the high risk of flooding in that area when it rains.

**Figure 7-1: Vegetation at the proposed Mokong Water Treatment Plant site**



The project area is not inhabited by any wild fauna and therefore no impacts on fauna are envisaged during construction.

#### **Mitigation**

- Care will be taken not to affect trees and cutting of trees will be avoided wherever possible through clear demarcation of construction areas;
- Construction Supervision will ensure clearance of vegetation is limited to only necessary areas. If cutting of trees is unavoidable, replanting of the respective number and species of trees will be carried out after completion of Works;
- Spilled cement or concrete should be collected and disposed away from natural water ways or storm water drainage;
- Sensitise workers and enable them to properly handle concrete spillages or waste cement.

#### **7.3.5 Noise pollution**

Construction of the proposed Project will most likely result in noise emissions as a result of the machines that will be used during excavation and construction vehicles delivering materials to site. During the construction phase of the WTP, noise generating activities will include mixing, casting and material movement. The sites in which one of the water storage reservoirs will be located is within a school compound (Kosoiywo Secondary School). The noise generated from the construction activities will likely interfere with learning activities by causing a distraction. Noise can be a nuisance if construction works begin too early in the day and continues into the night. In addition, workers with prolonged exposure to noisy environment may develop hearing problems.

In addition, there are some dense settlements in the project area thus there may be some effect of noise pollution. The project should therefore operate within the standards set in the NEMA noise regulations and air quality standards.

#### **Mitigation measures**

- Avoid construction when school is in session;
- Avoid night time construction when noise is loudest;

- Clearly label the high noise areas;
- Provide PPE (hearing protection) to workers operating within or visiting identified high noise areas;
- In order to meet noise level requirements, the works equipment should be equipped with standard noise attenuation features. Machines that exceed acceptable noise limits should be equipped with silencers or lagging materials or specially designed acoustic enclosures;
- Sensitize truck drivers and plant operators to switch off engines while offloading materials; to avoid gunning vehicle engines or hooting especially when passing through sensitive areas such as churches, residential areas and hospitals;
- Minimizing the number of motorised vehicles on use and number of trips through planning.

### **7.3.6 Air pollution**

Air pollution can degrade the environmental quality around settlements and could impact on public health. Dust will be emitted during excavation and related earthworks. Air borne particulate matter pollution is likely to occur during the pipeline route clearance, excavation and transportation of materials on site. This is likely to affect site workers and residents or business in the town and along the routes, in extreme situations leading to respiratory problems. Air pollution by exhaust of the vehicles used to transport the materials is a further negative impact usually closely related to the construction area. All these impacts are temporary and limited to those areas where machines are used. Manual trench excavation will generate much lower amounts of dust.

There is a dense settlement in the project area thus there will be some effect of noise and air pollution. The project should therefore operate within the standards set in the NEMA noise regulations and air quality standards.

#### **Mitigation measures**

- Minimizing the number of motorised vehicles on use and number of trips through planning
- Construction vehicles should use only predetermined tracks;
- Wet all active construction areas as and when necessary to lay dust;
- Compact, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites; and
- Construction vehicles should adhere to speed limits within construction and urban roads.

### **7.3.7 Incidences of social delinquency, spread of HIV/AIDS and other STDs**

The influx of people from other areas working during the construction phase would increase the possibility of increased infection rates. The spread of AIDS and other sexually transmitted diseases (STDs) can be linked to the construction activities and the resultant opening-up of new regions/developments. Although there are no empirical data to support this theory as far as Kenya is concerned, it is believed that migrant populations with different social activities such particularly as 'foreign' contractors and construction workers are the most likely vectors for these diseases.

Labour camps bring a temporary influx of people in an area. This may stimulate business in the Project area and also propagate the spread of sexually transmitted diseases such as HIV/AIDS due to sexual interactions between the project workforce and the local community.

Researchers have indicated that HIV prevalence rates are higher among spouses who stay or work away from town and spend away from home for more than a week. This group of individuals are mostly truck drivers and other employees who work for the contractor and are brought in as skilled labourers.

### **Mitigation measures**

- Contractor should be required to offer HIV/AIDS education/awareness to the workers and residents in collaboration with local public health institutions or other approved service providers;
- Provide condoms through strategically situated condom dispensers near lodges and hospitals where people are likely to pick them;
- Sensitize workers and the surrounding communities on awareness, prevention and management of HIV/AIDS through staff training, awareness campaigns, multimedia and workshops or during community *Barazas*; and
- Offer VCT services to the community with the help of local health facilities.

### **7.3.8 Solid waste disposal**

Solid wastes generated during construction include papers used for packing, plastics, cuttings and trimmings off materials, containers, rods of metals, sharp objects (nails) among others. Dumping around the site will interfere with the aesthetic status and has a direct effect on the surrounding community. Disposal of the same solid wastes off-site could also be a social inconvenience if done in the wrong places. The off-site effects could be aesthetic, pest breeding, pollution of physical environment including water resource, invasion of scavengers and informal recycling by communities.

### **Mitigation measures**

- A site waste management plan should be prepared by the contractor prior to commencement of construction works. This should include designation of appropriate waste storage areas, collection and removal schedule and identification of approved disposal site;
- Unusable construction waste, formwork and other construction material, must be disposed of at an approved dumpsite or sold to willing buyers for salvage value;
- Proper solid waste receptacles and storage containers should be provided, particularly for the disposal of lunch and drink boxes so as to prevent littering of the site.
- Arrangements should be made for the regular collection of litter and for its disposal with the Nandi County Government or other duly licensed waste transporters;
- Ensure that the solid waste collection, segregation, and disposal system is functioning properly at all times during operation; and
- Recycle and re-use wastes where possible such as scraps metal
- All solid waste should be managed in line with the Environmental Management and Coordination (Waste Management) Regulations, 2006.

### **7.3.9 Occupational and public health and safety**

Construction workers are likely to have injuries and hazards as the construction works unavoidably expose workers to occupational health and safety risks. The workers are also likely to be exposed to risk of accidents and injuries resulting from accidental falls, injuries from hand tools and construction equipment, exposure to excessive noise and vibration, dust etc.

Local services such as medical, water supply, sanitation and waste disposal can be over stretched by the sudden increase in population. The general public will also be exposed to safety hazards arising from construction activities involving construction vehicles, open trenches, dust, noise etc.

Construction activities of bush clearing, materials delivery, trench excavation and concrete mixing and construction traffic will generate a lot of dust especially during the dry seasons and this may affect the respiratory system.

Construction workers may be exposed to infections if they are not provided with clean drinking water, sanitation facilities and proper water disposal facilities.

Food for the construction workforce is usually provided by mobile individuals most of which operates without licenses. This can compromise health of the workers especially if such foodstuffs are prepared in unhygienic conditions.

