



Environmental and Social Impact Assessment for Mbale & Small Towns Water Supply and Sanitation Project

Final Report

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Acronyms and definitions

Acronyms

AWE:	Air Water Earth (the consultant)
CAPEX:	Capital expenditure
ESIA:	Environmental & Social Impact Assessment
DWRM:	Directorate of Water Resources Management (). DWD:
ESMP:	Environmental and Social Management Plan
GIS:	Geographical Information Systems
GoU:	Government of Uganda
LC:	Local Council
IP/PAP:	Interested Parties / project-affected people
NEMA:	National Environment Management Authority
PCRs:	Physical Cultural Resources
PCDP:	Public Consultation and Disclosure Plan
OHS:	Occupational Health and Safety
ToR:	Terms of Reference
UBOS:	Uganda Bureau of Statistics
WB:	World Bank
NWSC:	National Water and Sewerage Corporation
MWE:	Ministry of Water and Environment
WMDP:	Uganda Water Management and Development Project
WSP:	Waste stabilisation ponds
WTP:	Water treatment plant
WMD:	Wetland Management Directorate

Units and measures

Ha:	hectare
km:	kilometre
m:	metre

Executive Summary

1 PROJECT BACKGROUND

Uganda Government has requested IDA funds from the World Bank for implementing the Integrated Uganda Water Management and Development Project (IWMDP). The IWMDP was prepared under the Ministry of Water and Environment (MWE) as an integrated water resource management and development project with objectives of improving integrated water resources planning, management and development; and access to water and sanitation services in priority urban areas and rural growth centers. The project will also contribute to higher level goals of sustaining natural resources, improving service delivery, and increasing economic productivity. Part of the IWMDP funds is intended to be applied towards Water Supply and Sanitation Project in Mbale National Water and Sewerage Corporation (NWSC) service area and neighbouring small towns and rural growth centres of Busolwe, Kadama, Tirinyi, Kibuku, Butaleja and Budaka.

National Water & Sewerage Corporation (NWSC) is the implementing agency in Mbale Municipality while MWE through the Directorate of Water Development (DWD) is directly in charge with the small towns. Piped water will be extended from the NWSC Mbale Service Area to the neighbouring small towns and rural growth centres. The NWSC was established as a government parastatal organisation in 1972 to develop, operate, and maintain water supply and sewerage services in urban areas of Uganda.

The first piped water supply system in Mbale was constructed around 1939. The municipality relies on two treatment plants, namely Bungokho and Manafwa water treatment plants. Mbale has had its share of infrastructure development backlog experienced as all urban centres in Uganda that have undergone rapid growth. The backlog has placed immense pressure on the capacity of NWSC to effectively deliver water and sewerage services. Although a number of interventions have been undertaken in the production systems, little has been done in the distribution network and the expansion of sanitary services.

There are two isolated sewer networks in Mbale Town. One system is discharging into the Namatala Treatment Ponds and the other one is discharging into the Doko Treatment Ponds. Doko treatment ponds and Namatala Wetland were constructed in 1968/69 and 1986, respectively. The condition of the ponds seems to be fair, the biggest problem being the high amount of infiltration during rains. The sewer network in was established as a separate sewer. However, there have been reports of illegal stormwater connections. From the Feasibility Study carried out by Consulting Engineers Salzgitter (CES) in 2015, there were several residential properties that did connect their stormwater drains to the sewerage network in the Namatala catchment, which was a major cause of siltation in the sewers and treatment ponds. In addition, there was high infiltration because of broken sewers in the network. Many concrete pipes have in use for 40 to 60 years. The Doko treatment ponds appear to be in a good condition, except for the concrete works. The Namatala Wetlands are in urgent need of maintenance. The sewerage coverage is poor with only 14% of the households with water supply have a sewerage connection. Approximately 47 km (17%) of the current water supply network (total length ~ 279 km) consists of asbestos cement pipes which are according to NWSC in poor state. As a result, frequent bursts and leakages are experienced. Furthermore, development within the town over the last few years has taken place at a much faster rate than infrastructure provision, overwhelming NWSC's capacity to provide reliable services. Mbale Municipality has currently a population of around 100,000 inhabitants and the system was originally constructed for a population of around 45,000 people. With the town's boundaries having grown, it is now imperative that the water supply system be expanded to address the low per capita water production.

There is only piped water supply for the towns of Busolwe, Kibuku and Tirinyi. Budaka has a water supply system as well, but there is no operator in place and the pumps of the boreholes supplying the network are not functioning. The towns of Kadama and Butaleja do not have piped water. Despite having piped water in some of the towns a sizeable part of the population is taking water from boreholes with hand pumps that have low

yields and from shallow wells. The rivers are used as well as a water source. The connections to the water supply network are yard connections with very few exceptions. In all the towns most of the population rely on on-site sanitation facilities, mainly simple pit latrines and a few VIP latrines. The same applies to the institutions, like schools and health centres. The condition of the sanitation facilities in these institutions appeared to be satisfactory. In Tirinyi and Kibuku two new public toilets have been constructed, but they are not yet commissioned. Other than those two toilets there is no appropriate public sanitation facility in any of the growth centres.

The scope of work under this project will include:

- i) Catchment management measures for protecting the current water sources at Nabijjo and Nabyonga Dam;
- ii) Rehabilitation and expansion of the water treatment plants at Bungokho and Manafwa;
- iii) Investigations into possible new water sources;
- iv) Rehabilitation and expansion of the water supply and distribution system;
- v) Extension of water supply services to neighbouring small towns and rural growth centres;
- vi) Rehabilitation and expansion of the sewer network and construction of new wastewater treatment facilities for new drainage areas; and
- vii) Water and sanitation facilities in informal settlements.

2 OBJECTIVES OF THE ESIA

The main objective is to carry out a comprehensive environmental and social impact assessment for the proposed project works for provision of improved water supply services in the business districts of Mbale, Kibuku, Budaka, and Butaleja. The specific objectives included:

- i) Establishment of the project's potential environmental and social impacts and propose measures to mitigate them;
- ii) Assessment of the impacts of alternatives and advise the design consultant accordingly; and
- iii) Determination of the actions required by NWSC and other stakeholders to satisfactorily address the impacts.

3 PROPONENTS' CONTACT AND PROJECT COST ESTIMATE

Name and address:

Mbale Municipality

NATIONAL WATER AND SEWERAGE CORPORATION
The Senior Manager - Projects
39 Jinja Road,
P.O. Box 7053, Kampala, Uganda
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Small Towns and Rural Growth Centres

DIRECTORATE OF WATER DEVELOPMENT
Ministry of Water and Environment
Plot 21/28 Port Bell Road
P. O. Box 20026, Kampala, Uganda

The estimated project cost is Fifty Million United States dollars (USD 50,000,000).

4 LOCATION OF PROJECT SITE

Mbale lies approximately 245 km, by road, northeast of Kampala, on an all-weather tarmac highway. The coordinates of the town are: 1° 04' 50" N, 34°10' 30" E. Mount Elgon, one of the highest peaks in East Africa lies approximately 52 km east of Mbale. Mbale is home to the Islamic University in Uganda (IUIU), as well as the Moses Synagogue around which most of the Abayudaya ba Uganda live. The population includes members of the Gisu ethnic group, mainly the Bamasaaba and Bagisu. The Mbale water supply is being developed to also extend water to the neighbouring small towns of Busolwe, Butaleja, Kadama, Budaka, Kibuku and Tirinyi; Kadama, Budaka, Tirinyi and Kibuku being located along the Tirinyi-Mbale highway, while Busolwe and Butaleja are located off of the Mbale-Tororo Highway. The location of the proposed facilities in Mbale and the small towns are presented in Figures 3 to 18.

Budaka Town Council is located at grids 01° 01' 00" N, 33° 56' 42" E, approximately 36 km by road, west of Mbale. It hosts the Budaka District headquarters and is at altitude 3,810 ft. (1,160 m) above sea level. Kadama Town Board is 8km from Budaka town towards Tirinyi town along the Mbale - Iganga Highway. Kibuku Town Council is located between Grids 01°02'N and 33°50' E. The altitude ranges from 1000m to 1100m above sea level. It lies 53km by road west of Mbale town.

Busolwe Town Council is located at grids 00° 50' 57"N, 33° 55' 37"E; at an elevation of 3,609 ft (1,100 m) above sea level. It lies 47 km by road southwest of Mbale town.

Butaleja Town Council is located at grids 0°55'30.0"N, 33°56'42.0"E. It hosts the District headquarters. It lies at an elevation of 3,600 ft (1,100 m) above sea level. It lies at a distance 38 km by road southwest of Mbale town.

5 PROJECT COMPONENTS

a) New Water Intake and Transmission lines

Namatala water intake and transmission line: The current intakes of Nabijo and Nabuyonga are not sufficient anymore for the new water supply system. Thus, a new intake and a new transmission main between Namatala and Bungokho WTP are required. The pipeline shall follow in the beginning the contours and will be laid through agricultural land and forest. It is only the last 2 km before Mbale town that the pipeline alignment will follow existing roads. In addition, to the proposed Namatala Intake, the existing Nabijo and Nabuyonga intakes will be rehabilitated and air valves shall be fitted at the existing transmission mains to increase their capacity.

Alternative Water Supply during low flows in Namatala

The NWSC will carry out an Alternative Water Supply Study prior to construction to evaluate options to augment water source during low flows for Namatala and assess the reliability of the proposed water supply system. The options will include, among others but not limited to: (i) construction of a water impoundment structure at the Namatala intake site to store water during high flows and sustain the water demand during the dry spell, (ii) construction and rehabilitation of boreholes in the small towns, (iii) expansion of Manafwa water supply system, and (iv) a reduction in water service delivery at acceptable levels. These are not considered individual solutions, but complementary and inclusive; therefore, the final recommendation would likely be a combination of these options. The study will include specific recommendations and an implementation plan. The MWE and the NWSC will implement the recommendations under the IWMDP. Preliminary considerations of the feasibility of these options are included in Section ES 7,b,1.

Mbale town water transmission lines: Mbale municipality requires a new transmission main system and water supply to the west to Budaka, Kadama, Kibuku and Tirinyi. The transmission main system in Mbale will comprise of the existing DN 300 Steel pipe, which runs from the reservoir at Bungokho WTP along the Republic Road and ends shortly after the Clock Tower. This will be used as the main feeder for the Senior Quarters, parts of the Central Business Area and St. Paul Mbale College. A new DN 600 pipe will run down from Bungokho reservoir to the pressure break tank at Mbale District Local Government (350m towards Central

Business District (CBD) from Mbale Sports Club). A DN 300 will connect from the DN 600 to the pressure break tank. The outlet of the pressure break tank is a DN 500 pipe which runs in parallel to the republic road up to the clock tower. This pipe is the main feeder pipe for the pressure Zone 3. Two new transmission mains are required for the supply to the Growth Centres. The two mains need to be laid from: Mbale to Tirinyi / Kibuku and; Split point between Manafwa – Mbale to Butaleja and Busolwe

b) Main Reservoirs and Pressure Break Tanks

These will include:

- Bungokho (Central Reservoir, Supply to Zone 1, 2 (via existing DN 300 steel) & 3 in Mbale and Growth Centres to Tirinyi)
- Pressure Break Tank in Mbale (Supply Zone 3)
- Busoba Reservoir (between Manafwa and Mbale, supply to Busolwe and Butaleja)
- Mooni (Supply Zone 1, Mbale)

c) Reservoirs in the growth centres

Four new reservoirs with the size between 160 – 190 m³ will be constructed in Budaka, Kadama, Butaleja and Busolwe. The reservoir in Kadama shall be used at same time as pressure break tank for the supply to Tirinyi and Kibuku. All reservoirs will be supplied by the transmission mains from Mbale to Tirinyi or the split point between Mbale and Manafwa to Busolwe.

d) Distribution Networks

Mbale distribution network: Developments within Mbale over the last few years have taken place at a faster rate than the pace at which the water supply and sanitation infrastructure was developed, overwhelming the utility's capacity to provide a continuous water supply. With the town's boundaries having grown, it is now imperative that the water distribution system be expanded to address the low per capita water availability which currently stands at about 15 litres per day.

Most of the aged non-metallic pipelines will have to be replaced and the new connections done properly. Mbale Municipality will be divided into 4 different pressure zones, namely: Mooni, Senior Quarters, St. Paul Mbale College and Mbale. The distribution systems in and around Mbale were divided into the following sub-systems: Mbale, Manafwa, North and North-West. Mbale means the centre of Mbale Municipality; Manafwa the south of Mbale; North the north of Mbale up to Nakaloke and surrounding; and North-West the system to Kamonkoli and Kabwangasi. In total, 93 km of pipelines are required within Mbale Municipality; 12 km in the south of Mbale (Manafwa); 10 km in the north of Mbale and 20 km in the north-west of Mbale.

The existing network will mainly be used in the south-western part of Mbale (new HDPE network in Malukhu), in Namatala and in Busamaga. Most of the Asbestos Cement (AC) pipes that will be replaced are in the municipality centre.

More fire hydrants will also be provided within the distribution system. Currently there are 17 fire hydrants installed in Mbale, mostly at the new market and in the south of Mbale. It was proposed to add 20 additional hydrants mainly on the main roads and some strategic points in the water distribution network to archive a good coverage over entire Mbale.

Public stand posts: There are currently 136 Public Stand Posts (PSPs) and 18 water kiosks that are run mainly by private operators in Mbale. They cover almost 100% the informal areas of Namatala, Nabuyonga, Nkoma, Namakwekwe, Busamaga and Mooni. All of the informal settlements will get a formal water distribution network installed.

Approximately 43 new PSP including prepaid meters will be installed in the existing informal settlements within a walking distance of 200 m. The new PSPs will guarantee 24h water supply with the water tariff provided by NWSC for the low income population.

Replacement of house connections: All house connections on the existing AC pipes will be disconnected and reconnected to the new replacement pipes. The same will apply in cases where the existing pipes are too small and need to be reinforced by larger pipes.

Table ES1: Proposed new PSPs

Informal settlement	Area (ha)	Minimum number of water points per chosen walking distance (m) to a water point			
		500	200	100	50
Busamaga	116.59	2	10	38	149
Mooni	72.67	1	6	24	93
Namatala	89.67	2	8	29	115
Nkoma	109.07	2	9	35	139
Nabuyonga	90.21	2	8	29	115
Namakwekwe	19.01	1	2	7	25
Total		10	43	162	636

e) Distribution systems in growth centres

The water distribution systems in the growth centres will be extended in: Budaka, Tirinyi, Kibuku and Busolwe while new distribution systems will be laid in Kadama and Butaleja.

f) Upgrade of Water Treatment Plants

Upgrade Bungokho treatment plant: The deteriorating raw water quality has had an impact on the operational costs and reduced the capacity of the treatment facilities. It is proposed to upgrade, rehabilitate and expand the WTP at Bungokho, as the topography is suitable to serve the entire supply area (including the rural growth centres of Tirinyi, Kibuku, Kadama and Budaka) by gravity from here.

Rehabilitation of Bungokho Water Treatment Plant (Line 1): The main purpose of the Water Treatment Plant (WTP) rehabilitation is to introduce the necessary modifications in actual structures in order to increase the treatment capacity of the Plant from the actual 4,200 m³/day up to 9,450 m³/day and at the same time to implement more appropriate coagulation and flocculation units for treating surface waters of relatively rapid changing characteristics.

Extension Bungokho WTP (Line 2): The proposed solution to extend the Bungokho WTP in order to reach a treatment capacity of 18,900 m³/day consists of the construction of the units of a second treatment line (Line 2) with the same capacity as Line 1 (9,450m³/day).

Upgrading of Manafwa treatment plant: Due to human activities (for example, agricultural activities) in the catchment of River Manafwa, the sediment load in the River has continuously increased and the quality of water at the abstraction point to the WTP has deteriorated. This has resulted in the current treatment process chain failing to deliver the required quality and quantity of water at a reasonable cost. In addition, there are high costs associated with pumping water to the distribution reservoir at Bungokho. Consequently, there is need to upgrade the plant to allow for more appropriate coagulation and flocculation units for the treatment of surface waters of rapid changing characteristics like the raw water of River Manafwa at the intake point.

In addition, the raw water abstraction will be improved. A new intake structure shall be constructed next to the existing one. The new structure shall be fitted with a grit chamber to decrease the sediment load at the Clarifiers. A sump shall be provided from which raw water will be pumped and not anymore directly from the river, which causes frequent interruptions.

g) Mbale Sewerage System

Interventions aimed at improving the adequacy and efficiency of the existing waste stabilization ponds will be made under the project. From the findings of the feasibility study, the capacity of the wastewater treatment ponds was found to be satisfactory. It is recommended to install new inlet works with grit removal to avoid siltation of the ponds. Furthermore, at the Namatala treatment ponds the sluice gates shall be re-established to increase the treatment capacity by adjusting the flow regimes. It is also recommended to construct sludge drying beds at the treatment ponds that can receive and treat faecal sludge from the ponds.

Sewerage network Senior Quarters: The area around the Senior Quarters has been identified as a potential area for expansion due to the high water demand and its income structure. The Senior Quarters is the only high income neighbourhood in Mbale. Almost all of the houses have their water connections in the house and use septic tanks. Most of the bigger hotels in Mbale can be found in this area including the two main Hotels, the Mbale Resort and the Mount Elgon Hotel. Since most of the sanitation facilities in the area are already waterborne it must be expected that there is a high demand for sewerage services. The entire catchment shall drain towards an open area near the Nabijo River where a lifting station shall be built that connects the sewerage network with the existing sewer of the Namatala Catchment.

Rehabilitation of sewerage network – Indian Quarters: A new sewer shall be installed in the area of the Indian Quarter replacing a dilapidated existing sewer network. The new sewer shall be connected to an existing trunk sewer on the opposite side of the Kampala Road, which needs to be crossed. The total length of the new network is 2180 m and comprises 53 manholes. About 115 house connections are required to be relocated to the new sewer mains. At three locations an existing functional sewer will be connected to the new system.

Similar works than in the Indian Quarters are expected to be carried out on the Namatala Trunk Sewer. A section of 150 m shall be replaced with a new sewer line to correct a piece of pipeline with a wrong gradient. The remaining existing networks shall be pressure cleaned and camera inspected.

Rehabilitation Namatala treatment ponds: The following measures are proposed at the Namatala treatment ponds:

- i) Construction of new inlet structure and demolishing of old inlet structure;
- ii) Reinstatement of embankments at certain locations;
- iii) Construction of five new channels connecting the ponds including sluice gates and demolishing of existing channels;
- iv) Erection of boundary fence (live fence and diamond mesh fence);
- v) Re-construction of approximately 200 m of DN 400 mm trunk sewer with two life connections; and
- vi) Erection of a service building

The embankments around the ponds shall be reinstated by filling material which will also ease access to the ponds. Integral for the operation of the ponds is the reconstruction of the channels connecting the ponds. These shall be equipped with sluice gates in order to be able to isolate ponds and to change the flow regime, which is becoming necessary in future to avoid an overloading of the facultative ponds.

Rehabilitation Doko treatment ponds: The following measures are proposed at the Doko treatment ponds:

- i) Construction of new inlet structure and demolishing of old inlet structure;
- ii) Construction of roofed sludge drying beds including separate inlet structure, feeder and drainage pipework;
- iii) Construction of a solar powered drainage pump station;
- iv) Establishment of operations building;

- v) Erection of boundary fence (live fence and diamond mesh fence); and
- vi) Re-construction of approximately 70 m of DN 400 mm trunk sewer with one life connection.

Similar to the Namatala treatment ponds, the most important aspect in the rehabilitation of the Doko treatment ponds is the replacement of the inlet chamber and inclusion of a mechanical treatment step to avoid the siltation.

The Doko treatment ponds shall play a vital part of the Faecal Sludge Management of the Mbale Municipality. Sludge drying beds will be installed together with a small inlet structure that shall prevent the accumulation of solid waste in the faecal sludge. The structure shall be roofed to shorten the sludge drying time. The leachate of the sludge drying beds shall be collected under the drying beds with a drainage pipe and pumped to the inlet works using a solar-powered pump.

Sewerage connection Northern Cluster: The northern area of Mbale around the Islamic University in Uganda (IUIU) shall receive sewerage services. A gravity network and a treatment pond shall be constructed for that purpose. The network shall be a gravity network consisting of 10,950 m of OD 200, OD 250 and OD 315 mm uPVC sewer pipelines. Around 300 provisions for house connections shall be made by the Contractor at locations suitable for the terrain of the existing properties. Around 210 manholes shall be constructed.

The treatment ponds shall be constructed at a land close to the confluence of the Nabuyonga River into the Namatala River, which belongs to the IUIU. The treatment units shall include a mechanical treatment stage, an anaerobic pond and facultative ponds. The sludge from the anaerobic ponds shall be applied to sludge drying beds.

h) Sanitation Facilities

Two types of sanitation facilities are proposed, that is:

- a) Ablution blocks for the town centres and the informal settlements that include a shower unit; and
- b) Public toilets that are smaller in size for smaller settlements

Both types of facilities are divided into genders and have units for persons with disabilities. Sufficient hand wash basins will be installed to encourage hand washing and condom dispensers will be added to each unit.

All toilets are waterborne and shall be equipped with a 1 m³ water tank. The units shall be connected to a conservancy tank that shall be regularly emptied with a cesspool emptier. The faecal sludge shall then be driven to a suitable treatment facility.

i) Catchment Management and Sources Protection

The project will include interventions supporting sustainable management of the raw water catchment and protection of the current and proposed water sources, including restoration and re-vegetation of river banks, implementation of river bank protection regulations, implementation of wetland regulations, etc. The interventions will be guided by the source protection guidelines of the Directorate of Water Resources Management (DWRM). Based on the environmental impact assessment and management plan, the consultant shall produce designs for all structurally engineered protection measures required.

6 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

According to the World Bank's environmental categorisation, the proposed project is classified as EA Category B undertaking which requires detailed ESIA studies. The proposed construction and operation of the water supply and sanitation facilities will be restricted within the user-communities. Similarly, according to the *Third Schedule of the National Environment Act, Cap. 153 (Section 4a: "storage dams, barrages and weirs", and Section 12c: "sewage disposal works")*, Ugandan environmental laws and regulations, require undertaking a

full EIA for projects falling under this category. The World Bank requirements, policies and laws under which this ESIA was prepared and will be implemented are outlined below.

Box ES1: Policies and regulations reviewed

Policy framework:

- The National Environment Management Policy, 1994
- The National Water Policy, 1999
- The National Health Policy, 1999
- The National Gender Policy, 1997
- HIV/ AIDS Policy, 1992
- Occupational Health and Safety (OHS) Policy
- Uganda Vision 2040

Legal framework:

- Constitution of the Republic of Uganda, 1995
- National Environment Act, Cap 153
- Local Governments Act, Cap 243
- Water Act, Cap 152
- Land Act, Cap 227
- Public Health Act, Cap 281
- Investment Code Act, Cap 192
- National Water and Sewerage Corporation Statute, 1995
- Employment Act, 2006
- Occupational Safety and Health Act (2006)
- Physical Planning Act, 2010
- Historical Monument Act, 1967
- The Mining Act, 2003
- Children Act, Cap 59

Regulations/ Standards/ Guidelines:

- The Water Resources Regulations, 1998
- National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 1999
- National Environment (Noise Standards and Control) Regulations, 2003
- The National Environment (Wetlands, River Banks and Lakeshores Management) Regulations, 2000
- National Environment (Waste Management) Regulations, 1999
- Draft National Air Quality Standards, 2006
- The Water Supply Regulations, 1999
- National Environment (Audit) Regulations, 2006

Institutional framework:

- National Environmental Management Authority (NEMA)
- National Water and Sewerage Corporation (NWSC)
- Ministry of Water and Environment (MWE)
- Directorate of Water Resources Management (DWRM)
- Directorate of Environmental Affairs (DEA)
- Ministry of Lands, Housing and Urban Development (MLHUD)
- Ministry of Gender, Labour & Social Development (MGLSD)
- District Local Administration Structures
- Uganda National Roads Authority (UNRA)
- Ministry of Tourism, Wildlife and Heritage

World Bank Safeguard policies:

- OP/BP 4.01 - Environmental Assessment
- OP/BP 4.04 - Natural Habitats
- OP 4.36 – Forests
- OP 4.11 - Physical Cultural Resources
- OP 4.10 - Indigenous Peoples
- OP 4.12 - Involuntary Resettlement
- OP 7.60 - Disputed Areas

International conventions and agreements:

- 1968 African Convention on the Conservation of Nature and Natural Resources:
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat:
- 1987 Montreal Protocol on Substances that Deplete the Ozone Layer
- 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora
- 1992 Convention on Biological Diversity
- The Convention on Migratory Species of Wild Animals (CMS)

7 PROJECT ALTERNATIVES

a) 'No Project' Scenario

The existing Mbale water supply system constructed in the 1950s and rehabilitated in 1990 has now reached its design capacity due to the fast-growing population rate and water demand. Without the proposed development, the government of Uganda would not have the ability to provide safe water and sanitary services to over 250,000 people living in Mbale and the growth centres of Kadama, Kibuku, Tirinyi and Budaka towns.

The “no project” scenario is neither a tenable nor beneficial alternative because safe water supply and sanitation are required to support rapid socio-economic development within the region.

b) Alternatives Considered

This section provides a summary of the alternatives evaluated in the 2015 Feasibility Study and includes new options based on additional studies conducted under the preparation of the ESIA.

i) Water Supply

Raw water sources: Four main rivers for raw water supply within this project area have been identified. The Nabijo, Nabuyonga and Manafwa Rivers are currently used for water supply, while the River Namatala offers a further possibility for gravity raw water supply.

The dry season flow is the average of all flows in the dry months, which has been defined for December, January, February and March. For the Manafwa River the dry season average flow was relatively high (6.5 m³/s) while for River Namatala and River Nabuyonga, flows of 1.49 m³/s and 0.73 m³/s, respectively, existed. The absolute minimum flows that were measured at the gauging stations were 1.3, 0.33 and 0.001 m³/s for Manafwa, Namatala and Nabuyonga, respectively.

A water demand of 0.313 m³/s is needed for year 2040 (design horizon) to serve the northern and western areas of Mbale. The water supply for this service area will come from the Bungokho WTP. The Feasibility Study evaluated different raw water sources to increase water production at Bungokho, including Nabijo, Nabuyonga, Namatala, and Manafwa Rivers.

River Nabuyonga: The statistical analysis of data for Nabuyonga suggests enough water availability based on the mean total and dry season flow. However, absolute minimum flows already indicate the drying up of the river during the dry season although the wet season flow seems generally to be above 0.313 m³/s. Measurements carried by the design consultant indicated values above 0.4 m³/s until end of October. After October the flow decreased to values below the needed water demand to probable almost 0 at the end of the dry season in March.

River Nabijo: This is similar to River Nabuyonga. Flows are generally slightly lower. The design consultants flow measurements indicated sufficient water during the wet season until end of October for the investigated time period. Afterwards the flow decreases dramatically, most probable to almost zero by the end of the dry season in March.

River Namatala: For the Namatala River, data from the gauging station suggest that enough water is available, at least for most of the time during the year. The mean dry season flow is 1.49 m³/s with a 99% exceedance probability of 0.37 m³/s and a 95% exceedance probability of 0.47 m³/s. The absolute minimum value was 0.33 m³/s. The mean flow was estimated at 2.41 m³/s. The analysis suggests enough water is available to meet water demand by year 2040 (0.313 m³/s) for most of the year; however, Namatala's dry weather flows in some cases may not be sufficient to meet projected water demand and maintain an adequate environmental flow (EF).

As part of the ESIA preparation, the environmental flow in the Namatala River was evaluated. The ESIA estimated a minimum EF of 0.835 m³/s (refer to Annex K) leaving an abstractable flow of 0.342 m³/s in dry season (based on the mean dry season flow). The minimum EF includes domestic, livestock, and aquatic life water needs downstream of the proposed Namatala intake location. The amount was calculated based on conservative figures obtained using census population, livestock estimates, water use assumptions, biodiversity baseline, and international guidelines to assess EF. Actual data of water user's consumption was not readily available; therefore, the minimum EF assumed that all the sub-counties bordering River Namatala depend on it for supply, which is considered a worst-case scenario. For example, Kamonkoli small town will partly be served by the Project. Therefore, this amount of water should allow the river to sustain river health as well as meet the needs of riparian communities.

The minimum EF is disaggregated as follows:

Category	Water needs (m ³ /s)
Domestic water demand	0.111
Livestock water needs	0.572
Fish/aquatic life	0.149
Total	0.835

River Manafwa: Based on data from the gauging station, Manafwa River seems to have enough water. Absolute minimum value is 1.3 m³/s with 99% exceedance probability of 1.6 m³/s. Both values are significantly above the total water demand for the project.

Comparing all the four sources, River Manafwa is expected to have enough water. However, a guarantee cannot be given as extreme droughts can occur and human destruction of ecosystems continues. River Namatala has enough water for most times. Nevertheless, by the end of the dry season, flows could not be sufficient to meet the project water demand and the estimated minimum EF. Nabijo and Nabuyonga have enough water during the wet season, but during the dry season flows are too low for sufficient water supply, even if both sources are used.

For raw water supply to Bungokho during the dry season only two options were further considered in the 2015 Feasibility Study:

- Raw water supply from Manafwa (pumping)
- Raw water supply from Namatala (gravity)

Looking at the findings in the hydrological investigation no other options exists for the long-term water supply to the proposed Mbale service area. Further, four different scenarios were analysed. Three different pipeline diameters (DN 400, DN 500 and DN 600) were investigated between Manafwa and Bungokho and one between Namatala intake and Bungokho (DN 450).

The cost analysis clearly showed that the gravity pipe from Namatala River is the cheapest option for the raw water supply to Bungokho with running costs of 252 UGX/m³ and total production costs of 954 UGX/m³. Water from Manafwa would cost 1,253 UGX/m³ (running costs) and 2,314 UGX/m³ (production costs). Among the

three options to convey water from Manafwa to Bungokho, the DN 500 would be the cheapest option. In this scenario the pumps from Manafwa must have the following specifications: 3 pumps, 2 in operation, 1 as standby, $Q = 564 \text{ m}^3/\text{h}$, $H = 172\text{m}$. The Feasibility Study concluded that, a new raw water pumping main from Manafwa is more expensive than the gravity main from Namatala.

Based on the flow analysis and cost evaluation, Namatala River was selected as the major raw water source for the Bungokho WTP given advantages of running a gravity fed system. Manafwa River will continue to supply the Manafwa WTP with modifications at the intake because of the high sediment load. The Manafwa system will serve Manafwa, South of Mbale, Butaleja and Busolwe.

As indicated above, there is a risk of insufficient river flow during the dry months to meet the design water demand of $0.313 \text{ m}^3/\text{s}$ when considering the minimum EF. Therefore, the NWSC will carry out an Alternative Water Supply Study prior to construction to evaluate options to augment water source during low flows for Namatala and assess the reliability of the proposed water supply system. The options will include, among others but not limited to: (i) construction of a water impoundment structure at the Namatala intake site to store water during high flows and sustain the water demand during the dry spell, (ii) construction and rehabilitation of boreholes in the small towns, (iii) expansion of Manafwa water supply system, and (iv) a reduction in water service delivery at acceptable levels. The study will include specific recommendations and an implementation plan. Preliminary considerations of the feasibility of these options are described below.

Option 1. Modification of the intake structure to enable sufficient storage of water to sustain water demand during the dry spell to ensure abstraction rates are controlled so that minimum EF is maintained. Namatala's wet weather flows vary from $2.25 \text{ m}^3/\text{s}$ to $15 \text{ m}^3/\text{s}$ with a maximum close to $40 \text{ m}^3/\text{s}$, which provides an indication of sufficient water for storage. Although land requirement information is not yet available, there is 100 meters available on either side of the river as part of the river bank management national regulation that could be used for a storage type structure. In addition, NWSC will embark on a full-scale source protection measures in the Mbale catchment area for which will engage a RAP consultant to look into land management and compensation measures, including this potential intervention. This option will be evaluated in close collaboration with the DWRM and NEMA.

Option 2. construction of boreholes systems as a mitigation plan during the dry spell. A hydrogeological report conducted in 2015 studied the potential for groundwater exploration in the proposed Mbale service area. The objective of this study was to analyse the potential in the area based on available data from boreholes, field visits and groundwater potential maps. Results indicate that there are areas which have good ground water potential. Yields in the range of 5 to $23 \text{ m}^3/\text{h}$ were identified in the existing boreholes. Maps showing the physical features of the area reveals that for the most part is well drained and therefore receives enough recharge for the deep-seated aquifers which can produce high yielding boreholes. Water quality for most of the boreholes indicated acceptable levels for domestic purposes. The Kadama small town was the only area with low groundwater potential according to the groundwater map; however, some boreholes are providing reasonable yields. Additional studies will need to be conducted to determine the number, location and output of the boreholes taking in consideration that they would operate as an augmentation measure during dry season.

Option 3. As indicated above, for the Manafwa River the dry season average flow was relatively high ($6.5 \text{ m}^3/\text{s}$) and absolute minimum was recorded at $1.3 \text{ m}^3/\text{sec}$. Although, Manafwa river has sufficient water to meet 2040 water demand, the system was not selected as a primary source due to high operating cost. However, considering the potential vulnerability of the Namatala system, the Alternative Water Supply Study will consider the option of augmenting water supply from Manafwa.

Option 4. The consultant will also carry out a reliability assessment of the proposed Mbale water supply system to determine its vulnerability in supplying water to the Mbale service area. The study will assess levels of services during dry weather flow and drought conditions taking consideration water augmentation options and

operational efficiency and planning. This will be conducted in close collaboration with the MWE/DWRM and local government officials in consultation with the community.

These four options will be explored and studied further. There are not considered individual solutions, but complementary and inclusive; therefore, the final recommendation would likely be a combination of these options. The MWE and the NWSC will implement the recommendations under the IWMDP.

The Project will also include a source water protection program to improve environmental conditions in the rivers feeding to the Mbale water supply project and community sensitization activities to promote water conservation and overall understanding of the proposed water supply system. The NWSC and MWE expect that these measures will reduce the minimum EF estimated for Namatala.

Manafwa reservoir: The location of the new reservoir in the south is approximately 4000m north of Manafwa and 1700m south of the turn-off to Busolwe. Two supply options are possible:

- Option 1: Pumping all water from Manafwa to the southern reservoir from where the area north of the reservoir up to Mbale and the area around Manafwa WTP will be supplied. In this option the reservoir must have a size of 2000 m³.
- Option 2: Pumping only the water from Manafwa to the southern reservoir which is required for the supply in the area north of the reservoir up to Mbale. The area around Manafwa WTP will be supplied by direct pumping. In this option the reservoir must have a size of 1750 m³.

Option 1 was recommended as the cost implications are minor and it will reduce permanent pumping from Manafwa. In this case the existing DN 300 between Manafwa and the southern reservoir will serve as transmission and distribution main.

Water supply to small towns: To supply the small towns, two options, that is, gravity water supply from Mbale or a decentralised system with boreholes were investigated. Two main alternatives for the supply of the small towns were assessed, that is:

- Integrated approach: The entire project region could be combined into one supply area that would be fed from NWSC's Mbale Water Supply System.
- Decentralized approach: The growth centres would produce and supply their water on their own. The small towns were divided into three clusters: Budaka & Kadama, Tirinyi & Kibuku and Butaleja and Busolwe. The three clusters would have one combined system including own boreholes and a transmission main system up to the reservoirs in each small town.

For the comparison, two different aspects were assessed. Besides the different investment costs, the dynamic prime costs were calculated for each alternative and the different risks and challenges highlighted (Table ES2). Based on these two evaluations a recommendation was made.

For both supply zones the total water production costs are higher for the decentralized supply despite the lower initial investment costs. The higher electricity consumption, continuous reinvestments and a low residual value in 2040 are making the decentralized water supply more expensive in the long-run.

Table ES2: Challenges, Risks and Benefits for the different supply options

Aspect	Integrated Approach	Decentralised Approach
Supply security	<ul style="list-style-type: none"> ▪ Fair ▪ The Namatala and Manafwa Rivers appear to be very solid water sources ▪ Additional water sources could be easily integrated into the system, 	<ul style="list-style-type: none"> ▪ Poor for a long-term and only water supply solution ▪ The present aquifer has never been exploited to that extend; recharge of aquifer could become a problem especially in the

Aspect	Integrated Approach	Decentralised Approach
	<ul style="list-style-type: none"> A breakdown of the transmission main could leave a sizeable population without water. 	<ul style="list-style-type: none"> dry season for a long-term and only water supply solution Experience has shown that the reserve funds in small water supply schemes are often insufficient to cover for repairs.
Water quality	<ul style="list-style-type: none"> Good The water quality can be easily monitored and managed in the central treatment plants, but the travel time of the water can be long. 	<ul style="list-style-type: none"> Good Previous tests of groundwater indicate good quality in the project area
Management	<ul style="list-style-type: none"> Good The Mbale Water Supply System has been managed very well in the past. It can be assumed that this will continue in a similar way; however, an ever increasing supply area will become more difficult to manage especially in its fringes. 	<ul style="list-style-type: none"> Fair Smaller systems can be easily overseen, but experience has shown that they are often unattractive for experienced operators due to their small scale. Budaka for example could have an operating water supply system if the borehole pumps would have been replaced. Instead, Budaka has already since almost one year no operating water supply system.
Social and Environmental	<ul style="list-style-type: none"> Fair The transmission mains are following exclusively roads, therefore little impact is expected. A bigger population is severed as smaller villages and trading centres between the six growth centres are connected. Considerable amounts of water are abstracted from the rivers in the Wanale Mountains that might be lacking in the future for other purposes like irrigation, water supply or other needs. 	<ul style="list-style-type: none"> Fair Well fields are likely to be in private property. Improved water supply and distribution system may increase stress on the groundwater resources

From Table ES2, each supply strategy has its own benefits and challenges. Using scores and weights, a better option from the two was chosen/ recommended. Aspects in Table ES2 and the dynamic prime cost were given a score between -2 and 2 and different criteria have been attributed with weights. The dynamic prime costs and the supply security were attributed with the highest weights as these are the main aspects for both the operator and the customer.

Table ES3: Comparison of the scores for the supply options

Criteria		Score	
Type	Weight (%)	Integrated Approach	Decentralised Approach
Investment costs	10	-2	2
Dynamic prime costs	30	2	-2
Supply security	25	0	-2
Water quality	10	1	1
Management aspects	10	1	0
Social & Environmental aspects	15	0	0
Total	100	0.6	-0.8

By comparing all the different aspects, it can be said that the integrated approach is clearly the better option, especially due to the high risks associated with the stability of the aquifer and high operation costs of the decentralized water supply system. These aspects justify the high initial investment costs of the integrated water supply system.

Proposed transmission mains to the small towns: The integrated approach transmission main options are presented. Two towns, Tirinyi and Kibuku, have sufficient water sources available as they fill their reservoirs only once or twice per week. Thus, the transmission mains between Kadama and Tirinyi as well as between Kadama and Kibuku could be postponed and constructed only as soon as more water is required in both towns. However, the demand for both towns was included in the overall dimensioning of the pipeline capacity between Mbale and Kadama as it will be required in future.

As Kibuku is 20 m higher than Tirinyi it is proposed to have two separate lines from Kadama to Tirinyi and to Kibuku. Altogether three scenarios were investigated:

- Scenario 1: Pipeline design to Tirinyi/ Kibuku for the demand until 2040, gravity supply up to the north (Nakaloke) and north-west (Kamonkoli and Kabwangasi)
- Scenario 2: Pipeline design to Tirinyi/ Kibuku for the demand until 2030, installation of Booster Station in 2030 to supply up to Tirinyi/ Kibuku until 2040, gravity supply up to Kabwangasi until 2040
- Scenario 3: Pipeline Design to Tirinyi/ Kibuku for the demand until 2030, installation of Booster Station in 2030 to supply up to Tirinyi/ Kibuku until 2040, gravity supply up to Kabwangasi is not guaranteed from 2030 onwards. An additional booster station for the north-west might be required.

A dynamic prime cost analysis was done where all three above mentioned scenarios were compared with each other. Scenario 1 being gravity main has the lowest running costs until 2040 and beyond. Scenario 2 and 3 are almost the same although Scenario 2 has slightly lower running costs than Scenario 3. Scenario 3 has the lowest production costs. It has to be pointed out that a booster station to Kabwangasi was not considered in the cost comparison which will definitely increase the production and running costs in Scenario 3. Scenario 1 was therefore considered on the basis of running costs.

ii) Expansion of sewerage services

Two options for the expansion of sewerage services in Mbale were assessed. It was to be assessed if there are possibilities for extending the sewerage network and new areas outside the existing catchments needed to be identified. The biggest potential for sewerage services has been identified in the Senior Quarters and the Northern Division of Mbale. These two areas have been assessed into detail.

Senior Quarters: For the northern part of the Senior Quarters there are two alternatives for the connection to the existing sewerage network, one gravity option and a pumping option. The trunk main in the Senior Quarters will follow the corridor of the main stormwater channel in the neighbourhood. Where this channel connects with the Nabijo River it could either be pumped towards the existing network behind the High Court or a pipeline is built along the Nabijo River.

The option of the lifting station results in higher operating costs due to the power consumption and the maintenance of the mechanical and electrical equipment. There is also an increased demand on the skills that are required in the operation of the facility, but here NWSC Mbale proved that this can be done with the successful operation of two similar lifting stations.

The environmental impact is a major disadvantage of the gravity trunk main along the Nabijo River. Here, a large amount of trees would need to be removed as the line is running through a forest. In addition, the line is running very close to a river. Here sewerage can infiltrate to the river in case of any damage and flooding can undermine the structural integrity of the sewer. As the Nabijo is meandering significantly in this section, interventions will be required to protect the pipeline from erosion, which are expected to be very costly.

In terms of related costs, the network in the northern part of the Senior Quarters would cost a little less than 1 million USD. In case the network shall be connected to the Namatala catchment with a trunk sewer along the Nabijo River, an additional sum of 490,000 USD is expected. If it were to be connected with a lifting station, around 265,000 USD shall be added. In total, around 1.25 million USD for option A and 1.47 million USD for option B. to connect the Northern Part of the Senior Quarters to the existing sewerage network, depending on the chosen drainage option.

Considering the social and environmental issues, Option A was considered. The proposed sewerage network will drain close to a point along the Nabijo River, amount 500 m downstream of the Mbale Resort. This is also the point where the stormwater network of that area is discharging into the Nabijo River. From the last point of the network the area shall be connected through a lifting station to the existing sewerage network, which is discharging to the Namatala Treatment Ponds.

8 PUBLIC CONSULTATIONS AND DISCLOSURE

During conduct of the ESIA, consultative meetings were held with NEMA, Ministry of Water & Environment officials, Ministry of Gender Labour and Social Development, Mbale District Local Government and Municipality officials, and the project-affected communities. The ESIA will be submitted to NEMA for review and approval. NEMA review entails disclosure of the report in public libraries and at district headquarters.

Government of Uganda was appreciated for the proposed project in Mbale, Butaleja, Budaka and Kibuku Districts and NWSC, MWE/consultant commended for involving and consulting District officials because many times different projects come up but the local leaders /District Officials are ignored.

The importance of reporting to the district administration officials including the local councils before approaching the grassroots communities during execution of the project activities was emphasized to avoid problems that would arise in case of any security risks. The issues that were raised included:

Compensation: There is a need of transparency when it comes to compensation of the Project Affected Persons (PAPs). There was concern for PAPs whose land is small in size and the remaining portion is not sufficient for any development.

Furthermore, there were mooted concerns from PAPs regarding why their land which was affected by the project was not subject to compensation considering that activities such as construction and cultivation on those areas were to be restricted.

Employment: There was a concern on whether local communities will be involved and employed during construction of the proposed facilities. The contractor should consider employing the local people in the project affected areas and the procedure he will follow to engage them spelt out.

Surface water/soil pollution

- i) The developer and contractors should undertake hydrological investigations prior to development of the sites.
- ii) Create buffer zones of natural vegetation belts of at least 50m between the lagoons and the river.
- iii) Undertake proper site restoration and landscaping after construction, that is, stabilize all soils after construction and plant grass to control erosion.
- iv) The faecal sludge drying beds in waste stabilisation ponds should be constructed in such a way that leachate does not pollute the Namatala and Nabisho water resources.

Sensitization: There was concern by communities about the flow of information on the project. It was pointed out that sometimes the information provided was insufficient and that representatives of the project-affected villages should be involved so as to have input.

- i) The developer should design and implement a program to sensitize the surrounding communities on the use of the river and how they should relate to the established infrastructure.
- ii) NWSC/MWE should undertake regular monitoring of the water quality in R. Namatala and R. Sironko stream and keep the community/public informed.
- iii) The contractors should create good relationship with the communities through consultations prior to construction activities so that the communities have a role in the management of the water infrastructure such as cleaning around the reservoirs.

Air quality nuisance: Ensure that the physical and biological properties for aerobic conditions are maintained

Impacts on area aesthetics

- i) The contractor should plant tree shrubs and grass to improve area aesthetics
- ii) There should be proper restoration of the project site to improve the landscape and area aesthetics.

Possibility of noise emissions and issues of Occupational Health and Safety (OHS)

- i) The contractor should see to it that construction works are carried out during day time to limit noise interruption.
- ii) All workers should be provided with proper PPE.
- iii) The workers should be regularly checked to ensure good health conditions.
- iv) Compensation should be provided to injured or affected workers due to lack of proper protection.
- v) Take records of all injuries and infections reported to track improvements.

In summary, the questions that arose and response are presented below:

Issue: Compensation
Question: Will my house be broken if it is along the pipeline? Response: Only if you built the house within the road reserve. This will be broken down after equitable compensation for the house has been effected.
Question: Will we buy the pipes or shall the pipes be supplied free of charge? Response: The pipes being laid are transmission pipelines conveying large volumes of water under high pressures and not distribution pipes used to connect water to peoples' houses. The Ministry of Water and Environment (MWE) will however give chance to 100 community members on a first come first serve basis who are living within 500m, radius from the distribution point a chance to get connected to the water at a subsidised fee. They will pay half the amount of money required to purchase the pipes and the Gov't will meet the other cost. Members are therefore encouraged to take advantage of this chance if they qualify.
Question: Will I be compensated if my house is located on the reservoir tank site? Response: Yes you will.
Question: Will trees be compensated? Response: Yes they will be compensated for.
Question: If the land through which the distribution line will pass belongs to another person, will I pay for the land in order to connect water to my house? Response: No you don't, however you need to reach an understanding with your neighbour.
Question: Contractors tend to destroy people's properties, what measures are in place to control them? Response: The District/Municipal council officials are fully aware of the project and have been assigned monitoring roles such that in the event of a Contractor's negligent behaviour by destroying properties, he will be accountable for any damages caused.
Issue: Benefits

<p>Question: Will the person seeking employment on the project apply through or get a recommendation letter from the LC1 only?</p> <p>Response: Yes. This is so due to the fact that employment will be offered on a village level and it's only the LC1 chairperson who knows members of his village. This will ensure equal employment opportunities for all villages where the pipeline will traverse.</p>
<p>Question: How are those far from the road reserve going to benefit?</p> <p>Response: For as long as they are within the 500m radius from the distribution point, they can benefit from the subsidized rates if they apply early. For those living further than that, they will wait on NWSC to extend water to their homes. Otherwise the sole benefit for all community members living near of far from the road reserve is that Safe water will be extended closer to them as a result of the project.</p>
<p>Question: Shall I pay for water at my home or use it freely?</p> <p>Response: All water will be paid for and not used freely as the government together with NWSC will need money for purchasing the chemicals to treat the water, pay the workers and purchase pipes to extend water to other communities in need of it.</p>
<p>Question: The contractor should employ the youth in the village. Is the contract already awarded?</p> <p>Response: The contract hasn't yet been awarded as of now but the design Consultant is preparing the tender documents. If however there are youth who have the qualifications and have all the requirements stipulated in the tender document, they are free to apply for the contractor or sub-contractor role.</p>
<p>Question: If people who are qualified contractors in plumbing come, which office should they apply to?</p> <p>Response: They should apply to the Project Manager of the Contractor and submit their documents at the site office nearest to them.</p>
<p>Issue: Project</p>
<p>Question: Does the Project belong to the Government or any politician?</p> <p>Response: The project belongs to the Government of Uganda and is meant to benefit the people of Uganda and does not belong to any politician.</p>
<p>Question: Shall we be provided with water from transmission main or another distribution line?</p> <p>Response: Other distribution lines will be laid with the aim of supplying water to the various interested parties. The transmission main will not supply water to any individual's house due to the high pressure of the water it is conveying.</p>
<p>Question: During dry season, there is no water; where will water come from?</p> <p>Response: This is a new line drawing water from a new source R. Namatala to boost the existing supply, therefore water will be more readily available in during the dry season.</p>

9 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

An improvement in potable water supplies and sanitation may generate interrelated improvements in health, economic and social welfare of the community. However, in addition to the many possible beneficial impacts, adverse impacts may arise from these improvements. The impact of potable water supply and sanitation on health depends on the quality and quantity of the piped water supply and sanitation infrastructure; the proportion of population covered; and the utilization of the water and sanitation facilities by the population. In this chapter, prediction and analysis of possible positive and negative impacts of construction and operation of the water supply and sanitation project is presented, with main focus on the proposed new raw water intake from River Namatala to Bungokho Water treatment works in Isebere village, Mooni Parish, Bungokho-Mutoto sub-county. Upgrading of the water distribution and sewer networks within Mbale Municipal council will also be embarked on as well as conveyance of treated water to Tirinyi from Bungokho WTP. A second leg of the project will entail pipeline running from Manafwa Water treatment works to Busoba sub-county in Mbale before branching off to Butaleja and Busolwe Town Councils in Butaleja District.

Table ES4: Summary of the potential positive and negative impacts

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
7.2 POSITIVE IMPACTS							
7.2.1 Income to material/ equipment suppliers and contractors	a) Project will promote local procurement where technically or commercially reasonable and feasible.	Local communities and businesses benefit from procurement process	Number of local businesses benefiting from construction related procurement	Before and during commencement of construction	Contractor	NWSC/ District Local Governments of Project Area.	
	b) For earth materials, procurement will be made from legitimate sources to avoid encouraging environmental degradation	Project's material demand does not encourage environmental degradation	All quarries from which materials (sand, stone) are obtained are licensed by the local authorities	Before and during construction	Contractor	NWSC/MWE/ District Local Governments of Project Area	
7.2.2 Employment	a) Information to create awareness about the proposed project activities will be provided to the project-affected communities. Prepare both local communities psychologically and the new comers; Efforts to be geared toward instilling attitudes of tolerance, support and understanding of labour immigrants by the local communities. Regular Monitoring by District Local Governments (Community Development Officers, Probation Officers, Gender Officers) and MGLSD.	The participation of local community members in all project activities.	Local community awareness of project progress status	Before and during construction	Contractor in association with NWSC	NWSC/MWE/ District Local Governments of Project Area	10,000,000
	b) Unskilled labour will be recruited exclusively from local community, and semi-skilled labour will be recruited preferentially from such communities, provided that they have the requisite qualification, competence and desired experience.	Maximisation of participation of local community members during site preparation and construction activities.	Number of local people (unskilled and semi-skilled) employed during construction phase	Before and during construction	Contractor	NWSC/ District Local Governments of Project Area	
	c) Contractors will be encouraged to pay a "living wage" to all workers.	Some level of improved livelihood	Record of contractors' employment activities on a	Before and during construction	Contractor	NWSC/	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
		of the local community	monthly basis, including number of jobs created by employment type (skilled / semi-skilled / unskilled); number of jobs by gender, employment type and geographical area; total man hours and wages paid, by employment type, gender and geographical area; and rate of employee turnover by gender and area.			District Local Governments of Project Area	
	d) A training programme for artisans (builders, carpenters, plumbers) in the project area could be facilitated by the project to ensure skills transfer during the construction period.	Skills transfer to the community members hence empowering them to become job creators.	Number of local people trained during construction phase	Before and during construction	NWSC/MWE/ Contractor	NWSC/MWE/ District Local Governments of Project Area	20,000,000
	e) All Contractors to develop & implement a Labour Influx Management Plan and Workers' Camp & Accommodation Management Plans as part of C-ESMP; All workers to sign employment contract including Code of Conduct (Annex H – example); establish a Grievance Committee for Workers; sensitize workers on community based social behaviour and conduct; sensitize workers to not engage in sexual relations with underage girls and married women; establish a Grievance Redress Committee to act as link between community and the project; local leadership should always be sought as a first priority in solving issues.	Workers and community members live in harmony.	Number of cases reported	Throughout construction	Contractor	NWSC/MWE/ District Local Governments of Project Area	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
7.2.3 Infrastructure improvement	The communities along the road will further be sensitized and encouraged to be cooperative when this kind of infrastructure, for example, electric poles are being put in place.	Support infrastructure put in place without any hindrance	No complaints	Prior to commencement of construction	NWSC/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	
7.2.4 Improved health status of households and communities.	Educate users on the proper use, regular cleaning and effective maintenance of both the household and public facilities.	Improved health status of households	Clinical records of reported cases. Reduced incidences of illness at household level.		NWSC/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	
7.2.5 Educational Enrolment and Attendance	Encourage parents to take their children of enrolment age to school	Improved enrolment and attendance at all levels	Record of candidates at all institutional/ educational levels		NWSC/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	
7.2.6 Acquisition of New Skills	Where the required skills are available locally, the local people should be given priority commensurate to their level of training.	Improved capacity to handle assignment or repairs in the Project areas.	Number of local people employed for skilled jobs	Before commissioning of facilities	NWSC/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	
7.2.7 Improvement in Household Economic Status	Water tariffs will be set taking into consideration the different levels of users. The users should also be educated to avoid wasteful use of the resources	Time saved for other income generating activities	Number of new connections; public majority comfortable water tariffs.	Regularly as need arises	NWSC/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	
7.2.8 Saving in the Cost of Medical Treatment	Educate users on the proper use, regular cleaning and effective maintenance of both the household and public facilities	Savings made for investment or other household requirements	Household investments/ activities arising from improved water supply	Regularly as need arises – community outreach activities	NWSC/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	18,000,000
7.3 NEGATIVE IMPACTS							
7.3.1 Degradation of Land and Soil Erosion	a) The topsoil removed from the site during site preparation will be stored properly (away from runoff and possible contaminants) for reuse else.	No topsoil is washed away into the environment and is readily available for backfilling	Top soil or overburden in dumped at non-designated sites	Throughout construction	Contractor	NWSC/MWE/ District Local Governments of Project Area	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	b) All waste generated during site preparation and construction will be transported to an authorized disposal area. The contractor will seek guidance from Mbale Municipal Council and the Respective District Local Governments in project area on the final disposal point.	All waste collected and disposed of properly	No complaint from communities around the site and road of poor management of waste. No litter at project site and complaints from authorities	Throughout construction	Contractor	NWSC/MWE/ District Local Governments of Project Area	50,000,000
	c) Use of old equipment or even damaged equipment that is most likely to have oil leakages thus contaminate soils will be avoided.	No soils or land are contaminated as a result of project activities	Soil quality data	Maintenance of equipment throughout construction	Contractor	NWSC/MWE/ District Local Governments of Project Area	
	d) A waste management plan will be developed prior to start of construction activities.	Waste management plan developed	No complaint of poor management of waste from communities around the site and road. No litter at project site and complaints from authorities	Before construction	Contractor	NWSC/MWE/ District Local Governments of Project Area	
	e) Construction equipment will be properly maintained and fully functional to avoid leakages.	Equipment functioning properly	Records of maintenance/ soil quality data	Throughout construction	Contractor	NWSC/MWE/ District Local Governments of Project Area	
	f) Sewers will be made watertight during maintenance to avoid intrusion of storm water into the network and cut-off drains provided to WSPs. Storm water will be guided away from all sanitary facilities using cut-off drains around them.	No contamination of Land or soil erosion by wastewater from the sewers.	No complaints from the communities and authorities of sewage leakages	Throughout operation	NWSC	NEMA/District Local Governments of Project Area	
	g) The staff of the WSP will be trained for proper management of screenings, sludge, etc., to avoid soil contamination.	Skills enhancement of Staff at WSP	Number of staff trained /Training records	Annually throughout operation	NWSC/MWE/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	10,000,000
	h) Monthly tests will be done to assure the quality of effluent and treated sludge, to avoid	No soils or land are contaminated as a	Effluent quality data and sludge cake quality records	Monitoring activities throughout operation	NWSC/ District Local Governments of Project Area	NEMA/NWSC/ District Local	30,000,000 annually

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	partially treated wastewater and sludge from reaching the soils	result of project activities				Governments of Project Area	
7.3.2 Pollution of water resources	a) All construction equipment will be kept in good operating condition to avoid oil or fuel leakages that might contaminate water resources	No oil and/ or fuel leakage in water courses	Water quality data	Throughout construction	Contractor	NEMA/NWSC/ District Local Governments of Project Area	
	b) Fuel handling and oil spill measures will be implemented to prevent, control and address spill or leaks.	No oil and/ or fuel leakage in water courses	Water quality data	Monitoring throughout construction	Contractor	NEMA/NWSC/ District Local Governments of Project Area	12,000,000
	c) At Nabunyere (Sanitation facilities), the concrete mixing will not be done on site to avoid polluting the nearby swamp with excess washwater.	No swamp pollution with cement/concrete wash water	Water quality data	Throughout construction	Contractor	NEMA/NWSC/ District Local Governments of Project Area	
	d) Laying of water pipelines and sewer lines will mainly be done during the dry season to avoid sediment transport to the nearby land, water courses and roads;	No sediment transported to the nearby river courses	Water quality data	Throughout construction	Contractor	NEMA/NWSC/ District Local Governments of Project Area	
	e) The leakages from sewers, sludge drying beds and WSPs will be minimized by regular monitoring and maintenance of the network; connections between sewers will be made water-tight to prevent leakages of wastewater to groundwater; and frequent effluent quality monitored to avoid release of poorly treated effluents into the River.	No leakages into water courses and Groundwater	Water quality data and No complaints from communities around project sites	Throughout Operation	NWSC	NEMA/NWSC/ District Local Governments of Project Area	
	f) Monthly quality tests for effluent and receiving water resources will be done to ensure that the quality of effluent meets the national discharge standards or requirements;	Compliant effluent standards being discharged into receiving water courses	Water quality data and No complaints from communities around project sites	Throughout Operation	NWSC	NEMA/NWSC/ District Local Governments of Project Area	Covered under 7.3.1 h

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	g) A maintenance crew will be put in place to monitor and repair the network immediately a damage or leakage occurs to avoid accidental surface runoff intrusion to groundwater from the sewage network. Intrusion of storm water into the network and ponds can overburden facilities and cause discharge of partially treated wastewater into the water resources/ environment.	Timely repairs made on the network to avoid further leakages	Monitoring and repair records from maintenance crew.	Throughout Operation	NWSC	NWSC/ District Local Governments of Project Area	10,000,000 for monitoring activities
7.3.3 Generation of noise	a) Care will be exercised when selecting working equipment to avoid use of old equipment or damaged equipment with high level of noise emissions that would have a negative impact in the environment.	Construction activities generate permissible levels of noise.	No complaints from the communities and authorities/ record of noise levels	Before and during construction	Contractor	NWSC	
	b) Construction equipment will be properly maintained and fully functional.	Construction activities generate permissible levels of noise.	Record of noise levels/ no complaints from the communities and authorities/	Before and during construction	Contractor	NWSC	
	c) All generators and heavy duty equipment will be insulated or placed in enclosures to minimize disrupting ambient noise levels.	No excessive noise reaching neighbouring communities	No complaints from the communities and authorities/ record of noise levels	Before construction begins	Contractor	NWSC	
	d) Construction workers will be made aware of the silent nature of workplaces they are operating in and advised to limit verbal noise or other forms of noise. For example, metallic objects or tools can be passed on to a colleague rather than dropping or throwing them with loud bangs.	No excessive noise from the site	Record of noise measurements	Throughout construction	Contractor	NWSC	
	e) Noise levels emanating from machinery, vehicles and noisy construction activities will kept at a minimum (within the national noise	Construction activities generate	Record of noise measurements	Throughout construction	Contractor	NWSC/ District Local	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	level limits) for the safety, health and protection of people in the nearby buildings.	permissible levels of noise.				Governments of Project Area	
	f) During periods of inactivity, equipment will be switched off whenever possible. A limited number of construction activities may have to continue on a 24-hour basis. These include horizontal direction drilling, pipeline cleaning and hydrostatic pressure testing which are relatively low noise activities. Consultation will be undertaken with the relevant authorities in advance of any such operations. Where appropriate, residents living near to the pipeline construction activities will be kept informed of the contractors proposed working schedule (through implementation of the Community Liaison Management Plan) and will be advised of the times and duration of any abnormally noisy activity likely to cause concern	No vehicle engines running unnecessarily	Record of noise measurements	Throughout construction	Contractor	NWSC/ District Local Governments of Project Area	
	g) No construction activities will take place at night for sites where the closest residence is within less than 150 m from the project site.	No excessive noise from equipment during night time	No complaints from communities about night time construction activities	Throughout construction	Contractor	NWSC	
7.3.4 Improper Handling of AC Pipes and Accessories	a) NWSC should ensure that the hired contractor demonstrates having experience and capability to observe international good practice standards with asbestos, including training of workers and supervisors, possession of (or means of access to) adequate equipment and supplies for the scope of envisioned works, and a record of compliance with regulations on previous work. The Contractor will be required to	Experienced contractor or sub-contractor hired to ensure that AC pipe wastes are handled well. Hazardous collected and disposed as per waste management plan	Qualification and experience profile of the contractor or sub-contractor; Hazardous Waste Management Plan	Before commencement of construction activities	Contractor	NWSC	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	prepare a Hazardous Waste Management Plan.						
	b) The contractor shall follow NWSC procedures (Appendix I) and NEMA guidelines (Annex J) for handling waste AC materials	Hazardous wastes handled properly and o workers and the public are exposed to Asbestos dust	Procedure followed on site in handling the hazardous waste, records of inspection and waste disposal	During construction	Contractor	NWSC/ NEMA	
	c) Decommissioned AC pipes and accessories will be managed through a third party contractor certified by NEMA.	Hazardous wastes handled properly	Records of waste disposal; Proof of waste delivery and safe disposal	Throughout construction	Contractor	NWSC/ Mbale District Local Government (MDLG)/ Mbale Municipal Council (MMC)	
	d) The selected contractor shall provide adequate protection to his personnel handling asbestos, including respirators and disposable clothing.	No workers and the public are exposed to Asbestos dust	Presence and use of PPE on site	Through out handling activities for AC pipes	Contractor	NWSC/ MDLG/ MMC	
	e) Disposal of AC pipes shall be carried out in a way that minimizes worker and community asbestos exposure, for example, in a wet environment. AC pipes and other related asbestos containing material shall be packaged, labelled, transported, stored and disposed of at approved sites for disposal of hazardous waste, for example, Luweero Industries Limited in Nakasongola District or EnviroServe waste handling facility in Hoima District. Proof of delivery and safe disposal of waste will be provided and records maintained at all times.	No asbestos dust exposure	Records of waste disposal; Proof of waste delivery and safe disposal	Through out handling activities for AC pipes	Contractor	NWSC/ MDLG/ MMC	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	f) Before transportation, the properly sealed, labelled and secured AC pipes are kept inside a locked fenced area to prevent access by unauthorized personnel, and covered to prevent water accumulation.	Safe storage before transportation	Presence and condition of the storage facility	Throughout construction	Contractor/NWSC	MDLG/ MMC/ NEMA	250,000,000*
7.3.5 Improper management of waste	a) The Contractor will be required to prepare a Waste Management Plan.	Waste Management Plan in place.	Record/ Evidence of Waste Management Plan being used by Contractor	Throughout construction	Contractor	NWSC/ District Local Governments of Project Area	
	b) Contractors will undertake waste segregation onsite to separate hazardous waste from non-hazardous waste	Hazardous waste separated from non-hazardous waste on site and each waste stream disposed of according to NEMA requirements in designated sites.	Separate containers for hazardous waste and non-hazardous waste on site	Throughout construction	Contractor	NEMA/NWSC/ District Local Governments of Project Area	10,000,000
	c) The contractor, MWE and NWSC Area Management will work hand in hand with Mbale Municipal Council and respective Local governments to facilitate sound waste handling and disposal from the site. All wastes must be taken to the approved dumpsites. AC pipe waste will be handled separately from other hazardous wastes	Amount of waste disposed/ minimized by reuse, wherever feasible	Record of waste types and estimated quantity disposed/ diverted for reuse	Throughout construction	Contractor	NEMA/NWSC/ District Local Governments of Project Area	45,000,000
	d) The contractor will hire and improve on existing sanitary facilities in the vicinity of the project area or provide his own facilities (e.g. mobile toilets) which should be adequate at construction sites.	No human waste disposed of at construction sites	Presence of mobile toilets at construction sites/ sanitary hire agreements	Throughout construction	Contractor	NEMA/NWSC/ District Local Governments of Project Area	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	e) NWSC/MWE together with the respective District Local Governments at the growth centres will ensure that the solid waste is collected by a firm licensed by NEMA and that the collected waste is disposed of at dumpsite or landfill approved by NEMA	Safe handling and disposal of solid waste by NEMA registered firm.	NEMA registration certificate of approved firm.	Throughout Operation	NWSC/ District Local Governments of Project Area	NEMA/NWSC/ District Local Governments of Project Area	
7.3.6 Air pollution	a) A maintenance programme for equipment and vehicles will be implemented, to ensure air emissions like particulates, SO ₂ and NO ₂ are minimised.	Emissions from vehicles complying with national standards.	No complaints of excessive fumes. No excessive emissions released to the atmosphere as a result of faulty equipment. Strict maintenance program	During construction	Contractor	NWSC/ District Local Governments of Project Area	
	b) Travel speeds of construction vehicles along the road especially at trading/ business centres will be controlled using humps and setting travel speeds not exceeding 40km/h	Humps and speed limit signage put in place in the appropriate areas	Number of accidents and/ or complaints reported/ Journey management records	During construction	Contractor	NWSC	
	c) Trucks will be covered during haulage of construction materials to reduce on spillage of materials	No spillage of materials along the transportation routes	Recognition of locales of contractor's efforts to minimise dust nuisance.	During construction	Contractor	NWSC/ District Local Governments of Project Area	
	d) Wherever dust suppression is necessary, water will be sprayed over dusty areas	No excessive dust	Air quality data/ Environmental monitoring report	Monthly throughout construction	Contractor	NWSC/ District Local Governments of Project Area	
	e) Construction work will be undertaken by an experienced and duly registered contractor with a verifiable sense of environmental awareness and responsibility	Employment of best Construction practices to minimise adverse impacts	Record of environmental responsiveness of the contractor/ Environmental Management Plan	During construction	Contractor	NWSC/ District Local Governments of Project Area	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	f) Workers will be provided with PPE and the use of PPE shall be enforced	Workers are not exposed to elevated air pollution levels	No complaints of excessive fumes	During construction	Contractor	NWSC/ District Local Governments of Project Area	
	g) NWSC will develop an Operations and Maintenance Manual for the Sewage Treatment Plant to guide staff on how to effectively run the WSPs;	Effective performance of WSPs run by knowledgeable operators	Record of operation procedures undertaken by staff	Throughout Operation	NWSC	NWSC/ District Local Governments of Project Area	
	h) Facultative ponds will be commissioned before anaerobic ponds to avoid odour nuisance when anaerobic pond effluent discharges into an empty facultative pond;	Controlled Odour from the Facultative pond	No complaints from communities near the WSPs	Throughout Operation	NWSC	NWSC/ District Local Governments of Project Area	
	i) NWSC/MWE will ensure adequate operation and management of both the existing and the new facilities to avoid bad odours that would arise from improper management of the facilities;	No odours from project facilities	No complaints from communities near the WSPs	Throughout Operation	NWSC	NWSC/ District Local Governments of Project Area	
7.3.7 Occupational health safety (OHS) Risks	a) All construction workers will be oriented on safe work practices and guidelines and ensure that they adhere to them	Workers show a good understanding of and adhere to safe work practices	Records of workers' orientation	At the beginning of construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	b) Training will be conducted on how to prevent and manage incidences. This should involve proper handling of electricity, water etc. and sensitization on various modes of escape, conduct and responsibility during such incidences. All must fully be aware and mentally prepared for potential emergency	Up-to-date awareness of OHS requirements and preparedness by all workers to combat possible incidences	Records of training and details of staff trained	At the beginning of and during construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	c) Regular drills should constantly follow on various possible incidences. This will test the response of the involved stakeholders.	Workers are alert and responsive in case of incidences.	Record of drills	Throughout construction	Contractor	NWSC/ District Local Governments of	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
		Public and other staff safety				Project Area – SEO's, CDO's	
	d) Use signage to warn staff and/ or visitors that are not involved in construction activities of dangerous places.	Public and workers' safety	Presence of signage	During construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	e) Strict instructions should be given for drivers of heavy equipment	No risk of accidents on construction workers	Documentation of instructions	Throughout construction	Contractor	Traffic Officers, NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	f) Supervision of works should be done regularly to ensure that safety conditions are met while any deviation from safety regulations is immediately reclaimed following the best practices regarding safety at work equipment.	Public and workers' safety	Supervision record	During construction	NWSC & Supervision Consultant	MGLSD/ NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	g) Communication line must be ensured between workers and drivers of heavy equipment.	Public and workers' safety; No injuries arise from miscommunication	Presence of radio calls/Megaphones being utilised	During construction		Traffic Officers, NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	h) Develop evacuation procedures to handle emergency situations.	Reduced health and safety risks to construction workers	Presence of a documented evacuation procedure	During construction	Contractor	MGLSD/ NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	i) Provide adequate OHS personnel protective gear for the employees.	All personnel have adequate PPE	Record of PPE provided and staff; use of PPE on site	During construction	Contractor	NWSC/ District Local Governments of	Covered in 7.3.5 (f)

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
						Project Area – SEO's, CDO's	
7.3.8 Risk of accidents	a) Best transport safety practices (Journey Management Plans) will be adopted with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public.	No road accident caused by project traffic	Record of traffic related accidents in each month of construction duration	During construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	b) All workers, including sub-contractors and casual labourers, will undergo an environmental, health and safety induction before commencing work on site. This will include a full briefing on site safety and rules.	Workers aware of environmental, health and safety requirements	Record of induction; interviewing a sample of workers on environmental, health and safety issues	Before construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	c) The affected communities will be informed of the timing and duration of the construction activities across access roads and any uncertainties or potential for change.	Safety of the public and workers	Activity schedule and evidence of communication to the would-be affected communities	Before and during construction	Contractor/ NWSC	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	d) There will be restrictions on hours of driving (including night time restrictions where sensitive receptors may be affected) and timing of vehicle movements to avoid busy periods in urban areas, particularly the start and end of school and the working day	Safety of the public and workers	Activity schedule and journey management plans	During construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	e) No drivers or personnel under the influence of alcohol or any drug abuse will be allowed onsite	Public safety	Presence of a sound fence all around the site	During construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	f) The site, where possible, will be fenced and signalization put in place with security personnel to stop unauthorised people from accessing the site.	Public safety	Presence of a sound fence all around the site	During construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
7.3.9 Pressure on existing resources	a) Separate storage for water to use at the construction sites will be provided. Instead of connecting to the nearby/ communal water points, water bowzers will be adopted for water supply.	Uninterrupted water supplies to the communities	Presence of water bowzers/ storage tanks; water abstraction permit	Throughout construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	b) The NWSC/MWE, supervising consultant and contractor will phase the construction activities in such a way that water-consuming activities are not carried out concurrently but rather in combination with non-water-consuming activities in the same location, where possible.	Uninterrupted water supplies to the communities	Complaints of irregularities in water supply related to construction activities	Before construction	NWSC& Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	c) Through inductions and tool box meetings, NWSC/MWE will ensure that contractors are conversant with resource conservation practices in all project activities. Conservation awareness will focus on water use efficiency and general day-to-day measures such as turning off taps when water is not being used.	Uninterrupted water supplies to the communities	Record of water usage and conservation measures being implemented	During construction	Contractor NWSC DWD	District Local Governments of Project Area – SEO's, CDO's	
	d) Water abstraction will comply with rates allowed by the permit obtained from DWRM; The Namatala water intake will be designed to allow minimum EF pass through the abstraction point. Flow monitoring devices will be installed to monitor and ensure minimum EF.	Contractor complies with Permit requirements/ conditions. Minimum EF are maintained and monitored	Record of water abstracted	During construction and operation	Contractor NWSC/MWE	DWRM	
	e) For the Namatala water system, the NWSC will conduct an Alternative Water Supply Study to assess alternative water sources and a reliability analysis of the proposed Namatala water supply system during low flows as further set out in Section 2.5.2.1 of the ESIA, including	Alternative water supply study completed and recommendations implemented.	Approval by NWSC and the MWE	Before construction begin and during project implementation	NWSC and MWE	MWE/NWSC/District Local	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	specific recommendations and an implementation plan. The NWSC will carry out the recommendations derived from the study under the Project.						
	f) Earth materials will be sourced from a NEMA-approved source in a manner that reduces environmental and social impacts. Murram will be sourced in accordance with a NWSC approved murram/ subsoil extraction plan, which will be provided by the contractor prior to the start of works.	Project's material demand does not encourage environmental degradation	Approval from NEMA	ESIA for probable sources of materials before construction	Contractor	NEMA/ NWSC/DWD/ District Local Governments of Project Area – SEO's, CDO's	72,000,000
	g) Catchment management plans are being developed with the aim of conserving and allowing recharge of water resources.	Recharge of existing water resources	Increased volumes of water in existing water resources	Throughout operation	NWSC	NWSC/ DWD/ District Local Governments of Project Area – SEO's, District Engineer's, Water Officers'	
	h) Community sensitization regarding the water supply system and water conservation measures will be encouraged: saving water is an efficient way of reducing the overuse of ground water resources. It is not only decreases the amount of the water withdrawn, but may also reduce the threat of pollution	Uninterrupted water supplies to the communities	Record of water usage and conservation measures being implemented	Throughout operation	NWSC	NWSC/ DWD/ District Local Governments of Project Area – SEO's, District Engineer's, Water Officers'	
7.3.10 Landscape and land use impacts	a) Reinstatement Plan will be developed	Reinstatement plan developed and implemented	Record of the developed reinstated plan	Throughout operation	Contractor	NEMA/ NWSC/ DWD/District Local Governments of Project Area – SEO's, CDO's	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	b) Reinstatement of the water pipeline and sewer routes will be done in such as return the visual integrity of the landscape as closely as possible to its previous condition. Replant of trees should be done as long as they do not hinder the integrity of the pipe or sewer line.	Wherever practical, the subsoil graded during reinstatement to reflect the original profile across the working width with a stable landform that mirrors the pre-disturbed condition	Presence of heaped soils and/or materials; slope stability, relief, topographic diversity, acceptable surface water drainage capabilities, and compaction; level of vegetation regrowth	Throughout operation	Contractor	NEMA/ NWSC/DWD/ District Local Governments of Project Area – SEO's, CDO's	
	c) Where pipelines and sewers are not buried in ground, if any, they will be painted to blend with the environment. They will be adequately supported by concrete pillars and of such materials that cannot easily be damaged by the communities.	No damage to exposed sections of pipelines and sewers by communities.		Throughout operation	NWSC	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
7.3.11 Social misdemeanour by construction workers	a) As a contractual obligation, contractors shall be required to have an HIV/AIDS policy and a framework (responsible staff, action plan, etc.) to implement during project execution.	No illicit sexual relationships among construction workers and local community	All construction workers living in a camp adhere to "No fraternization" and comply with latest entry time into camp set to avoid prostitution. Monitor complaints from the community	Development of policy before construction	Contractor	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	b) All construction workers shall be oriented and sensitized about responsible sexual behaviour in project communities.	No aggravated spread of HIV/AIDS due to project implementation	All construction workers are aware of HIV/AIDS risk and responsible living.	Before construction	Contractor	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
7.3.13 Disruption of communication routes	a) Appropriate signage will be used and impacted owners will be informed ahead of disruption	No property owners are inconvenienced in accessing their properties	No complaints from property owners	Before and during construction	Contractor NWSC	NWSC/ DWD/ District Local Governments of Project Area –	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
						SEO's, CDO's, District Engineers	
	b) Disruptions to public access shall be identified in the Contractor's Traffic Management Plan, under which suitable notice of intending delays and closures are given to all concerned parties and approved prior to commencing work. All road closures shall be separately notified and agreed with the Local gov't administration.	Traffic Management Plan developed Stakeholders informed of impending closures in time and alternative routes communicated	Minimal or no interruption in pedestrian and traffic flow	Before and during construction	Contractor NWSC	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	c) Where access to or from an individual property is closed for a period of 2 hours or more, the owner shall be informed at least 24 hours in advance.	Stakeholders informed of impending closures in time	No complaints from property owners	Before and during construction	Contractor NWSC	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	d) Vehicular access to and from hospitals, police stations and fire stations shall be maintained through the use of steel road plates over open trenches. Pedestrian access to schools, health facilities, and other premises frequently accessed by the public will be maintained with the use of walking boards.	Appropriate infrastructure put in place to allow continued access to hospitals, clinics, schools, etc.	Minimal or no interruption in pedestrian and traffic flow to public facilities	Before and during construction	Contractor NWSC	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	e) The laying of pipelines and sewers, backfilling and temporary reinstatement shall follow trench excavation as quickly as possible and trenches will not be left open for extended periods.	Reinstatement done as quickly as possible	No complaints from affected communities	Before and during construction	Contractor	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
7.3.12 Loss and degradation of natural habitats	a) Construction activities should be restricted only to the areas that must be disturbed to avoid unnecessary disturbance	Minimal degradation of the	Area of restored habitat that had been disturbed.	During Construction	Contractor	NWSC/ DWD/ District Local Governments of	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
		habitat beyond the project foot print.				Project Area – SEO's, CDO's, District Engineers	
	b) All project workers should be sensitized to minimize damage to vegetation and flora	Minimal degradation of the habitat beyond the project foot print.	Record of worker sensitization about vegetation and flora.	During Construction	Contractor	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	c) Close monitoring and supervision of the construction operations to ensure compliance and avoid causing further damage to undesignated project areas	Minimal degradation of the habitat beyond the project foot print.	Record monitoring and supervision of the construction operations about project footprint.	During Construction	NWSC/ DWD	District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	d) Support and encouragement of communities to plant trees by providing planting material for fast-growing and multiple use species e.g. <i>Maesopsis eminii</i> and <i>Markhamia lutea</i>	All cut trees are offset.	Number of community planted trees in relation to the project.	During Construction and operation	Contractor/ NWSC/ DWD	District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	e) Support monitoring of performance of the planted trees	All replanted trees successfully grow.	Number of replanted trees that successfully grow.	During Construction and operation	Contractor/ NWSC/ DWD	District Local Governments of Project Area – SEO's, CDO's,	
	f) Where tree cutting is inevitable, replacement planting should be done wherever feasible.	All cut trees are offset.	Number of cut trees replaced.	During Construction and operation.	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
7.3.14 Disruption to public utilities	a) Prior to undertaking any works, the Contractor will obtain from the utilities agencies definition and details of all utilities sites within 50 m of the works.	Details of all utilities within 50m of the works obtained	Details and mapping of all utilities obtained	Before construction	Contractor & NWSC	Affected Utility firms, Local Governments of Project Area	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	b) Damage to any utility at a defined site shall be made good to the satisfaction of the responsible agency at the Contractor's cost. Damage to utilities not defined prior to construction, despite the Contractor having undertaken all reasonable liaisons with the responsible agencies, shall not be the responsibility of the Contractor. It shall be the responsibility of NWSC to ensure the utilities agencies respond in good time to the Contractor's requests for information.	All damages incurred rectified to the satisfaction of the respective utility agency	No damages incurred and where they happen, remedial measures implemented to the satisfaction of the utility agency	During construction	Contractor	NWSC/ Affected Utility firms	
	c) Contractors shall liaise with each of the agencies responsible for the maintenance of utilities that are to be crossed or temporarily diverted or otherwise affected by the works as to the timing and nature of any disruption of service. Where required, the responsible agency shall be requested to carry out the necessary works at the time required and at NWSC's cost. The Tender Documents shall contain sufficient information on utilities crossings to permit the Contractor to include the cost of the works for which he is responsible in his bid.	Tender documents contain all relevant information about the utilities within the project areas; Timely liaison made with the utility agencies to avoid inconveniences	Details and mapping of all utilities obtained and remedial measures planned	Before and during construction	Contractor	NWSC/ Affected Utility firms	
	d) The Contractor shall incorporate in his programme the proposed arrangements for traffic diversions in the form of a Traffic Management Plan, with details of all necessary signage and any temporary works for approval by the NWSC and the District/Municipality Engineers. The programme shall also contain details of the timing of the proposed closure, dates of	Minimal or no inconvenience to traffic flow caused	Approved Traffic Management Plan in place	Before construction	Contractor	NWSC/ GMC	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	closing and re-opening the route, and of any necessary remedial works.						
7.3.15 Permanent Land take	<p>a) Land will be acquired in accordance with Uganda's Land Access and Compensation Procedure taking into consideration the Development Partner's requirements. Amongst others, this requires:</p> <ul style="list-style-type: none"> ▪ Sensitisation of community members whose property will be affected. ▪ Completion of a full inventory of privately registered and/or cultivated and grazed or other uses of the land that will be taken for the project as well as structures and graves along the access road. ▪ Compensation to be paid in line with mandated rates agreed in consultation with District officials before commencement of construction activities. ▪ Ensuring that the Chief Government Valuer approves the valuation rates. 	Equitable compensation in accordance to National and international laws.	<p>Displayed list of fully compensated PAPs against Monies paid out to them.</p> <p>List of fully compensated PAPs against Monies paid out to them.</p>	Prior to commencement of construction.	NWSC/MWE	NWSC/ CGV Independent Hired External Monitor	
7.3.16 Septage Disposal	a) Institute and maintain a ticketing system for cesspool emptiers, where upon successful disposal, the operator of the sludge treatment facility would issue a receipt to the cesspool emptier.	Proper septage disposal in designated areas	Record of ticket issued at STP	During Operation	NWSC/ Kibuku Local Government	NEMA/ NWSC/ NWSC/ Kibuku Local Government – SEO's, CDO's	15,000,000
	b) Kibuku District Local Government/ Kadama sub-county and MWE, should put in place a system to monitor cesspool emptiers and in addition, have a public educational	Compliance of cesspool emptiers in proper septage disposal		During Operation	NWSC/ Kibuku Local Government	NWSC/ NWSC/ Kibuku Local Government – SEO's, CDO's	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	campaign to educate and inform the public about the system.						
	c) MWE and Kibuku District Local Government will work closely with operators of Cesspool Emptiers if any and train them in the proper handling and transport of sewage/ sludge;	Good septage handling and sewage disposal	No complaints from communities in and around Nabunyere village	During Operation	NWSC/ Kibuku Local Government	NWSC/ NWSC/ Kibuku Local Government – SEO's, CDO's	
ESTIMATED GRAND TOTAL							552,000,000

Cumulative Impacts

Positive Cumulative Impacts: There will be improved safe water supply within Mbale Municipal Council and the growth centres of Kadama, Tirinyi, and Kibuku as well as improved access to sanitary facilities as a result of the project's intervention to improve public health by way of pit latrines and faecal sludge drying beds. This will be in addition to improvements contributed by other projects in area, for example, improvement of the road network in the municipality and neighbouring areas.

Negative Cumulative Impacts: Induced development can cause in-migration as a result of increased economic activity and development. This is likely to happen in towns and trading centres and may result in social tensions or increase in prostitution, crime and excessive demand for resources (food, water, rented accommodation). As towns develop, prices of land, food and other commodities may increase, making them increasingly unaffordable for local residents.

10 MONITORING PROGRAM

This environmental-socio management plan, (ESMP) for proposed construction works and operation of the water supply and sanitation facilities under this project, identifies the potential environmental and social aspects that should be monitored. It identifies parties responsible for monitoring actions, associated costs, indicators and training or capacity building needs and reporting. Various aspects of the ESMP are detailed in sections below

Institutional Structure and Responsibilities: During the construction phase, there will be three parties involved with the ESMP, that is, the client (NWSC in Mbale Municipality and DWD in the small towns) with ultimate responsibility for E&S performance on the project; the Supervising Engineer (with an Environment and Social Specialist on their team) responsible for monitoring and supervising the implementation of the ESMP and contract requirements by the contractor(s); and the Contractor (with an Environment and Social Officer) who has responsibility for implementing the ESMP. NWSC and DWD in their respective areas of operation will ensure that both the Supervising Engineer and Contractor are doing their jobs effectively and that the ESMP is delivering the necessary environmental and social protection measures.

Therefore, the institutional responsibility of ensuring that this ESMP is implemented will rest with NWSC and DWD having a key role of reviewing consultants' reports for compliance with the ESMP, among others. The Project Managers from either institution shall have the ultimate responsibility for implementation of ESMP and will therefore ensure that resources are duly provided. Other roles will be:

- Monitoring implementation of mitigation actions by contractors
- Coordinating training and capacity building where planned

NWSC/DWD should ensure that all its personnel to be involved in implementation of this ESMP are adequately qualified and were appointed based on their qualification and suitability for respective roles. There is thus no training provided for them under this ESMP. Supervising Engineer is required to have an Environmental & Social management Specialist by contractual obligation. The Contractor's Environment and Social Officer will ensure that the provisions in this ESMP are implemented within the sites under their supervision and to collect and transmit relevant information to the Supervising Engineer.

Subcontractors will be required by a condition of their subcontract with the main contractor to actively manage environmental and social issues associated with their subcontract works and comply fully with all the applicable statutory regulations and the main contractor's environmental and social management plans. For significant aspects of work such as earthworks, the contractor may require subcontractors to provide their own Environmental and Social Management Plans and/or Method Statements for review by the Contractor's Environmental

consultant/Officer. These ESMP's shall be approved by the Resident Engineer in consultation with NWSC for adequacy before being implemented.

The Municipal & District Environmental Officers (DEOs) are responsible for overseeing environmental protection on behalf of NEMA. The DEOs within the respective project districts will have monitoring roles during execution of this ESMP in their respective project areas. Usually, these officials lack adequate facilitation so the project will need to provide auxiliary financial assistance for them to have effective participation in this project.

The contractor will be required to prepare ESMPs setting out the measures that they will take to implement the ESIA ESMP during the construction. This requirement also applies to NWSC and DWD during the operation phase of the project in their respective areas of operation.

Monitoring and Reporting Arrangements: Monitoring will verify if predicted impacts have occurred and check that mitigation actions recommended in the ESIA are implemented and their effectiveness. Monitoring will also identify any unforeseen impacts that might arise from project implementation.

Monitoring will be undertaken by NWSC/DWD (PCU) and Environmental Officers who represent NEMA at local administrative level. Monitoring by NEMA in this case can be considered "third party monitoring" but this is its regulatory mandate according to Sections 6 and 7 of the National Environment Act (Cap 135).

Another government agency that may undertake "third party monitoring" is the Occupational Health & Safety Department in Ministry of Gender, Labour & Social Development (MGLSD). This unit has authority to inspect any facility for compliance with national requirements on safety in workplaces. The project shall make no funding to MGLSD since this is provided for in its annual budget.

Monitoring will be done through site inspection, review of site records (Accident Log, issuance of PPE, waste records, trainings and inductions, permits and approvals, etc.), review of grievances logged by stakeholders and *ad hoc* discussions with potentially affected persons (construction workers, residents near the project facilities). At each monitoring, a discussion with chairpersons of environment committees of the areas' local councils (LC) could provide insight into views and grievances communities have about the project since they regularly interact with their community members.

Monitoring will be undertaken continuously daily over the construction period. Audits will be necessary both during construction and project operation. While construction audits will aim to verify compliance to impact mitigation requirements, post-construction audits are a regulatory requirement within 12 months and not more than 36 months after completion of construction, according to national EIA Regulations, 1998 Section 31(2).

Since construction duration is estimated to be 1½ years, this ESMP has included a budget for 1½ year's construction audit and a separate provision so that from year 2 to year 5 full environmental audits are done as per Uganda requirements.

Both construction and post-construction audits can be conducted internally (by NWSC/DWD) or by a consultant hired by NWSC/DWD. If undertaken by a hired consultant, a budget has been proposed for both in this ESMP.

Concise monthly monitoring reports should be compiled by the Contractor. The report will highlight the different activities undertaken to manage environmental and social aspects of the project in line with contract specifications, laws, standards, policies, and plans of Uganda and World Bank Safeguard policies. The report will be discussed during the monthly progress meetings. The Supervising Engineer guided by the Environmentalist and Social Specialist will approve the Contractor's monthly environmental and social monitoring report that will then be transmitted to NWSC or DWD for final approval. NWSC's or DWD's Environmental Management and Social

Specialist will also independently monitor the implementation of the ESMP and/or verify the accuracy and content of the Contractor's monitoring report and then report to the client. The report will also be shared with The World Bank and other relevant stakeholders. Strictly it will be the contractors compliance with the contract requirements (whether BoQ items or items considered part of other BoQ items) that will enable the Resident Engineer or Supervising Engineer to approve payment.

Construction- and post-construction phase auditing should culminate in reports that NWSC shall share with IDA, NEMA or other interested stakeholders. Note that while NWSC is under no obligation to disclose construction phase audits, annual post-construction audits must be submitted to NEMA as a regulatory requirement as per Section 31(2) of National EIA Regulations, 1998.

11 CONCLUSION

The proposed project has potential to significantly improve quality of life in the Mbale Municipality and the neighbouring towns both during construction and operation phases. Like in other areas, the long term socio-environmental benefits of a reliable supply of potable water and access to sanitary facilities include reduced morbidity and increased productivity of households; and increased enrolment of children in educational institutions. In addition, project development and operation in the municipality and small towns or rural growth centres will provide considerable economic opportunity and attraction of other services.

However, development of the project can also bring with it negative impacts. The key significant negative impacts will arise from operation of the sewage treatment plants, sludge drying beds and public toilets if not managed well. NWSC and DWD should use their vast experience in their respective areas of jurisdiction in operating and maintaining such systems to reduce and / or avoid occurrence of adverse effects during construction and operation of the facilities.

If the project is developed and infrastructure put in place operated in conformity with the legal requirements and annual audits conducted following suggestions provided in the ESMP, the benefits of this project to the nation would by far outweigh potential negative effects.

1 INTRODUCTION

1.1 BACKGROUND

Uganda Government has requested funds from the World Bank for implementing the Uganda Water Management and Development Project (IWMDP). The IWMDP was developed under the Ministry of Water and Environment (MWE) as an integrated water resource management and development project with objectives of improving integrated water resources planning, management and development; and access to water and sanitation services in priority urban areas and rural growth centers. It is believed that the project will contribute to higher level goals of sustaining natural resources, improving service delivery, and increasing economic productivity. Part of the IWMDP funds is intended to be applied towards Water Supply and Sanitation Project in Mbale NWSC service area and neighbouring small towns and rural growth centres of Busolwe, Kadama, Tirinyi, Kibuku, Butaleja and Budaka.

National Water & Sewerage Corporation (NWSC) is the implementing agency in Mbale Municipality while MWE through the Directorate of Water Development (DWD) is directly in charge with the small towns. Piped water will be extended from the NWSC Mbale Service Area to the neighbouring small towns and rural growth centres. The NWSC was established as a government parastatal organisation in 1972 to develop, operate, and maintain water supply and sewerage services in urban areas of Uganda.

Mbale Municipality is located in the East of Uganda in Mbale District (Figure 1). It is the main municipal, administrative and commercial centre of Mbale District and the surrounding sub-region. The district is named after the town and is bordered by Sironko District to the north, Bududa District to the north-east, Manafwa District to the south-east, Tororo District to the south, Butaleja District to the south-west and Bududa District to the west. Pallisa and Kumi Districts lie to the north-west of Mbale.

Budaka Town is located in Budaka District in Eastern Uganda. It is 28 km from Mbale Municipality along the Mbale - Iganga Highway. Budaka district borders the districts of Pallisa in the North, Mbale in the East, Butaleja in the South, and Kibuku in the West. The district is comprised of Budaka County which contains Budaka, Iki-Iki, Kaderuna, Kamonkoli, Lyama, Naboia, and Kameruka Sub-Counties; and Budaka Town Council.

Butaleja and Busolwe Towns are located in Butaleja District (Figure 2). Butaleja town is 26 km from Kachonga Trading Centre which is along the Mbale - Tororo Highway. The town is the administrative centre of Butaleja District and consists of 6 parishes which are divided into 16 villages. The core of the town is in Nanyulu Village, Nanyulu Parish and it is where most of the commercial and administrative units are located. Busolwe Town is 7 km from Butaleja Town and 30 km northwest of Tororo Municipality. The town consists of 4 parishes which are divided into 18 villages. The core of the town is in Busolwe and Busolwe Central Parishes.

Tirinyi, Kibuku and Kadama Towns are located in Kibuku District. Tirinyi town is located in Tirinyi Parish one of the five parishes in Tirinyi sub-county the others being Kataka, Kitantalo, Lwatama and Nanoko. Tirinyi Town is located in Tirinyi Parish and is the access route to Pallisa District. Kibuku Town is located in Kibuku Sub-County. The town is about 5 km from Tirinyi Sub-County and is accessed by a gravel road linking Mbale-Tororo Highway to Kibuku Town via Kataka. Kibuku Sub-County comprises of 4 parishes namely Namawondo, Bumiza, Nalubembe and Kibuku.

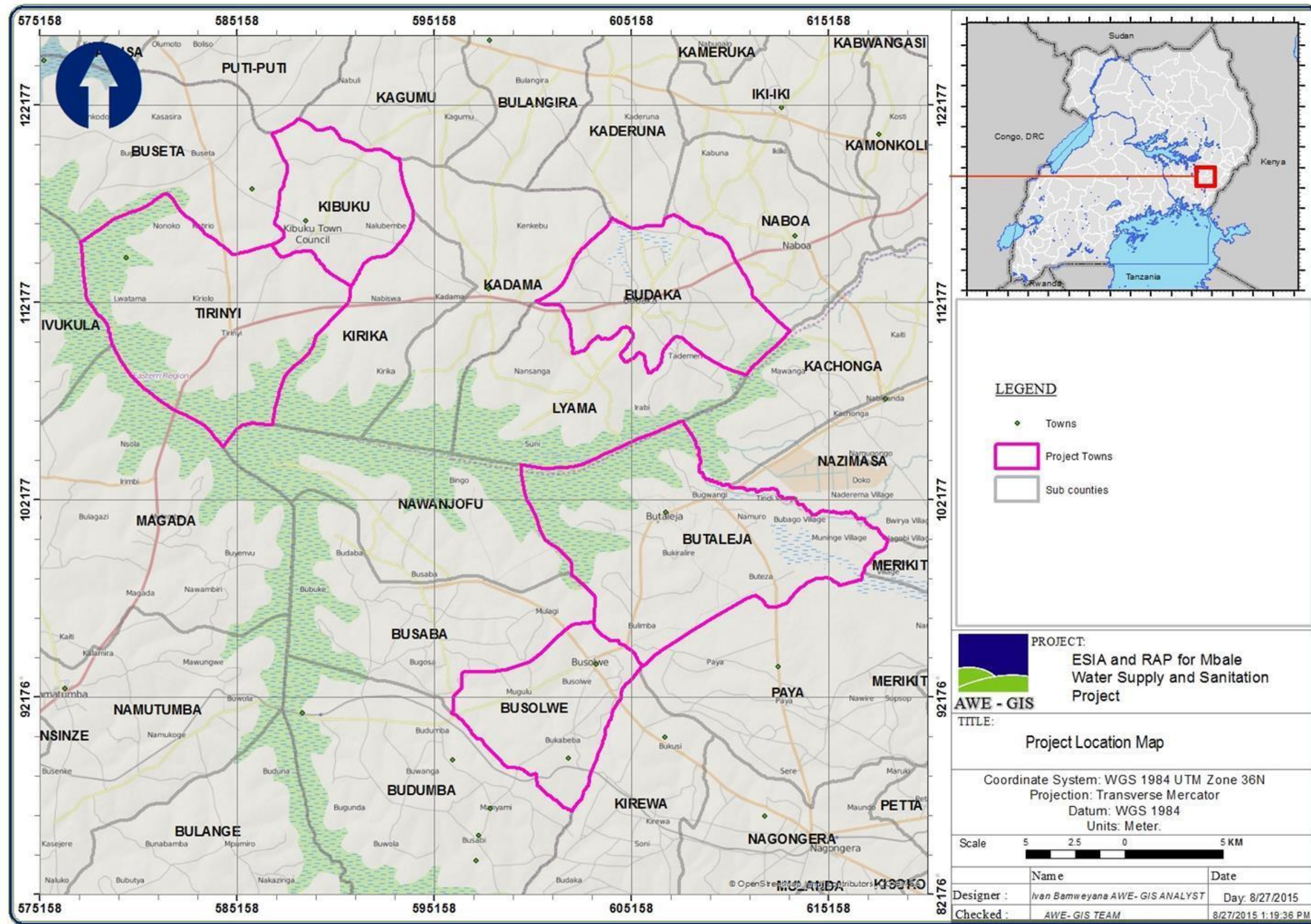


Figure 1 Location of the project districts relative to each other

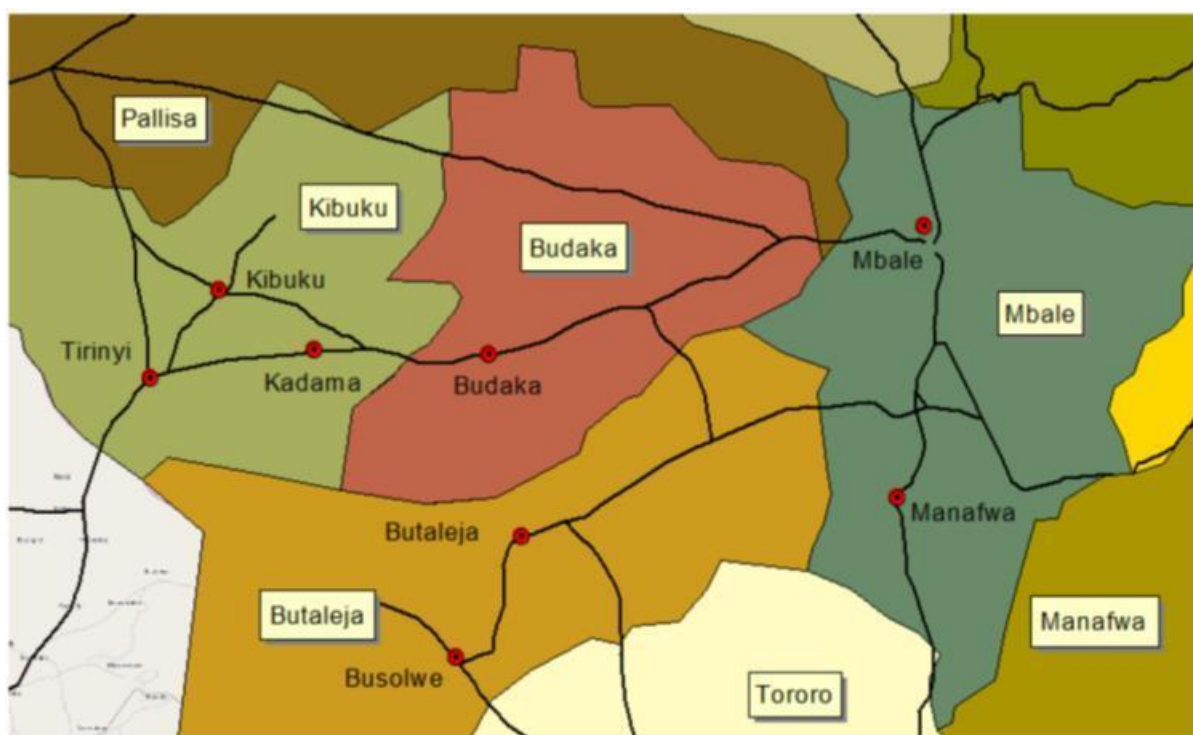


Figure 2 Location of the project towns within their respective districts

The first piped water supply system in Mbale was constructed around 1939. The municipality relies on two treatment plants, namely Bungokho and Manafwa water treatment plants. Mbale has had its share of infrastructure development backlog experienced as all urban centres in Uganda that have undergone rapid growth. The backlog has placed immense pressure on the capacity of NWSC to effectively deliver water and sewerage services. Although a number of interventions have been undertaken in the production systems, little has been done in the distribution network and the expansion of sanitary services.

Two sewage ponds, namely Doko treatment ponds and Namatala Wetland were constructed in 1968/69 and 1986. The condition of the ponds seems to be fair, the biggest problem being the high amount of infiltration during rains. The Doko treatment ponds appear to be in a good condition, except for the concrete works. The Namatala Wetlands are in urgent need of maintenance. The sewerage coverage is poor with only 14% of the households with water supply have a sewerage connection. Approximately 47 km (17%) of the current water supply network (total length ~ 279 km) consists of asbestos cement pipes which are according to NWSC in poor state. As a result, frequent bursts and leakages are experienced. Furthermore, development within the town over the last few years has taken place at a much faster rate than infrastructure provision, overwhelming NWSC's capacity to provide reliable services. Mbale Municipality has currently a population of around 100,000 inhabitants and the system was originally constructed for a population of around 45,000 people. With the town's boundaries having grown, it is now imperative that the water supply system be expanded to address the low per capita water production.

There is only piped water supply for the towns of Busolwe, Kibuku and Tirinyi. Budaka has a water supply system as well, but there is no operator in place and the pumps of the boreholes supplying the network

are not functioning. The towns of Kadama and Butaleja do not have piped water. Despite having piped water in some of the towns a sizeable part of the population is taking water from boreholes with hand pumps that have low yields and from shallow wells. The rivers are used as well as a water source. The connections to the water supply network are yard connections with very few exceptions. In all the towns the majority of the population rely on on-site sanitation facilities, mainly simple pit latrines and a few VIP latrines. The same applies to the institutions, like schools and health centres. The condition of the sanitation facilities in these institutions appeared to be satisfactory. In Tirinyi and Kibuku two new public toilets have been constructed, but they are not yet commissioned. Other than those two toilets there is no appropriate public sanitation facility in any of the growth centres.

1.2 SCOPE OF PROJECT

The scope of work under this project will include:

- i) Catchment management measures for protecting the current water sources at Nabijjo and Nabyonga Dam;
- ii) Rehabilitation and expansion of the water treatment plants at Bungokho and Manafwa;
- iii) Investigations into possible new water sources;
- iv) Rehabilitation and expansion of the water supply and distribution system;
- v) Extension of water supply services to neighbouring small towns and rural growth centres;
- vi) Rehabilitation and expansion of the sewer network and construction of new wastewater treatment facilities for new drainage areas; and
- vii) Water and sanitation facilities in informal settlements.

1.2 OBJECTIVE OF THE ESIA

The main objective is to carry out a comprehensive environmental and social impact assessment for the proposed project works for provision of improved water supply services in the business districts of Mbale, Kibuku, Budaka, and Butaleja. The specific objectives included:

- i) Establishment of the project's potential environmental and social impacts and propose measures to mitigate them;
- ii) Assessment of the impacts of alternatives and advise the design consultant accordingly; and
- iii) Determination of the actions required by NWSC and other stakeholders to satisfactorily address the impacts.

2 PROJECT DESCRIPTION

2.1 PROPONENTS' CONTACT AND PROJECT COST ESTIMATE

Name and address:

Mbale Municipality

NATIONAL WATER AND SEWERAGE CORPORATION
The Senior Manager - Projects
39 Jinja Road,
P.O. Box 7053, Kampala, Uganda
T: +256-414-315100
E: info@nWSC.co.ug

Small Towns and Rural Growth Centres

DIRECTORATE OF WATER DEVELOPMENT
Ministry of Water and Environment
Plot 21/28 Port Bell Road
P. O. Box 20026, Kampala, Uganda

The estimated project cost is Fifty million United States dollars (USD 50,000,000).

2.2 LOCATION OF PROJECT SITE

Mbale lies approximately 245 km, by road, northeast of Kampala, on an all-weather tarmac highway. The coordinates of the town are: 1° 04' 50" N, 34°10' 30" E. Mount Elgon, one of the highest peaks in East Africa lies approximately 52 km east of Mbale. Mbale is home to the Islamic University in Uganda (IUIU), as well as the Moses Synagogue around which most of the Abayudaya ba Uganda live. The population includes members of the Gisu ethnic group, mainly the Bamasaaba and Bagisu. The Mbale water supply is being developed to also extend water to the neighbouring small towns of Busolwe, Butaleja, Kadama, Budaka, Kibuku and Tirinyi; Kadama, Budaka, Tirinyi and Kibuku being located along the Tirinyi-Mbale highway, while Busolwe and Butaleja are located off of the Mbale-Tororo Highway. The location of the proposed facilities in Mbale and the small towns are presented in Figures 3 to 18.

Budaka Town Council is located at grids 01° 01' 00" N, 33° 56' 42" E, approximately 36 km by road, west of Mbale. It hosts the Budaka District headquarters and is at altitude 3,810 ft. (1,160 m) above sea level. Kadama Town Board is 8km from Budaka town towards Tirinyi town along the Mbale - Iganga Highway. Kibuku Town Council is located between Grids 01°02'N and 33°50' E. The altitude ranges from 1000m to 1100m above sea level. It lies 53km by road west of Mbale town.

Busolwe Town Council is located at grids 00° 50' 57"N, 33° 55' 37"E; at an elevation of 3,609 ft (1,100 m) above sea level. It lies 47 km by road southwest of Mbale town.

Butaleja Town Council is located at grids 0°55'30.0"N, 33°56'42.0"E. It hosts the District headquarters. It lies at an elevation of 3,600 ft (1,100 m) above sea level. It lies at a distance 38 km by road southwest of Mbale town.

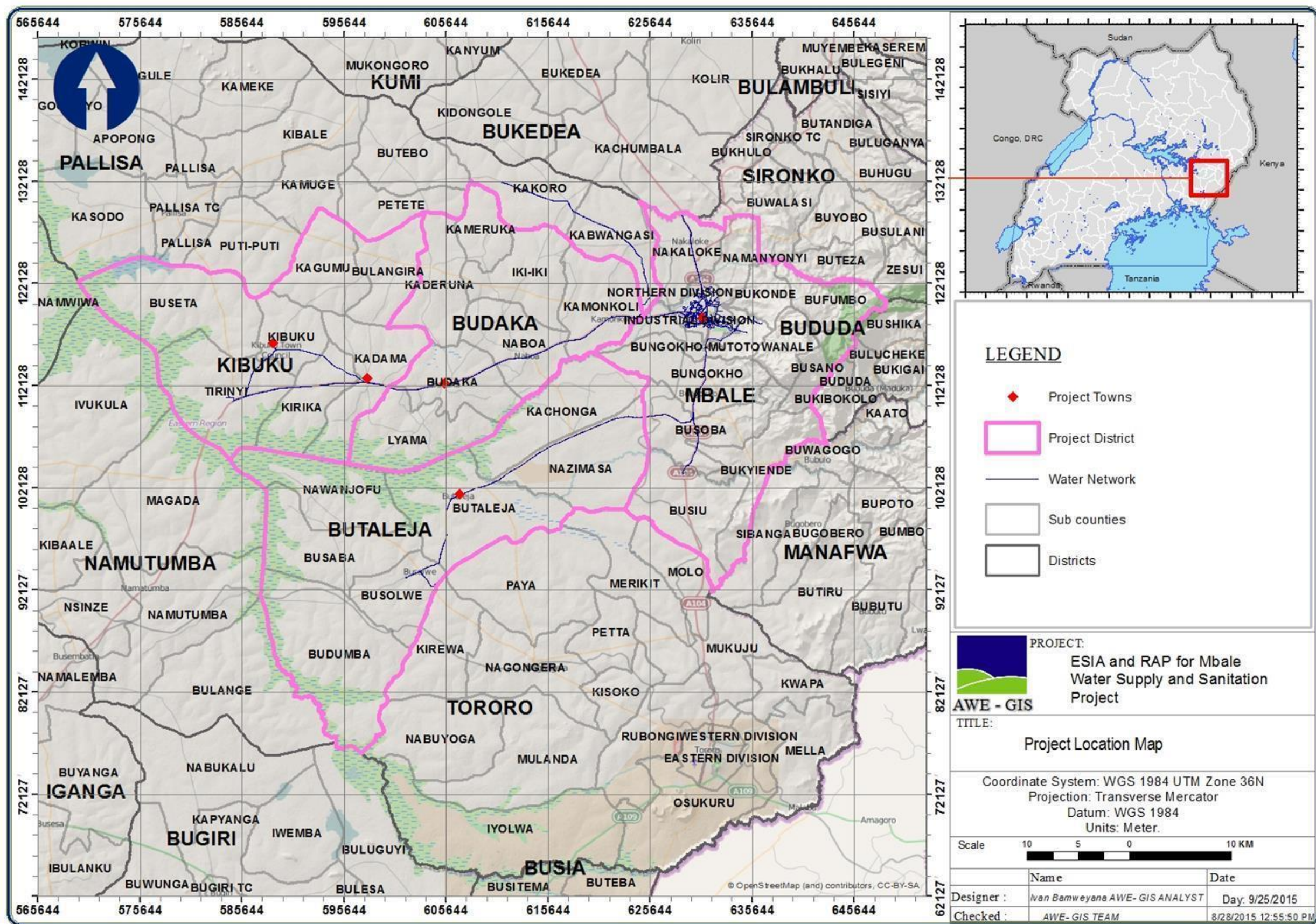


Figure 3 Location of the project towns within their respective districts

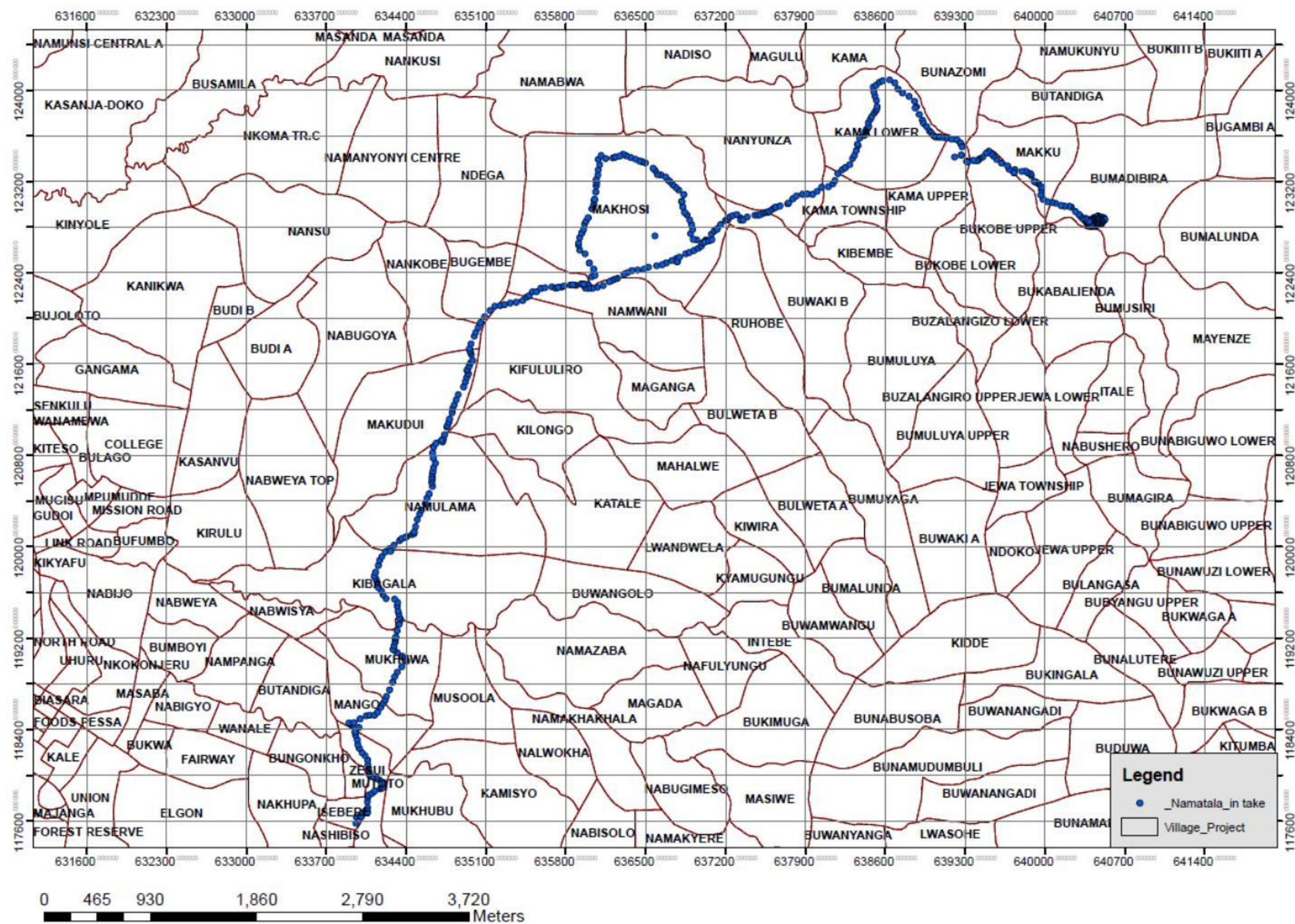


Figure 4 Layout and location of the proposed water transmission line from River Namatala to Bungokho waterworks

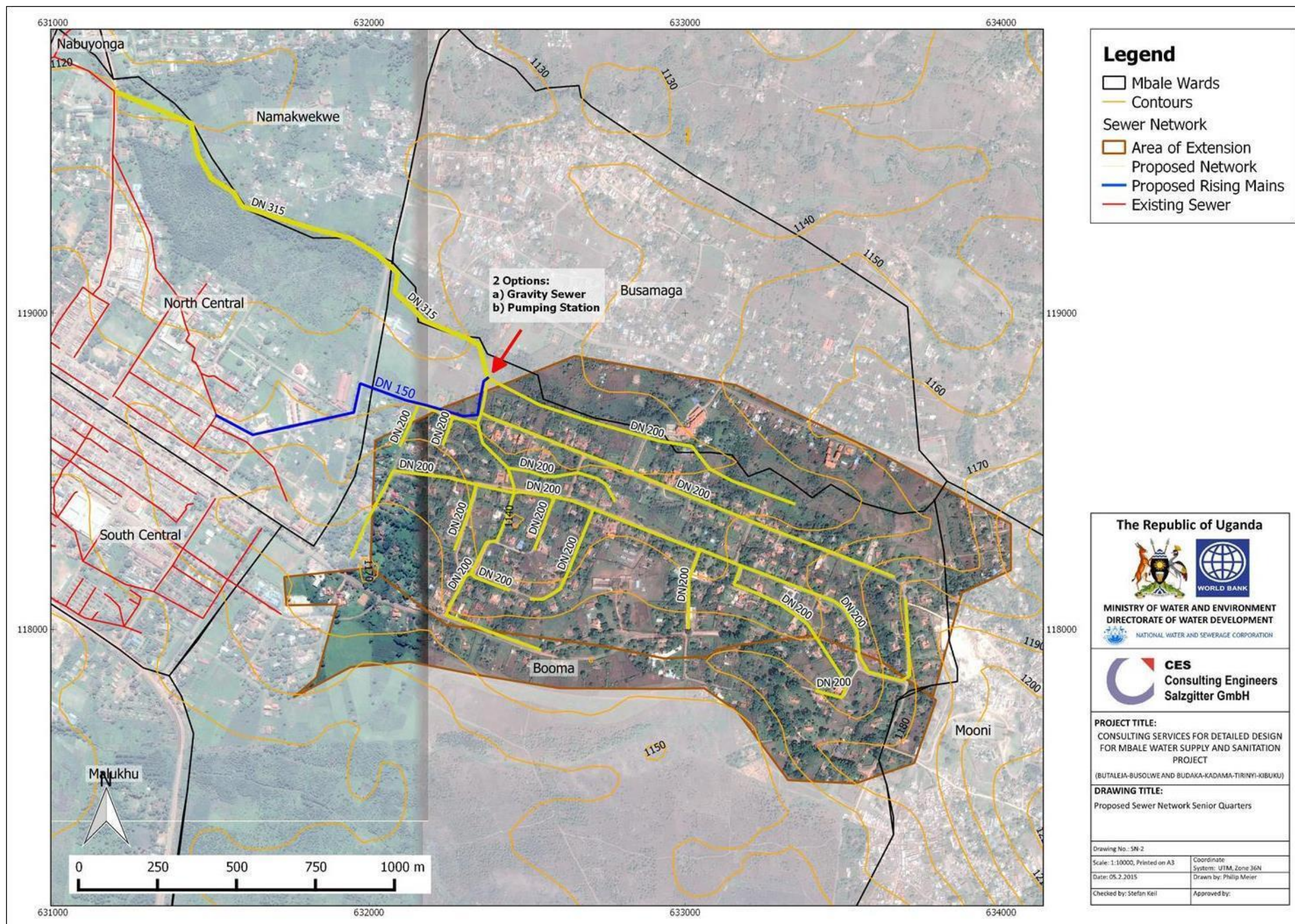


Figure 5 Layout and location of the proposed sewer network for the Senior Quarters in Mbale Municipality

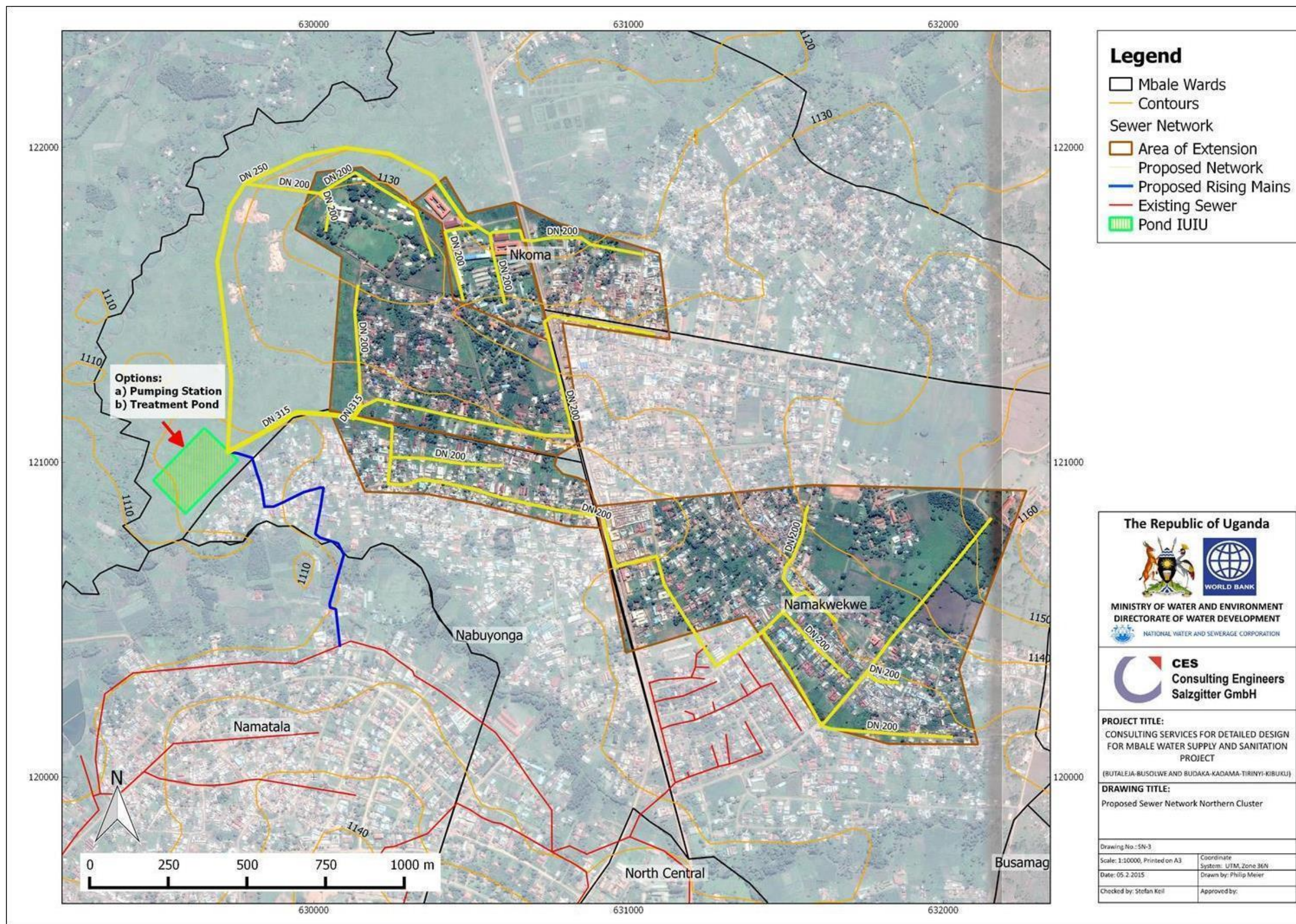


Figure 6 Layout and location of the proposed sewer network for the Northern Cluster in Mbale Municipality

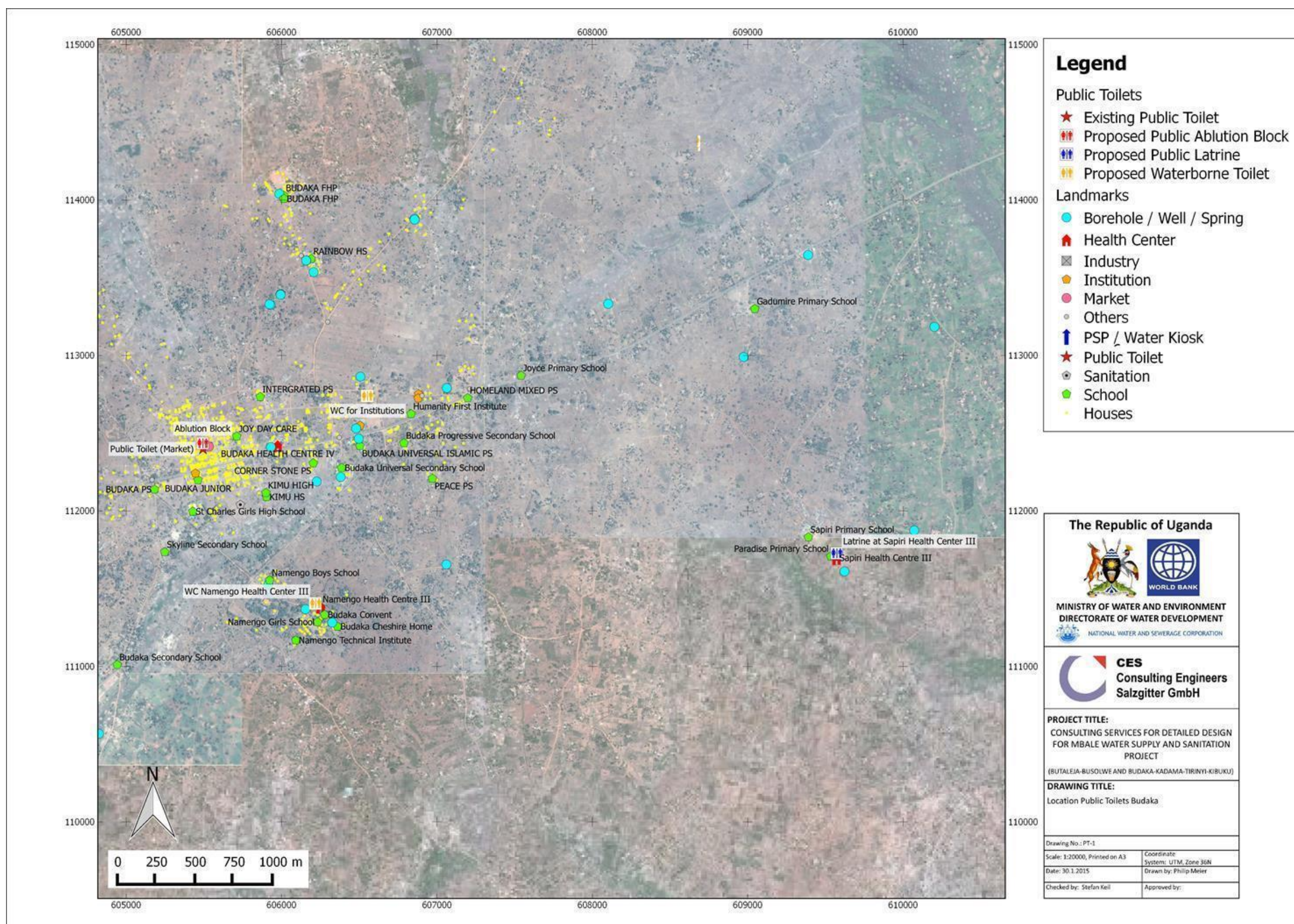


Figure 7 Location of the proposed public toilet facilities in Budaka

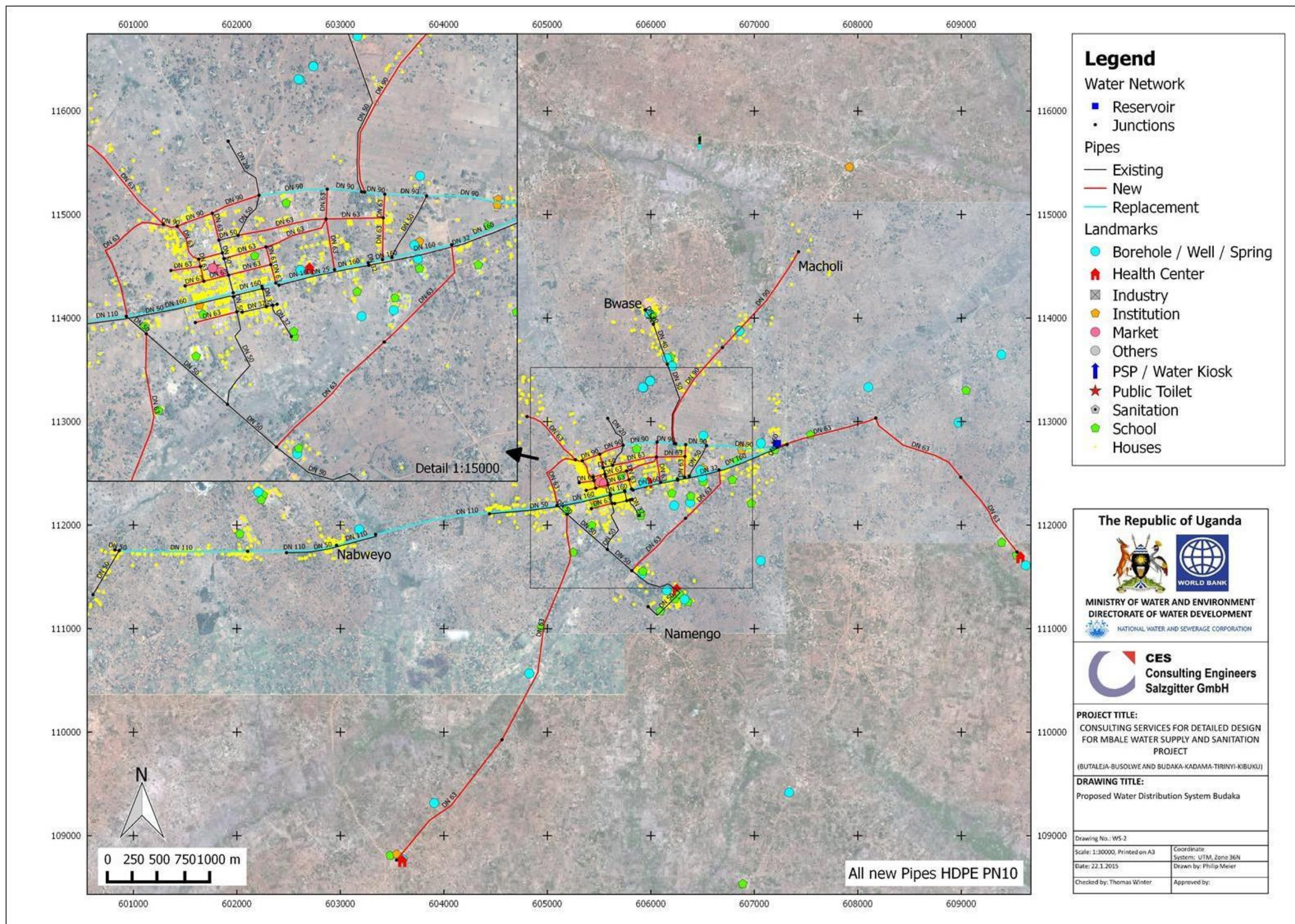


Figure 8 Location and layout of the proposed water distribution system in Budaka

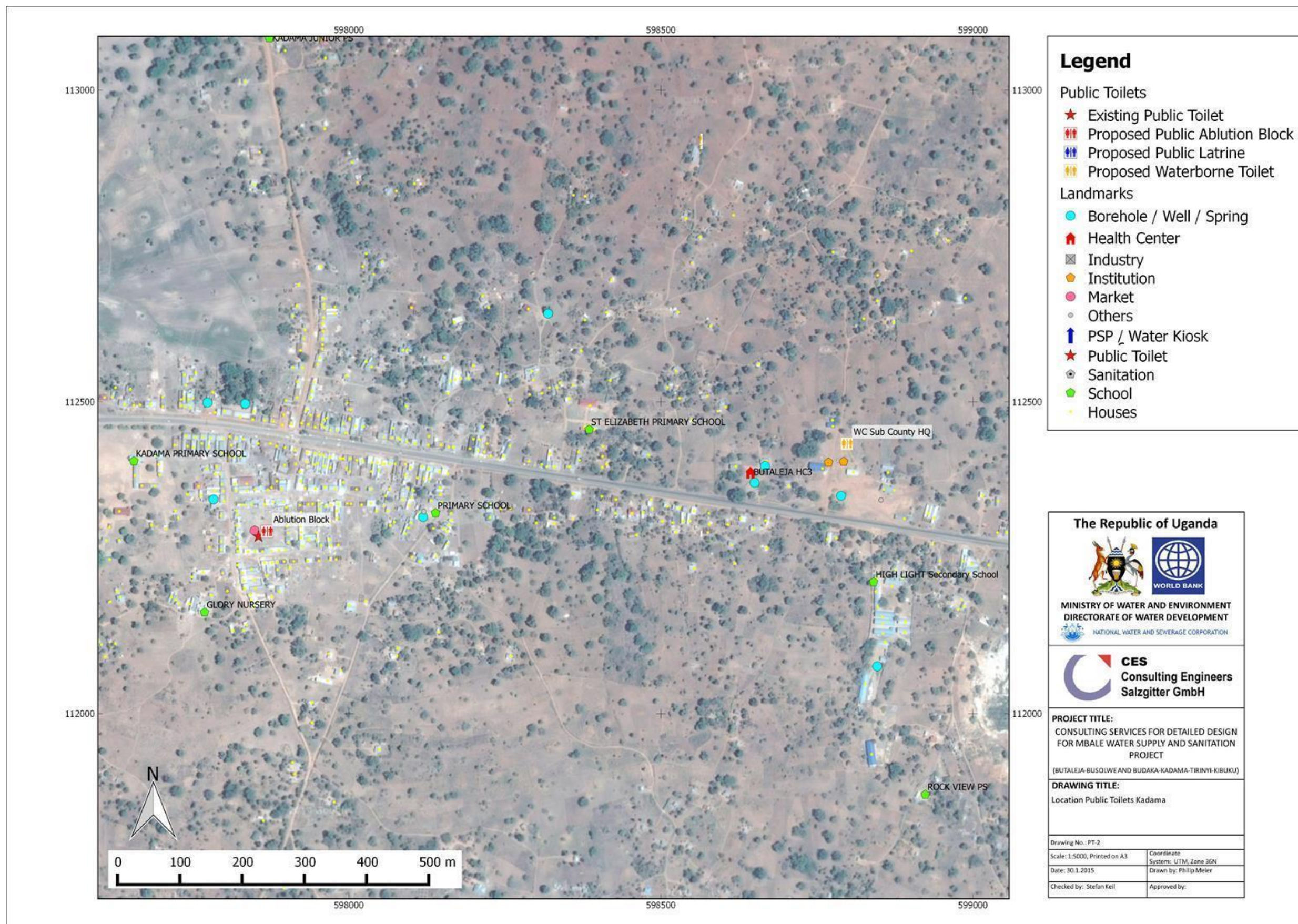


Figure 9 Location of the proposed public toilet facilities in Kadama

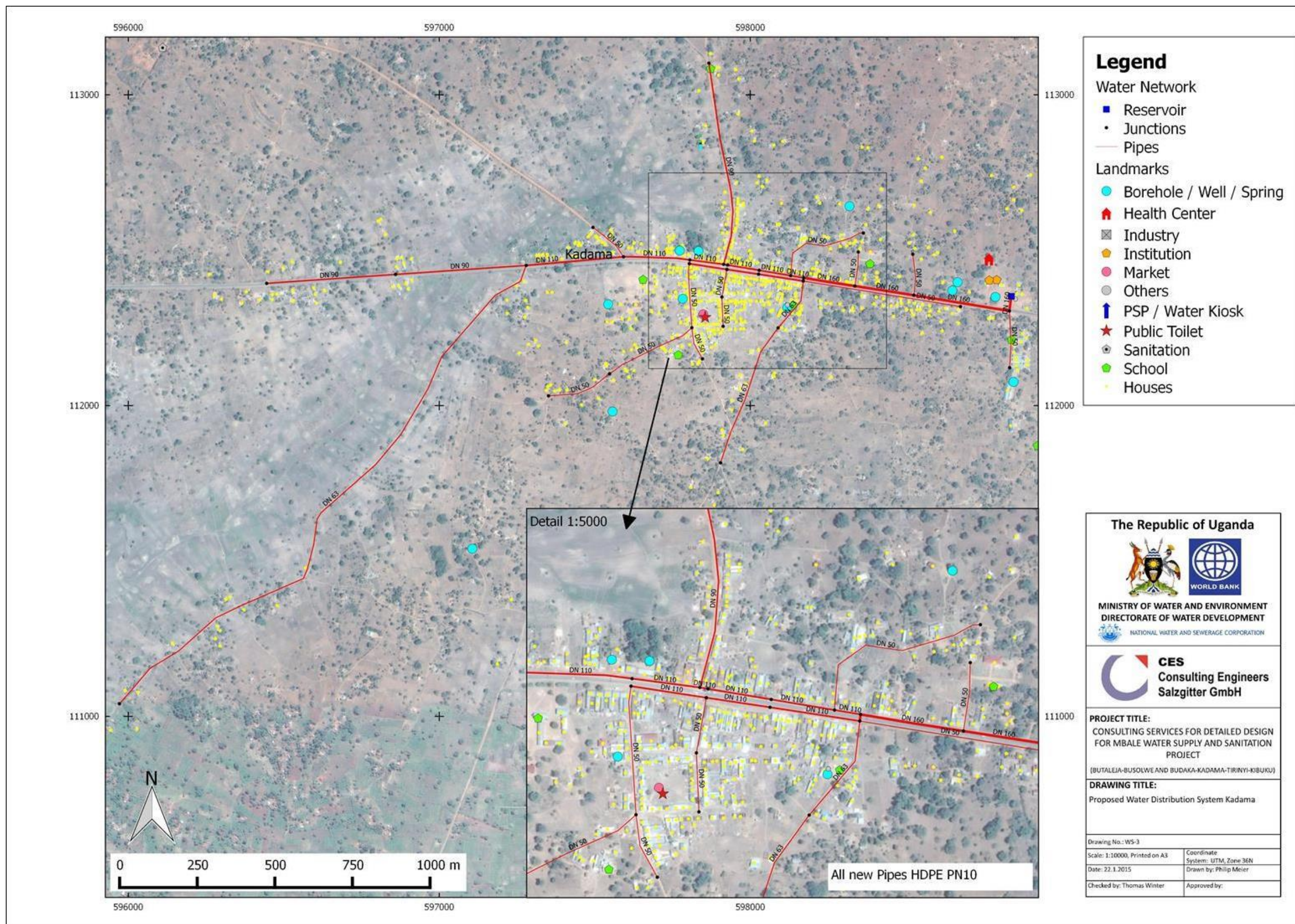


Figure 10 Location and layout of the proposed water distribution system in Kadama

