



**ATHI WATER
SERVICES BOARD**

**ENVIRONMENTAL AND SOCIAL MANAGEMENT
PLAN (ESMP) FOR THE NORTHERN COLLECTOR
TUNNEL PHASE 1 PROJECT**



MARCH 2019

ENVIRONMENT AND SOCIAL MANAGEMENT PLAN FOR NCT1

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1 INTRODUCTION

1.1 Project Background and rationale

Athi Water Services Board (AWSB), the Proponent, provides Water and Sewerage services in Nairobi City County and some of its satellite towns, whose water demand is increasing rapidly due to population increase into the City coupled with increased water demands from the industries. Nairobi is the country's largest economic centre and generates 45% of the country's GDP, in the process employing 43% of all Kenya's urban workers (Oxfam, 2009). It is also the largest industrial centre and food, beer, vehicles, soaps, textiles and chemicals are all produced or processed in the city.

The main source of water for Nairobi is the Eastern Aberdare Rivers within the Aberdare Conservation Area (ACA). The ACA includes the Aberdare National Park and the gazetted Forest Reserves that surround the National Park. The areas are all under Government protection through Kenya Wildlife Services (KWS) and Kenya Forest Service (KFS). They are not subject to catchment degradation through settlement and forest clearance, as has been recorded in other national forests, notably the Mau Forest. It can reasonably be assumed that the "protected area" status will not only be maintained by the Government, but will be strengthened; hence the sustainability of the surface water sources arising from the ACA is assured under current Government policy, subject to control of permitted abstraction.

The ground water contribution to Nairobi Water supply (domestic, commercial or industrial purpose) by public, private or individual boreholes is estimated to be approximately 45,000m³/day.

The present sources of water and their respective yields are as given below:

- Thika Dam 329,000 m³/day
- Sasumua Dam 58,000 m³/day
- Ruiru 21,700 m³/day
- (Chania) Ngethu 104,000 m³/day
- Kikuyu Springs 4,800 m³/day

The combined yield of the developed Water sources for Nairobi Water Supply is about 540,000m³/day against the current demand estimated at about 750,000m³/day. In order to bridge the existing supply gap and meet the projected future demand, a Feasibility Study and Master Plan for Developing New Water Sources for Nairobi and Satellite Towns up to the year 2035 was commissioned by AWSB and concluded in 2012 by Consultant Egis Bceom International in association with Mangat I.B. Patel & Partners.

The project is derived from Nairobi Water Master Plan for Developing New Water Sources for Nairobi and 13 Satellite Towns namely Kikuyu, Ruiru-Juja, Kiambu, Karuri, Githunguri, Mavoko Municipality, Ngong Township, Ongata Rongai, Thika, Gatundu, Limuru, Lari and Tala-Kangundo.

The Northern Collector Phase 1 (the Project) involves a transfer of water from Maragua River, Irati River and Gikie River to Thika dam (Ndakaini dam). AWSB undertook the Environmental and Social Impact Assessment (ESIA) which included the Environmental and Social Management Plan (ESMP) which is presented in this report.

1.2 Environmental and Social Management Plan

An environmental and social management plan (ESMP) is a project or site specific plan developed to ensure that appropriate environmental management practises are followed during a project's construction and/ or operation.

An effective ESMP ensures:

- Application of best practise environmental management of the project;
- The implementation of a project's EIA including its conditions of approval or consent;
- Compliance with environmental legislation; and
- That environmental risks associated with a project are properly managed.

This ESMP contains a description of mitigation measeures for adverse impacts, measures for enhancing beneficial impacts and the cost of mitigation against the impacts.

1.3 The Proposed Project

1.3.1 Project Location

The proposed Northern Collector Tunnel (NCT) is located in Kangema and Kigumo Sub-Counties of Murang'a County. Murang'a town is the County Headquarters, while the Sub-County Headquarters for Kangema and Kigumo are located in Kangema and Kigumo towns respectively. A map showing the location of Murang'a County is shown in Figure 1-1.

The administrative units covered by the project are shown in Table 1-1 below and presented in Figure 1-2.

Table 1-1: Administrative units covered by the project

Sub-County	Division	Location	Sub-Location
Kangema	Kanyenyaini	Ichichi	Ichichi
		Kiruri	Kiruri
Kigumo	Kangari	Makomboki	Makomboki
		Kangari	Kangari
			Mairi
	Kinyona	Kinyona	Kinyona
		Gacharage	Mununga
			Gacharage