#### **Mitigation measures**

Appointed contractor shall establish a Health and Safety Plan for all the construction works. Such plans shall incorporate and ensure:

- Work methods and Job safety analysis;
- Installation and maintaining warning signs along the major junctions on roads used by the construction vehicles;
- that all construction machines and equipment are in good working conditions to prevent occupational hazards;
- Appointment of a trained health and safety officer for the duration of the construction work;
- Provision of workers with appropriate PPE's and enforce usage;
- A First Aid Kit should be provided within the site and during construction phase. This should be fully equipped at all times and should be managed by qualified persons.
- Workers training on safety procedures and emergency response such as fire, oil and chemical spills, pipe bursts and other serious water loss risks;
- Fencing off or barricading active construction areas from the public and having restricted access;
- Installation and maintenance of appropriate hazard warning signs around the site;
- Due care should be taken to maintain hygienic conditions at site by providing proper sanitation facilities and ensuring standard cleanliness of the facilities;
- food suppliers have licenses from the local public health department for handling/vending the foodstuff; and
- The contractor maintains workmen's compensation cover. It should comply with Workmen's Compensation Act, as well as other ordinances, Regulations and union Agreements.

#### **7.3.10 Security**

Security is a prerequisite to/for any development as it ensures materials/project is secure. It also controls movement within the site especially for the intruders who might be injured by the materials and other hazardous features available within the site.

#### **Mitigation measures**

- The project site should be enclosed using suitable walls to beef-up security and to control movement within the site;
- There should be guard houses at the gate. Security guards should always monitor the gate of the facility to keep away the intruders and to control movement within the site;
- Contractor should provide adequate security during the construction period when there are no works on the site; and
- The guards stationed at the gates should document movements in and out of the site/property.

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## **7.4 Positive Impacts During Operation Phase**

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### **7.4.1 Improved sanitation and public health**

Construction of the new WTP for water abstracted from Mokong River and rehabilitation of the WTP in Taito, both in Nandi hills town will ensure that the residents are supplied with clean water for both domestic and commercial use. As a result, incidences of water related diseases are expected to immensely decline.

### **7.4.2 Improved access to water services**

Majority of the residents complained of having difficulties when getting water for their daily use. This is due to high transport cost attached, long distances and general lack of a clean source of water. The expansion of the existing water supply network will eliminate this challenge by reducing time spent in collection of water from other sources and elimination of the necessity of disinfection of water by boiling. These effects will have a positive impact on household budgets. People living in low income areas and informal settlements will benefit from the Project as they will be provided with safe water at reasonable walking distances by planned water kiosks. All in all, the project will play a part in meeting the SDG goal on improved Access to clean water and sanitation for all.

#### **Enhancement measures**

To serve some of the communities within the project area, several communal water points will be provided for the community water needs, the locations of these water kiosks will be identified in consultation with the local residents and will be chosen bearing in mind the close proximity to the people they intend to serve. The amount of water dispensed by the kiosks will vary depending on the number of residents in that area. Water meters will be installed at each of the water kiosks.

### **7.4.3 Empowerment of women**

Women play an important role in domestic and general economy of the town. However, the existing challenge of water shortage fall squarely on them as the society expects them to draw and provide water to the households. The long distances and the unreliability of the springs within their reach poses a daily challenge/barrier do their daily contribution to the economy as they spend more time in search of water. The expansion of the water supply network will however work in their benefit and award them more time to other economic activities such as farming, selling their products in the open market, businesses among other income generating activities.

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## **7.5 Negative Impacts during Operation Phase**

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### **7.5.1 Impact on the downstream community along the rivers**

At full operation of the new Works, increased abstraction of water from Taito stream can will lead to a reduced base flow of the river downstream of the Intake Damming the water in order to harness more volumes of it may impact greatly on the communities that live downstream of the river. This can potentially lead to conflict in the community over the water resource. However, since the water abstraction from Taito stream will not be increase but instead supplemented with water from River Mokong which has significantly higher volume, the reduction in the river's base flow is therefore not expected to be of major significance.

During the public meetings, some of the suggestions from the community in terms of water supply were as follows;

- The area residents proposed that there be an additional tank and distribution lines to serve the area residents of Kosoiywo, Kipsamo, Keteng, Ketbarak, and Kimolonik. These areas are reported to be water scarce and hardship areas;
- The area residents proposed that the project should consider pumping water to Ketbarak, which is the highest point in Kaplelmet. This would then ease distribution of water to the locations that are above the proposed distribution line.

#### **Mitigation**

- Consider widening the distribution networks in future in order to serve a wider population.
- Ensure that there is provision of a community water points in the mentioned locations where there is no distribution network;
- Consider alternative water sources like springs to alleviate the water scarcity for the area residents.

### **7.5.2 Sewage and effluent disposal impacts**

Provision of reliable water supply to the residents of Nandi Hills and its environs translates to increase in effluent/waste water disposal resulting from sanitary facilities, kitchen and laundry among others. The town currently has no existing sewer system therefore effluents emanating from such activities end up predominantly disposed in the open drainage system. This poses a health risk to the resident if no appropriate measures are taken.

#### **Mitigation**

- Sensitizing the residents on health and sanitation issues should be carried out to ensure that the waste water does not come into contact with food, kitchen wares, and stored water or end up in the river in its raw state;
- Laying down of a sewer system should be considered as part of the long term WATSAN development for the project area;
- Nandi County government to require all new urban households and commercial buildings using the flush system to incorporate septic tanks or soak pits in line with applicable standards; and
- Sanitary facilities should be kept clean always, through regular washing/cleaning too.

### **7.5.3 Impacts on occupational health**

During operation and maintenance of works by the attendants, there may be a certain risk of health impact for workers handling chemicals used for water treatment at the Treatment Works i.e. Aluminium Sulphate (Alum), Chlorine and Soda Ash. In addition, activities involving servicing and maintenance of electrical and pumping machines, cleaning of washout vales etc. when undertaken without proper mechanisms in place, can result in serious injuries and long-term health deterioration of affected workers.