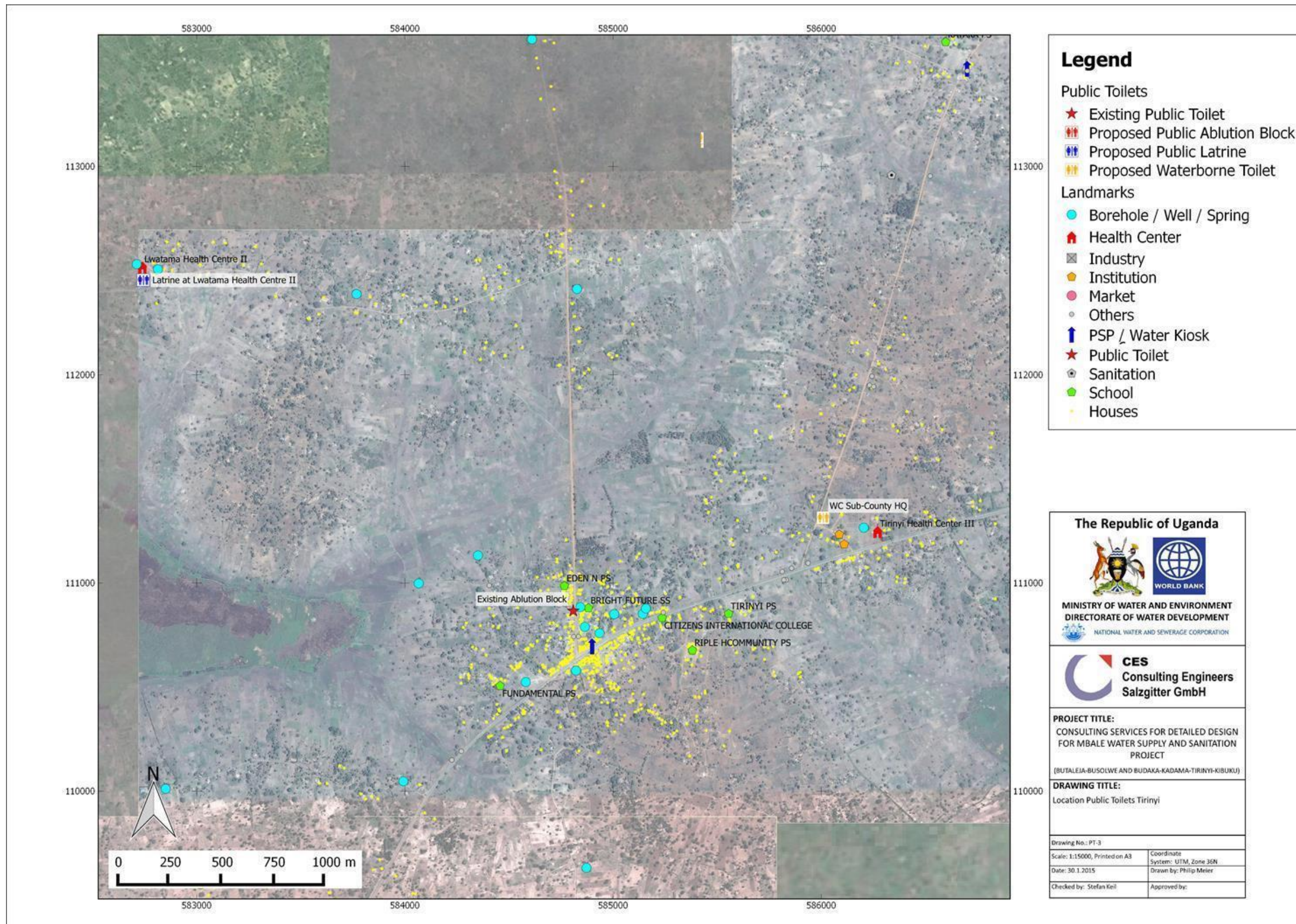


Figure 11 Location of the proposed public toilet facilities in Tirinyi

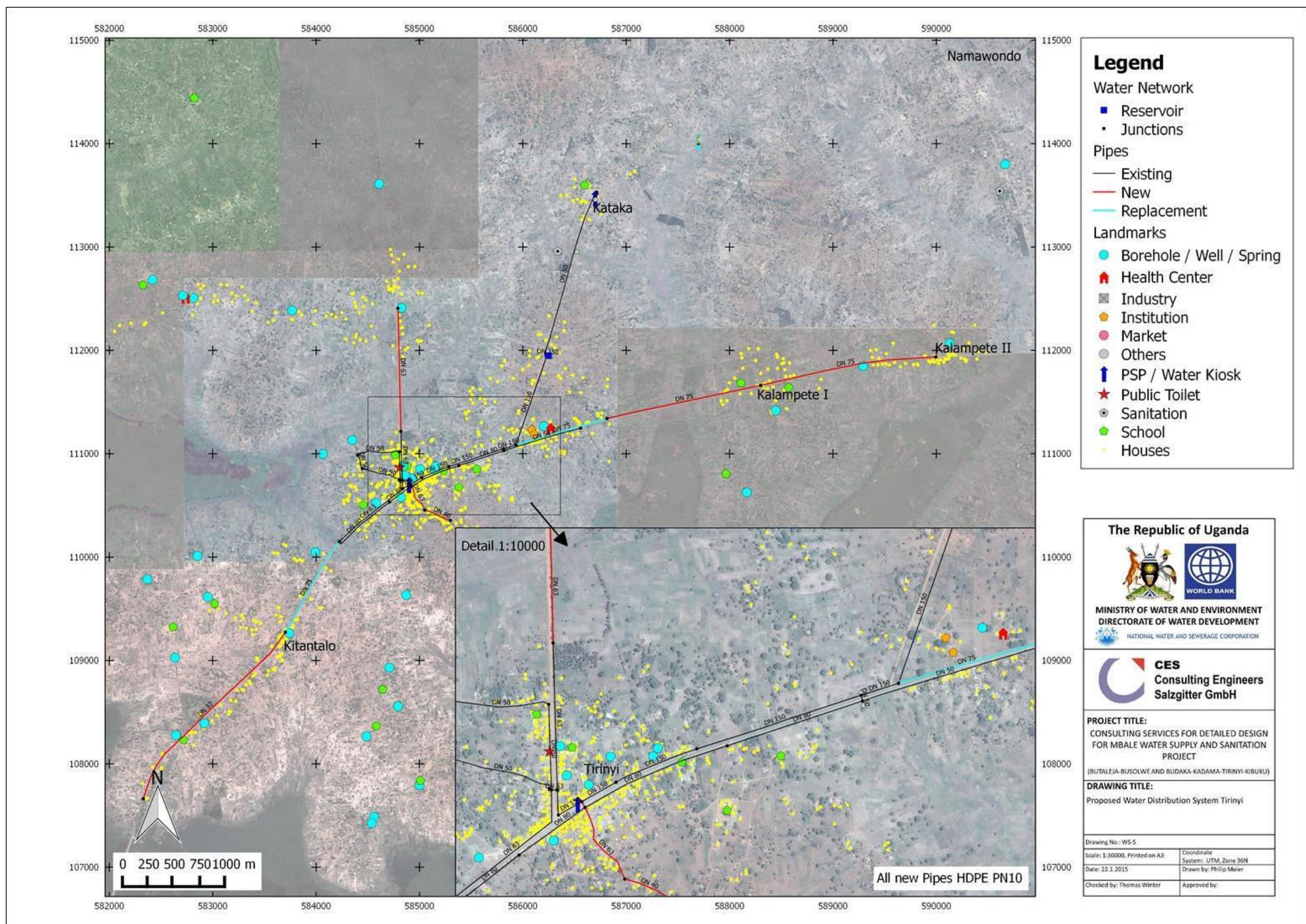


Figure 12 Location and layout of the proposed water distribution system in Tirinyi

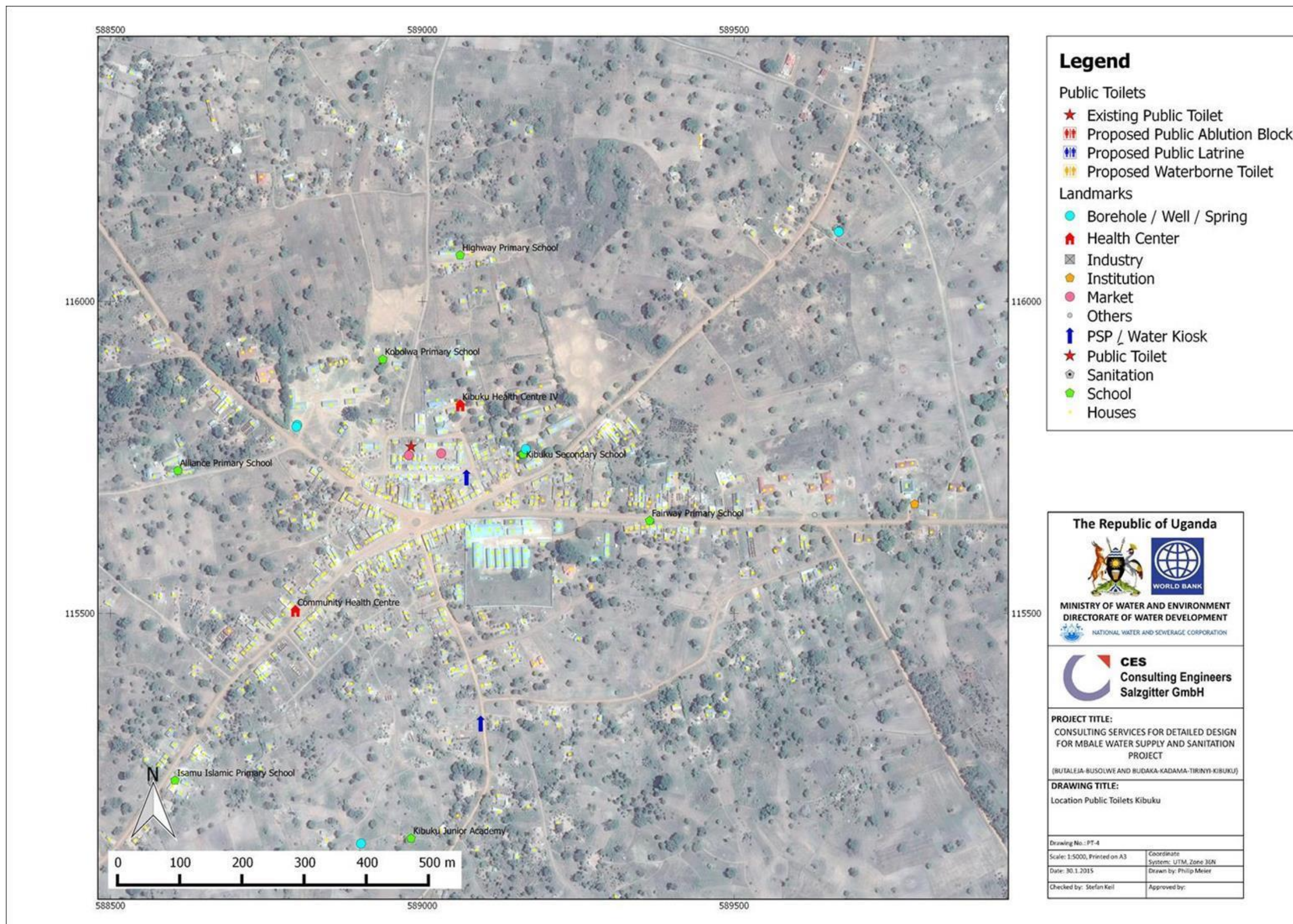


Figure 13 Location of the proposed public toilet facilities in Kibuku

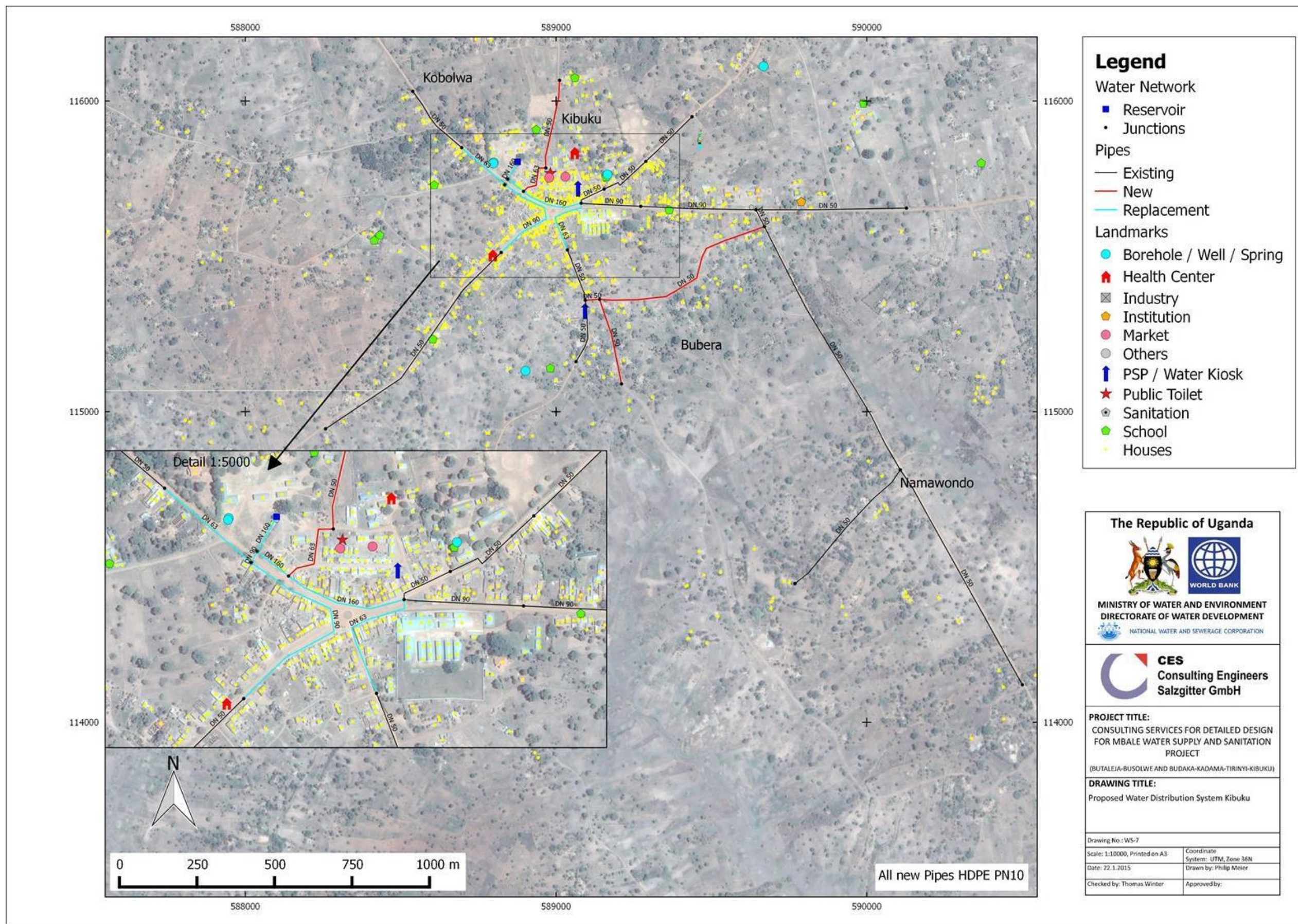


Figure 14 Location and layout of the proposed water distribution system in Kibuku

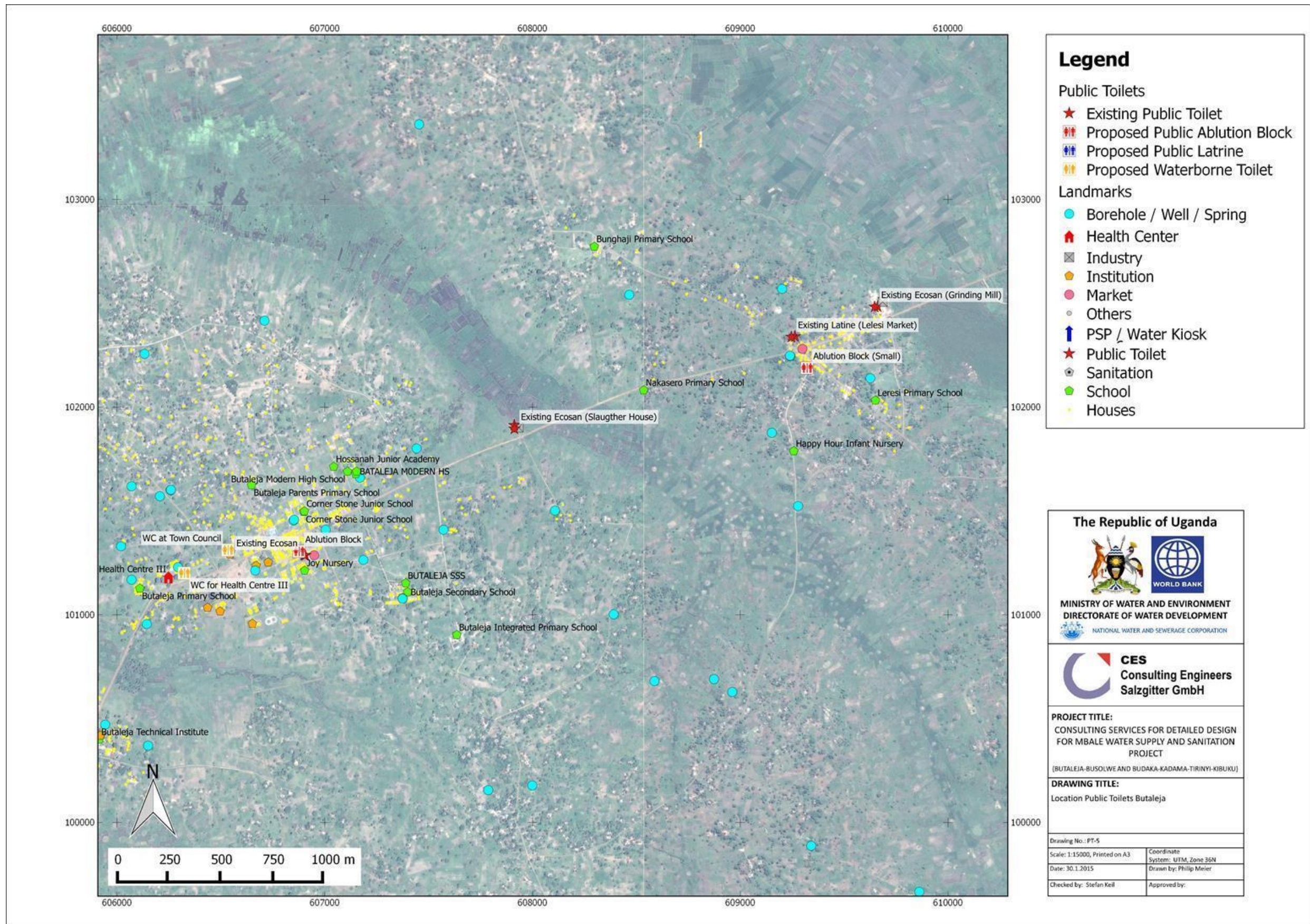


Figure 15 Location of the proposed public toilet facilities in Butaleja

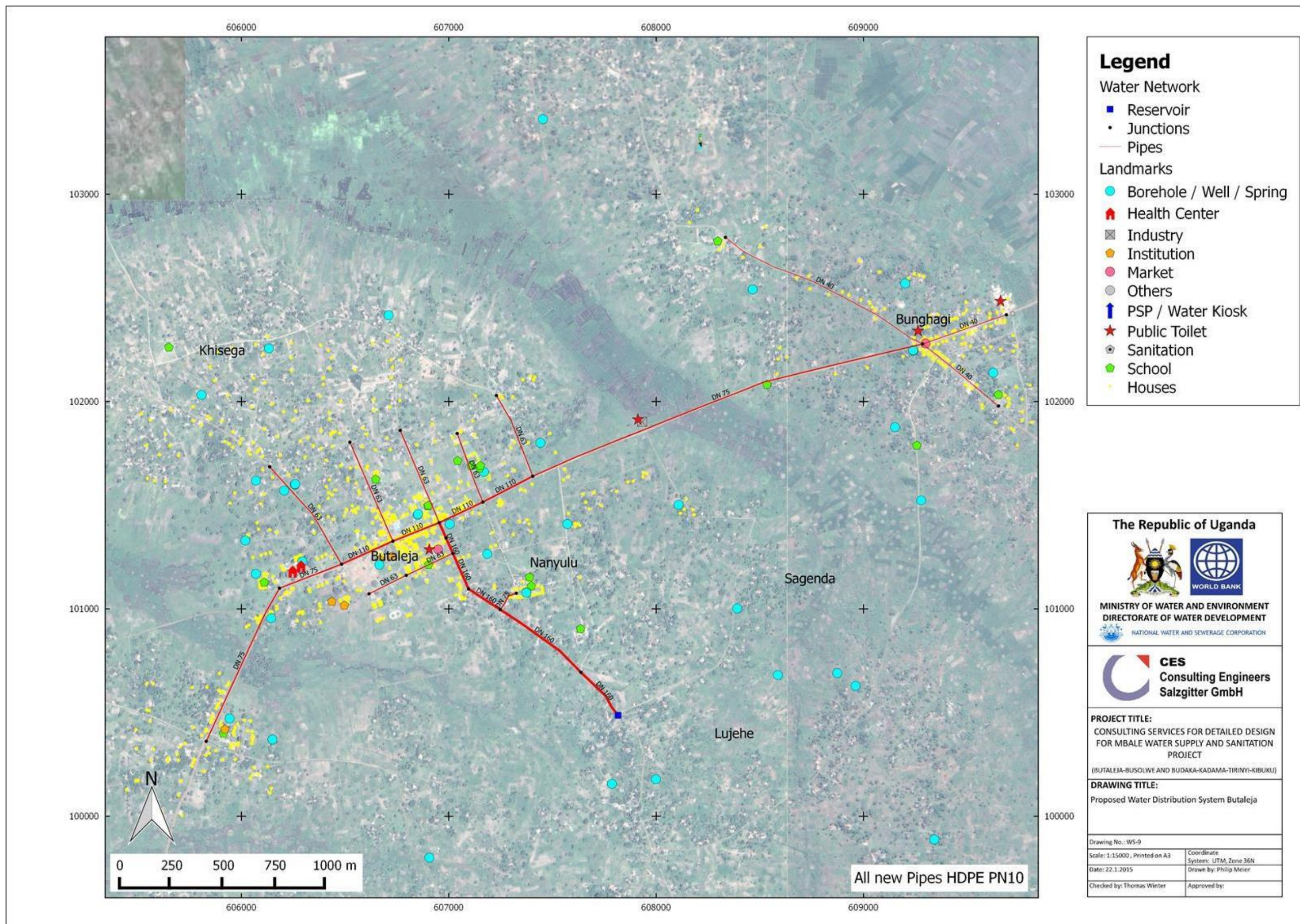


Figure 16 Location and layout of the proposed water distribution system in Butaleja

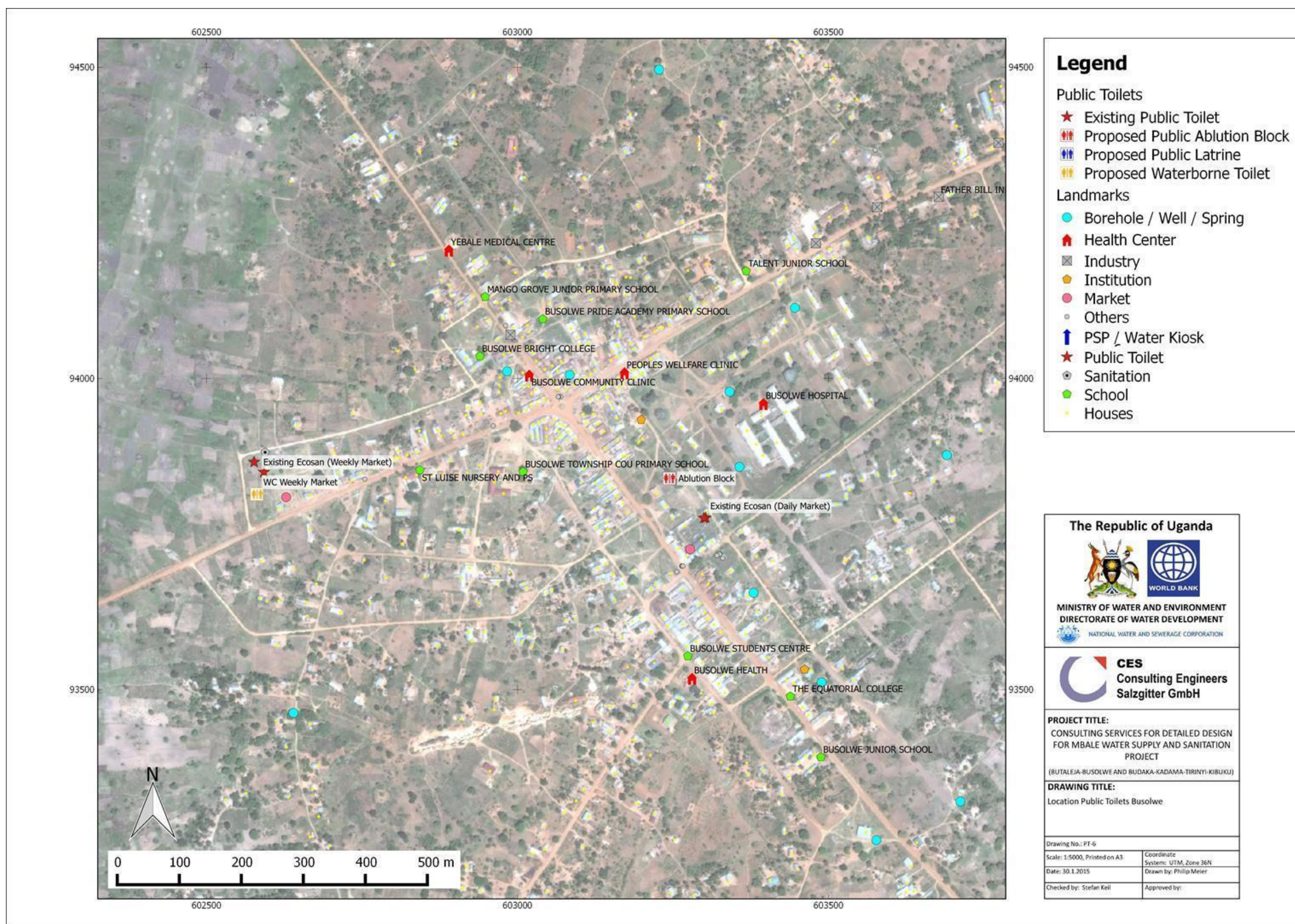


Figure 17 Location of the proposed public toilet facilities in Busolwe

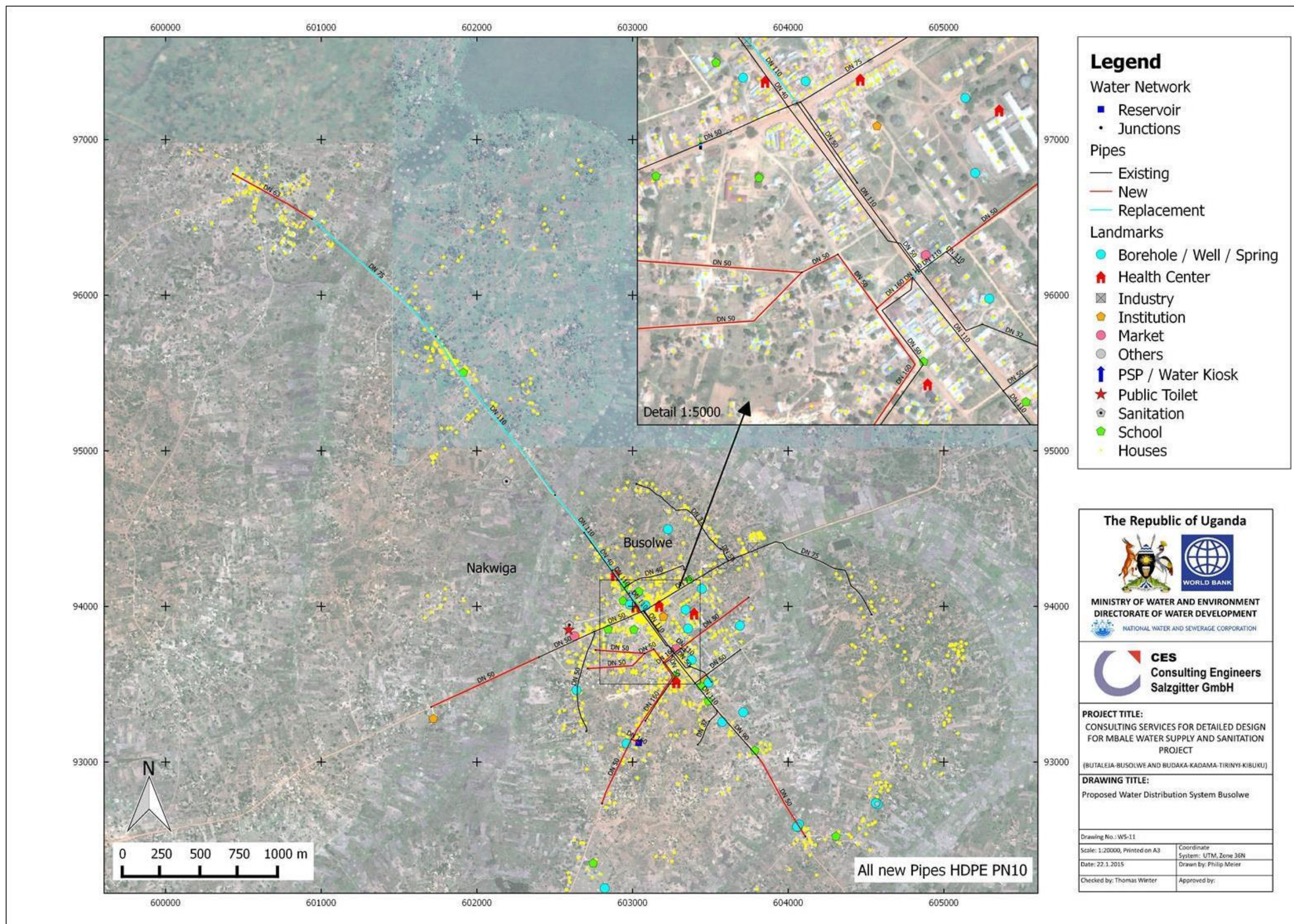


Figure 18 Location and layout of the proposed water distribution system in Busolwe

2.3 PROJECT COMPONENTS

2.3.1 Transmission lines

2.3.2.1 Namatala water intake and transmission line

The current intakes of Nabijo and Nabuyonga are not sufficient anymore for the new water supply system. Thus a new intake (Photo 1) and a new transmission main between Namatala and Bungokho WTP are required. A small weir needs to be constructed for the water abstraction. The weir is an integral part of the intake as it needs to fulfil two purposes: it needs to maintain a water level that allows enough water to pass the screen of the intake structure and it needs to make sure that the minimum EF is passing the weir. The intake will also include flow monitoring devices to ensure river flows are measured and the minimum EF is maintained.



Photo 1: Proposed location of intake and weir

The pipeline shall follow in the beginning the contours and will be laid through agricultural land and forest. It is only the last 2 km before Mbale town that the pipeline alignment will follow existing roads.

From preliminary assessment of the minimum EF for Namatala River (refer to Section 5.3.1.3 and Annex K), there is a risk of insufficient river flow during the dry months (January to February) to meet the project water demand and the estimated minimum EF. Therefore, prior to construction, the NWSC will carry out an Alternative Water Supply Study to evaluate options to augment water source during low flows for Namatala and assess the reliability of the proposed water supply system. The options will include, among others but not limited to: (i) construction of a water impoundment structure at the Namatala intake site to store water during high flows and sustain the water demand during the dry spell, (ii) construction and rehabilitation of boreholes in the small towns, (iii) expansion of Manafwa water supply system, and (iv) a

reduction in water service delivery at acceptable levels. These are not considered individual solutions, but complementary and inclusive; therefore, the final recommendation would likely be a combination of these options. The study will include specific recommendations and an implementation plan. The MWE and the NWSC will implement the recommendations under the IWMDP. Preliminary considerations of the feasibility of these options are included in Section 2.5.2.1.

2.3.2.2 Mbale town water transmission lines

Mbale municipality requires a new transmission main system and water supply to the west to Budaka, Kadama, Kibuku and Tirinyi. The transmission main system in Mbale will comprise of the existing DN 300 Steel pipe, which runs from the reservoir at Bungokho WTP along the Republic Road and ends shortly after the Clock Tower. This will be used as the main feeder for the Pressure Zone 2, that is, Senior Quarters, parts of the Central Business Area and St. Paul Mbale College (See Figure 19).

A new DN 600 pipe will run down from Bungokho reservoir to the pressure break tank at Mbale District Local Government (350m towards Central Business District (CBD) from Mbale Sports Club). The DN 600 ends with a tee 140m before the pressure break tank. A DN 400 needs to be connected (with the full pressure from Bungokho) which runs in parallel to the Republic Road up to the roundabout (Soroti / Kampala Road) for the supply to the north (Nakaloke) and west (Kamonkoli / Budaka / Tirinyi).

A DN 300 (throttle section, 140m long) will connect from the DN 600 to the pressure break tank. The outlet of the pressure break tank is a DN 500 pipe which runs in parallel to the republic road up to the clock tower. This pipe is the main feeder pipe for the pressure Zone 3.

Two new transmission mains are required for the supply to the Growth Centres. The two mains need to be laid from: Mbale to Tirinyi / Kibuku and; Split point between Manafwa – Mbale to Butaleja and Busolve

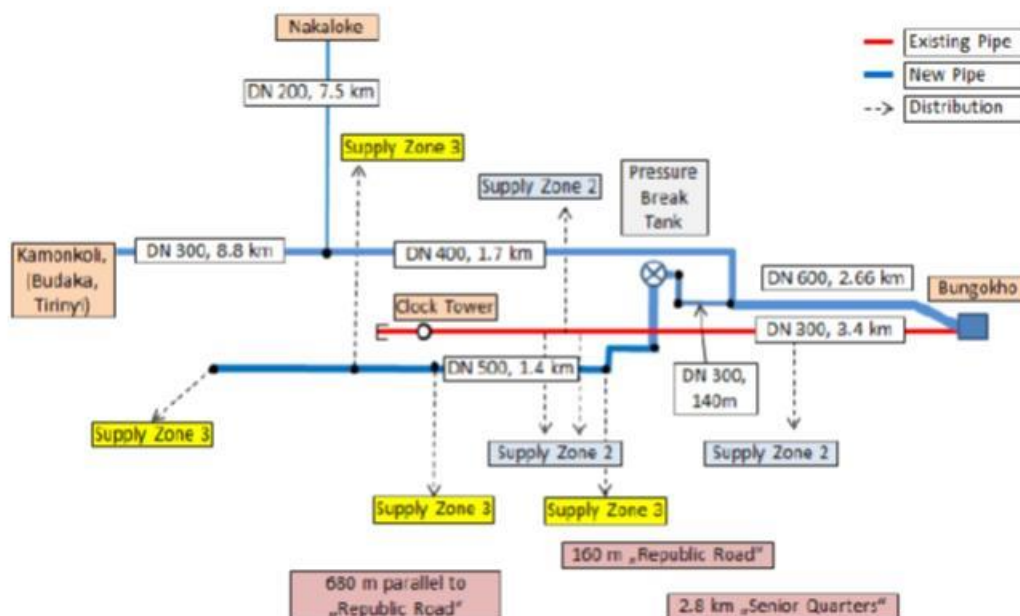


Figure 19 Schematic layout of the Mbale transmission main system

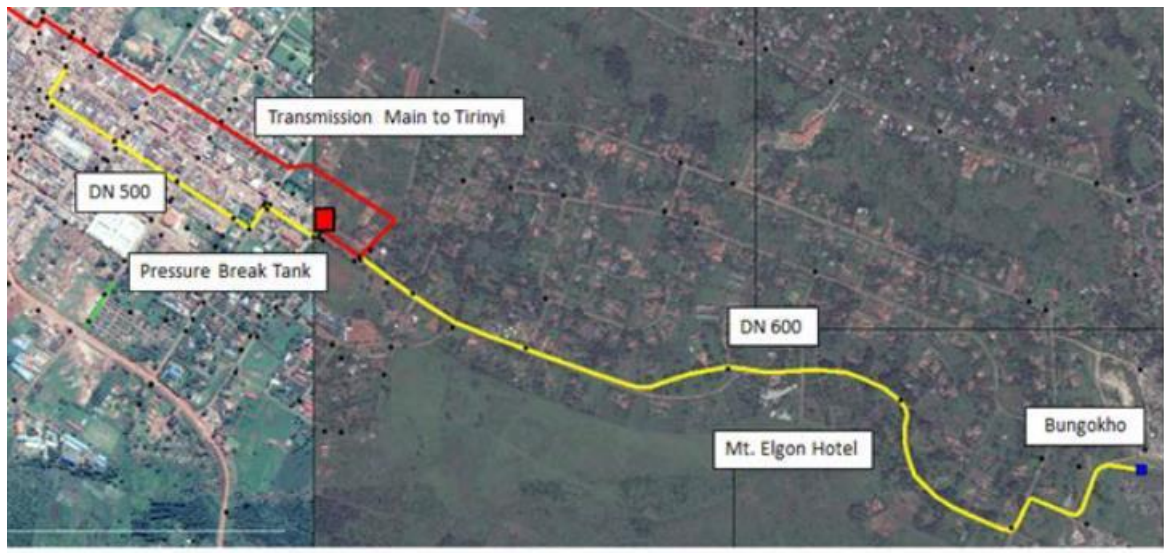


Figure 20 Lay out of Mbale transmission main

2.3.3 Main Reservoirs and Pressure Break Tanks

These will include:

- Bungokho (Central Reservoir, Supply to Zone 1, 2 (via existing DN 300 steel) & 3 in Mbale and Growth Centres to Tirinyi)
- Pressure Break Tank in Mbale (Supply Zone 3)
- Busoba Reservoir (between Manafwa and Mbale, supply to Busolwe and Butaleja)
- Mooni (Supply Zone 1, Mbale)

2.3.3.1 Bungokho reservoir

The Bungokho reservoir is an existing reservoir of Bungokho WTP which is located in the east of Mbale. The WTP was built around 1939. The following will be done to improve the state of the reservoir:

- • Installation of new inlet and outlet pipes including valves and water meter
- • Minor reservoir rehabilitation (hack out defective concrete, apply mortar, etc.)
- • Installation of pumps that shall pump treated water to the Mooni Reservoir

2.3.3.2 Pressure break tank

There is no pressure break tank currently in Mbale. To prevent hydro-static pressure above 6 bar in the north and north west of Mbale, a new pressure break tank of about 100m³ need will be constructed at “Mbale District Local Government” parking yard side.

2.3.3.3 Busoba reservoir

Currently, Busoba has no reservoir. A new reservoir will be constructed at Busoba that is fed from Manafwa to allow gravity supply to the north and south of the Busoba reservoir. The reservoir shall have a size of 2000 m³. The pipeline between Manafwa and Bungokho exists and is a DN 300 steel pipe. The location of the new reservoir in the south at Busoba is approximately 4000 m north of Manafwa and 1700 m south of the turn-off to Busolwe (Figure 21).

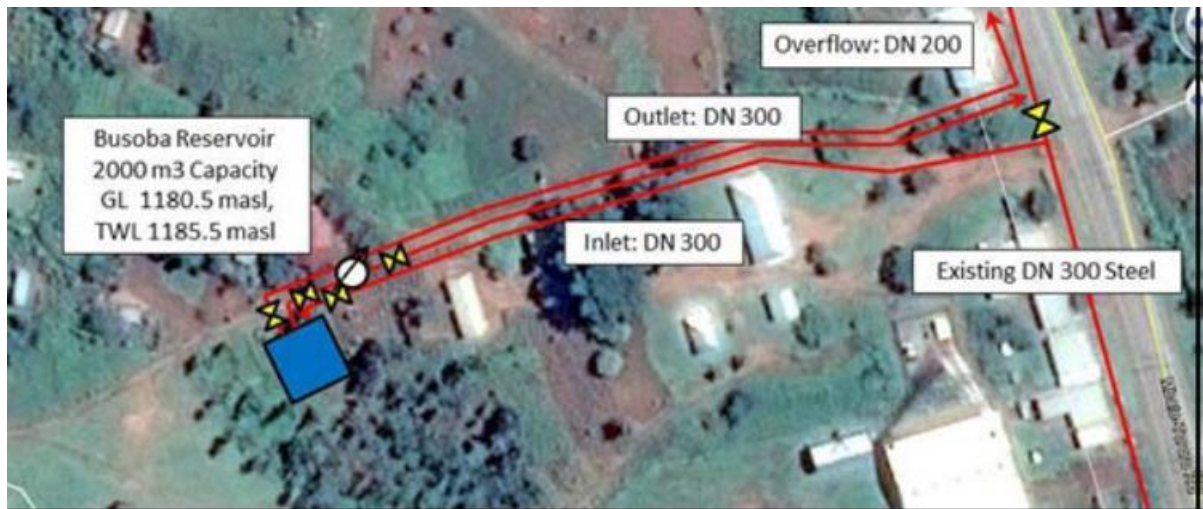


Figure 21 Location of the proposed reservoir at Busoba

2.3.3.4 Mooni reservoir

Like in Busoba, no reservoir exists currently at Mooni. A new 150m3 reservoir is proposed for Mooni and will be fed from Bungokho WTP to allow gravity supply to the area. A new feeder pipeline will be laid between Bungokho WTP and Mooni reservoir. The location of the new reservoir including the proposed feeder pipe is shown in Figure 22.

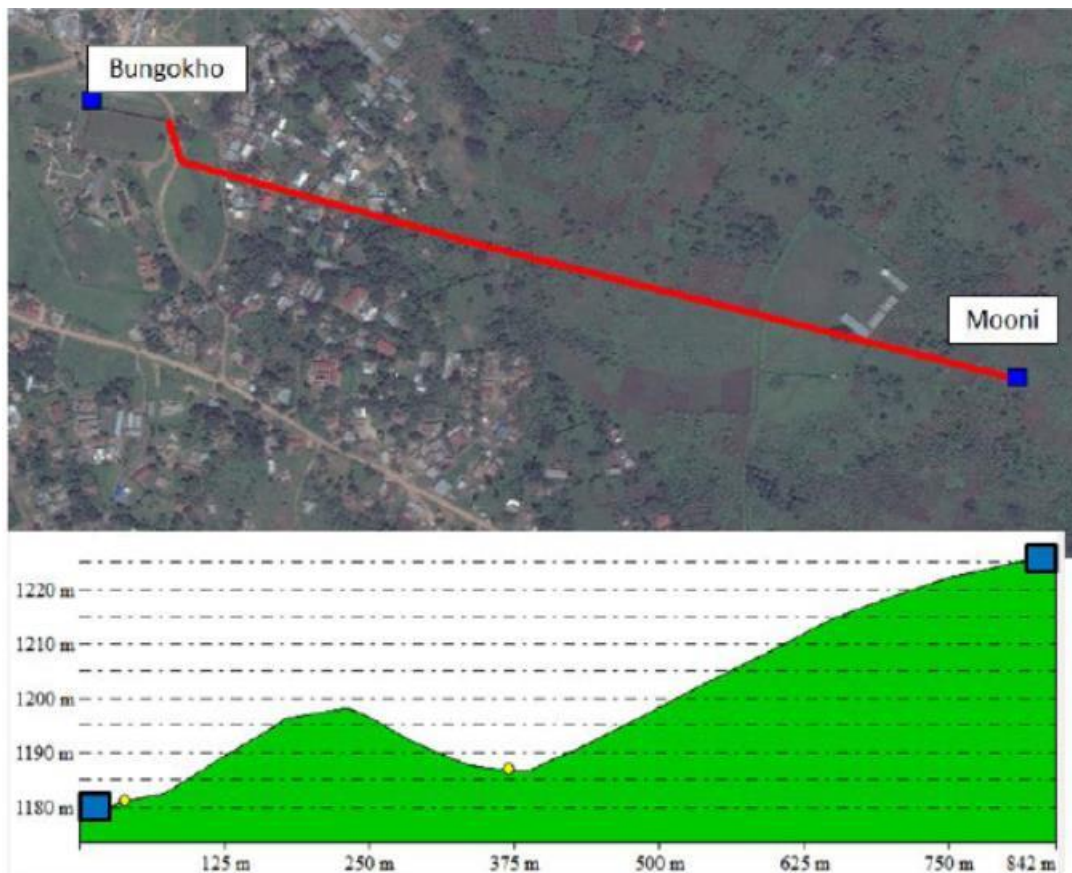


Figure 22 Location of the proposed reservoir at Mooni

2.3.3.5 Reservoirs in the growth centres

Four (4) new reservoirs with the size between 160 – 190 m³ will be constructed in Budaka, Kadama, Butaleja and Busolwe. The reservoir in Kadama shall be used at same time as pressure break tank for the supply to Tirinyi and Kibuku. All reservoirs will be supplied by the transmission mains from Mbale to Tirinyi or the split point between Mbale and Manafwa to Busolwe.

Budaka: In Budaka the existing reservoir (Photo 2) shall be used together with the new reservoir, which has to be constructed. Since the water supply system is currently not in operation, the chlorination unit and the water meter will be replaced.

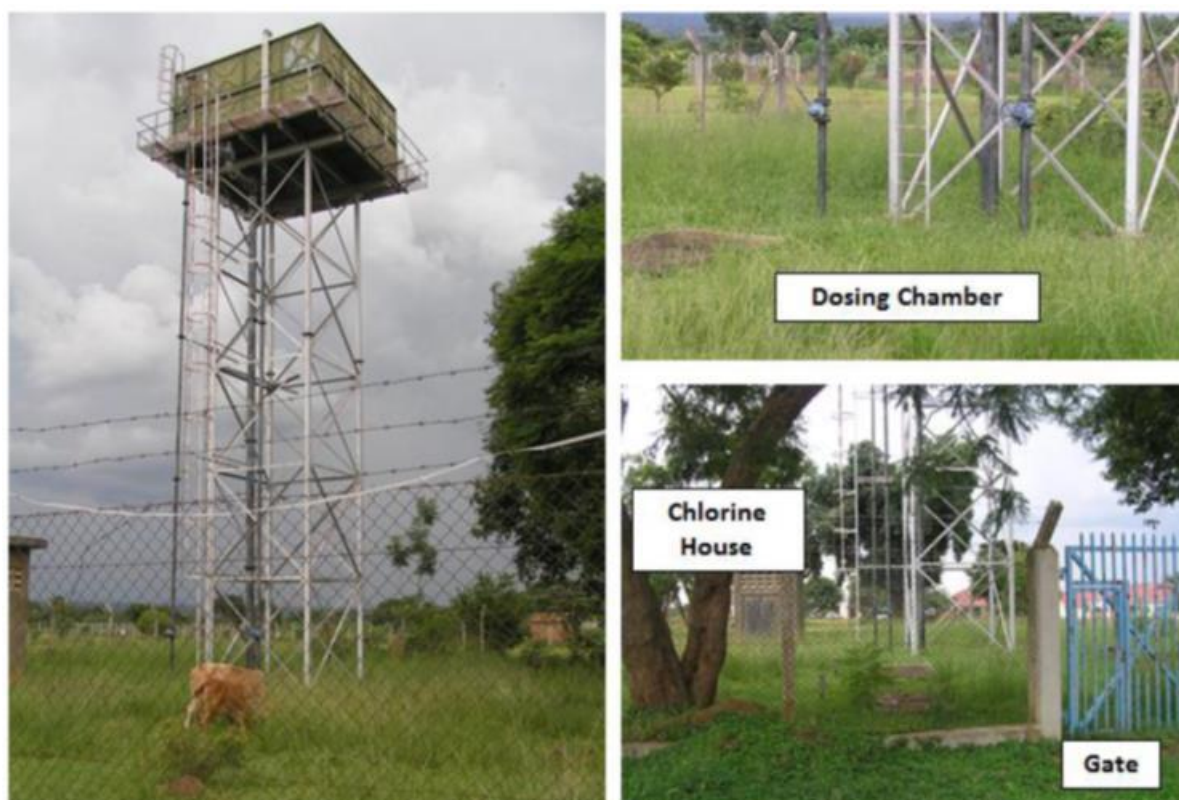


Photo 2: Existing reservoir structures at Budaka

Kadama: A new reservoir will be constructed at Kadama which serves as a reservoir for Kadama and a pressure break tank for Tirinyi and Kibuku. Because it will double both as a reservoir and break pressure tank, its capacity was slightly increased to 200 m³.

Butaleja: Butaleja currently has no water supply system in place. A new reservoir will be constructed.

Busolwe: Busolwe has a water supply system in place. The current reservoir is located at a lower level necessitating construction of a new one at a higher level.

Tirinyi: Tirinyi has an operational water supply system in place. The current reservoir is located in the north of the growth centre and can be connected at two different locations. The reservoir and associated facilities (the chlorination facility, valves and the water meter) are all in operating condition.

Kibuku: Kibuku has an operational water supply system in place. The current reservoir is located in the centre of the growth centre and need to be connected with the new transmission main. The chlorination facility, valves and the water meter are all in operating condition.

2.3.4 Distribution Networks

2.3.4.1 Mbale distribution network

Developments within Mbale over the last few years have taken place at a faster rate than the pace at which the water supply and sanitation infrastructure was developed, overwhelming the utility's capacity to provide a continuous water supply. With the town's boundaries having grown, it is now imperative that the water distribution system be expanded in order to address the low per capita water availability which currently stands at about 15 litres per day.

The majority of the aged non-metallic pipelines will have to be replaced and the new connections done properly. Mbale Municipality will be divided into 4 different pressure zones, namely: Mooni, Senior Quarters, St. Paul Mbale College and Mbale (Figure 23).

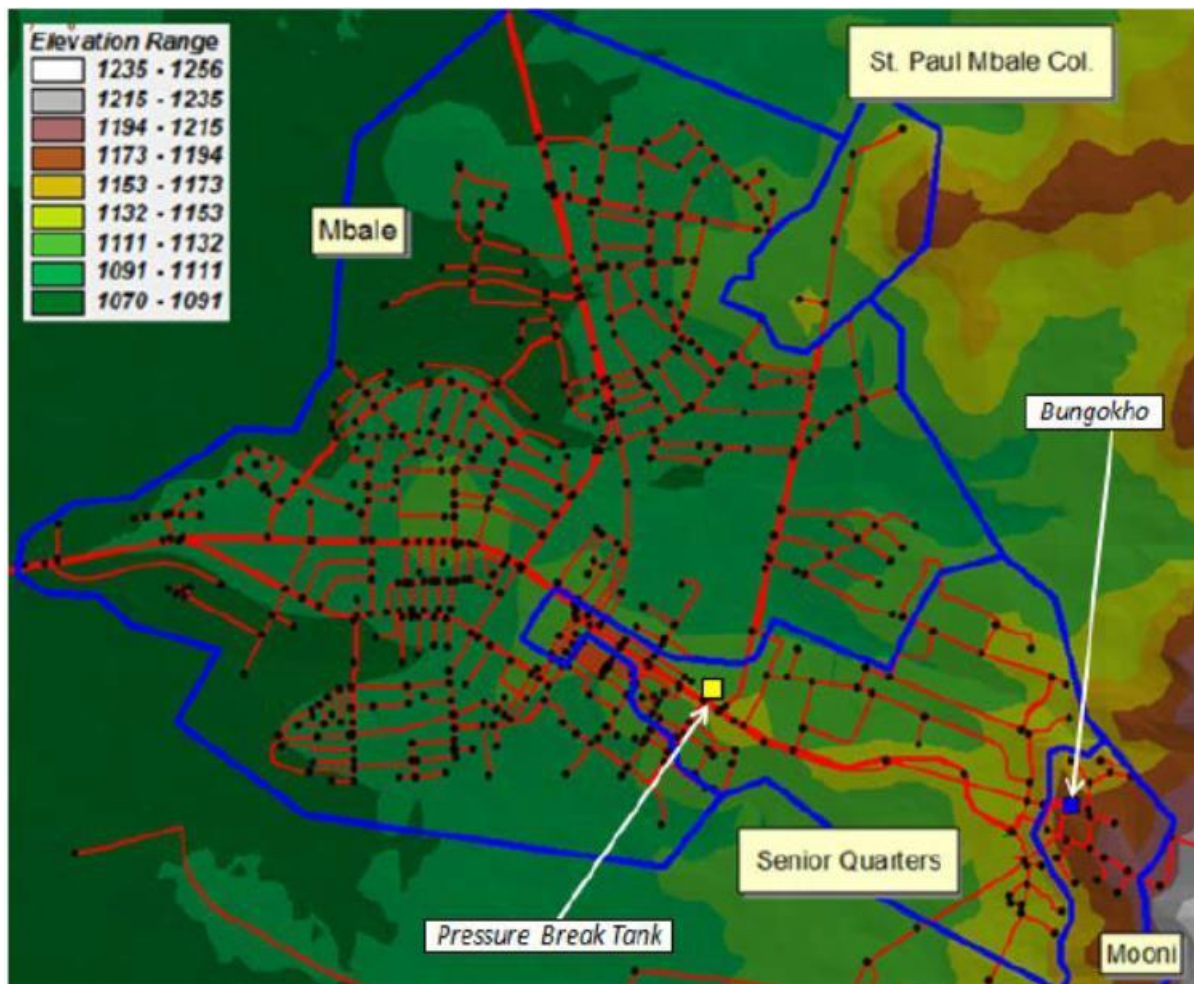


Figure 23 Proposed pressure zones in Mbale

The distribution systems in and around Mbale were divided into the following sub-systems:

- Mbale
- Manafwa
- North and
- North-West

Mbale means the centre of Mbale Municipality; Manafwa the south of Mbale; North the north of Mbale up to Nakaloke and surrounding; and North-West the system to Kamonkoli and Kabwangasi. The lengths of the new pipelines for Mbale Municipality and surrounding are presented in Table 1. In total, 93 km of pipelines are required within Mbale Municipality; 12 km in the south of Mbale (Manafwa); 10 km in the north of Mbale and 20 km in the north-west of Mbale.

Table 1: Required new pipeline lengths

Diameter/ material	Manafwa	North	North-west	Mbale	Total
OD 63, HDPE			5263	20820	26084
OD 75, HDPE		1608		500	2109
OD 90, HDPE	205			32929	33134
OD 110, uPVC			192	4409	4601
OD 140, uPVC	10997	55	5832	6266	23149
OD 160, uPVC	925	550	8304	7439	17218
OD 225, uPVC		7515			7515
OD 280, uPVC				17284	17284
OD 300, DI				3352	3352
OD 400, DI				169	169
Total	12127	9728	19591	93168	134615

All new and replaced pipes in Mbale are shown in Figure 24. The existing network will mainly be used in the south-western part of Mbale (new HDPE network in Malukhu), in Namatala and in Busamaga. Most of the AC pipes that will be replaced are in the municipality centre.

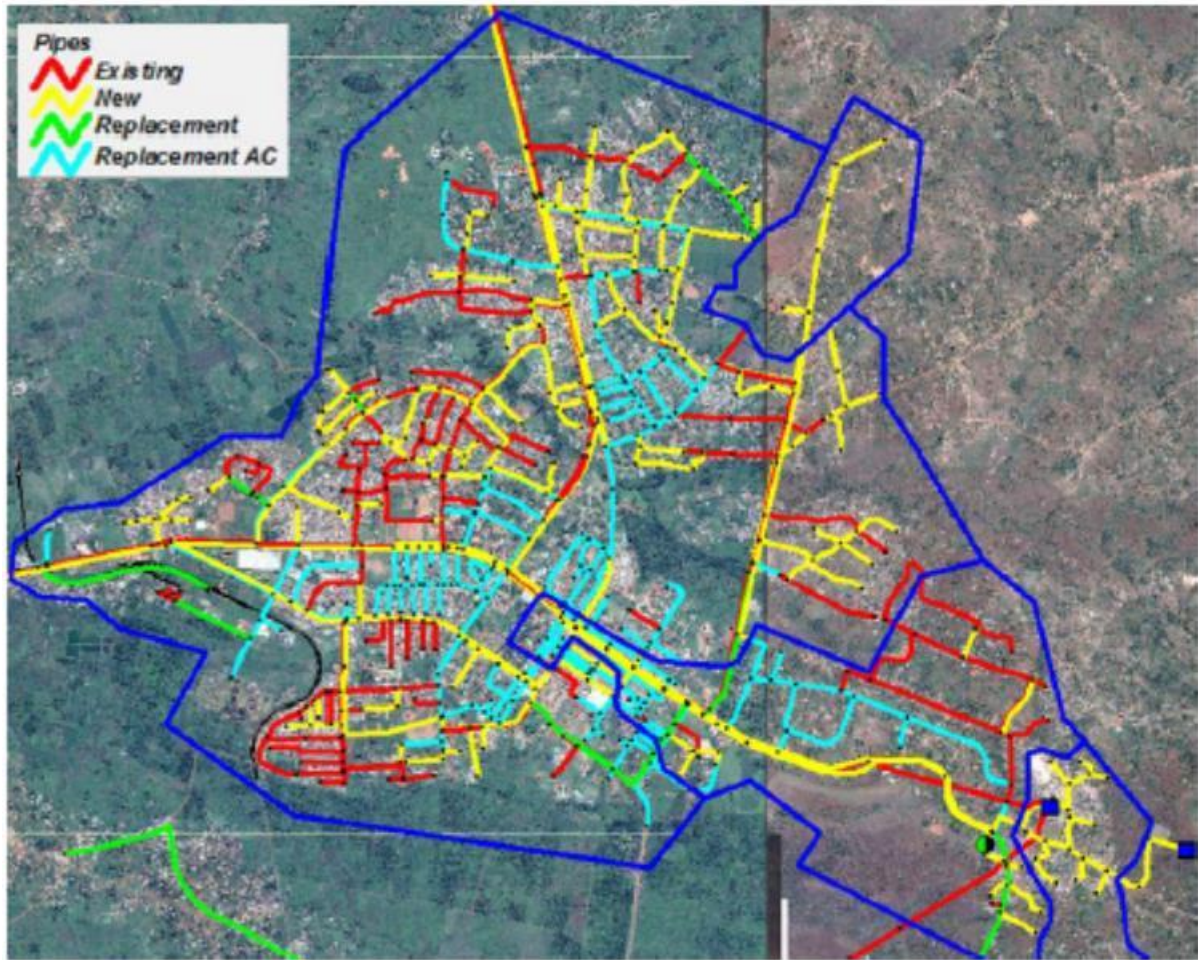


Figure 24 New or replaced pipes in Mbale

More fire hydrants will also be provided within the distribution system. Currently there are 17 fire hydrants installed in Mbale, mostly at the new market and in the south of Mbale. It was proposed to add 20 additional hydrants mainly on the main roads and some strategic points in the water distribution network to archive a good coverage over entire Mbale. The proposed location of new fire hydrants and location of the existing ones are indicated in Figure 25.

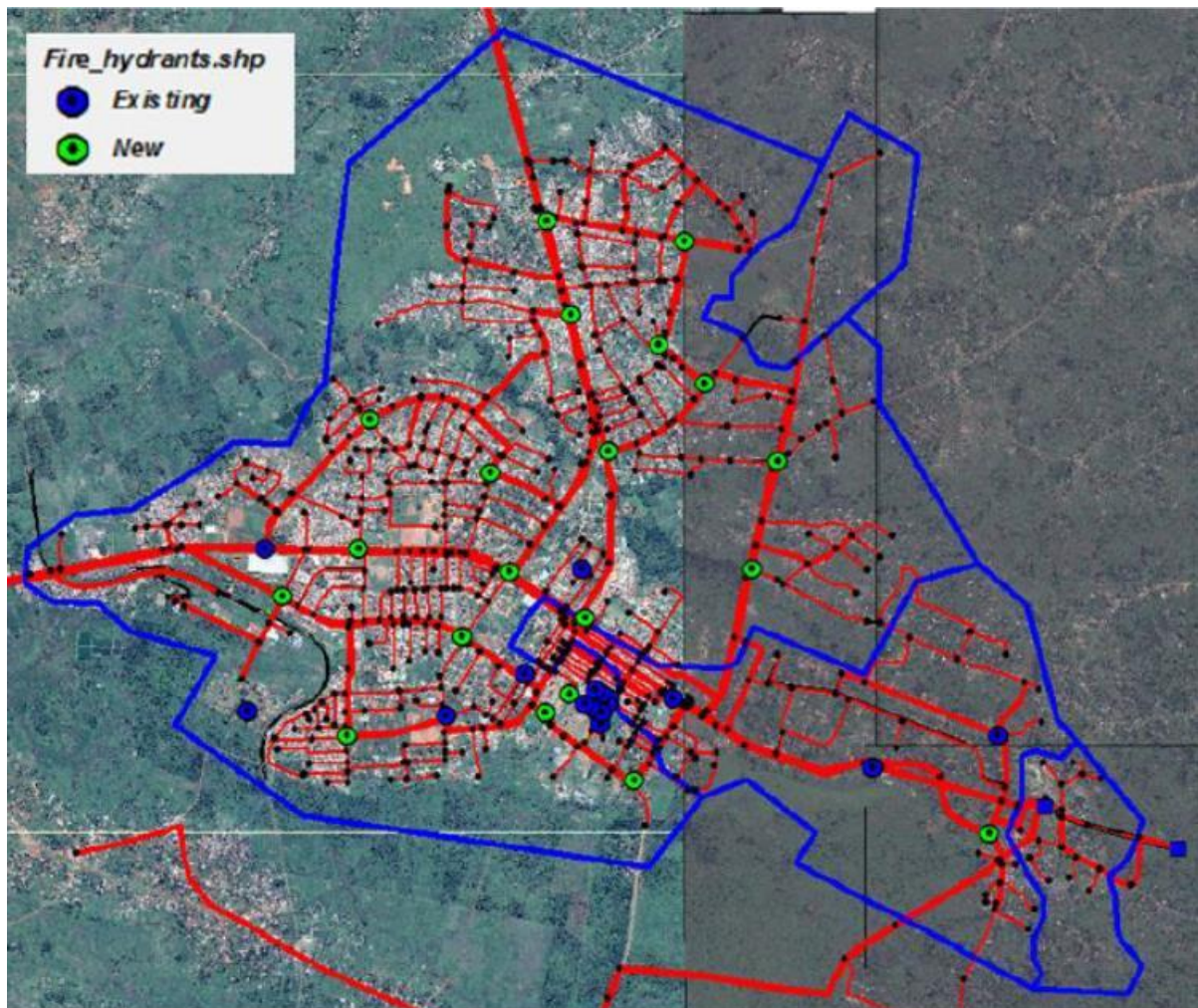


Figure 25 Location of fire hydrants in Mbale

Public stand posts: There are currently 136 Public Stand Posts (PSPs) and 18 water kiosks that are run mainly by private operators in Mbale. They cover almost 100% the informal areas of Namatala, Nabuyonga, Nkoma, Namakwekwe, Busamaga and Mooni. All of the informal settlements will get a formal water distribution network installed. The location of new and existing PSP and water kiosks is indicated in Figure 26 with a supply radius of 250 m.

Approximately 43 new PSP including prepaid meters will be installed in the existing informal settlements within a walking distance of 200 m. The new PSPs will guarantee 24h water supply with the water tariff provided by NWSC for the low income population.

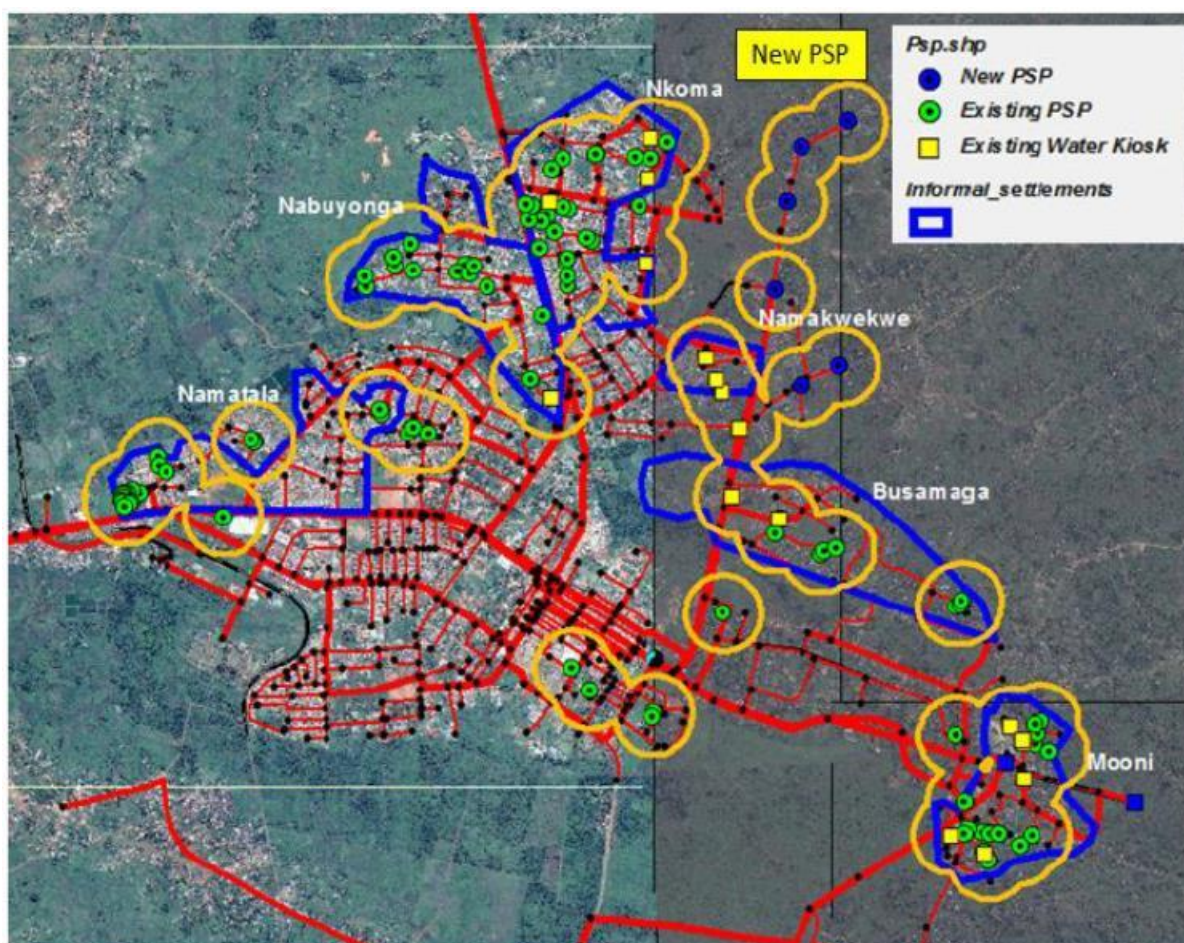


Figure 26 Location of new and existing PSPs and water kiosks in Mbale

Table 2: Proposed new PSPs

Informal settlement	Area (ha)	Minimum number of water points per chosen walking distance (m) to a water point			
		500	200	100	50
Busamaga	116.59	2	10	38	149
Mooni	72.67	1	6	24	93
Namatala	89.67	2	8	29	115
Nkoma	109.07	2	9	35	139
Nabuyonga	90.21	2	8	29	115
Namakwekwe	19.01	1	2	7	25
Total		10	43	162	636

Replacement of house connections: All house connections on the existing AC pipes will be disconnected and reconnected to the new replacement pipes. The same will apply in cases where the existing pipes are too small and need to be reinforced by larger pipes. The number of the required house connections is presented in Table 3.

2.3.4.2 Distribution systems in growth centres

The water distribution systems in the growth centres will be extended in: Budaka, Tirinyi, Kibuku and Busolwe while new distribution systems will be laid in Kadama and Butaleja.

Table 3: Number of required house connections (replacement)

Pipe	Network length (m)			Number of house connections
	Replacement	Replacement AC	Total	
OD 63, HDPE	5263	917	6180	630
OD 75, HDPE	257		257	26
OD 90, HDPE	673	29850	30523	3113
OD 110, uPVC		3652	3652	373
OD 140, uPVC	19898	321	20219	2062
OD 160, uPVC	2059	2702	4761	486
OD 280, uPVC	1434	1696	3130	319
OD 300, DI	1014		1014	103
Total	30598	39138	69736	7113

2.3.5 Upgrade of Water Treatment Plants

2.3.5.1 Upgrade Bungokho treatment plant

The deteriorating raw water quality has had an impact on the operational costs and reduced the capacity of the treatment facilities. It is proposed to upgrade, rehabilitate and expand the WTP at Bungokho, as the topography is suitable to serve the entire supply area (including the rural growth centres of Tirinyi, Kibuku, Kadama and Budaka) by gravity from here.

Rehabilitation of Bungokho WTP (Line 1): The main purpose of the WTP rehabilitation is to introduce the necessary modifications in actual structures in order to increase the treatment capacity of the Plant from the actual 4,200 m³/day up to 9,450 m³/day and at the same time to implement more appropriate coagulation and flocculation units for treating surface waters of relatively rapid changing characteristics. The measures proposed to upgrade the existing structures of Bungokho WTP include:

- i) New inlet works, that could accommodate the water coming from Namatala River Intake together with the water coming from rivers Nabijo and Nabuyonga;
- ii) Automated coagulant dosing installation;
- iii) Flow distribution to flocculation channels;
- iv) Flocculation in two flocculation channels (Flocculation channels - Line 1);
- v) Refurbishing of the existing rectangular clarifiers (Clarifiers – Line 1);
- vi) Refurbishing of the existing filters (Filters – Line 1);
- vii) New chlorination unit; and
- viii) Supply of adequate maintenance tools and laboratory equipment.

Extension Bungokho WTP (Line 2): The proposed solution to extend the Bungokho WTP in order to reach a treatment capacity of 18,900 m³/day consists of the construction of the units of a second treatment line (Line 2) with the same capacity as Line 1 (9,450m³/day). The following measures are required:

- i) Flocculation in two flocculation channels (Flocculation channels - Line 2);
- ii) Construction of four lamellar clarifiers (Clarifiers – Line 2);
- iii) Construction of a set of four filters and new filters building (Filters – Line 2); and
- iv) Sludge drying beds.

The process line of the upgraded and extended Bungokho WTP will comprise of the following treatments:

- i) Inlet works, flow measurement, flow regulation, coagulant/ flocculant dosing and flash mixing;
- ii) Flow distribution to four flocculation channels (two for each of the two lines);
- iii) Flow regulation and flow measurement at the inlet of each flocculation channel;
- iv) Flocculation in four flocculation channels (two flocculation channels in Line 1 and two flocculation channels in Line 2);
- v) Sedimentation in two refurbished rectangular clarifiers (Line 1) and in four lamellar sedimentation tanks (Line 2);
- vi) Rapid filtration in two sets of sand filters backwashed with air and water: existing set of six filters (Line 1) and new set of 4 filters (Line 2);
- vii) Disinfection by calcium hypochlorite dosing; and
- viii) Sludge treatment in ten drying beds.

2.3.5.2 Upgrading of Manafwa treatment plant

Due to human activities (for example, agricultural activities) in the catchment of River Manafwa, the sediment load in the River has continuously increased and the quality of water at the abstraction point to the WTP has deteriorated. This has resulted in the current treatment process chain failing to deliver the required quality and quantity of water at a reasonable cost. In addition, there are high costs associated with pumping water to the distribution reservoir at Bungokho. Consequently, there is need to upgrade the plant to allow for more appropriate coagulation and flocculation units for the treatment of surface waters of rapid changing characteristics like the raw water of River Manafwa at the intake point.

The improvements in the units of the chemically-assisted sedimentation of the Manafwa WTP proposed for upgrading the capacity of the plant include:

- i) Implementation of an automated coagulant dosing system, based in the regulation of the dosing rate in function of the measurements of a streaming current analyser actuating on the coagulant dosing pump;
- ii) Construction of flocculation units (low mixing chambers) with mechanical stirrers to ensure the formation of flocks of adequate settling rate; and
- iii) Refurbishing of the clarifiers in order to prevent hydraulic short circuiting.

In addition, the raw water abstraction will be improved. A new intake structure shall be constructed next to the existing one. The new structure shall be fitted with a grit chamber to decrease the sediment load at the Clarifiers. A sump shall be provided from which raw water will be pumped and not anymore directly from the river, which causes frequent interruptions. The proposed modifications or upgrades are indicated in Figure 27.

2.3.6 Mbale Sewerage System

Interventions aimed at improving the adequacy and efficiency of the existing waste stabilization ponds will be made under the project. From the findings of the feasibility study, the capacity of the wastewater treatment ponds was found to be satisfactory. It is recommended to install new inlet works with grit removal to avoid siltation of the ponds. Furthermore, at the Namatala treatment ponds the sluice gates shall be re-established to increase the treatment capacity by adjusting the flow regimes. It is also

recommended to construct sludge drying beds at the treatment ponds that can receive and treat faecal sludge from the ponds.

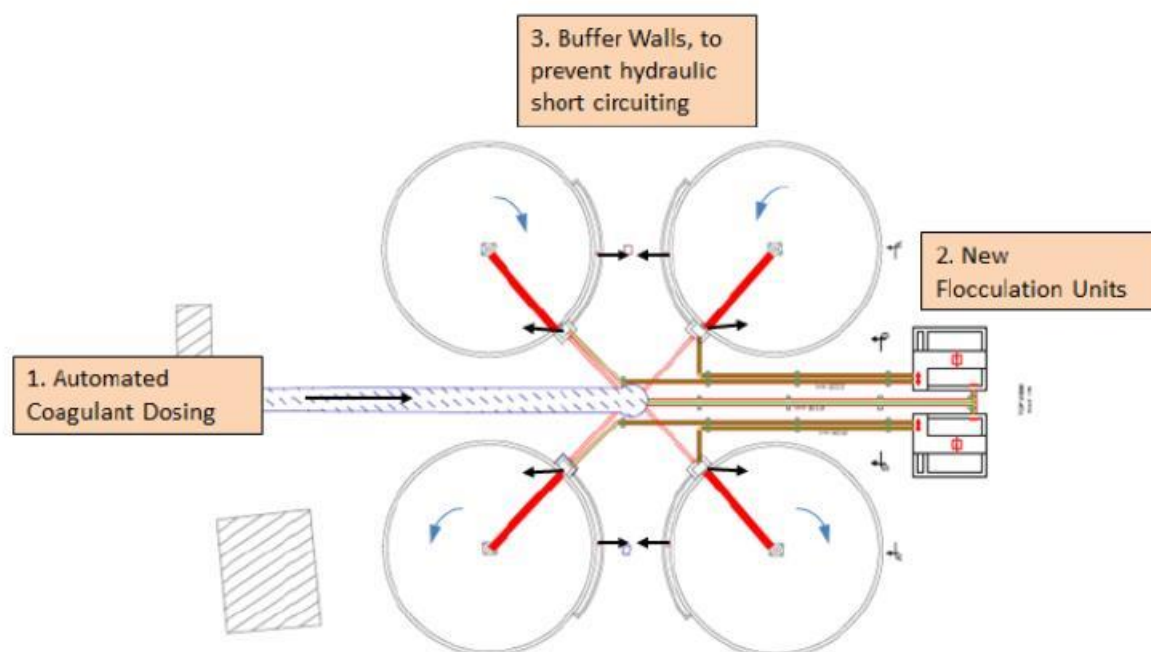


Figure 27 Proposed upgrade of Manafwa WTP

2.3.6.1 Sewerage network Senior Quarters

The area around the Senior Quarters has been identified as a potential area for expansion due to the high water demand and its income structure. The Senior Quarters is the only high income neighbourhood in Mbale. Almost all of the houses have their water connections in the house and use septic tanks. Most of the bigger hotels in Mbale can be found in this area including the two main Hotels, the Mbale Resort and the Mount Elgon Hotel. Since most of the sanitation facilities in the area are already waterborne it must be expected that there is a high demand for sewerage services. The entire catchment shall drain towards an open area near the Nabijo River where a lifting station shall be built that connects the sewerage network with the existing sewer of the Namatala Catchment (Figure 28).

2.3.6.2 Rehabilitation of sewerage network – Indian Quarters

A new sewer shall be installed in the area of the Indian Quarter replacing a dilapidated existing sewer network. The new sewer shall be connected to an existing trunk sewer on the opposite side of the Kampala Road, which needs to be crossed. The total length of the new network is 2180 m and comprises 53 manholes. About 115 house connections are required to be relocated to the new sewer mains. At three locations an existing functional sewer will be connected to the new system.

The proposed network in that area is shown in Figure 29. Similar works than in the Indian Quarters are expected to be carried out on the Namatala Trunk Sewer. A section of 150 m shall be replaced with a new sewer line to correct a piece of pipeline with a wrong gradient. The remaining existing networks shall be pressure cleaned and camera inspected.

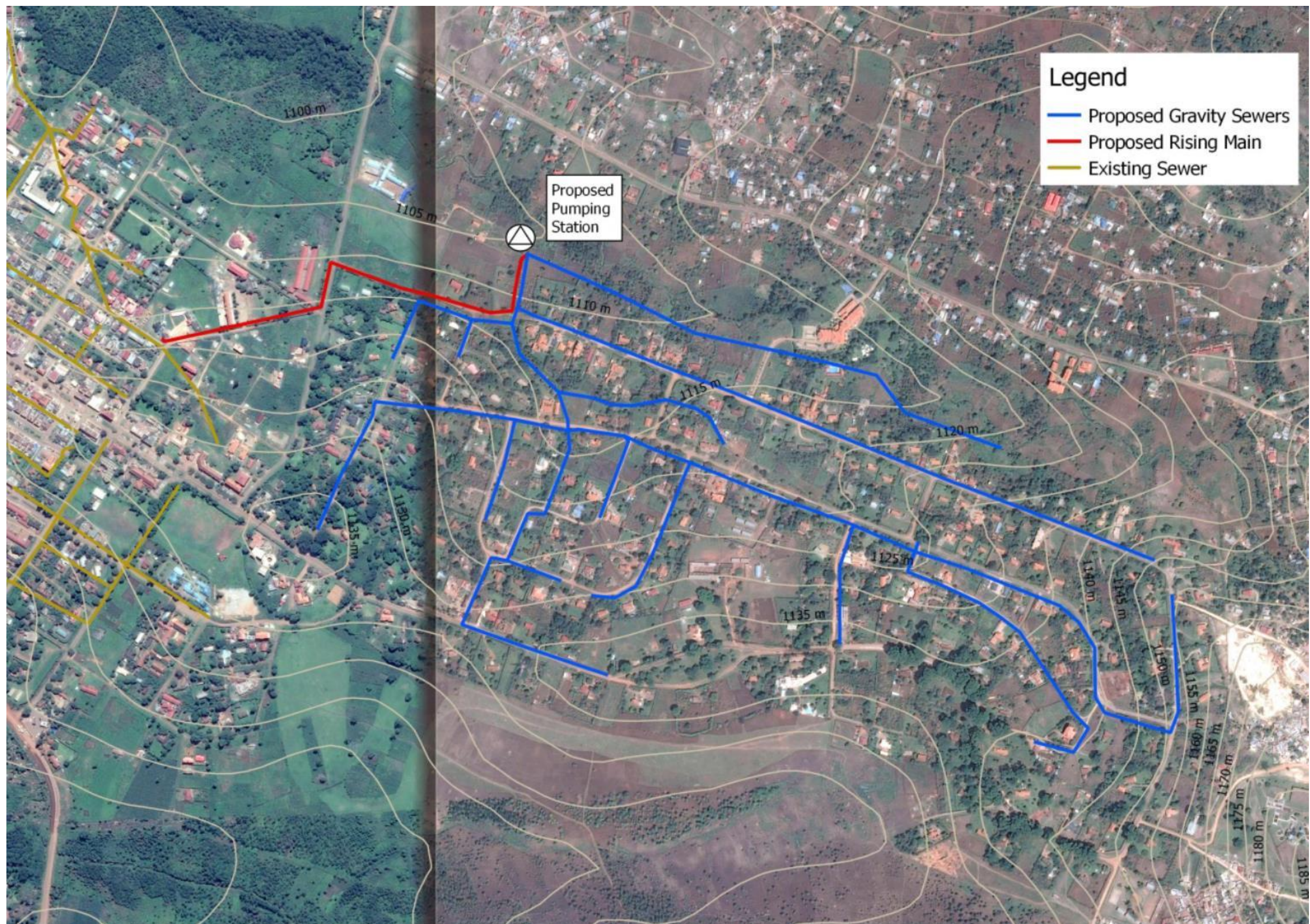


Figure 28 Proposed layout of the sewerage network for the Senior Quarters

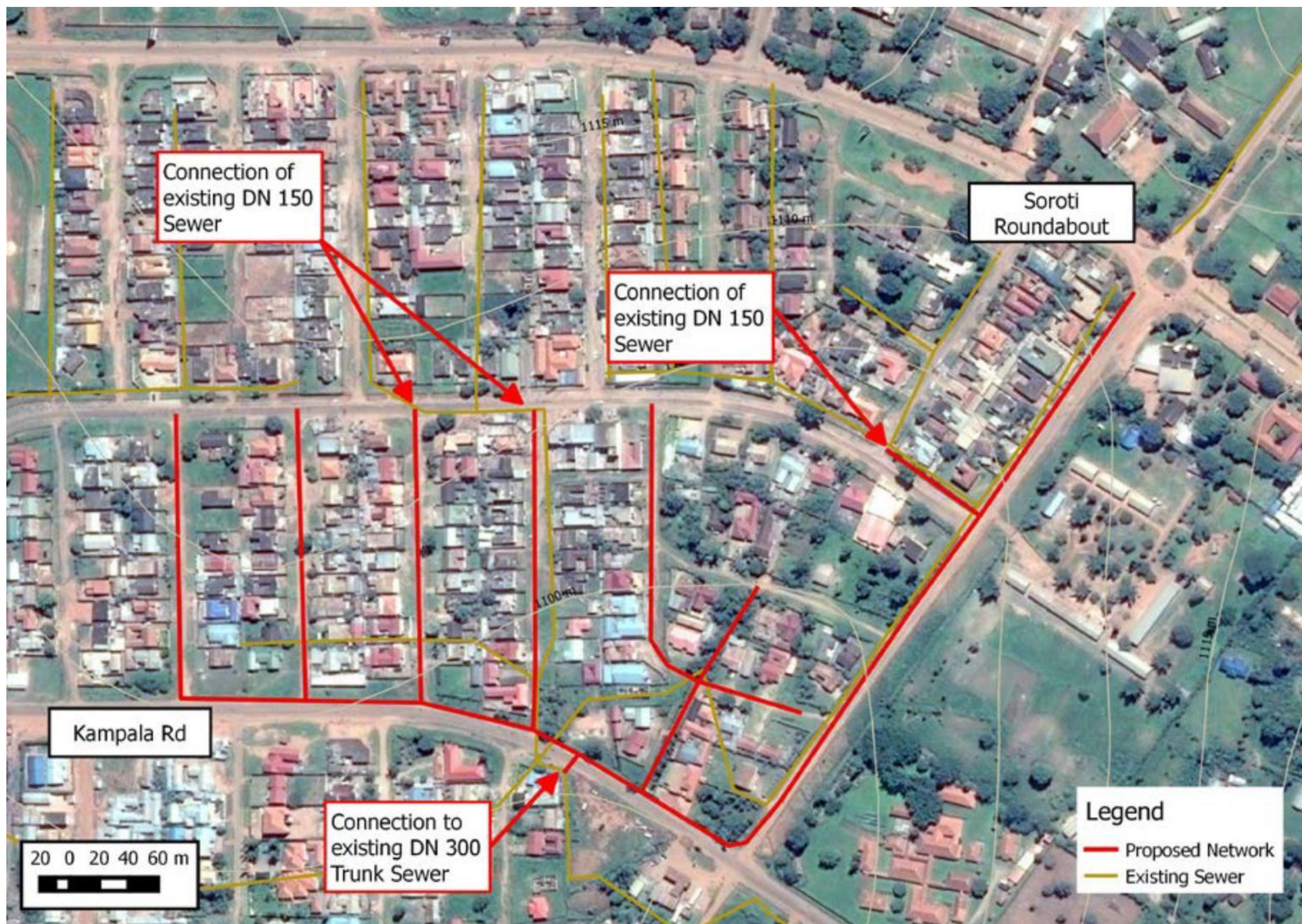


Figure 29 Proposed sewerage network in the Indian Quarters

2.3.6.3 Rehabilitation Namatala treatment ponds

The following measures are proposed at the Namatala treatment ponds:

- i) Construction of new inlet structure and demolishing of old inlet structure;
- ii) Reinstatement of embankments at certain locations;
- iii) Construction of five new channels connecting the ponds including sluice gates and demolishing of existing channels;
- iv) Erection of boundary fence (live fence and diamond mesh fence);
- v) Re-construction of approximately 200 m of DN 400 mm trunk sewer with two life connections; and
- vi) Erection of a service building

The embankments around the ponds shall be reinstated by filling material which will also ease access to the ponds. Integral for the operation of the ponds is the reconstruction of the channels connecting the ponds. These shall be equipped with sluice gates in order to be able to isolate ponds and to change the flow regime, which is becoming necessary in future to avoid an overloading of the facultative ponds.

2.3.6.4 Rehabilitation Doko treatment ponds

The following measures are proposed at the Doko treatment ponds:

- i) Construction of new inlet structure and demolishing of old inlet structure;
- ii) Construction of roofed sludge drying beds including separate inlet structure, feeder and drainage pipework;
- iii) Construction of a solar powered drainage pump station;
- iv) Establishment of operations building;
- v) Erection of boundary fence (live fence and diamond mesh fence); and
- vi) Re-construction of approximately 70 m of DN 400 mm trunk sewer with one life connection.

Similar to the Namatala treatment ponds, the most important aspect in the rehabilitation of the Doko treatment ponds is the replacement of the inlet chamber and inclusion of a mechanical treatment step to avoid the siltation.

The Doko treatment ponds shall play a vital part of the Faecal Sludge Management of the Mbale Municipality. Sludge drying beds will be installed together with a small inlet structure that shall prevent the accumulation of solid waste in the faecal sludge. The structure shall be roofed to shorten the sludge drying time. A typical cross section of the structure is shown in Figure 30. The leachate of the sludge drying beds shall be collected under the drying beds with a drainage pipe and pumped to the inlet works using a solar-powered pump.

2.3.6.5 Sewerage connection Northern Cluster

The northern area of Mbale around the Islamic University in Uganda (IUIU) shall receive sewerage services. A gravity network and a treatment pond shall be constructed for that purpose. The network shall be a gravity network consisting of 10,950 m of OD 200, OD 250 and OD 315 mm uPVC sewer pipelines. Around 300 provisions for house connections shall be made by the Contractor at locations suitable for the terrain of the existing properties. Around 210 manholes shall be constructed.

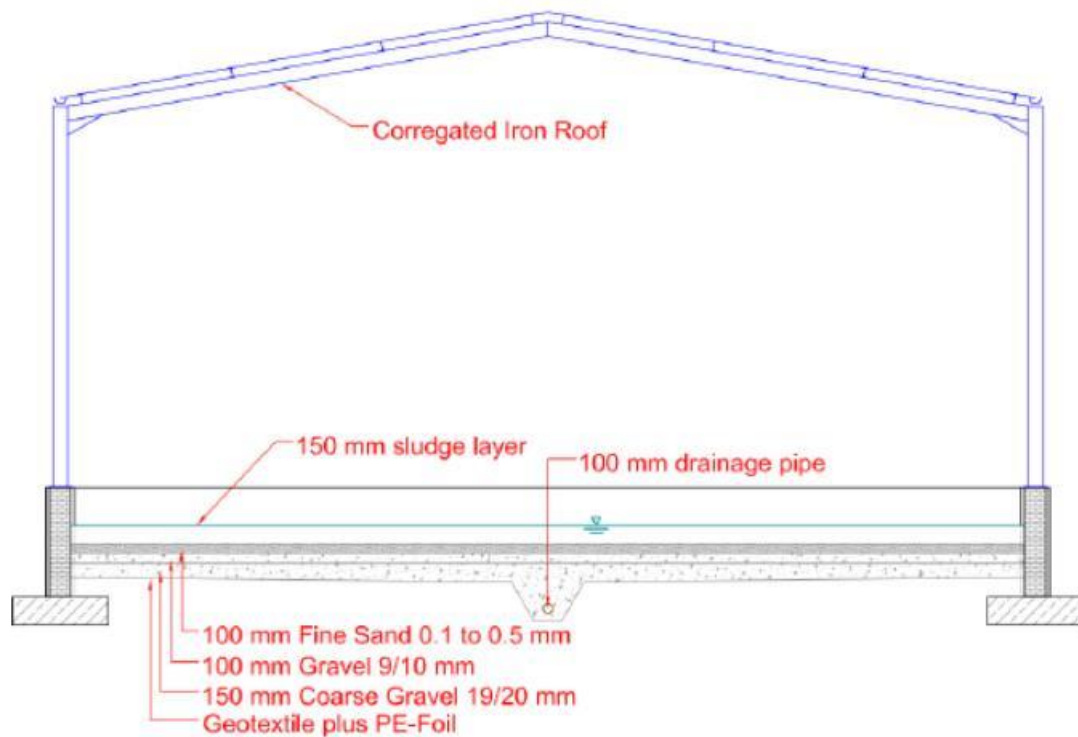


Figure 30 Cross section of the proposed sludge drying bed

The treatment ponds shall be constructed at a land close to the confluence of the Nabuyonga River into the Namatala River, which belongs to the IUIU. The treatment units shall include a mechanical treatment stage, an anaerobic pond and facultative ponds. The sludge from the anaerobic ponds shall be applied to sludge drying beds, as shown in Figure 31.

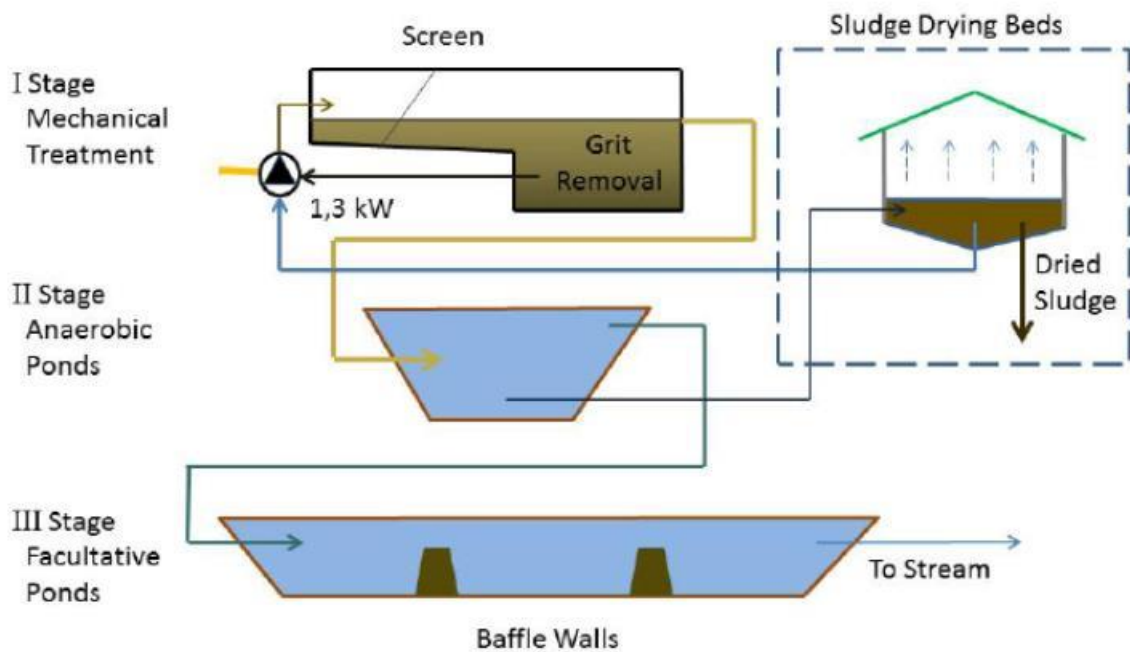


Figure 31 Schematic layout of the proposed pond treatment system for the Northern Cluster in Mbale

2.3.7 Sanitation Facilities

Two types of sanitation facilities are proposed, that is:

- a) Ablution blocks for the town centres and the informal settlements that include a shower unit; and
- b) Public toilets that are smaller in size for smaller settlements

Both types of facilities are divided into genders and have units for persons with disabilities. Sufficient hand wash basins will be installed to encourage hand washing and condom dispensers will be added to each unit. The plan view of the Ablution Block is shown in Figure 34.

All toilets are waterborne and shall be equipped with a 1 m³ water tank. The units shall be connected to a conservancy tank that shall be regularly emptied with a cesspool emptier. The faecal sludge shall then be driven to a suitable treatment facility.

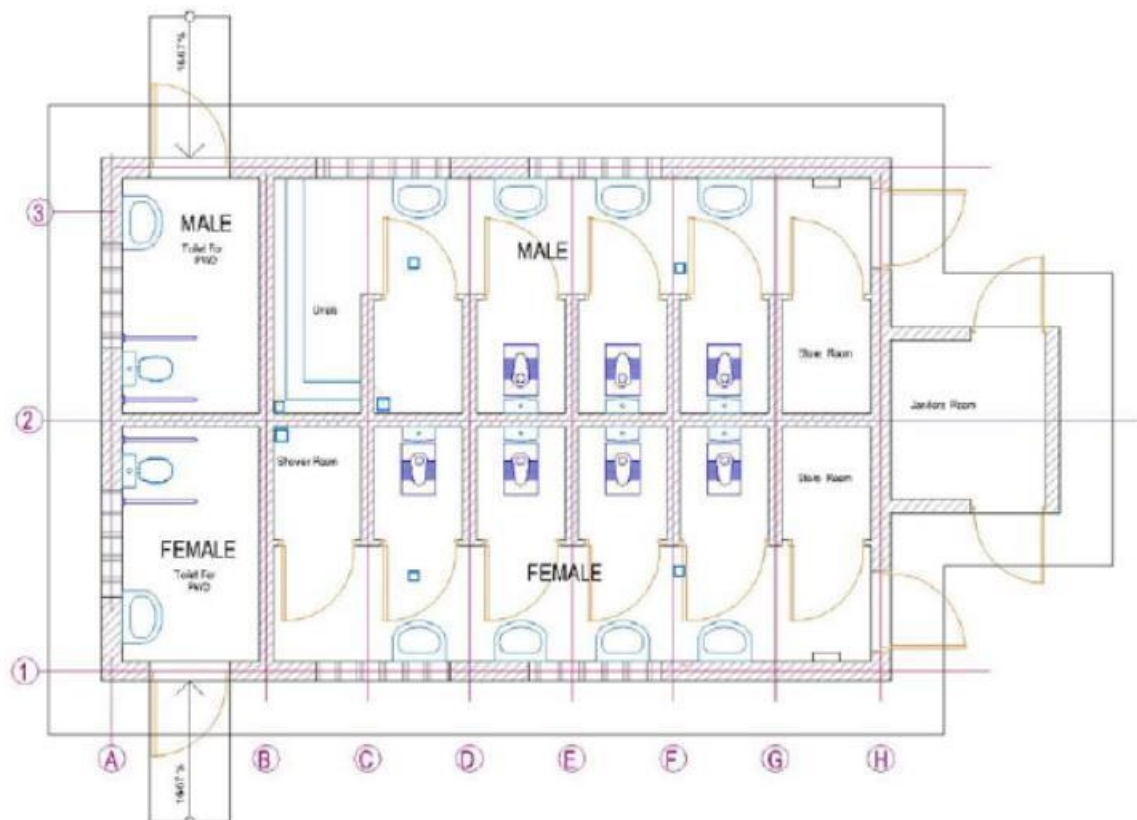


Figure 32 Plan of the proposed Ablution block

2.3.8 Catchment Management and Sources Protection

The project will include interventions supporting sustainable management of the raw water catchment and protection of the current and proposed water sources, including restoration and re-vegetation of river banks, implementation of river bank protection regulations, implementation of wetland regulations, etc. The interventions will be guided by the source protection guidelines of the Directorate of Water Resources Management (DWRM). Based on the environmental impact assessment and management plan, the consultant shall produce designs for all structurally engineered protection measures required.

2.4 PROJECT PHASES

2.4.1 Mobilization Phase

This phase will involve mobilisation of the construction human resource, equipment, construction materials, erection of temporary worker's camp and storage yard. The location of the project temporary camp will be agreed upon with the local leadership, landowners and contractor of the respective project areas.

2.4.2 Construction Phase

Upon completion of preliminary activities and onsite investigations, actual construction of the project components and facilities will start which will involve:

- Setting out to demarcate rights of way, work areas, clearing limits. Access paths, detours, bypasses and protective fences or barricades should all be in place before construction begins.
- Excavation of trenches for water pipe and sewer lines;
- Excavation for ponds for the sludge management facilities;
- Trench sheeting and bracing to protect collapsible trench side walls;
- Placing concrete to bases of foundations;
- Laying of main water pipes;
- Laying of sewer lines; and
- Backfilling, disposal of overburden and surface restoration to at least match the condition that existed prior to the water works construction.

All project activities under this phase are supposed to be carried along the tracks, route and access paths within the boundaries of the identified project sites without disturbing or obstructing the neighbours and businesses. To ensure this, the contractors will seal off the different site perimeters (where necessary) with corrugated iron sheets or other suitable material during project implementation. In case of trenches, proper barricade have to be applied to warn and protect the people of impending dangers of falling into open pits and trenches.

2.4.3 Demobilization Phase

Demobilisation phase will involve clearing of the project sites of all construction and unwanted material. The disposal of any unwanted material will be done by the contractor. The waste materials may include packaging, wood, steel crates, cardboard, wrapping materials, construction debris, boxes, sacks, drums, cans and chemical containers, etc. Damaged areas will need to be restored before commissioning the project. Upon completion of the contractor's obligations, the contractor will hand over the project to NWSC & MWE, the clients.

2.4.4 Operation Phase

This will involve employment of operators both skilled and unskilled, operation of the water supply system and sanitation facilities, maintenance of the facilities put in place, etc.

2.5 PROJECT ALTERNATIVES

2.5.1 'No Project' Scenario

The existing Mbale water supply system constructed in the 1950s and rehabilitated in 1990 has now reached its design capacity due to the fast-growing population rate and water demand. Without the proposed development, the government of Uganda would not have the ability to provide safe water and sanitary services to over 250,000 people living in Mbale and the growth centres of Kadama, Kibuku, Tirinyi and Budaka towns.

The “no project” scenario is neither a tenable nor beneficial alternative because safe water supply and sanitation are required to support rapid socio-economic development within the region.

2.5.2 Alternatives Considered

This section provides a summary of the alternatives evaluated in the 2015 Feasibility Study and includes new options based on additional studies conducted under the preparation of the ESIA.

2.5.2.1 Water Supply

Raw water sources: Four main rivers for raw water supply within this project area have been identified. The Nabijo, Nabuyonga and Manafwa Rivers are currently used for water supply, while the River Namatala offers a further possibility for gravity raw water supply.

The dry season flow is the average of all flows in the dry months, which has been defined for December, January, February and March. For the Manafwa River the dry season average flow was relatively high (6.5 m³/s) while for River Namatala and River Nabuyonga, flows of 1.49 m³/s and 0.73 m³/s, respectively, existed. The absolute minimum flows that were measured at the gauging stations were 1.3, 0.33 and 0.001 m³/s for Manafwa, Namatala and Nabuyonga, respectively.

A water demand of 0.313 m³/s is needed for year 2040 (design horizon) to serve the northern and western areas of Mbale. The water supply for this service area will come from the Bungokho WTP. The Feasibility Study evaluated different raw water sources to increase water production at Bungokho, including Nabijo, Nabuyonga, Namatala, and Manfwa Rivers.

River Nabuyonga: The statistical analysis of data for Nabuyonga suggests enough water availability based on the mean total and dry season flow. However, absolute minimum flows already indicate the drying up of the river during the dry season although the wet season flow seems generally to be above 0.313 m³/s. Measurements carried by the design consultant indicated values above 0.4 m³/s until end of October. After October the flow decreased to values below the needed water demand to probable almost 0 at the end of the dry season in March.

River Nabijo: This is similar to River Nabuyonga. Flows are generally slightly lower. The design consultants flow measurements indicated sufficient water during the wet season until end of October for the investigated time period. Afterwards the flow decreases dramatically, most probable to almost zero by the end of the dry season in March.

River Namatala: For the Namatala River, data from the gauging station suggest that enough water is available, at least for most of the time during the year. The mean dry season flow is 1.49 m³/s with a 99% exceedance probability of 0.37 m³/s and a 95% exceedance probability of 0.47 m³/s. The absolute minimum value was 0.33 m³/s. The mean flow was estimated at 2.41 m³/s. The analysis suggests enough water is available to meet water demand by year 2040 (0.313 m³/s) for most of the year; however, Namatala's dry weather flows in some cases may not be sufficient to meet projected water demand and maintain an adequate Environmental Flow (EF).

The ESIA estimated a minimum EF of 0.835 m³/s (refer to Annex K and Section 5.3.1.3), which includes domestic, livestock, and aquatic life water needs downstream of the proposed Namatala intake location.

River Manafwa: Based on data from the gauging station, Manafwa River seems to have enough water. Absolute minimum value is 1.3 m³/s with 99% exceedance probability of 1.6 m³/s. Both values are significantly above the total water demand for the project.

Comparing all the four sources, River Manafwa is expected to have enough water. However, a guarantee cannot be given as extreme droughts can occur and human destruction of ecosystems continues. River Namatala has enough water for most times. Nevertheless, by the end of the dry season, flows could not be sufficient to meet the project water demand and the estimated minimum EF. Nabijo and Nabuyonga have enough water during the wet season, but during the dry season flows are too low for sufficient water supply, even if both sources are used.

For raw water supply to Bungokho during the dry season only two options were further considered in the 2015 Feasibility Study:

- Raw water supply from Manafwa (pumping)
- Raw water supply from Namatala (gravity)

Looking at the findings in the hydrological investigation no other options exist for the long-term water supply to the proposed Mbale service area. Further, four different scenarios were analysed. Three different pipeline diameters (DN 400, DN 500 and DN 600) were investigated between Manafwa and Bungokho and one between Namatala intake and Bungokho (DN 450).

The cost analysis clearly showed that the gravity pipe from Namatala River is the cheapest option for the raw water supply to Bungokho with running costs of 252 UGX/m³ and total production costs of 954 UGX/m³. Water from Manafwa would cost 1,253 UGX/m³ (running costs) and 2,314 UGX/m³ (production costs). Among the three options to convey water from Manafwa to Bungokho, the DN 500 would be the cheapest option. In this scenario the pumps from Manafwa must have the following specifications: 3 pumps, 2 in operation, 1 as standby, Q = 564 m³/h, H = 172m. The Feasibility Study concluded that, a new raw water pumping main from Manafwa is more expensive than the gravity main from Namatala.

Based on the flow analysis and cost evaluation, Namatala River was selected as the major raw water source for the Bungokho WTP given advantages of running a gravity fed system. Manafwa River will continue to supply the Manafwa WTP with modifications at the intake because of the high sediment load. The Manafwa system will serve Manafwa, South of Mbale, Butaleja and Busolwe.

As indicated above, there is a risk of insufficient river flow during the dry months to meet the design water demand of 0.313 m³/s when considering the minimum EF. Therefore, the NWSC will carry out an Alternative Water Supply Study prior to construction to evaluate options to augment water source during low flows for Namatala and assess the reliability of the proposed water supply system. The options will include, among others but not limited to: (i) construction of a water impoundment structure at the Namatala intake site to store water during high flows and sustain the water demand during the dry spell, (ii) construction and rehabilitation of boreholes in the small towns, (iii) expansion of Manafwa water supply system, and (iv) a reduction in water service delivery at acceptable levels. The study will include specific recommendations and an implementation plan. Preliminary considerations of the feasibility of these options are described below.

Option 1. Modification of the intake structure to enable sufficient storage of water to sustain water demand during the dry spell to ensure abstraction rates are controlled so that minimum EF is maintained. Namatala's wet weather flows vary from 2.25 m³/s to 15 m³/s with a maximum close to 40 m³/s, which provides an indication of sufficient water for storage. Although land requirement information is not yet available, there is 100 meters available on either side of the river as part of the river bank management national regulation that could be used for a storage type structure. In addition, NWSC will embark on a full scale source protection measures in the Mbale catchment area for which will engage a RAP consultant to look into land management and compensation measures, including this potential intervention. This option will be evaluated in close collaboration with the DWRM and NEMA.

Option 2. construction of boreholes systems as a mitigation plan during the dry spell. A hydrogeological report conducted in 2015 studied the potential for groundwater exploration in the proposed Mbale service area. The objective of this study was to analyse the potential in the area based on available data from boreholes, field visits and groundwater potential maps. Results indicate that there are areas which have good ground water potential. Yields in the range of 5 to 23 m³/h were identified in the existing boreholes. Maps showing the physical features of the area reveals that for the most part is well drained and therefore receives enough recharge for the deep seated aquifers which can produce high yielding boreholes. Water quality for most of the boreholes indicated acceptable levels for domestic purposes. The Kadama small town was the only area with low groundwater potential according to the groundwater map; however, some boreholes are providing reasonable yields. Additional studies will need to be conducted to determine the number, location and output of the boreholes taking in consideration that they would operate as an augmentation measure during dry season.

Option 3. As indicated above, for the Manafwa River the dry season average flow was relatively high (6.5 m³/s) and absolute minimum was recorded at 1.3 m³/sec. Although, Manafwa river has sufficient water to meet 2040 water demand, the system was not selected as a primary source due to high operating cost. However, considering the potential vulnerability of the Namatala system, the Alternative Water Supply Study will consider the option of augmenting water supply from Manafwa.

Option 4. The consultant will also carry out a reliability assessment of the proposed Mbale water supply system to determine its vulnerability in supplying water to the Mbale service area. The study will assess levels of services during dry weather flow and drought conditions taking consideration water augmentation options and operational efficiency and planning. This will be conducted in close collaboration with the MWE/DWRM and local government officials in consultation with the community.

These four options will be explored and studied further. There are not considered individual solutions, but complementary and inclusive; therefore, the final recommendation would likely be a combination of these options. The MWE and the NWSC will implement the recommendations under the IWMDP.

The Project will also include a source water protection program to improve environmental conditions in the rivers feeding to the Mbale water supply project and community sensitization activities to promote water conservation and overall understanding of the proposed water supply system. The NWSC and MWE expect that these measures will reduce the minimum EF estimated for Namatala

Manafwa reservoir: The location of the new reservoir in the south is approximately 4000m north of Manafwa and 1700m south of the turn-off to Busolwe. Two supply options are possible:

- Option 1: Pumping all water from Manafwa to the southern reservoir from where the area north of the reservoir up to Mbale and the area around Manafwa WTP will be supplied. In this option the reservoir must have a size of 2000 m³.
- Option 2: Pumping only the water from Manafwa to the southern reservoir which is required for the supply in the area north of the reservoir up to Mbale. The area around Manafwa WTP will be supplied by direct pumping. In this option the reservoir must have a size of 1750 m³.

Option 1 was recommended as the cost implications are minor and it will reduce permanent pumping from Manafwa. In this case the existing DN 300 between Manafwa and the southern reservoir will serve as transmission and distribution main.

Water supply to small towns: To supply the small towns, two options, that is, gravity water supply from Mbale or a decentralised system with boreholes were investigated. Two main alternatives for the supply of the small towns were assessed, that is:

- Integrated approach: The entire project region could be combined into one supply area that would be fed from NWSC's Mbale Water Supply System.
- Decentralized approach: The growth centres would produce and supply their water on their own. The small towns were divided into three clusters: Budaka & Kadama, Tirinyi & Kibuku and Butaleja and Busolwe. The three clusters would have one combined system including own boreholes and a transmission main system up to the reservoirs in each small town.

For the comparison, two different aspects were assessed. Besides the different investment costs, the dynamic prime costs (Figures 33 and 34) were calculated for each alternative and the different risks and challenges highlighted (Table 4). Based on these two evaluations a recommendation was made.

From Figures 33 and 34, for both supply zones the total water production costs are higher for the decentralized supply despite the lower initial investment costs. The higher electricity consumption, continuous reinvestments and a low residual value in 2040 are making the decentralized water supply more expensive in the long-run.

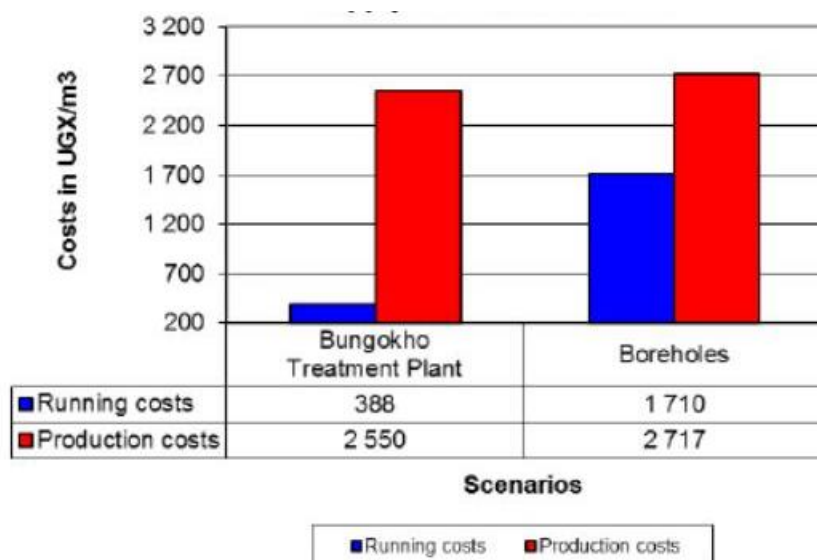


Figure 33 Dynamic prime costs for supply of Kadama cluster

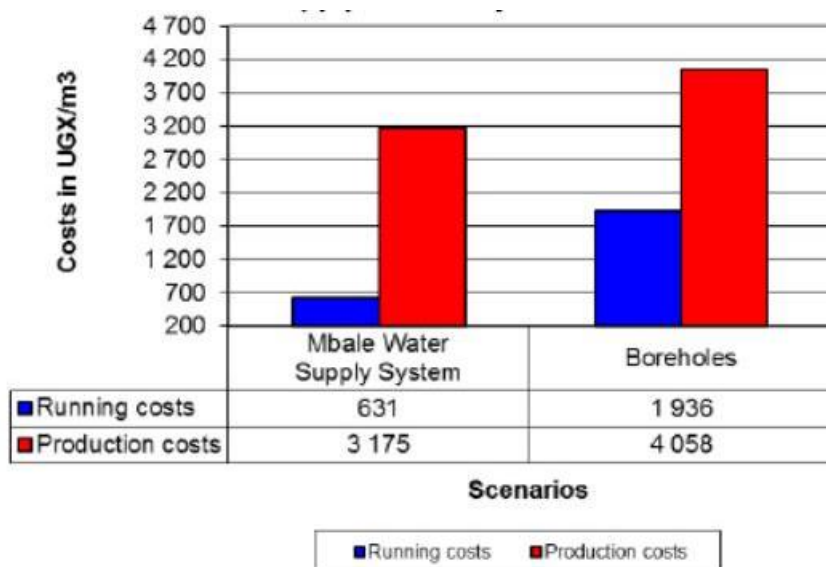


Figure 34 Dynamic prime costs for supply of Butaleja –Busolwe cluster

Table 4: Challenges, Risks and Benefits for the different supply options

Aspect	Integrated Approach	Decentralised Approach
Supply security	<ul style="list-style-type: none"> Fair The Namatala and Manafwa River appear to be very solid water sources. Additional water sources could be easily integrated into the system. A breakdown of the transmission main could leave a sizeable population without water. 	<ul style="list-style-type: none"> Poor for a long-term and only water supply solution The present aquifer has never been exploited to that extent; recharge of aquifer could become a problem especially in the dry season for a long-term and only water supply solution Experience has shown that the reserve funds in small water supply schemes are often insufficient to cover for repairs.
Water quality	<ul style="list-style-type: none"> Good 	<ul style="list-style-type: none"> Good

Aspect	Integrated Approach	Decentralised Approach
	<ul style="list-style-type: none"> The water quality can be easily monitored and managed in the central treatment plants, but the travel time of the water can be long. 	<ul style="list-style-type: none"> Previous tests of groundwater indicate good quality in the project area
Management	<ul style="list-style-type: none"> Good The Mbale Water Supply System has been managed very well in the past. It can be assumed that this will continue in a similar way; however, an ever increasing supply area will become more difficult to manage especially in its fringes. 	<ul style="list-style-type: none"> Fair Smaller systems can be easily overseen, but experience has shown that they are often unattractive for experienced operators due to their small scale. Budaka for example could have an operating water supply system if the borehole pumps would have been replaced. Instead, Budaka has already since almost one year no operating water supply system.
Social and Environmental	<ul style="list-style-type: none"> Fair The transmission mains are following exclusively roads, therefore little impact is expected. A bigger population is severed as smaller villages and trading centres between the six growth centres are connected. Considerable amounts of water are abstracted from the rivers in the Wanale Mountains that might be lacking in the future for other purposes like irrigation, water supply or other needs. 	<ul style="list-style-type: none"> Fair Well fields are likely to be in private property. Improved water supply and distribution system may increase stress on the groundwater resources

From Table 4, each supply strategy has its own benefits and challenges. Using scores and weights, a better option from the two was chosen/ recommended. Aspects in Table 5 and the dynamic prime cost were given a score between -2 and 2 and different criteria have been attributed with weights. The dynamic prime costs and the supply security were attributed with the highest weights as these are the main aspects for both the operator and the customer.

By comparing all the different aspects, it can be said that the integrated approach is clearly the better option, especially due to the high risks associated with the stability of the aquifer and high operation costs of the decentralized water supply system. These aspects justify the high initial investment costs of the integrated water supply system.

Table 5: Comparison of the scores for the supply options

Criteria		Score	
Type	Weight (%)	Integrated Approach	Decentralised Approach
Investment costs	10	-2	2
Dynamic prime costs	30	2	-2
Supply security	25	0	-2
Water quality	10	1	1
Management aspects	10	1	0

Criteria		Score	
Type	Weight (%)	Integrated Approach	Decentralised Approach
Social & Environmental aspects	15	0	0
Total	100	0.6	-0.8

2.5.2.2 Proposed transmission mains to the small towns

The integrated approach transmission main options are presented. Two towns, Tirinyi and Kibuku, have sufficient water sources available as they fill their reservoirs only once or twice per week. Thus, the transmission mains between Kadama and Tirinyi as well as between Kadama and Kibuku could be postponed and constructed only as soon as more water is required in both towns. However, the demand for both towns was included in the overall dimensioning of the pipeline capacity between Mbale and Kadama as it will be required in future. As Kibuku is 20 m higher than Tirinyi it is proposed to have two separate lines from Kadama to Tirinyi and to Kibuku. Altogether three scenarios were investigated:

- Scenario 1: Pipeline design to Tirinyi/ Kibuku for the demand until 2040, gravity supply up to the north (Nakaloke) and north-west (Kamonkoli and Kabwangasi)
- Scenario 2: Pipeline design to Tirinyi/ Kibuku for the demand until 2030, installation of Booster Station in 2030 to supply up to Tirinyi/ Kibuku until 2040, gravity supply upto Kabwangasi until 2040
- Scenario 3: Pipeline Design to Tirinyi/ Kibuku for the demand until 2030, installation of Booster Station in 2030 to supply up to Tirinyi/ Kibuku until 2040, gravity supply up to Kabwangasi is not guaranteed from 2030 onwards. An additional booster station for the north-west might be required.

A dynamic prime cost analysis was done where all three above mentioned scenarios were compared with each other. Scenario 1 being gravity main has the lowest running costs until 2040 and beyond. Scenario 2 and 3 are almost the same although Scenario 2 has slightly lower running costs than Scenario 3. Scenario 3 has the lowest production costs. It has to be pointed out that a booster station to Kabwangasi was not considered in the cost comparison which will definitely increase the production and running costs in Scenario 3. Scenario 1 was therefore considered on the basis of running costs.

2.5.2.3 Expansion of sewerage services

Two options for the expansion of sewerage services in Mbale were assessed. It was to be assessed if there are possibilities for extending the sewerage network and new areas outside the existing catchments needed to be identified. The biggest potential for sewerage services has been identified in the Senior Quarters and the Northern Division of Mbale.

Senior Quarters: For the northern part of the Senior Quarters there are two alternatives for the connection to the existing sewerage network, one gravity option and a pumping option (Figure 35). The trunk main in the Senior Quarters will follow the corridor of the main stormwater channel in the neighbourhood. Where this channel connects with the Nabijo River it could either be pumped towards the existing network behind the High Court (Option A) or a pipeline is built along the Nabijo River (Option B).

The option of the lifting station results in higher operating costs due to the power consumption and the maintenance of the mechanical and electrical equipment. There is also an increased demand on the skills that are required in the operation of the facility, but here NWSC Mbale proofed that this can be done with the successful operation of two similar lifting stations. The environmental impact is a major disadvantage of the gravity trunk main along the Nabijo River. Here, a large amount of trees would need to be removed as the line is running through a forest. In addition, the line is running very close to a river. Here sewerage can infiltrate to the river in case of any damage and flooding can undermine the structural integrity of the sewer. As the Nabijo is meandering significantly in this section, interventions will be required to protect the pipeline from erosion, which are expected to be very costly.

In terms of related costs, the network in the northern part of the Senior Quarters would cost a little less than USD 1 million. In case the network shall be connected to the Namatala catchment with a trunk sewer along the Nabijo River, an additional sum of USD 490,000 is expected. If it were to be connected with a lifting station, around USD 265,000 shall be added. In total, around USD 1.25 million for option A and USD 1.47 million for option B. to connect the Northern Part of the Senior Quarters to the existing sewerage network, depending on the chosen drainage option.

Considering the social and environmental issues, Option A was considered (Figure 36). The proposed sewerage network will drain close to a point along the Nabijo River, around 500 m downstream of the Mbale Resort. This is also the point where the stormwater network of that area is discharging into the Nabijo River. From the last point of the network the area shall be connected through a lifting station to the existing sewerage network, which is discharging to the Namatala Treatment Ponds.

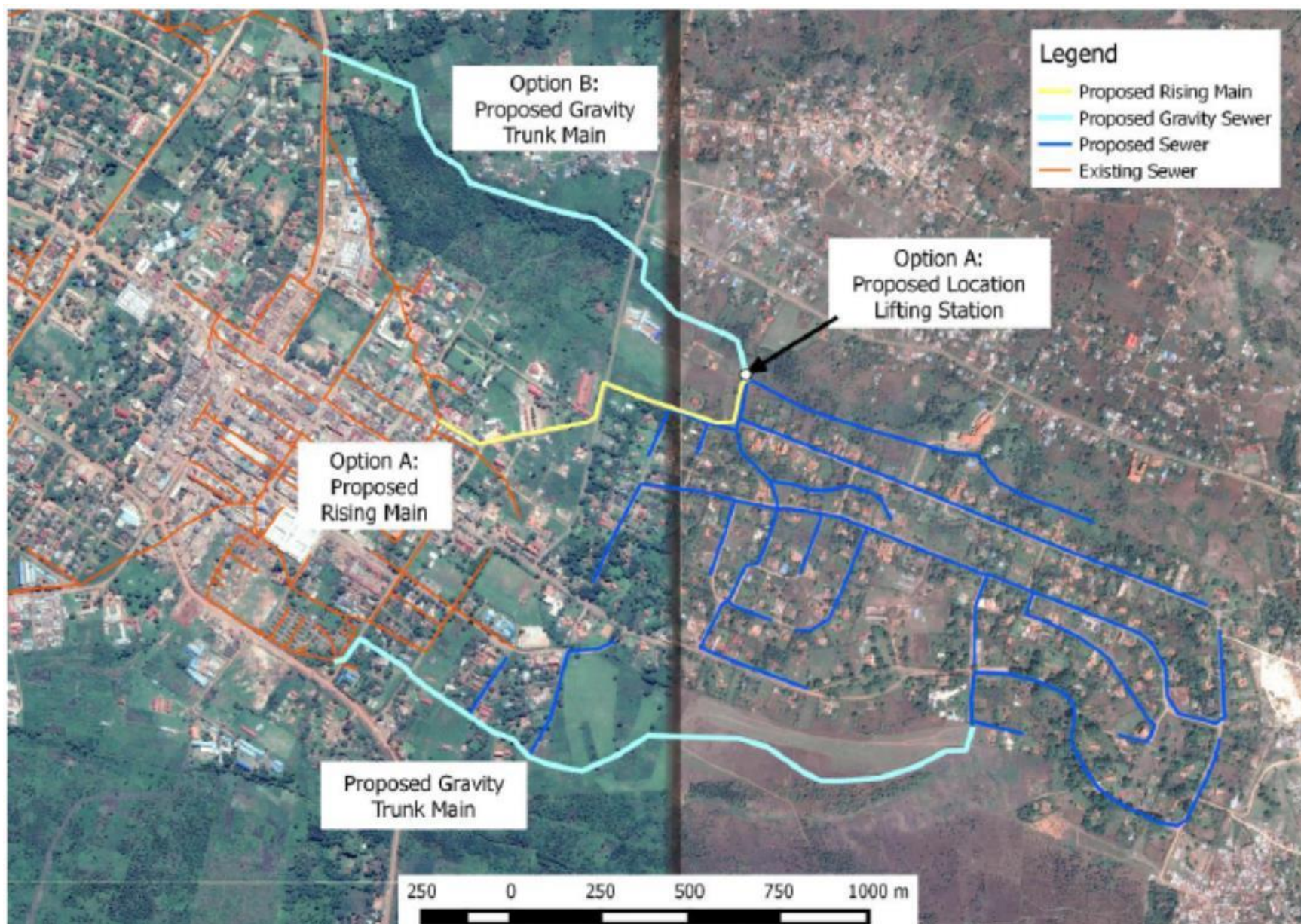


Figure 35 Options for connecting the Senior Quarters to the existing network

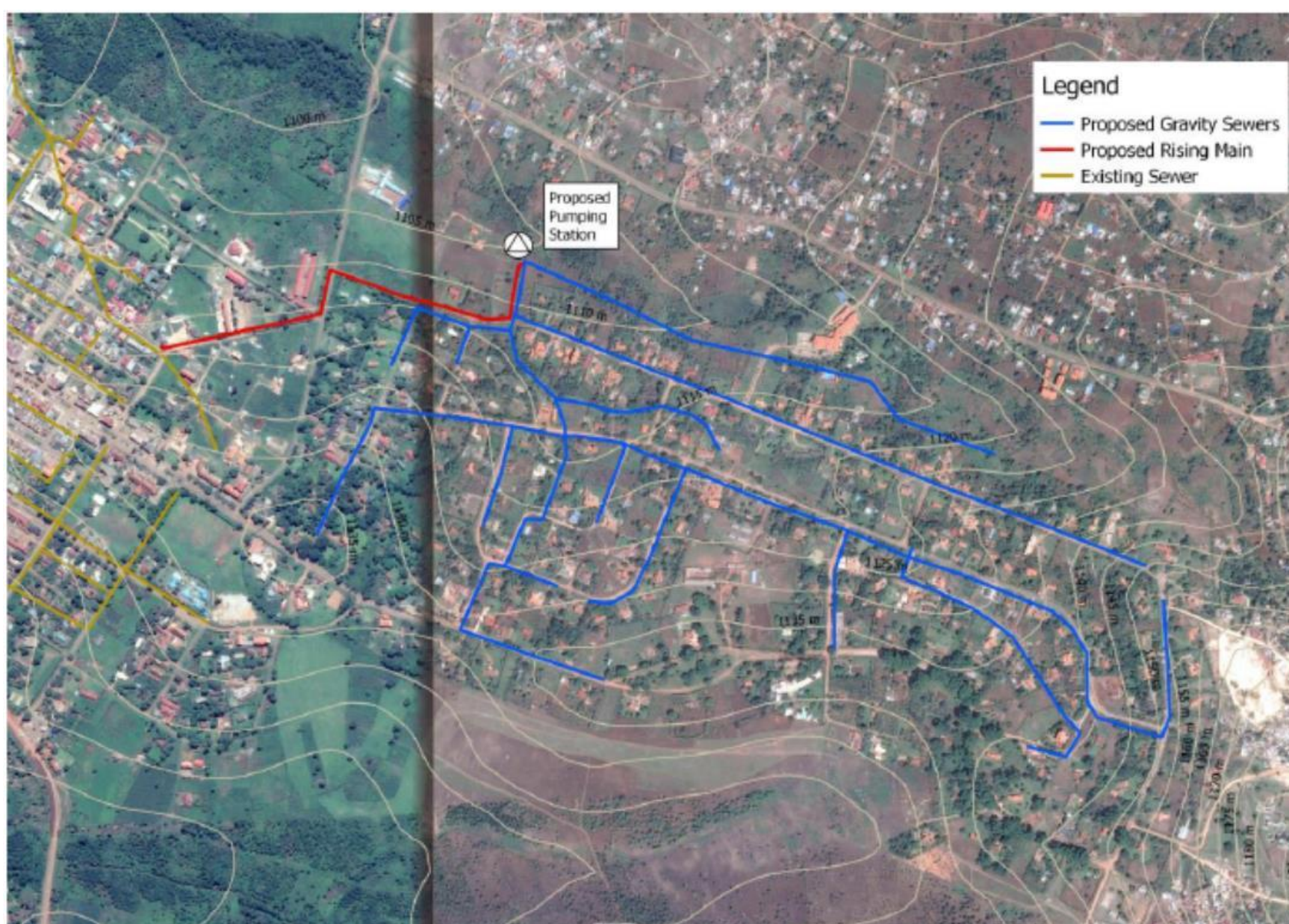


Figure 36 Proposed sewerage network in the Senior Quarters

3 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 INTRODUCTION

In Uganda, the key legislation governing an ESIA study includes the National Environmental Act (Cap 153) of the laws of Uganda and the Environmental Impact Assessment Regulations (1998). National Environmental Act established NEMA and entrusts it with the responsibility to ensure compliance with ESIA process and procedures in planning and execution of development projects. The procedures require that a project proponent prepares an EIS with a clear assessment of relevant potential impacts, based on terms of reference (TORs) developed from a scoping exercise. This requires that the ESIA addresses potential direct and indirect socio-environmental impacts during the pre-construction, construction, operation and decommissioning phases together with attendant environmental and social management plan (ESMP).

Policies, legal and institutional framework considered relevant to this proposed project are discussed in this section. Various laws here reviewed relate to minimum acceptable construction operational requirements, environmental quality, land use, public health, occupational safety, labour standards and international legal obligations.

3.2 POLICY FRAMEWORK

3.2.1 The National Environment Management Policy, 1994

The overall goal of this policy is the promotion of sustainable economic and social development mindful of the needs of future generations and the EIA is one of the vital tools it considers necessary to ensure environmental quality and resource productivity on a long-term basis. It calls for integration of environmental concerns into development policies, plans and projects at national, district and local levels. Hence, the policy requires that projects or policies likely to have significant adverse ecological or social impacts undertake an EIA before their implementation. This is also reaffirmed in the National Environment Act, Cap 153 which makes EIA a requirement for eligible projects (Third Schedule).

Relevance: At the national policy level, environment and development are interrelated and this policy requires that environmental aspects are considered in all development projects such as the proposed Mbale and small towns' water supply and sanitation project.

3.2.2 The National Water Policy, 1999

The goal of this policy is to provide guidance on development and management of the water resources of Uganda in an integrated and sustainable manner, so as to secure and provide water of adequate quantity and quality for all social and economic needs, with full participation of all stakeholders and mindful of the needs of future generations. The policy aims to:

- Promote rational use of water;
- Control pollution and promote safe storage, treatment and disposal of waste, which could pollute water and impact public health; and
- Promotion of awareness of water management and development issues and capacity building.

Relevance: This policy is relevant to the project since it will promote rational use of source water and avoidance of contamination of water course. The policy advocates for integrated and sustainable development management and use of water resources with full participation of all the key stakeholders.

3.2.3 The National Health Policy, 1999

The overall objective of this policy is to reduce mortality, morbidity and fertility, and the disparities therein.

Relevance: By ensuring availability of safe water supply and improved sanitation, the project will contribute to the reduction of water borne diseases thereby improving on the health of communities, especially the girl child and mothers who are mainly involved in collection of water. This project is in line with the strategies of this policy.

3.2.4 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 and wastewater treatment should be fully protected. Application of environmental impact mitigation measures on all activities of the project to be carried out on affected wetlands. NWSC and DWD have to work hand in hand with WMD and NEMA to halt encroachment on wetland such as the swamp in Pece Lukung village where the lagoons are situated and water is abstracted.

3.2.5 The National Gender Policy, 1997

The goal of this policy is to mainstream gender issues in the national development process in order to improve the social, legal/civic, political, economic and cultural conditions of the people of Uganda, particularly women. The policy recognizes women and children as the main carriers and users of water and related sanitation facilities. It anchors the importance of gender responsiveness in terms of planning, implementation and management of water and sanitation initiatives.

Relevance: This policy would especially apply in the recruitment process of labour, both during construction and operation phase. Men and women should have equal opportunities for available jobs. This policy also requires provision of a work environment that is safe and conducive to women, as it is for men, considering gender-disaggregated differences and vulnerabilities. For example, women should have separate facilities from men's at workers' camps.

3.2.6 HIV/ AIDS Policy, 1992

Current effort to combat HIV/AIDS is characterized by a policy of openness by Government and this has, to a large extent, been emulated by civil society, political and social institutions, and workplaces. HIV/AIDS is recognized by Ministry of Health as a considerable risk in construction of infrastructure projects and it (together with the Ministry of Gender, Labour and Social Development) encourages employers to develop in-house HIV/AIDS policies, provide awareness and prevention measures to workers and avoid discriminating against workers living with or affected by HIV/AIDS. To ensure HIV/AIDS is addressed in the workplace, the policy encourages employee awareness and education on HIV/AIDS. To protect the infected and affected persons from discrimination, employers are required to keep personal medical records confidential. Employees living with, or affected by, HIV and AIDS, and those who have any related concerns, are encouraged to contact any confidant within the organization to discuss their concerns and obtain information. It is anticipated that during the construction phase, there

may be an influx of people into the project area possibly resulting into sexual fraternisation and a risk of HIV/AIDS spread. The policy also guides about HIV/AIDS management including awareness and provision of condoms in workplaces.

Relevance: The requirements of this policy are expected to be fulfilled by the construction contractors or their subcontractors, especially in regard to having an in-house HIV Policy, worker sensitisation and provision of free condoms. This policy is relevant to the project if implementation of proposed construction activities leads to in-migration into the project area by people seeking construction jobs and indulging in prostitution or irresponsible sexual fraternisation associated with HIV/AIDS risk.

3.2.7 Occupational Health and Safety (OHS) Policy

This policy seeks to:

- Provide and maintain a healthy working environment;
- Institutionalize OHS in the power-sector policies, programs and plans; and
- Contribute towards safeguarding the physical environment.

The OHS Policy Statement is guided by the Constitution of the Republic of Uganda and other global, national and sector regulations and policies. The OHS Policy also takes into consideration the Health Sector Strategic Plan, all of which aim to improve the quality of life for all Ugandans in their living and working environment.

Relevance: This policy will be especially relevant for OHS of construction crews and subsequently, operation and maintenance personnel. The policy will also have relevance in mitigation measures that protect the public from health and safety impacts as a result of project construction and subsequent operation and maintenance activities.

3.2.8 Uganda Vision 2040

In 'Vision 2040', Uganda sets goals to achieve by the year 2040 ranging from political, economic, social, energy, water, and environment. With respect to environmental goals, Ugandans aspire to have sustainable social-economic development that ensures environmental quality and preservation of the ecosystem. Vision 2040 recognises water and sanitation infrastructure as a key driver of the economic development and notes that for Uganda to shift from a peasantry to an industrialized and urban society, it must develop its infrastructure.

The 2040 vision acknowledges that the slow accumulation of infrastructure i.e. water among others retards the economic development. It must be propelled by water as a factor of production in agricultural and industrial sectors. It estimates that Uganda's water consumption using 2010 as a baseline stands at 26 m³ per capita and will require it to be raised to 600 m³ per capita by year 2040 and this can only be achieved by raising percentage of population with access to safe piped water from 15 to 100 by 2040.

Relevance: To provide the necessary stimulus to the economy, the government in partnership with other development partners have embarked on the improvement of water supply and sanitation infrastructure of which Mbale and the small towns' service area got a share. Vision 2040 notes that to improve access and availability of water to the rural and urban areas, especially to economic zones and other productive

areas, new water supply lines should be established at an accelerated rate. Therefore, the proposed project is in line with aspirations of Vision 2040.

3.3 LEGAL FRAMEWORK

3.3.1 Constitution of the Republic of Uganda, 1995

The 1995 Uganda Constitution provides that every person has a right to own property [Section 26.1] and that no person shall be deprived of property or any interest in or right over property without payment of fair and adequate compensation. The same constitution gives government powers to acquire land (compulsory acquisition) in public interest [Article 273(a)]. The Constitution [Chapter 3, Article 17J] entrusts Government with the duty of ensuring that Ugandans enjoy a healthy environment.

Relevance: The Constitution is the cardinal law in Uganda upon which all environmental laws and regulations are founded. All environmental impact actions of the project are therefore meant to conform to the broader objectives of the Constitution which requires a healthy environment for all citizenry.

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 and expansion of the water treatment plants at Bungokho and Manafwa; the rehabilitation and expansion of the distribution system and sewer network; extension of water supply services to neighbouring small towns and rural growth centres; rehabilitation and expansion of the sewer network and construction of new wastewater treatment facilities for new drainage areas; and water and sanitation facilities in informal settlements are all aimed at sustainable development for the benefit of the locals and will be done following mitigation measures suggested in this report. All land acquisitions will adhere to provisions of the 1995 National Constitution.

