

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR ARUA WATER SUPPLY AND SANITATION PROJECT



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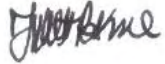
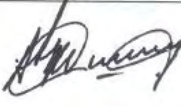
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List of Acronyms/Abbreviations

AAS	Atomic Absorption Spectrophotometer
AC	Asbestos Cement
ALARP	As low as reasonably practicable
AMC	Arua Municipal Council
ARI	Acute Respiratory Infections
AWSP	Arua Water Supply Project
BH	Boreholes
BOD	Biochemical Oxygen Demand
CFR	Central Forest Reserve
COD	Chemical Oxygen Demand
DDP	District Development Plan
DEO	District Environment Officer
DI	Ductile iron (material of pipe and fittings)
DISO	District Security Officer
DP	Development Plan
DW	Drinking water
DWD	Directorate of Water Development
DWRD	Directorate of Water Resources Development
ED	Effluent discharge
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
FM	Frequency Modulation
HDPE	High Density Polyethylene
HH	Household
HIV	Human Immune Virus
IFC	International Finance Corporation
ISO	International Organisation of Standardisation
K	Hydraulic conductivity
LC	Local Council
MDP	Municipality Development Plan
MEO	Municipal Environment Officer
MFO	Municipal Forestry Officer
MTTI	Ministry of Tourism, Trade and Industry
MoEMD	Ministry of Energy and Mineral Development
NDP	National Development Plan
NEMA	National Environment Management Authority
NES	National Environment Statute Vs (NEA = National Environment Act)
NFA	National Forestry Authority
Ni	Nickel
NTC	National Teachers College
NWSC	National Water and Sewerage Corporation
O&M	Operation and Maintenance
OD	Outside diameter
OHS	Occupational Health and Safety
OP	Operational Policies

PA	Project area
PAHs	Project affected households
PAIs	Project affected institutions
PAP	Poverty alleviation programme
RDC	Resident District Commissioner
RPC	Regional Prisons Commander
PAPs	Project affected persons
PES	Payment for Ecosystem Services
Pb	Lead
PN	Pressure nominal (when referring to pipes and pressure classes)
PPE	Personal Protective Equipment
PVC	Polyvinyl chloride
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SC	Sub-county
SDPs	Sub-county Development Plans
SWAT	Soil and Water Assessment Tool
ToR	Terms of reference
TTC	Thermal Tolerant Coliforms
TP	Treatment Plant
UNRA	Uganda National Roads Authority
uPVC	Unplasticised polyvinyl chloride
UShs	Uganda shillings
UWC	Universal Water Consultants
VES	Vertical electrical soundings
WMDP	Water Management and Development Project
WSP	Waste stabilisation ponds
WTW	Water treatment works
Zn	Zinc

EXECUTIVE SUMMARY

0.1 Introduction

Arua water supply project area has approximately 150,000 residents and currently approximately 100,000 people are served by the water supply network meaning that less than 70% of the people within the project area are being served. Arua also does not have any sewerage network or waste water treatment system. The Arua Water Supply and Sanitation Project aims at improving water and sanitation services in Arua Municipality and the surrounding seven sub-counties in the project area covering both the formal and informal settlements. The new project area of The Arua Water Supply and Sanitation Project covering Arua Municipality and seven sub-counties of Dadamu, Manibe, Vurra, Katrine, Ajia, Oluko and Pajulu has a total projected 2012 population of 387,100.

The implementation of the project has to be conducted in accordance with the international and national environmental laws and guidelines with the aim of promoting the positive impacts of the proposed project while minimizing the negative effects. In particular, this environmental and social impact assessment (ESIA) has been carried out in accordance with the National Environment Act, Cap 153 section 19(3) and World Bank safeguard policies. Accordingly, NWSC contracted NEMA certified practitioners to carry out the ESIA.

0.2 Scope of the ESIA

The main objective of the ESIA is to carry out a comprehensive (full) environmental and social impact assessment for the proposed Arua Water Supply and Sanitation Project, and propose measures to mitigate the adverse impacts while enhancing the positive ones. In addition to this, an evaluation of the possible alternatives for the project activities has been carried out.

The major tasks of the ESIA were:

- a) Assessment of national and international legislative, institutional and policy frameworks and guidelines relevant to the project;
- b) A description of the project's environmental and social baseline conditions;
- c) Identification, assessment and determination of the potential impacts of the project construction and operation phase;
- d) Identification and examination of alternatives to the project;
- e) Development of an Environmental Management Plan (EMP); and consultation with major stakeholders including the public and relevant Agencies.

0.3 Policy, legal and administrative framework

For the project to achieve its intended objectives, it will operate under various policies, legal and administrative frameworks. These include laws and policies of Uganda, World Bank and IFC legal requirements as well as international treaties and conventions.

0.4 Description of the environment and baseline conditions

The proposed project is to be implemented within Arua Municipal Council (AMC) in north-western region of Uganda, located 03 01' North and 30 58' East, 1200 m above sea level, in Arua District. The natural resources of Arua include forests, wetlands, water resources, soils and rocks. Arua is largely flat, with a few hills of the inselberg type, which rise abruptly from the plains as steep, bare masses of fresh solid rock. The major water source for Arua town is River Enyau. The groundwater is obtained from boreholes and protected as well as unprotected springs spread within the Municipality. In general, the vegetation is *Butyrosparmum-hyparrhenia* savanna characterized by such trees as: *Isobulinia doka*, *Danieh cliveer* and *Afseha Africana* and dry *Hyparrhenia spp.*

The socio-economic profile of the project area (PA) indicates that access to safe piped water is fair but intermittent and much lower during the dry season in the PAs. Sanitation and especially access to sanitation facilities is low within AMC and the surrounding sub-counties. Malaria, water and sanitation related gastro-intestinal infections, and acute respiratory infections (ARI) are the most prevalent diseases in the PA. Though primary educational facilities are relatively well distributed in the PA, enrolment and regular attendance is affected by poor access to safe water and decent sanitation for the girl child especially. Two predominant land tenure systems found in Uganda occur in the project area; customary, and leasehold, the predominant one being customary land tenure in rural areas while leasehold is common around AMC and the suburbs. Freehold is becoming regular with customary owners around town converting their landholding interests into freehold. The major tribes within the project area are the Lugbara (the main ethnic group in the region), Aringa, Kakwa, Madi and Alur.

The main source of income around AMC and the immediate suburbs is commercial trade (including informal trade) and formal regular paid employment; both private and public, followed by crop farming outside the urban areas especially along Arua-Pakwach road to Ocoko(Dubai), Mvara-Oluko road, Arua-Rhino Camp road (Wandi), Pajulu-Ediofe-Pokea-Onduparaka road, Mvara-Oduluba and Dadamu roads and Eweta-Muni-Nyio roads. The main agricultural activity is subsistence farming, with some crops being grown for sale. Major food crops grown are cassava, potatoes, millet, beans, sorghum and maize. The major cash crop is tobacco and coffee but cassava, millet and potatoes are increasingly being grown as cash crops.

0.5 Project description

The project is comprised of the following components:

- (a) Rehabilitation and expansion of the water treatment works (WTW).
- (b) Construction of up to seven boreholes to augment the current water source.
- (c) Transmission line from the boreholes to storage tanks.
- (d) Construction of an additional storage tank and enlargement of the existing tank.
- (e) Improvements and extensions to the existing water network.
- (f) Construction of waste stabilisation ponds (WSP).
- (g) Construction of a sewerage system for central Arua and transmission to the WSP.

- (h) Water and sanitation facilities in informal settlements.

The majority of the works is envisaged to take place within the confines of Arua Municipality and its immediate *periphery*. However, parts of the works may take place in rural settings, such as the potential drilling of boreholes, laying of the transmission line from the boreholes to the WTW, and the construction of the WSPs.

0.6 Potential environmental and social impacts

Arua Municipality currently lacks a wastewater reticulation system and sewage treatment plant. The current practice of faecal sludge disposal contributes to water pollution with faecal coliforms which in turn increases the disease burden of Arua Municipality and the surrounding suburbs. The proposed Arua Water Supply and Sanitation Project will therefore have significant positive environmental and social impacts of improved public health conditions in the project area. Specifically, the proposed water and sanitation project will have the following positive environmental and social impacts:

- (i) it will lead to increased educational enrolment and attendance as children will no longer spend most the time looking for and lining for water,
- (ii) it will improve the public health conditions in Arua Municipality and the surrounding seven sub-counties through increased coverage and provision of potable water and sewage collection and treatment facilities,
- (iii) it will stimulate social economic development, through reduced time (and consequences e.g. possibility to rape girls and women when going to fetch water over long distances), and will also reduce incidences of water and sanitation related diseases,
- (iv) it will provide employment to the local residents, especially the unskilled labourers (and to a smaller extent skilled labourers in sectors where they exist),
- (v) it will result in a decrease in household expenditure on unsafe water related health conditions,
- (vi) it will result in a reduction in community violence related to moving at night in search for water, overcrowding and jostling at water points and will also indirectly contribute to enhancement of public order,
- (vii) It will bring water close to homesteads and as a result lead to a reduction in instances of sexual violence related to water scarcity and inconsistent supply. There are incidences of sexual violence like rape that are related to scarcity of water, especially in situations where women and female children have to go out at night to wait for water at the taps, boreholes and protected springs,
- (viii) upon completion, the project will lead to a reliable supply of potable water and spur development.

However, there are inevitably a number of aspects of the project which have a potential for negative impacts. **Tables i** and **ii** show some of the identified major potential impacts of the proposed project. Only impacts assessed as major and moderate are given.

Table i:Major Potential Negative Impacts

Issue	Potential Impact
Soil erosion and contamination	Inappropriate construction practices and soil protection measures especially in construction of water works and WSPs may induce or accelerate soil erosion with possible pollution and siltation of downstream water sources.
Loss of vegetation	The large amount of earthworks involved in the construction of the WSPs may result into loss of vegetation, food crops and other flora.
Water pollution	Water pollution may result from the discharge of treated wastewater effluent during operation and maintenance (O&M) of waste treatment works and reservoir or from discharge of sludge from sedimentation tanks, containing alum; backwash water which may contain silt and dirt during O&M of WTW. Water may also be polluted by wastewater from construction camps, accidental spillage of fuels, lubricants and other chemicals and siltation of water courses from runoff laden with sediment and dust as well as high suspended solids from soil eroded from trenches, poorly constructed tracks during construction of boreholes.
Solid waste generation	Screenings may accumulate at the inlet to the waste stabilization ponds during O&M. Disposal of these, as well as sludge from the anaerobic pond (upon desludging, for example, once in every 5 years) may contaminate air, land and water.

Table ii: Moderate Potential Negative Impacts

Issue	Potential Impact
Noise pollution	Intermittent noise from construction equipment and heavy project vehicles during construction of WTW and pumps during O&M of boreholes can be a nuisance to sensitive receptors such as local communities and/or fauna.
Public safety and health	Safety risks to public health include: excavations and transportation of equipment, site workers and debris and movement of heavy equipment and obstructions of roads during construction of WTW and boreholes. Accidental ruptures and structural degradation of pipelines that may accrue from ageing and poor maintenance, accompanied by low pressure in the pipes during O&M of transmission and distribution pipelines may allow the intrusion of potentially polluted groundwater into the drinking water distribution system. Ruptured pipes may also cause flooding and if the water stagnates, this may pose a risk of water-borne diseases. Contamination of borehole water from pit latrines, poor waste disposal practices, or from the rocks forming the aquifers, may also pose health risks.

Occupational health and safety (OHS)	OHS is a major concern in all project components. Issues range from exposure of workers to occupational health and safety hazards from activities such as: excavations; working with heavy equipment; working under noisy conditions, working in confined spaces; lifting of heavy objects; storage, handling and use of hazardous substances and wastes during construction and O&M of WTW, boreholes and pipelines to working with sewage, chemicals, cleaning and disposal, closing and opening of valves for workers carrying out O&M of WSP.
Storage and handling of chemicals	Storage of alum and especially chlorine may induce rusting of holding metallic containers, and even rooftops, and if they are made of iron, they may contaminate the environment during O&M of WTW.
Raw materials use	Large quantities of construction materials will be involved, for example, cement, steel, oil, fuel, pipe materials (e.g. PVC, uPVC, concrete and/or steel). Also, large quantities of local materials, e.g. sand, gravel will be used during construction of WTW and WSP. If not well stored and utilized, as well as instituting management measures for waste materials, they can contaminate the environment.
Storage and handling of tools	Storage and handling of tools, for example, sewer rodding snakes, spades, wheel barrows, spanners etc, may contaminate the stores and pose hazards to the workers during O&M of WSP
Conflicting demands for water use	Groundwater abstraction during O&M of boreholes may lead to lowering of local water table levels hence reduction in water supply which may pose a serious risk of conflicts between various water uses such as for domestic, irrigation use and other purposes.
Disturbance and interruption of commercial and social activities	Improper laying of pipelines may cause traffic disruptions and congestion, resulting in temporary disturbance and interruption of commercial and social activities. It may also cause damage to infrastructure (roads, utility lines) and disruption of public services during construction and O&M of boreholes.
Socio-economic disruption	Trenches for laying of pipelines may be dug through peoples' gardens destroying crops and other properties which will affect their livelihood incomes. Some project activities like lagoons and water tank construction and laying some pipelines will require some land acquisition affecting people's livelihood and income. Furthermore, influx of people looking for employment and seeking improved water services in the project area may cause alteration of culture and introduce behavioural changes and negatively impact on public health especially in respect to HIV/AIDS.

0.7 Mitigation measures of identified impacts

For each of the identified impacts, mitigation measures have been suggested in accordance with a general rule defining mitigation criteria as:

- a) **Avoidance of major impacts:** major impacts are generally considered unacceptable, ones that would endure in the long-term or extend over a large area;
- b) **Reduction of major and moderate impacts to as low as reasonably practicable (ALARP)** by planning, designing and controlling mitigation measures. This implies that mitigation measures will be applied until the limitations of cost-effectiveness and practical application have been reached. The limitations are established by international practice;
- c) **Implementation of good practices for impacts rated as minor**, in order to ensure that impacts are managed within good reason.

The suggested mitigation measures for the major and moderate impacts are given in **Tables iii** and **iv**.

Table iii. Mitigation Measures for Major Negative Impacts

Issue	Description of mitigation measures
Soil erosion and contamination	• Carry out work under mild weather and avoiding strong rains or winds. • Remove and store topsoil in separate piles and reinstate after refilling of trenches, to enable natural re-vegetation. • The Contractor(s) should present procedures for, and ensure, implementation of measures to protect soils from any accidental or structural contamination. These include: ○ Storing all hazardous, sanitary and cleaning wastes in facilities approved by NEMA, Uganda. ○ Installing leak-proof fuel storages on concrete platform with gutters and grease separators, which are monitored periodically and repaired or replaced when required. ○ Strict enforcement and monitoring standard procedures for storing and handling hazardous wastes and raw materials (e.g. fuel or chemicals). ○ Placing strong drums for oil storage on impermeable floors in the stores. ○ Providing for appropriate hoses for re-fuelling of pumps and vehicles. ○ Parking vehicles on paved platforms whenever possible. ○ Ensuring that sites for cleaning, fuelling and maintaining equipment and vehicles are able to prevent leakage (e.g. paved or with settlers). ○ Treating wastewater from maintenance workshops in oil separators before discharge to sewers. • Isolating contaminated soil and treating /disposing it off in a way that will depend on the contaminant type.

Loss of vegetation	Inevitably, the construction of waste stabilisation ponds will lead to loss of vegetation, food crops and trees; thus, where families are affected, they should be compensated by; • Providing payment for any affected crops and trees. • Re-vegetation of embankments of the waste stabilization ponds. • Planting trees within the areas of the waste stabilisation ponds which is not inundated. • Creating buffer zones of natural vegetation belts of at least 50m between the lagoons and the river. • Lining the embankments of the lagoons with concrete to prevent erosion into the lagoons.
Water pollution	• No solid waste, fuels or oils should be discharged into water flows. • Test water samples from dewatering operations for contaminants according to NEMA, Uganda guidelines for discharge of effluents, which when exceeded, advice on appropriate discharge should be sought. • Hold and store sanitary and cleaning wastes in appropriate containers to be disposed of at approved sites. • Park vehicles preferably on paved platforms. • Fuel storages should not leak, and should be periodically monitored, and repaired or replaced when necessary. • Sites for cleaning, fuelling and maintaining vehicles should be able to prevent leakage (e.g. paved). • Maintain fuel and clean vehicles and equipment at workshops/sites with adequate leakage prevention (e.g. impermeable surface, settlers and oil separator).
Solid waste generation	• The Contractors should prepare a Solid Waste Management Plan which should contain: ○ An inventory of the types and quantities of waste to be produced, including their hazard class; ○ An assessment of any opportunities for reducing solid waste generation, especially hazardous and undesirable persistent and non-reusable waste types; • Waste types should be managed in terms of storage, transport and final destination, with reuse, recycling/recovery and disposal and/or incineration considered as its last options. • Records of types, quantities, origin, (temporary) storage, transport and elimination/reuse of solid waste should be kept and made available to the works supervisor upon request, as proof of proper waste management practices. • Only sites gazetted by the municipality should store wastes. • Filling material should as much as possible be obtained from excavated soils, which when contaminated should be

	disposed of as waste material at appropriate approved sites. • Uncontaminated top soil should be kept in separate piles and reinstated after refilling of trenches. • Excavated soil should be contained to avoid wash out and erosion. • Use licensed recycling/waste disposal companies to externally recycle, recover or dispose off waste. • Temporary storage of contaminated soils on site should be designed and implemented so as to minimize underground pollution.
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Table iv. Mitigation Measures for Moderate Negative Impacts

Issue	Potential Impact
Noise pollution	• Minimise noise according to NEMA, Uganda standards and World Bank guidelines. • Control noise and vibration on site(s). • Work programmes that have to be strictly followed should be provided to local communities. • Maintain vehicle and equipment according to manufactures' specifications. • Install adequate noise prevention devices, e.g. mufflers on noise generating sources. • Switch off engines of vehicles and machinery while they are not in use. • Provide information to the local communities (e.g. through the LC system or local radio (FM) stations) with regard to work programme, and strict adherence to such. • Workers who may unavoidably have to work with noise generating equipment, e.g. earthmoving equipment should be provided with ear plugs and advised/monitored to put them on.
Public safety and health	For WTW: • Fill up depressions caused as a result of the construction works. • Provide sufficient cut-off drains for the storm water that would otherwise enter work areas. • Provide sanitation facilities to workers on site. • Provide potable water to the workers on site. For other components: • Ensure that work sites (especially excavation works), particularly in the night have proper protection with clear marking of safety borders and signals and fence off all dangerous areas. • Inform riparian neighbours about the construction programme in advance. • Confine access to restricted work sites (including those with

	operation mechanical and electric equipment) to persons with permits. • Implement appropriate traffic management plans with the help of local police when (partial) closure of roads is required.
Occupational health and safety (OHS)	The Contractor should prepare and implement specific health and safety measures, and present these in a Health and Safety Management Plan. Measures should include (but not be restricted to) the following: ○ Enforcing and ensuring use of personal protection equipment by employees and particularly helmets and protective shoes. ○ Ensuring use of hearing protection equipment when working under noisy conditions. ○ Providing adequate health and safety training of all employees, including training on specific procedures as appropriate to various individual staff groups. ○ Providing adequate medical testing and insurance for all employees. ○ Putting in place appropriate fire fighting equipment, collecting trays and absorbent material at fuel storage tanks. ○ First aid boxes should be placed at each borehole site. ○ Planning for medical emergency evacuation plans for different types of incidents and injuries that might occur. ○ Provision of adequate sanitary facilities at construction sites. ○ Outlining procedures for working with heavy equipment and heavy lifting. ○ Provision of adequate waste and material storage facilities whose access should be restricted. ○ Ensuring basic rules with regard to protection of public health, including especially hygiene and disease (HIV) prevention.
Storage and handling of chemicals and raw materials use	• Storage of alum and especially chlorine may rust their holding metallic containers, and even rooftops, if they are made of iron.
Storage and handling of tools	• Tools used in sewers, manholes and sewage treatment plant should not be scattered in the environment. Instead, they should be kept in dedicated stores. • After using the equipments, they should be cleaned thoroughly and disinfected so that they do not disperse pollutants during transportation back to the stores. • The storage areas of the equipment used in manholes and sewers, or to carry hazardous material, e.g. sewer rodding snakes, spades, wheel barrows, spanners should be adequately disinfected.

Conflicting demands for water use	• Conduct a detailed hydrogeological investigation, including drilling and test pumping to determine safe yield of the boreholes to be developed without exceeding recharge rates or depriving other users (e.g. agriculture). • Adequately co-ordinate with other water users, especially the catchment management committees in accordance with the groundwater abstraction permit regulations of the Directorate of Water Resources Management.
Disturbance and interruption of commercial and social activities	• Inform local communities (e.g. through the LC system or FM radio stations) about the construction programme in advance. • Minimise relocation and damage as much as possible and where necessary do so within the resettlement policy framework and RAP. • Minimise temporary interference with private property (e.g. pipeline crossings over private lands) as much as possible. • Pay agreed compensation where there is any affected private land or other property prior to construction in accordance with the resettlement policy framework and RAP. • Inform local communities about any partial closure of roads in advance however temporary it may be. • Set up measures in traffic management plan at location of e.g. partial road closure. • Clean and maintain access roads in the neighbourhood of work sites of earth and sand on a daily basis. • Provide temporary access ways with the approval of local authorities where access roads are closed. • Carry out work under mild weather conditions; avoid strong rains or winds. • Reduce obstruction of access to and use and occupation of roads, footpaths and bridges. • Protect any items and/or sites of archaeological or cultural value (e.g. private graveyards) encountered during execution of the works with the aid of the appropriate authorities. • Choose the final pipeline alignment so that the period of realization of branch connections and fittings is short enough.
Socio-economic disruption	• Adequately co-ordinate with other water users, especially the catchment management committees in accordance with the groundwater abstraction permit regulations of the Directorate of Water Resources Management. • Adequate and prompt compensation of PAPs as suggested in RAP and in accordance with laws of Uganda and Development partner requirements. • Implement HIV/AIDS prevention and control plan as part of

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| | mitigation measures. <ul style="list-style-type: none"> • Give priority to the local population for casual employment and other positions for which they possess the required skills. |
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0.8 Analysis of project alternatives

Some project components are so specific and have been carefully analysed in terms of their actions and intended location so that no alternatives are proposed, for example, for the sewage treatment plant, the sewage lifting station and the sewer transmission to the waste stabilization ponds. For other project components, for example, the proposed locations of water storage tanks, some alternatives have been suggested. The storage tank proposed at Vurra village should be omitted. The inlet, outlet and overflow pipes of the existing storage tank at Arua Hill will be enlarged. The proposed storage tank at Giligili government land should be maintained. The omission of one storage tank will save the project some money.

0.9 Environmental Management Plan

An EMP has been drawn up and presents the actions required to ensure that the mitigation measures proposed in this environmental and social impact study are carried out to a satisfactory conclusion and thus ensure that the environmental risks are reduced to an acceptable level. The EMP provides a delivery mechanism to address potential adverse impacts, to enhance project benefits and to introduce standards of good practice to be adopted for all project works. The EMP covers each stage of the project from construction to operation. The EMP contains the following elements:

- The potential impacts of the project.
- Description of identified mitigation measures and feasible and cost-effective measures to reduce potentially significant adverse environmental and social impacts to acceptable levels.
- A monitoring programme proposed to ensure that mitigation measures are implemented and that remedial measures are undertaken if mitigation measures are inadequate.
- Clearly defining the responsibilities for mitigation and monitoring of the potential negative impacts defining roles of the Employer, Contractors and the various institutions.
- Implementation schedule of the various action points suggested.
- Cost implications of the recommended measures.

1 INTRODUCTION

1.1 BACKGROUND

Arua Municipal Council is one of the thirteen (13) Municipal councils in Uganda. It is found in Arua district, which is one of the 112 districts of the Republic of Uganda. Arua Municipality lies on the north western region of Uganda, located on latitude 03 01' North and 30 58' East, 1200 m above sea level, surrounded by Ayivu County in Arua District. The municipality is 15 km from the Democratic Republic of Congo to the west, 75 km from Sudan to the north and 540 km northwest of Uganda's capital city, Kampala. Arua Town was established in June 1914 as an administrative centre. In 1938 a township authority was formed in Arua and in 1939 Arua town board was established. It then grew to a town council and later Arua was declared a municipality in 1972. The vision of Arua Municipal Council is to achieve: *"A healthy, prosperous and productive population for sustainable development"*. As a result provision of water supply and sanitation to its stakeholders is in line with achieving this vision.

Arua Municipality has water treatment works but no sewage treatment plant and the disposal facilities are mainly septic tanks and soak away pits. The water treatment works are located on the banks of River Enyau, which flows along the western periphery of the municipality. Arua water service area was effectively taken over by National Water and Sewerage Corporation (NWSC) in August 2002 from Arua Municipal Council and the Directorate of Water Development (DWD). The Nile Water Partnerships is currently the operator of the Arua water service area.

The water treatment works has an installed design capacity of 5,760 m³ per day. The practical operating capacity of the water treatment works is 2,750 m³ per day. The plant operates at 48% of this capacity. The area has piped network length of 111 km supplying 5,000 customers. About 72% of the Arua town population is connected to the water supply system although access levels fall significantly during the dry season. The population currently served by the piped water is 101,000; which comprises also of customers beyond the Arua Municipality boundaries. Some of the areas outside of Arua Municipality boundaries, which are supplied by the water supply system, include Ombaci 7km north-east of Arua town centre along Rhino Camp road, Onduparaka, Giligili and Euata which are 5 km from Arua town; and Kuluva which is 11 km from Arua town being furthest point of the gazetted service area. Due to the increasing population in Arua Municipality and its environs, there is need to increase the capacity of the water treatment works and to extend the water supply network. As pointed out earlier, Arua water supply area does not have a sewage treatment facility. The Arua Water Supply and Sanitation Project is therefore aimed at meeting the increasing demand for water and sewerage services in Arua area.

Arua Water Supply and Sanitation Project aims at improving water and sanitation services in Arua Municipality and the surrounding seven sub-counties in the project area. The new project area of The Arua Water Supply and Sanitation Project which covers Arua Municipality and seven sub-counties of Dadamu, Manibe, Vurra, Katrine, Ajia, Oluko and Pajulu has a total projected 2012 population of **387,100**. The implementation of the project must be conducted in accordance with the national and international environmental laws and guidelines with the aim of promoting the positive impacts of the proposed project while

minimizing the negative effects. In particular, in the case of Uganda, this Environmental and Social Impact Assessment (ESIA) report was carried out in accordance with the National Environment Act, Cap 153, section 19(3) and the World Bank safeguard policies, which requires an Environmental Impact Assessment (EIA) to be undertaken by the developer where the lead agency, in consultation with the National Environment Management Authority (NEMA), is of the view that the project may have an impact on the environment; is likely to have a significant impact on the environment, or will have a significant impact on the environment, bearing in mind that this project will involve major civil works. As a result, NWSC contracted experts to carry out the assessment.

1.2 OBJECTIVE OF THE ESIA

The main objective of the ESIA which is in tandem with Terms of Reference (Annex 1) is to carry out a comprehensive (full) environmental and social impact assessment for the proposed Arua Water Supply and Sanitation Project, and propose measures to mitigate the adverse impacts while enhancing the positive ones. In addition to this, an evaluation of the possible alternatives for the project activities has been carried out. NEMA approved the terms of reference (Annex 1.1).

1.3 SCOPE OF THE ESIA

The ESIA has been limited to the proposed area for the project and its associated activities. It covers all environmental aspects of the proposed project and their associated impacts. The data and information presented in this report give baseline conditions for monitoring the impacts of the project activities during construction and operation phases. The ESIA findings have been compared against national and international legal requirements, as well as the World Bank Environmental and social safeguards. The Environmental Management and Monitoring Plan (EMP) has been developed to guide the implementation of the project activities.

2 DESCRIPTION OF THE PROPOSED PROJECT

2.1 INTRODUCTION

The Arua Water Supply and Sanitation Project was envisaged to comprise of the following:

- (a) Rehabilitation and expansion of the water treatment works (WTW).
- (b) Construction of up to seven boreholes to augment the current water source.
- (c) Transmission line from the boreholes to either the water treatment works, or a storage tank.
- (d) Construction of an additional storage tank and enlargement of the existing tank.
- (e) Improvements and extensions to the existing water network.
- (f) Construction of waste stabilisation ponds (WSP) and sewage pumping/lifting station.
- (g) Construction of a sewerage system for central Arua and transmission to the WSP.
- (h) Construction of water and sanitation facilities (public toilets) in informal settlements.
- (i) Catchment management and source protection, and
- (j) Access roads and power supply to waste stabilization ponds and other facilities.

The majority of the works is envisaged to take place within the confines of Arua Municipality and its immediate periphery. However, parts of the works may take place in rural settings, such as the proposed drilling of boreholes, laying of the transmission line from the boreholes to the WTW, and the construction of the WSPs. The detailed scope of the project activities for each of the project components are presented below:

2.2 DESCRIPTION OF PROJECT COMPONENTS

2.2.1 REHABILITATION OF THE WATER IMPOUNDMENT AND WEIR

Rehabilitation of the Water impoundment and weir falls under improvement of the raw water intake and is part of the rehabilitation of the WTW. The raw water source is River Enyau and water abstraction is through a concrete intake structure (Figure 2-1) that protrudes approximately 4 metres into the watercourse and a weir (Figure 2-1). The inlet structure is a U-channel of 8.4 metres length, 1.2 metres width and 3.1 metres depth. Flow in the river is regulated by a weir, approximately 40 metres downstream of the inlet structure. The weir is 16.5 metres long, 0.95 metres wide and 1.4 metres deep.

Rehabilitation will encompass work on the intake structure and de-silting of the impoundment. The spoil (estimated at 6,581 m³) from de-silting/dredging is to be disposed by landfilling in approved locations, e.g. in filling up/restoring the borrow pits formed due to extraction of materials for the water and wastewater treatment works. The land that is covered by the impoundment belongs to NWSC and they have been using it for a long time.. The total land area available for the development of the water treatment works is 2.6 acres of which 1.921 acres are presently occupied by the existing water treatment works structures. Consequently, the area of 0.684 acres is the land bordered by a barbed wire across the swamp and on the left hand side of the river as it flows towards the weir.



Figure 2-1: Google map showing Arua WTW, River Enyau and a Wetland

2.2.2 REHABILITATION AND EXPANSION OF THE WATER TREATMENT WORKS

All works for this project component are to be undertaken within the confines of the existing WTW owned by NWSC. The land surface area of the existing water treatment works, as well as the free area of land available for the development is provided in Section 2.2.1. The work to be done such as new aerators, additional sedimentation tanks, rehabilitation of existing filters and new filters, new chemical house, changes and improvements to electromechanical equipment, and building of minor structures for adding equipment to optimise the treatment process require very little space, which is available within the 1.921 acres of land currently occupied by the existing WTW structures. No people have encroached on the NWSC land according to the NWSC Area Manager of Arua. Mr. Christopher Mawanda. This was confirmed through field visits. Further, according to the Plant operator and Mr. Christopher Mawanda, the Staff of NWSC, who use the available free land within are aware that it belongs to NWSC and they plant only fast growing crops in small quantities for domestic consumption. At the time of carrying out this assessment, the staff were informed to harvest their crops and not to plant again in preparation for the project developments. The staff obliged with no hesitation. Rehabilitation and expansion of water treatment works will cost US\$ 6,564,755,755.

2.2.3 CONSTRUCTION OF BOREHOLES TO AUGMENT CURRENT WATER SOURCE

In the project inception, it was proposed to augment Arua's current water source with water from new boreholes. Possible borehole sites are depicted in **Annex 4**. It was suggested that up to 7 boreholes could be developed for this purpose, subject to detailed investigations. The recharge area, extents, and current usage of the aquifers are not yet known up to now and they would be determined through a detailed investigation. The land that may be identified for the location of the boreholes is unlikely to be owned by the NWSC. Communities around the borehole sites that could be potentially developed as well as NWSC staff have been consulted and their views are expressed in **Section 5**. The required land size for the augmentation boreholes is small, only about 700 square metres (0.173 acres) and has been valued at US\$ 3,854,844 only in the RAP. Land takes for this project sub-component will be partial and will not translate into physical resettlement. The PAPs will only "step back" on the same sites at both testing and where necessary development stage. Only 6 PAPs and 2 PAIs are potentially impacted upon in respect to this project sub-component implementation. Few crops and trees will be impacted upon by this project sub-component implementation valued at US\$ 268,000= only. The process of land acquisition will be governed by the Resettlement Action Plan (RAP). The construction costs of up to seven boreholes are estimated at: borehole construction, US\$ 494,670,000; borehole chlorine houses, US\$ 126,273,100 and borehole pump stations at US\$ 4,244,859,941.

The argumentation of boreholes will affect the flora as indicated below

REF/Roll No	Names of PAP	Type and Nature of affected trees	No.
BOR-1	WILSON AMAGU	None	N/A
BOR-2	MICHAEL ODIPA	None	N/A
BOR-3	TABU JACINDO HABIB		
BOR-4	LAND UNDER DISPUTE AMONG THREE PARTIES (JAIRI DIRI; AMATI CIRILO & ALEX DRAKU)	None	N/A
BOR-5	LOCAL GOVERNMENT PRISONS SERVICES DEPARTMENT AT GILGIL	None	N/A
BOR-6	BERO RICHARD	Building size eucalyptus trees	8
		Fire wood type eucalyptus tree	25
		Medium size sisal plantations	3
BOR-7	ST JOSEPHS' COLLEGE OMBACHI	None	N/A
BOR-8	BUATRU JOVANO	Mature mango tree	1
		Mature guava trees	4
		Fire wood type acacia tree	1

The taking over of community boreholes could be a source of conflict. It had been suggested in the Inception Report that “If the yield of the new borehole was lower than the yield of the existing community borehole, then the boreholes could be interchanged, namely the existing community borehole would be taken over by NWSC and the new borehole would be handed over to the community.” However, this suggestion was dropped at the presentation of the Design Inception Report. Therefore, no existing community boreholes will be developed by NWSC and as a result there will be no interference with community boreholes.

2.2.4 TRANSMISSION FROM BOREHOLES TO WTW/STORAGE TANK

The work includes transmission of water from the boreholes to either the WTW or storage tanks. With the exception of crossings (e.g. rivers, swamps), all pipelines will be buried. The external diameter of the transmission pipes will not be larger than 180 mm.

2.2.5 WORKS ON THE WATER STORAGE TANKS

NWSC owns a total of 1.957 acres of land on Arua Hill, including the area where the existing water storage tank of capacity of 1,350 m³ is located (Annex 8). The existing storage tank is situated on 0.190 acres of land and thus 1.766 acres is empty. The existing water storage tank is on the flatter surface at the top of Arua Hill. Consequently, the larger part of the 1.766 acres of empty land is sloping, and most of it with a steep slope, in excess of 20%. Consequently, there may be challenges in the development of the free land for the new water storage tank or expansion of the existing tank. However, considering that the existing tank of 1,350 m³ is located on only 10% of the available land belonging to NWSC on Arua Hill, the EIA screening has determined that the available land will be able to accommodate the proposed works. Enlargement of the inlet, outlet and overflow pipes; water proofing of the existing water storage tank at Arua Hill is expected to cost US\$ 916,744,668.00. An additional storage tank will be constructed at Giligili which is Government land belonging to Prisons. Construction cost of this tank is estimated at US\$ 2,510,578,908.

2.2.6 IMPROVEMENTS AND EXTENSIONS TO THE EXISTING WATER NETWORK

Improvements to be undertaken within the confines of Arua Municipality and the neighbouring sub-counties and it includes the replacement of existing asbestos cement (AC) pipes, laying of new pipes in areas that are already served by the water network to improve service provision, and laying of pipes in areas that are not yet served by the water network in the attached maps (Annexes 5 and 6). This will cover a distance of 77.95 km (4 km of DN 400 DI to PN 10, 5.06 km of uPVC OD 315 PN 6, 14.2 km of uPVC OD 315 PN 10, 5.7 km of uPVC OD 225 PN 10, 0.91 km of uPVC OD 160 PN 6, 6.9 km of uPVC OD 160 PN 10 and 6.4 km of uPVC OD 160 PN 16) at a cost of US\$ 9,514,152,661. The network intensification lines will also be put in place with a total length 16 km (2 km of HDPE OD 90 PN 10, 2 km of HDPE OD 90 PN 16, 2 km of HDPE OD 75 PN 10, 2 km of HDPE OD 75 PN 16, 2 km of HDPE OD 63 PN 10, 2 km of HDPE OD 63 PN 16, 2 km of HDPE OD 50 PN 10, 2 km of HDPE OD 50 PN 16); cost is US\$ 686,800,700.00. There will also be clear water transmission mains from the water treatment works to the storage tanks, of total length 5.224 km (1.2 km of DN 250 DI PN 25, 4 km of DN 400 DI PN 25 and 0.024 km of DN 500 DI PN 25). These activities will cost US\$ 3,167,182,312.

Transmission lines from the boreholes (i.e. borehole pumping) to a water storage tank at Giligili will involve 1.8 km uPVC OD 110 PN 16, 0.5 km uPVC OD 75 PN 16, 4.7 km uPVC OD 160 PN 16, and 8.5 km uPVC OD 75 PN 16. There will also be transmission lines from the boreholes to a storage tank at Arua Hill of a total length of 15.5 km will involve; 2.1 km uPVC OD 90 PN 16, 1.3 km uPVC OD 110 PN 16, 2.2 km uPVC OD 160 PN 16, 1.3 km uPVC OD 110 PN 16, 2.1 km uPVC OD 160 PN 16 and 0.5 km uPVC OD 75 PN 16. These transmission lines to the storage tanks will cost US\$ 4,695,517,430.

With the exception of crossings (e.g. rivers, swamps), all pipelines are to be buried. The external diameter of the largest pipes will not exceed 650 mm and most pipes will have a diameter of less than 250 mm. Within the town, there are no biophysical features to be affected. Both, within the municipality and where the water pipelines already exist, the replacement of existing pipes will be done to follow the routing of existing ones so as to minimise the impacts. The transmission pipeline to Muni National Teachers College (NTC) will traverse a seasonal wetland along the route and in this case the pipe will be anchored on concrete supports. Construction of these supports will be done in such a way so as to minimise obstruction of water flow.

2.2.7 CONSTRUCTION OF WASTE STABILISATION PONDS

The work will include the construction of waste stabilisation ponds for treatment of sewage from Arua town (**Annex 7**) and will cost US\$ 2,456,307,640. Two sites have been identified for this purpose. One site that is proposed for the construction of waste stabilisation ponds is at Onduparaka and the other is at the Prisons land in Arua Hill Division. The site at Onduparaka is close to Okaiva River Bridge crossing on Adumi road in Adumi Sub-county. The Onduparaka waste stabilization ponds will have 2 anaerobic ponds of 16.5 x 16.5 m (272.5 m² top surface area) and 4 m water depth, a facultative pond of 44 x 26 m (1144 m² top surface area) and 1.5 m water depth and two maturation ponds of 72 x 40 m (2,880 m² top surface area) and 1.5 m water depth.

The site at Prisons land in Arua Hill Division will take part of the prisons farm land as well as part of the Prisons eucalyptus tree plantation and borders, on one side, with the banks of River Enyau. This is Government land. The Prisons waste stabilization ponds will consist two anaerobic ponds of 19 x 19 m (361 m² top surface area) and 4 m water depth, a facultative pond of 71 x 43.5 m (3088.5 m² top surface area) and 1.5 m water depth and two maturation ponds of 49 x 28.5 m (1,396.5 m² top surface area) and 1.5 m water depth.

All locations are within means of access to the required infrastructure that is necessary for operating the waste stabilisation ponds (e.g. roads). All the two pieces of land identified for the waste stabilisation ponds are bordered by already existing murram roads. The access roads from the nearest public roads to Onduparaka ponds and Prisons ponds will be 40 m and 25 m respectively. No land acquisition is needed for constructing access roads. No power connection to the sites of waste stabilization ponds is envisaged.

The Onduparaka waste stabilization ponds will be situated partly on land owned by NWSC and partly on private land. The land owners have been identified and are listed below:

No.	Land Owner	Size of Land	
		Hectare	Acre
1	NWSC	0.750	1.852
2	Joseph Madira Anguyo Ogua	1.023	2.527
3	Stephen Nyakua	0.029	0.072
4	Patrick Draza	0.027	0.067
5	David Emazo	0.034	0.084
6	Godfrey Anguyo Ogua	0.131	0.324
7	Paul Aria Ogua	0.133	0.329
8	George Adrabo	0.497	1.228

It should be noted that most of the proposed land acquisition will not result into relocation and most of the affected households will only “step back” on the same piece of land. The land required for the WSPs is free of human settlement and is currently being used for scattered crop and tree farming at both sites. The anticipated land takes for the WSPs are partial and low and cover 51,205 sq. meters (12.653 acres) and will not result into physical relocation for the PAPs. There are 7 PAPs and 1 PAI impacted upon by this project sub-component. Only 1 temporary structure for one PAI will be affected. The required land takes for WSPs is valued at UShs. 111,144,000= only, while the impact on structures is valued at UShs. 1,269,000= only. The extent of impact of WSPs sub-component on crops and trees is estimated at UShs. 6,619,000= only..

2.2.8 CONSTRUCTION OF A SEWERAGE SYSTEM, TRANSMISSION TO THE WSP AND SEWAGE PUMPING/LIFTING STATIONS

Arua does not have any sewerage area. The Arua Water Supply and Sanitation Project is intended to provide, as a minimum, sewerage services to the central business part of Arua Municipality. For that purpose, sewer pipes will be laid and buried and manholes will be constructed at intervals not exceeding 100 m (**Annex 7**). With the exception of crossings (e.g. rivers, swamps), all pipelines are to be buried. The external diameter of the pipes will not exceed 250 mm. In addition, sewage pumping/lifting stations are to be constructed. These activities (construction, transmission and sewage pumping) will cost UShs 10,013,015,729. The sewerage system is designed to handle only domestic wastewater. Any industry wishing to discharge into the municipal sewerage system will have to carry out pretreatment of their wastes to meet the requirements prescribed by NWSC before discharging their pre-treated effluent into the NWSC sewers and consequently to the waste stabilization ponds.

The construction of waste stabilization ponds and other related activities will affect flora as indicated below.

Names of PAP	Type and Nature of affected trees	No.
PASTORI DIDI	Telephone pole size eucalyptus tree	3
	Building size eucalyptus trees	3
	Building size nsambya trees	3
	Fire wood type nsambya trees	4
	Mature & bearing pawpaw trees	4
	Mature sisal plantations	75
	Medium yam plants	280
	Mature lemon tree	1
	Mature brother heart tree	2
RASHID YASIN JUMASON	Mature & bearing Mango tree	1
	Mature & bearing Guava tree	1
	Electricity pole size teak tree	1
CADRI CHARLES	Mature & bearing Guava tree	3
	Fire wood type Nsambya trees	3
	Fire wood type Acacia trees	2

2.2.9 WATER AND SANITATION FACILITIES IN INFORMAL SETTLEMENTS

The project will provide water and sanitation services in informal settlements of Arua town. This will include public water extraction points and community/public toilets in Arua Municipality and at Onduparaka. At the present, residents in informal settlements in Arua Municipality obtain their water from boreholes. The boreholes are likely to be contaminated with faecal matter as depicted by the baseline data which indicate that some boreholes are already contaminated with faecal coliforms. Some households in Arua do not have individual sanitation facilities. Consequently the sanitation situation is either non-existent for some homes while others have very poor and unhygienic facilities which are likely to contaminate ground water sources. Twenty public water stand posts and ten public toilet facilities are expected to be constructed in informal settlements at a cost of US\$ 715,682,300.

2.2.10 CATCHMENT MANAGEMENT AND SOURCE PROTECTION

The project interventions for supporting sustainable management of water catchment and protection of water sources would include restoration and re-vegetation of river banks, implementation of riverbank protection regulations, implementation of wetland regulations, sensitization of residents on good practices aimed at protecting the river banks as well as the water quality of the river. According to the National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, 2000, a protection zone of at least thirty meters should be left on either side of the river. The thirty meters start from the highest water mark of the river.

Catchment management and source protection will be done in accordance with the strategy for the protection and management of River Enyau and the banks (2010). The strategy

proposes a no encroachment zone on both sides of River Enyau, of 50 m, measured from the edge of the river. It is the stretch of 50 m on both sides of the River Enyau, on which re-vegetation along the river banks is proposed to be carried out. Allowance of 50 m of undeveloped buffer zone from the river bank is provided for in the National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, 2000. The Strategy for the protection and management of River Enyau and the banks (2010), proposes planting of 1,000,000 trees of appropriate species along the banks of River Enyau. However, the tree species are not identified. We propose that trees and grasses that have a low water intake be planted along River Enyau. The proposed trees are *Mangifera indica* (a native fruit tree), *Maesopsi emini* and *Tectona grandis* (which are good for dry areas), as well as water weeds/grasses e.g. *Cyperus papyrus*, *Vossia cuspidata*, *Typha latifolia* and *Phragmites mauriatinus*. Sensitization of residents will encompass educating them on catchment protection measures in meetings, seminars, workshops, radio talk shows, and field demonstrations on planting trees and this will be carried out by the Environment Department within AMC boundaries; and by the Environment Department of Arua District in areas outside of Arua Municipality. This has been outlined in River Enyau Management Strategy under objective 4. Activity 1 of this objective will involve tree planting along the river banks at some specific locations (Logri, Vurra, Pajulu and Arua Municipality). It will be coordinated by the District Environment Officer and Municipal Environment Officer and is estimated to cost two million Uganda shillings. Activity 2 will involve demonstration on good/sustainable wetland utilisation practices such as measures for the control of erosion (e.g. bunding and tracing, mulching, grassing and controlled grazing) in the same area as indicated in activity 1. This is estimated to cost twenty million Uganda shillings.