#### **Mitigation**

- The risk of exposure of chemicals will be minimized by having adequate storage facilities for the chemicals and by putting appropriate safety equipment at the worker's disposal;
- Detailed instructions on use and precaution measures shall be available in a comprehensive Operation and Maintenance (O&M) Manual to be prepared and submitted to the Water Service Operator on completion of the Works;
- Provide material data sheets for all chemicals used at the treatment plant and undertake continuous staff training on safety and health, in line with OSHA, 2007;
- Formulate and implant occupational safety and health plan for all the project the O&M activities;



- Undertake annual safety and health audits in line with OSHA,2007

#### **7.5.4 Surface water pollution**

The operation of the new Water Treatment Plant (WTP) will produce sludge. As Aluminium Sulphate (AlSO<sub>4</sub>) is used for treatment of raw water, sludges from Chemical Mixing Tanks, Flocculation Basins and Sedimentation Tanks contain some trace amounts of these chemicals. When washed into rivers and streams, the aluminium can kill small water creatures and fish. Overflown sludge can also lead to temporary increase in river turbidity. The immediate downstream water may also be rendered unsuitable for direct use as currently done by some local residents

##### **Mitigation**

- Proper management of the treatment works to ensure that there are no overflows or operational failures that might eventually lead to the pollution of the underground and surface water;
- Continuous monitoring of water treatment effluent to ensure adherence to the Environmental Management and Coordination (Water Quality) Regulations, 2006 and Environmental Management and Co-ordination (Waste Management) Regulations, 2006;
- Downstream community notification in case of unprecedented overflow of wastes from water treatment sludge lagoons. A communication protocol should be developed for this.

#### **7.5.5 Noise pollution**

A number of generators are proposed for the booster pumps either operating one at a time or two at a time, depending on the pumping requirements. This will constitute constant source of noise throughout the operation period. The noise will be a nuisance o nearby settlements and attendant workers. This can be problem if improper mounting is done at the installation and no regular maintenance is undertaken on the generators.

##### **Mitigation measures**

- Ensure that suitable mounting is done at the installation stage incorporating noise and vibration abatement;
- Clearly label the high noise areas;
- Provide PPE (hearing protection) to workers operating within or visiting identified high noise areas;
- In order to meet noise level requirements, the generators should be equipped with standard noise attenuation features. Generators that exceed acceptable noise limits should be equipped with silencers or lagging materials or specially designed acoustic enclosures; and
- Ensure regular maintenance of installed generators to manufacturers' specifications.

#### **7.5.6 Greenhouse gas emissions and hydrocarbon wastes**

The same generators described above will be diesel powered and require regular servicing involving the replacement of oil filters, fuel filters etc. Emissions will contribute to greenhouse gases. However, the impact is deemed insignificant given the low power ratings of the generators.

Improper handling of associated maintenance wastes may be hazardous to the receiving environment.

##### **Mitigation measures**

- Ensure regular inspection and maintenance of installed generators according to manufacturer's specifications.

- Ensure regular servicing that included replacement of oil filters and fuel filters etc
- Ensure proper handling of hazardous wastes associated with maintenance; and
- Minimise the use of the generators to only when it is needed.

#### **7.5.7 Visual intrusion and landscape impact**

There will be some minor alterations in the topography of the area as a result of constructing new structures. A lot of earthworks will be done at these sites resulting in visual intrusion. For instance, the new water storage tanks might constitute new land marks in the area that may be visible from far.

##### **Mitigation**

- Landscape enhancement through planting of live hedges and trees.
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### **7.6 Positive Impacts During Decommissioning Phase**

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#### **7.6.1 Employment opportunities**

This a positive impact where both skilled, semi-skilled and unskilled workers will be employed during decommissioning phase.

#### **7.6.2 Site rehabilitation**

Decommissioning phase will lead to rehabilitation of the site that was cleared to pave way for construction activities. This will ensure that the environment is left as natural as possible close to or better than before. The site could therefore be converted back to a grazing ground.

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### **7.7 Negative Impacts during Decommissioning Phase**

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#### **7.7.1 Loss of portable water to residents**

During (partial) decommissioning period, the pipeline will be rendered dysfunctional hence leading to loss of portable water to Nandi Hills town residents. This might affect a sizeable fraction of the town's population and its environs since there will be difficulty in accessing clean water, loss of income for water vendors and increase in water-related diseases due to poor hygiene.

##### **Mitigation**

- CRVWWDA should provide an alternative access to portable water before the operation period of the pipeline and treatment plant expires; and
- Awareness should be carried out early in advance to inform the people on the major rehabilitation or decommissioning period and its anticipated impacts.

#### **7.7.2 Loss of jobs and income**

The people that will be employed to operate and maintain the water treatment system will lose their jobs immediately after the closure of the project. The loss of jobs will have far reaching impacts as it will lead to loss of income and social stress.

##### **Mitigation measures include:**

- Notify the employees in advance on the project closure date and adequately compensate them;

- Dismissal procedures to be compliant with Employment Act, 2007;
- Provide counselling & alternative skills for alternative activities;
- Employer should find alternative means of livelihood for the staff who were employed at the water treatment plant.

### 7.7.3 Noise pollution

Activities likely to produce noise during decommissioning include demolition of structures and excavation of pipeline works.

**Mitigation measures include:**

- Schedule noisy activities during the day time period;
- Use silencers on machines where possible;
- Ensure machinery is well maintained to reduce noise emitted.

### 7.7.4 Air/dust pollution

This is expected to result from demolishing of structures and excavation of water pipelines. This will affect demolition staff as well as the neighbouring residents.

**Mitigation measures include:**

- Practice dust management techniques, including watering down during drier period;
- Set up dust barriers/ screens at strategic locations;
- Provide and enforce the appropriate use of PPE against dust.
- Further follow ups should be done.

### 7.7.5 Solid waste material

It is expected that large amounts of solid waste material arising during decommissioning and hence proper disposal of these materials is critical.

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.

**Mitigation measures include:**

- Disposal of solid waste in compliance with EMCA 2006 Waste Management Regulations;
- Segregation of waste to encourage reuse and recycling;
- Ensuring that the contracted waste collector is registered with NEMA to collect and dispose wastes; and
- Careful disposal of any residual chemicals and wastes from the treatment plant.

## 7.8 Cumulative Impacts

Cumulative impacts relate to the aggregate of past, present and future actions, and may also arise from additional factors or developments related to the construction of proposed treatment works and water supply pipelines. Effects from different activities may also interact to cause additional effects not initially apparent when considering the individual developments or changes, and there may also be synergistic interaction between different factors.

The following cumulative impacts are anticipated from implementation of Nandi Hills town water supply augmentation and sanitation project

- Availability of reliable water supply will attract further investment to Nandi hills town. Increased generation of waste water from the town from increased availability of piped water and additional investments is anticipated. However, there is no waterborne sewerage in the town. This can cause serious waste water management and associated public health problems;
- The project targets river water. With increased farming activities and continued water abstraction, the river water might eventually be stressed from reduced ability to self-clean and suffer from heavier sedimentation load. This might in the long run also make water treatment expensive if no multi-agency approach is adopted to ensure sustainable catchment management strategy.