3.3.2 National Environment Act, Cap 153

The National Environment Act (Chapter 153 of Laws of Uganda) establishes and defines functions of NEMA as a body responsible for management, monitoring and supervision of all environmental conservation activities (Section 4). This act provides for various strategies and tools for environment management, which also includes the EIA (Section 19) for projects likely to have significant environmental impacts. The Act also mandates NEMA with a leading role to review environmental impact statements. NEMA sets multimedia environmental standards (Sections 24-32) to prevent contamination of air, water and soil resources. The Act also mandates NEMA with responsibility for in-situ and ex-situ conservation of biological fauna and flora resources either on land or in water (Sections 42 and 43). Section 48 empowers NEMA, district environment committees and local environment committees to be responsible for monitoring of local land-use plans, which should be in conformity with national land-use plan. Section 106 outlines provisions to enable compliance with obligations of international environmental conventions. Section 35 entrusts NEMA, lead agencies and local government environment committees with powers to protect the environment from human activities that could adversely affect it. Section 56 prohibits discharge of hazardous substances, chemicals, oil, etc. into the environment except in accordance with guidelines prescribed by NEMA. Section 12 on the Schedule requires that projects related to sewage disposal should undertake a full EIA.

This Act also formed the basis for enactment of the Environmental Impact Assessment Guidelines, 1997 and Environmental Impact Assessment Regulations, 1998 which together prescribe the EIA process in Uganda. The process is schematically presented in NEMA's Environmental Impact Assessment (EIA) Reference Manual as shown in Figure 37.

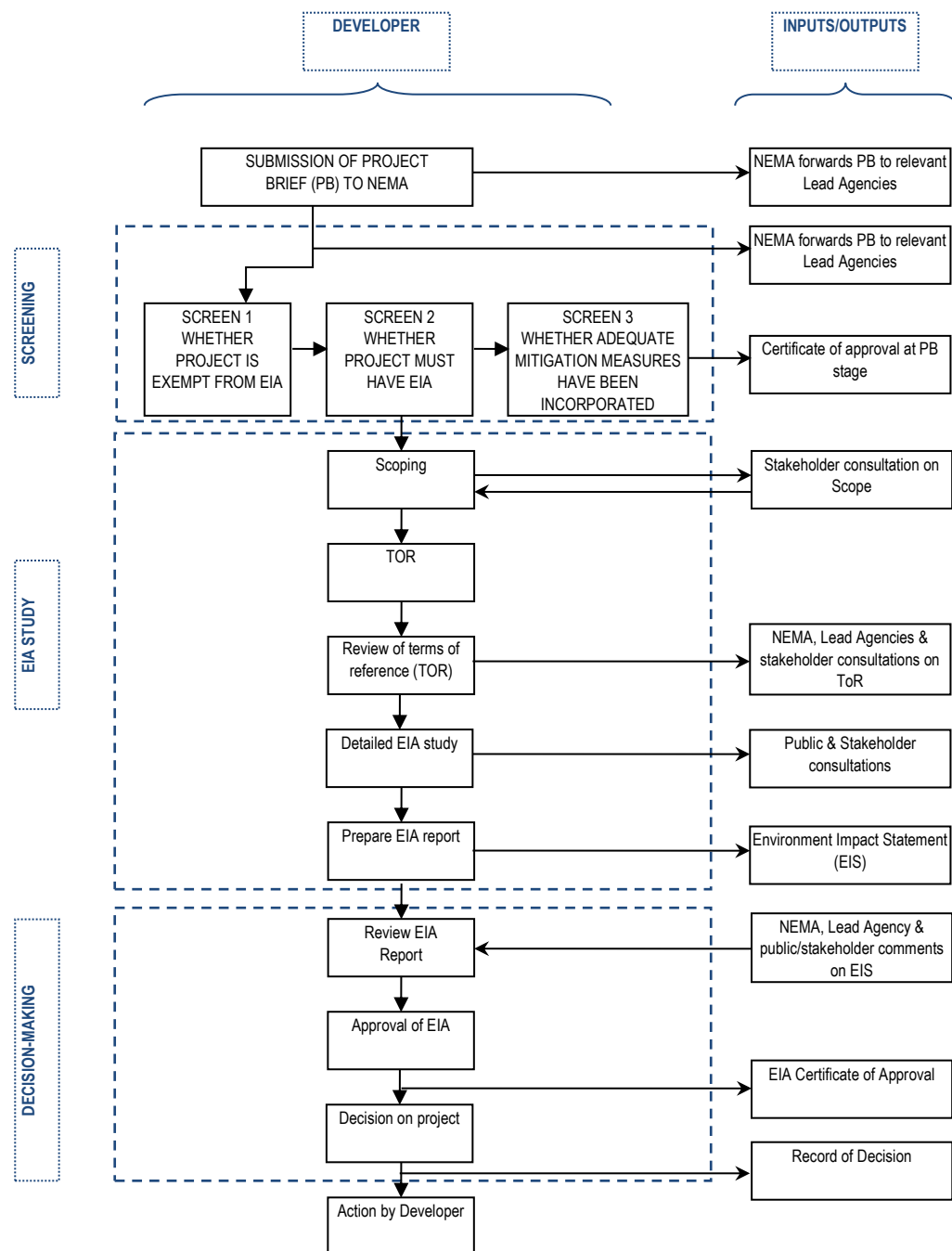


Figure 37 ESIA process in Uganda

Relevance: The Act governs and guides environmental management in Uganda. This ESIA is prepared to conform to the Act's requirement that projects likely to have significant environmental impact undertake an ESIA before they are implemented.

3.3.3 Local Governments Act, Cap 243

This Act provides for decentralized governance and devolution of central government functions, powers and services to local governments that have own political and administrative set-ups. According to Section 9 of the Act, a local government is the highest political and administrative authority in its area of jurisdiction and shall exercise both legislative and executive powers in accordance with the Constitution.

Relevance: The project will be under jurisdiction of Mbale, Budaka and Butaleja District Local Governments, which are mandated under the Local Governments Act, Cap 243 to sanction and oversee development projects in their respective local governments. The Environmental Officers for the Districts, the Mbale Municipality and project towns are mandated to inspect and monitor environmental considerations for development projects in their areas of jurisdiction.

3.3.4 Water Act, Cap 152

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. The act provides for hydraulic works and use of water. Under this section 18(2), a person wishing to construct any works or to take and use water may apply to the Director of Water Development Directorate (DWD).

Relevance: The Act provides guidance for requirements of implementation of water supply projects. As required by Section 18(2) of this Act, NWSC will apply to DWRM and DWD for permits for abstracting water from River Namatala and discharging effluents to the environment, respectively.

3.3.5 Land Act, Cap 227

The 1995 Constitution restored all private land tenure regimes (which had previously been abolished under the Land Reform Decree, 1975). It divested the state and the Uganda Land Commission of radical title to land that was expropriated in 1975, and vested it directly in the citizens of Uganda. The constitution provides for, inter alia:

- The right of every Ugandan to a clean and healthy environment (Article 39);
- The responsibility of government to enact laws that protect and preserve the environment from degradation and to hold in trust for the people of Uganda such natural assets as lakes, rivers, wetlands, game reserves and national parks [Article 237(2)];
- The right of every Ugandan to fair and adequate compensation in instances of land acquisition.

The Constitution provides that every person has a right to own property and that no person shall be compulsorily deprived of property or any interest in or right over property without prompt payment of fair and adequate compensation, prior to the taking of possession or acquisition of the property.

On land tenure regimes and transfer of land, the Constitution prescribes tenure regimes in accordance with rights and interests held in land. Article 237 of the Constitution, 1995, vests land in the citizens of Uganda and identifies four land tenure systems, namely: *customary, freehold, mailo and leasehold*. Understanding these systems (detailed in section 4 of the Land Act, 1998) is vital for compensation of households to be affected by the project. These tenure systems are outlined below:

Customary tenure: In this tenure, land is owned in perpetuity and tenure is governed by rules generally accepted as binding and authoritative by the class of persons to which it applies (that is, “customary regime is not governed by written law”). Customary occupants are occupant of former public land, and occupy the land by virtue of their customary rights; they have proprietary interest in the land and are entitled to certificates of customary ownership. Certificates for customary ownership are issued by the District Land Board, through application to the Parish Land Committee.

Freehold tenure: This tenure derives its legality from the Constitution. It involves the holding of land in perpetuity or for a period less than fixed by a condition and enables the holder to exercise, subject to the law, full powers of ownership.

Leasehold tenure: Lease tenure is created either by contract or by operation of the law. It is a form of tenure under which the landlord or lessor grants the tenant or lessee exclusive possession of the land, usually for a defined period and in return for a rental fee. The tenant has security of tenure and a proprietary interest in the land. The Constitution and the Land Act also protect “*rights of spouses and children*” with regard to land transactions. The head of household must acquire the consent of spouse and children prior to any sale of land on which the family ordinarily resides.

Mailo land tenure: The Mailo land tenure system is a feudal ownership introduced in Buganda by the British in 1900 under the Buganda Agreement. “Mailo” is a *Luganda* word for “mile” as the original grants under the agreement were measured in square miles. Prior to the 1975 Land Reform Decree, Mailo land was owned in perpetuity by individuals and by the Kabaka (hereditary King). Since no section of the proposed line traverses Buganda region, this type of tenure does not apply to the project.

Relevance: These tenure systems will be important during resettlement planning. Detail of land take and compensation are addressed in the line project resettlement action plan (RAP).

3.3.6 Public Health Act, Cap 281

The Public Health Act aims at avoiding pollution of environmental resources that support health and livelihoods of communities. It gives local authorities powers (Section 103) to prevent pollution of watercourses in interest of public good.

Relevance: *One of the components of this project is sanitation (sewage treatment plant and public sanitation facilities). The disposal of waste from the proposed sewage treatment system will have to be appropriately managed so as to prevent risk to public health, in line with the provisions of this Act.*

3.3.7 Investment Code Act, Cap 92

Section 18(2) (d) of the Act requires an investor to take necessary steps to ensure that development and operation of an investment project do not cause adverse ecological and socio-economic impacts.

Relevance: *NWSC and DWD are the implementing agencies for the project that received funding from the World Bank. This ESIA is in partial fulfilment of the requirements of this Act, since adverse ecological and socio-economic impacts as a result of the project implementation have been identified and mitigation measures developed.*

3.3.8 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.

Relevance: 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 the Mbale Municipality and the neighbouring small towns.

3.3.9 Employment Act, 2006

Employment Act, 2006 repeals the Employment Act (Cap 219) enacted in 2000. This Act is the principal legislation that seeks to harmonize relationships between employees and employers, protect workers interests and welfare and safeguard their occupational health and safety through:

- i) Prohibiting forced labour, discrimination and sexual harassment at workplaces (Part II; Part IV).
- ii) Providing for labour inspection by the relevant ministry (Part III).
- iii) Stipulating rights and duties in employment (weekly rest, working hours, annual leave, maternity and paternity leaves, sick pay, etc. (Part VI).
- iv) Continuity of employment (continuous service, seasonal employment, etc. (Part VIII).

This Act is relevant to the project both during the construction and operational phase.

Relation to the project: The Act will govern labour type and conditions under which persons hired by the project work. It prohibits Child labour (a condition the contractor must comply with) as well as providing guidance on work rights during the post-construction phase.

3.3.10 Occupational Safety and Health Act (2006)

The Act replaces the Factories Act (1964). It departs from the original listing of “don’ts” and adopts a scientific approach in which technical measures required for protection of workers are prescribed, hence taking on a “preventive approach”. The Act provides for prevention and protection of persons at all workplaces from injuries, diseases, death and damage to property. It covers not just the “factory” (as did the Factories Act) but also any workplace where persons are employed and its provisions extend not just to employees but to any other persons that may be legitimately present in a workplace and are at risk of injury or disease. Employers must protect workers from adverse weather and provide clean and healthy work environment, sanitary conveniences, sanitary and protective gear.

Relation to the project: The Act is applicable in relation to the protection of the project workers, during both construction and operation phases, against injuries during execution of their duties or work.

3.3.11 Physical Planning Act, 2010

This Act replaced the Town and Country Planning Act, Cap 246 which was enacted in 1951 and revised in 1964 but is now inconsistent with contemporary government system in Uganda. The 1951 Act was enacted to regulate and operate in a centralised system of governance where physical planning was

carried out at national level through the Town and Country Planning Board. Implementation of the Act was supervised by local governments, especially the urban local governments.

Uganda has since gone through many social, political and economic changes. For example, promulgation of the 1995 Constitution established a decentralised system of governance which divulged powers and functions including physical planning, finance and execution of projects from the central government to local governments. This therefore created a need to enact a physical planning legislation which is consistent with this Constitutional requirement. The Physical Planning Act, 2010 establishes district and urban physical planning committees, provides for making and approval of physical development plans and applications for development.

Section 37 of The Physical Planning Act, 2010 requires an EIA permit for developments before they are implemented. It states:

“Where a development application related to matters that require an environmental impact assessment, the approving authority may grant preliminary approval subject to the applicant obtaining an EIA certificate in accordance with the National Environment Act”.

Relevance to the project: NWSC and DWD shall use established guidelines for planning schemes, to acquire land and compensate for acquired lands, as well as safeguarding the natural environment, in line with the provisions of this Act. This ESIA is being conducted in fulfilment of Section 37 of the Act.

3.3.12 Historical Monuments Act (1967)

This Act was assented to on 21st October 1967, and came into force on 15th May 1968. It provides for preservation and protection of historical monuments and objects of archaeological, paleontological, ethnographical and traditional interest. According to this Act, the responsible Minister may, by statutory instrument, declare any object of archaeological, paleontological, ethnographical, traditional or historical interest to be a protected object. Once thus declared, the Act adds, no person whether owner or not shall do any of the following:

- Excavate soil so as to affect to its detriment, any object declared to be preserved or protected.
- Make alteration, addition to, or repair, destroy, deface or injure any object declared to be preserved or protected.

Sub-section 12(1) requires that any portable object discovered in the course of an excavation shall be surrendered to the Minister who shall deposit it in the Museum. The Act adds that, notwithstanding provisions of the subsection, where any object is discovered in a protected site, place, or monument, the owner of the protected site, place, or monument shall be entitled to reasonable compensation.

Relevance: This Act requires that any chance finds encountered during project construction shall be preserved by the Department of Monuments and Museum in the Ministry of Tourism, Wildlife and Heritage.

3.3.13 The Mining Act, Cap. 148 2003

Stone quarry sites and gravel borrow pits will be necessary for materials needed to construct the concrete works of the project components. Therefore applicable licenses shall be obtained from the Commissioner of the Geological Survey and Mines. The Mining Act of 2003 regulates mining developments including set up of new quarries and/or sandpits. Relevant environmental studies required for this license application are described in Part XI. The extraction of stone/aggregate and murram materials will be undertaken in line with the provisions of this Act. Issues of restoration of the sites after extraction of murram will be of key importance after construction of the proposed project.

Relevance: This Act will apply to the project's contractors who will be required to obtain license for extraction of stone/ aggregate and murram materials required for construction.

5.3.14 Children Act, Cap 59

The Act provides for the reform and consolidation of the law relating to children; to provide for the care, protection and maintenance of children; to provide for local authority support for children; to establish a family and children court; to make provision for children charged with offences and for other connected purposes. Part I section 5 states that: (1) it shall be the duty of a parent, guardian or any person having custody of a child to maintain that child and, in particular, that duty gives a child the right to— education and guidance; immunisation; adequate diet; clothing; shelter; and medical attention; and (2) any person having custody of a child shall protect the child from discrimination, violence, abuse and neglect. Part I, Section 8 protects children against harmful employment. No child shall be employed or engaged in any activity that may be harmful to his or her health, education or mental, physical or moral development.

Relevance: During the construction and operation phases child labour must not be used as required by this law.

3.4 REGULATIONS/ STANDARDS/ GUIDELINES

3.4.1 The Water Resources Regulations, 1998

With regard to water abstraction, Part II: Section 3 Sub-section (1) of these regulations requires application for Water Permits by anyone who: (a) Occupies or intends to occupy any land; (b) Wishes to construct, own, occupy or control any works on or adjacent to the land referred to in regulation 10; may apply to the Director for a water permit.

Relevance: NWSC intends to construct an intake and abstract water from River Namatala and should therefore fulfil the requirements of these regulations.

3.4.2 National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 1999

Section 6 (2) details maximum permissible limits for 54 regulated contaminants which must not be exceeded before effluent is discharged into water or on land. For this project, this standard is applicable to liquid waste/ sewage treatment plant and public toilets.

Table 6: National discharge standards for selected pollutants

Parameter	National discharge standards
BOD ₅ (mg/l)	50
Suspended solids (mg/l)	100
Faecal coliforms (counts/ 100ml)	10,000
Chlorine residual (mg/l)	1
pH	6-8
Phenols (mg/l)	0.2
Oil and grease (mg/l)	10
Total Phosphorus (mg/l)	10
Temperature (°C)	20-35

Source: *The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 1999.*

Relevance: Effluent discharged from the wastewater treatment plant should conform to these regulations. Since the project is funded by World Bank, the one that is more stringent, that is, Uganda regulations or WBG EHS Guidelines (Table 7) will override.

Table 7: Indicative values for treated sanitary sewage discharges

Pollutant	Unit	Guideline Value
pH	mg/l	6 – 9
BOD	mg/l	30
COD	mg/l	125
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Total coliform bacteria	Most Probable Number/100 ml	400 ^a

Source: *IFC/WB General EHS Guidelines*

3.4.3 National Environment (Noise Standards and Control) Regulations, 2003

Part III Section 8 (1) requires facility operators, to use the best practicable means to ensure that the emission of noise does not exceed the permissible noise levels. The regulations require that persons to be exposed to occupational noise exceeding 85 dBA for eight hours in a day should be provided with requisite hearing protection.

Table 8: Regulatory noise limits

Facility	Noise limits dB (A) (Leq)	
	Day*	Night*
Construction sites	60	50
Mixed residential (with some commercial and entertainment)	55	45
*Time frame: Day 6.00 a.m -10.00 p.m; Night 10.00 p.m. - 6.00 a.m.		

Source: *The National Environment (Noise Standards and Control) Regulations, 2003.*

Relevance: Both during construction and operation of the water supply and sanitation facilities, noise generated should not exceed limits prescribed by these regulations.

3.4.4 The National Environment (Wetlands, River Banks and Lakeshores 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.

In Regulation 17 (1), every landowner, occupier or user who is adjacent or contiguous with a wetland shall have a duty to prevent the degradation or destruction of the wetland and shall maintain the ecological and other functions of the wetland. The tool used under these Regulations to ensure compliance is the permit. The Executive Director of NEMA can only permit activities in a wetland if he or she is satisfied that such activities shall not degrade the wetland in question.

Relevance: Prior to any dredging works at River Namatala and discharge of effluent from the WSP into the environment, NWSC will seek permission from executive Director of NEMA, as provided for in these Regulations.

3.4.5 National Environment (Waste Management) Regulations, 1999

These regulations require waste disposal in a way that would not contaminate water, soil, and air or impact public health.

Relevance: These regulations apply to both construction and operation-phase waste which should be managed in a way such as to avoid environmental and public health impact.

3.4.6 Draft National Air Quality Standards, 2006

The draft national air quality standards provide the following regulatory limits (Table 9).

Table 9: Uganda's regulatory air quality standards for selected pollutants

Pollutant	Averaging time for ambient air	Standard for ambient air
Carbon dioxide (CO ₂)	8 hour	9.0 ppm
Carbon monoxide (CO)	8 hour	9.0 ppm
Hydrocarbons	24 hour	5 mg m ⁻³
Nitrogen oxides (NO _x)	24 hour 1 year arithmetic mean	0.10 ppm
Smoke	Not to exceed 5 minutes in any one hour	Ringlemann scale No.2 or 40% observed at 6m or more
Soot	24 hour	500 µg Nm ⁻³
Sulphur dioxide (SO ₂)	24 hour	0.15 ppm
Sulphur trioxide (SO ₃)	24 hour	200 µg Nm ⁻³

Note: ppm = parts per million; "N" in µg/Nm⁻³ connotes normal atmospheric conditions of pressure and temperature (25oC and 1 atmosphere).

Relevance: These standards will apply particularly during construction of all project components. There should be a justification for applying a less stringent limit value, or in the absence of an acceptable justification, the EHS guidelines (Table 10) will apply.

Table 10: World Health Organisation (WHO) ambient air quality guidelines

	Averaging Period	Guideline value in $\mu\text{g}/\text{m}^3$
Sulphur dioxide (SO ₂)	24-hour	20
	10 minute	500
Nitrogen dioxide (NO ₂)	1-year	40
	1-hour	200
Particulate Matter PM ₁₀	1-year	20
	24-hour	50
Particulate Matter PM _{2.5}	1-year	10
	24-hour	25
Ozone	8-hour daily maximum	100

Source: IFC/WB General EHS Guidelines

3.4.7 The Water Supply Regulations, 1999

The Water Supply Regulations, 1999 manage the water supply works including:

- Permits requirements and procedures for water supply works by authority or connection to land owner (Division 1, clauses 4 to 6);
- Application, examination and approval of Water supply plan (Division 2, clauses 7 to 11);
- Cost of works, security deposit, inspection of works and penalty for violation (Division 2, clauses 12 to 18);
- Metering system and charging rates (Part III, clauses 19 to 21).

3.4.8 National Environment (Audit) Regulations, 2006

Part V, Section 19, Sub-section (1) requires the operator or owner of a facility whose activities are likely to have a significant impact on the environment may, at any time, to carry out a voluntary environmental audit of the facility to determine its compliance with the National Environmental Act, Cap 153, these Regulations and other relevant laws.

Relevance: The project will involve construction and operation of water supply and sanitation facilities that have a potential to impact negatively of the environment. Therefore NWSC should conduct Environmental Audits to assess if there are impacts, to what extent and mitigate them.

3.5 INSTITUTIONAL FRAMEWORK

3.5.1 National Environmental Management Authority (NEMA)

The National Environmental Act, Cap 153 establishes NEMA as the principal agency responsible for coordination, monitoring and supervision of environmental conservation activities. NEMA is under the Ministry of Water and Environment (MWE) but has a cross-sectoral mandate to oversee the conduct of EIAs through issuance of guidelines, regulations and registration of practitioners. It reviews and approves environmental impact statements in consultation with any relevant lead agencies.

NEMA works with District Environment Officers and local environment committees at local government levels who also undertake inspection, monitoring and enforce compliance on its behalf. In Government ministries, NEMA works with Environmental Liaison Units to ensure incorporation of environmental issues in their activities, policies and programs.

Role in the project: NEMA will:

- Review and approve the ESIA report (ESIS)
- Through the Project Districts' Environment Officers, undertake environmental monitoring during project implementation.

3.5.2 National Water and Sewerage Corporation (NWSC)

The National Water and Sewerage Corporation (NWSC) Statute establishes the NWSC as a Water and Sewerage Authority and gives it the mandate to operate and provide water and sewerage services in areas entrusted to it on a sound commercial and viable basis. NWSC is a parastatal that operates and provides water and sewerage services for 111 urban centres across the country, of which Mbale Municipality is part. Sector reforms in the period 1998-2003 included commercialization and modernization of the NWSC operating in cities and larger towns as well as decentralization and private sector participation in small towns. NWSC also operates small conventional sewage treatment plants in a series of towns.

3.5.3 Directorate of Water Resources Management (DWRM)

The primary goal of the directorate is to promote sustainable development of Uganda's water sector. The directorate is into design and implementation of water quality assessments, monitoring ground and surface water resources, laboratory and field works and ultimately water pollution control.

3.5.4 Directorate of Water Development (DWD)

Lead agency responsible for policy guidance, coordination and regulation of all water sector activities including provision of oversight and support services to the local governments and other water supply service providers. DWD has the mandate to promote the provision of clean and safe water to all persons, investigate, control, protect and manage water in Uganda for any use in accordance with the provisions of the Water Statute, 1995.

3.5.5 Directorate of Environmental Affairs (DEA)

The Wetlands Management Department (WMD) within DEA is mandated to manage wetland resources and its goal is to sustain the biophysical and socio economic values of wetlands in Uganda for present and future generations. Wetlands are under a lot of pressure from conversion for industrial development, agriculture, wastewater treatment facilities. WMD has an inventory of the major wetlands in country in the National Wetlands Information System (NWIS). The inventory provides an overview of wetland resource, their values, threats and possible management options.

3.5.6 Ministry of Water and Environment (MWE)

The Ministry of Water and Environment is responsible for policy formulation, setting standards, strategic planning, coordination, quality assurance, provision of technical assistance, and capacity building. The ministry also monitors and evaluates sector development programmes to keep track of their performance, efficiency and effectiveness in service delivery. The ministry has three directorates: Directorate of Water Resources Management (DWRM), Directorate of Water Development (DWD) and the Directorate of Environmental Affairs (DEA).

The mandate of the MWE regarding sanitation and hygiene activities are stipulated in the memorandum of understanding (MoU) that was signed by Ministry of Health, Ministry of Education and Sports and the Ministry of Water and Environment. The role of MWE is limited to development of public sanitary facilities and promotion of good hygiene in small towns and rural growth centres. With respect to water production, MWE is the lead agency for water for production and development off farm.

3.5.7 Ministry of Lands, Housing and Urban Development (MoLHUD)

MoLHUD is responsible for providing policy direction, national standards and coordination of all matters concerning lands, housing and urban development. It is responsible for putting in place policies and initiating laws that ensure sustainable land management and promote sustainable housing for all and foster orderly urban development in the country. Through the MoLHUD, the government facilitates the provision and improvement of urban infrastructure and utilities while ensuring management and maintenance of the provided facilities. The Ministry has put in place strategies to prepare Sewerage Master Plan as well as provision of a centralised sewage treatment system and a drainage system for urban areas.

The ministry also has strategies in place to promote a culture of maintenance for the urban infrastructures and facilities including sewerage systems.

3.5.8 Ministry of Gender, Labour & Social Development (MGLSD)

This ministry sets policy direction and monitoring functions related to labour, gender and general social development. Its OHS Department in the ministry is responsible for inspection and mentoring of occupational safety in workplaces and this could be during project construction and operation of the laboratory facilities.

Role in the project: The OHS Department in this Ministry will be responsible for undertaking inspections of construction sites to ensure safe working conditions.

3.5.9 District Local Administration Structures

The proposed project is within the jurisdiction of Mbale, Budaka and Butaleja District Local Governments headed by a Local Council V (LC V) Chairman and Chief Administration Officer (CAO) who are the political head and technical head respectively. Various district offices whose functions would be relevant to the project include offices of Natural Resources/Environment, District Health Inspector, District Planner, Community Development Officer, District Director of Health Services, District Water Officer, Town Council and District Engineer. Equally important are village-level local council administration (LC I and LC III). Leaders at these levels of local administration are closer to residents and therefore important in effective community mobilization, sensitization and dispute resolution given that the laboratory is also going to serve cross-border communities.

Role in the project: Local government structures are important for mobilising support for the project as well as monitoring its social-environmental impacts both during construction and operation phases.

3.5.10 Uganda National Roads Authority (UNRA)

Uganda National Roads Authority (UNRA) was established by an Act of Parliament: The Uganda National Authority Act, No. 15 of 2006 and became operational on 1st July 2008. The mandate of UNRA is to

develop and maintain national roads network, advise Government on general roads policy and contribute to addressing transport constraints to development.

Role in the project: One of UNRA's responsibilities is the establishment and maintenance road reserves. Given that the water pipelines are in some places located in the road reserve especially on the Mbale-Tirinyi road, UNRA has to be informed so that any plans with respect to the project area takes into consideration the pipeline.

3.5.11 Ministry of Tourism, Wildlife and Heritage

In this ministry found the Department of Monuments and Museums mandated to protect, promote and present the cultural and natural heritage of Uganda through collection, conservation, study and information dissemination for enjoyment and education.

The department's key functions are:

- a) Research about natural and cultural heritage;
- b) Conservation and maintenance of important Physical Cultural Resources or Heritage Collections;
- c) Provision of professional knowledge and information on the archaeology and palaeontology of Uganda;
- d) Publication of research findings in appropriate publications;
- e) Exhibition and interpretation of specimens for public study and enjoyment;
- f) Monitoring implementation policies and strategies of historical and cultural heritage conservation and development;
- g) Development of strategies for community participation in cultural heritage;
- h) Promote public awareness about cultural and natural heritage through formal and informal education; and
- i) Provide technical guidelines to the private investors.

Relevance to the project: This Ministry will be responsible for preservation of any chance finds encountered during project implementation.

3.6 PROJECT CLASSIFICATION FOR ESIA PURPOSES

3.6.1 Classification according to Uganda's National Environment Act, Cap 153

The *Third Schedule* of the National Environment Act Cap 153 prescribes projects for which EIA is mandatory and according to Section 1 and Section 12 (b & d) in this Schedule, the project should undertake detailed EIA.

3.6.2 Project Classification according to World Bank

The Bank classifies a proposed project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. The project impacts may affect an area broader than the sites or facilities subject to physical works. Environmental assessment for a

Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives including the "without project" situation, and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

Category B: A proposed project is classified as Category B if it's potential adverse environmental impacts on human populations or environmentally important areas, including wetlands, forests, grasslands, and other natural habitats, are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than for Category A projects. Here the assessment also involves examination of the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further environmental assessment is required for a Category C project.

Category FI: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

The proposed project is classified as EA Category B. The proposed construction and operation of the water supply facilities will be restricted within the user-communities. The project will not directly affect ecosystems such wetlands, forests, grasslands, etc.

3.7 WORLD BANK SAFEGUARD POLICIES

The objective of the World Bank's environmental and social safeguard policies is to prevent and mitigate undue harm to people and their environment during the development process. These policies provide guidelines for bank and borrower staff in the identification, preparation, and implementation of programs and projects. Safeguard policies provide a platform for the participation of stakeholders in project design, and are an important instrument for building ownership among local populations (World Bank, 2006). The triggered safeguard policies are presented in the sub-sections below.

3.7.1 OP/BP 4.01 - Environmental Assessment

The World Bank's environmental assessment policy and recommended processing are described in Operational Policy (OP)/Bank Procedure (BP) 4.01: Environmental Assessment (Table 11). Its purpose is to improve decision making, to ensure that all options under consideration are sound and sustainable, and that potentially affected people have been properly consulted. Environmental Assessment (EA) is one of the 10 environmental, social, and legal Safeguard Policies of the World Bank. EA is used in the World Bank to identify, avoid, and mitigate the potential negative environmental impacts associated with Bank lending operations. This policy is considered to be the umbrella policy for the Bank's environmental 'safeguard policies'.

Table 11: WB OP/BP 4.01 Environmental Assessment (Jan 1999)

Objectives	Operational Principals
	1. Use a screening process for each proposed project, as early as possible, to determine the appropriate extent

Objectives	Operational Principals
To help ensure the environmental and social soundness and sustainability of investment projects.	and type of environmental assessment (EA) so that appropriate studies are undertaken proportional to potential risks and to direct, and, as relevant, indirect, cumulative, and associated impacts. Use sectorial or regional environmental assessment when appropriate.
	2. Assess potential impacts of the proposed project on physical, biological, socio-economic and physical cultural resources, including trans-boundary and global concerns, and potential impacts on human health and safety.
	3. Assess the adequacy of the applicable legal and institutional framework, including applicable international environmental agreements, and confirm that they provide that the cooperating government does not finance project activities that would contravene such international obligations.
	4. Provide for assessment of feasible investment, technical, and siting alternatives, including the "no action" alternative, potential impacts, feasibility of mitigating these impacts, their capital and recurrent costs, their suitability under local conditions, and their institutional, training and monitoring requirements associated with them.
	5. Where applicable to the type of project being supported, normally apply the Pollution Prevention and Abatement Handbook (PPAH). Justify deviations when alternatives to measures set forth in the PPAH are selected.
	6. Prevent and, where not possible to prevent, at least minimize, or compensate for adverse project impacts and enhance positive impacts through environmental management and planning that includes the proposed mitigation measures, monitoring, institutional capacity development and training measures, an implementation schedule, and cost estimates.
	7. Involve stakeholders, including project-affected groups and local nongovernmental organizations, as early as possible, in the preparation process and ensure that their views and concerns are made known to decision makers and taken into account. Continue consultations throughout project implementation as necessary to address EA-related issues that affect them.
	8. Use independent expertise in the preparation of EA where appropriate. Use independent advisory panels during preparation and implementation of projects that are highly risky or contentious or that involve serious and multi- dimensional environmental and/or social concerns.
	9. Provide measures to link the environmental assessment process and findings with studies of economic, financial, institutional, social and technical analyses of a proposed project.
	10. Provide for application of the principles in this Table to subprojects under investment and financial intermediary activities.
	11. Disclose draft EA in a timely manner, before appraisal formally begins, in an accessible place and in a form and language understandable to key stakeholders.

***Relevance:** The Project triggers this policy because although there is justification for the proposed water supply and sanitation infrastructure in the project districts, there are also environmental impacts associated with the construction and operation of these facilities. OP 4.01 requires an Environmental Assessment (EA) of projects proposed for WB financing to ensure that they are environmentally sound and sustainable, and thus to improve decision making. In this regard, a comprehensive Environmental and Social Impact Assessment has been undertaken by the Proponent to establish a detailed Environmental Management Plan that will provide guidelines for environmental stewardship of the construction and operational phases of the Project.*

3.7.2 OP/BP 4.04 - Natural Habitats

This OP seeks to ensure that World Bank-supported infrastructure and other development projects take into account the conservation of biodiversity, as well as the numerous environmental services and products which natural habitats provide to human society. The policy strictly limits the circumstances under which any Bank-supported project can damage natural habitats (land and water areas where most of the native plant and animal species are still present). Specifically, the policy prohibits Bank support for projects which would lead to the significant loss or degradation of any Critical Natural Habitats, whose definition includes those natural habitats which are either:

- Legally protected,
- Officially proposed for protection, or
- Unprotected but of known high conservation value.

Table 12: WB OP/BP 4.04 Natural Habitats (June 2001)

Objectives	Operational Principals
To promote environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions.	1. Use a precautionary approach to natural resources management to ensure opportunities for environmentally sustainable development. Determine if project benefits substantially outweigh potential environmental costs.
	2. Avoid significant conversion or degradation of critical natural habitats, including those habitats that are (a) legally protected, (b) officially proposed for protection, (c) identified by authoritative sources for their high conservation value, or (d) recognized as protected by traditional local communities.
	3. Where projects adversely affect non-critical natural habitats, proceed only if viable alternatives are not available, and if appropriate conservation and mitigation measures, including those required to maintain ecological services they provide, are in place. Include also mitigation measures that minimize habitat loss and establish and maintain an ecologically similar protected area.
	4. Whenever feasible, give preference to siting projects on lands already converted.
	5. Consult key stakeholders, including local nongovernmental organizations and local communities, and involve such people in design, implementation, monitoring, and evaluation of projects, including mitigation planning.

Objectives	Operational Principals
	6. Provide for the use of appropriate expertise for the design and implementation of mitigation and monitoring plans.
	7. Disclose draft mitigation plan in a timely manner, before appraisal formally begins, in an accessible place and in a form and language understandable to key stakeholders.

Relevance: The Project activities have limited potential to trigger this policy as most of the project areas are highly disturbed by agricultural and commercial activities..

3.7.3 OP 4.36 – Forests

The Bank's forests policy aims to reduce deforestation, enhance the environmental contribution of forested areas, promote reforestation, reduce poverty, and encourage economic development. Combating deforestation and promoting sustainable forest conservation and management have been high on the international agenda for two decades. However, little has been achieved so far and the world's forests and forest dependent people continue to experience unacceptably high rates of forest loss and degradation. Success in establishing sustainable forest conservation and management practices depends not only on changing the behaviour of all critical stakeholders, but also on a wide range of partnerships to accomplish what no country, government agency, donor, or interest group can do alone.

Table 13: WB OP/BP 4.36 Forests (November 2002)

Objectives	Operational Principals
To realize the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests.	1. Screen as early as possible for potential impacts on forest health and quality and on the rights and welfare of the people who depend on them. As appropriate, evaluate the prospects for new markets and marketing arrangements.
	2. Do not finance projects that would involve significant conversion or degradation of critical forest areas or related critical natural habitats, or that would contravene applicable international environmental agreements.
	3. Do not finance natural forest harvesting or plantation development that would involve any conversion or degradation of critical forest areas or related critical natural habitats.
	4. Support projects that adversely impact non-critical natural forests or related natural habitats only if viable alternatives to the project are not available and only if appropriate conservation and mitigation measures are in place.
	5. Support commercial, industrial-scale forest harvesting only when the operation is certified, under an independent forest certification system, as meeting, or having a time-bound action plan to meet, internationally recognized standards of responsible forest management and use.
	6. Ensure that forest restoration projects maintain or enhance biodiversity and ecosystem functionality and that all plantation projects are environmentally appropriate, socially beneficial and economically viable

Objectives	Operational Principals
	7. Give preference to small-scale community-level management approaches where they best reduce poverty in a sustainable manner
	8. Support commercial harvesting by small-scale landholders, local communities or entities under joint forest management where monitoring with the meaningful participation of local communities demonstrates that these operations achieve a standard of forest management consistent with internationally recognized standards of responsible forest use or that they are adhering to an approved time-bound plan to meet these standards.
	9. Use forest certification systems that require: <ul style="list-style-type: none"> a) compliance with relevant laws; b) recognition of, and respect for, legal or customary land tenure and use rights as well as the rights of Indigenous Peoples and workers; c) measures to enhance sound community relations; d) conservation of biological diversity and ecological functions; e) measures to maintain or enhance environmentally sound multiple benefits from the forest; f) prevention or minimization of environmental impacts; g) effective forest management planning; h) active monitoring and assessment of relevant forest management areas; and i) independent, cost effective, third-party assessment of forest management performance against measurable performance standards defined at the national level and compatible with internationally accepted principles and criteria of sustainable forest management through decision making procedures that are fair, transparent, independent, designed to avoid conflict of interest and involve the meaningful participation of key stakeholders, including the private sector, Indigenous Peoples, and local communities.
	10. Disclose any time-bound action plans in a timely manner, before appraisal formally begins, in an accessible place and in a form and language that are understandable to key stakeholders.

***Relevance:** The Project activities have limited potential to trigger this policy as only a few planted trees will be affected especially along the water pipelines. Most of the project areas are highly disturbed by agricultural and commercial activities.*

3.7.4 OP 4.11 - Physical Cultural Resources

Cultural resources are important as sources of valuable historical and scientific information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. The

loss of such resources is irreversible, but fortunately, it is often avoidable. The objective of OP/BP 4.11 on Physical Cultural Resources is to avoid, or mitigate, adverse impacts on cultural resources from development projects that the World Bank finances.

Table 14: WB OP/BP 4.11 Physical Cultural Resources (July 2006)

Objectives	Operational Principals
To assist in preserving physical cultural resources and avoiding their destruction or damage. PCR includes resources of archaeological, paleontological, historical, architectural, and religious (including graveyards and burial sites), aesthetic, or other cultural significance.	1. Use an environmental assessment (EA) or equivalent process to identify PCR and prevent or minimize or compensate for adverse impacts and enhance positive impacts on PCR through site selection and design.
	2. As part of the EA, as appropriate, conduct field based surveys, using qualified specialists
	3. Consult concerned government authorities, relevant non-governmental organizations, relevant experts and local people in documenting the presence and significance of PCR, assessing the nature and extent of potential impacts on these resources, and designing and implementing mitigation plans.
	4. For materials that may be discovered during project implementation, provide for the use of "chance find" procedures in the context of the PCR management plan or PCR component of the environmental management plan.
	5. Disclose draft mitigation plans as part of the EIA or equivalent process, in a timely manner, before appraisal formally begins, in an accessible place and in a form and language that are understandable to key stakeholders.

Relevance: The activities of the Project have limited potential to trigger this policy as the only cultural resources identified, that is, Mutoto cultural ground, is 100 m away from the proposed transmission to Butaleja.

3.7.5 OP 4.10 - Indigenous Peoples

Indigenous Peoples are identified as possessing the following characteristics in varying degrees: self-identification and recognition of this identity by others; collective attachment to geographically distinct habitats or ancestral territories and to the natural resources in these habitats and territories; presence of distinct customary cultural, economic, social or political institutions; and indigenous language. The World Bank policy on indigenous peoples underscores the need for Borrowers and Bank staff to identify indigenous peoples, consult with them, ensure that they participate in, and benefit from Bank-funded operations in a culturally appropriate way - and that adverse impacts on them are avoided, or where not feasible, minimized or mitigated.

Table 15: WB OP/BP 4.10 Indigenous Peoples (Sept 1991)

Objectives	Operational Principals
To design and implement projects in a way that fosters full respect for Indigenous Peoples' dignity, human rights, and cultural uniqueness and so that they: a) receive culturally compatible social and economic benefits; and b) do not suffer adverse effects during	1. Screen early to determine whether Indigenous Peoples are present in, or have collective attachment to, the project area.
	2. Undertake free, prior and informed consultation with affected Indigenous Peoples to ascertain their broad community support for projects affecting them and to solicit their participation: a) in designing, implementing, and monitoring measures to avoid adverse impacts, or,

Objectives	Operational Principals
	<p>when avoidance is not feasible, to minimize, mitigate, or compensate for such effects; and</p> <p>b) In tailoring benefits in a culturally appropriate manner.</p>
	<p>3. Undertake social assessment or use similar methods to assess potential project impacts, both positive and adverse, on Indigenous Peoples. Give full consideration to options preferred by the affected Indigenous Peoples in the provision of benefits and design of mitigation measures. Identify social and economic benefits for Indigenous Peoples that are culturally appropriate, and gender and inter-generationally inclusive and develop measures to avoid, minimize and/or mitigate adverse impacts on Indigenous Peoples.</p>
	<p>4. Where restriction of access of Indigenous Peoples to parks and protected areas is not avoidable, ensure that the affected Indigenous Peoples' communities participate in the design, implementation, monitoring and evaluation of management plans for such parks and protected areas and share equitably in benefits from the parks and protected areas.</p>
	<p>5. Put in place an action plan for the legal recognition of customary rights to lands and territories, when the project involves:</p> <p>a) activities that are contingent on establishing legally recognized rights to lands and territories that Indigenous Peoples traditionally owned, or customarily used or occupied; or</p> <p>b) The acquisition of such lands.</p>
	<p>6. Do not undertake commercial development of cultural resources or knowledge of Indigenous Peoples without obtaining their prior agreement to such development.</p>
	<p>7. Prepare an Indigenous Peoples Plan that is based on the social assessment and draws on indigenous knowledge, in consultation with the affected Indigenous Peoples' communities and using qualified professionals. Normally, this plan would include a framework for continued consultation with the affected communities during project implementation; specify measures to ensure that Indigenous Peoples receive culturally appropriate benefits, and identify measures to avoid, minimize, mitigate or compensate for any adverse effects; and include grievance procedures, monitoring and evaluation arrangements, and the budget for implementing the planned measures.</p>
	<p>8. Disclose the draft Indigenous Peoples Plan; including documentation of the consultation process, in a timely manner before appraisal formally begins, in an accessible place and in a form and language that are understandable to key stakeholders.</p>

Objectives	Operational Principals
	9. Monitor implementation of the Indigenous Peoples Plan, using experienced social scientists.

Relevance: By definition, these are people or communities who claim a historical continuity and cultural affinity with societies endemic to their original territories that developed prior to exposure to Western culture civilization. These communities often consider themselves distinct from wider society or majority of cultures that contest their cultural sovereignty and self-determination. In Uganda, a distinct example is Batwa pygmies found in tropical rainforests in South-western Uganda. None of the project facilities traverses or is located in any indigenous people communities.

3.7.6 OP 4.12 - Involuntary Resettlement

This policy is triggered in situations involving involuntary taking of land and involuntary restrictions of access to legally designated parks and protected areas. The policy aims to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts. It promotes participation of displaced people in resettlement planning and implementation, and its key economic objective is to assist displaced persons in their efforts to improve or at least restore their incomes and standards of living after displacement. The policy prescribes compensation and other resettlement measures to achieve its objectives and requires that borrowers prepare adequate resettlement planning instruments prior to Bank appraisal of proposed projects.

Table 16: WB OP/BP 4.12 Involuntary Resettlement (Dec 2001)

Objectives	Operational Principals
To avoid or minimize involuntary resettlement and, where this is not feasible, to assist displaced persons in improving or at least restoring their livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.	1. Assess all viable alternative project designs to avoid, where feasible, or minimize involuntary resettlement
	2. Through census and socio-economic surveys of the affected population, identify, assess, and address the potential economic and social impacts of the project that are caused by involuntary taking of land (e.g., relocation or loss of shelter, loss of assets or access to assets, loss of income sources or means of livelihood, whether or not the affected person must move to another location) or involuntary restriction of access to legally designated parks and protected areas.
	3. Identify and address impacts also if they result from other activities that are: <ul style="list-style-type: none"> a) directly and significantly related to the proposed project, b) necessary to achieve its objectives, and c) Carried out or planned to be carried out contemporaneously with the project.
	4. Consult project-affected persons, host communities and local nongovernmental organizations, as appropriate. Provide them opportunities to participate in the planning, implementation, and monitoring of the resettlement program, especially in the process of developing and implementing the procedures for determining eligibility for compensation benefits and development assistance (as documented in a resettlement plan), and for establishing appropriate and accessible grievance mechanisms. Pay particular attention to the needs of vulnerable groups among those displaced, especially those below the poverty line, the landless, the elderly, women and children, Indigenous Peoples, ethnic minorities, or other displaced persons who may not be protected through national land compensation legislation.

Objectives	Operational Principals
	<p>5. Inform displaced persons of their rights, consult them on options, and provide them with technically and economically feasible resettlement alternatives and needed assistance, including:</p> <ul style="list-style-type: none"> a) prompt compensation at full replacement cost for loss of assets attributable to the project; b) if there is relocation, assistance during relocation, and residential housing, or housing sites, or agricultural sites of equivalent productive potential, as required; c) transitional support and development assistance, such as land preparation, credit facilities, training or job opportunities as required, in addition to compensation measures; d) cash compensation for land when the impact of land acquisition on livelihoods is minor; and e) Provision of civic infrastructure and community services as required.
	6. Give preference to land-based resettlement strategies for displaced persons whose livelihoods are land-based.
	7. For those without formal legal rights to lands or claims to such land that could be recognized under the laws of the country, provide resettlement assistance in lieu of compensation for land to help improve or at least restore their livelihoods.
	8. Disclose draft resettlement plans, including documentation of the consultation process, in a timely manner, before appraisal formally begins, in an accessible place and in a form and language that are understandable to key stakeholders
	9. Apply the principles described in the involuntary resettlement section of this Table, as applicable and relevant, to subprojects requiring land acquisition.
	<p>10. Design, document, and disclose before appraisal of projects involving involuntary restriction of access to legally designated parks and protected areas, a participatory process for:</p> <ul style="list-style-type: none"> a) preparing and implementing project components; b) establishing eligibility criteria; c) agreeing on mitigation measures that help improve or restore livelihoods in a manner that maintains the sustainability of the park or protected area; d) resolving conflicts; and e) Monitoring implementation.
	11. Implement all relevant resettlement plans before project completion and provide resettlement entitlements before displacement or restriction of access. For projects involving restrictions of access, impose the restrictions in accordance with the timetable in the plan of actions
	12. Assess whether the objectives of the resettlement instrument have been achieved, upon completion of the project, taking a count of the baseline conditions and the results of resettlement monitoring.

***Relevance:** The activities of the Project will trigger this policy as the proposed water supply and sanitation facilities will be located in areas where people were conducting mostly agricultural activities. However, apart from involuntary resettlement with respect to socio-economic activities on land, there will not be resettlement of people from their settlements to other places.*

3.7.7 OP 7.60 - Disputed Areas

Projects in Disputed Areas may affect the relations between the Bank and its borrowers, and between the claimants to the disputed area. Therefore, the Bank will only finance projects in disputed areas when either there is no objection from the other claimant to the disputed area, or when the special circumstances of the case support Bank financing, notwithstanding the objection. The policy details those special circumstances. In such cases, the project documents should include a statement emphasizing that by supporting the project, the Bank does not intend to make any judgment on the legal or other status of the territories concerned or to prejudice the final determination of the parties' claims.

Table 17: WB OP/BP 7.60 - Disputed Areas (June 2001)

Objectives	Operational Principals
<p>The objective of this policy is to ensure that projects in disputed areas are dealt with at the earliest possible stage:</p> <ul style="list-style-type: none">a) so as not to affect relations between the WB and its member countriesb) so as not to affect relations between the borrower and neighbouring countriesc) So as not to prejudice the position of either the WB or the countries concerned.	<p>This policy is triggered if the proposed project will be in a "disputed area".</p>

Relevance: All areas proposed for the project facilities are under rightful legal jurisdiction of the Republic of Uganda and not disputed by any other nation. This issue is addressed in detail by the Impacts Assessment in section of the ESIA.

3.8 IFC - EHS GUIDELINES – WATER AND SANITATION (DECEMBER 10, 2007)

The IFC Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. Industry sector EHS guidelines are designed to be used together with the General EHS Guidelines document, which provides guidance to users on common EHS issues potentially applicable to all industry sectors.

The EHS Guidelines for Water and Sanitation include information relevant to the operation and maintenance of: potable water treatment and distribution systems; collection of sewage in centralized systems such as piped sewer collection networks or decentralized systems such as septic tanks subsequently serviced by pump trucks; and treatment of collected sewage at centralized facilities.

The Guidelines provide GIIP advice relating to the following elements of Water Projects:

Environment Safety

- Drinking water
- Water withdrawal
- Water treatment
- Water distribution

Occupational Health and Safety

- Accidents and injuries
- Chemical exposure
- Hazardous Atmosphere
- Exposure to pathogens and vectors
- Noise

Community Health and Safety

- Drinking water
- Sanitation

Performance Indicators and Industry Benchmarks

- Environment
- Occupational health and safety

Relevance: The IFC Environmental, Health, and Safety (EHS) Guidelines (Water and Sanitation, 2007) are relevant to the Project as they provide the latest internationally accepted GIIP for relevant OHS issues. The recommendations contained within the Guidelines have been reviewed during the development of this ESIA and incorporated in to the prescribed management and mitigation measures as appropriate. Drinking water quality standards to be applied are those set out in the EHS Guidelines.

3.9 INTERNATIONAL AGREEMENTS

Uganda has signed and/or ratified several international agreements and conventions relating to the environment both at regional and global level such as ones below. However, due to the low environmental sensitivity of the project sites no impact associated with these conventions are anticipated as shown below:

- 1968 African Convention on the Conservation of Nature and Natural Resources:
Reason: No sensitive natural resources are found at or along the proposed project sites.
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat:
Reason: No gazetted wetlands are traversed by the project facilities.
- 1987 Montreal Protocol on Substances that Deplete the Ozone Layer
Reason: No such substances will be used during construction and operation of the project facilities.
- 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora
Reason: No project facility is located in a protected wildlife area.
- 1992 Convention on Biological Diversity
Reason: There was no significant biological diversity in the project area.
- The Convention on Migratory Species of Wild Animals (CMS) aimed at conserving species of wild animals that migrate across or outside national boundaries.

Reason: This convention is relevant to the Project as implementation could impact on migratory species to only very small extent by attracting birds to wastewater stabilisation ponds.

The foregoing notwithstanding, the contractor and NWSC/DWD will have a contractual obligation to avoid impacts that may violate above conventions, wherever encountered.

4 ESIA METHODOLOGY

4.1 INTRODUCTION

This section describes the broad principles of methodology of the ESIA indicating approaches, practices and techniques used for impact identification, quantification, analysis and abatement. Impacts of the project were predicted in relation to environmental and social receptors and natural resources. This was accomplished by comparing prevailing conditions (“pre-project”) and “post-project” situations.

The requirement for environmental assessment in Uganda is set out by the National Environment Act (1995) and the Environmental Impact Assessment Regulations (1998). The process was guided by the EIA Guidelines (NEMA, 1997).

The methodology used consisted of a review of Uganda’s institutional arrangements, regulations and policies and those of the World Bank and World Health Organisation. Also done were baseline measurements, identification of impact receptors and their relation to project’s site; and consultations with various stakeholders. Other activities included data collection & analysis and review of engineering designs.

Impacts of the project were predicted in relation to environmental and social receptors and natural resources. This was accomplished by comparing prevailing conditions (“pre-project”) and “post-project” situations.

4.2 ESTABLISHMENT OF ENVIRONMENTAL & SOCIO-ECONOMIC BASELINE CONDITIONS

4.2.1 Physical Environment

Baseline water quality, air quality and noise levels were measured, not only to inform construction contractors about pre-construction conditions existing at proposed sites, but also the first annual environmental audit: subsequent baseline conditions would be those values measured in the first annual full environmental audit. These were determined through the following actions:

Air quality: Baseline air quality was measured using a pair of digital MX6 iBrid™ portable gas meters (Industrial Scientific-Oldham) and a Microdust 880nm digital aerosol monitor (Casella®) (Photo 1). Measurement points or locations were selected basing on presence of potential receptors.

Ambient noise: Baseline noise measurements were undertaken at locations around the proposed storage facility site with potential receptors. Measurement of ambient noise levels was carried out using a precision integrating sound level meter (Photo 2), with an active range of 0-140 decibels (dB) and complying with IEC 651 and ANSI S4 standards. A Casella CEL-621C digital noise logger was set to record for a sample period of ten minutes at each of the selected locations. The assessment procedure involved recording the LA_{MAX} and LA_{MIN} decibel levels. Measurement points were recorded using a GPS receiver and the noise sources together with the ambient environment at each location noted.



CASELLA Microdust meter



Digital 6-gas MX6 iBrid meter

Photo 3: Digital CASELLA microdust and 6-gas MX6 iBrid™ meters to be used to measure air quality



➤ Noise measurement will be done with a CASELLA CEL-621C2/K1 Integrating 1/3 Octave Band Sound Level Meter (Class2)

Photo 4: Noise measurement meter

Drinking water samples and surface water quality sampling was conducted along the river as well as upstream and downstream of the proposed facilities. Samples were stored at 4°C and the following day transported to NWSC laboratory at Bugolobi for biological and physiochemical analysis. In situ measurements were undertaken with a multi-probe water quality meter (HANNA HI 9828).

Sample Table: Expected water analysis results of the project

Sample No.	Parameters	Locations and nature of Water resource (e.g. river, swamp or springs)		Permissible limits as per DWD
1	pH			
2	Colour			
3	Turbidity			
4	Total dissolved solids (TDS) (mg/L)			
5	Total Hardness as CaCO ₃ (mg/L)			
6	Calcium as Ca (mg/L)			
7	Magnesium as Mg (mg/L)			
8	Chloride as Cl (mg/L)			
9	Sulphate as SO ₄ (mg/L)			
10	Nitrates as NO ₃ (mg/L)			
11	Iron as Fe (mg/L)			
12	Total Alkalinity (as CaCO ₃)			

Soil environment: Specific sites for soil sampling were earmarked in Mbale district in the project area along the proposed sewer line. For correct classification and understanding of the soils of the project area, soil profile description method was employed and the soil properties of all the horizons up to the parent material were described. This method involved exposing a profile by digging a 1.5m² area soil test pit with a depth of 1.5m or up to the parent material. The test pits were strategically sited to represent the areas within the project area. The sites were selected within the villages where the proposed sewer line is transecting and where other construction works have been planned. Four sites were selected in that respect as follows: at the proposed intake site (Makku Village, Bukiti parish, Bunyanya sub-county, Sironko District) at the reservoir site (Mukhubu village, Mooni Mukhubu Ward parish, Mutoto Sub-County, Mbale District) at the treatment plant (Zesui Village, Mukhubu Ward Parish, Wanale Division Sub-county, Mbale District) and along the sewer line (Bugembe village, Nabweya parish, Namanyonyi Sub-County, Mbale District). For each of the horizons in the profile, soil properties described included: depth of the horizon, boundary regularity and sharpness, moisture status, colour, texture, structure (degree of structural development and the shapes of the different soil peds), consistence, porosity, compactness, presence of fauna, drainage, roots distribution and size with their quantifying adjectives such as shape, nature, health and age. In addition, details of the vegetation, slope gradient and susceptibility to erosion around the samples area were recorded.



Photo 5: Characterization of soil test pits

Hydrological assessment: A rainfall runoff model SWAT was setup for project area. The main inputs to the model were land use/cover, soil, meteorological variables and slope ranges extracted from digital elevation model. A combination of the Land use/cover, soil type and slope ranges resulted into hydrological response unit for the estimation of the surface runoff yield for the catchment. The HRU were then reclassified based on the dominant combination of the soils, land use/cover and slopes. The delineation of existing conditions drainage catchments and graphical information relating to other parameters like slopes, length of longest path, sub-basin area were provided. Rainfall runoff simulations were based on the soil conservation service (SCS). A hydrologic model provided quantitative estimates of the mean annual, mean monthly and daily flows.

Environmental flow (EF) Approach: Uganda has no guidelines for determination for environmental flow. The Ministry of Water and Environment's Directorate of Water Resources Management hence advised the team to establish acceptable environmental flow based on the site-specific socio-environmental characteristics. Therefore, determination of environmental flow has been based on baseline aquatic flora

and fauna information and water needs by riparian communities for both domestic and livestock needs. Actual data of water user's consumption was not readily available; therefore, the minimum EF assumed that all the sub-counties bordering River Namatala depend on it for supply, which is considered a worst-case scenario. In absence of national guidelines, international practices were applied as discussed in the sections below. Appendix K and Section 5.3.1.3 include the methodology and calculation of the minimum EF for the Namatala River

Different Methodologies for the Assessment of Environmental Flow. There is no single best way to do an environmental flow assessment. The choice of methodology depends on the availability of resources, that is, data, time, funds, etc. The major criteria for determining environmental flows should include the conservation of the variability of the natural flow. Besides lack of national guidelines, the concept of environmental flows is complicated by the poor understanding of the relationship between river flows and river ecology. A database of various methodologies for environmental flow assessment, established in 2003, contains useful information on 134 methodologies with key references. This database is a valuable source of different environmental methodologies. The methodologies can be sorted by type, region or country where they have been applied.

There are four categories of environmental flow methodologies, which are recognized by most scientists in the environmental flow field (Tharme, 2008). These four levels are listed in Table 18.

Table 18: The four significant different types of environmental flow methodologies

Environmental Flows Methodology	Description
Hydrological (Desktop Estimates, Look Up Table)	<p>This is a simple and rapid method that uses hydrological data to derive the environmental flow requirement. A "minimum flow" often represents the flow intended to maintain the recommended river condition. Hydrological methodologies are generally used for the planning level and have been applied widely, both in developed and developing countries.</p> <p>These methods rely on examination of stream flow statistics and typically based on mean annual flow (MAF) or monthly median flows. The Tennant Method is the most widely used hydrological method.</p>
Hydraulic Rating (Rapid Determinations)	<p>These type of methodologies measure changes in various single river hydraulic variables (e.g. depth and velocity) to develop a simple relationship between biota habitat availability and river flow. A common methodology is the Wetted Perimeter Method, developed in Australia.</p>
Habitat Simulation (Habitat Rating, Expert Panels, Intermediate)	<p>The Habitat Simulation methodology provides links between discharge and available habitat conditions. It uses key target biota to predict habitat discharge curves or habitat time and exceedence services. PHABSIM, developed in U.S.A. is the most commonly applied methodology.</p>

Environmental Flows Methodology	Description
Holistic (Holistic Approaches, Frameworks, Comprehensive)	In a holistic approach all important flow characteristics (high floods, base flows, etc.) are identified. These methodologies incorporate hydrological, hydraulic and habitat simulation models. The Building Block Methodology (BBM) is a holistic methodology and was developed in South Africa.

EF determination for this project chose to use a hydrological method. They are often referred to as desktop models and rely primarily on the use of hydrological data, usually in the form of historical flow records. The results are often presented as a minimum required flow to maintain the ecological status at some acceptable level.

The Tennant Method (or Montana Method) and the Range of Variability Approach (RVA), both developed in USA are the most frequent used hydrological methods on a global perspective (Tharme, 2008). The Tennant Method (Tennant, 1976) differs from most other hydrological methodologies because it included expert opinions and detailed field studies when it was developed. Tennant findings are summarised as follows:

- a) 10% of the average flow is a minimum flow recommended to sustain short-term survival habitat for most aquatic life forms;
- b) 30% is recommended as a base flow to sustain good survival conditions for most aquatic forms and general recreation; and
- c) 60% provides excellent to outstanding habitat for most aquatic life forms and for the majority of recreational uses.

The Tennant's approach either uses mean annual discharge (MAD) or Median Monthly Flows for Determining Instream Flow Needs. The use of monthly median flows for recommending minimum instream flows is based on the principle that fish in a particular stream have adapted to the historic streamflow regime, which, at least for base flows, is best defined by median rather than mean flows.

In determining the environmental flow for this project, a key guiding principle was to ensure that there is no risk of critical lack of water in the river even during low flows to ensure the sustenance of river health and aquatic life therein as well as downstream water users. This is because even if higher flows ensued after a period of flows that are below *environmental flows*, irreparable damage would already have occurred (due to lack of water or drying up of aquatic habitats. This situation needs to be avoided by both design and operation of the proposed project.

4.2.2 Biological Environment

a) Terrestrial flora

Specific points along each pipeline were identified for vegetation and flora studies. All these sample sites were geo-referenced producing a baseline of information on the basis of which future impacts could be evaluated. Characterization of the project area was based on the floristic, and landscape features observed at the different sites. The sample points were effectually random points along the proposed pipeline and existing community roads.

The area traversed by water pipeline is relatively large and traverses largely through built up environment, extensive subsistence farmland including coffee and banana plantation, and seasonal and permanent wetlands including Lwabi and Nakwasi wetland system. The pipeline area negotiates steep slopes, valley bottoms and flat lands but it largely follows the river course in many places. Ninety five percent (95%) of the natural vegetation stands have therefore been modified for settlement and agricultural purposes and as such vegetation cover is already of a modified state. This was done to provide information necessary for ascertaining species richness and diversity; identifying species of conservation concern (in terms of range restriction, rarity and threat), identify ecologically sensitive sites, altered habitats as well as providing a quick review of vegetation and flora assemblages at the proposed site.

During the course of vegetation and flora baseline studies, data were sourced from possible areas through desk-based studies. These reinforced findings of the field surveys conducted from the proposed site for pipeline development. The field survey was conducted in July 2015 to collect further site-specific information on habitats and species presence. Global Positioning System (GPS) units were used to record the geographical coordinates of the survey locations. The vegetation specialist traversed the proposed site making points of interest depending on the set objectives. Photographs were taken and notes made at each different point of interest to record the habitat and species of flora as well as landscape features of importance.

Species richness, abundance, invasive, and sensitive habitat were investigated. Sensitivity of habitats was assessed from presence of i) threatened taxa in accordance to IUCN conservation assessment, ii) rarity, iii) endemism; presence of: iv) fragile watersheds, v) steep slopes, and vi) riparian areas.

Transect: During the actual field surveys, records of the features of the landscape and environment including the dominant habitats and common species within the survey area, were made along transects. A transect method was used to sample the vegetation and flora in the proposed pipeline areas from the three pipelines. Vegetation types traversed by each transect was identified. Along each transect estimation of species abundance on DAFOR scale, presence of disturbances, signs of usability and presences of invasive species were made at determined points in a space of 20 m radius. Opportunistic recording of species not recorded at the regular survey locations was done in between survey locations. The three transects were designed to follow the 3 pipelines as designed.

The vegetative communities in the study area were classified using the Langdale-Brown et al. (1964) system. This system recognizes 22 ecosystem types, identified by letters between A to Z. Although the Langdale-Brown (L-B) system is now 50 years old, it was used in preference to the more recent National Biomass Study (1996) for several reasons as indicated by Van Breugelet *et al.* (2011). The L-B system is based on plant community composition rather than just plant biomass, which was more relevant to the goal of characterizing vegetation and identifying sensitive habitats. Secondly, although much of Uganda's vegetation has been extensively altered over the past few decades the L-B system can still be considered to represent the potential of an area to support an ecosystem type, which is relevant for a study of environmental impacts (Kalema J, et al., 2010, Pomeroy D, et al., 2002). Finally the L-B system provides 22 vegetative categories compared to the 13 adopted by the National Biomass System (USAID 2014), this greater level of resolution allows us to assess the potential impacts of water development project on ecosystems at a finer scale.

b) Terrestrial fauna

Herpetiles: Field data was obtained by conducting a survey of amphibians and reptiles in and around Mbale and Butalejja water pipeline project area. Various methods i.e. Visual Encounter Surveys, opportunistic surveys and local consultations were used. The species were identified, counted and recorded. The conservation status of the herpetofauna is reported using the IUCN Red Listing (IUCN 2014).

Visual Encounter Surveys (VES) - This method involved walking through the study areas or habitats for a prescribed time period systematically searching for amphibians turning logs or stones, inspecting retreats, watching out for surface-active species and listening out for frog calls. Visual encounter survey method is commonly used to determine the species richness of an area, to compile a species list and to estimate relative abundances of species within an assemblage.

Opportunistic Encounters - This method involves recording any amphibian or reptilian species encountered anywhere and at any time within the study area, or brought in / reported by local people. Opportunistic searches were used to maximize the number of species encountered in the study area.

Local Consultations - Local people are a valuable source of information since they are constantly in touch with their environment; they encounter amphibians and reptiles of different kinds as they carry out their daily activities. We talked to some local people who informed us about the availability of some species of reptiles and amphibians. Some of the records were later confirmed by encountering some of them in the field. The reptiles and amphibians were identified using standard reference books available namely; Schiotz (1972) and Drewes (2006).

Mammals: These are some of the principal biodiversity components of great importance in environmental assessment and conservation planning. They are often used as indicators of environmental health and continue to be of great value in conservation decision making. This is largely due to their ecological importance (as regulators of food chain, seed dispersers, regulators of communities of plants and other animals etc.) and economic importance as food sources, tourist attractions, and disease vectors among others. They are included in the environmental impact assessment studies of the impending water development works as part of the Mbale water and sanitation project. This report among other things outlines the results of a mammal survey conducted as part of the latter project.

Village transects and Consultations - A reconnaissance tour around the project area was conducted to identify areas of conservation importance and those suitable for sampling. In this effect a drive through was conducted and no site was identified as being a critical mammal habitat. Transects were moved through the villages on foot to identify any prospects of mammal presence (especially through foot prints and dung deposition) and to consult the local people. The consultations basically involved asking local people of the animals they encounter in their day to day activities. Respondents were picked randomly and responses from all were collated to generate one species list for the area.

Opportunistic encounters - This involves opportunistic sightings while moving through the project area. These records are ideally not from designated sampling areas but within the larger project area. They are essential in enriching the species list of the project area. While moving through the villages, different animals were opportunistically encountered.

Birds: Site species composition was managed by Timed Species Count (TSC) method (Pomeroy 1992), where all species positively identified were listed in order seen or heard. For each site each TSC lasted for 40 minutes. To make the count, we moved slowly around the study sites listing any species which were anywhere within the site, regardless of how far away from the transect, species flying over the transect were also recorded. Along each count, predominant vegetation type of the habitat was recorded

Twelve sites were randomly and or purposively selected basing on habit type and expected species abundance and richness. Four were predominantly wetland sites (Doho rice scheme, Bugema, Manafwa and Busolwe). Whereas eight sites were predominantly agricultural and these include; Namatale, Kama-lower, Makhosi, Bungukho, Buwaki, Makudui, Mooni and Kifuluriro.

c) Aquatic flora and fauna

Phytoplankton: Phytoplankton was determined in terms of cell density and bio volume using an Inverted Microscope and Modified Utermohl. Sedimentation Technique using (Hasle 1978) in terms of Cells /ml and converted to cell/l.

An integrated water column sampler was used to collect phytoplankton. A large plastic container (20 L) was filled using the integrated water sampler. The composite sampler was mixed and a pre-labelled 125-ml amber bottle was manually immersed into the container. The bottle was labelled with the date, station ID, sample type, replicate number, and preservative type. The sample was immediately preserved with 2-ml Lugol's solution per 100-ml of sample (Vollenweider 1974) and stored in the dark.

Phytoplankton was counted using the inverted microscope procedure of Utermohl as described by Lund et al. (1958). Sub-samples were settled for at least 24 hours in a sedimentation chamber prior to counting. Replicate areas were enumerated at a magnification of no less than 500X (Lund et al. 1958). For enumeration of rare, large taxa, the entire chamber was subsequently scanned and counted at low magnification. Results were expressed as cells/ml and then converted to Cells/L using appropriate geometric formulae (Downing and Rigler 1984) for all algal taxa.

Zoo plankton: The total zooplankton volume was determined by the displacement volume method. In this method the zooplankton sample was filtered through a piece of clean, dried netting material. The mesh size of netting material was 20 micron metre mesh size of the net used for collecting the samples. The interstitial water between the organisms was removed with the blotting paper. The filtered zooplankton was then transferred with a spatula to a measuring cylinder with a known volume of 75% ethanol. The displacement volume is obtained by recording the volume of fixative in the measuring jar displaced by the zooplankton. The settled volume was obtained by making the sample to a known volume in the measuring jar. The plankton was allowed to settle for at least 24 hours before recording the settled volume.

Fish: Information on the fish species was mainly obtained from the District Fisheries Officer and no fish was trapped during the field surveys.

4.2.3 Social Environment

A detailed social impact assessment and evaluation of the positive and negative, direct and indirect, immediate and long term, and permanent and temporary impacts due to the construction and operation

of water and sanitation facilities and associated works was carried out. Assessment of the impacts identified in either qualitative or quantitative terms, according to their inherent nature and the availability of adequate data to enable predictive analysis has been undertaken and incorporated into this report under Impacts Section Chapter 6.

4.3 CULTURAL HERITAGE

The study involved a desktop study of the history of the area. A study of the main ethnic groups in the project area namely the Bagisu, Bagwere and the Banyole was undertaken. Lastly fieldwork on the supply pipeline from Namatala river intake to Bungokho water treatment plant plus the survey of the water supply route Mbale- Budakaa – Tirinyi and the survey of the proposed water supply route Mbale-Busolwe –Butaleja. The survey investigated the presence of physical cultural resources which could be affected by the project. The study was conducted by David Kalanzi a Cultural Heritage Consultant.

4.4 CONSULTATION AND PROJECT DISCLOSURE

Relevant and adequate project information was provided to stakeholders to enable them to understand project risks, impacts and opportunities. Stakeholder consultation aimed at:

- Generating understanding of the project
- Understanding local expectations of the project
- Characterising potential environmental, socio-economic impacts
- Garnering consensus on mitigation options

The following techniques were used:

- Face-to-face or telephone interviews
- Data and literature review
- Email consultation correspondences

Consultative meetings were held with Mbale, Budaka, Kibuku and Butaleja District Local Government officials and Mbale Municipality officials, and the project-affected communities.

4.5 REVIEW OF POLICY, REGULATIONS, INSTITUTIONAL FRAMEWORK & INTERNATIONAL GUIDELINES

This was done to determine if the proposed project was in line with national policies and met environmental laws and regulations, to achieve this, the following actions were undertaken:

- i) Review of national environmental laws, policies and institutional framework.
- ii) Review of World Bank Group (IDA is one of the 5 World Bank Group member organizations) guidelines on environment.

4.6 IMPACT IDENTIFICATION AND ANALYSIS

4.6.1 Impact Description

Describing a potential impact involved an appraisal of its characteristics, together with the attributes of the receiving environment. Relevant impact characteristics included whether the impact is:

- Adverse or beneficial;
- Direct or indirect;
- Short, medium, or long-term in duration; and permanent or temporary;
- Affecting a local, regional or global scale; including trans-boundary; and
- Cumulative (such an impact results from the aggregated effect of more than one project occurring at the same time, or the aggregated effect of sequential projects. A cumulative impact is “the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions”).

Each of these characteristics is addressed for each impact. Consideration of the above gives a sense of the relative **intensity** of the impact. The **sensitivity** of the receiving environment was determined by specialists based on the baseline data collected during the study.

4.6.2 Impact Evaluation

Each impact is evaluated using the criteria listed in Table 19. To provide a relative illustration of impact severity, it is useful to assign numerical or relative descriptors to the impact intensity and receptor sensitivity for each potential impact. Each is assigned a numerical descriptor of 1, 2, 3, or 4, equivalent to very low, low, medium or high. The severity of impact was then indicated by the product of the two numerical descriptors, with severity being described as negligible, minor, moderate or major, as illustrated in Table 21. This is a qualitative method designed to provide a broad ranking of the different impacts of a project. Illustrations of the types of impact that were assigned the different grades of severity are given in Table 22.

Table 19: Classification of impact evaluation

	Classification	Description
1	Extent:	Evaluation of the area of occurrence/influence by the impact on the subject environment; whether the impact will occur on site, in a limited area (within 2 km radius of the site); locally (within 5 km radius of the site); regionally (district wide, nationally or internationally).
2	Persistence/Duration:	Evaluation of the duration of impact on the subject environment, whether the impact was temporary (<1 year); short term (1 – 5 years); medium term (5 – 10 years); long term (>10); or permanent.
3	Social Context / Sensitivity or Potential for Stakeholder Conflict:	Assessment of the impacts for sensitive receptors in terms of ecological, social sensitivity and such things as rare and endangered species, unusual and vulnerable environments, architecture, social or cultural setting, major potential for stakeholder conflicts. The sensitivity classification is shown below: High sensitivity: Entire community displacement, destruction of world heritage and important cultural sites, large scale stakeholder conflict, etc. Medium sensitivity: Displacement of some households, moderate level of stakeholder concern Low sensitivity: No displacements, no potential for stakeholder conflict.
4	Regulatory and Legal Compliance:	Evaluation of the impact against Local and International legislative requirements. High: Prohibition terms for specific activities/emissions. Major breach of regulatory requirements resulting in potential prosecution or significant project approval delays.

	Classification	Description
		Medium: Potential breach of specific regulatory consent limits resulting in non-compliance. Low: No breach of specific regulatory consent limits anticipated.
5	Overall Impact rating (Severity):	Using a combination of the above criteria, the overall severity of the impact was assigned a rating Severe, Substantial, Moderate, Minor and negligible. Refer to Table 21 for broad categories of impact for each rating. Note: These are just guidelines that will constitute professional judgement required in each individual case.

4.6.3 Intensity of Impact

The scale of intensity is defined on the basis of ecological-toxicological studies and expert judgment and is presented in Table 20.

4.6.4 Impact Significance

Impact significance is determined from an impact significance matrix (Table 21) which compares severity of the impact with probability of its occurrence. Impact significance criteria are as follows:

Table 20: Intensity scale gradation for environmental impacts

Scale of Impact Intensity	Criterion	Score
Very low	Environmental changes are within the existing limits of natural variations	1
Low	Environmental changes exceed the existing limits of natural variations. Natural environment is completely self-recoverable.	2
Medium	Environmental changes exceed the existing limits of natural variations and results in damage to the separate environmental components.. Natural environment is remains self-recoverable.	3
High	Environmental changes result in significant disturbance to particular environmental components and ecosystems. Certain environmental components lose self-recovering ability.	4

Table 21: Determination of impact severity

		Sensitivity of receptor			
		Very low	Low	Medium	High
		1	2	3	4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

- **Major:** These denote that the impact is unacceptable and further mitigation measures must be implemented to reduce the significance. Shaded red in the Table 22.

- **Moderate:** Impacts in this region are considered tolerable but efforts must be made to reduce the impact to levels that are as low as reasonably practical. Shaded orange in the impact significance matrix.
- **Minor:** Impacts in this region are considered acceptable. Shaded blue.
- **Negligible:** Impacts in this region are almost not felt. Shaded green.

4.7 CUMULATIVE IMPACTS

Cumulative effects manifest when socio-environmental conditions are already or will be affected by past or reasonably probable future development or activities. The ESIA identified current, past and probable future similar activities that may compound socio-environmental conditions in the project area.

4.8 MITIGATION OF ENVIRONMENTAL IMPACTS

Mitigation measures are designed in order to avoid, reduce, mitigate, or compensate for adverse environmental and social impacts and inform the Environmental and Social Management Plan (ESMP).

Table 22: Illustration of significance values that would apply to various impacts

	Major impact	Moderate impact	Minor
Legislative compliance	Expected non-compliance with national regulatory standards or good industry practice (e.g. IFC Performance Standards)	Potential for non-compliance with national regulatory standards or good industry practice.	Expected compliance with national regulatory standards or good industry practice, or no regulations apply
Biophysical environment	<ul style="list-style-type: none"> ▪ Impairment of ecosystem with no expectation of recovery within 20 years. ▪ Effect contrary to the objectives of management plans for internationally or nationally protected populations, habitats or sites with no expectation of recovery within 5 years. ▪ Environmental changes giving rise to issues of public or international concern. Impacts that harm human health, or damage a site of historic, cultural or archaeological value. ▪ Long-term (>10 years) and widespread changes to habitat or ecosystems features or functions that reduce its integrity, affect the ability to sustain valued components and may require extensive intervention. The habitat/ecosystem may not recover to its baseline state. ▪ Disturbance of a sufficient portion of the biogeographic population of a species to cause a decline in abundance, distribution or size of the genetic pool such that the population of the species, and other species dependent on it, will not recover naturally to former levels. ▪ Major loss or major alteration to an internationally designated site whereby key elements will be fundamentally changed. 	<ul style="list-style-type: none"> ▪ Impairment of ecosystem with expectation of recovery within 10 years. ▪ Effect contrary to the objectives of management plans for internationally or nationally protected populations, habitats or sites with expectation of recovery within 1-5 years. ▪ Disturbance of a sufficient portion of the biogeographic population of a species to cause a decline in abundance, distribution or size of the genetic pool such that the population of the species, and other species dependent on it, will not recover within several generations. ▪ Major loss or major alteration to a locally designated site whereby key elements will be fundamentally changed. ▪ Injury or death of an IUCN listed "Vulnerable" species. ▪ Incident that requires mobilization of national/company response equipment. ▪ Major change to the visual quality, setting and feeling associated with a rare or unique locally recognized landscape. ▪ Fundamental change to hydrology and hydrogeology resulting in temporal changes to the watershed. 	<ul style="list-style-type: none"> ▪ Impairment of Forest ecosystem with expectation of recovery within 5 years. ▪ Ecosystem change is within the range of natural variation, but may be detectable; or ecosystem change that is unlikely to be noticed; or change resulting in positive, desirable or beneficial effects on an ecosystem. ▪ Reduction in ecosystem or habitat integrity, but recovery to baseline state is expected within 2-5 years with minimal intervention. ▪ Disturbance of a bio-geographic population or individuals of a species resulting in a decline in abundance or distribution over one or two generations, but that does not change the integrity of the population of the species or populations of other dependent species. ▪ Incident that requires mobilization of onsite response equipment and crews. ▪ A noticeable but not fundamental change to hydrology or hydrogeology. ▪ The development will not affect the key characteristics that contribute to the distinctiveness and/or value of the landscape.

	Major impact	Moderate impact	Minor
	<ul style="list-style-type: none"> ▪ Incident that requires mobilization of international response equipment and crews. ▪ Injury or death of an IUCN listed "Endangered" species. ▪ Major change to the visual quality, setting and feeling associated with a rare or unique (inter)nationally recognized landscape. ▪ Widespread and permanent change to hydrology and hydrogeology in an internationally or nationally designated site. 		
Social environment	<ul style="list-style-type: none"> ▪ Damage to social, cultural or economic activity considerably beyond programme lifetime. ▪ Long term or life threatening health effects that may increase mortality rates. ▪ Physical resettlement (as defined in IFC PS 5) of a community. ▪ Changes that differentially negatively affects the life chances (access to health care/medicines) of vulnerable groups (disabled, elderly, female-headed households and those living below official poverty or subsistence levels). ▪ Damage to a site of international cultural importance or national site where damage is likely to provoke protest/unrest. ▪ Damage to a site of national cultural importance or local site where damage is likely to provoke protest/unrest. ▪ Unplanned in-migration flows sufficient to cause exceedance of the capacity of numerous components of physical or social infrastructure. 	<ul style="list-style-type: none"> ▪ May adversely affect the economic and social wellbeing of residents for the duration of the programme. ▪ Raises issues of limited public concern. ▪ Physical resettlement (as defined in IFC PS 5) one or more household/businesses. ▪ Reduction in assets, or access to assets, such that economic displacement (as defined in IFC PS 5) affects five or more individuals, households or businesses. ▪ Job losses in small communities very limited alternative opportunities in the near – medium term (within one year of job losses). ▪ Changes likely to prejudice success of an existing policy or plan. ▪ Changes that differentially affects the livelihoods of vulnerable groups (disabled, elderly, female-headed households and those living below poverty or subsistence levels). ▪ Damage to a site of local or regional cultural importance. ▪ Medium to long-term (>1 year) financial loss to businesses where recovery may be difficult. 	<ul style="list-style-type: none"> ▪ Negative effect within existing fluctuation of the society or economy. ▪ Reduction in assets, or access to assets, such that economic displacement (as defined in IFC PS 5) affects 1-4 individuals, households or businesses. ▪ Job losses in a community able to adapt and provide alternative job opportunities in the near – medium term (within one year). ▪ Short-term (<1 year) financial loss to owners of businesses where recovery is likely. ▪ Unplanned in-migration not expected to cause infrastructure capacity exceedance. ▪ Decline in access to health care facilities and acquisition of treatment.

	Major impact	Moderate impact	Minor
	<ul style="list-style-type: none"> Increases of cultural conflict likely not to be contained within existing social control norms. 	<ul style="list-style-type: none"> Unplanned in-migration flows sufficient to cause exceedance of the capacity of at least one component of infrastructure. Increases in incidences of cultural conflict, but expected to be contained within existing social control norms. Movement of development traffic through very sensitive areas (e.g. near schools, hospitals) or that may exceed carrying capacity of roads. Movement of development traffic through community areas or having the potential to add unsuitable loadings to the infrastructure. Increased public exposure to health threats that may increase morbidity rates. 	

5 ENVIRONMENTAL AND SOCIO-ECONOMIC BASELINE

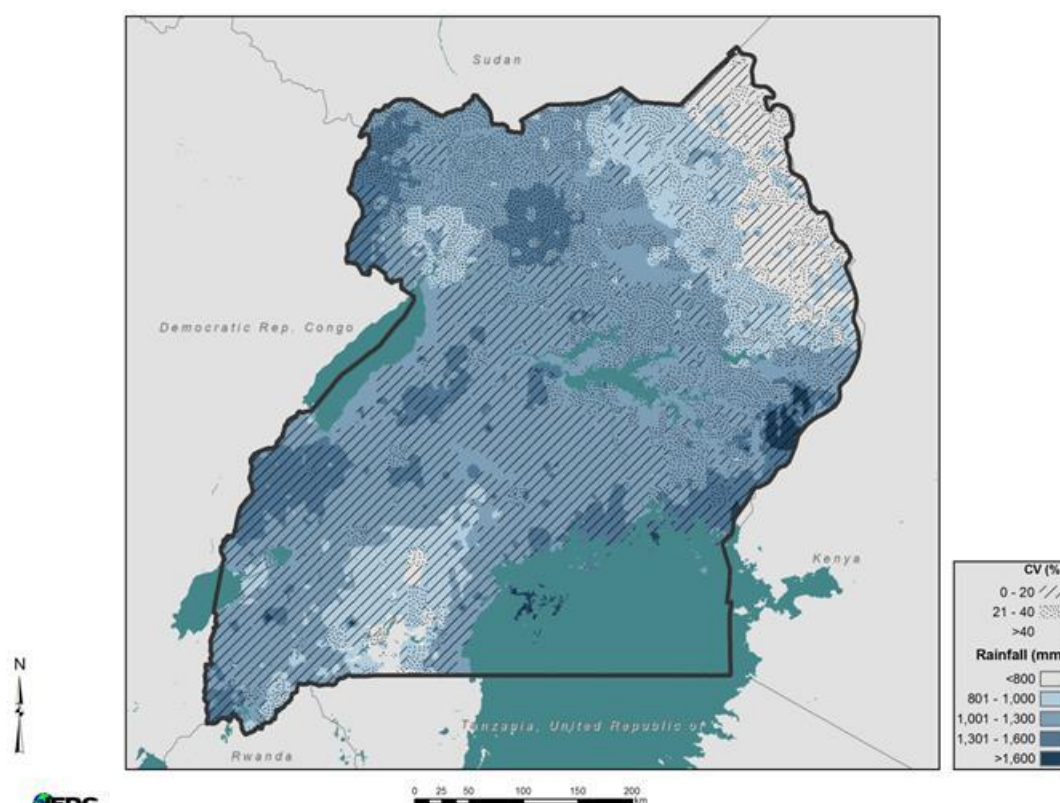
This Chapter describes the environmental and socio-economic baseline conditions in the proposed project area in which the proposed water supply and sanitation project is to be located and in which impacts may be experienced, that is, Mbale, Budaka, Tirinyi, Kibuku, Kadama and Busolwe. A detailed socio-environmental baseline assessment will be done during the ESIA but sections below provide preliminary site investigations and observations made during the scoping exercise. A baseline overview of conditions in project districts is provided first to give context to observations made during the scoping study. The proposed project will be located in the districts of Mbale, Budaka, Kibuku, and Butaleja.

5.1 MBALE DISTRICT

5.1.1 Environmental Profile

5.1.1.1 Climate

The climate of Mbale is influenced by its proximity to the equator and its position at the foot of Wanale Ridge. The climate is warm and humid without extremes; with temperatures ranging from 23 – 25°C. Rainfall is fairly distributed ranging between 1250 mm and 1750 mm per year (Figure 38).



Source: IFDC (www.amitsa.org)

Figure 38 Distribution of annual rainfall in Uganda

5.1.1.2 Geology, geomorphology and soils

Mbale has gentle hills and valleys covering a geographical area of 24.35 sq. km. Its relief varies from 1212 m above sea level in the South Eastern Border region to 1080 m above sea level, in the west. The

soils of Mbale municipality are largely of the formalistic gneiss that is in the last stages of tropical weathering. Their volcanic nature renders them fertile for support of plant life. The larger part of the municipality is developed given the firm and stable nature of complex basement rendering it ideal for the development of housing to the high density settlement. The types of soils in Mbale District and the Municipality are presented in Figure 39.

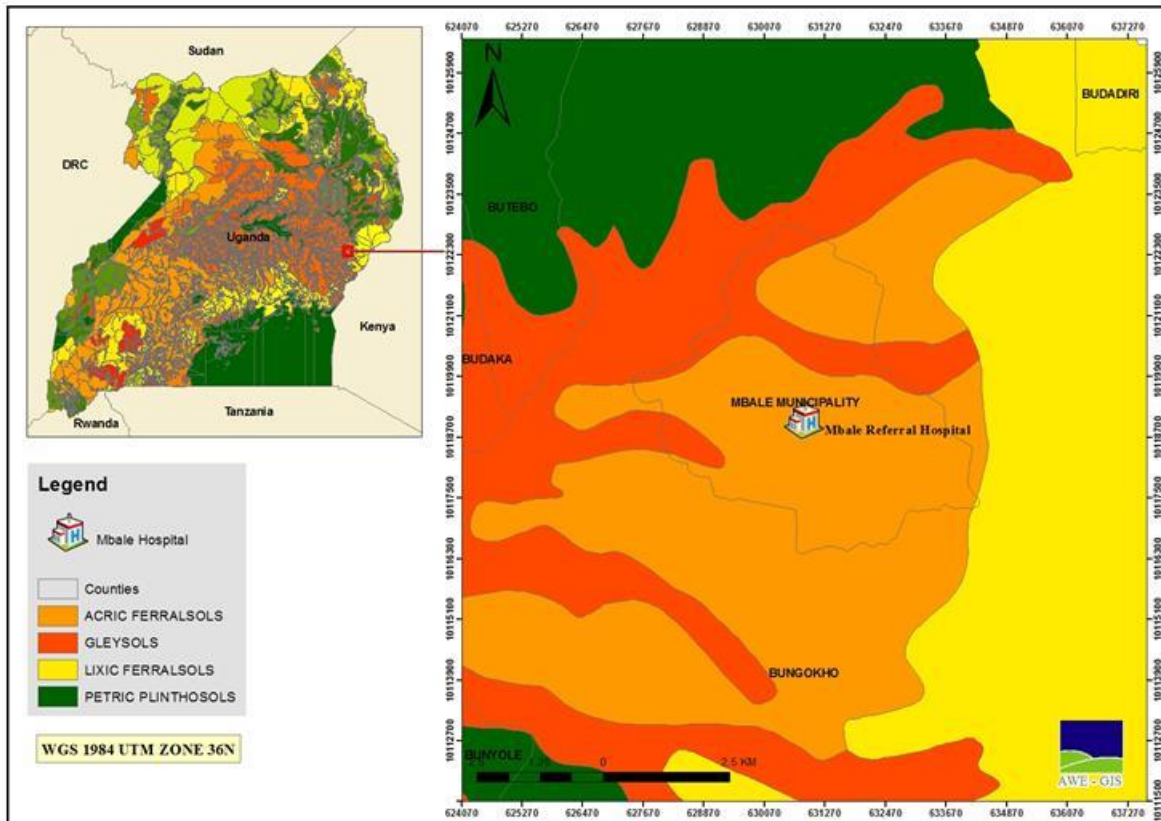


Figure 39 Types of soils in Mbale District and Municipality

5.1.1.3 Water resources and drainage

The municipality is drained from east to west by three major rivers that have their sources on Wanale Ridge. River Nashibiso and its tributary Napwoli drain into the southern part of the town. These are bound by an extensive plain under forest reserve management. River Nabiyonga and its major tributary Namatala drain across the northern area of the town. Several primary and secondary drains have been developed to originate from within the town area and drain into these rivers. All the mentioned rivers drain into River Namatala which forms the north-west boundary of Mbale Municipality. Rivers in the project are presented in Figure 40.

Four main rivers for raw water supply within this project area have been identified. The rivers Nabijo, Nabuyonga and Manafwa are currently used for water supply, while the River Namatala offers a further possibility for gravity raw water supply. The output of this assessment can support the decision for the best strategy of water supply within this project. For River Namatala the consultant received data of hydrological flows from 1990 to 2014 (Gauging Station 82212 and 82213), while data for Nabuyonga (Gauging Station 82248) is available from 1972-1996. No data exists for the Nabijo River, because no gauging station has been constructed for this stream.



Figure 40 Water resources in the Mbale project area

5.1.2 Socio-economic and Land Use Activities

5.1.2.1 Administrative units

Mbale District has 1 municipality with 3 divisions, 4 counties with 31 sub-counties, 148 parishes and 1448 villages (Table 23). Mbale Municipality is comprised of three Divisions namely: Northern, Industrial and Wanale (Figure 41). The divisions of the Municipality are further subdivided into Wards and Cells as indicated in Table 24. The proposed project will be located in both counties of the district with the largest component in Mbale Municipality.

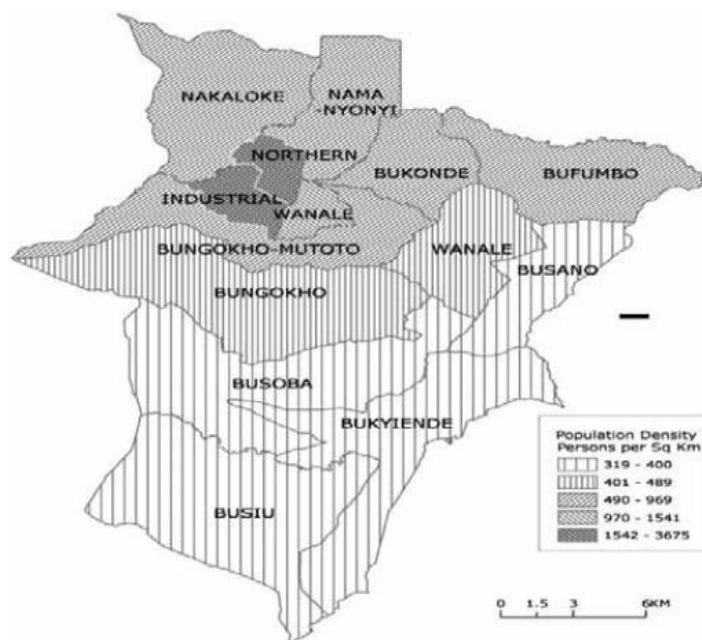


Figure 41 Administrative boundaries of Mbale district and the location of the Municipality

Table 23: Mbale District Administrative Units

County Name	Sub-County	Parish	Number of Villages/Cells
BUNGOKHO	Bubyanu	10	57
	Budwale	4	23
	Bufumbo	7	45
	Bukasakya	5	22
	Bukonde	7	66
	Bukyiende	4	66
	Bumasikye	4	31
	Bumbobi	4	25
	Bungokho	5	38
	Bungokho-mutoto	6	43
	Busano	4	44
	Busiu	6	44
	Busoba	4	60
	Lukhonje	4	36
	Lwasso	4	27
	Nakaloke SC	4	32

County Name	Sub-County	Parish	Number of Villages/Cells
	Nakaloke Town Council	7	30
	Namanyonyi	4	48
	Nyondo	4	33
	Wanale	5	43
MBALE MUNICIPALITY	Industrial Division	4	35
	Northern Division	5	39
	Wanale Division	3	25
Total	23	114	912

Source: District Planning Unit, Mbale 2012

Table 24: Wards and cells in Mbale Municipality

Divisions	Wards	Cells
Wanale	Boma	Masaba, Union, Elgon, Nakhupa, Bungokho, Fairway, Bukwa, Nabigyo and Wanale
	Busamaga West	Nabweya, Health Centre, Mosque and Bumboi
	Busamaga East	Nampanga, Butandiga, Namalogo and Namatsyo
	Mukhubu	Isebele, Sawa, Shiende and Zesui
	Mooni	Namubiru, Mutoto, Nashibiso and Nagudi
Northern	Nabuyonga	Sebei, Buwalasi, Kichafu, Kisenyi, Mulembe and Magezi
	Nkoma	Busajja, Hygiene, Buyonjo, Bujoloto, Gangama, Senkulu, Wanambwa and Nambozo
	North Central	Hospital, Clock Tower, Duka, North Road, Byasala, Uhuru, Pesa and Nkokonjeru
	Namakwekwe	Nabigyo, Link Road, Bufumbo, Mission, Kachumbala, Gudoi, Mugisu, Kiteso, Bulago, College and Mpumude
	University	Staff, Sheraton, Northern and Village
Industrial	South Central	St. Andrew's, Wasike, Naboa, Republic Street, Foods, Lwakhakha, Park, Police, Kale and Cathedral
	Masaba	Butaleja, Bumasifa, Pallisa, Malawa, Bugwere and Temuteo Mukasa
	Malukhu	Sironko, Busano, Majanga, Wanyera, Muti, Primary and Muyembe
	Namatala	Somero, Mvule, Sisye, Nyanza, Wandawa, Doko, Bubirabi and Kiduda

5.1.2.2 Employment

Mbale is strategically located in Uganda which makes it attractive and competitive. It is surrounded by a rich agricultural region which provides the Municipality with agricultural produce. Its close location to Kenya provides the town with opportunities for various economic activities and trans-border trade. However, the informal sector is the major source of employment for the residents of Mbale. The sector consists of small entrepreneurs and people with flexible but non-permanent employment, although a large number of entrepreneurs are not registered with any authority. The lack of opportunities for formal sector employment and the decline in minimum wage has led to the growth of the informal sector whose activities are largely unmeasured, unregulated and unaccounted for (UN-Habitat, 2012). The main economic activities carried out in Mbale include trade, transport services such as transport on motor cycles (boda-bodas), telecommunication services, restaurants, lodges and hotel services, and food processing industries. In slum areas however, there are high levels of unemployment, especially among the youth.

5.1.2.3 Population and demographic characteristics

The estimated population of Mbale District is 492,804 as per 2014 census (Table 25) of which 237,610 are males and 255,194 females. The rural population was estimated at 369,083 persons while the urban population stood at 123,721 persons implying that the largest proportion of the population is rural. Currently the average population growth rate is 2.5 while that of the country is 3.03 (UBOS, 2014). The population of Mbale Municipality is distributed in the three divisions with the largest, most populous and economically most prosperous being Industrial Division. The large population in Industrial Division is attributed to the large population of immigrants as compared to Wanale Division, which is predominately a residential area comprising mainly Senior Quarters. Industrial Division is also the location of most industrial setups in the municipality and covers the busiest parts of the central business district. This explains its relatively high population.

Table 25: Current Population in Mbale District

County	Sub-County	Number of households	Average size of household	Male	Female	Total Population
Bungokho	Bubyangu	4,274	4.9	10,114	10,783	20,897
	Budwale	1,575	4.9	3,838	3,919	7,757
	Bufumbo	3117	5.5	8,107	8,945	17,052
	Bukasakya	7,802	4.2	15,888	17,096	32,984
	Bukhiende	4,708	4.7	10,765	11,407	22,172
	Bukonde	3,958	4.9	9,288	9,983	19,271
	Bumasikye	2,497	4.8	5,856	6,258	12,114
	Bumbobi	3,454	4.6	7,620	8,176	12,796
	Bungokho	6,277	4.5	13,475	14,628	28,103
	Bungokho Mutoto	8,255	4.2	16,904	17,843	34,747
	Busano	3,132	4.7	7,305	7,432	14,737
	Busiu	5,058	4.7	11,675	12,177	23,852
	Busoba	4,596	4.7	10,511	11,329	21,840
	Lukhonge	2,065	4.7	4,755	5,027	9,782
	Lwasso	1,712	5.3	4,475	4,550	9,025
	Nakaloke	4,553	4.9	10,747	11,947	22,694
	Nakaloke TC	5,661	4.8	12,994	14,538	27,532
	Namanyonyi	6,736	4.5	14,971	15,741	30,712
	Nyondo	2,529	4.7	5,881	6,406	12,287
	Wanale	2,699	4.9	6,510	6,751	13,261
Mbale Municipality	Industrial Division	10,722	3.8	20,638	21,672	42,310
	Northern Division	10,546	3.4	18,440	20,636	39,076
	Wanale Division	3,606	4.0	6,853	7,950	14,803

Source: UBOS, 2014

5.1.2.4 Healthcare services

There are a number of health institutions in Mbale Municipality, with the Mbale Regional Hospital being the largest and serving as a referral hospital for the eastern region of Uganda. Other health institutions include the CURE Hospital for specialized orthopaedic services, the Ahamadiya Hospital, the Municipal

Health Centre, Namakwekwe Maternity Centre and Namatala Health Centre IV. Private clinics, First Aid posts and drug shops are fairly distributed in the municipality.

5.1.2.5 Level of education and literacy

Educational institutions are many, ranging from nursery, primary, and secondary schools to higher institutions of learning, which vary from privately owned to Government institutions. Most of these institutions are found in the Northern Division, while the rest are in Wanale Division. The major higher institutions of learning include: the Islamic University in Uganda, the School of Clinical Officers, and the Mbale School of Hygiene. Others include Mbale Secondary School believed to be one of the oldest schools in Eastern Uganda. The literacy level is at 67.4 percent.

5.1.2.6 Land use activities and tenure

The land use in the catchment Areas is mainly subject to highly cultivated land. Only patches of the former dense forests in the catchment areas at the slopes of Mount Elgon remained, due to population pressure and subsequent impacts of economic activities and agriculture. Main land use activities are based on subsistence agriculture for crops such as bananas, potatoes, beans, cabbage, cassavas, maize, beans or nuts. Other agricultural activities include livestock farming, apiculture or forestry. Apart from coffee production, forestry of Eucalyptus is commonly practiced for timber, firewood and charcoal production. Other economic activities include mining, such as for sand and stones, as well as brick making.



Photo 6: Cultivation activities along the banks of River Namatala

Land tenure is under customary and freehold system and the municipality has no control over land use because of the customary nature of land tenure. The privatization/ liberalization of the economy has led to the growth of buildings and structures, many of which are built without following the environmental and zoning guidelines. Slums have mushroomed uncontrolled, further contributing to the degradation of land. The lack of basic social amenities in some areas has led to increased development in areas that have access to the basic social amenities such as water, sewer lines and electricity; this has led to overcrowding in certain parts of the town. Over-population and land shortage is forcing people to encroach on flood plains, road reserves, drainage channels, and public land.

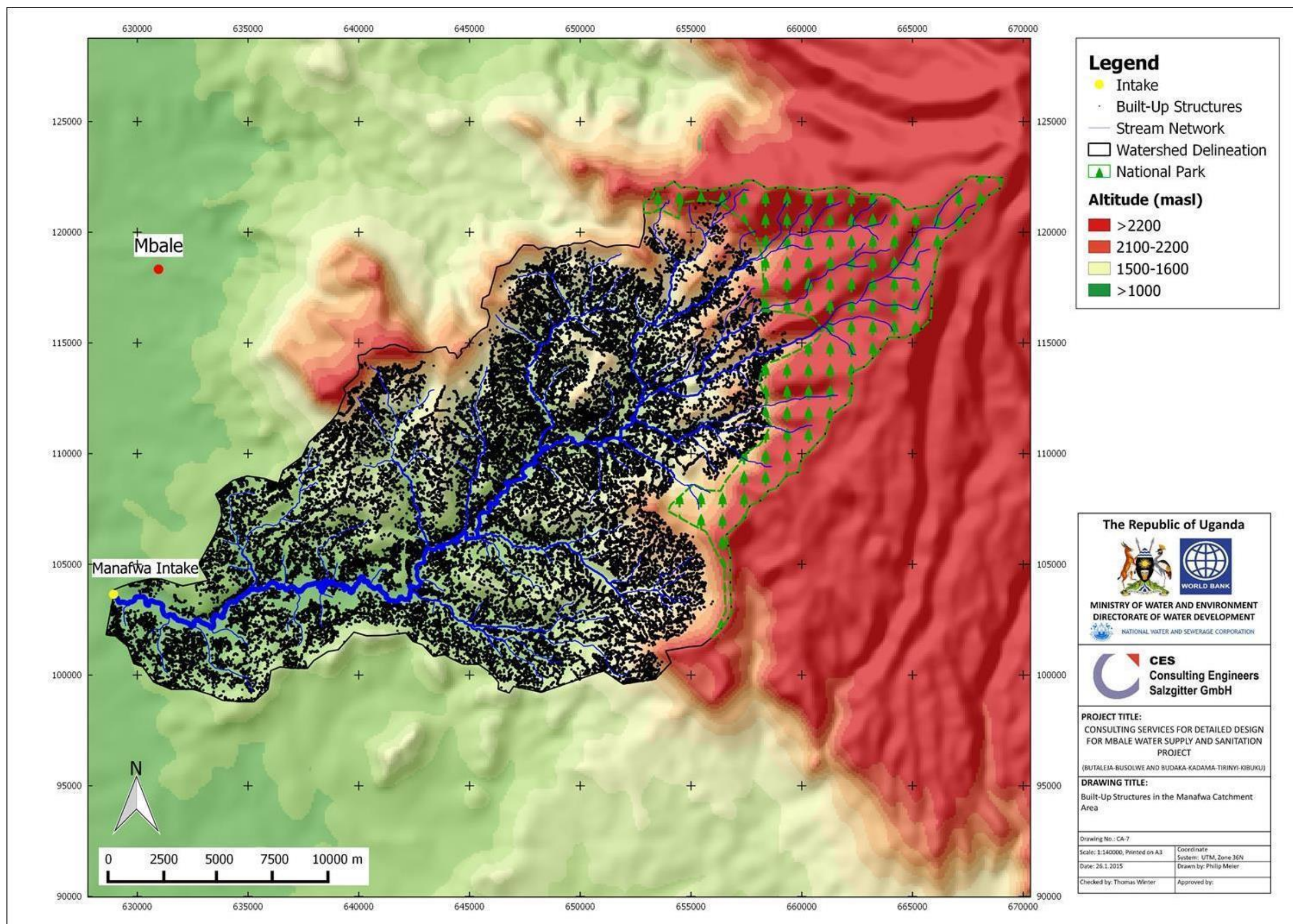


Figure 42 Built up structures in Manafwa catchment area

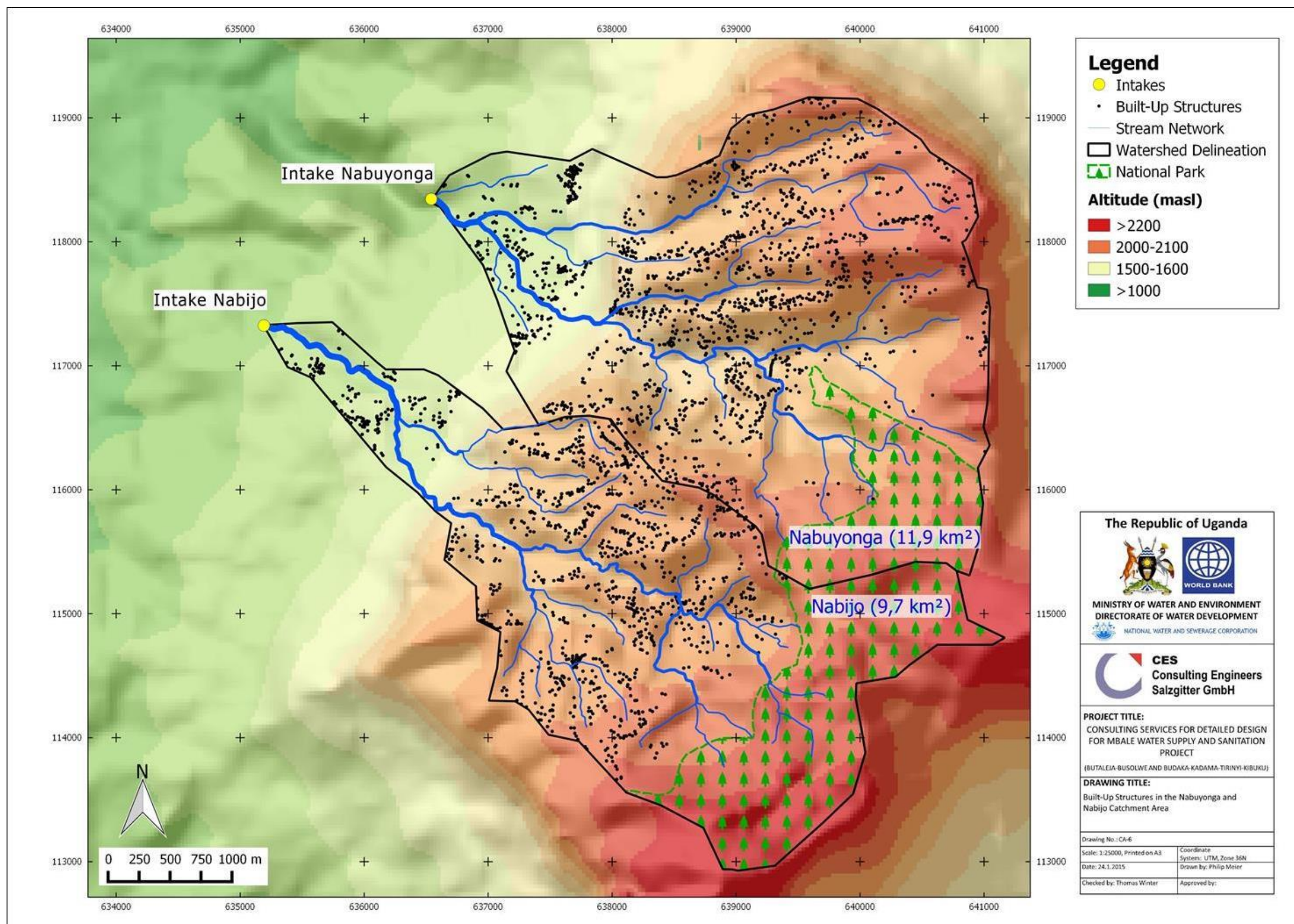


Figure 43 Built-up structures in Nabuyonga and Nabijo catchment areas

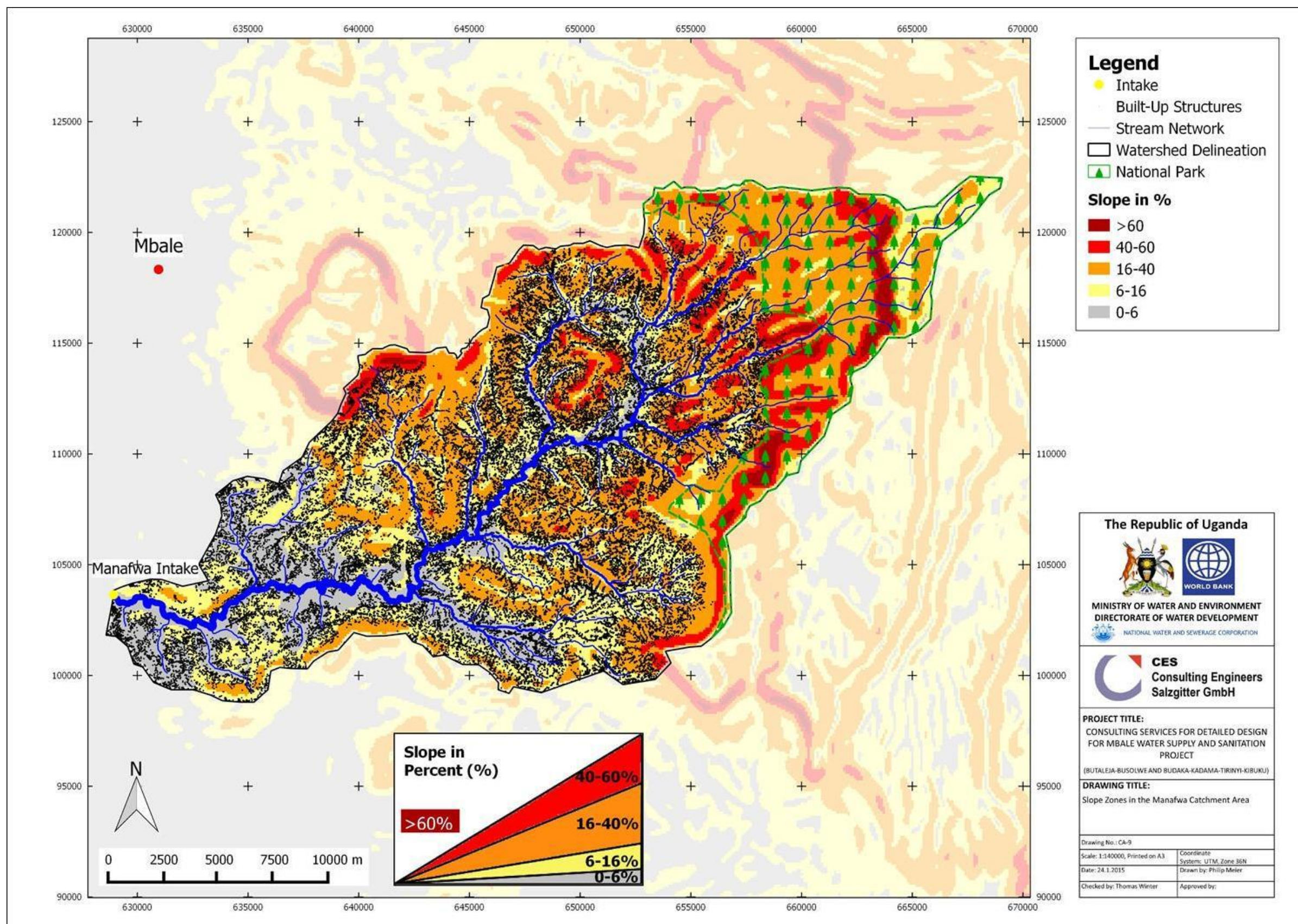


Figure 44 Built up structures (black dots) in Namatala catchment area

5.1.2.7 Water supply and sanitation

According to NWSC approximately 78% of the population in Mbale is currently connected to the water supply system. Water is treated at the Manafwa and Bungokho water treatment plants. From there it is supplied via a central reservoir to Mbale and surrounding towns. A normal house connection (1/2", less than 50 m) costs UGX 105,000 in Mbale. The price includes the pipe, a water meter and the labour for the installation. A deposit of 30,000 UGX has to be paid which remains on the customer's account. Once connected consumers pay their consumption, as listed in Table 26.

Table 26: Water tariff structure as per 1st July 2014

Type of consumer	Charges (UGX/ m³)
Public standpipes	1323
Residential	2046
Institutional/ Government	2518
Industrial/ Commercial:	
▪ Below 1500 m³ per month	3089
▪ Over 1500 m³ per month	2468

From the socio-economic survey conducted by CES during the feasibility study, in all of the six growth centres between 60 – 85% of the population is using borehole water, water from springs and shallow wells and the river. In Busolwe and Tirinyi/Kibuku about 17% - 20% of households were connected to piped water from a private operator and the water consumption amounted to one (1) jerry can per person per day which is equal to 20 l/p/d. The average income in the Growth Centres was estimated at UGX 87,000 in Tirinyi and Kibuku and UGX 181,000 in Butaleja and Busolwe far lower than the average income in rural areas of Uganda (UGX 303,700). The average monthly income is only in Budaka (UGX 486,000) higher. A house connection will cost more than the average monthly salary in Tirinyi and Kibuku and approximately 60% of the average monthly salary in Butaleja and Busolwe (assuming the NWSC house connection costs of UGX 105,000 in Mbale). The survey indicated that the majority of the population in the Growth Centres had willingness to pay for improved services (83% - 97%) with the main reasons that would hinder them from private house connections being the connection fees (26% - 48%) and the user charges (13% - 39%). Most of the inhabitants in Busolwe and Butaleja are willing to pay UGX 50 (25 - 35%) or even UGX 100 (20 – 32%) per jerry can (20l). The willingness to pay per month is between UGX 7,500 (40%) – 15,000 (50%) with only 5% that cannot afford to pay more than UGX 7,500 /month.

The water quality of the proposed raw water source (River Namatala) and the effluent receiving rivers in provided in Tables 27 to 32. The level of raw water quality and production of the water treatment plants will or may improve if the water source protection plans are implemented. Similarly, the quality effluent from Doko and Namatala WSPs is foreseen to improve after rehabilitation.

Table 27: Insitu water quality measurements at the proposed intake on River Namatala

Point	DO (ppm)	Temperature (°C)	pH	EC (µS/cm)	ORP	Pressure (mbar)	Salinity	TDS (ppt)
Upstream	5.08	24.0	8.10	110	-56.5	886.9	0.05	54
Proposed intake point	6.63	24.2	7.58	138	-29.0	887.0	0.06	68
Downstream	5.62	23.6	7.70	157	-82.0	889.7	0.08	78
National Standards for potable water (un-treated water)		20 - 30	6.5- 8.5	25000				1200

Table 28: Water quality of Rivers Nabuyonga and Nabijo as raw water sources

River	Month/Year	pH	Colour (Ptu)	Turbidity (NTU)	Total Dissolved Solids (mg/l)	Total Hardness (mg/l)	Chloride (mg/l)	Sulphate (mg/l)	Nitrate (mg/l)	Iron as Fe (mg/l)	Total Alkalinity (as mg CaCO ₃ /l)
Nabuyonga	Oct-17	7.30	300	554	86	50	9	2	0.63	0.630	58
	Nov-17	7.40	348	87.5	38.7	40	14	2	0.47	0.710	54
	Dec-17	7.90	165	22.1	35	58	5	1	0.22	0.247	38
	Jan-18	8.60	206	24.5	54.8	60	7	1	0.17	0.522	40
	Feb-18	9.10	410	16.6	37.2	76	11	2	0.225	0.423	84
	Mar-18	8.10	140	58.8	55.1	80	8	1	0.14	0.472	60
	Average	8.07	261.50	127.25	51.13	60.67	9.00	1.50	0.31	0.50	55.67
Nabijo	Oct-17	7.80	467	2234	70	64	4	1	0.381	0.411	60
	Nov-17	7.80	394	120.9	35.7	56	3	1	0.29	0.385	34
	Dec-17	7.50	231	35.2	40	42	3	2	0.163	0.187	33
	Jan-18	7.90	244	33.7	72.2	66	5	1	0.102	0.408	50
	Feb-18	8.30	330	14.2	38.3	80	4	2	0.13	0.361	227
	Mar-18	7.93	185	72.6	60.8	100	2	2	0.108	0.427	80
	Average	7.87	308.50	418.43	52.83	68.00	3.50	1.50	0.20	0.36	80.67

Source: NWSC, 2018

Table 29: Water quality of River Namatala as raw water source

Parameter	Unit	Dry Season					Start of Rain Season					National Standards for Water Supply
		1	2	3	Mean	4	5	6	7	8	Mean	
pH		6.75	8.08	8.08	7.64	6.5	6.75	6.75	6.75	6.75	6.70	6.5 – 8.5
Colour	PTU	23	55	64	47.3	213	98	120	95	105	126.2	15
Turbidity	NTU	5.49	4.62	4.8	4.97	7.87	8.35	7.69	7.97	11.2	8.62	5
Electrical Conductivity	µS/cm	60.4	61.1	60.7	60.73	80.6	81	80.5	80.4	85.4	81.58	1500
Total Dissolved Solids	mg/l	29.8	30.3	30.7	30.27	40.4	40.5	40.2	40.2	42.3	40.72	1500
Total Suspended Solids	mg/l	9	2	9	6.7	5	7	11	12	8	8.6	0
Alkalinity	mg/l	35	40	45	40.00	50	45	45	50	100	58.00	500
Total Hardness	mg/l	40	45	50	45.00	80	70	65	70	40	65.00	500
Total iron	mg/l	0.054	0.052	0.055	0.05	0.13	0.09	0.12	0.18	1.73	0.45	0.3
Manganese	mg/l	0.119	0.11	0.113	0.11	0.062	0.061	0.071	0.053	0.08	0.07	1
Total Faecal Coliforms	Cfu/100ml	750	50	600	466.7	750	755	775	800	1650	946.0	0

Source: CES, 2015

Table 30: Water quality of effluent receiving rivers

River	Month/Year	pH	BOD (mg/l)	COD (mg/l)	Total Nitrogen (mg/l)	Total Phosphorus (mg/l)	Total Suspended Solids (mg/l)	Total Coliform (Cfu/100ml)
Namatala	Oct-17	7.42	22	30	7.7	4.1	36	3000
	Nov-17	7.33	11.2	50	1.1	0.733	67	1400
	Dec-17	7.55	31.7	42.7	1.8	1.57	43	4000
	Jan-18	7.26	21	64	1.77	0.523	28	1000
	Feb-18	7.65	14	33	0.98	0.63	30	1200
Nashibiso	Oct-17	7.26	52	154	11.8	2.26		3600
	Nov-17	7.8	56	134	10.11	4.63	43	2200
	Dec-17	6.67	12.5	24	7.1	3.2	38	2000
	Jan-18	7.11	138	224	4.41	1.531	90	42000
	Feb-18	7.7	62	101	2.61	1.434	17	200000

Table 31: Raw water quality for Bunghoko and Manafwa WTP

STATION / Scheme		RAW WATER								
		pH	EC	Apparent Colour	Turbidity	TSS	Alkalinity (Total)	Hardness	Faecal Coliforms	Iron (Total)
			µS/cm	PtCo	NTU	mg/L	mg/L	mg/L	CFU/100mL	mg/L
Bunghoko	October 2017	7.32	100	301	2234.00	322	60	64	3.60E+01	0.630
	November 2017	7.44	114	348	120.90	100	34	40	2.40E+00	0.710
	December 2017	7.86	114	165	35.20	35	34	42	2.40E+00	0.247
	January 2018	8.60	184.8	206	33.7	28	50	66	2.60E+00	0.522
	February 2018	9.13	517	ND	4.21	21	227	80	1.20E+01	0.423
	March 2018	7.60	140	826	135.0	104	48	56	3.40E+01	0.423
	Average	7.99	194.88	369.20	427.17	101.67	75.50	58.00	14.90	0.49
	Minimum	7.32	99.50	165.00	4.21	21.00	34.00	40.00	2.40	0.25
	Maximum	9.13	517.00	826.00	2234.00	322.00	227.00	80.00	36.00	0.71
Manafwa	October 2017	7.42	133	1263	413.00	236	n/d	n/d	3.20E+00	n/d
	November 2017	7.06	106	618	176.00	125	40	50	3.20E+00	0.430
	December 2017	7.23	152	266	203.30	78	40	50	3.20E+00	0.240
	January 2018	7.58	160.0	97.3	15.4	8	ND	ND	2.00E+02	ND
	February 2018	7.46	171	49	17.80	20	106	76	2.60E+01	0.252
	March 2018	7.46	171	49	17.80	20	106	76	2.90E+01	0.252
	Average	7.37	148.98	390.35	140.55	81.20	73.00	63.00	44.10	0.29
	Minimum	7.06	106.00	48.90	15.40	8.00	40.00	50.00	3.20	0.24
	Maximum	7.58	171.30	1263.00	413.00	236.00	106.00	76.00	200.00	0.43

Table 32: Treated water quality from Bunghoko WTP

STATION / Scheme	FINAL WATER										
	pH	Electrical Conductivity	Apparent Colour	Hardness	Alkalinity (Total)	TSS	Faecal Coliform	Turbidity	Iron (Total)	Residual Aluminium	Free.Cl ₂
		Us/cm	PtCo	mg/L	mg/L	mg/L	cfu/100mL	NTU	mg/L	mg/L	mg/L
Bunghoko	7.1	123	12	62	62	2	0.00E+00	8.00	1.120		0.50
	7.2	121	5	40	42	5	0.00E+00	2.54	0.016	0.108	0.97
		7	130	2	52	30	0.00E+00	0.480	0.04	0.07	0.21
	7.56	200.5	9	74	68	2	0.00E+00	3.02	0.066	0.078	0.80
	8.7	546	ND	84	12	0	0.00E+00	1.65	0.010	0.054	1.04
	7.7	200	11	72	48	2	0.00E+00	3.830	0.06	0.078	0.77
	7.67	199.63	33.46	55.67	47.33	6.83	0.00	3.25	0.22	0.08	0.72
	7.13	7.39	5.00	2.00	12.00	0.00	0.00	0.48	0.01	0.05	0.21
	8.71	546.00	130.30	84.00	68.00	30.00	0.00	8.00	1.12	0.11	1.04
Manafwa	7.6	149	1	44	48	1	0.00E+00	2.30	0.110		0.57
	7.0	122	0	30	36	0	0.00E+00	0.44	0.011		1.20
		7	151	6	30	36	0.00E+00	2.640	0.07		0.50
	7.58	160.5	4	ND	ND	1	0.00E+00	4.40	ND	ND	0.78
	7.6	177	1	79	122	2	0.00E+00	2.20	0.232	0.18	0.91
	7.6	177	1	79	122	2	0.00E+00	2.20	0.232	0.18	0.91
	7.46	132.15	26.34	47.60	71.60	6.88	0.00	2.36	0.13	0.18	0.81
	6.99	6.97	0.00	6.00	30.00	0.00	0.00	0.44	0.01	0.18	0.50
	7.60	177.20	151.00	79.00	122.00	36.00	0.00	4.40	0.23	0.18	1.20

There are two isolated sewer networks in Mbale Municipality. One system is discharging into the Namatala Treatment Ponds and the other one is discharging into the Doko Treatment Ponds. The two sewerage treatment ponds operated by NWSC are located in the west of Mbale. The Doko Treatment Pond is located south of the Kampala Road and the Namatala Treatment Pond is located north of this road. The Namatala Treatment Ponds were constructed in 1985. The ponds have a total volume of approximately 40,000 m³ and a surface area of 2.75 ha. The ponds are located at approximately 1110 masl. Several flow measurements were conducted that averaged to a flow of 1,030 m³ per day. The biggest peak that has been measured was 1,300 m³ per day. The Doko Treatment Ponds were constructed in the 1985. The total volume of the ponds is 44,010 m³. The ponds are located approximately 1106 masl. Several flow measurements have been conducted resulting in an average daily flow 1120 m³ per day.

Although the sewer network in Mbale was established as a separate sewer, there have been reports of illegal stormwater connections. Especially in the Namatala catchment there are several residential properties that did connect their stormwater drains to the sewerage network, which causes siltation in the pipelines and treatment ponds. The quality of effluent from Namatala and Doko waste stabilisation pond systems is presented in Table 33. Most of the parameters exceed that the national effluent standards hence the need to rehabilitate and improve on the performance of these pond systems.

Table 33: Quality of effluent from Namatala and Doko waste stabilisation pond systems

Waste stabilisation pond	Month/ Year	pH	BOD (mg/l)	COD (mg/l)	TN (mg/l)	TP (mg/l)	TSS (mg/l)	Total Coliform (CFU/10 0ml)
Doko	Oct-17	7.19	220	106	7.2	2.16	86	41000
	Nov-17	7.50	119	226	9.6	2.42	50	28000
	Dec-17	11.18	252	338	6.4	2.18	28	3000
	Jan-18	9.05	117	139	3.11	1.97	51	3000
	Feb-18	7.93	110	778	8.2	2.58	29	2200
	Mean	8.57	163.6	317.4	6.902	2.262	48.8	15440
Namatala	Oct-17	7.65	158	148	12.2	5.67	13	5400
	Nov-17	7.51	87	118	7.7	3.63	3	4500
	Dec-17	7.68	159	221	13.2	5.22	46	3800
	Jan-18	8.90	123	148	5.35	2.65	19	4100
	Feb-18	8.97	252	574	4.6	1.858	12	2600
	Mean	8.142	155.8	241.8	8.61	3.8056	18.6	4080
Effluent Discharge Standard		6.0 – 8.0	50	100	10	10	100	5000

The majority of the population has access to sanitation facilities, mainly to simple pit latrines. Especially in the growth centres, the use of waterborne toilets is not very widespread. Between 78% (Tirinyi, Kibuku, Kadama) and 95% (Budaka, Butaleja and Busolwe) are using private pit latrines. Between 4% - 8% are using public pit latrines in Butaleja and Busolwe

5.2 SMALL TOWNS

5.2.1 Environmental Profile

5.2.1.1 Climate

The districts have two rainfall seasons, the main one from March to June and the second one from August to November. The variations in the temperatures are not significant and have a sub humid climate with relative humid ranging from 52% to 89%.

5.2.1.2 Topography, vegetation and soils

The topography of the project districts is generally low and flat characterized by shallow seasonal wetlands (Figure 45). Its altitude ranges from 900-1200m above sea level (average of 1145m above sea level). The vegetation cover has been largely modified by cutting down trees, grazing, annual or biennial grass fire (burning) compounded by an overload of traditional farming systems. The dominant grass cover is savannah grassland. The swampy vegetation is very common along the major wetlands of the districts. Isolated cases of forest cover exist in some districts like Kibuku with local forest reserves of Sala Wetland in Kirika and Goli goli Nangaiza in Kagumu sub-county. The soils are plinthosols (Ferruginous) tropical soils with low nutrient status that renders them unsuitable for arable farming (Figure 46).

5.2.1.3 Geology

According to the Geological Map of Uganda (Compiled by and drawn by Department of Geological Surveys and Mines; scale: 1:1,250,000), this area is generally underlain by precambrian basement rocks of wholly granitized or high to medium metamorphic formation of the Basement Complex. These rocks comprise of Kisoko granite which occupies the bigger central part of the area, Southern and Northern parts are covered by Medium grained granite with pegmatites and Mbale porphyritic granite respectively. The rest of the project area is covered by unconsolidated sediments comprising of Alluvium, swamp and lacustrine deposits mainly in swampy valleys.

5.2.1.4 Hydrology

The drainage system is dominated by rivers flowing from Namatala and Lwere swamp complexes and Mpologoma swamp (Figure 47). These wetland ecosystems have their water sheds mainly on the slopes of Mountain Elgon. These wetland ecosystems feed into Lake Kyoga drainage system. Mpologoma is the major river which forms a natural boundary between Kibuku and Butaleja districts. Many streams and rivers have disappeared over the years due to deforestation on the slopes of Mountain Elgon and encroachment on the major catchment areas of Namatala, Lwere complexes and Mpologoma.

5.2.2 Socio-economic Profile

5.2.2.1 Land use and land tenure system

The most common types of land tenure systems are leasehold and customary. Due to the very nature of small land holdings, most of the land is used for subsistence agriculture (Figure 48). However, it should be noted that Kibuku district has some parts of the land gazetted as local forest reserves. This forest reserve is in Saala in Kirika sub-county. Therefore land which was formerly for subsistence agricultural is being converted into urban settlements. Some parts of the wetlands are being converted into industrial activities and commercial agriculture (paddy rice cultivation).

There is great dependency on wetlands for sustenance of livelihoods due to their high level of productivity. The population is engaged in rice cultivation as a cash crop in Doho and Lwoba Schemes. The other crops grown include millet, vegetables, sweet potatoes maize, sugar cane, and sorghum. Grazing is common in the wetlands throughout the year though mostly in the dry season. Subsistence fishing is also carried out in the permanent wetlands and seasonally in the seasonal wetlands and floodplains. Some wetlands are used as hunting ground for wild game. They are also sources of tree products for construction local medicines, charcoal burning and making of floats for instance on the Hisiro island in Butaleja district.

5.2.2.2 Employment

Agriculture is the backbone of the economy in all project towns. The small town's major activity is crop farming accounting for an average of 98% with minimal animal rearing. However, crop farming in Mbale is estimated at 73.3% whereas trade in agriculture and non-agricultural products as well as investment properties are on the raise this area. The major crops grown are coffee, beans, matooke and maize in Mbale, and cassava, millet, sorghum, maize, groundnuts and rice in the whole area. The region in general is endowed with good climate and fertile soils in most parts, which favours a wide range of crops that can be grown throughout the year. Like many other regions in the country, communities in the project towns majorly dependent on subsistence agriculture.

5.2.2.3 Water supply and sanitation

The major sources of water in the towns include boreholes, protected springs, ponds and traditional wells. In Busolwe, 65% of the population relies on boreholes followed by piped water at 20.4%. In Butaleja 84% of the population uses boreholes as the major source of water. The other sources included ponds, traditional wells and protected springs. In Budaka town during the rainy season, most households (69.7%) obtain water from hand pumps fitted on deep drilled wells, the second largest category are those that use tradition wells. Tirinyi –Kibuku –Kadama towns, the major sources of water are boreholes fitted with hand pumps, shallow wells, hand dug wells, rain water harvesting, rivers and water vendors.

The population in the growth centres is mainly served by pit latrines. The most common method of waste water disposal was by dumping into the yard, 24%, followed by dumping into the soak-away pit (22%). 71% of the respondents had a problem with stagnant water. The majority of the respondents reported that disposal of refuse is mainly done by burning (67%). The results also indicate that 73% of the people do not boil drinking water in Tirinyi and Kibuku towns.