2.3 APPROACH AND METHODS USED DURING THE ASSESSMENT

2.3.1 INTRODUCTION

The environmental and social impact study started with review of terms of reference and available literature and information on the proposed project after which an inception report was prepared. The team took into account the existing legislation and regulations dealing with Uganda's natural resources management. International and lender legislations and regulations were also consulted. The team visited the field and carried out field assessments and consultations, and sampling for analysis of water and soil samples.

The methodology used for environmental impact assessment followed the sequence summarised in **Fig. 2-2** with consultations incorporated into every phase. The five main steps are outlined in subsequent sections.

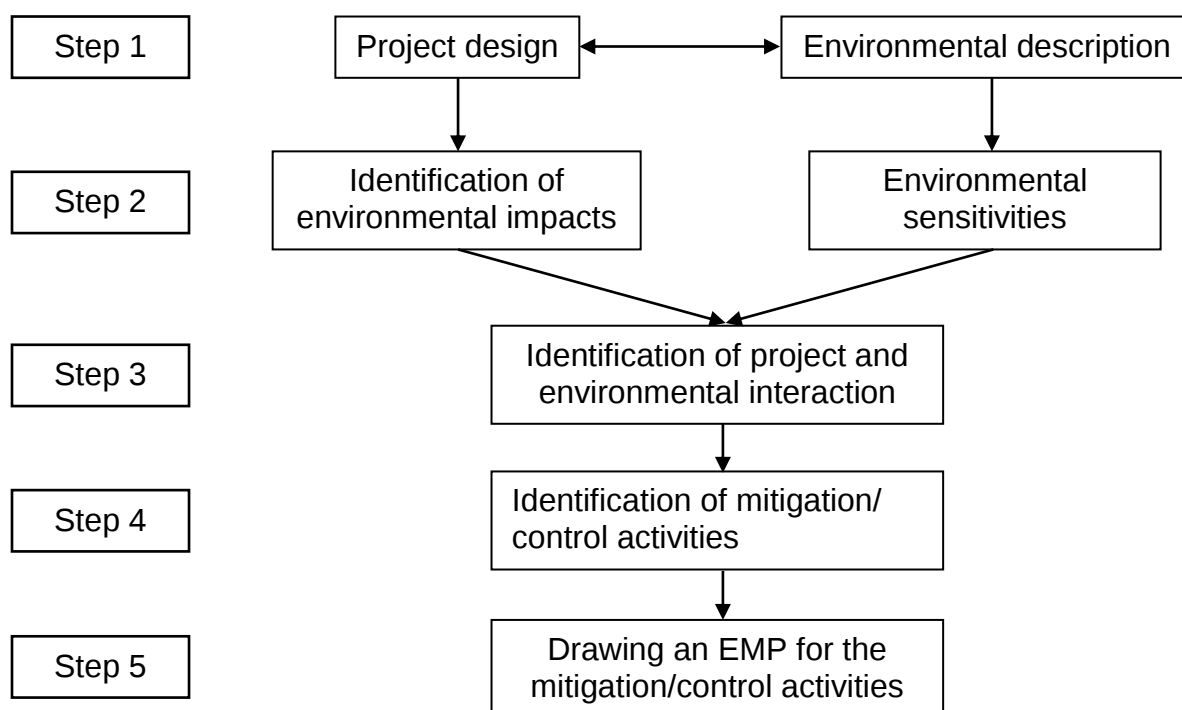


Figure 2-2. Methodology for Environmental Impact Assessment (EIA)

Step 1:Analysed the proposed project in terms of activities to be undertaken, and facilities to be established as well as collection of baseline information on the state of the environment. It included reconnaissance visits to project locations.

Step 2:Identified any project activities and facilities that might potentially cause interferences with the environment. It also assessed any particular environmental sensitivities and conditions that are of relevance to the proposed project.

Step 3:Identified any potential impacts of the project on the environment depending on the analysis carried out in steps 1 and 2. In view of the project activities and associated facilities, as well as the specific environmental conditions, the potential significance of such impacts were determined.

2.3.2 ACTIVITIES AND METHODS

2.3.2.1 *Field visits and inspections*

Field visits and inspections were carried out by the ESIA team so as to get acquainted with project activities in the study area, and also map out sampling sites. The areas that were visited include:

- (a) River Enyau where raw water is to be abstracted,
- (b) the current NWSC water treatment works (WTW) at Arua,
- (c) the existing water tank to be expanded and two other areas where it is proposed to erect two additional storage tanks,
- (d) the areas around Arua town where boreholes are expected to be drilled,

- (e) areas where water transmission lines and sewage pipes will be laid,
- (f) the areas at Prisons and Onduparaka where waste stabilisation ponds (WSP) are to be constructed,
- (g) sites where sewer pipes for transmission to the WSP will be laid,
- (h) the site where the sewage lifting station is to be constructed,
- (i) places proposed for provision of sanitation facilities and water in informal settlements,
- (j) wetlands and other ecologically sensitive environments that may be affected by the project,
- (k) all the proposed end points of the water distribution mains,
- (l) the upstream of River Enyau, where agriculture is largely practiced as well as the downstream of River Enyau where it enlarges with increased flow, and
- (m) a dam on Vurra road, which has been used as storage for a small water supply system for missionaries and a hospital.

During the field visits, the ESIA team conducted baseline surveys and assessments, field measurements and stakeholder consultations. **Fig. 2-3** shows the sites that were surveyed and the sampling locations. Coupled with sample collection and analysis of some of the variables, issues that were of interest to the team include:

- (i) Generation of atmospheric emissions and dispersions,
- (ii) Noise generation,
- (iii) Waste generation and management,
- (iv) Generation and management of hazardous wastes,
- (v) Generation of dust and particulate matter,
- (vi) Water quality,
- (vii) Hydrology,
- (viii) Geology and soil types,
- (ix) Occupational safety and health issues,
- (x) Traffic management and transport methods for project activities,
- (xi) Potential for accidents (e.g. in uncovered ditches, due to broken pipes, spills, traffic)
- (xii) Potential sources of water and soil pollution e.g. sewage from camps, siltation from increased runoff,
- (xiii) Legal compliance requirements,
- (xiv) Environment management and monitoring programmes,
- (xv) Community issues including compensation and resettlement,
- (xvi) Terrestrial and aquatic fauna and flora and associated habitats,
- (xvii) Aesthetic issues,
- (xviii) Land use and other social economic livelihood activities around the project site,
- (xix) Cultural, heritage and religious issues,
- (xx) Technology transfer and utilization,
- (xxi) Organisational aspects, roles and responsibilities,
- (xxii) Collaborations with other stakeholders.

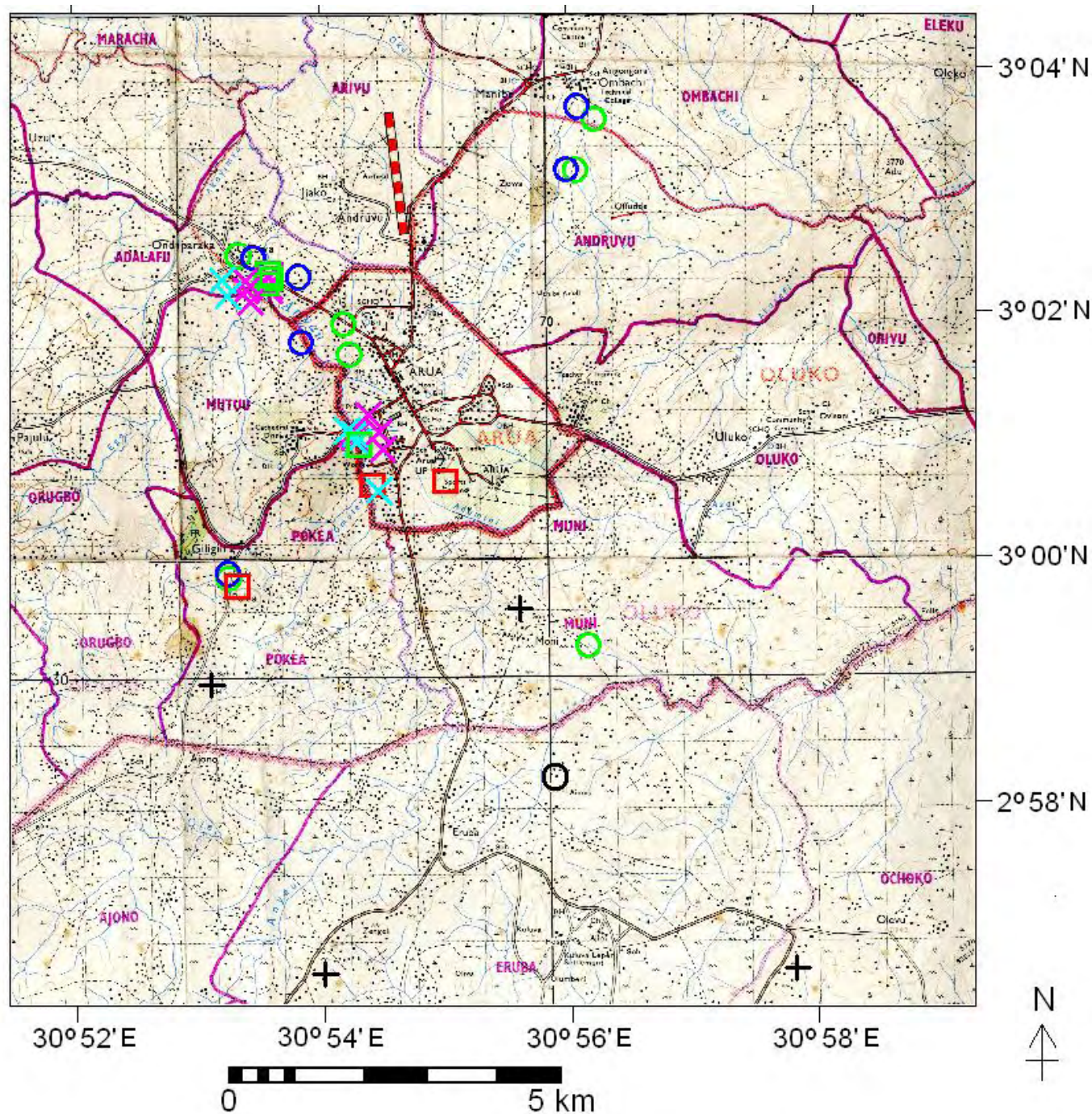


Figure 2-3: Topographic map of the greater Arua showing field sites surveyed for EIA. (Legend is on the next page)

Legend

- | | |
|--|----------------------------|
| ✕ Soil samples | ○ Geophysical VES sites |
| ✕ Water samples | □ Proposed lagoons |
| □ Water works, proposed pumps and reservoirs | + Proposed pipeline extent |
| ○ Boreholes and springs | ○ Waste disposal site |

2.3.2.2 Literature review

Key documents pertinent to the study were reviewed. Some documents were obtained from NWSC. Key documents included:

- (a) Arua Emergency Water Supply Project – Inception Report (2011),
- (b) Consultancy Services for the Detailed Design and Tender Documentation of the Arua Area Water Supply Improvement Project – EIA (2010),
- (c) Detailed Engineering Design of Arua Water Supply and Sanitation Project (2011),
- (d) Relevant Ugandan legislation regarding development projects and environmental legislation for Uganda,
- (e) Hydrogeological survey of 7 boreholes in Arua Town. Consultancy Report prepared for National Water and Sewerage Corporation by Universal Water Consultants Ltd. in November 2011,
- (f) Strategy for the Protection and Management of River Enyau and the Banks (2010).
- (g) International, regional, provincial or communal environmental related guidelines,
- (h) International Finance Corporation (IFC)/World Bank Environmental, Health and Safety (EHS) Guidelines, in particular, the General Guidelines, the World Bank OP 4.01 Environmental Assessment, OP 4.04 Natural Habitat Policy, OP 4.09 Pest Management and OP 4.12 Involuntary Resettlement Policy.
- (i) Arua District Development Plan, 2010-2015
- (j) Arua Municipal Council Development Plan, 2010-2015
- (k) Sub-County Development Plans, 2010-2015 for Dadamu, Pajulu, Oluko, Manibe, Vurra, Katrine and Ajia sub-county
- (l) Arua Water Supply and Sanitation Project Baseline Survey, 2011.

2.3.2.3 Field measurements

The physico-chemical variables of water namely; temperature (°C) and pH (units according to ISO 10523: 2008), electrical conductivity (μS/cm) and total dissolved solids (ppm) (ISO 284: 2003) were measured *in situ* (procedures certified by the International Organisation of Standardisation - ISO) just below water surface using portable meters. All the meters had previously been calibrated with standard buffers prior to use in the field. River water samples for analyses of physical, chemical and microbiological quality parameters were collected using a standard sampler from just below the surface at 0.2 m depth. The results are presented in Section 3.1.2 (Table 3-1).

2.3.2.4 Water quality analysis

Water samples (0.5-litre) were collected into clean, capped PVC bottles, placed in a cooler and out of sunlight while on transit to the environmental laboratory of the Department of Civil Engineering, Makerere University. Samples were analysed within 6.5 hours from extraction from the river. Determinations in the laboratory included major physical, chemical and microbiological quality parameters such as turbidity, colour, nitrates, sulphates, chlorides, total alkalinity, total phosphorus, BOD₅, COD, iron, manganese, *Faecal streptococcus* and thermotolerant coliforms. Quality control was followed during the water quality analysis using standard methods according to APHA/AWWA/WEF (1998).

2.3.2.5 Soil sampling and analysis

Soil samples were augured at depths of about 50 cm below the surficial, organic-rich soil layer. This depth represented the unsaturated zone through which adulterated infiltrating surface waters are expected to recharge various forms of ground water. Four samples were collected across each of the two sites proposed for lagoon construction (Fig. 2-3). Samples (1 kg) were collected into black polythene bags and transported to the laboratory at the Department of Geology and Petroleum Studies, Makerere University, for detailed analyses. Attributes including the colour of the soil samples were determined. Samples were wet-sieved using nylon sieves and the size ranges were weighed after drying (60°C) in an oven overnight within the geochemical laboratory of the Department of Geology and Petroleum Studies,. Sieve mesh sizes followed the Wentworth (1922) classification that included <0.063 mm (clay and silt), <0.125 mm (very fine sand), <0.25 mm (fine sand), <0.5 mm (medium sand) and >0.5 mm (coarse sand and gravel). Unsaturated hydraulic conductivity of the soils with depth was estimated from particle-size analyses using the pedotransfer functions devised by Hazen in 1892 and modified by Shepherd in 1989 (Cronican and Gribb, 2004). Chemical analyses for trace elements (lead Pb, nickel Ni, zinc Zn, and cadmium Cd) were carried out using an atomic absorption spectrophotometer (AAS).

2.3.2.6 Flora and fauna

In all field visits described in Section 2.3.2.1, direct observations were made on the flora and fauna species and the findings are presented under various components in Chapter 3.

2.3.2.7 Community and stakeholder consultations data collection methods

Through the Area Manager NWSC Arua Area (who gave the team introduction letters and attended most of the meetings), the assessment team was able to meet different stakeholders in Arua Municipal Council and the neighbouring sub counties. The Project areas were visited to assess and collect data related to bio-physical and socio-economic characteristics of the proposed project activities with respect to environmental issues. Observations, checklists and guidelines related to ESIA were also used.

The methodology employed for the social impact assessment involved a number of qualitative data collection methods; Community dialogues or interviews with local community people in the PAs, interview with community leaders and local government administrators, technocrats and leaders, interviews with central government representatives (RDC, RPC), and a review of relevant secondary sources related to the project areas.

Community discussions were held at selected parishes and trading centres in the project areas. The selected parishes included: Awindiri, Bazar and Mvara in Arua Hill Division. Pangisa, Kenyatta and Tanganyika in River Oli Division. Arivu, Ariwala, Oduluba, Tanganyika, Yapi and Zeuva in Dadamu Sub-county. Adalafu, Ambeku, Driwala, Komte, Okaliba and Pokea in Pajulu Sub-county. Ocoko parish in Ajia Sub-county. Kuluva, Ayelembe and Eruba in Vurra Sub-county. Ewadri and Ombaci in Manibe Sub-county, and Ambeku, and Onzivu parishes in Oluko Sub-county.

Key informant interviews were held with selected Central Government Agencies representative or regional offices in Arua: Resident District Commissioner (RDC), Regional Prisons Commander (RPC), Uganda National Roads Authority (UNRA), Uganda Forestry Authority(UFA), and Arua District and Arua Municipal Council administrators, technical staff and political leaders, selected Sub-county administrators, technical staff and leaders in the project area. The detailed lists of key persons consulted are reflected in Annex3. Also informal consultations were held with randomly selected water vendors, *boda-boda* and car washing associations and public toilet operators in Arua Municipality. Therefore, views of the project area community members and beneficiaries were obtained including representatives from the following:

- Arua District Local Government
- Ministry of Water and Environment (Directorates of Water Development, Water Resources Management and Environmental Affairs)/NWSC (lead project agency).
- National Environment Management Authority (NEMA) National Forestry Authority
- District Internal Security Officers (DISO);
- Ministry of Works and Transport /UNRA regional office
- Ministry of Water and Environment/ National Forestry Authority regional office
- Arua Municipal Council – Town Clerk’s Office
- Arua Municipal Council – Mayor’s Office
- Arua Municipal Council – Health Department Office
- Arua Municipal Council – Public Works and Roads Office
- Arua Municipal Council – R.Oli Division-Town Clerk’s Office
- Arua Municipal Council – AHD Town Clerk’s Office
- Arua Municipal Council – R.Oli Division-LC III Chairperson Office
- Arua Municipal Council – AHD LC III Chairperson Office
- National Forestry Authority – Arua regional Offices
- Resident District Commissioner (RDC)
- Regional Prisons Commander (RPC)
- Department of Water – Arua District
- Department of Community Development – Arua District
- Department of Lands and Survey – Arua District
- Department of District Forestry Services – Arua District
- Department of Works and Roads – Arua District
- Department of Environment – Arua District

- National water and Sewerage Corporation – Arua Branch
- Uganda National Roads Authority (UNRA) regional office – Arua
- Vurra Sub County
- Katirni Sub County
- Dadamu Sub County.
- Manibe Sub-county
- Pajulu Sub County
- Ajai Sub County
- Oluko Sub County
- Community members at village and parish level in the PAs.
- Community leaders at parish and village level
- Selected Civil Society Organisations or Associations such as *Boda-boda* associations, car washing associations, market operator associations

3 DESCRIPTION OF THE ENVIRONMENT AND BASELINE CONDITIONS

3.1 BIOPHYSICAL ENVIRONMENT

3.1.1 PHYSICAL ENVIRONMENT AND NATURAL RESOURCES

The proposed project is to be implemented within Arua Municipal Council (AMC) and the neighbouring sub-counties. AMC lies on the north-western region of Uganda, located on latitude 03 01' North and 30 58' East, 1200 m above sea level, surrounded by Ayivu County in Arua District. The municipality is 15 km from the Democratic Republic of Congo to the West, 75 km from Sudan to the North and it is 540 km northwest of Uganda's City Kampala. It is a civic centre of Arua district administration and the largest commercial and social coordinating point in the district as well as for many regional activities in the West Nile Region. The area coverage of AMC is 10.5 km². It has two divisions i.e. Arua Hill Division covering 7.38 km² and River Oli Division covering 3.12 km².

The natural resources of Arua include forests, wetlands, water resources, soils and rocks. Arua is largely flat, with a few hills of the inselberg type, which rise abruptly from the plains as steep, bare masses of fresh solid rock. On the hill tops, grey granite and gneisses are left exposed over wide areas with no soil cover at all. These gneisses and granites are intensively metamorphosed and deformed forming red coarse sands, silts and subordinate amounts of clay, gravel and diatomite that dominate Arua town. Soil depth is not more than 15 cm on hill tops. The soil depth is deeper than 15 cm in the rest of the flat areas and is fairly fertile along the valleys due to alluvial deposits found along the lower portions of the slopes.

The land use pattern from the municipality to the peri-urban and neighbourhood parts of Arua Municipality generally changes (in order) from human settlement, including a mixture of business establishments (banks, parks, markets), social service facilities like schools and religious establishments to brick laying and finally to agricultural production. Agricultural production is not only in the peripherals, but also in the centre of Arua Municipality. Within the town centre are various markets and as you move from the town centre, there are various trading centres, especially along the roads leading out of Arua town. In terms of agricultural production, the main activity is subsistence agriculture. The major food crops grown are cassava, beans, sweet potatoes, groundnuts, sorghum, maize and vegetables. Other food crops grown include; pigeon peas, soya beans, yams, rice etc. Livestock mainly cattle, goats, pigs and poultry are also kept for both cash and other cultural purposes. Outside of Arua Municipality, people depend solely on wood fuel for cooking and for sale to fetch income for survival. Another use of wood fuel is for tobacco curing. Additionally, trees are being felled down to open up more land for agriculture. This situation is experienced along river Enyau, from the town centre to the upstream. No areas sensitive to changes in water quality and quantity were identified downstream.

3.1.2 WATER RESOURCES

The water resources of Arua comprise of rivers and streams, majority of which are seasonal. There are also ground water resources supplying water via springs and wells. The source of water for Arua town is River Enyau. From its source near the border of Uganda

and the Democratic Republic of Congo, River Enyau is approximately 30 km to the WTW in Arua Municipality. It discharges into the River Nile at approximately 42 km downstream of the WTW, thereby making River Enyau to be approximately 72 km in length. It has a catchment of 8871.7sqkm (generated using SWAT). The Arua intake works are situated on River Enyau, approximately 15.8 km from the source of the river. The river has a generally mild slope ranging from 1.09% for the first 7 km upstream to 0.5% closer to the intake works. There are three tributaries that join the river before it reaches the intake works, the major two being River Oje and River Emuleva. The source of River Enyau is in Ezuku Forest reserve. River Enyau is gauged much further downstream at the Arua-Moyo Road crossing.

The National Water and Sewerage Corporation pumps water from River Enyau, treats it and supplies it to areas within and outside Arua municipality. About 72% of the population of Arua town, comprising of 101,000 persons is connected to the water supply system. The water supply situation is reliable during the wet season, but is severely affected during the dry season when the water level reduces to very little flow in River Enyau for a few days. The seasonal rivers within the municipality normally dry up during the dry season. The groundwater is obtained from boreholes and from protected and unprotected springs spread within the Municipality. Some boreholes and spring water sources are contaminated by faecal matter from nearby pit latrines and septic tanks in the Central Business District. In swampy areas for example, in Chongaloya cell, Gurua cell in Arua Hill Division and Oli B, Abia cell in River Oli Division, the contamination of ground water by faeces from pit latrines is worse. There are some wetlands in Arua Municipality, covering approximately 2.5% of the total land area. The wetlands are increasingly being encroached upon for settlement and cultivation especially along Rivers Osu and Enyau. The wetlands allow water to stay in one place long enough to maximize infiltration and thus access to water supplies for plants. The wetlands in Arua are not demarcated. It is important to demarcate the wetlands and the Wetlands Management Department has plans to demarcate all wetlands' boundaries of Uganda. However the timeline is not known as the Department does not have the required resources yet. The wetlands are protected in accordance with the National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, 2000. However, enforcement of the regulations is weak. The strategy for the protection and management of River Enyau and its banks (2010), has enforcement of wetland protection policies as one of its activities. Furthermore activities in or near the wetlands should take extra precautions to observe the guidelines so that the wetland is not degraded.

Water quality samples were taken from sites which are likely to be impacted by the water treatment works and the operation of the waste stabilisation ponds and the results are presented in Table 3-1. The water sampling points are shown in Figure 2-3.

Table 3-1: Water quality samples taken at the NWSC waterworks and the proposed site for the construction of waste stabilization ponds:

Sample ID Parameters	A1	A2	L1	L2	TP	ED Stds*	DW Stds*	WB guideline values**
pH	6.94	7.39	6.79	7.25	7.49	6-8	6.5-8.5	6-9
Electrical conductivity, $\mu\text{S}/\text{cm}$	140	145	145	142	131	ns	1000	ns
Temperature, $^{\circ}\text{C}$	21	21	21	21	21	20-35	ns	ns
Turbidity, NTU	20	22	70	35	20	ns	5	ns
Apparent colour, PtCo	174	195	449	285	229	100	15	ns
Total dissolved solids, mg/l	70	73	76	71	65	ns	700	50
Nitrates, mg/l	6.6	n.d	n.d	n.d	3.08	20	45	ns
Sulphates, mg/l	n.d	n.d	n.d	n.d	n.d	500	200	ns
Chlorides	3.1	3.6	3.7	3.4	3.7	30	250	0.2
Total Alkalinity, mg/l	100	105	100	30	90	ns	500	ns
Total Phosphorus, mg/l	0.08	0.16	1.17	0.27	0.12	10	ns	2.0
BOD ₅ , mg/l	31	28	43	24	23	30	ns	50
COD, mg/l	45	43	62	35	34	100	ns	ns
Iron, mg/l	1.0	1.0	1.3	1.7	1.0	5	0.3	3.5
Manganese, mg/l	0.04	0.05	0.08	0.06	0.03	1	0.2	ns
Faecal Streptococci, cfu/100ml	864	1218	1773	1173	773	ns	0	ns
Thermotolerant (faecal) coliforms cfu/100ml	7.1×10^3	2.14×10^3	5.17×10^3	5.7×10^3	1.4×10^3	5000	0	<400 MPN/100 ml

* National Effluent Discharge Standards (ED) and Drinking water standards (DW); ns-not specified; n.d –not detected, detection limit for nitrates and sulphates are 0.5mg/l and 0.07mg/l respectively; ** Pollution Prevention and Abatement Handbook, General Environmental Guidelines WORLD BANK GROUP July 1998 and IFC/World Bank Group: Feneral EHS Guidelines, April 2007 **Key:** A1=Lagoon site 2- Bridge close to prison washing bay; A2=About 50m downstream; L1= Lagoon site 1-Upstream (1st bridge on Adumi road leading to Onduparaka); L2= Downstream (further lagoon site); TP= Treatment Plant Water Works abstraction; MPN= Most Probable Number

The results show that apparent colour levels and *Faecal Streptococci* exceed effluent discharge and drinking water standards for Uganda. TDS and chloride levels exceed World Bank Guidelines for Contaminated Storm water discharged to Surface Waters. Given that sites A1, A2, L1 and L2 are to be used as recipients of treated wastewater, the water samples collected at these locations conform to the national effluent discharge standards with regard to all the measured parameters except for apparent colour, BOD₅ and TTCs. The high apparent colour levels (>100 PtCo) may be due to presence of suspended material as well as discharges from washing activities of motor vehicles and clothes. The fact that L1 exhibits relatively high BOD₅ levels may be attributed to the activities noted at this location:

cattle watering, car and cloth washing as well as the low river flow. The poor microbiological quality of the river at A1, A2, L1 and L2 is an indication of faecal contamination which may follow from poor sanitation practices and human activities such as cow grazing and watering. High chloride contents could be from animal waste.

Any wastewater discharges into the stream must therefore be treated in order not to create any further deterioration with respect to the apparent colour, bacteriological quality and BOD₅. Sampled location TP which is to be used for water supply, conforms to the drinking water standards with regard to the measured parameters except for turbidity, apparent colour, iron, *Faecal streptococci* and thermotolerant coliforms. The level of the TTCs at TP is an indication of very high risk (>1000 cfu/100ml) with respect to water borne diseases which requires that water must be treated prior to consumption (which NWSC does).

There are a lot of activities, including motor vehicle washing, cattle watering and washing clothes into the River Enyau and River Okaiva. These are the probable causes of the poor water quality at the sampling points as described above. There were plans to construct a car washing bay adjacent to River Enyau near the Government prison but this was not completed. The water from the car washing bay was supposed to infiltrate via a soak away pit before discharging into River Enyau. It is important that all activities involving washing of cars and clothes and watering of animals directly in River Enyau, should be stopped. Mitigation measures in Table 8-5 suggest ways of achieving this.

3.1.3 HYDROGEOLOGY OF ARUA

The project proposes to use groundwater from aquifers as one of the sources of water supply and a hydrogeological investigation has already been carried out. Groundwater within Arua Municipality occurs in deep weathered suites overlying fresh rock formations (Universal Water Consultants, UWC, 2011). Water is likely to occur both in the regolith (weathered rock) and in deep fractured zones. Arua town was found to have medium to high groundwater potential based on shallow wells and springs in the area. This is also supported by data collected from the district which gives yields of existing boreholes between 1 – 6 m³/hr. The variation is related to geological and morphological conditions. The highest yielding well is estimated to be 12.49 m³/hr whereas the lowest yield is 0.2 m³/hr.

The study carried out by UWC (2011) involved geo-electrical resistivity profiles and Vertical Electrical Soundings (VES) on selected profile locations that indicated a high likelihood of groundwater occurrence meriting development. These surveys were carried out close to existing borehole locations. Seven survey sites were recommended as first drilling priorities with a maximum drilling depth of 140 m (Table 3-2).

Table 3-2. Recommended sites from geophysical resistivity surveys and proposed maximum drilling depths for the recommended boreholes.

No.	Location	VES	UTM Easting (m)	UTM Northing (m)	Water bearing zone (m)	Expected depth to bedrock (m)	Max. drilling depth (m)
1	Ozuvu	55	265603	336349	27-58; 58-83	30	120
2	Angufea B	44	270312	337653	27-58; 83-120	30	140
3	Ombachi	41	270474	338594	40-83; 83-120	30	140
4	Kenya	45	266320	335063	19-58; 83-120	40	140
5	Ambeko	57R	266274	336064	19-40; 58-83	30	90
6	Giligili	58	265187	331594	27-40; 58-83	30	120
7	Nyio	33	273382	333178	27-58; 58-120	30	140

Existing borehole (well) completion records from the District show that the majority of boreholes have yields $<5 \text{ m}^3/\text{hr}$ (Table 2 of Annex 1 of UWC report). However, there are no test pumping records that would collaborate the sustainability of the few higher ($>5 \text{ m}^3/\text{hr}$) yield wells which are generally located further away ($>10 \text{ km}$) from the town centre. Unless test pumping data for the above borehole sites is carried out, the analysis of available hydrogeological data does not provide conclusive information.

3.1.4 GEOLOGY AND SOILS

Arua District is underlain by early Proterozoic granitised rocks which include the Aruan and Watian Series (**Fig 3-1**). The main rock groups are pyroxene gneisses, charnockites and acid gneisses. Pleistocene to recent alluvium deposits and black soils occur in the rift valley trough. The weathering pattern of the rocks varies, which in turn determines the groundwater potential in the District. This has a significant bearing on the proposed groundwater development.

Arua Municipal Council has mostly loamy soil, rocky in some areas with sandy soil along River Enyau especially in Otokotoa cell and Enyau cell in Kenya Ward, River Oli Division. These soils have fine texture with loose structures, which are easily eroded and leached. The soils are fertile and this promotes small-scale farming especially along the valleys and the slopes of the hills.

There is a lateritic layer in most soils. This reduces the rooting depth and moisture conditions where it is close to the surface, making it difficult to cultivate. Sub-soils lack minerals for plants. They are good for building and construction.

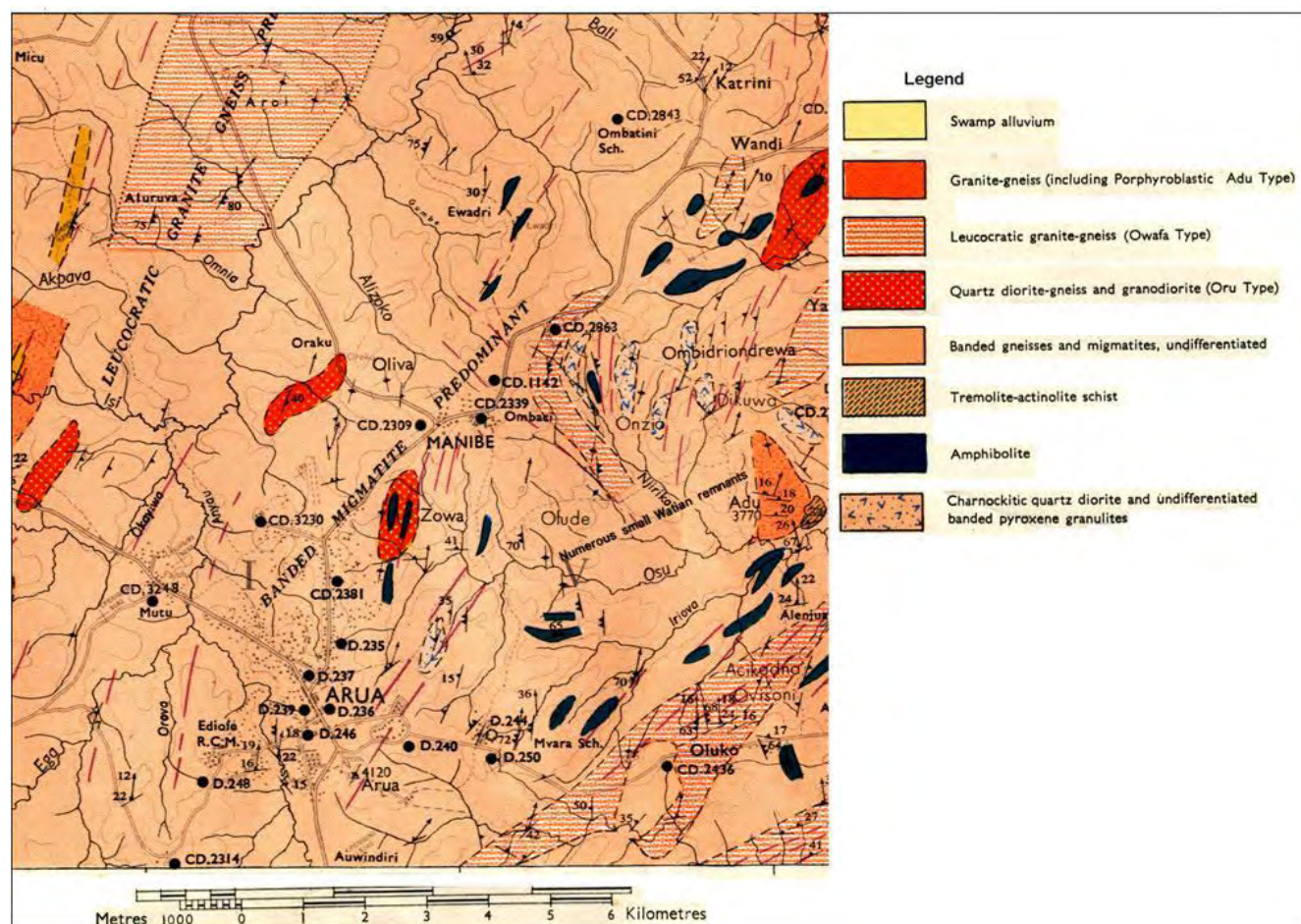


Figure3-1. Geological map of the Arua region of West Nile (GSMD, 1964)

Soil types in Arua Municipality include:

- (a) Yellow-red sandy, clay loam latosols varying from dark grey to dark brown which are slightly acidic and mainly derived from granite, gneissic and sedimentary rocks. They occur on gently undulating hilly topography.
- (b) Brown-yellow clay loams with laterite horizon with variation of dark brown which are slightly acidic. These occur on flat ridge tops or on top of undulating topography.
- (c) Light-grey white mottled loamy soils with laterite horizon ground (water laterite), structureless loamy soils. They are acidic-alkaline and are mainly found on the lower and bottom slopes (source: Arua District Development Report; 2010-2015).

Soil samples taken from sites proposed to host lagoons include Onduparaka which is generally dark grey and organic rich fines (silt and clays), whereas that from Prisons Bay site is less grey in colour and coarser (sandy) in texture (Table 3-3). An estimate of the unsaturated zone hydraulic conductivity of these soils was made from a pedotransfer function consisting of particle size distribution (Cronican and Gribb, 2004).

Table 3-3: Particle size distribution (%) of the soil samples collected at Onduparaka and Prisons Washing Bay in Arua.

Sample	Colour	>500 μm	>250 μm	>125 μm	>63 μm	<63 μm	Fines (silt & clay)	Sands
Onduparaka 01	dark grey, humic	6	13	18	3	61	61	39
Onduparaka 02	dark grey, humic	7	17	21	3	53	53	47
Onduparaka 03	dark grey, humic	6	22	8	2	62	62	38
Onduparaka 04	dark grey, humic	3	19	30	11	37	37	63
Prisons Bay 05	light grey, low organic matter	10	32	27	9	22	22	78
Prisons Bay 06	light grey, low organic matter	33	10	17	2	38	38	62
Prisons Bay 07	light grey, low organic matter	9	22	26	8	34	34	66
Prisons Bay 08	light grey, low organic matter	10	13	14	3	60	60	40

Estimates show that Onduparaka has unsaturated hydraulic conductivity (K) values of 0.02-0.05 md^{-1} , and the Prisons Bay has K values from 0.02-0.11 md^{-1} . Both of these sites reveal low unsaturated K values which is likely to play a key role in adequately attenuating contaminants that may potentially leak from the lagoons from reaching the underground water sources.

3.1.5 CLIMATE

Arua municipality has annual relative humidity in the range of 30-46%. Arua Municipality, just like the whole district of Arua has a bimodal rainfall pattern with light rains between April and October of each year. The wettest months are normally August and September when 120 mm/month of rainfall is received. Light rains are experienced between May and July. The average annual total rainfall is 1250 mm. The mean monthly evaporation ranges from 130 mm to 180 mm in the dry season of December to March. The normal pattern of rainfall has been fluctuating in the recent past with delayed rains in March and at times extended rainfall into December and January which are supposed to be dry. Temperatures in Arua remain high throughout the year ranging from 21°C to 32°C. In the dry season (December – March), the maximum day temperatures reach 39°C (Arua Municipal Council Development Plan, 2010-2015). The temperatures in Arua Municipality fall within the tropical range of temperatures conducive for the treatment processes in waste stabilization ponds, thereby supporting this method to be suitable for treating wastewater from Arua Municipality.

3.1.6 TOPOGRAPHY

Arua Municipal Council has a fairly flat land with spotted hills (i.e. Arua Hill, Awindiri Hill, and Bugolobi Hill) in Arua Hill Division and valleys like River Enyau, River Osu and River Oli valley are the most notable within the municipality. The topography has been utilised such that the highest hill within Arua Municipality (i.e. Arua Hill) is proposed to be the site for water storage tank, while low points are suggested for the waste stabilisation ponds. Due to the valleys in between the spotted hills, a sewage pumping/lifting has been proposed to pump sewage to the proposed site of the waste stabilisation ponds at Onduparaka.

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 VEGETATION

It is important to understand the vegetation of Arua as this will play an important role in re-vegetation of places that will be excavated/laid bare during the project activities. It will be necessary that sites are restored to as much as practically possible to conditions there were in before project activities. The natural vegetation of Arua Municipality used to be characterized by open land with equatorial type of savannah grass, with small pockets of forest on top of the hills. The original vegetation of Arua Municipality was composed of mixed wooded savanna, which has greatly been reduced by housing settlements and subsistence farming. By far, where it exists, the savanna is the most predominant vegetation in Arua Municipality. In general, the vegetation is *Butyrospermum-hyparrhenia* savanna. It is characterized by such trees as; *Isobulinia doka*, *Danieh cliveer* and *Afseha Africana* and dry *Hyparrhenia* grasssavanna. Post cultivation communities of *Imperata-Hyparrhenia* and *Hyparrhenia-Periduum* are found on the lower grounds. Specific types of vegetation in the areas where the developments of the Arua Water Supply and Sanitation project are to be constructed have been identified and are described in the subsequent sections:

(a) *Rehabilitation of the water impoundment and weir*

The vegetation includes trees: *Mangifera indica*, *Grevillia robusta*, *Pinus* spp., *Terminalia superba*; herbs: *Vernonia amygdalen* and grasses of *Leerhasia hexandra*, *Penisetum purpureum*, *Paspalum* spp., *Mariscus* spp. and *Fimbristylis dichotoma*. There are also food crops of *Saccharum officinalum*, *Zea mais*, *Musa* spp. and *Oryza sativa* (rice) which belong to the employees of NWSC working at the Arua water treatment works.

(b) *Rehabilitation of the water works*

There are no perennials in this area, except the trees of *Mangifera indica*, *Grevillia robusta*, *Pinus* spp., *Terminalia superba*, which will not be cut during the rehabilitation works.

(c) *Enlargement of the existing tank and construction of two additional storage tanks*

The identified flora is dominated by Eucalyptus tree species. Other trees include *Mangifera indica* and *Erythrina abyssinica*. There are also shrubs of *Lantana camara*, grasses *Imperata cylindrica*, *Hyperrharia ruffa* and weeds of *Erlangia misera*.

Another location for the additional storage tank is the prisons land near Pokea seminary. At this location there are food crops namely, *Sorghum* sp; *Mamhot aesculentum* and *Daucus carota* (carrots); Grasses of *Digitaria scalarum*, *Chloris phycothrix* and *Cynodon dactylon*. Weeds of *Bidens pilosa*; *Conyza floriabunda* as well as trees of *Eucalyptus* sp; *Mangifera indica* and *Techtona grandis* also exist.

(d) *Improvements and extensions to the existing water network*

The flora in this seasonal wetland comprise of Eucalyptus tree species, trees of *Borassus aethiopum* and *Tamarindus indica*; as well as grasses *Hyperrhania ruffa* and *Imperata cylindrica*.

(e) Proposed site for construction of waste stabilisation ponds

The biological features of the site at Onduparaka comprise of trees of *Vernonia amygdalena*, food crops of *Lycopersion aesculentum*, grasses of *Pennisetum purpureum*; and others species such as *Tithonia diversifolia*.

The biophysical features of the site at Prisons farm in Arua Hill division comprise of trees of *Eucalyptus* sp, and food crops viz Sorghum sp and *Manihot esculenta*.

3.2.2 WETLANDS

Wetlands cover approximately 2.8 % (87km²) of the total land area of the Arua district. Arua Municipality has some wetlands covering approximately 2.5% of the total land area. The wetlands are increasingly being encroached upon for settlement and cultivation especially along Rivers Osu and Enyau. The status of wetlands in Arua has been given in Section 3.1.2. It will be crucial that wetlands are not encroached upon by the project activities and that they are spared as much as possible from pollution if they are to continue to play the role of filtering pollutants that would find their way into water courses.

3.3 SOCIAL ECONOMIC PROFILE OF THE PROJECT AREA

3.3.1 PROJECT AREA (PA) SOCIAL ECONOMIC PROFILE DESCRIPTION-GENERAL

a) Location and ethnicity

The project area is well beyond the boundaries of Arua Municipal Council and includes the following sub-counties: Pajulu SC, Dadamu SC, Oluko SC, Vurra SC, Ajia SC, Katrine SC and Manibe SC. According to the baseline survey for Arua Water Supply and Sanitation Project (2011) the ethnic composition in the project area is; Lugbara (74.1%), the largest ethnic group in the district and municipality, followed by the Kakwa (8.3%), Maadi (4.8%), Alur/Luo (4.3%), Non Citizen/refugee (4.3%) and other ethnic groups (8.1%).

b) Land tenure

Two predominant land tenure systems found in Uganda occur in the project area; Customary, and Leasehold, the predominant one being *customary* land tenure in rural areas while leasehold is predominant around AMC and the suburbs. Freehold is becoming more regular with customary owners around town converting their landholding interests into freehold.

c) Settlement pattern, population and land use

In the project area, except for Arua Municipal Council, in particular Arua Hill Division, land use in other areas is not planned. Arua Water Supply and Sanitation Project Baseline Survey, 2011, results indicate that about half of the housing settlements or dwellings /residences in the PA are permanent (47.6%), followed by those that were semi- permanent or built using brick and mud (38.8%) and those that were temporary or built using mud and wattle (13.4%) and those that were temporary or built using polythene sheeting (0.2%). More of the permanent housings were reported in AHD (73.6%) as compared to other project areas like River Oli Division (48%), Pajulu Sub-county (39.2%), Oluko Sub-county (32.8%), Manibe Sub-county (31.4%) and Dadamu Sub-county (41.8%). Similarly, more of the semi-permanent, permanent and temporary dwelling structures were more pronounced in Dadamu, Manibe, Oluko, Pajulu and Vurra Sub-counties and River Oli Division as compared to Arua Hill Division in Arua Municipal Council. Land use around Arua Municipal Council is in the following order; housing, commercial, institutional/social service structures, subsistence

farming and industrial. The land use in other project areas has been described in the respective sub-county project areas in the sub-sections that follow (from 1.6.3-1.6.10). Social and physical infrastructures have failed to match with the population growth, majority of houses are not planned, rely on pit latrine and solid waste disposal is poor. The total projected 2012 population in the PA is 387,100 as reflected in the **table 3-4**.