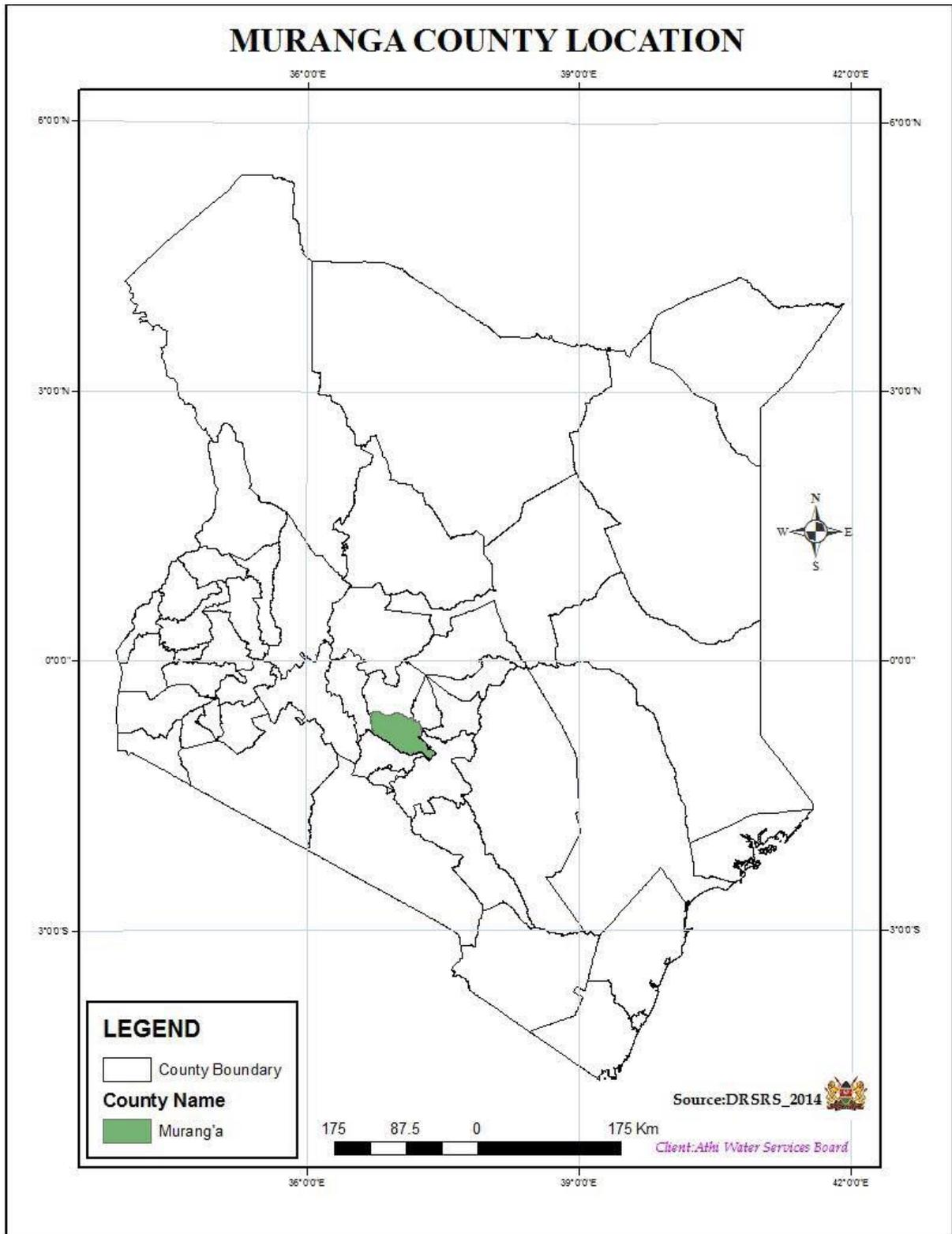


Figure 1-1: Location of the Murang'a County within Kenya

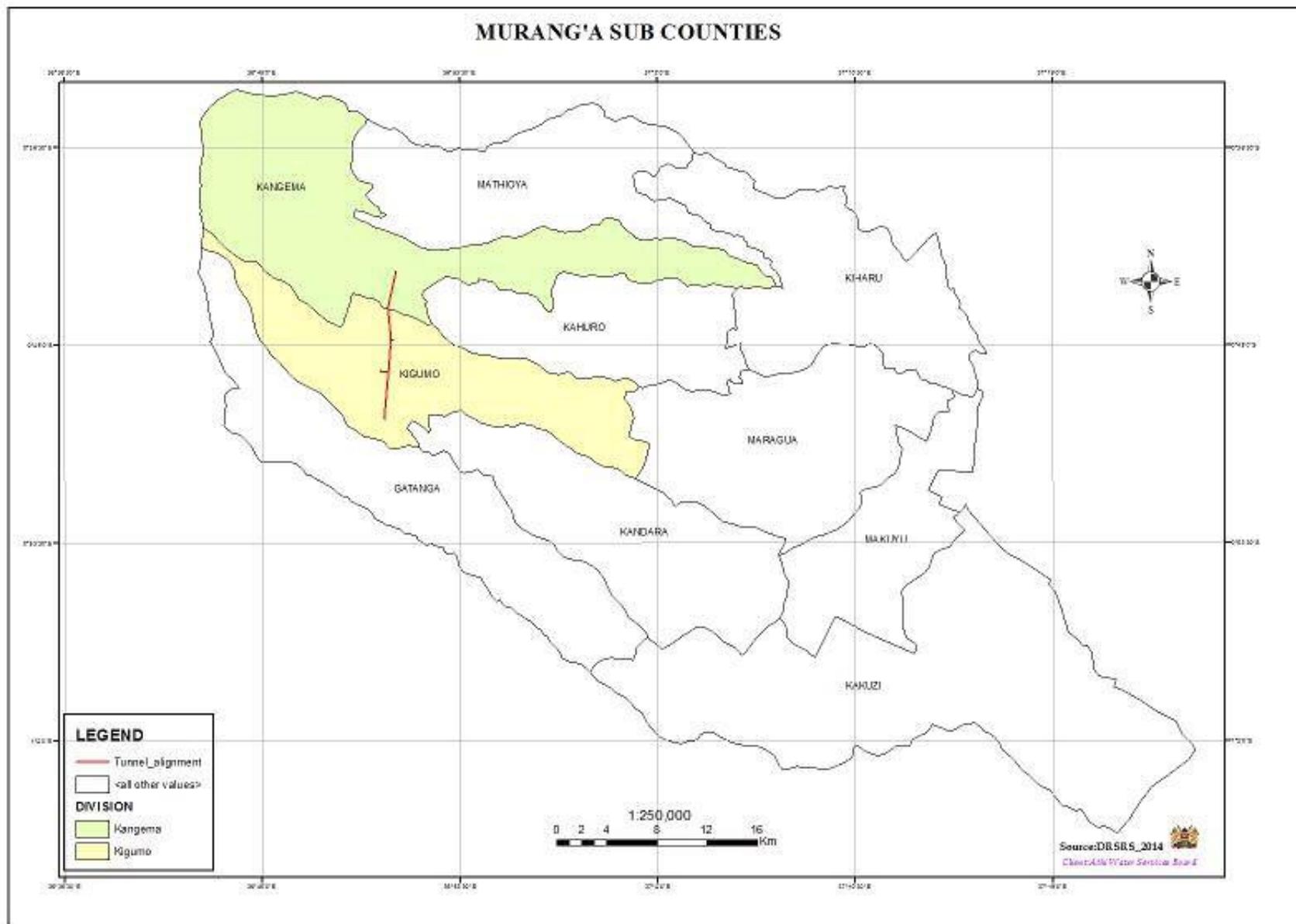


Figure 1-2: Sub counties Covered by the Project

1.3.2 Project Description

The Northern Collector Tunnel (NCT) Phase 1 is a proposed new raw water transfer tunnel along the eastern fringe of the Aberdare Conservation Area approximately 60km north of Nairobi. The tunnel project will transfer raw water through approximately 11.8km from intakes at the Maragua, Gikigie and Irati Rivers to an outlet at the Githika River near Makomboki trading centre, upstream of the existing Thika Reservoir. The intake points on these rivers are about 5km from the eastern edge of the Aberdare Conservation Area. The principal features of the NCT Phase 1 include the following:

- River diversion weir and related intake hydraulic structures at Maragua River including:
 - 20m wide, 5m high weir including trench diversion intake
 - 37m long, 4m deep de-silting basin
 - Compensation channel
- River diversion weir and related intake hydraulic structures at Gikigie River including:
 - 14m wide, 3.3m high weir including trench diversion intake
 - 17m long, 2m deep de-silting basin
 - Compensation channel
- River diversion weir and related intake hydraulic structures at Irati River including:
 - 20m wide, 4.4m high weir including trench diversion intake
 - 25m long, 2m deep de-silting basin
 - Compensation channel
- Drop shaft and connection gallery connecting the Irati intake to the main tunnel
- River outlet at Githika River including:
 - Cut and cover portal outlet from the main tunnel
 - 20m long outfall stilling basin structure
- Main Northern Collector Tunnel Phase 1 (main tunnel) including portals, excavation, initial support and permanent concrete lining. The tunnel is approximately 11.8km long and of 3m finished internal diameter:
 - Connection adit from Githika tunnel to the main tunnel;
 - Drop Shaft and connection adit at the Irati intake;
 - Access gallery from Kaanja Valley to the main tunnel.

Diversion and intake structures are to be constructed on three rivers namely Maragua, Gikigie and Irati, to divert $3\text{m}^3/\text{s}$, $1\text{m}^3/\text{s}$ and $2\text{m}^3/\text{s}$ respectively to the collector tunnel. The pertinent features of the NCT project is presented in Figure 1-3.

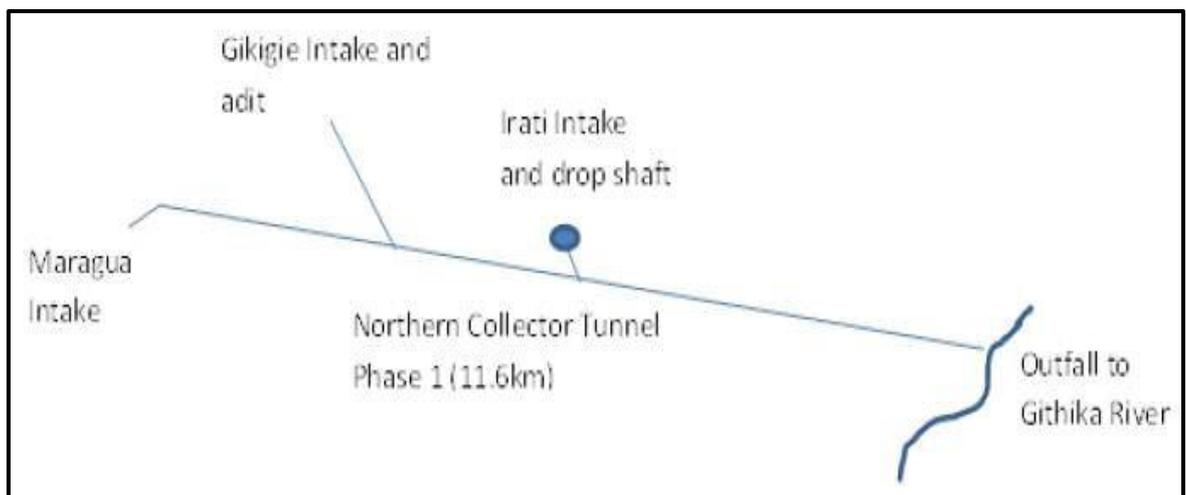


Figure 1-3: Schematic layout of Northern Collector

The water diverted from the intakes is conveyed through the NCT Phase 1 to an outfall on River Githika as per schematic arrangement above.

1.4 Objectives of the ESMP

The objectives of the ESMP are to:

- Define the management and mitigation measures to be applied by AWSB and all contractors to identified environmental and social impacts both during construction and operation phases of the project.
- Provide specific guidelines as to the extent, timeframe and responsible parties in implementing the advised mitigation and management measures.
- Provide AWSB management, its contractors and other stakeholders with legally permissible, workable, project-specific on-site environmental management controls over the project life.
- Enable AWSB to ensure that project contractors fulfil stated environmental obligation on their behalf.
- Reduce the environmental and social impacts of construction activities through the proactive employment of sound and effective working practises.
- Provide for structured documentation of emerging environmental concerns and corrective actions taken to manage them.
- Demonstrate due diligence.

2 ENVIRONMENTAL AND SOCIAL MANAGEMENT

This section presents how site specific concerns and mitigation measures will be addressed through the engineering, procurement, construction and operation phases of the NCT1 project. The ESMP provides a link between the impacts of project activities and the mitigation measures and responsibilities proposed to minimize these impacts and enhance the positive impacts.

2.1 Responsibilities of the ESMP

In order to ensure sound development and effective implementation of the ESMP, it is necessary to identify and define the responsibilities and authority of the various persons and organisations that will be involved in the project. Entities that should be involved in the implementation of this ESMP include but are not limited to the following:

- a) AWSB;
- b) NCW&SC;
- c) Contractor (s);
- d) Ministry of Water and Sanitation;
- e) NEMA;
- f) WRA;
- g) Directorate of Occupational Safety and Health;
- h) Department of Mines and Geology;
- i) KFS and KWS;
- j) County government of Murang'a; and
- k) Local administration.

(a) AWSB / Project Implementation Unit (PIU)

The project implementing agency is AWSB under the Ministry of Water and Sanitation. AWSB has set up a Project Implementation Unit (PIU), with a Technical Manager.

AWSB should co-ordinate all aspects of the environment during project implementation and operations (with involvement of NCWSC). This should include following the construction to monitor, review and verify the implementation of the project's ESMP.

(b) Project Contractor (s)

A project contractor will be appointed by AWSB. The contractor must be required to comply with the requirements of the ESIA, this ESMP, and any ESIA licences conditions as may be issued with NEMA as well as all relevant legislations.

(c) Ministry of Water and Sanitation

The ministry is responsible for overall policy direction and is hence better placed to ensure coordination of the said agencies for the conservation and management of the available water resources within the Aberdare water tower and ensure that a clean environment is sustained throughout the project life.

(d) Water Resources Authority (WRA)

WRA's regional office in Embu and the sub regional office in Murang'a will be involved in the project through its issuance of project water rights and regulations of water abstraction, study for water resources development and coordination of water use within the Upper Tana catchment area.