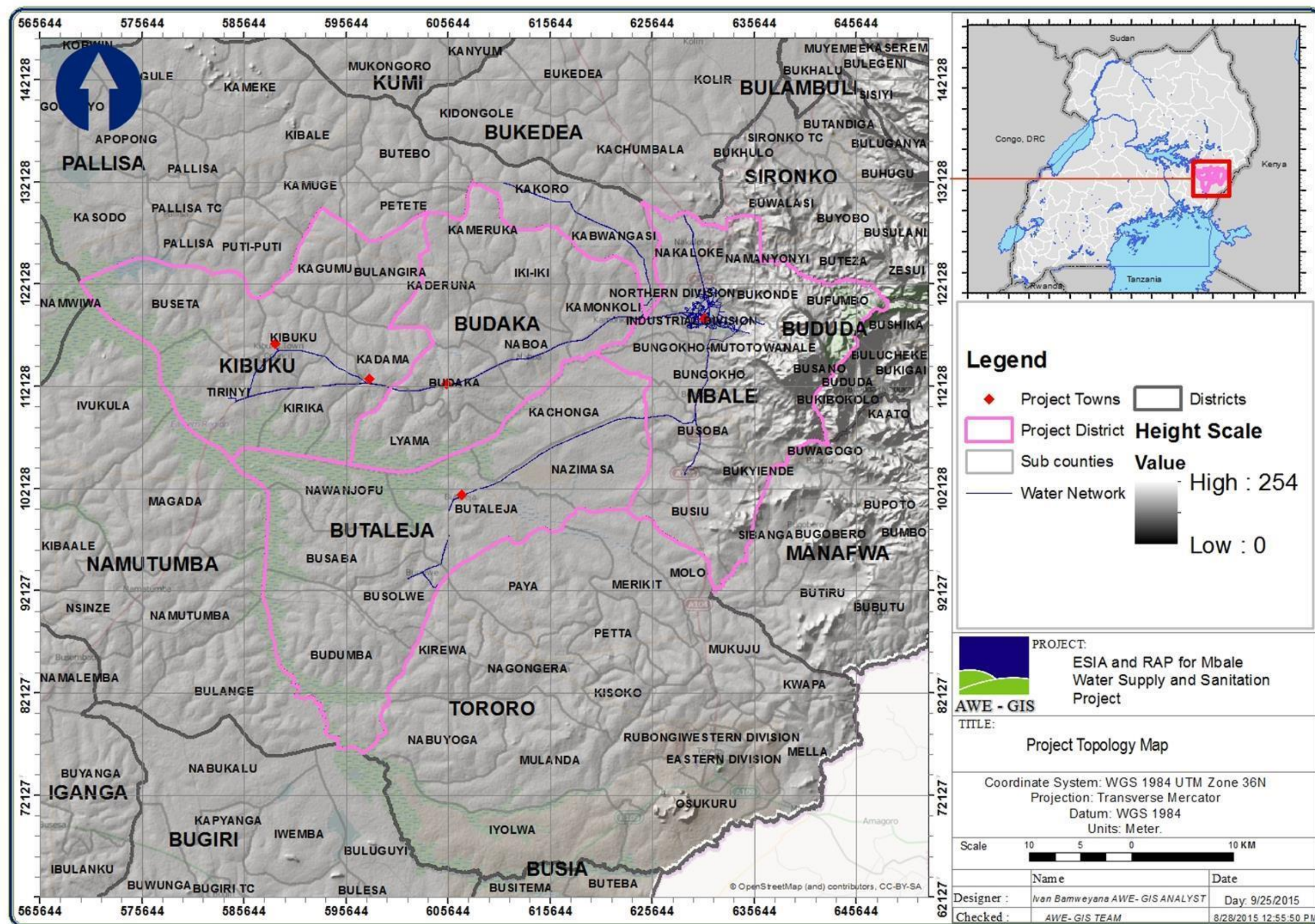


Figure 45 Topography of the project towns

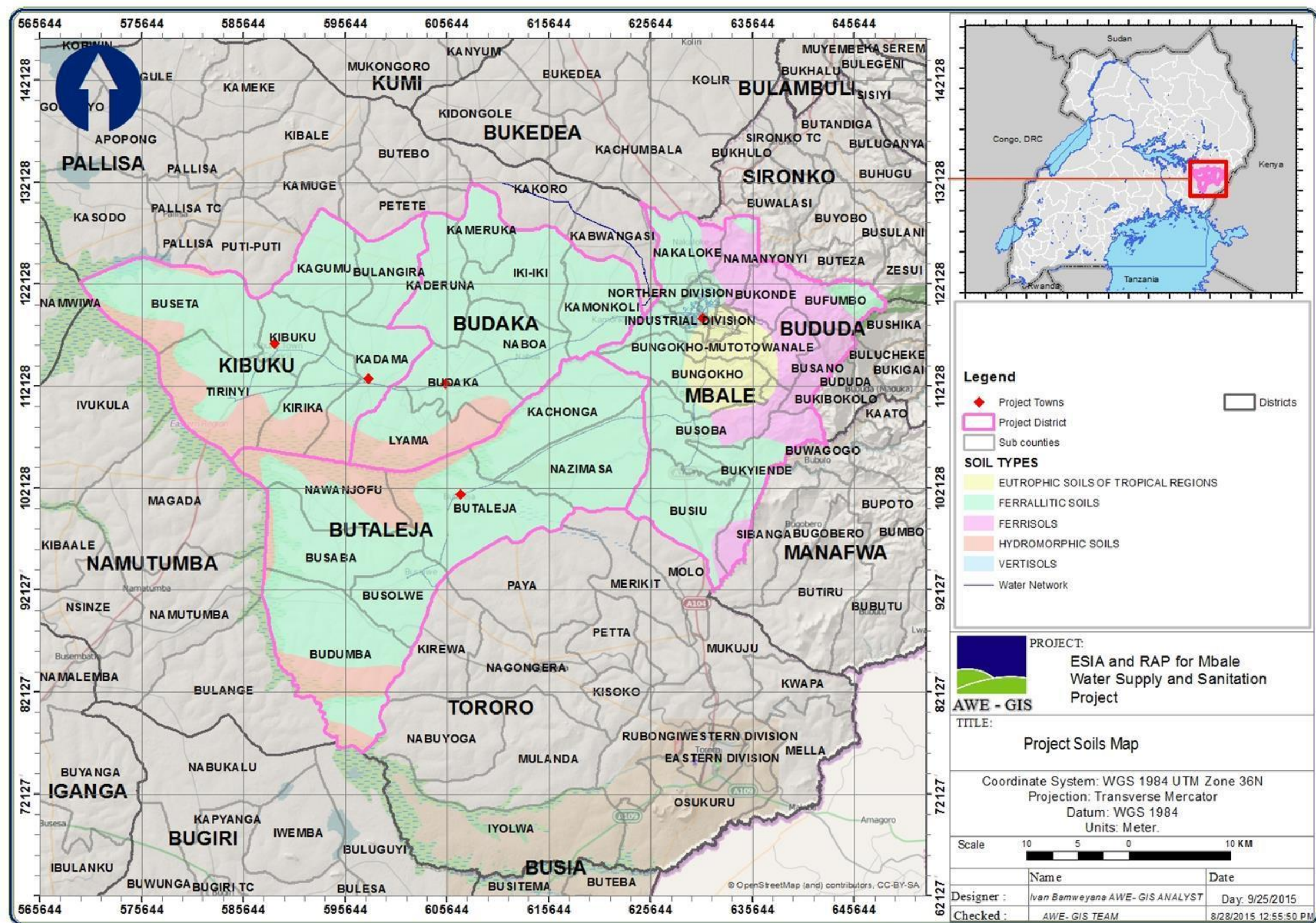


Figure 46 Soil types at the proposed project towns

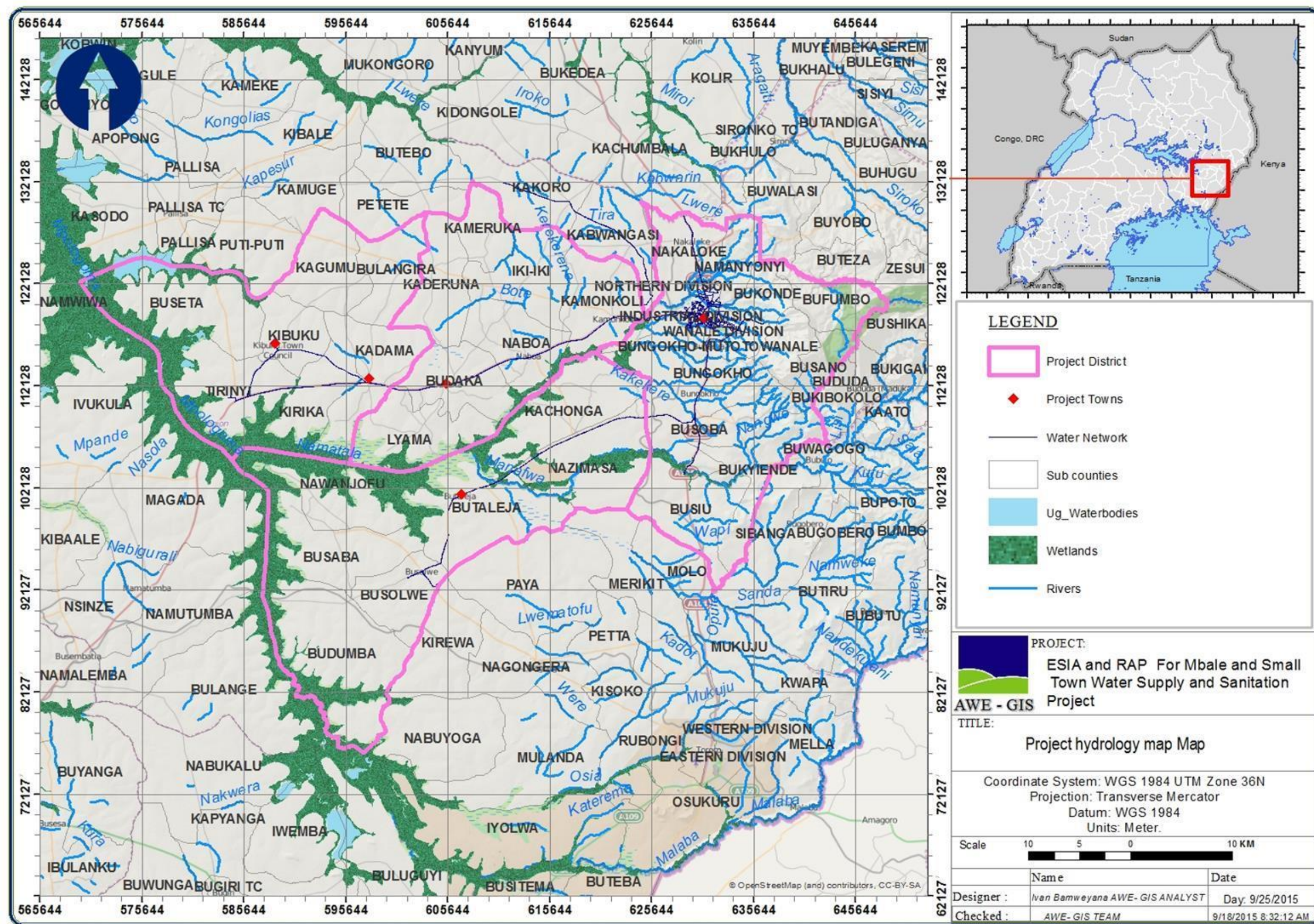


Figure 47 Hydrology at the project districts

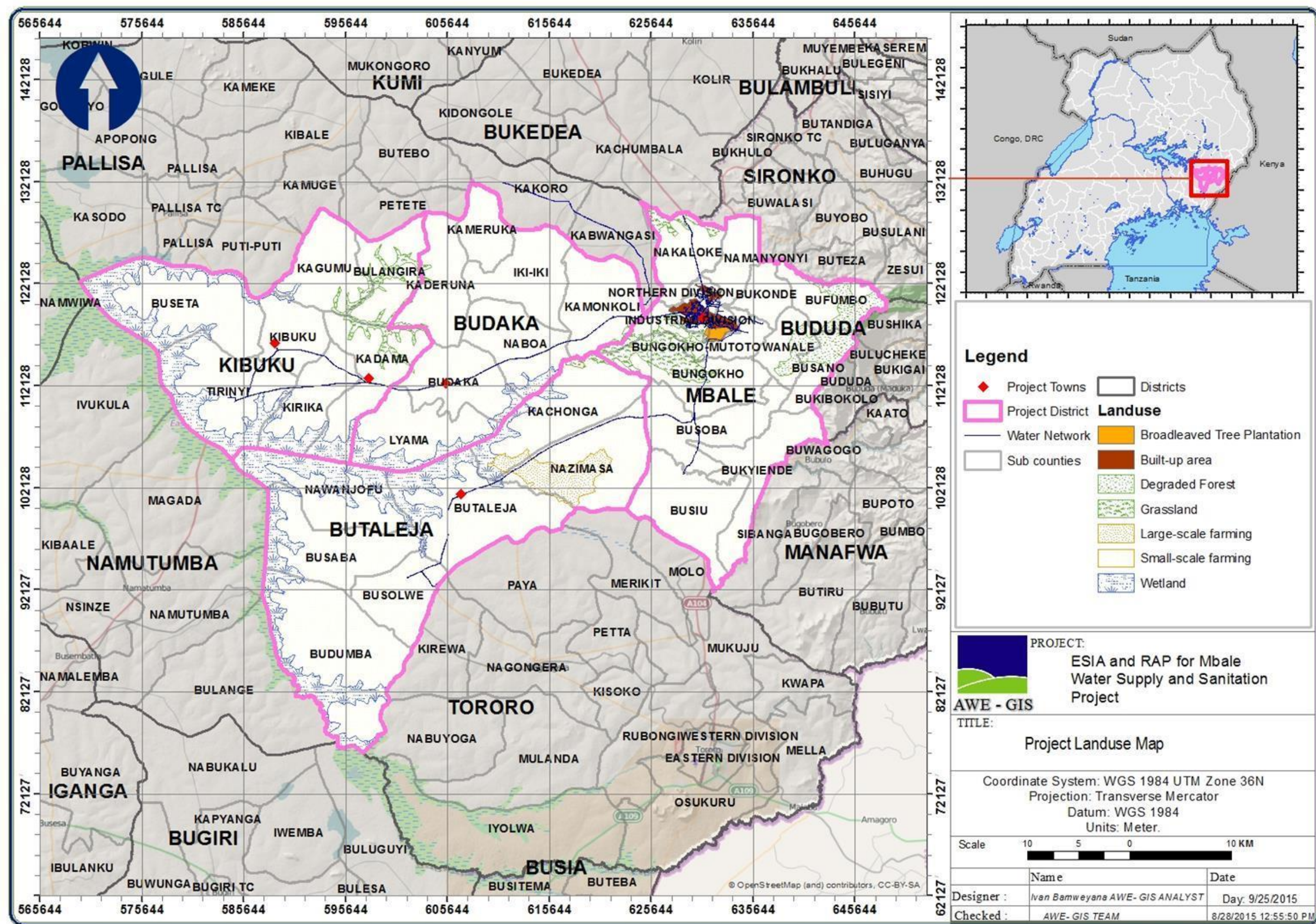


Figure 48 Land use in the project districts

5.2.2.4 Demographics

The total population of the district project towns is estimated at 656,942 people (UBOS, 2014) with an average growth rate of 3.68% which is higher than the national average of 3.03%. The districts in general have more females estimated at 340,670 than male estimated at 316,272 in 2014. In Table 34, it is also indicated that Kibuku district has the highest estimated average growth rate at 3.8% compared to the other districts. The high growth rates in this region imply that several people will migrate to small towns with the aim of looking for better opportunities thus increasing the demand for social services.

Table 34: Population in project town districts

District	Male	Female	Urban	Rural	Households	Non house holds	Total	Growth rate
Budaka	100,196	108,243	23,834	184,605	207,538	901	208,439	3.53
Butaleja	119,068	126,805	36,249	209,629	245,223	650	245,873	3.71
Kibuku	97,008	105,622	8,478	194,152	201,919	711	202,630	3.81
Total	316,272	340,670	68,561	588,386	654,680	2,262	656,942	

5.3 SITE SPECIFIC BASELINE

5.3.1 Physical Environment Baseline

5.3.1.1 Air quality

Uganda currently has no comprehensive database about national air quality. However, motor vehicles are major emission sources for several air pollutants, including nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), and hydrocarbons (HCs) (WHO, 2005). Measurements carried out at selected locations at the proposed project site indicated an environment free from key air pollutants such as carbon monoxide, ammonia, nitrogen and nitrogen oxide emissions as indicated in Table 35.

Table 35: Air quality at the proposed project sites

Location (UTM 36M coordinates)	Particulates (µg/m ³)	CO ₂ (%)	O ₂ (%)	H ₂ (ppm)	PID (ppm)	Notes
640418E, 122836N (Bumadibira Bridge)	1	0.03	20.9	0	0	Wet morning
638446E, 123149N (Kamma Lower)	1	0.03	20.9	1	0	Sunny humid weather
636727E, 122577N (Makhosi)	1	0.03	20.9	0	0.4	Sunny humid weather
634150E, 122365N (Nankobe)	1	0.03	20.9	1	0	Sunny humid weather
634850E, 120368N (Namulama)	1	0.03	20.9	1	0	
634174E, 119885N (Kibagala)	1	0.03	20.9	2	0	
634400E, 119014N (Mukhuwa)	9	0.03	20.9	0	0	Motorcycle traffic
632875E, 116426N (Mutoto)	17	0.03	20.9	0	0	Motorcycle traffic
634544E, 118225 (Mango)	2	0.03	20.9	0	0	Light vehicular traffic

Location (UTM 36M coordinates)	Particulates ($\mu\text{g}/\text{m}^3$)	CO ₂ (%)	O ₂ (%)	H ₂ (ppm)	PID (ppm)	Notes
631064E, 114941N (Bugema)	11	0.03	20.9	3	0	Highway traffic
631042E, 112895N (Mailo 4)	5	0.03	20.9	2	0	Highway traffic
630298E, 111461N (Bungokho)	4	0.03	20.9	0	0	Highway traffic
628832E, 103613N (Manafwa waterworks)	1	0.03	20.9	1	0	Highway traffic
630274E, 107175N (Busoba)	1	0.03	20.9	0	0	Highway traffic
626953E, 109314N (Bukhumwa)	8	0.03	20.9	0	0	
624197E, 109034N (Kachonga)	34	0.03	20.9	5	1.2	Light vehicular traffic
621366E, 108571N (Naweyo)	4	0.03	20.8	0	0.8	
619667E, 107860N (Namaji)	1	0.03	20.9	5	1.9	Motorcycle traffic
618044E, 107162N (Nabiganda)	6	0.03	20.9	3	3.1	Light vehicular traffic
614837E, 105607N (Nampologoma)	14	0.03	20.9	0	0	
609375E, 102293N (Leresi)	1	0.03	20.9	1	0	Light vehicular traffic
606798E, 101343N (Butaleja)	19	0.03	20.9	0	0	Light vehicular traffic
603235E, 94051N (Busolwe) Town Council)	3	0.03	20.9	0	0.8	Vehicular traffic
634646E, 117456N (Mooni Primary School)	1	0.03	20.9	0	0	
634032N, 117648N (Mukubu)	1	0.03	20.9	0	0	NWSC water works

Inference from measurements: At all measurement locations, no detectable levels of NO, NO₂, CO, H₂S, Cl₂, ClO₂, SO₂, VOCs and combustible gases (CH₄ inclusive) were encountered. These measurements indicate a generally pristine environment with respect to air quality.

5.3.1.2 Noise

The major sources of noise in urban centres of Uganda include humans and transportation activities. The most common source of noise at the project site is from transportation activities, principally motor vehicles and motor cycles (commonly known as boda boda). Noise levels recorded at the proposed project sites are presented in Table 36.

Table 36: Noise levels measured at the proposed project sites

Location (UTM 36N coordinates)	Sound pressure level dB(A)	Meet NEMA LAeq standards (Day-time limit of 50 dBA) for residential areas?	Notes
640418E, 122836N (Bumadibira Bridge)	61.8	No	River roar
638446E, 123149N (Kamma Lower)	42.7	Yes	Human conversations. Rustling leaves.
636727E, 122577N (Makhosi)	41.4	Yes	Human conversations. Chirping birds.
634150E, 122365N (Nankobe)	42.3	Yes	Human conversations. Chirping birds.
634850E, 120368N (Namulama)	47.1	Yes	Human conversation.
634174E, 119885N (Kibagala)	46.5	Yes	Human conversations. Chirping birds.
634400E, 119014N (Mukhuwa)	39.4	Yes	Human conversations. Chirping birds.
632875E, 116426N (Mutoto)	58.2	No	Human conversations. Playing children. Motorcycle traffic. Chirping crickets.
634544E, 118225 (Mango)	47.7	Yes	Human conversation. Light traffic.
631064E, 114941N (Bugema)	71.2	No	Highway traffic.
631042E, 112895N (Mailo 4)	68.6	No	Highway traffic. Chirping birds
630298E, 111461N (Bungokho)	64.4	No	Highway traffic. Human conversation.
628832E, 103613N (Manafwa Water Works)	54.2	No	Chirping birds. Rustling leaves. Highway traffic.
630274E, 107175N (Busoba)	58.8	No	Highway traffic. Multiple loud stereos. Human conversation.
626953E, 109314N (Bukhumwa)	54.2	No	Vehicular traffic. Human conversations.
624197E, 109034N (Kachonga)	55.1	No	Light vehicular traffic
621366E, 108571N (Naweyo)	47.1	Yes	Human conversations.
619667E, 107860N (Namaji)	51.9	No	Light vehicular traffic. Stereos playing. Human conversations.
618044E, 107162N (Nabiganda)	55.6	No	Light vehicular traffic. Chirping birds.
614837E, 105607N (Nampologoma)	55.1	No	Vehicular traffic. Human conversations.
609375E, 102293N (Leresi)	53.6	No	Vehicular traffic. Human conversations. Chirping birds.
606798E, 101343N (Butaleja)	62.5	No	Vehicular traffic. Multiple loud stereos. Human conversations. Chirping birds.
603235E, 94051N (Busolwe) Town Council)	60.4	No	Vehicular traffic. Multiple public address systems. Human activity.
634646E, 117456N (Mooni Primary School)	44.6	Yes	Playing school children.
634032N, 117648N (Mukubu)	49.1	Yes	Distant mosque public address system. Chirping birds. Human

Location (UTM 36N coordinates)	Sound pressure level dB(A)	Meet NEMA LAeq standards (Day-time limit of 50 dBA) for residential areas?	Notes
			conversation. Light vehicular traffic approaching or exiting NWSC water works.

* Based on Landuse Category D (Residential + Industry or small scale production + commerce) for which daytime and night limits are 60 and 50 dBA, respectively according to The National Environment (Noise Standards and Control) Regulations 2003.

Inference from measurements: These measurements indicate a generally pristine environment with respect to ambient noise levels. These measurements indicate a generally pristine environment with respect to ambient noise levels. However, as would be expected due to the increased human activities in more urban/roadside environments, towns along the road from Mbale to Busolwe had day time noise levels that are higher than is stipulated in the NEMA regulations.

5.3.1.3 Hydrology and catchment characteristics of River Namatala

Namatala watershed is in Mbale district. The Upper Namatala catchment covers the part of the game reserve with the lower part transversing through seasonal and permanent wetlands before joining the river Mpologoma. The Namatala system specifically originates from Wanale Mountains and crosses the sub counties of Bungokho, Jami village of Bunyole County and Nakaloke County in Pallisa. Most of the area covered by this system is in the lowlands of Mbale District. The soils can be explained in terms of geology and geomorphological processes which have significant impact on soil formation processes. Namatala catchment at Mbale-Soroti road is approximately 123.6 km².

The mean dry season flow is relatively high 1.49 m³/s for Namatala compared to anticipated water demand of 0.313 m³/s. The mean flow was estimated at 2.41 m³/s while flows exceeding 95% and 99% of time was estimated to be 0.47 m³/s and 0.37 m³/s respectively. The analysis suggests enough water is available to meet water demand by year 2040 (0.313 m³/s) for most of the year; however, Namatala's dry weather flows in some cases may not be sufficient to meet projected water demand and maintain an adequate environmental flow (EF).

As part of the ESIA preparation, the environmental flow in the Namatala River was evaluated. The ESIA estimated a minimum EF of 0.835 m³/s (refer to Annex K) leaving an abstractable flow of 0.342 m³/s in dry season (based on the mean dry season flow). The minimum EF includes domestic, livestock, and aquatic life water needs downstream of the proposed Namatala intake location. The amount was calculated based on conservative figures obtained using census population, livestock estimates, water use assumptions, biodiversity baseline, and international guidelines to assess EF. Actual data of water user's consumption was not readily available; therefore, the minimum EF assumed that all the sub-counties bordering River Namatala depend on it for supply, which is considered a worst-case scenario. For example, Kamonkoli small town will partly be served by the Project. Therefore, this amount of water should allow the river to sustain river health as well as meet the needs of riparian communities.

The minimum EF is disaggregated as follows:

Category	Water needs (m3/s)
Domestic water demand	0.111
Livestock water needs	0.572
Fish/aquatic life	0.149
Total	0.835



Photo 7: Proposed site for the intake works on River Namatala

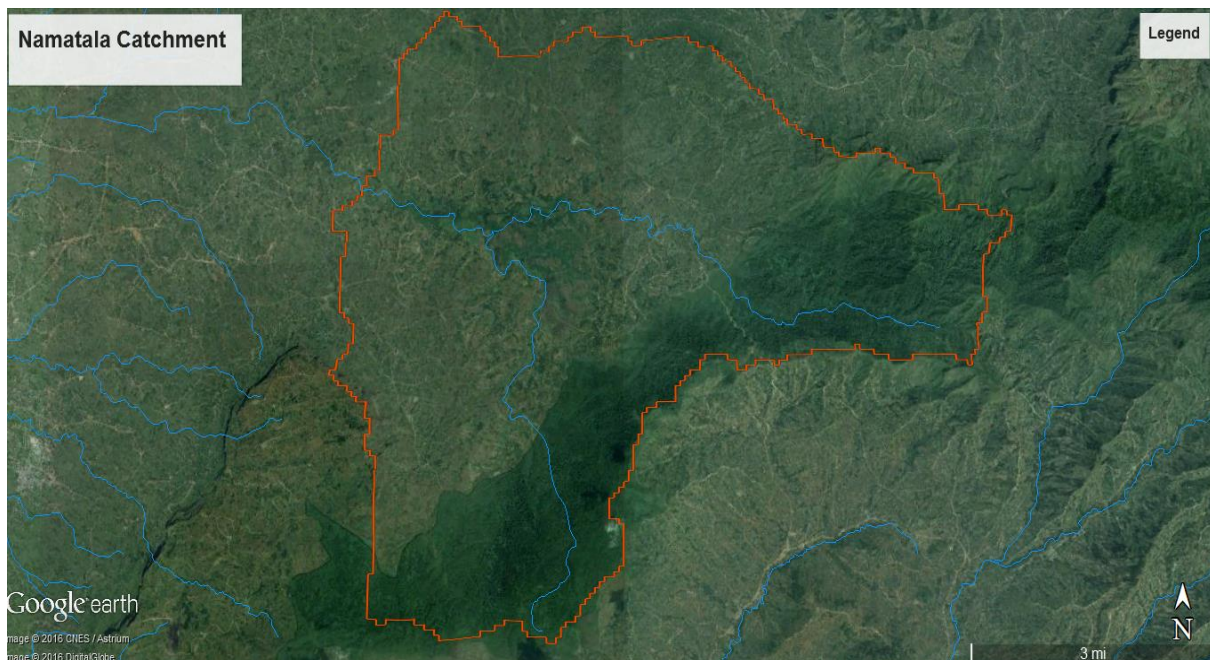


Figure 49 Namatala catchment draining through gauge station on Mbale-Soroti road

5.3.2 Biological Environment Profile

Vegetation and flora: The area traversed by the pipeline from Bumadirila intake to Mukhubu treatment plant cuts across built up area, subsistence farmland (including maize, banana, coffee, Ground nuts, and

sugarcane gardens), woodlots (including *Eucalyptus* spp, *Pinus* spp, and *Grevilia robusta*), and mixed woodlots of *Eucalyptus*, *Pinus*, *Tectonia*, *Maesopsis eminii*, *Albizia* spp, *Milicia excelsa* & *Azadirachta indica*) and patches of post-cultivated light bushland and grassland with scattered trees. The Bugema-Manafwa pipeline crosses built up area including small towns and linear settlement along the Mbale-Tororo road, subsistence gardens mainly maize, taro (wetland yams), rice, cassava and Banana. It also cuts across a small patch of fallow land dominated mainly by herbaceous plants of *Bidens pilosa*, *Panicum maximum* and *Sorghum arundinaceum*. The Mbale-Busolwe line traverse through built up area, subsistence gardens of maize, banana, Potatoes, Beans, cassava, and rice; it also cuts across extensive rice farmland of Doho irrigation scheme, and the only remnant *Cyperus papyrus*-*Cyperus dives* swamp in areas of Lwabi and Nakwasi. A description of the vegetation type and major/dominant flora from all the three pipelines is given in Table 37.

Table 37: Vegetation types and dominant species at the project site

Pipeline route	Vegetation description	Dominant species
Bumadibira –Mukhubu Pipeline	<ul style="list-style-type: none"> ✓ Subsistence farmland ✓ Post cultivated grassland with scattered trees ✓ Post cultivated light bushland ✓ Woodlots 	<ul style="list-style-type: none"> - <i>Zea mays</i> - <i>Coffea</i> spp - <i>Musa</i> sp - <i>Albizia coriaria</i> - <i>Mangifera indica</i> - <i>Thevetia peruviana</i> - <i>Synedrella nodiflora</i> - <i>Saccharum officinarum</i> - <i>Psidium guajava</i> - <i>Persea americana</i> - <i>Maesopsis eminii</i> - <i>Manihot esculenta</i> - <i>Markhamia lutea</i> - <i>Cymbopogon nardus</i> - <i>Cynodon dactylon</i> - <i>Artocarpus heterophyllus</i> - <i>Eucalyptus grandis</i> - <i>Grevilia robusta</i>
Bugema- Manafwa pipeline	<ul style="list-style-type: none"> ✓ Subsistence farmland ✓ Post cultivated grassland with scattered trees ✓ Post cultivated light bushland ✓ Woodlots 	<ul style="list-style-type: none"> - <i>Zea mays</i> - <i>Oryza sativa</i> - <i>Acacia polyacantha</i> - <i>Cynodon dactylon</i> - <i>Markhamia lutea</i> - <i>Eucalyptus grandis</i> - <i>Tithonia diversifolia</i> - <i>Grevilia robusta</i> - <i>Persea americana</i> - <i>Psidium guajava</i> - <i>Milicia excelsa</i> - <i>Manihot esculenta</i>
Mbale- Busolwe pipeline	<ul style="list-style-type: none"> ✓ Subsistence farmland ✓ Post cultivated grassland with scattered trees ✓ Post cultivated light bushland ✓ Woodlots ✓ <i>Cyperus</i> swamp 	<ul style="list-style-type: none"> - <i>Oryza sativa</i> - <i>Zea mays</i> - <i>Artocarpus heterophyllus</i> - <i>Albizia coriaria</i> - <i>Grevilia robusta</i> - <i>Pinus caribaea</i> - <i>Panicum trichocladum</i> - <i>Senna siamea</i>

Pipeline route	Vegetation description	Dominant species
		<ul style="list-style-type: none"> - <i>Senna spectabilis</i> - <i>Sesbania sesban</i> - <i>Mangifera indica</i> - <i>Manihot esculenta</i> - <i>Markhamia lutea</i> - <i>Ficus natalensis</i> - <i>Ficus ovata</i> - <i>Eucalyptus grandis</i> - <i>Cyperus dives</i> - <i>Cyperus rotundus</i> - <i>Cyperus papyrus</i>

The images in Photo 9 highlight the fact that except in a few sections covered by species of *Cyperus*, the natural vegetation cover in general landscape is already very much simplified in some cases into monocultures such as rice growing.

Species Richness: The surveyed sites yielded a total of 149 plant species in 120 genera and 40 families in the sampled areas altogether of which 44 species were trees and 31 shrubs. A plot of the species richness by growth form is presented in Figure 50 and the full list of all plants encountered is presented in Appendix C. While shrubs and trees encountered formed the woody biomass in the study area, they are found scattered in extensive crop land.

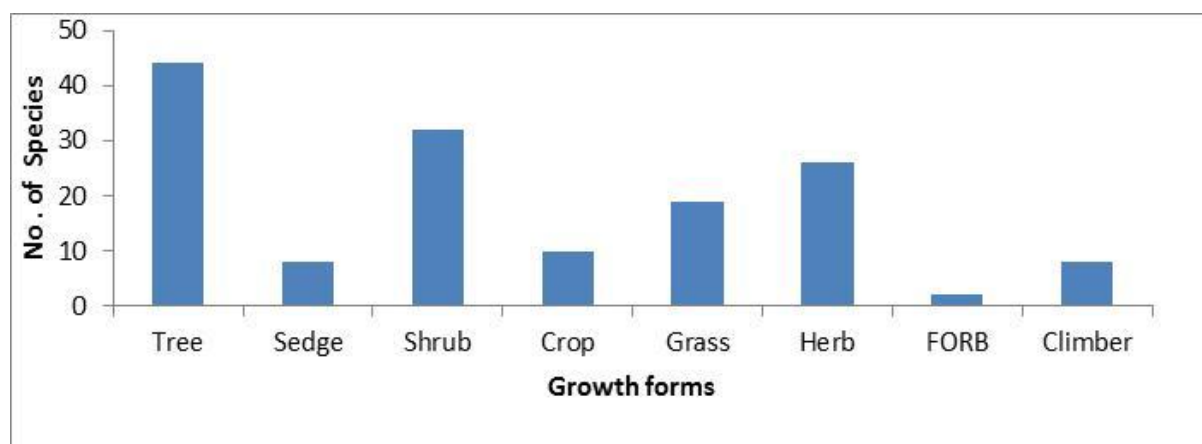


Figure 50 Distribution of the recorded plant species in the different growth forms

Species of conservation concern: Some plant species of conservation concern (in terms of range restriction, rarity, and threat) were observed in the project area. These include the following:

a) Species recorded that are listed by IUCN

Milicia excelsa is one of the species listed under IUCN Red List of Threatened Species, version 2015.31 as a nearly threatened species (IUCN red list (2015)). This species is sparsely distributed within the project site.

b) Species recorded that are listed by NFA

Milicia excelsa, *Tamarindus indica*, *Markhamia lutea* and *Maesopsis eminii* are all on Uganda's National Forestry Authority Reserved Species list, and are therefore protected from exploitation and threat to their habitats. *Milicia excelsa* is on the list because of commercial logging and its use for

timber, specifically for quality indoor and outdoor furniture, firewood and charcoal. The fruits of *Tamarindus indica* are commonly used as food but are threatened with felling for fuel wood. *Maesopsis eminii* and *Markhamia lutea* are used for poles, timber and fire wood.



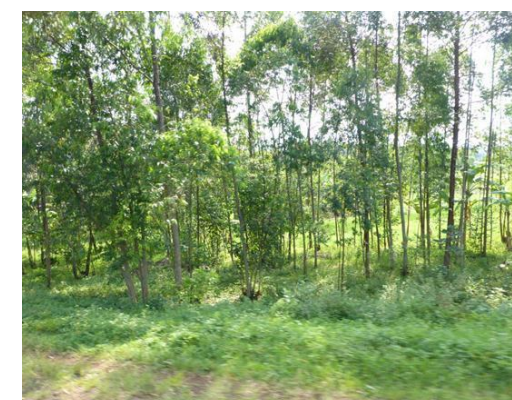
Zea mays and ground nuts garden with scattered *Albizia-Mangifera- Erythrina* trees at geographical coordinates N1.11437, E34.22278



Post cultivated mixed light bushland in between gardens and a small river at geographical coordinate N1.09439, E34.20867



Zea mays garden at geographical N1.10399, E34.21481 along Ndega road



Eucalyptus woodlot along Mbale- Busolwe route.



Cyperus dives wetland along Mbale –Busolwe pipeline route. This is continuous with Nakwiga *Cyperus papyrus* swamp



Eucalyptus woodlots, *Musa* sp gardens and *Zea mays* gardens at Bumadibira intake Point



Eucalyptus-Grevilia woodlot, Banana plantation with scattered trees of *Milicia excelsa*, *Ficus natalensis*; *Zea mays* and Ground nuts gardens besides Mooni mini water reservoir. Geographical coordinate N1.06215, E34.21148



Open grassland with scattered trees of *Mangifera indica* at Mukhubu water treatment plant.



Cyperus papyrus swamp along Mbale- Busolwe pipeline. This is located a few kilometers from Doho irrigation scheme. It's the only natural intact vegetation remnant within the project site. Its edges are affected by *Oryza sativa* growing.



Busolwe mini water reservoir in a seasonally flooded grassland located along Busolwe – Tororo road



Oryza sativa, *zea mays* gardens and *Eucalyptus* woodlot in a reclaimed wetland on the Mbale-Tororo high way within Bugema village.



Banana plantation along Bugema –Manafwa pipeline route.



Mixed *Casuarina-pinus* woodlot along the Bugema- Manafwa pipeline route



Oryza sativa at Doho irrigation scheme

Photo 8: Vegetation types along the three proposed Pipeline routes

c) Invasive species

The following species are all a result of introduction in Uganda, with a large potential to suppress the indigenous species of plants (Global Invasive Species Programme 2003):

- i) ***Eichhornia crassipes*** is one of the most notorious invasive species that has been recorded in the fresh waters of Uganda and beyond (Howard & Matindi 2003). It was recorded from permanent *Cyperus papyrus* swamp along Mbale-Busolwe pipeline.
- ii) ***Mimosa pigra*** is a moist ground invasive shrub capable of covering large parts of wetlands once disturbances are chronic. This is scattered within the reclaimed wetlands especially along the Bugema-Manafwa pipeline.
- iii) ***Lantana camara*** invades areas that are drier than *Mimosa pigra*. Both species thrive with disturbance (Cronk & Fuller 2001). Their presence makes the indigenous flora in any given area susceptible to suppression effects (Global Invasive Species Programme 2003).
- iv) **Other invasive species** encountered include *Senna siamea*, *Senna spectabilis* and *Ricinus communis*.

However, since the project impact zone is very narrow and small, little destruction of valuable species is expected.

Hepertiles: Most of the water pipeline is going to pass through settlements and a few areas with pertinent biodiversity concerns. A total of 13 species of Hepertiles were recorded in the entire project area.

Intake - This is located along river Namatale in Bumadibira, it's mostly dominated by cultivated areas with patches of fallow lands. Six species were recorded here; they are *Ptychadena mascareniensis*, *Mabuya striata*, *Amietophrynus maculirabris*, *Hyperolius viridiflavus*, *Hyperolius kivuensis* and *Amientia angolensis*

Reservoir - There are two mini water reservoirs in Mooni and Busolwe. Both of the reservoirs are located in settlement and cultivated areas. Busolwe is located in Butalejja while mooni is located in Mbale. Specimens recorded in the two areas area; *Hemidactylus brookii* *Mabuya striatus* and *Acanthocercus atricolis*.

Treatment plant - This is located in Bungokho a settlement area, two hepertiles were recorded here ie *Mabuya striatta* and *Acanthocercus atricolis*.

Water pipeline route - Most of the areas through which the pipeline will pass are located in settlement and gardens. However a few areas especially along small streams, rice puddles, fallow lands and swamps represented some of the areas from which hepertiles were recorded.

River Namatala - This is located at 0640501N, 0122858E with most of its banks heavily cultivated. Are total of 10 species were recorded from this survey point, they included; *Phrynobatrachus natalensis*, *Hyperolius viridiflavus*, *Amietophrynus maculatus*, *Amietophrynus regularis*, *Amietia angolensis*, *Xenopus victorianus*, *Haplobatrachus occipitalis*, *Mabuya striata*, *Mabuya maculilabris* and *Acanthocercus atricolis*.

Three species of amphibians were recorded at a small stream right after Bugema town along Tororo road (630936N, 113848E). The species include *Phrynobatrachus natalensis*, *Ptychadena mascareniensis* and *Psammophis mossambicus*

Rice puddles in the Doho irrigation system had a reasonable number of amphibian species abundance. *Ptychadena mascareniensis* was the most abundant. Other species recorded are, *Amietophrynus maculatus* and *Phrynobatrachus natalensis*.

Nakwasi wetland is a papyrus swamp located at 610162 N, 102613 E, its part of the Kyoga wetland system with permanent standing water. Species recorded here are *Hyperolius nasutus*, *Hyperolius viridiflavus*, *Xenopus victorianus*, *Haplobatrachus occipitalis*, *Naja melanoleuca*, and *Ptychadena mascareniensis*.

The conservation status of amphibians in Uganda is generally unknown because of data deficiency. However, according to the IUCN Red List Category, all amphibians recorded during the study are of least conservation concern (Table 38).

Table 38: Amphibians fauna of Mbale water pipeline project

Species	Common Name	IUCN Status
<i>Amientia angolensis</i>	Angola River Frog	Least Concern (LC)
<i>Ptychadena mascareniensis</i>	Mascarean frog	Least Concern (LC)
<i>Phrynobatrachus natalensis</i>	Natal puddle frog	Least Concern (LC)
<i>Xenopus victorianus</i>	Victoria clawed frog	Least Concern (LC)
<i>Hyperolius kivuensis</i>	Kivu reed frog	Least Concern (LC)
<i>Hyperolius viridiflavus</i>	Common reed frog	Least Concern (LC)
<i>Hyperolius nasutus</i>	Sharp nosed reed frog	Least Concern (LC)
<i>Amietophrynus maculatus</i>	Flat backed toad	Least Concern (LC)
<i>Haplobatrachus occipitalis</i>	Common bull-frog	Least Concern (LC)
<i>Amietophrynus regularis</i>	Common toad	Least Concern (LC)

Table 39: Reptilian fauna of Mbale water pipeline project

Species	Common Name	IUCN Status
<i>Mabuya striata</i>	Striped Skink	Not Evaluated
<i>Naja melanoleuca</i>	Forest water cobra	Least Concern (LC)
<i>Psammophis mossambicus</i>	Olive sand snake	Least Concern (LC)
<i>Acanthocercus atricolis</i>	Blue headed Agama	Least Concern (LC)
<i>Mabuya maculilabris</i>	Speckled skink	Least Concern (LC)
<i>Hemidactylus brooki</i>	Brook's gecko	Least Concern (LC)

Mammals: A total of 7 mammal species were recorded in the project area (Table 40). Six of the encountered species are listed as Least Concern (LC) on the IUCN Red List of Threatened Species (Version 2015.2). The Leopard (*Panthera pardus*) is listed as Near Threatened (NT). This, however, does not raise any conservation issues as the animals seen or noticed to appear around the villages are

vagrants from the forests of the Wanale Mountain only wandering through the villages at night. The critical habitats where these animals come from are beyond the project scope therefore will not be affected.

The habitats along the pipeline are majorly human settlements, small towns and cultivated areas with a range of crops including cassava, maize, bananas, rice etc. There are majorly fruit trees interspersed with in, the most notable ones including Mango (*Mangifera indica*), Ovacado (*Persea Americana*) and Jack fruit.

Table 40: Mammal species recorded in the project area and their conservation status

Common Name	Scientific Name	Conservation Status
Side Striped Squirrel	<i>Euxerus erythropus</i>	LC
Leopard	<i>Panthera pardus</i>	NT
African Grass Rat	<i>Arvicanthis niloticus</i>	LC
Striped Grass Mouse	<i>Lemniscomys striatus</i>	LC
Savanna-hare	<i>Lepus victoriae</i>	LC
Common Jackal	<i>Canis aureus</i>	LC
Banded Mongoose	<i>Mungos mungo</i>	LC

The key sites of the project, that is, the water treatment plant (in Mukhubu village); the reservoir (in Mooni village) and the intake (in Bumadibira village) all form a continuum of human settlements, small towns and cultivated areas with no considerable conservation importance as far as mammals are concerned. The villages in the project area in Mbale surround the Wanale Mountain range. This is largely forested and is the most likely source of the reported wild animals in the villages. River Namatala is also an important habitat feature to point out in the project area.

The nature of the vegetation cover at selected points in the pipeline routes is demonstrated in Photo 10. There is a clear absence of natural vegetation cover which has been cleared for either settlement or farmland. These kinds of areas do not hold significant populations (if any) of medium to large sized mammals. Small mammals will still continue to exist in the search areas although species with particular habitat requirements such as forest interior and/or intact wetland specialists will also be displaced and lost out.

Birds: A summary of the bird species richness and habitat preference of the birds recorded from the different survey points is presented in Table 39. Over all species that are dependent on availability of some tree stand (f – forest visitors) were the most numerous in most survey areas. There was a near absence of forest specialist species (FF) except for one species in the Makhosi area. Wetland species were also widely occurring although the numbers of species encountered were generally lower than those of the forest visitors.



A section of R. Namatala in Bumadibira



One of the cultivated areas in Makudui village



A section of the Wanale Mountain in Mooni village



A cultivated rice field in Nakwasi village

Photo 9: Different habitat sections in the project area.

Table 41: Number of bird species for each transect site in the categories shown

Sites		Doho	Manafwa	Mooni	Bungukho	Makudui	Bugembe	Busolwe	Kifuluriro	Makhosi	Buwaki	Kama-Lower	Namatala
Habitat Specialist	FF Forest specialist									1			
	F Forest generalist		3	3	1	3	4	1	2	1	1	1	2
	f Forest Visitor	7	13	11	12	17	16	7	14	12	7	13	15
	W Wetland specialist	18	3	1	1	1	13	10		2	2	1	3
	w Wetland associate	9	5	3	6	5	13	13	8	2	4	6	8
	G Grassland specialist	4	4	2	4	2	3	3	2	1	2	1	3
	Ae Aerial feeder	1	2	1	2	1	4	3	1	1	2	3	3
Migrant	P Palearctic	2		1	1	2	2	1	1	1			
	A Afrotropical	3	3	1	1	1	5	4	2	1		1	1
Conservation	G-EN Globally endangered	1			1								

Sites		Doho	Manafwa	Mooni	Bungukho	Makudui	Bugembe	Busolwe	Kifuluriro	Makhosi	Buwaki	Kama-Lower	Namatatale
	R-Vu Regionally Vulnerable	2	1			1	1	4					2
	R-NT Regionally Near threatened	4	2		1	2	1	1	1	1			2
	R-RR Regional Responsibility	1	2	2	2		4	2	1	1	2	3	

The two globally endangered species identified were the Grey Crowned Crane *Balearica regulorum* and the Hooded Vulture *Necrosyrtes monachus*, Doho rice scheme is very important for breeding of the Grey Crowned crane (Gumonye-Mafabi 1991). However, no information is known about breeding of the Hooded Vulture in the country. Forest species were well represented including one forest generalist; such numbers could be attributed to high numbers of local trees in the cultivated areas and especially areas close to Mt Elgon. The number of wetland species was high especially in areas around Bugembe, Busolwe, Doho and Manafwa.

Aerial feeders such as, Palm swifts, little swifts and Angola swallows were numerous throughout the study sites. Generally, number of Afro tropical species was higher than that of Palearctic species since the later are expected to return around September. Forest visitors and Grassland specialist were well represented, this could be due to too much rain in the area which impacted on the nature of vegetation and birds too.

a) Wetland dominated sites

Doho: Thirty seven (37) species were recorded, 1 of which is endangered (Grey Crowned Crane), 18 were wetland specialist. The Doho rice scheme (IBA) is known for its, in particular the large number of papyrus and terrestrial endemics. The area is important for the breeding of Grey Crowned crane (Gumonye-Mafabi 1991) which is classified endangered (Birdlife International 2015), and other species such as Black-headed Heron, Sacred Ibis and African Spoonbill (Byaruhanga per.comm).

The rice scheme is an important site for some migratory species and big congregations are occasionally recorded (Byaruhanga, Kasoma & Pomeroy 2001). Species such as the Black winged stilt, black-tailed Godwit and Spotted Redshank are sometimes numerous.

Manafwa: There were 38 species, majority were forest specialist (13), nine were wetland birds, three raptor species were observed soaring into the sky above and they were; Brown Snake Eagle *Circaetus cinereus* which is a *Regionally Near Threatened* (R-NT) species, Dark Chanting Goshawk *Melierax metabates* and Lizard Buzzard *Accipiter monogrammicus*. There were several trees with Black headed weaver nests.

Busolwe: Opportunistic observations through this site resulted into 40 species; the most conspicuous species is the African Spoonbill *Platalea alba* (Photo 12).



Photo 10: Part of Doho which formed part of the transect



Photo 11: Spoonbill

It is one the few areas in the country where spoonbills nest. Other species which nested together with spoonbills included Long-Tailed Cormorant *Phalacrocorax africanus*, Black-Headed Heron *Ardea melanocephala* and Cattle Egret *Bubulcus ibis*.

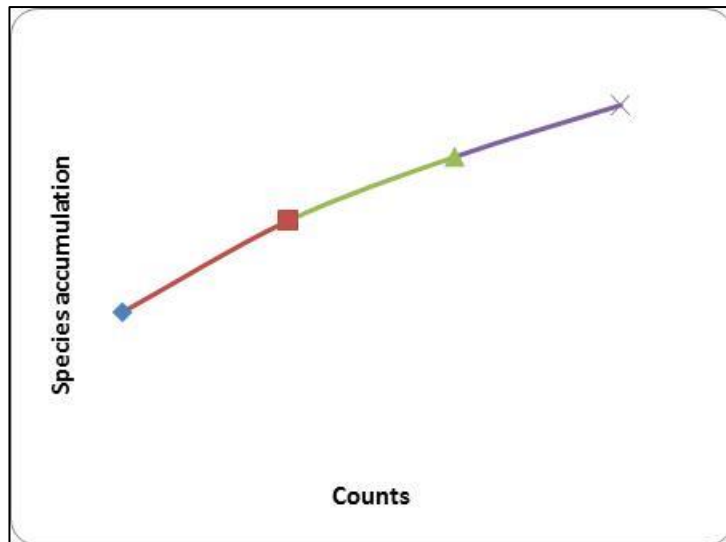


Figure 51 Species accumulation curve for birds in wetland dominated sites

The number of new species for any preceding count increased at a fast rate, the curve suggests that there could be other wetland predominant species which were not identified, and thus there is need for more counts to come up with a complete habitat list.

Bugema: This was the most species richest site; we recorded 51 species, of which 16 were forest visitor, 13 were wetland specialist and 13 were wetland generalist. No Forest specialist and endangered species were recorded.

b) Predominantly cultivated site

There were eight sites which were predominantly cultivated namely; Namatali, Kama-lower, Buwaki, Makhosi, Kifuruli, Makudui, Mooni and Bungukho.

Namatale: River Namatale (the proposed water source) is part of this site; there were 37 species, of which majority were forest specialist (15), no forest specialist, 8 wetland associate, 3 were grassland and wetland specialists, the three aerial feeders were palm swifts, Angola swallows and the Rock martin, it was found nesting on the walls of the bridge on the river. Vieillot's Black Weaver *Ploceus nigerrimus* were also nesting besides the river together with Black headed weavers.



Photo 12: Section of River Namatale that is within the proposed project impact area

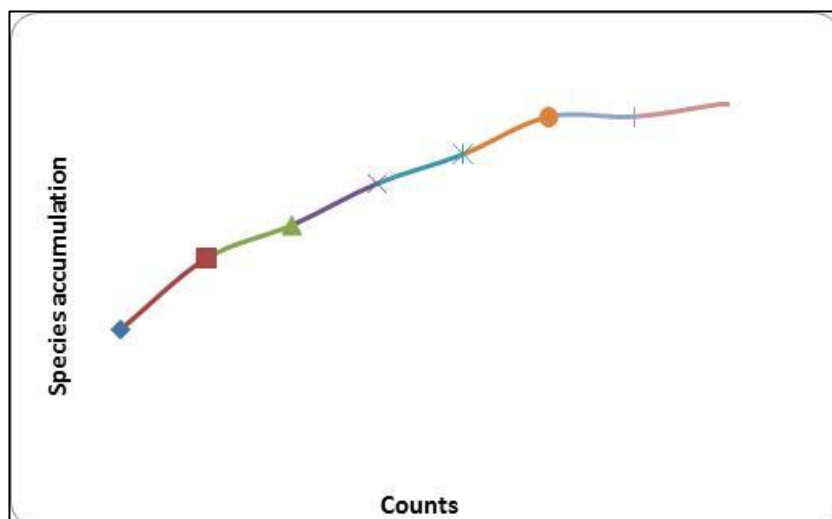


Figure 52 Species accumulation curve in the agricultural sites

After count six (Figure 52), the rate at which the number of new species added to the overall list was much lower suggesting that to a greater extent, the species list for the area was close to complete for the survey period.

Phytoplankton: The phytoplankton community of river Namatala consists mainly of blue greens, greens and flagellates (Table 42).

Table 42: Phytoplankton species found in River Namatala from the two sampling sites

Site Name	Taxon	Number of Organisms Per Litre
SITE 1 Upstream	BLUE GREENS	
	<i>Oscillatoria (sp)</i>	22
	<i>zygnema (sp)</i>	186
	<i>Anabeana (sp)</i>	14
	<i>calothrix (sp)</i>	22
	GREENS	
	<i>Chlorella (sp)</i>	06
	<i>Nitella (sp)</i>	32
	<i>Peridinum (sp)</i>	62
	<i>Clodophora(sp)</i>	44
	<i>Volvox (sp)</i>	90
	FLAGELLATES	
SITE 2 Down stream	<i>Phacus (sp)</i>	10
	<i>Euglena (sp)</i>	03
	BLUE GREENS	
	<i>Microcystis (sp)</i>	102
	<i>Zygnema (sp)</i>	32
	<i>Oscillatoria(sp)</i>	49
	<i>Anabeana(sp)</i>	16
	<i>Calothrix (sp)</i>	84

	GREENS	
	<i>Chlorella (sp)</i>	34
	<i>Cladophora (sp)</i>	58
	<i>Peridinium (sp)</i>	19
	<i>Nitella (sp)</i>	64
	<i>Westella (sp)</i>	10
	DIATOMS	06
	<i>Sydedra (sp)</i>	

Zoo plankton: The zooplankton community of River Namatala consists mainly of rotifers and crustaceans as indicated in Table 43.

Table 43: Zooplankton species found in River Namatala from the two sampling sites

Site Name	Taxon	Number of Organisms Per Litre
SITE 1 Upstream	ROTIFERS	
	<i>Brachionus (sp)</i>	24
	<i>Proales(sp)</i>	18
	<i>Lecane (sp)</i>	39
	<i>Porlyathral (sp)</i>	66
	<i>Trichocerca (sp)</i>	10
	<i>Euclanis (sp)</i>	22
	CRUSTACEANS	
	<i>Cyclops (sp)</i>	20
	<i>Bosmina (sp)</i>	08
	<i>Diaphanosoma (sp)</i>	05
SITE 2 Down stream	ROTIFERS	
	<i>Hydracarina (sp)</i>	06
	<i>Lecane (sp)</i>	46
	<i>Trichocerca (sp)</i>	40
	<i>Proales (sp)</i>	47
	<i>Porlyathra (sp)</i>	72
	<i>Brachionus (sp)</i>	64
	<i>Euclanis (sp)</i>	44
	CRUSTACEANS	
	<i>Bosmina (sp)</i>	10
	<i>Cyclops (sp)</i>	23
	<i>Diaphanosoma (sp)</i>	18

Fish: Fish species occurring in River Namatala documented in survey were *Mormyrus* spp.and *Clarias* spp. The fish is especially abundant in the rainy seasons when the river banks flood. None of the fish species identified in the area were identified as rare or endangered. It is however very important to note that the fish diversity of River Namatala in the project area is very low. From the local knowledge survey and interaction with the local authorities (District Fisheries Officer of Sironko and community leaders, they confirmed that fisheries activities are almost non-existent in the downstream project area part of the river. It is therefore anticipated that the project will have minimal or no impact on the fisheries of the river in the project footprint.

5.3.3 Cultural Heritage

The project area was like the rest of Uganda first inhabited by the hunter gatherer people. These people had been in the area since the Stone Age period. From 1000B.C the Bantu people entered the great lakes region of East Africa.

The hunter gatherers were either submerged in the Bantu communities or they were pushed up in the Elgon Mountain and the remnants of these hunter gatherers are known as the Ndorobo. Of the Bantu groups, the Bagisu were the first to arrive. They adopted the circumcision custom from the Kalenjin Nilotic people who were their neighbors to the east. Later on the Bagwere people of Budaka district entered the area from the west after the breakup of the Bunyoro kitara kingdom around 1400 A.D which they specify as their place of origin. They were also closely followed in the area by the Banyole of Butaleja District who came into eastern Uganda with the Basamia people with whom they are closely related in customs.

With the coming of colonialism, the area was first ruled by Semei Kakungulu a Muganda warlord / General who was employed by the British to put in place the administrative structure for the British and who then established Mbale town as his administrative headquarters for the whole region.

Later on after the retirement of Kakungulu, the area was first divided into Bugisu and Bukedi districts. After independence Uganda has continuously been subdivided and as of the time of this report, the project area is located in the districts of Mbale, Butaleja and Budaka.

There is one important site in the project area. This is the Mutoto Cultural site where circumcision is undertaken by the Bagisu Tribe. The circumcision season is flagged off from this site every two years by Inzu ya Masaba the cultural institution of the Bagisu Tribe.



Photo 13: Mutoto cultural ground with huts for circumcision candidates in the background

The coordinates of this ground are 36N 0632707, UTM 0116635. The Mutoto sub county headquarters are located at this site and it maintains this cultural ground. The water supply pipe line route from Manafwa to Busolwe and Butaleja towns is located 100meters from the circumcision grounds,

The project will not have an impact on the physical cultural resources of the area .Observations during the survey of the proposed water supply routes as well as inquiries during the focus group consultative meetings indicated that no cultural or historical site would be affected by the project.

As regards archaeological resources, there were no known resources in the area found during the survey which can be impacted by the project although their existence cannot be ruled out. A procedure for handling chance finds will have to come into effect in the case of significant archaeological discoveries during the construction phase of the pipeline routes. The pipelines will be underground and trenches will have to be dug to lay the pipes. A chance finds procedure to this effect was developed in consultation with the staff of the project staff in Mbale during the survey and is appended as an annex to this report.

6 KEY STAKEHOLDER VIEWS AND SUGGESTIONS

Stakeholders consulted had the following views, some of which were utilised in above impact identification and analysis.

Government of Uganda was appreciated for the proposed project in Mbale, Butaleja, Budaka and Kibuku Districts and NWSC, MWE/consultant commended for involving and consulting District officials because many times different projects come up but the local leaders /District Officials are ignored.

The importance of reporting to the district administration officials including the local councils before approaching the grassroots communities during execution of the project activities was emphasized to avoid problems that would arise in case of any security risks.

Compensation: There is a need of transparency when it comes to compensation of the Project Affected Persons (PAPs). There was concern for PAPs whose land is small in size and the remaining portion is not sufficient for any development.

Furthermore, there were mooted concerns from PAPs regarding why their land which was affected by the project was not subject to compensation considering that activities such as construction and cultivation on those areas were to be restricted.

Employment: There was a concern on whether local communities will be involved and employed during construction of the proposed facilities. The contractor should consider employing the local people in the project affected areas and the procedure he will follow to engage them spelt out.

Surface water/soil pollution

- i) The developer and contractors should undertake hydrological investigations prior to development of the sites.
- ii) Create buffer zones of natural vegetation belts of at least 50m between the lagoons and the river.
- iii) Undertake proper site restoration and landscaping after construction, that is, stabilize all soils after construction and plant grass to control erosion.
- iv) The faecal sludge drying beds at the WSPs should be constructed in such a way that leachate doesn't pollute the existing valley dam as it is the only source of water for the locals.

Sensitization: There was concern by communities about the flow of information on the project. It was pointed out that sometimes the information provided was insufficient and that representatives of the project-affected villages should be involved so as to have input.

- i) The developer should design and implement a program to sensitize the surrounding communities on the use of the river and how they should relate to the established infrastructure.
- ii) NWSC/MWE should undertake regular monitoring of the water quality in R. Namatala and R. Sironko stream and keep the community/public informed.
- iii) The contractors should create good relationship with the communities through consultations prior to construction activities so that the communities have a role in the management of the water infrastructure such as cleaning around the reservoirs.

Air quality nuisance: Ensure that the physical and biological properties for aerobic conditions are maintained

Impacts on area aesthetics

- i) The contractor should plant tree shrubs and grass to improve area aesthetics
- ii) There should be proper restoration of the project site to improve the landscape and area aesthetics.

Possibility of noise emissions and issues of Occupational Health and Safety (OHS)

- i) The contractor should see to it that construction works are carried out during day time to limit noise interruption.
- ii) All workers should be provided with proper PPE.
- iii) The workers should be regularly checked to ensure good health conditions.
- iv) Compensation should be provided to injured or affected workers due to lack of proper protection.
- v) Take records of all injuries and infections reported to track improvements.

Issue: Compensation
Question: Will my house be broken if it is along the pipeline? Response: Only if you built the house within the road reserve. This will be broken down after equitable compensation for the house has been effected.
Question: Will we buy the pipes or shall the pipes be supplied free of charge? Response: The pipes being laid are transmission pipelines conveying large volumes of water under high pressures and not distribution pipes used to connect water to peoples' houses. The Ministry of Water and Environment (MWE) will however give chance to 100 community members on a first come first serve basis who are living within 500m, radius from the distribution point a chance to get connected to the water at a subsidised fee. They will pay half the amount of money required to purchase the pipes and the Gov't will meet the other cost. Members are therefore encouraged to take advantage of this chance if they qualify.
Question: Will I be compensated if my house is located on the reservoir tank site? Response: Yes you will.
Question: Will trees be compensated? Response: Yes they will be compensated for.
Question: If the land through which the distribution line will pass belongs to another person, will I pay for the land in order to connect water to my house? Response: No you don't, however you need to reach an understanding with your neighbour.
Question: Contractors tend to destroy people's properties, what measures are in place to control them? Response: The District/Municipal council officials are fully aware of the project and have been assigned monitoring roles such that in the event of a Contractor's negligent behaviour by destroying properties, he will be accountable for any damages caused.
Issue: Benefits
Question: Will the person seeking employment on the project apply through or get a recommendation letter from the LC1 only? Response: Yes. This is so due to the fact that employment will be offered on a village level and it's only the LC1 chairperson who knows members of his village. This will ensure equal employment opportunities for all villages where the pipeline will traverse.
Question: How are those far from the road reserve going to benefit? Response: For as long as they are within the 500m radius from the distribution point, they can benefit from the subsidized rates if they apply early. For those living further than that, they will to wait on NWSC to extend water to their homes. Otherwise the sole benefit for all community members living near of far from the road reserve is that Safe water will be extended closer to them as a result of the project.
Question: Shall I pay for water at my home or use it freely?

<p>Response: All water will be paid for and not used freely as the government together with NWSC will need money for purchasing the chemicals to treat the water, pay the workers and purchase pipes to extend water to other communities in need of it.</p>
<p>Question: The contractor should employ the youth in the village. Is the contract already awarded?</p> <p>Response: The contract hasn't yet been awarded as of now but the design Consultant is preparing the tender documents. If however there are youth who have the qualifications and have all the requirements stipulated in the tender document, they are free to apply for the contractor or sub-contractor role.</p>
<p>Question: If people who are qualified contractors in plumbing come, which office should they apply to?</p> <p>Response: They should apply to the Project Manager of the Contractor and submit their documents at the site office nearest to them.</p>
<p>Issue: Project</p>
<p>Question: Does the Project belong to the Government or any politician?</p> <p>Response: The project belongs to the Government of Uganda and is meant to benefit the people of Uganda and does not belong to any politician.</p>
<p>Question: Shall we be provided with water from transmission main or another distribution line?</p> <p>Response: Other distribution lines will be laid with the aim of supplying water to the various interested parties. The transmission main will not supply water to any individual's house due to the high pressure of the water it is conveying.</p>
<p>Question: During dry season, there is no water; where will water come from?</p> <p>Response: This is a new line drawing water from a new source R. Namatala to boost the existing supply, therefore water will be more readily available in during the dry season.</p>



Kachonga A & B, Nebo, Kato, Muvule, Mirembe, Bukedi College Kachonga (BCK), Bugadunya Villages-MaziMasa SubCounty-Butaleja District.



Makhai A, Makhai B and Namwaro Villages in Busoba Sub-county.



Busoba, Lusaafu, Namwaro and Butunde in Mbale district



Lubanga, Matibo and Kamuli Villages in Butaleja Town Council



Busolwe South, Busolwe North, and Nakuyiga Villges in Busolwe Town Council.



Sapiri, Gadumire and Nakawolo Villages-Budaka District



Bambone, Lukangole and Nanyulu in Busolwe sub-county



Bumbwire, Bukholi and Kiralaka Villages- Kamomkoli Sub-county



Budaka township, Nakibulu, Nankone, Nabweyo, Nalado and Nasawo Villages in Budaka Town Council

Photo 14: Some of the photographs of consultative meetings held in Mbale and neighbouring towns

7 POTENTIAL SOCIO-ENVIRONMENTAL IMPACTS

7.1 INTRODUCTION

An improvement in potable water supplies and sanitation may generate interrelated improvements in health, economic and social welfare of the community. However, in addition to the many possible beneficial impacts, adverse impacts may arise from these improvements. The impact of potable water supply and sanitation on health depends on the quality and quantity of the piped water supply and sanitation infrastructure; the proportion of population covered; and the utilization of the water and sanitation facilities by the population. In this chapter, prediction and analysis of possible positive and negative impacts of construction and operation of the water supply and sanitation project is presented, with main focus on the proposed new raw water intake from River Namatala to Bungokho Water treatment works in Isebere village, Mooni Parish, Bungokho-Mutoto sub-county. Upgrading of the water distribution and sewer networks within Mbale Municipal council will also be embarked on as well as conveyance of treated water to Tirinyi from Bungokho WTP. A second leg of the project will entail pipeline running from Manafwa Water treatment works to Busoba sub-county in Mbale before branching off to Butaleja town council and Busolwe town Council in Butaleja District.

7.2 POSITIVE IMPACTS

The development and operation of the proposed project will have substantial positive environmental and social impacts. Specifically, the following positive impacts are anticipated during construction phase of the different project components:

7.2.1 Income to Material/ Equipment Suppliers and Contractors

The scale of construction works is large and widespread, including the areas of Bungokho-Mutoto and Busoba sub-counties and Mbale Municipality all in Mbale District; Kamonkoli, Budaka Rural and Budaka Township all in Budaka district; Kadama and Tirinyi sub-counties in Kibuku District; Mazimasa sub-county, Butaleja and Busolwe Town councils in Butaleja District. Although some of the equipment and materials required for the project will be sourced nationally and internationally to ensure quality is achieved, a number of equipment and materials (such as gravel, bricks, lumber, steel reinforcement and cement for civil works) can be sourced locally. Local suppliers of materials and equipment who get involved in the project will benefit financially. This is a *positive* but would occur during both the construction and operation phase although largely occur during the construction.

	Construction	Operation
Project phase when impact will occur	√	√

Enhancement measure: Earth materials needed for construction, for example, murram, aggregate (stones and sand) are obtained from quarry operations. Conscious or unwitting purchase of these materials from unlicensed operations indirectly promotes environmental degradation at illegal quarry sites and can cause medium- to long-term negative impacts. It should therefore be a contractual obligation for contractors to procure construction materials from quarries legitimately licensed by Mbale, Budaka, Kibuku and Butaleja District Local Governments and duly approved by NEMA.

7.2.2 Employment

Construction will avail skilled and unskilled job opportunities for residents, especially youths, in the project area which includes Bungokho-Mutoto, Busoba sub-counties and Mbale Municipality all in Mbale District; Kamonkoli, Budaka Rural and Budaka Township all in Budaka district; Kadama and Tirinyi sub-counties in Kibuku District; Mazimasa sub-county, Butaleja and Busolwe Town councils in Butaleja District. Skilled labour will include artisans such as plumbers, carpenters, masons while unskilled labour will include trench excavation.

During the operation of the expanded water supply system and sewer network, additional long-term technical and non-technical job opportunities for professionals, casual labourers, etc. will be available. Staffing will be required in the above Local Government structures to operate the expanded water supply system by:

- Operating the system in accordance with the service standards;
- Maintaining the system;
- Developing the system;
- Billing the consumers;
- Collecting revenue;
- Receiving applications for and making new connections;
- Making extensions to the system or assets;
- Attending to all customers;
- Keeping records of the operations of the system; and
- Writing status reports for the operations of the system.

The level of staffing and the staffing costs are uniform and currently, the Mbale area has a staff complement of about 62 staff in total. It is envisaged that there will be a significant change in the number, which will increase to over 150 staff with approximately 12 Key staff manning each of the growth centres upon project completion.

	Construction	Operation
Project phase when impact will occur	√	√

Enhancement measure: Wherever feasible, local people should be considered for job opportunities commensurate with their level of skills. Adequate occupational health and safety standards should be provided to ensure the work environment is conducive.

- i) Information to create awareness about the proposed project activities will be provided to the project-affected communities including targeting women.
- ii) Unskilled labour will be recruited exclusively from local community, and semi-skilled labour will be recruited preferentially from such communities, provided that they have the requisite qualification, competence and desired experience.
- iii) Contractors will be encouraged to pay a “living wage” to all workers and to ensure that workers have contracts.
- iv) A training programme for artisans (builders, carpenters, plumbers) in the project area could be facilitated by the project to ensure skills transfer during the construction period.

- v) Contractor will develop and implement Labour Influx Management Plan, Workers Camp Management Plan and Code of Conduct. An example of the code of conduct for contractors and sub-contractors is provided in Appendix H.

7.2.3 Infrastructure Improvement

With the installation of improved water and sewer network within Mbale Municipality; infrastructure improvement and/or development will be sparked off in those areas as well as the growth centres. Modern infrastructure induces development, stimulates investment and employment and helps improve marginal investment opportunities. The access road will have to be improved thus the community will benefit from an improved road network and those who can afford to connect to the power grid will have the opportunity to do so since the connection point will have been brought closer to their homes.

	Construction	Operation
Project phase when impact will occur		√

Enhancement measure: The extent to which development becomes a positive or negative impact will be determined by the effectiveness of the planning framework. Such induced developments should be of a type that is desirable and sustainable and for this to happen, all future developments must be undertaken within the framework of proactive government policy and strict planning and environmental enforcement by the responsible Local Government.

It is also vitally important that the new infrastructure, particularly the sewerage system within Mbale Municipality, be made fully operational as soon as possible, if necessary with incentives, perhaps in the form of relief on connection charges, to ensure all existing property owners are quickly connected to fully realise the benefits of the project.

7.2.4 Improved Health Status of Households and Communities

The provision of an adequate, safe water supply and sanitation has positive impacts on the health of users by greatly reducing the incidence of communicable enteric and infectious related diseases, which, in many instances occur in communities due to lack of adequate sanitation and potable water supply. Both potable water supplies as well as safe disposal of human excreta are needed to break the chain of transmission of diseases.

In addition to improvement in provision of sewerage system within Mbale Municipality, sanitation situation at the growth centres will also be improved by provision of ablution blocks with water borne public toilets with the exception of Busolwe where only a four Stance public toilet will be constructed. This will directly contribute to improved public health and Sanitation situation within Mbale Municipality and the growth centres. Currently, Mbale municipality has got Doko Treatment Ponds that were constructed in 1985 as the only sewage treatment plant whilst the growth centres have neither formal sewage collection nor treatment facilities. The Eco-san public toilets constructed in the growth centres were rejected by the community members thus the construction of the ablution blocks and public toilets as part of the project will promote improved public health status. Rehabilitation of the treatment ponds in Mbale municipality as well as the public toilets will reduce and or eliminate the indiscriminate disposal of human excreta and wastewater/ sullage. This, however, can only be achieved if the water borne systems/ toilets are used properly and maintained well.

	Construction	Operation
Project phase when impact will occur		√

Enhancement measures: Users will be educated on the proper use, regular cleaning and effective maintenance of both the household and public facilities.

7.2.5 Educational Enrolment and Attendance

Operation of the different components of the project will lead to considerably near and consistent access to safe water. In relation to provision of potable water supply, time savings are the most immediate and easily measured benefits although its magnitude will depend on the conditions prevailing before installing the piped water supply.

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.

	Construction	Operation
Project phase when impact will occur		√

Enhancement measures: Parents and/ or guardians will be encouraged to take their children or dependants of enrolment age to school.

7.2.6 Acquisition of New Skills

Most water supply and sanitation projects are built through the labour of local residents who are directed by a small cadre of sub-professional or supervisory personnel from outside the community. Community participation can also have a great impact on the effectiveness and sustainability of water supply and sanitation programs. It can also help to minimize many of the potential negative environmental impacts associated with them.

	Construction	Operation
Project phase when impact will occur	√	√

Enhancement measures: Where the required skills are available locally, the local people will be given first priority commensurate to their level of training.

7.2.7 Improvement in Household Economic Status

The provision of potable water supply and sanitation has positive beneficial impact on health and ultimately directly and indirectly on productive and economic benefits.

Livestock and poultry keeping: Improved water supply would lead to an increase in poultry and livestock keeping in homesteads. A permanent water source near or on the farm will permit an increase in cattle and improve the production of milk and beef. Those farmers who previously felt water to be a crucial constraint preventing them from keeping such livestock as grade cows and pigs, poultry like chicken or expanding their activities in this regard, may find it feasible to do so.

Small scale gardens: The provision of piped potable water supply may have positive beneficial impact on the irrigation of small scale gardens if there is excess water available and it can be used for irrigation of small scale garden plots near each household or tap. This will have positive beneficial *impacts* on increasing agricultural productivity and perhaps also improving nutrition status of households.

Small scale industries: The ample availability of piped potable water supply may lead to improvements in the small scale industrial development and increased production.

Improved crop yield: The sludge cake commonly referred to as bio-solids from the sludge drying beds can be used as a fertilizers on farmlands to improve the crop yields thus generating more income for the farmers. These will be sold to farmers at a subsidised price since the raw sewage comes from the community members themselves. These Bio-solids increase agricultural yields and improve soil condition by providing nitrogen, phosphorous and potassium in a less soluble form than farmyard manure and artificial fertilisers, thus remaining in the soil for longer and are less prone to leaching into groundwater or run-off, which pollutes waterways.

	Construction	Operation
Project phase when impact will occur		√

Enhancement measures: Water tariffs should be set taking into consideration the different levels of users. Modalities as indicated in Sub-section 5.1.2.7 would be sought. The users should also be educated to avoid wasteful use of the resources.

7.2.8 Saving in the Cost of Medical Treatment

The provision of potable water supply and sanitation may lead to improved health of the population. This can be realised if there is a reduction in cases of water related diseases hence reduction of some of the expenses currently made for health and medical services.

	Construction	Operation
Project phase when impact will occur		√

Enhancement measures: Users will be educated on the proper use, regular cleaning and effective maintenance of both the household and public facilities.

7.3 NEGATIVE IMPACTS

7.3.1 Degradation of Land and Soil Erosion

Site preparation will involve clearing of strips of vegetation to allow for excavations to begin. Soils excavated may be heaped besides the trenches hence exposed to agents of erosion such as wind and storm water. Topsoil stripping during levelling and grading of the right of way (ROW), maintenance works at Doko WSP and the excavation of subsoil during trenching will break up the soil structure. Poor disposal or management of the wastewater generated will lead to land and/ or water pollution and related drainage problems. If sewers and Doko WSPs are not watertight, then storm water and/or groundwater infiltration would lead to overflows that could impact negatively on the soil environment. In cases where households

are connected to piped water and not to sewerage system, they may use septic tanks whose cesspools may lead to contamination of soil.

The reuse of treated wastewater for irrigation will improve the fertility of agricultural lands of the area. Nevertheless, when unsatisfactorily treated effluents are released, these might contaminate the soils. If the grease and sludge are not properly handled and managed, they can contaminate the nearby soils and create unsightly conditions. The dried sludge will be removed periodically from the sludge drying beds and shall be taken to tip, burnt or be given to interested farmers.

Also equipment engaged in activities might cause contaminations of soil due to leakage of fuels and lubricants from equipment. The fuel and lubricating oils required by the construction equipment have the potential to contaminate soil and water resources if they leak or are spilled during handling or use.

These impacts are negative and the stakeholders likely to be affected are nearby community, land and aquatic fauna and flora. Its extent will be mainly local limited within site boundary and communities in its immediate vicinity. The project components that may contribute to these impacts are presented below.

Project component	Project phase when impact will occur	
	Construction	Operation
Water and sewer pipelines	√	√
Modification of Doko & Namatala Waste Stabilization Ponds and construction of ablution blocks with water borne public toilets	√	√

Impact significance: Even though there are earthworks (for example grading, levelling and compaction), the terrain around the proposed sites is flat and given that similar activities have already taken place and considering the project footprint, the likelihood of the impact occurring is low. The likelihood of the impact arising from improper management of sanitation facilities occurring is high if water users are not educated on techniques for safely disposing of wastewater or sullage from their households, especially in informal settlements. The **intensity** of the impacts is **medium** and **sensitivity** of the receptor is rated **medium** given that in some parts of growth centres, these systems are appearing for the first time resulting in a **moderate** impact significance.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies – construction phase

- A waste management plan will be developed prior to start of construction activities.
- Topsoil and subsoil removed from the site during site preparation will be stored properly (away from runoff and possible contaminants) for reuse elsewhere or for backfilling and reinstatement. Topsoil will be protected through separation from subsoil and storage in a manner that, as far as possible,

retains the soil structure and minimises the risk of topsoil loss. The trench will be subsequently backfilled with subsoil, followed by topsoil. In order to prevent loss of fertility and degradation of the seed bank within stored topsoil (where present), the topsoil will be stored for as short a time as possible, allowing for engineering constraints.

- iii) Contractor will avoid use of old equipment and damaged equipment that is most likely to have oil leakages thus contaminate the soils and the Contractor will ensure that equipment is properly maintained and fully functional to avoid leakages that may contaminate soils.
- iv) During reinstatement, the trench back-fill material will be compacted to a level similar to the original surrounding soils to avoid subsidence as a consequence of rain water channelling.
- v) Recreation of a stable landform that mirrors the pre-disturbed condition (e.g. contours, shape, level of compaction, etc.) as this will minimise the risk of preferential erosion and therefore facilitate natural revegetation.
- vi) Upon completion of subsoil and topsoil reinstatement, disturbed areas will be inspected jointly by the construction contractor and MWE/NWSC personnel for slope stability, relief, topographic diversity, acceptable surface water drainage capabilities, and compaction.
- vii) All waste generated during site preparation and construction will be transported to an authorized disposal area. The contractor will seek guidance from Mbale Municipality and the respective District Local Government of the growth centres on the final disposal point.
- viii) Waste shall not be taken out of the Site without a Waste Manifest.
- ix) A Spill Kit will be maintained onsite to clean-up any accidental spills.

Mitigation strategies – operation phase

- x) Sewers will be made watertight during maintenance to avoid intrusion of storm water into the network and cut-off drains provided to WSPs. Storm water will be guided away from all sanitary facilities using cut-off drains around them.
- xi) The staff of the WSP and STP will be trained for proper management of screenings, sludge, etc., to avoid soil contamination.
- xii) Periodic tests will be done to assure the quality of effluent and treated sludge, to avoid partially treated wastewater and sludge from reaching the soils.
- xiii) Proper measures (for example, ensuring that manholes are in place and in good condition) will be taken to avoid accidental surface runoff intrusion from the manholes of the sewage network, which can overburden the plant and cause discharge of partially treated wastewater from the plant onto land.

Adoption of the above mitigation measures will reduce impact intensity to “very low” resulting in a residual impact of minor significance.

7.3.2 Pollution of Water Resources

During construction activities, the principal potential contaminants associated with the construction activities include: sediments, fuels and lubricating oils; domestic wastes; welding wastes; paints and solvents; and hydro-testing chemicals if used (for example, biocides, oxygen scavengers and corrosion inhibitors), etc. Oils and greases contain hydrocarbons and/or heavy metals such as lead, chromium and cadmium, which are known drinking water pollutants. Increased water runoff and erosion from various work sites could potentially result in siltation of water courses like River Namatala and its network, etc. Significant erosion can occur at unstable River Namatala banks and spoil dumps also resulting in the sediment transport and siltation. During construction, there may also be need to stockpile assorted

materials on site. There is a potential pollution risk if construction materials are not stored or handled responsibly such as to lead to stockpiles wash away.

The sewage/excreta produced by the construction personnel have a high potential of contaminating water resources if not properly handled. Transportation of pollutants with runoff would affect the water quality hence the communities/ livestock depending on it. General wastes may have the same effect if not handled properly.

During the operation phase, the treated effluent of the WSPs will be discharged in existing streams or rivers. Treated effluent from Doko WSP system will discharge into Nashibiso River while that from Namatala WSP will empty into R. Namatala. The treated effluents will not generate significant impacts, if the facilities are operated and maintained according to the designed standards. However, discharge of improperly and inadequately treated effluents will cause surface and groundwater contamination. There is also the possibility for pollution of the groundwater and surface water due to leakages from and intrusion of storm water to the facilities (sewers, manholes, ponds, soak pits of septic tanks of public toilets).

In the operation of Namatala and Doko Waste Stabilization Ponds, there might or will be increased amount of sand in the sewage due to the fact that several properties connect their storm water to the sewerage. This will most likely increase the amount of BOD being released in the final effluent as well as sludge that settles at the bottom of the anaerobic and facultative ponds requiring de-sludging more often than usual. High BOD results in potential for increased nutrients (Phosphates and Nitrates into water resulting in eutrophication downstream). High concentrations of nutrients combined with high temperatures, can result in “blooms” of aquatic vegetation, particularly microscopic algae. In highly eutrophic waters, algal blooms can cause de-oxygenation of water resulting in fish mortality, bad odour or colour and difficulties in treating the water for drinking purposes. However, this can be negated by the frequent cleaning of screens and regular de-sludging of the anaerobic and facultative ponds for effective reduction in BOD. The clarification of water and further nutrient and pathogen removal would also lead to sedimentation in the maturation ponds, which primarily increases the effective treatment of sewage by use of WSPs. These would all consequently lead to changes in downstream water quality.

Project component	Project phase when impact will occur	
	Construction	Operation
Water and sewer pipelines	√	√
Modification of Doko & Namatala Waste Stabilization Ponds	√	√

Impact significance: The likelihood of the impact occurring is high. The duration of the impact will generally be short-term during construction but long-term during operation. The extent of the impact will be local for the water and sewer pipelines but regional for the WSPs facilities given that R. Namatala is a trans-district River running through Sironko, Bududa, Mbale, Budaka, Kibuku and Butaleja districts. The **intensity** of the impact is assessed as **Low** given the short term duration of construction activities and the dilution impact made by the greater R. Namatala Network as the river progresses further downstream to the other districts of Budaka, Butaleja and Kibuku where aeration due to turbulence would have far reaching effects in improving the quality. In addition, NWSC will procure an experienced contractor for the construction activities and will be in charge of operation and maintenance of the facilities. The **sensitivity** of the receptor is **high** given the scarcity of the water resource and the number of users who

depend on the River as a source of livelihood (that is, fishing, Rice growing and brick making). This results in a **moderate** impact significance.

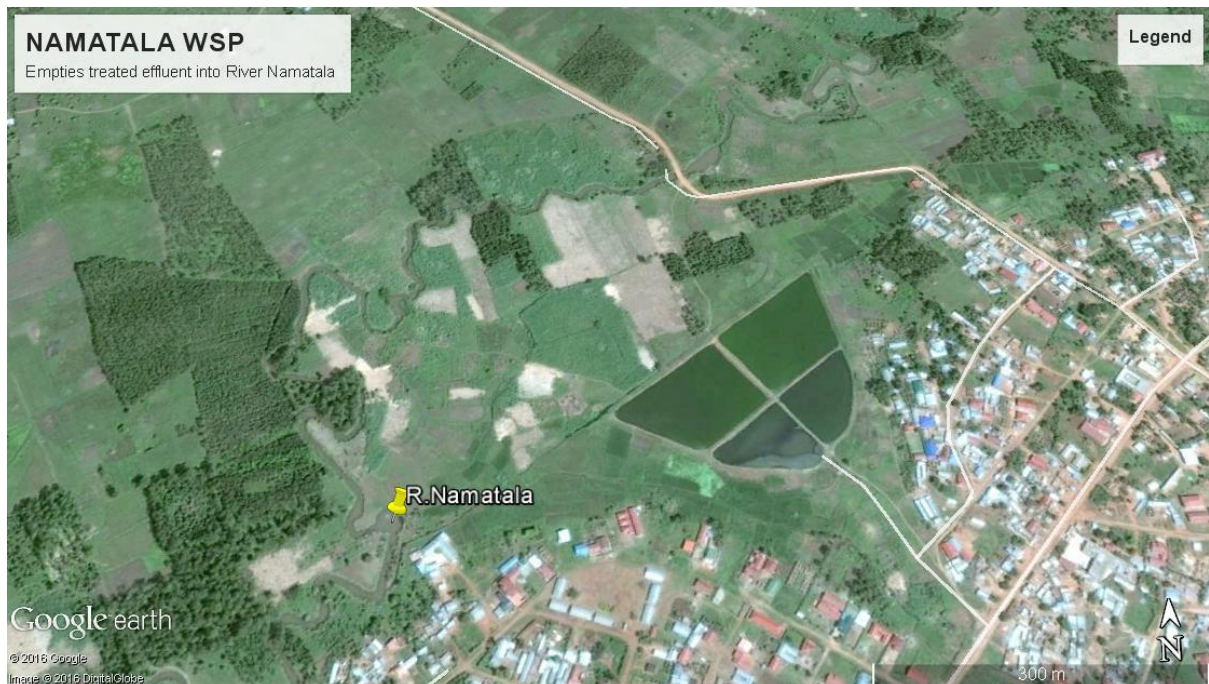


Figure 53 Namatala Waste Stabilization Pond which empties into R. Namatala



Figure 54 Doko Waste Stabilization Pond which empties into R. Nashibiso

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies - construction phase

- i) All construction equipment will be kept in good operating condition to avoid oil or fuel leakages that might contaminate water resources. Poorly maintained machinery will not be allowed to operate on site. All routine maintenance of construction machinery and vehicles shall be carried out in a designated workshop / maintenance area with concrete hard standing surface and drainage to an oil interceptor.
- ii) Stockpile areas for materials such as sand, gravel, stone, laterite, and topsoil, as well as overburden dumps will be located away from water courses and will be surrounded by perimeter or cut-off drains with sediment and other pollutant traps located at drain exits. Cut-off drains will be maintained throughout the subsequent operation phase;
- iii) Water quality downstream of the affected resources (R. Namatala and its network) will be monitored on a monthly basis, with samples taken and analysed for all forms of contaminants.
- iv) All hazardous wastes including material soiled with hazardous wastes and empty containers of hazardous materials shall be stored in a designated area on site for regular removal and disposal by a registered contractor in accordance with the National Environment (Waste Management) Regulations, 1999. All other wastes generated during site preparation and construction will be transported by the contractor or a company that has been specifically contracted to an authorized disposal area. The contractor will seek guidance from Mbale Municipality and the respective District Local Government for the growth centres on the final disposal point.
- v) Fuel handling and oil spill measures will be implemented to prevent, control and address spill or leaks. Fuel storage and dispensing on site shall not be allowed. Fuel and oil handling will be assigned to trained personnel and procedures for fuel storage, operation of mobile fuel tankers and refuelling areas will be well defined. Impermeable sheets, spill mats, and drip trays will also be provided in the appropriate areas to curb fuel and oil leakage to the ground. This will be done at designated places at the contractor's camp and in accordance with relevant standards set by the Energy Regulation Board and Uganda Bureau of Standards.
- vi) Laying of water pipelines and sewer lines will mainly be done during the dry season to avoid sediment transport to the nearby land, water courses and roads;
- vii) Any cleaning and hydrotest water which could cause contamination of surface (or ground) waters will be tested and treated as necessary prior to discharge, including debris and sediment removal.
- viii) NWSC will ensure the contractor complies with its environmental management policies, EIA recommendations and national regulations.

Mitigation strategies – operation phase

- ix) NWSC will ensure adequate operation and management of both the existing WSPs and the new facilities to avoid leakages and discharge of inadequately treated effluent;
- x) The leakages from sewers, sludge drying beds and WSPs will be minimized by regular monitoring and maintenance of the network; connections between sewers will be made water-tight to prevent leakages of wastewater to groundwater; and frequent effluent quality monitored to avoid release of poorly treated effluents into the River.
- xi) All requirements for construction of the sludge drying beds, especially for providing water impermeable basins, efficient drainage system for leachate and flood protection structures like cut-off drains and embankments will be put in place and respected;
- xii) Awareness campaign will be launched for the residents about proper operation and maintenance of both water supply and sanitation facilities put in place in order to reduce the introduction of grease, solid waste and other non-biodegradable particulates into the sewerage network;
- xiii) Monthly quality tests for effluent and receiving water resources will be done to ensure that the quality of effluent meets the national discharge standards or requirements;
- xiv) Sanitary facilities, for example, toilets and human settlements will not be allowed to be built or developed within 30-50 m of boreholes to avoid potential contamination of the groundwater;
- xv) A maintenance crew will be put in place to monitor and repair the network immediately a damage or leakage occurs to avoid accidental surface runoff intrusion to groundwater from the sewage network. Intrusion of storm water into the network and ponds can overburden facilities and cause discharge of partially treated wastewater into the water resources/ environment.
- xvi) Maintain, repair and refuel vehicles and machinery at an offsite garage/workshop;
- xvii) Emergency Lines (hotline) will be established to enable the public to immediately notify NWSC of any damages to the sewer lines to ensure timely response and repair of such damages; and
- xviii) Location/ layout drawings of water pipelines and sewers will be availed to other agencies (e.g. UNRA) and regularly updated to ensure they are not damaged during road maintenance activities.

Adoption of the above mitigation measures will reduce impact intensity to “Very low” level resulting in a residual impact of minor significance.

7.3.3 Generation of Noise

Generation of noise will mainly occur during the construction phase. The use of heavy equipment including bulldozers, graders and dump trucks during site preparation and transportation of materials will generate noise and vibrations. Traffic associated with the pipeline and sewer line construction will be routed via main roads and along the right of way (ROW) as far as is possible (for example Naboa, Bishop Wasike, Hospital and Republic roads, etc. within Mbale Municipality). Some minor roads will have to be used for access to the construction sites and some new access roads will be created. The levels of noise generated will depend on the type and condition of equipment employed by the contractor; and the number of employees at a particular site, in addition to the time of the day during which construction activities are taking place. The increase in traffic movements on minor roads may cause a noticeable increase in daytime noise levels through small villages; this effect will be localised and temporary, and will, for the most part, be restricted to the construction phase of the project. A number of roads will require repair prior to use for construction vehicle access (e.g. Mbale-Butaleja road around Nabigganda trading Centre that will have to be widened to enable the trucks maneuver the turn with ease). These repairs will help to reduce noise levels generated by such access, and other vehicular movements. With noise being

perceived as one of the most undesirable consequences of construction activity, it might become a nuisance to the settlements within its environs. The proposed sites are currently devoid of sources of high noise pollution as stipulated in Table 28. Since the noise levels in the area are low, the activities will therefore temporarily increase such levels.

Project component	Project phase when impact will occur	
	Construction	Operation
Water and sewer pipelines	√	
Modification of Doko & Namatala Waste Stabilization Ponds and construction of ablution blocks with water borne public toilets	√	

Impact significance: Given that most of the proposed routes for the sewers and water pipelines are located in relatively noisy areas of Mbale Municipality and its neighbourhood, the receptor **sensitivity** is considered to be '**low**' due to the continuous construction activities during the day that might irritate the nearby locals although the noise attenuates with increasing distance from the source. The **intensity** of impact is assessed as **low** resulting into a **minor** impact significance.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies:

- i) Contractor will be careful when selecting the working equipment to avoid use of old equipment or damaged equipment with high level of noise emissions that would have a negative impact on the environment. Contractor will ensure that equipment is properly maintained and fully functional.
- ii) Construction workers will be made aware of the permissible noise levels at the workplace and surrounding environment, and be advised to limit verbal noise or other forms of noise. For example, metallic objects or tools can be passed on to a colleague rather than dropping or throwing them with loud bangs. Construction truck drivers will be required to switch off vehicle engines while offloading materials. According to National Environment (Noise Standards and Control) Regulations, 2003; noise levels at construction sites should not exceed 60 dBA and 50 dBA during the day and night, respectively.
- iii) All generators and heavy duty equipment will be insulated or placed in enclosures to minimize disrupting ambient noise levels. Pumps, generators and other mobile equipment will be sited as far as practicable from housing and other noise sensitive locations. Regular maintenance, monitoring and, where necessary, the use of silencing equipment will be employed with the aim of reducing noise emissions.
- iv) The contractor will submit detailed information on the noise levels which will be generated by the specific methods and equipment proposed and the actions that will be implemented to minimise the

noise impact. Equipment shall be operated within their specifications and capacity (for example, avoid overloading machines).

- v) During periods of inactivity, equipment will be switched off whenever possible. A limited number of construction activities may have to continue on a 24-hour basis. These include horizontal direction drilling, pipeline cleaning and hydrostatic pressure testing which are relatively low noise activities. Consultation will be undertaken with the relevant authorities in advance of any such operations. Where appropriate, residents living near to the pipeline construction activities will be kept informed of the contractor's proposed working schedule (through implementation of the Community Liaison Management Plan) and will be advised on the times and duration of any abnormally noisy activity likely to cause concern.
- vi) Project vehicles will have a restricted speed limit of 40 km/h through settlements and trading centres to minimise noise.
- vii) No construction activities will take place at night for sites where the closest residence is within less than 150 m from the project site.

7.3.4 Improper Handling of Asbestos Cement (AC) Pipes

During construction, asbestos cement (AC) pipes and accessories will be replaced by uPVC pipes. If improperly done, removal of AC pipes can release asbestos fibres into the air, posing risks to public health. Health hazards from breathing asbestos dust include asbestosis, a lung scarring disease, and various forms of cancer (including lung cancer and mesothelioma of the pleura and peritoneum). These diseases usually arise decades after the onset of asbestos exposure. Mesothelioma, a signal tumour for asbestos exposure, occurs among workers' family members from dust on the workers' clothes and among neighbors of asbestos air pollution point sources.

Project component	Project phase when impact will occur	
	Construction	Operation
Water pipelines and sewers	√	

Impact significance: The **sensitivity** of receptors is assessed as '**high**' given that the effects of asbestos are carcinogenic. The impact intensity is assigned '**medium**' rating resulting in a **major** impact significance.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies

- i) NWSC will ensure that the hired contractor demonstrates having experience and capability to observe international good practice standards with asbestos, including training of workers and supervisors, possession of (or means of access to) adequate equipment and supplies for the scope of envisioned works, and a record of compliance with regulations on previous work. The Contractor will be required to prepare a Hazardous Waste Management Plan.
- ii) The contractor shall follow NWSC & NEMA procedures (Appendix I & J) for handling waste AC materials
- iii) Decommissioned AC pipes and accessories will be managed through a third party contractor certified by NEMA.
- iv) The selected contractor shall provide adequate protection to his personnel handling asbestos, including respirators and disposable clothing.
- v) Disposal of AC pipes shall be carried out in a way that minimizes worker and community asbestos exposure. This way, all AC pipes and other related asbestos containing material shall be packaged, labelled, transported, stored and disposed of at approved sites for disposal of hazardous waste, for example, Luweero Industries Limited in Nakasongola District or EnviroServe waste handling facility in Hoima District.
- vi) Before transportation, the properly sealed, labeled and secured AC pipes are kept inside a locked fenced area to prevent access by unauthorized personnel, and covered to prevent water accumulation.
- vii) The contractor and NWSC Area Management will work hand in hand with the Municipal Council to facilitate sound waste handling and disposal from the site to the approved Mbale Municipal Council dumping site. All wastes will be taken to the approved dumpsites. AC pipe waste will be handled following NEMA Asbestos Handling and Disposal Procedure (Appendix J).
- viii) Proof of delivery and safe disposal of waste will be provided and records maintained at all times.

Adoption of the above mitigation measures will reduce impact intensity to “low” resulting in a residual impact of minor significance.

7.3.5 Improper Management of Waste

During construction, waste will be generated, including vegetation stripped from site, soil excavated from foundation sites, packaging waste (cement bags, paper, polythene sheets, and wood pallets), metal scrap, wire cuttings, wooden planks, polyethene sheets, PET water bottles, empty paint and solvent containers and waste oil from construction equipment or vehicles. Some of the waste materials such as paints, cement, adhesives and cleaning solvents contain hazardous substances, while some including metal cuttings and plastic containers are not biodegradable and can have long-term and cumulative effects on the environment.

Other wastes which will be generated by non-construction activities because of the presence of the workers, for example, during operation of facilities include food debris, contaminated water from washing, cleaning equipment, tools and vehicles. Inappropriate disposal of waste or spoil could have medium or long-term environmental and public health impact. Improper managing of these wastes could result in:

- Littering, health and safety risks associated with uncontrolled public access to disposal sites;
- Impairment of local air quality and increased health risks due to open burning of wastes; and

- Contamination of soil, air, surface water (in this case Swamp located adjacent to the STP site) and impact on public health when hazardous waste is improperly disposed of.

Operation of the WSPs generates relatively large quantities of sludge and solid waste that provoke negative impact on all media (soil, groundwater, air, etc.). There will be a need to remove the screenings and grit from all sites (Doko and Namatala WSPs) on an operational basis. Sludge will mainly come from the anaerobic and facultative ponds of the WSPs. Improper treatment of sludge could lead to putrefaction and other related problems such as bad odour, health effects etc. The removed suspended materials and screenings if not properly stored and managed on regular basis, can also cause odours.

Project component	Project phase when impact will occur	
	Construction	Operation
Water and sewer pipelines	√	
Modification of Doko & Namatala Waste Stabilization Ponds and construction of ablution blocks with water borne public toilets	√	√

Impact significance: The **sensitivity** of receptors is assessed as '**high**' given that some sites are located close to wetlands and streams, for example, the WSPs located near River Namatala and the lack of a well streamlined waste management system in Mbale and the growth centres. The impact intensity is assigned '**Low**' rating resulting in a **moderate** impact significance.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies-Construction phase

- The Contractor will be required to prepare a Waste Management Plan that will ensure that:
 - The wastes are properly segregated and separated to encourage recycling of some useful waste materials, that is, some excavated material can be used as backfills.
 - Solid waste storage bins and/or skips are provided at contractor's camp site and at the construction sites and ensure they are collected or emptied in time. Depending on the rate of accumulation, waste collection is made at least once in 24 hours and done in such a way to minimize nuisance of smell and dust during collection.
 - Hazardous wastes such as paints, cement, adhesives are managed through a third party contractor certified by NEMA.
 - Washing is not done at working areas but should be restricted to workers' camps and on paved areas to control runoff.
- The contractor, MWE and NWSC Area Management will work hand in hand with Mbale Municipal Council and respective Local governments to facilitate sound waste handling and disposal from the site. All wastes must be taken to the approved dumpsites. AC pipe waste will be handled separately from other hazardous wastes.

- iii) Proof of delivery and safe disposal of waste will be provided and records maintained at all times.
- iv) The contractor will hire and improve on existing sanitary facilities in the vicinity of the project area or provide his own facilities (e.g. mobile toilets) which should be adequate at construction sites.

Mitigation strategies - operation phase

- v) NWSC will ensure adequate operation and management of both the existing and the new facilities to avoid improper management of waste;
- vi) NWSC/MWE together with the respective District Local Governments at the growth centres will ensure that the solid waste is collected by a firm licensed by NEMA and that the collected waste is disposed of at dumpsite or landfill approved by NEMA;
- vii) Solid waste will be collected and disposed of in an approved dumpsite. Proof of delivery and safe disposal of waste should be provided and records maintained at all times;
- viii) Adequate bins will be provided to prevent access by vermin at the sewage treatment plant and public toilets; and
- ix) Strengthen the existing Water and Sanitation Committees especially the public water supply points.

Adoption of the above mitigation measures will reduce impact intensity to “very low” resulting in a residual impact of minor significance.

7.3.6 Air Pollution

The most significant issues that could potentially impact on air quality and climate during construction are combustion gas emissions and nuisance dust. During the construction phase there will be an increase in road traffic associated with material and equipment haulage. The principal sources of combustion gases are the exhausts of vehicles and construction equipment, power generation at the work camps and pipe storage yards. The potential impacts are nuisance to people in the area, coverage of crops (possibly leading to reduced yields) and deposition on natural vegetation and small animals, including bees.

During the operation, air pollution would mainly come from the public toilets and WSPs. If they are not operated and managed well, malodours are generated and can impact on communities in the downwind direction. Discharge of partially treated effluents due to overloading of the systems or negligence of the operator, in this case NWSC, in ensuring proper operation and maintenance could render the systems a nuisance and unfriendly to the environment and surrounding communities. The dried sludge shall be removed periodically from the sludge drying area and shall be taken to tip or be given to interested farmers. Burning can contribute to air pollution. The removed greasy material from the grease and sand trap if not properly stored and managed on regular basis, can also result in bad odours.

Due to the temporary nature of construction, dust emissions are not anticipated to have a long-term impact on local air quality. Dust nuisance will decline as stripped areas of land re-vegetate. Ambient air quality measurements (Table 27) indicate that the environment around the proposed project sites is currently devoid of sources of high noise and air pollution.

Project component	Project phase when impact will occur	
	Construction	Operation
Water and sewer pipelines	√	

Project component	Project phase when impact will occur	
	Construction	Operation
Modification of Doko & Namatala Waste Stabilization Ponds and construction of ablution blocks with water borne public toilets	✓	✓

Impact significance: The above impacts will affect roadside communities, communities neighbouring the proposed sites and road users. The manageability of the impact is high since typical impacts are well understood in conventional infrastructure construction industry and the ability to adapt to the impact is high because construction activities have been going on in the project area. Due to the intermittent and short-term nature of the activities, the **intensity** of impact is assessed as **low** and **sensitivity** of the receptors as **high**. The impact significance is therefore **moderate**.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies – construction phase

- Construction work will be undertaken by an experienced and duly registered contractor with a verifiable sense of environmental awareness and responsibility;
- Travel speeds of construction vehicles along the road especially at trading/ business centres will be controlled using humps and setting travel speeds not exceeding 40km/h;
- Trucks will be covered during haulage of construction materials to reduce on spillage of materials and wherever dust suppression is necessary, water will be sprayed over dusty areas;
- Workers will be provided with PPE and the use of PPE shall be enforced;
- All surfaced roads shall be subject to road cleaning and un-surfaced roads to dust suppression, the methodology and frequency of which shall be included in the Contractor's Traffic Management Plan;
- Stockpiles of friable material will be grassed in order to prevent wind erosion;
- A maintenance programme for equipment and vehicles will be implemented, to ensure air emissions like particulates, SO₂ and NO₂ are minimised.

Mitigation strategies – operation phase

- NWSC/MWE will ensure adequate operation and management of both the existing and the new facilities to avoid bad odours that would arise from improper management of the facilities;
- The perimeter of the proposed sites will be vegetated with trees and plants of varying heights thereby forming wind breakers in addition to chain link fences;
- Proper measures will be taken to avoid accidental surface runoff intrusion from the manholes of the sewage network, which can overburden the facilities and cause foul odours;
- NWSC will develop an Operations and Maintenance Manual for the Sewage Treatment Plan to guide staff on how to effectively run the WSPs;

- xii) Facultative ponds will be commissioned before anaerobic ponds to avoid odour nuisance when anaerobic pond effluent discharges into an empty facultative pond;
- xiii) Anaerobic ponds must be commissioned by filling them with raw sewage and seeded with sludge from a conventional sewage treatment plant or septic tanks. After filling and seeding, the pond should gradually be loaded up to the design-loading rate.

Adoption of the above mitigation measures will reduce impact intensity to “very low” resulting in a residual impact of minor significance.

7.3.7 Occupational Health and Safety (OHS) Risks

Construction traffic, excavation machinery and trenches may pose accident risk to workers either when equipment is operated by inexperienced workers or when in a poor mechanical condition or falls into the trenches. Inadequate OHS risks or problems could also result from insufficient medical capability at the construction site; or neglect of safety equipment, precautions and procedures.

During operation and maintenance of the water supply and sanitation facilities, occupational health and safety problems will arise. Workers at the facilities might experience negative health impacts, particularly during the removal and collection of screenings, grit, greases, sludge and sands etc. at the sewage; fatal falls, suffocation and injury while working in confined places like deep trenches. Storage and handling of tools, for example, sewer rodding snakes, spades, wheel barrows, spanners etc. if not well cleaned and disinfected may contaminate the stores and pose hazards to the workers. Other causes of OHS problem include but not limited to:

- Lifting of heavy and sharp objects;
- Poor transportation of materials for maintenance;
- Improper storage as well as handling and use of dangerous substances/ chemicals;
- Inadequate lighting and ventilation in workplaces;
- Lack of adequate training (or neglect of safety precautions/ guidelines) in use of equipment and tools;
- Misuse of equipment and materials for functions they are not designed;
- Lack of safety signage in specific areas;
- Electrical hazard;
- Eye hazards such as splashes;
- Lack of adequate PPE; and
- Biological hazards (vermin, mosquitos, pathogens, etc.).

Project component	Project phase when impact will occur	
	Construction	Operation
Water and sewer pipelines	√	√
Modification of Doko & Namatala Waste Stabilization Ponds and construction of ablution blocks with water borne public toilets	√	√

Impact significance: Accidents could cause considerable ecological damage, financial loss and harm to human life. While largely reversible, some impacts such as loss of human life and body injury are irreversible. The receptor **sensitivity** is considered **medium** given that although such impacts may be irreversible once they occur; the workers have done similar work and have knowledge on how to avoid

such incidences. The impact **intensity** is considered to be **medium** since NWSC will procure a qualified contractor who is aware of OHS measures and NWSC will be incharge of operating the facilities for which it has vast experience. Nevertheless, this gives rise to an impact of **moderate** significance.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies

- i) A qualified Health and Safety Officer will be recruited by the Contractor to oversee OHS matters on a daily basis.
- ii) All construction workers will be oriented on safe work practices and guidelines and ensure that they adhere to them.
- iii) Appropriate signage will be used to warn staff and/ or visitors that are not involved in construction and operation activities in dangerous places.
- iv) Regular drills will be constantly followed on various possible incidences. This will test the response of the involved stakeholders. Such drills will keep them alert and they will become more responsive in case of incidences.
- v) Training will be conducted on how to prevent and manage incidences. This should involve proper handling of electricity, water etc. and sensitization on various modes of escape, conduct and responsibility during such incidences. All must fully be aware and mentally prepared for potential emergency.
- vi) Personnel will only undertake tasks for which they are trained/ qualified. A formal 'permit to work' system will be in place and strict instructions will be given for operators of equipment.
- vii) Strict instructions will be given to drivers of heavy equipment and operators of equipment/ machinery. Ensure electrical safety at fabrication workshops by putting in place secure electrical connections and providing adequate insulation. All temporary electrical installations in use on site such as generators and welding sets should be adequately and effectively earthed at all times during operation.
- viii) Supervision of works will be done regularly (daily during construction and weekly during operation) to ensure that safety conditions are met while any deviation from safety regulations is immediately reclaimed following the best practices regarding safety at work.
- ix) Communication line will be ensured between workers and drivers of heavy equipment.
- x) Evacuation procedures to handle emergency situations will be developed. A van will be dedicated to this purpose during and throughout construction activities.
- xi) Adequate OHS personnel protective gear will be provided to the employees. The guide below should be useful:

Hearing (Over 80 Decibels for 8 hours a day requires hearing protection)

- Ear Muffs: One size fits all, comfortable, less ear infection risk

- Ear Plugs: Small, lightweight, can get dirty and cause infection

Face/Eye (Working with any chemical or using any mechanical equipment)

- Face Shield: Protect face from splashing and particles
- Safety Glasses: Protection from solids (cutting, sanding, grinding)
- Safety Goggles: Protects eyes from splashing

Hand (Use correct gloves for the job)

- Chemical Gloves: (Nitrile, Latex, PVC)
- Gloves for other use: special gloves for cutting, burning, abrasions/ blisters

Body

- Overalls: Can protect against dust, vapours, splashes

Foot Protection

- If electrical hazard present ensure boots offer protection
- Safety Toe/Steel Toe Boots: Always worn when potential for falling hazards exists
- Water/Chemical Resistant Boots: Use in a spill situation
- Non-slip boots for working on wet/slippery floors.

Working in water

- Water rescue apparel
- Water proof cardboard element

- xii) Strict adherence to safety measures and procedures are required to minimise (or eliminate) risks of accidents or hazardous developments occurring and ensure healthy and safe conditions for all persons working on the site. To ensure occupational health and safety on construction sites, the Contractor shall be obliged to comply with all applicable Ugandan construction Health and Safety Standards as required by the Occupational Safety and Health Act of 2006. These include provisions of the Factories Act, Labour Unions Act and Workman's Compensation Act.
- xiii) First aid box will be available at all active construction sites.
- xiv) An Accident Log will be maintained onsite to register all injuries and to investigate their causes during both the construction and operation phases of the project.
- xv) Emergency resources (e.g., fire extinguishers, stocked First Aid kits, Emergency Contacts, Doctor on Call, etc.) will be maintained at all active construction sites and at water and wastewater facilities during operation.
- xvi) The Contractor shall ensure that all areas requiring access including platforms, under platforms, underpasses, excavations, etc. have enough illumination.
- xvii) Ensure that excavations (soak pits, septic tanks, etc.) especially for public toilets are undertaken under strict guidance to avoid chances of collapse.
- xviii) All construction workers will be oriented on safe work practices and guidelines especially regarding work in confined spaces and it will be ensured that they adhere to them.
- xix) The contractor will first determine the nature of soil to be excavated before any excavation is done; the type of soils at the site – construction of toilets will be investigated to devise the extra care and expertise.
- xx) Before starting any pipeline excavation works, the contractor will undertake planning so that the significant hazards (e.g. collapse of the sides, materials falling on workers in the excavation; dangers

associated with excavation machinery; and falls of people and/or livestock into the excavation) can be addressed.

- xxi) The Contractor shall provide a signal man, barricades and safety sign boards around the excavations.
- xxii) Routine maintenance (removal of garbage, removal of screenings and grit, slashing around the embankments, repair of damages to the fence, etc.).
- xxiii) The manufacturer's instructions and Material Safety Data Sheets (MSDS) must be followed for the storage of all chemicals used in water and sewage treatment. Storage must conform to compatibility restrictions.
- xxiv) Regular fumigation of the Plant will be undertaken to kill disease vectors such as mosquitoes.

Adoption of the above mitigation measures will reduce impact intensity to “very low” resulting in a residual impact of minor significance.

7.3.8 Risk of Accidents

The water pipeline and sewers will have to be laid across existing roads (e.g. Naboa, Bishop Wasike, Hospital, Duka, Mbale -Tirinyi highway, Busoba - Butaleja roads) that are used by motorists and cyclists in addition to pedestrians. The trenches created for the pipe or sewer crossing can lead to accidents if proper signage is not put in place. Vehicles and trucks transporting construction materials to the site may result in community risk of traffic-related accidents, especially when the safe speed limits are not adhered to. Most of the water pipelines and sewer lines will be laid within the road reserves that traverse several communities with a significant number of school going children and traders, for example, Nabiswa Church of Uganda Primary School and Jami Primary School located along the Mbale-Tirinyi highway, and other commercial activities like shops mostly situated within Mbale Municipality and Nabigganda area in Butaleja.

Construction traffic accidents would be a significant social impact and likely to affect children, women, disabled, elderly people and livestock. The duration of the risk will be short-term occurring only during the construction phase. Although some effects of the accidents (e.g. minor injuries) may be reversible, some, for example, loss of human life is irreversible.

Project component	Project phase when impact will occur	
	Construction	Operation
Water and sewer pipelines	√	√
Modification of Doko & Namatala Waste Stabilization Ponds and construction of ablution blocks with water borne public toilets	√	

Impact significance: The receptor sensitivity is **high** given that there are a number of pedestrians and commercial activities along the roads while the intensity is **medium** given the temporary nature of the construction activities, however, some of the impacts like loss of life or damage to body may be irreversible. The impact significance is thus assessed to be **major**.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor

	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies

- i) Contractor will adopt best transport safety practices (Journey Management Plans (JMPs)) with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public by: employing safe traffic control measures, including road signs and flagmen/traffic guides to warn of dangerous conditions and children crossings; and setting speed limits on all access roads in the project area will be 40km/h for light vehicles and 30km/h for heavy vehicles. Through the JMPs, optimum routes from material storage areas to the construction sites will be identified to avoid sensitive receptors such as schools and hospitals.
- ii) The Contractor shall provide dedicated site entrances and exits for personnel, which shall be manned 24 hours per day, 7 days per week including holidays.
- iii) Some roads in Mbale Municipality e.g. Republic street are being surfaced. NWSC should contact UNRA and request for service ducts to be installed at points where sewers and water mains will cross roads to avoid cutting through roads that have just been upgraded.
- iv) The Contractor will have a community liaison Officer (CLO) to get feedback/complaints from communities regarding the operations of the project and issues the communities think are not being done in a proper manner. The CLO would also be responsible for informing project-affected communities of the timing and duration of the construction activities across access roads and any uncertainties or potential for change.
- v) All workers, including sub-contractors and casual labour, will undergo an environmental, health and safety induction before commencing work on site. This will include a full briefing on site safety and rules.
- vi) Restrictions on hours of driving (including night time restrictions where sensitive receptors may be affected) and timing of vehicle movements will be emphasized to avoid busy periods in urban areas, particularly the start and end of school and the working day.
- vii) No drivers or personnel under the influence of alcohol or any drug abuse will be allowed onsite.
- viii) The site, where possible, will be fenced and signalization put in place with security personnel to stop unauthorised people from accessing the site.
- ix) Strict adherence to safety measures and procedures are required to minimise (or eliminate) risks of accidents or hazardous developments occurring and ensure healthy and safe conditions for all persons working on the site and the project-affected communities. To ensure occupational health and safety on construction sites, the Contractor shall be obliged to comply with all applicable Ugandan construction Health and Safety Standards as required by the Occupational Safety and Health Act of 2006. These include provisions of the Factories Act, Labour Unions Act and Workman's Compensation Act.

Adoption of the above mitigation measures will reduce impact intensity to “very low” resulting in a residual impact of minor significance.

7.3.9 Pressure on Existing Resources

During the construction stage, demand for basic amenities such as water, fuel and gravel may put pressure on the existing resources such as water stress to the local communities and landscape blight due to unrestored borrow sites. Water scarcity is especially prevalent during the dry seasons where the water levels in the Rivers drop to a minimum and yet there are several aspects of the project that will require the resource during the construction phase, e.g. concrete mixing, compaction and dust suppression at the site and access roads etc.

Construction employment opportunities may attract an external workforce to the project areas who would in turn pose pressure on resources such as water, wood fuel, building materials, food, social infrastructure including medical facilities and land. This may mean increased encroachment on, and degradation of land as well as increased pressure on available community water resources. An increase in population also means increased pressure on the social infrastructure and risk of environmental pollution from human excreta and solid waste.

During the operational phase, the continuous abstraction of water from R. Namatala and R. Manafwa might reduce the flow levels downstream due to ineffective compensation. From water resources assessment River Manafwa is expected to have enough water. However, a guarantee cannot be given as extreme droughts can occur and human destruction of ecosystems continues. River Namatala has enough water for most times. However, by the end of the dry season, flows could not be sufficient to meet the projected water demand and the estimated minimum EF. Therefore, downstream users and aquatic biota could be affected if minimum EF is not maintained. In addition, the Mbale service area may not have sufficient water to meet its water needs during the dry season.

Project component	Project phase when impact will occur	
	Construction	Operation
Laying of Water and sewer pipelines	√	
Water treatment plant supply	√	√
Namatala intake water supply	√	√
Modification of Doko & Namatala Waste Stabilization Ponds	√	
Ablution blocks with water borne public toilets	√	√

Impact significance: Duration of the impact will be short-term or long-term depending on the recharge from the catchment and socio-economic activities prevailing given that Mbale Municipality is vying for City status. The extent of the impact will be local to respective districts for resources like gravel, wood fuel etc. but regional for the water resource as both R. Namatala and R. Manafwa are Trans-district Rivers. The **intensity** of the impact is **medium** if not alternative measures are instituted in the dry season to ensure that the water demand is covered but there are plans to put in place catchment basin management measures that would contribute in recharging the affected drainage basins. **Sensitivity** of the receptor is rated **medium** given that there are other sources that can still be relied on by the community e.g. Boreholes, spring wells etc. and abstraction permits are required for regulatory purposes. Therefore significance of the impact is **moderate**.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies – Construction Phase

- i) For the Namatala system, the NWSC will carry out an Alternative Water Supply Study prior to construction to evaluate options to augment water source during low flows for Namatala and assess the reliability of the proposed water supply system. The options will include, among others but not limited to: (i) construction of a water impoundment structure at the Namatala intake site to store water during high flows and sustain the water demand during the dry spell, (ii) construction and rehabilitation of boreholes in the small towns, (iii) expansion of Manafwa water supply system, and (iv) a reduction in water service delivery at acceptable levels. The study will include specific recommendations and an implementation plan. There are not considered individual solutions, but complementary and inclusive; therefore, the final recommendation would likely be a combination of these options. The MWE and the NWSC will implement the recommendations under the IWMDP.
- ii) The contractor will provide separate storage for water to use at the construction sites. Instead of connecting to the nearby/ communal water points, the contractor should opt to use water bowsers for water supply from the nearest surface water point.
- iii) The NWSC/MWE, supervising consultant and contractor will phase the construction activities in such a way that water-consuming activities (for example, concrete works, pressure testing) are not carried out concurrently but rather in combination with non-water-consuming activities (for example, trench excavation, pipe laying) in the same location, where possible.
- iv) Through inductions and toolbox meetings, NWSC/MWE will ensure that contractors are conversant with resource conservation practices in all project activities. Conservation awareness will focus on water use efficiency and general day-to-day measures such as turning off taps when water is not being used.
- v) The Contractor and NWSC will acquire water abstraction permits with conditions to guide the amount of water to be abstracted as stipulated in the Water Supply Regulations (1999).
- vi) Earth materials will be sourced from NEMA-approved sources in a manner that reduces environmental and social impacts. Approved sources are known and easy to monitor and regulate by both the district local administration and NEMA.

Mitigation strategies - operation phase

- vii) Catchment management plans are being developed with the aim of conserving and allowing recharge of water resources.
- viii) Community sensitization regarding the water supply system and water conservation measures will be encouraged: saving water is an efficient way of reducing the overuse of ground water resources. It is not only decreases the amount of the water withdrawn, but may also reduce the threat of pollution

- ix) NWSC should adhere to the safest maximum abstractable water quantities throughout the project life. The Namatala water intake will be designed to allow minimum EF pass through the abstraction point. Flow monitoring devices will be installed to monitor minimum EF by NWSC and DWRM
- x) NWSC should adhere to the stipulated limits in the water abstraction permit obtained from DWRM.

Adoption of the above mitigation measures will reduce impact intensity to “very low” resulting in a residual impact of minor significance.

7.3.10 Landscape and Land Use Impacts

Construction of the ablution blocks with water borne toilets will alter the land usage of the proposed sites where the toilets will be located respectively. This land use alteration will be long-term lasting the entire project lifetime. Other project aspects that will temporarily impact on the land use of the project areas will be the use of land for construction maintenance yards, construction camps and pipe yards.

Project aspects that will impact on the landscape of the area are the temporary and the permanent adoption of land for the water supply facilities (Reservoir tanks in the growth centres, block valves and access roads) and sewage management facilities, etc. Sourcing earth materials such as murrum and gravel which are used for construction works can have visual and socio-environmental impacts if borrow pit areas are not properly restored after use. Water impounded in derelict borrow pits forms a breeding ground for mosquitoes or other disease vectors, posing health risks to local communities, which is a negative but reversible impact. In addition, there will be change in the land use at the proposed sites for wastewater management facilities hence a change in the visual quality.

Project component	Project phase when impact will occur	
	Construction	Operation
Laying of Water and sewer pipelines	√	
Water treatment plant supply	√	√
Modification of Doko & Namatala Waste Stabilization Ponds	√	
Ablution blocks with water borne public toilets	√	√

Impact significance: Duration of the impact will be long-term and the extent of the impact will be local. The **intensity** of the impact is **low** given that some of the facilities are already existent and only modifications will be made to them and, sludge drying beds blend well with the environment. **Sensitivity** of the receptor is rated **high**. Therefore significance of the impact is **moderate**.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies

- i) The contractor will be required to develop and implement a Reinstatement Plan.

- ii) Murrum and subsoil will be obtained preferentially from a licensed source and in accordance with any terms of the license. "Licensed" means approved by NEMA or the respective District Local Governments. The contractor will provide a copy of the license to NWSC before the beginning of works at the murrum/subsoil extraction location;
- iii) If no suitable licensed source of murrum/subsoil is available in the area and the contractor plans to obtain the material from a private landowner, then the contractor will:
 - Provide NWSC/MWE with a copy of the written agreement between the contractor and the owner of the murrum/subsoil source in advance of the beginning of works at the location. The identity of the landowner will be certified by a certificate of ownership or a paper signed by the LC1 chairperson and/ or Head of Clan;
 - Engage and consult any households and/or communities in close proximity to the identified murrum/topsoil source and provide evidence of these consultations to the NWSC;
 - Ensure adequate compensation on mutually agreed terms is made to people who are either physically or economically displaced by the activities of the contractor. The contractor will provide documentation of the compensation terms (minutes of consultation meetings, signed agreements with affected persons, compensation receipts etc.) to NWSC;
 - Assess health and safety risks linked to murrum/subsoil extraction and transport, and implement appropriate mitigation measures. The risk assessment will be provided to NWSC ahead of the beginning of works;
 - Provide a restoration plan for review, and ensure that the actions of the restoration plan are implemented to the satisfaction of concerned authorities. Sign-off from the relevant authorities will be required and copies of the sign-off will be provided to NWSC.
 - NWSC will submit to NEMA the documentation related to management of the identified borrow pits, especially the restoration plan of the borrow pits.
- iv) Restoration of borrow pits to as close to pre-project conditions as possible will be done immediately after use in cases where they are specifically opened up for this project. Native vegetation must be used for re-seeding the excavated site.
- v) Where grading impacts on the local topography, reinstatement will be undertaken in a manner which is generally sympathetic to the existing contours.
- vi) Reinstatement of the water pipeline and sewer routes will be done in such as return the visual integrity of the landscape as closely as possible to its previous condition.
- vii) Wherever possible the removal of existing mature trees will be avoided, for example, for the sewerage network provided that the integrity of the pipeline/ sewer line is not jeopardised.
- viii) In areas where grading of the working width impacts on the local topography, reinstatement will be undertaken in a manner which is generally sympathetic to the existing contours.
- ix) Where sections of the road are cut, these will be reinstated immediately after construction or maintenance activities.
- x) Where pipelines and sewers are not buried in ground, if any, they will be painted to blend with the environment. They will be adequately supported by concrete pillars and of such materials that cannot easily be damaged by the communities.

Adoption of the above mitigation measures will reduce impact intensity to "very low" resulting in a residual impact of minor significance.

7.3.11 Social Misdemeanour by Workers

While most workers may originate from the local community where they have families, there might be others from distant places and working away from their families. With some disposable income to spend, this might induce illicit sexual relationships, with attendant risk for spread of HIV/AIDS. Irresponsible sexual relationships in project communities can break families and heighten risk of contracting HIV/AIDS. Illicit sexual relationships can be short-term but have long-term and irreversible effects if HIV were contracted. If this impact occurred, extent of disease spread would be local or national depending on origin and next destination of infected persons.

Project component	Project phase when impact will occur	
	Construction	Operation
Laying of Water and sewer pipelines	√	
Water treatment plant supply	√	
Modification of Doko & Namatala Waste Stabilization Ponds	√	
Ablution blocks with water borne public toilets	√	

Impact significance: Duration of the impact will be short-term or long-term depending on whether HIV/AIDS is contracted and the extent of the impact will be local or national depending on origin of construction workers. The likelihood of the impact occurring is low if contractor adequately sensitise workers about responsible and safe behaviour. The **intensity** of the impact is **very low** given that similar construction activities like for roads are already taking place in the area. **Sensitivity** of the receptor is rated **high** given that HIV/AIDS, if contracted, is a long-term effect. Therefore significance of the impact is **minor**.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies

- As a contractual obligation, contractors shall be required to have an HIV/AIDS policy and a framework (responsible staff, action plan, etc.) to implement during project execution.
- All construction workers shall be orientated and sensitized about responsible sexual behaviour in project communities.
- All Contractors to develop & implement a Labour Influx Management Plan and Workers' Camp & Accommodation Management Plans as part of C-ESMP
- All workers to sign employment contract including Code of Conduct. The contractors will develop and follow a code of conduct. An example is provided in Appendix H
- Establish a Grievance Committee for Workers
- Casual workers be employed from host community to reduce labour influx

- vii) Sensitize workers on community based social behaviour and conduct; sensitize workers to not engage in sexual relations with underage girls and married women;
- viii) Establish a Grievance Redress Committee to act as link between community and the project; local leadership should always be sought as a first priority in solving issues;
- ix) prepare both local communities psychologically and the new comers;
- x) Efforts to be geared toward instilling attitudes of tolerance, support and understanding of labour immigrates by the local communities;
- xi) Regular Monitoring by District Local Governments (Community Development Officers, Probation Officers, Gender Officers) and MGLSD

7.3.12 Loss and Degradation of Natural Habitats

The area traversed by project facilities is relatively large and traverses largely through built up environment, extensive subsistence farmland, seasonal and permanent wetlands including Lwabi and Nakwasi wetland system. The proposed Mbale-Busolwe water pipeline route traverses through built up area, subsistence gardens of maize, banana, Potatoes, Beans, cassava, and rice; it also cuts across extensive rice farmland of Doho irrigation scheme, and the only remnant *Cyperus papyrus-Cyperus dives* swamp in areas of Lwabi and Nakwasi. Given the pipeline and sewer corridors, there will be minimal vegetation clearance during construction activities especially during excavation of land. This is expected to cause minimal disturbance since almost all natural vegetation was converted into farm land.

Loss of tree cover may occur along all the routes during pipeline construction but this will notably be in areas where the proposed pipeline route passes through mixed patches of post cultivated areas, woodlots, and agricultural gardens. Consequently, no significant impacts or loss of habits will result from construction and operation of the proposed pipeline.

Project phase when impact will occur	Construction	Operation
	√	

Impact significance: Impact **intensity** is considered **low** since there are no natural forested stretches along the pipeline route. Moreover where natural vegetation exists along the proposed pipeline route, it exists in a post cultivated form except at Lwabi and Nakwasi Cyprus swamp. The **sensitivity** of the receptor is rated **low** given that most of the areas traversed by the project were already disturbed with human activities resulting in a **minor** impact significance.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies

- i) Construction activities should be restricted only to the areas that must be disturbed to avoid unnecessary disturbance
- ii) All project workers should be sensitized to minimize damage to vegetation and flora
- iii) Close monitoring and supervision of the construction operations to ensure compliance and avoid causing further damage to undesignated project areas
- iv) Support and encouragement of communities to plant trees by providing planting material for fast-growing and multiple use species e.g. *Maesopsis eminii* and *Markhamia lutea*
- v) Support monitoring of performance of the planted trees
- vi) Where tree cutting is inevitable, replacement planting should be done wherever feasible.

7.3.13 Disruption to Communication Routes

The excavation of trenches and pipe/sewer installation along main roads within Mbale municipality will result in considerable and unavoidable delays to traffic flows. At the present time, and until the contractor has developed a detailed programme of work, the exact timing and duration of delays, the overall impact upon the community is difficult to assess. The impact upon vehicular movement will generally be confined to increased journey time and the costs associated with delays, which in the majority of cases will only be of minor inconvenience. Effective traffic management will be key in determining the severity of impacts. Delays will be most noticeable during morning and evening peak 'rush-hours' even though these are relatively modest in Mbale Municipality. In addition to the general disruption of communications, laying of sewers and water pipes will result in the temporary loss of access as work progresses past individual property entrances. This will be most serious when crossing roads and in front of public building and emergency service centres.

Project component	Project phase when impact will occur	
	Construction	Operation
Water pipelines and sewers	√	√

Impact significance: Duration of the impact will generally be short-term and the extent of the impact will be local. The **intensity** of the impact is **low** given that the road network in the municipality is well planned and has interconnections in most parts of the project area. **Sensitivity** of the receptor is rated **low**. Therefore significance of the impact is **minor**.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies

- i) Appropriate signage will be used and impacted owners will be informed ahead of disruption.
- ii) Disruptions to public access shall be identified in the Contractor's Traffic Management Plan, under which suitable notice of intending delays and closures are given to all concerned parties and approved prior to commencing work. All road closures shall be separately notified and agreed with

the Municipality administration. However, partial closures and traffic delays managed with flagmen need not be separately notified.

- iii) Where access to or from an individual property is closed for a period of 2 hours or more, the owner shall be informed at least 24 hours in advance.
- iv) Vehicular access to and from hospitals, police stations and fire stations shall be maintained through the use of steel road plates over open trenches. Pedestrian access to schools, health facilities, and other premises frequently accessed by the public will be maintained with the use of walking boards.
- v) The laying of pipelines and sewers, backfilling and temporary reinstatement shall follow trench excavation as quickly as possible and trenches will not be left open for extended periods.

7.3.14 Disruption to Public Utilities

During the installation of new subsurface infrastructure, it is very easy to damage existing service cables and pipelines or temporarily interrupt supplies to consumers. For example, some of the telecom and power lines have been installed underground although most are above ground. Also underground are existing water supply pipelines and sewers that are assets of the project proponent.

Project component	Project phase when impact will occur	
	Construction	Operation
Water pipelines and sewers	√	√

Impact significance: Duration of the impact will generally be short-term and the extent of the impact will be local. The **intensity** of the impact is **low** given that such utilities are well demarcated and the **Sensitivity** of the receptor is rated **low**. Therefore significance of the impact is **minor**.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies

- i) Prior to undertaking any works, the Contractor will obtain from the utilities agencies definition and details of all utilities sites within 50m of the works. These agencies shall include, but not necessarily be limited to, the following:
 - Umeme;
 - Telecom companies;
 - National Water & Sewerage Corporation, etc.
- ii) Damage to any utility at a defined site shall be made good to the satisfaction of the responsible agency at the Contractor's cost. Damage to utilities not defined prior to construction, despite the Contractor having undertaken all reasonable liaisons with the responsible agencies, shall not be the

responsibility of the Contractor. It shall be the responsibility of NWSC to ensure the utilities' agencies respond in good time to the Contractor's requests for information.

- iii) NWSC will ensure that water supply to the project affected communities is not interrupted for more than 24 hours. Announcements will also be made to ensure consumers store enough water to take them through the period of interrupted service provision.
- iv) Contractors shall liaise with each of the agencies responsible for the maintenance of utilities that are to be crossed, temporarily diverted or otherwise affected by the works as to the timing and nature of any disruption of service. Where required, the responsible agency shall be requested by NWSC to carry out the necessary works at the time required and at NWSC's cost. The Tender Documents shall contain sufficient information on utilities' crossings to permit the Contractor to include the cost of the works for which he is responsible in his or her bid.
- v) The Contractor shall incorporate his or her programme his or her proposed arrangements for traffic diversions in the form of a Traffic Management Plan, with details of all necessary signage and any temporary works for approval by the NWSC and the Municipality Engineer. The programme shall also contain details of the timing of the proposed closure, dates of closing and re-opening the route, and of any necessary remedial works.

7.3.15 Permanent Land-take

Construction of the STP, ablution blocks with water borne toilets, reservoir tanks in the growth centres and laying of the water and sewer pipelines will to certain extents involve taking of land permanently from the original owners. The proposed Mbale Pressure break tank (100m³ capacity) at and Busoba reservoir (2000m³ capacity and size (24.6m X 24m X 4.5m)) and the other reservoir tanks in the growth centres will be placed on government land hence avoiding displacement and compensation of the would-be land owners. Modification works at the WSPs will not require any new land-take as the system will only be improved within the existing boundaries.

Laying of the Water and Sewer pipelines will be done within the boundaries of the existing road reserves that is owned by the Government. However, in the event that there are people's properties within the road reserves, due compensation will be effected prior to construction works.

Project component	Project phase when impact will occur	
	Pre-Construction	Operation
Water and sewer pipelines	√	
Modification of Doko & Namatala Waste Stabilization Ponds	√	
Ablution blocks with water borne public toilets	√	

Impact significance: The likelihood of this impact occurring is high because land will be lost to the reservoirs. Impact intensity is **low** since most of the said land is not under intensive agricultural activities and Government owns most of the affected land. Sensitivity of receptors is **high** because properties will be affected for the water pipeline especially around Budaka area where most persons encroached into the road reserves. Therefore significance is **moderate**.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Inten sity	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor

	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies:

- i) NWSC/MWE will ensure that the project-affected persons identified through the Resettlement Action Plan study of the project are compensated for the land and property on it in time and fairly.
- ii) Land will be acquired in accordance with the Resettlement Action Plan developed for the project based on Uganda's Land Access and Compensation Procedure and World Bank's Safeguard requirements (OP/BP 4.12), which requires amongst others:
 - Sensitization of community members whose property will be affected.
 - Completion of a full inventory of privately registered and/cultivated, grazed or other uses of the property that will be taken for the project as well as structures and graves within the road reserves.
 - Compensation to be paid in line with mandated rates agreed in consultation with the respective Project District Officials' before commencement of construction activities.
 - Ensuring that the Chief Government Valuer approves the valuation rates.

Adoption of the above mitigation strategies will lower the impact intensity to "very low" rate resulting in a *minor* significance.

7.3.16 Sludge Disposal

Sludge will be generated during rehabilitation of the Doko and Namatala Waste Stabilisation Ponds. This activity has the potential to have two negative impacts. The first being unscrupulous cesspool emptiers collecting funds to carry septage from the source to approved disposal facilities and depositing it at unapproved locations and the second being the smell.

Project component	Project phase when impact will occur	
	Construction	Operation
Waste management facilities		√

Impact significance: The **intensity** of the impact is **high** once septage is disposed of in the wrong place while **sensitivity** of the receptor is rated **high** due to the discomfort experienced as a result of the stench from wrong disposal of septage, hence resulting in a **major** impact significance.

		Sensitivity of receptor			
		Very low 1	Low 2	Medium 3	High 4
Intensity of impact	Very low 1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low 2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium 3	3 Minor	6 Moderate	9 Moderate	12 Major
	High 4	4 Minor	8 Moderate	12 Major	16 Major

Mitigation strategies:

- i) Institute and maintain a ticketing system for cesspool emptiers, where upon successful disposal, the operator of the waste treatment facility would issue a receipt to the cesspool emptier.
- ii) Kibuku District Local Government/ Kadama sub-county and MWE, should put in place a system to monitor cesspool emptiers and in addition, have a public educational campaign to educate and inform the public about the system.
- iii) NWSC and Mbale District Local Government will work closely to ensure that transporters of sludge take it to designated areas for disposal.
- iv) The MWE, NWSC and the District Local Government will work together to identify the most suitable way of disposing off the treated sludge. If the sludge is to be reused as a soil conditioner, it will be tested to ensure its safety before being given to farmers.

Adoption of the above mitigation measures will reduce impact intensity to “low” resulting in a residual impact of moderate significance.

7.4 CUMULATIVE IMPACTS

7.4.1 Positive Cumulative Impacts

There will be improved safe water supply within Mbale Municipal Council and the growth centres of Kadama, Tirinyi, and Kibuku as well as improved access to sanitary facilities as a result of the project's intervention to improve public health by way of pit latrines and faecal sludge drying beds. This will be in addition to improvements contributed by other projects in area, forexample, improvement of the road network in the municipality andneighbouring areas.

7.4.2 Negative Cumulative Impacts

Induced development can cause in-migration as a result of increased economic activity and development. This is likely to happen in towns and trading centres and may result in social tensions or increase in prostitution, crime and excessive demand for resources (food, water, rented accommodation). As towns develop, prices of land, food and other commodities may increase, making them increasingly unaffordable for local residents.

8 ENVIRONMENTAL-SOCIO MANAGEMENT PLAN (ESMP)

This environmental-socio management plan, ESMP (Table 44) for proposed construction works and operation of the water supply and sanitation facilities under this project, identifies the potential environmental and social aspects that should be monitored. It identifies parties responsible for monitoring actions, associated costs, indicators and training or capacity building needs and reporting. Various aspects of the ESMP are detailed in sections below

8.1 INSTITUTIONAL ARRANGEMENTS

8.1.1 Institutional Structure and Responsibilities

During the construction phase, there will be three parties involved with the ESMP, that is, the client (NWSC in Mbale Municipality and DWD in the small towns) with ultimate responsibility for E&S performance on the project; the Supervising Engineer (with an Environment and Social Specialist on their team) responsible for monitoring and supervising the implementation of the ESMP and contract requirements by the contractor(s); and the Contractor (with an Environmental Specialist, Social Development Specialist and Health & Safety Specialist) who has responsibility for implementing the ESMP. NWSC and DWD in their respective areas of operation will ensure that both the Supervising Engineer and Contractor are doing their jobs effectively and that the ESMP is delivering the necessary environmental and social protection measures.

Therefore, the institutional responsibility of ensuring that this ESMP is implemented will rest with NWSC and DWD having a key role of reviewing consultants' reports for compliance with the ESMP, among others. The Project Managers from either institutions shall have the ultimate responsibility for implementation of ESMP and will therefore ensure that resources are duly provided. Other roles will be:

- Monitoring implementation of mitigation actions by contractors
- Coordinating training and capacity building where planned

NWSC/DWD should ensure that all its personnel to be involved in implementation of this ESMP are adequately qualified and were appointed based on their qualification and suitability for respective roles. There is thus no training provided for them under this ESMP. Supervising Engineer is required to have an Environmental & Social management Specialist by contractual obligation. The Contractor's Environment and Social Officer will ensure that the provisions in this ESMP are implemented within the sites under their supervision and to collect and transmit relevant information to the Supervising Engineer.

Subcontractors will be required by a condition of their subcontract with the main contractor to actively manage environmental and social issues associated with their subcontract works and comply fully with all the applicable statutory regulations and the main contractor's environmental and social management plans. For significant aspects of work such as earthworks, the contractor may require subcontractors to provide their own Environmental and Social Management Plans and/or Method Statements for review by the Contractor's Environmental consultant/Officer. These ESMP's shall be approved by the Resident Engineer in consultation with NWSC for adequacy before being implemented.

The Municipal & District Environmental Officers (DEOs) are responsible for overseeing environmental protection on behalf of NEMA. The DEOs within the respective project districts will have monitoring roles during execution of this ESMP in their respective project areas. Usually, these officials lack adequate facilitation so the project will need to provide auxiliary financial assistance for them to have effective participation in this project.

The contractor will be required to prepare ESMPs setting out the measures that they will take to implement the ESIA ESMP during the construction. This requirement also applies to NWSC and DWD during the operation phase of the project in their respective areas of operation.

8.1.2 Monitoring and Reporting Arrangements

Monitoring will verify if predicted impacts have actually occurred and check that mitigation actions recommended in the ESIA are implemented and their effectiveness. Monitoring will also identify any unforeseen impacts that might arise from project implementation.