### **Mitigation**

- Liaise with WRA to demarcate of the riparian area to sensitize people (through WRUAs) from farming and undertaking other proscribes activities along the riparian areas that contribute to river sedimentation.
- Equip the community with appropriate resources like seedlings to plant trees along the riparian;
- It is proposed to remove this sludge by filtration in Sludge Drying Beds to be constructed at the Treatment Works. Sludges from Chlorination and pH Correction Tanks contain Chlorine and Soda Ash. These sludges will be removed in Soak away Pits. All chemical sludges will be buried on site, and the pH of the soil monitored continuously. There will be no disposal of the sludge into the River.

## **8 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN**

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### **8.1 Environmental and Social Management Plan**

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The Environmental and Social Management Plan (ESMP) is prepared to show how site-specific concerns and mitigation measures are addressed through the construction, operation and decommissioning phase of the proposed Water supply project for Nandi Hills.

The ESMP has been developed with project knowledge and information available to date. As project commencement and scheduling plans are developed and changed, components of the ESMP might require amending. This is therefore a working document, which can be updated whenever new information is received or site conditions change.

The contents will include but not be limited to:

- Current environmental and social issues and parameters to be mitigated;
  - Mitigation measures proposed;
  - Lines of responsibility;
  - Cost of undertaking the environmental and social mitigation measures;
  - The time frame in which these mitigation measures will be implemented.
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### **8.2 Purpose and objectives of ESMP and Monitoring Plan**

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The specific objectives of the ESMP and Monitoring Plan are to:

- Serve as a commitment and reference for the contractor to implement the ESMP including conditions of approval from NEMA.
  - Serve as a guiding document for the environmental and social monitoring activities for the supervising consultant, contractor and the client management including requisite progress reports.
  - Provide detailed specifications for the management and mitigation of activities that have the potential to impact negatively on the environment.
  - Provide instructions to relevant project personnel regarding procedures for protecting the environment and minimizing environmental effects, thereby supporting the project goal of minimal or zero incidents.
  - Document environmental concerns and appropriate protection measures; while ensuring that corrective actions are completed in a timely manner.
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### **8.3 Auditing of the ESMP**

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CRVWDA and the contractor shall conduct regular audits to the ESMP to ensure that the system for implementation of the ESMP is operating effectively. The audit shall check that a procedure is in place to ensure that:

- The ESMP being used is the up to date version;
- Variations to the ESMMP and non-compliance and corrective action are documented;
- Appropriate environmental training of personnel is undertaken;
- Emergency procedures are in place and effectively communicated to personnel;
- A register of major incidents (spills, injuries, complaints) is in place and other documentation related to the ESMP; and

- Ensure that appropriate corrective and preventive action is taken by the Contractor once instructions have been issued.
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## **8.4 Responsibilities of the ESMP**

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In order to ensure the sound development and effective implementation of the ESMP, it will be necessary to identify and define the responsibilities and authority of the various persons and Organizations which will be involved in the project. The following entities should be involved in the implementation of this ESMP:

- CRVWWDA;
- NEMA;
- Contractor;
- Supervising Consultant;
- Nandi County Government; and
- Directorate of Occupational Safety and Health- Nandi County

### **8.4.1 CRVWWDA**

CRVWWDA who is the proponent will be charged with the responsibility of ensuring that the proposed development has been put up in an environmentally sound manner. This can be achieved by inclusion of environmental specifications in the tender specifications, selection of renowned environmentally conscious contractors and supervision to ensure that the objectives of this ESMP are met.

### **8.4.2 LVSWWDA**

LVSWWDA is working together with CRVWWDA to implement the project. Nandi County, the project county, is within the Lake Victoria south catchment area. Hence, the agencies will have to coordinate and supervise the successful implementation of this water supply and sanitation project.

### **8.4.3 National Environment Management Authority (NEMA)**

The responsibility of NEMA to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government of Kenya in the implementation of all policies relating to the environment.

### **8.4.4 The Contractor**

The firm contracted to detail the design and put up the Water Treatment plant will be required to comply with the requirements of the ESMP within this report. To ensure strict compliance environmental specifications of this ESMP should form part of the contract documents.

### **8.4.5 Supervising Consultant**

The sourced supervising consultant will have to ensure that the proposed ESMP is up to date and is being used by the contractor. Periodic audits of the ESMP will have to be done to ensure that its performance is as expected.

### **8.4.6 Nandi County Government**

The relevant departmental officers in the above local authorities should be called upon where necessary during project implementation to provide the necessary permits and advisory services to the project implementers.

#### **8.4.7 Directorate of Occupational Safety and Health- Nandi County**

Directorate of Occupational Safety and Health Services (DOSHS) will be responsible for registering the project site as a work station and subsequent enforcement of relevant provisions in occupational safety and health in line with Occupational Safety and Health Act, 2007.

#### **8.4.8 Water Resource Authority (WRA)**

WRA is responsible for regulation of water resources issues such as water allocation, source protection and conservation, water quality management and pollution control and international waters. Its roles and responsibilities are as follows:

- Planning, management, protection and conservation of water resources;
- Planning, allocation, apportionment, assessment and monitoring of water resources;
- Issuance of water permits;
- Water rights and enforcement of permit conditions;
- Regulation of conservation and abstraction structures;
- Catchment's and water quality management;
- Regulation and control of water use; and
- Coordination of the Integrated Water Resource Management (IWRM) Plan.

The proponent will have to seek and obtain a permit from WRA and pay the fees to use the water from the identified rivers (Taito stream and Mokong River)

#### **8.4.9 Kenya Forest Service (KFS)**

KFS is be responsible for issuance of permits to allow felling of trees in the project area especially since the intake site has tree species such as Blue gum found growing on the river banks that are naturally growing or have been planted by individuals.

Also, the proponent will also have to seek authority from KFS in using their land as the site for building and operating the water treatment plant and any fees that will be prescribed.

Table 8-1 presents the ESMP for the proposed water supply and sanitation project during the construction, operation and decommissioning phases, respectively.