(e) NEMA

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.

Apart from the national office in Nairobi, NEMA has local offices in the project area at Murang'a town through which environmental supervision of the project will be conducted.

(f) Directorate of Occupational Safety and Health

Directorate of Occupational Safety and Health (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.

(g) Department of Mines and Geology

Licensing of any explosives and ensuring safe handling and use.

(h) KFS and KWS

Conservation and management of wild fauna and protected forest within the Aberdare water tower.

(i) County Government of Murang'a

Murang'a County government is responsible for various environment and public health management issues and should be incorporated to help enforcement of proposed mitigation and monitoring activities within the project.

In addition, the county government is better placed in dissemination of project information to the local levels through the members of county assembly and ward administrators. Continuous liaison between AWSB and the county government is thus recommended.

(j) The Local Administration

The relevant local administrators should be called upon where necessary during project implementation to provide the necessary advisory services and support to the project implementers.

2.2 Implementation

An Environmental and Social Management Plan has been prepared to identify and sequence environmental activities that are needed in order to complete a required construction process. Prior to commencement the Contractor will be required to prepare his own Construction Environmental and Social Management Plan that is in line with the project ESIA and also meets all ESIA license conditions.

2.2.1 Method statements

Method statements would be completed on behalf of the Main Contractor or Sub Contractor by an Occupational Safety and Health Officer and qualified Environmentalist or other appropriate experienced personnel, in consultation with AWSB environmental staff and, where necessary,

environmental consultants. Their production would include a review of the environmental and safety and health risks and commitments, as identified in the ESMP and risk assessment, so that appropriate control measures are developed and included within the construction process.

Method statements would be reviewed by PIU, the Main or Sub Contractor's appointed environmental manager and, where necessary, by an appropriate environmental specialist. Where necessary, all method statements would be submitted to the enforcement agencies as appropriate. Method statements would contain as a minimum:

- Location of the activity and access/egress arrangements;
- Works to be undertaken and methods of construction;
- Equipment including any machinery and materials to be used;
- Labour and supervision requirements;
- Safety, Health and environmental considerations; and
- Any permit or consent requirements including registration of the work place and approval of deployed equipment where required e.g. of cranes.

2.2.2 Control of construction processes

(a) Supervision of construction activities

All construction activities including those carried out by subcontractors and suppliers would be supervised, or regularly checked through the completion of site inspections by the Contractors Environmental Manager, to ensure that requirements identified in risk assessments or method statements have been implemented. The frequency and extent of this supervision would vary according to the degree of competence displayed by the workforce and the level of risk to the environment.

Environmental deliverables required by the CEMP would be subject to regular independent supervision by either the Environmental Manager or the relevant environmental specialists. These inspections would be used to confirm that:

- Construction works are progressing in accordance with the agreed method statements';
- Agreed protection or mitigation measures are in place, prior to or during the implementation of construction activities;
- Construction works have been completed in accordance with the design and commitments made during the statutory approval process.

(b) Environmental inspection and reporting

The Contractors Environmental Manager would carry out an assessment of the project's environmental performance, based upon the reports from the environmental management representatives during the period, reports from the environmental specialists and from his own site inspections. This would be carried out at a frequency at no greater than monthly intervals but could be held more regularly depending on the nature of the construction activity. An assessment of the performance over the month would be made and quantified. A monthly report detailing performance for the period would be provided to the AWSB and would include a summary of environmental inspections completed, audits undertaken, complaints and incidents.

The monthly environmental report would:

- Consider past performance from inspections, audit reports and monitoring data;
- Plan actions required to mitigate forthcoming risks; and
- Disseminate best practice.

2.2.3 Environmental and social due diligence during construction

During the construction phase, environmental due diligence will be incorporated into the

Project implementation mainly to:

- Control the residual risk of accidental environmental damage; and
- Prevent the negative environmental impacts during construction.

The contractor and supervising engineer will have the primary responsibility for the due diligence. The supervising Engineer **MUST** be required to include environmental considerations in the monthly progress reports and indicate progress in the implementation of mitigation measures as outlined in the ESMP.

The Construction risks to be monitored will include, but not be limited to the following issues:

- Handling of any hazardous materials including hydrocarbons as part of construction activities;
- Movement of machinery;
- Management of borrow and spoil areas including soil erosion;
- Sedimentation of watercourses;
- Collection and disposal of wastes;
- Management of pollution incidents;
- Safety and health management at construction sites; and
- Addressing local community concerns on the project implementation activities.

The Table 2-1 and 2-2 give a summary of the Environmental and Social Management Plan during Construction and operation phases of the project.

2.2.4 Construction Environmental and Social Management Plan

Table 2-1: Construction Environmental and Social Management Plan

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
Construction Phase					
Construction of weirs, adits, portals and outfall; Acquisition of easement above tunnel alignment	Loss of land and resettlement; and Economic displacement	<ul style="list-style-type: none"> Implement RAP before commencement of the construction works; Plan construction activities to take place during off farming seasons to reduce impacts on crops; and Ensure advance communication to farmers whose farms are likely to be affected allowing time for harvesting of any seasonal crops before the works commence. 	AWSB	Before construction	In line with RAP report
Tunnel construction activities including boring and blasting of rocks	increased risks of landslides and other Geological/ seismic hazards	<ul style="list-style-type: none"> Implement Geotechnical monitoring through Excavation Performance Review (EPR) system to continuously monitor the Geotechnical stability during the construction phase using appropriate instrumentation; and Formulate an emergency communication plan for alerting the local community where the need arises 	Contractor and AWSB	Construction	No additional cost to BOQ
Earthworks and transportation activities	Soil erosion and sediment generation	<ul style="list-style-type: none"> Contractor must ensure clear delineation of construction work areas to avoid unnecessary vegetation clearance and soil loosening; The contractor must implement planned erosion control measures to avoid erosion in areas that are prone to erosion, e.g. steep slopes and drainage lines; Topsoil stockpiles will be vegetated to prevent erosion; No topsoil to be utilized during any construction activity; Implement soil conservation measures at stockpiled sites; Where feasible, topsoil must be reinstated and rehabilitated on top of sub soil; All excavation works must be properly backfilled and compacted; Ensure downstream water users are informed about 	Contractor	Construction	No additional cost to BOQ