Who monitors and how: Monitoring will be undertaken by NWSC/DWD (PCU) and Environmental Officers who represent NEMA at local administrative level. Monitoring by NEMA in this case can be considered “third party monitoring” but this is its regulatory mandate according to Sections 6 and 7 of the National Environment Act (Cap 135).

Another government agency that may undertake “third party monitoring” is the Occupational Health & Safety Department in Ministry of Gender, Labour & Social Development (MGLSD). This unit has authority to inspect any facility for compliance with national requirements on safety in workplaces. The project shall make no funding to MGLSD since this is provided for in its annual budget.

Monitoring will be done through site inspection, review of site records (Accident Log, issuance of PPE, waste records, trainings and inductions, permits and approvals, etc.), review of grievances logged by stakeholders and *ad hoc* discussions with potentially affected persons (construction workers, residents near the project facilities). At each monitoring, a discussion with chairpersons of environment committees of the areas’ local councils (LC) could provide insight into views and grievances communities have about the project since they regularly interact with their community members.

Frequency: Monitoring will be undertaken continuously on a daily basis over the construction period.

Audits: Audits will be necessary both during construction and project operation. While construction audits will aim to verify compliance to impact mitigation requirements, post-construction audits are a regulatory requirement within 12 months and not more than 36 months after completion of construction, according to national EIA Regulations, 1998 Section 31(2).

Since construction duration is estimated to be 1½ years, this ESMP has included a budget for 1½ year’s construction audit and a separate provision so that from year 2 to year 5 full environmental audits are done as per Uganda requirements.

Both construction and post-construction audits can be conducted internally (by NWSC) or by a consultant hired by NWSC. If undertaken by a hired consultant, a budget has been proposed for both in this ESMP.

Reporting: Concise monthly monitoring reports should be compiled by the Contractor. The report will highlight the different activities undertaken to manage environmental and social aspects of the project in line with contract specifications, laws, standards, policies, and plans of Uganda and World Bank Safeguard policies. The report will be discussed during the monthly progress meetings. The Supervising Engineer guided by the Environmentalist and Social Specialist will approve the Contractor's monthly environmental and social monitoring report that will then be transmitted to NWSC or DWD for final approval. NWSC's or DWD's Environmental Management and Social Specialist will also independently monitor the implementation of the ESMP and/or verify the accuracy and content of the Contractor's monitoring report and then report to the client. The report will also be shared with The World Bank and other relevant stakeholders. Strictly it will be the contractors compliance with the contract requirements (whether BoQ items or items considered part of other BoQ items) that will enable the Resident Engineer or Supervising Engineer to approve payment.

Construction- and post-construction phase auditing should culminate in reports that NWSC shall share with IDA, NEMA or other interested stakeholders. Note that while NWSC is under no obligation to disclose construction phase audits, annual post-construction audits must be submitted to NEMA as a regulatory requirement as per Section 31(2) of National EIA Regulations, 1998.

8.2 GRIEVANCE MECHANISM

This section describes avenues for affected persons to lodge a complaint or express a grievance against the project, its staff or contractors during project implementation. It also describes the procedures, roles and responsibilities for addressing grievances and resolving disputes. Every aggrieved person shall be able to trigger this mechanism to quickly resolve their complaints.

The objectives of the grievance process are:

- i) Ensure that appropriate and mutually acceptable corrective actions are identified and implemented to address complaints;
- ii) Verify that complaints are satisfied with outcomes of corrective actions;
- iii) Avoid the need to resort to judicial proceedings.

The grievance mechanism at each project facility will be fed from three main sources:

- Community residents and the respective local leaders;
- Supervising engineer, clerk of works or contractor; and
- Monitoring team who will forward issues/concerns identified in the field.

Steps of the grievance process are described below. A flow chart outlining the main actions and decision points is shown in Figure 32.

Step 1: Receipt of complaint

A verbal or written complaint from a complainant will be received by the Clerk of Works or Project Office and recorded in a complaints log s(he) keeps on site. The log will indicate grievances, date lodged, action taken to address complaint or reasons the grievance was not acted on; information provided to complainant and date the grievance was closed. Grievances should be lodged at any time, either directly to the Clerk of Works/ Project Office or through the Local Council Chairperson. The process for lodging a complaint is outlined below:

- i) Clerk of Works/ Project Office (Project Engineer, two (2) Sociologists or Community Liaison Officers and one support staff) receives complaint(s) from complainant and records it in log (in English).
- ii) Clerk of Works/ Project Office reads the recorded complaint translating it into local language for the complainant to confirm correct detail of complaint has been documented.
- iii) Complainant signs the log to confirm grievance was accurately recorded.

Step 2: Determination of corrective action

If in his/her view, a grievance can be solved at this stage, the Clerk of Works/ Project Office will determine a corrective action in consultation with the aggrieved person. Remedial action(s) and timeframe within which they must be accomplished has been described and the party responsible for implementing them will be recorded in the complaint log.

Grievances will be resolved and status reported back to complainants within 5 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 not more than 1 month from lodging a grievance.

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 5 days of receipt of the grievance. Consent to proceed with the corrective action will be sought from the complainant and witnessed by a local council chairperson (LC Chairman).

Step 4: Implementation of corrective action

Agreed corrective action will be undertaken by the project or its contractor within the agreed timeframe. The date of the completed action will be recorded in the log against the complainant's grievance.

Step 5: Verification of corrective action

To verify satisfaction, the aggrieved person will be asked to return if not satisfied with the corrective action.

Step 6: Action by NWSC and project contractors

If the Clerk of Works cannot solve the grievance, he will refer it to NWSC (and contractor) through the Supervising Engineer. It is believed all possible grievances can be solved at this level.

The grievance process to be followed is depicted in Figure 55.

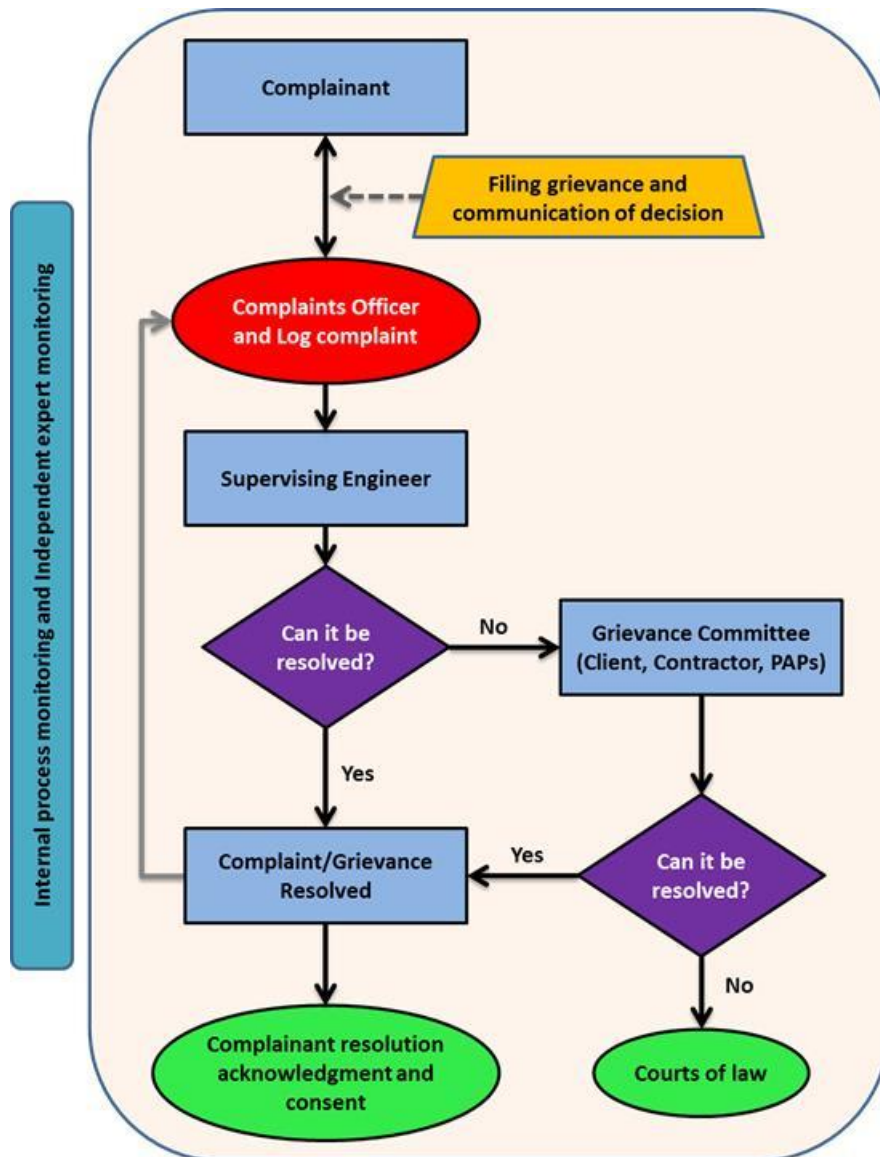


Figure 55 Mechanism for grievance management

Table 44: Environmental & social monitoring & management plan

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
7.2 POSITIVE IMPACTS							
7.2.1 Income to material/ equipment suppliers and contractors	a) Project will promote local procurement where technically or commercially reasonable and feasible.	Local communities and businesses benefit from procurement process	Number of local businesses benefiting from construction related procurement	Before and during commencement of construction	Contractor	NWSC/ District Local Governments of Project Area.	
	b) For earth materials, procurement will be made from legitimate sources to avoid encouraging environmental degradation	Project's material demand does not encourage environmental degradation	All quarries from which materials (sand, stone) are obtained are licensed by the local authorities	Before and during construction	Contractor	NWSC/MWE/ District Local Governments of Project Area	
7.2.2 Employment	a) Information to create awareness about the proposed project activities will be provided to the project-affected communities; prepare both local communities psychologically and the new comers; Efforts to be geared toward instilling attitudes of tolerance, support and understanding of labour immigrants by the local communities. Regular Monitoring by District Local Governments (Community Development Officers, Probation Officers, Gender Officers) and MGLSD	The participation of local community members in all project activities.	Local community awareness of project progress status	Before and during construction	Contractor in association with NWSC	NWSC/MWE/ District Local Governments of Project Area	10,000,000
	b) Unskilled labour will be recruited exclusively from local community, and semi-skilled labour will be recruited preferentially from such communities, provided that they have the requisite qualification, competence and desired experience.	Maximisation of participation of local community members during site preparation and construction activities.	Number of local people (unskilled and semi-skilled) employed during construction phase	Before and during construction	Contractor	NWSC/ District Local Governments of Project Area	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	c) Contractors will be encouraged to pay a “living wage” to all workers.	Some level of improved livelihood of the local community	Record of contractors’ employment activities on a monthly basis, including number of jobs created by employment type (skilled / semi-skilled / unskilled); number of jobs by gender, employment type and geographical area; total man hours and wages paid, by employment type, gender and geographical area; and rate of employee turnover by gender and area.	Before and during construction	Contractor	NWSC/ District Local Governments of Project Area	
	d) A training programme for artisans (builders, carpenters, plumbers) in the project area could be facilitated by the project to ensure skills transfer during the construction period.	Skills transfer to the community members hence empowering them to become job creators.	Number of local people trained during construction phase	Before and during construction	NWSC/MWE/ Contractor	NWSC/MWE/ District Local Governments of Project Area	20,000,000
	e) All Contractors to develop & implement a Labour Influx Management Plan and Workers’ Camp & Accommodation Management Plans as part of C-ESMP; All workers to sign employment contract including Code of Conduct (Annex H – example) ; Establish a Grievance Committee for Workers; Sensitize workers on community based social behavior and conduct; sensitize workers to not engage in sexual relations with underage girls and married women; Establish a Grievance Redress Committee to act as link between community and the project; local leadership	Workers and community members live in harmony.	Number of cases reported	Throughout construction	Contractor	NWSC/MWE/ District Local Governments of Project Area	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	should always be sought as a first priority in solving issues;						
7.2.3 Infrastructure improvement	The communities along the road will further be sensitized and encouraged to be cooperative when this kind of infrastructure, for example, electric poles are being put in place.	Support infrastructure put in place without any hindrance	No complaints	Prior to commencement of construction	NWSC/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	
7.2.4 Improved health status of households and communities.	Educate users on the proper use, regular cleaning and effective maintenance of both the household and public facilities.	Improved health status of households	Clinical records of reported cases. Reduced incidences of illness at household level.		NWSC/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	
7.2.5 Educational Enrolment and Attendance	Encourage parents to take their children of enrolment age to school	Improved enrolment and attendance at all levels	Record of candidates at all institutional/ educational levels		NWSC/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	
7.2.6 Acquisition of New Skills	Where the required skills are available locally, the local people should be given first priority commensurate to their level of training.	Improved capacity to handle assignment or repairs in the Project areas.	Number of local people employed for skilled jobs	Before commissioning of facilities	NWSC/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	
7.2.7 Improvement in Household Economic Status	Water tariffs will be set taking into consideration the different levels of users. The users should also be educated to avoid wasteful use of the resources	Time saved for other income generating activities	Number of new connections; public majority comfortable water tariffs.	Regularly as need arises	NWSC/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	
7.2.8 Saving in the Cost of Medical Treatment	Educate users on the proper use, regular cleaning and effective maintenance of both the household and public facilities	Savings made for investment or other household requirements	Household investments/ activities arising from improved water supply	Regularly as need arises – community outreach activities	NWSC/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	18,000,000
7.3 NEGATIVE IMPACTS							
7.3.1 Degradation of	a) The topsoil removed from the site during site preparation will be stored properly (away	No topsoil is washed away into the environment	Top soil or overburden in dumped at non-designated sites	Throughout construction	Contractor	NWSC/MWE/ District Local	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
Land and Soil Erosion	from runoff and possible contaminants) for reuse else.	and is readily available for backfilling				Governments of Project Area	
	b) All waste generated during site preparation and construction will be transported to an authorized disposal area. The contractor will seek guidance from Mbale Municipal Council and the Respective District Local Governments in project area on the final disposal point.	All waste collected and disposed of properly	No complaint from communities around the site and road of poor management of waste. No litter at project site and complaints from authorities	Throughout construction	Contractor	NWSC/MWE/ District Local Governments of Project Area	50,000,000
	c) Use of old equipment or even damaged equipment that is most likely to have oil leakages thus contaminate soils will be avoided.	No soils or land are contaminated as a result of project activities	Soil quality data	Maintenance of equipment throughout construction	Contractor	NWSC/MWE/ District Local Governments of Project Area	
	d) A waste management plan will be developed prior to start of construction activities.	Waste management plan developed	No complaint of poor management of waste from communities around the site and road. No litter at project site and complaints from authorities	Before construction	Contractor	NWSC/MWE/ District Local Governments of Project Area	
	e) Construction equipment will be properly maintained and fully functional to avoid leakages.	Equipment functioning properly	Records of maintenance/ soil quality data	Throughout construction	Contractor	NWSC/MWE/ District Local Governments of Project Area	
	f) Sewers will be made watertight during maintenance to avoid intrusion of storm water into the network and cut-off drains provided to WSPs. Storm water will be guided away from all sanitary facilities using cut-off drains around them.	No contamination of Land or soil erosion by wastewater from the sewers.	No complaints from the communities and authorities of sewage leakages	Throughout operation	NWSC	NEMA/District Local Governments of Project Area	
	g) The staff of the WSP and STP will be trained for proper management of screenings, sludge, etc., to avoid soil contamination.	Skills enhancement of Staff at WSP and STP	Number of staff trained /Training records	Annually throughout operation	NWSC/MWE/ District Local Governments of Project Area	NWSC/MWE/ District Local Governments of Project Area	10,000,000

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	h) Monthly tests will be done to assure the quality of effluent and treated sludge, to avoid partially treated wastewater and sludge from reaching the soils	No soils or land are contaminated as a result of project activities	Effluent quality data and sludge cake quality records	Monitoring activities throughout operation	NWSC/ District Local Governments of Project Area	NEMA/NWSC/ District Local Governments of Project Area	30,000,000 annually
7.3.2 Pollution of water resources	a) All construction equipment will be kept in good operating condition to avoid oil or fuel leakages that might contaminate water resources	No oil and/ or fuel leakage in water courses	Water quality data	Throughout construction	Contractor	NEMA/NWSC/ District Local Governments of Project Area	
	b) Fuel handling and oil spill measures will be implemented to prevent, control and address spill or leaks.	No oil and/ or fuel leakage in water courses	Water quality data	Monitoring throughout construction	Contractor	NEMA/NWSC/ District Local Governments of Project Area	12,000,000
	c) At Nabunyere (sanitation facilities), the concrete mixing will not be done on site to avoid polluting the nearby swamp with excess washwater.	No swamp pollution with cement/concrete wash water	Water quality data	Throughout construction	Contractor	NEMA/NWSC/ District Local Governments of Project Area	
	d) Laying of water pipelines and sewer lines will mainly be done during the dry season to avoid sediment transport to the nearby land, water courses and roads;	No sediment transported to the nearby river courses	Water quality data	Throughout construction	Contractor	NEMA/NWSC/ District Local Governments of Project Area	
	e) The leakages from sewers, sludge drying beds and WSPs will be minimized by regular monitoring and maintenance of the network; connections between sewers will be made water-tight to prevent leakages of wastewater to groundwater; and frequent effluent quality monitored to avoid release of poorly treated effluents into the River.	No leakages into water courses and Groundwater	Water quality data and No complaints from communities around project sites	Throughout Operation	NWSC	NEMA/NWSC/ District Local Governments of Project Area	
	f) Monthly quality tests for effluent and receiving water resources will be done to ensure that the quality of effluent meets the	Compliant effluent standards being discharged into	Water quality data and No complaints from communities around project sites	Throughout Operation	NWSC	NEMA/NWSC/ District Local	Covered under 7.3.1 h

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	national discharge standards or requirements;	receiving water courses				Governments of Project Area	
	g) A maintenance crew will be put in place to monitor and repair the network immediately a damage or leakage occurs to avoid accidental surface runoff intrusion to groundwater from the sewage network. Intrusion of storm water into the network and ponds can overburden facilities and cause discharge of partially treated wastewater into the water resources/ environment.	Timely repairs made on the network to avoid further leakages	Monitoring and repair records from maintenance crew.	Throughout Operation	NWSC	NWSC/ District Local Governments of Project Area	10,000,000 for monitoring activities
7.3.3 Generation of noise	a) Care will be exercised when selecting working equipment to avoid use of old equipment or damaged equipment with high level of noise emissions that would have a negative impact in the environment.	Construction activities generate permissible levels of noise.	No complaints from the communities and authorities/ record of noise levels	Before and during construction	Contractor	NWSC	
	b) Construction equipment will be properly maintained and fully functional.	Construction activities generate permissible levels of noise.	Record of noise levels/ no complaints from the communities and authorities/	Before and during construction	Contractor	NWSC	
	c) All generators and heavy duty equipment will be insulated or placed in enclosures to minimize disrupting ambient noise levels.	No excessive noise reaching neighbouring communities	No complaints from the communities and authorities/ record of noise levels	Before construction begins	Contractor	NWSC	
	d) Construction workers will be made aware of the silent nature of workplaces they are operating in and advised to limit verbal noise or other forms of noise. For example, metallic objects or tools can be passed on to a colleague rather than dropping or throwing them with loud bangs.	No excessive noise from the site	Record of noise measurements	Throughout construction	Contractor	NWSC	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	e) Noise levels emanating from machinery, vehicles and noisy construction activities will kept at a minimum (within the national noise level limits) for the safety, health and protection of people in the nearby buildings.	Construction activities generate permissible levels of noise.	Record of noise measurements	Throughout construction	Contractor	NWSC/ District Local Governments of Project Area	
	f) During periods of inactivity, equipment will be switched off whenever possible. A limited number of construction activities may have to continue on a 24-hour basis. These include horizontal direction drilling, pipeline cleaning and hydrostatic pressure testing which are relatively low noise activities. Consultation will be undertaken with the relevant authorities in advance of any such operations. Where appropriate, residents living near to the pipeline construction activities will be kept informed of the contractors proposed working schedule (through implementation of the Community Liaison Management Plan) and will be advised of the times and duration of any abnormally noisy activity likely to cause concern	No vehicle engines running unnecessarily	Record of noise measurements	Throughout construction	Contractor	NWSC/ District Local Governments of Project Area	
	g) No construction activities will take place at night for sites where the closest residence is within less than 150 m from the project site.	No excessive noise from equipment during night time	No complaints from communities about night time construction activities	Throughout construction	Contractor	NWSC	
7.3.4 Improper Handling of AC Pipes and Accessories	a) NWSC should ensure that the hired contractor demonstrates having experience and capability to observe international good practice standards with asbestos, including training of workers and supervisors, possession of (or means of access to) adequate equipment and supplies for the	Experienced contractor or sub-contractor hired to ensure that AC pipe wastes are handled well. Hazardous collected and disposed as per	Qualification and experience profile of the contractor or sub-contractor; Hazardous Waste Management Plan	Before commencement of construction activities	Contractor	NWSC	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	scope of envisioned works, and a record of compliance with regulations on previous work. The Contractor will be required to prepare a Hazardous Waste Management Plan.	waste management plan					
	b) The contractor shall follow NWSC procedures (Appendix I) and NEMA guidelines (Annex J) for handling waste AC materials	Hazardous wastes handled properly and o workers and the public are exposed to Asbestos dust	Procedure followed on site in handling the hazardous waste, records of inspection and waste disposal	During construction	Contractor	NWSC/ NEMA	
	c) Decommissioned AC pipes and accessories will be managed through a third party contractor certified by NEMA.	Hazardous wastes handled properly	Records of waste disposal; Proof of waste delivery and safe disposal	Throughout construction	Contractor	NWSC/ Mbale District Local Government (MDLG)/ Mbale Municipal Council (MMC)	
	d) The selected contractor shall provide adequate protection to his personnel handling asbestos, including respirators and disposable clothing.	No workers and the public are exposed to Asbestos dust	Presence and use of PPE on site	Through out handling activities for AC pipes	Contractor	NWSC/ MDLG/ MMC	
	e) Disposal of AC pipes shall be carried out in a way that minimizes worker and community asbestos exposure, for example, in a wet environment. AC pipes and other related asbestos containing material shall be packaged, labelled, transported, stored and disposed of at approved sites for disposal of hazardous waste, for example, Luweero Industries Limited in Nakasongola District or EnviroServe waste handling facility in Hoima	No asbestos dust exposure	Records of waste disposal; Proof of waste delivery and safe disposal	Through out handling activities for AC pipes	Contractor	NWSC/ MDLG/ MMC	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	District. Proof of delivery and safe disposal of waste will be provided and records maintained at all times.						
	f) Before transportation, the properly sealed, labeled and secured AC pipes are kept inside a locked fenced area to prevent access by unauthorized personnel, and covered to prevent water accumulation.	Safe storage before transportation	Presence and condition of the storage facility	Throughout construction	Contractor/NWSC	MDLG/ MMC/ NEMA	250,000,000*
7.3.5 Improper management of waste	a) The Contractor will be required to prepare a Waste Management Plan.	Waste Management Plan in place.	Record/ Evidence of Waste management Plan being used by Contractor	Throughout construction	Contractor	NWSC/ District Local Governments of Project Area	
	b) Contractors will undertake waste segregation onsite to separate hazardous waste from non-hazardous waste	Hazardous waste separated from non-hazardous waste on site and each waste stream disposed of according to NEMA requirements in designated sites.	Separate containers for hazardous waste and non-hazardous waste on site	Throughout construction	Contractor	NEMA/NWSC/ District Local Governments of Project Area	10,000,000
	c) The contractor, MWE and NWSC Area Management will work hand in hand with Mbale Municipal Council and respective Local governments to facilitate sound waste handling and disposal from the site. All wastes must be taken to the approved dumpsites. AC pipe waste will handled separately from other hazardous wastes	Amount of waste disposed/ minimized by reuse, wherever feasible	Record of waste types and estimated quantity disposed/ diverted for reuse	Throughout construction	Contractor	NEMA/NWSC/ District Local Governments of Project Area	45,000,000
	d) The contractor will hire and improve on existing sanitary facilities in the vicinity of the project area or provide his own facilities (e.g.	No human waste disposed of at construction sites	Presence of mobile toilets at construction sites/ sanitary hire agreements	Throughout construction	Contractor	NEMA/NWSC/ District Local	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	mobile toilets) which should be adequate at construction sites.					Governments of Project Area	
	e) NWSC/MWE together with the respective District Local Governments at the growth centres will ensure that the solid waste is collected by a firm licensed by NEMA and that the collected waste is disposed of at dumpsite or landfill approved by NEMA	Safe handling and disposal of solid waste by NEMA registered firm.	NEMA registration certificate of approved firm.	Throughout Operation	NWSC/ District Local Governments of Project Area	NEMA/NWSC/ District Local Governments of Project Area	
7.3.6 Air pollution	a) A maintenance programme for equipment and vehicles will be implemented, to ensure air emissions like particulates, SO ₂ and NO ₂ are minimised.	Emissions from vehicles complying with national standards.	No complaints of excessive fumes. No excessive emissions released to the atmosphere as a result of faulty equipment. Strict maintenance program	During construction	Contractor	NWSC/ District Local Governments of Project Area	
	b) Travel speeds of construction vehicles along the road especially at trading/ business centres will be controlled using humps and setting travel speeds not exceeding 40km/h	Humps and speed limit signage put in place in the appropriate areas	Number of accidents and/ or complaints reported/ Journey management records	During construction	Contractor	NWSC	
	c) Trucks will be covered during haulage of construction materials to reduce on spillage of materials	No spillage of materials along the transportation routes	Recognition of locales of contractor's efforts to minimise dust nuisance.	During construction	Contractor	NWSC/ District Local Governments of Project Area	
	d) Wherever dust suppression is necessary, water will be sprayed over dusty areas	No excessive dust	Air quality data/ Environmental monitoring report	Monthly throughout construction	Contractor	NWSC/ District Local Governments of Project Area	
	e) Construction work will be undertaken by an experienced and duly registered contractor with a verifiable sense of environmental awareness and responsibility	Employment of best Construction practices to minimise adverse impacts	Record of environmental responsiveness of the contractor/ Environmental Management Plan	During construction	Contractor	NWSC/ District Local Governments of Project Area	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	f) Workers will be provided with PPE and the use of PPE shall be enforced	Workers are not exposed to elevated air pollution levels	No complaints of excessive fumes	During construction	Contractor	NWSC/ District Local Governments of Project Area	
	g) NWSC will develop an Operations and Maintenance Manual for the Sewage Treatment Plan to guide staff on how to effectively run the WSPs;	Effective performance of WSPs run by knowledgeable operators	Record of operation procedures undertaken by staff	Throughout Operation	NWSC	NWSC/ District Local Governments of Project Area	
	h) Facultative ponds will be commissioned before anaerobic ponds to avoid odour nuisance when anaerobic pond effluent discharges into an empty facultative pond;	Controlled Odour from the Facultative pond	No complaints from communities near the WSPs	Throughout Operation	NWSC	NWSC/ District Local Governments of Project Area	
	i) NWSC/MWE will ensure adequate operation and management of both the existing and the new facilities to avoid bad odours that would arise from improper management of the facilities;	No odours from project facilities	No complaints from communities near the WSPs	Throughout Operation	NWSC	NWSC/ District Local Governments of Project Area	
7.3.7 Occupational health safety (OHS) Risks	a) All construction workers will be oriented on safe work practices and guidelines and ensure that they adhere to them	Workers show a good understanding of and adhere to safe work practices	Records of workers' orientation	At the beginning of construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	b) Training will be conducted on how to prevent and manage incidences. This should involve proper handling of electricity, water etc. and sensitization on various modes of escape, conduct and responsibility during such incidences. All must fully be aware and mentally prepared for potential emergency	Up-to-date awareness of OHS requirements and preparedness by all workers to combat possible incidences	Records of training and details of staff trained	At the beginning of and during construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	c) Regular drills should constantly follow on various possible incidences. This will test the response of the involved stakeholders.	Workers are alert and responsive in case of incidences.	Record of drills	Throughout construction	Contractor	NWSC/ District Local Governments of	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
		Public and other staff safety				Project Area – SEO's, CDO's	
	d) Use signage to warn staff and/ or visitors that are not involved in construction activities of dangerous places.	Public and workers' safety	Presence of signage	During construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	e) Strict instructions should be given for drivers of heavy equipment	No risk of accidents on construction workers	Documentation of instructions	Throughout construction	Contractor	Traffic Officers, NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	f) Supervision of works should be done regularly to ensure that safety conditions are met while any deviation from safety regulations is immediately reclaimed following the best practices regarding safety at work equipment.	Public and workers' safety	Supervision record	During construction	NWSC & Supervision Consultant	MGLSD/ NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	g) Communication line must be ensured between workers and drivers of heavy equipment.	Public and workers' safety; No injuries arise from miscommunication	Presence of radio calls/Megaphones being utilised	During construction		Traffic Officers, NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	h) Develop evacuation procedures to handle emergency situations.	Reduced health and safety risks to construction workers	Presence of a documented evacuation procedure	During construction	Contractor	MGLSD/ NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	i) Provide adequate OHS personnel protective gear for the employees.	All personnel have adequate PPE	Record of PPE provided and staff; use of PPE on site	During construction	Contractor	NWSC/ District Local Governments of	Covered in 7.3.5 (f)

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
						Project Area – SEO's, CDO's	
7.3.8 Risk of accidents	a) Best transport safety practices (Journey Management Plans) will be adopted with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public.	No road accident caused by project traffic	Record of traffic related accidents in each month of construction duration	During construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	b) All workers, including sub-contractors and casual labourers, will undergo an environmental, health and safety induction before commencing work on site. This will include a full briefing on site safety and rules.	Workers aware of environmental, health and safety requirements	Record of induction; interviewing a sample of workers on environmental, health and safety issues	Before construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	c) The affected communities will be informed of the timing and duration of the construction activities across access roads and any uncertainties or potential for change.	Safety of the public and workers	Activity schedule and evidence of communication to the would-be affected communities	Before and during construction	Contractor/ NWSC	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	d) There will be restrictions on hours of driving (including night time restrictions where sensitive receptors may be affected) and timing of vehicle movements to avoid busy periods in urban areas, particularly the start and end of school and the working day	Safety of the public and workers	Activity schedule and journey management plans	During construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	e) No drivers or personnel under the influence of alcohol or any drug abuse will be allowed onsite	Public safety	Presence of a sound fence all around the site	During construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	f) The site, where possible, will be fenced and signalization put in place with security personnel to stop unauthorised people from accessing the site.	Public safety	Presence of a sound fence all around the site	During construction	Contractor	NWSC/ District Local Governments of	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
						Project Area – SEO's, CDO's	
7.3.9 Pressure on existing resources	a) Separate storage for water to use at the construction sites will be provided. Instead of connecting to the nearby/ communal water points, water bowzers will be adopted for water supply.	Uninterrupted water supplies to the communities	Presence of water bowzers/ storage tanks; water abstraction permit	Throughout construction	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	b) The NWSC/MWE, supervising consultant and contractor will phase the construction activities in such a way that water-consuming activities are not carried out concurrently but rather in combination with non-water-consuming activities in the same location, where possible.	Uninterrupted water supplies to the communities	Complaints of irregularities in water supply related to construction activities	Before construction	NWSC& Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's	
	c) Through inductions and tool box meetings, NWSC/MWE will ensure that contractors are conversant with resource conservation practices in all project activities. Conservation awareness will focus on water use efficiency and general day-to-day measures such as turning off taps when water is not being used.	Uninterrupted water supplies to the communities	Record of water usage and conservation measures being implemented	During construction	Contractor NWSC DWD	District Local Governments of Project Area – SEO's, CDO's	
	d) Water abstraction will comply with rates allowed by the permit obtained from DWRM. The Namatala water intake will be designed to allow minimum EF pass through the abstraction point. Flow monitoring devices will be installed to monitor and ensure minimum EF.	Contractor complies with Permit requirements/ conditions Minimum EF are maintained and monitored	Record of water abstracted	During construction	Contractor NWSC/MWE	DWRM	
	e) For the Namatala water system, the NWSC will conduct an Alternative Water Supply Study to assess alternative water sources and a reliability analysis of the proposed Namatala water supply system during low flows as	Alternative water supply study completed and recommendations implemented.	Approval by NWSC and the MWE	Before construction begin and during project implementation	NWSC and MWE	MWE/NWSC/District Local	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	further set out in Section 2.5.2.1 of the ESIA, including specific recommendations and an implementation plan. The NWSC will carry out the recommendations derived from the study under the Project.						
	f) Earth materials will be sourced from a NEMA-approved source in a manner that reduces environmental and social impacts. Murram will be sourced in accordance with a NWSC approved murram/ subsoil extraction plan, which will be provided by the contractor prior to the start of works.	Project's material demand does not encourage environmental degradation	Approval from NEMA	ESIA for probable sources of materials before construction	Contractor	NEMA/ NWSC/DWD/ District Local Governments of Project Area – SEO's, CDO's	72,000,000
	g) Catchment management plans are being developed with the aim of conserving and allowing recharge of water resources.	Recharge of existing water resources	Increased volumes of water in existing water resources	Throughout operation	NWSC	NWSC/ DWD/ District Local Governments of Project Area – SEO's, District Engineer's, Water Officers'	
	h) Community sensitization regarding the water supply system and water conservation measures will be encouraged: saving water is an efficient way of reducing the overuse of ground water resources. It is not only decreases the amount of the water withdrawn, but may also reduce the threat of pollution	Uninterrupted water supplies to the communities	Record of water usage and conservation measures being implemented	Throughout operation	NWSC	NWSC/ DWD/ District Local Governments of Project Area – SEO's, District Engineer's, Water Officers'	
7.3.10 Landscape and land use impacts	a) Reinstatement Plan will be developed	Reinstatement plan developed and implemented	Record of the developed reinstated plan	Throughout operation	Contractor	NEMA/ NWSC/ DWD/District Local Governments of Project Area – SEO's, CDO's	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	b) Reinstatement of the water pipeline and sewer routes will be done in such as return the visual integrity of the landscape as closely as possible to its previous condition. Replant of trees should be done as long as they do not hinder the integrity of the pipe or sewer line.	Wherever practical, the subsoil graded during reinstatement to reflect the original profile across the working width with a stable landform that mirrors the pre-disturbed condition	Presence of heaped soils and/or materials; slope stability, relief, topographic diversity, acceptable surface water drainage capabilities, and compaction; level of vegetation regrowth	Throughout operation	Contractor	NEMA/ NWSC/DWD/ District Local Governments of Project Area – SEO's, CDO's	
	c) Where pipelines and sewers are not buried in ground, if any, they will be painted to blend with the environment. They will be adequately supported by concrete pillars and of such materials that cannot easily be damaged by the communities.	No damage to exposed sections of pipelines and sewers by communities.		Throughout operation	NWSC	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
7.3.11 Social misdemeanour by construction workers	a) As a contractual obligation, contractors shall be required to have an HIV/AIDS policy and a framework (responsible staff, action plan, etc.) to implement during project execution.	No illicit sexual relationships among construction workers and local community	All construction workers living in a camp adhere to "No fraternization" and comply with latest entry time into camp set to avoid prostitution. Monitor complaints from the community	Development of policy before construction	Contractor	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	b) All construction workers shall be oriented and sensitized about responsible sexual behaviour in project communities.	No aggravated spread of HIV/AIDS due to project implementation	All construction workers are aware of HIV/AIDS risk and responsible living.	Before construction	Contractor	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
7.3.13 Disruption of communication routes	a) Appropriate signage will be used and impacted owners will be informed ahead of disruption	No property owners are inconvenienced in accessing their properties	No complaints from property owners	Before and during construction	Contractor NWSC	NWSC/ DWD/ District Local Governments of Project Area –	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
						SEO's, CDO's, District Engineers	
	b) Disruptions to public access shall be identified in the Contractor's Traffic Management Plan, under which suitable notice of intending delays and closures are given to all concerned parties and approved prior to commencing work. All road closures shall be separately notified and agreed with the Local gov't administration.	Traffic Management Plan developed Stakeholders informed of impending closures in time and alternative routes communicated	Minimal or no interruption in pedestrian and traffic flow	Before and during construction	Contractor NWSC	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	c) Where access to or from an individual property is closed for a period of 2 hours or more, the owner shall be informed at least 24 hours in advance.	Stakeholders informed of impending closures in time	No complaints from property owners	Before and during construction	Contractor NWSC	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	d) Vehicular access to and from hospitals, police stations and fire stations shall be maintained through the use of steel road plates over open trenches. Pedestrian access to schools, health facilities, and other premises frequently accessed by the public will be maintained with the use of walking boards.	Appropriate infrastructure put in place to allow continued access to hospitals, clinics, schools, etc.	Minimal or no interruption in pedestrian and traffic flow to public facilities	Before and during construction	Contractor NWSC	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	e) The laying of pipelines and sewers, backfilling and temporary reinstatement shall follow trench excavation as quickly as possible and trenches will not be left open for extended periods.	Reinstatement done as quickly as possible	No complaints from affected communities	Before and during construction	Contractor	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
7.3.12 Loss and degradation of natural habitats	a) Construction activities should be restricted only to the areas that must be disturbed to avoid unnecessary disturbance	Minimal degradation of the	Area of restored habitat that had been disturbed.	During Construction	Contractor	NWSC/ DWD/ District Local Governments of	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
		habitat beyond the project foot print.				Project Area – SEO's, CDO's, District Engineers	
	b) All project workers should be sensitized to minimize damage to vegetation and flora	Minimal degradation of the habitat beyond the project foot print.	Record of worker sensitization about vegetation and flora.	During Construction	Contractor	NWSC/ DWD/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	c) Close monitoring and supervision of the construction operations to ensure compliance and avoid causing further damage to undesignated project areas	Minimal degradation of the habitat beyond the project foot print.	Record monitoring and supervision of the construction operations about project footprint.	During Construction	NWSC/ DWD	District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	d) Support and encouragement of communities to plant trees by providing planting material for fast-growing and multiple use species e.g. <i>Maesopsis eminii</i> and <i>Markhamia lutea</i>	All cut trees are offset.	Number of community planted trees in relation to the project.	During Construction and operation	Contractor/ NWSC/ DWD	District Local Governments of Project Area – SEO's, CDO's, District Engineers	
	e) Support monitoring of performance of the planted trees	All replanted trees successfully grow.	Number of replanted trees that successfully grow.	During Construction and operation	Contractor/ NWSC/ DWD	District Local Governments of Project Area – SEO's, CDO's,	
	f) Where tree cutting is inevitable, replacement planting should be done wherever feasible.	All cut trees are offset.	Number of cut trees replaced.	During Construction and operation.	Contractor	NWSC/ District Local Governments of Project Area – SEO's, CDO's, District Engineers	
7.3.14 Disruption to public utilities	a) Prior to undertaking any works, the Contractor will obtain from the utilities agencies definition and details of all utilities sites within 50 m of the works.	Details of all utilities within 50m of the works obtained	Details and mapping of all utilities obtained	Before construction	Contractor & NWSC	Affected Utility firms, Local Governments of Project Area	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	b) Damage to any utility at a defined site shall be made good to the satisfaction of the responsible agency at the Contractor's cost. Damage to utilities not defined prior to construction, despite the Contractor having undertaken all reasonable liaisons with the responsible agencies, shall not be the responsibility of the Contractor. It shall be the responsibility of NWSC to ensure the utilities agencies respond in good time to the Contractor's requests for information.	All damages incurred rectified to the satisfaction of the respective utility agency	No damages incurred and where they happen, remedial measures implemented to the satisfaction of the utility agency	During construction	Contractor	NWSC/ Affected Utility firms	
	c) Contractors shall liaise with each of the agencies responsible for the maintenance of utilities that are to be crossed or temporarily diverted or otherwise affected by the works as to the timing and nature of any disruption of service. Where required, the responsible agency shall be requested to carry out the necessary works at the time required and at NWSC's cost. The Tender Documents shall contain sufficient information on utilities crossings to permit the Contractor to include the cost of the works for which he is responsible in his bid.	Tender documents contain all relevant information about the utilities within the project areas; Timely liaison made with the utility agencies to avoid inconveniences	Details and mapping of all utilities obtained and remedial measures planned	Before and during construction	Contractor	NWSC/ Affected Utility firms	
	d) The Contractor shall incorporate in his programme the proposed arrangements for traffic diversions in the form of a Traffic Management Plan, with details of all necessary signage and any temporary works for approval by the NWSC and the District/Municipality Engineers. The programme shall also contain details of the timing of the proposed closure, dates of	Minimal or no inconvenience to traffic flow caused	Approved Traffic Management Plan in place	Before construction	Contractor	NWSC/ GMC	

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	closing and re-opening the route, and of any necessary remedial works.						
7.3.15 Permanent Land take	<p>a) Land will be acquired in accordance with Uganda's Land Access and Compensation Procedure taking into consideration the Development Partner's requirements. Amongst others, this requires:</p> <ul style="list-style-type: none"> ▪ Sensitisation of community members whose property will be affected. ▪ Completion of a full inventory of privately registered and/or cultivated and grazed or other uses of the land that will be taken for the project as well as structures and graves along the access road. ▪ Compensation to be paid in line with mandated rates agreed in consultation with District officials before commencement of construction activities. ▪ Ensuring that the Chief Government Valuer approves the valuation rates. 	Equitable compensation in accordance to National and international laws.	<p>Displayed list of fully compensated PAPs against Monies paid out to them.</p> <p>List of fully compensated PAPs against Monies paid out to them.</p>	Prior to commencement of construction.	NWSC/MWE	NWSC/ CGV Independent Hired External Monitor	
7.3.16 Septage Disposal	<p>a) Institute and maintain a ticketing system for cesspool emptiers, where upon successful disposal, the operator of the waste management facilities would issue a receipt to the cesspool emptier.</p> <p>b) Kibuku District Local Government/ Kadama sub-county and MWE, should put in place a system to monitor cesspool emptiers and in addition, have a public educational</p>	<p>Proper septage disposal in designated areas</p> <p>Compliance of cesspool emptiers in proper septage disposal</p>	<p>Record of ticket issued at STP</p>	<p>During Operation</p> <p>During Operation</p>	<p>NWSC/ Kibuku Local Government</p> <p>NWSC/ Kibuku Local Government</p>	<p>NEMA/ NWSC/ NWSC/ Kibuku Local Government – SEO's, CDO's</p> <p>NWSC/ NWSC/ Kibuku Local Government – SEO's, CDO's</p>	<p>15,000,000</p>

Impact	Mitigation/Enhancement commitments	Desired Outcomes	Monitoring: Performance Indicators/Targets or Acceptance Criteria	Timing	Responsibility	Monitoring Institution	Estimated annual cost (Uganda Shillings)
	campaign to educate and inform the public about the system.						
	c) MWE and Kibuku District Local Government will work closely with operators of Cesspool Emptiers if any and train them in the proper handling and transport of sewage/ sludge;	Good septage handling and sewage disposal	No complaints from communities in and around Nabunyere village	During Operation	NWSC/ Kibuku Local Government	NWSC/ NWSC/ Kibuku Local Government – SEO's, CDO's	
ESTIMATED GRAND TOTAL							552,000,000

* The cost is estimated for handling and storage of damaged parts of AC pipes in the process of excavation given that most of them will be plugged and left in the ground but during excavations some may be damaged. In the case when they are left in the ground, NWSC should ensure that call-first-before you excavate policy is put in place to ensure before any development takes place at particular site, these pipes are removed and handled in the proper manner.

9 CONCLUSION

The proposed project has potential to significantly improve quality of life in the Mbale Municipality and the neighbouring towns both during construction and operation phases. Like in other areas, the long term socio-environmental benefits of a reliable supply of potable water and access to sanitary facilities include reduced morbidity and increased productivity of households; and increased enrolment of children in educational institutions. In addition, project development and operation in the municipality and small towns or rural growth centres will provide considerable economic opportunity and attraction of other services.

However, development of the project can also bring with it negative impacts. The key significant negative impacts will arise from operation of the sewage treatment plants and public toilets if not managed well. NWSC and DWD should use their vast experience in their respective areas of jurisdiction in operating and maintaining such systems to reduce and / or avoid occurrence of adverse effects during construction and operation of the facilities.

If the project is developed and infrastructure put in place operated in conformity with the legal requirements and annual audits conducted following suggestions provided in the ESMP, the benefits of this project to the nation would by far outweigh potential negative effects.

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APPENDIX A: STAKEHOLDER ENGAGEMENT

Record 1: NALONDO B AND MAKO VILLAGES

Week		45		Meeting date		3/11/2015	
				Recorded by		Vivian Ochen	
Meeting/subject		ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING NALONDO B AND MAKO VILLAGES, BUSOBA SUB-COUNTY				Total pages	
						02	
Present	Apology	Copy	Name	Organisation/Village	Designation		
			Signed list of communities appended				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd	Water Engineer		
Item		Update					
1		Introduction					
		<p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none"> Project Background Project Location Project Description on-going Activities Project activities ESIA/RAP Process 					
		Question and Answer Session					
1.1		Compensation and pipeline <ul style="list-style-type: none"> Will my house be broken if it is along the pipeline? Will we buy the pipes or shall the pipes be supplied free of charge? Will I be compensated if my house is located on the reservoir tank site? Will trees be compensated? If the land through which the pipeline will pass belongs to another person, will I pay for the land in order to connect water to my house? Contractors tend to destroy people's properties, what measures are in place to control them? 					
1.2		On Benefits <ul style="list-style-type: none"> Will the person seeking employment on the project apply through or get a recommendation letter from the LC1 only? How are those far from the road reserve going to benefit? Shall I pay for water at my home or use it freely? The contractor should employ the youth in the village. Is the contract already awarded? If people who are qualified contractors in plumbing come, which office should they apply to? 					
1.3		On Ownership <ul style="list-style-type: none"> Does the Project belong to the Government or any politician? 					

Record 2: MAKHAI A AND B, AND NAMWARO VILLAGES

Week		45		Meeting date		3/11/2015	
				Recorded by		Vivian Ochen	
Meeting/subject		ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN BUSOBA SUB-COUNTY			Total pages		01
Present	Apology	Copy	Name	Organisation/Village	Designation		
			Signed list of communities appended				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd	Water Engineer		
Item	Update						
1	Introduction						
	<p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none"> ▪ Project Background ▪ Project Location ▪ Project Description ▪ on-going Activities ▪ Project Activities ▪ ESIA/RAP Process 						
	Question and Answer Session						
1.1	Compensation <ul style="list-style-type: none"> • People in the road reserve await compensation? • Airtel constructed fibre optic cables. Compensation was not transparent; some people were paid while others were not. Will the same be done for this project? 						
1.2	Water Supply and pipeline construction <ul style="list-style-type: none"> • Shall we be provided with water from transmission main or another distribution line? • Is it the line being constructed currently? <p>Response: No, that one goes to Nabumali.</p>						
1.3	Recruitment <ul style="list-style-type: none"> • Will it be at sub-county level or village level at LC I level? 						
1.4	Comment <ul style="list-style-type: none"> • Warn contractor's staff on the use of vulgar language lest they risk being arrested. 						

RECORD 3: MAXIMASA

Week		45		Meeting date		4/11/2015	
				Recorded by		Vivian Ochen	
Meeting/subject		ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN MAZIMASA SUB-COUNTY			Total pages		02
Present	Apology	Copy	Name	Organisation/Village	Designation		
			Signed list of communities appended				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd	Water Engineer		
Item	Update						
1	Introduction						
	<p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none"> ▪ Project Background ▪ Project Location ▪ Project Description ▪ Ongoing Activities ▪ Project Activities ▪ ESIA/RAP Process 						
	Question and Answer Session						
	Dry Season						
	<ul style="list-style-type: none"> • During dry season, there is no water; where will water come from? 						
1.1	Water Supply and pipeline construction						
	<ul style="list-style-type: none"> • What do I do to extend water to my home? 						
1.2	Compensation						
	<ul style="list-style-type: none"> • Do I get compensated for both trees and crops? • If a tree has been compensated, do I take it or you take it because it has already been paid for? • How do we benefit if the land is bare? • If the new pipes cross from the same place where the old pipe crossed on my land, will I be compensated? 						
1.3	Road Reserve						
	<ul style="list-style-type: none"> • I built in the road reserve, what do I do? • We are ignorant of the Road reserve boundary demarcated by UNRA, please clarify? • We built without knowing the extent of the road reserve, what do we do? • Why isn't it on the right high side and only on the left? 						
1.4	Failure to remove property						
	<ul style="list-style-type: none"> • If I fail to remove my things within the time given, what do I do? 						

Week	45	Meeting date	4/11/2015
		Recorded by	Vivian Ochen
Meeting/subject	ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN MAZIMASA SUB-COUNTY		Total pages 02
1.5	Payment <ul style="list-style-type: none"> Contractor is not paying hotel bills and staff from the village. How do we tackle this when they run away? 		
1.6	Willingness to pay <ul style="list-style-type: none"> How do you demonstrate willingness to pay? 		

Record 4: MUHAGO, KANHAYI, NAMUSERU, NEW SCHEME (DOHO RICE SCHEME), KOLI AND MUHUYU

Week			45		Meeting date	4/11/2015
					Recorded by	Vivian Ochen
Meeting/subject			ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN MAZIMASA SUB-COUNTY		Total pages	01
Present	Apology	Copy	Name	Organisation/Village	Designation	
			Signed list of communities appended			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd	Water Engineer	
Item		Update				
1		Introduction				
		<p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none">▪ Project Background▪ Project Location▪ Project Description▪ Ongoing Activities▪ Project Activities▪ ESIA/RAP Process				
		Question and Answer Session				
1.1		Compensation <ul style="list-style-type: none">• What do I do with seasonal crops?• If I have a title, how do I benefit if my land extends up to the road?				

Week	45	Meeting date	4/11/2015
		Recorded by	Vivian Ochen
Meeting/subject	ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN MAZIMASA SUB-COUNTY		Total pages 01
1.2	Water Supply and pipeline construction <ul style="list-style-type: none"> Will residents have a chance to get connected and won't the tariff be high? During dry periods, Bukedi College Kachonga reservoir is blocked and Nampologoma does not have water. Is it possible for every centre to have a reservoir tank? Apart from residents close to the road, will other residents be given a chance to get connected? What distance? What qualifies the first one hundred (100) to be connected? Response: Willingness to pay.		
1.3	Road reserve <ul style="list-style-type: none"> What is the width of the road reserve? Having boreholes near the road reserve, won't the quality be affected? In the event that a house falls in the road reserve, what happens? 		
1.4	Comment		

Record 5: Bambone, nanyuru and Lukangole

Week			45		Meeting date	4/11/2015
					Recorded by	Vivian Ochen
Meeting/subject			ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN BUTALEJA TOWN COUNCIL		Total pages	01
Present	Apology	Copy	Name	Organisation/Village	Designation	
			Signed list of communities appended			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd	Water Engineer	
Item		Update				
1		Introduction				
		<p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none">▪ Project Background▪ Project Location▪ Project Description▪ on-going Activities▪ Project Activities▪ ESIA/RAP Process				
		Question and Answer Session				

Week	45	Meeting date	4/11/2015
		Recorded by	Vivian Ochen
Meeting/subject	ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN BUTALEJA TOWN COUNCIL		Total pages 01
1.1	Water Supply and pipeline construction <ul style="list-style-type: none"> • If I am 2km away, will I be able to get water amongst the first 100 people? • How do we know that water quality is good or bad? 		
1.2	Compensation <ul style="list-style-type: none"> • If I have a business under the tree, will I be compensated? • I have graves within the road reserves. Do I get paid first before I remove them or vice versa? 		
1.3	Construction <ul style="list-style-type: none"> • How long will it take for construction to take place? 		

Record 6: Bulindi, Buhobe, Butaleja, Buhehe, Busasi and Lunghule

Week			45		Meeting date	4/11/2015	
					Recorded by	Vivian Ochen	
Meeting/subject			ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN BUTALEJA TOWN COUNCIL			Total pages	01
Present	Apology	Copy	Name	Organisation/Village		Designation	
			Signed list of communities appended				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd		Water Engineer	
Item		Update					
1		Introduction					
		<p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none">▪ Project Background▪ Project Location▪ Project Description▪ on-going Activities▪ Project Activities▪ ESIA/RAP Process					
		Question and Answer Session					

Week	45	Meeting date	4/11/2015
		Recorded by	Vivian Ochen
Meeting/subject	ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN BUTALEJA TOWN COUNCIL		Total pages 01
1.1	Water Supply and pipeline construction <ul style="list-style-type: none"> • How will the distribution network be? • Is there a rate to be paid for the water? • Rates vis-à-vis distance to pipeline? 		
1.2	Employment <ul style="list-style-type: none"> • Can we get subcontracting jobs? 		
1.3	Road reserve <ul style="list-style-type: none"> • Can we build in the road reserve? 		

Record 7: Busolwe South Village

Week	45	Meeting date	6/11/2015		
		Recorded by	Vivian Ochen		
Meeting/subject	ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN BUTALEJA TOWN COUNCIL		Total pages 01		
Present	Apology	Copy	Name	Organisation/Village	Designation
			Signed list of communities appended		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd	Water Engineer
Item	Update				
1	Introduction				
	<p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none"> ▪ Project Background ▪ Project Location ▪ Project Description ▪ on-going Activities ▪ Project Activities ▪ ESIA/RAP Process 				
	Question and Answer Session				

Week	45	Meeting date	6/11/2015
		Recorded by	Vivian Ochen
Meeting/subject	ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN BUTALEJA TOWN COUNCIL		Total pages 01
1.1	Water Supply and pipeline construction <ul style="list-style-type: none"> To whom do we address the application process? Will distribution to my house be for free or payment will be needed? Wait, the Town Council wants to eat Is it possible for the pipes to be relocated in other areas as opposed to going through Busolwe because, there are many shops? 		
1.2	Compensation <ul style="list-style-type: none"> Full compensation, will it be fair? 		
1.3	Road reserve <ul style="list-style-type: none"> Will I get compensated if the pipe is near the road? 		
1.4	Benefit <ul style="list-style-type: none"> There are 19 villages, will they all benefit from this project? 		
1.5	Request <ul style="list-style-type: none"> Please give us the contacts of the Ministry Officials? 		

Record 8: Kamonkoli, Kiralaka and Nyanza Villages

Week			46		Meeting date	8/11/2015	
					Recorded by	Vivian Ochen	
Meeting/subject			ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN TIRINYI CENTRAL			Total pages	02
Present	Apology	Copy	Name	Organisation/Village		Designation	
			Signed list of communities appended				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd		Water Engineer	
Item		Update					
1		Introduction					

Week	46	Meeting date	8/11/2015
		Recorded by	Vivian Ochen
Meeting/subject	ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN TIRINYI CENTRAL		Total pages 02
	<p>Agenda</p> <p>1-Opening Prayer</p> <p>2-Introduction remarks LC3</p> <p>3-Welcome remarks LC1 Kamonkoli</p> <p>4-Consultant's brief</p> <p>5-Question and answer session</p> <p>6-Closing remarks LC2 Kamonkoli 2</p> <p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none"> ▪ Project Background ▪ Project Location ▪ Project Description ▪ on-going Activities ▪ Project Activities ▪ ESIA/RAP Process 		
	Question and Answer Session		
1.1	<p>Water Supply and pipeline construction</p> <ul style="list-style-type: none"> • What happens if existing pipes are cut, who replaces? • When do surveyors come? • When do they apply and who is it addressed to? • How do the first 100 people qualify? • Why Namatala? • Some projects do not complete within the time frame. When does it start and stop? • Are the 100 people from every town or the whole stretch? • What is the difference between the existing water system and the new one? • How are we catering for public institutions in this project? • If I already have a line, will I get connected to the new line or not? • If I am among the 100 lucky people, and pipes have to go through people's homes but have rejected, what do I do? 		
1.2	<p>Employment</p> <ul style="list-style-type: none"> • Give authority to locals to report a contractor if he or she does not employ locals. 		
1.3	<p>Road reserve</p> <ul style="list-style-type: none"> • Will I get compensated if the pipe is near the road? 		
1.4	<p>Benefit</p> <ul style="list-style-type: none"> • There are 19 villages, will they all benefit from this project? 		
1.5	<p>Request</p> <ul style="list-style-type: none"> • Please give us the contacts of the Ministry Officials? 		

Record 9: Lupada1, Nambago and Busikwe Villages

Week		46		Meeting date	8/11/2015
				Recorded by	Vivian Ochen
Meeting/subject		ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN TIRINYI CENTRAL		Total pages	01
Present	Apology	Copy	Name	Organisation/Village	Designation
			Signed list of communities appended		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd	Water Engineer
Item		Update			
1		Introduction			
		<p>Agenda</p> <p>1-Opening Prayer</p> <p>2-Welcome remarks LC1</p> <p>3-Consultant's brief</p> <p>4-Question and answer session</p> <p>5-Closing remarks LC3</p> <p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none"> ▪ Project Background ▪ Project Location ▪ Project Description ▪ on-going Activities ▪ Project Activities ▪ ESIA/RAP Process 			
		Question and Answer Session			
1.1		<p>Water Supply and pipeline construction</p> <ul style="list-style-type: none"> • What is the distance of the distribution pipes? • If the pipe goes through people's property, who pays? • How do they demand for the bills/money? • Who brings or selects witnesses? • Do they start billing on day one or a grace period is first given? • Where do we pay? • How much does the water cost? • If I want for business, is there a difference in the tariff? • When does the project start? Is this a campaign ploy for the president? 			

Record 10: Budaka Township

Week		46		Meeting date	8/11/2015
				Recorded by	Vivian Ochen
Meeting/subject		ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN TIRINYI CENTRAL		Total pages	02
Present	Apology	Copy	Name	Organisation/Village	Designation
			Signed list of communities appended		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd	Water Engineer
Item		Update			
1		Introduction			
		<p>Agenda</p> <p>1-Opening Prayer</p> <p>2-Welcome remarks LC1</p> <p>3-Consultant's brief</p> <p>4-Question and answer session</p> <p>5-Closing remarks LC3</p> <p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none"> ▪ Project Background ▪ Project Location ▪ Project Description ▪ On-going Activities ▪ Project Activities ▪ ESIA/RAP Process 			
		Question and Answer Session			
1.1		Water Supply and pipeline construction <ul style="list-style-type: none"> • When does the project start? • What is the cost of a unit of water? • Will 105,000/= be enough to connect water to their homes? • Who are the lucky 100 people, is it from Mbale or every town? • Private operator changes price, won't it be the same for this project? • Who is responsible for taking water into the house? 			
1.2		Employment <ul style="list-style-type: none"> • Will drunkards be employed? • Can you give us assurance that the contractor will employ local residents? 			
1.3		Conduct of contractor <ul style="list-style-type: none"> • Who pays if contractor staff is caught with someone's wife? 			

Week	46	Meeting date	8/11/2015
		Recorded by	Vivian Ochen
Meeting/subject	ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN TIRINYI CENTRAL		Total pages 02
1.4	Compensation <ul style="list-style-type: none"> • Will trees cut be compensated? • If pipes pass through people's property, who compensates? • Is the compensation in shifts or once and once for all? 		

Record 11: Nalado, Nalwaya and Nabweyo

Week			46			Meeting date		9/11/2015		
						Recorded by		Vivian Ochen		
Meeting/subject			ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN TIRINYI CENTRAL				Total pages		02	
Present	Apology	Copy	Name		Organisation/Village		Designation			
			Signed list of communities appended							
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen		Air Water Earth Ltd		Water Engineer			
Item		Update								
1		Introduction								
		<p>Agenda</p> <p>1-Opening Prayer</p> <p>2-Welcome remarks LC1</p> <p>3-Consultant’s brief</p> <p>4-Question and answer session</p> <p>5-Closing remarks LC3</p> <p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none">▪ Project Background▪ Project Location▪ Project Description▪ on-going Activities▪ Project Activities▪ ESIA/RAP Process								
		Question and Answer Session								

Week	46	Meeting date	9/11/2015
		Recorded by	Vivian Ochen
Meeting/subject	ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN TIRINYI CENTRAL		Total pages 02
1.1	Water Supply and pipeline construction <ul style="list-style-type: none"> If roads are not opened yet by the Town Council, but foot paths exist, what happens? Who do we address the application for water to? If I have a house plan but have not yet built a house, will I be considered in the 100? When does the project start? 		
1.2	Employment <ul style="list-style-type: none"> What jobs can be given to those who can read and write? 		
1.3	Sensitization <ul style="list-style-type: none"> Will sensitization be effected in all centres up to Tirinyi or only this one? 		
1.4	Compensation <ul style="list-style-type: none"> If I live behind someone whose house is by the roadside, who pays for the land? 		
1.5	Cesspool <ul style="list-style-type: none"> Can cesspool trucks empty semi-permanent pit latrines? 		

Record 11: Nabunyere faecal sludge

Week			46		Meeting date	10/11/2015	
					Recorded by	Vivian Ochen	
Meeting/subject			ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN TIRINYI CENTRAL			Total pages	01
Present	Apology	Copy	Name	Organisation/Village		Designation	
			Signed list of communities appended				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd		Water Engineer	
Item		Update					
1		Introduction					

Week	46	Meeting date	10/11/2015
		Recorded by	Vivian Ochen
Meeting/subject	ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN TIRINYI CENTRAL		Total pages 01
	<p>Agenda 1-Opening Prayer 2-Welcome remarks LC1 3-Consultant's brief 4-Question and answer session 5-Closing remarks LC1</p> <p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none"> ▪ Project Background ▪ Project Location ▪ Project Description ▪ on-going Activities ▪ Project Activities ▪ ESIA/RAP Process 		
	Question and Answer Session		
1.1	Water Supply and pipeline construction <ul style="list-style-type: none"> • Will free taps be available? • Is it from the main on this road and to what distance? • If I live beyond 500m, what happens if I am in need of the water? • When does the contractor start? • What are the costs involved and how much does a unit of water cost? 		
1.2	Employment <ul style="list-style-type: none"> • How do we apply and when do we apply for the jobs? • Will they allow our sons to work if language is a barrier? 		
1.3	Sensitization <ul style="list-style-type: none"> • Re-sensitization or provide brochures because, some points might be forgotten. 		
1.4	Dam <ul style="list-style-type: none"> • Talk about the dam? 		

Record 12: WSDF

Week		46		Meeting date	11/11/2015
				Recorded by	Vivian Ochen
Meeting/subject		ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN MBALE		Total pages	02
Present	Apology	Copy	Name	Organisation/Village	Designation
			Signed list of communities appended		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd	Water Engineer
Item		Update			
1		Introduction			
		<p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none"> ▪ Project Background ▪ Project Location ▪ Project Description ▪ Ongoing Activities ▪ Project Activities ▪ ESIA/RAP Process 			
		Question and Answer Session			
1.1		Catchments have been degraded. Communities need to co-exist with the catchment.			
1.2		Communities are sensitive to land issues.			
1.3		Incentives need to be given to the people to practice better methods of agriculture so as not to degrade the environment.			
1.4		River Manafwa has seasonal fluctuations; something needs to be done to guarantee sustainability.			
1.5		River Namatala – How do we ensure that it is not disturbed?			
1.6		Water resource assessment using existing data and water demand assessment especially with the JICA.			
1.7		Incentives that the government provides for proper land utilisation. River Manafwa has a high demand for irrigation by people who are downstream. If the volume of abstraction is increased upstream, then downstream users will face problems.			
1.8		Storage should be ensured during wet season and utilisation during the dry season.			
1.9		Flows should be regulated.			
1.10		Catchment conservation needs to be done.			

Week		46	Meeting date	11/11/2015	
			Recorded by	Vivian Ochen	
Meeting/subject		ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN MBALE		Total pages	02
1.11	Sustainable systems in place for catchment source protection: <ul style="list-style-type: none">• Zoning with incentives;• Sensitizing people; and• What can be done to ensure activities encourage sustainability?				
1.12	Sustainable rates (tariffs) for catchment protection.				
1.13	Damming- Plan for a reservoir, displaced people and create a dam to store water during wet seasons. Short term-leisure parks, plant trees and minimise silting in the rivers.				

Record 13: Namawondo II

Week			46		Meeting date	11/11/2015	
					Recorded by	Vivian Ochen	
Meeting/subject			ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN MBALE			Total pages	01
Present	Apology	Copy	Name	Organisation/Village		Designation	
			Signed list of communities appended				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd		Water Engineer	
Item		Update					
1		Introduction					
		<p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none">▪ Project Background▪ Project Location▪ Project Description▪ on-going Activities▪ Project Activities▪ ESIA/RAP Process					
		Question and Answer Session					

Week	46	Meeting date	11/11/2015
		Recorded by	Vivian Ochen
Meeting/subject	ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN MBALE		Total pages 01
1.1	Compensation <ul style="list-style-type: none"> If a house was built in a road reserve, will it be compensated? If animals are knocked down, who compensates? 		
1.2	Water Supply and pipeline construction <ul style="list-style-type: none"> If I reside behind your house 500m, do I get a chance to get connected? Will every road in Namawondo II get those pipes 30m? How long will they wash the tank? If one is already connected to the existing line, do they have to re-apply? 		
1.3	Benefit <ul style="list-style-type: none"> How do business owners operating under trees benefit? 		

Record 14: Bwikomba and Nyanza

Week		46			Meeting date	11/11/2015
					Recorded by	Vivian Ochen
Meeting/subject		ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN MBALE			Total pages	01
Present	Apology	Copy	Name	Organisation/Village	Designation	
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<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd	Water Engineer	
Item		Update				
1		Introduction				
		<p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none">▪ Project Background▪ Project Location▪ Project Description▪ Ongoing Activities▪ Project Activities▪ ESIA/RAP Process				
		Question and Answer Session				

Week		46	Meeting date	11/11/2015	
			Recorded by	Vivian Ochen	
Meeting/subject		ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN MBALE		Total pages	01
1.1	Compensation <ul style="list-style-type: none">• If you built in the road reserve, do you get compensated?• If valuers find tree stumps, does one get compensated?• If my veranda is in the road reserve, what happens?				
1.2	Water Supply and pipeline construction <ul style="list-style-type: none">• If I need the water and some people in between do not want it, what happens?• Does the pipe have a reserve like the roads do?				
1.3	Benefit <ul style="list-style-type: none">• If a kiosk owner took a loan and operates in a road reserve, how do they get helped?				
1.4	Employment <ul style="list-style-type: none">• Are there other jobs for women other than cooking?• How many workers will the project employ in every village?• Can people be sub-contracted to dig pits?• If I cannot write now but need to apply, how do I go about it?				

Record 15: Bugwene cell, Doko Nsambya, Doko cell, Nyanza and under the tree

Week		46		Meeting date	11/11/2015
				Recorded by	Vivian Ochen
Meeting/subject		ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN MBALE		Total pages	01
Present	Apology	Copy	Name	Organisation/Village	Designation
			Signed list of communities appended		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd	Water Engineer
Item		Update			
1		Introduction			

Week	46	Meeting date	11/11/2015
		Recorded by	Vivian Ochen
Meeting/subject	ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN MBALE		Total pages 01
	<p>Agenda 1-Opening Prayer 2-Opening remarks LC1 3-Introduction 4-Consultant's brief 5-Question and answer session 6-Closure</p> <p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none"> ▪ Project Background ▪ Project Location ▪ Project Description ▪ Ongoing Activities ▪ Project Activities ▪ ESIA/RAP Process 		
	Question and Answer Session		
1.1	Compensation <ul style="list-style-type: none"> • Who gets compensated; landlord or tenant? 		
1.2	Water Supply and pipeline construction <ul style="list-style-type: none"> • Will it reach Nakaloke? <p>Response: Yes</p> <ul style="list-style-type: none"> • Where will the water be distributed? • When/where do the applications get? • Will shops be required to be closed during construction? • When will the project start? • How were the demarcations of the areas where pipes will be laid done? 		
1.3	Complaint <ul style="list-style-type: none"> • Where do I raise my complaint if the Chairpersons are not involved? 		

Record 16: Naboa, Food and Cathedral

Week		46		Meeting date	11/11/2015
				Recorded by	Vivian Ochen
Meeting/subject		ESIA & RAP FOR MBALE WATER SUPPLY AND SANITATION PROJECT- MEETING IN MBALE		Total pages	01
Present	Apology	Copy	Name	Organisation/Village	Designation
			Signed list of communities appended		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vivian Ochen	Air Water Earth Ltd	Water Engineer
Item		Update			
1		Introduction			
		<p>Agenda</p> <p>1-Opening Prayer</p> <p>2-Opening remarks LC1</p> <p>3-Introduction</p> <p>4-Consultant's brief</p> <p>5-Question and answer session</p> <p>6-Closure</p> <p>The presentation provided a detailed description of the proposed Mbale Water Supply and Sanitation Project. An outline of the discussion was as follows:</p> <ul style="list-style-type: none"> ▪ Project Background ▪ Project Location ▪ Project Description ▪ on-going Activities ▪ Project Activities ▪ ESIA/RAP Process 			
		Question and Answer Session			
1.1		Compensation <ul style="list-style-type: none"> • Are we paid? • Valuation was done in 2015, but payment will be done in 2018, but using 2015 price. What happens? 			
1.2		Water Supply and pipeline construction <ul style="list-style-type: none"> • Will the sewer lines be replaced because they are blocked? 			
1.3		Concern <ul style="list-style-type: none"> • Municipal Council wants to take up contracts of pavers and slabs. There is need to be clear on roles. • Valuers differ. • How safe are the people living around? • Will local leaders be compensated? • Pass leaflets and brochures. 			

APPENDIX B: HYDROLOGICAL ASSESSMENT REPORT

1 Introduction

The project area is drained from east to west by three major rivers that have their sources on Wanale ridge and river Manafwa with its source in Mountains. River Nashibisho and its tributary Napwoli drain the southern part of the town. These are bound by an extensive plain under Mbale forest plantation. River Nabiyonga which acts as a current raw water source for Mbale and its major tributary Namatso drains across the northern area of Mbale town. Several channels also drain from within the town into rivers. River Namatala also traverse the project on northern side of the project area and has a gauging station along Mbale soroti road. Off the slopes of Mt Elgon the river Namatala and Manafwa are draining westward, passing Mbale to the north and south, respectively. With springs in the Wanale Mountains east of Mbale the river Nabuyonga and Nabijo are draining into the Namatala River in the west of Mbale (Figure 1). Approximately between Budaka and Butaleja the River Manafwa is draining into the Namatala River, forming the seasonal wetlands of Namatala. In this area smaller tributaries and wetlands drain into the Namatala Wetlands from the higher altitude slopes in proximity of the growth centres. In the west of the study area close to Tirinyi the Namatala River is draining into the Mpologoma River.

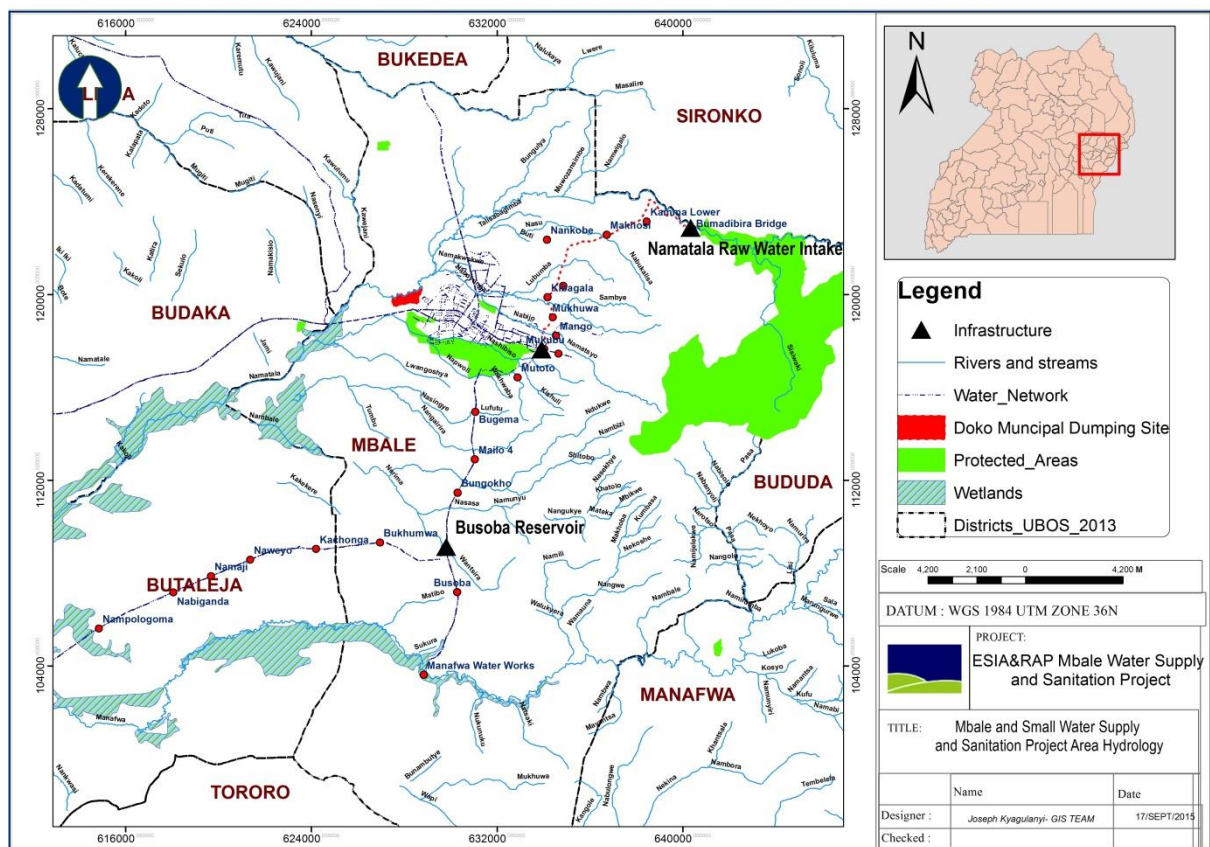


Figure 1 Project area hydrology and protected areas

Having an equatorial climate the project area enjoys plenty of rain and sunshine moderated by the relative high altitude, the climate is tropical wet and dry, however due to higher altitude, average temperatures are quite lower than what is typically seen in other tropical cities. Rainfall is major source of recharge for water resources in project area and most of it is noticed between March and October. The lowest rainfall is observed in January. Mbale municipality water supply is from river Manafwa, river Nabijo and Nabiyonga total production capacity of 130,000m³ per month. However the river discharge drastically reduces during the dry spells such that there will be insufficient amounts to meet the current and anticipated water demand by 2040.

2 Topography

Topography of Mbale and other small towns is influenced by Mt Elgon; the elevation is highest with altitudes of over 3000m at the slopes of Mt Elgon and approximately 1200-1700m in the river valleys to the east of Mbale (Figure 2). The area is characterized by steep slopes of gradients ranging from 20 to 50% in the mountains and approximately 2-10% in proximity of the main rivers. The overall slope percentage for the watersheds east of Mbale is approximately 18%. Towards the west of Mbale the mountainous character changes into swamps and wetland. The elevation for the wetlands along the Namatala River ranges from approximately 1110m close to Mbale and 1060 m in the west of the study area close to Tirinyi. The Growth Centres to the west of Mbale are approximately 20 to 80 m higher in altitude compared to the surrounding low flat planes of the wetlands.

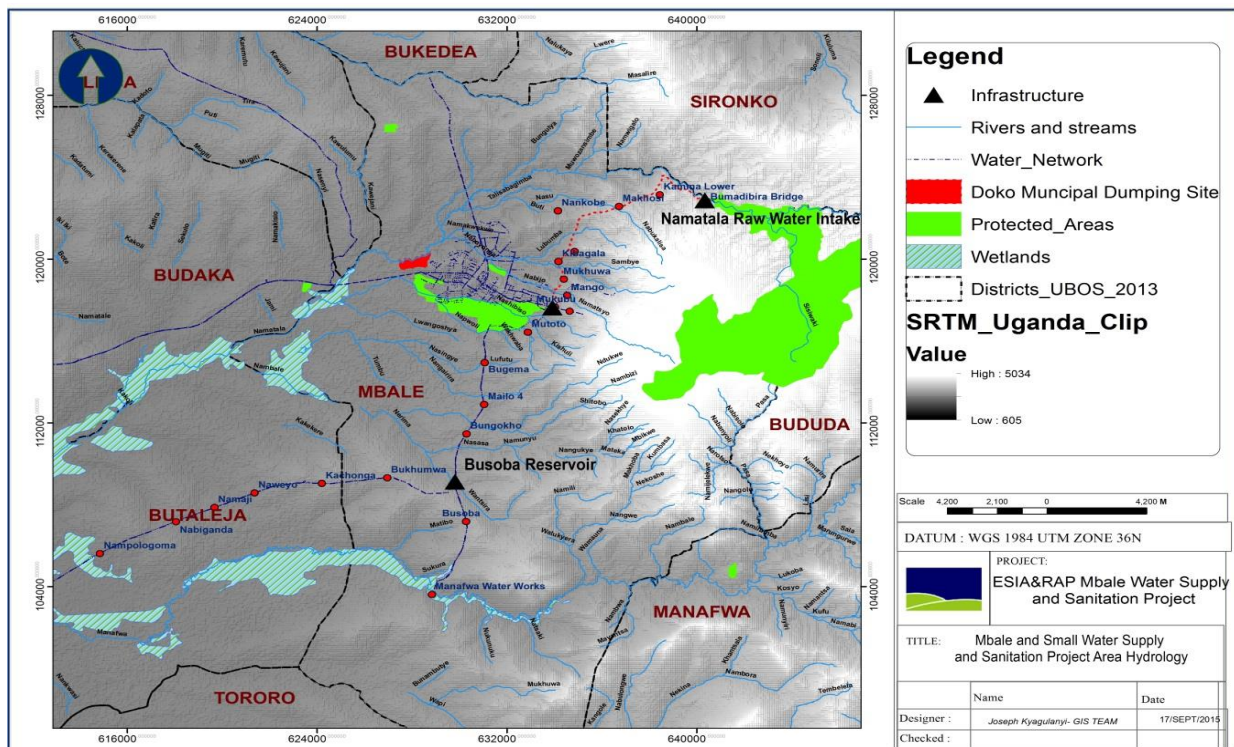


Figure 2 Project Area Topography and hydrology

3 Climatology

The climate in Mbale is tropical with mean annual temperatures and rainfall of 23.0°C and 1183mm respectively. The region experiences a bimodal rainfall pattern with the driest month being January. The first rain season occurs from late March to June and the second from September to November. Over the years there has been a shift from April to May as the wettest month and the onset of the first rains is sometimes delayed until April. The other observed trend has been towards more rainfall during the previously shorter rains periods of September to November. On average there is 32 mm of precipitation in January. With an average of 167 mm, most precipitation falls in May. With an average of 24.2 °C, February is the warmest month. July has the lowest average temperature of the year. It is 22.0°C (Figure 3).

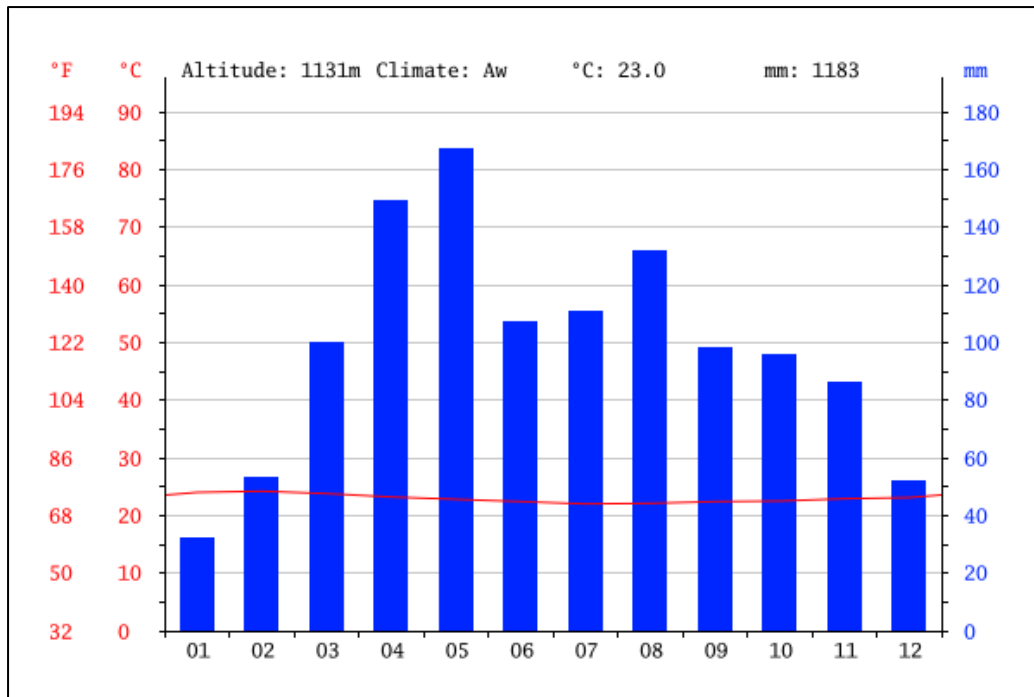


Figure 3 Temperature and rainfall patterns and trends over the project area

4 Location and description of proposed activity

The proposed Mbale and Small towns' water supply and sanitation project is located in Mbale, Budaka, Kibuku and Butaleja Districts of Eastern Uganda subregion. Among the areas to be served include Mbale Municipality, Trinyi, Kadama, Kibuku, Butaleja, Busolve and Budaka town councils. The applicant (MWE) wishes to abstract an amount of 0.313m³/s from Namatala and Manafwa for domestic purposes to benefit an ultimate population of about 333,792 by 2040 (Figure 4). The total water demand to be supplied by Bungokho WTP is approximately between 27,000 m³/d while the water demand to be met by Manafwa WTP is approximated to 6,700m³/d by 2040.

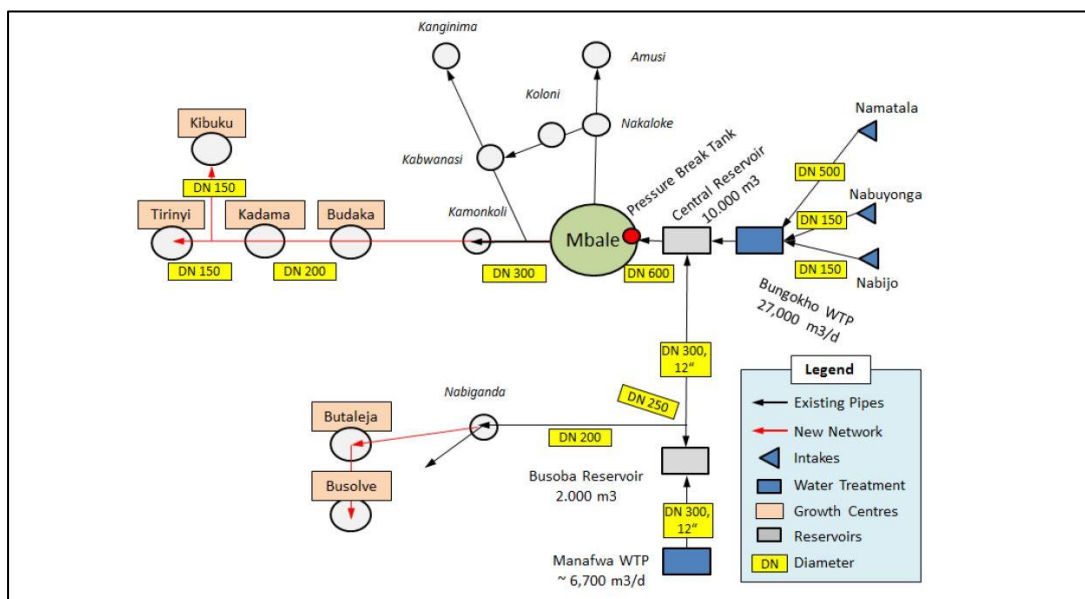


Figure 4 Overview of the new system



Figure 5 Proposed intake location on River Namatala to supply Mbale

The total distance to be covered is about 12 km from the intake to Bunghko Water Treatment plant where it will be treated before it is transmitted to the Triniyi, Kadama, Budaka and Kuibuku towns. The southern wing of the project including the towns of Busolwe and Butaleja is to be supplied by line off the main transmission line from river Manafwa. A reservoir will be constructed at Busoba to supply the areas near Busoba town council. The Reservoir at Busoba will have a capacity of 2000m³ while the central reservoir at Bunghko has a capacity of 10,000m³. The Namatala River has to be used as additional intake for the future water supply and as alternative to the existing intakes at Nabijo and Nabuyonga. A new raw water pumping main from Manafwa, only to bridge the dry period (December – March), is more expensive than the gravity main from Namatala. The transmission main from Namatala shall follow contours in the beginning through agricultural, forests and then cross a series of stream. Only 2 km of the pipeline alignment will follow existing roads. The intake location provides sufficient elevation difference to Bunghko WTP allowing the water to gravitate with minimum energy consumption through pumping. A small weir shall be constructed for water abstraction (Figure 6).

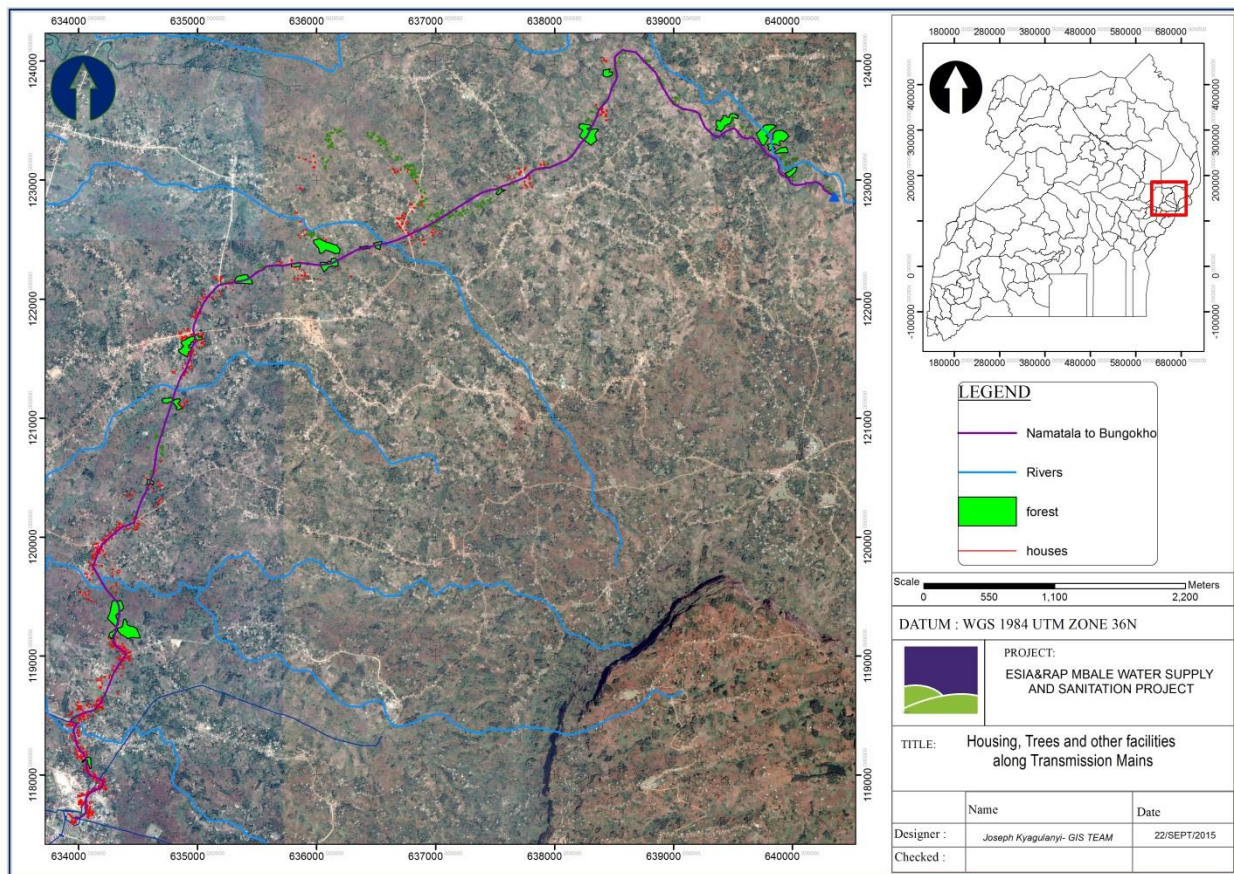


Figure 6 Pipeline alignment from proposed Intake Point to Bungokho WTP crossing a series of streams

5 Namatala Catchment

5.1 Description of Namatala Catchment

Namatala watershed is located in Mbale district. The Upper Namatala catchment covers the part of the game reserve with the lower part transversing through seasonal and permanent wetlands before joining the river Mpologoma. The Namatala system specifically originates from Wanale Mountains and crosses the sub counties of Bungokho, Jami village of Bunyole County and Nakaloke County in Pallisa. Most of the area covered by this system is in the lowlands of Mbale District. The soils can be explained in terms of geology and geomorphological processes which have significant impact on soil formation processes. Namatala catchment at Mbale-Soroti road is approximately 123.6 km².

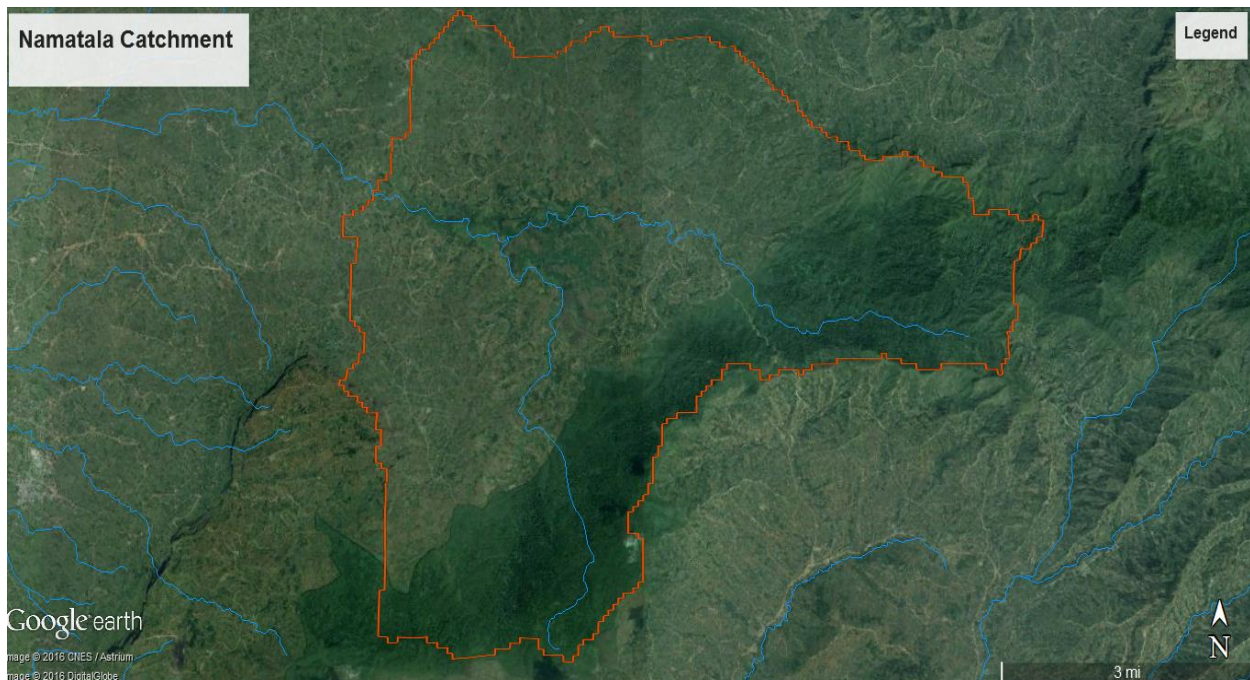


Figure 6 Namatala Catchment draining through gauge station on Mbale-Soroti road

5.2 Hydrological characteristics and analysis

Flow statistics: Hydrological data was obtained for the two major rivers that are going to be used as sources of raw water for Mbale and Small towns' water supply and Sanitation project. The two main rivers selected by CES consultant include River Namatala and River Manafwa. The gauging station for river Namatala is located on Soroti road north of Mbale town and approximately drains an area of 160km². The hydrograph and datasets used in this hydrological assessment were from 1997 to 2014. The hydrograph for river Namatala indicate two peaks in April, May and November. The flows in wet season vary between 2.15m³/s to 15m³/s with maximum flow close to 40m³/s as indicated in Figure 7.

In the dry season the low flow reduce significantly and are in a range 0.326m³/s to 1m³/s. in the recent years from 2000's series onwards the min flow always fell below 0.4m³/s. The surface water from the Namatala River, flowing on the outskirts of Mbale has been considered as a potential water source (with up to 2000 m³/day).

5.3 Availability of Water at proposed intake site

Flow duration analysis: The flow duration curve for Namatala catchment indicated that it's a relatively stable catchment with ability to sustain base flows for some of very high flows for very short time. Different indices extracted provided vital information about the catchment. Q70 (0.43m³/s) represented the base flow component of the flow regime since the flow in River Namatala is highly variable between wet and dry season with flow regime in River Namatala being largely intermittent. In the following figure the return period and exceedance probability of the discharge at Namatala River is shown. For a 95% exceedance probability based on all data a flow of approximately 0.47m³/s will occur. In other words it means that in 95% the flow will be higher than 0.47m³/s or in 5% the flow will be lower than 0.47m³/s. A 99% exceedance probability has a flow of approximately 0.37m³/s.

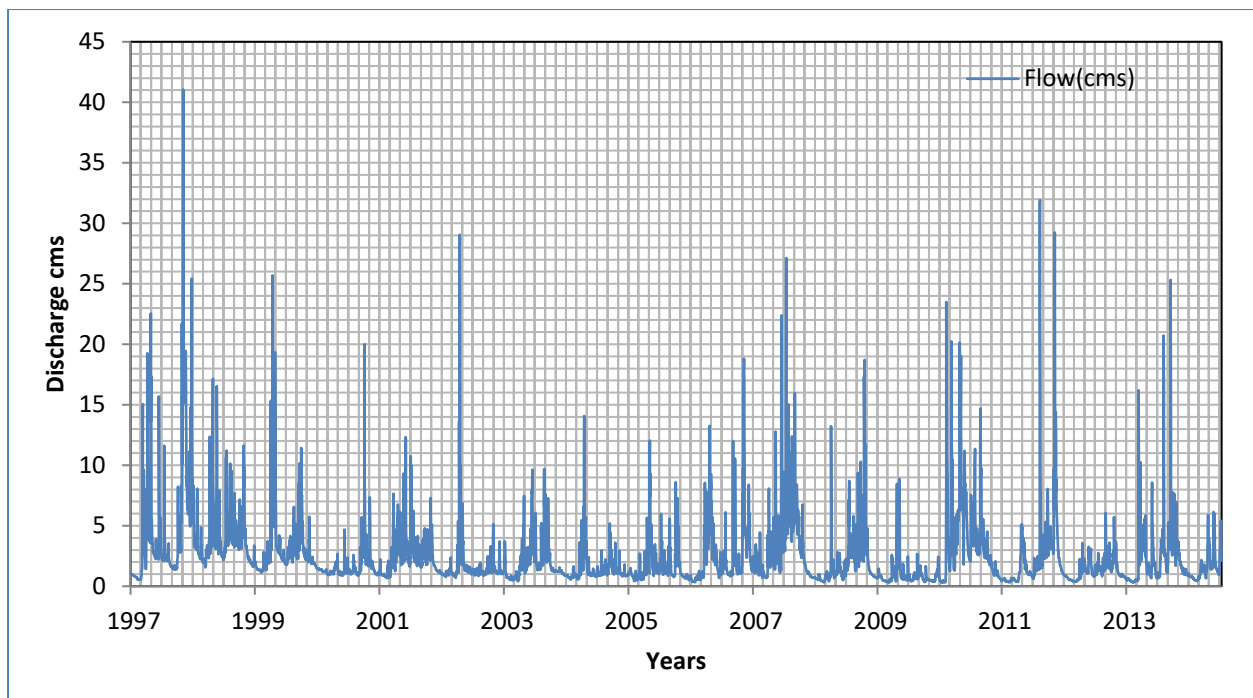


Figure 7 Flows of River Namatala at gauging station on Soroti Road (1997-2014)

The catchment had relatively sustainable base flow as a result of slow response to rainfall. The catchment and stream's variability was investigated by Q20/Q90 ratio. The ratio (6.57) revealed catchment has capacity to store and recharge the flows slowly from saturated zones near the ground surface. Q90-Q10 expressed the variability which excludes the extremes at both ends (dry and wet). The slow slopes of the flow duration curve shows significant contribution of base flow to stream flow, the ratio of Q90 to Q50 indicated the proportion contributed from ground water storage (Mohamoud, 2010). The percentage of time at zero flow helped distinguish between flow regime (ephemeral, seasonal and permanent stream).

The variability in daily flows characterized the stream as perennial. A daily discharge at 50th percentile (1.64 m³/s) is recommended for designing the reservoir storage. The monthly flow-duration values are just like the annual flow-duration values, except that they are determined using only those daily discharges that fall within a certain month of the year. For example, in a 30-year stream flow record, there are exactly 900 daily values for the month of April. The value for Q10 is the flow that is exceeded exactly 10 percent of the time, or on 90 days. The low flow of the Namatala was revealed from the flow duration curve using the flows exceeded 95% of the time since the Namatala is perennial river. 95% exceeded flow was used to measure low flow towards the end of the dry season.

Flow descriptors into high flows (Q0.1, Q0.5, Q1 and Q5 and Q10), the median flows are indicated by Q20, Q30, Q40, Q59 and Q60 percentile flows and the low flows (Q80, Q90, Q95, Q99) according to Mohamoud (2010). A pragmatic approach led to the selection of the 80th percentile as the threshold of low flows, similarly 10% of flows above the 80th percentile can be selected as a suitable portion of water for abstraction. The flow duration analysis gives the low flow (Q80) as 0.8620 m³/s. The flow caters for both reserve flow and domestic use. The difference between low flow (Q80) and reserve flow (Q95) is 0.359 m³/s, which is the allocatable water as with normal flow; the flow balance is reduced by unregistered illegal abstractors.

Low flow analysis: Low flow in Namatala catchment were associated with base flow, Wallace and Cox (2002), Hayes and Nelms (2001) recommended the use of Q90 (0.47 m³/s) and Q50 (1.4 m³/s) as conservation estimator of mean base flow. The base flow variability for Namatala basin was revealed by the ratio Q50/Q90 (2.48) and Q10/Q95 (10.42). Low flow quartiles are very crucial in water quality management applications including waste

load allocations and discharge permits and in siting treatment plants and sanitary landfills with the catchment, the low flow statistics especially 10-year 7-day average low flow is very essential. A 10 year 7-day mean annual minimum for Namatala catchment was estimated to be 1.2 m³/s. Daily mean stream flows were also analyzed for Namatala gauging station to calculate the annual 7-day low flow for each year. Different low flow indices have been developed as indicated in Tables 1 and 2 to ensure sustainable abstraction, ecosystem maintenance and water quality monitoring. Low flow 7Q10 (7-day 10 year low flow condition according to Singh (1974) is most commonly used for stream water quality standards. The water quality of Namatala stream can be considered acceptable unless the stream flow is 7Q10 which was estimated to be 0.3 m³/s and any diversion beyond the 7Q10 could degrade the water quality of the stream beyond the accepted standard (Chiang and Johnson, 176). There are numerous and diverse reasons applied to the use of the 7Q10 flow for regulation purposes. For critical protection of protection of aquatic life, on which effects of contaminants are felt over relatively short period of time, the critical low flow used for toxic contaminants is the 7Q10 (0.3 m³/s). For the protection of uses that consider the development of long-term effects, a critical low flow estimated for a longer period of time is more suitable while remaining safe. For the drinking water sources, the consumption of aquatic organisms and terrestrial wildlife, the flow 30Q5 (0.4 m³/s), is used. This corresponds to the minimum average flow over 30 consecutive days with a probability of recurrence of once every 5 years. For conventional parameters (TSS, phosphorus, BOD₅) and faecal coliforms, the critical low flow 7Q2 (0.5 m³/s) is used, that is, the minimum average flow over 7 consecutive days with a probability of once every 2 years can be adopted for Namatala catchment.

Table 1: Minimum flow frequency analysis for N-day aggregation periods for River Namatala

Percent of Time Exceed	1	3	7	15	30	60	90	120	183
99	2.2	1.6	1.6	1.7	1.7	1.9	2	2.3	3
95	1.3	1	1.1	1.1	1.2	1.4	1.5	1.6	2.1
90	1.0	0.8	0.9	0.9	1.0	1.1	1.2	1.4	1.8
80	0.7	0.7	0.7	0.7	0.8	0.9	1	1.2	1.5
50	0.5	0.5	0.5	0.5	0.6	0.7	0.8	0.8	1.1
20	0.3	0.3	0.4	0.4	0.4	0.5	0.6	0.6	0.9
10	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.6	0.8
5	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.5	0.7
2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.7
1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.6
0.5	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.6
0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.4	0.6

The low variability of river catchment flow was reflected in relatively flat slope of the flow duration curve, the low flow range for river Namatala was between 70% to 99% of the flow duration curve though Q95 (0.47m³/s) and Q90 (0.60m³/s) are most used as low flow indices in most of the review government literature and academic sources. Since the Namatala is perennial stream Q₉₅ (0.47 m³/s) was adopted as an indicator of extreme low flow conditions for the catchment. Q₅ (1.47 m³/s) according to Metcalfe et al. (2003) can be used to recommend seasonal minimum discharges to waterpower project and provide a basis for protection of aquatic biodiversity within the catchment. The use of Q95 and Q90 are varied are similar to the 7Q low flow indices. Similar to the 7Q10 flow, the Q95 flow can be used as a biological index for licensing of water takings and for effluent discharge limits. To examine the links between climate warming and low stream flow monthly Q90 and monthly Q50 (Table 2) can be adopted according to Yulianti and Burn (1998).).

Table 2: Monthly flow duration analysis for River Namatala

Percent of Time Exceeded	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
99.0	0.33	0.33	0.35	0.41	0.64	0.50	0.44	0.62	0.5288	0.39	0.38	0.45	0.37
95.0	0.38	0.36	0.41	0.75	0.90	0.63	0.62	0.87	0.868	0.65	0.48	0.63	0.47
90.0	0.43	0.40	0.46	1.02	0.98	0.79	0.89	0.95	0.972	1.10	0.84	0.69	0.60
80.0	0.56	0.44	0.59	1.37	1.19	0.98	1.05	1.08	1.3842	1.31	1.01	0.79	0.86
50.0	0.83	0.66	1.03	2.79	2.05	1.56	1.90	1.85	2.4755	2.52	1.51	1.02	1.49
25.0	1.18	1.17	1.96	4.87	3.27	2.57	3.19	3.23	3.7032	3.62	2.57	1.49	2.85
15.0	1.40	1.48	2.67	6.12	4.53	3.32	4.20	4.37	4.4864	4.40	4.39	1.89	3.85
10.0	1.61	2.00	3.39	7.39	5.41	4.53	5.40	5.40	5.3579	5.35	6.85	2.34	4.90
5.0	3.14	2.65	5.01	10.97	7.73	6.00	7.30	7.31	7.4558	7.62	15.19	5.86	7.17
2.0	4.31	5.66	9.54	15.74	9.93	8.00	10.03	11.16	9.9632	11.10	18.24	8.62	10.57
1.0	7.04	10.09	10.58	19.31	12.92	11.54	11.51	16.21	11.3858	15.67	25.03	10.27	14.90
0.1	8.31	23.49	20.25	29.05	19.03	22.39	27.11	31.90	25.332	21.68	41.06	25.42	29.16
Min	0.33	0.33	0.33	0.38	0.56	0.462	0.41	0.59	0.407	0.34	0.38	0.38	0.326
Max	8.31	23.48	20.25	29.05	19.03	22.388	27.11	31.90	25.332	21.68	41.06	25.42	41.057

Flood flow analysis: Annual peak daily flood flows were picked from the record of 17 years (1997 and 2014) and the frequency of occurrence computed as probability of exceedance and return period in years. The partial duration series was adopted to cater for such issues by considering all independent peaks which exceed a given threshold. The highest flood of 41.06 m³/s was recorded in November 1997. The peak flows for Namatala catchment ranged between 41.06 m³/s to 6.10 m³/s with mean peak flow of 10.27 m³/s. Because of the short record of data (15 years), the Q95 exceedance flood was estimated by extrapolating the frequency curve. Q95 annual flood was estimated at 6.24 m³/s. Flood flow at Q50 (1.4925 m³/s) less reserve flow Q95 (0.457m³/s) leaves a balance of 1.0355m³/s.

The Pearson Type III distribution with log transformation of the flood data (Log-Pearson Type III) is recommended as the basic distribution for defining the annual flood series (USWRC, 1967; IACWD, 1982; Griffs and Stedinger 2007b). The peak flows extracted from time series were fitted on Log Pearson Type 111 distribution to perform a flood frequency analysis for Namatala. A flood frequency curve was constructed at catchment outlet to show how often flood discharges of different sizes (magnitudes) will be equaled or exceeded. A plot of ranked extreme value and probability of exceedance yielded the frequency curve for catchment. K factors for a particular return period at corresponding coefficient of Skewness were obtained from the frequency tables. Using the general equation, extreme events at each return periods Tr were obtained. Table 3 shows flood events for different recurrent intervals based on Log-Pearson Type 3 distribution model.

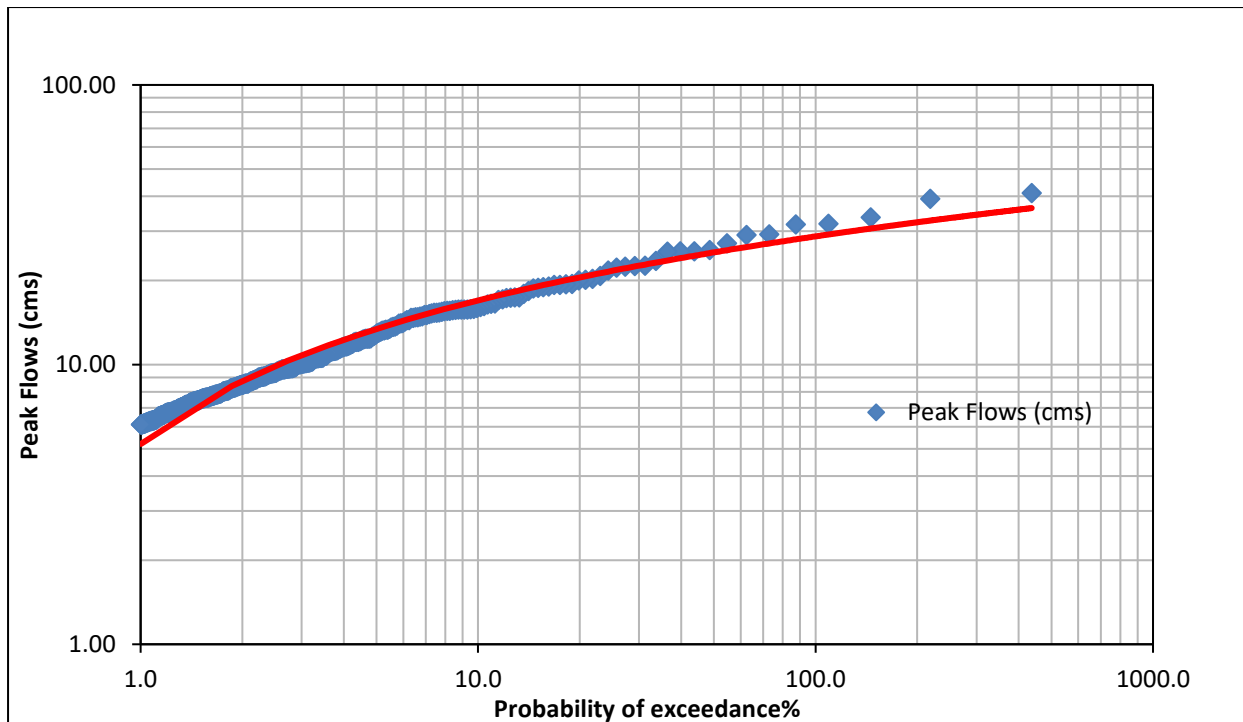


Figure 8 Analytical frequency curve for Peak flow for Namatala catchment

Table 3: Flood events for recurrence intervals of interest for Namatala Stream

Recurrence Interval	2	5	10	25	50	100	200
Frequency Factor (K) at coefficient of Skewness Cs	-0.195	0.732	1.34	2.087	2.626	3.149	3.661
Log X	0.94	1.10	1.20	1.32	1.41	1.49	1.58
Antilog X	8.78	12.47	15.69	20.82	25.52	31.11	37.75

Since there are seasonal variations during which the storms or floods do not occur or are not severe and other seasons when they are more severe, also damages associated with flood often vary with season of the year, thus it was important to establish frequency curves for each month based on the maximum flows for n-days aggregation period. The annual, seasonal or monthly maximum series of discharge is frequently required for flood analysis, whilst minimum series may be required for drought analysis.

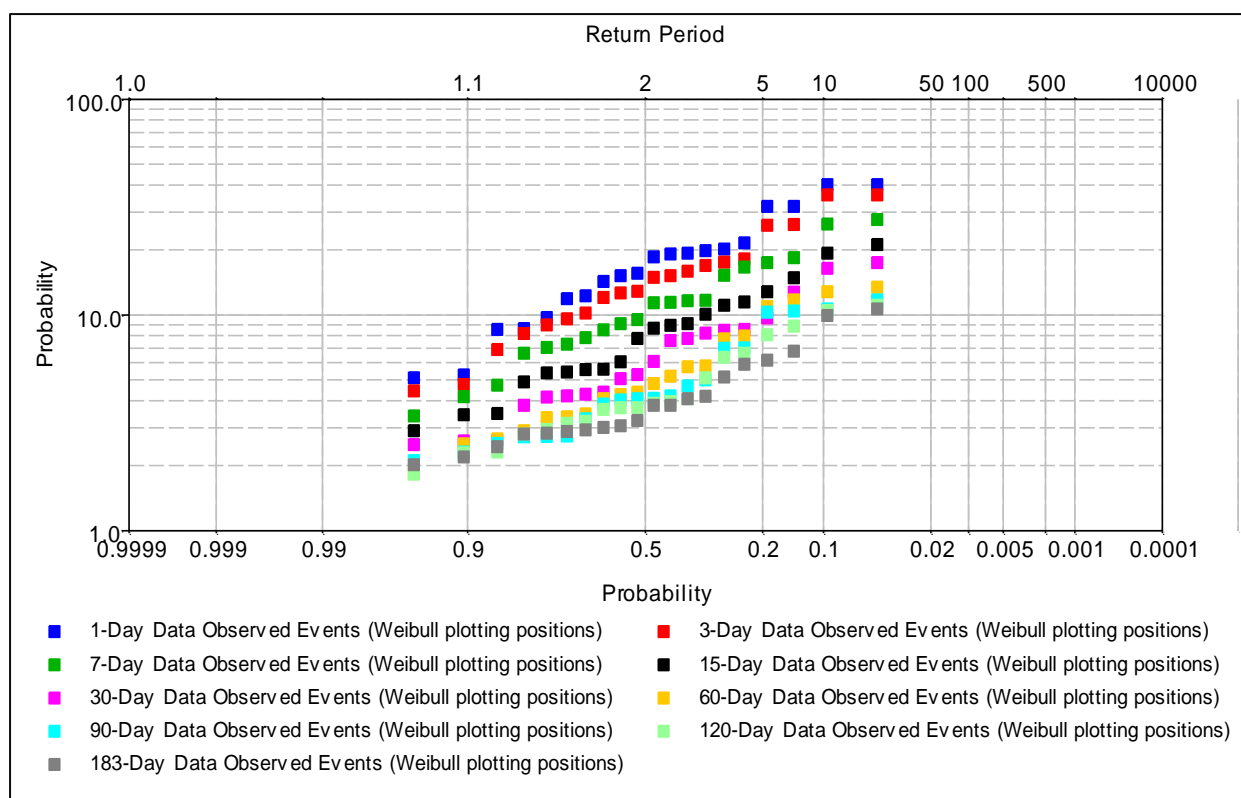


Figure 9 Maximum volume frequency analysis for Namatala

Table 4: Maximum volume frequency analysis for N-day aggregation periods

Percent of Chance Exceedance	1	3	7	15	30	60	90	120	183
0.2	78.6	74.8	55.5	47.2	42.3	32.2	27.5	25	24.1
0.5	66.9	61.6	45.8	37.4	32.5	25.2	21.8	19.9	18.9
1	58.6	52.7	39.3	31.2	26.4	20.7	18.1	16.6	15.6
2	50.7	44.6	33.3	25.8	21.4	16.9	15	13.8	12.8
5	40.7	34.9	26.2	19.7	15.9	12.8	11.4	10.5	9.7
10	33.5	28.2	21.3	15.7	12.5	10.1	9.1	8.5	7.7
20	26.4	22	16.7	12.3	9.6	7.8	7.1	6.6	6
50	16.7	14	10.8	8.1	6.3	5.2	4.6	4.4	3.9
80	10.5	9.2	7.2	5.8	4.6	3.7	3.3	3.1	2.8
90	8.2	7.5	5.9	5	4	3.2	2.8	2.7	2.4
95	6.7	6.4	5.1	4.4	3.7	2.9	2.5	2.4	2.2
99	4.6	4.7	3.8	3.7	3.2	2.5	2.1	2	1.9

6 Conclusions of Namatala Assessment

The dry season flow is relatively high 1.49 m³/s for River Namatala compared to anticipated water demand of 0.313 m³/s. Though lower flows can be experienced at the proposed abstraction point nevertheless the absolute minimum flows (0.326 m³/s) are still greater than the water supply demand required by 2040. The mean flow was estimated at 2.41 m³/s while flows exceeded 95% and 99% of time was estimated to be 0.47 m³/s and 0.37 m³/s respectively. The analysis suggests enough water is available to meet water demand by design horizon of 2040;

however, minimum EF for the Project needs to consider. Refer to Annex K for the determination of minimum EF for the Namalata River downstream of the proposed intake.

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APPENDIX C: ECOLOGICAL REPORT

DESCRIPTION OF THE BIOLOGICAL ENVIRONMENT IN THE PROPOSED PROJECT AREAS FOR THE ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT OF THE WATER AND SANITATION DEVELOPMENT FACILITY IN EASTERN UGANDA IN MBALE AND BUTALEJJA

FIELD SURVEY TEAM

Samuel Mutebi - Plants

Herbert Kasozi - Mammals

Micheal Kibuule - Birds

Sadic Waswa - Hepertiles

1 GENERAL INTRODUCTION

The Ministry of Water and Environment through Water and Sanitation Department, implements the Water and Sanitation Development Facility – East (WSDF-E) in 39 districts of eastern Uganda including Manafwa, Mbale, Butaleja, Pallisa and Budaka. This is focused on development of piped water systems in Small Towns and Rural Growth Centers, expansion and rehabilitation of existing schemes in participating districts, execution of planned/uncompleted activities inherited from the North Eastern Towns Water and Sanitation Project (NETWSP) addressing water supply and sanitation, establishment of structures to ensure sustainable operation and maintenance of newly constructed water supply systems. These activities have capacity to cause impacts on the biological diversity especially during the development and implementation phase.

The set environmental protection and conservation policies, laws and regulations require all development activities with capacity to adversely affect the environment (social, physical and biological) be subjected to Environmental Impact Assessment (EIA). This is based on the ground that projects that can cause adverse impacts on the social and bio-physical environment are anticipated, scored and alternatives thought before implementation.

Today phenomena of rapid loss and degradation of habitats and habitat fragmentations are listed as the most important causes of biodiversity loss in the contemporary world. These phenomena are happening across a range of natural and manipulated ecosystems, including sensitive areas such as watershed, riparian ecosystems, biodiversity hotspots and protected areas. Environmental sustainability and future depend on conservation of biodiversity and maintenance of life support systems, which are being affected by human activity. This devastation of biodiversity and general degradation are taking place in the wake of minimal monitoring of various biodiversity and ecological aspects. Therefore in an attempt to develop a system or mechanisms for timely interventions to minimize impact of human activity on biodiversity and ecosystem health, all development projects (small, Medium to large) are subjected to environmental impact studies so as to assess their impact on the biological diversity, and set the required monitoring indicators necessary to conserve and maintain the integrity of ecosystems and habitats where different taxa thrive. This served as the basis for vegetation and flora studies, to assess the impact of water developed activities in the district of Mbale and Butaleja, all in eastern part of Uganda on vegetation and flora diversity, which is the primary terrestrial and semi-aquatic habitat component.

2 PURPOSE OF THE STUDY

The study aimed at:

- i) Ascertaining species richness and diversity; identifying species of conservation concern (in terms of range restriction, rarity and threat), identify ecologically sensitive sites, altered habitats and provide a quick review of vegetation and flora assemblages at the proposed site.
- ii) Carry out detailed baseline survey on fauna within and around the project area.
- iii) Mammals: The surveys were essentially aimed at;
- iv) Identifying and assessing potential impacts of the project on the species and their habitats.
- v) Proposing mitigation/management measures and a monitoring protocol necessary to minimize negative impact on the species and habitats.

3 BIODIVERSITY RATIONALE

Plants, birds, small mammals, amphibians, reptiles, fish and butterflies, satisfy most of the criteria specified for good indicator groups that can be used for environmental evaluation and monitoring (Pearson, 1995; Pollard, 1977). These taxa are taxonomically well-known and stable; their populations are readily surveyed, and may be specialized in most cases within a narrow range of habitats. All taxa are sensitive to environmental change and anthropogenic modifications, and as such serve as ideal indicators of habitat condition. For this reason, plants that

form a basis for most terrestrial and sub terrestrial habitats were targeted during focused rapid habitat assessment survey across the proposed pipeline area.

Herpetiles: Although Uganda covers just 241,551 Km² and accounts for only 0.18% of the world's terrestrial and fresh water surface, Uganda is also considered as one of the world's biodiversity hotspots. there are however instances where it is required that the natural environment is transformed to other forms of utilization such as infrastructural development, with these changes happening, there is always a need for an assessment of the extent to which the ecosystems and the biodiversity there in will be affected is important.

Ecologically, amphibians are important; they are mostly predators, acting as primary and secondary carnivores. Their prey consists mostly of insects, some of which are pests to crops or disease vectors. They are also inter-linked in food chains, often acting as food for other vertebrates, such as cats, birds, snakes and sometimes man. Amphibians are known to be an easily recognizable taxon in given habitats; and populations are sometimes specialized within a narrow habitat. This makes it easy and practical to monitor changes in composition over time, given different conditions (Heyer *et al.*, 1994). Impacts on their habitat are reflected in changes in numbers and species diversity in a short time. These are some of the factors that have made amphibians to be recognized, as good indicators of habitat change.

Reptiles are important in nature. They are important predators within the food webs of their habitats. As such, they help keep animals that humans regard as pests under control.

Given their sensitivity to habitat alteration and pollution, amphibians may serve as indicators of overall environmental health. Amphibians are bio indicators of an altered ecosystem and are very sensitive environmental monitors. Significant declines could indicate deterioration in the quality of the environment. This role as indicators can be based on the assumption that the adverse effects of environmental degradation will be reflected in reduction of hepertilian diversity (Magurran, 1988). Amphibians unlike people respire at least partly through their skin making them much sensitive to environmental disturbance (IUCN/SSC, 2003).

The eggs and embryos of frogs in wetlands are very sensitive indicators of any adverse changes in the water chemistry (Channing, 2001).

4 STUDY AREA

Birds: Twelve study sites were randomly and or subjectively selected along the pipeline route. Each site was visited once and at different times of the day, the counts went on well despite two occasions of rainfall in the first two site counts (Namatale and Kama-Lower). Generally, the area to be affected has mainly two habitat components; Most of the area surveyed is cultivated and the rest is covered by wetlands. Bananas, Maize, indigenous and exotic trees dominated most of the agricultural area. Most wetland sites are being used for rice growing. Human settlement facilities (houses) along the route are relatively low. The study identified three major bird critical areas; this was based on the nature of the site, number and nature of the bird species composition in such areas. The most critical area is Doho rice scheme which is an Important Bird Area, the second area is the one inhabited by Namatale River (proposed water source for the project) and the third is Manafwa water treatment plant area. The opportunistic observations in all the selected twelve sites brought the total number of species see to 119 out of 1040 currently known from Uganda (Nature Uganda, unpubl). Site species list was here attached as an appendix.

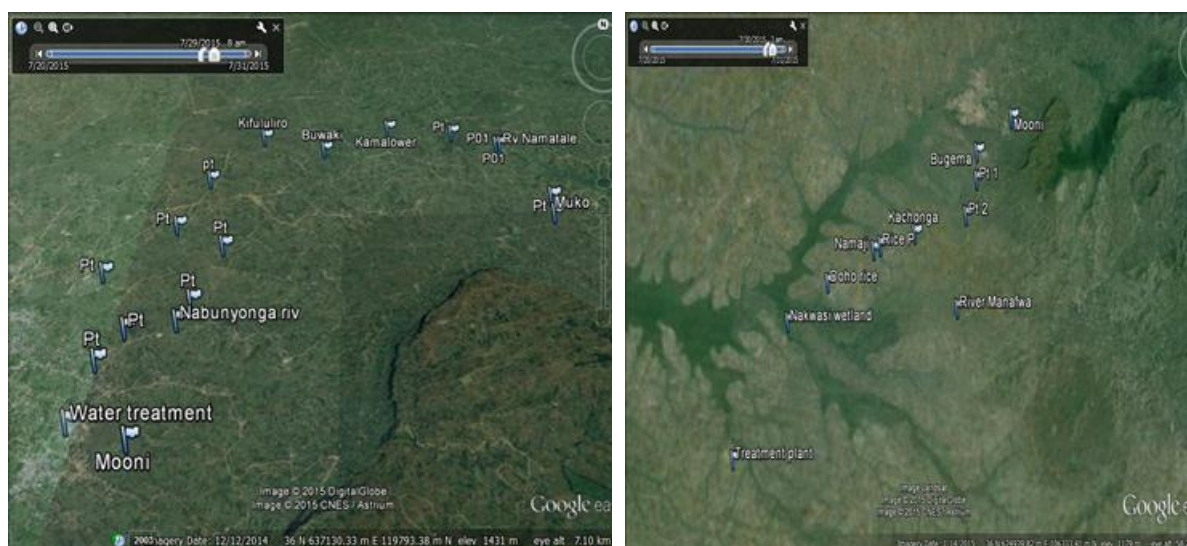
Plants: Vegetation forms the basis for occurrence of all the other components of biodiversity since it serves as food for many animal groups, provides and shapes habitats in which they stay and regulates many survival functions of ecosystems. These latter include climate moderation, control and/or moderation of runoff and flooding, controlling erosion, and maintaining the balance of vital gases (Oxygen, and Carbon dioxide among others) in the atmosphere. Plant species richness and habitat occurrence were surveyed in the project areas to inform about the

habitat integrity and species richness and therefore to gain an understanding of the potential negative impacts that could arise from the proposed development.

The survey was conducted within a radius of 100m of the proposed water pipeline, within 250m at mini reservoir sites (Mooni and Busolwe) and major water treatment sites of Manafwa and Mukhubu. The choice of the survey sites was largely influenced by the sensitivity of the habitat either for protection/conservation of biological resources or habitat variability. Fortitudes however were made to get the position where most disturbances were expected to be.

Three pipelines which include a pipeline from Bumadirila intake to Mukhubu water treatment plant???; Mbale town to Manafwa treatment plant and Mbale –Busolwe pipeline were chosen for the study see fig 1(a) and (b) below.

Studies were also done at sites of the mini water reservoirs of Mooni and Busolwe. The Bumadirila–Mukhubu pipeline covered the following villages; - Bumadirila, Kama lower, Makku, Buwaki B, Makhosi, Kifululiro, Makudui and Nankobe all in Mbale district. The second pipeline from Bugema town to Manafwa treatment plant covered villages of Bugema town, Bungokho, Busooba, and Manafwa where the treatment plant is located; all these are also in Mbale. The Mbale-Busolwe pipeline pass via Buhumwa, Kachonga Nampologoma, Naweyo, Namazi, Doho irrigation scheme, Lwabi & Nakwasi wetland, Nakwiga and Busolwe town to the mini water reservoir on Busolwe –Tororo road.



a) Bumadirila intake point to Mukhubu treatment plant b) Bugema- Manafwa and Mbale- Busolwe pipelines

Figure 1 Satellite imagery showing the pipeline route surveyed

Hepertiles: The project is going to be implemented in Mbale district within the Mountain Elgon conservation area and Butalejja. Part of the study Area is in the foothills of Mountain Elgon but most is along settlements in Mbale district and Butalejja. The climate is moist to moderate dry with an annual rainfall of over 1,270mm (<http://www.ugandawildlife>).

5 METHODS

Plants: Specific points along each pipeline were identified for vegetation and flora studies. All these sample sites were geo-referenced (figure 1) producing a baseline of information on the basis of which future impacts could be evaluated. Characterization of the project area was based on the floristic, and landscape features observed at the

different sites. The sample points were effectually random points along the proposed pipeline and existing community roads.

The area traversed by water pipeline is relatively large and traverses largely through built up environment, extensive subsistence farmland including coffee and banana plantation, and seasonal and permanent wetlands including Lwabi and Nakwasi wetland system. The pipeline area negotiates steep slopes, valley bottoms and flat lands but it largely follows the river course in many places. Ninety five percent (95%) of the natural vegetation stands have therefore been modified for settlement and agricultural purposes and as such vegetation cover is already of a modified state. This was done to provide information necessary for ascertaining species richness and diversity; identifying species of conservation concern (in terms of range restriction, rarity and threat), identify ecologically sensitive sites, altered habitats as well as providing a quick review of vegetation and flora assemblages at the proposed site.

During the course of vegetation and flora baseline studies, data were sourced from possible areas through desk-based studies. These reinforced findings of the field surveys conducted from the proposed site for pipeline development. The field survey was conducted in July 2015 to collect further site-specific information on habitats and species presence. Global Positioning System (GPS) units were used to record the geographical coordinates of the survey locations. The vegetation specialist traversed the proposed site making points of interest depending on the set objectives. Photographs were taken and notes made at each different point of interest to record the habitat and species of flora as well as landscape features of importance.

Species richness, abundance, invasive, and sensitive habitat were investigated. Sensitivity of habitats was assessed from presence of i) threatened taxa in accordance to IUCN conservation assessment, ii) rarity, iii) endemism; presence of iv) fragile watersheds, v) steep slopes, and vi) riparian areas.

Transect: During the actual field surveys, records of the features of the landscape and environment including the dominant habitats and common species within the survey area, were made along transects. A transect method was used to sample the vegetation and flora in the proposed pipeline areas from the three pipelines. Vegetation types traversed by each transect was identified. Along each transect estimation of species abundance on DAFOR scale, presence of disturbances, signs of usability and presences of invasive species were made at determined points in a space of 20 m radius. Opportunistic recording of species not recorded at the regular survey locations was done in between survey locations. The three transects were designed to follow the 3 pipelines as designed.



Photo 1: Bumadibira intake – Maize gardens and Eucalyptus woodlots



Photo 2: Banana plantation at Buwaki along Bumadibira-Mukhubu pipeline



Photo 3: A remnant bushland patch along Madibirila-Mukhubu pipeline



Photo 4: Manafwa river and treatment plant



Photo 5: Eucalyptus woodlot along Mbale-Busolwe pipeline



Photo 6: Doho irrigation scheme-rice gardens

Images captured in different sections of the proposed project area which demonstrate the already human impacted nature of the landscape are presented in Photos 1 to 6. These kinds of scenario suggest the areas are no longer natural, but never the less they will still have a biodiversity value for species that stay on even in agro-ecosystems.

The vegetative communities in the study area were classified using the Langdale-Brown et al. (1964) system. This system recognizes 22 ecosystem types, identified by letters between A to Z. Although the Langdale-Brown (L-B) system is now 50 years old, it was used in preference to the more recent National Biomass Study (1996) for several reasons as indicated by Van Breugelet *al.*, 2011). The L-B system is based on plant community composition rather than just plant biomass, which was more relevant to the goal of characterizing vegetation and identifying sensitive habitats. Secondly, although much of Uganda's vegetation has been extensively altered over the past few decades the L-B system can still be considered to represent the potential of an area to support an ecosystem type, which is relevant for a study of environmental impacts (Kalema J, et al., 2010, Pomeroy D, et al., 2002). Finally the L-B system provides 22 vegetative categories compared to the 13 adopted by the National Biomass System (USAID 2014), this greater level of resolution allows us to assess the potential impacts of water development project on ecosystems at a finer scale.

Herpetiles: Field data was obtained by conducting a survey of amphibians and reptiles in and around Mbale and Butalejja water pipeline project area. Various methods i.e. Visual Encounter Surveys, opportunistic surveys and local consultations were used. The species were identified, counted and recorded. The conservation status of the hepertofauna is reported using the IUCN Red Listing (IUCN 2014).

Visual Encounter Surveys (VES) - This method involved walking through the study areas or habitats for a prescribed time period systematically searching for amphibians turning logs or stones, inspecting retreats, watching out for surface-active species and listening out for frog calls. Visual encounter survey method is commonly used to determine the species richness of an area, to compile a species list and to estimate relative abundances of species within an assemblage.

Opportunistic Encounters - This method involves recording any amphibian or reptilian species encountered anywhere and at any time within the study area, or brought in / reported by local people. Opportunistic searches were used to maximize the number of species encountered in the study area.

Local Consultations - Local people are a valuable source of information since they are constantly in touch with their environment; they encounter amphibians and reptiles of different kinds as they carry out their daily activities. We talked to some local people who informed us about the availability of some species of reptiles and amphibians. Some of the records were later confirmed by encountering some of them in the field. The reptiles and amphibians were identified using standard reference books available namely; Schiotz (1972) and Drewes (2006).

Mammals: These are some of the principal biodiversity components of great importance in environmental assessment and conservation planning. They are often used as indicators of environmental health and continue to be of great value in conservation decision making. This is largely due to their ecological importance (as regulators of food chain, seed dispersers, regulators of communities of plants and other animals etc.) and economic importance as food sources, tourist attractions, and disease vectors among others. They are included in the environmental impact assessment studies of the impending water development works as part of the Mbale water and sanitation project. This report among other things outlines the results of a mammal survey conducted as part of the latter project.

Village transects and Consultations - A reconnaissance tour around the project area was conducted to identify areas of conservation importance and those suitable for sampling. In this effect a drive through was conducted and no site was identified as being a critical mammal habitat. Transects were moved through the villages on foot to identify any prospects of mammal presence (especially through foot prints and dung deposition) and to consult the local people. The consultations basically involved asking local people of the animals they encounter in their day to day activities. Respondents were picked randomly and responses from all were collated to generate one species list for the area.

Opportunistic encounters - This involves opportunistic sightings while moving through the project area. These records are ideally not from designated sampling areas but within the larger project area. They are essential in enriching the species list of the project area. While moving through the villages, different animals were opportunistically encountered.

Birds: Site species composition was managed by Timed Species Count (TSC) method (Pomeroy 1992), where all species positively identified were listed in order seen or heard. For each site each TSC lasted for 40 minutes. To make the count, we moved slowly around the study sites listing any species which were anywhere within the site, regardless of how far away from the transect, species flying over the transect were also recorded. Along each count, predominant vegetation type of the habitat was recorded

Twelve sites were randomly and or purposively selected basing on habit type and expected species abundance and richness. Four were predominantly wetland sites (Doho rice scheme, Bugema, Manafwa and Busolwe). Whereas eight sites were predominantly agricultural and these include; Namatale, Kama-lower, Makhosi, Bungukho, Buwaki, Makudui, Mooni and Kifuluriro.

6 RESULTS

6.1 Vegetation and Flora

The area traversed by the pipeline from Bumadirila intake to Mukhubu treatment plant cuts across built up area, subsistence farmland (including maize, banana, coffee, Ground nuts, and sugarcane gardens), woodlots (including *Eucalyptus* spp, *Pinus* spp, and *Grevilia robusta*), and mixed woodlots of *Eucalyptus*, *Pinus*, *Tectonia*, *Maesopsis eminii*, *Albizia* spp, *Milicia excelsa* & *Azadirachta indica*) and patches of post-cultivated light bushland and grassland with scattered trees. The Bugema-Manafwa pipeline crosses built up area including small towns and linear settlement along the Mbale-Tororo road, subsistence gardens mainly maize, taro (wetland yams), rice, cassava and Banana. It also cuts across a small patch of fallow land dominated mainly by herbaceous plants of *Bidens pilosa*, *Panicum maximum* and *Sorghum arundinaceum*. The Mbale-Busolwe line traverse through built up area, subsistence gardens of maize, banana, Potatoes, Beans, cassava, and rice; it also cuts across extensive rice farmland of Doho irrigation scheme, and the only remnant *Cyperus papyrus*-*Cyperus dives* swamp in areas of Lwabi and Nakwasi. Table 1 below gives a description of the vegetation type and major/dominant flora from all the three pipelines.

Table 35: Vegetation types and dominant species at the project site

Pipeline route	Vegetation description	Dominant species
Bumadibira –Mukhubu Pipeline	<ul style="list-style-type: none"> ✓ Subsistence farmland ✓ Post cultivated grassland with scattered trees ✓ Post cultivated light bushland ✓ Woodlots 	<ul style="list-style-type: none"> - <i>Zea mays</i> - <i>Coffea</i> spp - <i>Musa</i> sp - <i>Albizia coriaria</i> - <i>Mangifera indica</i> - <i>Thevetia peruviana</i> - <i>Synedrella nodiflora</i> - <i>Saccharum officinarum</i> - <i>Psidium guajava</i> - <i>Persea americana</i> - <i>Maesopsis eminii</i> - <i>Manihot esculenta</i> - <i>Markhamia lutea</i> - <i>Cymbopogon nardus</i> - <i>Cynodon dactylon</i> - <i>Artocarpus heterophyllus</i><i>Eucalyptus grandis</i> - <i>Grevilia robusta</i>
Bugema- Manafwa pipeline	<ul style="list-style-type: none"> ✓ Subsistence farmland ✓ Post cultivated grassland with scattered trees ✓ Post cultivated light bushland ✓ Woodlots 	<ul style="list-style-type: none"> - <i>Zea mays</i> - <i>Oryza sativa</i> - <i>Acacia polyacantha</i> - <i>Cynodon dactylon</i> - <i>Markhamia lutea</i> - <i>Eucalyptus grandis</i> - <i>Tithonia diversifolia</i> - <i>Grevilia robusta</i> - <i>Persea americana</i> - <i>Psidium guajava</i> - <i>Milicia excelsa</i> - <i>Manihot esculenta</i>
Mbale- Busolwe pipeline	<ul style="list-style-type: none"> ✓ Subsistence farmland ✓ Post cultivated grassland with scattered trees ✓ Post cultivated light bushland ✓ Woodlots ✓ <i>Cyperus</i> swamp 	<ul style="list-style-type: none"> - <i>Oryza sativa</i> - <i>Zea mays</i> - <i>Artocarpus heterophyllus</i> - <i>Albizia coriaria</i> - <i>Grevilia robusta</i> - <i>Pinus caribaea</i> - <i>Panicum trichocladum</i> - <i>Senna siamea</i>

Pipeline route	Vegetation description	Dominant species
		<ul style="list-style-type: none"> - <i>Senna spectabilis</i> - <i>Sesbania sesban</i> - <i>Mangifera indica</i> - <i>Manihot esculenta</i> - <i>Markhamia lutea</i> - <i>Ficus natalensis</i> - <i>Ficus ovata</i> - <i>Eucalyptus grandis</i> - <i>Cyperus dives</i> - <i>Cyperus rotundus</i> - <i>Cyperus papyrus</i>

The images in Table 2 highlight the fact that except in a few sections covered by species of *Cyperus*, the natural vegetation cover in general landscape is already very much simplified in some cases into mono-cultures such as rice growing.