**Table 8-1: Environmental and Social Management Plan**

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
<b>Construction Phase</b>					
Soil related impacts	Disposal of excavated soil	<ul style="list-style-type: none"> <li>The project shall therefore pursue the zero-waste policy on the management of excavated soils and debris.</li> <li>The excavated soil will not be disposed off site. Instead the soil will be used in the proposed project areas included the development of impounding structures, re-spreading in areas to be landscaped to enhance aesthetics along the wayleave area and the development of access roads; and</li> <li>The valuable top soil containing organic material, nutrients as well as seeds and the soil fauna should be excavated separately and piled in an appropriate manner for re-use. The top soil should be spread over the excavated area in order to improve the conditions for development of a vegetation cover thus accelerating the restoration process. This rule should be followed particularly in farmland areas which are supposed to be cultivated again after the construction works. In these areas, majority of the pipelines, where applicable, will be laid along the fences. Areas adjacent to the construction sites will not be disturbed and care will be taken to minimize the area of impairment by storage of construction material (gravel and sand) and pipes.</li> <li>Program of Works should be prepared in line with Nandi Hills weather pattern so as to avoid such works during rainy seasons;</li> </ul>	Main Contractor for Civil Works	During the entire construction phase	<b>42,000</b> <i>(for 1.2m high sand bags along 200m of the Mokong River bank)<sup>1</sup></i>  Mitigation measures to be included in contractor's contract document
	Soil contamination	<ul style="list-style-type: none"> <li>Plan emergency response measures in case of accidental oil spills;</li> <li>Maintenance of construction equipment shall be done only on designated purpose-built surfaces to avoid contamination of soil; and</li> <li>All spoils should be disposed off appropriately and the site</li> </ul>			

<sup>1</sup> One sandbag costs \$3–6, and to protect a door opening with a sandbag wall of +1.2 m requires 72 bags at ~\$210–420 <https://www.mdpi.com/2073-4441/10/11/1646/htm>



Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		shall be fully cleaned before handing over are among ways of minimizing soil contamination.			
	Soil erosion	<ul style="list-style-type: none"> <li>Putting up of sand bags along drainage channels and the river bank will trap soil particles before they end up into the river;</li> <li>Where possible, avoid unnecessary disturbance/excavations;</li> <li>Strictly implement the ESMP suggested for the project.</li> </ul>		Prior to, during and after excavation	
Land use	Loss of productive land	<ul style="list-style-type: none"> <li>In case of any land acquisition is confirmed necessary following completion of detailed design, a comprehensive ARAP study shall be undertaken prior to commencement of the project in order to compensate the affected land owners. The process should be consultative and involve all stakeholders in the affected community. However, using the public utility land is highly recommended.</li> </ul>	Consultant Contractor Client	Before and during construction	Cost to be captured in the Abbreviated RAP report
Impacts on water sources	erosion, sedimentation, foreign material spills, pollution slumping,	<ul style="list-style-type: none"> <li>Including checks on equipment condition (especially leaks of oils, fuel, hydraulics), refuelling protocols (at safe location away from water, availability of spill kits and knowledge of their use, and emergency spill procedures);</li> <li>Any on site/camp storage areas for fuels, oils or other liquid chemicals would be sited away from surface water drains. They must have an impermeable base and would not drain directly into the surface water drains. Where practicable, drainage from storage compounds would be passed through oil interceptors prior to discharge;</li> <li>Apply standard best practice site sediment control procedures to minimise sediment in site drainage waters returning to the river;</li> <li>Ensure all staff and workers are fully aware of the limits to the site for each activity, Standard Operating Procedures, and emergency procedures;</li> <li>Ensure that all construction equipment and vehicles are serviced off site at licensed garages or at purpose-built service bays; and</li> <li>Any contaminated soil should be handled properly as</li> </ul>	Main Contractor for Civil Works	During the entire construction phase of the project	Mitigation cost to be included in contractor's contract document

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		<p>hazardous waste and removed from site for safe disposal;</p> <ul style="list-style-type: none"> <li>Conduct quarterly monitoring of the water to determine whether there is contamination of the water source by surface runoff from the tea plantations.</li> </ul>			
Flora and fauna	Loss of vegetation and habitat for avifauna	<ul style="list-style-type: none"> <li>Care will be taken not to affect trees and cutting of trees will be avoided wherever possible.</li> <li>Construction Supervision will ensure clearance activities to minimum. If cutting of trees is unavoidable, replanting of the respective number and species of trees will be carried out after completion of Works.</li> <li>Spilled cement or concrete should be collected and disposed away from natural water ways or storm water drainage;</li> <li>Sensitise workers and enable them to properly handle concrete spillages or waste cement.</li> </ul>	Main Contractor for Civil Works	During the entire construction phase	<b>21,000</b> <i>(Landscaping at 15,900/- per ha for ~ 1.3 ha to be cleared of vegetation)<sup>2</sup></i>
Noise pollution	Impact on human health	<ul style="list-style-type: none"> <li>Avoid construction when school is in session</li> <li>Avoid night time construction when noise is loudest;</li> <li>Clearly label the high noise areas;</li> <li>Provide PPE (hearing protection) to persons operating within or visiting identified high noise areas;</li> <li>In order to meet noise level requirements, the works equipment should be equipped with standard noise attenuation features. Machines that exceed acceptable noise limits should be equipped with silencers or lagging materials or specially designed acoustic enclosures;</li> <li>Inform local residents when construction activities are likely to generate excessive noise in order to minimize disruption to local residents;</li> <li>Sensitize truck drivers and plant operators to switch off engines while offloading materials; to avoid gunning vehicle engines or hooting especially when passing through sensitive areas such as churches, residential areas and hospitals;</li> <li>Minimizing the number of motorised vehicles on use and</li> </ul>	Main Contractor for Civil Works	During the entire construction phase	<b>50,000</b> <i>(Ear muffs for approx. 50 workers)</i>  Mitigation guidelines to be included in the contractor's contract document

<sup>2</sup> SDG target 15.3 on land degradation neutrality for 2015 – 2030 is USD 318 billion per year for restoration of 2 billion ha. Reference: Liagre L., Almuedo P. L., Walter S.; McGuire D., Besacier C., Matta R., Conigliaro M. (2015). Forest and landscape Restoration. <http://www.fao.org/3/a-i5031e.pdf>

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
Air pollution	Impact on plant and human health	<p>number of trips through planning.</p> <ul style="list-style-type: none"> <li>Minimizing the number of motorised vehicles on use and number of trips through planning.</li> <li>Construction vehicles should use only predetermined tracks;</li> <li>Wet all active construction areas as and when necessary to lay dust;</li> <li>Compact, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites; and</li> <li>Construction vehicles should adhere to speed limits within construction roads.</li> </ul>	Main Contractor for Civil Works	During the entire construction phase	<b>3,000</b> per day <i>(for sprinkling water from a 5,000 L water bowser to reduce dust)</i>
HIV and AIDS	Spread of HIV / AIDS and STI related infections.	<ul style="list-style-type: none"> <li>Contractor should be required to offer HIV/AIDS education to the workers and residents in collaboration with local health institutions;</li> <li>Provide condoms through strategically situated condom dispensers near lodges and hospitals where people are likely to pick them;</li> <li>Sensitize workers and the surrounding communities on awareness, prevention and management of HIV/AIDS through staff training, awareness campaigns, multimedia and workshops or during community <i>Barazas</i>; and</li> <li>Offer VCT services to the community with the help of local health facilities.</li> </ul>	Main Contractor for Civil Works	During the entire project cycle	No additional cost (4,000,000 as per BoQ, Bill No. 1)
Solid waste disposal	<ul style="list-style-type: none"> <li>Reduction in aesthetics,</li> <li>pest breeding, pollution of physical environment</li> </ul>	<ul style="list-style-type: none"> <li>A site waste management plan should be prepared by the contractor prior to commencement of construction works. This should include designation of appropriate waste storage areas, collection and removal schedule and identification of approved disposal site;</li> <li>Unusable construction waste, formwork and other construction material, must be disposed of at an approved dumpsite or sold to willing buyers for salvage value;</li> <li>Proper solid waste receptacles and storage containers should be provided, particularly for the disposal of lunch and drink boxes so as to prevent littering of the site;</li> </ul>	Main Contractor for Civil Works	During the entire construction phase	<b>130,000</b> (5 garbage bins of 1100 L capacity)