Table 3-4. Project Area Population By Division /Sub-County

Area	2010			2011			2012		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
AMC	28,200	29,300	57,500	29,200	30,200	59,400	30,200	31,200	61,400
Arua Hill Di	9,500	10,100	19,600	9,800	10,400	20,200	10,200	10,700	20,900
R. Oli Div	18,700	19,200	37,900	19,300	19,800	39,100	20,000	20,400	40,400
Dadamu	16,500	18,100	34,600	17,100	18,700	35,800	17,700	19,300	37,000
Manibe	14,300	15,900	30,200	14,800	16,400	31,200	15,300	16,900	32,200
Oluko	17,700	19,300	37,000	18,300	19,900	38,200	18,900	20,600	39,500
Pajulu	21,500	23,900	45,400	22,300	24,700	47,000	23,100	25,500	48,600
Ajia	11,800	12,900	24,700	12,200	13,300	25,500	12,600	13,800	26,400
Vurra	19,500	22,200	41,700	20,200	22,900	43,100	20,900	23,600	44,500
Katrini	16,100	17,900	34,000	16,700	18,400	35,100	17,200	19,000	36,200
Total	173,800	188,800	362,600	179,900	194,700	374,600	186,100	201,000	387,100

(Source: Arua District Planning Unit Population Projections 2010)

3.3.2 PROJECT AREA SOCIAL ECONOMIC PROFILE DESCRIPTION: ARUA MUNICIPAL COUNCIL (AMC)

a) Location

Arua Municipal Council (AMC) is one of the thirteen municipal councils in Uganda. The origin of Arua Municipal Council is directly linked with the time of the establishment of the colonial rule in Uganda. Arua Town became established in June 1914. In 1938, a Township Authority was formed in Arua and in the following year 1939, it grew to a Town Council. Arua was declared to be a Municipality in 1972. AMC lies on the North Western region of Uganda, located on latitude 03 01' North and 30 58' East, 1200 m above sea level, surrounded by Ayivu County in Arua District. The municipality is 15 Km from the Democratic Republic of Congo to the West, 75 km from Sudan to the North and it is 540 km North West of Uganda's Capital City, Kampala. It is a civic center of Arua district administration and the largest commercial and social coordinating point in the district as well as for many regional activities in the West Nile. The area coverage of AMC stands at 10.5sq km. AMC has two divisions i.e. Arua Hill Division covering 7.38 sq. km and River Oli Division covering 3.12 sq. km. Project activities for water and sewerage distribution mains will follow most of the roads in Arua Municipal Council. Some of the WTPs/lagoons will also be located in Arua Municipal Council at Prisons Cell/LCI. The sewerage pumping station will also be located in Arua Municipal Council.

b) Access to social services: water and sanitation

The major source of safe water in Arua Municipal Council is the tap water supplied by NWSC with coverage of over 70%¹ during rainy season but dropping much lower during the dry season (Arua Municipal Council DP, 2010-2015). Other water sources are seasonal rivers, protected springs (23) and the several boreholes (58) some of which are contaminated. The informal settlement pattern in River Oli Division explains the poor sanitation problems in the division where there are less sanitation facilities, poor hygiene, poor feeding pattern and high poverty levels among the residents. Toilet coverage in 2010 was 62.4%. Least toilet coverage was registered in Gurua cell; 29%, while highest toilet coverage was in Mvara .S.S. cell; 96%. Hand washing after using the toilet is very low standing at only 20% in 2011 (Quarterly Water and Sanitation Monitoring Report- Arua Municipal Council, Last Quarter, 2011). Toilet facilities especially in River Oli Division are temporarily built using mud, water and straw/grass and cannot be classified as safe (Arua Municipal Council -DP, 2010-2015). There are 57 Public Stand Pipes in the Municipality; 15 in Arua Hill Division and 42 in River Oli Division, and of these 47 are functional and 10 are non functional. All non functional PSPs in all the wards are due to disconnections as a result of non-payment. There are 56 Boreholes in the Municipality, 52 are functional and 4 non functional representing 92% and 8% respectively. There are 13 springs/wells in Arua Municipal Council, 9 in Arua Hill Division and 4 in River Oli Division. The springs are generally in poor repair state except Onia spring in Prison cell. Most of the springs have defective water delivery pipes and obstructed flow due to human activities (Quarterly Water and Sanitation Monitoring Report- Arua Municipal Council, Last Quarter, 2011). There is indiscriminate disposal of solid waste. The refuse street bins are not enough for the garbage generated (Arua Municipal Council DP, 2010-2015).

c) Water Quality in Arua Municipality

Evidence from the routine water quality monitoring by the Department of Public Health- Arua Municipal Council indicates that most of the non piped water source in the municipality are contaminated with *E-coli* (85%)². Therefore, most of the non-piped water sources were unfit for human consumption and the situation was unlikely to get better given the increased densification in Arua Municipal Council and the suburbs. During the dry season, most people in AMC rely on these non-piped water sources whose quality is already poor.

d) Settlement pattern, population and land use

AMC by 2010 had a population of 57,000. AMC has a high rate of population growth rate of 6% as compared to 3.3% at national level. The increase in population is more in River Oli Division(i.e. twice the increase in Arua Hill Division), that explains the type of settlement in the division, with high average HH size of 8 as compared to that in Arua Hill Division of 5. The proportion of children (population below 18 years of age) was 52% according to the 2002 census compared to the national proportion 56 %. The old population forms 2% of the population compared to the national proportion of 5%. There is generally more organised housing settlement and road infrastructure in Arua Hill Division as compared to River Oil Division.

The core development challenges of Arua Municipality among others include the following: unplanned physical developments and informal settlements; food insecurity; High rate of population growth rate of 6% as compared to the national rate of 3.3%; Low HH incomes (high rate of poverty);

¹This needs to be treated with caution because the service coverage includes several areas outside the AMC administrative boundaries.

² This water quality monitoring was undertaken in the first quarter of the 2010/2011 financial year by Department of Public Health-Arua Municipality.

where majority of the population live below the poverty line of \$1 per day; Inadequate access to social services especially water, power, health and education; accelerated environmental degradation; prevalence of HIV/AIDS; outdated structural plan to guide housing development and laying of social services delivery infrastructure like water mains and roads.

Permanent, semi permanent and temporary structures exist in AMC with temporary structures forming 60 %. Social and physical infrastructures have failed to match with the population growth. Majority of houses do not have in-house piped water, rely on pit latrines, open garbage disposal. Poor drainage and poor access roads have lead to residential areas being prone to incidents of environmental diseases like cholera, malaria, typhoid, dysentery and intestinal diseases. Majority of permanent houses are in Mvara wards; 70% and the least in Kenya ward 32.6%. Anyafio East and Central have the highest number of permanent houses; 100% and Gurua cell has the least; 26%. In ROD 90% of the houses are grass thatched (Arua Municipal Council DP, 2010-2015).

4 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

4.1 LOCAL POLICY FRAMEWORK

The following policies and legal framework (Table 4-1) are relevant to the Arua Water Supply and Sanitation project and the relevant clauses that are likely to be triggered by activities of this project are highlighted. By complying with this legislation, the project will be developed and implemented with minimum negative impacts to the environment. In that way, the project will be able to achieve its intended objectives of improving water and sanitation services in Arua Municipality's formal and informal settlements in a sustainable manner so that the project benefits the present and future generations.

Table 4-1. Policy framework relating to Arua Water Supply and Sanitation Project

Policy Title	Policy Goal	Relevance to Arua Water Supply and Sanitation Project
National Environment Management Policy, 1994	To promote sustainable economic and social development that enhances environmental quality.	Environment Impact Assessment (EIA) must be conducted for proposed Arua Water Supply and Sanitation project so that it promotes economic and social development in a sustainable way.
The National Policy for the Conservation and Management of Wetland Resources 1995.	To curtail the rampant loss of wetland resources and ensure that benefits from wetlands are sustainable and equitably distributed. Wetlands acting as sources of water supply wastewater treatment should be fully protected.	Application of environment impact mitigation procedures on all activities of the project to be carried out in or around affected wetlands. NWSC has to work hand in hand with WID and NEMA to halt encroachment on wetland areas around the River Enyau and the part where water is abstracted.
The National Water Policy, 1999	The discharge of effluents into surface waters to a permit in line with the Waste Discharge Regulations (1998).	The effluent to be discharged from waste stabilisation ponds at Prisons and Onduparaka into rivers Enyau and Okaiva, respectively, shall be treated to meet effluent discharge standards so as not to pollute the receiving waters.
National Gender Policy, 1997	Provides a framework and mandate for all stakeholders to address the gender imbalances within their respective sectors.	The gender policy recommends that integration of gender issues in national policies and projects will improve national welfare, contribute towards sustainable development, and improve the work of the ministries.

4.2 LOCAL LEGAL AND REGULATORY FRAMEWORK

This section presents in Table 4-2, the relevant local legal and regulatory framework relating the Arua Water Supply and Sanitation Project.

Table 4-2. Legal and regulatory framework relating to Arua Water Supply and Sanitation Project

ACT	RELEVANT PROVISIONS	Relevance to Arua Water Supply and Sanitation Project
The Constitution of the Republic of Uganda; 1995; amended as at 15 th February 2006, Government of Uganda.	The State shall promote sustainable development and public awareness of the need to manage land, air and water resources in a balanced and sustainable manner for the present and future generations.	Chapter 15, Article 237, Clauses (1) (2) (a) & (b) gives the Government the powers as guided by the Parliament to acquire land anywhere within the country and place it to the best use to benefit the citizens of the country, where deemed necessary. The rehabilitation of the waterworks at Mira village, Nsambya North in Arua hill Division as well as project components within Arua municipality will be done while following mitigation measures suggested in this report. Equally, the design of impoundment and water abstraction, as well as protection of River Enyau banks are all aimed at sustainable development for the benefit of citizens of Arua Municipality. All land acquisitions will adhere to the provisions of the 1995 National Constitution
National Environment Act Cap 153	Section 19 (3), requires a developer of a project to submit an acceptable EIA Report in accordance with the guidelines in the Third Schedule of this Act.	The project is required by Law to submit EIA for the proposed infrastructure developments. This project is in line with this regulatory requirement as an environmental impact assessment is part of the project cycle, and is the subject of this report.
The National Water and Sewerage Corporation Statute (1995)	Section 3 of this statute, states that the NWSC shall operate and provide water and sewerage services in areas entrusted to it under the Water Statute of 1995.	Some of the functions that are mentioned in the NWSC Statute include (a) management of water resources in ways which are beneficial to the people of Uganda (b) provision of water and sewerage services (c) development of water and sewerage systems in urban centres and big National Institutions throughout the country. NWSC is therefore fulfilling one of its mandates to supply water to Arua Municipality, which is a gazetted urban area in Uganda.
Environmental Impact Assessment Regulation 13/1998 and Environmental Audits Guidelines	According to sections 19-20 of the NEA, all projects that have or are likely to have a significant impact on the environment are required to undergo an environmental impact assessment (EIA) process prior to implementation.	According to Section 3(2) some of the requirements of EIA are to establish adequate environment standards and to monitor changes that may result in the implementation of the project. NWSC is on the right track by carrying environmental impact assessment for this major project.
The National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, 2000	Regulation 12(1) prohibits any person from carrying out an activity in a wetland without a permit issued by the Executive Director of NEMA.	Under regulation 34(1), a developer desiring to conduct a project which may have significant impact on a wetland (for example dredging), river bank or lake shore, shall be required to carry out an environmental impact assessment in accordance with sections 20, 21, and 22 of the NES. Therefore, prior to the dredging works at the WTW and discharge of effluent in rivers Enyau and Okaiva, NWSC will seek permission from executive Director of NEMA.
The Water Act,	- The Act provides for hydraulic	- Under section 18 (2), a person wishing to

ACT	RELEVANT PROVISIONS	Relevance to Arua Water Supply and Sanitation Project
Cap 152 and the Water Resources Regulations, 1998	works and use of water. -The Act provides for use, protection and management of water resources and supply; to provide for the constitution of water and sewerage authorities; and to facilitate the devolution of water supply and sewerage undertakings.	construct any works or take and use water may apply to the Director of Water Development Directorate in a prescribed form for a permit to do so. - Under Section 31 (1) of the Act, a person commits an offence who, unless authorised under this Part of the Act, causes or allows wastes to come in contact with, or be discharged into water or allows water to be polluted.
Water (Waste Discharge) Regulations, 1998	The water (Waste Discharge) Regulations of 1998, are aimed at regulating the effluent or discharge of wastes on to land or into water.	Under regulation 5(1), a waste discharge permit is required for a person who owns a facility which discharges or will discharge effluent or waste into the aquatic environment or on land. The alum sludge and backwash water from the water treatment works are currently discharged into River Enyau, downstream of the weir at the WTW. No discharge of wastewater effluent at the moment, but these upon completion of the waste stabilisation ponds, discharge will be eminent in R. Enyau and R. Okaiva.
The Land Act, Cap 227	Section 42 states that Government or Local Government may acquire land in accordance with the provisions of Article 26 and clause 237 of the constitution.	Section 74 (i) states that where it is necessary to execute public works on any land (e.g. construction of road), an authorised undertaker shall enter into mutual agreement with occupier or owner of the land in accordance with this act, and where no agreement is reached, the Minister may, compulsorily acquire land in accordance with Section 43 of the Act. NWSC has purchased (through mutual agreement) some of the land needed for some of the developments, e.g., the land at Onduparak and is negotiating with landowners and with government to use a small part of land at Prisons for the waste stabilisation ponds. All PAPs have been identified in the RAP study and will be compensated for their land, which NWSC will need to acquire before use.
Occupational Safety and Health Act, 2006	The Act aims at ensuring the existence of safety and health at all work places and work environment.	The project should adhere to occupational safety and health rules according to the mitigation measures suggested in this report.
Workers' Compensation Act (2000)	This requires compensation to be paid to a worker who has been injured or acquired an occupational disease or has been harmed in any way in the course of his/her work.	NWSC shall ensure that all contractors and sub-contractors provide personal protective equipment (PPE) to employees to minimize accidents and injuries. NWSC will also have to provide such PPE equipment to all workers directly under NWSC. Additionally compensation will be paid to those affected.
National Environment (Conduct and Certificate of	Regulation 176 (1) states that no person shall conduct an EIA or carry out any activity relating to the conduct of an environmental	The consultants who carried out this EIA are certified practitioners

ACT	RELEVANT PROVISIONS	Relevance to Arua Water Supply and Sanitation Project
Environment Practitioners Regulations (2003)	impact study, or environmental audit as provided under the Act, unless the person has been duly certified and registered in accordance with the regulations	
The National Environment (Waste Management) Regulations, 1999	Regulation 9 (8) stipulates that at any reasonable time, an environmental inspector can: (a) stop and inspect any vehicle used for transportation of waste; and (b) enter upon any premises where waste is stored.	During the life cycle of this project, The developer and the Sub-contractor (s) must at any reasonable time, be ready and willing to allow an environmental inspector to inspect their premises and project activities or garbage transportation trucks to ensure that regulations are complied with.
The National Environment (Control of Smoking in Public Places) Regulations, 2004.	Section 3 entitles every person to a healthy environment, free from second-hand smoke. It further obliges all persons to safeguard the health of non-smokers. Sections 4 & 5 prohibit smoking in public places.	NWSC shall enforce the non-smoking ban, especially in all public work places during construction and operation phases of the project and will ensure that there are clear signs indicating that smoking is restricted and prohibited in such areas.
The National Environment (Noise Standards and Control) Regulations, 2000.	Regulations 6 & 7 (II) sets permissible noise levels, Part III (Regulations 8, 9, 10 & 11) calls for the control and mitigation of noise; Regulation 9 specifically prohibits the generation of noise by place and time. Part IV instructs for a licence for noise in excess of permissible levels.	NWSC must enforce noise standards and working hours at the site allocated for development, both during the construction stage, as well as during operation and maintenance.
The Town and Country Planning Act 1964	The Town and Country Planning Act 1964 govern land use and land planning in urban and rural areas.	NWSC shall use established guidelines for planning schemes, to acquire land and compensate for acquired lands, as well as safeguarding the natural environment.
Public Health Act Cap 281	Section 7 provides local authorities with administrative powers to take all lawful, necessary and reasonable practicable measures for preventing the occurrence of, or for dealing with any outbreak or prevalence of, any infectious, communicable or preventable disease, to safeguard and promote the public health.	NWSC shall provide for adequate sanitary facilities, proper solid and liquid waste management and provide and operate first Aid services especially in public places; and shall ensure that such facilities are available in all other privately allocated and developed areas requiring such to possess them. Anybody falling sick and needing services beyond the first Aid shall be referred to the nearest health centre. NWSC will implement an HIV/AIDS prevention and control plan as part of mitigation measures.
The Local Governments Act Cap 243	Provides for the system of local governments based on the decentralization of district for the enforcement of environmental law. The functions of the Municipal Councils include: land surveying and administration, physical planning, environmental	NWSC shall work closely with Arua Municipality Council in carrying out activities of the project.

ACT	RELEVANT PROVISIONS	Relevance to Arua Water Supply and Sanitation Project
	protection (forests and wetlands, streams etc.) and ensuring proper sanitation,	

4.3 INTERNATIONAL LEGAL AND LENDERS REQUIREMENTS

Uganda is a party to a number of international and regional agreements which requires her to comply with provisions of the agreements when developing projects like the Arua Water Supply and Sanitation Project.

The Arua Water Supply and Sanitation Project will be partly sponsored by the World Bank and other institutions. International financial institutions have environmental and social safeguard policies that are designed to avoid, mitigate, or minimize adverse environmental and social impacts of projects supported by them. These are summarised in Tables 4-3. In addition, some relevant international treaties and conventions and their applicability to the Arua Water Supply and Sanitation Project are given in Table 4-4.

Table 4-3: World Bank/IFC Legal Requirements

Policy title	Key issues	Applicability
Environmental Assessment Policy (OP/BP 4.01)	Preventing, minimizing, mitigating or compensation for adverse impacts caused by the project.	The EIA has been conducted and during the process, measures of preventing, minimising or mitigating and compensating for adverse impacts have been proposed.
Natural Habitat Policy (OP 4.04)	Avoiding significant conversion (loss) or degradation of natural habitats, whether directly (through construction) or indirectly (through human activities induced by the project.	Measures have been proposed for the avoidance of significant conversion and loss or degradation of natural habitats for example, forests and wetlands.
Pest Management (OP 4.09)	Prevention of pollution of water sources when using pesticides in agriculture	Mitigation measures outlined in the catchment management plan of River Enyau suggests no use of pesticides within the river banks
Involuntary Resettlement Policy (OP 4.12)	Avoid involuntary resettlement where possible and assist displaced project affected people in restoring their livelihoods and living standards.	Involuntary resettlement has been minimized and where people's properties are to be affected , compensation is suggested
OP 4.11 Physical Cultural Resources	Physical cultural resources (movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance) are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrower's national legislation, or its obligations under relevant international environmental treaties and agreements.	Triggered because of Civil Works. Consequently, In the EIA process, public consultations were conducted among relevant project-affected groups, concerned government authorities, and relevant nongovernmental organizations in documenting the presence and significance of physical cultural resources, assessing potential impacts, and exploring avoidance and mitigation options. A chance finds procedure (Annex 13) will guide handling and management of any PCRs that may be found during civil/earth works.
Access to Information Policy (2010)	Promoting inclusiveness and strengthening participation in the design of project and policies; and Facilitating public oversight of Bank-supported operations during their preparation and implementation and providing opportunity to better monitor use of public funds. This also helps expose potential wrongdoing and corruption and enhances the possibility that problems will be identified and addressed early on.	All information on this project and project components has been discussed with stakeholders during the consultation process
General Environment Health and Safety Guidelines April 2007	The use of Asbestos Containing Material (ACM) should be avoided in new buildings and construction or as a new material in remodeling or renovation activities. A management plan should be developed for	No materials containing Asbestos will be used in constructing infrastructure components of the project.

Policy title	Key issues	Applicability
	existing facilities with ACM, asbestos and should clearly identify locations where the ACM is present, its condition (e.g., whether it is in friable form or has the potential to release fibers), procedures for monitoring its condition, procedures to access the locations where ACM is present to avoid damage, and training of staff who can potentially come into contact with the material to avoid damage and prevent exposure. It further specifies that for decommissioning, disposal of ACM should be carried out by specially trained individuals following host country requirements, or in their absence, internationally recognized procedures	

Table 4-4: Summary of International Treaties and Conventions

Treaty title	Key issues	Applicability
Kyoto Protocol to the United Nations Framework Convention	Promotion of sustainable forest management practices, afforestation and reforestation	It is proposed to carry out afforestation and reforestation along the banks of River Enyau.
United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (UCCD, 1992).	Integration and sustainability of natural resources, promotion of alternative sources of energy and alleviation of pressure on fragile natural resources.	Measures have been suggested to protect natural resources and fragile ecosystems for example, wetlands and forests
Stockholm Declaration (Declaration of the United Nations Conference on the Human Environment 1972)	Principle 15 of the Stockholm Declaration states that, "Planning must be applied to human settlements and urbanization with a view to avoiding adverse effects on the environment and obtaining maximum social, economic and environmental benefits for all". In this respect, projects aimed at exploiting local people or the environment is discouraged.	During the EIA process, wide consultations have been performed to avoid adverse effects on the environment, at both abstraction of water, treating it, conveying it, collecting the sewage and conveying it as well as treating it.
Asbestos Convention (C162) of 1968 (International Labour Organisation)	Advocates for development of national laws and regulations for the —prevention and control of, and protection of workers against health hazards due to occupational exposure to asbestos. The convention outlines aspects of best practice: monitoring the working environment, and Workers' health among others.	No asbestos materials are to be used in the project.
EAC Treaty	Promotion of clean and healthy environment is a prerequisite for sustainable development.	Mitigation measures of all project components aim at achieving a clean and healthy environment

5. STAKEHOLDER CONSULTATIONS

During the assessment, different community members and other stakeholders were consulted (Annex 3) and their views are summarised in the subsequent sections.

Arua Municipal leaders emphasized the need for the project design team and contractors to work with Arua Municipal Engineering Department and Town Planner regarding the established and planned roads, and other facilities that need to be considered in the design of the project. They pointed out that the need for the project design team and RAP team to consult the Arua Municipal Council over the issue of *kiosks* along road reserves.

“On several occasions, NWSC just digs up the roads without consulting us... Sometimes you find roads closed.” (AMC Technical Staff).

Municipal leaders and community members noted with concern the need to train NWSC workers to be more responsive towards consumers’ concerns than is currently the case. Community leaders around Arua Municipal Council also observed that several of the households in AMC are fairly economically empowered and would afford connection fees to the expanded water supply network.

District, Arua Municipal Council and sub-county leaders were apprehensive about the sustainability of water abstraction from R. Enyau towards the planned expanded water supply system. They suggested that project designers should in the long term consider more sustainable options like pumping water from R. Nile. Leaders also cautioned the need for inter-agency collaboration especially in the protection and conservation of the catchment system for R. Enyau as a short and long term requirement that should be integrated in the project design. Some community members also proposed considering R. Ega which does not dry throughout the year – as an alternative water source for the project.

“Why don’t you get water from the Nile so that there is a complete solution to this problem?” (community member – Adalafu Parish).

Community members at Ediofe noted that the proposed lagoons at prisons land would eventually affect the income of sand miners in that area and the income to prisons authorities that accrues from authorizations of sand mining. Investigations further downstream indicate that other areas can be considered for sand mining without affecting the livelihoods of people engaged in sand mining.

Community members were also concerned about the safety of water from R. Enyau especially for downstream areas after the proposed lagoons location points. Community members expressed fear about increased pollution of R. Enyau after establishment of lagoons. Community leaders and technical staff consulted observed the need for long term community sensitization about lagoons before and after project implementation to allay community fears and other negative concerns, since water from R. Enyau is used for cooking, washing and also drinking during the dry season.

“Won’t wastewater from lagoons affect water quality in R. Enyau?” (community member Adalafu).

Community leaders in Vurra sub-county also observed that some community members were not aware about road reserves and therefore, raised the need for community sensitization about the proposed project activities within the road reserves. Community leaders in Vurra and Pajulu sub-counties also observed that R. Enyau was being used for irrigation of crops especially during the dry season along the valley basins. This is incidentally the same time when demand for water is highest from NWSC. Community leaders advised that community members need to be involved in mitigation or conservation efforts for R. Enyau and the catchment. Vurra sub-county is implementing an ordinance on protecting wetlands and rivers and streams including R. Enyau. There is need for inter-sectoral collaboration between the project, NWSC, NEMA and local governments in this regard.

Community members also observed the need for more open stand pipes (water kiosks) to cater for several of the community members who may not readily afford the connection fees for in-house tap water connection. In this regard, they also raised the need for regulating the price of water at open stand pipes to make it more affordable by the community poor.

Some community members were eager to know how much they would have to pay in order for their residences to get connected to the piped water network after the project is implemented. They requested that NWSC puts up posters in the local language and through radio informing people about the project construction activities and post project construction procedures and requirements for getting connected to the piped water network. Community leaders in River Oli Division also requested that the project design should consider a subsidized connection fee for the urban poor in informal settlements of AMC.

Community members in Komte Parish and Alivu parish in Pajulu and Oluko sub-counties also raised related concerns about inability of community members to afford the water tariffs. They observed that there are several cases of disconnections due to failure to pay water bills.

“Many people have run away from NWSC taps because of the costs....so the costs should be reduced for the common man.....otherwise several people will not afford” (Community leader-Komte parish).

Prisons management at Giligili observed that improved water supply and sanitation (sewage) will save prisons authorities from recurrent expenditures on emptying septic tanks and will improve the hygiene of prisons environment and prisoners in general terms. This is because the incidence of water and sanitation related health conditions among prisoners and staff is likely to reduce considerably. The prison authorities at Giligili also noted that their existing water source – the borehole sometimes breaks down and due to lack of spares, they spend considerable time using other non-safe water sources like unprotected springs. They anticipated that improved water supply system by NWSC would help them mitigate such situations.

Technical staff and leaders consulted in Arua Municipal Council observed that in heavily built up areas around town like Avenue road, Duka lane, market lane, Rhino Camp road to Go-down road junction, there will be need for strong adjustments of the required working space corridor of 8 meters off the edge of the roads since several commercial and residential buildings have been constructed within that corridor. They also proposed

use of manual labour in such areas to minimize damage to people's houses instead of using machine excavators.

Community members were generally eager to know when the project construction activities would commence given the dire need for safe water in the area. They also expressed concern about the likelihood of project activity implementation affecting peoples' livelihood activities and other properties along the 'way leaves' and at other project sites that will involve land acquisition.

"For a long time, water has been a problem in this area, we have had several meetings on water, nothing has materialized, we have followed up on this issue, still nothing has come up.... How sure are we today that what you are telling us is the truth? Won't we be disappointed again?" (Community leaders Ombokoro, Muni and Ambeku parish community consultations).

"When will the project start.....? we are badly off in terms of water during the dry season; why are you still doing research instead of beginning the project?". (Community member: Tanganyika, Iyap and Arivu parish consultations).

"Within the municipality, when they were opening up new roads they destroyed people's crops, trees and houses without any respect and compensation. I hope this does not arise with this project." (community leader – Kenya Ward/ parish Arua Municipal Council).

"In several places we went to during road opening we destroyed several pipes of NWSC. This is because they did not consult us when putting these pipes.....also some pipes were put at a very shallow depth" (Ag. Town Clerk River Oli Division Arua Municipal Council).

"You need to access the Arua Municipal Council master lay out sheets to guide you on the width of the roads and take care of your concerns" (Town Engineer Arua Municipal Council).

5.1 GENERAL OBSERVATIONS

The ESIA study indicated that Arua Municipality is developing very fast including the neighbouring sub-county areas of Pajulu, Manibe, Oluko, Dadamu and Vurra, *albeit* with poor physical planning services in place. This will pose a remarkable challenge to water and sanitation infrastructure/service mains extension. Arua Municipality is also pushing for a city status and the degazetting of Barifa Forest to pave way for a planned residential and industrial area implying that future domestic and industrial water needs will be higher within the municipality. Pajulu, Oluko and Dadamu are centers to several current and upcoming educational institutions, while Vurra and Oluko are increasingly becoming destination centers for schools and few industrial establishments. This implies that demand for institutional water will become higher in the nearer future. Alternative water sources to piped water in Arua Municipality are boreholes, shallow wells and

spring water sources. However, most of the alternative water sources are contaminated and have been deemed unfit for human consumption.

The district, municipal and sub-county leadership and some community members received news about the Arua Water and Sanitation Project with enthusiasm and expressed willingness to cooperate at all levels with NWSC and other stakeholders to ensure successful implementation of the project. Consultations with Arua Municipal Council staff and Government agencies pointed to the fact that the Arua Water Supply and Sanitation Project was in tandem with the core of the development strategies within the National Development Plan (NDP, 2010-2015), Arua District Development Plan (DDP, 2010-2015) the Sub-county Development Plans (SDPs) and the Arua Municipality Development Plan 2010-2015. The RDC of Arua District mentioned that the project was well within the Presidential Manifesto for the region as far as safe water and sanitation is concerned. Most of the town and community leaders that were talked to observed that the current rates/tariff structure for domestic water was generally affordable. Overall, the project social benefits outweigh the risks in the short and long-term.

5.2 GENERAL RECOMMENDATIONS TO ENHANCE SUSTAINABILITY OF PROJECT

1. Farmers along River Enyau upstream areas need to be sensitized about proper land use practices in order to protect the river recharge system and guarantee water flow. Sensitization could involve meetings, seminars, workshops, radio talk shows, and demonstrations on planting trees (Section 2.2.10).
2. Community leaders recommended a reduction in domestic connection fees for the urban poor and the rural areas in the neighboring project sub-county areas of Pajulu, Manibe, Dadamu, Oluko, Katrine, Ajia and Vurra.
3. The project design should include a sensitization/educational programme component especially on safe water use and proper sanitation behavior if the anticipated and desired public health impact for improving access to safe water and sanitation is to be achieved. Without substantial investment and program for health education on safe water handling and proper sanitation practices, the investment in water infrastructure alone may not lead to the desired public health effects. In partnership with the local authorities, this programme will be designed, financed and implemented to leverage proper hygiene and water handling practices in the project area. Given the fact that this is the routine mandate of the local authorities. It is recommended that the local authorities like Arua District and Arua Municipal Council – Public Health and Health Education Departments be supported to design a sensitization/educational programme on water handling and proper sanitation practices to be implemented immediately to add on to the limited existing efforts at the local levels.
4. There is need for inter-sectoral collaboration especially with Arua Municipal Council Engineering and Works Department, Public Health Department, District Works and Roads Department and Uganda National Roads Authority to offer guidance on the classification and extent of road widths and reserves since some of the main project activities (laying transmission pipes for water and sewage) will take place along road reserves.
5. Technical staff at Arua Municipal Council observed that the sanitation component in the project design is very limited given the increasing densification of AMC and

the neighboring suburbs. To be able to increase project outcomes use (sewerage system and lagoons) and contribute further to the narrowing of the sanitation gap, it was recommended that a cesspool emptier (preferably managed by AMC) that offers, subsidized emptying services for those HHs not connected to the sewer line be included in the project design.

6. It is recommended that adequate and prompt compensation for PAP households be implemented before project activity implementation. Therefore, there is need for an adequate information system that continually updates the PAPs on all pending issues related to their compensation.
7. The introduction of more Public Stand Pipes and boosting supply through existing ones will lead to reduced prices of water at public taps. To strengthen this outcome, local authorities in collaboration with NWSC will have to work out a regulatory framework for open stand pipes operators to ensure all round affordability to community members. Community members, leaders and some of the heads of departments consulted observed that some of the proposed project activities will negatively affect a number of peoples' livelihood along some of the roads and partial land acquisition for proposed augmentation borehole points at Onduparaka, Nyio, Giligili and Ombachi; and partial land acquisition for public toilets in AMC and at Onduparaka for Pajulu sub-county. The community members were particularly worried and concerned about the lengthy compensation process for the PAPs. The local leaders recommended that all people affected by the project be promptly and adequately compensated.

Overall, the stakeholder consultations revealed potential of conflict and demand for information as explained above. The declining water flow of River Enyau and its deteriorating water quality are cause for concern. Measures for this deterioration in quantity and quality have been suggested in sections 2.10 and in 3.1.2 above. Besides, the Strategy for the protection and management of River Enyau and the banks (2010) is aimed at protecting the river and thus restoring the water quantity and quality in the river and thus, this strategy should be implemented. The activities of the protection and management of River Enyau should be communicated to all stakeholders on time in order to avoid conflict. That is why it is proposed to recruit a full time E&H staff during the project implementation to handle, among other tasks, the important task of constant interface and communication of activities to protect and manage River Enyau to all relevant stakeholders, and to ensure that inter-sectoral collaboration is happening. Thereafter, the activity of H&S and inter-sectoral collaboration shall be taken up by AMC and NWSC (Arua office).

6 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

6.1 INTRODUCTION

In this section, an identification and analysis of the potential positive and negative impacts accruing from the Arua Water Supply and Sanitation project is presented. In evaluating the impacts of the project components, reference has been made to the World Bank operational policies OP 4.01 on Environmental Assessment, OP 4.04 Natural Habitat Policy, OP 4.09 Pest Management and OP 4.12 Involuntary Resettlement Policy. The impacts have been structured into phases, of construction, operation as well as decommissioning.

6.2 ANTICIPATED POSITIVE IMPACTS

The Arua Water Supply and Sanitation Project will be implemented with the aim of improving water supply and sewerage coverage and reliability within the Arua Municipality. The works include, improvement of the water distribution services to the population by expanding the networks and water distribution points, increasing quantities of water distributed and/or improving the efficiency and reliability of the distribution systems, improving the quality of water distributed, extending the water supply to the urban poor; as well as construction of a sewerage reticulation system, waste stabilization systems and sanitation systems for the urban poor.

Arua Municipality currently lacks a wastewater reticulation system and sewage treatment plant. Consequently, the private sector involved in this practice, digs holes in vacant land outside of Arua Municipality, where they dispose the faecal sludge (Plate 6-1). This practice contributes to water pollution with faecal coliforms (Annex 2). This also impacts increases the disease burden of Arua Municipality. No wonder, intestinal worms, gastrointestinal disorders, and ARI (Acute respiratory infections) feature high in the list of top ten diseases in Arua Municipality and the neighbouring seven sub-counties in the project area. An improved water and sanitation system for Arua Municipality will therefore improve the hygiene and reduce health hazards.



Plate 6-1: Disposal of faecal sludge outside of Arua Town

As a result, the proposed Arua Water Supply and Sanitation Project will have substantial positive environmental and social impacts of improved public health conditions in the Municipality. Specifically, the proposed water and sanitation project will have the following positive environmental and social impacts:

(a) Educational Enrolment and Attendance

The implementation of the Arua Water Supply and Sanitation Project in the project areas will lead to considerably near and consistent access to safe water. Consequently, time spent on searching and waiting for water by women and children will be saved. This will enable children, especially the girl child to regularly and promptly attend school, while mothers will get more time to prepare their children for school. Assuming other factors are available (such as scholastic materials, teachers) school attendance and performance will improve.

(b) Reduced Domestic Violence

The Arua Water Supply and Sanitation Project will lead to a reduction in domestic violence part of which is indirectly related to lack of access to consistent and nearby safe water sources. It was reported that in situations where the woman in household delays to cook food because of lack of water for cooking, some men physically or psychologically torture their spouses. The same situation arises when some women delay at the water source for considerably long hours. In the long term a reduction in domestic violence will lead to improved domestic relations and observance of human rights at the household level.

(c) Improved Public Order

An improved water supply system will lead to a reduction in instances of sexual violence related to water scarcity and inconsistent supply. Indirectly, this will lead to an improvement in public order and governance. There are incidences of sexual violence like rape that are related to scarcity of water, especially in situations where women and female children have to go out at night to wait for water at the taps, boreholes and protected springs.

(d) Improved Household Health Status

Some of the non-piped water sources in Arua Municipality are contaminated. Access to consistent safe piped water and decent public toilet facilities will improve the sanitation especially in Arua Municipality. The implementation of the project will minimise the level of exposure to unsafe water. The provision of public toilets that are affordable and accessible will also contribute to narrowing the sanitation gap in the project area. The provision of public toilets and extension of sewage service lines will also greatly minimize localized exposure to water pollution at points of use associated with lack of decent sanitation facilities and poor hygiene practices.

(e) Improved Public Health

The implementation of the project sub-component on sanitation will directly contribute to improved public health especially around Arua Municipality. Putting in place a sewerage system for the central business district and public toilets in several of the poor informal settlements in Arua Municipality will contribute to improved public health in several ways.

- (i) Introduction of public toilets will reduce indiscriminate disposal of faecal matter by some community members who don't have prompt access to public toilets.

- (ii) The establishment of *lagoons* will enable cesspool emptier operators have a central depository than is currently the practice of indiscriminate dumping around the suburbs of Arua Municipality. The establishments of lagoons will also lead to cesspool emptying services becoming cheaper and more affordable to a large section of the community. This will minimize the current practice where toilets once full are emptied in the neighbourhood at night without mitigation practices.
- (iii) There will be improved household income due to employment of local labour. It is generally anticipated that local labour will be employed especially for casual activities. This anticipation is very high on the side of community leaders and members in the project areas.
- (iv) There will be improved household income due to increased purchase power within the project area. Household enterprises like shops, farmers, restaurants, housing rentals, etc will benefit from the presence of project construction workers who will regularly purchase such items.

(f) Improvement in household economic status and productive competitiveness

There will be reduced expenditure on water since the project activities involve extending the water transmission lines to several none and underserved areas and install open stand pipes (20) in poor and informal settlements in the project area. Currently, average expenditure on water stands at US\$ 100 to US\$ 200 per 20 litre jerrycan from open stand pipes and US\$ 500 from water vendors. Improvements in supply will lead to consistent access to nearby and affordable safe piped water.

6.3 ANTICIPATED NEGATIVE IMPACTS

6.3.1 INTRODUCTION

Even though the project has many positive impacts that will lead to social economic development in Arua Municipality, it also will come with negative impacts that need to be mitigated during the construction, operation and decommissioning phases.

As presented in Section 2.3.1, the categorisation of impacts has been based on the severity of the potential impact using predefined impact rating criteria as **minor**, **moderate** or **major** according to the definitions below.

- (a) **Minor impact** – an effect will be experienced, but the impact magnitude is sufficiently small and well within accepted standards, and/or the receptor is of low sensitivity/value.
- (b) **Moderate impact** – an impact that will be within accepted limits and standards. They may vary from a threshold below which the impact is minor up to a level that might be just short of breaching an established regulatory limit.
- (c) **Major impact** – is where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors.

Extent: within limited area (<200m from site), local (up to 10 km) or wide (regional or global > 10km); **Duration:** temporary (1 year), short term (1-5 years), medium term (5 - 10 years) long term (> 10– 50 years) or permanent.

6.3.2 IMPACTS ON STRUCTURES, LAND AND PUBLIC HEALTH

Several of the project activities (water and sewage pipelines) will take place within the road reserves of both central government and local government roads. A number of properties have been identified and will be affected by Arua Water Supply and Sanitation Project implementation activities and a RAP has been prepared. The RAP will ensure that the undesirable social and economic issues, which will arise from the implementation of project activities, are addressed in order to mitigate any negative impacts on people whom the project is intended to benefit and serve. The RAP will also enable adequate compensation to be made for all measurable livelihood losses incurred by the PAPs and set in place appropriate remedial measures including grievance channels for the PAPs and other community members (Annex 14).

For the PAPs and property assessment under the RAP, the NWSC technical recommendation of 4m working space with the road reserves, and the Ministry of Works and Transport road reserve classifications have been followed along the UNRA, District and Community Access roads within the project area. A number of other properties have been identified and will be affected by project implementation activities. Land for lagoons, calibration/augmentation boreholes, public toilets and water reservoir and some distribution main has been identified for acquisition. Most of the proposed land acquisition will not result into relocation and most of the affected HHs will only “step back” on the same piece of land. The land required for the WSPs is free of human residential settlement and is currently being used for scattered crop and tree farming at both sites. The anticipated land takes for the WSPs are partial and low at 51,205 sq. meters (12.653 acres) and will not result into physical relocation for the PAPs. There are 7 PAPs and 1 PAI impacted upon by this project sub-component. Only 1 temporary structure for one PAI will be affected. The required land takes for WSPs is valued at US\$111,144,000= only, while the impact on structures is valued at US\$1,269,000= only. The extent of impact of WSPs sub-component on crops and trees is estimated at US\$6,619,000= only..

A total of 768 structures will be affected excluding land and crops. Most of the structures to be affected are *Kiosks* (36.5%), followed by live hedges/barbed wire (30%), permanent houses (7.5%), covered verandahs (6.56%), paved yard (6%), pit latrines/bath shades (3.7%), temporary houses (3.7%), brick wall fence (2.7%), semi-permanent houses (1%), graves (1.4%) and other properties (1.4%). Most of the *kiosks* are earmarked for temporary relocation. Relatively fewer permanent buildings along roads around Arua Municipality, Dadamu Sub-county, Pajulu Sub-county and Oluko Sub-county, will be affected. These have been duly assessed and valued. Total land acquisition is estimated at 19,998.572 square meters equivalent to 4.942 acres. Given the areas marked for project activity take over, most of the respective PAPs respondents interviewed (98%) observed that relocation was not necessary, while other PAPs were yet to consult other family members over the same. In respect to the affected property, 85.7% were owners of property, while 14.3% were either licensees or renting.

In Arua Hill Division, the project affected sites or parishes are; Awindiri, Bazar and Mvara. In River Oil Division, PAHs are in the following parishes; Pangisa, Kenyatta and Tanganyika. In Dadamu sub-county, project affected household (PAHs) are in the following parishes; Arivu, Ociba, Ariwala, Oduluba, Tanganyika, Yapi and Zeuva. In Pajulu sub-county, PAHs are in the following parishes; Adalafu, Ambeku, Driwala, Komte, Okaliba and Pokea. In Ajai sub-county the PAH is in Ocoko parish, while in Vurra sub-county, the PAHs are in the following parishes; Kuluva and Eruba. In Manibe SC, the

PAH are in the following parishes; Ewadri and Ombaci, while in Oluko sub-county, the PAH are in Ambeku, Bunyu and Onzivu parishes.

According to the PAP census, the AWSP activity implementation will directly affect 831 Households. In this report, these are referred to as Project Affected Households (PAHs) with a total of 4952 HH members. Also, the project activity implementation will directly affect 66 Institutions. In this report, these are referred to as Project Affected Institutions (PAIs). Of these PAHs, 24.8% are in Arua Hill Division and 28.5% in River Oil Division in AMC, while 19.8% are in Dadamu SC, 2.5% in Manibe SC, 8.7% in Oluko SC, 14% in Pajulu SC, 1.5% in Vurra SC and 0.1% in Ajia SC. There are no PAPs or PAHs in Katrine SC. The main mitigation measure for PAPs will be adequate and prompt compensation in order to help the PAPs regain or restore their livelihood productive systems and livelihood incomes.

Total land acquisition for this RAP is estimated at 103,260.869 square meters equivalent to 25.516 acres; in the following break-down; WSP/lagoons, 51,204.869 square meters (49.6%); Water/Sewer Lines, 36,783 square meters (35.6%); augmentation boreholes 700 square meters (0.67%); Water Reservoirs, 12,500 square meters (12.1%); and Sewer Lifting Stations 2,073 square meters (2.0%). Details of this are in the separate report of RAP.

One of the development concerns and anticipated negative outcome is potential exposure and increase in HIV/AIDS. Physical and social interactions between construction workers and locals may negatively impact on public health. Usually, projects like the proposed one are often associated with an increase in the spread of sexually transmitted infections (STI), and HIV/AIDS in particular, and this is one of the major development challenges in the area as a result of the socialisation between the locals and construction workers and boosted prostitution. NWSC and its Contractor will put in place an HIV/AIDS control and prevention plan that will include an awareness campaign and HIV/AIDS related services for the Contractor's workers and neighbouring community members in order to promote safe sex practices and other control measures in order to reduce this anticipated negative outcome (see Annex 12).

The HIV/AIDS impact mitigation plan will involve providing a comprehensive range of services including the identification of possible HIV/AIDS cases, testing with pre- and post-counseling, the treatment of associated infections, referral of appropriate cases, education to promote better quality of life and promotion of precautions, provision of condoms and the application of occupational exposure policies. This will be implemented during construction and will be the role of the Contractor or assigned to an approved service provider. This has been made clear in Sub-Clause 6.7 of the General Conditions of Contract which form part of the Bidding Documents. The Sub-Clause deals with, among other health issues, HIV-AIDS Prevention for the workers and the project immediate or direct zone of influence and the focus will be on the areas of prevention and control of STIs and HIV/AIDS. This is because prevention is still the mainstay of the strategic response to HIV/AIDS in the country. The detailed HIV/AIDS control and prevention plan is presented in annex 12.

6.3.3 DETAILED IMPACT ASSESSMENT

The following impacts have been identified to relate to the project activities presented in the subsequent sections. Their mitigation measures are presented in Section 7.