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
		<p>any unprecedented release of heavily silted water into the river;</p> <ul style="list-style-type: none"> Where possible, construction activities should be scheduled to occur outside of the rainy season, to reduce the anticipated volume of runoff during construction; and Sediment traps and barriers must be employed due to steep terrain. 			
Use and servicing of fossil fuel powered plant; Oil storage; Concrete production and use	Soil pollution	<ul style="list-style-type: none"> No vehicle/plant maintenance shall take place on undesignated site. In case of emergency, a drip tray shall be used to avoid diesel and / or oil spills; Concrete mixing shall not be done on bare soil. Concrete must be mixed on mortarboards, a large metal sheet or concrete slab. The slabs for concrete mixing shall be removed on completion of construction works; Excavated material shall be stockpiled at a demarcated site, within the construction zone; Once the construction activities have terminated, rehabilitation 	Contractor	Construction	No additional cost to BOQ
Deployment of heavy plant and earthworks	Soil compaction	<ul style="list-style-type: none"> Vehicles must be kept on existing/designated roads / tracks where possible; Minimize compaction during stockpiling by working the soil in the dry state; Rip compacted areas to reduce runoff and re-vegetate where required; All topsoil and other soil profiles must be managed strictly. 	Contractor	Construction	No additional cost to BOQ
Various construction activities	Surface and ground water pollution	<ul style="list-style-type: none"> Implement Standard Operating Procedures (SOPs) for working in water, 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 	Contractor	Construction	3,000,000

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
		<p>emergency spill procedures);</p> <ul style="list-style-type: none"> • 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 bund with a capacity of 110% 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 (e.g. settling ponds) 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, SOPs, and emergency procedures; • Ensure that all construction equipment and vehicles are serviced off site at licensed garages; • Any contaminated soil should be handled properly as hazardous waste and removed from site for safe disposal; and • Careful management of the sites and education of all construction staff would curtail the risk of pollution spills. 			
Construction camps	Overstretching local utilities; and incidences of insecurity	<ul style="list-style-type: none"> • Careful planning of construction camp; • Any contractor's camp should have a comprehensive waste management and sanitation plan and facilities commensurate with population of workers and activities in the camps; • Any storage tanks and equipment should have correct labels and Material Safety Data Sheets; • Adequate Emergency Response Plan should be in place in the camps; • The contractor should employ best practice management "housekeeping" (site cleanliness, waste disposal etc.) at all times; 	Contractor	Construction	2,000,000

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
		<ul style="list-style-type: none"> The contractor's facilities should be completely removed from site after use and the land restored to its previous condition or better; AWSB in collaboration with the local administration can facilitate the development of a police post next to the camp area to increase security. 			
Handling hydrocarbons on site	Oil spills	<ul style="list-style-type: none"> Vehicle maintenance should be done on purpose-built impervious concrete platforms with oil and grease traps; Ensure that all equipment are in good condition, clean and free from leaks; Oil spill containment and cleanup equipment should be kept at the contractor's camp. Construct oil skimming tanks at the locations directed and in accordance with details approved by the Engineer. Oil recovered from the skimming tanks shall be stored in drums and removed from the site for safe disposal; Monitor effluent discharge from the oil skimming tanks. Effluent discharge shall not exceed 25 mg/litre or the limit specified by the NEMA. 	Contractor	Construction	2,500,000
Employment of locals	Shifting of labour from tea picking to construction; Increased school drop-outs as school going age-group seek to work on the project	<ul style="list-style-type: none"> The contractor should be encouraged to offer wages within the prevailing rates; Where feasible, labour intensive tunnel construction activities should be planned to occur during off-peak periods for tea picking; and Contractor must abide by labour laws and avoid any employment of children. 	Contractor	Construction	No addition cost to BOQ
Diversion weirs and associated weir construction works	Interference with migratory fishes	<ul style="list-style-type: none"> Minimize activities to areas of construction and initiate habitat restoration immediately after construction works are through; Ensure sufficient compensation flow; and Restore disturbed areas to near-to-nature to blend with the immediate environment. 	Contractor	Construction	800,000

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
Oil spills and sediments releases	Riverine microhabitat alterations; Loss of otter dens; and Loss of breeding and nursery grounds for fishes and invertebrates such as the freshwater crabs <i>Potamonautes spp</i>	<ul style="list-style-type: none"> • Ensure adequate waste management plan is in place and in use from the onset of construction; and • Oil spill containment and clean-up equipment should always be available at the construction site with trained response team; • Implement erosion and sediment management plan; • Systematic search, capture and safe release of otters inhabiting the right of way (for the weir structures) and fish pass); and • Selective clearing and restoration of vegetation after construction 	Contractor and KWS	Construction	2,000,000
Site clearance and earthworks	Loss of vegetation cover and Illegal logging of trees of conservation significance	<ul style="list-style-type: none"> • Strictly control vegetation clearance and ensure it is only done when absolutely necessary through delineation of works areas; • Compensate for affected tea bushes and tree/woodlots before construction works begin and allow for salvage of affected timber; • Re-vegetate disturbed areas with locally occurring grasses, shrubs and indigenous trees soon after completion of each section; • Where encountered, plants of conservation importance should be avoided as feasible; • Establish and enforce code of conduct for its employees which must among others abhor illegal logging even from chance encounters of protected tree species within the project area; and • Ensure compliance with Wildlife (Conservation and Management) Act, 2013 and sensitize employees on the same. 	Contractor	Construction	1,800,000
Tunnel construction	Spoil generation	<ul style="list-style-type: none"> • Maximise the re-use of excavated materials in the works as far as feasible; • Investigate opportunities to set up MOU for use of spoil material elsewhere by the county government (e.g. for road construction and rehabilitation). 			