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		<ul style="list-style-type: none"> <li>• Arrangements should be made for the regular collection of litter and for its disposal with the Nandi County Government or other duly licensed waste transporters;</li> <li>• Ensure that the solid waste collection, segregation, and disposal system is functioning properly at all times during operation; and</li> <li>• Recycle and re-use wastes where possible such as scraps metal</li> <li>• All solid waste should be managed in line with the Environmental management and coordination (Waste Management) Regulations, 2006.</li> </ul>			
Occupational Public health and safety	Health of the workers and the community	<ul style="list-style-type: none"> <li>• Work methods and Job safety analysis;</li> <li>• Installation and maintaining warning signs along the major junctions on roads used by the construction vehicles;</li> <li>• that all construction machines and equipment are in good working conditions to prevent occupational hazards;</li> <li>• Appointment of a trained health and safety officer for the duration of the construction work;</li> <li>• Provision of workers with appropriate PPE's and enforce usage;</li> <li>• A First Aid Kit should be provided within the site and during construction phase. This should be fully equipped at all times and should be managed by qualified persons.</li> <li>• Workers training on safety procedures and emergency response such as fire, oil and chemical spills, pipe bursts and other serious water loss risks;</li> <li>• Fencing off or barricading active construction areas from the public and having restricted access;</li> <li>• Installation and maintenance of appropriate hazard warning signs around the site;</li> <li>• Due care should be taken to maintain hygienic conditions at site by providing proper sanitation facilities and ensuring standard cleanliness of the facilities;</li> <li>• food suppliers have licenses from the local public health</li> </ul>	LVSWWDA  Main Contractor for Civil Works	During the entire project cycle	<b>1,824,000</b>

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		<p>department for handling/vending the foodstuff;</p> <ul style="list-style-type: none"> <li>The contractor maintains workmen's compensation cover. It should comply with Workmen's Compensation Act, as well as other ordinances, Regulations and union Agreements.</li> </ul>			
Security	Vandalization	<ul style="list-style-type: none"> <li>The project site should be enclosed using suitable walls to beef-up security and to control movement within the site.</li> <li>There should be guard houses at the gate. Security guards should always monitor the gate of the facility to keep away the intruders and to control movement within the site.</li> <li>Contractor should provide adequate security during the construction period when there are no works on the site.</li> <li>The guards stationed at the gates should document movements in and out of the site/ property.</li> </ul>	Main Contractor for Civil Works	During the entire project cycle	No additional cost (captured in BoQ)
<b>Operation Phase</b>					
Impact on the downstream community living along the rivers from which water is being drawn	Unavailability of water for use for the communities living downstream of the water project	<ul style="list-style-type: none"> <li>Consider widening the distribution networks in future in order to serve a wider population;</li> <li>Ensure that there is provision of a community water points in the mentioned locations where there is no distribution network;</li> <li>Consider alternative water sources like springs to alleviate the water scarcity for the area residents.</li> </ul>	LVSWWDA  Local Water and Sewerage company	During the operation phase of the project.	
Sewage and effluent disposal	Health and sanitation related diseases issues	<ul style="list-style-type: none"> <li>Sensitizing the residents on health and sanitation issues should be carried out to ensure that the waste water does not come into contact with food, kitchen wares, and stored water or end up in the river in its raw state.</li> <li>Laying down of a sewer system should be considered as part of the long term WATSAN development for the project area;</li> <li>Nandi County government to require all ne urban household and commercial buildings using the flash system to incorporate septic tanks or soak pits in line with applicable standards; and</li> <li>Sanitary facilities should be kept clean always, through regular washing/cleaning too.</li> </ul>			<b>600,000</b> (10 High Density Polyethelene portable toilets @ 60,000) + 20,000 p.m. for exhauster services
Impacts on occupational		<ul style="list-style-type: none"> <li>The risk of exposure of chemicals will be minimized by having adequate storage facilities for the chemicals and by putting</li> </ul>	LVSWWDA		<b>144,000</b> yearly

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
health		<p>appropriate safety equipment at the worker's disposal.</p> <ul style="list-style-type: none"> <li>Detailed instructions on use and precaution measures shall be available in a comprehensive Operation and Maintenance (O&amp;M) Manual to be prepared and submitted to the Water Service Operator on completion of the Works;</li> <li>Provide material data sheets for all chemicals used at the treatment plant and undertake continuous staff training on safety and health, in line with OSHA, 2007;</li> <li>Formulate and implant occupational safety and health plan for all the project the O&amp;M activities;</li> <li>Undertake annual safety and health audits in line with OSHA,2007.</li> </ul>	Local Water and Sewerage company		<i>(supposing 7 staff i.e. operations, maintenance, supervision, clerical, laboratory, yard work)</i>
Water pollution	Contamination of water sources	<ul style="list-style-type: none"> <li>Proper management of the treatment works to ensure that there are no overflows or operational failures that might eventually lead to the pollution of the underground and surface water;</li> <li>Continuous monitoring of water treatment effluent to ensure adherence to the Environmental Management and Coordination (Water Quality) Regulations, 2006 and Environmental Management and Co-ordination (Waste Management) Regulations, 2006;</li> <li>Downstream community notification in case of unprecedented overflow of wastes from water treatment sludge lagoons. A communication protocol should be developed for this.</li> </ul>	LVSWWDA  Local Water and Sewerage company  County Government of Nandi	Throughout the operation phase	<b>800,000</b> per year <i>(for quarterly water sampling and analysis of the source river water)</i>
Operation of generators.	Noise pollution	<ul style="list-style-type: none"> <li>Ensure that suitable mounting is done at the installation stage incorporating noise and vibration abatement;</li> <li>Clearly label the high noise areas;</li> <li>Provide PPE (hearing protection) to workers operating within or visiting identified high noise areas;</li> <li>In order to meet noise level requirements, the generators should be equipped with standard noise attenuation features. Generators that exceed acceptable noise limits should be equipped with silencers or lagging materials or specially designed acoustic enclosures; and</li> </ul>	Local Water and Sewerage company	Throughout the operation phase	Mitigation guidelines to be included in the contractor's contract document