Table 6-1: Potential impacts related to rehabilitation of water works

Project component: Water Treatment works		Phase: Construction		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
Air pollution	Emissions from construction equipment and project vehicles.	Direct, Minor	Limited	Temporary
Noise pollution	Intermittent noise from construction equipment and heavy project vehicles.	Direct, Moderate	Limited	Temporary
Water pollution	Water pollution from dredging activities, accidental spillage of fuel and lubricants.	Direct, Major	Limited	Temporary
Water levels	Water levels may be affected by rehabilitating the impoundment weir and reservoir.	Direct, Major	Wide	Short to Long term
Soil erosion and contamination	Inappropriate construction practices and soil protection measures which may induce or accelerate soil erosion with possible pollution and siltation of downstream water sources; Removal of top soil may lead to loss of soil fertility.	Direct, Major	Limited	Temporary
Solid waste generation	Domestic waste from camps may be an eye sore and may contaminate soil and water resources.	Direct, Moderate	Limited	Temporary
Impacts on flora and fauna	Loss of wetland plants and associated fauna; Cleared vegetation may compromise aesthetic value of the sites.	Direct, Minor	Limited	Temporary
Public Safety including accidents as a result of increased vehicular traffic	Excavations and transportation of equipment, site workers and debris and movement of heavy equipment may pose a safety risk to the general public; Increase in the likelihood of accidents within and around the vicinity of water works area from possible careless driving of project vehicles. Creation of quarries and borrow pits may be a potential for accidents as people and animals can fall in them.	Direct, Moderate	Limited	Temporary
Public health problems	Pools of stagnant water may form in pits, holes and excavated ditches during the wet season and create suitable habitats for disease vectors such as mosquitoes. Potential of HIV and other sexually transmitted diseases spread as well as poor hygiene in workers camps.	Direct, Moderate	Limited	Temporary
Occupational health and safety	Exposure of workers to occupational health and safety hazards from activities such as: excavations; working with heavy equipment; working under noisy conditions, working in confined spaces; lifting of heavy objects; storage, handling and use of hazardous substances and wastes; Poor hygiene and sanitation in workers camps.	Direct, Moderate	Limited	Temporary
Disturbance	Interference with economic livelihoods	Direct, Minor	Limited	Temporary

Project component: Water Treatment works		Phase: Construction		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
and interruption of commercial and social activities	such as commercial and social activities.			
Disruption of social order	Influx of people in the area which may affect the local economy, cause alteration of culture and introduce undesirable behavioural changes.	Direct, Minor	Limited	Temporary
Raw material use	Large quantities of construction material will be involved, for example, cement, steel, oil fuel, pipe materials (e.g. PVC, uPVC, concrete and/or steel). Also, large quantities of local materials, e.g. sand, gravel will be involved. Additional impacts include wet season excavation, creation of quarry sites and borrow pits. If excavated areas are not re-instated and if materials are not well stored and utilized, as well as instituting management measures for waste materials, contamination of the environment may occur.	Direct, Moderate	Limited	Temporary
Visual amenities	Construction sites e.g. creation of pits during excavations, if not well managed, may have impacts on aesthetics of the surroundings with the possibility to affect the neighbouring residents to the WTW with moderate view point.	Direct, Minor	Limited	Temporary

Project component: Water treatment works		Phase: Operation and maintenance		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
Air pollution	Emissions from generators.	Direct, Minor	Limited	Long term
Noise pollution	Intermittent noise from generators.	Direct, Minor	Limited	Long term
Water pollution	Water pollution from discharge of sludge from sedimentation tanks, containing alum; backwash water which may contain silt and dirt.	Direct, Moderate	May spread along R. Enyau	Long term
Water levels	Water levels may be affected by operating the impoundment weir and reservoir.	Direct, Major	Wide	Short to Long term
Solid waste generation	Wastes, for example, used containers and packaging materials of alum and chlorine.	Direct, Minor	Limited	Long term
Impacts on flora and fauna	Discharge of sludge and back wash water.	Direct, Minor	Downstream R. Enyau	Long term

Project component: Water treatment works		Phase: Operation and maintenance		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
Storage and handling of chemicals	Storage of alum and especially chlorine may induce rusting of holding metallic containers, and even rooftops, if they are made of iron.	Direct, Moderate	Limited	Long term
Occupational health and safety	Exposure of workers to occupational health and safety hazards while working with chemicals, cleaning and disposal, closing and opening of valves.	Direct, Moderate	Limited	Long term
Local incapacity/ inexperience to manage the facilities.	This will lead to poor operation and maintenance as well as deterioration of infrastructure and inadequate monitoring of environmental impacts of project activities.	Direct, Major	Wide	Long term
Water access	The poor people within the project area may not afford to pay for the water.	Direct, Moderate	Limited	Long term
Conflicts	Potential for conflicts arising from protection and management of River Enyau and its banks; land acquisition.	Direct, Moderate	Limited	Long term

Table 6-2: Potential impacts related to development of boreholes

Project component: Boreholes		Phase: Construction		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
Air pollution	Emissions from vehicles and construction equipment.	Direct, Minor	Limited	Temporary
Noise pollution	Intermittent noise from drilling which may be a nuisance to such as neighbouring communities and their livestock.	Direct, Minor	Limited	Temporary
Water pollution	Water pollution from waste disposal, accidental spillage of fuel, lubricants, other drilling chemicals.	Direct, Moderate	Limited	Temporary
Soil erosion and contamination	Contamination from accidental or structural spillage of fuels, lubricants, chemicals and sanitary waste generated by the workers; Removal of top soil may lead to loss of soil fertility.	Direct, Minor	Limited	Temporary
Solid waste generation	Domestic waste from camps and drilling spoil may contaminate soil and water resources.	Direct, Minor	Limited	Temporary
Impacts on flora and fauna	Loss of vegetation and associated fauna at drill sites; Cleared trees will compromise aesthetic value of the sites.	Direct, Minor	Limited	Temporary
Raw material use	Materials if not used or disposed of in a proper way, may cause contamination of water and soil and reduce aesthetics of the site;	Direct, Minor	Limited	Temporary

Project component: Boreholes		Phase: Construction		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
	Additional impacts include wet season excavation, creation of quarry sites and borrow pits. Creation of quarries and borrow pits may be a potential for accidents as people and animals can fall in them. If excavated areas are not re-instated; and if materials are not well stored and utilized, as well as instituting management measures for waste materials, contamination of the environment may occur.			
Public Safety including potential of accidents due to increased vehicular traffic	Excavations, and transportation, movement of heavy equipment as well as obstructions of roads may pose a safety risk to the general public. Increase in the likelihood of accidents within the borehole construction locations.	Direct, Moderate	Limited	Temporary
Public health problems	Pools of stagnant water may form in pits, holes and excavated ditches which can create suitable habitats for disease vectors such as mosquitoes. Potential of HIV and other sexually transmitted diseases spread as well as poor hygiene in workers camps.	Direct, Moderate	Limited	Temporary
Occupational health and safety	Exposure of workers to occupational health and safety hazards from activities such as: excavations; working with heavy equipment; working under noisy conditions; working in confined spaces; lifting of heavy objects; storage, handling and use of dangerous substances and wastes.	Direct, Moderate	Limited	Temporary
Disturbance and interruption of commercial and social activities	Interference with commercial and social activities.	Direct, Minor	Limited	Temporary
Disruption of social order	Influx of people in the area may affect the local economy, cause alteration of culture and introduce behavioural changes.	Direct, Minor	Limited	Temporary
Occupation of land resulting in partial displacement	It is estimated that each borehole may require an area of ~100 m ² (possibly being used for other purposes such as agriculture and	Direct, Partial, Moderate	Limited	Long term. Land acquisition will be partial and will not result into

Project component: Boreholes		Phase: Construction		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
	residential) which will not be used during the operation of the borehole.			relocation
Occupation of land resulting in resettlement	It is estimated that each borehole may require an area of ~100 m ² (possibly being used for other purposes such as agriculture and residential) which will not be used during the operation of the borehole.	Direct, Moderate	Limited	Long term (analysed in the RAP study). Land acquisition will be partial and will not result into relocation
Water access	The poor people within the project area may not access water during construction of boreholes.	Direct, Moderate	Local	Temporary
Conflicts	Potential for conflicts arising from land acquisition for boreholes.	Direct, Moderate	Local	Long term

Project component: Boreholes		Phase: Operation and Maintenance		
Impact type	Potential Impact	Impact Type and Rating	Extent	Duration
Conflicting demands for water use	Groundwater abstraction may lead to lowering of local water table levels hence reduction in water supply which may pose a serious risk of conflicts between various water uses such as for domestic, irrigation use and other purposes.	Direct, Moderate	Local	Long term
Noise pollution	Noise from pumps, which can be a nuisance to sensitive receptors such as local communities and/or fauna.	Direct, Moderate	Local	Long term
Public health risks from contaminated water	Water contamination from natural, accidental and structural contamination can go unnoticed and cause health risks to water users. There may also be contamination from nearby pit latrines, poor waste disposal practices, or from the rocks forming the aquifers.	Direct, Moderate	Local	Long term
Water access	The poor people within the project area may not afford to pay for the water.	Direct, Moderate	Local	Long term
Conflicts	Potential for conflicts arising from land acquisition for boreholes.	Direct, Moderate	Local	Long term
Local incapacity/inexperience to manage facilities	Failure to operate/maintain equipment/machinery. Accidents due to lack of enough technical knowledge in safety requirements for equipment/machinery operation. Inadequate monitoring of environmental impacts of project	High	Limited	Long term

Project component: Boreholes		Phase: Operation and Maintenance		
Impact type	Potential Impact	Impact Type and Rating	Extent	Duration
	activities.			

Table 6-3. Potential impacts related to laying of transmission lines

Project component: Pipelines		Phase: Construction		
Impact type	Potential Impact	Impact Type and Rating	Extent	Duration
Air pollution	Emissions from construction vehicles and equipment.	Direct, Minor	Local	Temporary
Noise pollution	Noise pollution from heavy vehicles and construction equipment may cause nuisances to neighbouring communities and their livestock.	Direct, Minor	Local	Temporary
Water pollution	Water pollution may result from: i) wastewater from construction camps. ii) accidental spillage of fuels, lubricants and other chemicals. iii) siltation of water courses from runoff laden with sediment and dust. iv) high suspended solids from soil eroded from trenches, poorly constructed tracks.	Direct, Moderate	Local	Temporary
Soil erosion and contamination	Site clearance of vegetation and excavation works using heavy equipment may induce/accelerate soil erosion and siltation of water courses and gardens. Contamination may occur as a result of accidental or structural spillage of fuels, lubricant chemicals, sanitary wastewater, etc., as well as from leakage from inadequately protected solid waste storage facilities and sites. Soil may lose its fertility because of removal of topsoil.	Direct, Minor	Wide	Short term
Solid waste generation	Vegetation and soil from excavation, as well as waste from contractor's camps, construction waste material, pipe off-cuts and packaging material may produce large quantities of waste.	Direct, Moderate	Wide	Short term
Impacts on flora and fauna	Removal of natural vegetation may lead to potential habitat loss of its associated fauna.	Direct, Minor	Wide	Temporary
Public health problems	Public health problems may occur in the case of badly managed construction camps and work	Direct, Moderate	Local	Temporary

Project component: Pipelines		Phase: Construction		
Impact type	Potential Impact	Impact Type and Rating	Extent	Duration
	sites. These include: i) Pools of stagnant water may be a source of water borne diseases. ii) Poor hygiene in camps.			
Public Safety	Safety problems at the construction sites may arise from excavations, transportation and movement of heavy equipment. Manually executed works expected to dominate the pipeline laying will take a longer construction time leading to prolonged safety risks such as falling into trenches.	Direct, Minor	Wide	Temporary
Visual amenities	Laying of pipelines may have a negative impact on aesthetics of the surroundings such as the soils from the trenches that will be dumped along the trenches	Direct, Minor	Wide	Temporary
Disturbance and interruption of commercial and social activities	Improper laying of pipelines may cause traffic disruptions and congestion, resulting in temporary disturbance and interruption of commercial and social activities. It may also cause damage to infrastructure (roads, utility lines) and disruption of public services.	Direct, Moderate	Wide	Temporary
Socio-economic disruption	Trenches for the pipelines may be dug through peoples' gardens destroying crops, in front of shops, displacing kiosks along road reserves and other properties which will affect their livelihood and incomes. A total of 768 structures will be affected excluding land and crops. Most of the structures to be affected are Kiosks (36.5%), followed by live hedges/barbed wire (30%), permanent houses (7.5%), covered verandahs (6.56%), paved yard (6%), pit latrines/bath shades (3.7%), temporary houses (3.7%), brick wall fence (2.7%), semi-permanent houses (1%), graves (1.4%) and other properties (1.4%). Most of the kiosks are earmarked for temporary relocation. Furthermore, influx of people in the area may cause alteration of	Direct, Moderate	Wide	Temporary (adequate compensation and disturbance allowances will ensure restoration of livelihoods and incomes)

Project component: Pipelines		Phase: Construction		
Impact type	Potential Impact	Impact Type and Rating	Extent	Duration
	culture and introduce behavioural changes.			
Socio-economic disruption	Trenches for the pipelines will involve some land acquisition.	Direct, Moderate	Wide	Long term (adequate compensation and disturbance allowances will ensure restoration of livelihoods and incomes)
Occupational health and safety	Workers may be exposed to occupational health and safety hazards from project activities such as: accidents in excavations; working with heavy equipment; working under noisy conditions., working in confined spaces; lifting of heavy objects; storage, handling and use of dangerous substances and wastes. Workers may also be potentially exposed to HIV and other sexually transmitted diseases.	Direct, Moderate	Local	Temporary

Project component: Pipelines		Phase: Operation and Maintenance		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
Alteration of natural drainage patterns	Drainage patterns of streams where pipes cross may be altered by laying of the pipelines, for example, if garbage is carried in the stream/drainage channels and is blocked at the pipe crossing, it may block or alter the water flow.	Direct, Minor	Wide	Long term
Water pollution	Water pollution may result from spillage of fuel and lubricants during maintenance; waste disposal along damaged lines may also cause pollution. For sewer lines that will be crossing rivers and swamps (not to be buried), pollution may arise from leakage of sewage in case the pipes get damaged.	Direct, Moderate	Wide	Long term
Noise pollution	Noise generated from vehicles used during maintenance or from generators in case they are used to pump the water	Direct, Minor	Local	Temporary

Project component: Pipelines		Phase: Operation and Maintenance		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
	can be a nuisance to sensitive receptors.			
Air pollution	This could be in form of emissions from maintenance vehicles.	Direct, Minor	Local	Temporary
Solid waste generation	Solid wastes may be produced by maintenance works, especially where sections of pipelines are replaced.	Direct, Minor	Local	Temporary
Soil erosion and contamination	Inspection and maintenance works for the pipelines may require clearance of sites of vegetation, as well as the execution of excavation works, possibly using heavy equipment. This may induce or accelerate erosion.	Direct, Minor	Local	Temporary
Impacts on flora and fauna	Inspection and maintenance works may require the removal of the natural vegetation, leading to potential habitat loss of its associated fauna.	Direct, Minor	Local	Temporary
Nuisances and public health risks as a result of operational failures of the distribution network	Accidental ruptures and structural degradation of pipelines that may accrue from ageing and poor maintenance, accompanied by low pressure in the pipes may allow the intrusion of potentially polluted groundwater into the drinking water distribution system. Ruptured pipes may also cause flooding and if the water stagnates, this may pose a risk of water-borne diseases.	Direct, Moderate	Local	Long term
Energy consumption	Operation of the water distribution system may involve the use of energy for pumping which will cause a relative increase in energy demand.	Direct, Minor	Local	Long term
Occupational health and safety	Occupational health and safety problems may arise during maintenance of the pipelines. These may include: lifting of heavy and sharp objects and transportation of materials for maintenance, storage as well as handling and use of dangerous substances.	Direct, Minor	Local	Temporary
Local incapacity/ Inexperience to manage the	This will lead to poor operation and maintenance as well as deterioration of infrastructure	Direct, High	Wide	Long term

Project component: Pipelines		Phase: Operation and Maintenance		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
facilities	as well as accidents due to lack of enough technical knowledge in safety requirements for equipment/machinery operation. Inadequate monitoring of environmental impacts of project activities.			
Disturbance and interruption of commercial and social activities	Interference with commercial and social activities will be very low.	Direct, Minor	Limited	Temporary (it is anticipated the way leaves will generally be left clear of any major developments for purposes of maintenance)
Disturbance and interruption of commercial and social activities	Maintenance activities for the water distribution network may cause traffic disruptions and congestion, resulting in disturbance and interruption of commercial and social activities. Other infrastructure e.g. roads, sewer lines, drains may also be disrupted.	Direct, Moderate	Wide	Temporary

Table 6-4. Potential impacts related to construction of waste stabilization ponds

Project component: Wastewater Treatment Plant (Waste stabilization ponds)		Phase: Construction		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
Air pollution	Emissions from construction equipment and project vehicles.	Direct, Minor	Limited	Temporary
Noise pollution	Intermittent noise from construction equipment and heavy project vehicles.	Direct, Moderate	Limited	Temporary
Water pollution	Water pollution from erosion of soil into the river Enyau at Prisons and at Onduparaka.	Direct, Moderate	Limited	Temporary
Soil erosion and contamination	Inappropriate construction practices and soil protection measures may induce or accelerate soil erosion with possible pollution and siltation downstream.	Direct, Major	Limited	Temporary
Solid waste generation	Cleared vegetation and spoil may compromise aesthetic value of the sites; domestic waste from camps be an eye sore and may contaminate	Direct, Moderate	Limited	Temporary

Project component: Wastewater Treatment Plant (Waste stabilization ponds)		Phase: Construction		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
	soil and water resources.			
Loss of vegetation	A lot of earthworks are involved in the construction of waste stabilization ponds and this will result into loss of vegetation and trees.	Direct, Major	Limited	Long term
Impacts on flora and fauna	Slight shift in the habitats of fauna species and loss of flora over areas not exceeding 5 acres (in total).	Direct, Temporary	Limited	Long term
Public Safety including potential for accidents due to increased vehicular traffic	Excavations, and transportation of equipment, site workers and debris and movement of heavy equipment may pose a safety risk to the general public; Increase in the likelihood of accidents within and around the vicinity of the areas of waste stabilization ponds.	Direct, Moderate	Limited	Temporary
Public health problems	Pools of stagnant water may form in pits, holes and excavated ditches which can create suitable habitats for insect disease vectors such as mosquitoes which cause malaria. Potential of HIV spread as well as poor hygiene in workers camps.	Direct, Moderate	Limited	Temporary
Occupational health and safety	Exposure of workers to occupational health and safety hazards from activities such as: excavations; working with heavy equipment; working under noisy conditions, working in confined spaces; lifting of heavy objects; storage, handling and use of hazardous substances and wastes.	Direct, Moderate	Limited	Temporary
Disturbance and interruption of commercial and social activities	Interference with commercial and social activities will be very low. Lagoon constriction will involve some land acquisition.	Direct, Minor	Limited	Long term (with adequate and prompt compensation for PAPs replacement is highly possible within the neighbourhood)
Disturbance and interruption of commercial and social activities	Interference with commercial and social activities.	Direct, Minor	Limited	Temporary
Disruption of social order	Influx of people in the area in search for employment at construction sites may affect the local economy, cause alteration of culture and introduce	Direct, Minor	Limited	Temporary

Project component: Wastewater Treatment Plant (Waste stabilization ponds)		Phase: Construction		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
	behavioural changes.			
Raw material use	Large quantities of construction material will be involved, for example, cement, oil, fuel, pipe materials (e.g. PVC, uPVC). Also, large quantities of local materials, e.g. sand, gravel will be involved. If not well stored and utilized, can contaminate soil and nearby water sources.	Direct, Moderate	Limited	Temporary
Visual amenities	Construction sites, if not well managed, have impacts on aesthetics to the surroundings with the possibility to affect the neighbouring residents of the WTW with moderate view point.	Direct, Minor	Limited	Temporary

Project component: Wastewater Treatment Plant (Waste stabilization ponds)		Phase: Operation and maintenance phase		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
Air pollution	Emissions from generators.	Direct, Minor	Limited	Long term
Noise pollution	Intermittent noise from generators.	Direct, Minor	Limited	Long term
Water pollution	Water pollution from the discharge of treated wastewater effluent.	Major	Downstream of R. Enyau	Long term
Solid waste generation	The screenings may accumulate at the inlet to the waste stabilization ponds. Disposal of these, as well as sludge from the anaerobic pond (upon desludging, for example, once in 5 years) may contaminate air, land and water.	Direct, Major	May affect areas beyond WSP	Long term
Impacts on flora and fauna	Discharge of treated wastewater effluent may affect aquatic flora and fauna.	Direct, Moderate	Downstream of R. Enyau	Long term
Storage and handling of tools	Storage and handling of tools, for example, sewer rodding snakes, spades, wheel barrows, spanners etc may contaminate the stores and pose hazards to the workers.	Direct, Moderate	Limited	Long term
Occupational health and safety	Exposure of workers to occupational health and safety hazards while working with sewage, chemicals, cleaning and disposal, closing and opening of valves.	Direct, Moderate	Limited	Long term
Local incapacity/ Inexperience to manage the facilities	This will lead to poor operation and maintenance as well as deterioration of infrastructure as well accidents due to lack of enough technical knowledge in safety requirements for equipment/machinery operation. Inadequate monitoring of	Direct, Low (WSP do not require skilled labour to operate)	Limited	Long term

Project component: Wastewater Treatment Plant (Waste stabilization ponds)		Phase: Operation and maintenance phase		
Issue	Potential Impact	Impact Type and Rating	Extent	Duration
	environmental impacts of project activities.			

6.4 ANALYSIS OF CUMULATIVE IMPACTS IN THE RIVER ENYAU CATCHMENT

The Arua Water Supply and Sanitation Project will be implemented in a Municipal Council setting where there other competing land uses. This has a potential of triggering cumulative environmental impacts i.e. impacts both from the project and other activities that are likely to affect the same environmental resources or receptors. The most important valued ecosystem components (VEC) within the River Enyau catchment likely to be affected are:

- (a) Surface water of the river
- (b) Groundwater resources
- (c) Flora and fauna as well as loss of aesthetic value

Table 6-5 gives a summary of the potential cumulative impacts and recommended mitigation measures:

Table 6-5: Potential Cumulative Impacts

Ecosystem Component	Other “stressors” (potential sources of cumulative impact)	Potential impact	Description of mitigation measures
Surface water (river volume/flow, quality)	Other industrial uses, municipal use, human wastes from un-sewered settlements, animal waste from livestock	- Reduction in water volumes/quantity - Compromise of water quality - Seasonal drying up of river - Possible pollution resulting from treatment of water (e.g. chlorine, biocides) and sewage discharge	- Engage other stakeholders e.g. Directorate of Water Resources Management to determine optimum amount of water to be abstracted - Agree on abstraction volumes with downstream and groundwater users e.g. allow 30% of the river discharge for environmental flow requirements - Collaborate with AMC to carry out community awareness and training to prevent pollution - Implement the water and sanitation facilities component in informal settlements - Establish regular monitoring of programmes and inspection of reservoir water and discharge from WSP to ensure compliance with National Effluent Discharge

Ecosystem Component	Other “stressors” (potential sources of cumulative impact)	Potential impact	Description of mitigation measures
			and Drinking Water Standards • Maximise available land to accommodate chemical house, sedimentation ponds to reduce cumulative impacts
Groundwater resources	• Abstraction from community boreholes	• Depletion/contamination of local aquifers • Increased availability of water may lead pastoralists to use groundwater for animals resulting in overgrazing with accompanying erosion that may lead to sedimentation within the catchment	• Conduct a detailed hydrogeological investigation, including test pumping and drilling to determine safe yield of the boreholes to be developed without exceeding recharge rates or depriving other users • Together with AMC, monitor groundwater levels and yields in surrounding community boreholes • AMC should carry out community awareness and training programmes regarding the use of domestic supply boreholes for stock
Flora and fauna/Landscape aesthetics	• Opening up land due to urban development for construction of e.g. residences, industries, access roads	• Disturbance or loss of terrestrial species and their habitat due to increased development activities • Increased erosion and ensuing sedimentation/siltation of R. Enyau	• AMC should implement laws that require developers to rehabilitate/restore any disturbed sites when carrying out development activities • NWSC to use available access roads as much as practicable and participate in maintenance

7 ANALYSIS OF ALTERNATIVES

7.1 INTRODUCTION

The Arua Water Supply and Sanitation Project is an important project for the socio-economic development of Arua as it is dealing with water as a common good and sanitation as a service for the people of Arua Municipality and the surrounding seven sub-counties. Consequently, the project is important and no alternative project can replace it in terms of the overall objective. The analysis of alternatives is therefore in the context of alternatives to the proposed project components. Some project components are so specific and have been carefully analysed in terms of their actions and intended location so that no alternatives are proposed, for example, for the sewage treatment plant, the sewage lifting stations and the sewer transmission to the waste stabilization ponds. For other project components, for example, the proposed locations of water storage tanks, alternatives have been suggested.

7.2 REHABILITATION OF THE WATER IMPOUNDMENT AND WEIR

The water supply for Arua is abstracted from River Enyau, Plate 7-1. The proposed works at the water abstraction point will include alterations to the existing intake works and provision of raw water storage as described below.



Plate 7-1: Wetland at the periphery of River Enyau where water is abstracted

The total land area available for the development of the water treatment works is 2.6 acres of which 1.921 acres are presently occupied by the existing water treatment works structures. Within the area presently occupied by the existing waterworks, there is enough space for any expansion works including new alum dosing system, new chemical dosing house and treatment process units, for example, new aerators, additional sedimentation tanks, additional filters and new contact and clear water tank.

In order to establish the quantity and reliability of the water flow in River Enyau at the intake point, a hydrological investigation was carried out by the Design Team. Using data obtained from the Directorate of Water Resources Management (DWRM), it was established that the flow in the river fluctuates widely in a year. Over the last 30 years, the flow has varied from 0.0 to 681,696 m³/day. The low flow analysis indicates that the

flow in the river exceeds the demand in 65% of the time. This is a concern since the D7Q95 (average 7-day flow that is exceeded 95% of the time) at the site is 2,505 m³/d. If 30% of the flow is left for environmental flow requirements, then a maximum of 1,753 m³/day can safely be abstracted from the site daily. This is far lower than the required demand of 15,575 m³/day. The current onsite available storage is about 4,000 m³ and the maximum practical water depth is 1.5m. This gives a raw water storage capacity of 6,000 m³ which also does not meet the requirements of the project. It is worth mentioning again that, during public consultations, communities were concerned about using R. Enyau as a water source as it frequently dries up. Unfortunately, no other River within Arua has a higher flow or steadier flow than R. Enyau.

As a result a development strategy, which involves the exploitation of R. Enyau in the short and medium term, has been agreed upon between the Design Team and the Developer (NWSC) as outlined below:

- (a) The current abstraction point on River Enyau be developed because it is close to, and therefore will feed into the existing water treatment works therefore requiring no complete new water treatment works. The existing water works is to be rehabilitated and its capacity expanded to meet the present and future demand.
- (b) Even though R. Enyau has a low flow during the dry season, the river flow increases tremendously during the wet season. The storage capacity at the reservoir is to be increased by dredging the existing reservoir at the water works, and thus some of the excess water available during the wet season can be stored to be utilized during the dry season.
- (c) A strategy has been developed for the protection and management of R. Enyau and the banks (2010). This strategy is aimed at protecting the river to restore/ increase the water quantity and quality in the river and thus, this strategy should be implemented.
- (d) A reliable water supply needs to be identified as the current source cannot clearly meet the demand throughout the year. This could include an impounding reservoir to store some of the flow during the wet season for use in the dry season. Shifting the abstraction point further down the river where the low flow is sufficient for the town or finding an entirely new source. However, assessment of these alternatives and subsequent design activities were outside the scope of the assignment, according to the design team and thus, this should be carried out under a separate future study.
- (e) For the moment, the water works will be designed for the full ultimate demand, ready to receive water from a separate water resource that will developed in the future. It will initially be operated to track the flow at the existing source. It will thus be able to operate at full capacity during the wet season, dropping to 25% of the capacity at the peak of the dry season.
- (f) As a stopgap measure, groundwater (up to seven production boreholes) will be developed to alleviate the situation during the dry season.

A hydrogeological survey was conducted, and seven potential sites have been identified and recommended for drilling. The estimated yields, based on calibration of the existing boreholes, are as in the Table 7-1.

Table 7-1: Borehole Characteristics

No.	Location	Max. depth (m)	Yield (m ³ /hr)	Ground levels (m)	Northing	Easting
VES 41	Ombachi	140	30	1190	338594	270474
VES 44	Angufea B	140	8	1170	337653	270312
VES 45	Kenya	140	30	1180	335063	266320
VES 55	Ozuvu	120	12	1170	336349	265603
VES 57	Ambeko	90	30	1180	336064	266274
VES 58	Giligili	120	8.4	1250	331594	265187
VES 37	Nyio	140	7.3	1240	333178	273382

These will be drilled to an approximate depth of 130 m using a minimum casing of 6". Four boreholes will feed into the Giligili reservoir (namely VES 45, VES 55, VES 57 and VES 58) and three into the reservoir on Arua Hill (namely VES 37, VES 41 and VES 44). The delivery manifolds from these groups of boreholes will each be DN150 ductile iron. Chlorine will be dosed before the water enters the reservoirs.

7.3 ALTERNATIVE FOR THE STORAGE TANKS

With the exception of Arua Hill, where the NWSC water storage tank is located, Arua Municipality and the immediate environs which have been gazetted as the water and sewerage area of Arua, are largely flat.

Besides, NWSC owns a total of 1.957 acres of land situated from the foot to the top of Arua Hill, where the existing water storage tank of capacity of 1,350 m³ is located. The existing water tank was supposed to be enlarged. Since the existing water tank is situated on 0.190 acres of the 1.957 acres of land available, it means that 1.766 acres (from the foot to the top of Arua Hill) is vacant and could be used for expansion works of the water storage requirements. The existing amount of free land available within the NWSC land at Arua Hill seems to be sufficient for the construction of all storage capacity planned in the project. According to the Design Team, the water pressure from Arua Tank Hill has been checked and found to be enough to reach Vurra. Therefore, only one other location of the tank at Giligili prison land may be considered. The land previously identified for the water storage tank at Giligili is government land while that at Vurra village is private land and therefore has to be bought. As a result, omitting a water storage tank at Vurra village will save the project some money while not compromising the service.

7.4 ALTERNATIVE FOR THE BOREHOLES

The boreholes considered in the hydrogeological survey (section 7.2) are intended to be used as a short-term measure to augment water supply when the flow in river Enyau is minimum. In the future, more emphasis should be placed on increasing the impoundment reservoir size and consequently the storage capacity of the reservoir at the present water works, to meet the present and future demand in the medium term. In the long-term, the proposed strategies for the protection of River Enyau should be implemented, which may result in more water in River Enyau. Other long-term strategies may include abstracting water from very high yielding boreholes close to Maracha (20 km) or where River Enyau

becomes much larger with an increased storage capacity, in the areas of Terego sub-county (about 30 km from Arua town), Plate 7-2.



Plate 7.2 Flow of River Enyau in Terego Sub County

7.5 TRANSMISSION FROM BOREHOLES TO WTW/STORAGE TANK

It was intended to pump water from boreholes to the water works for treatment and /or directly to the water storage tanks. The transmission system to the storage tank was considered on the basis that the water would also be treated (chlorinated) at the tank site. Refer to Annex 2 for the water quality of existing boreholes. The water from the boreholes will be treated (in a borehole chlorination house) before water enters the storage tanks.

7.6 WASTE STABILISATION PONDS

One possible location for the waste stabilisation ponds was initially proposed to be on the periphery of Arua town at Barifa Central Forest Reserve (CFR). The Barifa CFR is under the stewardship of the National Forest Authority. The reserve measures approximately 236 hectares and was gazetted in 1946. If Arua municipality were to allocate a site in Barifa CFR to be used for the construction of waste stabilisation ponds, the CFR would have to be degazetted first and thereafter, a forest planted in another location in Arua to compensate for the lost one. The lengthy procedure that would have to be followed as well as the sensitivity of Barifa as a Central Forest Reserve (CFR) did not favour its suitability for waste stabilisation ponds. Consequently, two other sites, which are described below, were chosen.

The two sites which have already been identified include one at Onduparaka and the other at the Prisons land in Arua Hill Division. The site at Onduparaka is close to Enyau River bridge crossing on Adumi road in Adumi Sub-county. The site at Prisons land in Arua Hill Division will take part of the prisons farm land as well as part of the Prisons eucalyptus tree plantation and borders, on one side, with the banks of River Enyau.

8 MITIGATION MEASURES

8.1 INTRODUCTION

It is recommended that positive impacts of the project should be enhanced and maximized. Mitigation measures need to be put in place for the negative impacts. The Arua Water Supply and Sanitation Project will be implemented with a high degree of professional practice, which will incorporate ethics and integrity. However, in order to safeguard the environment, fauna, flora, people and their property, the mitigation measures highlighted in this section are suggested for implementation during the construction and operation phases. Given that HIV/AIDS is one of the development concerns in the project area, and a potential negative outcome, an HIV/AIDS control plan as part of the mitigation measures has been included in this report and is presented as Annex 12.

8.2 MITIGATION MEASURES OF THE IDENTIFIED IMPACTS

For each of the identified impacts, mitigation measures have been suggested in accordance with a general rule defining mitigation criteria as:

1. **Avoidance of major impacts:** major impacts are generally considered unacceptable, ones that would endure in the long-term or extend over a large area;
2. **Reduction of major and moderate impacts to as low as reasonably practicable (ALARP)** by planning, designing and controlling mitigation measures. This implies that mitigation measures will be applied until the limitations of cost effectiveness and practical application have been reached. The limitations are established by international practice;
3. **Implementation of good practices for impacts rated as minor**, in order to ensure that impacts are managed within good reason.

Generally, mitigation measures have been applied in the design of the project, through a hierarchy as described (Table 8-1). Similar considerations, in the context of ALARP, will apply to the ongoing development of the mitigation measures during detailed design.

Table 8-1. Mitigation hierarchy for the planned project activities

Avoid at source: Reduce at source Avoiding or reducing at source is essentially 'designing' the project so that a feature causing an impact is designed out (e.g. a pipeline re-routed) or altered (e.g. reduced working width). Often this is called minimization.
Abate on site This involves adding something to the basic design to abate the impact – for example, pollution controls fall in this category. This is often called end-of-pipe.
Abate at receptor If an impact cannot be abated on-site, then measures can be implemented off-site – an example of this would be to install double-glazed windows to minimize the impact of noise at a nearby residence.
Repair or Remedy Some impacts involve unacceptable damage to a resource, e.g. agricultural land during pipeline construction. Repair essentially involves restoration and re-instatement type measures.
Compensate in kind Where other mitigation approaches are not possible or fully effective, then compensation, in some measure, for loss, damage or general intrusion might be appropriate. This could be 'in-kind' such as planting new woodland elsewhere to replace what has been lost.
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In terms of the institutional capacity to handle the Environment and Safety (E&S) of the project, it is proposed that the project should employ a person responsible for E&S aspects during implementation. It is also important to note that no record or evidence of compliance with EIA or other environmental regulation could be found within NWSC or Arua Municipal Council. It is for this reason that we proposed that the contractor should include E&S team during the construction and this has been included in the table of mitigation measures. After the project, the Arua Municipal Council will take over the E&S of the project within the boundaries of Arua Municipal Council and the district Environment department will take over E&S aspects outside of the Arua Municipal Council boundaries. The staff in Arua Municipal Council and in Arua District Local Government to handle E&S are available and qualified even though they are few. Additionally, it is important to note that the E&S staff within Arua Municipal Council and Arua District Local Government are not facilitated sufficiently and thus, there is need for more staff and more facilitation to handle E&S aspects related to this project. We have provided for a training on site in E&S to both NWSC staff and Arua Municipal Council (See A10-4).

Table 8-2. Mitigation of impacts related to rehabilitation of waterworks and construction of reservoirs and storage tanks

Project component: Water Treatment works, reservoirs and storage tanks	
Construction phase	
Impact type	Description of mitigation measures
Air pollution	• Maintain vehicle and equipment according to manufacturers' specifications. • Use standard fuel and lubricants. • Avoid unnecessary car idling and switch off engines of vehicles and machinery while not in use • Sprinkle water to work areas to reduce and prevent dust during dry weather periods. • Clean access routes in surrounding area on a daily basis to prevent dust. • Collect and hold cleaning wastes (e.g. rags) in appropriate containers. • Workers who may unavoidably have to work in dusty workplaces should be provided with nose and ear masks to protect them from excessive dust.
Noise pollution	• Minimise noise according to NEMA, Uganda standards and World Bank guidelines. • Control noise and vibration on site. • Work programmes should be provided to local communities (e.g. through the LC system or local radio (FM) stations) and strictly followed. • Maintain vehicle and equipment according to manufacturers' specifications. • Install adequate noise prevention devices, e.g. mufflers on noise generating sources. • Switch off engines of vehicles and machinery while not in use. • Workers who may unavoidably have to work with noise generating equipment, e.g. earthmoving equipment should be provided with ear plugs and advised to put them on.
Water and soil pollution	• No solid waste, fuels or oils should be discharged into surface water bodies, e.g. River Enyau. • The contractor following the guidelines for management of materials and wastes during construction and operation should take care of preventing the project from damaging the river. • The sewage pipe network should be laid at a reasonable depth and covered to protect it from damage that could lead to leakages. • Undertake hydrological investigations prior to development of the sites. • Frequent testing and monitoring of water quality of R. Enyau should be carried out to ensure conformity to NEMA, Uganda standards for discharge of effluents guidelines, which when exceeded, advice on appropriate discharge should be sought. • Hold and store cleaning wastes in appropriate containers to be disposed of at approved sites. • Vehicles should preferably be parked on paved platforms. • Fuel storages should not leak, and should be periodically monitored, and repaired or replaced when necessary. • Sites for cleaning, fuelling and maintaining vehicles should be paved so as to prevent leakage • Maintain fuel and clean vehicles and equipment at workshops/sites with adequate leakage prevention (e.g. impermeable surface, settlers and oil separator).
Water levels	• Allow for minimum dry weather flow,

Project component: Water Treatment works, reservoirs and storage tanks	
Construction phase	
Impact type	Description of mitigation measures
	• Store more water in the wet season and but continue to release the environmental flow,
Soil erosion and contamination	• Carry out work under mild weather and avoid strong rains or winds. • Remove and store topsoil in separate piles and reinstate after refilling of trenches, to enable natural re-vegetation. • The Contractor(s) should present procedures for, and ensure implementation of measures to protect soils from any accidental or structural contamination. These include: ○ Storing all hazardous, sanitary and cleaning wastes in facilities approved by NEMA, Uganda. ○ Installing leak-proof fuel storages on concrete platform with gutters and grease separators, which are monitored periodically and repaired or replaced when required. ○ Strict enforcement and monitoring standard procedures for storing and handling hazardous wastes and raw material (e.g. fuel or chemicals). ○ Placing strong drums for oil storage on impermeable floors in the stores. ○ Providing for appropriate hoses for re-fuelling of pumps and vehicles. ○ Parking vehicles on paved platforms whenever possible. ○ Ensuring that sites for cleaning, fuelling and maintaining equipment and vehicles should be able to prevent leakage (e.g. paved or with settlers). ○ Treating wastewater from maintenance workshops in oil separators before discharge to sewers. ○ Isolating contaminated soil and treating /disposing it off in a way that will depend on the contaminant type.
Solid waste generation	• The Contractor should prepare a Solid Waste Management Plan, which should contain: ○ An inventory of the types and quantities of waste to be produced. ○ The most appropriate waste management approach for each type of waste including details on (temporary) storage, transport and final destination of the waste. ○ An assessment of any opportunities for reducing solid waste generation, in particular of hazardous and undesirable (persistent and non-reusable) types of wastes. • The Contractor should maintain records of types, quantities, origin, (temporary) storage, transport and elimination/reuse of solid waste, and make these available to the works supervisor upon his request, as proof of proper waste management practices. • Any waste including excess soil should be disposed of at gazetted sites. The solid waste shall not accumulate on site, to cause odour, fly, or rodent problems. • Excavated soils should be reused as much as possible as filling material and should be contained after excavation. • Provisional material storage on site should be designed and undertaken in such a way as to ensure that soils and underground water are not polluted. • Use licensed recycling companies to externally recycle, recover or dispose of waste.
Impacts on flora and fauna	• Zone out working areas to reduce ecological destruction, • Restore disturbed natural sites through environmental rehabilitation; restoring top soils and (re-)introduce genetic species

Project component: Water Treatment works, reservoirs and storage tanks	
Construction phase	
Impact type	Description of mitigation measures
	similar to those destroyed in order to re-establish the natural local ecology.
Public Safety	• Ensure that work sites (especially excavation works), have proper protection with clear marking of safety borders and signals and fence off all dangerous areas. • Inform riparian neighbours about the construction programme in advance and adhere to it. • Confine access to restricted work sites (including those with operation of mechanical and electric equipment) to persons with permits. • Implement appropriate traffic plans with the help of local police when (partial) closure of roads is required.
Public health problems including increased vehicular traffic	• Fill up all depressions to avoid pools of stagnant water may form in pits, holes and excavated ditches which can create suitable habitats for insect disease vectors such as mosquitoes which cause malaria. • Inform local communities about the construction programme in advance. • In case access roads have to be closed, inform local communities and road users in advance. • Use reflective signature to direct traffic to designated areas. • Use flag men to give directions to traffic. • Install speed reduction humps at crossings of many people, e.g. at a school, market. • Sensitise drivers to observe speed limits
Raw material use	• Consider environmental performance of suppliers of raw material in the selection process. • Explore ways of reducing raw material use. • Special emphasis should be made on raw materials that may be reused and/or recycled/recovered.
Occupational health and safety	• Ensure that work sites (especially excavation works), especially in the night have proper protection with clear marking of safety borders and signals and fence off all dangerous areas. • AMC should carry out training of staff in EH&S monitoring and evaluation. • The contractor should recruit H&S person during construction. • Inform riparian neighbours about the construction programme in advance and adhere to it. • Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits.
Disturbance and interruption of commercial and social activities	• Inform local communities about the construction programme in advance and adhere to it. • In case access roads have to be closed, inform local communities in advance. • Clean and maintain access roads in the neighbourhood of earth and sand on a daily basis. • Provide temporary access ways with the approval of local authorities where access roads are closed. • Carry out work under mild weather; avoid strong rains or winds. • Reduce obstruction of access to and use and occupation of roads, footpaths and bridges. • Protect any items and/or sites of archaeological or cultural value (e.g. private graveyards) discovered during works with the aid of the appropriate authorities. • Where livelihoods and property are affected, valuation and prompt compensation be undertaken for the PAPs

Project component: Water Treatment works, reservoirs and storage tanks	
Construction phase	
Impact type	Description of mitigation measures
Disruption of social order and prevention of HIV/AIDS and other sexually transmitted diseases	- Sensitise all workers to ensure awareness of and sensitivity to the local cultures, traditions and lifestyles, - Implement the HIV/AIDS impact mitigation plan that will involve providing a comprehensive range of services including the identification of possible HIV/AIDS cases, testing with pre- and post-counseling, the treatment of associated infections, referral of appropriate cases, education to promote better quality of life and promotion of precautions, provision of condoms and the application of HIV/AIDS occupational exposure policies.
Visual amenities	- Do not pile excavated soil to form high stockpiles for long durations, - Clean up the site upon completion of the work.
Water access	In its tariff structure NWSC has a public stand post rate which is currently at 25 shillings per 20 litre jerry can of water. Public stand posts are installed free of charge in areas where the general population is unable to apply for a new connection/pay for subsequent bills under the ordinary domestic/commercial tariff structure. This is much less of a burden to the people in these dwellings and is a sustainable way of ensuring water use and demand management.
Conflicts	- There are likely to be other conflicts partly related to property and compensation, that may arise during the construction and operational phase. As a result there should be a broad mechanism and to address the conflicts; registering conflicts against the project and resolving them. This has been partly addressed in the RAP grievance handling mechanism. For RAP related conflicts, these will be handled by a grievance office. For other conflicts, during the construction phase the Environment, Health and Safety Officer should be in charge of the complaints/ conflicts. During the operational phase these should be handled by Local Water User Committee under National Water and Sewerage Corporation (NWSC). The committee meets once in 2 months to discuss among other things infrastructural development related issues. Through this medium of communication and in liaison with the Local Government Office, the District Natural Resources Officer will be charged with assigning to the project an officer to track and follow up any conflicts arising in this regard. This will enable NWSC and AMC to have a good communication, grievance and feedback mechanism (Annex 14). - Land acquisition and project affected property should be adequately and promptly compensated for.

Project component: Water treatment works, reservoirs and storage tanks	
Phase: Operation and maintenance	
Impact type	Description of mitigation measures
Water Access and Tariffs	- NWSC and AMC should develop a communication system about water use and associated costs. Community members should be made aware that they need to pay operational and maintenance costs associated with water supply and that water supplied by NWSC is of good quality - Poor people should be sensitised on water demand management and use of water sparingly, preferably, use treated water for food preparation and drinking; and then water from other sources that are contaminated (springs, boreholes, shallow wells) for other purposes such as laundry
Air pollution	Same as in construction phase
Noise pollution	Same as in construction phase

Project component: Water treatment works, reservoirs and storage tanks	
Phase: Operation and maintenance	
Impact type	Description of mitigation measures
Water pollution	• Same as in construction phase • The strategy for the protection and management of River Enyau and its banks (2010) should be implemented. • The contractor following the guidelines for management of materials and wastes during construction and operation should take care of preventing the project from damaging the river. • Activities include meetings, seminars, workshops, radio talk shows, and field demonstrations on planting trees.
Solid waste generation	• NWSC should prepare a Solid Waste Management Plan, which NWSC or the operator of the system should implement
Impacts on flora and fauna	• Same as in construction phase
Storage and handling of chemicals	• Alum and chlorine should be stored in leak proof containers • Storage containers should be checked regularly for leakage. If any leakage is detected, the chemical should be removed and it should be repaired and if it cannot be repaired, it should be put out of use and disposed according to NEMA regulations regarding disposal of solid wastes containing hazardous materials • Clay tiled roofs or concrete C25 should be preferred against iron sheet roofing.
Occupational health and safety	• Same as in construction phase • Train some staff (10 in number) in NWSC (five) and AMC (five) on Environment and Safety to take over in the O&M.
Water access	• Poor people should be sensitised on water demand management and use of water sparingly, preferably, use treated water for food preparation and drinking; and then water from other sources that are contaminated (springs, boreholes, shallow wells) for other purposes such as laundry
Conflicts	• AMC should sensitize the people on the advantages of protecting River Enyau and its banks, • Land acquisition (if any), should be compensated for.
Local incapacity/ inexperience to manage the facilities.	• Ensure trained NWSC staff participate in O&M and form community committees to be trained in routine O&M procedures.

Table 8-3: Mitigation measures for borehole development

Project component: Boreholes	
Phase: Construction	
Impact type	Description of mitigation measures
Air pollution	• Maintain vehicle and equipment according to manufacturers' specifications. • Use standard fuel and lubricants. • Sprinkle water to reduce and prevent dust during dry weather periods. • Clean access routes in surrounding area on a daily basis to prevent dust. • Collect and hold cleaning wastes in appropriate containers. • Workers who may unavoidably have to work in dusty workplaces should be provided with nose and ear masks to protect them from excessive dust and one should ensure that they are put on.