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
		<ul style="list-style-type: none"> • Properly dispose off the spoil in the approved spoil sites identified by the design team; and • Implement erosion and siltation management plan. 			
Solid Waste generation	Waste handling challenges	<ul style="list-style-type: none"> • The contractor should enforce the appropriate management methods based on the three Rs (Reduce, Reuse, and Recycle). • For waste handling the contractor should provide litter collection facilities such as bins; • Final disposal of the site waste should be done at a location that shall be approved by Resident Engineer in accordance with the Waste Management Plan after consultation with the relevant stakeholders, including the County Administration and local community; • The disposal site need to be more than 100 meters from watercourses and in a position that will facilitate the prevention of storm-water runoff from the site from entering the watercourse; • The tender documents should specify proper solid waste handling as provided in the waste management plan during site preparation phase of construction prior to project works commencing in identifying optimal waste re-use options and licensed disposal areas. This should strictly be adhered to by the Contractor; • The Contractor should not burn chemical or hazardous wastes on site or dump in open pits; and • Maximise the re-use of all excavated materials in the works 	Contractor	Construction	1,500,000
Generation of construction wastes	Liquid waste pollution	<ul style="list-style-type: none"> • All grey water runoff or uncontrolled discharges from the site/working areas (including wash-down areas) to water courses should be contained and properly channelled; • Water containing such pollutants as cements, concrete, lime, chemicals and fuels shall be discharged into a 	Contractor	Construction	1,300,000

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
		<p>conservancy tank for removal from site;</p> <ul style="list-style-type: none"> • Potential pollutants of any kind and in any form shall be kept, stored and used in such a manner that any escape can be contained and the water table not endangered; • Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas (including groundwater) are not polluted; and • Act promptly on any pollution incidents on site. 			
Air quality and dust emissions	Dust nuisance and toxic emissions with respiratory health problems	<ul style="list-style-type: none"> • Sensitize workers on management of air pollution from vehicles and machinery; • Vehicles delivering soil materials should be covered to reduce dust emissions; • Activities generating dust (excavation, handling and transport of soils) to be carried out in calm weather. The Resident Engineer shall suspend earthworks operations wherever visible dust is affecting properties adjoining the work site; • Consider watering of the access roads during dry season to suppress dust; • Provide dust masks to all personnel on dust-prone work sites; • Records of related complaints should be kept by the contractor and communicated to the Resident Engineer; • All construction machinery should be maintained and serviced in accordance with the equipment specifications and manufacturer's standards; and • The removal of vegetation shall be avoided until such time as clearance is required and exposed surfaces shall be re-vegetated or stabilised as soon as practically possible. 	PIU and Contractor	Construction	600,000

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
Noise generation by construction activities	Noise nuisance and related health problems	<ul style="list-style-type: none"> Noise levels shall be kept within acceptable limits preferably as stipulated within the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) Control Regulations, 2009 and construction activities shall, where possible, be limited to normal working hours; Monitor noise and vibration in sensitive locations above the tunnel (hospitals, teaching facilities, churches) and along the haulage routes to ensure the NEMA requirements regarding noise and vibration are met and if the standards are exceeded measures must be taken to reduce noise and vibration; Equipment should be maintained regularly to reduce noise resulting from friction; Workers exposed to high-level noise must wear personal protective equipment (PPE); Use of silencers on the construction plant, where applicable, should be encouraged; Residents in close proximity should be given at least 24 hours notification of any abnormal noise source e.g. planned blasting; and Institute a community complaints/redress mechanism to identify and respond to any unanticipated noise/vibration related complaints. 	Contractor	Construction	1,600,000
Use fossil fuels and Air conditioners in camps	Generation Ozone depleting gases	<ul style="list-style-type: none"> Ensure use of approved fuels from licensed suppliers only; Regular maintenance of machinery to manufactures' specifications; Ensure that any cooling units installed at the camps only use ozone friendly coolants in compliance with NEMA guidelines. 	Contractor	Construction	No addition to BOQ
Influx of immigrant workers	Social delinquency and spread of STIs including HIV/AIDS	<ul style="list-style-type: none"> Ensure the contractor liaises with local public health officials and NGO's within the project area in educating the community; 	Contractor	Construction	No addition to BOQ

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
		<ul style="list-style-type: none"> • Locate construction camps locations away from concentration of schools; • Formation of peer groups from among the project staff to ensure continuity in training and awareness raising; and • The contractor should ensure that the project workers are sensitised on the local culture. 	Contractor/Supervisor Engineer/PIU	Construction	No addition to BOQ
Migration of workers to the NCT site, increased earnings, dislocations in traditional culture and changes in family dynamics.	Gender Based Violence (GBV)	<ul style="list-style-type: none"> • Develop and implement a GBV action plan with an Accountability and Response Framework as part of C-ESMP. The GBV Action Plan will follow guidance on the World Bank's Good Practice Note for Addressing Gender Based Violence in Investment Project Financing involving Major Civil Works dated 28 September 2018. In general, it should include (i) how the project will put in place the necessary protocols and mechanisms to address the GBV risks and (ii) how to address any GBV incidents that may arise. • All workers to sign Code of Conduct which addresses GBV and penalties. • Active sensitization and engagement with the communities, particularly women and girls, on raising the awareness of the potential arrival of external workers, social conducts and behaviors, and adequate grievance redress mechanisms; • Mandatory training for all employees on the legal conducts in local communities and legal consequences for non-compliance, sensitize them on the implications of engaging in sexual relationships with underage girls and married women. • Contractor should source for local workforce as much as 	Contractor/Supervisor or Engineer/PIU	Construction	<p>Costs provided in the contract of the GBV expert.</p> <p>Additional 2,000,000 to be provided for contingencies</p>

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
Construction traffic	Traffic inconveniences and damage to local roads	<ul style="list-style-type: none"> • Ensure the local roads and bridges to be used by the project are improved before construction works start; • Ensure that all regulations relating to traffic management are observed and notify the local traffic officials and KTDA of the construction activities; • Where necessary, traffic management plan should be developed together with alternative arrangements / diversions. The plan should define the construction routes and speed limits; and • Install adequate and appropriate traffic warning signage and associated road furniture as well as enforcing speed limits for construction vehicles on the project affected roads. 	Contractor	Construction	No addition to BOQ
Various construction activities	Safety and health risks to workers and the general public	<ul style="list-style-type: none"> • Develop Construction Safety and Health Policy in compliance with OSHA, World Bank and international best practice e.g. IFCs Environmental, Health and Safety Guidelines. The policy should be approved by Environment, Health and Occupation Officer from AWSB and DOSH; • Establish and enforce a strict code of conduct for all project drivers including outside suppliers delivering materials. The code should focus on safety, especially speed, and loading, especially banning all carriage of staff, workers and passengers except in seats; • Implement the specified H&S programme throughout the construction period. • The contractor should establish an emergency response procedure and display on all work areas during construction activities; • Construction sites should be adequately barricaded from the general public and conspicuous warnings posted in national and local languages; and • The contractor should ensure compliance with all standards and legally required health and safety procedures in line with OSHA, 2007 and associated rules and regulations. 	Contractor	Construction	No addition to BOQ