				
<p><i>Zea mays</i> and ground nuts garden with scattered <i>Albizia-Mangifera-Erythrina</i> trees at geographical coordinates N1.11437, E34.22278</p>	<p>Post cultivated mixed light bushland in between gardens and a small river at geographical coordinate N1.09439, E34.20867</p>	<p><i>Zea mays</i> garden at geographical N1.10399, E34.21481 along Ndega road</p>	<p><i>Eucalyptus</i> woodlot along Mbale- Busolwe route.</p>	<p><i>Cyperus dives</i> wetland along Mbale –Busolwe pipeline route. This is continuous with Nakwiga <i>Cyperus papyrus</i> swamp</p>
				
<p><i>Eucalyptus</i> woodlots, <i>Musa</i> sp gardens and <i>Zea mays</i> gardens at Bumadibira intake Point</p>	<p><i>Eucalyptus-Grevilia</i> woodlot, Banana plantation with scattered tress of <i>Milicia excelsa</i>, <i>Ficus natalensis</i>; <i>Zea mays</i> and Ground nuts gardens besides Mooni mini water reservoir. Geographical coordinate N1.06215, E34.21148</p>	<p>Open grassland with scattered trees of <i>Mangifera indica</i> at Mukhubu water treatment plant.</p>	<p><i>Cyperus papyrus</i> swamp along Mbale- Busolwe pipeline. This is located a few kilometers from Doho irrigation scheme. It's the only natural intact vegetation remnant within the project site. Its edges are affected by <i>Oryza sativa</i> growing.</p>	<p>Busolwe mini water reservoir in a seasonally flooded grassland located along Busolwe – Tororo road</p>
				
<p><i>Oryza sativa</i>, <i>zea mays</i> gardens and <i>Eucalyptus</i> woodlot in a reclaimed wetland on the Mbale- Tororo high way within Bugema village.</p>	<p>Banana plantation along Bugema –Manafwa pipeline route.</p>	<p>Mixed <i>Casuarina- pinus</i> woodlot along the Bugema-Manafwa pipeline route</p>	<p><i>Oryza sativa</i> at Doho irrigation scheme</p>	

Photo 7: Vegetation types along the three proposed Pipeline routes

Species Richness: The surveyed sites yielded a total of 149 plant species in 120 genera and 40 families in the sampled areas altogether of which 44 species were trees and 31 shrubs. Figure 3 plots the species richness by growth form and appendix 1 presents the full list of all plants encountered. While shrubs and trees encountered formed the woody biomass in the study area, they are found scattered in extensive crop land.

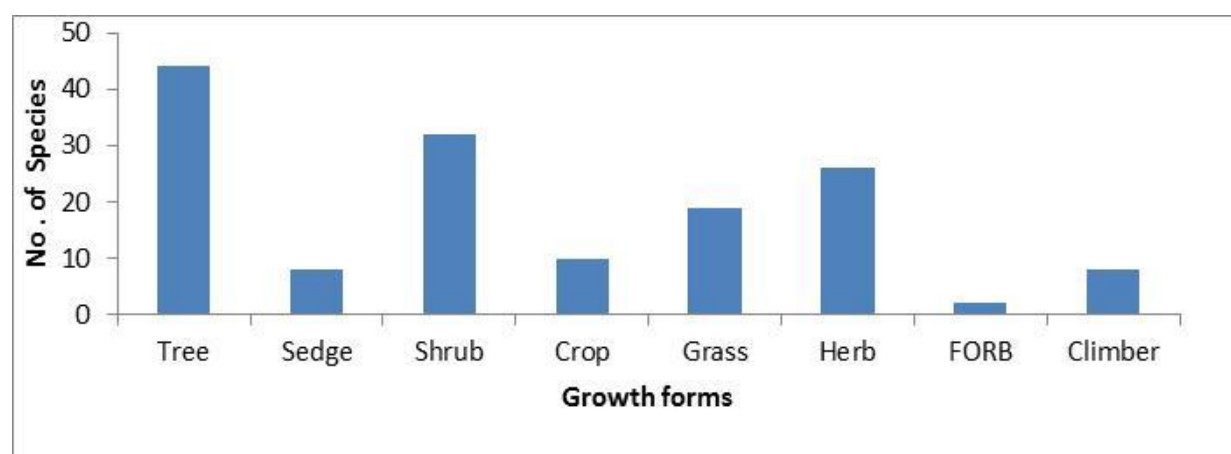


Figure 3 Distribution of the recorded plant species in the different growth forms

Species of conservation concern: Some plant species of conservation concern (in terms of range restriction, rarity, and threat) were observed in the project area. These include the following:

d) Species recorded that are listed by IUCN

Milicia excelsa is one of the species listed under IUCN Red List of Threatened Species, version 2015.3I as a nearly threatened species (IUCN red list (2015)). This species is sparsely distributed within the project site.

e) Species recorded that are listed by NFA

Milicia excelsa, *Tamarindus indica*, *Markhamia lutea* and *Maesopsis eminii* are all on Uganda's National Forestry Authority Reserved Species list, and are therefore protected from exploitation and threat to their habitats. *Milicia excelsa* is on the list because of commercial logging and its use for timber, specifically for quality indoor and outdoor furniture, firewood and charcoal. The fruits of *Tamarindus indica* are commonly used as food but are threatened with felling for fuel wood. *Maesopsis eminii* and *Markhamia lutea* are used for poles, timber and fire wood.

f) Invasive species

The following species are all a result of introduction in Uganda, with a large potential to suppress the indigenous species of plants (Global Invasive Species Programme 2003):

- v) ***Eichhornia crassipes*** is one of the most notorious invasive species that has been recorded in the fresh waters of Uganda and beyond (Howard & Matindi 2003). It was recorded from permanent Cyperus papyrus swamp along Mbale-Busolwe pipeline.
- vi) ***Mimosa pigra*** is a moist ground invasive shrub capable of covering large parts of wetlands once disturbances are chronic. This is scattered within the reclaimed wetlands especially along the Bugema-Manafwa pipeline.
- vii) ***Lantana camara*** invades areas that are drier than *Mimosa pigra*. Both species thrive with disturbance (Cronk & Fuller 2001). Their presence makes the indigenous flora in any given area susceptible to suppression effects (Global Invasive Species Programme 2003).
- viii) **Other invasive species** encountered include *Senna siamea*, *Senna spectabilis* and *Ricinus communis*.

However, since the project impact zone is very narrow and small, little destruction of valuable species is expected.

6.2 Hepertiles

Most of the Water pipeline is going to pass through settlements and a few areas with pertinent biodiversity concerns. A total of 13 species of Hepertiles were recorded in the entire project area.

Intake: This is located along river Namatale in Bumadibira, it's mostly dominated by cultivated areas with patches of fallow lands. Six species were recorded here; they are *Ptychadena mascareniensis*, *Mabuya striata*, *Amietophrynus maculirabris*, *Hyperolius viridiflavus*, *Hyperolius kivuensis* and *Amientia angolensis*

Reservoir: There are two mini water reservoirs in Mooni and Busolwe. Both of the reservoirs are located in settlement and cultivated areas. Busolwe is located in Butalejja while mooni is located in Mbale. Specimens recorded in the two areas area; *Hemidactylus brookii* *Mabuya striatus* and *Acanthocercus atricolis*.

Treatment plant: This is located in Bungokho a settlement area, two heptiles were recorded here ie *Mabuya striatta* and *Acanthocercus atricolis*.

Water pipeline route: Most of the areas through which the pipeline will pass are located in settlement and gardens. However a few areas especially along small streams, rice puddles, fallow lands and swamps represented some of the areas from which heptiles were recorded.

River Namatale: This is located at 0640501N, 0122858E with most of its banks heavily cultivated. Are total of 10 species were recorded from this survey point, they included; *Phrynobatrachus natalensis*, *Hyperolius viridiflavus*, *Amietophrynus maculatus*, *Amietophrynus regularis*, *Amietia angolensis*, *Xenopus victorianus*, *Haplobatrachus occipitalis*, *Mabuya striata*, *Mabuya maculilabris* and *Acanthocercus atricolis*.

Three species of amphibians were recorded at a small stream right after Bugema town along Tororo road (630936 N, 113848 E). The species include *Phrynobatrachus natalensis*, *Ptychadena mascareniensis* and *Psammophis mossambicus*

Rice puddles in the Doho irrigation system had a reasonable number of amphibian species abundance. *Ptychadena mascareniensis* was the most abundant. Other species recorded are, *Amietophrynus maculatus* and *Phrynobatrachus natalensis*.

Nakwasi wetland, is a papyrus swamp located at 610162 N, 102613 E, its part of the Kyoga wetland system with permanent standing water. Species recorded hear are *Hyperolius nasutus*, *Hyperolius viridiflavus*, *Xenopus victorianus*, *Haplobatrachus occipitalis*, *Naja melanoleuca*, and *Ptychadena mascareniensis*.

The conservation status of amphibians in Uganda is generally unknown because of data deficiency. However, according to the IUCN Red List Category, all amphibians recorded during the study are of least conservation concern.

Table 3: Amphibians fauna of Mbale water pipeline project

Species	Common Name	IUCN Status
<i>Amientia angolensis</i>	Angola River Frog	Least Concern (LC)
<i>Ptychadena mascareniensis</i>	Mascarean frog	Least Concern (LC)
<i>Phrynobatrachus natalensis</i>	Natal puddle frog	Least Concern (LC)
<i>Xenopus victorianus</i>	Victoria clawed frog	Least Concern (LC)

Species	Common Name	IUCN Status
<i>Hyperolius kivuensis</i>	Kivu reed frog	Least Concern (LC)
<i>Hyperolius viridiflavus</i>	Common reed frog	Least Concern (LC)
<i>Hyperolius nasutus</i>	Sharp nosed reed frog	Least Concern (LC)
<i>Amietophrynus maculatus</i>	Flat backed toad	Least Concern (LC)
<i>Haplobatrachus occipitalis</i>	Common bull-frog	Least Concern (LC)
<i>Amietophrynus regularis</i>	Common toad	Least Concern (LC)

Table 4: Reptilian fauna of Mbale water pipeline project

Species	Common Name	IUCN Status
<i>Mabuya striata</i>	Striped Skink	Not Evaluated
<i>Naja melanoleuca</i>	Forest water cobra	Least Concern (LC)
<i>Psammophis mossambicus</i>	Olive sand snake	Least Concern (LC)
<i>Acanthocercus atricollis</i>	Blue headed Agama	Least Concern (LC)
<i>Mabuya maculilabris</i>	Speckled skink	Least Concern (LC)
<i>Hemidactylus brooki</i>	Brook's gecko	Least Concern (LC)

6.3 Mammals

Species accounts: A total of 7 mammal species were recorded in the project area (Table 5). Six of the encountered species are listed as Least Concern (LC) on the IUCN Red List of Threatened Species (Version 2015.2). The Leopard (*Panthera pardus*) is listed as Near Threatened (NT). This however does not raise any conservation issues as the animals seen or noticed to appear around the villages are vagrants from the forests of the Wanale Mountain only wandering through the villages at night. The critical habitats where these animals come from are beyond the project scope therefore will not be affected.

Current state of the habitats: The habitats along the pipeline are majorly human settlements, small towns and cultivated areas with a range of crops including cassava, maize, bananas, rice etc. There are majorly fruit trees interspersed with in, the most notable ones including Mango (*Mangifera indica*), Ovacado (*Persea americana*) and Jack fruit.

Table 5: Mammal species recorded in the project area and their conservation status

Common Name	Scientific Name	Conservation Status
Side Striped Squirrel	<i>Euxerus erythropus</i>	LC
Leopard	<i>Panthera pardus</i>	NT
African Grass Rat	<i>Arvicanthis niloticus</i>	LC
Striped Grass Mouse	<i>Lemniscomys striatus</i>	LC
Savanna-hare	<i>Lepus victoriae</i>	LC
Common Jackal	<i>Canis aureus</i>	LC
Banded Mongoose	<i>Mungos mungo</i>	LC

The key sites of the project i.e. the water treatment plant (in Mukhubu village); the reservoir (in Mooni village) and the intake (in Bumadibira village) all form a continuum of human settlements, small towns and cultivated areas with no considerable conservation importance as far as mammals are concerned. The villages in the project area in Mbale surround the Wanale Mountain range. This is largely forested and is the most likely source of the reported wild animals in the villages. River Namatale is also an important habitat feature to point out in the project area.



A section of R. Namatale in Bumadibira



One of the cultivated areas in Makudui village



A section of the Wanale Mountain in Mooni village



A cultivated rice field in Nakwasi village

Photo 8: Different habitat sections in the project area.

Photo 8 demonstrates the nature of the vegetation cover at selected points in the pipeline routes. There is a clear absence of natural vegetation cover which has been cleared for either settlement or farmland. These kinds of areas do not hold significant populations (if any) of medium to large sized mammals. Small mammals will still continue to exist in the search areas although species with particular habitat requirements such as forest interior and/or intact wetland specialists will also be displaced and lost out.

6.4 Birds

A summary of the bird species richness and habitat preference of the birds recorded from the different survey points is presented in Table 6. Over all species that are dependent on availability of some tree stand (f – forest visitors) were the most numerous in most survey areas. There was a near absence of forest specialist species (FF) except for one species in the Makhosi area. Wetland species were also widely occurring although the numbers of species encountered were generally lower than those of the forest visitors.

Table 6: Number of bird species for each transect site in the categories shown

Sites		Doho	Manafwa	Mooni	Bungukho	Makudui	Bugembe	Busolwe	Kifuluriro	Makhosi	Buwaki	Kama-Lower	Namatale
Habitat Specialist	FF Forest specialist									1			
	F Forest generalist		3	3	1	3	4	1	2	1	1	1	2
	f Forest Visitor	7	13	11	12	17	16	7	14	12	7	13	15
	W Wetland specialist	18	3	1	1	1	13	10		2	2	1	3
	w Wetland associate	9	5	3	6	5	13	13	8	2	4	6	8
	G Grassland specialist	4	4	2	4	2	3	3	2	1	2	1	3
	Ae Aerial feeder	1	2	1	2	1	4	3	1	1	2	3	3
Migrant	P Palearctic	2		1	1	2	2	1	1	1			
	A Afrotropical	3	3	1	1	1	5	4	2	1		1	1
Conservation status	G-EN Globally endangered	1			1								
	R-Vu Regionally Vulnerable	2	1			1	1	4					2
	R-NT Regionally Near threatened	4	2		1	2	1	1	1	1			2
	R-RR Regional Responsibility	1	2	2	2		4	2	1	1	2	3	

The two globally endangered species identified were the Grey Crowned Crane *Balearica regulorum* and the Hooded Vulture *Necrosyrtes monachus*, Doho rice scheme is very important for breeding of the Grey Crowned crane (Gumonye-Mafabi 1991). However no information is known about breeding of the Hooded Vulture in the country. Forest species were well represented including one forest generalist; such numbers could be attributed to high numbers of local trees in the cultivated areas and especially areas close to Mt Elgon. The number of wetland species was high especially in areas around Bugembe, Busolwe, Doho and Manafwa.

Aerial feeders such as, Palm swifts, little swifts and Angola swallows were numerous throughout the study sites. Generally, number of Afro tropical species was higher than that of Palearctic species since the later are expected to return around September. Forest visitors and Grassland specialist were well represented, this could be due to too much rain in the area which impacted on the nature of vegetation and birds too.

c) Wetland dominated sites

Doho: Thirty seven (37) species were recorded, 1 of which is endangered (Grey Crowned Crane), 18 were wetland specialist. The Doho rice scheme (IBA) is known for its, in particular the large number of papyrus and terrestrial endemics. The area is important for the breeding of Grey Crowned crane (Gumonye-Mafabi 1991) which is classified endangered (Birdlife International 2015), and other species such as Black-headed Heron, Sacred Ibis and African Spoonbill (Byaruhanga per.comm).

The rice scheme is an important site for some migratory species and big congregations are occasionally recorded (Byaruhanga, Kasoma & Pomeroy 2001). Species such as the Black winged stilt, black-tailed Godwit and Spotted Redshank are sometimes numerous.



Photo 9: Part of Doho which formed part of the transect

Manafwa: There were 38 species, majority were forest specialist (13), nine were wetland birds, three raptor species were observed soaring into the sky above and they were; Brown Snake Eagle *Circaetus cinereus* which is a *Regionally Near Threatened* (R-NT) species, Dark Chanting Goshawk *Melierax metabates* and Lizard Buzzard *Kaupifalco monogrammicus*. There were several trees with Black-headed weaver nests.

Busolwe: Opportunistic observations through this site resulted in 40 species; the most conspicuous species is the African Spoonbill *Platalea alba* (Photo 10).



Photo 10: Spoonbill

It is one of the few areas in the country where spoonbills nest. Other species which nested together with spoonbills included, Long-Tailed Cormorant *Phalacrocorax africanus*, Black-Headed Heron *Ardea melanocephala* and Cattle Egret *Bubulcus ibis*.

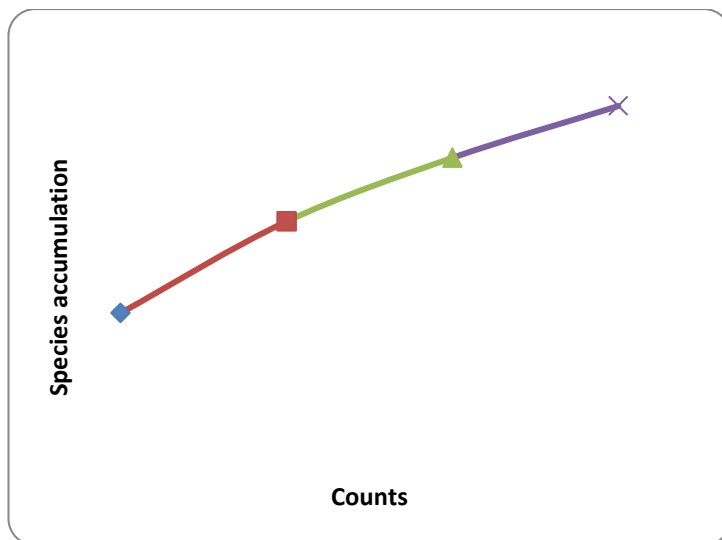


Figure 9 Species accumulation curve for birds in wetland dominated sites

The number of new species for any preceding count increased at a fast rate, the curve suggests that there could be other wetland predominant species which were not identified, and thus there is need for more counts to come up with a complete habitat list.

Bugema: This was the most species richest site; we recorded 51 species, of which 16 were forest visitor, 13 were wetland specialist and 13 were wetland generalist. No Forest specialist and endangered species were recorded.

d) Predominantly cultivated site

There were eight sites which were predominantly cultivated namely; Namatali, Kama-lower, Buwaki, Makhosi, Kifuruliro, Makudui, Mooni and Bungukho.

Namatale: River Namatale (the proposed water source) is part of this site; there were 37 species, of the which majority were forest specialist (15), no forest specialist, 8 wetland associate, 3 were grassland and wetland specialists, the three aerial feeders were palm swifts, Angola swallows and the Rock martin, it was found nesting on the walls of the bridge on the river. Vieillot's Black Weaver *Ploceus nigerrimus* were also nesting besides the river together with Black headed weavers.



Figure 10 Section of River Namatale that is within the proposed project impact area

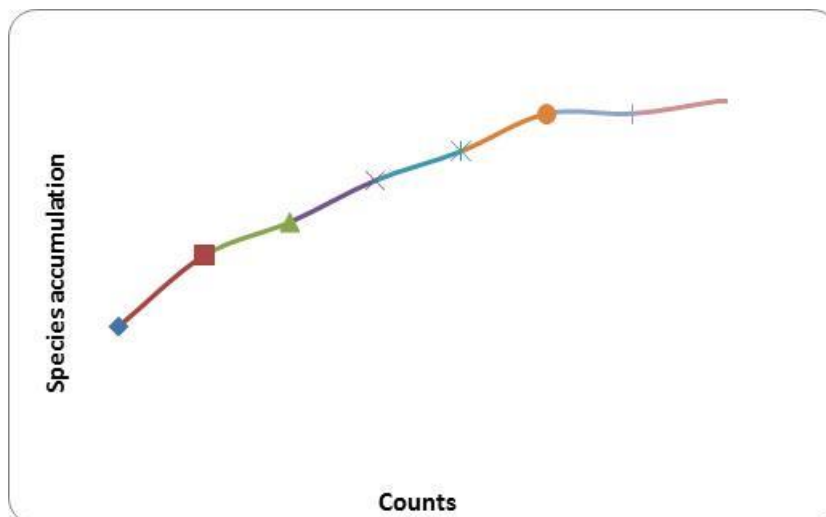


Figure 11 Species accumulation curve in the agricultural sites

After count six (Figure 11), the rate at which the number of new species added to the overall list was much lower suggesting that to a greater extent, the species list for the area was close to complete for the survey period.

7 POTENTIAL ENVIRONMENTAL IMPACTS

7.1 Likely impact to flora

There will be minimal vegetation clearance during installation of pipeline especially during excavation of land. This is expected to cause minimal disturbance since almost all natural vegetation were converted into farm land.

Loss of tree cover may occur along all the routes during pipeline construction but this will notably be in areas where the proposed pipeline route passes through mixed patches of post cultivated areas, woodlots, and agricultural gardens (Coffee and). However, no significant impacts or loss of habits will result from construction and operation of the proposed pipeline.

These negative impacts will occur both during pipeline construction and operation where clearing of vegetation especially tall trees and shrubs will occur. The impacts are short-term and of local spatial extent.

7.2 Likely Impacts on heptiles

Human activities in any natural environment affect amphibian and reptilian fauna in two ways: adversely, by destroying natural habitat, and favorably, by creating new habitats Khan (1990). Most of the impacts will be due to vegetation clearance, road and drainage system construction, and harassment of the reptiles especially the snakes. The parent ecosystems which provided the amphibians with suitable habitats for reproduction, habitats including cover and breeding places will be destroyed in the project area, thus leading to exposure of heptiles to the brutality of humans who have negative attitudes towards them.

7.3 Likely impacts to mammals and birds

The natural habitats are already largely modified into cultivated areas, settlements and towns. The large mammals reported to occur in the area are likely vagrants from the close forests of the Wanale Mountain Range which is out of the project scope. These were identified as the only critical habitat and they face no impending adverse impact. No impending adverse impacts on mammals and their habitats can be therefore pointed out. We don't envisage major impacts on birds either since we don't see the project resulting into very major habitat conversion.

7.4 Impact significance

- i) The likelihood of impact on flora is low since the pipeline does not require constant vegetation clearance during installation and maintenance.
- ii) Impact severity is considered low and significance is relatively low since there are no natural forested stretches along the pipeline route. Moreover where natural vegetation exists along the proposed pipeline route, it exists in a post cultivated form except at Lwabi and Nakwasi Cyprus swamp. Here minimal to moderate disturbances are expected but with low significance.
- iii) Of the heptiles, the species encountered during the study are widely distributed in Uganda and in other countries. No species of conservation concern were encountered or recorded. On the above basis, the water pipeline project will have minimal impact on amphibian and reptilian populations.
- iv) For birds and mammals we don't envisage major negative impacts.

7.5 Mitigation measures

- i) The contractor should considerably limit vegetation clearance along the line corridor so as to avoid excessive and unnecessary loss of trees outside the projected useable area. Where woodlot exists, the pipeline should be planned to pass through gaps between tree stands.
- ii) The pipeline installation could consider adopting a proactive approach of being involved in reforestation programs, or supporting tree-planting as a compensatory measure for vegetation cover lost during development of pipeline.
- iii) The surrounding area having been cleared of the natural vegetation, for crop growing, there will be a need to encourage the communities to grow high variety trees particularly improved fruit trees to increase on the woody vegetation.
- iv) The pipeline should be designed to pass on the surface where permanent swamps exist.
- v) During construction habitat disturbance should be minimized as much as possible. To minimize death, vegetation clearance should always be done first, as this scares away some amphibians and reptiles, as opposed to direct use of graders to clear the way for access road construction, or direct dumping of construction materials and excavated soils. Also people involved in the construction should be encouraged and sensitized not to harass amphibians and reptiles.
- vi) Many species of birds require trees – for nesting, roosting, and as a source of food (insects on the leaves, flowers, fruits, etc). Thus during pipeline development, areas with many trees should be avoided.
- vii) A big number of wetland birds normally breed in the wetland edges, and most of them are species of conservation concern. Therefore, maximum care during excavation process should be taken so as to minimize on nest losses.

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Appendices

Appendix 1: List of Plants Encountered within the Project area

Family	Species	Growth form	Bamadibira – Mukubhu line	Bugema-Manafwa line	Mbale-Busolwe line
Acanthaceae	<i>Acanthuspolystachyus</i>	Shrub		O	
Acanthaceae	<i>Asystasia gangetica</i>	Herb		O	
Acanthaceae	<i>Justicia</i> sp	Herb	O		
Amaranthaceae	<i>Aerva lanata</i>	Herb		F	
Amaranthaceae	<i>Amaranthus lividus</i>	Herb		O	F
Anacardiaceae	<i>Lannea</i> sp	Shrub	O		
Anacardiaceae	<i>Mangifera indica</i>	Tree	D	F	F
Anacardiaceae	<i>Rhus natalensis</i>	Shrub		O	
Anacardiaceae	<i>Rhus vulgaris</i>	Shrub	O		
Annonaceae	<i>Annona senegalensis</i>	Shrub	O		
Apiaceae	<i>Centella asiatica</i>	Herb	O		
Araceae	<i>Colocasia esculenta</i>	Crop	O	F	
Arecaceae	<i>Borassus aethiopum</i>	Tree			O
Arecaceae	<i>Elaeis guineensis</i>	Tree	O		
Arecaceae	<i>Phoenix reclinata</i>	Tree			O
Asteraceae	<i>Acmella oleracea</i>	Herb	F		F
Asteraceae	<i>Ageratum conyzoides</i>	Herb	O	O	O
Asteraceae	<i>Aspilia africana</i>	Herb	F		
Asteraceae	<i>Bidens pilosa</i>	Herb	O	O	F
Asteraceae	<i>Conyza floribunda</i>	Herb	O	O	
Asteraceae	<i>Eclipta alba</i>	Herb			O
Asteraceae	<i>Galinsoga parviflora</i>	Herb	O		
Asteraceae	<i>Helichrysum</i>	Herb	O		
Asteraceae	<i>Microglossa pyrifolia</i>	Shrub	O		
Asteraceae	<i>Synedrella nodiflora</i>	Herb	F		F
Asteraceae	<i>Tagetes minuta</i>	Herb		O	
Asteraceae	<i>Tithonia diversifolia</i>	Herb	O	F	
Asteraceae	<i>Vernonia amygdalina</i>	Shrub	O	O	
Asteraceae	<i>Vernonia smithiana</i>	Shrub	O		
Bignoniaceae	<i>Markhamia lutea</i>	Tree	F	F	A
Bignoniaceae	<i>Spathodea campanulata</i>	Tree	O	O	O
Bignoniaceae	<i>Stereospermum kunthianum</i>	Tree	O		
Boraginaceae	<i>Cordia</i> sp	Tree	O		
Brassicaceae	<i>Brassica oleracea</i>	Crop	F		
Casuarinaceae	<i>Casuarina equisetifolia</i>	Tree			F
Combretaceae	<i>Terminalia superba</i>	Tree			F
combretaceae	<i>Terminalia brownii</i>	Tree	O		
Convolvulaceae	<i>Ipomoea cairica</i>	Climber		O	O
Convolvulaceae	<i>Ipomoea obscura</i>	Climber			O
Convolvulaceae	<i>Ipomoea wightii</i>	Climber			O

Family	Species	Growth form	Bamadibira – Mukubhu line	Bugema-Manafwa line	Mbale-Busolwe line
Cucurbitaceae	<i>Momordica foetida</i>	Climber			O
Cucurbitaceae	<i>Luffa cylindrica</i>	Climber		O	
Cupressaceae	<i>Cupressus</i> sp	Tree	O	F	
Cyperaceae	<i>Abildgaardia ovata</i>	Sedge	O		
Cyperaceae	<i>Bulbostylis hispidula</i> subsp. <i>filiformis</i>	Sedge	O		
Cyperaceae	<i>Cyperus cyperoides</i>	Sedge	O		
Cyperaceae	<i>Cyperus dives</i>	Sedge		O	A
Cyperaceae	<i>Cyperus latifolius</i>	Sedge			O
Cyperaceae	<i>Cyperus papyrus</i>	Sedge			D
Cyperaceae	<i>Cyperus rotundus</i>	Sedge		O	F
Cyperaceae	<i>Kyllinga pumila</i>	Sedge	O		
Euphorbiaceae	<i>Acalypha villicaulis</i>	Shrub	O		
Euphorbiaceae	<i>Alchornea cordifolia</i>	Shrub	O		O
Euphorbiaceae	<i>Euphorbia heterophylla</i>	Herb	O		
Euphorbiaceae	<i>Macaranga schweinfurthii</i>	Tree	R		
Euphorbiaceae	<i>Manihot esculenta</i>	Crop	F	F	F
Euphorbiaceae	<i>Ricinus communis</i>	Shrub	O		O
Euphorbiaceae	<i>Sapium ellipticum</i>	Tree	O		
Euphorbiaceae	<i>Thevetia peruviana</i>	Shrub	F	F	F
Fabaceae	<i>Acacia hockii</i>	Shrub	O		
Fabaceae	<i>Acacia polyacantha</i>	Tree	O	D	
Fabaceae	<i>Acacia sieberiana</i>	Tree			O
Fabaceae	<i>Aeschynomene uniflora</i>	Shrub			F
Fabaceae	<i>Albizia coriaria</i>	Tree	F	A	D
Fabaceae	<i>Albizia grandibracteata</i>	Tree		O	
Fabaceae	<i>Chamaecrista mimosoides</i>	Herb	F	F	F
Fabaceae	<i>Crotalaria</i> sp	Herb		O	
Fabaceae	<i>Desmodium salicifolium</i>	Herb	O		
Fabaceae	<i>Entada abyssinica</i>	Tree	O		
Fabaceae	<i>Erythrina abyssinica</i>	Tree	O		
Fabaceae	<i>Arachis villosulicarpa</i>	Crop	F		
Fabaceae	<i>Indigofera arecta</i>	Shrub	O	O	
Fabaceae	<i>Indigofera spicata</i>	Herb	O		
Fabaceae	<i>Leucaena leucocephala</i>	Tree	O		
Fabaceae	<i>Mimosa pigra</i>	Shrub			O
Fabaceae	<i>Phaseolus vulgaris</i>	Crop			F
Fabaceae	<i>Piliostigma thonningii</i>	Tree	O		
Fabaceae	<i>Pseudarthria hookeri</i>	Shrub	O		
Fabaceae	<i>Rhynchosia grandiflora</i>	Climber	O		
Fabaceae	<i>Rhynchosia stipulosa</i>	Climber	O		
Fabaceae	<i>Senna bicapsularis</i>	Shrub	O		
Fabaceae	<i>Senna obtusifolia</i>	Herb	O	O	O

Family	Species	Growth form	Bamadibira – Mukubhu line	Bugema-Manafwa line	Mbale-Busolwe line
Fabaceae	<i>Senna siamea</i>	Tree	O	O	F
Fabaceae	<i>Senna spectabilis</i>	Tree		F	F
Fabaceae	<i>Sesbania sesban</i>	Shrub			F
Fabaceae	<i>Tamarindus indica</i>	Tree			O
Fabaceae	<i>Tephrosia linearis</i>	Herb	O		
Lamiaceae	<i>Hoslundia opposita</i>	Shrub	O		
Lamiaceae	<i>Leonotis nepetifolia</i>	Herb	R	O	O
Lamiaceae	<i>Ocimum gratissimum</i>	Shrub	F		
Lauraceae	<i>Persea americana</i>	Tree	F	F	O
Malvaceae	<i>Dombeya sp</i>	Shrub	R		
Malvaceae	<i>Sida acuta</i>	Herb	O	O	
Malvaceae	<i>Triumfetta rhomboidea</i>	Herb	O		
Meliaceae	<i>Azadirachta indica</i>	Tree		F	
Moraceae	<i>Artocarpus heterophyllus</i>	Tree	F	F	D
Moraceae	<i>Ficus exasperata.</i>	Tree	O		
Moraceae	<i>Ficus mucoso</i>	Tree	O	O	O
Moraceae	<i>Ficus natalensis</i>	Tree	O	F	F
Moraceae	<i>Ficus ovata</i>	Tree	O		F
Moraceae	<i>Ficus platyphylla</i>	Tree		O	
Moraceae	<i>Ficus vallis-choudae</i>	Tree	O	O	O
Moraceae	<i>Milicia excelsa</i>	Tree	O	F	O
Musaceae	<i>Musa sp</i>	Crop	A	F	F
Myrtaceae	<i>Eucalyptus grandis</i>	Tree	A	D	A
Myrtaceae	<i>Psidium guajava</i>	Shrub	F	F	
Myrtaceae	<i>Syzygium cumini</i>	Tree		O	
Nymphaeaceae	<i>Nymphaea lotus</i>	Herb			O
Onagraceae	<i>Ludwigia octovalvis</i>	Herb			O
Phyllanthaceae	<i>Phyllanthus sp</i>	Shrub	R		
Phytolaccaceae	<i>Phytolacca dodecandra</i>	Shrub	O		
Pinaceae	<i>Pinus caribaea</i>	Tree		F	A
Poaceae	<i>Brachiaria brizantha</i>	Grass	O		
Poaceae	<i>Cymbopogon nardus</i>	Grass	F		
Poaceae	<i>Cynodon dactylon</i>	Grass	F	F	F
Poaceae	<i>Digitaria abyssinica</i>	Grass	F	O	
Poaceae	<i>Digitaria velutina</i>	Grass	O	O	
Poaceae	<i>Echinochloa colona</i>	Grass			F
Poaceae	<i>Echinochloa pyramidalis</i>	Grass		O	
Poaceae	<i>Hyparrhenia filipendula</i>	Grass	F		
Poaceae	<i>Imperata cylindrica</i>	Grass	O		
Poaceae	<i>Leersia hexandra</i>	Grass			F
Poaceae	<i>Melinis repens</i>	Grass		O	
Poaceae	<i>Oryza sativa</i>	Crop		A	D

Family	Species	Growth form	Bamadibira – Mukubhu line	Bugema-Manafwa line	Mbale-Busolwe line
Poaceae	<i>Panicum maximum</i>	Grass	F		
Poaceae	<i>Panicum trichocladum</i>	Grass			A
Poaceae	<i>Paspalum conjugatum</i>	Grass	F		
Poaceae	<i>Paspalum scrobiculatum</i>	Grass	O		
Poaceae	<i>Phragmites mauritianum</i>	Grass			O
Poaceae	<i>Saccharum officinarum</i>	Crop	F		
Poaceae	<i>Sorghum arundinaceum</i>	Grass			F
Poaceae	<i>Sporobolus pyramidalis</i>	Grass	R		
Poaceae	<i>Sporobolus africanus</i>	Grass		O	
Poaceae	<i>Zea mays</i> L.	Crop	A	A	A
Polygonaceae	<i>Persicaria senegalensis</i>	Forb			F
Polygonaceae	<i>Persicaria setosula</i>	Forb		O	O
Pontederiaceae	<i>Eichhornia crassipes</i>	Herb			O
Proteaceae	<i>Grevillea robusta</i>	Tree	F	F	F
Rhamnaceae	<i>Maesopsis eminii</i>	Tree	F		
Rubiaceae	<i>Coffea arabica</i>	Shrub	A		
Rubiaceae	<i>Coffea canephora</i>	Shrub	F		
Rutaceae	<i>Citrus sinensis</i>	Shrub	R		
Solanaceae	<i>Solanum incanum</i>	Shrub	O		
Solanaceae	<i>Solanum melongena</i>	Crop	O		
Verbenaceae	<i>Lantana camara</i>	Shrub	O	F	O
Verbenaceae	<i>Lantana trifolia</i>	Shrub	R		
Verbenaceae	<i>Tectona grandis</i>	Tree		O	O
Verbenaceae	<i>Vitex doniana</i>	Tree	O		
Verbenaceae	<i>Vitex</i> sp	Tree	R		

Appendix 2: Number of species along the proposed pipeline arranged according to Atlas numbers

Atlas No.	Species name	Habitat	Conservation status
6	LONG-TAILED CORMORANT <i>Phalacrocorax africanus</i>	W	
7	AFRICAN DARTER <i>Anhinga rufa</i>	W	R-VU
9	PINK-BACKED PELICAN <i>Pelecanus rufescens</i>	W	
14	SQUACCO HERON <i>Ardeola ralloides</i>	W	
17	CATTLE EGRET <i>Bubulcus ibis</i>	G	
22	INTERMEDIATE EGRET <i>Egretta intermedia</i>	W	
23	GREAT WHITE EGRET <i>Egretta alba</i>	W	R-VU
24	PURPLE HERON <i>Ardea purpurea</i>	W	R-NT
25	GREY HERON <i>Ardea cinerea</i>	W	R-NT
26	BLACK-HEADED HERON <i>Ardea melanocephala</i>	w	
28	HAMERKOP <i>Scopus umbretta</i>	w	
29	YELLOW-BILLED STORK <i>Mycteria ibis</i>	W	
30	AFRICAN OPEN-BILLED STORK <i>Anastomus lamelligerus</i>	A,w,G	
33	WOOLLY-NECKED STORK <i>Ciconia episcopus</i>	W	R-NT
36	MARABOU STORK <i>Leptoptilos crumeniferus</i>	w	
39	HADADA IBIS <i>Bostrychia hagedash</i>	w	
42	SACRED IBIS <i>Threskiornis aethiopica</i>	W	
44	AFRICAN SPOONBILL <i>Platalea alba</i>	W	
48	WHITE-FACED WHISTLING DUCK <i>Dendrocygna viduata</i>	W	
51	SPUR-WINGED GOOSE <i>Plectropterus gambensis</i>	W	
73	BLACK-SHOULDERED KITE <i>Elanus caeruleus</i>	G	
75	BLACK KITE <i>Milvus migrans</i>	p,A	
80	HOODED VULTURE <i>Necrosyrtes monachus</i>	f	G-EN
86	BROWN SNAKE EAGLE <i>Circaetus cinereus</i>		R-NT
90	AFRICAN HARRIER HAWK <i>Polyboroides typus</i>	f	
96	DARK CHANTING GOSHAWK <i>Melierax metabates</i>		
100	SHIKRA <i>Accipiter badius</i>	f	
109	LIZARD BUZZARD <i>Kaupifalco monogrammicus</i>	f	
120	BOOTED EAGLE <i>Hieraaetus pennatus</i>	P	
122	LONG-CRESTED EAGLE <i>Lophaelus occipitalis</i>	f	
142	HELMETED GUINEAFOWL <i>Numida meleagris</i>	G	
154	CRESTED FRANCOLIN <i>Francolinus sephaena</i>		
178	BLACK CRAKE <i>Amaurornis flavirostris</i>	W	
185	GREY CROWNED CRANE <i>Balearica regulorum</i>	W,G	G-EN
197	BLACK-WINGED STILT <i>Himantopus himantopus</i>	p,W	
243	SPOTTED REDSHANK <i>Tringa erythropus</i>	P,W	
268	AFRICAN GREEN PIGEON <i>Treron calva</i>	F	
271	BLUE-SPOTTED WOOD DOVE <i>Turtur afer</i>	f	
281	SPECKLED PIGEON <i>Columba guinea</i>		
283	RED-EYED DOVE <i>Streptopelia semitorquata</i>	f	
289	LAUGHING DOVE <i>Streptopelia senegalensis</i>		
290	GREY PARROT <i>Psittacus erithacus</i>	FF	R-NT

Atlas No.	Species name	Habitat	Conservation status
302	ROSS'S TURACO <i>Musophaga rossae</i>	F	
305	EASTERN GREY PLANTAIN EATER <i>Crinifer zonurus</i>		
309	RED-CHESTED CUCKOO <i>Cuculus solitarius</i>	A,F	
320	DIDRIC CUCKOO <i>Chrysococcyx caprius</i>		
326	BLUE-HEADED COUCAL <i>Centropus monachus</i>	w	
358	AFRICAN PALM SWIFT <i>Cypsiurus parvus</i>	Ae	
365	LITTLE SWIFT <i>Apus affinis</i>	Ae	
368	BLUE-NAPED MOUSEBIRD <i>Urocolius macrourus</i>		
369	SPECKLED MOUSEBIRD <i>Colius striatus</i>		
373	GREY-HEADED KINGFISHER <i>Halcyon leucocephala</i>	A,f,w	
375	WOODLAND KINGFISHER <i>Halcyon senegalensis</i>	A	
378	AFRICAN PYGMY KINGFISHER <i>Ceyx picta</i>	f,w	
383	PIED KINGFISHER <i>Ceryle rudis</i>	W	
385	LITTLE BEE-EATER <i>Merops pusillus</i>	G	
401	BROAD-BILLED ROLLER <i>Eurystomus glaucurus</i>	A,f,w	
422	BLACK-AND-WHITE-CASQUED HORNBILL <i>Bycanistes subcylindricus</i>	F	
431	YELLOW-RUMPED TINKERBIRD <i>Pogoniulus bilineatus</i>	F	
433	YELLOW-FRONTED TINKERBIRD <i>Pogoniulus chrysoconus</i>	f	
443	DOUBLE-TOOTHED BARBET <i>Lybius bidentatus</i>	f	
473	CARDINAL WOODPECKER <i>Dendropicos fuscescens</i>		
498	WHITE-HEADED SAW-WING <i>Psaldoprocne albiceps</i>	f,Ae	R-RR
507	ROCK MARTIN <i>Hirundo fuligula</i>	Ae	
509	WIRE-TAILED SWALLOW <i>Hirundo smithii</i>	w,Ae	
512	ANGOLA SWALLOW <i>Hirundo angolensis</i>	w,Ae	
515	YELLOW WAGTAIL <i>Motacilla flava</i>	P,w,G	
520	AFRICAN PIED WAGTAIL <i>Motacilla aguimp</i>	w	
547	YELLOW-THROATED GREENBUL <i>Chlorocichla flavicollis</i>	f	
562	COMMON BULBUL <i>Pycnonotus barbatus</i>	f	
576	WHITE-BROWED ROBIN-CHAT <i>Cossypha heuglini</i>	f	
586	SPOTTED MORNING THRUSH <i>Cichladusa guttata</i>		
601	SOOTY CHAT <i>Myrmecocichla nigra</i>		
612	AFRICAN THRUSH <i>Turdus pelios</i>	f	
621	AFRICAN MOUSTACHED WARBLER <i>Melocichla mentalis</i>		
626	AFRICAN REED WARBLER <i>Acrocephalus baeticatus</i>	w	
638	RED-FACED CISTICOLA <i>Cisticola erythrops</i>	w	
647	WINDING CISTICOLA <i>Cisticola galactotes</i>	w	
658	TAWNY-FLANKED PRINIA <i>Prinia subflava</i>	f,w	
677	GREY-BACKED CAMAROPTERA <i>Camaroptera brachyura</i>	f	
701	GREY-CAPPED WARBLER <i>Eminia lepida</i>	f,w	R-RR
713	NORTHERN BLACK FLYCATCHER <i>Melaenornis edoliodides</i>		
732	AFRICAN BLUE FLYCATCHER <i>Elminia longicauda</i>	f	
739	AFRICAN PARADISE FLYCATCHER <i>Terpsiphone viridis</i>	f	
761	BROWN BABBLER <i>Turdoides plebejus</i>		

Atlas No.	Species name	Habitat	Conservation status
787	SCARLET-CHESTED SUNBIRD <i>Chalcomitra senegalensis</i>	f	
790	BRONZE SUNBIRD <i>Nectarinia kilimensis</i>	f	
801	BEAUTIFUL SUNBIRD <i>Cinnyris pulchella</i>		
803	RED-CHESTED SUNBIRD <i>Cinnyris erythrocerca</i>	W	R-RR
808	VARIABLE SUNBIRD <i>Cinnyris venusta</i>	f	
810	COPPER SUNBIRD <i>Cinnyris cuprea</i>	f,w	
811	YELLOW WHITE-EYE <i>Zosterops senegalensis</i>	f	
812	COMMON FISCAL <i>Lanius collaris</i>	G	
815	GREY-BACKED FISCAL <i>Lanius excubitoroides</i>	A,f,w	
828	SULPHUR-BREASTED BUSH-SHRIKE <i>Malaconotus sulfureopectus</i>	f	
831	BROWN-CROWNED TCHAGRA <i>Tchagra australis</i>		
833	BLACK-CROWNED TCHAGRA <i>Tchagra senegala</i>		
841	TROPICAL BOUBOU <i>Laniarius aethiopicus</i>	f	
843	BLACK-HEADED GONOLEK <i>Laniarius erythrogaster</i>	f	
853	FORK-TAILED DRONGO <i>Dicrurus adsimilis</i>	f,F	
855	PIED CROW <i>Corvus albus</i>		
858	PIAPIAC <i>Ptilostomus afer</i>		
871	SPLENDID STARLING <i>Lamprotonis splendidus</i>		
872	RUPPELL'S LONG-TAILED STARLING <i>Lamprotonis purpuropter</i>	F	
881	GREY-HEADED SPARROW <i>Passer griseus</i>		R-RR
895	LITTLE WEAVER <i>Ploceus luteolus</i>	f,W	
907	VIEILLOT'S BLACK WEAVER <i>Ploceus nigerrimus</i>	w	R-NT,R-RR,G-NT
908	BLACK-HEADED WEAVER <i>Ploceus cucullatus</i>	f	
908	BLACK-HEADED WEAVER <i>Ploceus cucullatus</i>	f	
910	YELLOW-BACKED WEAVER <i>Ploceus melanocephalus</i>	F	R-VU
925	RED-BILLED QUELEA <i>Quelea quelea</i>	A	
928	BLACK-WINGED RED BISHOP <i>Euplectes hordeaceus</i>	w	
932	FAN-TAILED WIDOWBIRD <i>Euplectes axillaris</i>	G	
959	RED-BILLED FIREFINCH <i>Lagonosticta senegala</i>	f	R-NT,f
969	COMMON WAXBILL <i>Estrilda astrild</i>	w	
974	RED-CHEEKED CORDON-BLEU <i>Uraeginthus bengalus</i>		
980	BRONZE MANNIKIN <i>Lonchura cucullata</i>	G	
981	BLACK-AND-WHITE MANNIKIN <i>Lonchura bicolor</i>		
985	PIN-TAILED WHYDAH <i>Vidua macroura</i>		
995	YELLOW-FRONTED CANARY <i>Serinus mozambicus</i>		

APPENDIX D: NEMA APPROVED TERMS OF REFERENCE FOR THE ESIA



NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

NEMA/4.5

20th November, 2015

Dr. Adolf Spitzer,
Project Manager,
Water Management and Development Project,
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Tel: 256-414- 251064, 251065, 251068
342758, 342759, 342717

Fax: 256-414-257521 / 232680

E-mail: info@nemaug.org

Website: www.nemaug.org



RE: REVIEW OF SCOPING REPORT AND TERMS OF REFERENCE PERTAINING TO THE PROPOSED MBALE WATER SUPPLY AND SANITATION PROJECT

This is in reference to the Scoping Report and Terms of Reference (TOR) for carrying out an environmental and social impact assessment (ESIA) for the above-mentioned Project, which you submitted to this Authority for review and consideration for approval. This Authority has finalised the review and grants formal **APPROVAL** of the said Scoping Report and TOR.

In addition, you are advised to consider during the conduct of the EIAs and preparation of the EIA report, the key aspects highlighted below,

- (i) Carry out comprehensive stakeholder consultations involving, among others, the Bushenyi and Sheema District Local Government Authorities, the concerned local communities in the targeted project areas that will accommodate the project infrastructure and the related activities, and other Authorities responsible for provision and management of other public utilities (*road network, among others*), respectively; and, ensure that the concerns/views of the stakeholders **are well-documented and appended to the ESIA report.**
- (ii) Provide **correct citation of full details of the location of the project areas/towns** targeted to accommodate the proposed project components, auxiliary support structures, and activities – preferably in tabulated format – that is, *by names of villages, zones, parishes, sub-counties, municipal council, town councils, counties, and district – whichever is applicable.*
- (iii) Provide comprehensive **baseline information and data** relating particularly to the proposed project areas that will accommodate the project components and characteristics of the immediate environs, other existing facilities, regulated sensitive and fragile areas, settlements, as well as the **water source(s)** targeted to support the respective Project Towns; and **a set of coloured photographs** showing the current state of some of the critical sections within the respective Project Towns, respectively.

1 of 2

- (iv) Include in the ESIA report **coloured location / google maps** (*preferably covering A-4 or A-3 paper size*) that are clear, well-labelled and legible and showing the project areas, and a set of **GPS coordinates**.
- (v) Append to the EIA report **a set of proposed lay-outs of the project components** – *preferably each covering A-3 paper size* – that are clear, well-labelled and legible.
- (vi) Provide comprehensive narratives on all the proposed **project components, activities** to be set up in the Project Towns, and the size of the workforce.
- (vii) Provide comprehensive **analyses of alternatives/options**, in terms of the project design, type technology, alignment of infrastructure, and other aspects.
- (viii) Provide comprehensive narratives on **any identified project-affected communities/entities** and compensation aspects, among other factors.
- (ix) Provide **detailed evaluation of the potential environmental impacts and risks** associated with the proposed project components and activities.
- (x) Include in the ESIA report **comprehensive mitigation and environmental management and monitoring plans**, respectively (*preferably in table matrix format*), that relate to the identified potential environmental impacts.
- (i) Consider any other critical environmental aspects/concerns not been initially foreseen during the preparation of the Scoping Report and TOR, and **include an evaluation of such aspects/concerns in the ESIA report**.
- (xi) Indicate the **total project (investment) cost** covering all the project components and activities.

This is, therefore, to recommend that you proceed with carrying out the ESIA for the proposed Project. We look forward to receipt of copies of a comprehensive environmental and social impact statement, for our further action.



Margaret Aanyu

FOR: EXECUTIVE DIRECTOR

c.c The Director,
Directorate of Water Resources Management,
ENTEBBE.

Eng. Lammeck Kajubi,
Air, Water Earth (AWE) Ltd.,
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Kampala.

Tel: +256 712 403357 / 782 580480

APPENDIX E: ARCHAEOLOGICAL RESOURCES CHANCE FINDS PROCEDURE FOR THE PROPOSED MBALE & SMALL TOWNS WATER SUPPLY AND SANITATION PROJECT

ABBREVIATIONS

CFP:	Chance Finds Procedure
ESMP:	Environment and Social Management Plan
IFC:	International Finance Corporation
KIP:	Key performance indicators
MTTI:	Ministry of Tourism, Trade & Industry
NEMA:	National Environment Management Authority
PS:	Performance Standard
RAP:	Resettlement Action Plan

DEFINITIONS

Chance find: Tangible cultural heritage encountered unexpectedly during project implementation.

Chance find procedure: A project-specific procedure that outlines actions to be taken if previously unknown cultural heritage is encountered.

1 INTRODUCTION

This Chance Finds Procedure (CFP) is proposed for the Mbale & Small Towns Water Supply and Sanitation Project, implementation of which will be a responsibility of the contractor.

1.1 Purpose of the CFP

This CFP will serve the following purposes:

- translate commitments in the ESIA into implementation procedures that will protect physical cultural resources during construction of the project;
- Serves as a key tool the contractor can utilise to manage and monitor preservation of resources of cultural heritage significance; and
- Provide transparency to stakeholders that commitments made in the ESIA in regard to preservation of finds of heritage value are actually being fulfilled.

This CFP provides:

- Responsibilities for implementation of the procedure;
- Impact management measures to be implemented;
- Verification and monitoring; and
- Records and reporting requirements.

1.2 Objective of CFP

Through its contractor, NWSC seeks to ensure that impacts on cultural heritage resources are minimized as far as possible. Thus the overall objective of this CFP is to describe an approach and procedures to be undertaken by the contractor with regard to protection of chance finds encountered during project implementation.

1.3 Scope of CFP

This CFP sets out requirements for management of cultural heritage resources during project implementation. The focus of the procedure is primarily mitigation during earthworks at the project site. It is expected that earthworks will be undertaken at following sites, at which chance finds may be encountered.

- Wastewater/ sewage and sludge management facilities;
- Water pipelines and sewers;
- Borrow sites where gravel may be obtained (if any).

1.4 Definition of “Cultural Heritage”

For purposes of this CFP, cultural heritage includes:

- i) Archaeological deposits and remains;
- ii) Historical monuments, sites and buildings;
- iii) Places of worship;
- iv) Cemeteries and graveyards; and,
- v) Places associated with folklore, mythology (and traditions) and the location of historical and cultural festivals, events and rituals.

1.5 Commitments

This CFP is developed based on target areas and commitments below:

Table 1: Target areas and commitments

	Target area	Commitment
1	Unidentified archaeological features	This CFP will be implemented to fulfill requirements of Uganda’s Historical Monuments Act, 1967.
2	Early earthworks involving excavations (see Sec 1.4 above)	A specialist archaeologist from the <i>Department of Museums and Monuments</i> in the <i>Ministry of Tourism, Trade & Industry</i> (MTTI) will be on site at the stage of commencing civil works entailing excavations and on call to come to site to investigate, inspect and retrieve any chance finds encountered. Retrieved chance finds will be submitted to the National Museum.

1.6 Relationship to Other Project Documents

This CFP should be implemented in conjunction with:

- Contractor’s environment & social management plan;
- Project overall ESMP that specified project-wide requirements for environmental and social management;
- The ESIA report for this project; and
- Resettlement Action Plan (RAP) that covers the framework and procedures to be followed during land acquisition for construction of the project.

1.7 Uganda’s Historical Monuments Act, 1967

This CFP is to be executed in compliance with Uganda’s *Historical Monuments Act, 1967*. In this Act, sub-section 12(1) requires that any portable object discovered in the course of an excavation is surrendered to the Minister who shall deposit it in the Museum.

Management of archeological chance finds is a responsibility of the Department of Museums and Monuments in the Ministry of Tourism, Trade & Industry.

2 CHANCE FINDS MANAGEMENT PROCEDURE

2.1 Personnel and Responsibilities

This procedure is based on three recommendations below:

- i) The contractor will have a *Socio-Environmental Officer* (SEO) on the site during project construction. The contractor's SEO will closely work with the developer's socio-environmental staff to ensure compliance with national and financier's requirements as well as implementation of this chance finds procedure.
- ii) During ground opening and excavations, the developer will facilitate an Archaeologist from the *Department of Museums and Monuments* in MTTI to be on site and ensure that any chance finds encountered are managed according to requirements of The Historical Monuments Act, 1967.
- iii) All construction staff involved in earthworks should be trained in basis skills of recognising suspected chance finds and the procedure of notifying the SEO and Archeologist.

Specific roles of persons to be involved in implementation of this procedure are outlined below

2.1.1 Role of the contractor's Socio-Environmental Officer

The SEO is required to:

- i) Communicate contents and requirements of this plan to contractor;
- ii) Sensitise workers to ensure that all are aware of their responsibilities in regard to protection chance finds;
- iii) Inform the Archaeologist of any chance finds encountered on site;
- iv) Coordinate inspection and monitoring by the MTTI Archaeologist. The SEO should keep in close contact with the archaeologist throughout the construction period;
- v) Implement measures recommended by the archaeologist for management of "chance finds" encountered;
- vi) Conduct cultural heritage tool box talks to construction personnel as advised by the Archaeologist; and
- vii) Maintain records (daily logs) related to archaeological finds during construction.

2.1.2 Role of the MTTI archaeologist

An archaeologist contracted (on a non-permanent basis) from the department responsible for museums and monuments in MTTI will have the following roles:

- i) Archaeological monitoring of all earthworks;
- ii) Advice/ guidance to the contractor with respect to halting construction activities if earthworks encounter chance finds;
- iii) Conducting preliminary assessment of all previously unidentified archaeological features encountered and submission of these to the National Museum;
- iv) Provision of advice on the significance and management of unidentified archaeological features encountered;
- v) Processing/ excavation of any unidentified subsurface archaeological features encountered in accordance with standard procedures recommended by the Department of Museums and Monuments;
- vi) Maintain watching briefs during opening up site or deep excavations at any location during construction, with clear procedures for protection and documentation of any "chance finds" encountered;
- vii) Maintain monitoring records of all unidentified archaeological features encountered;
- viii) Develop a set of points to be discussed in "Tool Box" sessions to create awareness among construction crews on "chance finds"/ archaeological features. Note that as part of their sensitization, workers will be required to cease work if they encounter archaeological features and report to Contractor's SEO, who will notify the Archaeologist; and
- ix) Write a report for the developer upon completion of construction. This report will be submitted to the Supervising consultant, Contractor, Developer and Department of Museums and Monuments. The report will

summarise findings of archaeological monitoring, describing any features encountered and their preservation significance.

The archeologist will also undertake “Watching briefs” as the primary element of management and protection of cultural heritage during project construction. Watching briefs will consist of passive visual investigation during ground breaking at excavation sites.

Objectives of the “watching briefs” will be to:

- Record subsurface archaeological features discovered during earth-moving activities;
- Provide advice to the contractor on significance of subsurface archaeological features discovered; and
- Provide advice to the contractor on areas where ground disturbing activities may continue or where necessary need to be “worked around” or stopped.

The following will be implemented during the “watching brief”:

- Prior to commencing any construction activities, the contractor will give a brief to the archaeologist about site(s) they plan to excavate;
- The archaeologist will conduct a walkover to identify site’s archaeological sensitivity through characteristics such as soil type, topography, etc.; and
- The archaeologist will witness/ observe site clearance, soil stripping and excavations for presence of subsurface archaeological features.

2.1.3 Role of the Contractor

The contractor will be required to:

- i) Heed advice from the Archaeologist in respect to halting earthworks when chance finds are encountered; and
- ii) Provide cultural heritage tool box talks to construction crews as advised by the Archaeologist.

2.2 General Rule When Chance Finds are Encountered

Upon identification of suspected archaeological remains, the location must not be disturbed until it is inspected by the archaeologist from MTTI.

2.3 Procedures

In the event that genuine archaeological remains are encountered, the procedures to be adopted are described in the sections below.

2.3.1 Human remains

If encountered during earthworks, human remains must be handled with dignity and respect. If identified before disturbing the ground, such a location should be staked or flagged off to prevent additional disturbance. However, for uncemented graveyards, it may not always be possible to identify, distinguish and protect a burial ground from construction activities and therefore the following procedures will be followed if suspected human remains are found:

- i) Work will immediately cease in affected location and contact the contractor’s SEO who will notify the MTTI Archaeologist;
- ii) If the affected location is likely to be disturbed by other workers on site, an employee will be assigned to stand watch until the archaeologist arrives;

- iii) Any exposed bones will be covered with plastic sheeting but not backfilled, until the archaeologist arrives to inspect the chance finds;
- iv) If excavated fill has been loaded into a truck, it will be emptied at a suitable location for inspection by the archaeologist; and
- v) The contractor will resume work once the archaeologist's inspection is completed and an instruction to recommence works issued.

2.3.2 Artefact scatters

The following procedures will be adopted when unanticipated artifact scatters are encountered:

- i) The contractor will immediately stop work at the location where finds are encountered and contact the SEO who will notify MTTI Archaeologist;
- ii) The affected location will be staked or flagged off to prevent further disturbances;
- iii) If excavated fill has been loaded into a truck, it will be emptied at a nearby secure location for inspection by the archaeological consultant; and
- iv) The contractor will resume work only after the archaeologist has completed a site inspection and given the go-ahead for works to resume.

2.3.3 Isolated artefact finds

Due to their shape and colour, which often contrasts with the surrounding soil, artifacts are easy to identify by non-archaeologists during earthworks or other activities on site.

Should an isolated artifact be observed, the following procedures will be adopted:

- i) If the artifact is in imminent danger of being destroyed or damaged, it will be collected and its location marked with a flag;
- ii) Whenever possible, the artifact will be left on the ground where it was found;
- iii) The SEO will be notified that the location requires an archaeological inspection;
- iv) The SEO will notify the archaeologist of the chance find;
- v) The SEO will ensure that other workers near the location are aware of the need to avoid disturbing the area until inspected by the archaeologist; and
- vi) The archaeological consultant will inspect the affected location, after which the SEO will be advised that construction works can proceed.

2.3.4 Historical remains

All types of historic archaeological materials are subsumed within this category, including isolated historical artifacts. When historic remains or suspected historic archaeological remains are encountered the following procedures will be adopted:

- i) SEO will order cessation of work will and notify the archaeologist;
- ii) The affected location will be staked or flagged off to prevent further disturbances;
- iii) The archaeologist will determine if the materials encountered are of real historic significance; and
- iv) The contractor will resume work only after the archaeologist issues instruction for the works to resume.

If isolated historic or suspected historic archaeological artifacts are observed, the following procedures will be followed:

- i) If the artifact is in imminent danger of being damaged, it will be collected by the SOE and put in a bag (e.g. a Ziploc bag), along with any fragments thereof;
- ii) If detached fragments are found, a label must be included with the date of the find and its position;
- iii) Its depth and location must be marked with a stake or flag,

- iv) Otherwise, whenever possible, the artifact mbe left on the ground at the location where it was found; and
- v) The SEO will notify the archaeologist, who will determine if an inspection is required. If no follow-up inspection is necessary, the archeologist will advise the SEO that construction can continue.

3 TRAINING

General awareness training will be provided by an archaeologist from MTTI to all construction crews and the contractor's SEO. The training will incorporate information on cultural heritage, its significance, protection status of previously unidentified subsurface archaeological features in the area and construction activities that may destroy them.

This awareness will be maintained through tool-box talks that should be regularly conducted with all construction crews.

4 MONITORING

Monitoring will be done by the contractor's SEO with the principal objective being to provide assurance that:

- Project construction is compliant with this procedure; and
- Evidence is collected to demonstrate that commitments related to cultural heritage protection are being effectively met.

Key performance indicators below will be utilised in the monitoring

4.1 Key Performance Indicators

The contractor's SEO will undertake monitoring of chance finds management based on KIPs in Table 2.

Table 2: Monitoring criteria

	KIP/ measure	Rationale	Performance target	Monitoring frequency
1	Conduct cultural heritage awareness training	Ensures workers are aware of cultural heritage in the area and the possibility of sub-surface resources to be encountered.	90%	Every 3 months
2	Number of "chance finds" damaged by construction activities	Monitors effectiveness managing chance finds	Zero	Monthly

4.2 Action Tracking

All non-compliance with this procedure shall be followed up and corrective action taken. The contractor's SEO is expected to maintain an *actions tracking system* as part of archaeological monitoring. Cultural heritage management action tracking including close out of actions (solutions and preventive actions taken) will be reported quarterly by the contractor to the project developer.

5 REPORTING AND RECORD KEEPING

Records in sections below will be kept by indicated personnel.

5.1 MTTI's Archaeologist

The archaeologist will report the following to the Contractor's Socio-Environmental Officer:

- Daily log of activities on a weekly basis;

- Results of any assessments of “chance finds” as soon as the assessment is completed; and
- A detailed report of field activities, findings and conclusions following a period of major earthworks.

5.2 Contractor’s Socio-Environmental Officer

The Contractor’s SEO will report the following to Frontier’s Socio-Environment Manager.

- Awareness records on cultural heritage resource among workers on a weekly basis;
- Bi-weekly report summarizing cultural heritage management activities;
- Action tracking system on a weekly basis; and
- Performance against key indicators (KPI).

REFERENCES

Republic of Uganda, 1967: Historical Monuments Act.

NEMA 2010: Environmental Sensitivity Atlas for the Albertine Graben, Kampala.

APPENDIX F: PHOTOGRAPHS OF SOME PROJECT SITES



Proposed site for the waste stabilisation pond system for the Northern Cluster



Proposed site for the intake works on River Namatala



Proposed site for the pumping station for the Senior Quarter network

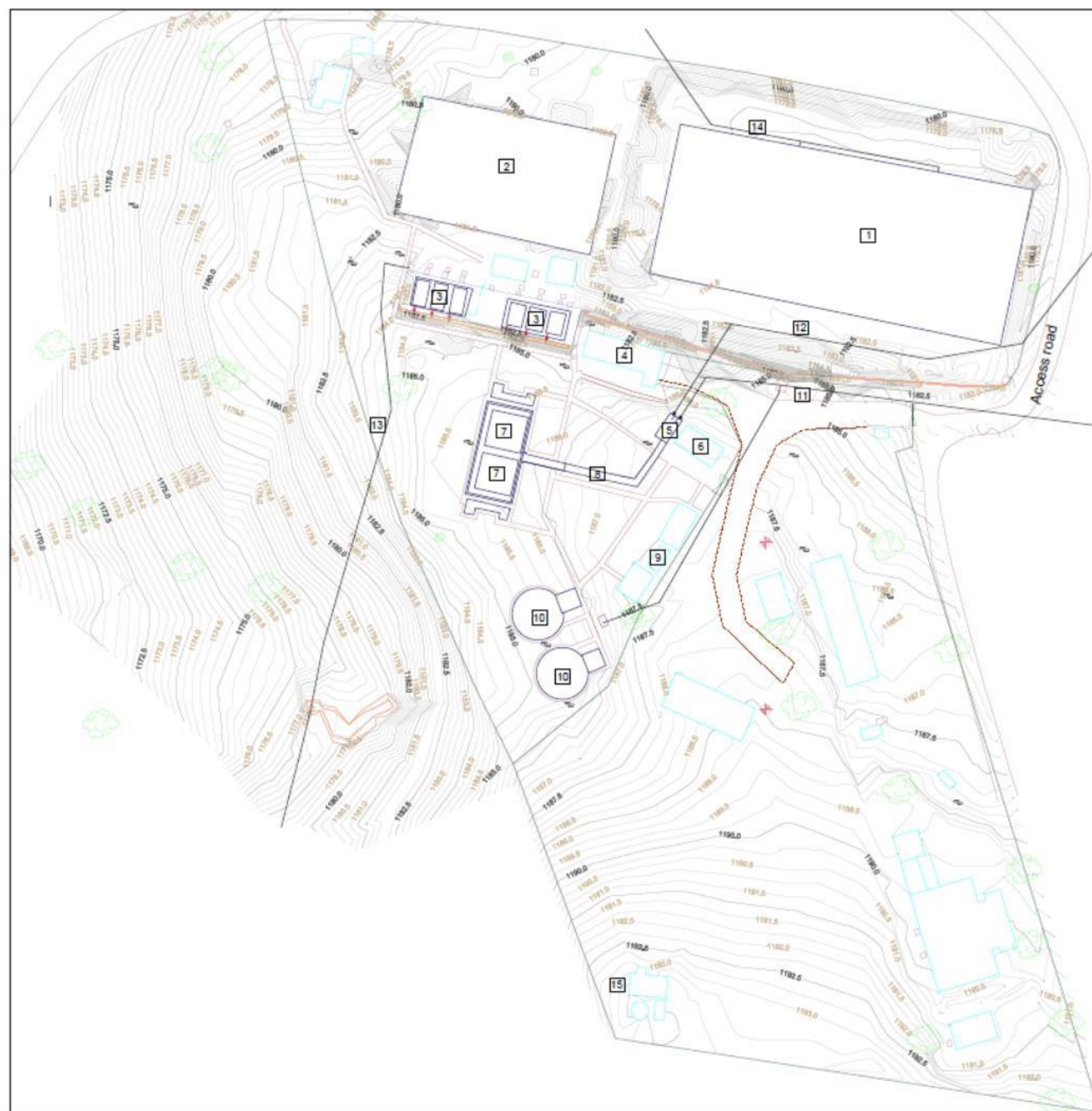


Proposed site for the Butaleja water reservoir



Proposed site for the Busolwe water reservoir

APPENDIX G: PROJECT LAYOUT DRAWINGS



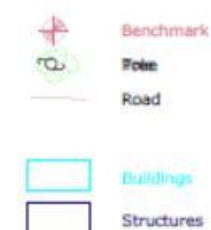
- Benchmark
 Pole
 Road
 Electric pole/lines
 Intermediate Contour
 Buildings
 Structures
 Existing Pipe
 Abandoned Tank
 Sand Filters
 Workshop and Stores
 Raw water intake
 Chemical Store
 Rectangular clarifiers
 Mixing Channels
 Laboratory
 Circular clarifiers
 Nabijo Raw water Pipeline
 Nabujonga Raw water pipeline
 Treated water from Manafwa
 Treated water from the Reservoir
 Backwash water Reservoir
- PIPE LINE NAMES**

FOR TENDER PURPOSES ONLY

The Republic of Uganda  MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT  NATIONAL WATER AND SEWERAGE CORPORATION	
 CES Consulting Engineers Salzgitter GmbH	
PROJECT TITLE: MSALE WATER SUPPLY AND SANITATION PROJECT	
DRAWING TITLE: UPGRADE AND EXTENSION BUNGOKHO WATER TREATMENT PLANT - GENERAL LAY OUT OF EXISTING PLANT	
NAME	SCALE: 1:500
DESIGNED: Javier Espinoza	FORMAT: A3
DRAWN: Barco Acidi	DATE: August 2018
APPROVED: Oskar Giersterbauer	
DRAWING NO.: WMDP/MSA / 9 /10-L-001	
SHEET NO.: 1 of 1	



LEGEND

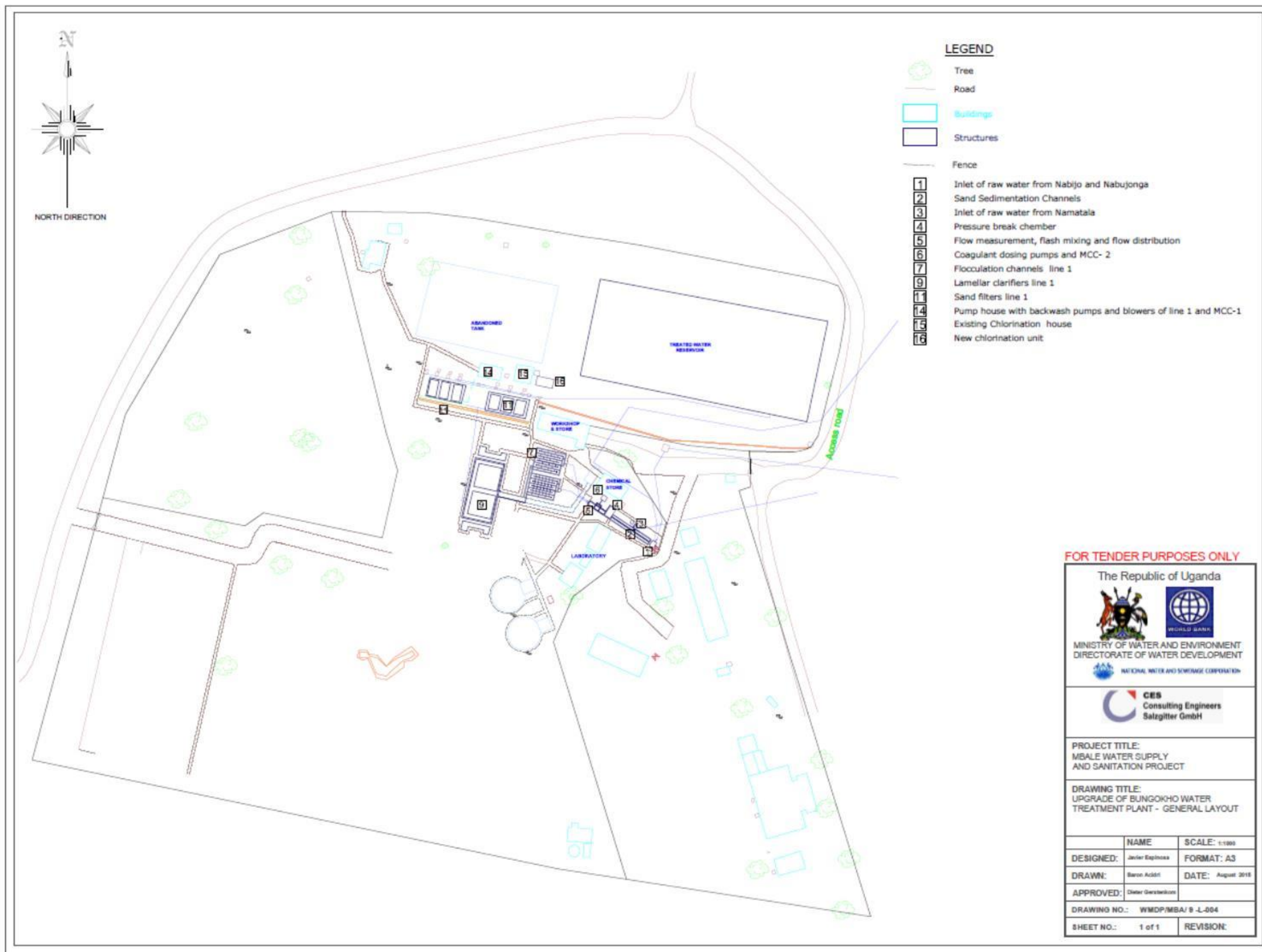


PIPE LINE NAMES

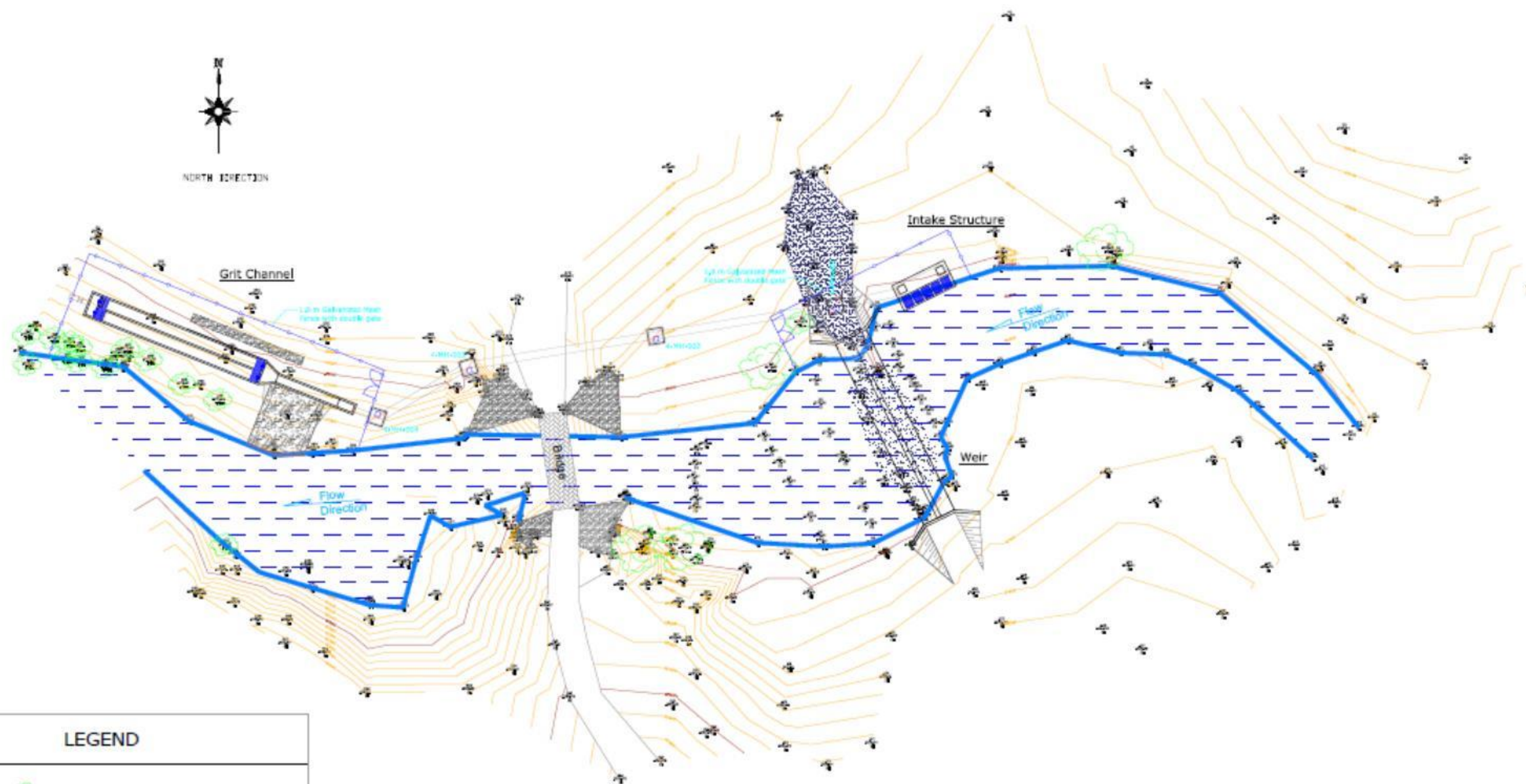
- 1 Raw water from Nabijo DI. Ø 150
- 2 Raw water from Nabujonga DI. Ø 150
- 3 Clarified water from Circular clarifier DI. Ø 175
- 4 Clarified water from Rectangular clarifier DI. Ø 150
- 5 Filtered water to reserver DI. Ø 150
- 6 Service water to GI. Ø 25
- 7 Filtered water to elevated reserver DI. Ø 50
- 8 Backwash water DI. Ø 225
- 9 Treated water from Manafwa DI. Ø 200
- 10 Discharge pipe DI. Ø 200
- 11 Treated water to Distribution

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<p>The Republic of Uganda</p>   <p>MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT</p> <p>NATIONAL WATER AND SEWERAGE CORPORATION</p>	
<p> CES Consulting Engineers Salzgitter GmbH</p>	
<p>PROJECT TITLE: MBALE WATER SUPPLY AND SANITATION PROJECT</p>	
<p>DRAWING TITLE: UPGRADE AND EXTENSION OF BUNGOKHO WATER TREATMENT PLANT - EXISTING PIPES</p>	
NAME	SCALE:
DESIGNED: Jeyfer Enginosa	FORMAT: A3
DRAWN: Baron Achidi	DATE: August 2016
APPROVED: Dieter Gerstbeck	
DRAWING NO.: WMDP/MBA/ 9 / 10-L-002	
SHEET NO.: 1 of 1	



NAMATALA RAW WATER

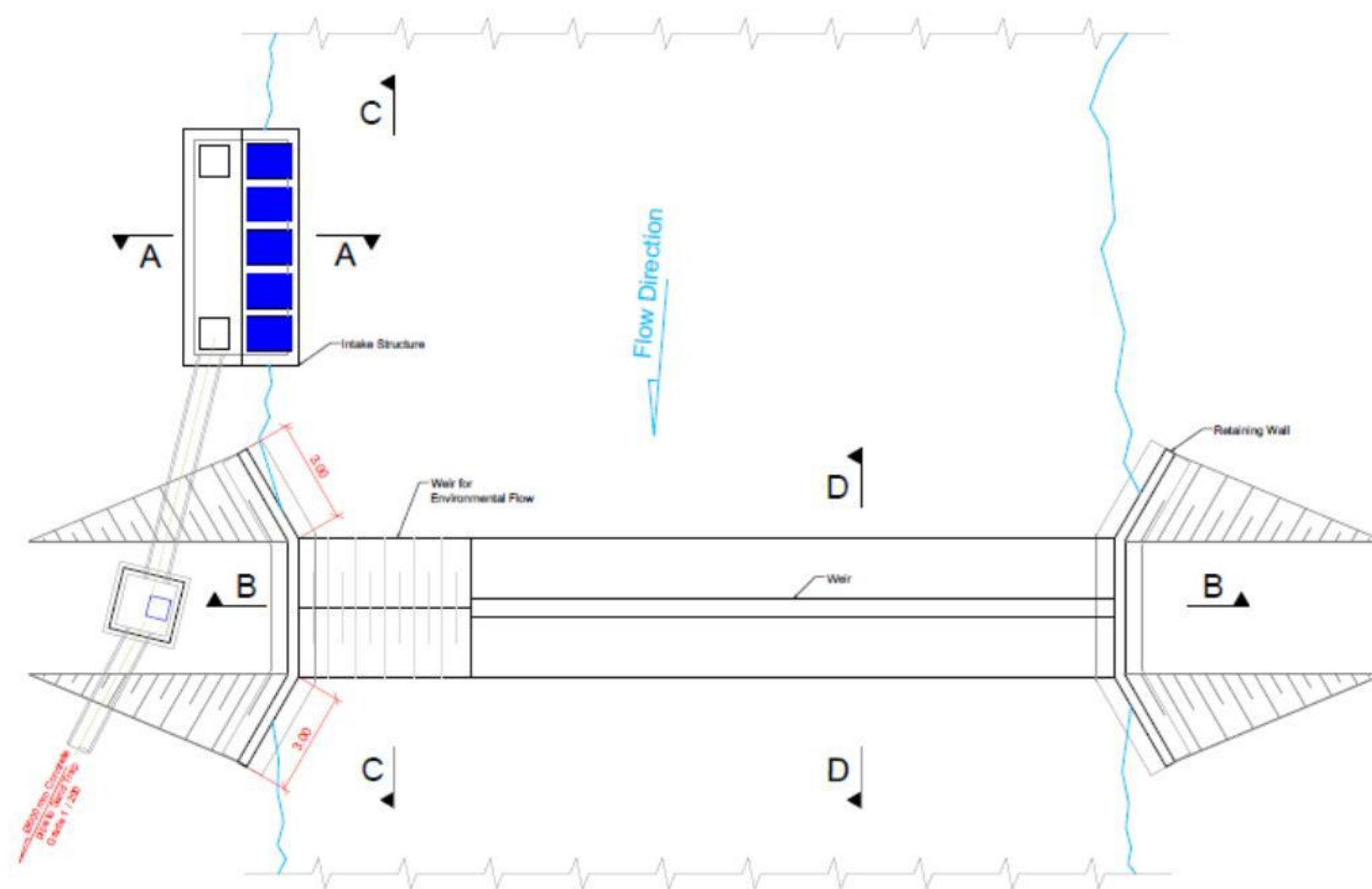


LEGEND



-  Tree
-  Road
-  Index contour
-  Intermediate Contour
-  Fencing
-  Water
-  Rock
-  Gabion

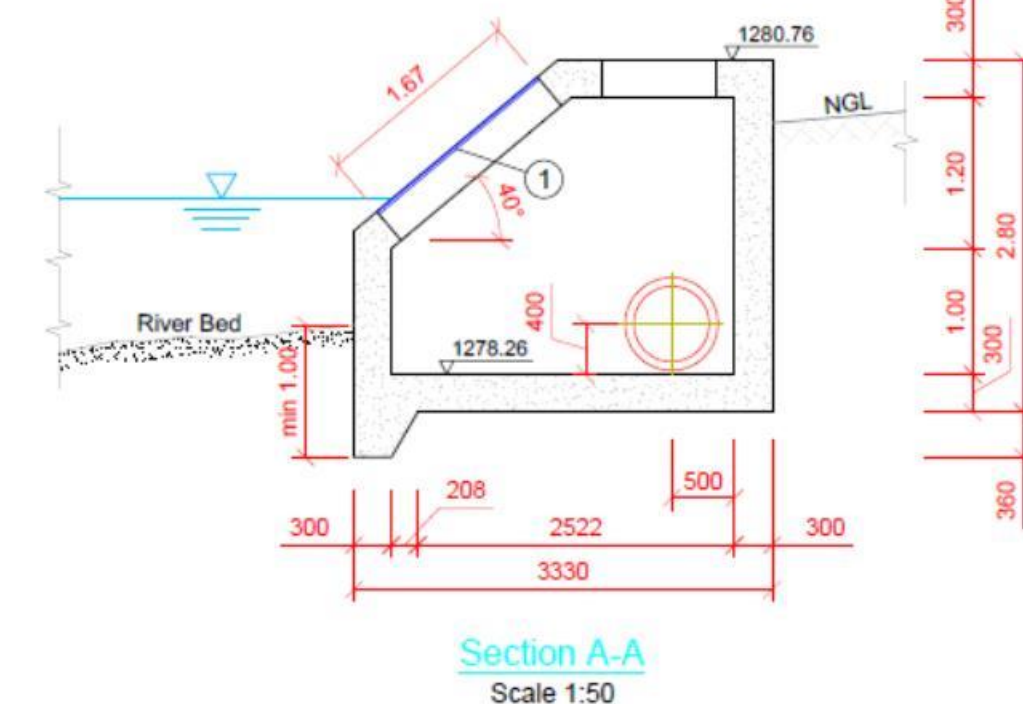
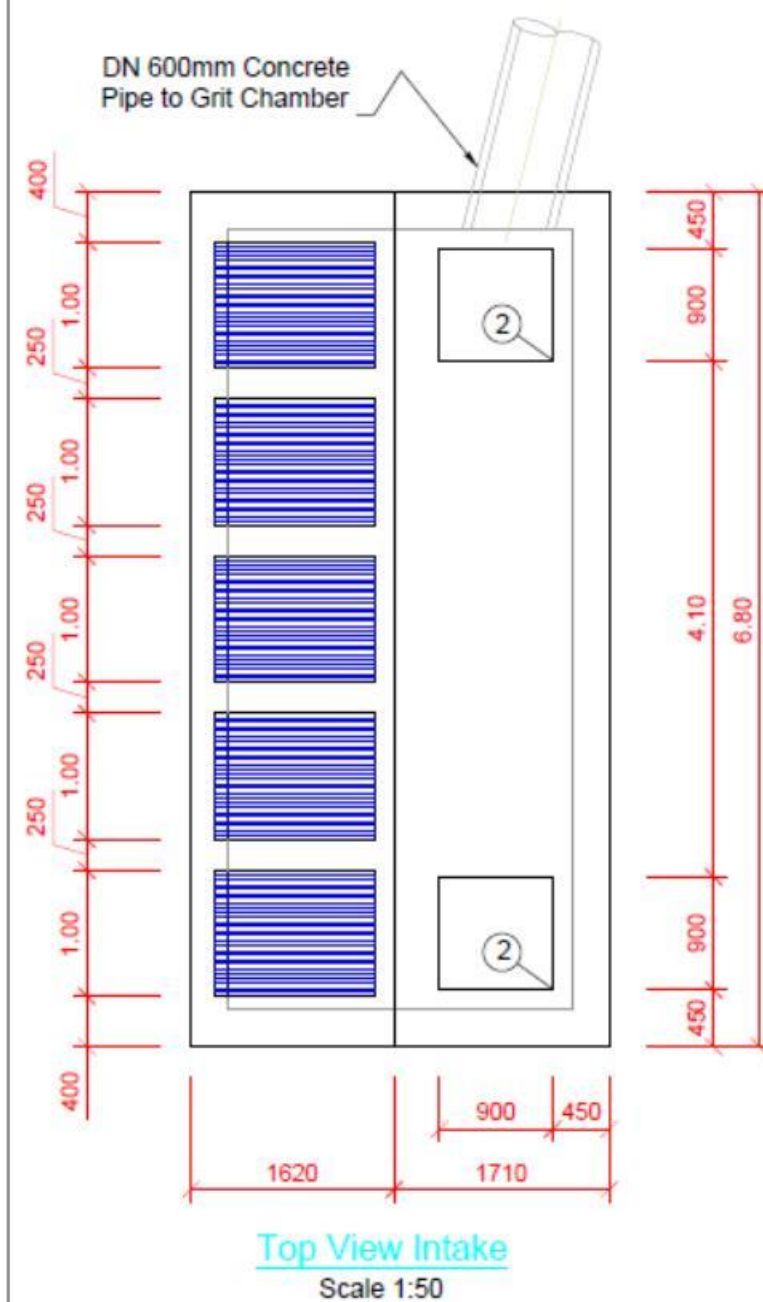
FOR TENDER PURPOSE ONLY

<p>The Republic of Uganda</p>  <p>MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT</p>	
<p>CCS Consulting Engineers Kampala, Uganda</p>	
<p>PROJECT TITLE: WATER SUPPLY AND SANITATION PROJECT</p>	
<p>DRAWING TITLE: Hydrology Data</p>	
DESIGNED BY:	SCALE: 1:500
DRAWN BY:	FORMAT: A3
APPROVED BY:	DATE: 14/09/2011
DRAWING NO.: WSD/000001/001	
SHEET NO.: 1 of 1	SECTION: 1



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<p>CES Consulting Engineers Satzgitter GmbH</p>		
<p>PROJECT TITLE: MBALE WATER SUPPLY AND SANITATION PROJECT</p>		
<p>DRAWING TITLE: Namatala Intake</p>		
	NAME	SCALE: as indicated
DESIGNED:	Stefan Kall	FORMAT: A3
DRAWN:	Stefan Kall	DATE: May 2018
APPROVED:	Ulrich Gerschlager	
DRAWING NO.: WMOP/MSA/4-S-002		
SHEET NO.:	1 of 3	REVISION: 1



PIPE & FITTING SCHEDULE

ITEM	Qty.	Dis.	BoQ Item	DETAILS	DESCRIPTION
①	5		4N22		1670 x 1000 mm Stainless Steel Screen, 25mm round bars, 50 mm clearance, incl. fixation
②	2		4N231		900 x 900 mm Access Lid including Frame and Lock Box, hot dip galvanized to BS ISO 1461, as per drawing nr WMDP/MBM/1-D-006

Notes

Pipework, Valves and Equipment

1. ANY RECOMMENDATIONS WITH REGARD TO THE SPECIFICATION MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER BEFORE ORDERING THE MATERIALS.
2. ALL STAINLESS STEEL TO BE OF GRADE 304 TO ASTM 304 OR 1.4301 TO DIN 17753 OR BETTER.
3. HOT DIP GALVANIZING TO BS 5954:1981. NO GALVANIZING SHALL BE QUARANTINED WITHOUT PRIOR APPROVAL OF THE ENGINEER.
4. ON-SITE WELDING OF GALVANIZED IRON ONLY PERMITTED BY THE ENGINEER.

Concrete

5. ALL STRUCTURAL CONCRETE TO BE C25/30 AND ALL MASS CONCRETE TO BE C30/37.
6. ALL EXPOSED CONCRETE CORNERS TO BE CHAMFERED.
7. WHERE THE PIPE ENTERS REINFORCED STRUCTURES A 150mm RUBBER WRAP (50 DIAMETER) SHALL BE INSTALLED.
8. 50mm BLINDING TO BE POURED BENEATH EVERY STRUCTURE.
9. ALL CONCRETE STRUCTURES TO BE WATER-STOPPED.
10. NO CONCRETE SHALL BE POURED WITHOUT THE PRIOR APPROVAL OF THE ENGINEER.
11. AT WORK, ROCK DOWNS TO BE DRILLED 800mm INTO THE BEDROCK, SPACING 250mm.

General

12. THE CONTRACTOR SHALL PRODUCE AND SUBMIT SHOP DRAWINGS FOR ALL PIPEWORK AND EQUIPMENT FOR APPROVAL BY THE ENGINEER.
13. TECHNICAL DATA SHEETS OF ALL FITTINGS AND SPECIALS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL.

FOR TENDER PURPOSE ONLY!

The Republic of Uganda

MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT

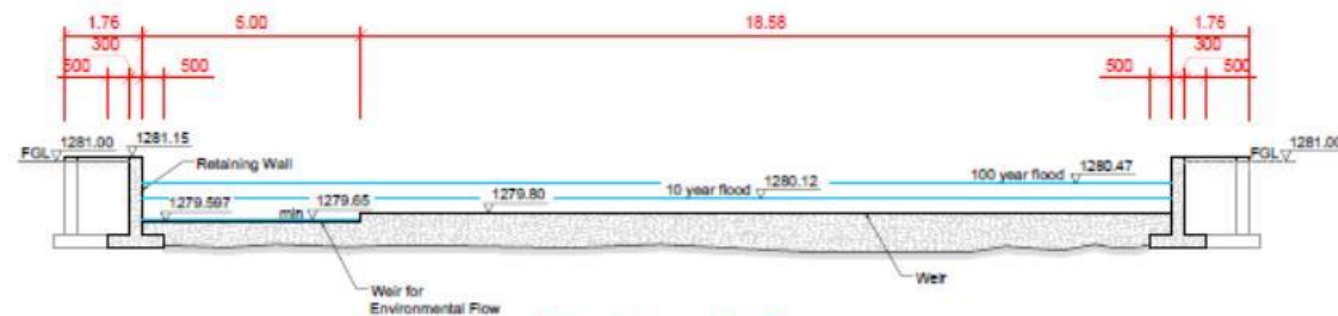
NATIONAL WATER AND SEWERAGE CORPORATION

CES
Consulting Engineers
Salzgitter GmbH

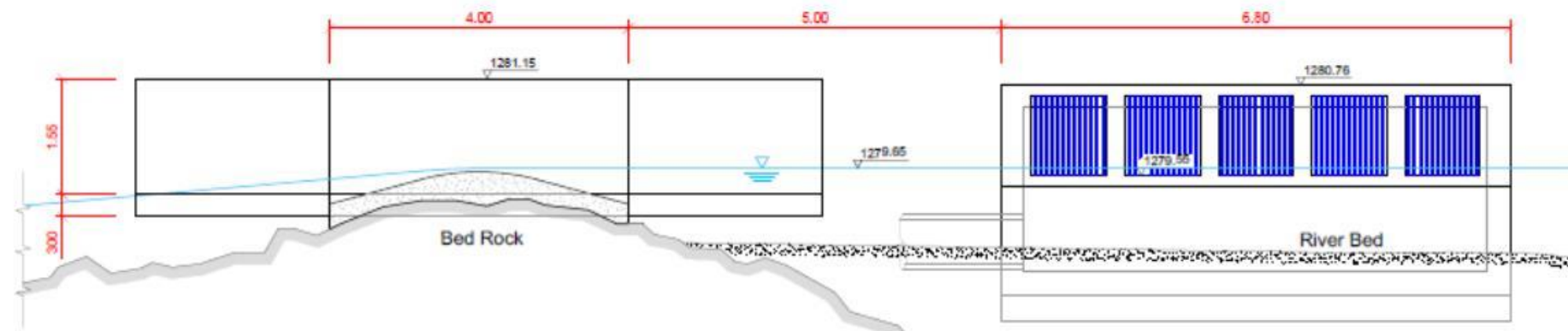
PROJECT TITLE:
MBALE WATER SUPPLY
AND SANITATION PROJECT

DRAWING TITLE:
Namatala Intake

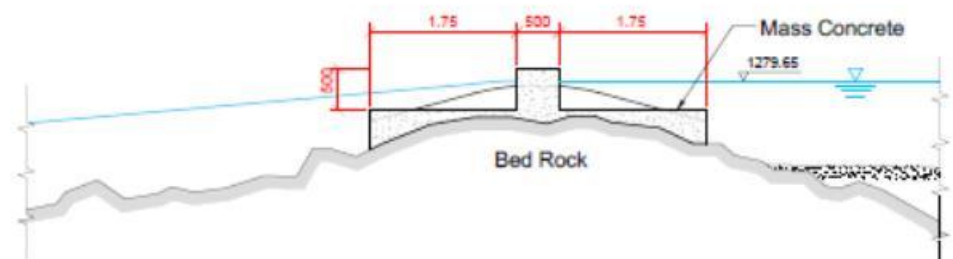
DESIGNED:	Shafiq Hail	SCALE:	as indicated
DRAWN:	Shafiq Hail	FORMAT:	A3
APPROVED:	Shafiq Hail	DATE:	May 2018
DRAWING NO.:		WMDP/MBM/1-D-002	
SHEET NO.:		2 of 3	REVISION: 1



Section B-B
Scale 1:100



Section C-C
Scale 1:50



Section D-D
Scale 1:50

FOR TENDER PURPOSE ONLY

The Republic of Uganda

MINISTRY OF WATER AND ENERGY
DIRECTORATE OF WATER DEVELOPMENT

WATER SUPPLY AND SANITATION PROJECT

DESIGN TITLE: **WATER SUPPLY AND SANITATION PROJECT**

DESIGNER: **WATER SUPPLY AND SANITATION PROJECT**

SCALE: **1:100**

DATE: **2023**

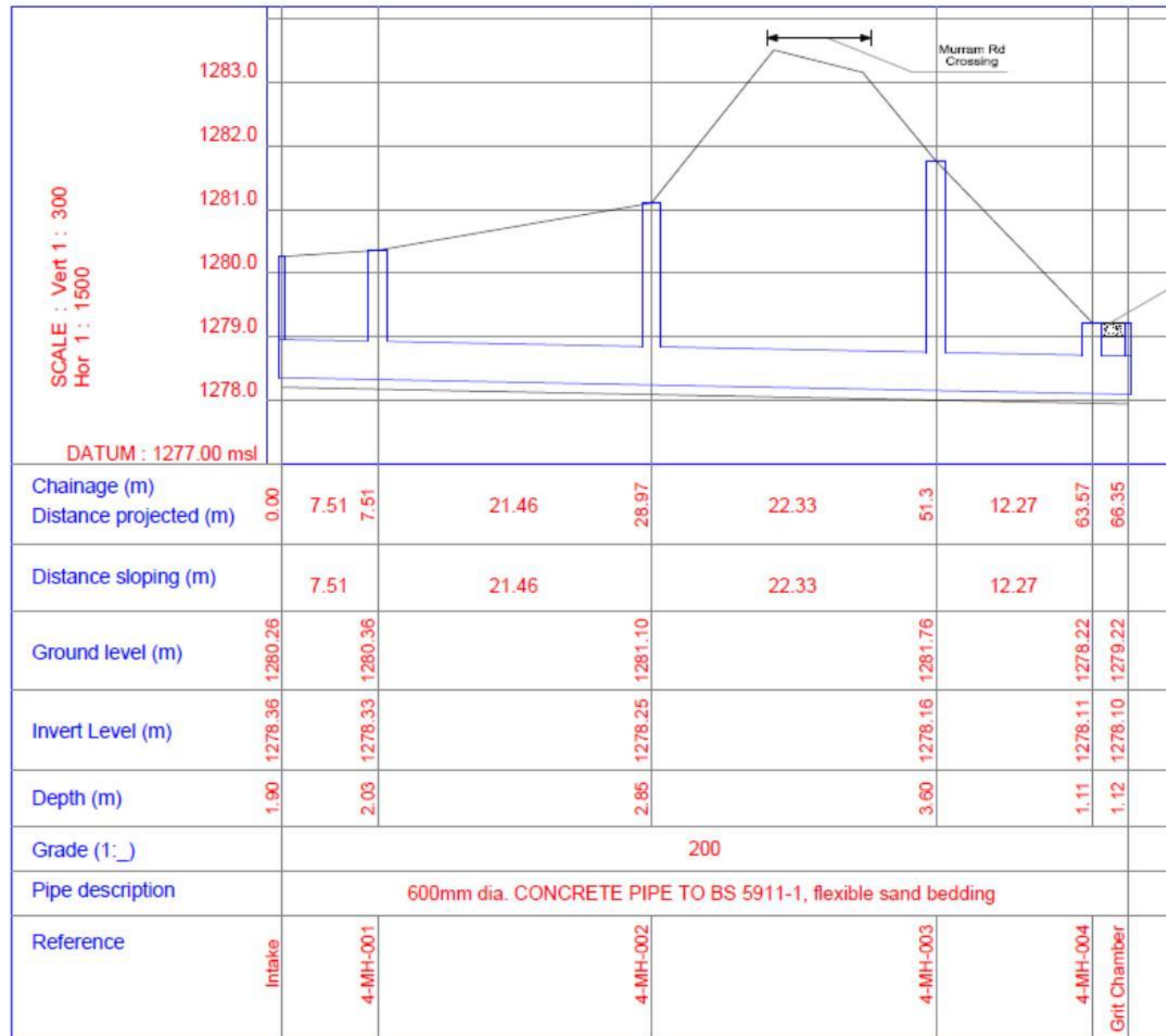
PROJECT NO.: **WATER SUPPLY AND SANITATION PROJECT**

SHEET NO.: **1** OF **1**

Notes

1. CONCRETE PRESSURE PIPES TO BS 5911-1 WITH SBR GASKETS TO BS EN 681-1
2. IN AREAS OF LOW COVER (<0.9 M) A REINFORCED CONCRETE SLAB SHALL BE PLACED ON TOP OF THE TRENCH TO PROTECT THE PIPE, WIDTH 1.6 M, THICKNESS 200 MM, ONE LAYER OF Y10 300 MM SPACING IN BOTH DIRECTIONS, CONCRETE C25/19
3. FLEXIBLE SAND BEDDING TO BE USED ALONG ENTIRE LENGTH
4. ALL MANHOLES 1500 MM X 1500 MM AS PER STANDARD DRAWING

200mm Reinforced Concrete Slab on top trench (1.6 m wide)



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The Republic of Uganda

MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT

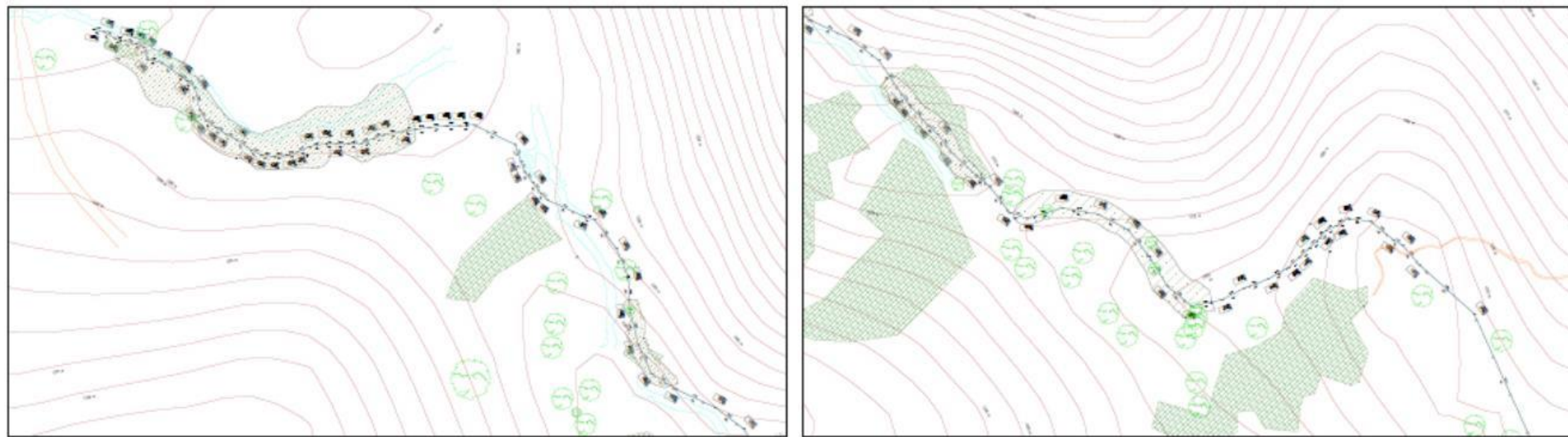
NATIONAL WATER AND SEWERAGE CORPORATION

CES
Consulting Engineers
Salzgitter GmbH

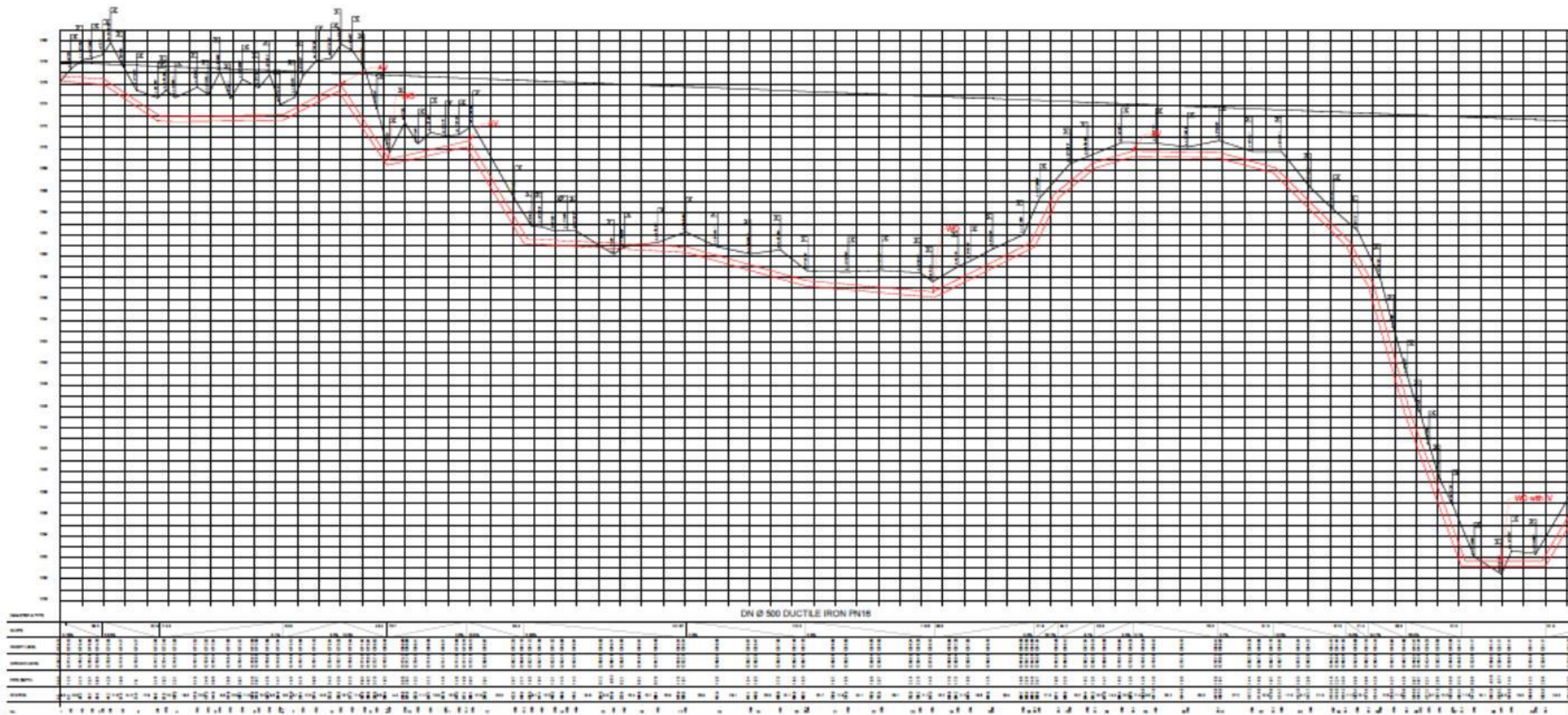
PROJECT TITLE:
WATER SUPPLY AND SANITATION
PROJECT

DRAWING TITLE:
NAMATALA INTAKE -
CONCRETE PIPE

NAME	SCALE: as indicated
DESIGNED: Stefan Hall	FORMAT: A3
DRAWN: Stefan Hall	DATE: May 2018
APPROVED: Stefan Hall	
DRAWING NO.: WMDP/MB/4-P-001	
SHEET NO.: 1 of 1	REVISION: 1

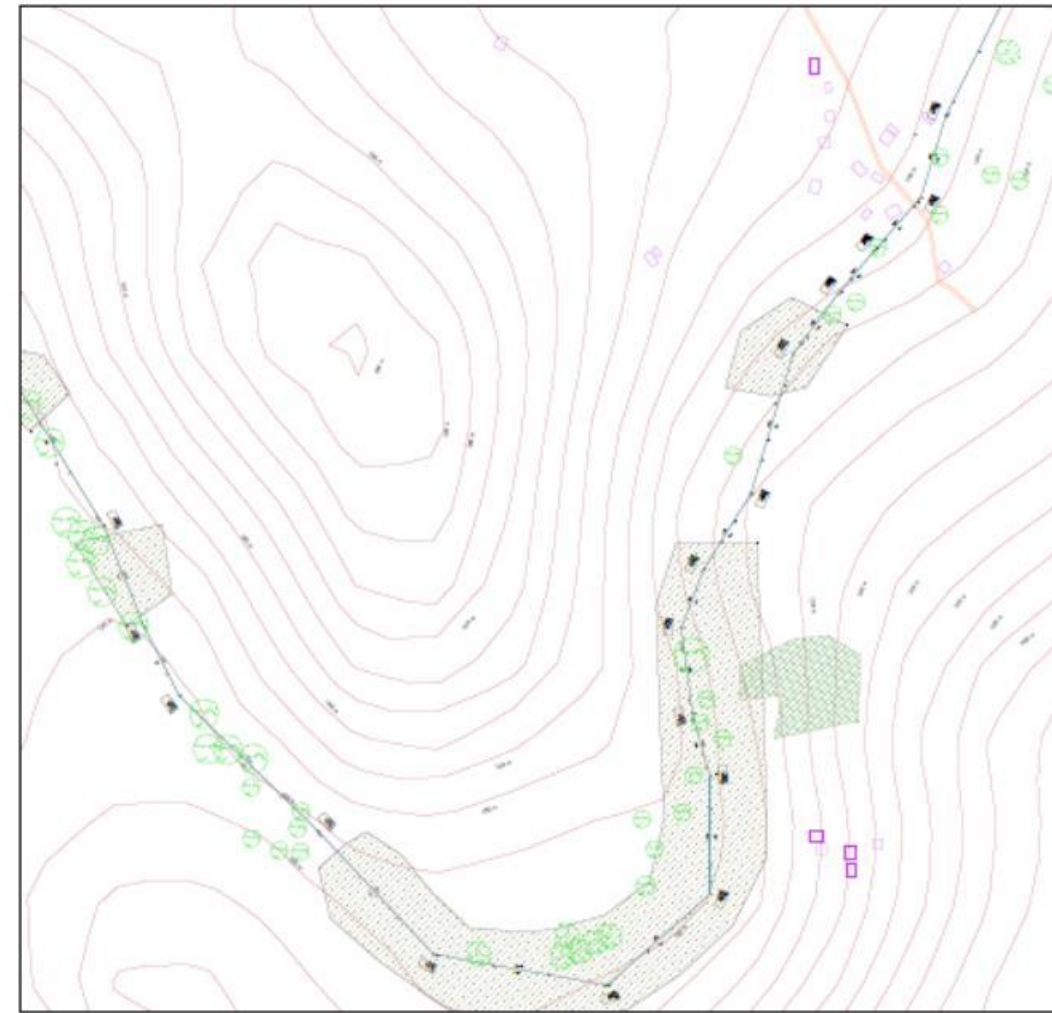
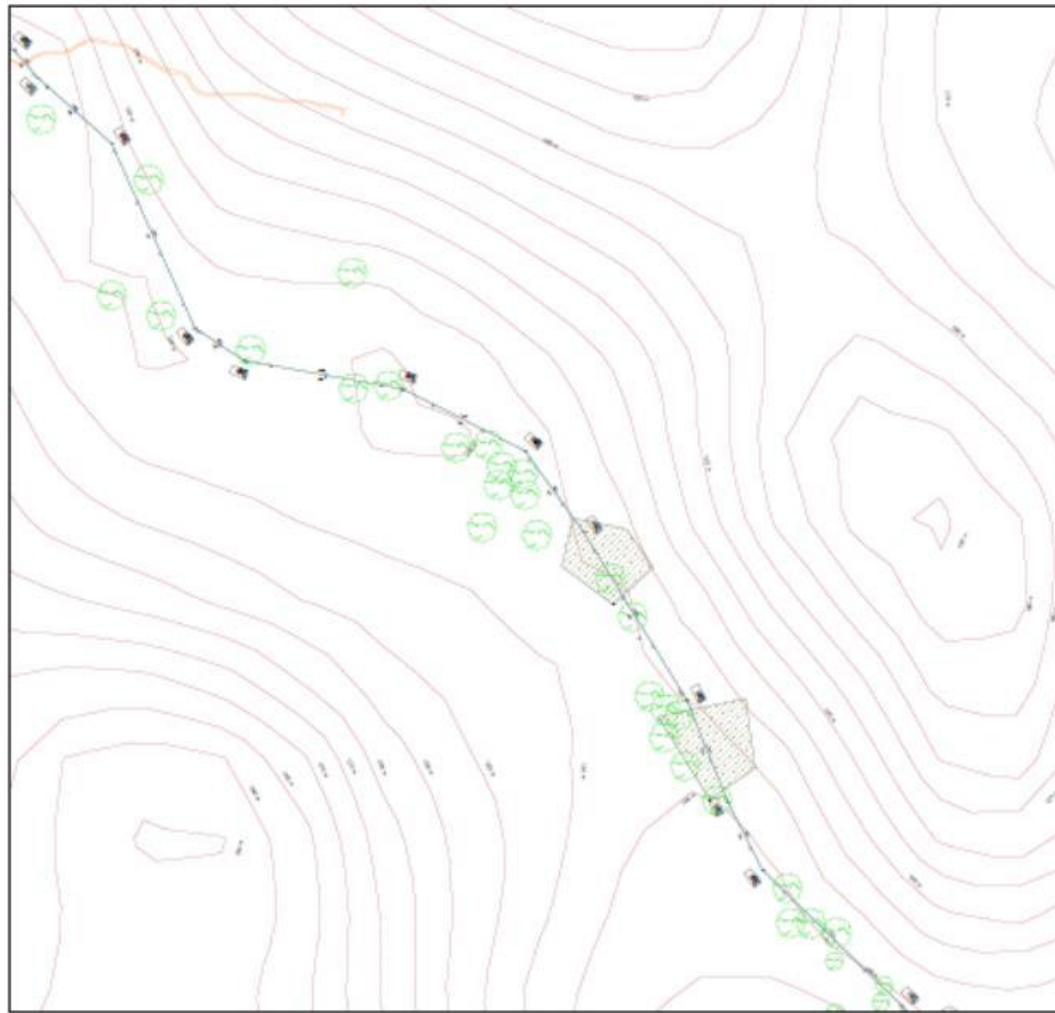


LEGEND	
	Tree
	Road
	Pipe line
	Contour
	House
	Rock & Boulders
	Forest
WO	Wash out
WO with IV	Wash out with Isolation valve
AV	Air valve

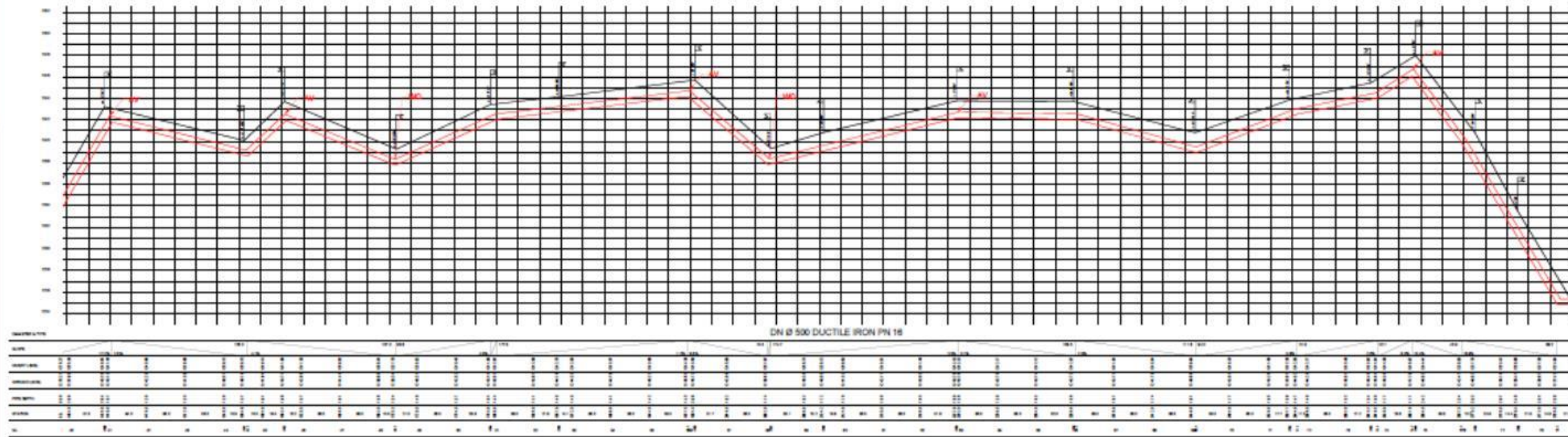


FOR TENDER PURPOSES ONLY

 The Republic of Uganda MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT A.P.A.	
 CES Consulting Engineers Seligler GmbH	
PROJECT TITLE: MSALE WATER SUPPLY AND SANITATION PROJECT	
DRAWING TITLE: NAMATALE INTAKE - TRANSMISSION MAIN	
DESIGNED:	SCALE: as indicated
DRAWN:	DATE: May 2015
APPROVED: Project Coordinator	
DRAWING NO.: WSP/PM/SA/P-002	
SHEET NO.: 1 of 8	REVISION: 1

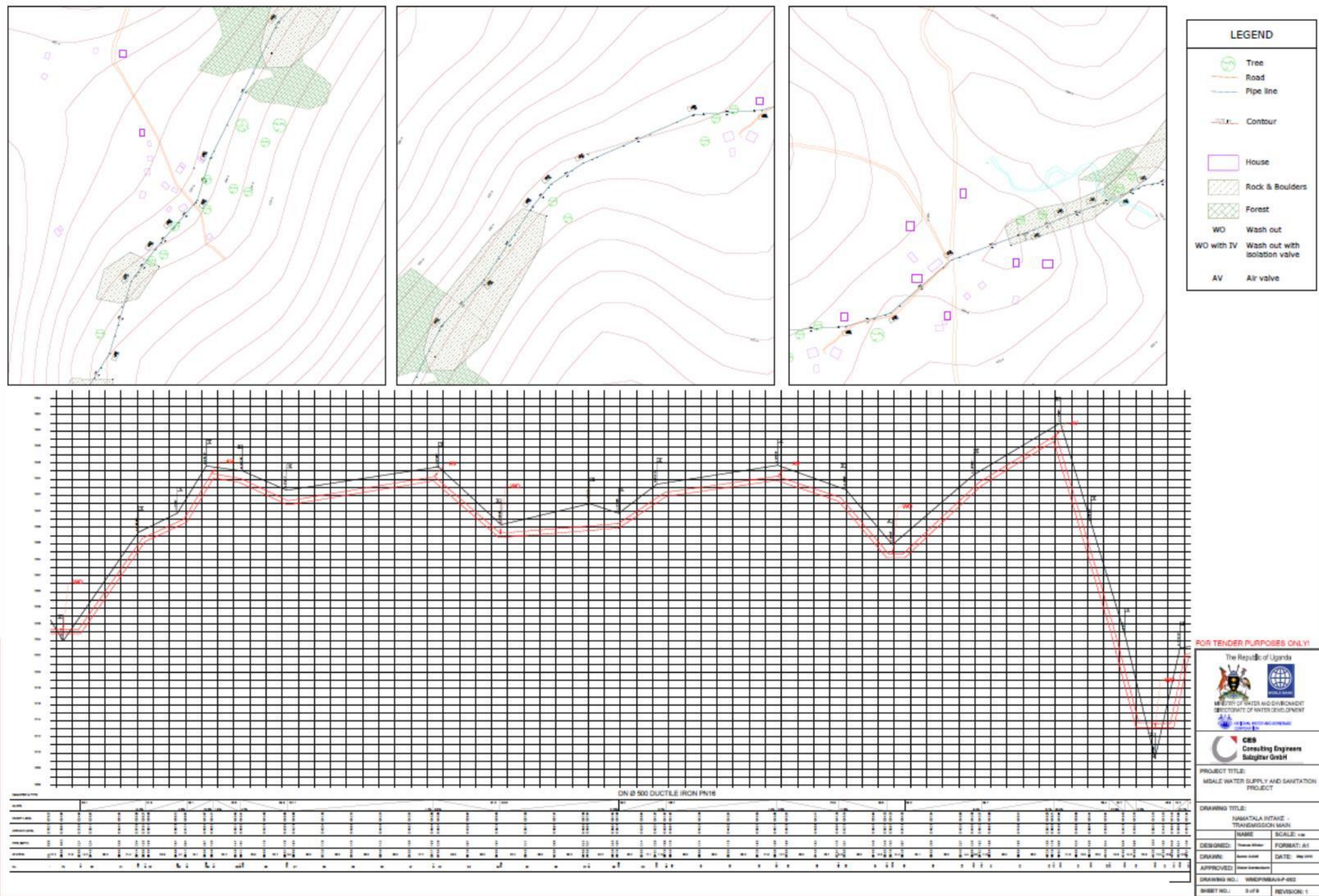


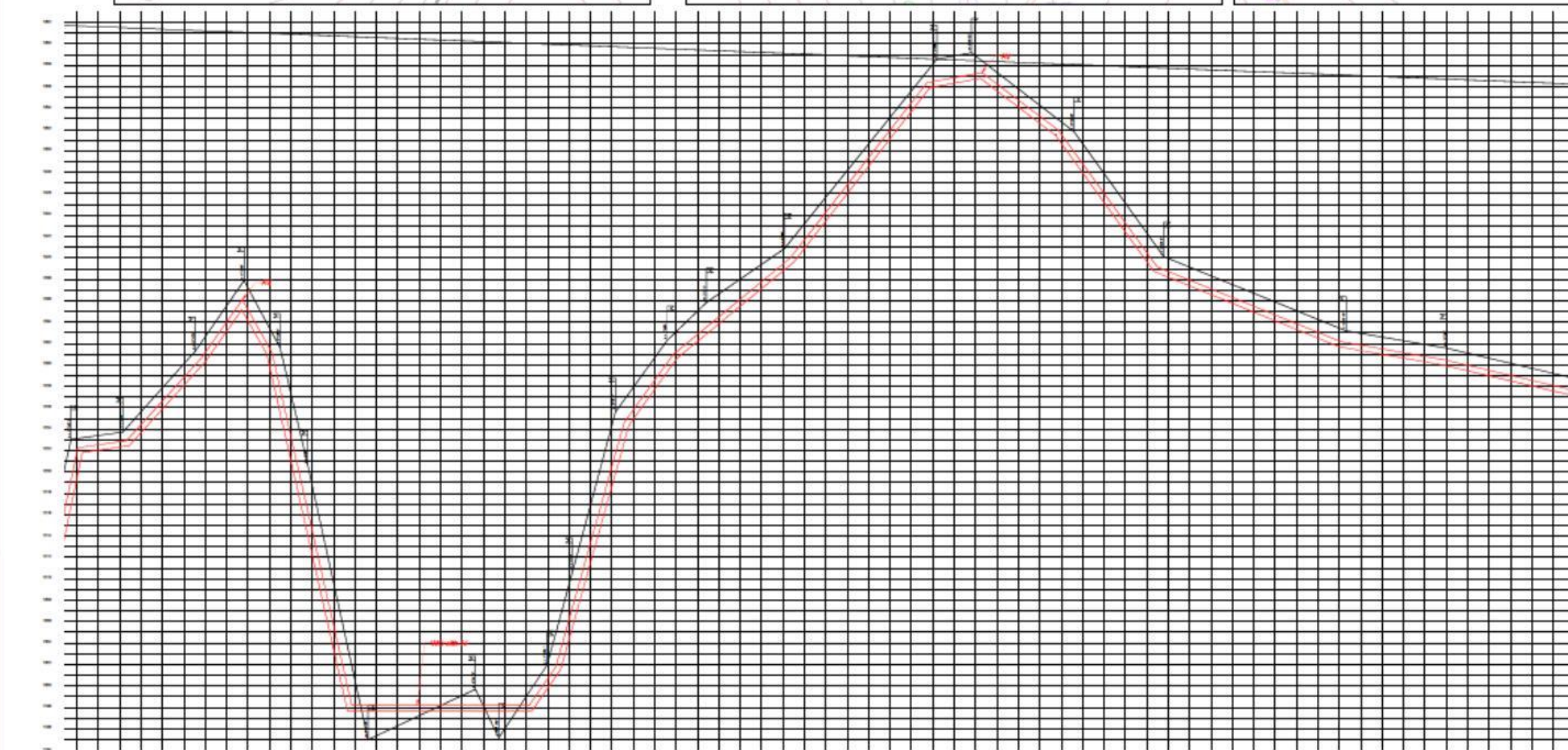
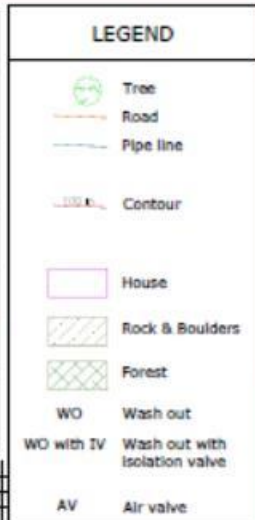
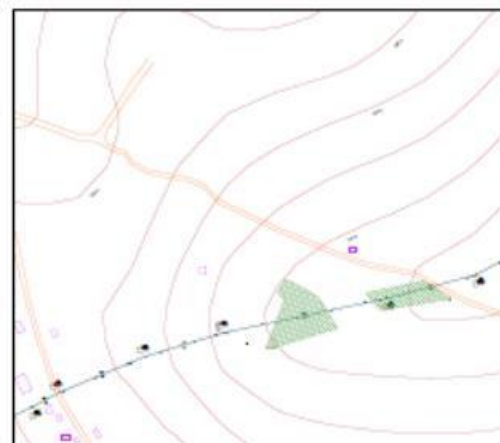
LEGEND	
	Tree
	Road
	Pipe line
	Contour
	House
	Rock & Boulders
	Forest
WO	Wash out
WO with IV	Wash out with isolation valve
AV	Air valve



FOR TENDER PURPOSES ONLY

CBS Consulting Engineers Salzgitter GmbH	
PROJECT TITLE: MEALE WATER SUPPLY AND SANITATION PROJECT	
DRAWING TITLE: NABATATA INTAKE - TRANSMISSION MAIN	
DESIGNED: Thomas Weber	SCALE: 1:100
DRAWN: Simon Aichele	FORMAT: A1
APPROVED: Oliver Sandemann	DATE: May 2015
DRAWING NO.: WABPMB/14/P-002	
SHEET NO.: 2 of 8	REVISION: 1



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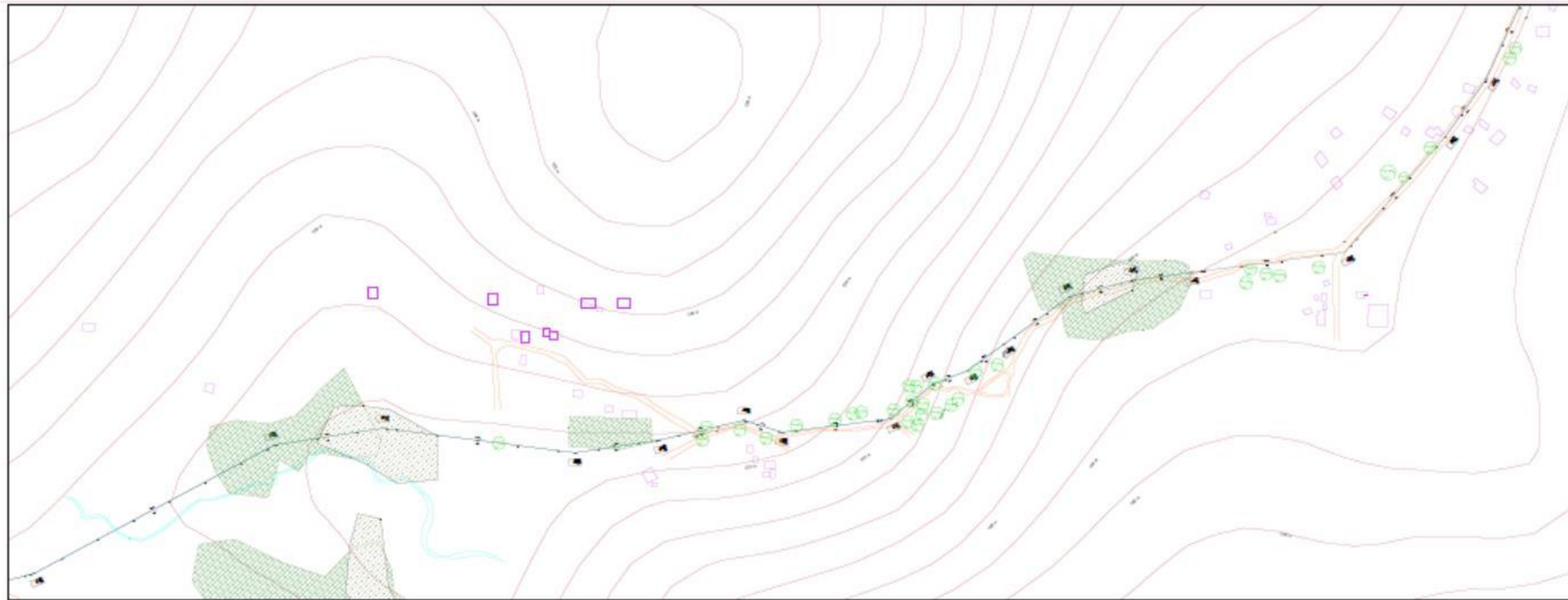
FOR TENDER PURPOSES ONLY!