Project component: Boreholes	
Phase: Construction	
Impact type	Description of mitigation measures
Noise pollution	• Minimise noise according to Uganda standards and World Bank guidelines. • Control noise and vibration on site. • Work programmes should be provided to local communities (e.g. through the LC system or local radio (FM) stations) and adhered to. • Maintain vehicle and equipment according to manufactures' specifications. • Install adequate noise prevention devices, e.g. mufflers on noise generating sources. • Switch off engines of vehicles and machinery while not in use. • Workers who may unavoidably have to work with noise generating equipment, e.g. earthmoving equipment should be provided with ear plugs and ensure that put them on.
Water pollution	• No solid waste, fuels or oils should be discharged into water flows. • Test water samples from well testing for contaminants according to NEMA, Uganda standards for discharge of effluents guidelines, which when exceeded, advice on appropriate discharge should be sought. • Drilling methods should follow standard procedures to prevent groundwater contamination during the process. • Hold and store sanitary and Cleaning wastes should be held and temporarily stored in appropriate containers to be disposed of at approved sites. • Vehicles should preferably be packed on paved platforms. • Fuel storages should not leak, and should be periodically monitored, and repaired or replaced when necessary. • Sites for cleaning, fuelling and maintaining vehicles should be paved so as to prevent leakage • Vehicles and equipment at workshops/sites should be regularly maintained, cleaned and fuel leakage should be avoided through use of impermeable surface, settlers and oil separators. Fuelling and car servicing should be carried out at designated fuel stations.
Soil erosion and contamination	• Carry out work should under mild weather; avoid strong rains or winds. • Remove and store topsoil stored in separate piles and reinstate after refilling of trenches, to enable natural re-vegetation. • The Contractor(s) should present procedures for, and ensure implementation of measures to protect soils from any accidental or structural contamination. These include: ○ Storing all hazardous, sanitary and cleaning wastes in facilities approved by NEMA, Uganda. ○ Installing leak-proof fuel storages on concrete platform with gutters and grease separators, which are monitored periodically and repaired or replaced when required. ○ Strictly enforcing and monitoring standard procedures for storing and handling hazardous wastes and raw material (e.g. fuel or chemicals). ○ Placing strong drums for oil storage on impermeable floors in the stores. ○ Providing appropriate hoses for refuelling of pumps and vehicles. ○ Parking vehicles on paved platforms whenever possible ○ Ensuring sites for cleaning, fuelling and maintaining equipment and vehicles are able to prevent leakage (e.g. paved

Project component: Boreholes	
Phase: Construction	
Impact type	Description of mitigation measures
	- or with settlers). ○ Treatment of wastewater from maintenance workshops in oil separators before discharge to sewers. • Contaminated soil should be isolated and treated/disposed of in a way that will depend on the contaminant type.
Solid waste generation	• The Contractor should prepare a Solid Waste Management Plan, which should contain: ○ An inventory of the types and quantities of waste to be produced. ○ The most appropriate waste management approach for each type of waste including details on (temporary) storage, transport and final destination of the waste. ○ An assessment of any opportunities for reducing solid waste generation, in particular of hazardous and undesirable (persistent and non-reusable) types of wastes. • The Contractor should maintain records of types, quantities, origin, (temporary) storage, transport and elimination/reuse of solid waste, and make these available to the works supervisor upon his request, as proof of proper waste management practices. • Any waste including excess soil should be disposed of at gazetted sites. The solid waste shall not be allowed to accumulate on site, to cause odour, fly, or rodent problems • Excavated soils should be reused as much as possible as filling material. • Provisional material storage on site should be designed and undertaken in such a way as to ensure that soils and underground water are not polluted. • Use licensed recycling companies to externally recycle, recover or dispose off waste.
Impacts on flora and fauna	• Working areas should be zoned out to reduce ecological destruction. • Compensate owners of fruit and commercial trees before the cut down. . • Restore disturbed natural sites through environmental rehabilitation, restoring top soils and (re-) introduction of genetic species to re-establish the natural local ecology.
Raw material use	• Consider environmental performance of suppliers of raw material in the selection process. • Explore ways of reducing raw material use. • Special emphasis should be made on raw materials that may be reused and/or recycled/recovered.
Public health problems	• Ensure that work sites (especially excavation works), especially in the night have proper protection with clear marking of safety borders and signals and fence off all dangerous areas. • Inform riparian neighbours about the construction programme in advance and adhere to it. • Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits.
Occupational health and safety	• The Contractor should prepare and implement specific health and safety measures, and present these in a Health and Safety Management Plan. Measures should include (but not be restricted to): ○ Enforce and ensure use of personal protection equipment by employees and particularly helmets and protective shoes.

Project component: Boreholes	
Phase: Construction	
Impact type	Description of mitigation measures
	○ Ensure use of hearing protection equipment when working under noisy conditions. ○ Provide adequate health and safety training of all employees, including training on specific procedures as appropriate to various individual staff groups. ○ Provide adequate medical testing and insurance for all employees. ○ Appropriate fire fighting equipment, collecting trays and absorbent material should be in place at fuel storage tanks. ○ First Aid boxes should be placed at each borehole site. ○ Plan for medical emergency evacuation plans for different types of incidents and injuries that might occur. ○ Provision of adequate sanitary facilities at construction sites. ○ Outlining procedures for working with heavy equipment and heavy lifting. ○ Provision of adequate waste and material storage facilities whose access should be restricted. ○ Implement the HIV/AIDS impact mitigation plan that will involve providing a comprehensive range of services including the identification of possible HIV/AIDS cases, testing with pre- and post-counseling, the treatment of associated infections, referral of appropriate cases, education to promote better quality of life and promotion of precautions, provision of condoms and the application of HIV/AIDS occupational exposure policies.
Visual amenities	● Rehabilitate the site on borehole completion. ● Keep disturbance to a minimum.
Disturbance and interruption of commercial and social activities	● Inform local communities about the construction programme in advance. ● In case access roads have to be closed, inform local communities in advance. ● Clean and maintain access roads in the neighbourhood of earth and sand on a daily basis. ● Provide temporary access ways with the approval of local authorities where access roads are closed. ● Carry out work under mild weather; avoid strong rains or winds. ● Reduce obstruction of access to and use and occupation of roads, footpaths and bridges. ● Protect any items and/or sites of archaeological or cultural value (e.g. private graveyards) discovered during works with the aid of the appropriate authorities. ● Provide adequate and prompt compensation for project affected property like land, crops, tress and structures
Occupation of land resulting in resettlement	● Keep the size of land to be occupied by the borehole and related structures to a minimum. ● Determine and implement adequate resettlement compensation measures as per the RAP during testing and development.

Project component: Boreholes	
Operation and Maintenance	
Impact type	Description of mitigation measures
Conflicting demands for water use	● Conduct a detailed hydrogeological investigation, including test pumping and drilling to determine safe yield of the boreholes to be developed without exceeding recharge rates or depriving other users (e.g. agriculture).

Project component: Boreholes	
Operation and Maintenance	
	- Adequately co-ordinate with other water users, especially the water users committees, catchment management committees in accordance with the groundwater abstraction permit regulations of the Directorate of Water Resources Management
Noise pollution	- Keep pump house noise levels and vibrations to a minimum using where necessary noise prevention measures such as mufflers. - Properly maintain equipment according manufacturers' specifications and put in place a periodical repair/revision programme. - Use manual excavations in high densifications around the central business district of Arua municipality
Public health risks to water users as a result of contaminated water	- Ensure good housekeeping at the borehole. - Follow standard operation and maintenance of the borehole and related equipment (pumps). - Regularly monitor water quality for any contamination following well completion, e.g. at least on weekly basis for the first year of operation. - Involve the public in the detection of potential contamination through awareness creation and opening of a complaint desk.
Local incapacity/ inexperience to manage the facilities.	Ensure trained NWSC staff participate in O&M and form community committees to be trained in routine O&M procedures.

Table 8-4: Mitigation measures for the transmission and distribution lines

Project component: Pipelines	
Phase: Construction	
Impact type	Description of mitigation measures
Air pollution	- Maintain vehicle and equipment according to manufactures' specifications. - Use standard fuel and lubricants. - Sprinkle water to work areas to reduce and prevent dust during dry weather periods. - Clean access routes in surrounding area on a daily basis to prevent dust. - Collect and hold sanitary and cleaning wastes in appropriate containers. - Workers who may unavoidably have to work in dusty workplaces should be provided with nose and ear masks to protect them from excessive dust.
Noise pollution	- Minimise noise according to NEMA, Uganda standards and World Bank guidelines. - Control noise and vibration on site. - Work programmes that have to be strictly followed should be provided to local communities (e.g. through the LC system or local radio (FM) stations) and adhered to.

Project component: Pipelines	
Phase: Construction	
Impact type	Description of mitigation measures
	• Maintain vehicle and equipment according to manufacturers' specifications. • Install adequate noise prevention devices, e.g. mufflers on noise generating sources. • Switch off engines of vehicles and machinery while not in use. • Workers who may unavoidably have to work with noise generating equipment, e.g. earthmoving equipment should be provided with ear plugs and advised/monitored to put them on.
Water pollution	• No solid waste, fuels or oils should be discharged into water flows. • Test water samples from dewatering operations for contaminants according to NEMA, Uganda standards for discharge of effluents guidelines, which when exceeded, advise on appropriate discharge should be sought. • Hold and store sanitary and cleaning wastes in appropriate containers to be disposed of at approved sites. • Park vehicles preferably on paved platforms. • Fuel storages should not leak, and should be periodically monitored, and repaired or replaced when necessary. • Sites for cleaning, fuelling and maintaining vehicles should be able to prevent leakage (e.g. paved). • Maintain fuel and clean vehicles and equipment at workshops/sites with adequate leakage prevention (e.g. impermeable surface, settlers and oil separator).
Soil erosion and contamination	• The Contractor(s) should present appropriate procedures for, and ensure implementation of measures to protect soils from any accidental or structural contamination. These include: ○ Storing all hazardous, sanitary and cleaning wastes in facilities approved by NEMA, Uganda. ○ Installing leak-proof fuel storages on concrete platform with gutters and grease separators, which are monitored periodically and repaired or replaced when required. ○ Strictly enforcing and monitoring standard procedures for storing and handling hazardous wastes and raw material (e.g. fuel or chemicals). ○ Placing strong drums for oil storage on impermeable floors in the stores. ○ Providing appropriate hoses for refuelling of pumps and vehicles. ○ Parking vehicles on paved platforms whenever possible ○ Ensuring sites for cleaning, fuelling and maintaining equipment and vehicles are able to prevent leakage (e.g. paved or with settlers). ○ Treatment of wastewater from maintenance workshops in oil separators before discharge to sewers. • Contaminated soil should be isolated and treated/disposed of in a way that will depend on the contaminant type.
Solid waste generation	• The Contractors should prepare a solid Waste Management Plan should contain: ○ An inventory of the types and quantities of waste to be produced, including their hazard class; ○ An assessment of any opportunities for reducing solid waste generation, especially hazardous and undesirable persistent and non-reusable waste types; • Waste types should be managed in terms of storage, transport and final destination, with reuse, recycling/recovery and disposal and/or incineration considered as its last options.

Project component: Pipelines	
Phase: Construction	
Impact type	Description of mitigation measures
	- Records of types, quantities, origin, (temporary) storage, transport and elimination/reuse of solid waste should be kept and made available to the works supervisor upon request, as proof of proper waste management practices. - Only sites gazetted by the municipality should store wastes. - Filling material should as much as possible be obtained from excavated soils, which when contaminated be disposed of as waste material at appropriate approved sites. Uncontaminated top soil should be kept in separate piles and reinstated after refilling of trenches. - Excavated soil should be contained to avoid wash out and erosion - Use licensed recycling/waste disposal companies to externally recycle, recover or dispose off waste. - Temporary storage of contaminated soils on site should be designed and implemented so as to minimize underground pollution.
Impacts on flora and fauna	- Zone out working areas to reduce ecological destruction. - Restore disturbed natural sites through environmental rehabilitation, restoring top soils and (re-) introduction of genetic species to re-establish the natural local ecology.
Raw material use	- Consider environmental performance of suppliers of raw materials in the selection process. - Explore ways of reducing raw material use. - Special emphasis should be made on raw materials that may be reused and/or recycled/recovered.
Public health problems	- Follow solid management practices. - Ensure sufficient sanitary facilities are provided on sites and offices. - Encourage use of local labour wherever possible, with imported labourers facilitated with proper housing, including sanitary facilities. - Ensure that all labourers follow basic rules with respect to protection of public health (including hygiene and disease prevention). - Implement the HIV/AIDS impact mitigation plan that will involve providing a comprehensive range of services including the identification of possible HIV/AIDS cases, testing with pre- and post-counseling, the treatment of associated infections, referral of appropriate cases, education to promote better quality of life and promotion of precautions, provision of condoms and the application of occupational exposure policies. - Carry out proper maintenance of sites (levelling of the surface) and through the removal of water from ditches after rainfall or groundwater infiltration to limit standing water on construction sites.
Public Safety	- Ensure that work sites (especially excavation works), especially in the night have proper protection with clear marking of safety borders and signals and fence off all dangerous areas. - Inform riparian neighbours about the construction programme in advance. - Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits. - Implement appropriate traffic management plans with the help of local police when (partial) closure of roads is required.

Project component: Pipelines	
Phase: Construction	
Impact type	Description of mitigation measures
Visual amenities	• Limit size of construction sites and camps. • Conserve vegetation around construction sites to serve as visual shields. • Ensure good housekeeping for adequate organisation and maintenance of construction sites. • Restore construction sites (buried trenches) immediately upon completion of works.
Disturbance and interruption of commercial and social activities	• Inform local communities (e.g. through the LC system or FM radio stations) about the construction programme in advance. • Minimise relocation as much as possible and where necessary do so within the resettlement policy framework. • Minimise temporary interference with private property (e.g. pipeline crossings over private lands) as much as possible. • Pay agreed compensation where there is any affected private land or other property prior to construction in accordance with the RAP • Inform local communities about any partial blockage of roads in advance however temporary it may be. • Set up traffic management plans at location of (e.g. partial closure). • Clean and maintain access roads in the neighbourhood work sites of earth and sand on a daily basis. • Provide temporary access ways with the approval of local authorities where access roads are closed. • Carry out work under mild weather conditions; avoid strong rains or winds. • Reduce obstruction of access to and use and occupation of roads, footpaths and bridges. • Protect any items and/or sites of archaeological or cultural value (e.g. private graveyards) discovered during works with the aid of the appropriate authorities. • Choose the final pipeline alignment so that the period of realization of branch connections and fittings is short enough.
Land acquisition	• Use appropriate alignment of pipelines in order to avoid as much as possible the need for resettlement. • Reduce of required working depth of 4m within the central business district of Arua Municipality road reserves along Duka lane, Godown road, Market lane etc. • Implement the RAP for prompt and adequate compensation for PAPs.
Land acquisition	• Use appropriate alignment of pipelines in order to avoid as much as possible the need for resettlement. • If resettlement is inevitable, develop and implement appropriate plans within the resettlement policy framework.
Occupational health and safety	• The Contractor(s) should prepare and implement specific health and safety measures, and present these in a Health and Safety Management Plan. Measures should include (but not be restricted to): ○ The use of personal protection equipment by employees and particularly helmets and protective shoes. ○ The use of hearing protection equipment when working under noisy conditions. ○ Adequate health and safety training of all employees, including training on specific procedures as appropriate to various individual staff groups. ○ Adequate medical testing and insurance for all employees. ○ Appropriate fire fighting equipment, collecting trays and absorbent material should be in place at fuel storage tanks. ○ Provision of rescue equipment and medical first-aid facilities at each site ○ Implement the HIV/AIDS impact mitigation plan that will involve providing a comprehensive range of services

Project component: Pipelines	
Phase: Construction	
Impact type	Description of mitigation measures
	including the identification of possible HIV/AIDS cases, testing with pre- and post-counseling, the treatment of associated infections, referral of appropriate cases, education to promote better quality of life and promotion of precautions, provision of condoms and the application of occupational exposure policies. ○ Medical emergency evacuation plans for different types of incidents and injuries that might occur. ○ Provision of adequate sanitary facilities at construction sites. ○ Outlining procedures for working with heavy equipment and heavy lifting. ○ Provision adequate waste and material storage facilities whose access should be restricted. ○ Basic rules with regard to protection of public health, including especially hygiene and disease (HIV) prevention.

Project component: Pipelines	
Phase: Operation and Maintenance	
Impact type	Description of mitigation measures
Air pollution	• Same as in the construction phase.
Noise pollution	• Same as in the construction phase.
Water pollution	• Same as in the construction phase.
Air pollution	• Same as in the construction phase.
Noise pollution	• Same as in the construction phase.
Water pollution	• Same as in the construction phase.
Solid waste generation	• Opportunities should be pursued for the reduction of solid waste, in particular of hazardous waste generation and undesirable (persistent and non-reusable) types of wastes during especially maintenance of the pipelines. • Waste types should be managed in terms of storage, transport and final destination, with reuse, recycling/recovery and disposal and/or incineration considered as its last options. • Records of types, quantities, origin, (temporary) storage, transport and elimination/reuse of solid waste generated during maintenance should be kept and made available to the works supervisor upon request, as proof of proper waste management practices.
Soil erosion and contamination	• Same as in the construction phase
Impacts on flora and fauna	• Same as in the construction phase
Raw material use	• Same as in the construction phase
Public health problems	• Same as in the construction phase

Project component: Pipelines	
Phase: Operation and Maintenance	
Impact type	Description of mitigation measures
Public safety	• Same as in the construction phase
Visual amenities	• Same as in the construction phase
Disturbance and interruption of commercial and social activities	• Same as in the construction phase
Occupational health and safety	• Same as in the construction phase
Local incapacity/inexperience to manage the facilities.	• Ensure that trained NWSC staff participate in O&M and form community committees to be trained in routine O&M procedures.

Table 8-5. Mitigation measures of impacts related to construction of waste stabilization ponds and sewage lifting station

Project component: Wastewater Treatment Plant (Waste stabilization ponds) and Sewage Lifting (pumping) Station	
Phase: Construction	
Impact type	Description of mitigation measures
Air pollution	• Maintain vehicle and equipment according to manufacturers' specifications. • Use standard fuel and lubricants. • Sprinkle water to work areas to reduce and prevent dust during dry weather periods. • Clean access routes in the surrounding area on a daily basis to prevent dust. • Collect and hold cleaning wastes in appropriate containers. • Workers who may unavoidably have to work in dusty workplaces should be provided with nose and ear masks to protect them from excessive dust. • Regularly desludge the lagoon as accumulated sludge contributes to bad odour. • Vegetation barriers (shelterbelts) have the potential to be an effective and inexpensive odour control device. As the odour source is near the ground and the tendency of the plume is to travel along the ground, vegetation of even modest heights may be ideal for plume interception and disruption. • Create good relationship with the communities through consultations prior to construction activities so that the communities have a role in the management of the lagoon activities.
Noise pollution	• Minimise noise according to NEMA, Uganda standards and World Bank guidelines. • Control noise and vibration on site. • Work programmes that have to be strictly followed should be provided to local communities. • Maintain vehicle and equipment according to manufacturers' specifications. • Install adequate noise prevention devices, e.g. mufflers on noise generating sources. • Switch off engines of vehicles and machinery while not in use. • Provide information to the local communities (e.g. through the LC system or local radio (FM) stations) with regard to work

Project component: Wastewater Treatment Plant (Waste stabilization ponds) and Sewage Lifting (pumping) Station	
Phase: Construction	
Impact type	Description of mitigation measures
	programme, and strict adherence to such. Workers who may unavoidably have to work with noise generating equipment, e.g. earthmoving equipment should be provided with ear plugs and advised/monitored to put them on.
Water pollution	- No solid waste, fuels or oils should be discharged into surface water bodies, e.g. River Enyau. - The contractor following the guidelines for management of materials and wastes during construction and operation should take care of preventing the project from damaging the river. - The car washing bay at Prisons should be completed and a similar one should also be built on River Okaiva at Adumi road near Onduparaka. - In areas identified to experience a lot of washing activities, e.g. Adumi road crossing and prisons, the project may consider supporting the construction of washing areas and soakpits for water to infiltrate through before reaching River Enyau. - All water from the washing and watering animals should pass through soak pits before discharging into River Enyau. - People should also be sensitized to wash clothes and water their animals outside of the river so that it passes through soil infiltration system (e.g. soak pit) before discharging into River Enyau. - Frequently test water samples from R. Enyau for contaminants and monitor water quality according to NEMA, Uganda standards for discharge of effluents guidelines, which when exceeded, advice on appropriate discharge should be sought. - Hold and store sanitary and cleaning wastes in appropriate containers to be disposed of at approved sites. - Park vehicles preferably on paved platforms. - Fuel storages should not leak, and should be periodically monitored, and repaired or replaced when necessary. - Sites for cleaning, fuelling and maintaining vehicles should be able to prevent leakage (e.g. paved). - Maintain, fuel and clean vehicles and equipment at workshops/sites with adequate leakage prevention (e.g. impermeable surface, settlers and oil separator). - At least 600mm freeboard should be provided at the lagoon pond embankments to prevent overflow arising from normal rainfall events and wind driven waves. - Develop and implement an appropriate drainage/civil solution for runoff from the areas around the lagoons to be directed away from the lagoons. - Regularly monitor ground water sources to establish any changes in water quality, and how it may be associated with the activities of the lagoon. - Compact clay to act as liners of the lagoon cells to prevent infiltration of waste water. - Design and implement a program to sensitize the surrounding communities especially at Onduparaka on the use of the river and how they should relate to the lagoon. - NWSC should undertake regular monitoring of the water quality in River Enyau and keep the community/public informed.
Water levels	Allow for minimum dry weather flow by use of flow regulating structures,

Project component: Wastewater Treatment Plant (Waste stabilization ponds) and Sewage Lifting (pumping) Station	
Phase: Construction	
Impact type	Description of mitigation measures
	• Store more water in the wet season and but continue to release the environmental flow, via flow regulating structures
Soil erosion and contamination	• Carry out work under mild weather and avoid strong rains or winds. • Remove and store topsoil in separate piles and disposal in approved areas. • Re-vegetate the embankments of the waste stabilization ponds. • The Contractor(s) should present procedures for, and ensure implementation of measures to protect soils from any accidental or structural contamination. These include: ○ Storing all hazardous, sanitary and cleaning wastes in facilities approved by NEMA, Uganda. ○ Installing leak-proof fuel storages on concrete platform with gutters and grease separators, which are monitored periodically and repaired or replaced when required. ○ Strictly enforce and monitor standard procedures for storing and handling hazardous wastes and raw material (e.g. fuel or chemicals). ○ Place strong drums for oil storage on impermeable floors in the stores. ○ Provide appropriate hoses for re-fuelling of pumps and vehicles. ○ Parking vehicles on paved platforms whenever possible ○ Sites for cleaning, fuelling and maintaining equipment and vehicles should be able to prevent leakage (e.g. paved or with settlers). ○ Treat wastewater from maintenance workshops in oil separators before discharge to sewers. ○ Contaminated soil should be isolated and treated/disposed of in a way that will depend on the contaminant type.
Solid waste generation	• The Contractor should prepare a Solid Waste Management Plan, which should contain: ○ An inventory of the types and quantities of waste to be produced. ○ The most appropriate waste management approach for each type of waste including details on (temporary) storage, transport and final destination of the waste. ○ An assessment of any opportunities for reducing solid waste generation, in particular of hazardous and undesirable (persistent and non-reusable) types of wastes. • The Contractor should maintain records of types, quantities, origin, (temporary) storage, transport and elimination/reuse of solid waste, and make these available to the works supervisor upon his request, as proof of proper waste management practices. • Any waste including excess soil should be disposed off at gazetted sites. The solid waste shall not accumulate on site, to cause odour, fly, or rodent problems. • Excavated soils should be reused as much as possible as filling material. • Provisional material storage on site should be designed and undertaken in such a way so as to ensure that soils and underground water are not polluted. • Use licensed recycling companies to externally recycle, recover or dispose off waste.
Loss of vegetation	• Inevitably, the construction of waste stabilisation ponds will lead to loss of vegetation and trees; thus, where families are

Project component: Wastewater Treatment Plant (Waste stabilization ponds) and Sewage Lifting (pumping) Station	
Phase: Construction	
Impact type	Description of mitigation measures
	affected, compensate them by providing an equivalent size of land that has been lost, • Re-vegetate the embankments of the waste stabilization ponds, • Plant trees within the areas of the waste stabilisation ponds which is not inundated
Impacts on flora and fauna	• Zone out working areas out to reduce ecological destruction, • Seek consent from NFA, to clear and cut down trees and pay the appropriate fees. • Restore disturbed natural sites that are not to be inundated with wastewater through environmental rehabilitation, restoring top soils and (re-)introduce genetic species similar to those destroyed in order to re-establish the natural local ecology.
Public Safety	• Ensure that work sites (especially excavation works), have proper protection with clear marking of safety borders and signals and fence off all dangerous areas. • Inform riparian neighbours about the construction programme in advance and adhere to it. • Confine access to restricted work sites (including those with operation of mechanical and electric equipment) to persons with permits. • Implement appropriate traffic management plans with the help of local police when (partial)closure of roads is required.
Public health problems	• Fill up depressions caused as a result of the construction works, • Provide sufficient cut-off drains for the storm water that would otherwise enter work areas, • Provide sanitation facilities to workers on site, • Provide potable water to the workers on site,
Occupational health and safety	• The Contractor(s) should prepare and implement specific health and safety measures, and present these in a Health and Safety Plan. Measures should include (but not be limited to): ○ The use of personal protection equipment (PPE) by employees and particularly helmets and protective shoes. ○ The use of hearing protection equipment when working under noisy conditions. ○ Adequate health and safety training of all employees, including training on specific procedures as appropriate to various individual staff groups. ○ Adequate medical testing and insurance for all employees. ○ Appropriate fire fighting equipment, collecting trays and absorbent material should be in place at fuel storage tanks. ○ Provision rescue equipment and medical first-aid facilities at each site ○ Medical emergency evacuation plans for different types of incidents and injuries that might occur. ○ Provision of adequate sanitary facilities at construction sites. ○ Outlining procedures for working with heavy equipment and heavy lifting. ○ Provision adequate waste and material storage facilities whose access should be restricted. ○ Basic rules with regard to protection of public health, including especially hygiene and disease (HIV) prevention. Implement the HIV/AIDS impact mitigation plan that will involve providing a comprehensive range of services including the identification of possible HIV/AIDS cases, testing with pre-and post-counseling, the treatment of

Project component: Wastewater Treatment Plant (Waste stabilization ponds) and Sewage Lifting (pumping) Station	
Phase: Construction	
Impact type	Description of mitigation measures
	associated infections, referral of appropriate cases, education to promote better quality of life and promotion of precautions, provision of condoms and the application of occupational exposure policies.
Increased vehicular traffic	• Inform local communities about the construction programme in advance. • In case access roads have to be closed, inform local communities and road users in advance. • Use reflective signature to direct traffic to designated areas. • Use flag men to give directions to traffic and pedestrians. • Install speed reduction humps at crossing of many people, e.g. at a school, market. • Sensitise drivers to observe speed limits.
Disturbance and interruption of commercial and social activities	• Inform local communities about the construction programme in advance. • In case access roads have to be closed, inform local communities in advance. • Clean and maintain access roads in the neighbourhood of earth and sand on a daily basis. • Provide temporary access ways with the approval of local authorities where access roads are closed. • Carry out work under mild weather (not strong rains or winds). • Reduce obstruction of access to and use and occupation of roads, footpaths and bridges. • Protect any items and/or sites of archaeological or cultural value (e.g. private graveyards) discovered during works with the aid of the appropriate authorities.
Disruption of social order	• Sensitize all workers to ensure awareness of and sensitivity to the local cultures, traditions and lifestyles and sensitise workers to be well behaved • Sensitize workers and carry out awareness campaigns on dangers of HIV/AIDS and other infectious diseases. Implement the HIV/AIDS impact mitigation plan that will involve providing a comprehensive range of services including the identification of possible HIV/AIDS cases, testing with pre- and post-counseling, the treatment of associated infections, referral of appropriate cases, education to promote better quality of life and promotion of precautions, provision of condoms and the application of occupational exposure policies.
Raw material use	• Consider environmental performance of suppliers of raw material in the selection process. • Explore ways of reducing raw material wastage. • Special emphasis should be made on raw materials that may be reused and/or recycled/recovered.
Visual amenities	• Do not pile excavated soil to form high stockpiles for long durations • Clean up the site upon completion of the work.
Occupation of land, resulting into resettlement	• Keep the size of land to be occupied by the waste stabilization ponds and the sewage lifting station and related structures to a minimum. • Determine and implement adequate resettlement measures under the guidance of the local authorities and in accordance Land Act and Land Acquisition Act.

Project component: Wastewater Treatment Plant (Waste stabilization ponds)	
Phase: Operation and maintenance	
Type of impact	Description of mitigation measure
Air pollution	• Maintain the generators according to manufactures' specifications, • Use standard fuel and lubricants. • Clean access routes in surrounding area on a daily basis to prevent dust. • Collect and hold sanitary and cleaning wastes in appropriate containers.
Noise pollution	• Minimise noise according to NEMA, Uganda standards and World Bank guidelines. • Install adequate noise prevention devices, e.g. mufflers on noise generating sources, soundproofing or installing silencers or other appropriate noise reduction measures.
Water pollution	• As in the construction phase, plus the following: • Treat effluent to meet effluent discharge standards according to the NEMA, Uganda and World Bank standards. • Contain and dispose of screenings according on approved sites, • When the anaerobic pond is desludged, the sludge should be treated in sludge drying beds to be provided at the waste stabilization site. • The effluent from the sludge drying beds should be sent to the inlet of the anaerobic pond so that it is treated through the system before discharge into the environment.
Obnoxious smells	• The area of the waste stabilization should be fenced off by a hedge of not less than 1 meter high in order to prevent the wind blowing and sending off obnoxious smells to neighbouring communities, • The sewage treatment plant should be operated according to the procedures to be provided by the design team, • The screenings and the sludge from the anaerobic pond should not be scattered around the site.
Impacts on area aesthetics	• Plant tree shrubs and grass to improve area aesthetics. • Proper restoration of the project site to improve the landscape and area aesthetics of especially the Onduparaka lagoon at it is near the road.
Public health of people and animals	• Entry into the area of the waste stabilization should be restricted to animals and people, so that no persons or animals should enter without the permission and presence of the operator, • The compound and grass in the area of waste stabilization ponds should be properly maintained so that the area does not become bushy to harbour dangerous snakes, mosquitoes and other dangerous terrestrial and aquatic species.
Solid waste generation	• Screenings should be contained and disposed of in approved areas, • Other solid wastes generated at the site will be minimal and should be stored on site until they are collected by the Municipality or other authorized service provider for disposal.
Impacts on flora and fauna	• Effluent should be treated to meet discharge standards according to NEMA and the World Bank.
Storage and handling of tools	• Tools used in sewers, manholes and sewage treatment plant should not be scattered in the environment. instead, they should be kept in dedicated stores, • After using the equipment, they should be cleaned thoroughly and disinfected so that they do not disperse pollutants during transportation back to the stores, • The storage areas of the equipment used in manholes and sewers, or to carry hazardous material, e.g. sewer rodding

Project component: Wastewater Treatment Plant (Waste stabilization ponds)	
Phase: Operation and maintenance	
Type of impact	Description of mitigation measure
	snakes, spades, wheel barrows, spanners should be adequately disinfected.
Impact due to poor lagoon designs, operation and maintenance	• Ensure that the plans are approved by the relevant authorities including Arua District Local Government before construction. • Sewage treatment process and control monitoring should be undertaken to provide information to the operating staff on the condition and performance of the system and allow for early warning of possible upsets or operational problems. • Compliance monitoring is also required under the operating permit or certificate of approval and reports sent to the regulatory agency (NEMA). • Site inspections and regular sampling should be undertaken to determine quality of effluent and help in establishing quality improvement techniques such as additional aeration, addition of chemicals especially for phosphorus removal and pre-treatment to reduce lagoon loading is required.
Impacts of the proposed locations of the lagoons on the riparian communities	• Ensure regular maintenance of the lagoons and implementation of the mitigation measures to reduce impacts on the surrounding community of especially the Onduparaka lagoon. • Maintain reasonable distances (65m) from the residents/community for the Onduparaka Lagoon and at least 30m from the river for both Onduparaka and the Arua Prisons lagoons. • Fence off the sites for the lagoons and plant trees and shrubs to reduce odour and unsightly conditions. • Sensitize the community especially of the Onduparaka lagoon on the lagoon operation and expected maintenance activities.
Local incapacity/inexperience to manage the facilities.	• Ensure trained NWSC staff participate in O&M and form community committees to be trained in routine O&M procedures.

9 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

The EMP of all construction works and the associated costs are depicted in Table 9-2 to 9-4 and the overall costs are summarised in Table 9-1.

Table 9-1: Summary of the construction costs

Activity	Construction (UShs)	Construction (USD)	Operation and Maintenance (UShs)	Operation and Maintenance (USD)	Total (UShs)	Total USD
Waterworks, construction of reservoirs and WSP	408,500,000	177,609	231,000,000	100,435	639,500,000	278,043
Boreholes	62,200,000	27,043	15,000,000	6,522	77,200,000	33,565
Transmission lines	292,700,000	127,261	20,500,000	8,913	313,200,000	136,174

Table 9.2: EMP for all construction works (waterworks, construction of reservoirs and storage tanks, Waste stabilization ponds and sewage pumping stations)

PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (UShs.)	ESTIMATED TOTAL COST (UShs)	RESPONSIBILITY	MONITORING INSTITUTION
Construction Phase (waterworks, construction of reservoirs, storage tanks and Waste stabilization ponds)							
A1. Air pollution	Emissions from vehicles and construction equipment.	A1-1: Maintain vehicle and equipment according to manufactures' specifications. A1-2: Use standard fuel and lubricants.	-Record of repairs -Fuels and lubricants conforming to specifications	500,000 (monthly maintenance cost)	48,000,000	Contractor	Arua Municipality Environment Officer (MEO)/District environment officer (DEO) NWSC
		A1-3: Sprinkle water to work areas to reduce and prevent dust during dry weather periods.	-Record of water sprinkling	70,000	7,000,000	Contractor	Ditto
		A1-4: Clean access routes in surrounding area on a daily basis to prevent dust.	-Record of cleaning	300,000 (monthly cleaner salary)	5,000,000	Contractor	Ditto
		A1-5: Collect and hold sanitary and cleaning wastes in appropriate containers.	-Designated sanitary containers	200,000 (monthly cleaner salary)	3,500,000	Contractor	Ditto
		A1-6: Workers who may unavoidably have to work in dusty workplaces should be provided with nose and ear masks to protect them from excessive dust.	- PPEs Distribution list/stores, percentage of workers using nose and ear masks	500,000	2,000,000	Contractor	Ditto

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$.)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
A2. Noise pollution	Intermittent noise from vehicles and equipment to sensitive receptors	A2-1: Minimize noise according to NEMA, Uganda standards and World Bank guidelines. A2-2: Control noise and vibration on site. A2-3: Install adequate noise prevention devices, e.g. mufflers on noise generating sources.	-Noise making machines/equipment fitted with mufflers -Record of noise measurements	500,000	5,000,000	Contractor	Respective LC 1Councils, MEO and DEO
		A2-4: Maintain vehicle and equipment according to manufactures' specifications.	-Record of vehicle and equipment maintenance	Included in A1-1	Included in A1-1	Contractor	Ditto
		A2-5: Switch off engines of vehicles and machinery while not in use.	-Equipment log sheets	0	0	Contractor	Ditto
		A2-6: Provide information to the local communities (e.g. through the LC system or local radio (FM) stations) with regard to work programme, and strict adherence to such.	-Receipts from radio stations for announcements made	300,000	15,000,000	Contractor	Ditto
		A2-7: Workers who may unavoidably have to work with noise generating equipment, e.g. earth-moving equipment should be provided with ear plugs and advised/monitored to put them on.	-Store of PPEs including nose and ear masks	Included in A1-6	Included in A1-6	Contractor	Ditto
A3 Water pollution	Water pollution from waste, dredging activities, accidental spillage of fuel, lubricants	A3-1: Contain solid wastes so that no solid waste, fuels or oils should be discharged into surface water bodies, e.g. R. Enyau.	-Monitoring reports on status of waste management	0	0	Contractor	NWSC, MEO and DEO
		A3-2: Test water samples from R. Enyau for contaminants according to NEMA, Uganda standards for discharge of effluents guidelines, which when exceeded, advise on appropriate discharge should be sought.	-Results of water quality analysis	1,800,000 (one time sampling)	18,000,000	Contractor	Ditto
		A3-3: Hold and store sanitary and cleaning wastes in appropriate containers to be disposed of at approved sites.	-Designated sanitary containers	Included in A1-5	Included in A1-5	Contractor	Ditto
		A3-4: Park vehicles preferably on paved platforms A3-5: Fuel storages should not leak, and should be periodically monitored, and repaired or replaced when necessary. A3-6: Sites for cleaning, fuelling and maintaining vehicles should be able to prevent leakage (e.g. paved). A3-7: Maintain fuel and clean vehicles and equipment at workshops/sites with	-Monitoring reports on parking of vehicles and status of fuel storages	30,000,000 (lumpsum for parking and storage areas)	30,000,000	Contractor	Ditto

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$.)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
		adequate leakage prevention (e.g. impermeable surface, settlers and oil separator).					
A4 Soil erosion and contamination	Inappropriate construction practices and soil protection measures may induce or accelerate soil erosion with possible pollution and siltation downstream	A4-1: Carry out work under mild weather (not strong rains or winds). A4-2: Contaminated soil should be isolated and treated/disposed of in a way that will depend on the contaminant type. A4-3: Remove and store topsoil in separate piles and reinstate after refilling of trenches, to enable natural re-vegetation.	-Stockpiles of topsoil -Written down soil protection measures and record of implementation -Results of chemical analysis of treated soils	1,500,000 (only soil chemical analysis has been included – single round of sampling)	15,000,000	Contractor	Respective LC 1Councils MEO
		A4-4: Storing all hazardous, sanitary and cleaning wastes in facilities approved by NEMA, Uganda. A4-5: Installing leak-proof fuel storages on concrete platform with gutters and grease separators, which are monitored periodically and repaired or replaced when required.	-Monitoring reports, -Operational store	30,000,000 (lumpsum for store)	30,000,000	Contractor	Respective LC 1Councils MEO, DEO
		A4-6: Strictly enforce and monitor standard procedures for storing and handling hazardous wastes and raw material (e.g. fuel or chemicals).	-Monitoring reports	10,000,000 (yearly, outsourced)	40,000,000	Contractor even they though outsource	Respective LC 1Councils MEO, DEO
		A4-7: Place strong drums for oil storage on impermeable floors in the stores. A4-8: Provide appropriate hoses for re-fuelling of pumps and vehicles.	-Designated sanitary containers	1,000,000 (yearly)	4,000,000	Contractor	Respective LC 1Councils MEO, DEO
		A4-9: Parking vehicles on paved platforms whenever possible A4-10: Sites for cleaning, fuelling and maintaining equipment and vehicles should be able to prevent leakage (e.g. paved or with settlers).	-Monitoring reports on parking of vehicles and status of fuel storages	Included in A3-(4-7)	Included in A3-(4-7)	Contractor	Respective LC 1Councils MEO, DEO
		A4-11: Treat wastewater from maintenance workshops in oil separators before discharge to sewers.	-Reports on water quality analyses	Included in A3-2	Included in A3-2	Contractor, NWSC	Respective LC 1Councils MEO, DEO
A5: Solid waste generation	Cleared vegetation may compromise aesthetic value of the sites; domestic waste from camps be an eye sore and may contaminate soil and water resources	A5-1: The Contractor should prepare a Solid Waste Management Plan, as described in section 7 of this report.	-Written down Solid Waste Management Plan (SWMP) and implementation schedule	10,000,000 (Lumpsum for preparing SWMP)	10,000,000	Contractor	MEO
		A5-2: The contractor should maintain	-Records of types of	Costs included in	Costs included in	Contractor	MEO

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$.)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
		records of types, quantities, origin, (temporary) storage, transport and elimination/reuse of solid waste A5-3: Any waste including excess soil should be disposed of at gazetted sites. The solid waste shall not accumulate on site, to cause odour, fly, or rodent problems.	wastes generated, transport and delivery to gazette sites	A5-6 below	A5-6 below		
		A5-4: Excavated soils should be reused as much as possible as filling material.	-No visible soil stockpiles -Depressions filled	0	0	Contractor	MEO
		A5-5: Provisional material storage on site should be designed and undertaken in such a way as to ensure that soils and underground water are not polluted.	-Sealed storage containers on site	1,000,000 (Yearly)	4,000,000	Contractor	MEO
		A5-6: Use licensed recycling companies to externally collect and recycle, recover or dispose off waste	-Contracts with licensed waste disposal/recycling firms	700,000 (Quarterly)	5,600,000	Contractor	MEO
A6: Impacts on flora and fauna	Wetland plants and associated fauna may be affected	A6-1: Zone out working areas to reduce ecological destruction.	-Zoned out areas	0	0	Contractor	Respective LC 1 Councils Arua Municipality Forestry Officer (MFO) and MEO
		A6-2: Agree with and compensate owners of fruit and commercial trees	-Written agreement with the owners and indication the amount of money to paid for the compensation of the trees.	And average of 30,000 for eucalyptus trees and 50,000 for fruit trees	1,500,000		Ditto
		A6-3: Restore disturbed natural sites through environmental rehabilitation; restoring top soils and (re-)introduce genetic species similar to those destroyed in order to re-establish the natural local ecology.	-Disturbed sites restored after well completion	5,00,000 (Yearly)	20,000,000		Ditto
A7: Public Safety	Excavations, and transportation of equipment, site workers and debris and movement of heavy equipment may pose a safety risk to the general public	A7-1: Ensure that work sites (especially excavation works), have proper protection with clear marking of safety borders and signals and fence off all dangerous areas.	-Demarcated work sites and signals	1,000,000	1,000,000	Contractor	MEO
		A7-2: Inform riparian neighbours about the	-Written	5,000,000	5,000,000	Contractor	Respective LC 1

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$.)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
		construction programme in advance.	communication to neighbouring communities -Receipts from radio stations for announcement				Councils, MEO
		A7-3: Confine access to restricted work sites (including those with operation of mechanical and electric equipment) to persons with permits.	-Security guards to restrict access	1,500,000 (monthly)	72,000,000	Contractor	Respective LC 1 Councils, MEO
		A7-4: Implement appropriate traffic plans with the help of local police when (partial)closure of roads is required.	-A traffic management plan	5,000,000	5,000,000	Contractor	Respective LC 1 Councils, MEO, Uganda Police
A8: Raw material use	Large quantities of construction material will be involved, for example, cement, steel, oil fuel, pipe materials (e.g. PVC, uPVC, concrete and/or steel). Also, large quantities of local materials, e.g. sand, gravel will be involved. If not well stored and utilized, as well as instituting management measures for waste materials, they can contaminate the environment	A8-1: Consider environmental performance of suppliers of raw material in the selection process. A8-2: Explore ways of reducing raw material use. A8-3: Special emphasis should be made on raw materials that may be reused and/or recycled/recovered.	-List of suppliers for raw materials -Records of raw materials used	0 (SWMP details A8-2 and A8-3)	0	Contractor	MEO
A9: Public health problems	Pools of stagnant water may form in pits, holes and excavated ditches which can create suitable habitats for insect disease vectors such as mosquitoes.	A9-1: Fill up all depressions to avoid pools of stagnant water that may form in pits, holes and excavated ditches which can create suitable habitats for insect disease vectors such as mosquitoes which cause malaria.	-All excavated potential depressions re-instated, filled and re-vegetated.	5,000,000	5,000,000	Contractor	Respective LC 1 Councils MEO
	People may fall in ditches and be injured	A9-2: Mark all dangerous areas and fence them off. A9-3: Restrict access to work areas by unauthorized persons	-All dangerous areas fenced off and warning signs -Written communication to neighbouring communities -Security guards to	1,000,000 (yearly)	4,000,000	Contractor	Respective LC 1 Councils MEO, NWSC

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$.)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
			restrict access				
A10: Occupational health and safety	Exposure of workers to occupational health and safety hazards from activities such as: excavations; working with heavy equipment; working under noisy conditions, working in confined spaces; lifting of heavy objects; storage, handling and use of hazardous substances and wastes.	A10-1: Ensure that work sites (especially excavation works), especially in the night have proper protection with clear marking of safety borders and signals and fence off all dangerous areas.	-Written down Health and Safety Management Plan (HSMP) including the suggested mitigation measures with a HSMP Committee to oversee its implementation	5,000,000	5,000,000	Contractor	Arua Municipality Labour Officer (MLO), MEO
		A10-2: Inform riparian neighbours about the construction programme in advance.	-Written communication to neighbouring communities -Receipts from radio stations for announcement	As in A7-2	As in A7-2	Contractor	Respective LC 1 Councils, MEO
		A10-3: Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits.	-Presence of security guards	As in A9-2	As in A9-2		Respective LC 1 Councils, MEO
		A10-4: Train five NWSC staff and AMC staff in Environment and Safety	-Presence of trained staff in E&S	10,000,000 (Yearly for 3 years)	30,000,000		
A11: Increased vehicular traffic	Increase in the likelihood of accidents within and around the vicinity of water works area.	A11-1: Inform local communities about the construction programme in advance. A11-2: In case access roads have to be closed, inform local communities and road users in advance.	-Written communication to neighbouring communities -Receipts from radio stations for announcements	As in A7-2	As in A7-2	Contractor	Uganda Police
		A11-3: Use reflective signature to direct traffic to designated areas. A11-4: Use flag men to give directions to traffic. A11-5: Install speed reduction humps at crossings of many people, e.g. at a school, market.	-Traffic Management Plan (TMP) in place -Record of vehicular accidents and incidents	10,000,000	10,000,000	Contractor	Respective LC 1 Councils, MEO, Uganda police
		A11-6: Sensitize drivers to observe speed limits	Sensitization reports	100,000	1,000,000	Contractor	NWSC
A12: Visual amenities	Construction sites, if not well managed, have impacts on aesthetics of	A12-1. Do not pile excavated soil to form high stockpiles for long durations, A12-2: Clean up the site upon completion	Cleared and restored site	0	0	Contractor	Respective LC 1 Councils, MEO, NWSC