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
		<ul style="list-style-type: none"> Include a specific and independent task in the supervision contract concerning H&S supervision and compliance, together with the staff resources to carry this out. 	AWSB	Before construction	2,000,000
	Sexual harassment risk between workers working on the project	<ul style="list-style-type: none"> All workers to sign Code of Conduct which addresses SH at the workplace and penalties; Sensitize workers on dangers and consequences of sexual harassment. 	Contractor	Construction	No addition to BOQ
Camp and plant installation	Pressure on and disruption of utility services	<ul style="list-style-type: none"> Ensure any power demand beyond the existing capacity is installed before construction begins; Liaise with relevant utility service providers and roads authorities to minimize any service disruptions; Ensure advance notice to all stakeholders including water service providers and KTDA of any planned disruptions 	Contractor	Construction	No addition to BOQ
Earthworks and spoil stockpiling	Modification of landscape	<ul style="list-style-type: none"> Encourage reuse of spoil materials e.g. in roads construction and maintenance, as far as feasible to reduce land area used for spoil storage; and Incorporate landscaping at adits and portals to camouflage the introduced concrete surfaces. 	Contractor	Construction	2,000,000
Influx of immigrant workers	Growth of unplanned settlements	<ul style="list-style-type: none"> As much as feasible, the unskilled labour should be obtained from amongst the locals; Provide adequate accommodation for non-local workforce; and Liaise with Murang'a county government to control developments in the area and ensure provision of adequate services 	Contractor	Construction	No addition to BOQ
Tunnelling works	Destruction of previously unidentified physical cultural resources	<ul style="list-style-type: none"> Formulate a chance-find procedure for implementation whenever any archaeological sites are encountered 	Contractor	Construction	500,000

2.2.5 Operation Environmental and Social Management Plan

Table 2-2: Operation ESMP

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
Water diversion into the tunnel	Reduced downstream flow (affecting both domestic and ecological needs)	<ul style="list-style-type: none"> Allow for downstream compensation flow at Irati weir to a minimum of 0.67 m³/s; Ensure strict adherence to the proposed abstraction weirs operation principles; Construct fish passes as planned and ensure they are regularly maintained to allow safe passage for all identified migratory species; Deliberate, compensation release of adequate amount of water downstream to mitigate alteration of the river ecosystem 	AWSB and NCW&SC	Operation	No additional cost
		<ul style="list-style-type: none"> Undertake wet season survey and subsequent annual aquatic fauna surveys for both wet and dry seasons to monitor trends and inform any further management interventions 	AWSB	Operation	10,000,000
		<ul style="list-style-type: none"> The Aberdare catchment conservation efforts should be enhanced to reduce possible sedimentation in to northern collector rivers, which may end up in the Thika reservoir, causing sedimentation of the reservoir Ensure demarcation and protection of riparian reserves of the affected rivers. This will offer favourable cover and temperatures for the rainbow trout 	KFS KWS WRA AWSB	Operation	
	<ul style="list-style-type: none"> Conduct routine In-stream Flow Release compliance audit/monitoring once operation commences and use gathered information to guide management interventions. 	WRA	Operation	10,000,000 (annually)	
	Reduced water temperatures downstream	<ul style="list-style-type: none"> Encourage local communities to plant indigenous trees on the riparian lands to ensure water temperatures are not increased; 	AWSB, NEMA and WRA	Operation	

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
	Deterioration of downstream water quality	<ul style="list-style-type: none"> Conduct regular water sampling and laboratory analysis to monitor the water quality variations 	WRA	Operation	
	Increased inflow into Githika river and Thika reservoir	<ul style="list-style-type: none"> For possible increased inundation of the riverine areas, stream channel expansion from the outfall may help to counter the increased flow. Installation of a gauging station after outfall, will help monitor the water levels changes, so as appropriate measures can be taken; and Ensure that the new off take is continuously operational at optimal levels to evacuate the increased volumes. 	AWSB	Operation	No additional cost after implementation of pipeline component
	Changes in riverine and riparian floral compositions	<ul style="list-style-type: none"> Observe the minimum ecological flow after intake for R. Maragua, R. Irati and R. Gikigie; Support local communities to plant indigenous trees along the rivers and not the exotic Eucalyptus trees as is the present case. Awareness on the same should be enhanced; Undertake continuous ecological monitoring of hydrophytes and high water specific species to track and mitigate any emerging impacts of the project on the plants. 	AWSB	Operation	6,000,000
Water diversion into the tunnel	Changes in riverine and riparian floral compositions	<ul style="list-style-type: none"> The riparian extent of the project affected rivers should be defined by WRA (based on the 6-30m rule from river banks) and be enforced to prevent people farming up to the river banks to reduce siltation 	NEMA and WRA	Operation	No additional cost

Project Activity/ environmental concern	Possible Impacts	Mitigation Measures	Institutional Responsibility	Time Frame	Estimated Costs (KES)
Tunnel O&M activities	Safety risks during tunnel maintenance operations	<ul style="list-style-type: none"> • AWSB should establish and implement NCT1 tunnel specific comprehensive O&M Safety and Health Management Plan within which it ensures that: <ul style="list-style-type: none"> • All potential hazards are identified and appropriate mitigations put in place; • Pre-entry activities are defined including the method statements, hazards assessment, incident action plan, communication plan, personnel accountability plan, personal protective equipment list, and atmospheric monitoring equipment list; • Appropriate PPE for O&M staff are available throughout; • Requisite instrumentation and available and operable; • Liaise with the Ministry of Health should to ensure clinic and ambulances to be built/acquired under the project remain operational in the project area throughout the operational life 	AWSB	Operation	
Increased inflow into Thika dam	Concerns of dam safety	<ul style="list-style-type: none"> • Review and update the existing safety and Emergency Plan for Thika dam. 	AWSB	Before commissioning	To be determined by AWSB
Tunnel leaks	Loss of water	<ul style="list-style-type: none"> • Monitor volumes at intakes and outfall to allow loss detection; and • Ensure regular inspection and maintenance of the tunnel. 	AWSB and NCW&SC	Operation	No additional cost
Fish pass failure	Impeded migration of fish	<ul style="list-style-type: none"> • Test and evaluate efficacy of fish passes within the first two years of commissioning 	AWSB and NCW&SC	Operation	Operation and Maintenance

2.3 Environmental and Social Monitoring

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 PIU and the respective County Environmental Officers. The contractor and PIU 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 ongoing 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.