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		<ul style="list-style-type: none"> <li>Ensure regular maintenance of installed generators to manufacturers specifications.</li> </ul>			
Greenhouse gas emissions and hydrocarbon wastes from operation of generators.	Air pollution	<ul style="list-style-type: none"> <li>Ensure regular inspection and maintenance of installed generators according to manufacturer's specifications.</li> <li>Ensure regular servicing that included replacement of oil filters and fuel filters etc</li> <li>Ensure proper handling of hazardous wastes associated with maintenance;</li> <li>Minimise the use of the generators to only when it is needed.</li> </ul>	LVSWWDA  Local Water and Sewerage company	Throughout the operation phase	Mitigation guidelines to be included in the contractor's contract document
<b>Decommissioning Phase</b>					
Pipes rendered dysfunctional	Loss of portable water	<ul style="list-style-type: none"> <li>CRVWWDA should provide an alternative access to portable water before the operation period of the pipeline and treatment plant expires; and</li> <li>Awareness should be carried out early in advance to inform the people on the major rehabilitation or decommissioning period and its anticipated impacts.</li> </ul>	CRVWWDA  Contractor	Decommissioning phase	
Employment	Loss of jobs and source of income	<ul style="list-style-type: none"> <li>Notify the employees in advance on the project closure date and adequately compensate them;</li> <li>Dismissal procedures to be compliant with Employment Act, 2007;</li> <li>Provide counselling &amp; alternative skills for alternative activities;</li> <li>Employer should find alternative means of livelihood for the staff who were employed at the water treatment plant.</li> </ul>	CRVWWDA's Environment Quality and Liaison Officer	During decommissioning phase	Mitigation guidelines to be included in the contractor's contract document

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
Noise from demolition equipment	Noise Pollution	<ul style="list-style-type: none"> <li>Schedule noisy activities during the day time period;</li> <li>Use silencers on machines where possible;</li> <li>Ensure machinery is well maintained to reduce noise emitted.</li> </ul>	CRVWDA's Chief Administration Officer	Throughout decommissioning phase	As a per decommissi oning plan to be independen tly prepared be the contractor and agreed by the client and supervising consultant
Air and dust from demolition of equipment	Air and dust pollution	<ul style="list-style-type: none"> <li>Practice dust management techniques, including watering down during drier period;</li> <li>Set up dust barriers/ screens at strategic locations;</li> <li>Provide and enforce the appropriate use of PPE against dust.</li> <li>Further follow ups should be done.</li> </ul>	CRVWDA's Chief Environment Quality and Liaison Officer	Throughout decommissioning phase	As a per decommissi oning plan to be independen tly prepared be the contractor and agreed by the client and supervising consultant
Solid waste material	Aesthetic degradation; Contamination of surface waters; breeding points for disease causing bacteria.	<ul style="list-style-type: none"> <li>Disposal of solid waste in compliance with EMCA 2006 Waste Management Regulations;</li> <li>Segregation of waste to encourage reuse and recycling;</li> <li>Ensuring that the contracted waste collector is registered with NEMA to collect and dispose wastes; and</li> <li>Careful disposal of any residual chemicals and wastes from the treatment plant.</li> </ul>			As a per decommissi oning plan to be independen tly prepared be the contractor and agreed by the client and supervising consultant



Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
<b>Cumulative impacts</b>					
Increase in population leading to increase in waste generation	Waste water management and public health problems	<ul style="list-style-type: none"> <li>• Liaise with WRA to demarcate of the riparian area to sensitize people (through WRUAs) from farming and undertaking other proscribes activities along the riparian areas that contribute to river sedimentation;</li> </ul>			
Future increase in farming activities	Heavy sedimentation load due to reduced ability of the river to self-clean.	<ul style="list-style-type: none"> <li>• Equip the community with appropriate resources like seedlings to plant trees along the riparian;</li> <li>• It is proposed to remove this sludge by filtration in Sludge Drying Beds to be constructed at the Treatment Works. Sludges from Chlorination and pH Correction Tanks contain Chlorine and Soda Ash. These sludges will be removed in Soak away Pits. All chemical sludges will be buried on site, and the pH of the soil monitored continuously. There will be no disposal of the sludge into the River.</li> </ul>			

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## 8.5 Environmental and Social Monitoring

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The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will also enable response to new and developing issues of concern. The activities and indicators that have been recommended for monitoring are presented in the ESMP.

Environmental monitoring is also carried out to ensure that all construction and operation activities comply and adhere to environmental provisions and standard specifications, so that all mitigation measures are implemented. The contractor shall employ an officer responsible for implementation of social/environmental requirements. This person will maintain regular contact with the proponent's environmentalist and the respective County Environmental Officers. The contractor and proponent's environmentalist have responsibility to ensure that the proposed mitigation measures are properly implemented during the construction phase.

The environmental monitoring program will operate through the construction, and operation phases. It will consist of a number of activities, each with a specific purpose with key indicators and criteria for significance assessment.

Monitoring includes:

- Selection of environmental parameters;
- Visual observations; and
- Regular sampling and test measurements of these parameters.

Periodic on-going monitoring will be required during the life of the Project and the level can be determined once the Project is operational.

Monitoring will be done in three fronts:

- Physical monitoring;
- Biological monitoring; and
- Social monitoring.

### 8.5.1 Internal monitoring

It is the responsibility of the proponent to conduct regular internal monitoring of the project to verify the results of the Contractor's ESMP implementation and to audit direct implementation of environmental mitigation measures contained in the ESMP and construction contract clauses for the Project.

The monitoring should be a systematic evaluation of the activities of the operation in relation to the specified criteria of the condition of approval.

The objective of internal monitoring and audit will be:

- To find out any significant environmental and safety and health hazards and their existing control systems in force; and
- Meeting the legal requirements as stipulated in the Environmental Management & Coordination Act, EMCA-1999 and OSHA, 2007.

### 8.5.2 External monitoring and evaluation

Further to internal audits, it is recommended that a consultant be hired to carry out Annual Environmental Audits in line with NEMA requirements. NEMA has the overall responsibility for issuing approval for the Project and ensuring that their environmental guidelines are followed

during Project implementation. Its role therefore is to review environmental monitoring and environmental compliance documentation submitted by the implementing authorities and they would not normally be directly involved in monitoring the Project unless some specific major environmental issue arose.

LVSWWDA through the consultant will therefore provide NEMA with reports on environmental compliance during implementation as part of their progress reports and annual environmental auditing reports. Depending on the implementation status of environmentally sensitive project activities, NEMA may perform annual environmental reviews in which environmental concerns raised by the project will be reviewed alongside project implementation.