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (UShs.)	ESTIMATED TOTAL COST (UShs	RESPONSIBILITY	MONITORING INSTITUTION
	the surroundings with the possibility to affect the neighbouring residents of the WTW with moderate view point.	of the work.					
A13: Disturbance and interruption of commercial and social activities	Interference with commercial and social activities.	A13-1: Inform local communities about the construction programme in advance. A13-2: In case access roads have to be closed, inform local communities in advance. A13-3: Clean and maintain access roads in the neighbourhood of earth and sand on a daily basis. A13-4: Provide temporary access ways with the approval of local authorities where access roads are closed. A13-5: Carry out work under mild weather (not strong rains or winds). A13-6: Reduce obstruction of access to and use and occupation of roads, footpaths and bridges. A13-7: Protect any items and/or sites of archaeological or cultural value (e.g. private graveyards) discovered during works with the aid of the appropriate authorities.	-Written communication to neighbouring communities - Presence of access roads - Refer also to TMP A11-3 to A11-5 - Record of protection and/or compensation of items of cultural values	(see A7-2, A11-3 to A11-5)	(see A7-2, A11-3 to A11-5)	Contractor	Respective LC 1 Councils Arua Municipality Welfare Officer, Traffic police, NWSC
Disruption of social order	Influx of people in the area may affect the local economy, cause alteration of culture and introduce behavioural changes	A14-1: Sensitize all workers to ensure awareness of and sensitivity to the local cultures, traditions and lifestyles, A14-2: Implement the HIV/AIDS impact mitigation plan that will involve providing a comprehensive range of services .	Record of sensitization sessions	2,000,000 (yearly)	8,000,000	Contractor	MEO/ Municipal Health Office
		A14-3: HIV/AIDS sensitisation, identification of possible HIV/AIDS cases, testing with pre- and post-counseling, the treatment of associated infections, referral of appropriate cases, education to promote better quality of life and promotion of precautions, provision of condoms and the application of HIV occupational exposure policies (this applies to the whole project cycle).	Receipts	10,000,,000 (yearly)	100,000,000,000	Contractor	MEO
Operation and Maintenance(waterworks, construction of reservoirs, storage tanks and Waste stabilization ponds)							
B1: Air pollution	Emissions from generators	B1-1: Same as in construction phase, but in relation to generators and pumping	Logs of maintenance schedules	5,000,000 (Annually)	5,000,000	NWSC	Respective LC 1's Municipality Water

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$.)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
		stations					Officer
B2: Noise pollution	Intermittent noise from generators	B2-1: Same as in construction phase, but in relation to generators and pumping stations	Logs of maintenance schedules	Included in B2-1	Included in B2-1	NWSC	MEO
B3: Water pollution	Water pollution from discharge of sludge from sedimentation tanks, containing alum; backwash water may contain silt and dirt; insufficiently treated effluents may pollute receiving water bodies	B3-1: Same as in construction phase; and in addition: B3-2: Routine inspections and monitoring the treatment performance of WTP and also of Waste water treatment plant.	Inspection reports	0	0	NWSC	NEMA/WID
		B3-3: Treatment and disposal of screenings	Reports of amounts of screenings disposed	1,000,000 (Annually)	1,000,000	NWSC	NEMA/WID
		B3-4: Monitoring water quality of receiving water bodies	Water quality monitoring reports	15,000,000 (Annually)	15,000,000		
		B3-5: Implement of Strategy for protection and management of River Enyau and its banks (2010)	Reports of meetings, workshops, seedlings planted	20,000,000 (Annually for 3 years)	60,000,000	AMC and NWSC	NEMA/AMC
B4: Solid waste generation	Little amounts of wastes, for example, used containers and packaging of alum and chlorine	B4-1: NWSC should prepare a Solid Waste Management Plan, which NWSC or the operator of the system should implement	SWMP in place and implemented, neat premises	0	0	NWSC	MEO/NEMA
B5: Impacts on flora and fauna	Discharge of sludge, back washwater and treated waste water effluent may affect flora and fauna	B5-1: Same as in construction phase	Monitoring reports of treatment efficiency and disposal of screenings, sludge and backwash water	0	0	NWSC	MEO/NEMA
B6: Storage and handling of chemicals	Storage of alum and especially chlorine may rust their holding metallic containers, and even rooftops, if they are made of iron.	B6-1: Storage containers should be checked regularly for leakage. If any leakage is detected, the chemical should be removed and it should be repaired and if it cannot be repaired, it should be put out of use and disposed according to NEMA regulations regarding disposal of solid wastes containing hazardous materials	Inspection reports	0	0	NWSC	MEO/NEMA
		B6-2: Alum and chlorine should be stored in leak proof containers	Neat storage containers	0	0		MEO/NEMA
		B6-3: Clay tiled roofs or concrete C25 should be preferred against iron sheet roofing.	Neat roof	0	0		MEO/NEMA
B7: Occupational	Exposure of workers to occupational health and	B7-1: Same as in construction phase	Availability of protective wear, e.g.	5,000,000 (Annually)	5,000,000	NWSC	MEO/NEMA

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$.)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
health and safety	safety hazards from working with chemicals, cleaning and disposal, closing and opening of valves Failure to achieve desired public health associated potable water supply	B7-2: Sensitize local communities about personal hygiene and cleanliness of water sources	gloves, overalls, masks, helmets etc. Use clean water containers for collecting water and home use	1,000,000 (annually for 3 years)	3,000,000	AMC and NWSC	MEO/NEMA
B8: Obnoxious smells	Waste stabilization ponds may smell, especially when there is wind blowing towards residential areas and roads	B8-1: The area of the waste stabilization should be fenced off by a hedge of not less than 1 meter high in order to prevent the wind blowing and sending off obnoxious smells to neighbouring communities,	Fenced area of waste stabilization pond	50,000 (Per LM, for approximately 800 m per pond area, i.e., times two)	80,000,000	Project/Contractor	MEO/NEMA
		B8-2: The sewage treatment plant should be operated according to the procedures to be provided by the design team	Well maintained and operated sewage treatment plant	40,000,000 (Annually)	40,000,000	NWSC	MEO/NEMA
		B8-3: The screenings and the sludge from the anaerobic pond should not be scattered around the site.	WSPs clear of screenings and sludge	2,000,000 (Annually)	2,000,000	NWSC	MEO/NEMA
B9: Public health of people and animals	Animals and people (especially children) may play around the area of waste stabilization ponds. Animals may feed on grass growing on the embankments of the waste stabilization ponds	Entry into the area of the waste stabilization should be restricted to animals and people, so that no persons or animals should enter without the permission and presence of the operator	Fenced area of waste stabilization pond	See B8-1	See B8-1	See B8-1	See B8-1
		The compound and grass in the area of waste stabilization ponds should be properly maintained so that the area does not become bushy to harbour dangerous snakes, mosquitoes and other dangerous terrestrial and aquatic species.	A well maintained compound	12,000,000 (Annually)	12,000,000 (Annually)	NWSC	MEO/NEMA
B10: Storage and handling of tools	Storage and handling of tools, e.g. sewer rodding snakes, spades, wheel barrows, spanners etc may contaminate the stores and pose hazards to the workers.	B10-1: Tools used in sewers, manholes and sewage treatment plant should not be scattered in the environment. Rather, they should be kept in dedicated stores.	Well maintained equipment	10,000,000 (Annually for maintenance)	10,000,000	NWSC	MEO/NEMA
		B10-2: After using the equipment, they should be cleaned thoroughly and	Well cleaned equipment and	1,000,000	1,000,000	NWSC	MEO/NEMA

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (UShs.)	ESTIMATED TOTAL COST (UShs)	RESPONSIBILITY	MONITORING INSTITUTION
		disinfected so that they do not disperse pollutants during transportation back to the stores	presence of disinfectants				
		B10-3: The storage areas of the equipment used in manholes and sewers, or to carry hazardous material, e.g. sewer rodding snakes, spades, wheel barrows, spanners should be adequately disinfected.	Well cleaned store and presence of disinfectants	Included in B10-2	Included in B10-2	NWSC	MEO/NEMA

Table 9-3: EMP for borehole development

PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (UShs)	ESTIMATED TOTAL COST (UShs)	RESPONSIBILITY	MONITORING INSTITUTION
C: Construction Phase							
C1: Air pollution	Emissions from vehicles and construction equipment.	C1-1: Maintain vehicle and equipment according to manufactures' specifications. C1-2: Use standard fuel and lubricants.	- Record of repairs - Fuels and lubricants conforming to specifications	1,500,000 monthly	21,000,000 for seven boreholes – 2 months	Contractor	Arua Municipality Environment Officer (MEO)
		C1-3: Sprinkle dust to reduce and prevent dust during dry weather periods.	- Record of water sprinkling	300,000	600,000	Ditto	Ditto
		C1-4: Clean access routes in surrounding area daily to prevent dust	- Record of cleaning	600,000 (monthly salary for 2 cleaners)	1,200,000	Ditto	Ditto
C2: Noise pollution	Intermittent noise from borehole nuisance to sensitive receptors	C2-1: Minimise noise according to NEMA, Uganda standards. C2-2: Control noise and vibration on site. C2-3: Install adequate noise prevention devices, e.g. mufflers on noise generating sources	-Noise making machines/equipment fitted with mufflers -Record of noise measurements	1,500,000	3,000,000	Contractor	Respective LC 1Councils MEO
		C2-4: Maintain vehicle and equipment according to manufactures' specifications.	Record of vehicle maintenance	Included in C1-1		Ditto	Ditto
		C2-5: Work programmes that have to be strictly followed should be provided to local communities.	-Work schedules	0	0	Ditto	Ditto
		C2-6: Switch off engines of vehicles and	-Equipment log	0	0	Ditto	Ditto

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
		machinery while not in use.	sheets				
		C2-7: Provide information to the local communities (e.g. through the LC system or local radio (FM) stations) with regard to work programme, and strict adherence to such.	- Receipts from radio stations for announcements made	300,000	600,000	Ditto	Ditto
C3: Water pollution	Water pollution from waste disposal, accidental spillage of fuel, lubricants, other drilling chemicals and agrochemicals	C3-1: Ensure no solid waste, fuels or oils are discharged into water flows. C3-2: Test water samples from well testing for contaminants according to NEMA, Uganda standards for discharge of effluents guidelines, which when exceeded, advice on appropriate discharge should be sought. C3-3: Drilling methods should follow standard procedures to prevent groundwater contamination during the process.	-Results of water quality analysis -Logs of drilling methods	1,800,000 (one time sampling)	1,800,000	Contractor	MEO
		C3-4: Hold and store sanitary and cleaning wastes in appropriate containers to be disposed of at approved sites.	-Records of generated sanitary and cleaning wastes	600,000 (monthly salary for 2 cleaners)	1,200,000	Ditto	Ditto
		C3-5: Park vehicles preferably on paved platforms. C3-6: Fuel storages should not leak, and should be periodically monitored, and repaired or replaced when necessary. C3-7: Sites for cleaning, fuelling and maintaining vehicles should be able to prevent leakage(e.g. paved). C3-8: Maintain, fuel and clean vehicles and equipment at workshops/sites with adequate leakage prevention (e.g. impermeable surface, settlers and oil separator).	-Monitoring reports on status of fuel storages	10,000,000 (lumpsum for parking and storage areas)	10,000,000	Ditto	Ditto
C4: Soil erosion and contamination	Contamination from accidental or structural spillage of fuels, lubricants, chemicals and sanitary wastewater or from	C4-1: Carry out work under mild weather (not strong rains or winds). C4-2: Remove and store topsoil stored in separate piles and reinstate after refilling of trenches, to enable natural re-vegetation.	-Stockpiles of topsoil	Part of contract	0	Contractor	Respective LC 1 Councils MEO

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
	leakage from inadequately protected solid waste storage facilities and sites.	C4-3: The Contractor(s) should present procedures for, and ensure implementation of measures to protect soils from any accidental or structural contamination. These include: -Storing all hazardous, sanitary and cleaning wastes in facilities approved by NEMA, Uganda. -Installing leak-proof fuel storages on concrete platform with gutters and grease separators, which are monitored periodically and repaired or replaced when required. -Strictly enforce and monitor standard procedures for storing and handling hazardous wastes and raw material (e.g. fuel or chemicals). -Placing strong drums for oil storage on impermeable floors in the stores. -Providing appropriate hoses for refuelling of pumps and vehicles. -Parking vehicles on paved platforms whenever possible -Ensuring sites for cleaning, fuelling and maintaining equipment and vehicles are able to prevent leakage (e.g. paved or with settlers). -Treatment of wastewater from maintenance workshops in oil separators before discharge to sewers.	-Written down soil protection measures and record of implementation	15,000,000 (lump sum)	15,000,000	Ditto	Ditto
		C4-4: Contaminated soil should be isolated and treated/disposed of in a way that will depend on the contaminant type.	-Results of chemical analysis of treated soils	5,000,000 (for soil treatment and chemical analysis of soils)	5,000,000	Ditto	Ditto
		C5-1: The Contractor should prepare a Solid Waste Management Plan, which should contain: o An inventory of the types and quantities of waste to be	-Written down Solid Waste Management Plan (SWMP) and implementation schedule	4,000,000 (Lump sum for preparing SWMP)	4,000,000	Contractor	MEO
C5: Solid waste generation	Cleared trees will compromise aesthetic value of the sites; domestic waste from camps and drilling spoil						

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
	may contaminate soil and water resources	produced. -The most appropriate waste management approach for each type of waste including details on (temporary) storage, transport and final destination of the waste. -An assessment of any opportunities for reducing solid waste generation, in particular of hazardous and undesirable (persistent and non-reusable) types of wastes.					
		C5-2: The Contractor should maintain records of types, quantities, origin, (temporary) storage, transport and elimination/reuse of solid waste, and make these available to the works supervisor upon his request, as proof of proper waste management practices. C5-3: Any waste including excess soil should be disposed of at gazetted sites. The solid waste shall not be allowed to accumulate on site, to cause odour, fly, or rodent problems. C5-4: Excavated soils should be reused as much as possible as filling material.	-Records of types of wastes generated, transport and delivery to gazette sites	1,500,000 per month	3,000,000	Ditto	Ditto
		C5-5: Use licensed recycling companies to externally recycle, recover or dispose off waste.	-Contracts with licensed waste disposal/recycling firms	Included in C5-2 above	Included in C5-2 above	Ditto	Ditto
		C5-6: Provisional material storage on site should be designed and undertaken in such a way as to ensure that soils and underground water are not polluted.	-Sealed storage containers	300,000 per month	600,000	Ditto	Ditto
C6: Impacts on flora and fauna	Loss of vegetation and associated fauna at drill site	C6-1: Zone out working areas out to reduce ecological destruction. C6-2: Seek consent from NFA, to clear and cut down trees and pay the appropriate fees.	-Zoned out areas -Permits from NFA	0	0	Contractor	Respective LC 1 Councils Arua Municipality Forestry Officer (MFO) and MEO
		C6-3: Restore disturbed natural sites through environmental rehabilitation, restoring top soils and (re-) introduction of genetic species to re-	-Disturbed sites restored after well completion	2,000,000 (lump sum)	2,000,000	Ditto	Ditto

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
		establish the natural local ecology.					
C7: Raw material use	Materials if not reusable may cause aesthetic intrusion and some may be harmful to the environment	C7-1: Consider environmental performance of suppliers of raw material in the selection process. C7-2: Explore ways of reducing raw material use. C7-3: Special emphasis should be made on raw materials that may be reused and/or recycled/recovered.	-List of suppliers for raw materials -Records of raw materials used			Contractor	MEO
C8: Public Safety	Excavations, and transportation, movement of heavy equipment as well as obstructions of roads may pose a safety risk to the general public	C8-1: Ensure that work sites (especially excavation works), especially in the night have proper protection with clear marking of safety borders and signals and fence off all dangerous areas.	-Demarcated work sites and signals	1,000,000 (lump sum)	1,000,000	Contractor	MEO
		C8-2: Inform riparian neighbours about the construction programme in advance.	-Written communication to neighbouring communities	0	0	Ditto	Ditto
		C8-3: Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits.	-Security guards to restrict access	600,000 (salary for 2 guards per site for two months)	1,200,000	Ditto	Ditto
C9: Public health problems	Pools of stagnant water may form in pits, holes and excavated ditches which can create suitable habitats for insect disease vectors such as malaria.	C9-1: Ensure that work sites (especially excavation works), especially in the night have proper protection with clear marking of safety borders and signals and fence off all dangerous areas.	-All dangerous areas fenced off and warning signs	Costs included in C8-1	Costs included in C8-1	Contractor	Respective LC 1 Councils MEO
		C9-2: Inform riparian neighbours about the construction programme in advance. C9-3: Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits	-Written communication to neighbouring communities -Security guards to restrict access	Costs included in C8-3	Costs included in C8-1	Ditto	Ditto
C10: Occupational health and safety	Exposure of workers to occupational health and safety hazards from activities such as: excavations; working with heavy equipment; working under noisy conditions., working in confined spaces; lifting	C10-1: The Contractor should prepare and implement specific health and safety measures, and present these in a Health and Safety Management Plan. Measures should include (but not be restricted to): -The use of personal protection equipment by employees and particularly helmets and protective shoes.	-Written down Health and Safety Management Plan (HSMP) including the suggested mitigation measures with a HSMP Committee to oversee its implementation	5,000,000 (lump sum for designing and implementing HSMP)	5,000,000	Contractor	Arua Municipality Labour Officer (MLO) MEO

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
	of heavy objects; storage, handling and use of dangerous substances and wastes	-The use of hearing protection equipment when working under noisy conditions. -Adequate health and safety training of all employees, including training on specific procedures as appropriate to various individual staff groups. -Adequate medical testing and insurance for all employees. -Appropriate fire fighting equipment, collecting trays and absorbent material should be in place at fuel storage tanks. -First Aid box at each borehole. -Medical emergency evacuation plans for different types of incidents and injuries that might occur. -Provision of adequate sanitary facilities at construction sites. -Outlining procedures for working with heavy equipment. -Procedures for heavy lifting. -Provision adequate waste and material storage facilities whose access should be restricted.					
		C10-2: Basic rules with regard to protection of public health, including especially hygiene and disease (HIV) prevention.	-Written down procedures	0	0	Ditto	Ditto
C-11: Increased vehicular traffic	Increase in the likelihood of accidents within the borehole construction locations.	C11-1: design and implement a traffic management plan to regulate traffic in and out of the plant	-Traffic Management Plan (TMP) in place	500,000 (lump sum to design and implement TMP)		Contractor	Uganda Police
		C11-2: all drivers to strictly abide by Traffic Regulations C11-3: speed limits to be strictly observed	-Record of vehicular accidents and incidents	0	0	Ditto	Ditto
C12: Visual amenities	Impairment of aesthetic value from cleared surfaces, poor housekeeping etc.	C12-1: Rehabilitate the site on well completion. C12-2: Keep disturbance to a minimum	-Restored site	1,000,000 (lump sum for rehabilitation of 2 sites)	1,000,000	Contractor	Respective LC 1 Councils Arua Municipality Forestry Officer (MFO) and MEO
C13: Disturbance and interruption of	Interfere with commercial and social	C13-1: In case block access roads have to be closed, inform local communities in	-Written communication to	Costs of cleaning included in C1-4	Costs of cleaning	Contractor	Respective LC 1 Councils

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
commercial and social activities	activities	advance. C13-2: Clean and maintain access roads in the neighbourhood of earth and sand and maintained on a daily basis. C13-3: Carry out work under mild weather (not strong rains or winds).	neighbouring communities		included in C1-4		Arua Municipality Welfare Officer
		C13-4: Provide temporary access ways with the approval of local authorities where access roads are closed. C13-5: Reduce obstruction of access to and use and occupation of roads, footpaths and bridges.	-Presence of access roads	Part of contract of borehole construction	Part of contract of borehole construction	Ditto	Ditto
		C13-6: Protect any items and/or sites of archaeological or cultural value (e.g. private graveyards) discovered during works with the aid of the appropriate authorities.	-Record of protection/compensation of items of cultural values	To depend on sites discovered	To depend on sites discovered	Ditto	Ditto
D: Operation and Maintenance							
D1: Conflicting demands for water use	Groundwater abstraction may lead lowering of local water table levels hence reduction in water supply which may pose a serious risk of conflicts between various water uses such as for domestic, irrigation use and other purposes	D1-1: Conduct a detailed hydrogeological investigation, including test pumping and drilling to determine safe yield of the boreholes to be developed without exceeding recharge rates or depriving other users (e.g. agriculture).	-Hydrogeological investigation report	Hydrogeological investigation to be separate contract		NWSC	Municipality Water Officer
		D1-2: Adequately co-ordinate with other water users, especially the catchment management committees in accordance with the groundwater abstraction permit regulations of the Directorate of Water Resources Management	-Minutes of meetings with other water users	0	0		Respective LC 1's Municipality Water Officer
D2: Noise pollution	Noise from pumps, which can be a nuisance to sensitive receptors such as local communities and/or fauna.	D2-1: Keep pump house noise levels and vibrations to a minimum using where necessary noise prevention measures such as mufflers.	-Records of noise measurement -Noise generating sources fitted with noise reduction devices	500,000 (every six months for fitting noise reduction devices	2,000,000 p.a.	Contractor NWSC	MEO
		D2-2: Properly maintain equipment according manufacturers' specifications and put in place a periodical repair/revision programme.	-Record of vehicle/equipment maintenance	300,000 monthly	3,600,000 p.a.	Ditto	Municipal Water Officer
D3: Public health risks from contaminated water	Water contamination from natural, accidental, structural and can cause health	D3-1: Ensure good housekeeping at the borehole. D3-2: Follow standard operation and maintenance of the borehole and related	-Record of borehole maintenance	400,000 monthly for borehole repair	4,800,000 p.a.	Contractor NWSC	Respective LC 1's Municipality Water Officer

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
	risks to water users. This may be from pit latrines, poor waste disposal practices, agro-chemicals or from the rocks forming the aquifers.	equipment (pumps).					
		D3-3: Regularly monitor water quality for any contamination following well completion, e.g. at least on weekly basis for the first year of operation.	-Water quality monitoring reports	3,000,000 annually	3,000,000	Ditto	Municipality Water Officer
		D3-4: Involve the public in the detection of potential contamination through awareness creation and opening of a complaint desk.	-Minutes of sensitization meetings with local communities	600,000 annually for facilitation	600,000	Ditto	Respective LC 1's Municipality Water Officer

Table 9-4: EMP for laying of transmission lines from the boreholes to either the WTW, or a storage tank

PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
E. Construction							
E1: Air pollution	Pollution as a result of emissions from construction vehicles and equipment	E1-1: Maintain vehicle and equipment according to manufactures' specifications. E1-2: Use standard fuel and lubricants.	-Record of repairs -Fuels and lubricants conforming to specifications.	3,000,000 monthly	36,000,000 p.a.	Contractor	MEO
		E1-3: Sprinkle dust to reduce and prevent dust during dry weather periods.	-Record of water sprinkling	300,000 monthly	3,600,000 p.a.	Ditto	Respective LC 1 Councils MEO
		E1-4: Clean access routes in surrounding area on a daily basis to prevent dust.	-Record of cleaning	600,000 monthly for salaries	7,200,000 p.a.	Ditto	Respective LC 1 Councils MEO
E2: Noise pollution	Noise pollution heavy vehicles and construction equipment may cause nuisances to sensitive receptors.	E2-1: Minimise noise according to NEMA, Uganda standards. E2-2: Control noise and vibration on site.	-Record of noise measurements	1,500,000 p.a for noise measurements	1,500,000	Contractor	Respective LC 1 Councils MEO
		E2-3: Maintain vehicle and equipment according to manufactures' specifications.	-Record of vehicle maintenance	Included in E1-1	Included in E1-1	Ditto	Ditto
		E2-4: Work programmes that have to be	-Work schedules	0	0	Ditto	Ditto

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
		strictly followed should be provided to local communities.					
		E2-5: Install adequate noise prevention devices, e.g. mufflers on noise generating sources. Switch off engines of vehicles and machinery while not in use.	-Noise making machines/equipment fitted with mufflers	3,000,000 (lump sum)	3,000,000	Ditto	Ditto
		E2-6: Provide information to the local communities (e.g. through the LC system or local radio (FM) stations) with regard to work programme, and strict adherence to such.	-Receipts from radio stations for announcements made	300,000 p.m.	3,600,000 p.a.		
E3: Water pollution	Water pollution may result from wastewater from construction camps; accidental spillage of fuels, lubricants and other chemicals; siltation of water courses from runoff laden sediment and dust	E3-1: Ensure no solid waste, fuels or oils are discharged into water flows. E3-2: Test water samples from dewatering operations for contaminants according to NEMA, Uganda standards for discharge of effluents guidelines, which when exceeded, advise on appropriate discharge should be sought.	-Results of water quality analysis	4,000,000 p.a. for water testing	4,000,000	Contractor NWSC	MEO
		E3-3: Hold and store sanitary and cleaning wastes in appropriate containers to be disposed of at approved sites.	-Monitoring reports on sanitary and cleaning wastes	6,000,000 p.a. for disposal	6,000,000	Contractor	Ditto
		E3-4: Park vehicles preferably on paved platforms. E3-5: Fuel storages should not leak, and should be periodically monitored, and repaired or replaced when necessary. E3-6: Sites for cleaning, fuelling and maintaining vehicles should be able to prevent leakage (e.g. paved). E3-7: Maintain, fuel and clean vehicles and equipment at workshops/sites with adequate leakage prevention (e.g. impermeable surface, settlers and oil separator).	-Monitoring reports on status of fuel storages	Maintenance included in E1-1 Lump sum of 10,000,000 p.a. for other measures	10,000,000	Ditto	Ditto
E4: Soil erosion and contamination	Site clearance of vegetation and excavation works using heavy equipment may induce/accelerate soil erosion and siltation of water courses and gardens.	E4-1: Carry out work under mild weather (not strong rains or winds). E4-2: Remove and store topsoil stored in separate piles and reinstate after refilling of trenches, to enable natural re-vegetation.	-Stockpiles of topsoil	Part of contract on pipeline construction	0	Contractor	Respective LC 1Councils MEO
		E4-3: The Contractor(s) should present procedures for, and ensure	-Written down soil protection measures	(Included in E3-6)	(Included in E3-6)	Ditto	Ditto

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PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
	Contamination may occur as a result of accidental or structural spillage of fuels, lubricant chemicals, sanitary wastewater, etc., as well as from leakage from inadequately protected solid waste storage facilities and sites	implementation of measures to protect soils from any accidental or structural contamination. These include: -Installing leak-proof fuel storages on concrete platform with gutters and grease separators, which are monitored periodically and repaired or replaced when required. -Placing strong drums for oil storage on impermeable floors in the stores. -Ensuring sites for cleaning, fuelling and maintaining equipment and vehicles are able to prevent leakage (e.g. paved or with settlers).	and record of implementation				
		E4-4: -Storing all hazardous, sanitary and cleaning wastes in facilities approved by NEMA, Uganda. -Strictly enforce and monitor standard procedures for storing and handling hazardous wastes and raw material (e.g. fuel or chemicals). -Providing appropriate hoses for refuelling of pumps and vehicles. -Parking vehicles on paved platforms whenever possible -Treatment of wastewater from maintenance workshops in oil separators before discharge to sewers.		20,000,000 (Lump sum)	20,000,000 p.a.	Ditto	Ditto
		E4-5: Contaminated soil should be isolated and treated/disposed of in a way that will depend on the contaminant type.		15,000,000 for treatment and analysis of soil	15,000,000 p.a.	Ditto	MEO
E5: Solid waste generation	Solid waste generated from clearing of trees and bush on pipeline route as well as excess soil or garbage dumped along the trenches and from household wastes from	E5-1: The Contractor should prepare a Solid Waste Management Plan, which should contain: -An inventory of the types and quantities of waste to be produced. -The most appropriate waste management approach for each	-Written down Solid Waste Management Plan (SWMP) and implementation schedule	3,000,000 (lump sum for developing SWMP)	3,000,000	Contractor	MEO

ESIA for Arua Water Supply and Sanitation Project

PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
	construction camps can cause soil and water pollution as well as compromising aesthetic value	type of waste including details on (temporary) storage, transport and final destination of the waste. -An assessment of any opportunities for reducing solid waste generation, in particular of hazardous and undesirable (persistent and non-reusable) types of wastes.					
		E5-2: The Contractor should maintain records of types, quantities, origin, (temporary) storage, transport and elimination/reuse of solid waste, and make these available to the works supervisor upon his request, as proof of proper waste management practices.	-Records of types of wastes generated, transport and delivery to gazette sites	300,000 p.m. for person recording	3,600,000 p.a.	Contractor NWSC	MEO
		E5-3: Any waste including excess soil should be disposed of at gazetted sites. The solid waste shall not be allowed to accumulate on site, to cause odour, fly, or rodent problems	-Records of wastes delivered to gazette sites	12,000,000 (lump sum for waste disposal)	12,000,000	Ditto	Ditto
		E5-4: Excavated soils should be reused as much as possible as filling material.	-No soil stockpiles	Part of contract for laying pipelines	0	Contractor	Ditto
		E5-5: Provisional material storage on site should be designed and undertaken in such a way as to ensure that soils and underground water are not polluted.	-Sealed waste containers	300,000 p.m.	3,600,000 p.a.	Ditto	Ditto
		E5-6: Use licensed recycling companies to externally recycle, recover or dispose off waste.	-Contracts with licensed waste disposal/recycling firms	Included in E5-3.		Contractor NWSC	Ditto
E6; Impacts on flora and fauna	Removal of natural vegetation may lead to potential habitat loss of its associated fauna.	E6-1: Zone out working areas to reduce ecological destruction.	-Zoned out areas -Permits from NFA	Contract for pipe laying		Contractor	Arua Municipality Forestry Officer (MFO) and MEO
		E6-3: Restore disturbed natural sites through environmental rehabilitation, restoring top soils and (re-) introduction of genetic species to re-establish the natural local ecology.	-Disturbed sites restored after well completion	5,000,000 (lump sum)	5,000,000	Ditto	Respective LC 1 Councils MEO
E7: Public health problems	Public health problems may occur in the case of badly managed construction camps	E7-1: Ensure sufficient sanitary facilities are provided on sites and offices.	-Sanitary facilities on site	15,000,000 per facility	To depend on number of camps	Contractor	Respective LC 1 Councils MEO Municipal Health Labour Officer

ESIA for Arua Water Supply and Sanitation Project

PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
	and work sites. These include: Pools of stagnant water may be a source of water borne diseases Poor hygiene in camps	E7-2: Encourage use of local labour wherever possible, with imported labourers facilitated with proper housing, including sanitary facilities	-Number of workers recruited from communities	To depend on positions that will be available		Ditto	Municipal Health Labour Officer
		E7-3: Ensure all labourers follow basic rules with respect to protection of public health (including hygiene and disease prevention).	-Written rules on public health protection and their implementation	0	0	Ditto	Municipal Health Labour Officer MEO
		E7-4: Carry out proper maintenance of sites (levelling of the surface) and through the removal of water from ditches after rainfall or groundwater infiltration to limit standing water on construction sites.	-Well maintained sites with no trenches and stagnant water	Part of contract of pipe laying		Ditto	MEO
E8: Public Safety	Safety problems at the construction sites may arise from excavations, transportation and movement of Manually executed works expected to dominate the pipeline laying will take a longer construction time leading to prolonged safety risks such as falling into trenches	E8-1: Ensure that work sites (especially excavation works), especially in the night have proper protection with clear marking of safety borders and signals and fence off all dangerous areas. E8-2: Inform riparian neighbours about the construction programme in advance.	-All dangerous areas fenced off and warning signs -Written communication to neighbouring communities	20,000,000 (lump sum for fencing camps)	20,000,000	Contractor	Respective LC 1 Councils MEO
		E8-3: Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits	-Security guards to restrict access	300,000 p.m. (salary for guard)	To depend on number of sites	Ditto	Ditto
		E8-4: Implement appropriate traffic plans with the help of local police when (partial)closure of roads is required.	-Traffic plans in place	Part of contract of laying pipelines			
E9: Visual amenities	Laying of pipelines may have a negative impact on aesthetics of the surroundings such as the soils from the trenches that will be dumped along the trenches	E9-1: Limit size of construction sites and camps. E9-2: Conserve vegetation around construction sites to serve as visual shields. E9-3: Ensure good housekeeping for adequate organisation and maintenance of construction sites	-Visual shields made up of vegetation -Good housekeeping practices	0	0	Contractor	Respective LC 1 Councils MEO
		E9-4: Restore construction sites (buried trenches) restored immediately upon completion of works.	-Restored site	Part of contract of laying pipelines			
E10: Disturbance and interruption of commercial and social activities	Improper laying of pipelines may cause traffic disruptions and congestion, resulting in temporary disturbance and interruption of	E10-1: Inform local communities (e.g. through the LC system or FM radio stations) about the construction programme in advance. E10-2: Minimise relocation as much as possible and where necessary implement	-Receipts from radio stations for announcements made -Written communication to	Included in E2-6.			

ESIA for Arua Water Supply and Sanitation Project

PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
	commercial and social activities. It may also cause damage to infrastructure (roads, utility lines) and disruption of public services	the RAP. E10-3: Minimise temporary interference with private property (e.g. pipeline crossings over private lands) as much as possible.	neighbouring communities				
		E10-4: Pay agreed compensation where there is any affected private land or other property prior to construction in accordance with the RAP. E10-5: Inform local communities need about any partial (blockage) of roads in advance however temporary it may be	-Record of protection and/or compensation for affected communities and agreements for compensation	To depend on number of people and property to be compensated		Contractor	Tororo District Local Council
		E10-5: Clean and maintain access roads in the neighbourhood work sites of earth and sand on a daily basis	-Record of cleaning	Included in E1-4.		Ditto	Respective LC 1 Councils MEO
		-Provide temporary access ways with the approval of local authorities where access roads are closed -Carry out work under mild weather (not strong rains or winds). -Reduce obstruction of access to and use and occupation of roads, footpaths and bridges.	-Presence of access roads	Part of contract for laying pipelines		Ditto	Respective LC 1 Councils Uganda Police
		-Protect any items and/or sites of archaeological or cultural value (e.g. private graveyards) discovered during works with the aid of the appropriate authorities.	-Minutes of sensitisation meetings with communities	To depend on sites discovered		Ditto	Respective LC 1 Councils Arua Municipality Welfare Officer
		-Choose the final pipeline alignment so that the period of realization of branch connections and fittings is short enough.	-Change in design	To be determined after change in design has been agreed upon		Ditto	Municipality Welfare Officer
E11: Occupational health and safety	Workers may be exposed to occupational health and safety hazards from project activities such as: accidents in excavations; working with heavy equipment; working under noisy conditions., working in confined spaces; lifting of heavy objects; storage, handling and	E11-1: The Contractor(s) should prepare and implement specific health and safety measures, and present these in a Health and Safety Plan. Measures should include (but not be restricted to): -The use of personal protection equipment by employees and particularly helmets and protective shoes. -The use of hearing protection equipment when working under noisy conditions. -Adequate health and safety	-Written down Health and Safety Management Plan (HSMP) including the suggested mitigation measures with a HSMP Committee to oversee its implementation	20,000,000 (lump sum for designing and implementing HSMP)	20,000,000	Contractor	MEO Municipal Health Labour Officer

ESIA for Arua Water Supply and Sanitation Project

PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (US\$)	ESTIMATED TOTAL COST (US\$)	RESPONSIBILITY	MONITORING INSTITUTION
	use of dangerous substances and wastes	training of all employees, including training on specific procedures as appropriate to various individual staff groups. -Adequate medical testing and insurance for all employees. -Appropriate fire fighting equipment, collecting trays and absorbent material should be in place at fuel storage tanks. -Provision of rescue equipment and medical first-aid facilities at each site - Medical emergency evacuation plans for different types of incidents and injuries that might occur. -Provision of adequate sanitary facilities at construction sites. -Outlining procedures for working with heavy equipment. -Procedures for heavy lifting. -Provision of adequate waste and material storage facilities whose access should be restricted. -Basic rules with regard to protection of public health, including especially hygiene and disease (HIV) prevention.					
F. Operation and Maintenance							
F1: Alteration of natural drainage patterns	Drainage patterns of streams such as Oshow and Azita may be altered by laying of the pipelines; water flows may also be blocked which may affect other water users	F1-1: In areas where pipelines are above the water table, factor in geohydrological considerations and change alignment accordingly	-Change in design	To depend on final design		Contractor	Arua Municipality Water Officer
F2: Solid waste generation	Domestic waste from camps and spilt oils, chemicals	F2-1: Same as in construction but on a lower scale	-Solid Waste Management Plan in place and being and its implementation	1,500,000 p.a. (lump sum)	1,500,000 p.a.	Contractor	MEO

ESIA for Arua Water Supply and Sanitation Project

PHASE/ IMPACT TYPE	POTENTIAL IMPACT	MITIGATION MEASURES	MONITORING INDICATOR	ESTIMATED UNIT COST (UShs)	ESTIMATED TOTAL COST (UShs)	RESPONSIBILITY	MONITORING INSTITUTION
	during maintenance may contaminate soil and water resources						
F3: Air pollution	Emissions from vehicles and n equipment used in maintenance	F3-1: Same as in construction but on a lower scale	-Logs of maintenance schedules	500,000 p.m.	6,000,000 p.a.	Ditto	Ditto
F4: Noise pollution	Same as in construction phase	F4-1: Same as in construction but on a lower scale	-Logs of maintenance schedules	500,000 p.m.	6,000,000 p.a.	Ditto	Ditto
F5: Water pollution	Water pollution may result from wastewater from construction camps; accidental spillage of fuels, lubricants and other chemicals	F5-1: Same as in construction but on a lower scale	-Reports of water quality	2,000,000 p.a.	2,000,000	Ditto	Ditto
F6: Soil erosion and contamination	Contamination from oils, lubricants and chemicals during maintenance	F6-1: Same as in construction but on a lower scale	-Written down soil protection measures and record of implementation	Included in F2			
F7: Impacts on flora and fauna	Loss of vegetation and associated fauna at drill site	F7-1: Same as in construction but on a lower scale	-Disturbed sites restored after well completion	1,000,000 p.a.	1.000.000	Ditto	Municipal Forestry Officer
F9: Public health problems	Diseases that may arise out of maintenance activities	F9-1: Same as in construction but on a lower scale	-Written rules on public health protection and their implementation	0	0	Ditto	MEO
F10: Occupational health and safety	Exposure of workers to occupational health and safety hazards	F10-1: Same as in construction but on a lower scale	-Written down Health and Safety Management Plan (HSMP) including the suggested mitigation measures with a HSMP Committee to oversee its implementation	2,000,000	2,000,000	Ditto	MEO Municipality Labour Officer
F11: Disturbance and interruption of commercial and social activities	F11.1: Interfere with commercial and social activities	Same as in construction but on a lower scale	-Written communication to neighbouring communities about maintenance programme	2,000,000 lump sum	2,000,000	Ditto	Ditto

10 CONCLUSIONS AND RECOMMENDATIONS

This report presents a comprehensive (full) environmental and social impact assessment for the proposed Arua Water Supply and Sanitation Project, and proposed measures for mitigating the adverse impacts while enhancing the positive ones during the phases of construction, operation and maintenance. An evaluation of the possible alternatives for the project activities was also performed.

10.1 CONCLUSIONS

The anticipated benefits of the construction and operation and maintenance of the Arua Water Supply and Sanitation Project are immense. The project will provide a reliable supply of portable water to the residents of Arua Municipality and immediate surroundings, which comes along with many benefits. For example, the proposed water supply and sanitation project will result into an improvement of public health conditions, spur social economic development, provide employment to local residents and bring the water closer to the residents thereby reducing community violence and sexual harassment that may occur when children, especially the girl children and women go to fetch water over long distances during the evening/night.

However, just like most developments, the immense benefits of the Arua water supply and sanitation project do not necessarily insulate this project from negative impacts. In order to evaluate the project so that its impacts on the environment and social economic set up are minimised, an evaluation of the possible project alternatives was also conducted. The nature and location of some components e.g. the sewage treatment plant, the sewage lifting stations and the sewer transmission to the waste stabilization ponds were found to be so specific that no alternative was proposed. In that case, the impacts of those project components were carefully analysed in terms of their actions and intended location. Alternatives were suggested for some other project components e.g. the proposed locations of water storage tanks. The storage tank proposed at Vurra village should be omitted and instead, the inlet, outlet and overflow pipes of the existing storage tank at Arua Hill be enlarged. The proposed storage tank at Giligili government land should be maintained. The omission of one storage tank will save the project some money.

For both the project components, which are suggested to be maintained and those where alternatives were suggested, an evaluation of the positive and negative impacts was performed, and an Environmental Monitoring Plan (EMP) drawn. All negative impacts can be mitigated following the EMP. Suggestions were also proposed on the enhancement of the positive impacts. The project should be developed in conformity with all legal requirements, notable among which, include acquisition of water abstraction permit from DWD, a wastewater discharge permit from DWRM) and a Wetland/Riverbank use Permits from NEMA. The developer should ensure that the wastes and chemicals are handled and disposed off in accordance with the EMP, and must comply with the protection measures for the safety of all persons interfacing with the project and the environment at both stages of construction, operation and maintenance. If the project is developed following the suggestions given in the EMP of this ESIA, it is our contention that there will be no negative impacts to deter the development of the Arua Water Supply and Sanitation Project.

10.2 RECOMMENDATIONS

Based on the immense project benefits of the Arua Water Supply and Sanitation Project, which have been stated above, and the fact that the identified negative impacts can be mitigated following the proposed EMP, we strongly recommend to NEMA to review and approve this ESIA to enable further development of the project.

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ANNEXES

Annex 1; Terms of Reference



Arua Water Supply and Sanitation Project; TERMS OF REFERENCE

for

**Environmental and Social Impact Assessment
Consultancy Services**

1.0 INTRODUCTION AND BACKGROUND

The Arua Water and Sanitation project objectives are to improve water and sanitation services in Arua town and several of the settlements within the municipality. Services will be provided to both formal and informal settlements.

Arua municipality has approximately 188,000 residents and currently there are approximately 44,000 people that are served by the water supply network. This means that approximately 75% of the people within the area covered by the water network, and large areas of Arua, are not served at all. Arua also does not have any sewerage system or waste water treatment system.

Project Scope:

The design work for this project will focus on infrastructure improvements in Arua, including:

- a) Rehabilitation of the water treatment works (WTW) including impoundment and weir.
- b) Construction of up to two boreholes to augment the current water source.
- c) Transmission line from the boreholes to either the water treatment works, or a storage tank.
- d) Construction of two additional storage tanks and enlargement of the existing tank.
- e) Improvements and extensions to the existing water network.
- f) Construction of waste stabilisation ponds (WSP).
- g) Construction of a sewerage system for central Arua and transmission to the WSP.
- h) Water and sanitation facilities in informal settlements.

The majority of the works will take place within the confines of Arua town and its immediate periphery. However, parts of the works may take place in rural settings, such as the potential drilling of boreholes, laying of the transmission line from the boreholes to the WTW, and the construction of the WSPs. The detailed scope of activities involved in each of the project components are outlined below:

Rehabilitation of the water impoundment and possible raising of the weir

This work falls under improvement of the raw water intake and is part of the rehabilitation of the WTW. The raw water source is the River Enyau and water abstraction is through a concrete intake structure that protrudes approximately 4 metres into the watercourse. The structure is a U-channel of 8.4 metres length, 1.2 metres width and 3.1 metres depth. Flow in the river is regulated by a weir, approximately 40 metres downstream of the inlet structure. The weir is 16.5 metres long, 0.95 metres wide and 1.4 metres deep. Rehabilitation will encompass work on the intake structure, de-silting of the impoundment and, possibly, raising of the weir by up to 1 metre. The possible raising of the weir is for storing more water in the wetland during times of high river flows than is currently the case. The land that is covered by the impoundment belongs to the NWSC and evidence for this will be provided. The consultant, assisted by NWSC, will review current land uses and provide evidence that no people have encroached on NWSC premises, and that the planned works will not affect current land use in a way that would impact livelihood of people. Figure shows the the River Enyau and wetland at Arua WTW, the inlet structure and weir.



Figure 1: Arua WTW, River Enyau and Wetland

Rehabilitation of the water treatment works

All works for this project component will be undertaken within the confines of the existing WTW. The land is owned by the National Water and Sewerage Corporation and evidence will be provided for this purpose. The consultant, assisted by NWSC, will review current land uses and provide evidence that no people have encroached on NWSC premises. Work will be on the rehabilitation of filters, changes and improvements to electromechanical equipment, and building of minor structures for adding equipment to optimise the treatment process.

Construction of up to two boreholes to augment the current water source

Augmenting Arua's current water source with water from new boreholes is being studied. Up to 2 boreholes will be developed for this purpose, subject to detailed investigations. The location, recharge area, extents, and current usage of the aquifers are not yet known and will be determined through a detailed investigation. The land that may be identified for the location of the boreholes is unlikely to be owned by the NWSC.

Preliminary screening of boreholes in the surrounding of Arua town has been carried out and several boreholes are thought to have a high yield, while currently being used by comparatively small communities. Ideas have been discussed of sharing such boreholes between NWSC and local communities, or of drilling alternative boreholes in areas of lower yields for the local community in exchange for the higher yield borehole, and the consultant with NWSC will facilitate free, prior, informed consultations with the target communities about such sharing or exchange arrangements.

Transmission line from the boreholes to either the WTW, or a storage tank

The work includes transmission of water from the boreholes to either the WTW or storage tanks. With the exception of crossings (e.g. rivers, swamps), all pipelines will be buried. The external diameter of the transmission pipes will not be larger than 180mm.

Construction of two additional storage tanks and enlargement of the existing tank

The work is likely to include construction of two additional storage tanks and enlargement of the existing tank in Arua town. The projected volume of each of the new storage tanks is 250m³. Land acquisition for the two storage tanks to be constructed is necessary. The existing tank to be enlarged has a volume of 1,350m³ and is on land that is owned by the NWSC. However, depending on the design, the NWSC owned land may be too small and some adjacent land may need to be acquired.

Improvements and extensions to the existing water network

The work will be undertaken within the confines of Arua town and include replacement of existing pipes, laying of new pipes in areas that are already served by the water network to improve service provision, and laying of pipes in areas that are not yet served by the water network. With the exception of crossings (e.g. rivers, swamps), all pipelines will be buried. The external diameter of the largest pipes will not exceed 650mm and most pipes will have a diameter of less than 250mm.