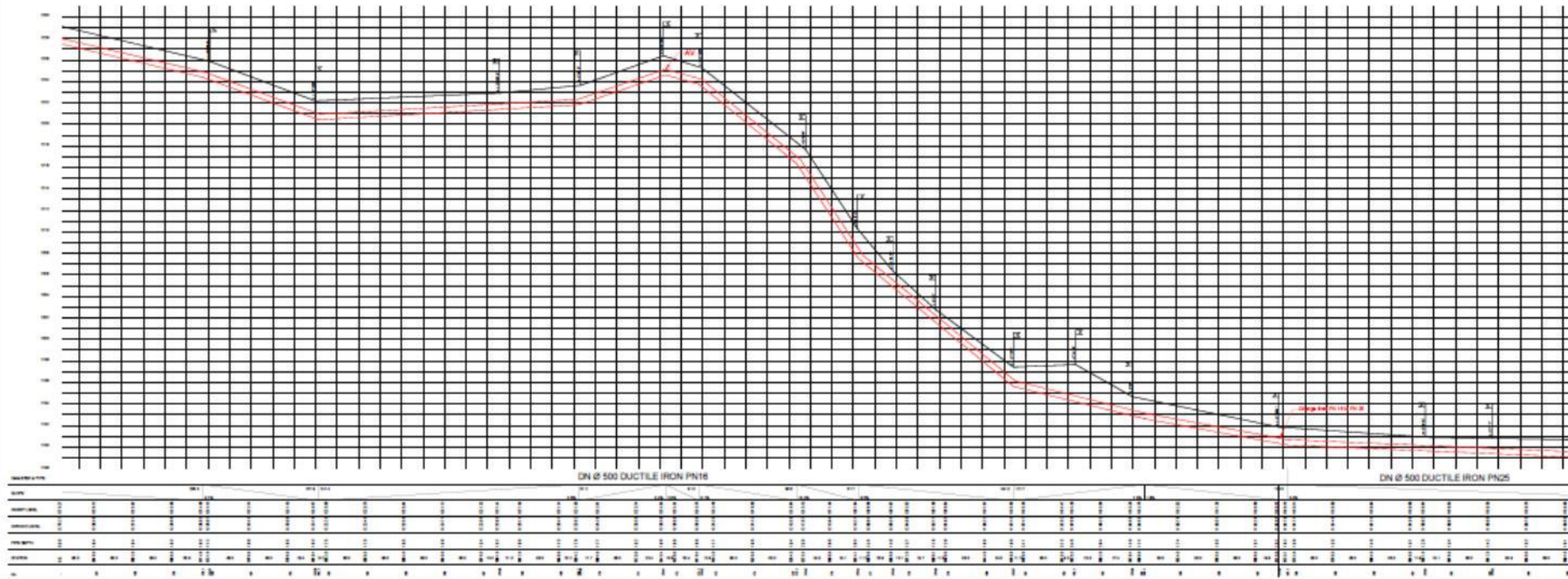
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DRAWING TITLE:
NAMATAKA INTAKE -
TRANSMISSION MAIN

	NAME	SCALE: 1:10
DESIGNED:	Thomas Miller	FORMAT: A1
DRAWN:	Robert Smith	DATE: May 2000
APPROVED:	John Green	
DRAWING NO.: WHP/MSA-6-P-002		
SHEET NO.:	4 of 8	REVISION: 1

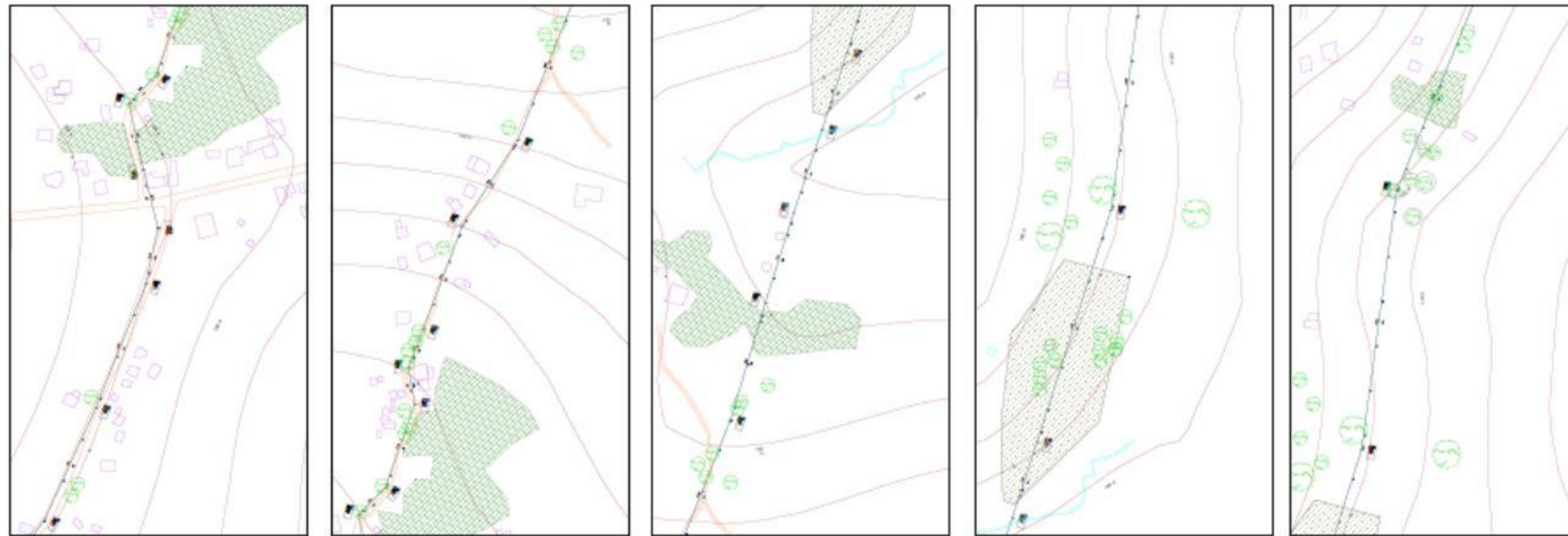


LEGEND	
	Tree
	Road
	Pipe line
	Contour
	House
	Rock & Boulders
	Forest
WO	Wash out
WO with IV	Wash out with isolation valve
AV	Air valve

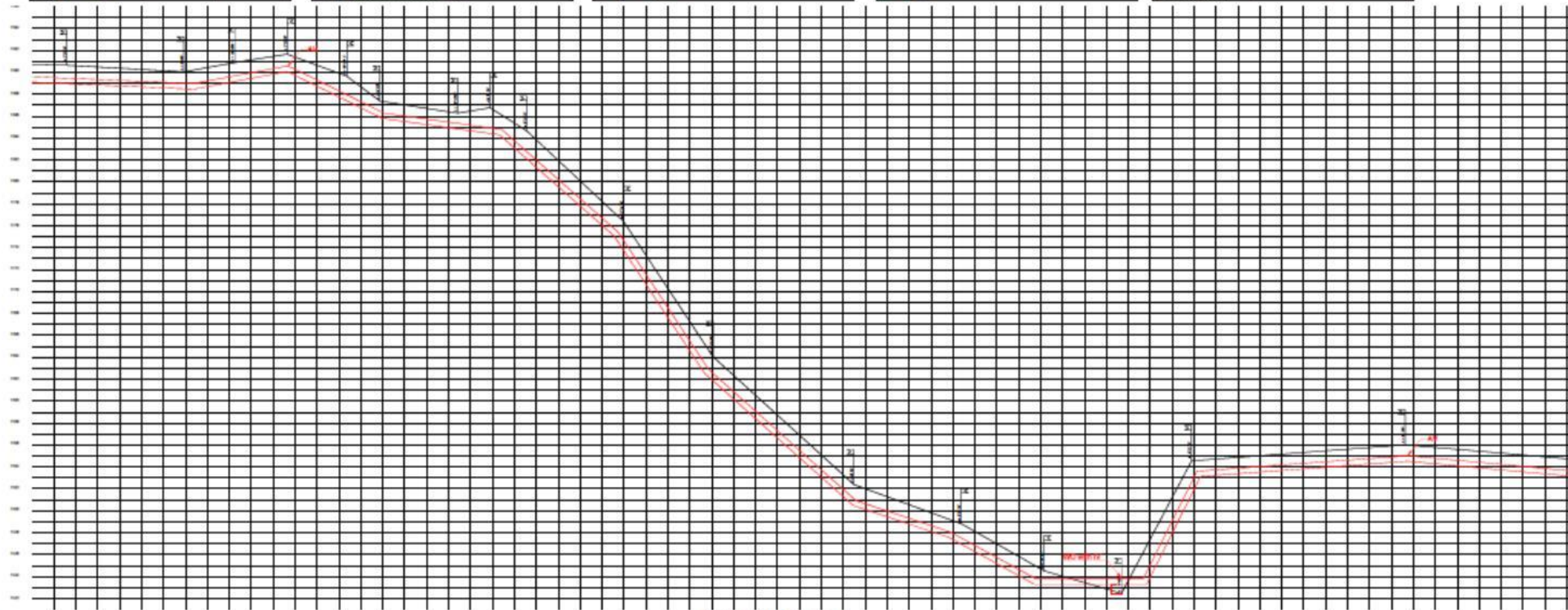


FOR TENDER PURPOSES ONLY

PROJECT TITLE: MBALE WATER SUPPLY AND SANITATION PROJECT	
DRAWING TITLE: NAMATKA INTAKE - TRANSMISSION MAIN	
DESIGNED:	SCALE: 1:100
DRAWN:	DATE: May 2019
APPROVED:	
DRAWING NO.: WSDP/MBAL/P-002	
SHEET NO.: 1 of 1	REVISION: 1

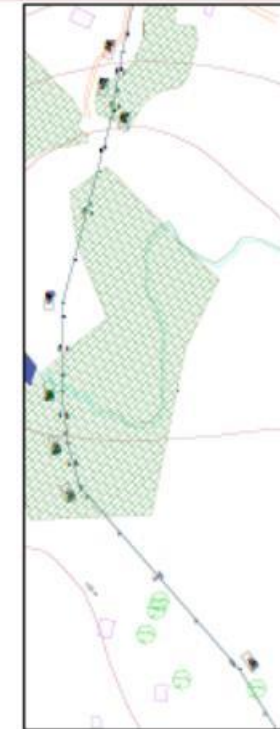
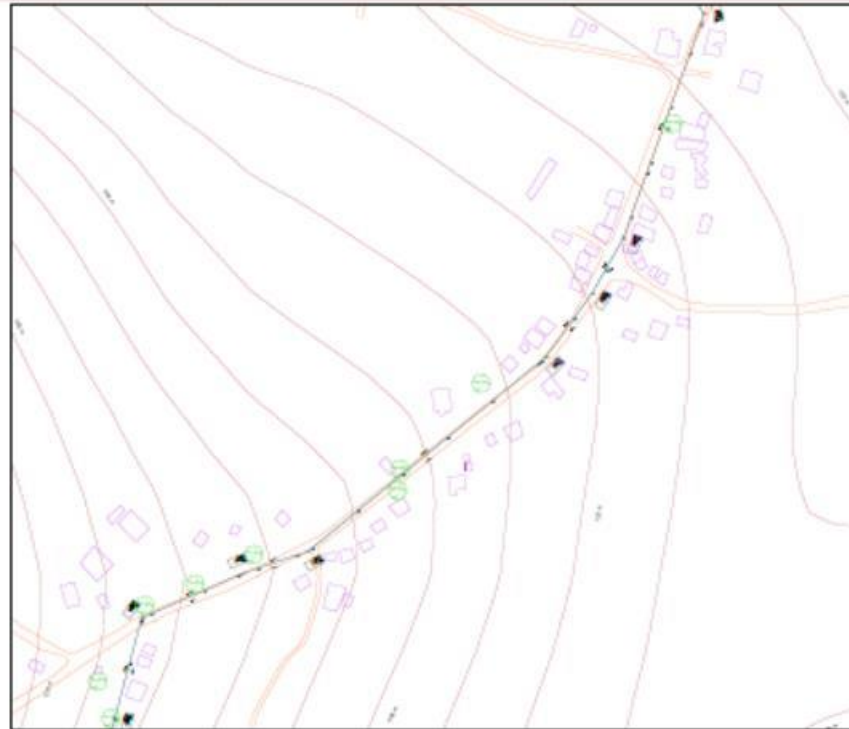


LEGEND	
	Tree
	Road
	Pipe line
	Contour
	House
	Rock & Boulders
	Forest
WO	Wash out
WO with IV	Wash out with isolation valve
AV	Air valve

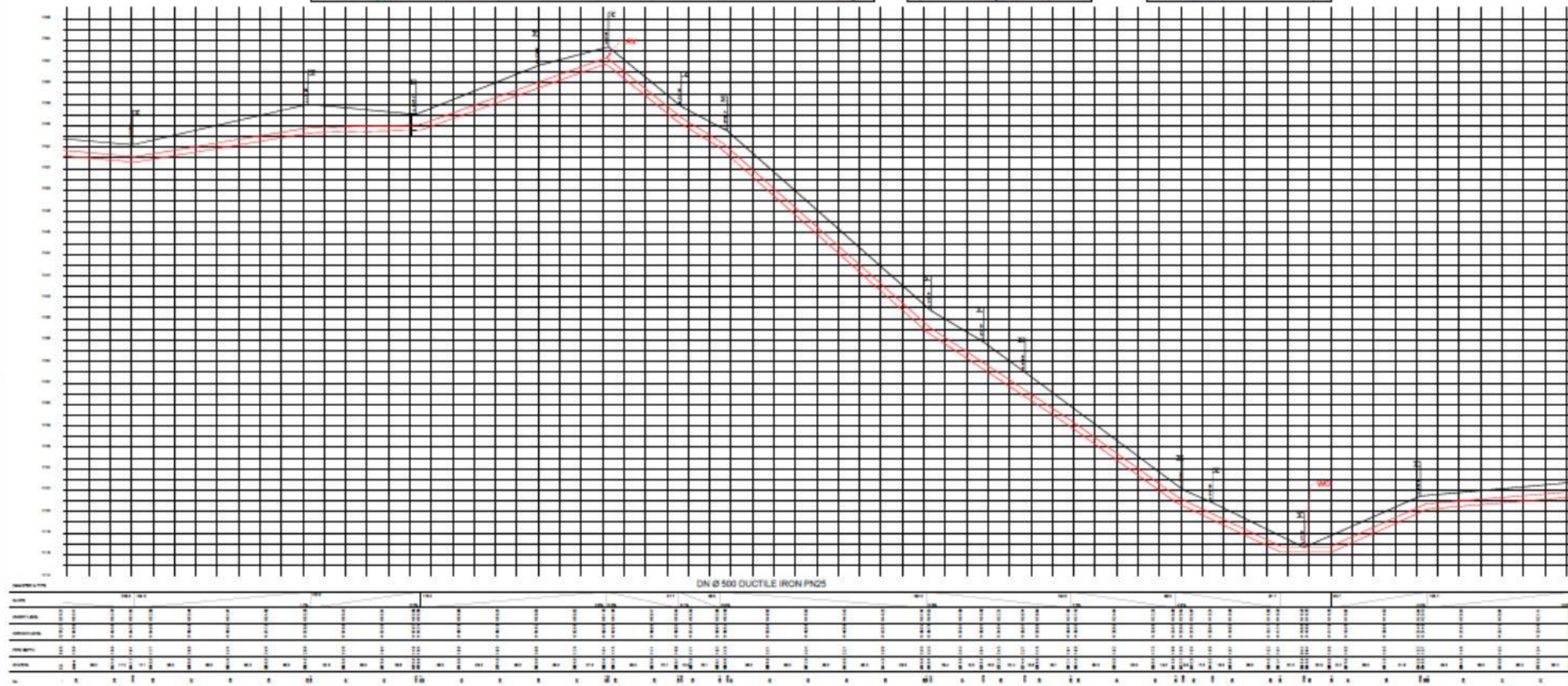


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 The Republic of Uganda MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT WATER AND SANITATION COORDINATOR	
 CBS Consulting Engineers Salzgitter GmbH	
PROJECT TITLE: MEALE WATER SUPPLY AND SANITATION PROJECT	
DRAWING TITLE: NAMKATA INTAKE - TRANSMISSION MAIN	
DESIGNED: Thomas Weber	SCALE: 1:50
DRAWN: Simon Jucker	DATE: May 2019
APPROVED: Simon Jucker	
DRAWING NO.: WSP/MS/SP/002	
SHEET NO.: 8 of 8	REVISION: 1

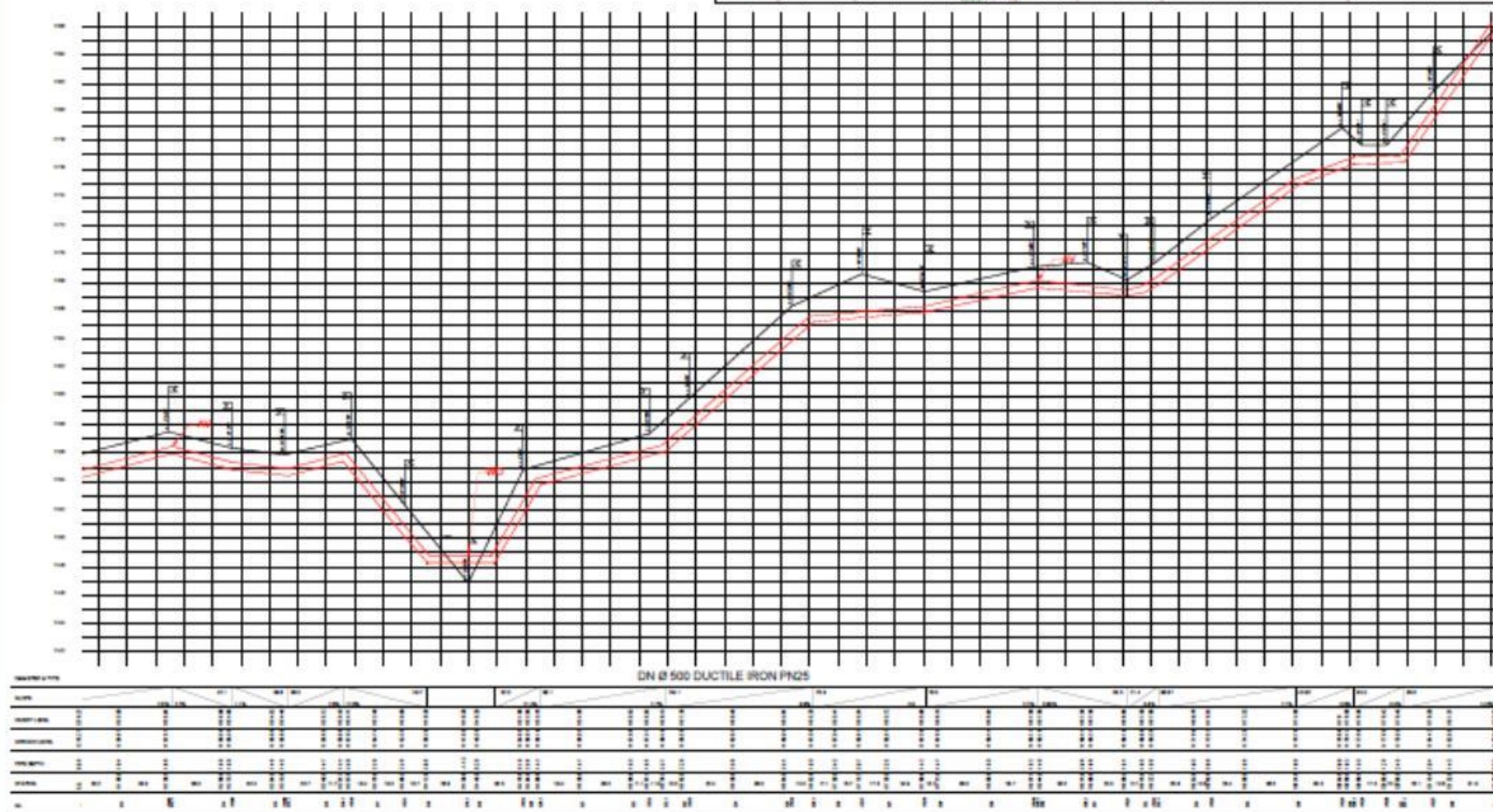
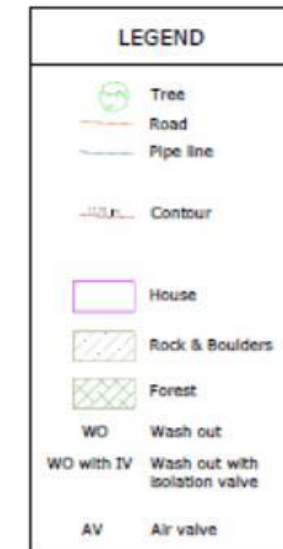
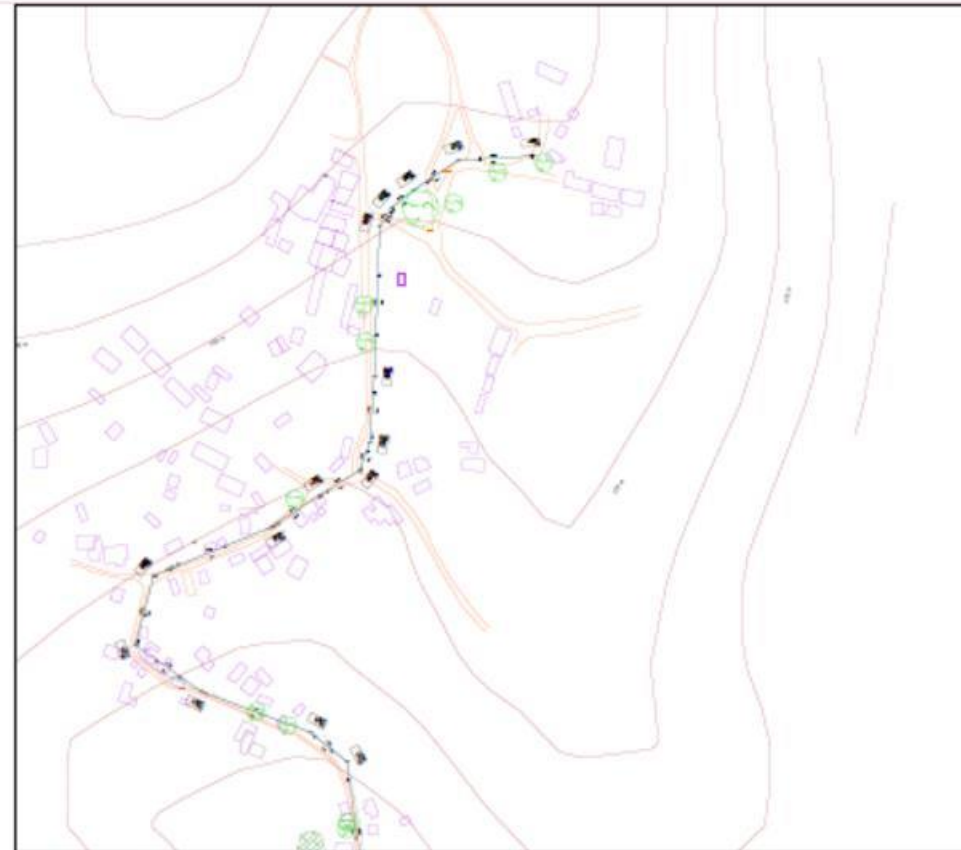



LEGEND	
	Tree
	Road
	Pipe line
	Contour
	House
	Rock & Boulders
	Forest
WO	Wash out
WO with IV	Wash out with isolation valve
AV	Air valve



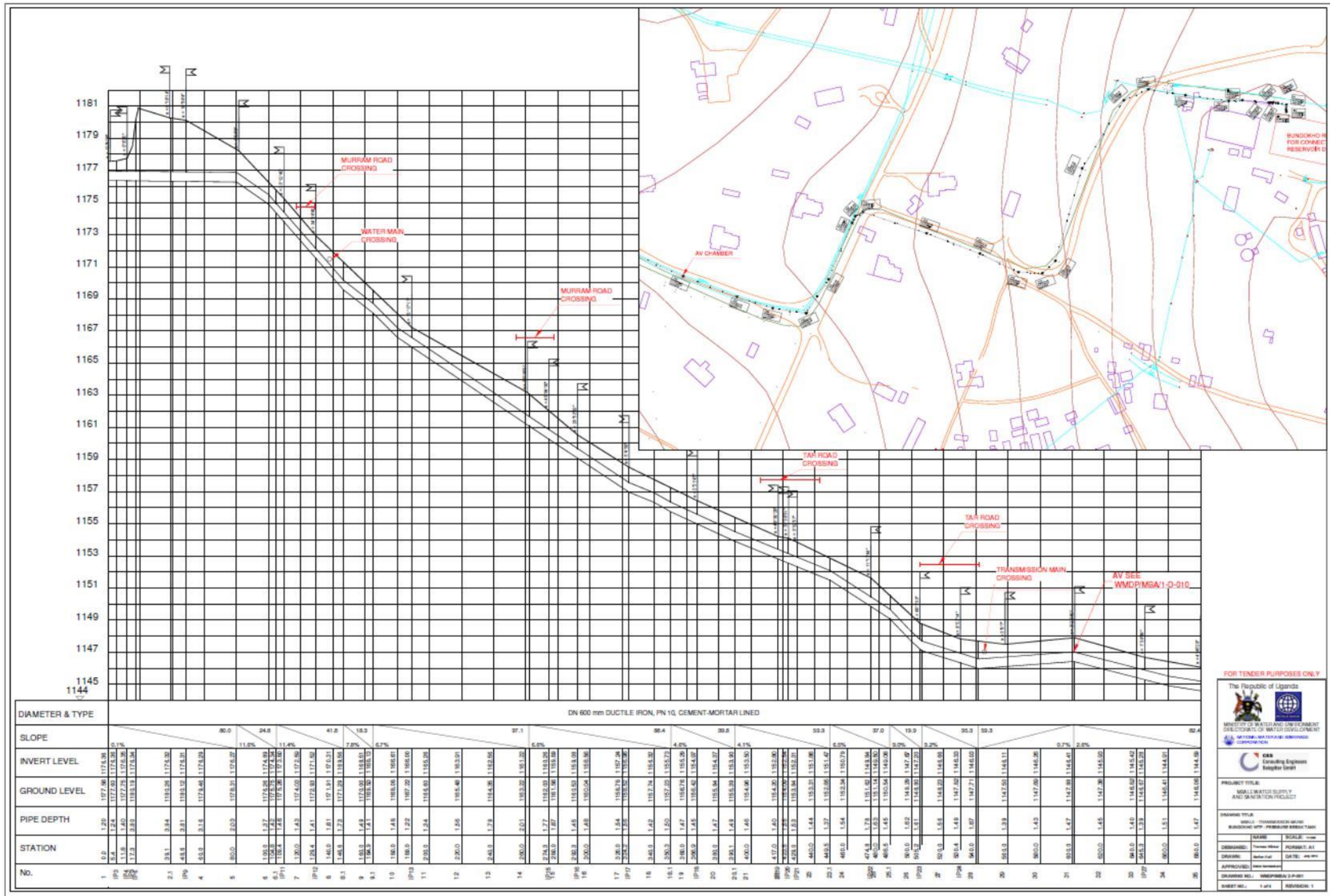
FOR TENDER PURPOSES ONLY!

 The Republic of Uganda MINISTRY OF WATER AND ENERGY DIRECTORATE OF WATER DEVELOPMENT WATER SUPPLY AND SANITATION CONTROL	
 CBS Consulting Engineers Subziyir Gash	
PROJECT TITLE: MEALE WATER SUPPLY AND SANITATION PROJECT	
DRAWING TITLE: NAMATOLA INTAKE - TRANSMISSION MAIN	
DESIGNED:	SCALE: 1:50
DRAWN:	FORMAT: A1
APPROVED:	DATE: May 2014
DRAWING NO.: WSP/MB/SP-002	
SHEET NO.: 7 of 8	REVISION: 1



FOR TENDER PURPOSES ONLY									
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 <p>GES Consulting Engineers Sulzinger GmbH</p>									
<p>PROJECT TITLE:</p> <p style="text-align: center;">MEALE WATER SUPPLY AND SANITATION PROJECT</p>									
<p>DRAWING TITLE:</p> <p style="text-align: center;">NIMATKALA INTAKE - TRANSMISSION MAIN</p>									
	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">NAME</td> <td style="width: 50%;">SCALE 1:400</td> </tr> <tr> <td>DESIGNED: Thomas Atkinson</td> <td>FORMAT: A1</td> </tr> <tr> <td>DRAWN: Stefan Jochel</td> <td>DATE: May 2009</td> </tr> <tr> <td>APPROVED: Stefan Jochel</td> <td></td> </tr> </table>	NAME	SCALE 1:400	DESIGNED: Thomas Atkinson	FORMAT: A1	DRAWN: Stefan Jochel	DATE: May 2009	APPROVED: Stefan Jochel	
NAME	SCALE 1:400								
DESIGNED: Thomas Atkinson	FORMAT: A1								
DRAWN: Stefan Jochel	DATE: May 2009								
APPROVED: Stefan Jochel									
<p>DRAWING NO.: WSP/MBWA/P-002</p>									
SHEET NO.: 8 of 8	REVISION: 1								

MBALE TRANSMISSION MAIN



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The Republic of Uganda
MINISTRY OF WATER AND ENVIRONMENT
DEPARTMENT OF WATER DEVELOPMENT
Uganda Water and Sewerage Corporation

PROJECT TITLE:
MUSALWA WATER SUPPLY
AND SANITATION PROJECT

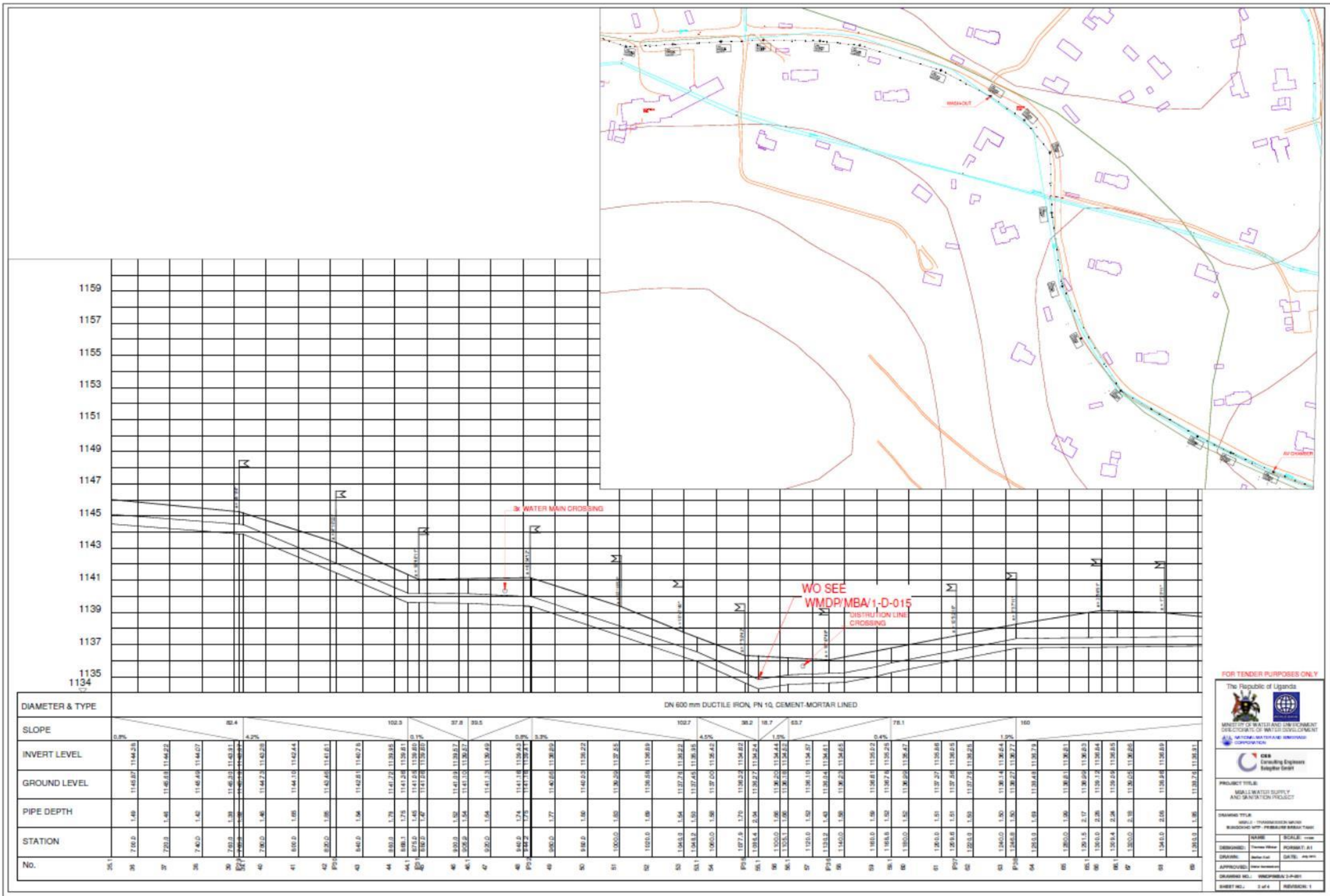
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WALLS - TRANSMISSION MAIN
BUNDOKHO WTP - PERIMETER BREAKTANK

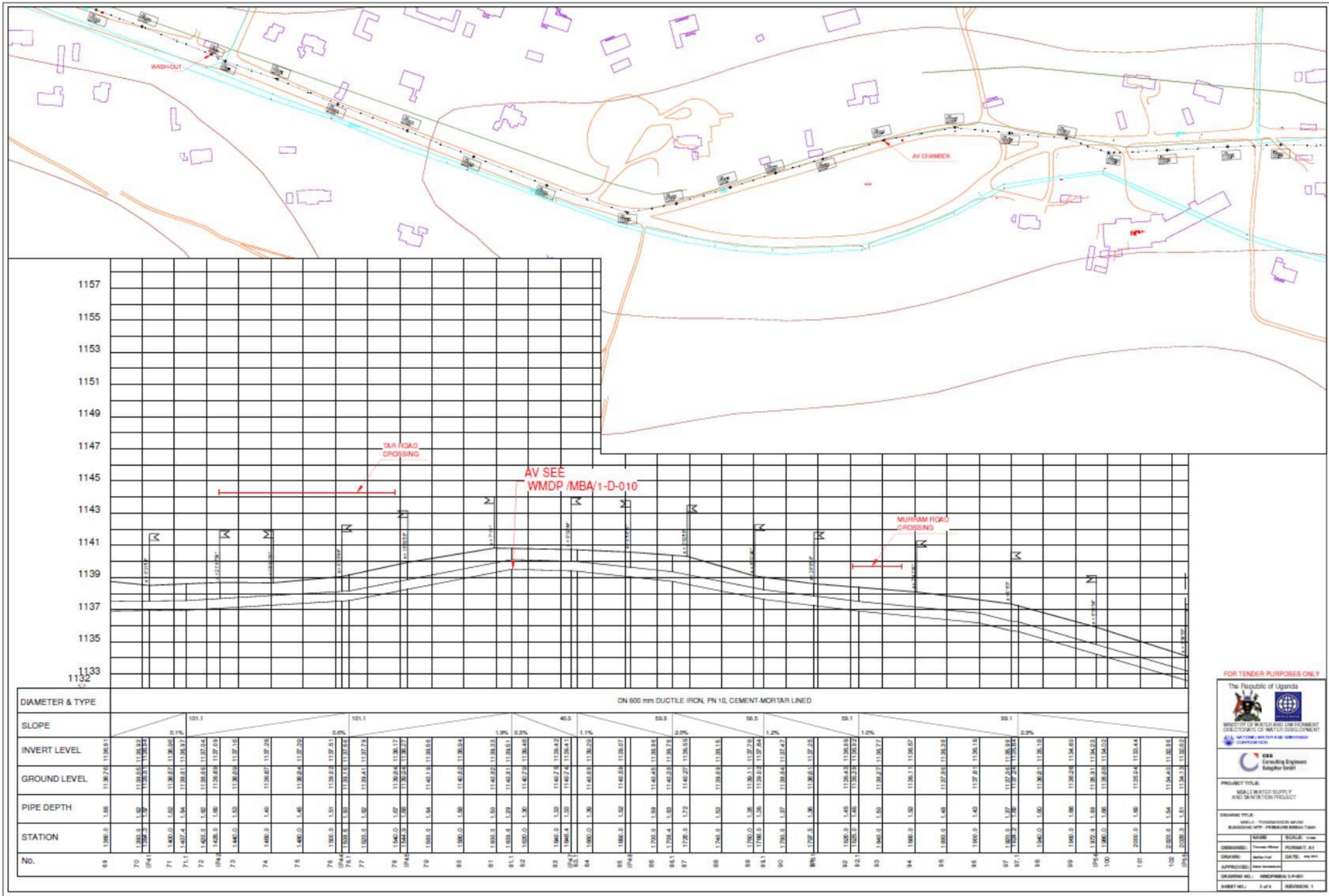
NAME	SCALE
DESIGNED: Thomas Mubiru	FORMAT: A1
DRAWN: Andrew Chacha	DATE: 04/09/2018
APPROVED: [Signature]	

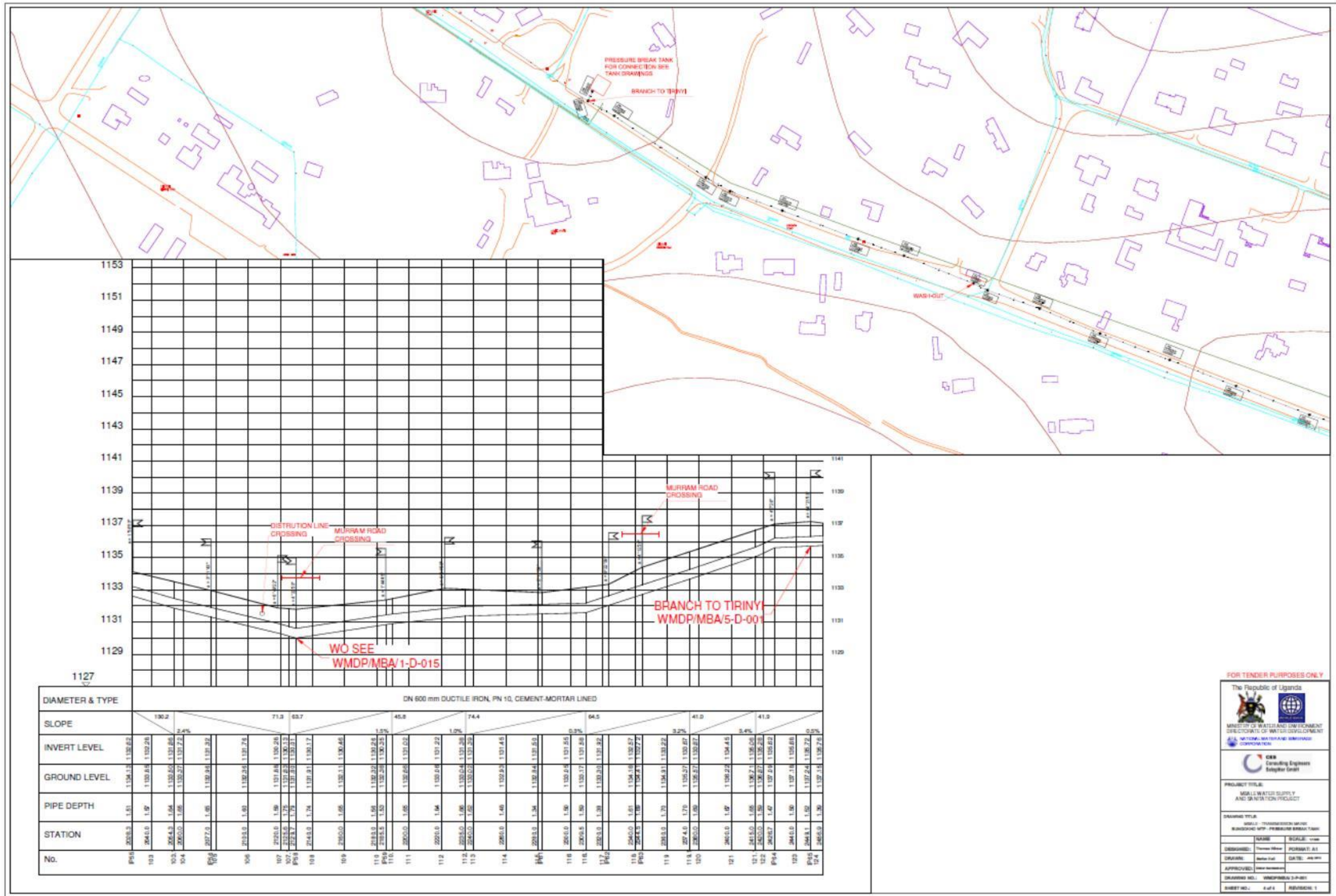
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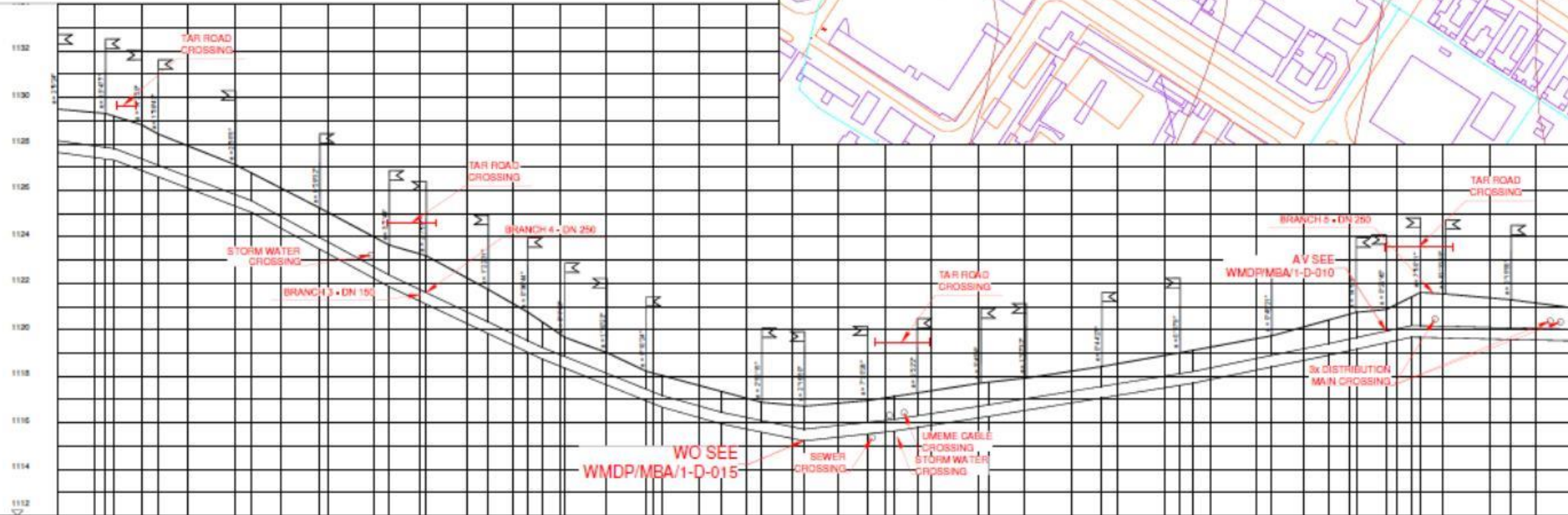
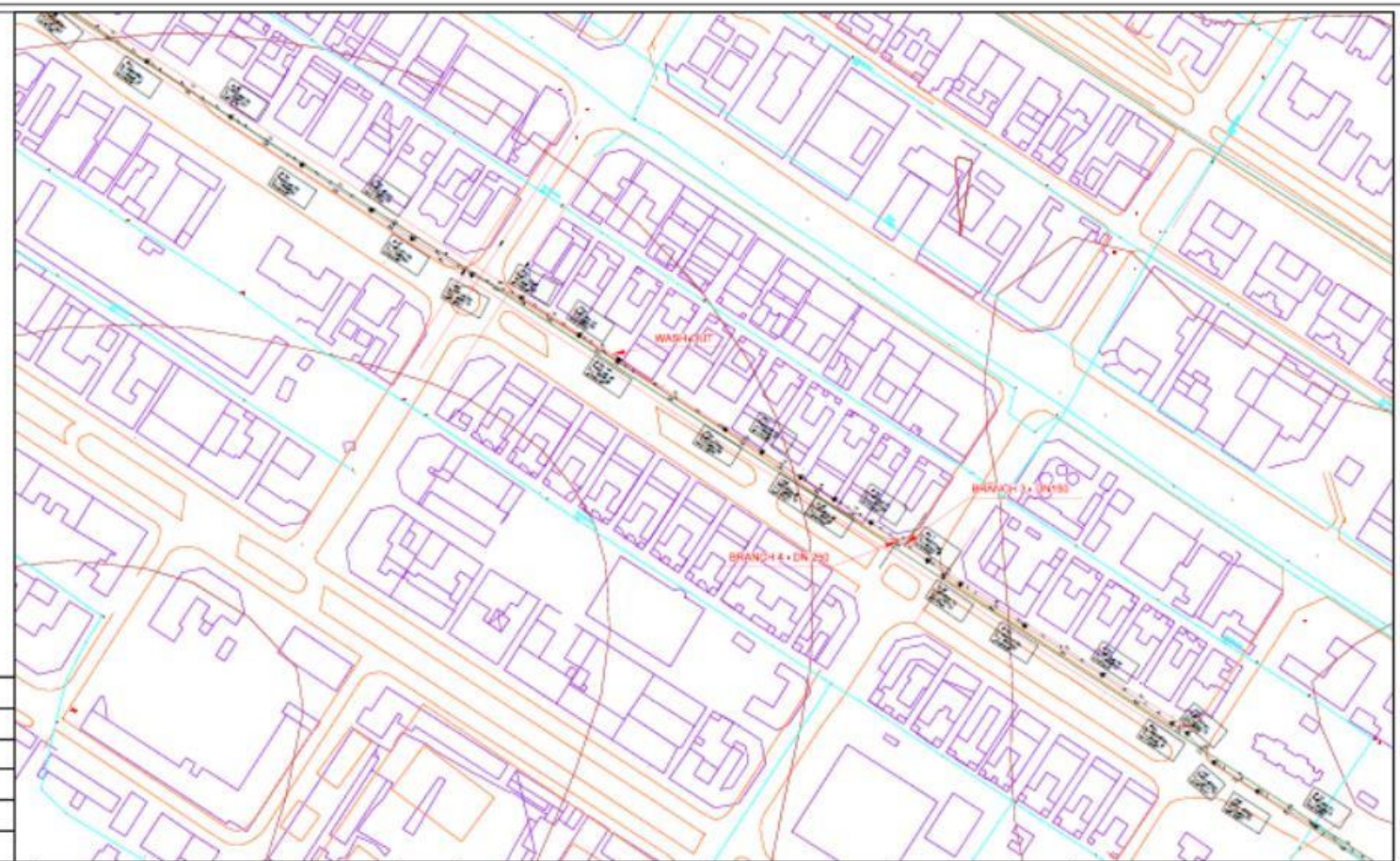
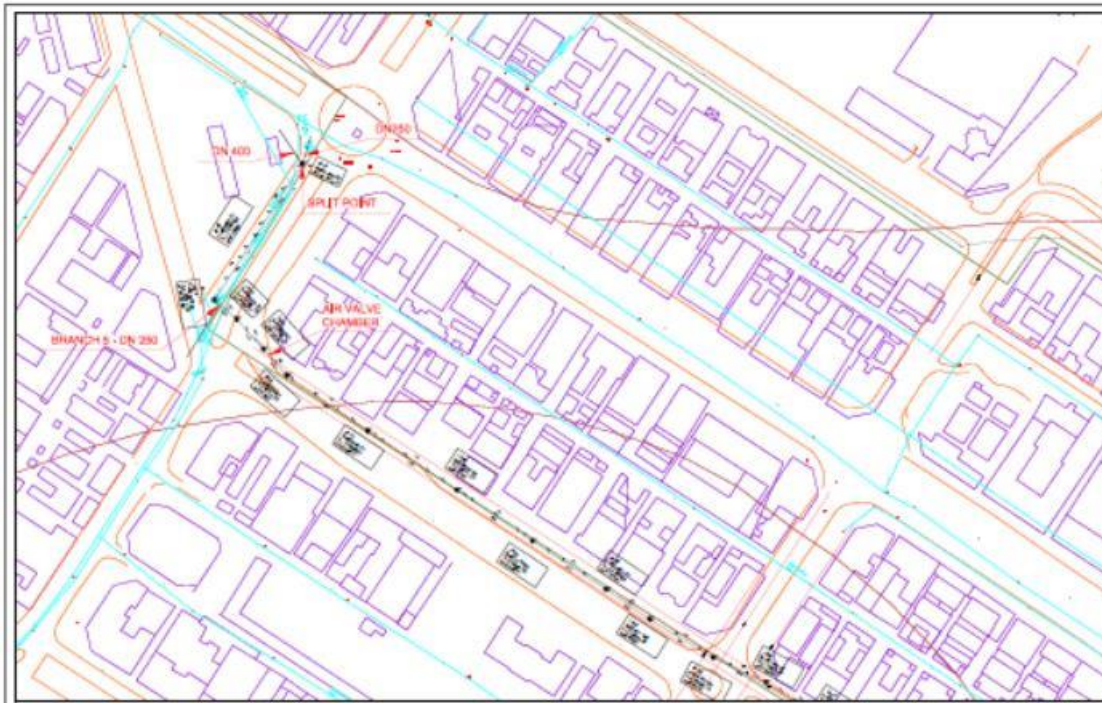
SHEET NO.: 1 OF 1

REVISION: 1









DIAMETER & TYPE		DN 500 mm DUCTILE IRON, PN 10, CEMENT-MORTAR LINED																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
SLOPE		30.0				30.1				30.2				30.3				30.4				30.5				30.6				30.7				30.8				30.9				31.0				31.1				31.2				31.3				31.4				31.5				31.6				31.7				31.8				31.9				32.0				32.1				32.2				32.3				32.4				32.5				32.6				32.7				32.8				32.9				33.0				33.1				33.2				33.3				33.4				33.5				33.6				33.7				33.8				33.9				34.0				34.1				34.2				34.3				34.4				34.5				34.6				34.7				34.8				34.9				35.0				35.1				35.2				35.3				35.4				35.5				35.6				35.7				35.8				35.9				36.0				36.1				36.2				36.3				36.4				36.5				36.6				36.7				36.8				36.9				37.0				37.1				37.2				37.3				37.4				37.5				37.6				37.7				37.8				37.9				38.0				38.1				38.2				38.3				38.4				38.5				38.6				38.7				38.8				38.9				39.0				39.1				39.2				39.3				39.4				39.5				39.6				39.7				39.8				39.9				40.0				40.1				40.2				40.3				40.4				40.5				40.6				40.7				40.8				40.9				41.0				41.1				41.2				41.3				41.4				41.5				41.6				41.7				41.8				41.9				42.0				42.1				42.2				42.3				42.4				42.5				42.6				42.7				42.8				42.9				43.0				43.1				43.2				43.3				43.4				43.5				43.6				43.7				43.8				43.9				44.0				44.1				44.2				44.3				44.4				44.5				44.6				44.7				44.8				44.9				45.0				45.1				45.2				45.3				45.4				45.5				45.6				45.7				45.8				45.9				46.0				46.1				46.2				46.3				46.4				46.5				46.6				46.7				46.8				46.9				47.0				47.1				47.2				47.3				47.4				47.5				47.6				47.7				47.8				47.9				48.0				48.1				48.2				48.3				48.4				48.5				48.6				48.7				48.8				48.9				49.0				49.1				49.2				49.3				49.4				49.5				49.6				49.7				49.8				49.9				50.0				50.1				50.2				50.3				50.4				50.5				50.6				50.7				50.8				50.9				51.0				51.1				51.2				51.3				51.4				51.5				51.6				51.7				51.8				51.9				52.0				52.1				52.2				52.3				52.4				52.5				52.6				52.7				52.8				52.9				53.0				53.1				53.2				53.3				53.4				53.5				53.6				53.7				53.8				53.9				54.0				54.1				54.2				54.3				54.4				54.5				54.6				54.7				54.8				54.9				55.0				55.1				55.2				55.3				55.4				55.5				55.6				55.7				55.8				55.9				56.0				56.1				56.2				56.3				56.4				56.5				56.6				56.7				56.8				56.9				57.0				57.1				57.2				57.3				57.4				57.5				57.6				57.7				57.8				57.9				58.0				58.1				58.2				58.3				58.4				58.5				58.6				58.7				58.8				58.9				59.0				59.1				59.2				59.3				59.4				59.5				59.6				59.7				59.8				59.9				60.0				60.1				60.2				60.3				60.4				60.5				60.6				60.7				60.8				60.9				61.0				61.1				61.2				61.3				61.4				61.5				61.6				61.7				61.8				61.9				62.0				62.1				62.2				62.3				62.4				62.5				62.6				62.7				62.8				62.9				63.0				63.1				63.2				63.3				63.4				63.5				63.6				63.7				63.8				63.9				64.0				64.1				64.2				64.3				64.4				64.5				64.6				64.7				64.8				64.9				65.0				65.1				65.2				65.3				65.4				65.5				65.6				65.7				65.8				65.9				66.0				66.1				66.2				66.3				66.4				66.5				66.6				66.7				66.8				66.9				67.0				67.1				67.2				67.3				67.4				67.5				67.6				67.7				67.8				67.9				68.0				68.1				68.2				68.3				68.4				68.5				68.6				68.7				68.8				68.9				69.0				69.1				69.2				69.3				69.4				69.5				69.6				69.7				69.8				69.9				70.0				70.1				70.2				70.3				70.4				70.5				70.6				70.7				70.8				70.9				71.0				71.1				71.2				71.3				71.4				71.5				71.6				71.7				71.8				71.9				72.0				72.1				72.2				72.3				72.4				72.5				72.6				72.7				72.8				72.9				73.0				73.1				73.2				73.3				73.4				73.5				73.6				73.7				73.8				73.9				74.0				74.1				74.2				74.3				74.4				74.5				74.6				74.7				74.8				74.9				75.0				75.1				75.2				75.3				75.4				75.5				75.6				75.7				75.8				75.9				76.0				76.1				76.2				76.3				76.4				76.5				76.6				76.7				76.8				76.9				77.0				77.1				77.2				77.3				77.4				77.5				77.6				77.7				77.8				77.9				78.0				78.1				78.2				78.3				78.4				78.5				78.6				78.7				78.8				78.9				79.0				79.1				79.2				79.3				79.4				79.5				79.6				79.7				79.8				79.9				80.0				80.1				80.2				80.3				80.4				80.5				80.6				80.7				80.8				80.9				81.0				81.1				81.2				81.3				81.4				81.5				81.6				81.7				81.8				81.9				82.0				82.1				82.2				82.3				82.4				82.5				82.6				82.7				82.8				82.9				83.0				83.1				83.2				83.3				83.4				83.5				83.6				83.7				83.8				83.9				84.0				84.1				84.2				84.3				84.4				84.5				84.6				84.7				84.8				84.9				85.0				85.1				85.2				85.3				85.4				85.5				85.6				85.7				85.8				85.9				86.0				86.1				86.2				86.3				86.4				86.5				86.6				86.7				86.8				86.9				87.0				87.1				87.2				87.3				87.4				87.5				87.6				87.7				87.8				87.9				88.0				88.1				88.2				88.3				88.4				88.5				88.6				88.7				88.8				88.9				89.0				89.1				89.2				89.3				89.4				89.5				89.6				89.7				89.8				89.9				90.0				90.1				90.2				90.3				90.4				90.5				90.6				90.7				90.8				90.9				91.0				91.1				91.2				91.3				91.4				91.5				91.6				91.7				91.8				91.9				92.0				92.1				92.2				92.3				9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FOR TENDER PURPOSES ONLY

The Republic of Uganda

MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT

UWA NATIONAL WATER AND SEWERAGE CORPORATION

URS Consulting Engineers
Bogota, Colombia

PROJECT TITLE:
MSA WATER SUPPLY
AND SANITATION PROJECT

DRAWING TITLE:
WMDP/MSA/1-D-010
PRESSURE MAINS PLAN - CLOSURE

NAME: SCALE: 1:1000

DESIGNED: DATE: 01/01/2011

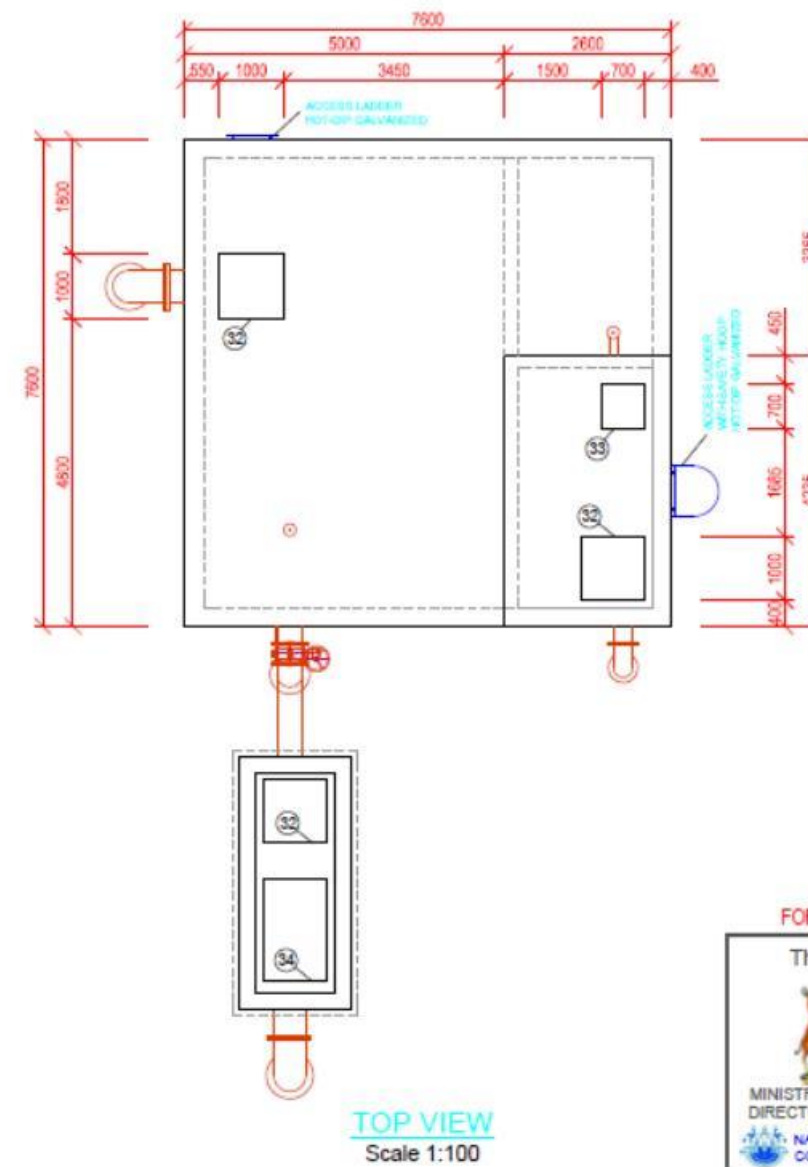
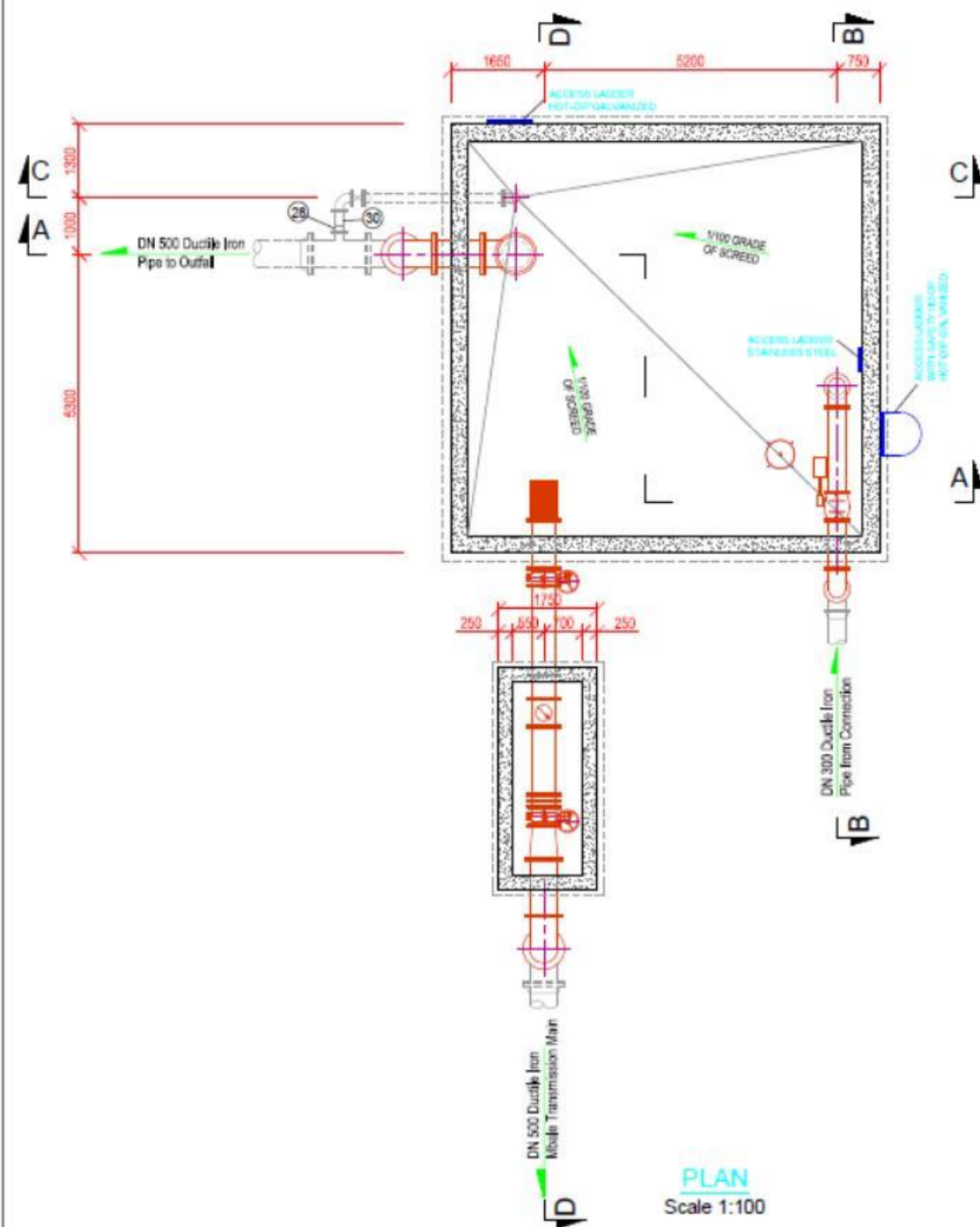
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APPROVED: DATE: 01/01/2011

DRAWING NO.: WMDP/MSA/1-D-010

SHEET NO.: 1 OF 1

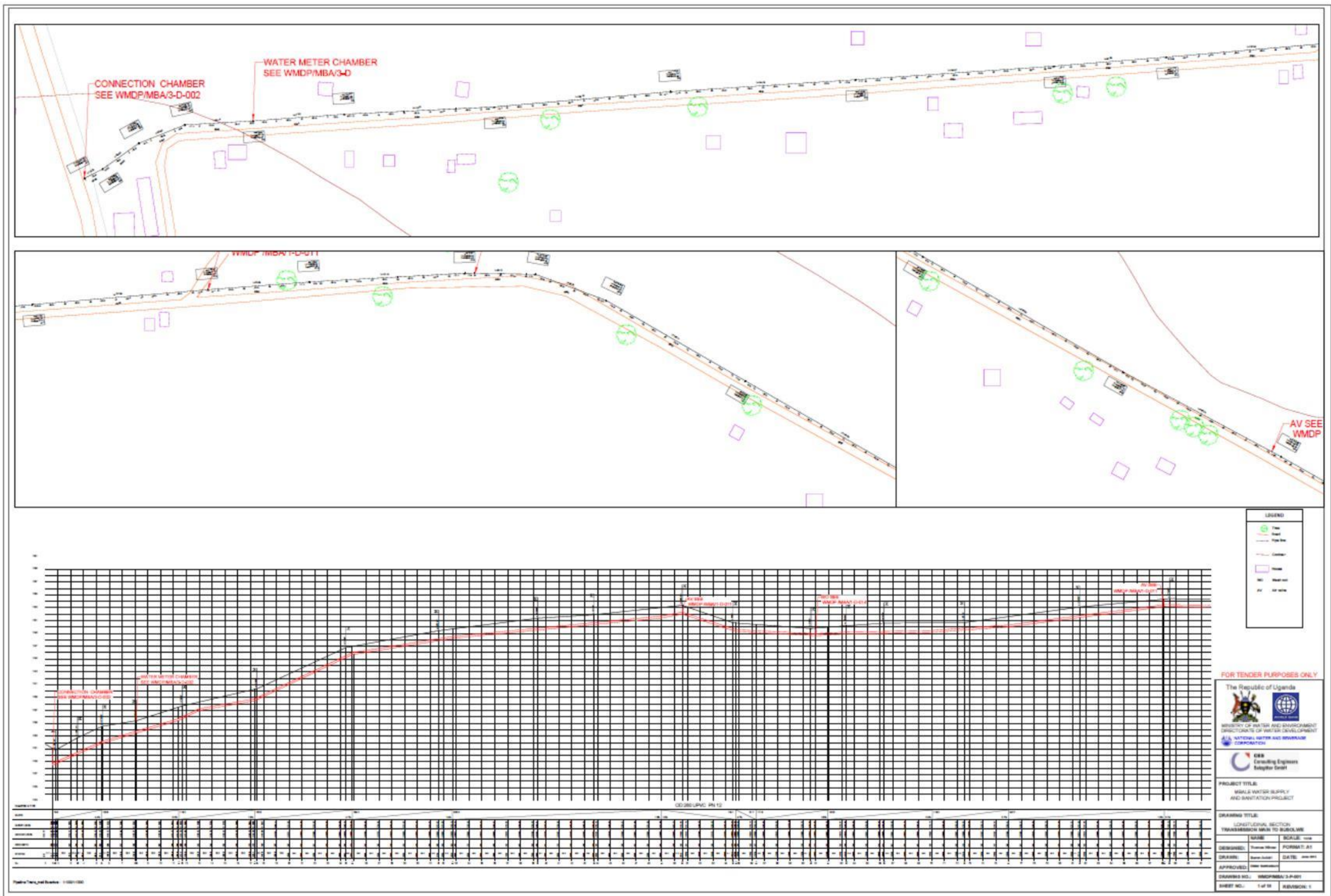
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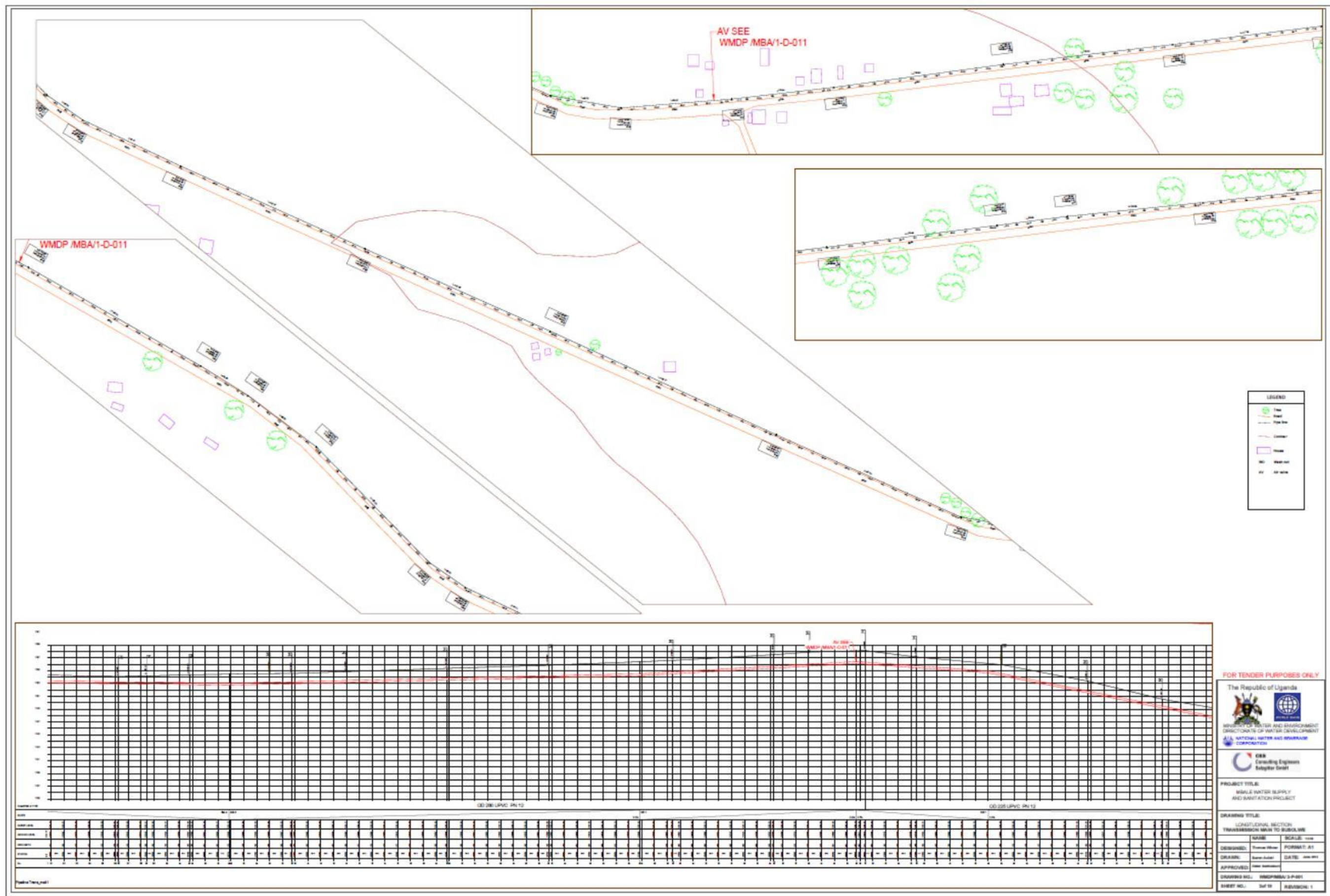


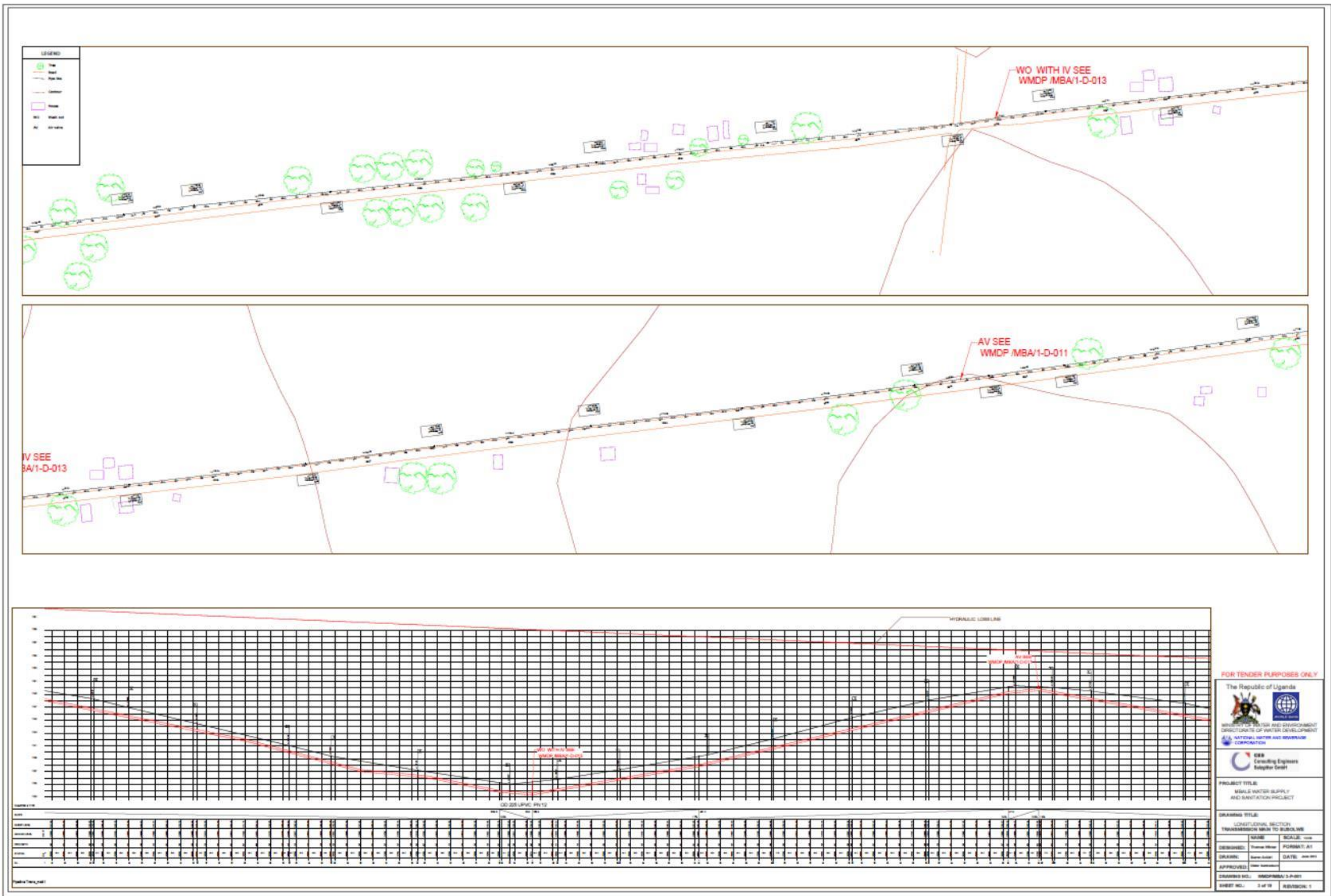
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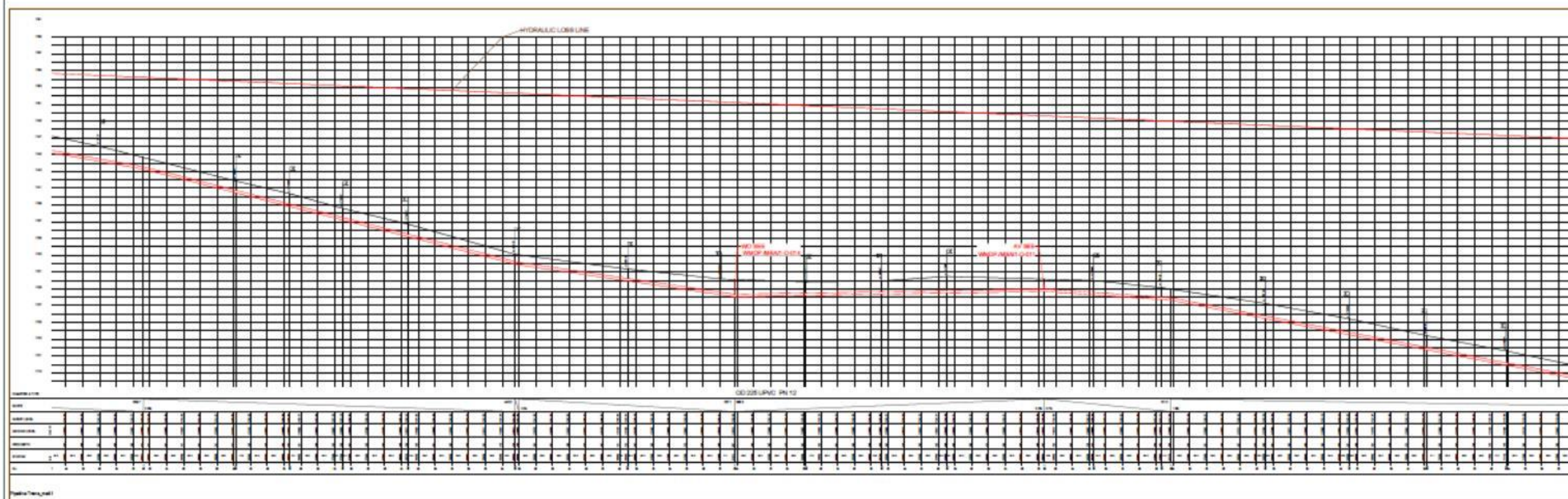
The Republic of Uganda		
 		
MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT		
NATIONAL WATER AND SEWERAGE CORPORATION		
 CES Consulting Engineers Salzgitter GmbH		
PROJECT TITLE: MBALE WATER SUPPLY AND SANITATION PROJECT		
DRAWING TITLE: MBALE - RESERVOIRS PRESSURE BREAK TANK		
	NAME	SCALE: as indicated
DESIGNED:	Thomas Winter	FORMAT: A3
DRAWN:	Stefan Hall	DATE: July 2018
APPROVED:	Dieter Gerdtschorn	
DRAWING NO.: WMDP/MBA/E-S-001		
SHEET NO.: 1 of 4	REVISION: 1	

BUSOLWE TRANSMISSION MAIN









LEGEND	
	Tree
	Prop. line
	Ground
	House
	Manhole
	AV valve

FOR TENDER PURPOSES ONLY

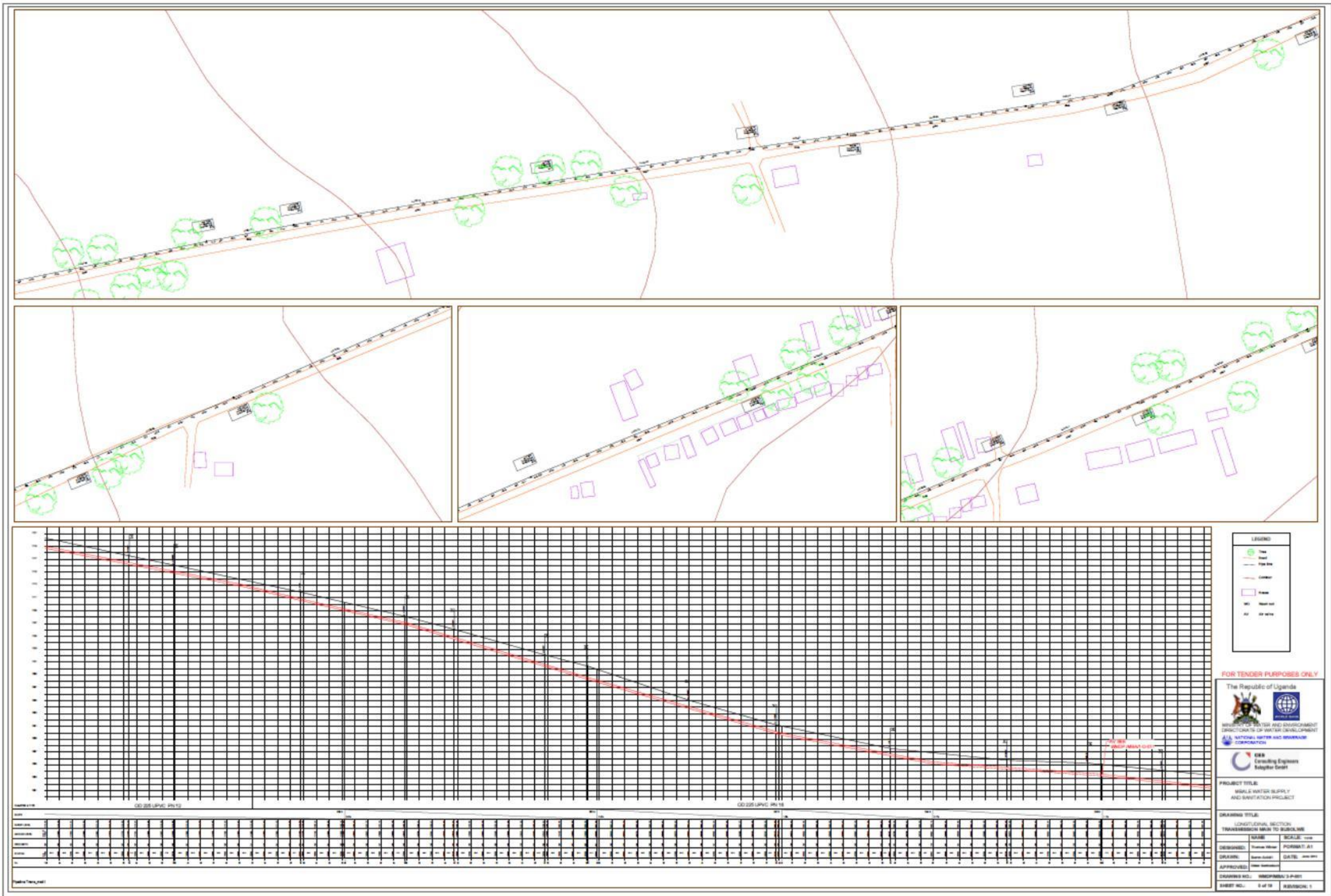


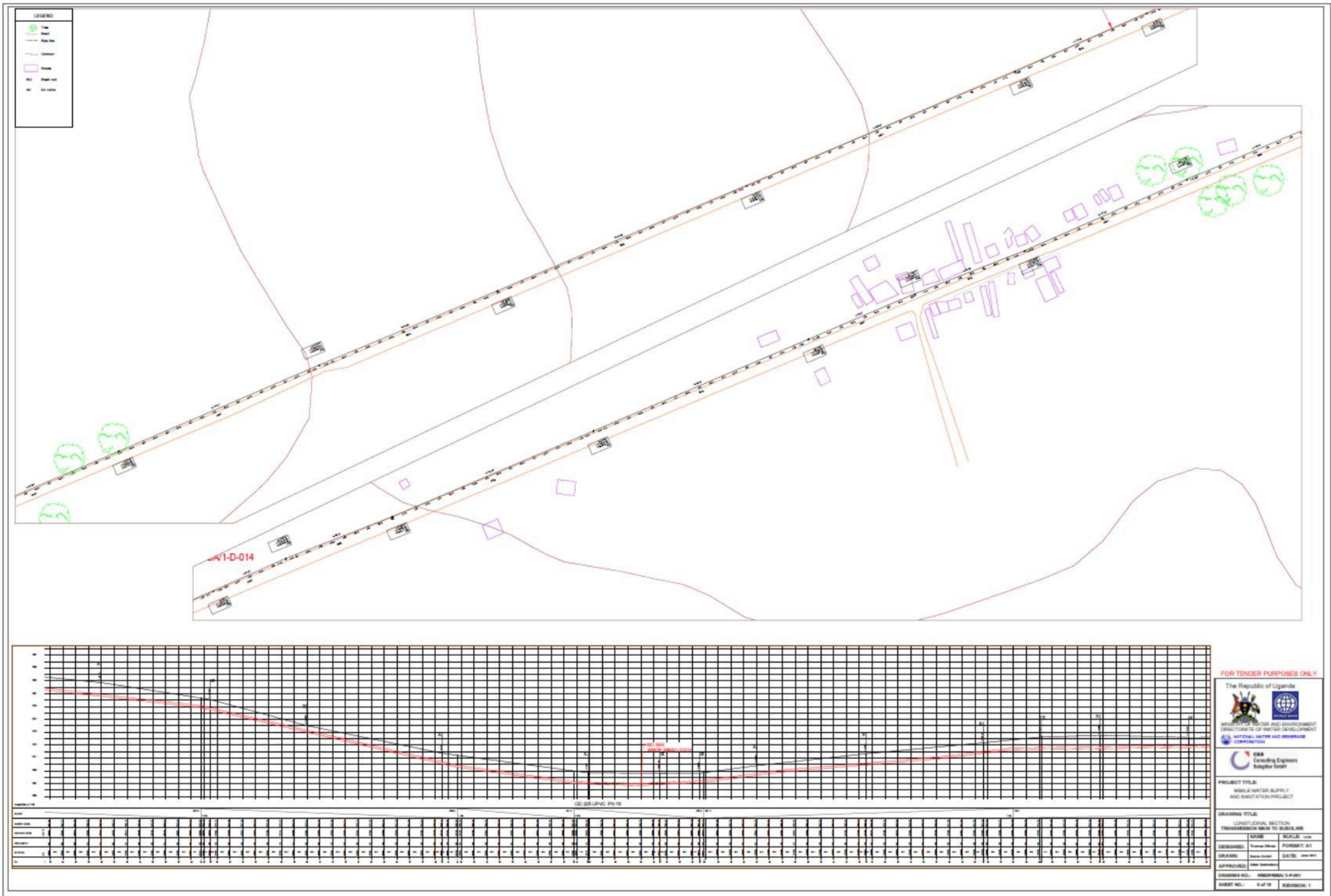
DESIGNING ENGINEERS
Bakula Group

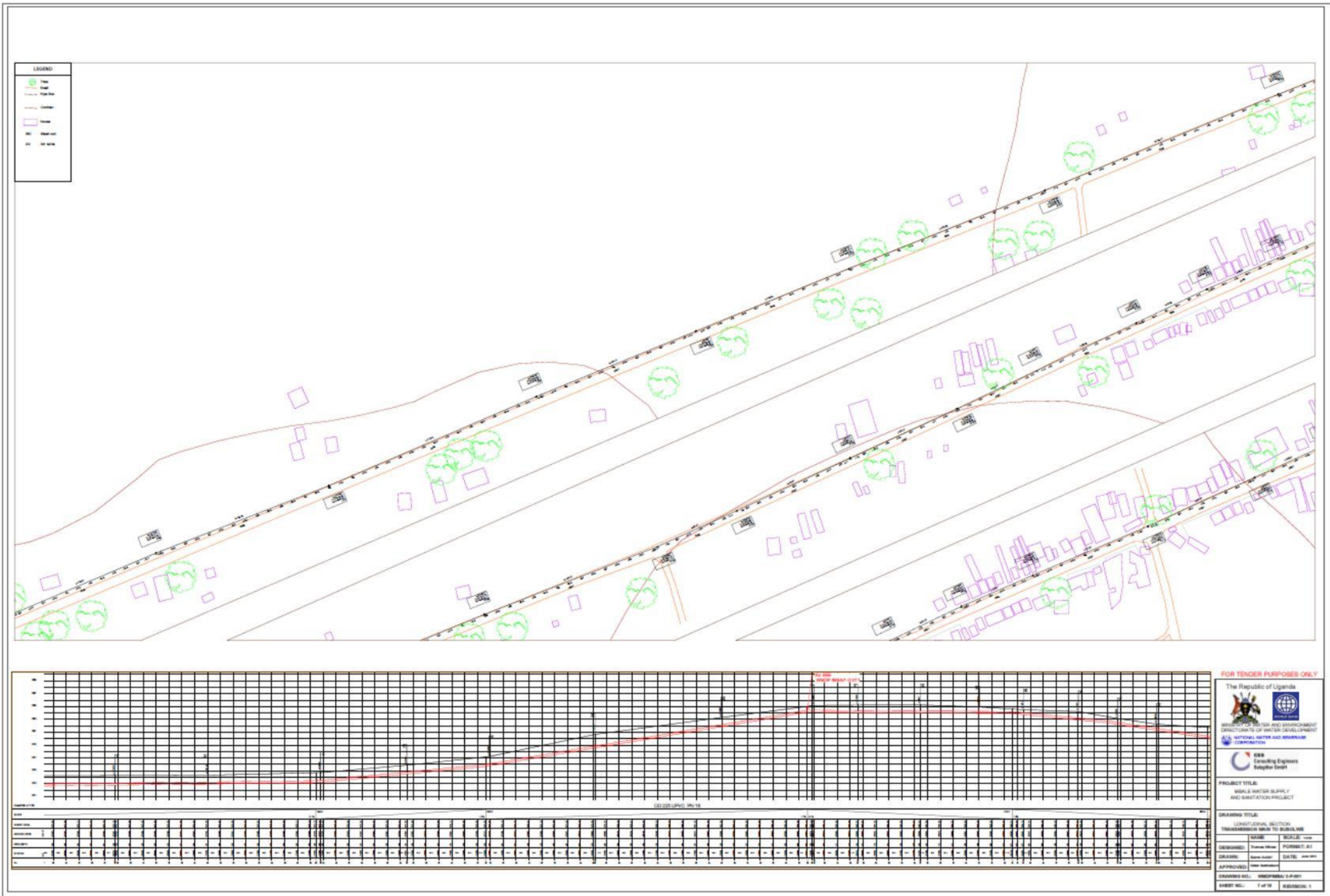
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WATER SUPPLY
AND SANITATION PROJECT

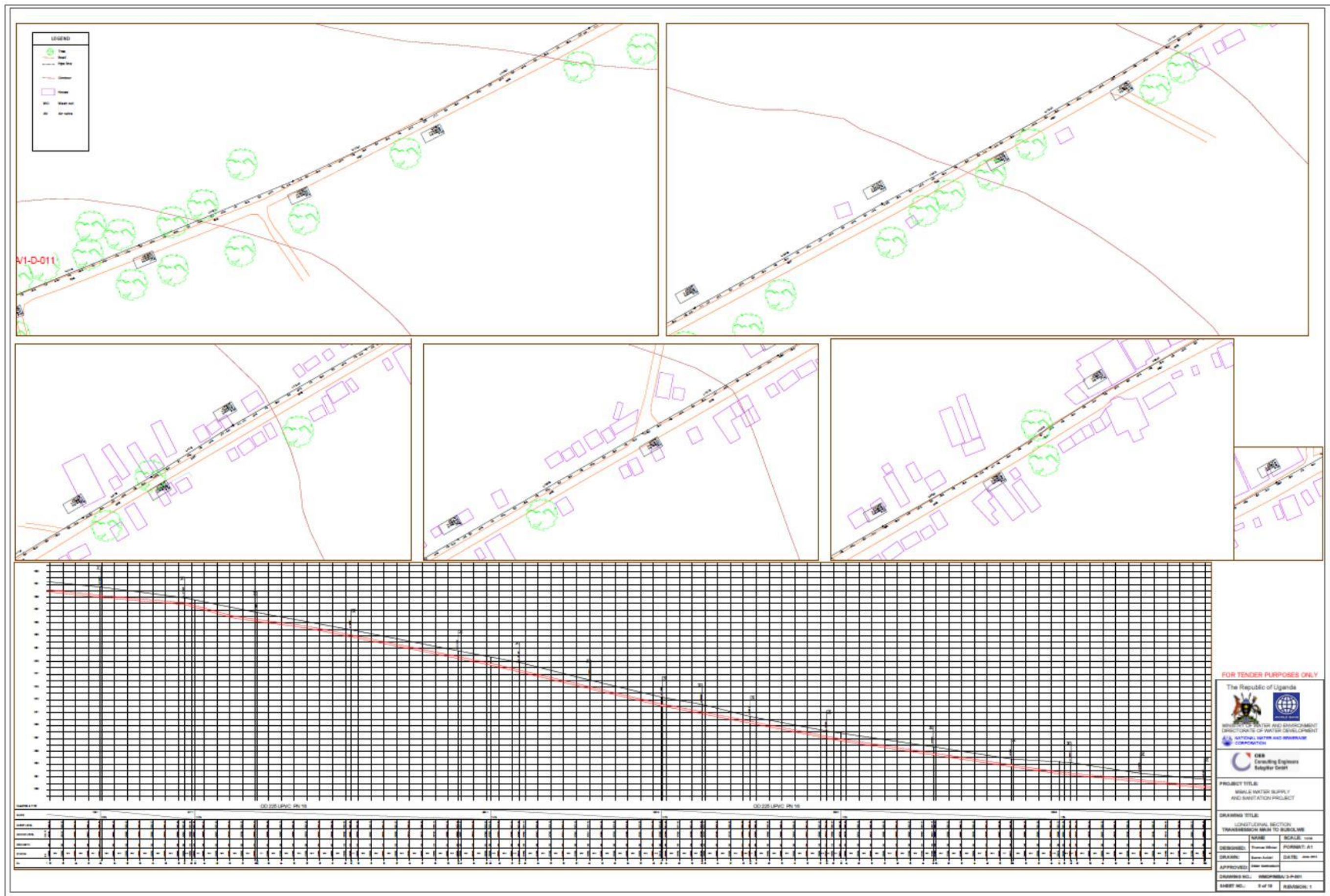
DRAWING TITLE:
LONGITUDINAL SECTION
TRANSMISSION MAIN TO SUBSTATION

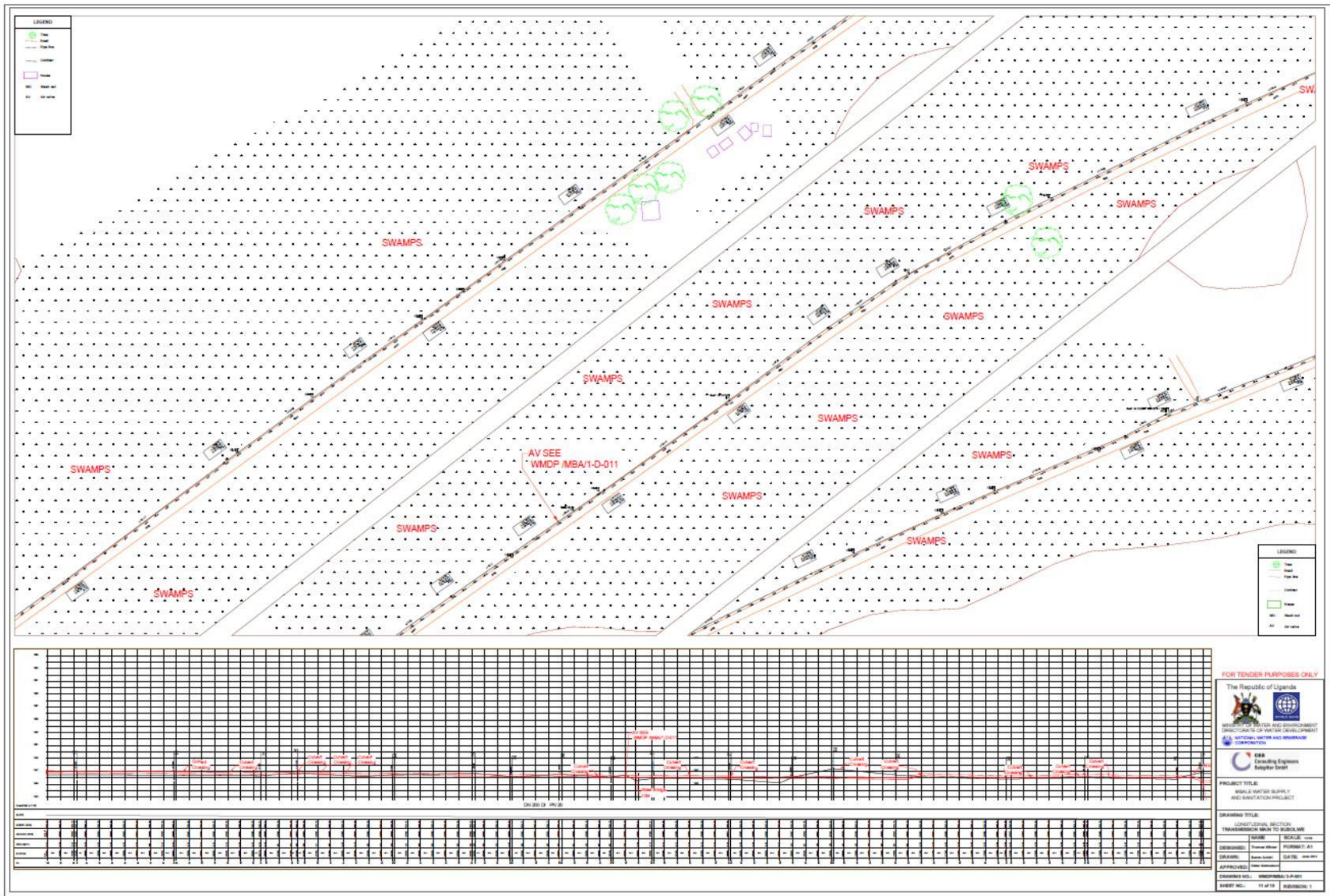
NAME	SCALE
DESIGNED: Thomas Mubiru	FORMAT: A1
DRAWN: Bakula Group	DATE: 2019/07/19
APPROVED: Bakula Group	
DRAWING NO.: WMDP/MBA/1-D-011	
SHEET NO.: 4 of 10	REVISION: 1

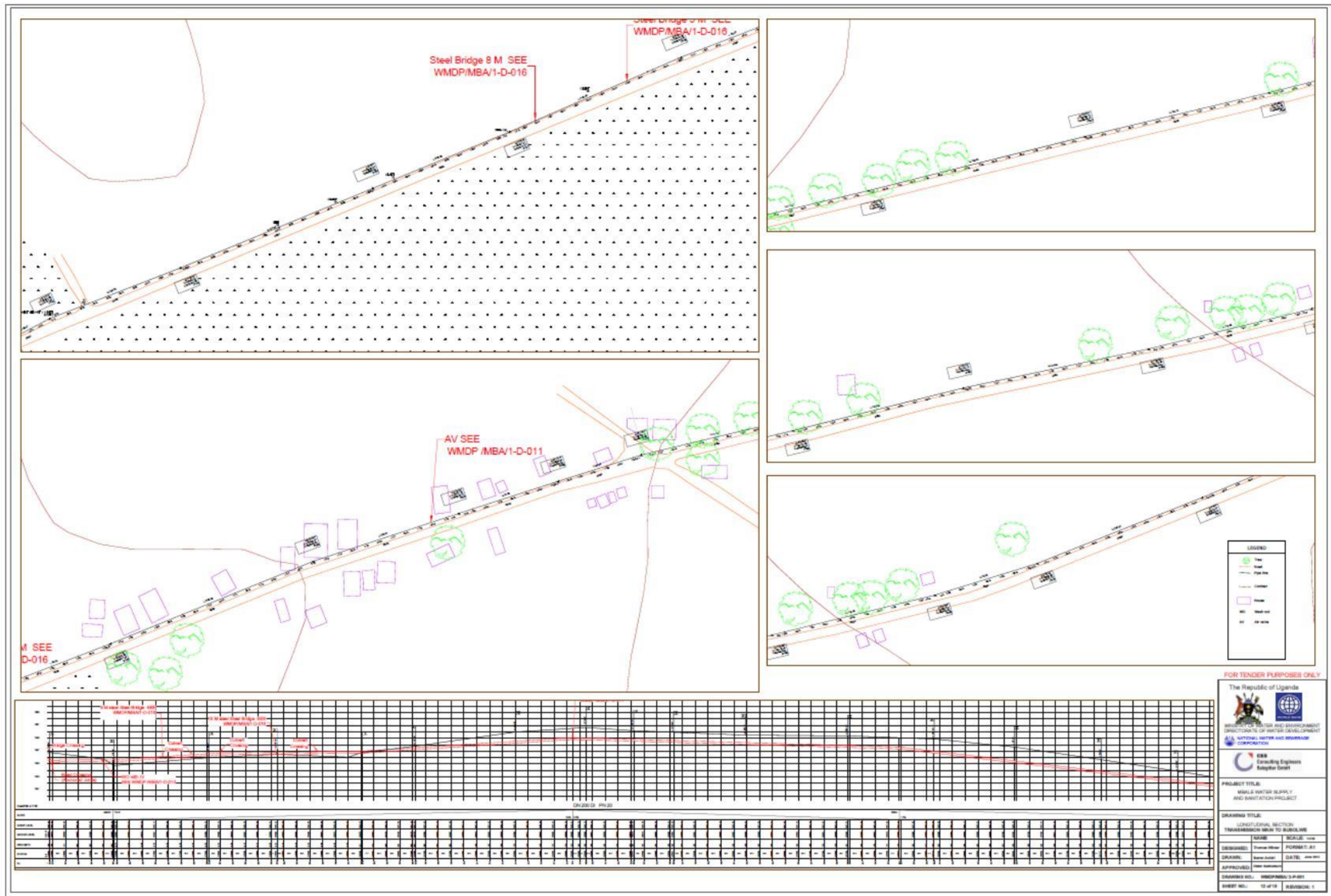


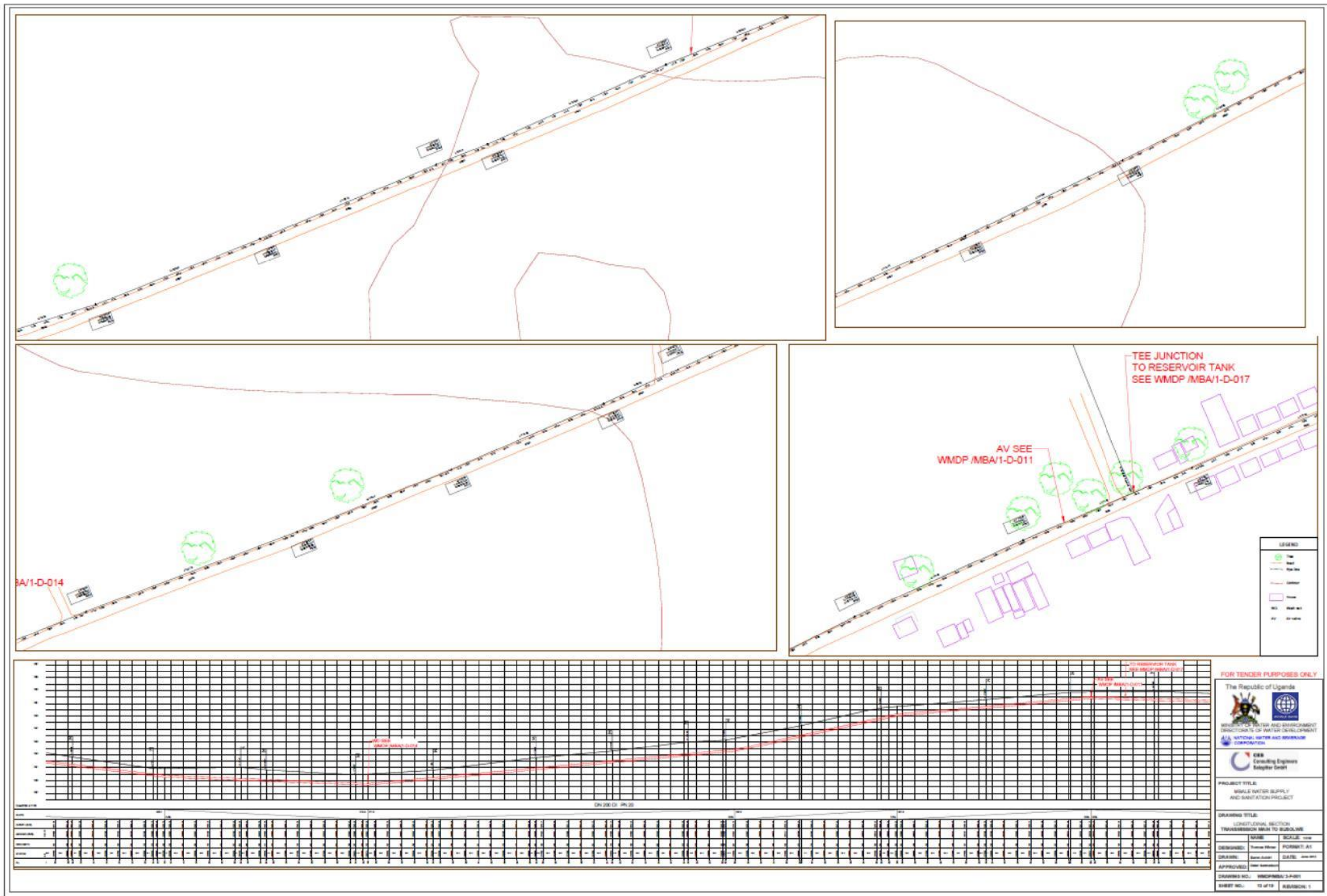


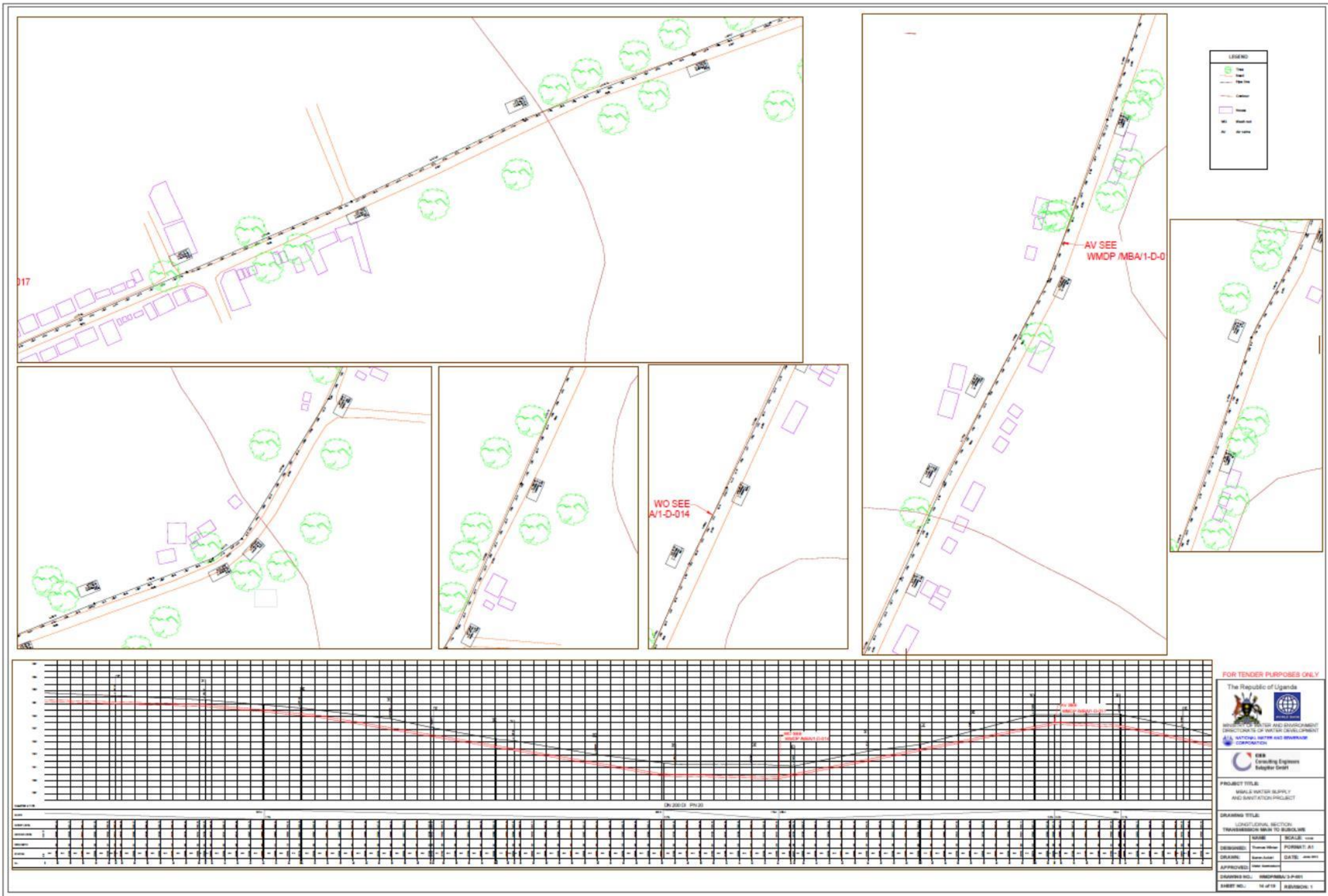


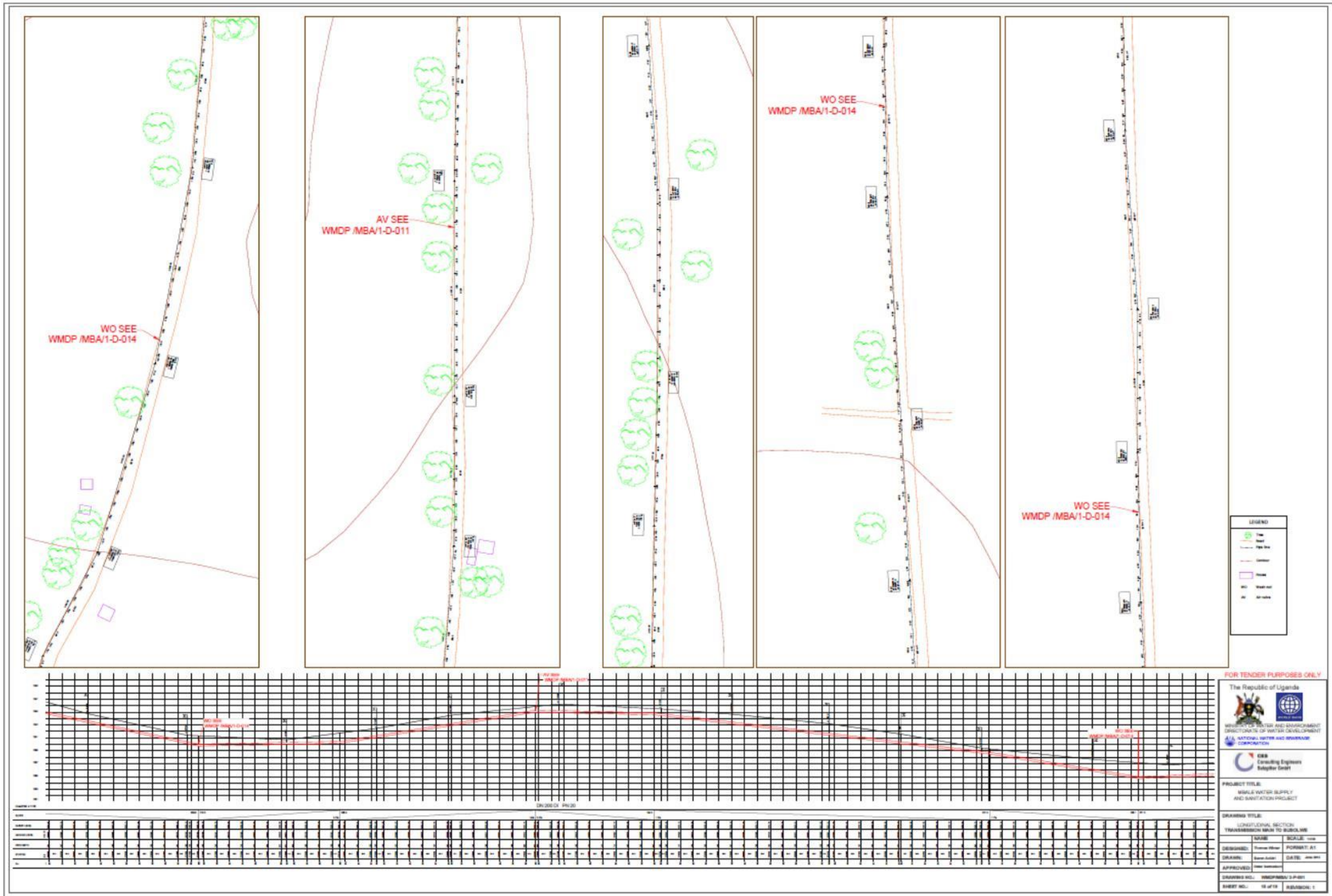


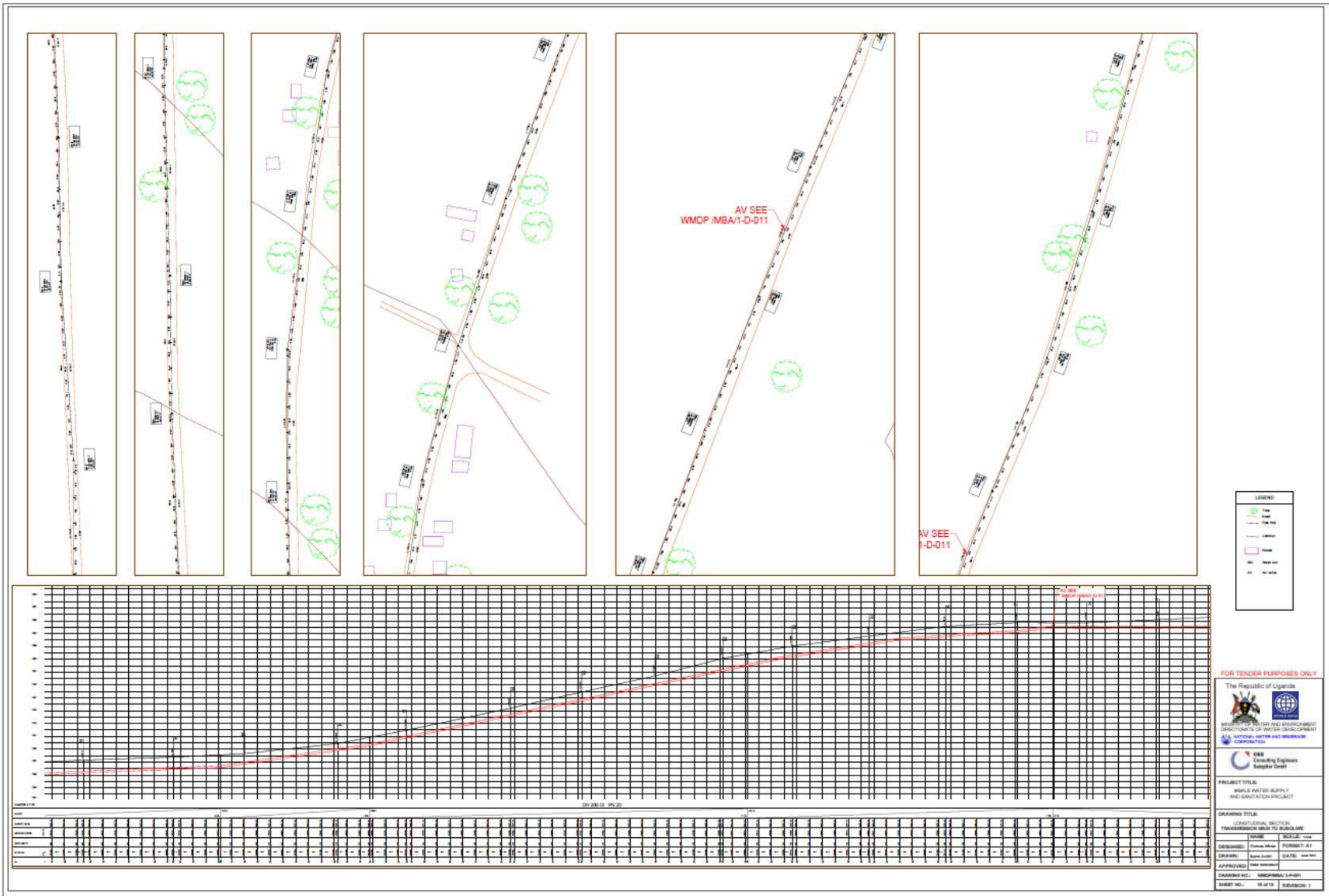


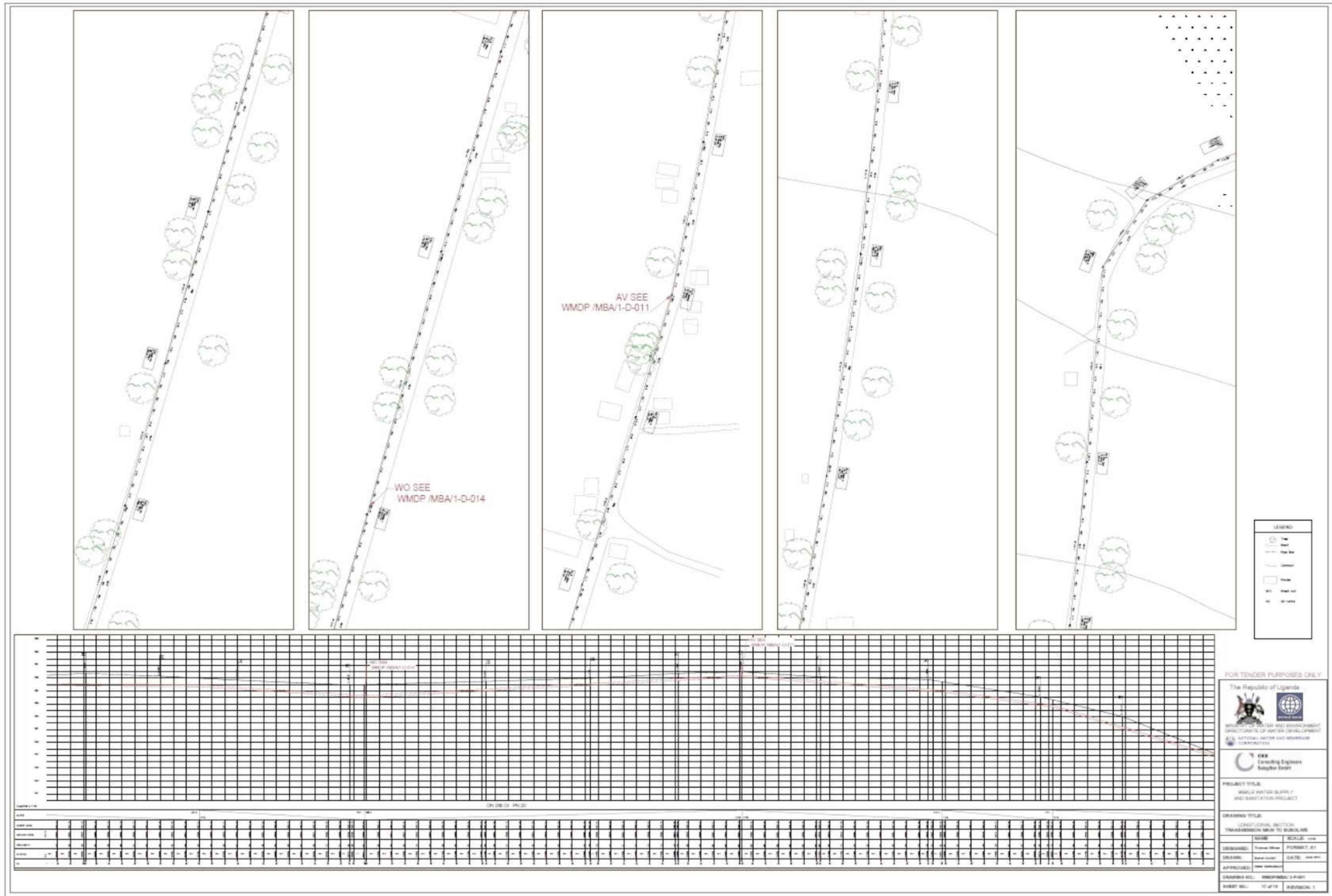


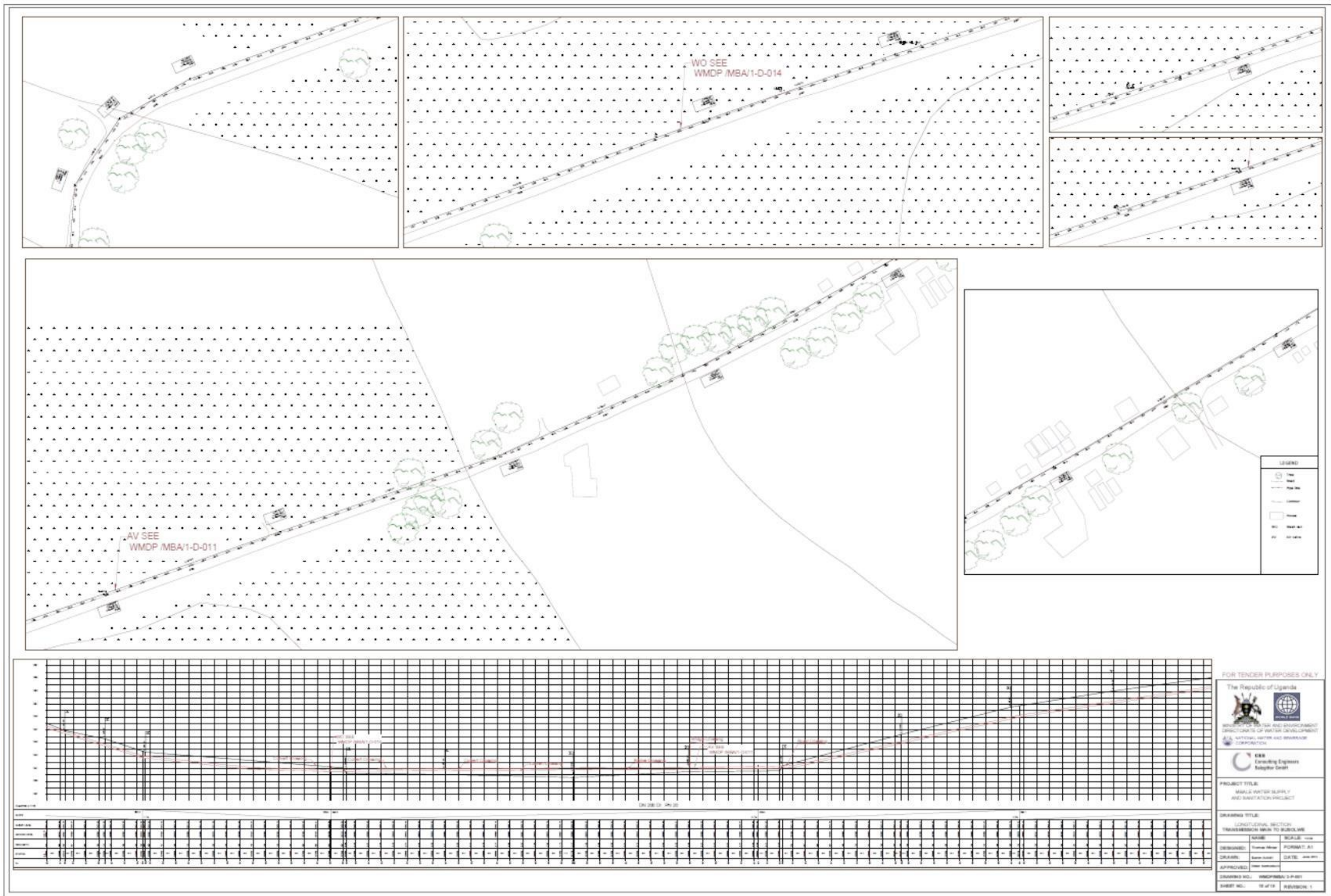


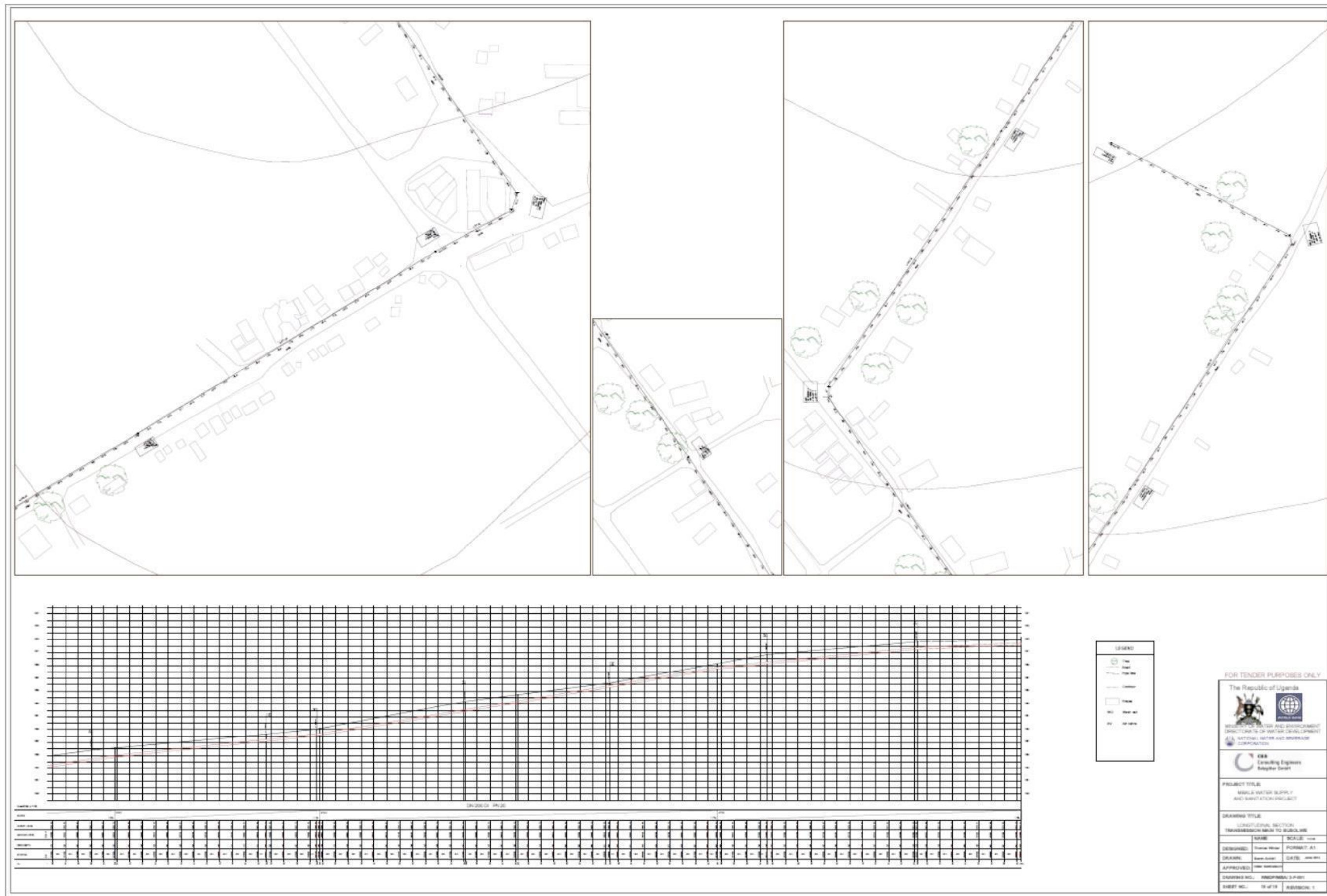


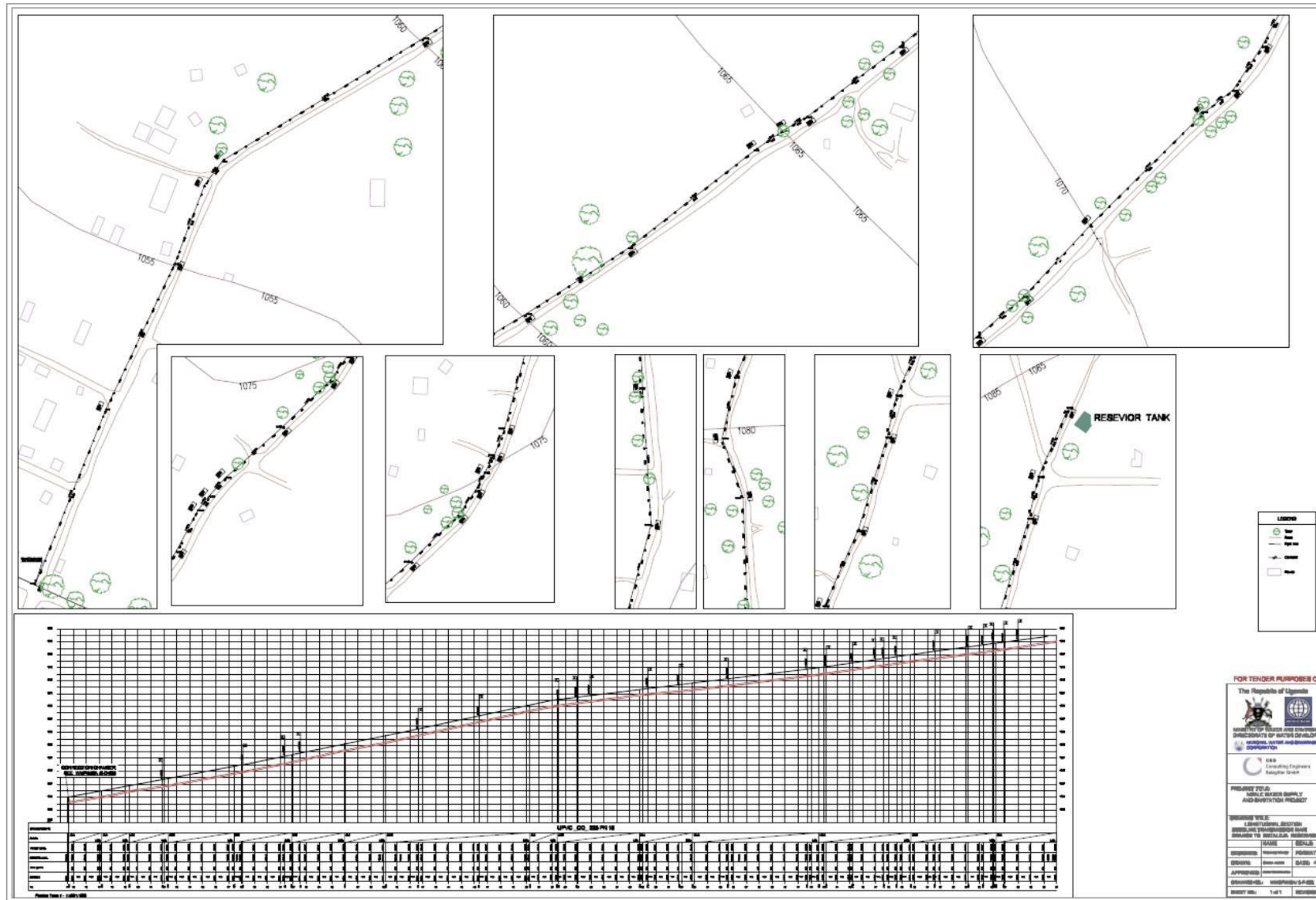


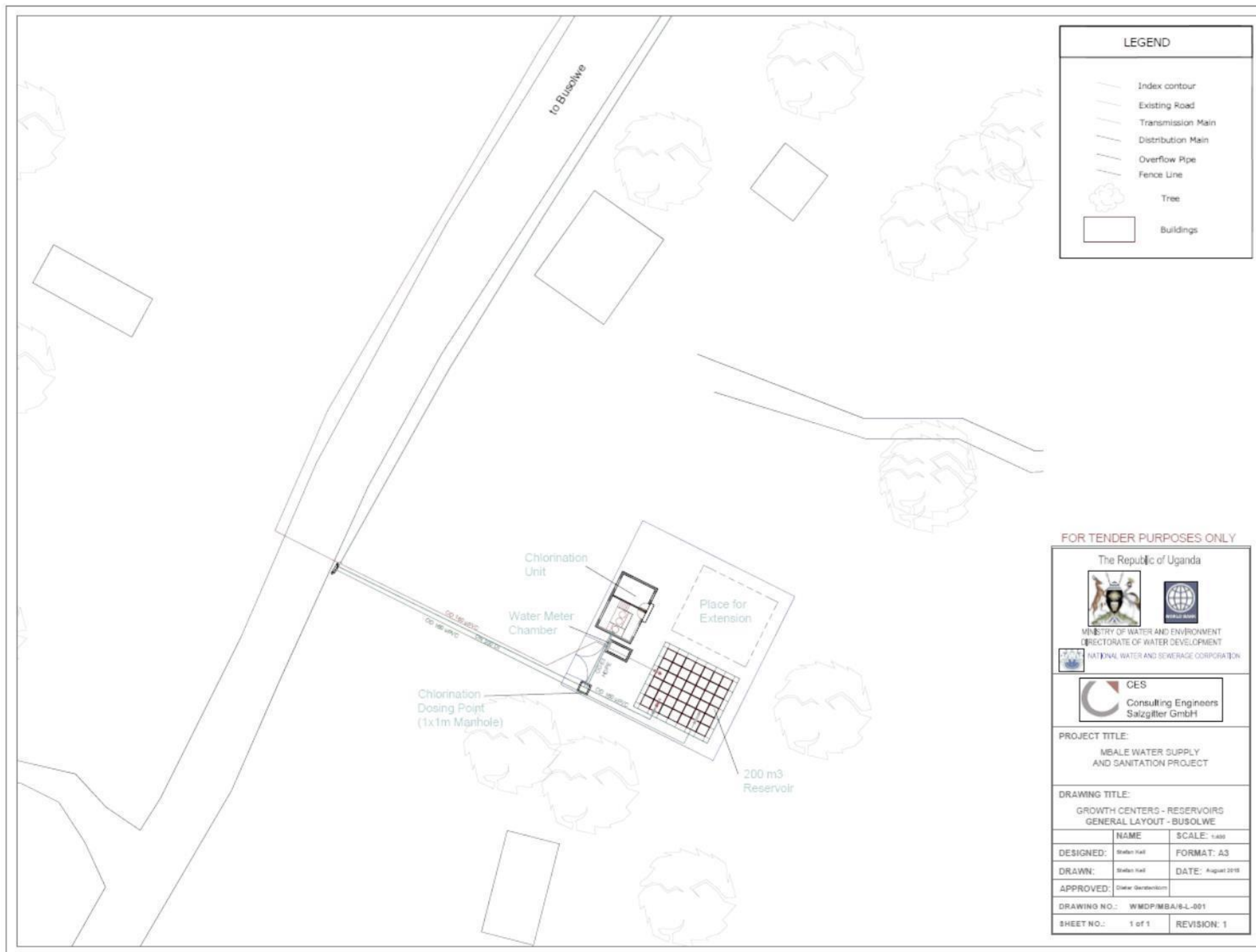




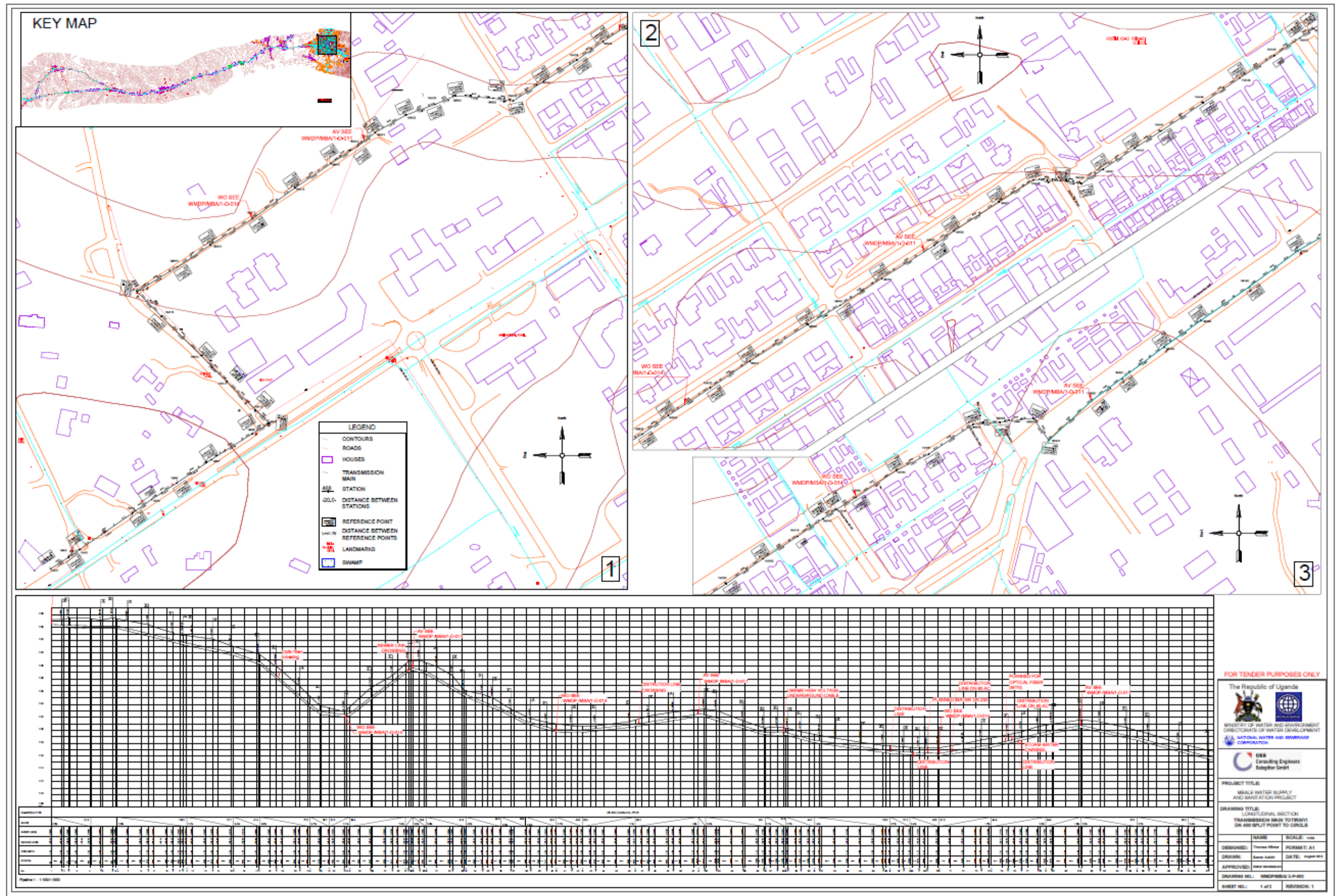




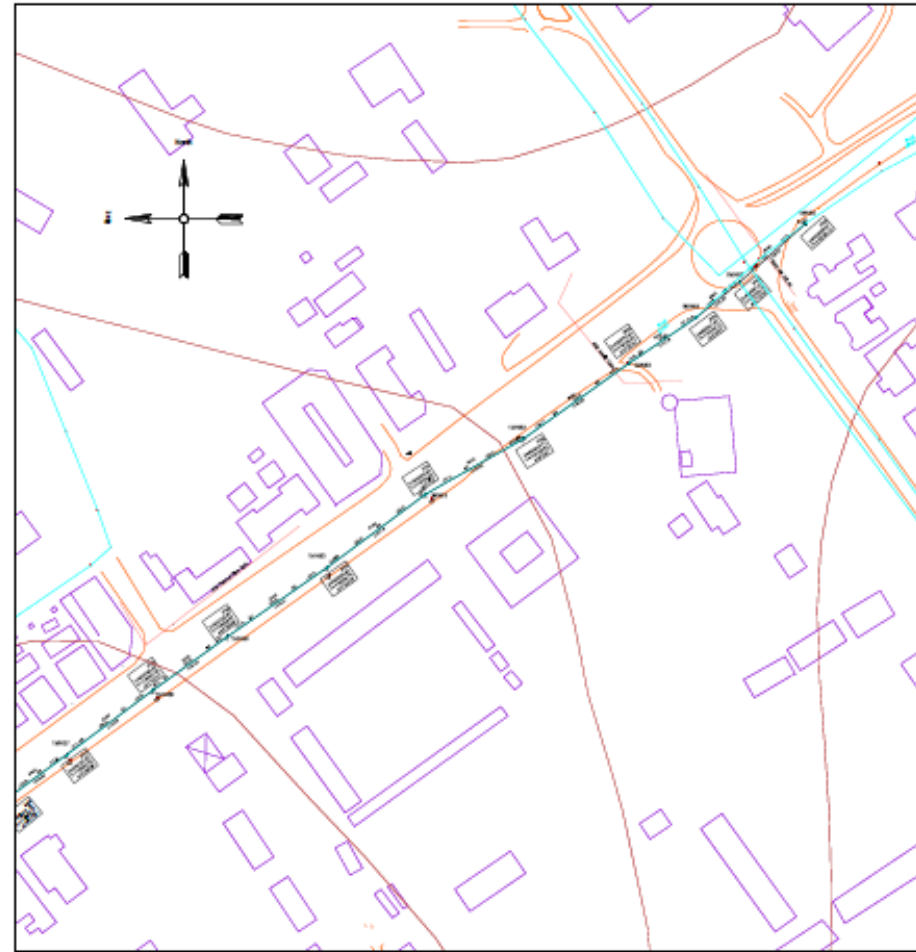
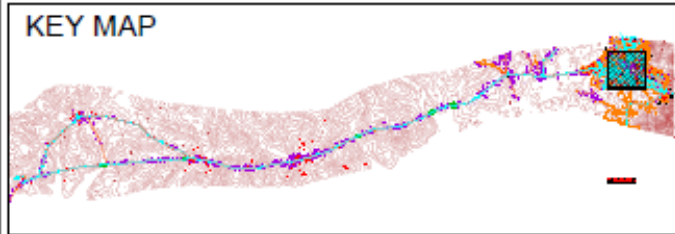