The proposed monitoring plan is presented in Table 8-2.

**Table 8-2: Monitoring Plan**

Environmental Component	Parameter	Standard	Location	Frequency	Implementation	Supervision
Land/Wayleave acquisition	Signed consent forms and compensation paid as per land and crop valuation	Valuation roll	Intake, Treatment Plant site and Transmission Mains	Monthly until construction is complete	LVSWWDA	LVSWWDA
Noise levels	Complaints; and Noise levels on dB (A) scale	EMCA guidelines on Noise	Selected Active construction Sites	As directed by the supervision consultant	Contractor	Supervision Consultant
Air Quality	Total suspended particles Visible dust	EMCA and WHO guidelines	Populated areas	Monthly	Contractor.	Supervision Consultant LVSWWDA
Soil Erosion	Visual evidence	FAO and Soils Report	All construction areas	Quarterly	Contractor	Supervision Consultant
Surface water width	Width of the rivers	WRA Guidelines	Rivers and streams	Monthly	O&M Contractor	LVSWWDA and WRA
Surface water quality – intakes and receiving waters	pH Salinity (EC) Nitrates Phosphorus Pesticide residues Coliforms BOD COD	EMCA Guidelines	Intake points and selected points downstream of irrigation areas	Monthly Monthly 6 months 6 months Monthly Monthly Monthly Monthly	O&M Contractor	LVSWWDA
Solid waste	Spoils, domestic refuse, metallic scraps, sludge	Disposal sites	Construction sites Water treatment Plant	Quarterly	LVSWWDA and Contractor.	Supervision Consultant
Soil Erosion	Turbidity in rivers and storm water	NEMA guidelines	Site, Marjory on river bank and high terrain	During and after the rainy seasons	Contractor	Supervision Consultant
Rehabilitation of work sites	Monitoring to ensure all work sites are progressively rehabilitated	ESMP	Site	As required	Contractor	Supervision Consultant
Accidents	Environment, Occupational safety and health officer engaged; Safety	ESMP	Project area	Quarterly	Contractor	LVSWWDA and DOSHS

Environmental Component	Parameter	Standard	Location	Frequency	Implementation	Supervision
	procedures; Safety training for workers, accident reports, community consultations and feedback					
Health	Project Health & Safety Plan, posters displayed, health awareness campaigns conducted,	ESMP	Project area	Quarterly	Contractor	LVWWDA
Vegetation and habitats	Vegetation structure, species density, diversity, fuel wood usages, commercial forestry and illegal logging incidences	ESMP	Project area and environs	Annually	Contractor	LVWWDA
Aquatic environment/River crossings	Flow velocity Wetted perimeter PH Depth Salinity Turbidity Habitat connectivity	ESMP	All affected rivers	Quarterly	Contractor	LVWWDA
Efficiency at waste water treatment works	Effluent quality indicators	Design specifications and Water Quality standards	All waste water treatment works	Quarterly	LVWWDA	NEMA & WRA

## 9 CONCLUSION AND RECOMMENDATIONS

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The development of the proposed water supply project for Nandi Hills town and its environs is necessary as its implementation will significantly improve access to clean water by the beneficiaries. This will lead to overall improved level of sanitation and health as a result of reduced occurrence of water and sanitation related diseases.

The project will involve rehabilitation of the existing Taito water treatment plant infrastructure and construction of a new water treatment plant for the new proposed abstraction point at Mokong River. The new proposed abstraction from Mokong River is a good supplementary option since, based on hydrological analysis, the water that can be abstracted from Taito Stream cannot sustainably yield the desired volume to meet the projected demand. This will lead to increase of the volume of water to be supplied to the town as well the proposed additional distribution channels.

The positive impacts identified in the project implementation are

- Solving the persistent water shortage challenge and non-availability of safe drinking water in Nandi Hills town;
- Creation of employment opportunities and economic enhancement;
- Improved public health;
- Improved access to water; and
- Women empowerment.

From the stakeholder meetings held in Nandi Hills and at the targeted water sources, the community has no objection to the project and would in fact like the project to be implemented as soon as possible. They strongly expressed their wish to have a wider area covered by the additional distribution network since many of those who reside in the area between the water treatment plant and the water storage tank are within the project zone of impact yet they are not beneficiaries. Access to water still remains a challenge to those people as well as the residents from other surrounding locations where the water distribution network did not reach. The suggested options included;

- Adding a water tank at Ketbarak and distribution lines to serve the area residents of Kosoiywo, Kipsamo, Keteng, Ketbarak, and Kimolonik. These areas are reported to be water scarce and hardship areas.
- Pumping water to Ketbarak, which is the highest point in Kaplelmet. This would then ease distribution of water to the locations that are above the proposed distribution line.

The proposed mitigation measure which will be included in the project is provision of water abstraction points for the community. The final location for these community water points will be decided upon by the design and build contractor in consultation with the community members at detailed design stage.

For the negative environmental impacts identified, adequate mitigation measures have been proposed in order to alleviate the expected negative impacts and to make the project environmentally and socially acceptable. An ESMP has been prepared, and it includes: the mitigation plan; the monitoring and enforcement requirements; and the responsible persons/organizations. All the recommendations/ mitigations mentioned in the study should be financed and incorporated in the construction and supervision contracts as applicable. Strict controls and Supervision of the Contractor will ensure compliance with required mitigation measures. It is therefore recommended that:

- The augmentation of the existing water supply for Nandi Hills project should be granted a NEMA construction licence to commence.
- The Final Detailed Design (2019) of pipeline alignment has optimised use of public road reserves as feasible, but where private land or property is affected, an

Abbreviated Resettlement Action Plan is recommended to ensure that any project affected person is compensated for the associated loss;

- A monitoring programme should be adhered to during both construction and operation phases.

This ESIA has been based on the Final Detailed Design of the water supply and sanitation project, having been updated from the ESIA done by CAS Consultants Ltd in the year 2016 based on the project's preliminary design.

Deforestation, farming along the riparian and pollution from tea plantations along the riparian is the most outstanding impact of the environment to the proposed project. These can all impact on the quality and availability of the water and on a larger scale, the sustainability of the project.

It is further recommended that:

- Apply standard best practice site sediment control procedures to minimise sediment in site drainage waters returning to the river;
- Conduct quarterly monitoring of the effluent from water treatment plant to ensure compliance with the water quality standards;
- There should be a multidisciplinary approach to addressing the re-afforestation and phasing out the planting of blue gum trees along the river banks. This should be a joint effort between KFS, WRA, NEMA, Nandi County government and the Community through the WRUAs registered by WRA;
- Engage the public in awareness campaigns for the protection and conservation of the catchment area; and
- Encourage the community to participate in afforestation and re-afforestation of the region.