Construction of waste stabilisation ponds

The work will include the construction of waste stabilisation ponds for treatment of sewage from Arua town. It is planned to locate the works on the periphery of Arua town and one of the possible locations may be in the Barifa Central Forest Reserve (CFR). The Barifa CRF is under the stewardship of the National Forest Authority. The reserve measures approximately 236 hectares and was gazetted in 1946.³ Arua municipality plans to degazette the reserve and compensate for it with planting a forest in another location. The current state of discussions on this matter is unknown but it must be stressed that the area must be degazetted before it can be identified as a potential location for the WSPs. Ideally, the WSPs should be located such that there is no infringement into the central forest reserve. Should infringement be unavoidable, the consultant, together with the NWSC, shall provide evidence that the legal status of the land allows for the construction of WSPs.

Considerations need also to be taken concerning the infrastructure that needs to be put in place for operating the waste stabilisation ponds (e.g. roads, electric power).

In addition, the possible impacts on the surrounding community during operations need to be considered (e.g. odour, noise, traffic).

Construction of a sewerage system for central Arua and transmission to the WSP

Arua does not have any sewerage area and it is intended to provide, as a minimum, sewerage services to the central district of town. For that, sewer pipes need to be laid and buried and manholes need to be constructed. With the exception of crossings (e.g. rivers, swamps), all pipelines will be buried. The external diameter of the largest pipes will not exceed 650mm and most pipes will have a diameter of less than 400mm.

Water and sanitation facilities in informal settlements

The project will provide water and sanitation services in informal settlements of Arua town. This will include public water extraction points and community latrines. The impacts of building and operating these structures need to be considered as part of the EIA.

Catchment management and source protection

The project will include interventions supporting sustainable management of water catchment and protection of water sources, including restoration and re-vegetation of river banks, implementation of riverbank protection regulations, implementation of wetland regulations, etc. The scope and location of these activities has not been determined during the feasibility studies. The consultant will propose the

³Report Of The Standing Committee On Commissions, Statutory Authorities And State Enterprises On The Performance Of The National Forestry Authority From 2004 To 2007 (http://www.parliament.go.ug/index.php?option=com_docman&task=doc_download&gid=122&Itemid=102).

location, scope and type of catchment management and water source protection measures as a part of the EMP, to mitigate risks to the project from unsustainable use of the upstream areas.

2.0 OBJECTIVE OF THE ASSIGNMENT

This assignment is commissioned to undertake an EIA for the Arua water and sanitation project. The work is to determine the project's potential environmental and social impacts and propose measures to mitigate these. The EIA and the project feasibility study should be undertaken in parallel, so that all alternatives proposed are also assessed for their environmental impacts.

The EIA will draw on a previous study (*Strategy For The Protection And Management Of River Enyau And The Banks*), that will be supplied to the consultant by the NWSC. Field data collection will be an essential part of the work.

3.0 THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) – OBJECTIVES AND PRINCIPLES

The EIA should be carried out in line with requirements of the legal, policy and regulatory framework of Uganda as well as the World Bank policy OP4.01: "Environmental Assessment," and other World Bank safeguard and information disclosure policies.

Items where World Bank policy requirements are more comprehensive must be addressed over and above the requirements of the regulatory framework of Uganda.

4.0 SCOPE OF THE ASSIGNMENT

As a minimum, the EIA should capture the aspects outlined under paragraphs 4.1 to 4.9:

4.1 Geographical Extent of Project Activities

The nature of project activities is outlined in the project scope, under paragraph 1.0. The maps in Figure 2 and Figure 3 show the project area. In addition, the consultant shall refer to the following documents that are to be provided by the NWSC:

Arua Emergency Water Supply Project – Inception Report (2011)

Consultancy Services for the Detailed Design and Tender Documentation of the Arua Area Water Supply Improvement Project – EIA (2010)

Detailed Engineering Design of Arua Water Supply Project (2010)

The design work for the Arua water and sanitation project will be based on the work that is reported in the documents above. Therefore, these reports provide fairly detailed descriptions of the scope and the locations of various project components.

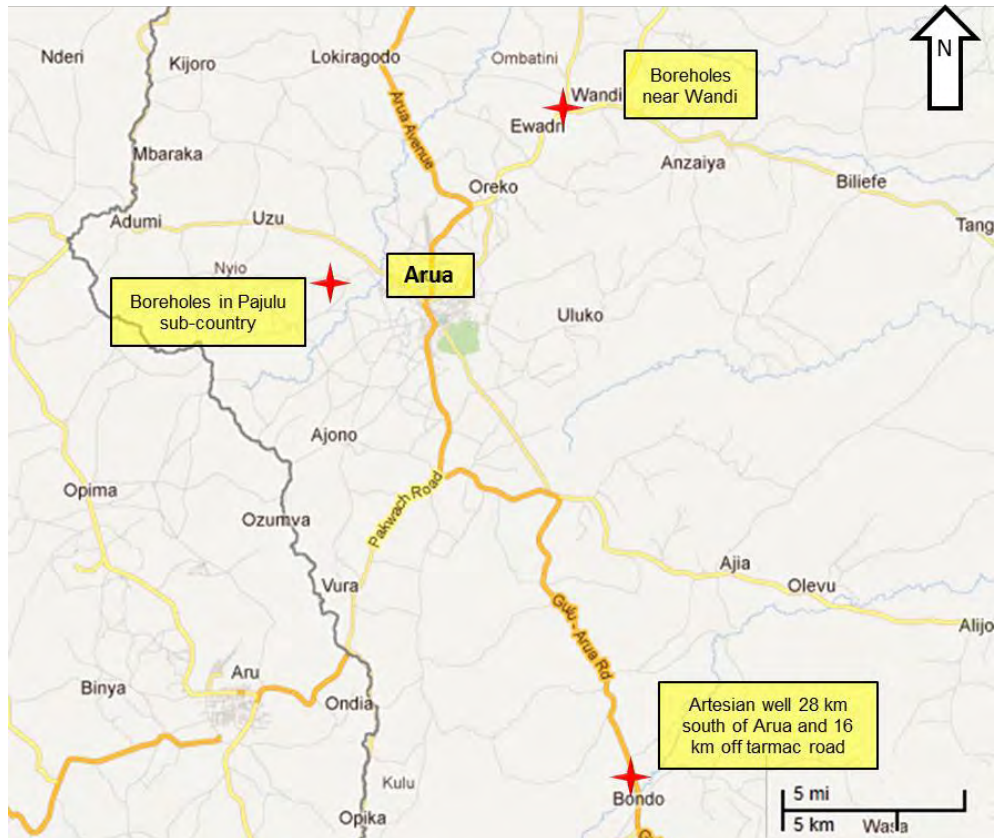


Figure 2: Map showing Arua and the Furthest Destination of Boreholes Identified Suitable for Augmenting Current Water Supply

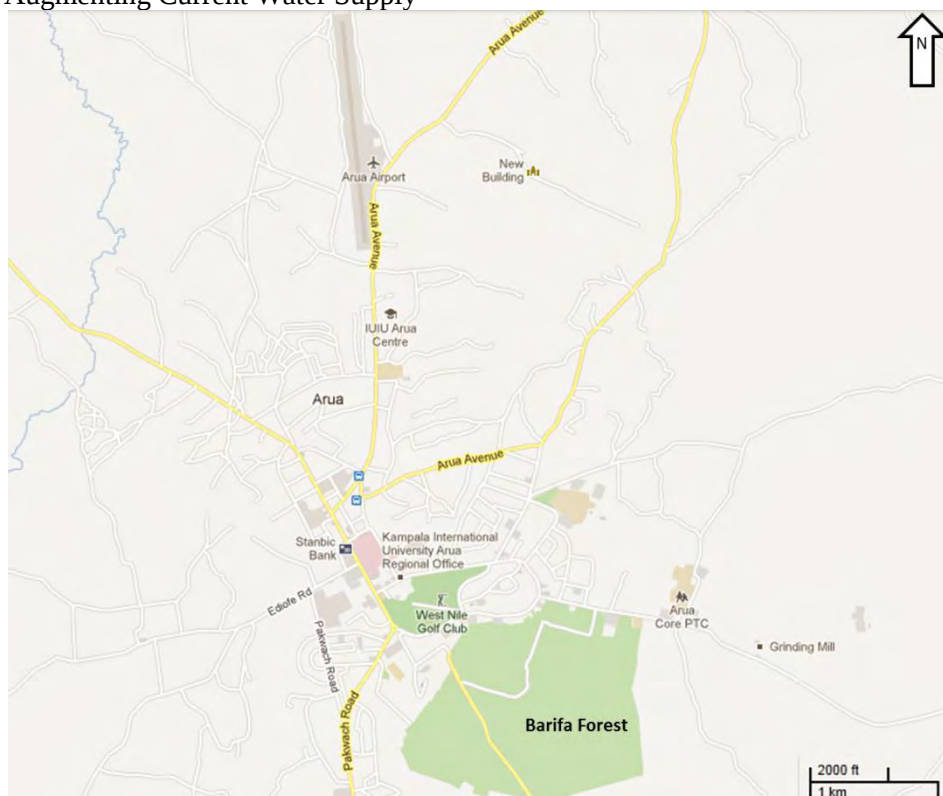


Figure 3: Map Showing Arua and Barifa Forest

4.2 Policy and Legal Framework

Identify laws, regulations and guidelines that will govern the conduct of the assessment or specify the content of its report. The work should cover the following:

National laws and/or regulations on environmental assessments.

Regional, provincial or communal environmental assessment regulations.

Environmental assessment policies of the World Bank.

Identify design or operating standards which project components must meet to be in compliance with environmental safeguards, such as effluent standards, extraction limits, receiving water quality standards, noise standards, road safety standards, etc.

Any legal steps necessary to ensure the effective implementation of the identified environmental protection and impact mitigation measures.

World Bank Operational Policy 4.01: "Environmental Assessment," other safeguard policies, and the World Bank Policy on Access to Information (July 1, 2010) to shall serve as a guidance for this work.

4.3 Description of Potentially Affected Areas

The consultant shall provide a baseline description of the project social and physical environment, and identify all peoples and areas that are potentially affected by the project, collect population data, document topography, current land use status and physical land conditions, and identify environmentally sensitive areas. As a minimum, the consultant shall assess the following:

- The locations where the feasibility study suggests the development of boreholes or other project infrastructure.
- The potential impact of the proposed boreholes on the groundwater reservoir and on users who already utilise the aquifer. If at all possible, the consultant should also elaborate on the combined impact of all current users on the aquifer.
- The cumulative environmental impacts of water extraction and effluent discharge on the affected waterbodies and their socio-economic consequences.
- The route of the transmission lines from the boreholes to their point of discharge. Depending on the results of the feasibility study, the point of discharge may be a storage tank, or the WTW.
- The locations of the new storage tanks.
- Depending on the outcome of the feasibility study and if applicable, the extension area for enlarging the existing storage tank on Arua Hill.
- The service area of the existing water network, focusing on locations where the network is to be rehabilitated, or intensified.
- All areas into which the water network is to be expanded.
- The service area for the new wastewater collection system.
- The locations that are potentially affected by the rehabilitation and improvement works in the WTW.
- The locations that are potentially affected by the rehabilitation and improvement works on the raw water source. Particular focus shall be on work on the raw water intake structure; the rehabilitation and possible raising of the weir – which would result in a larger submerged area when the reservoir is full; and the de-silting of the reservoir.
- The areas that are proposed as locations for the WSPs. During the feasibility study, several potential locations may be identified and all of them shall be assessed on their potential impacts.
- The effluent disposal route from the WSPs and the impact of effluents on the receiving water body.
- All routes for where infrastructure that is necessary for operating the WSPs is planned (e.g. roads, electric power).
- Locations in informal settlements where water and sanitation facilities are planned.
- All potential impacts from routine operations of the water and wastewater facilities (e.g. sludge disposal from the WTW, sludge disposal from the WSPs, screenings disposal from the WSPs, odour, noise, dust, additional traffic, etc.).

The work shall include both, desk- and field studies. The extent of field studies shall be for the Arua water and sanitation programme and may include interviews with residents of affected areas, government officials, and NGOs. The consultant shall propose the scale of field work and request approval from the NWSC and the World Bank prior to commencement of the studies. The consultant shall summarise the outcome of this work in which a broad assessment will have been made of the major biophysical and

social impacts likely to be generated by the project. The consultant shall report his findings using text, tables, diagrams and maps.

4.4 Potential Impacts of the Project Construction Phase

The consultant shall assess the potential construction methods and point out any potential impacts on the environment that are construction related. For example:

- Temporary drainage of wetlands, if necessary, to allow access.
- Impacts on the environment due to extraction of raw materials (quarrying).
- Temporary changes to flow regimes of watercourses due to construction of coffer dams.
- Possible impacts on flow volumes in watercourses due to water extraction for building activities.
- Potential impacts on livelihoods, land uses, and community / social aspects.

For all issues identified, measures for mitigation and reinstatement shall be proposed in the EMP (e.g. removal of temporary access, restoration of wetlands, site control to prevent encroaching, etc.). Potential environmental impacts that can reasonably be expected to be part of construction routine shall not be part of this work but will be covered by the contractor's method statements (e.g. minimisation of noise, dust, odour, prevention of pollution spills).

4.5 Potential Impacts of the Project Operational Phase

The consultant should summarise the project process and point out their potential impacts on the environment. This part of the assignment shall concentrate on operational processes and include, for example:

- Impact of raw water abstraction on source.
- Anticipated wastewater volumes and quality.
- Anticipated effluent quality.
- Impact of WSPs' effluent on receiving water body.
- Chemicals used in processes and their potential impacts on the environment when disposed.
- Impact of general waste disposal.
- Impact of operations related traffic.
- Potential impacts on livelihoods, land uses, and community / social aspects.

Handling of chemicals and other potentially harmful materials as part of the project operations that form part of the works manual will be summarised in a separate chapter in the EIA. The consultant shall also summarise all issues related to pest management, to ensure compliance with OP4.09 on Pest Management.

4.6 Determination of the Potential Impacts of the Project

Based on the work undertaken for sections 4.3, 4.4 and 4.5, produce an environmental analysis of the following:

- Significant positive and negative impacts.
- Direct and indirect impacts.
- Immediate and long-term impacts.
- Identify impacts that are unavoidable or irreversible (residual impacts).

Wherever possible, describe impacts quantitatively, in terms of environmental costs and benefits. Assign economic values when feasible. Characterise the extent and quality of available data, explaining significant information deficiencies and any uncertainties associated with predictions of impact. If found necessary, provide TORs for studies to obtain the missing information. Special attention should be given to:

- The extent to which the water source will be impacted by the abstraction of water. For watercourse abstraction, the length that will be significantly impacted shall be stated. For groundwater abstraction, the impact on the aquifer in terms of water table and reservoir medium (e.g. compaction) shall be stated.

- The extent to which receiving water quality standards and / or beneficial use objectives will be achieved with the proposed type and level of treatment in the WSPs.
- The length of watercourse that will be positively or negatively affected by the discharge from the WSPs, and the magnitude of the changes in water quality parameters.
- Projected quantitative changes in beneficial uses, such as fisheries (species composition, productivity), recreation and tourism (visitor-days, overnights, expenditures), and waters available for portable supply, irrigation, and industrial use.
- Sanitation and public health benefits anticipated.

4.7 Analysis of Alternatives

The consultant shall briefly describe and evaluate alternatives that were examined in the course of developing the proposed project and identify other alternatives that would achieve the same objectives. The concept of alternatives extends to the following:

- Siting and design.
- Technology selection.
- Operation and maintenance procedures for the proposed systems.
- The consultant should compare the alternatives in terms of:
- Potential environmental impacts, including land and energy requirements.
- Estimated capital and operating costs.
- Reliability and suitability under local conditions.
- Institutional, training, and monitoring requirements.

The description should indicate which impacts are irreversible or unavoidable and which may be mitigated. To the extent possible, costs and benefits of each alternative shall be quantified, incorporating the estimated costs of any associated mitigating measures. The alternative of not constructing the project should be included to demonstrate environmental conditions without the project being implemented.

4.8 Development of an Environmental Management Plan (EMP)

The consultant shall propose mitigation measures to manage the potential impacts, and discuss costs, timing, monitoring, and institutional responsibilities for the mitigation measures as well as the institutional enhancement and training requirements to implement them. The EMP for this project shall include the following issues:

- Proposed work programs, timing and budget estimates.
- Staffing and training requirements.
- Monitoring and evaluation.
- Other necessary support services to implement the mitigating measures.
- The EMP should also consider measures for emergency response to accidental events as appropriate.
- Location, type and scope of catchment management and source protection measures.

The consultant shall prepare a detailed plan to monitor the implementation of mitigating measures and the impacts of the project during rehabilitation / construction and operation. The plan should include an estimate of capital and operating costs and a description of other inputs needed to implement the plan, such as training and institutional strengthening. The plan shall also address environmental monitoring of the disposal sites for sludge and screenings, and include a regular schedule of monitoring and reporting on the quality of potentially affected surface and ground waters.⁴

The consultant shall review the authority and capability of institutions at local, regional, and national levels and, if appropriate, recommend steps to strengthen or expand them so that the EMP may be

⁴Depending upon local conditions and predicted impacts upon the local community, there may be need for a resettlement action plan (RAP). A RAP is developed in parallel to the EIA and the consultant commissioned for this work shall work in close cooperation with the consultant commissioned for the RAP.

implemented effectively. The recommendations may extend to inter-sectoral arrangements, management procedures, training, staffing, and financial support.

An outline of the contents of the EMP will be included in the project's operational manual and should be included along with environmental protection clauses for contracts and specifications in the BOQs and construction and operating contracts.

Offset-based mitigation measures (both land for land and enhanced management or ecological stability of remaining areas) will be considered to offset the residual impacts, especially regarding taking of forests or wetlands for the project.

4.9 Inter-Agency Coordination and Public / NGO Participation

The consultant shall assist the client in coordinating the EIA with relevant agencies, consult with groups likely to be affected by the proposed project, and with local NGOs on the environmental and social aspects of the proposed project. In this matter, the EIA consultant shall work closely with the consultant who has been commissioned to work on the RAP.

Consultations shall be organised for all issues identified as being of material interest to the public. In particular, the consultant shall organise stakeholder consultations concerning the shared use of water resources and their associated catchments. Here, the consultant shall identify key stakeholders, provide ample notice and information prior to consultations, identify meeting locations that all stakeholders can reach with reasonable effort, and otherwise reasonably facilitate the public consultations and participation that are free and informed.

The client, with the assistance of the consultant, shall provide relevant information to affected groups in a timely manner prior to consultation. The material shall be in a form and language that is understandable and accessible to the groups being consulted. The consultant shall maintain a record of the public consultations and the records should indicate the following:

- Means other than consultations used to seek the views of affected stakeholders (e.g. surveys).
- Date and location of the consultation meetings.
- List of attendees, their affiliation, and contact address.
- Summary minutes.

5.0 REPORTING

The reporting requirements of the consultant shall remain the same as specified in the TOR in the main contract.

Concerning format of the report, the consultant may find it helpful to consider the following:

- The report should be concise and limited to significant social and environmental issues.
- The main text should focus on findings, conclusions and recommended actions, supported by summaries of the data collected and citations for any references used in interpreting those data.
- Detailed or uninterrupted data are not appropriate in the main text and should be presented in appendices or a separate volume.
- Unpublished documents used in the assessment may not be readily available and should also be assembled in an appendix.
- The report should be organised in accordance to the outline below. (This is the format suggested in World Bank Document OP 4.01):
 - i. Executive Summary.
 - ii. Policy, Legal and Administrative Framework.
 - iii. Description of the Proposed Project.
 - iv. Description of the Environment.
 - v. Significant Environmental Impacts.
 - vi. Analysis of Alternatives.
 - vii. Environmental Management Plan, including mitigation, monitoring, capacity development and training and implementation schedule and costs; include environmental protection clauses for incorporation in contract agreements.
 - viii. Inter-Agency and Public/NGO Consultation.
 - ix. List of References.
 - x. Appendices:

- a. List of Environmental Assessment Preparers.
- b. Records of Inter-Agency and Public / NGO Communications.
- c. Data and Unpublished Reference Documents.
- d. Map, drawing and pictorial complement, especially to convey information on the project affected area and proposed project activities.

6.0 CONSULTANT QUALIFICATIONS

The consultant shall provide all personnel necessary for the completion of the study. The following key skills shall be included as a minimum requirement for the consultant's personnel:

Position	Description
Environmental Specialist, Team Leader	A graduate degree in environmental engineering, or equivalent, with 10 years of relevant experience in EIA preparation for infrastructure projects. The person shall be a NEMA-registered environmental practitioner, have familiarity with World Bank's EIA and other safeguards policies from similar works financed by the World Bank. The person must be conversant with environmental engineering and environmental planning relevant to the proposed project.
Sociologist	Sociologist degree with 5 years of experience in social impact assessments related to infrastructure projects.
Hydrologist	A university degree in hydrology, or equivalent, with 5 years of experience in assessing impacts from water storage by watercourse impoundments, ground- and surface water abstraction, and effluent discharges from water and sanitation projects, on the water source / receiving water.
Water and Wastewater Specialist	A university degree with 5 years of hands on experience in the management of water supply and wastewater.

Note: the team will be required to work closely with specialists undertaking the social analysis and to define arrangements for the final report.

7.0 EXPECTED OUTPUTS

The consultant shall prepare and submit an inception report, followed by a draft EIA report to the client, who is the implementing agency. The client will review and comment on the report. Following the incorporation of the client's comments, the financier shall review the draft EIA to issue a 'no objection' before the consultant submits the final report for NEMA approval.

The EIA will be disclosed both in-country and at the World Bank's infoshop prior to appraisal of the main project.

The EIA shall be submitted as an electronic copy in software to be determined by the client. In addition, six paper copies of the report shall be submitted to the client.

8.0 THE TIMING AND DURATION OF THE ASSIGNMENT

The assignment shall be completed within sixteen (16) weeks.

The Client shall review and comment on the submitted reports within 2 weeks from the date of report receipt and thereafter the consultant shall prepare the final draft report within 3 weeks.

The EIA approved by all stakeholders within 4 weeks after submission of the final draft report. (Approval means signature of the 'final draft report'. The consultant shall title this draft 'final report').

All reports shall be submitted as six (6) hardcopies and a softcopy.

ESIA for Arua Water Supply and Sanitation Project
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Item	Activity	Timing (from the date of contract effectiveness) in weeks	Mile stones/outputs
1.	Inception	2	Inception report
2.	EIA studies	11	Draft EIA report
3.	Review by client	13	Comments
4.	Consultant incorporates clients comments	16	Final Draft Report
4.	Review and Approval of EIA report by all project stakeholders	24	Final Report

9.0 ANY FACILITIES, SERVICES OR RESOURCES TO BE PROVIDED BY THE IMPLEMENTING AGENCY

The client will provide the project site maps and / or survey drawings of the area and any relevant studies prior to contract effectiveness.

Annex 1.1: Approval by NEMA



NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

NEMA/4.5

7th December, 2011

The Managing Director,
National Water and Sewerage Corporation,
P.O. Box 7053,
KAMPALA.

Tel: 256-414-315000/232919
: 256-312-260414/5

**RE: TERMS OF REFERENCE FOR THE ENVIRONMENTAL AND SOCIAL
IMPACT ASSESSMENT OF ARUA WATER SUPPLY EXPANSION AND
SEWERAGE DEVELOPMENT PROJECT FOR ARUA MUNICIPALITY, ARUA
DISTRICT**

Reference is hereby made to the submission to this Authority on 20th October, 2011, of the Terms of Reference (ToR) for carrying out an Environmental Impact Assessment for the above referenced project, for review and consideration for approval.

This Authority has reviewed the Terms of Reference and found them adequate enough to address the environmental concerns associated with the project. In addition to the environmental aspects identified and the scope of work outlined in the ToR, you are required to ensure that the team of consultants that is to conduct the EIA for the proposed project, covers the scope of work in a comprehensive manner. You are also advised to ensure that adequate stakeholder's consultations are undertaken during the conduct of EIA, and that evidence of stakeholder consultations appended to the EIA report.

Also be mindful of the need to include the following in the EIA Report:

- (a) Approved site lay-out plan for the water supply and sewerage system;
- (b) Ground Water Investigation findings/Soil and water analysis report;
- (c) Location/google map;
- (d) Land ownership documents; and
- (e) A set of photographs of current state of the project.

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This is, therefore, to issue formal **APPROVAL** of the ToR, and to recommend that you proceed with carrying out of the EIA for the proposed project.

We look forward to your cooperation and receipt of a comprehensive EIA report for our further consideration.


for Dr. Gerald Musoke Sawula
EXECUTIVE DIRECTOR

Annex 2: Water Quality of Selected Boreholes

Water source type	Location of Source by cell	No of <i>E. Coli</i> counts@ 100ml
Junior Quarters	Junior Quarter	06
Bishop Drandua	Arua Hill	00
Chongaloya market	Chongaloya	
Awindiri P/S	Nsambya south	00
Barifa		02
Dump site		00
Niva P/S	Niva	00
Water supply	Niva	00
Bethany	Nsambya North	02
Adriko	Adriko	00
Arua hill P/S	Arua Hill	06
Christina BH	Kebir	00
Academy BH	Academy	00
Club BH	Club	00
Ozua BH	Ozua	00
Oluodri BH	Oluodri	00
Orphanage	Orphanage	00
Otrakutra	Otrakutra	00
Baruku central BH	Baruku central	00
Late Luijji BH	Oli. C	10
Danida BH	Oli.B	00
Anyafio circular BH	Golf course	400
Arua public S,S	Arua public	62

Annex 3: People Consulted During the ESIA Assessment

NO.	NAMES/Venue	POSITION	CONTACT
1.	Tollea Franco	Community Dev. Department Arua District	0782-702855
2	Andiandu Joackin	District Environment Officer - Arua	
	KATRINY S/C		
1.	Abiriga Philliam	Sub-county Chief	0752-200987
2.	Mokili Godwin	S/C – NAAD Cord	0752-200990
	UNRA Regional Officer – Arua Station		
1.	Onguruco Martin	A/E	0772-343400
1.	Draku Anson Abam	Senior Ass. Eng.	0772-612844
	ARUA NWSC – Brand Manager		
1.	Mwandha Christopher	Area Manager NWSC	0717-315799
	ARUA MC. HEADQUARTERS		
1.	Andua Martin Drani	Ag. Town Clerk	0772-656616
2.	Afubo Mathew	Senior Eng; Assistant	0772-901190
	LAND OFFICE		
1.	Tabu Sabo Nancy	District Land office	0779-574999
	DADAMU S/Q HQ's		
1.	Ndaa M.O Sam	Chairman LC III	0751-946706
2.	Yusuf Enton	C.D.O	075-2292484
3.	Anim Orodriyo	Sec. Finance & Phaona	0784-651619
4.	Adiga Reuben	Parish chief	0782071106
5.	Ondoru Dorothy	H.1	0784415313
	ZEBRA T.C PANGISA WARD		
1.	Haruna Ndema	Opinion Leader	0772-514012
2.	Hilal Naseem	Opinion Leader	0782-175860
3.	Mohamed Ochima	Opinion Leader	0752-329918
4	Apangu Santino		
5	Erejo Ruven	Opinion Leader	0779-476818
6	Bayo Lawrence	VHT Cordinator	0752-967929
7	Togbo James	Chairman VHT	0792-998463
8	Ondoga Bernard		0774-564921
9	Chaiga Bazil	Publicity	0754-312240
10	Dralem Afelly	Opinion Leader	0785-526918
11	Moko Salima	NWSC	0778-099629
12	Alule Pontius S		
13	Abima Cassiano	Opinion Leader	0778-838474
14	Maina Alerea	L.C.1 Sec. Oyote	0778-838474
15	Cucu Chandiga	LC II Sec Diab	
16	Atiku Abdallan	LC II Pabgusa C/M	0782-708766
17	Asea Marco	Opinion Leader	0784-508026
18	Gorogoro George	LC I C/man Bibia	0752-275956

ESIA for Arua Water Supply and Sanitation Project

19	Khalan Abdallah	Gen. Sec. Pangisha	0775-300068
20	Munduru Rukia	L.C.1 C/P OSU	071-4663202
21	Asiku John	LC I c/M Azia	0751-803175
22	Edema Alex	Opinion Leader	
23	Pariyo Wilfred	Opinion Leader	0772-422618
24	Ojoni A Bosco	Opinion Leader	
25	Acidri Dickson	Opinion Leader	0752-249575
26	Chachu Malimmugu	LC I S/C Ojulua	0774-105318
27	Oliver Saru		0776-792114
28	Akua A. Robert		0785-573420
29	Asinduru Dorcus	Town Agent	0752-275948
	DIVISION COUNCIL HALL TANGANYIKA WARD		
1.	Adam Auule	LC II chairperson	0785-568036
2	Onzi Ramadhan	AASP/CROP R.O.D	0782-584639
3	Abidrabo Richard	EPRA Facili. R.O.D	0782-842120
4	Ijaga Muzamil	LC 1 Swalia Cell	0774-352742
5	Drazuru Baipha Polly	ACDO	0774-684898
6	Sida Fadila	Councilor Kenya	0784-653035
7	Dradebo Fadul	Speaker R.O.D	0752-261710
8	Debo E Hassery	Town Agent / Ag SATC	0751-933690
9	Abima Bernard	Assistant Engineer	0774-362245
10	Enzama Wilson	LC OCIC	0784-632874
11	Aliga K.	LC I Oboloko EAST	0782-994657
12	Asea Robert	Advisor	0773-126002
13	Droma - Sabir	LC 1 Oli "A" Celi	0753-644441
14	Dr. Nguma Willy	PO/SNC - ROD	0773-889909
15	Ashiraf Gadhaifi OM	Community Facilitator	0715-242607
16	Andutoko Moses	LC 1 Chairman	0872-148327
	KEBIR CELL (KENYA WARD)		
1.	Orizima Mzand	Chairman	0773-991939
2	Debo E Hassery	Ag. SATC	0751-933690
3	Drileonzi Brian	Town Agent	0774-076486
4	Yenge Mazini	LC 1 Chairperson Keber	0756-781847
5	All Bure	Sec	0782-522576
6	Andama Godfrey	LC 1 Chairperson	0787-158442
7	Bogere Godfrey	Community Member	0783-753931
8	Swaib Rajab	Party chairperson	0758-659758
9	Dudu Jafar	LC 1 Ombizeon	0774-137537
10	Julufa Chariru	01	
11	Zainabu Chadiru	01	0774-501010
12	Farida Sijali	01	
13	Koko Rukia	Opinion Leader	0783-317240
14	Asianzu Ayisa	01	0785-560165
15	Amina Swadiki	01	0758-838884
16	Lekuku Sema	Elder Women	
17	Kasifa Ismail	O.L women	
18	MB Aliga Shaffi	Bus	
19	Muhamood Hassan	LC member	0772-198653
20	Alli Moro	LC member	0773-365908
21	Muzamil Tibo	Elder UP Mon	0782-979469
22	Animu Bako	Elder	

ESIA for Arua Water Supply and Sanitation Project

23	Said Ogwal	LC 1 Chairman Jacinto	0772-684659/ 0758-359970
24	Musa Lega	LC 1/V Mriri	0782-683971
25	Okunu R.	LC II S	0767-793822
26	Ejaga Summary	LC II SPE	0753-363583
27	Obeti Hussen	LC II A/C	0782-160401
28	Agarile Yunusu Juma	LC 1 Chairman Ozua	0779-742711
29	Eyokia M. Brenda	Community member	
	ARUA HILL DIVISION		
1.	Olea Herbert	AEO	0713-563151
2	Amaga Mike Solomon	TA	0773-888915
	RIVER OLI DIVISION OFFICE		
1	Debo E. Hassery	Ag. SATC/Town agent	0751-933690
	ONDUPARAKA T/C Consultations for Adalefu		
1	Okinaru Bralor	Councilor	0785-998938
2	Alisa Sebastian	Chairman LC II	0775-358182
3	Onzima Anjelo	Anelder Ekar	Ekarakafe Vill.
4	Inzikuru Zainah	L.C.1	0711-110890
5	Angudeyo Mary	Gen. Sec Ambeko	0782-147375
6	Edema John	Chairman LC 1	0775-992542
7	Taban Saffi	Member	0755-519979
8	Agonzi Deo	Occupant	0772-649376
9	Awama Nicholas	Member	0782-392857
10	Akutia Silas	Member	
11	Nyakua Unbino	Member	
12	Asizu Silas	Opinion leader	0753-483743
13	Toko Mario	Member	
14	Enuka Elia	Member	
15	Azabo Sunday	Member	
16	Odipio K. Anjulo	Member	
17	Mama Sanuel	Member	0775-697495
18	Candia Peter	Member	
19	Osabu	Member	
20	Anguyo Peter	Member	
	TANGANYIKA PARISH		
1	Muhamed Aljab		
2	Swaib Ahmed	B/man	0772-515116
3	Ratib Molinga	Elder Tanganyika	0777-178223
4	Atiku Bernard	VHT	
5	Azibo Saverio	LC 1 C/B T.C	NIL
6	Asingua Kasto	Elder	NIL
7	Buni Chistopher	Elder	0782-119460
8	Tia Samuel	Chairman LC 1 Kijoro	0752-444361
9	Haji Tusuf Dimba	C/chief Elder	0774-451704
10	Haji Abdul Hakim	Elder	0773-380810
11	Muhamad M. Rizisar		0775-300050
12	Sabir Muhamad		0785-627350
13	Drate Tamim H.	V/chairman LC1 Madi	0783-798520

ESIA for Arua Water Supply and Sanitation Project

14	Asirafu Orionzi	Chairman Boda	0777-714283
15	Adinah Rajab	Mak	0782-324229
16	Zainab Juma		NIL
17	Amade Van	VHT LC1 VC	0784-415945
18	Butilizi N. Manzuli	Opinion leader	0392-814261
19	H.M Rizaalla	Opinion leader	0772-875761
20	Shaban Ogeniho	LC 1 chairman	0773-977395
21	Hatib Juma	Concerned CITZ	0772-848974
22	Siraji Mahamud R.H	Nsihami	0773-017831
23	Adiga Reuben	Parish chief	0782-071106
	OLUKO SUB-COUNTY HEADQUARTER Community Consultative Ombokoro and Muni		
1.	Ngilonzia Manase	Head teacher	0774-993368
2	Ayoma Kiliopa	LC 1 Ogayi	0784-492050
3	Ayaba Joseph	Farmer	0775-503570
4	Agutu Timothy	Farmer	
5	Avua Stephen	L.C 1 Chairman	P.O. Box 1
6	Amagua Robert	L.C 1 chairman	
7	Abati Mickson	Civil Servant	0772-994815
8	Andama Dylan	Civil Servant	0772-515511
9	Draburus Michael	Civil Servant	0775-991111
10	Atiku Emmanuel	Civil Servant	0772-474628
11	Adriku Roberi	Civil Servant	0713-584860
12	Buyoku Jimmy	Farmer	0783-656574
13	Col Anguyo Emmanuel	Peasant	0774-006339
14	Angubo Fenhas		0782-878019
15	Ancinyoko Joseph	Gisololuko	0784-081821
	OCOKO TRADING CENTER – Ajiya Sub- county		
1	Adriku Robert	LC 1 Secretary	0777-374429
2	Eyatre S.		0779-582101
3	Nikumu Alfred		
4	Andurionzi Ahanif		
5	Ezamgo Phillim	Boda Boda	
6	Onzima Roni	Boda Boda	
7	Manemiusi	William	
8	Adeddu	Rbute	
9	Aleti Stephen	Ombadeko	
10	Asedri Moses	Dubai	0774-515459
11	Abasiku Amis Taban	Dubai	0714-571980
12	Acidri Robert	Dubai	
13	Santino Dema	Dubai	
14	Asizo Jovowale	Dubai	
15	Emui Paulo	Dubai	
16	Andama Dickens	Dubai	0772-887417
17	Alioni Bosco	Dubai	0776-046435
18	Dema Christopher	Dubai	
	ODIANYADRI – Eruba Parish Vurra Sub-county		
1	Andrua John	Farmer	

ESIA for Arua Water Supply and Sanitation Project

2	Ombatia Simon	Elder	
3	Atiku Naphtal	Farmer	
4	Ayikoru Grace		
5	Tomasi Alele		
6	Elizabeth Baku	Trader	
7	Refina Abejua	F.	
8	Amaniyo	Ngih	
9	Ocokoru	HEACI	
10	Avacia Winifred		
11	Amanicia H.		
12	Tipeku Dorusa		
13	Amuiko Monica	Business	
14	Bileru Loyce	Business	
15	Bako Irene	Business	
16	Azikubu Lucy	Farmer	
17	Aliru Judith		
18	Mary Bako	Trader	
	VURRA SUB-COUNTY		
1	Ateku James	Chief	0772-638416
2	Andama Vincent	H/A	0782-254011
3	Yikii Denis	Ayelembe	0774-430449
4	Kayo Homard	Ayelembe	0782-071790
5	Ceni Richard	Ayelembe	
6	Adia Patrick	Ayelembe	0779-169454
7	Obeti Gabriel	Ayelembe	0755-584601
8	Buatre Alex	Ayelembe	0774-487070
9	Aleko Duko	Kyelemu	
10	Paritre Nason		0775-251043
11	Mademaga Victory	Ayelembe	
12	Salim Ahmed	Ayelembe	
13	Ombua Godfrey	Ajono	
14	Nsimayiti N.J	Anzoo	0782-252597
15	Candia Tom Baja	Rondo	0777-572254
	OLI C. OL DIVISION Arua Municipality		
1	Edobo Emmanuel	Secretary	0788-233929
2	Atiku Festo	Member	0779-569652
3	Ajiga Patrick	Member	0782-713383
4	Andama Patrick	Member	0787-956270
	PAJULU SUB-COUNTY		
1	Dramadri Micheal	Production Officer	0782-834487
2	CPL Agaali Charles	O.C Post	07740468401
3	Draso Sam	S/Ac	0772-320891
4	Abiniku Henry	Giiso Pajulu	0752-567371
5	Anguzu Joseph	Sec Fin. Plan & Adm.	0777-280322
6	Gongo Martin	V/chairman	0773-385313
	OKALEMBE T/C Drilala Parish		
1	Avujua Stephen	Member	
2	Acidri Feni Moses	LC 1 chairman	
3	Ajionzi Alex Adule	Councillor	0753-609758

ESIA for Arua Water Supply and Sanitation Project

4	Gongo Martin	Vice chairman	0773-385313
5	Anwora Drahan	Councillor	0785-798758
6	Agamile Rophin	LC 1 chairman	0752-928810
7	Enduma Valentine	Member	
8	Bayo Biajo	Member	0781-333136
9	Afubo John Bayo	Member	
	EDIOFE BOYS P/S : Komite Parish Pajulu S/C		
1	Anguzu Joseph	Councilor Komite	0777-280322
2	Ondia Honourous	Opinion leader	0773-996244
3	Aguta J. Festo	L.C	
4	Okubra Alex	LC 1 Burra	
5	Anguni Sunday	Teacher	0773-355954
6	Drani Simon Ondia	LC II Chairperson	0774-136045
7	Aliga Jackson	LC 1 Chairperson	0772-654210
8	Adua James	LC II chairman	0782-789256
	MANIBE SUB-COUNTY H/Q		
1.	Odjani Charles A.		0781-624788
2	Obiguma Nason	Sec. Social Services	
3	Adrar Masim	LC 1	0775-247458
4	Amandu Gabriel	Elder	
5	Atibuni Joseph	Speaker	0774-186606
6	Bayo Bosco	LC 1	0777-184474
7	Niku Geoffrey	CDO	0772-632814
8	Dudu Augustine	LC 1	0785-935983
	ODIA NYADRI – Druba Darise Yurra S/C		
1.	Jurua Alfred	F.L.D	0757-396824
2	Mbirigt Petea		
3	Ojidri Jacksui	Farmer	0783-753617
4	Kama Kashaba Jimmy	Programme Officer	0772-367940
5	Edemala Samuel	AAO	0773-021963
6	Simon Drabi	M	
7	Mungusi John	Youth	0787-658726
8	Tito Ondoia		
9	Wathum Franco		0774-762885
10	Mundua Wilson	Teacher	0758-270122
	MUNICIPAL COUNCIL OFFICER – Arua		
1	Kalsum Adbu	D/Mayor	0753-413683
2	Ayikoru Sallu Hamza	Chairperson Fin.	0752-866124
3	Chandiru Zaitun	Councilor	0774-133282
4	Ondoru Molly	Councilor Kenya	0782-926241
5	Toko Solomon	Councilor	0712-991202 / 0701-991202

Annexes 4-8 (Maps)

Annex 4: General Lay out-Borehole sites (see a separate PDF file)

Annex 5: Distribution Network-General Layout (see a separate PDF file)

Annex 6: Distribution Network-General Layout –Sheet04 of 14(see a separate PDF file)

Annex 7: Sewerage System General Layout (see a separate PDF file)

Annex 8: Location of Water Storage Tanks (see a separate PDF file)

ANNEX 9: ENVIRONMENTAL CONTRACT CLAUSES

Safety, Security and Environmental Management

1. Before the order to commence the Works, the Contractor is required to implement the Environmental Management Plan (EMP) as specified in the Environmental Impact Assessment, prepared for the particular water and sanitation project. The plan shall spell out how the Contractor should achieve environmental targets and objectives specified in the EMP and agreed upon by the NWSC and NEMA. The plan shall include, to the extent practicable and reasonable, all the steps to be taken by the Contractor to protect the environment in accordance with the provisions of the “National Environmental Management Policy”, 1994; National Environment Act, Cap 153; “The National Water Policy” of 1999 and “Waste Discharge Regulations” of 1998. Where the EMP does not exist, the clauses contained herein shall form the basis of a rehabilitation (restoration) plan.
2. Notwithstanding the Contractor’s obligation under the above sub-clause, the Contractor shall implement all measures necessary to restore the sites to acceptable standards and abide by environmental performance indicators specified under EMP to measure progress towards achieving objectives during execution or upon completion of the Works. These measures shall include but not be limited to the following:
 - (a) Ensure that existing water flow regimes in rivers, streams and other natural or irrigation channels is maintained and/or re-established where they are disrupted due to civil works being carried out.
 - (b) Ensure that noise levels emanating from machinery, vehicles and noisy construction activities are kept at a minimum for safety, health and protection of workers within the vicinity of high noise levels and communities near rock-blasting areas.
 - (c) Minimize the effect of dust on the surrounding environment resulting from earth mixing sites, dispersing coal ashes, vibrating equipment, temporary access roads, etc. to ensure safety, health and the protection of workers and communities living downwind of dust producing activities.
 - (d) Prevent oils, lubricants and waste water used/produced during the execution of works from entering into rivers, streams, irrigation channels and other natural water bodies/reservoirs and also ensure that stagnant water in uncovered borrow pits is treated in the best way to avoid creating possible breeding grounds for mosquitoes.
 - (e) Prevent and minimize the impacts of quarrying, earth borrowing, piling and building of temporary construction camps and access roads on the bio-physical environment including protected areas and arable lands; local communities and their settlements. In as much as possible restore/rehabilitate all sites to acceptable standards.
 - (f) Upon discovery of ancient heritage, relics, graves or anything that might or is believed to be of archeological or historical importance during the execution of works report such findings to the Ministry of Tourism, Wildlife and Heritage in

- fulfillment of the relevant statutory requirements and outline measures aimed at protecting such historical or archeological resources.
- (g) Discourage construction workers from engaging in the exploitation of natural resources such as hunting, fishing and collection of forest products or any other activity that might have a negative impact on the social and economic welfare of the local communities.
 - (h) Implement soil erosion control measures in order to avoid surface run off and prevent siltation, etc.
 - (i) Ensure that garbage, sanitation and drinking water facilities are provided in construction workers camps.
 - (j) Ensure public safety and meet traffic safety requirements for the operation of work to avoid accidents.
3. The Contractor shall indicate the period within which he/she shall maintain status on Site after completion of the Works to ensure significant perturbations arising from such works have been taken into account.
 4. The Contractor shall adhere to the proposed activity implementation schedule and the monitoring plan/ strategy to ensure effective feedback of monitoring information to both the Engineer and the NWSC so that impact management can be implemented properly, and if necessary, adapt to changing and unforeseen conditions.
 5. The NWSC environmental staff in conjunction with the NEMA shall inspect significant sites where the Works have been carried out and proposed mitigation measures implemented and shall give certification regarding the adequacy or inadequacy of rehabilitation (restoration) measures carried out on the bio-physical environment and compensation for socio-economic disruption resulting from implementation of the Works.
 6. If the Contractor fails to implement the approved Environmental Management Plan, the NWSC shall seek legal redress through NEMA and appropriate penalties shall be instituted in accordance with the provisions of the relevant policies/acts.

SPECIFIC ENVIRONMENTAL ISSUES TO BE CONSIDERED

Worksite/campsite Waste Management

- All vessels (drums, containers, bags, etc.) containing oil/fuel/surfacing materials and other hazardous chemicals must be bundled in order to contain spillage. All waste containers litter and any other waste generated during the construction shall be collected and disposed of at designated sites in line with the waste management regulations of the NEMA.
- All drainage and effluent from storage areas, workshops and campsites shall be captured and treated before being discharged into the drainage system in line with the water pollution control regulations of the NEMA.
- Used oil from maintenance shall be collected and disposed of appropriately at designated sites or taken back to designated dealers

- Entry of runoff to the Site shall be restricted by constructing diversion channels or holding structures such as banks, drains, dams, etc. to reduce the potential of soil erosion and water pollution.
- Construction waste shall not be left in stockpiles at the project Site. Waste and other excess material shall be used for rehabilitating (restoring) borrow areas and landscaping around the road.
- If other spoil disposal sites are necessary, they shall be located in areas of low land use value and where they will not result in material being easily washed into drainage channels. Wherever possible, spoiled materials should be placed in low-lying areas and should be compacted and planted with species indigenous to the locality.