2.3.1 Internal monitoring

It is the responsibility of the proponent, AWSB through the PIU, to conduct regular internal monitoring of the project to verify the results of the Contractor 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.

2.3.2 External monitoring and evaluation

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.

AWSB 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.

Table 2-3: Monitoring Plan

Environmental Component	Parameter	Standard	Location	Frequency	Implementation	Supervision
Land take and resettlement	Signed consent forms and compensation paid as per land and crop valuation	Valuation roll	Conveyance line	Monthly until construction is complete	AWSB	Supervision Consultant
Gender Based Violence Cases	<ul style="list-style-type: none"> Existence of a code of conduct Number of worker and community trainings undertaken Number of GBV cases reported and resolved 	GBV Action Plan	All project sites	Monthly until construction is complete	Contractor/AWSB	Supervision Consultant
Noise levels	Complaints; and Noise levels on dB (A) scale	EMCA guidelines on Noise	Selected Sites	As directed by the supervision consultant	Contractor	Supervision Consultant
Air Quality	Total suspended particles, H ₂ S, CO ₂ , CH ₄	EMCA and WHO guidelines	Populated areas	Monthly	Contractor.	AWSB
Soil Quality	pH ECe Exchangeable sodium percentage (ESP) Sodium adsorption ratio (SAR) Organic matter Cation Exchange Capacity (CEC) Nitrates P, K, Ca status	FAO and Soils Report	Composite samples from mineral soil at 5-30 cm depth, each sample to represent ~16 ha	Quarterly	Contractor	AWSB
Groundwater depth	Depth to groundwater	WRA Guidelines	Existing boreholes and wells	Monthly	O&M Contractor	AWSB and WRA
Groundwater quality	pH Salinity (EC) Nitrates Phosphorous Pesticide residues	WRA Guidelines	Existing boreholes and wells	Monthly Monthly 6 months 6 months if indicated by drainage or surface water tests	O&M Contractor	AWSB and WRA

Environmental Component	Parameter	Standard	Location	Frequency	Implementation	Supervision
Surface water quality – intakes and receiving waters	pH Salinity (EC) Nitrates Phosphorous Pesticide residues Coliforms BOD COD	EMCA Guidelines	Intake points and selected points downstream of intake areas	Monthly Monthly 6 months 6 months Monthly Monthly Monthly Monthly	O&M Contractor	AWSB
Solid waste	Slag, domestic refuse, metallic scraps, sludge	Disposal sites	Quarterly	Daily	AWSB and Contractor.	Supervision Consultant
Soil Erosion	Turbidity in rivers and storm water	NEMA guidelines	Site, Marjory on river bank	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	Occupational safety and health adviser engaged; Safety procedures; Safety training for workers, accident reports, community consultations and feedback	ESMP	Project area	Quarterly	Contractor	AWSB and DOSH
Health	Project Health facilities Project Ambulances Signs, posters displayed, health awareness campaigns conducted	ESMP	Project area	Monthly	Contractor	AWSB
Vegetation and habitats	Vegetation structure, species density, diversity, fuel wood usages and illegal logging incidences	ESMP	Project area and environs	Annually	Contractor	AWSB
Aquatic environment	Flow velocity Wetted perimeter PH Depth Salinity Turbidity Habitat connectivity	ESMP	All project rivers up to the confluence with Sagana	Quarterly	Contractor	AWSB
Seismic risks	Instrumentation installed	ESMP	Tunnel	Quarterly	Contractor	AWSB

Environmental Component	Parameter	Standard	Location	Frequency	Implementation	Supervision
Efficiency at waste water treatment works for the Nairobi City County	Effluent quality indicators	Design specifications and Water Quality standards	All waste water treatment works	Quarterly	AWSB	NEMA

2.4 Corrective Actions

In cases of non compliance, non conformity, complaints, incidents or accidents, the environment manager shall coordinate investigations and define stern actions to be taken to correct such situations. Non-conforming products or processes would initiate a Non-Conformance Report, which would identify the nature of the problem, the proposed corrective action, action taken to prevent recurrence of the problem and verification that the agreed actions have been carried out.

The environmental schedules will play central role in informing on the issues, cases or activities that need to be corrected for environmentally sustainable running of construction and operational phases of the project.

The findings and recommendations of periodic environmental and social audits, other concerned issues and recommendations for improvements raised from time to time during the tunnel operations will be periodically reviewed by the supervisor, and the findings will be presented to AWSB for action.

2.5 Communication and Coordination

Internal project communications would be via two processes:

- Weekly team meetings;
- A monthly Project Environmental Review.

2.5.1 Weekly team meetings

Weekly meetings chaired by the Resident Engineer would be held by the construction team to review performance and co-ordinate short-term planning of forthcoming activities. Environmental management representatives would use these meetings to report on the findings of their inspections together with any systematic or recurring issues. Actions from these meetings would be recorded via minutes and reviewed by the Project Manager.

2.5.2 Monthly Project Environmental Review

Environmental issues would be primarily discussed at a monthly Project Environmental Review, chaired by the Project Manager and attended by the Contractors Environmental Manager, the Supervising consultant and AWSB environmental and social team, relevant sub contractors environmental representatives and, when necessary, environment specialists and representatives from statutory consultees. The Project Environmental Review would:

- Consider past performance from inspections, audit reports and monitoring data.
- Plan actions required to mitigate forthcoming risks.
- Disseminate best practice.

2.6 Environmental Due Diligence during Construction and Operation Phases

During the construction phase, environmental due diligence will be incorporated into the Project implementation mainly to:

- Control the residual risk of accidental environmental damage;
- Prevent the negative environmental impacts during construction.

The contractor(s) and supervising Engineer will have the primary responsibility for the due diligence. The supervising Engineer will be required to include environmental considerations in the monthly progress reports and indicate progress in the implementation of mitigation measures as outlined in the ESMP.

2.7 ESMP Review

Since the ESMP is mainly based on anticipated impacts, it is not static. To continually improve the effectiveness of the implementation phase of the plan, review and amendment may be needed.

The review or amendment of this ESMP may be informed by the following;

- Regulated risk assessment
- Environmental Audits
- Changes in the scope of the project
- Where there is need for additional improvements in an area of environmental and/or social Impact.