Material Excavation

- Contractors shall obtain appropriate licenses/permits from relevant authorities to operate quarries or borrow areas.
- The location of quarries and borrow areas shall be subject to approval by relevant authorities including traditional authorities if the land on which the quarry or borrow areas fall is traditional land and by the Environmental Management Authority.
- Extraction sites shall not be located in the vicinity of settlement areas, cultural sites, wetlands or any other valued ecosystem component and shall not be located at less than 10 km from such areas.
- Extraction sites shall not be located adjacent to stream channels wherever possible to avoid siltation of river channels. Where they are located near water sources, borrow pits and perimeter drains shall surround quarry sites.
- Extraction sites shall not be located in forest reserves. However, where there are no other alternatives, permission shall be obtained from the National Forest Authority (NFA) and an environmental impact study shall be conducted.
- Extraction sites shall not be located on high or steep ground or in areas of high scenic value.
- Only sites that can easily be rehabilitated (restored) shall be chosen. Areas with minimal vegetation cover such as flat and bare ground or areas covered with grass only or covered with shrubs with height of less than 1.5 m.
- Extraction site boundaries shall be demarcated and marked to minimize vegetation clearing.
- Vegetation clearing shall be restricted to the area required for safe operation of construction work. Vegetation clearing shall not be done for more than three months in advance of operation.
- Extraction site shall not be located in archeological areas. Excavations in the vicinity of such areas shall proceed with great care and shall be done in the presence of staff of Ministry of Tourism, Wildlife and Heritage.
- Stockpile areas shall be located in areas where trees can act as buffers to prevent dust pollution. Perimeter drains shall be built around stockpile areas. Sediment and other pollutant traps shall be located at drainage exits from workings.

Rehabilitation and soil erosion prevention

- To the extent practicable rehabilitate (restore) the site progressively so that the rate of rehabilitation is similar to the rate of construction.

- Always remove and retain topsoil for subsequent rehabilitation (restoration). Soils shall not be stripped when they are wet as this can lead to soil compaction and loss of structure.
- Topsoil shall not be stored in large heaps. Low mounds of no more than 1 to 2 m high are recommended.
- Revegetate the stockpile to protect the soil from erosion, discourage weeds and maintain an active population of beneficial soil microbes.
- Locate stockpiles where they will not be disturbed by future construction activities.
- To the extent practicable reinstate natural drainage patterns where they have been altered or impaired.
- Remove toxic materials and dispose of them in designated sites. Backfill excavated areas with soils or overburden that is free of foreign material that could pollute ground water and soil.
- Identify potentially toxic overburdened screen with suitable material to prevent mobilization of toxins.
- Ensure the reshaped land is formed so as to be inherently stable, adequately drained and suitable for the desired long-term land use and that would allow natural regeneration of vegetation.
- Minimize the long-term visual impact by creating landforms, which are compatible with the adjacent landscape.
- Minimize erosion by wind and water both during and after the process of reinstatement.
- Compacted surfaces shall be deep ripped to relieve compaction unless subsurface conditions dictate otherwise.
- Revegetate the area with plant species that will control erosion, provide vegetative diversity, and that will through succession; contribute to a stable and compatible ecosystem. The choice of plant species for rehabilitation (restoration) shall be done with preference to the local plant species and in consultations with local research institutions, forest department and the local people, as they will be long-term beneficiaries.

Water resources management

- The Contractor shall at all cost avoid conflicting with water demands for local communities.
- Abstraction of water both surface and underground shall only be done with the consultation of the local community and after obtaining a permit from the relevant Water Authority.
- Abstraction of water from wetlands shall be avoided. Where necessary, authority has to be obtained from relevant authorities.
- Temporary damming of streams and rivers shall be done in such a way that disruption of water supplies to communities downstream is avoided and maintain the ecological balance of the river system.
- No construction water containing spoils or site effluent especially cements and oil shall be allowed to flow into natural water drainage courses.
- Wash water from washing out of equipment shall not be discharged into water courses or road drains.
- Site spoils and temporary stockpiles shall be located away from the drainage system and surface run off shall be directed away from stockpiles to prevent erosion.

Traffic management

- Location of access roads/detours shall be done in consultation with the local community especially where access road shall traverse important ecosystem component. Access roads shall not traverse wetland areas.
- Upon the completion of the Works, all the roads shall be rehabilitated.
- Access roads shall be sprinkled with water at least 5 times a day in settled areas and 3 times a day in unsettled areas to suppress dust emissions.

Health and safety

- The Contractor in advance of the construction work shall mount an awareness and hygiene campaign. Workers and local residents shall be sensitized on health risks particularly of AIDS.
- The Contractor will be enforced to provide personal protective equipment to the workers, with penalty for non compliance. Workers will be encouraged to wear the equipment provided, for their own safety.
- Adequate road signs to warn pedestrians and motorists of construction activities, diversions, etc. shall be provided at appropriate points.
- Construction vehicles shall not exceed maximum speed limit of 40 km per hour.
- All necessary first aid arrangements will be available on Site.
- Emergency procedures and communication protocols will be in place prior to any activity on Site in order to deal with any emergency, which may arise; and, maintaining a safe and healthy place of work.
- Prior to any activity on Site a formal agreement will be established with a local Medical Doctor (Doctor on call) to support any medical treatment which may be required.
- A briefing about safety and health precautions referred to as a tool box talk, will be conducted regularly by all the supervisors and the foremen to their respective workforce.
- Enough toilets and urinals will put in place at assigned locations on Site and will be maintained clean and dry. Contents of these facilities will be contained so as to avoid environmental pollution.
- Safe drinking water will be provided on Site and workers will be encouraged to drink enough water.
- Alcohol, intoxicants and non-prescribed medicine shall not be permitted on Site and the persons suspected to be under their influence shall not be allowed onto the Site.
- The Contractor will implement the provisions in the Workers Compensation Act (of 2000) and more importantly will sensitize workers about their pay and other entitlements like compensation, insurance, taxation, etc.

ANNEX 10: COMMUNITY AND STAKEHOLDERS CONSULTATION ISSUES

Stakeholder	Key Issues/Concerns	Suggestions and recommendations
Technical staff of AMC and Arua District Local Government	Project impacts along road reserves will be high in heavily build up areas such as central business area and some parts of River Oli Division	Adjustments (reduction) of the required working space corridor of 4 meters from the edge of the roads since several commercial and residential buildings have been constructed within that corridor. Need to use manual labour in such areas to minimize damage to property
Central Government Agencies (Prisons, Forestry, RDC, UNRA)	Public land acquisition and negotiation powers for prisons land lie with authorities in Kampala	Advised the RAP team to advise the developer/client to enter into negotiations with Prisons, District/Forestry Authorities Headquarters in Kampala over the anticipated land acquisition for the reservoir and WSP/lagoons
	NWSC should pay ground rent to the local authorities for land that belongs to the local government	
	NWSC should be involved in the protection of the catchment for the water source (R. Enyawu) as this is what feeds their business. They should invest in activities like tree planting etc	
General Community	Some of the UNRA agency roads were undergoing expansion and rehabilitation and some compensation was likely to place along some of the road reserves where AWSP activities will take place.	UNRA observed the need for inter-sectoral collaboration especially along its agency roads currently undergoing rehabilitations and expansion in the PA
	Likely impact of the project activities on their livelihood in respect to food crops, commercial trees and fruit trees, land takes, property destruction and displacements like those who derived sustenance from roadsides enterprises such as <i>Kiosks</i> and makeshift eating joints	Need for prompt and adequate compensation for the PAPs Some PAPs should be educated and assisted during the compensation process like opening up bank accounts and filling in claim forms
	Proposed lagoons at prisons land at Ediofe would eventually	Consultations further downstream indicate that other nearby areas can be

Stakeholder	Key Issues/Concerns	Suggestions and recommendations
	affect the income of sand miners Some PAPs were operating along road reserves without permission	considered for sand mining without affecting the livelihoods of people engaged in sand mining. All PAPs irrespective of legal status will be considered for compensation
	Community members expressed fear about increased pollution of R. Enyau after establishment of lagoons	Long term community sensitization about lagoons before and after project implementation to allay community fears
	Some community members were not aware about road reserves limits	Community sensitization about the concept of “road reserves”
Local Gov Council Leaders/Executives and Other Community Local Leaders	Municipality plans and facilities for social services along road reserves need to be respected and considered	Work with District, Municipal Engineering Department and Town Planner about established and planned roads, and other facilities that need to be considered in the design to minimize resettlement Affected community social services facilities must be replaced and improved All PAPs must be compensated before project activity implementation and involve local leaders in compensation process
	Community members and PAPs may not have adequate information about the project and compensation process	Regularly disseminate project related information through local radio programmes in the local languages Adequate notice needs to be provided to PAPs who have seasonal crops so that they can harvest them in time

ANNEX 11. CONSULTATIONS WITH KEY STAKEHOLDERS; CENTRAL GOVERNMENT

Organisation	Concern/Issues	Remarks / Response by the Developer
DWD	(a) Did not think that it would be practical to operate seven motorized boreholes in Arua. That instead, the weir should be raised to create enough reservoir at the river, and that even if this activity inundates people's property, the owners should be compensated. (b) They suggested applying for all permits on the utilization of the wetland and also on the abstraction of water. (c) They also suggested not to pump sewage, but instead to get more than one location where sewage will flow by gravity.	(a) It was noted that the number of boreholes to be operated would eventually depend on the yield and quality of water at each proposed borehole site. They are also meant to supplement the water supply during the dry seasons. The option of raising the weir will be considered in the next phase. (b) This will be done (c) It was pointed out that the issue of easy maintenance of the sewerage system had been considered at the design stage and efforts were made to avoid pumping of sewage as far as practicable.
NEMA	For as long as studies are carried out on the activity to be done in the wetland and show that the wetland would not be degraded, then a permit for the use of the wetland for that activity should be applied for.	This will be done
NFA	Recommended consultations with Arua Local Government where the Forest belongs. This had already been done.	No response needed
Wetlands Management Department	The wetland should be kept free of pollution. If sludge is to be dried or disposed of in the wetland, a thorough detailed study should be done to establish the contaminants present in that sludge and how the wetland species will be safeguarded against the effects of those pollutants. This study should detail the species diversity (flora and fauna) in the wetland and their tolerance limits related to the pollutants coming out of the sludge. Borrowing from the example of Mbarara, if a sufficient size of reservoir is not allowed for, there is a risk of 'exposing' the intake pipes during the rainy season. A big reservoir might displace very many people, and it might also have other negative impacts. Smaller cascaded reservoirs might solve this kind of problem.	Before locating sludge drying beds in a wetland, a detailed study will be carried as recommended.

ANNEX 12: HIV/AIDS MANAGEMENT AND CONTROL OF HIV/AIDS and STIs**HIV/AIDS MANAGEMENT AND CONTROL OF HIV/AIDS and STIs WITHIN
CONTRACTOR'S CAMP AND IMMEDIATE ZONE OF IMPACT****1.1 Introduction**

The HIV/AIDS impact mitigation plan will involve providing a comprehensive range of services including the identification of possible HIV/AIDS cases, testing with pre- and post-counseling, the treatment of associated infections, referral of appropriate cases, education to promote better quality of life and promotion of precautions, provision of condoms and the application of occupational exposure policies. This will be implemented during construction and will be the role of the Contractor or assigned to an approved service provider. This has been made clear in Sub-Clause 6.7 of the General Conditions of Contract which form part of the Bidding Documents. The Sub-Clause deals with, among other health issues, HIV-AIDS Prevention for the workers and the project immediate or direct zone of influence (DZI)⁵ and the focus will be on the areas of prevention and control of STIs and HIV/AIDS⁶. This is because prevention is still the mainstay of the strategic response to HIV/AIDS in the country. The HIV/AIDS prevention and control components that will be emphasized are:

1. HIV prevention among the community
2. HIV prevention among the contractor's workers
3. HIV prevention counseling, testing, and referral services
4. Health education and risk reduction activities
5. STIs prevention activities
6. Laboratory HIV/AIDS and STI support services and
7. Collaboration and coordination with other civil society related programs

The target group for this HIV/AIDs and STI campaign will be all the Site staff and labour (including all the Contractor's employees, all Subcontractors' and any Employer's employees, and all truck drivers and crew making deliveries to Site for construction activities) and to the immediate local communities. The campaign will address issues concerning the risks, dangers and impact, and appropriate avoidance behaviour with respect to sexually transmitted diseases (STD) or sexually transmitted infections (STI) in general and HIV/AIDS in particular. A number of references and other essential requirements like materials and skills (standards) are highlighted in Table 1 in this annex. A tentative cost for this component is estimated at Uganda Shillings 100,000,000 millions only.

⁵ In defining the zones of influence, cognizance was accorded to spatial extent of planned project activities, duration and intensity of proposed activities both during construction and operational phase. DZI is the area that will receive primary impacts resulting from project activities. The DZI areas for this project include the municipality and the seven sub-counties where all the project sub-components will be implemented (see: Roads and the environment: A Handbook /edited by Christopher Hoban and Koji Tsunokawa: World Bank technical paper No. 376) 1997. ISBN 0-8213-4031-X, pg5).

⁶ The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Employer's personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics. The Contractor shall conduct an HIV-AIDS awareness programme preferably via an approved service provider, and shall undertake such other measures as are specified in the Contract to reduce the risk of the transfer of the HIV virus between and among the Contractor's personnel and the local community, to promote early diagnosis and to assist affected individuals.

1.2 Strategic Objective for Prevention and Control of HIV/AIDS/STIs

The objective is to contribute to the prevention of HIV/AIDS and STIs transmission and mitigation of the effects of HIV/AIDS through several interventions as defined below. The Contractor shall throughout the contract (including the Defects Notification Period) undertake the following strategies and interventions.

1.2.1 Strategies and interventions

(a) Strengthen HIV prevention through health education and reduction of sexual transmission of HIV; and through the following:

- (i) conduct HIV/AIDS related Information, Education and Communication (IEC) campaigns, at least every month;
- (ii) provide male or female condoms for all site staff and labour as appropriate and the general community;
- (iii) provide life skills education targeting workers and youth in the DZI;
- (iv) provide for STI and HIV/AIDS screening, diagnosis, counselling and referral to a dedicated national STI and HIV/AIDS programme;
- (v) establish a unit and mechanism for effective diagnosis and management of other opportunistic infections; and also post exposure prophylaxis (PEP) to minimise the risk of infection among health care personnel following potential exposure to blood-borne pathogens.

(b) Improve access to quality HIV treatment and care services for the workers

- (i) seek collaboration from the Ministry of Health (MoH) accredited units for referral of workers for specialized care including antiretroviral therapy (ART) services;
- (ii) establish a counseling unit to ensure that workers and other community members are counseled and psycho-socially supported;
- (iii) ensure that essential, safe, and quality medicines for STI and HIV related infections are available;
- (iv) support other community based health workers to offer HIV/STIs health education, counseling and social support for the community groups. Community-based organisations (CBOs) and non-governmental organization (NGOs) will be considered for support to engage in community based HIV/AIDS education based on their comparative advantage in reaching out to the community.

(c) Design and distribute IEC for HIV/AIDS and STI prevention and control

- (i) design and procure IEC materials for HIV/AIDS and STIs control and prevention as part of health education and risk reduction activities;
- (ii) distribute IEC materials on HIV/AIDS and STIs control and prevention.

Table 1. Summary of the ESIA HIV/AIDS Impact Mitigation Plan - AWSSP

ESIA Impact Mitigation Plan for HIV/AIDS.	Standards			
	References and Educational Materials	Equipment	Medicines and Supplies	Staff competence (required skills and capacities)
A comprehensive range of services including the identification of possible cases, testing with pre- and post-counseling, the treatment of associated infections, referral of appropriate cases, education to promote preventive behavior, provision of condoms and the application of HIV/AIDS occupational exposure policies.	1. National HIV/AIDS Strategic Plan 2. HIV/AIDS treatment policy guidelines. 3. HIV/AIDS Clinical Care Guidelines 4. HIV/AIDS Guidelines for work place and community based services. 5. HIV/AIDS/STD posters and pamphlets in the local languages	Laboratory equipment for all possible STIs and rapid HIV testing kits	Gloves and protective aprons, goggles, condoms, Post exposure prophylaxis, ARTs (if protocol allows)	Staff relate to patients in a non-discriminatory and non-judgmental manner and maintain strict confidentiality about patient's HIV status; undertake a physical examination according to guidelines ; do pre- and post-test counseling after informed consent; take laboratory specimens for HIV test; continue counseling ; promote optimal health and safer sexual healthy lifestyle, early treatment; diagnose acute infections and referral for further management.

ANNEX 13: Physical Cultural Resources and Chance Findings (OP 4.11)

Introduction

1 The Policy ensures that Physical Cultural Resources (PCR) are identified and protected and national laws governing the protection of physical cultural property are complied with. Findings of physical cultural resources (PCR) survey indicate resources that might be chanced upon during the project construction activities. Uganda has a legislative framework (Historical Monuments Act of 1967) that takes care of cultural resources. The Department of Museums & Monuments has archaeologists with experience in procedures to recover “chance findings” in line with national regulations. NWSC will ensure that conservation of cultural resources is a demonstrable requirement in bidding documents and contracts for the civil works.

Archeological Chance Findings and Impact Management

2 Measure will be taken to avoid damage to previously unidentified subsurface archaeological features through the vigilance of the contractor’s environmental officer and awareness of construction workers. In the unlikely event that some cultural resources such as previously unidentified graves are, by chance, encountered during construction, it will be the responsibility of the contractor to inform the Resident Engineer (RE) who will get in touch with the Local Community Leaders to identify the owners of such graves and plan for relocations following local traditional norms.

3 Work at such sites will be temporary stopped and the specific site sealed off, until when such culturally and religiously acceptable relocation has been done by the concerned owners or guardians of such chance graves.

4 The RE will provide advice to the contractor about skipping or temporary halting work at such point (s) until when an acceptable plan of action for relocation has been implemented.

5 The contractor will work with the RE staff (Sociologist) and the district and sub-county technical staff (District Valuer, District Community Development Office/District Cultural Officer or represented by the sub-county Community Development Officer) in collaboration with the community leaders and owners to determine and plan for necessary and acceptable relocation.

6 A report about the time (likely delay of project work time lost or taken for relocation) and resource implications and necessary course of action to take and the eventual action taken will be submitted as part of the monthly reporting form the contractor and RE.

7 The general costs of relocation of such chance graves is generally minimal and can be consumed under the miscellaneous costs of the contractor bill of quantities or under the anticipated grievances/litigation costs in the RAP.

8 In case the cultural resources are beyond the mandate of the Local Communities are encountered; an Archeologist from the Department of Museums & Monuments, Ministry of Tourism, Trade and Industry will be called upon for advice and necessary action.

Role of Archaeologist

9. If the cultural resources cannot be handled at local level, it is proposed that a specialist archaeologist be contracted (on a non-permanent basis) from the Department of Museums & Monuments in the Ministry of Tourism, Trade & Industry. Roles of the archaeologist will be:

- (i) Advice/ guidance to the contractor with respect to halting or moving construction activities if earthworks encounter archaeological features.
- (ii) Provision of advice on the significance and management of unidentified archaeological features encountered.
- (iii) Processing/ excavation of any unidentified subsurface archaeological features encountered in accordance with standard procedures recommended by the Department of Museums and Monuments.
- (iv) Maintaining monitoring records of all unidentified archaeological features encountered.
- (v) To advise both NWSC and the Ministry of the importance of the discovery and provide recommendation for further investigations and protection measures.

ANNEX 14: GRIEVANCES MANAGEMENT SYSTEM AND PROCEDURE

1. Grievance Procedure and Rationale

This section describes the procedure and mechanism through which community members and PAPs will be able to report, make, place/lodge or express a grievance against the project, its staff or contractors as part of the mitigation measures. It also describes the roles and responsibilities for different structures in resolving grievances. A grievance is any dissatisfaction or sense of injustice, or unfairness felt by a person-in this respect a community member, PAP or his/her representative in connection with his/her compensation entitlements, RAP implementation process, the project developer, contractor and other scenarios related to project implementation. The grievance is usually brought to the attention of the person(s) in charge, referred to here as the Grievance Officer (GO). This grievance procedure is intended to put in place and facilitate accessible, prompt and cost effective handling of grievances at the nearest points of service to community members and the PAPs.

The aim and purpose of this system is to make the grievance handling procedures accessible, prompt and affordable to the PAPs given the generally low values of some of the properties to be affected; and also provide an alternative to the costly and time consuming formal courts procedures for handling grievances and disputes. The objective of the grievance handling systems and procedure is to establish for the community members and PAPs mechanisms for raising complaints related to compensation for loss of land and other livelihood properties and assets and having such complaints resolved as amicably as possible through acceptable and binding corrective actions.

2. Grievance Mechanism

The grievance mechanism is adopted from the MWE-RPF, 2012 already disclosed. The grievance mechanism operating at each location will receive inputs from four main sources:

- (a) Directly from the PAPs or other members of affected community.
- (b) From the RAP implementation team.
- (c) From the Monitoring and Evaluation Officer who will forward issues/concerns identified in the field.
- (d) From the Local Government Offices at the Sub-county/Municipality Divisional Levels since these are as close to the community as possible.

Steps of the grievance process are described below.

i. STEP 1: RECEIPT OF COMPLAINT/GRIEVANCE

A verbal or written complaint from a PAP or community member will be received by the GO (refer to **Table 1** for the roles of the GO) or an assigned contact officer in a given administrative jurisdiction/authority near to community level and recorded in a grievance log which will be held in each Sub-county/Division Offices. The contact officer at the sub-county will be the Sub-county Chief/Assistant Town Clerk in charge of the Division in AMC.

Table 1: Role of a Grievance Officer

A Grievance Officer (GO), who will be a member of the Project Implementation Team, will lead the grievance mechanism. Principal responsibilities of the GO will include:

- (a) Recording the grievances, both written and oral, of the affected people, categorizing and prioritizing them and providing solutions within a specified time period.
- (b) Discussing grievances on a regular basis with the Working Group and coming up with decision/actions for issues that can be resolved at that level.
- (c) Informing the Steering Committee of serious cases within an appropriate time frame.
- (d) Reporting to the aggrieved parties about developments regarding their grievances and decisions of the Steering Committee.
- (e) Providing inputs into the monitoring and evaluation process

Source: MWE-RPF (Ministry of Water and Environment-Resettlement Policy Framework), 2012

The grievance team will hold meetings at sub-county headquarters where grievances are received by a contact person who would then hand over received complaints to the GO, for entering into the grievance log using the grievance form.

The grievance log will indicate grievances, date opened/lodged, actions taken to address or reasons the grievance was not acted upon (e.g., the grievance was not related to the resettlement process); information provided to complainant and date the grievance was closed.

Grievances can be lodged at any time, either directly to the GO or the Sub-county/Divisional Office. The process for lodging a complaint is outlined below:

- a) The GO will receive a complaint from the complainant or from the appointed contact person at the sub-county/divisional offices.
- b) The GO will ask the claimant questions in their local language, write the answers in English and enter them in English onto the Grievance Form.
- c) A representative of an independent local civil society organization witnesses translation of the grievance into English.
- d) The GO reads the complaint in English and translates it into the complainant's local language on the Grievance Form.
- e) The local leader (could be the LC 1 chairperson/representative of an independent local civil society organization) and the complainant both sign

the Grievance Form after they have both confirmed the accuracy of the grievance.

- f) The GO lodges the complaint in the Grievance Log.

ii. STEP 2: DETERMINATION OF CORRECTIVE ACTION

If in their judgment, the grievance can be solved at this stage and the GO and a representative of a local independent civil society/organization will determine a corrective action in consultation with the aggrieved person. A description of the action; the time frame in which the action is to take place; and the party responsible for implementing the action will be recorded in the grievance data base.

Grievances will be resolved and status reported back to complainants within 30 days. If more time is required this will be communicated clearly and in advance to the aggrieved person. For cases that are not resolved within the stipulated time, detailed investigations will be undertaken and results discussed in the monthly meetings with affected persons. In some instances, it may be appropriate to appoint independent third parties to undertake the investigations.

iii. STEP 3: MEETING WITH THE COMPLAINANT

The proposed corrective action and the timeframe in which it is to be implemented will be discussed with the complainant within 30 days of receipt of the grievance. Written agreement to proceed with the corrective action will be sought from the complainant (e.g. by use of an appropriate consent form). If no agreement is reached, Step 2 will be re-visited.

iv. STEP 4: IMPLEMENTATION OF CORRECTIVE ACTION

Agreed corrective actions will be undertaken by the project developer or its contractors within the agreed timeframe. The date of the completed action will be recorded in the grievance database.

v. STEP 5: VERIFICATION OF CORRECTIVE ACTION

To verify satisfaction, the aggrieved person will be approached by the GO to verify that the corrective action has been implemented. A signature of the complainant will be obtained and recorded in the log and/or on the consent form (see Step 3). If the complainant is not satisfied with the outcome of the corrective action additional steps may be undertaken to reach agreement between the parties. If additional corrective action is not possible alternative avenues maybe pursued.

vi. STEP 6: ACTION BY LOCAL LEADERS AND PROJECT CONTRACTORS

If the GO and independent observer cannot solve the grievance, it will be referred to relevant parties such as local leaders, District Officers, Construction Contractor, Valuer and MWE, for consultation and relevant feedback provided.

vii. STEP 7: ACTION BY GRIEVANCE COMMITTEE

If the complainant remains dissatisfied and a satisfactory resolution cannot be reached, the complaint will be handled by the Grievance Committee. A dedicated Grievance Committee will be established to assess grievances that arise from disputes. This will include the following members:

- a) District Land Office Surveyor;
- b) Representative of the valuer; and
- c) Grievance Officer
- d) SC/Divisional LC III Council Representative where it applies.

This committee must have a quorum of at least three persons. Decisions will be reached by simple majority. The Grievance Committee should be constituted for as long as grievances are being lodged.

Once the Grievance Committee has determined its approach to the lodged grievance, this will be communicated to the GO, who will communicate this to the complainant. If satisfied, the complainant signs to acknowledge that the issue has been resolved satisfactorily. If the complainant is not satisfied however, the complainant notes the outstanding issues, which may be re-lodged with the Grievance Committee or the complainant may proceed with judicial proceedings.

viii. STEP 8: ACTION BY DEVELOPER (NWSC)

If no satisfactory solution is reached by the Grievance Committee the complainant can be advised to lodge the complaint with the management of the developer (NWSC) at their regional offices to make the process easily accessible to the complainants. If no satisfactory solution is reached by NWSC management, the complainant has the option to seek redress via judicial processes.

ix. STEP 9: ALTERNATIVE ACTION BY CHIEF GOVERNMENT VALUER (CGV)

Some grievances may be beyond the capacity of the GO or the Grievance Committee to handle expeditiously without the technical support of other professionals like the CVG. Some of the grievances may be specifically related to the valuation process, valuation rates and awards. Therefore the GO will determine whether a complaint can be resolved by the Grievance Committee or, if not, should be referred to the CGV for technical and administrative advice.

The CGV will make necessary consultations with offices he/she deems fit to consult in his/her capacity as CGV. If satisfactory solution is not achieved or provided by the CGV, the aggrieved person can resort to the judicial process.

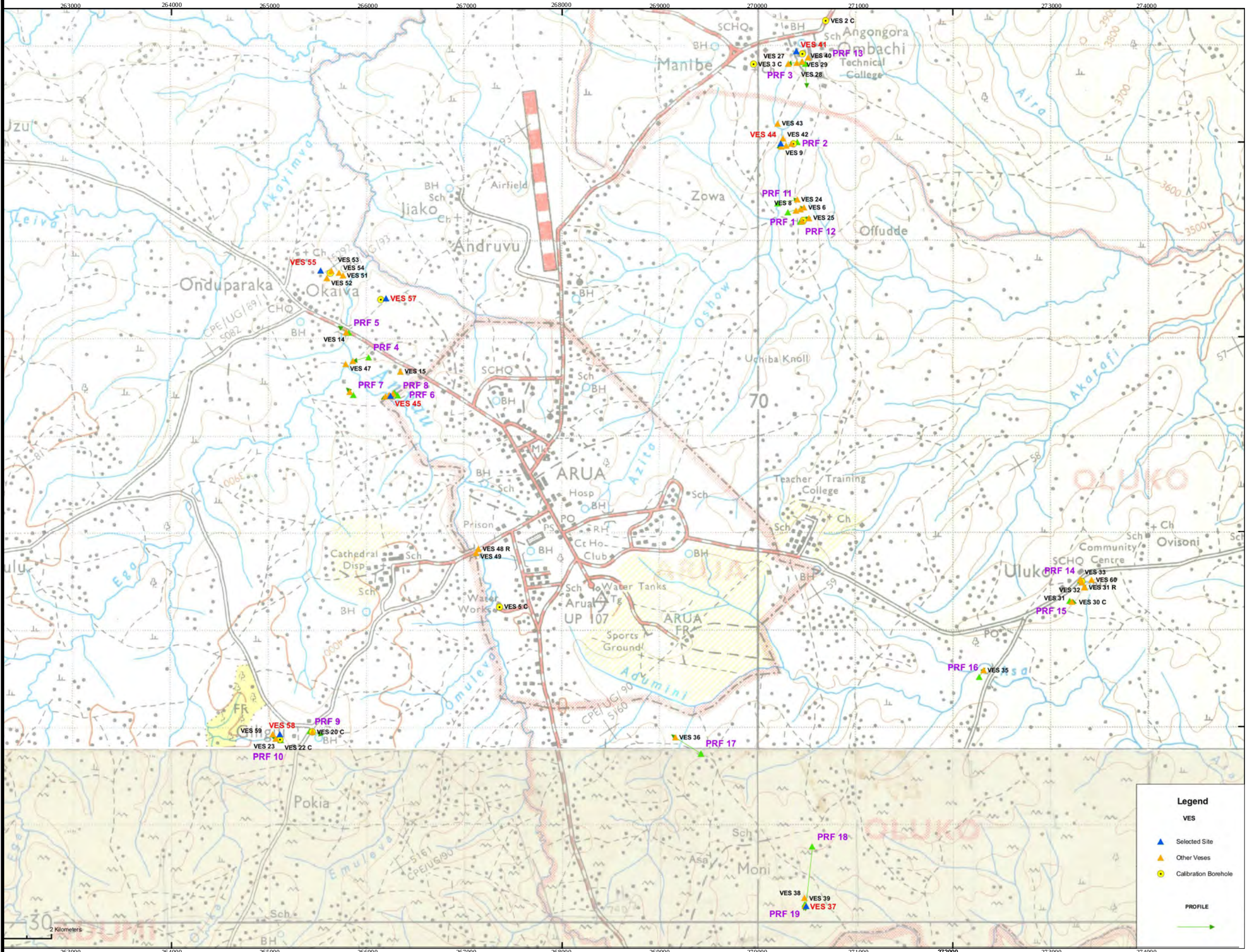
3. Capacity Building for the Grievance Officer and Grievance Committee

It will be important for the appointed GO to be appointed based on his/her experience and training in conflict resolution through mediation and reconciliation. It will also be important for the GO to have sufficient skills in data management including data entry, data analysis and storage. This notwithstanding, it will be important that steps are taken to orient and build the capacity of the GO as part of the project implementation team in conflict resolution procedures such as mediation and reconciliation and other management areas such as record keeping and report writing and ICT equipment management.

The Grievance Committee members will also need to be oriented about the grievance management system suggested in the RAP as adapted from the RPF. The capacities of the grievance committee members will also need to be built around issues of conflict identification, conflict information analysis and resolution based on issues in the land legislation through reconciliation and mediation.

4. Other alternatives

The other alternative recourse suggested as a last resort is for the complainant to seek redress from formal courts of law. The Land Act, Cap 227 establishes Land Tribunals at regional/district level. It empowers the Land Tribunals to determine disputes relating to amount of compensation to be paid for land acquired compulsorily for public interest. The affected person may appeal to a higher ordinary court. The Land Acquisition Act allows for any person to appeal to the High Court within 60 days of the award being made. The Land Act, Cap 227 also states that traditional authority mediators can play a role in settling land disputes.



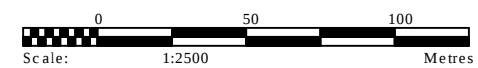
LEGEND

Building/House

Contours

Road

Annex 4: Borehole Sites



CLIENT

THE REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT
NATIONAL WATER AND SEWERAGE CORPORATION (NWSC)

PROJECT

**ARUA WATER SUPPLY EXPANSION AND
SANITATION PROJECT**

CONSULTANTS

**GAUFF CONSULTANTS (U) LTD
CONSULTING ENGINEERS**
P.O.BOX 201, Kampala, Uganda
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In Association With

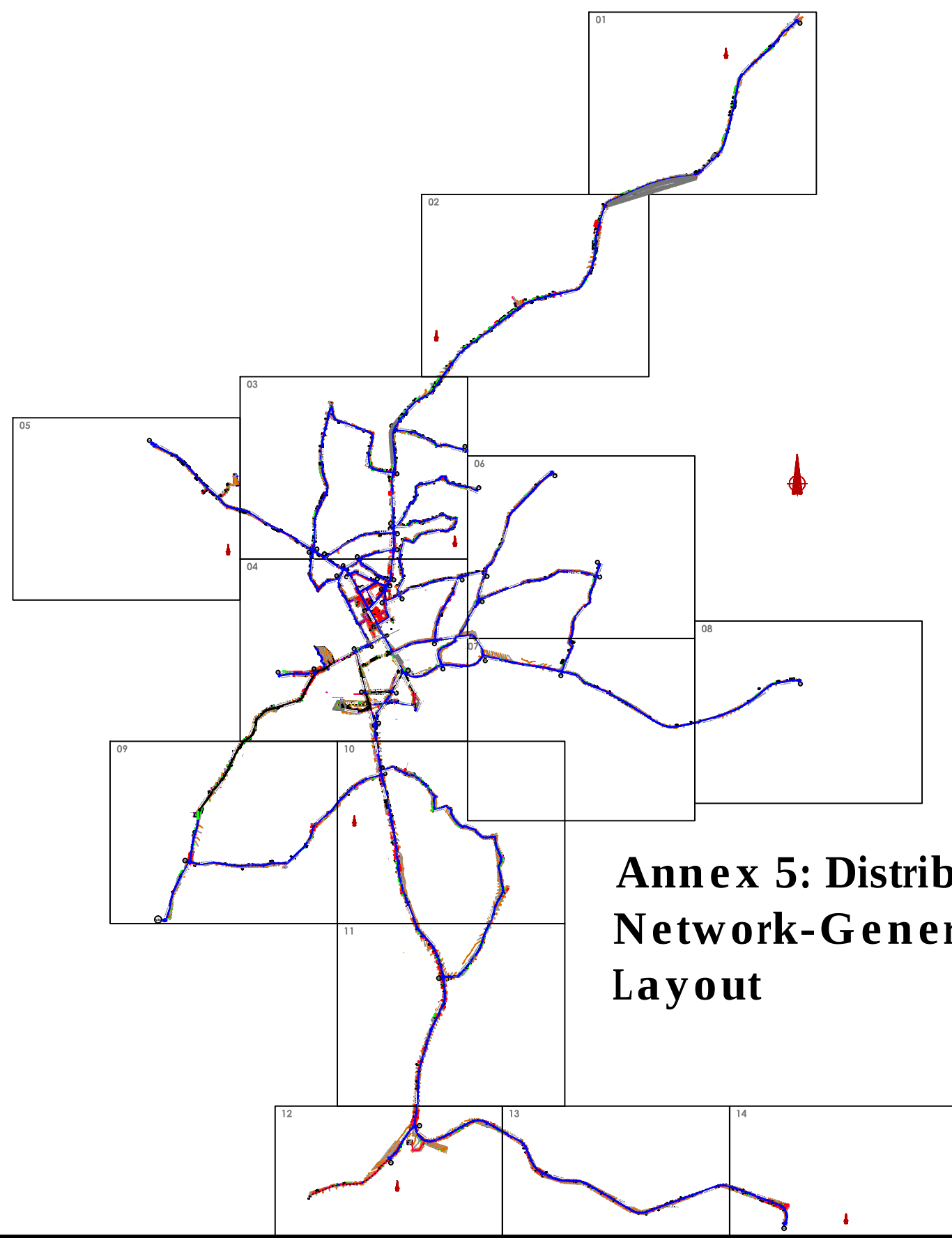
GAUFF INGENIEURE
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D-60437 Frankfurt am Main
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Fax: +49-69-5 00 08-11

DETAILED ENGINEERING DESIGN

DRAWING TITLE

**GENERAL LAYOUT
BORE HOLE SITES**

SCALE	NTS	DRAWING No.	AEWSSP/W/0.1.0
SURVEYED	E.F.T, M.K. & K.S	DESIGNED	ODE
DRAWN	EAZ	CHECKED	ODE
DATE	JAN 2012	APPROVED	ND



Annex 5: Distribution Network-General Layout

LEGEND

- Water Pipeline
- Ground Level
- Building/House
- Contours
- Road

0 5.0 10.0

Vertical Scale: 1:250 Metres

0 50 100

Horizontal Scale: 1:2500 Metres

CLIENT

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MINISTRY OF WATER AND ENVIRONMENT
NATIONAL WATER AND SEWERAGE CORPORATION (NWSC)

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DETAILED ENGINEERING DESIGN

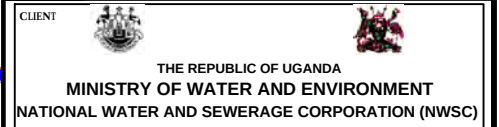
DRAWING TITLE

**DISTRIBUTION NETWORK
GENERAL LAYOUT**

SCALE	NTS	DRAWING No.	AEWSSP/W/0.0.0
SURVEYED	E.F.T, M.K, & K.S	DESIGNED	ODE
DRAWN	EAZ	CHECKED	ODE
DATE	DEC 2011	APPROVED	ND

Annex 6: Part of the Distribution Network

 Water Pipeline
 Ground Level
 Building/House
 Contours
 Road



CONSULTANTS

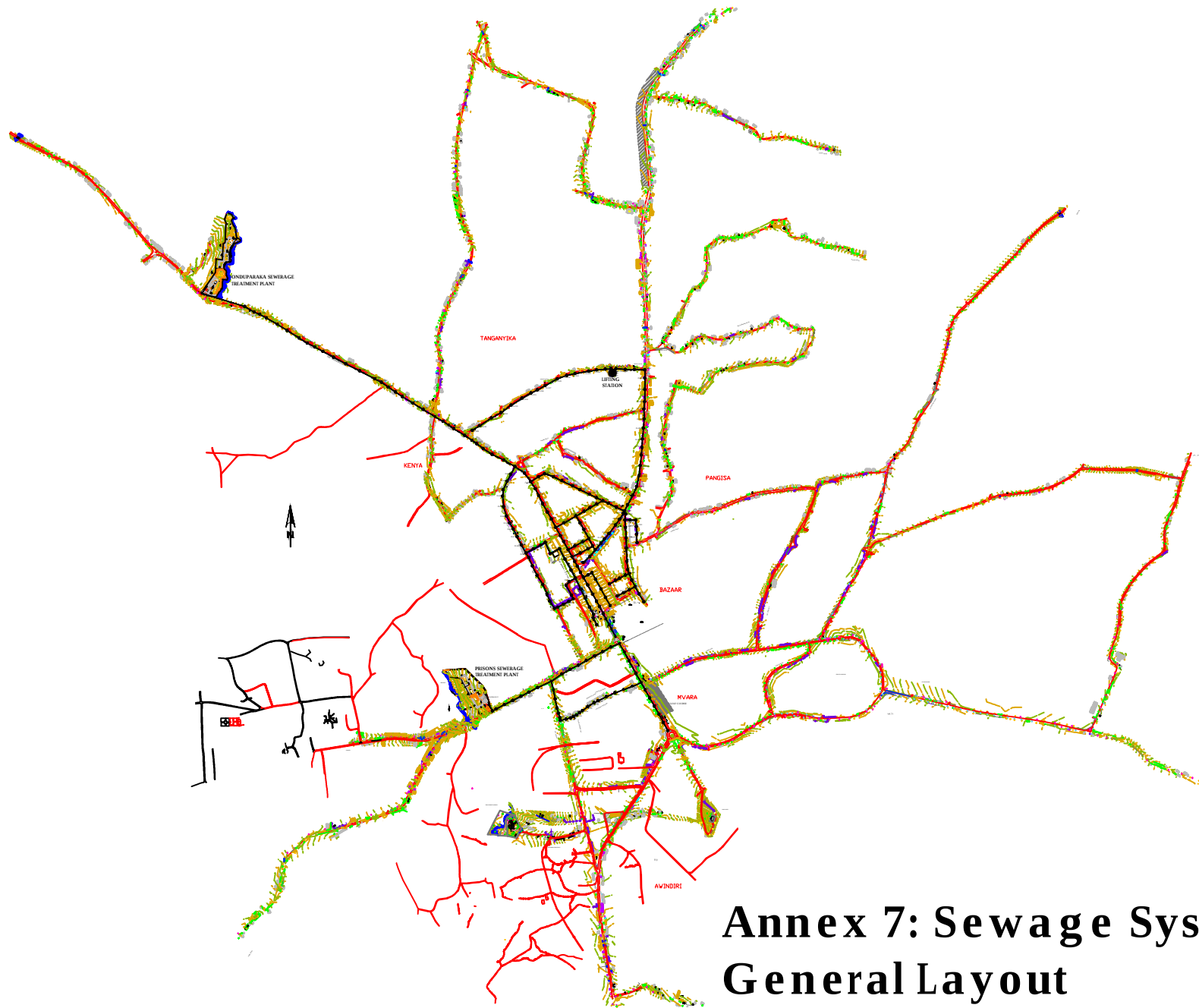

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Fax No: +256-41-259 508

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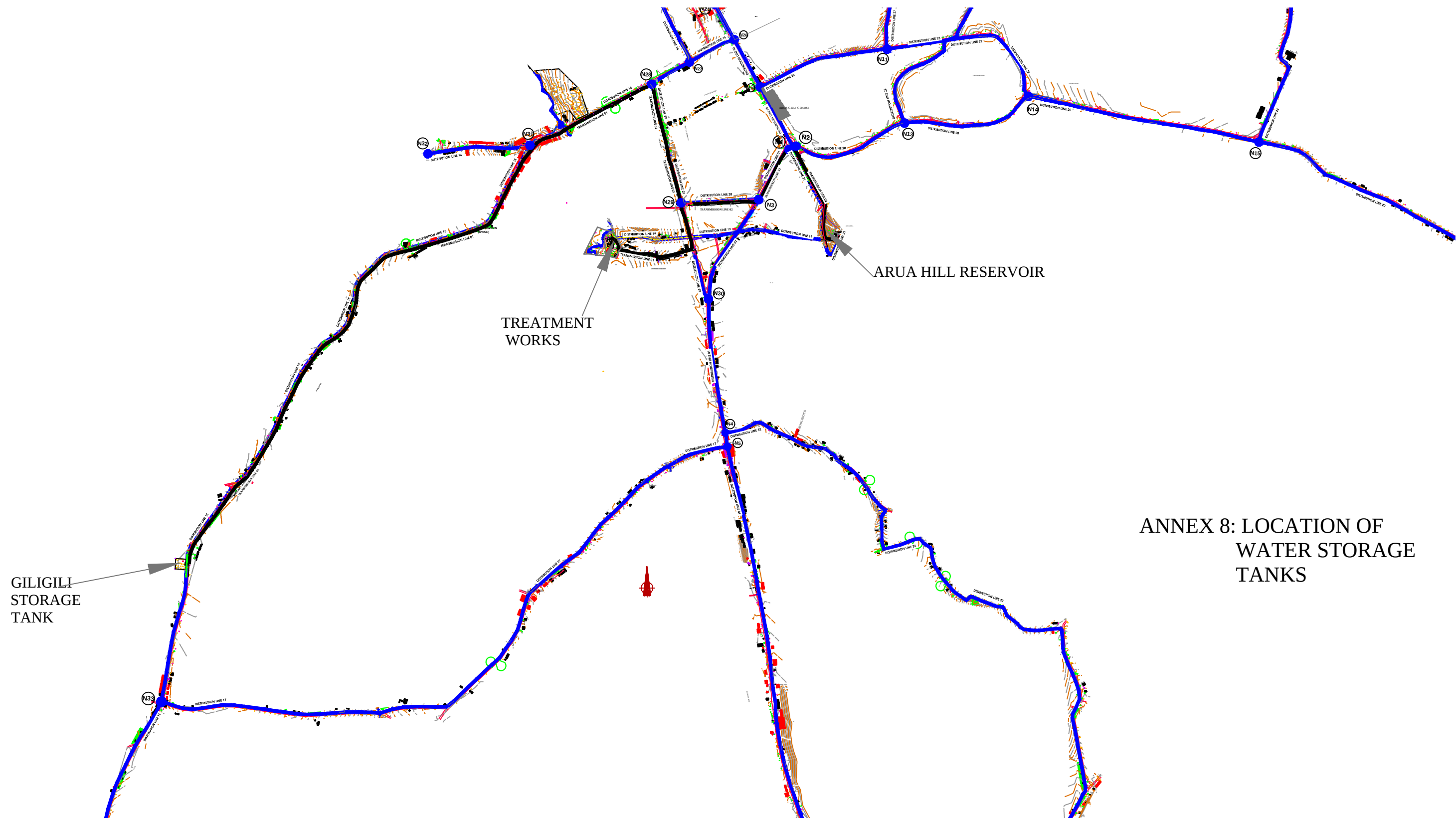

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DRAWING TITLE
GENERAL LAYOUT
SHEET 04 OF 14

SCALE	AS SHOWN	DRAWING No.	AEWSSP/W/0.0.4
SURVEYED	E.F.T, M.K. & K.S	DESIGNED	ODE
DRAWN	FAZ	CHECKED	ODE
DATE	DEC 2011	APPROVED	ND



**Annex 7: Sewage System
General Layout**



ANNEX 8: LOCATION OF
WATER STORAGE
TANKS