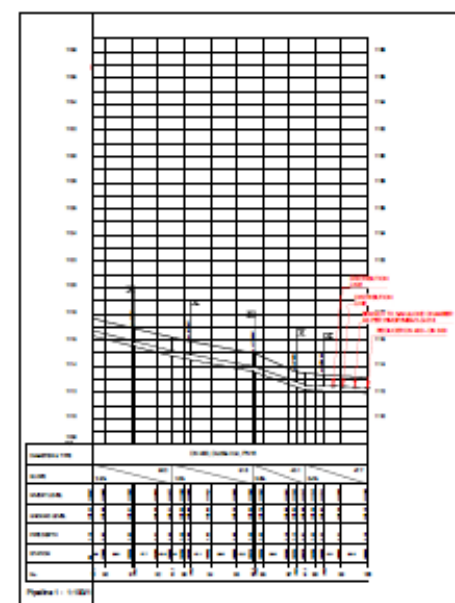
TIRINYI TRANSMISSION MAIN



KEY MAP

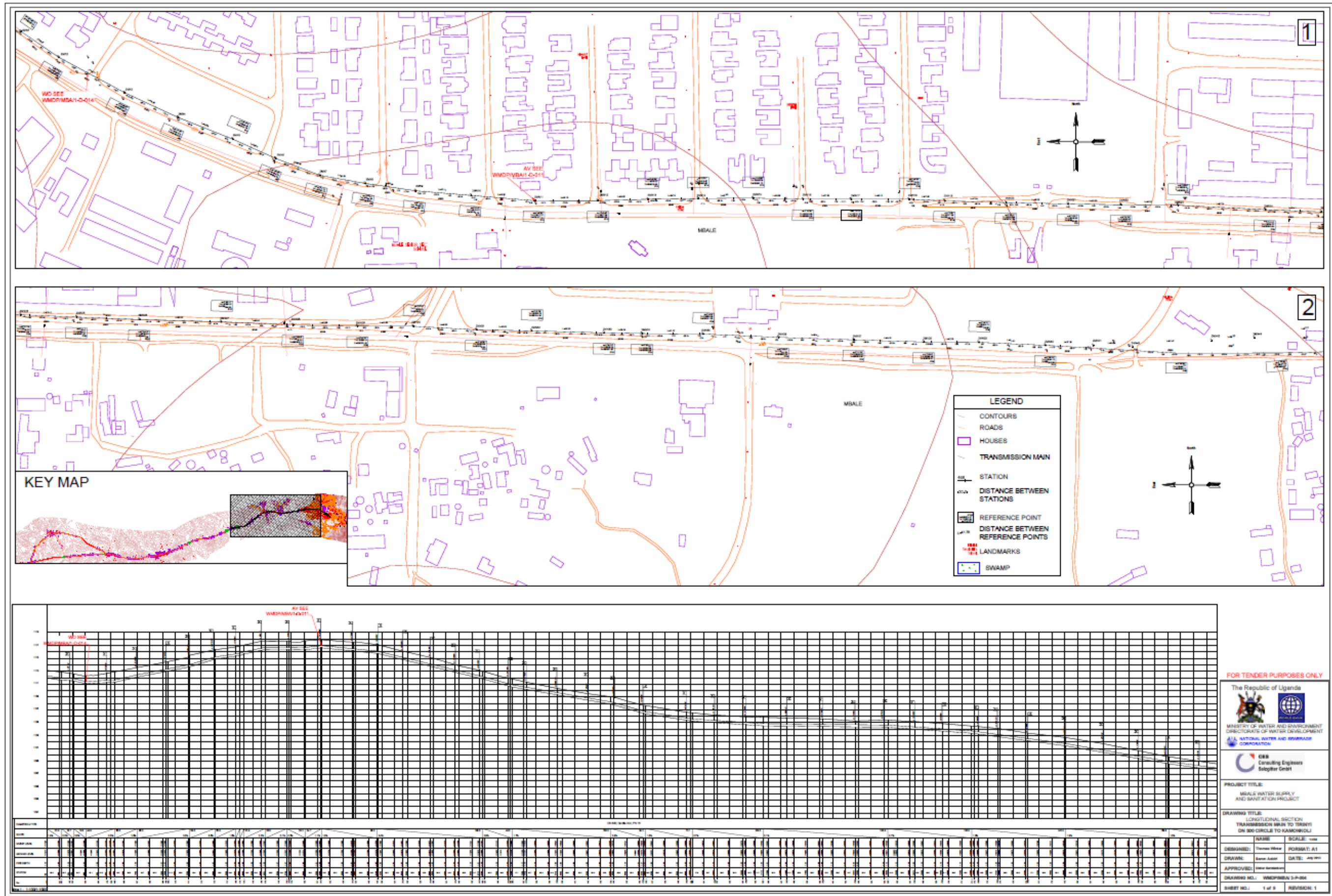


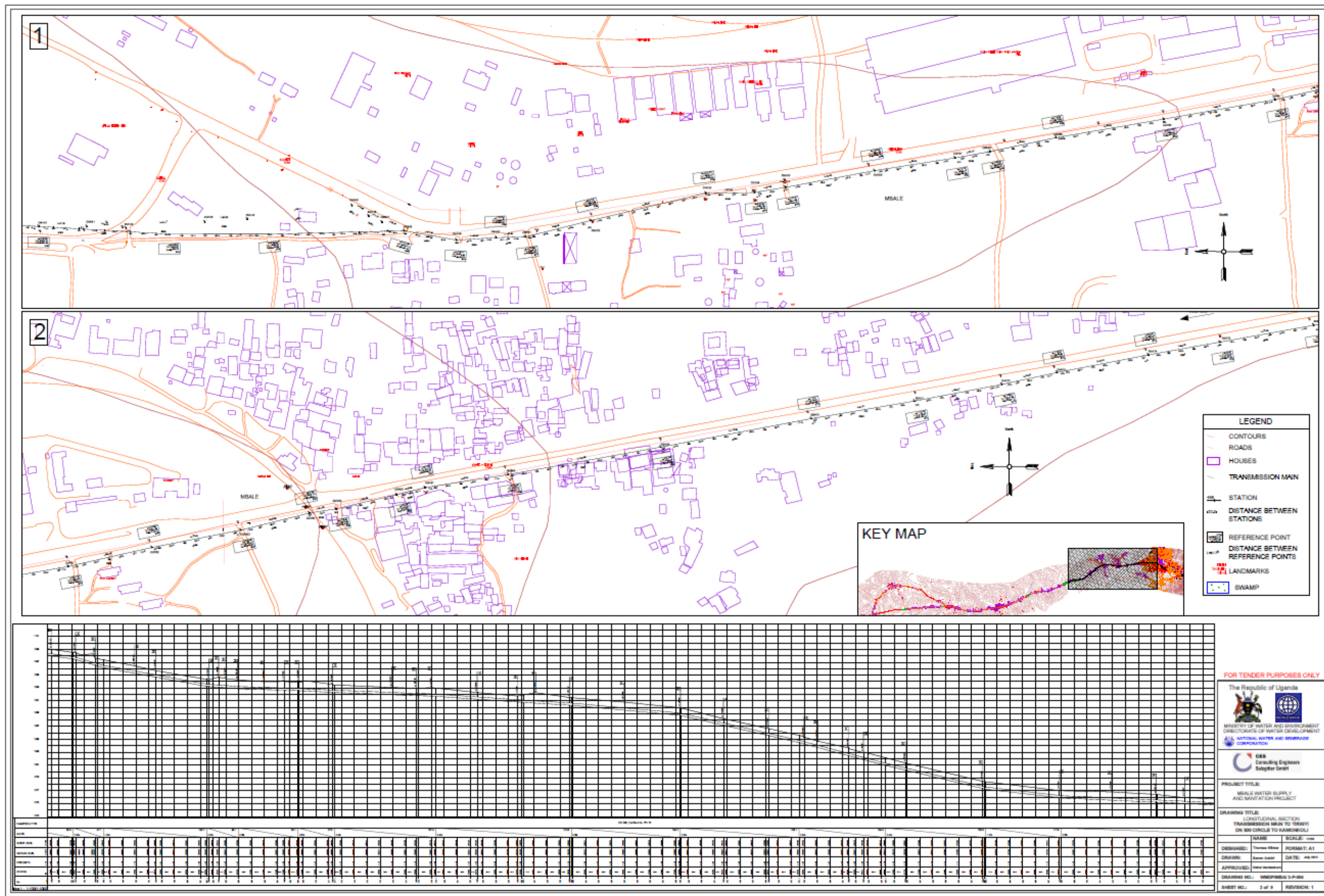
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	CONTOURS
	ROADS
	HOUSES
	TRANSMISSION MAIN
	STATION
	DISTANCE BETWEEN STATIONS
	REFERENCE POINT
	DISTANCE BETWEEN REFERENCE POINTS
	LANDMARKS
	SWAMP

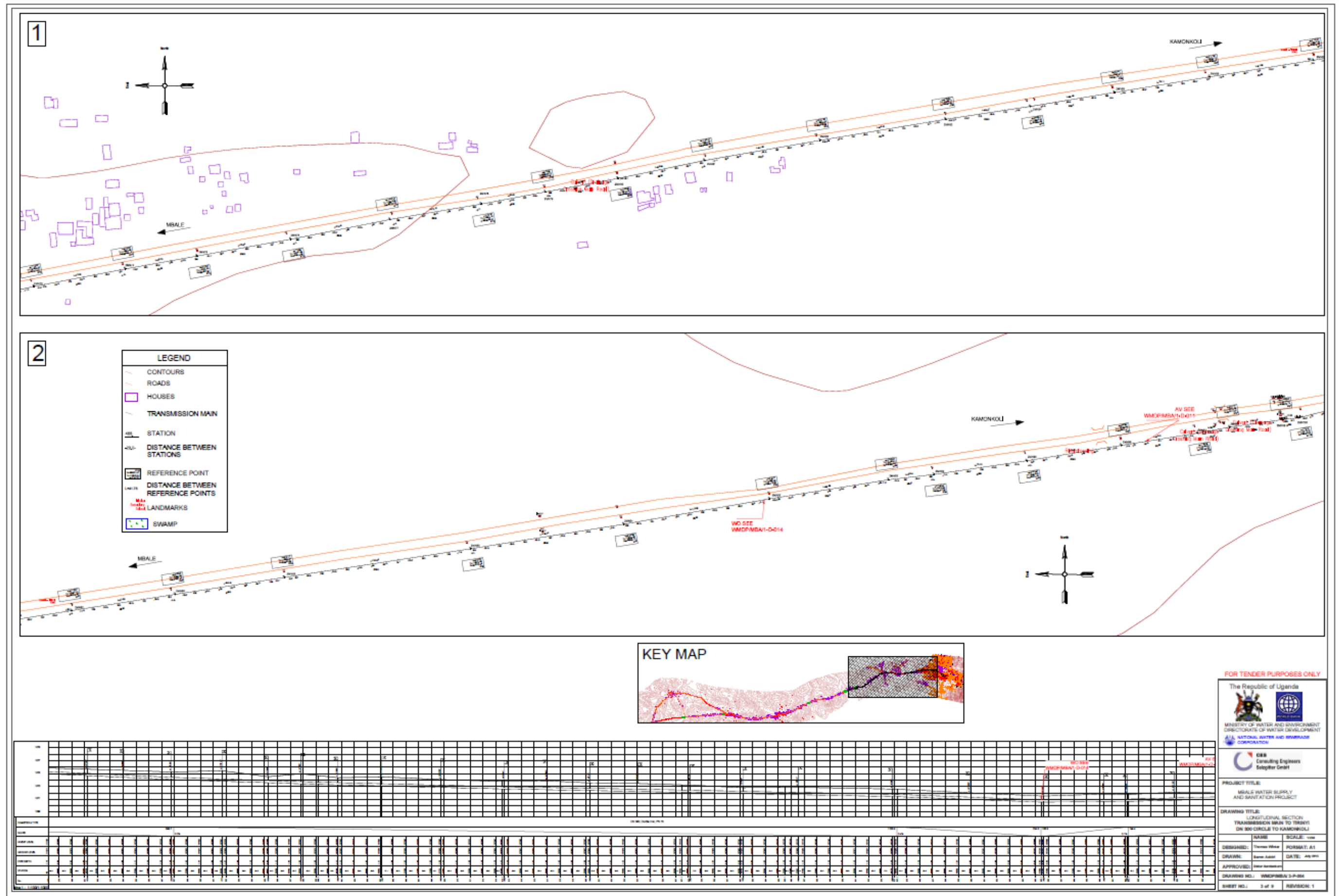


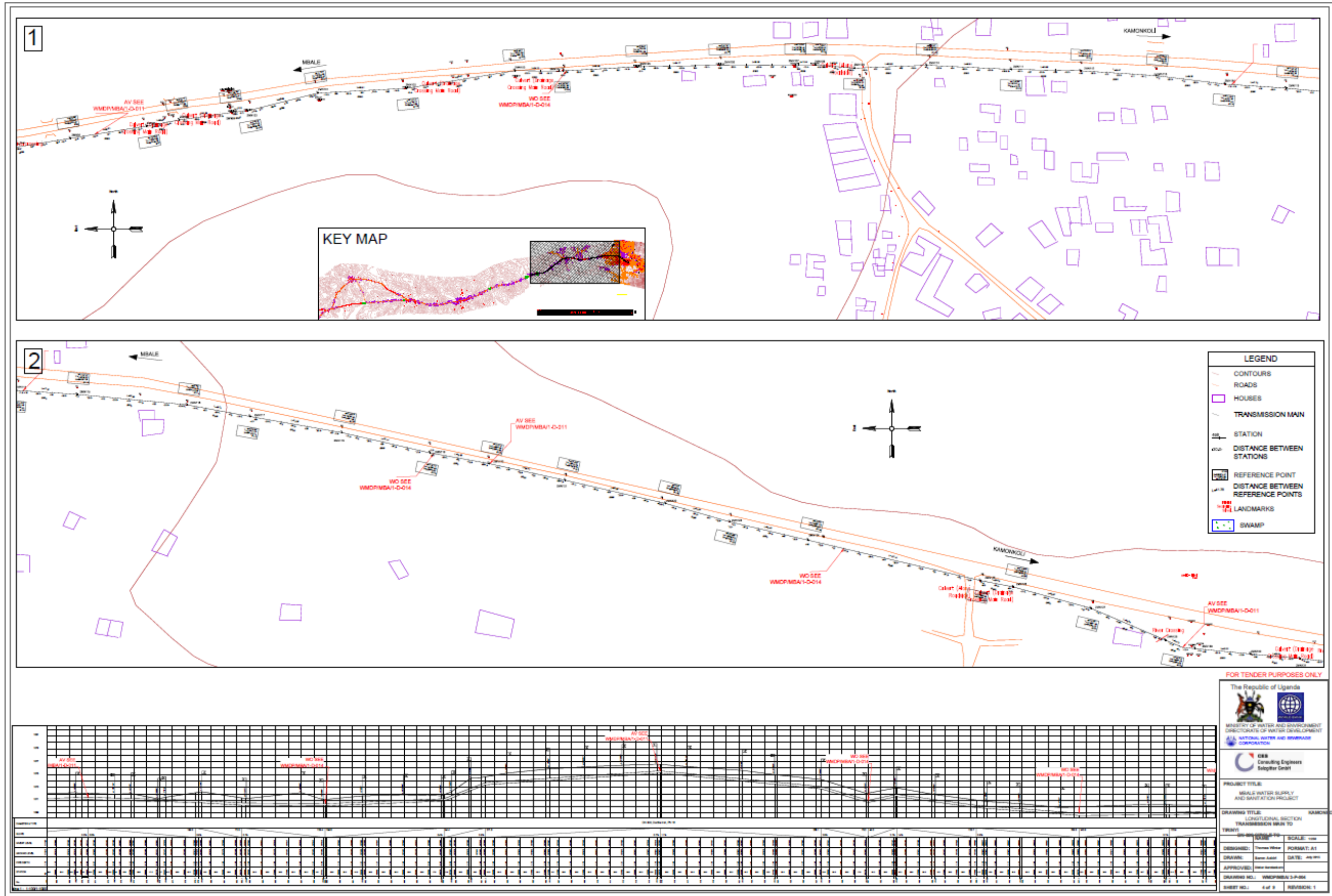
FOR TENDER PURPOSES ONLY

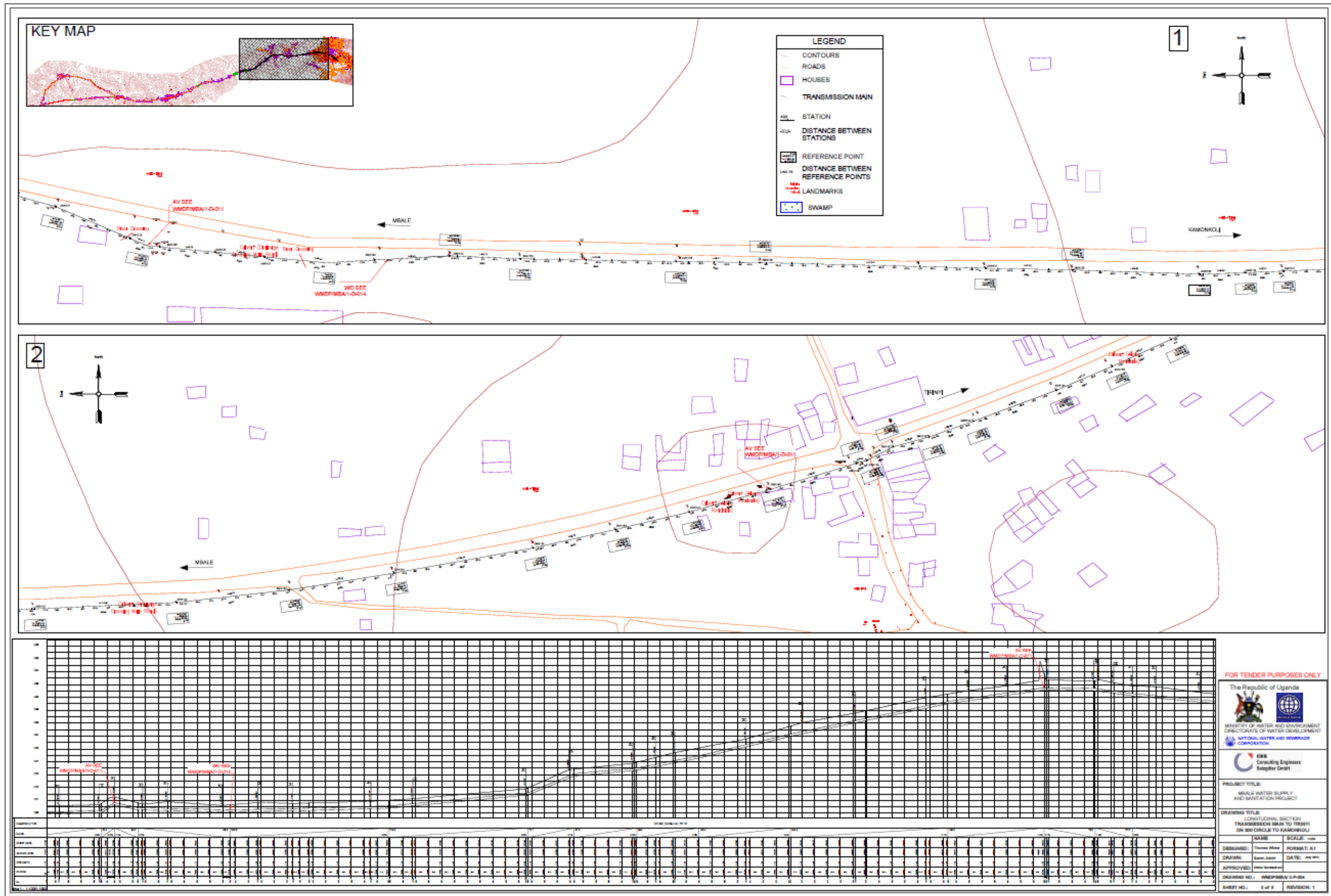
<p>The Republic of Uganda</p> <p>MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT J.L. NATIONAL WATER AND SEWERAGE CORPORATION</p>	
<p>DBB Consulting Engineers Solely for DBB</p>	
<p>PROJECT TITLE: MUALS WATER SUPPLY AND SANITATION PROJECT</p>	
<p>DRAWING TITLE: LONGITUDINAL SECTION TRANSMISSION MAIN TO TOWN ON 400 SPLUT POINT TO CIRCLE</p>	
NAME	SCALE: 1:1000
DESIGNED: Thomas Mbarika	FORMAT: A1
DRAWN: Simon Akub	DATE: August 2014
APPROVED: Peter Mbarika	
DRAWING NO.: WWS/PM/24-P-002	
SHEET NO.: 2 of 2	REVISION: 1

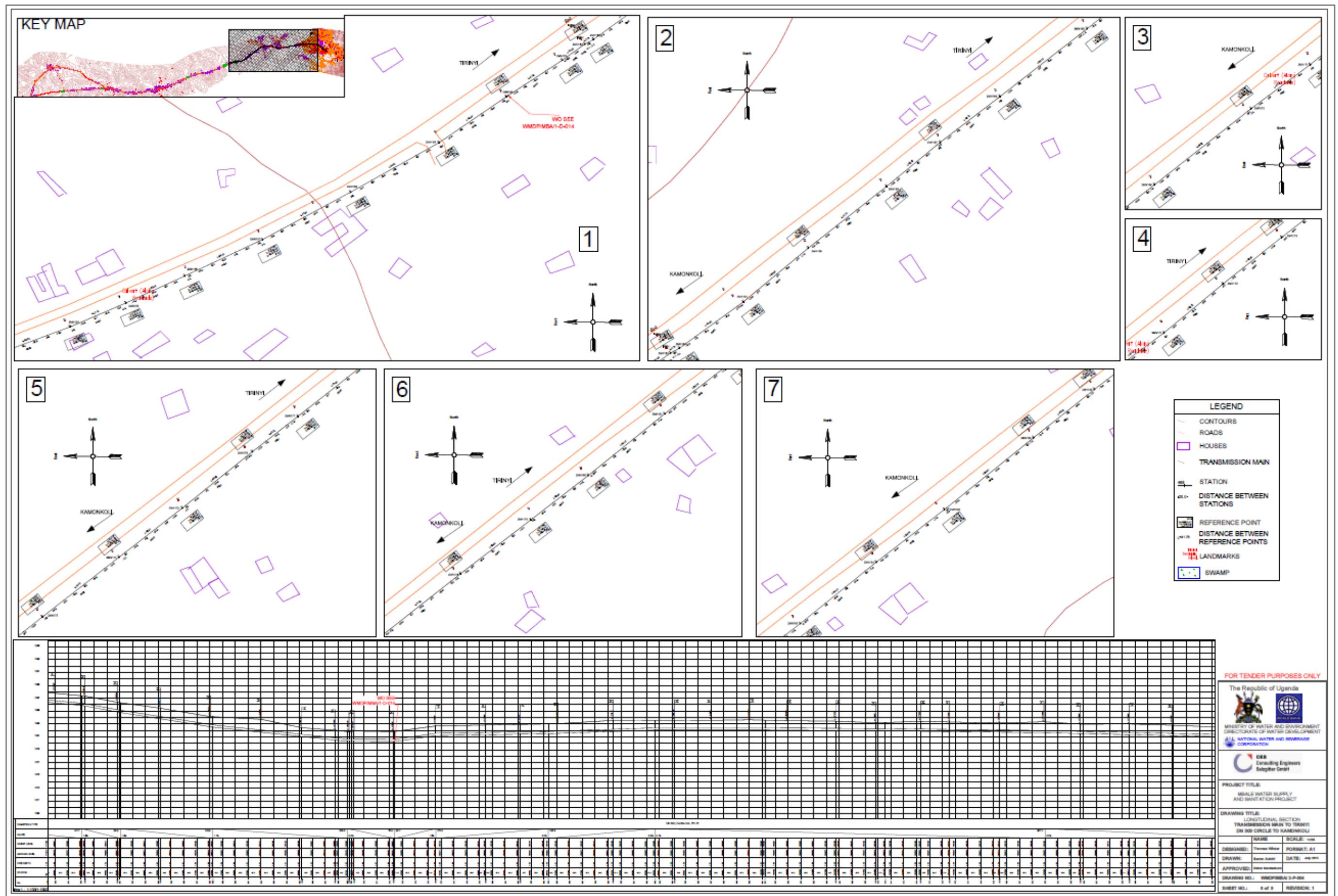


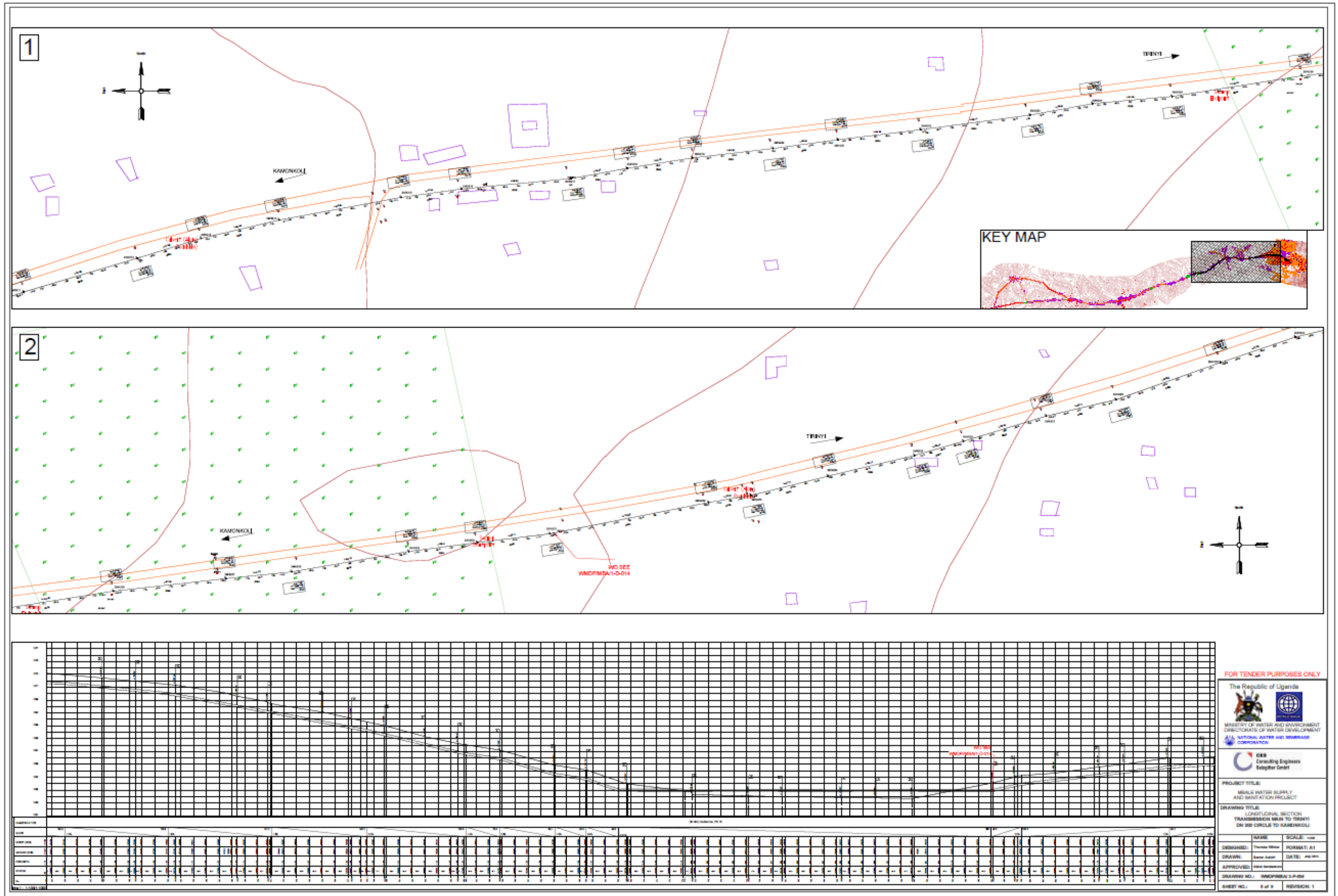


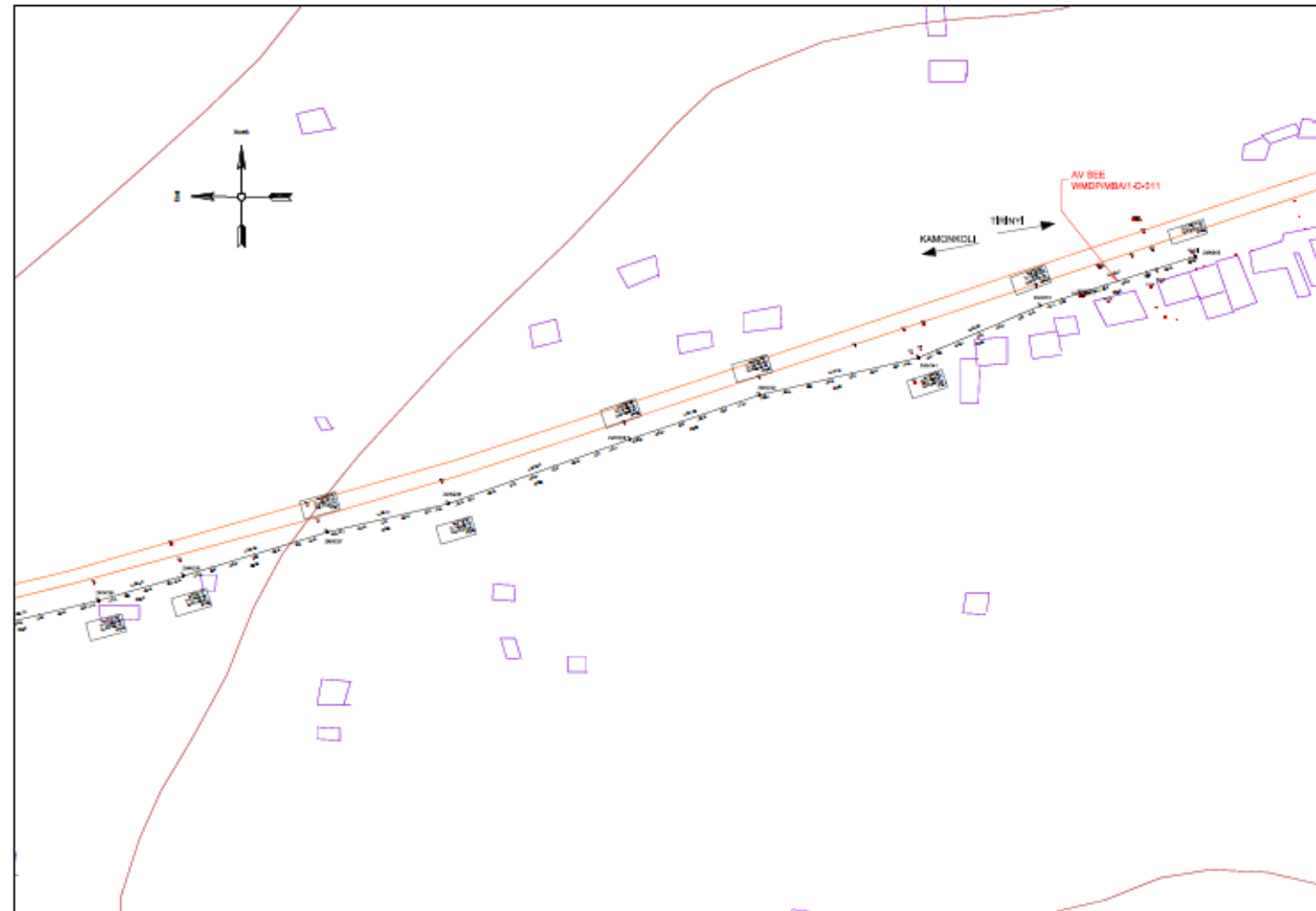




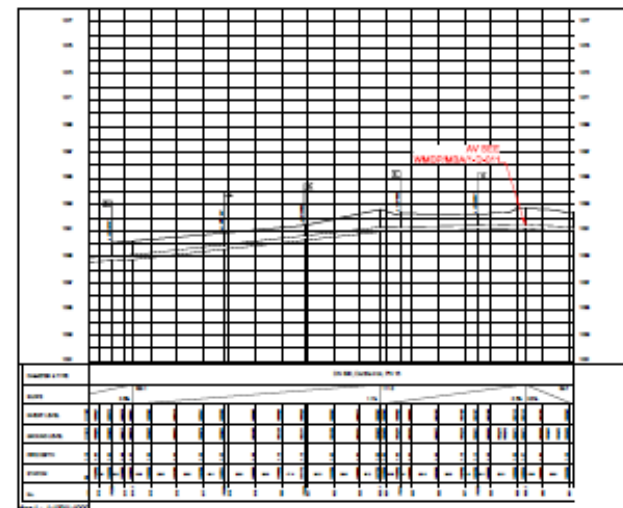
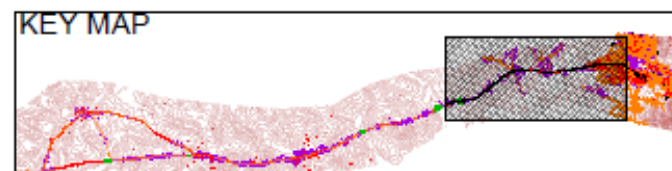








LEGEND	
	CONTOURS
	ROADS
	HOUSES
	TRANSMISSION MAIN
	STATION
	DISTANCE BETWEEN STATIONS
	REFERENCE POINT
	DISTANCE BETWEEN REFERENCE POINTS
	LANDMARKS
	SWAMP



FOR TENDER PURPOSES ONLY

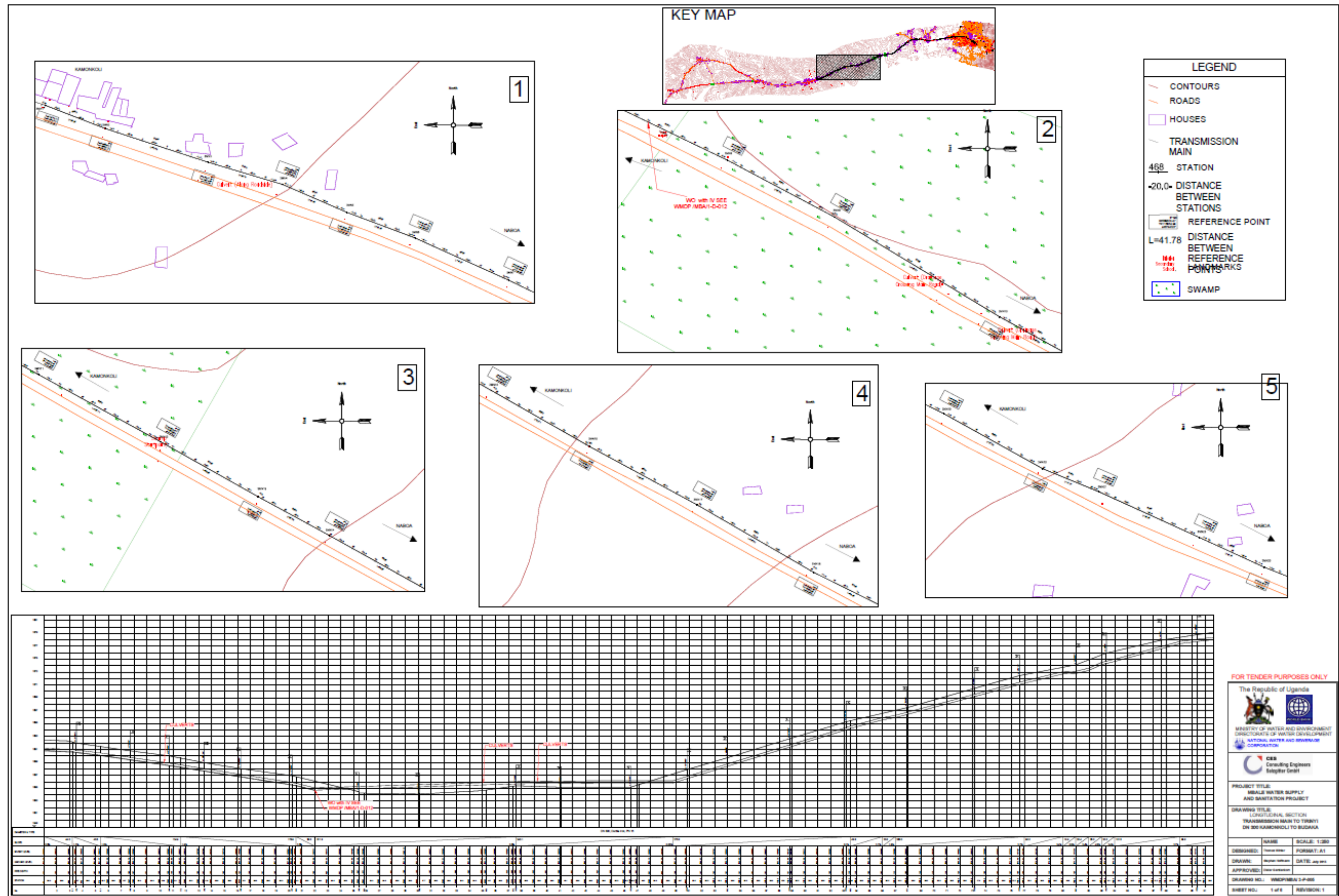
The Republic of Uganda
 MINISTRY OF WATER AND ENVIRONMENT
 DIRECTORATE OF WATER DEVELOPMENT
 NATIONAL WATER AND SEWERAGE CORPORATION

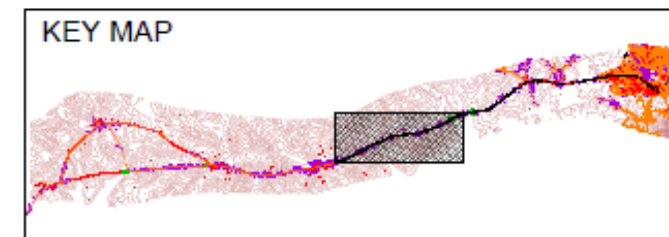
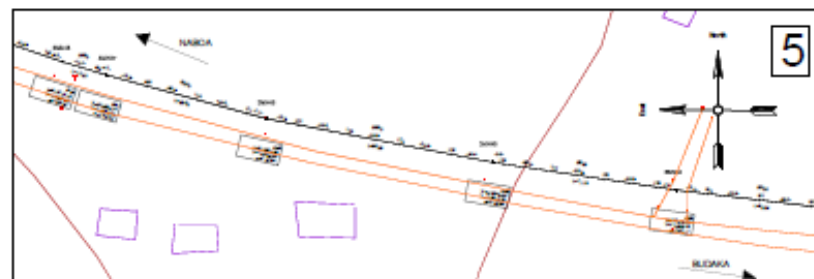
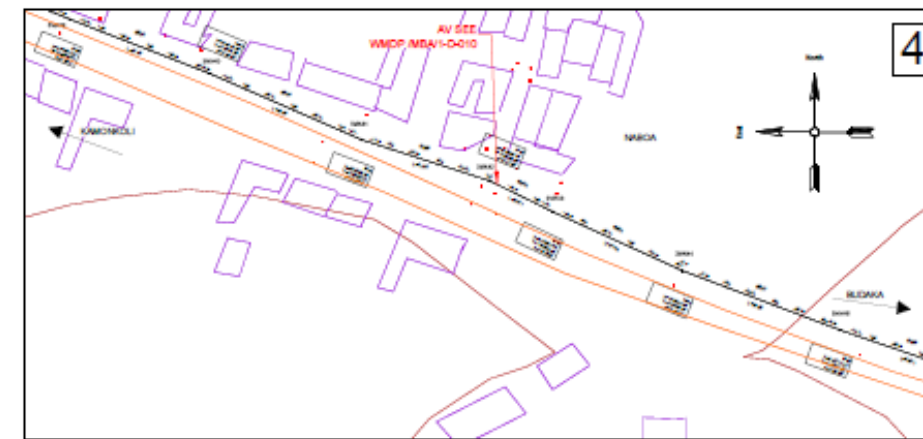
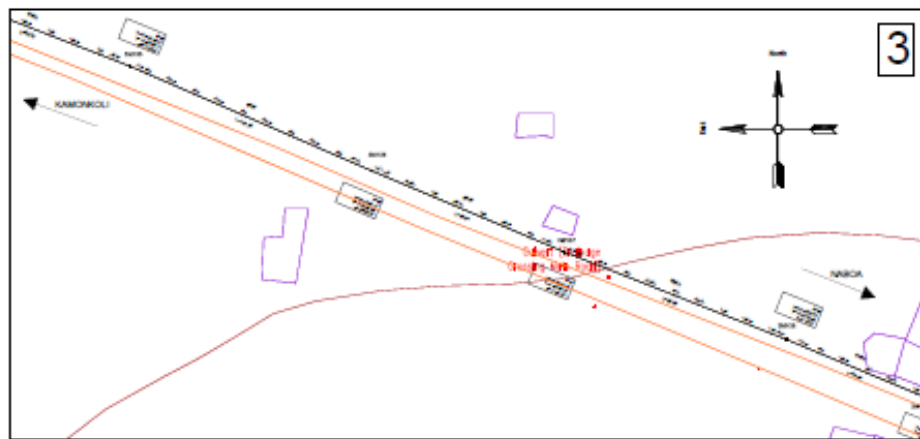
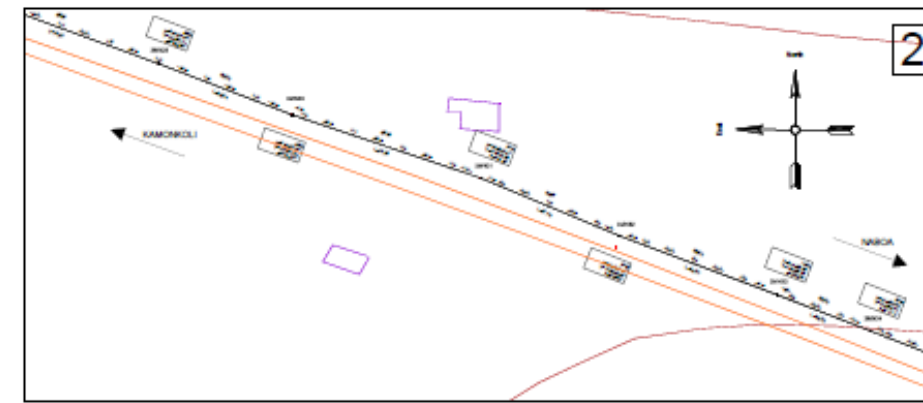
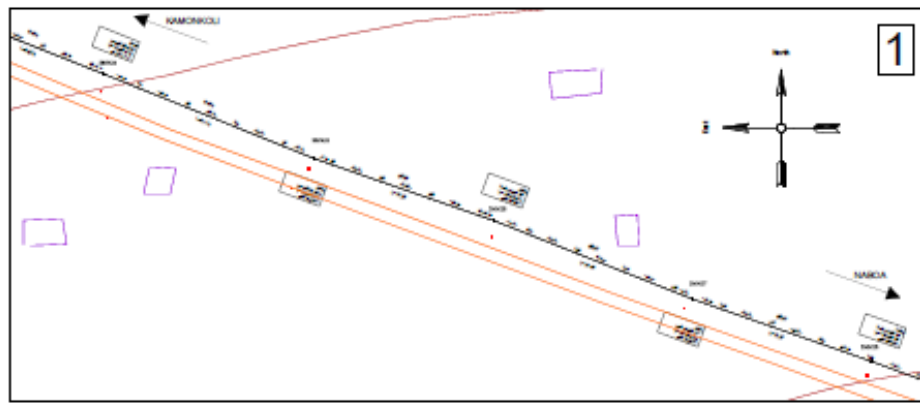
CBR Consulting Engineers
 Sole Proprietor

PROJECT TITLE:
 MUALI WATER SUPPLY
 AND SANITATION PROJECT

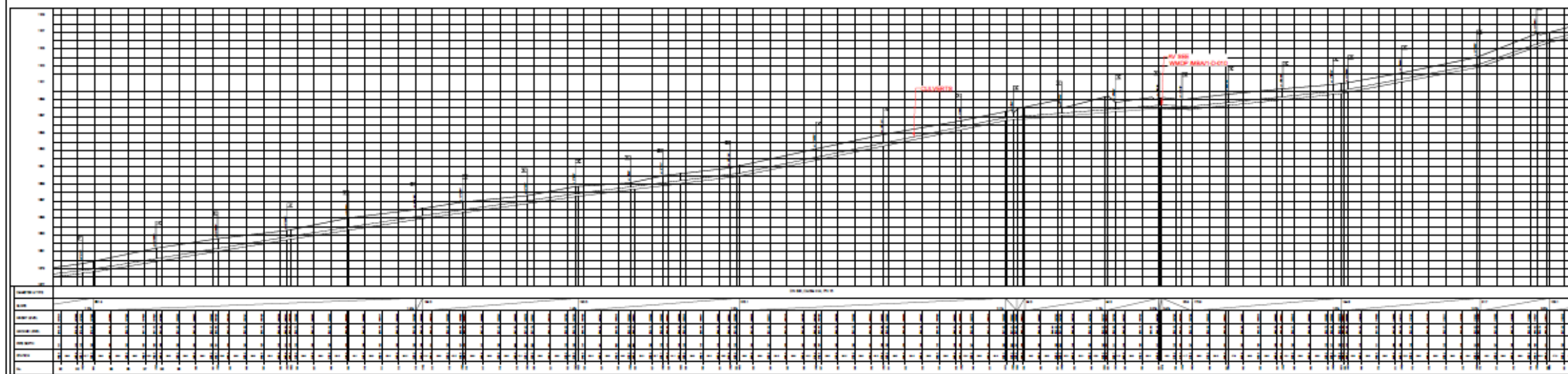
DRAWING TITLE:
 LONGITUDINAL SECTION
 TRANSMISSION MAIN TO TRINIT
 ON RD CIRCLE TO KAMUKOKO

NAME	SCALE
DESIGNED: Thomas Mwanza	FORMAT: A1
DRAWN: Samson Juma	DATE: July 1991
APPROVED: Peter Mwanza	
DRAWING NO.: WMDPMBU/3-P-004	
SHEET NO.: 3 of 3	REVISION: 1

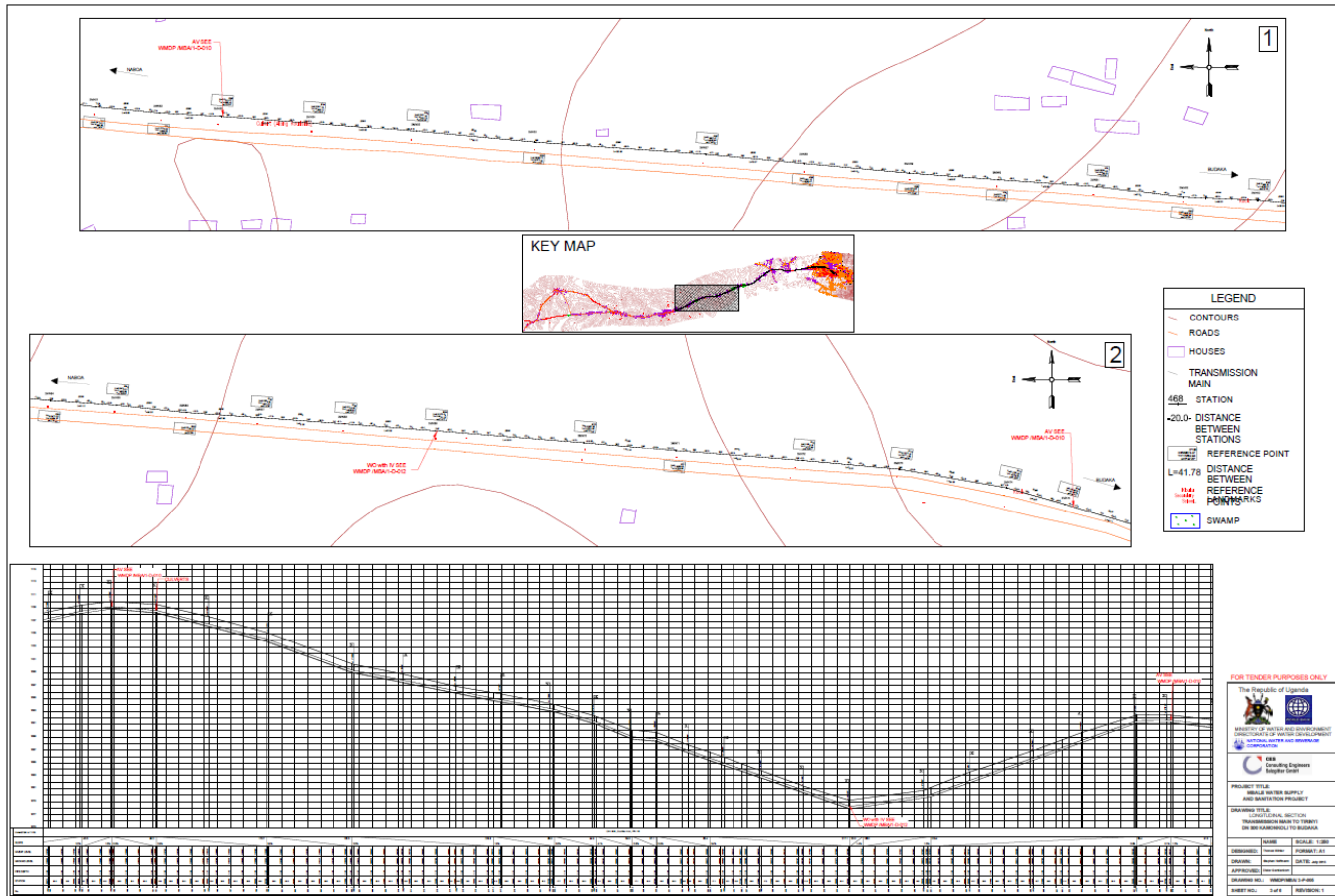


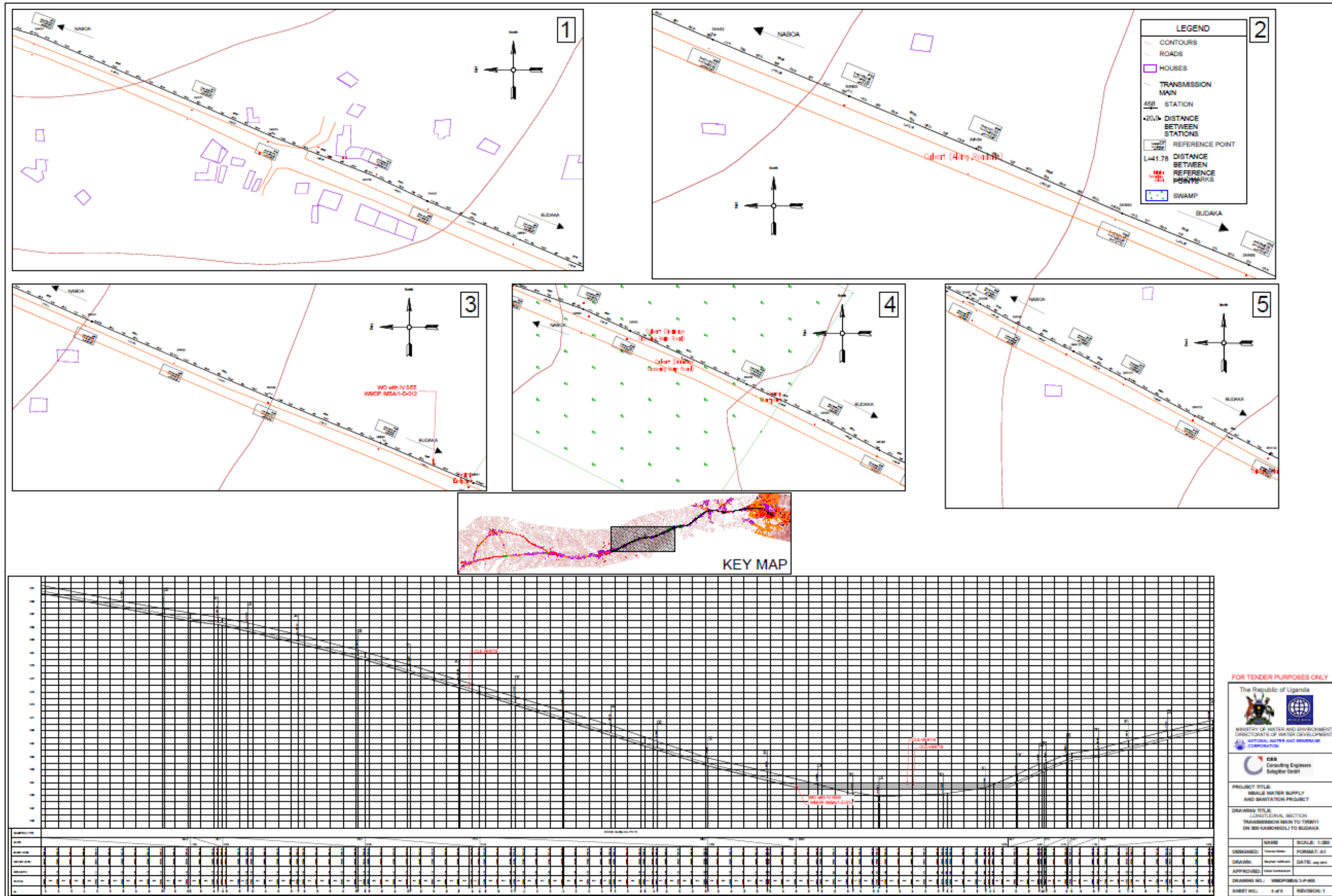


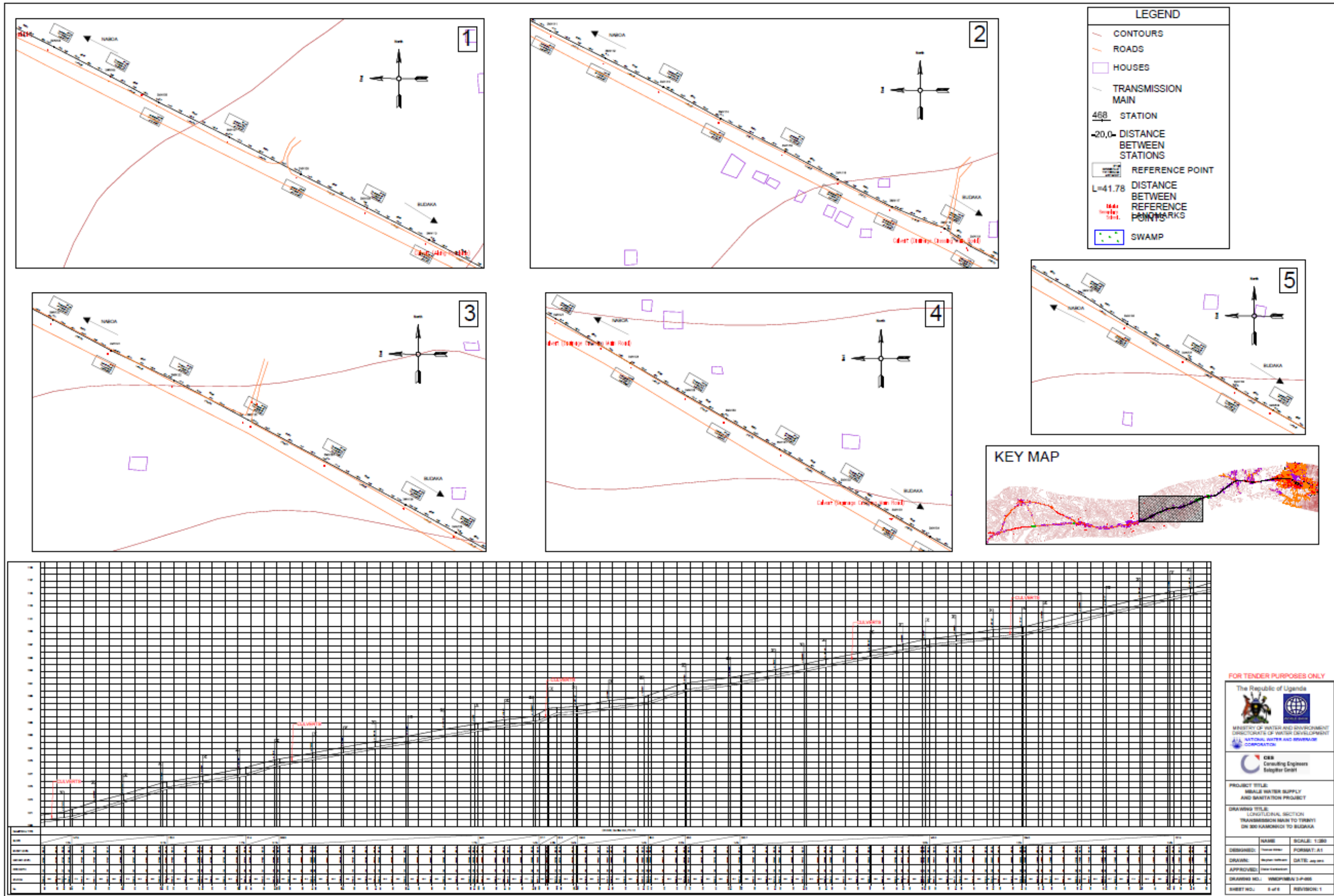
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	ROADS
	HOUSES
	TRANSMISSION MAIN
	STATION
	468 DISTANCE BETWEEN STATIONS
	REFERENCE POINT
	L=41.78 DISTANCE BETWEEN REFERENCE POINTS
	SWAMP

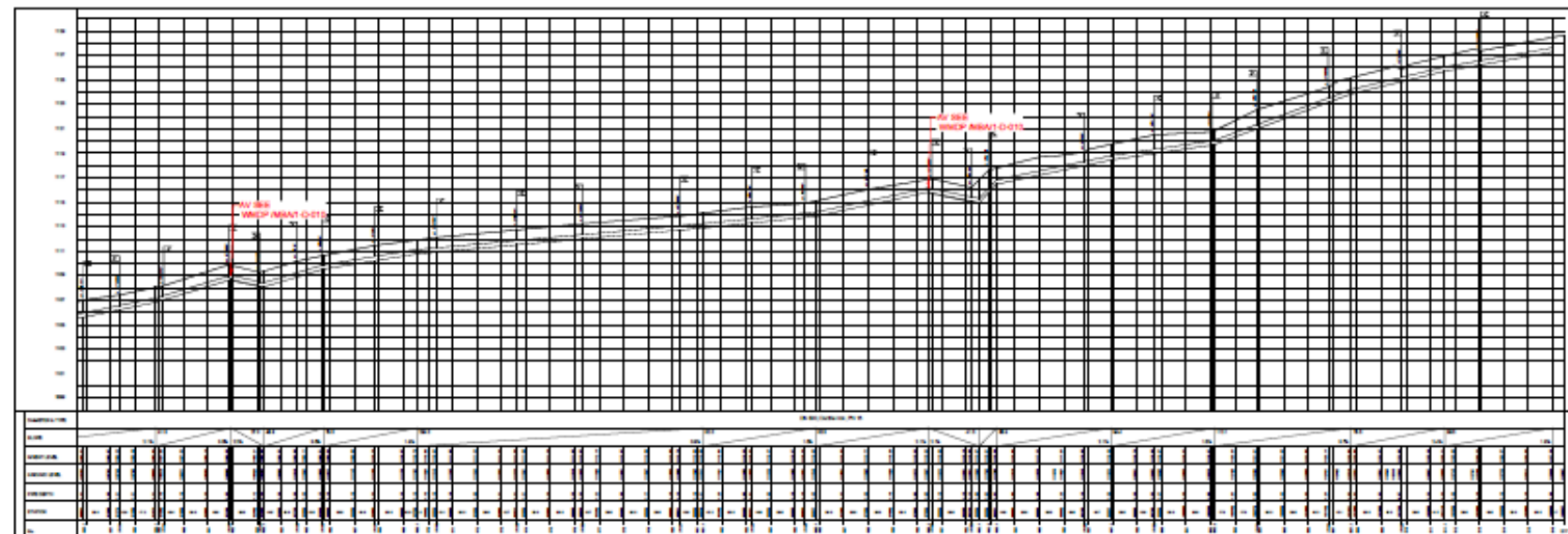
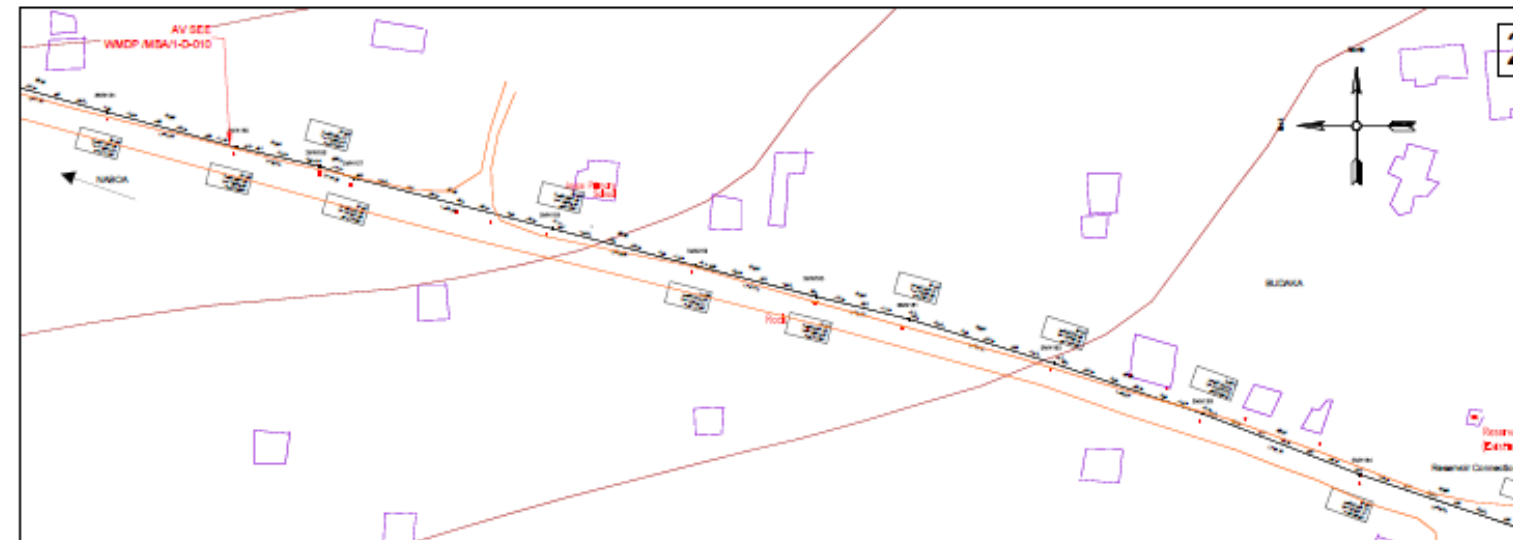
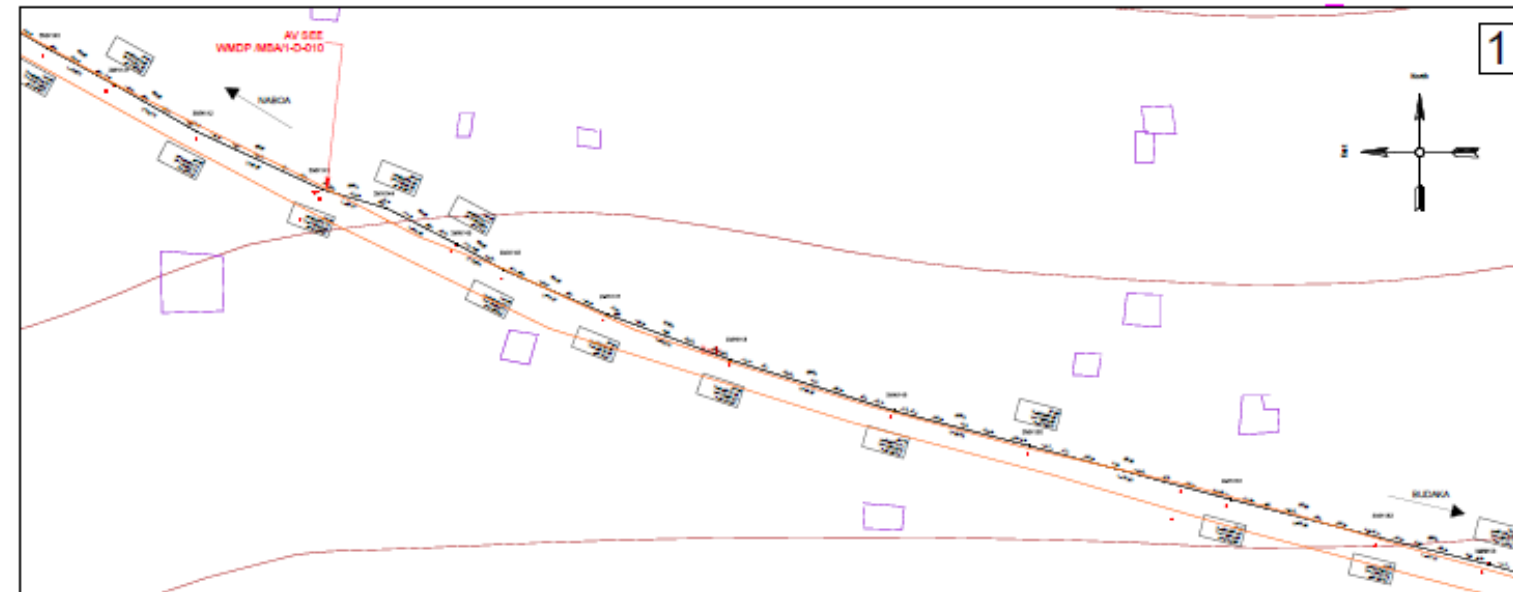
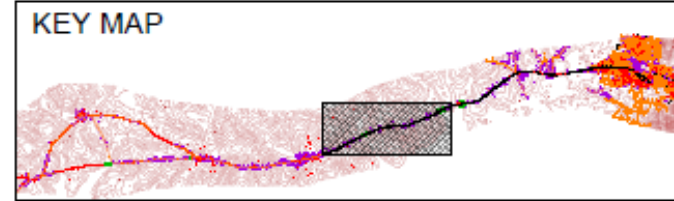









FOR TENDER PURPOSES ONLY	
PROJECT TITLE: MBALE WATER SUPPLY AND SANITATION PROJECT	
DRAWING TITLE: LONGITUDINAL SECTION TRANSMISSION MAIN TO TERNYI ON 300 KARAMONDOLI TO BUGAWA	
NAME	SCALE: 1:200
DESIGNED: Thomas Mubiru	FORMAT: A1
DRAWN: Thomas Mubiru	DATE: July 2014
APPROVED: Thomas Mubiru	
DRAWING NO.: WNSP/MBAL/3-P-005	
SHEET NO.: 2 OF 2	REVISION: 1









LEGEND	
	CONTOURS
	ROADS
	HOUSES
	TRANSMISSION MAIN
468	STATION
-20,0-	DISTANCE BETWEEN STATIONS
	REFERENCE POINT
L=41.78	DISTANCE BETWEEN REFERENCE POINTS
	REFERENCE POINTS
	SWAMP

FOR TENDER PURPOSES ONLY

The Republic of Uganda




**MINISTRY OF WATER AND ENVIRONMENT
DIRECTORATE OF WATER DEVELOPMENT**

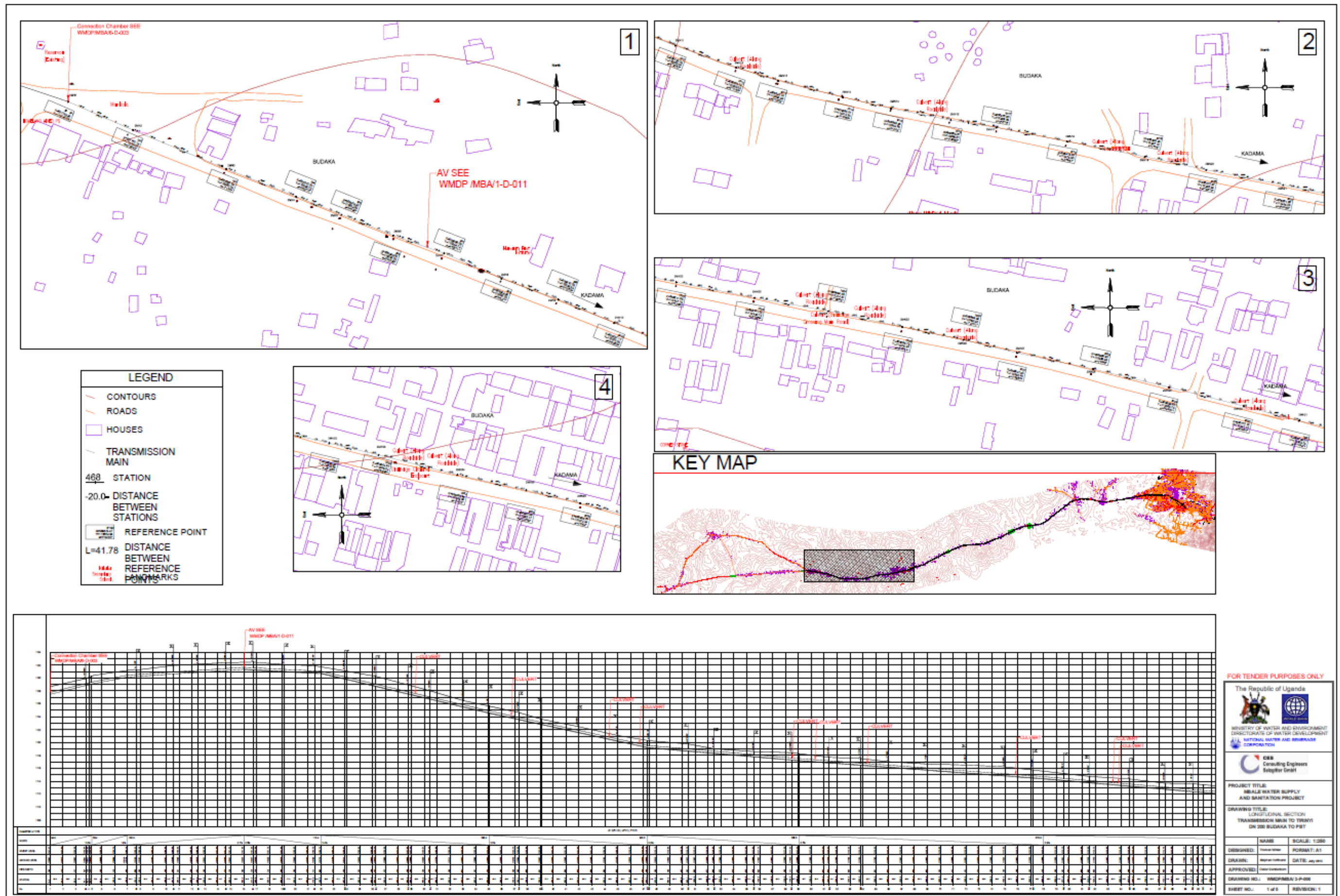
**NATIONAL WATER AND SEWERAGE
CORPORATION**

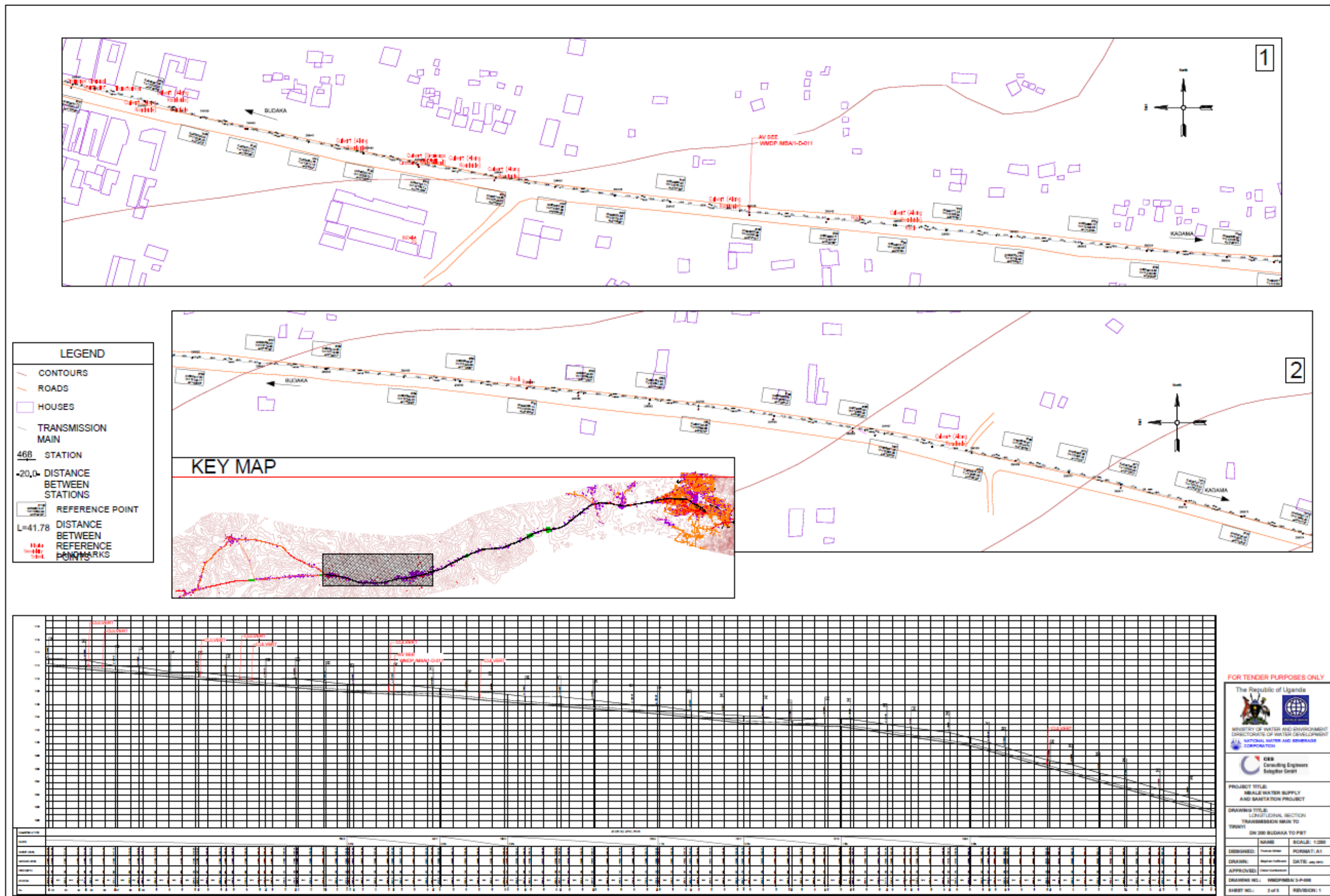


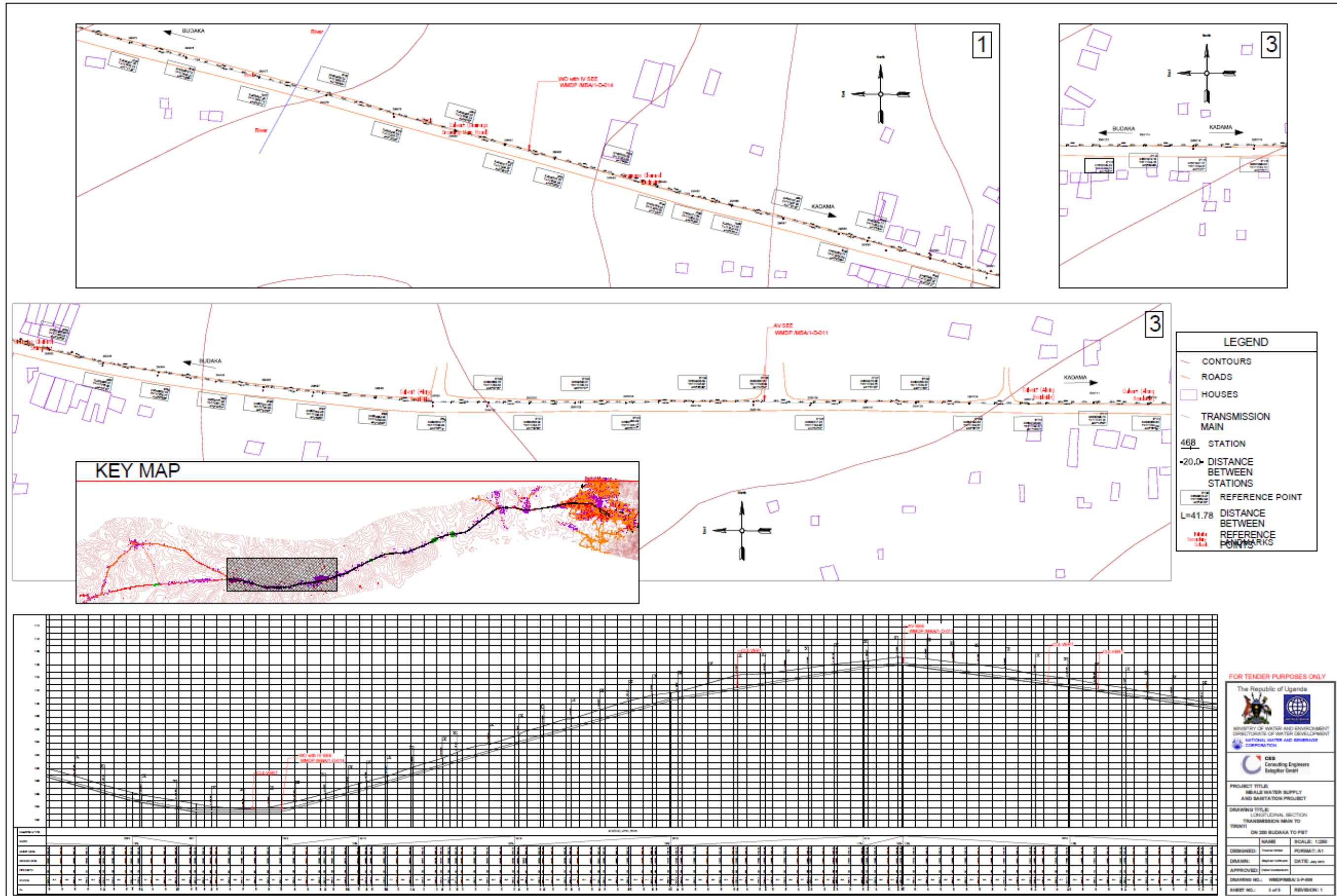
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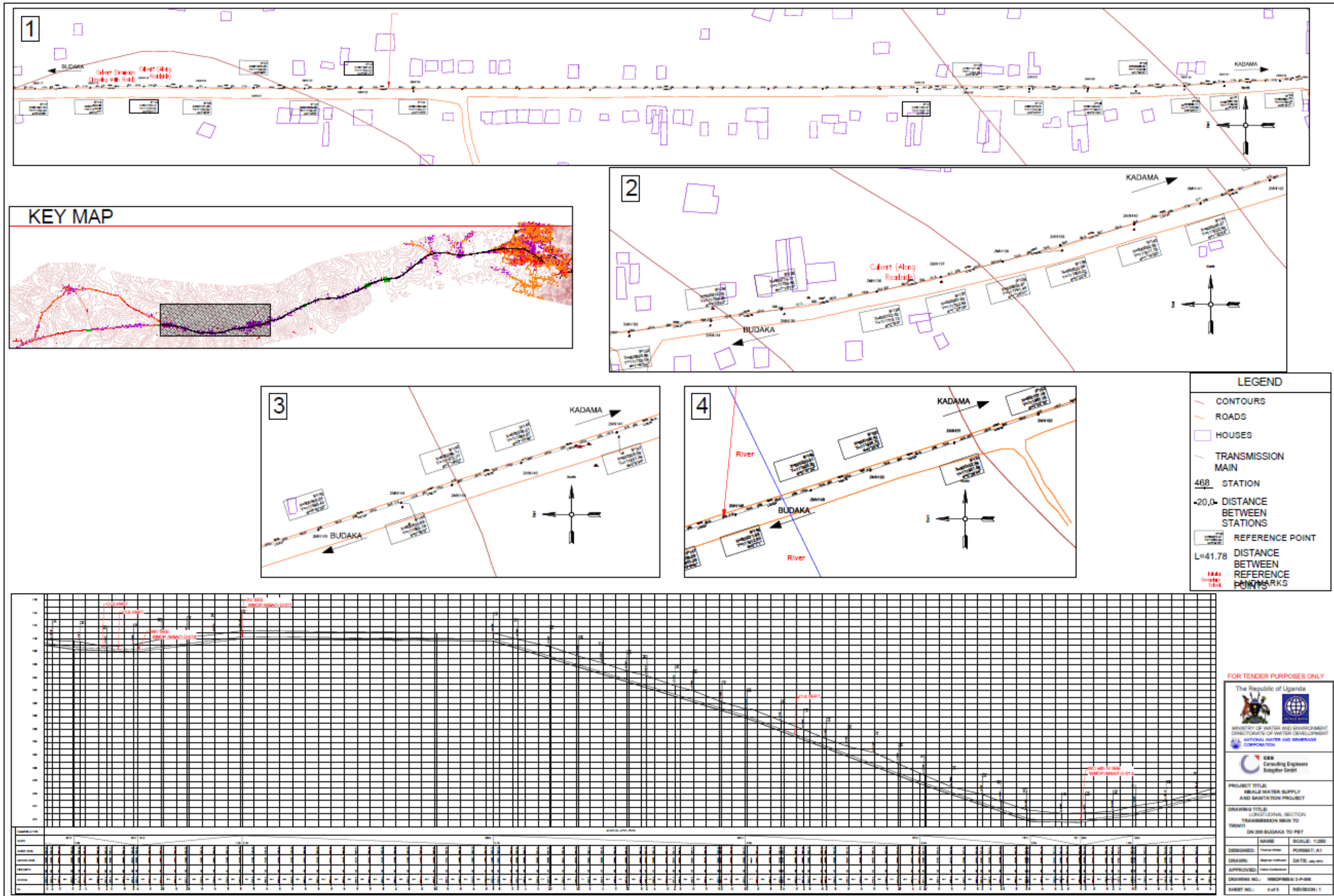
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Institute (CENI)

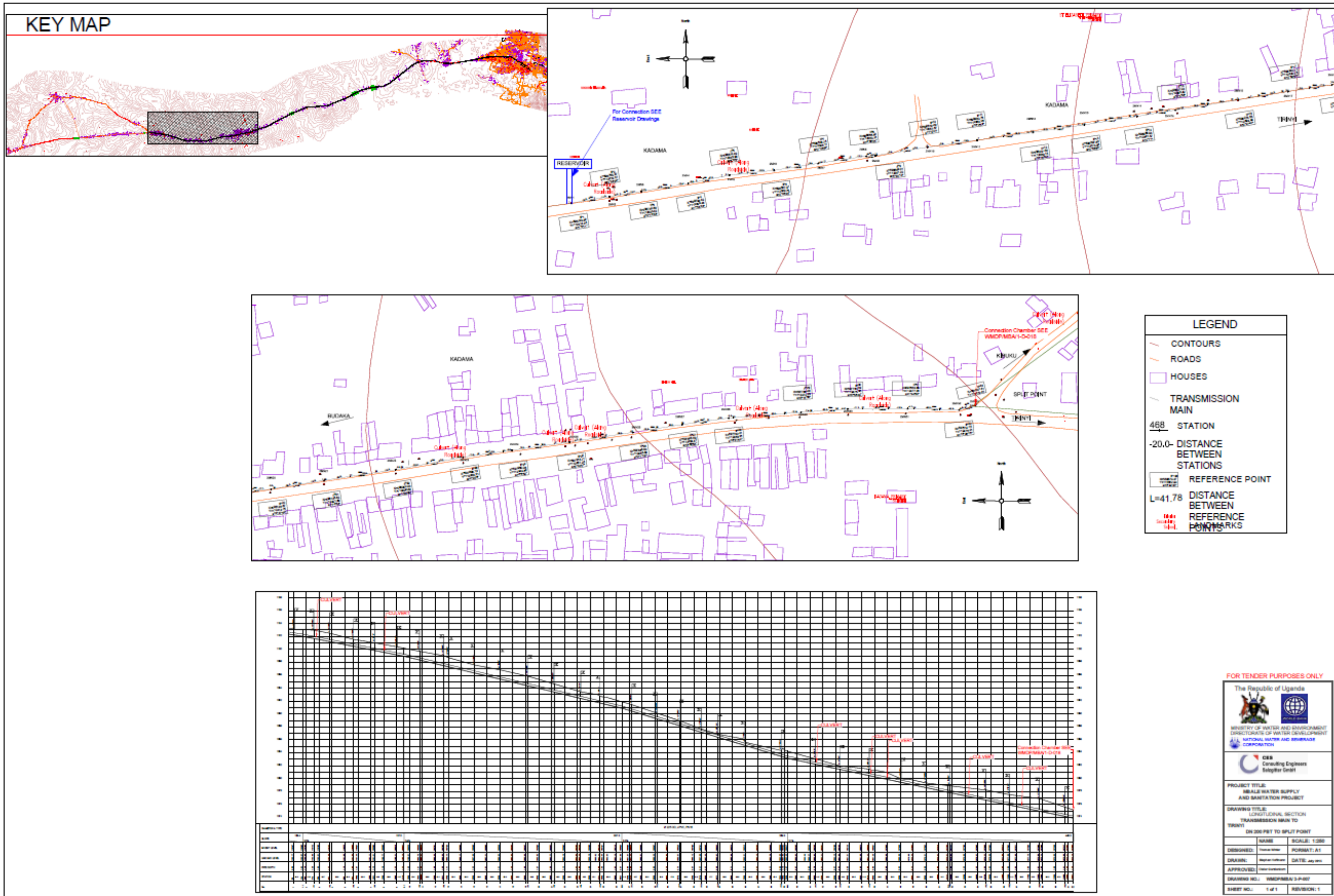
PROJECT TITLE: SMALLS WATER SUPPLY AND SANITATION PROJECT	
DRAWING TITLE: LONGITUDINAL SECTION TRANSMISSION MAIN TO TRINITY ON 300 KARCHINDILI TO BUDAGA	
NAME:	SCALE: 1:250
DESIGNED: <small>Design Engineer</small>	FORMAT: A1
DRAWN: <small>Design Assistant</small>	DATE: <small>any date</small>
APPROVED: <small>Chief Engineer</small>	
DRAWING NO.: WSEPM/2015-0-000	
SHEET NO.: 8 of 8	REVISION: 1

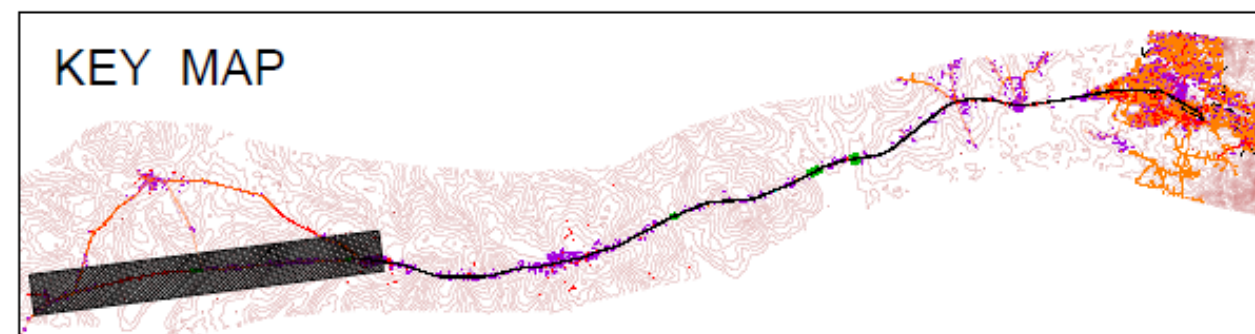
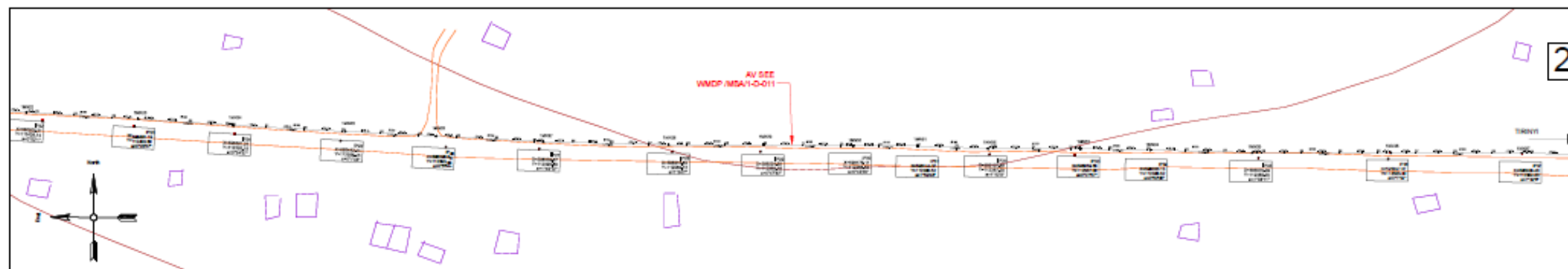
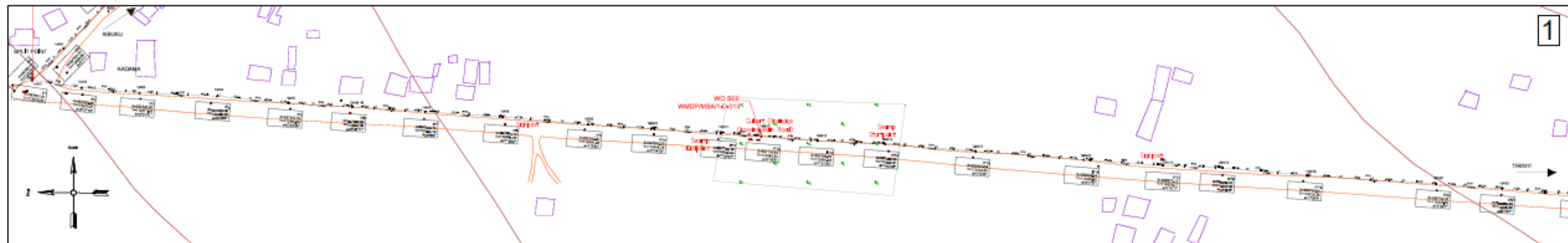




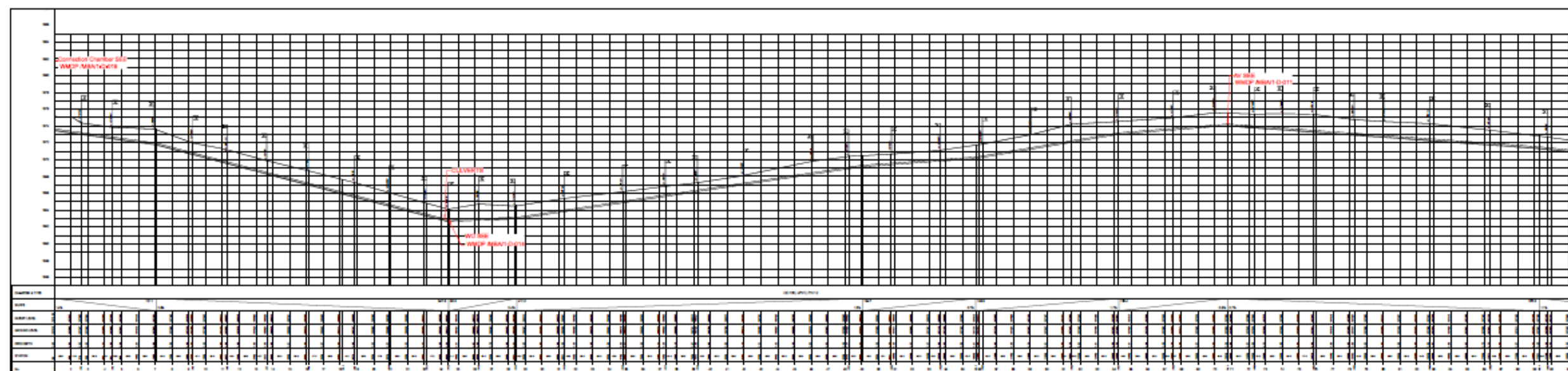




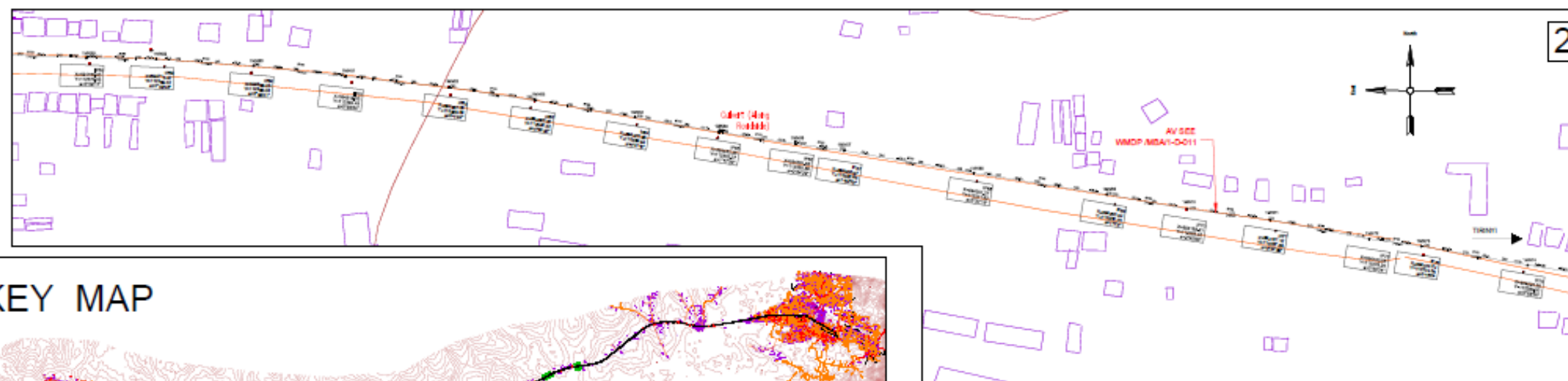
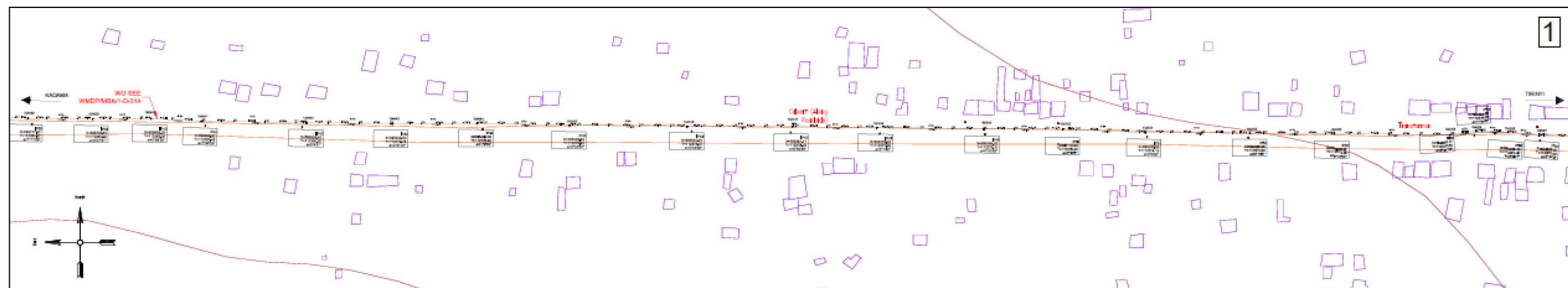




LEGEND	
	CONTOURS
	ROADS
	HOUSES
	TRANSMISSION MAIN
	STATION
	DISTANCE BETWEEN STATIONS
	REFERENCE POINT
	DISTANCE BETWEEN REFERENCE POINTS
	LANDMARKS
	SWAMP

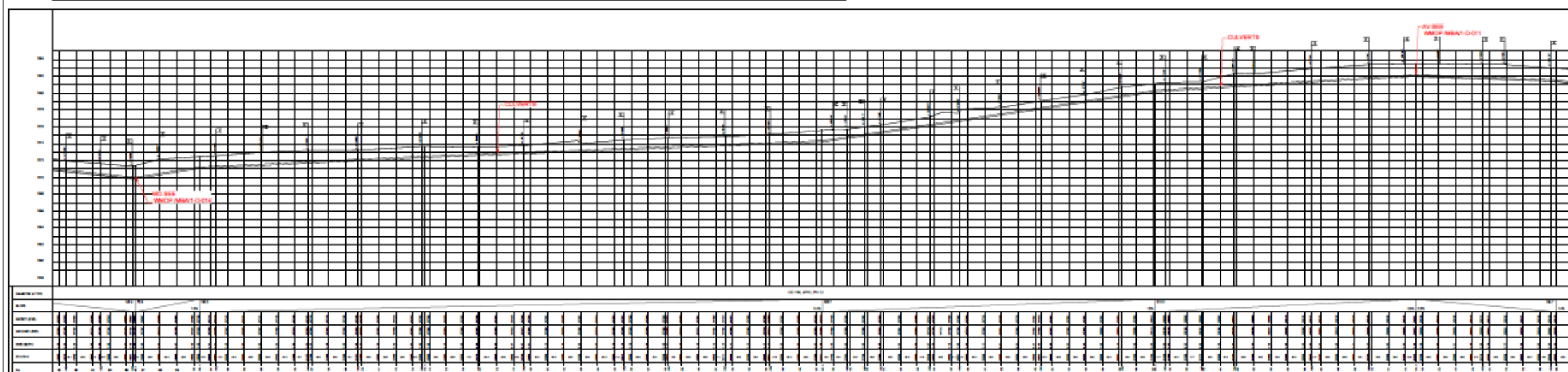
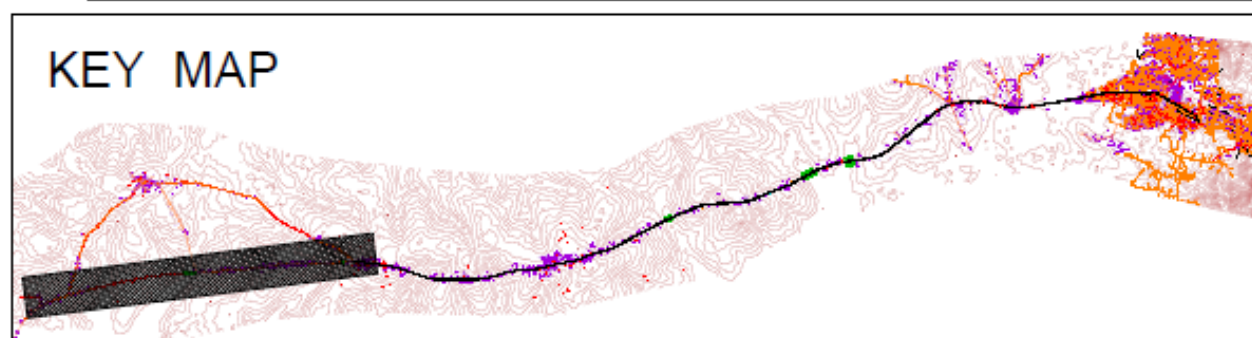


FOR TENDER PURPOSES ONLY	
PROJECT TITLE: MSA WATER SUPPLY AND SANITATION PROJECT	
DRAWING TITLE: LONGITUDINAL SECTION TRANSMISSION MAIN TO TRENTO ON 180 SPLIT POINT TO TRENTO	
DESIGNED: [Name]	SCALE: 1:200
DRAWN: [Name]	FORMAT: A1
APPROVED: [Name]	DATE: [Date]
DRAWING NO.: WINDP/MSA/1-0-011	
SHEET NO.: 1 of 7	REVISION: 1



LEGEND	
	CONTOURS
	ROADS
	HOUSES
	TRANSMISSION MAIN
	STATION
	DISTANCE BETWEEN STATIONS
	REFERENCE POINT
	DISTANCE BETWEEN REFERENCE POINTS
	LANDMARKS
	SWAMP

KEY MAP



FOR TENDER PURPOSES ONLY



DESIGNED BY: [Name]
DRAWN BY: [Name]
APPROVED BY: [Name]

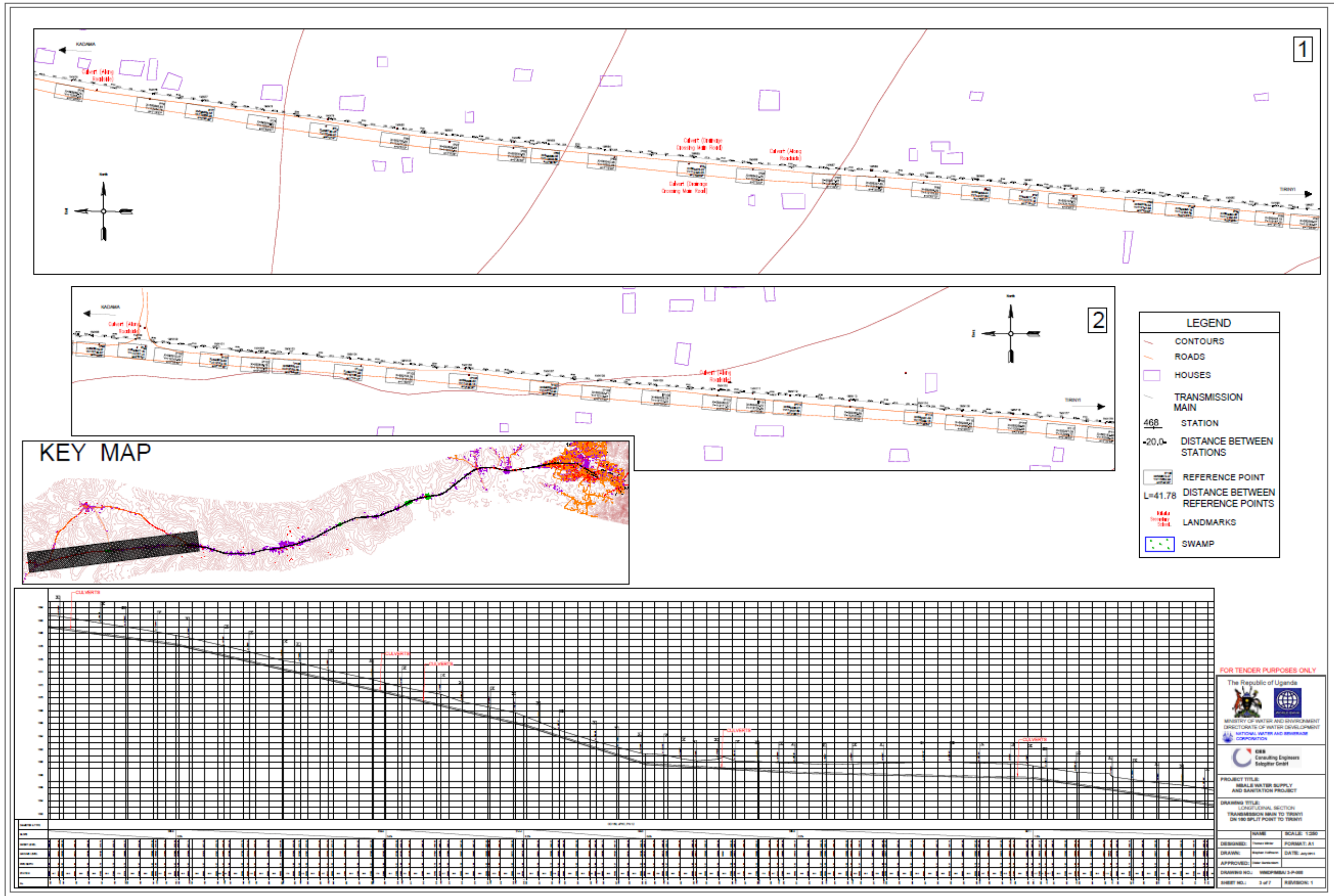
PROJECT TITLE: MSALE WATER SUPPLY AND SANITATION PROJECT

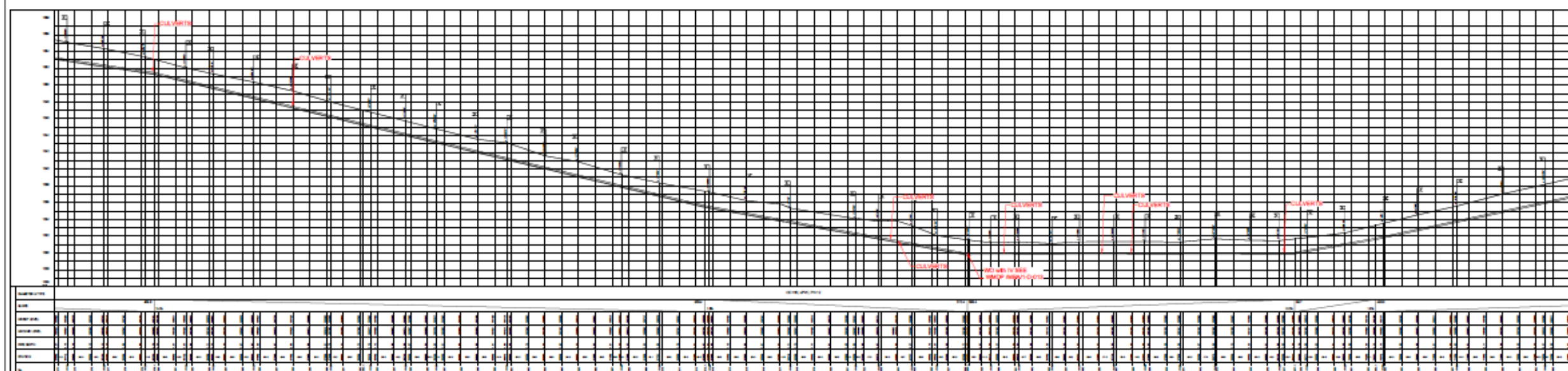
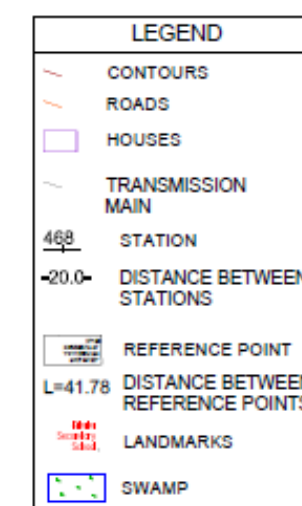
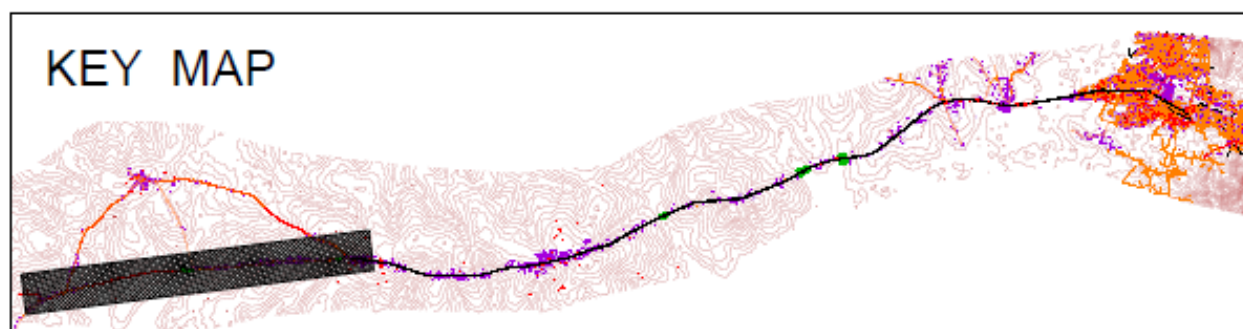
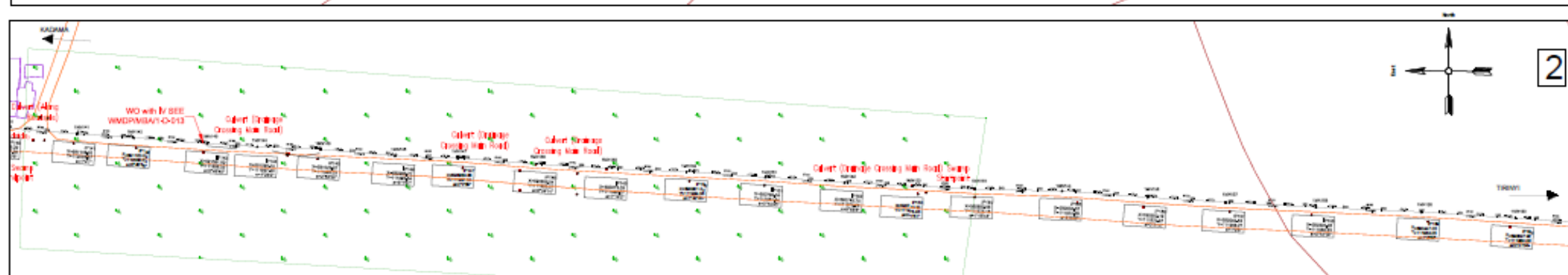
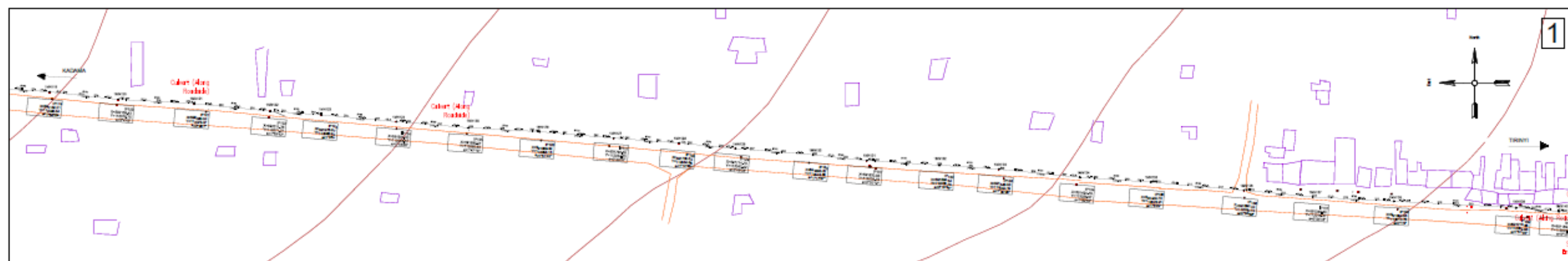
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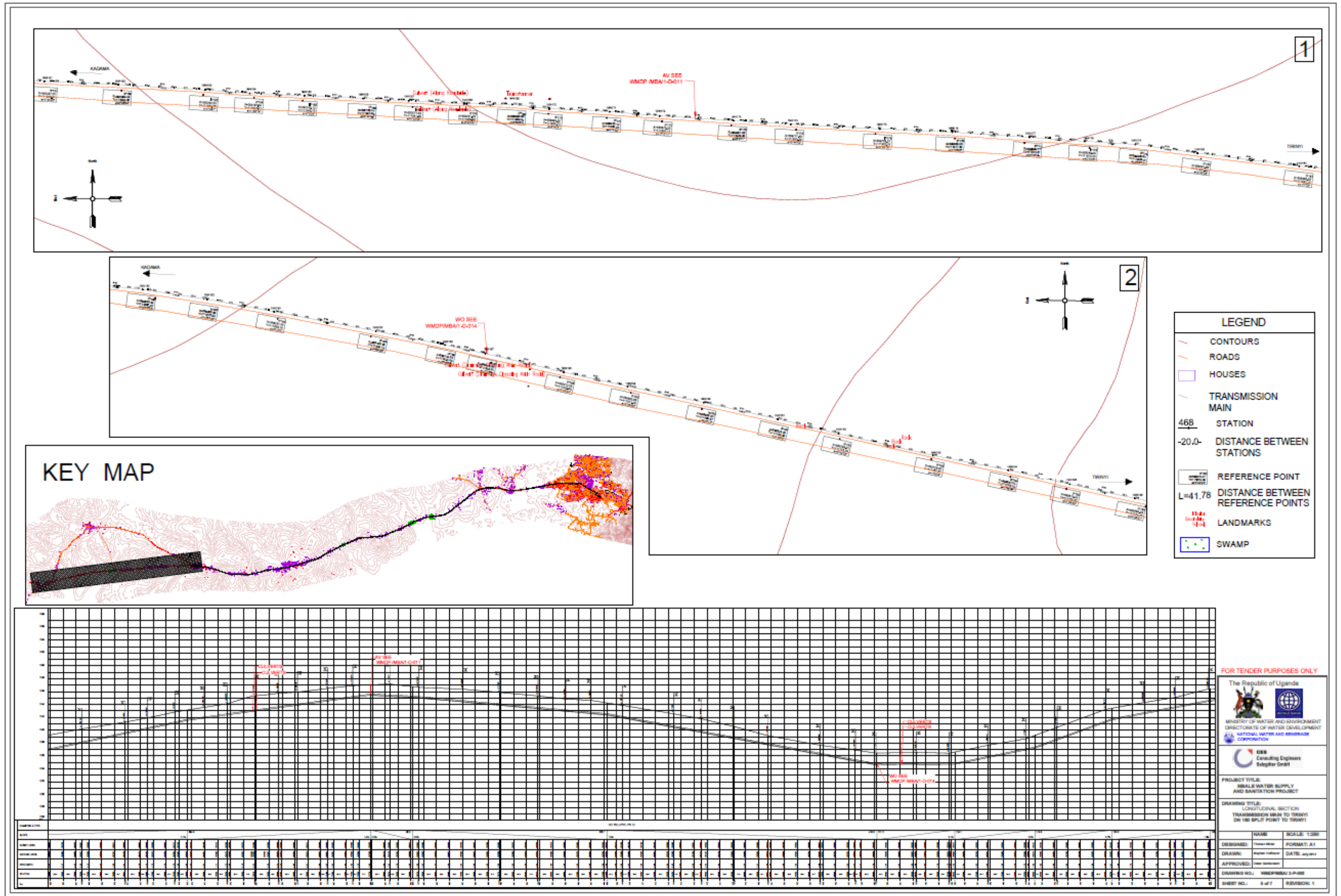
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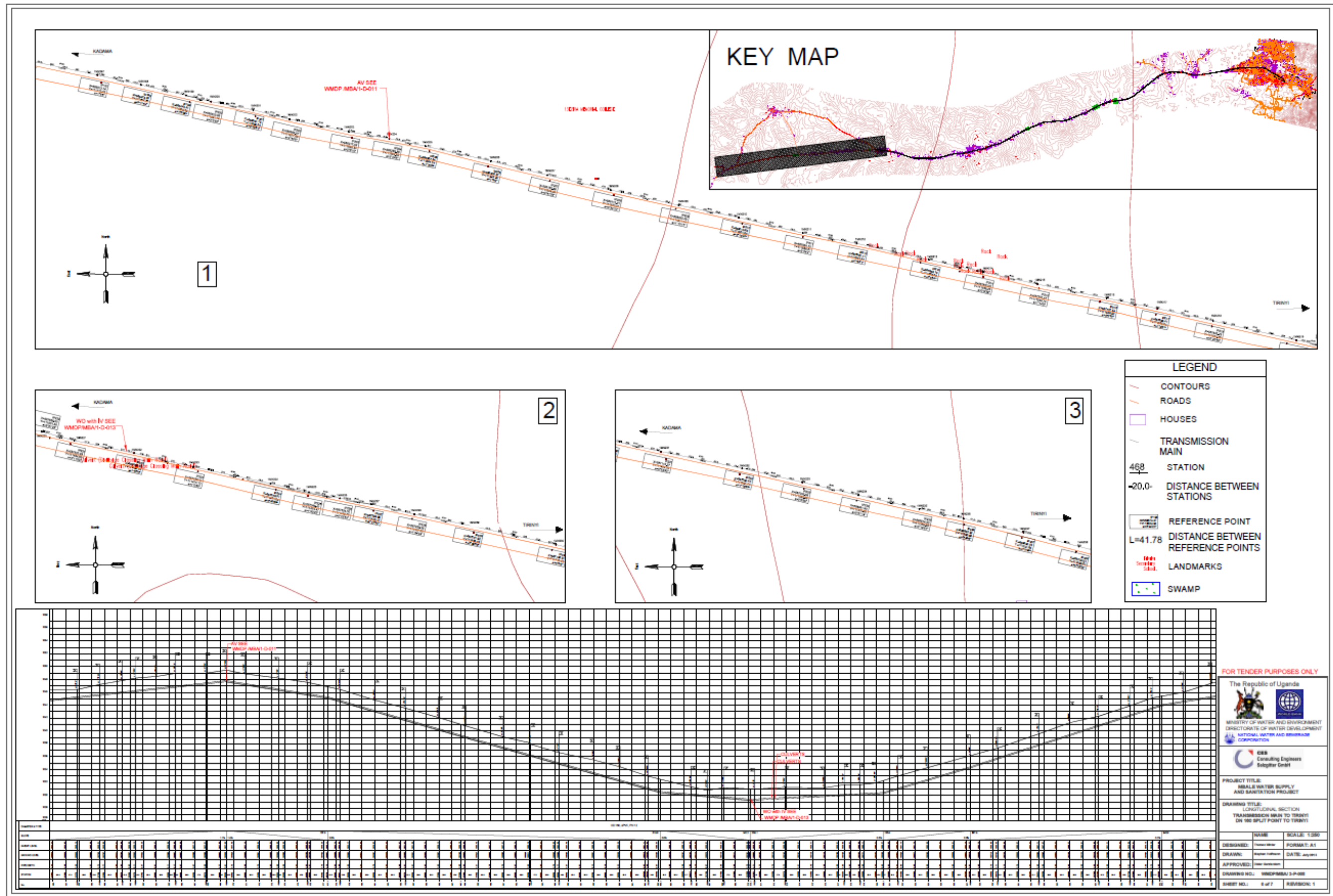
SHEET NO.: 2 of 7

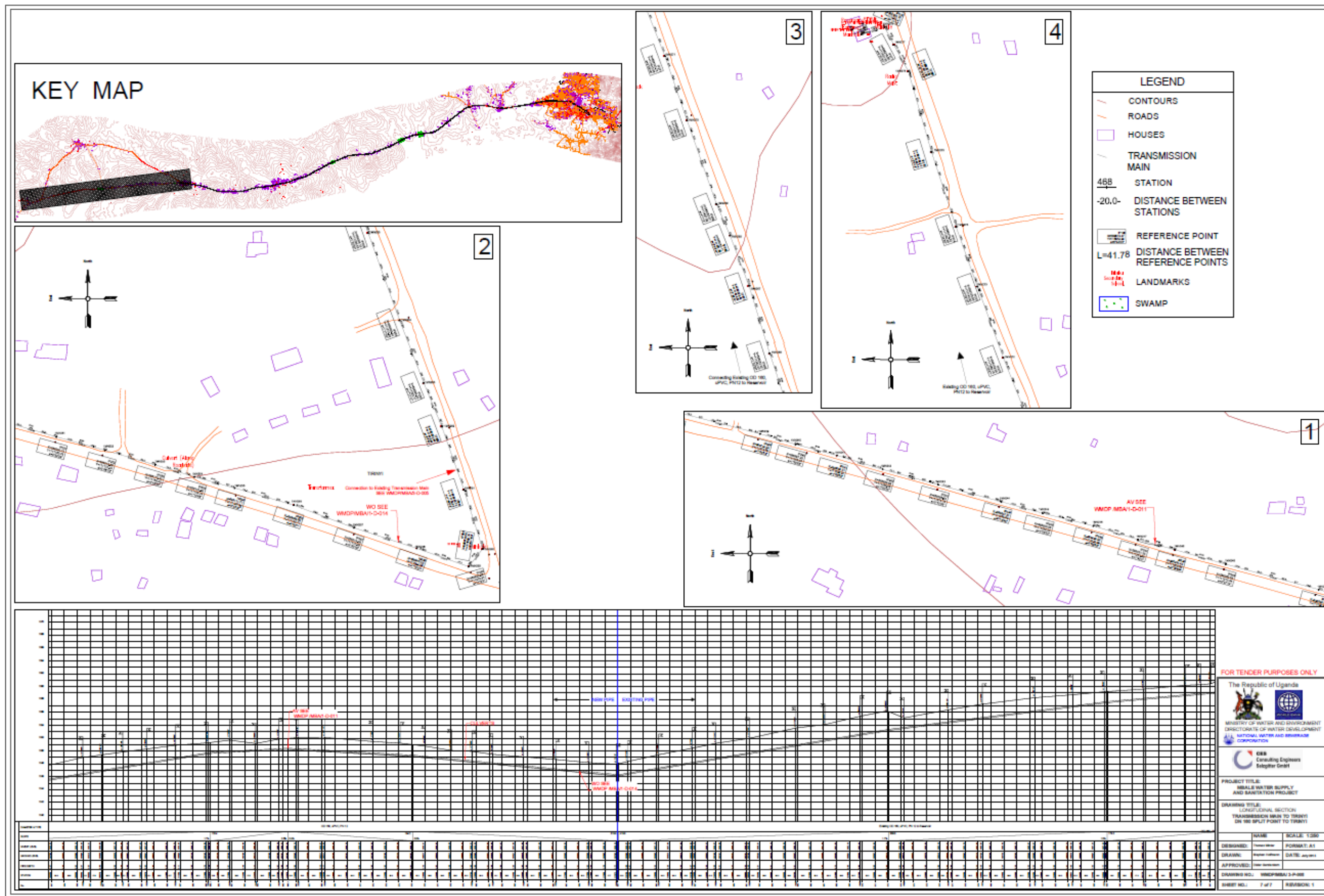
REVISION: 1

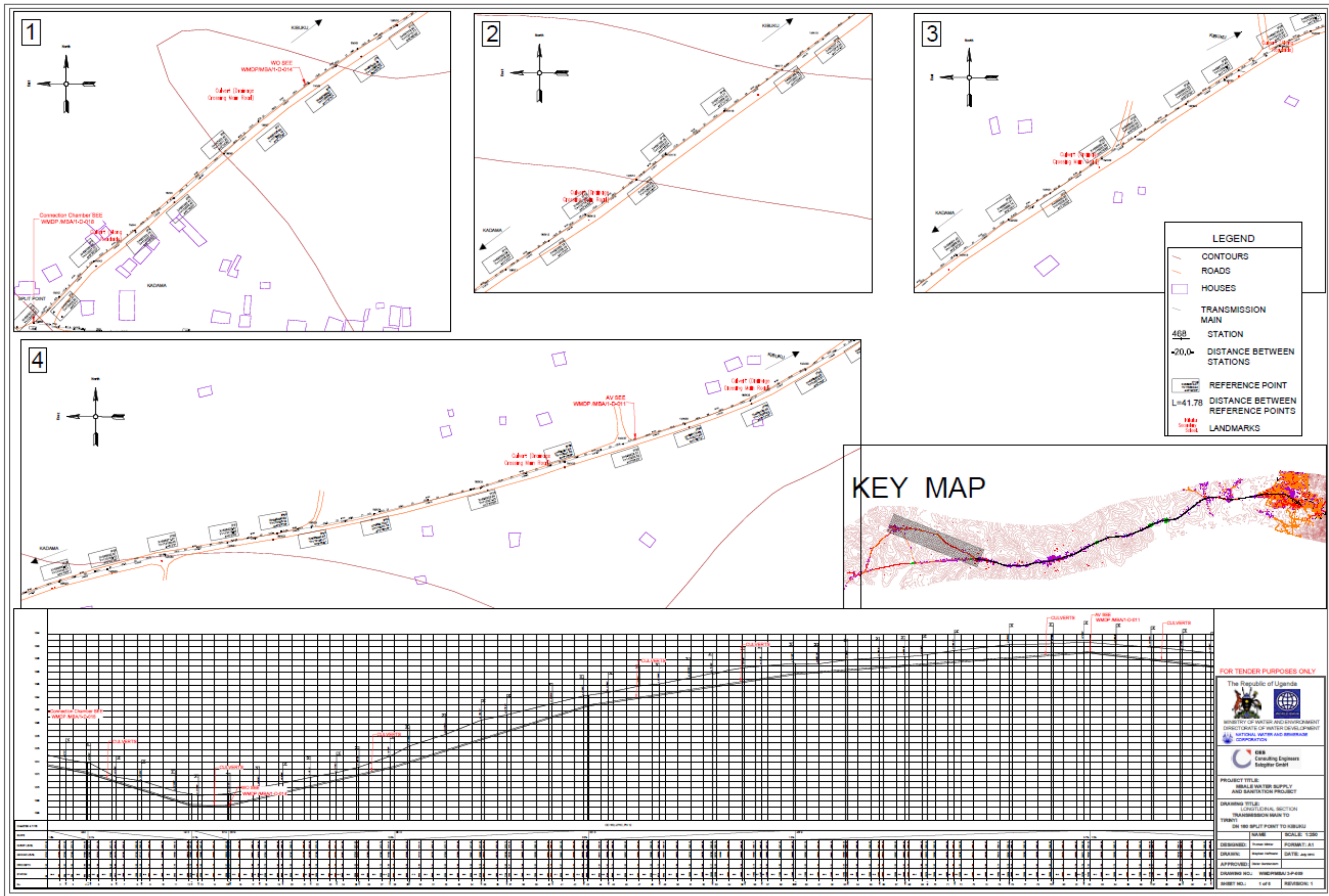


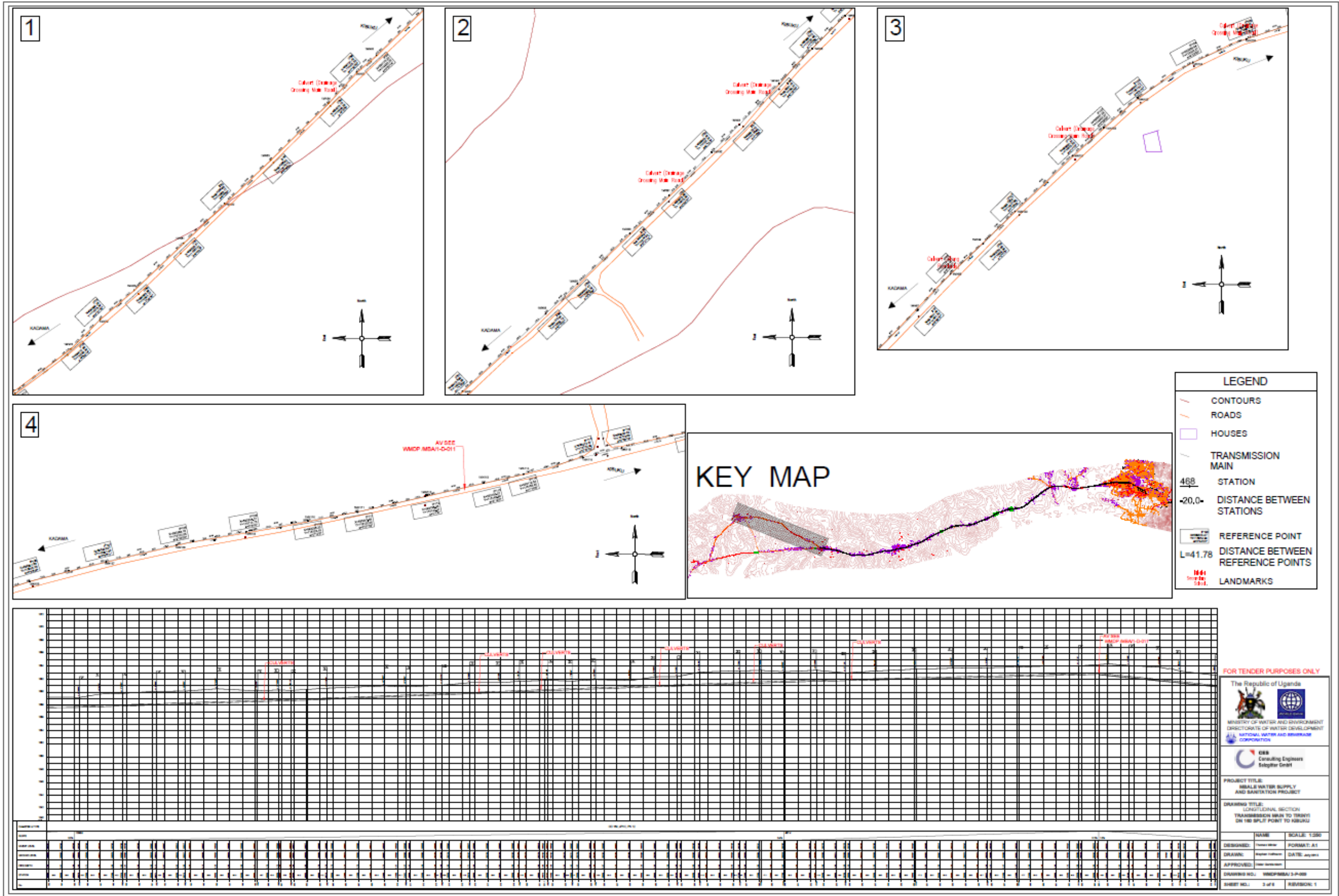


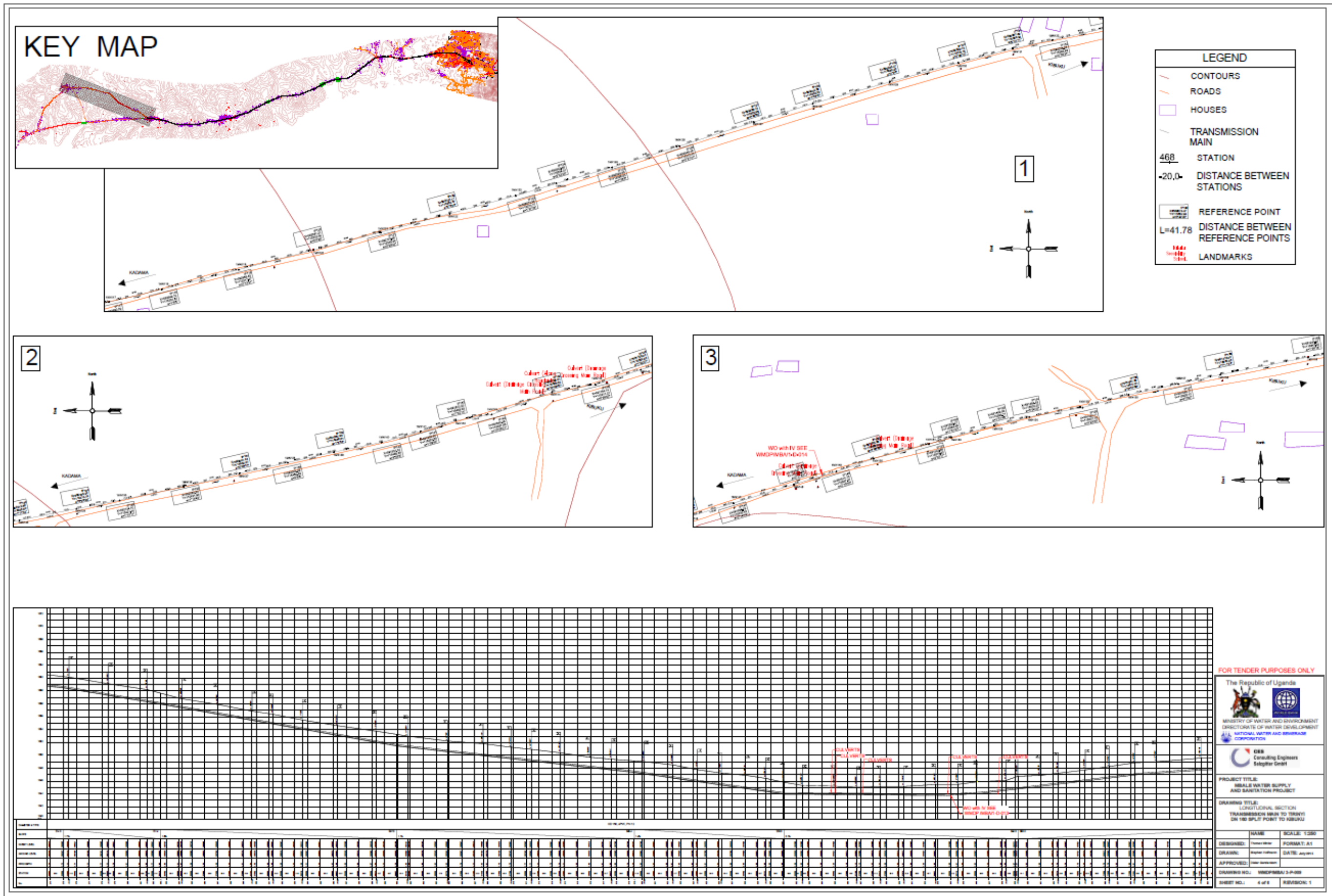


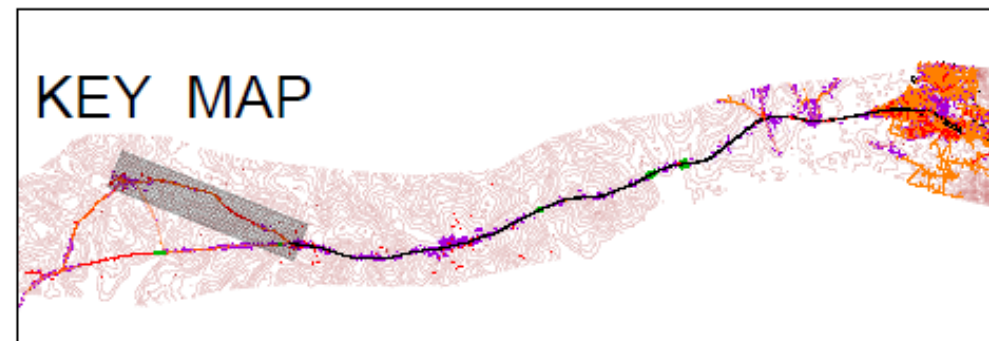
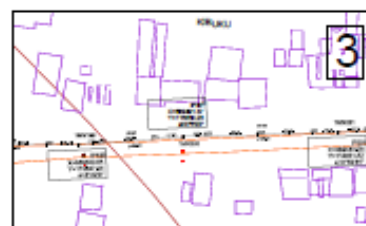
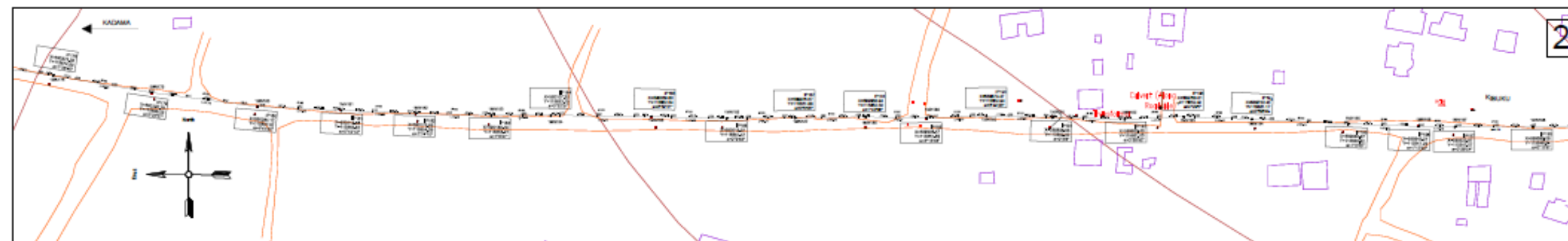
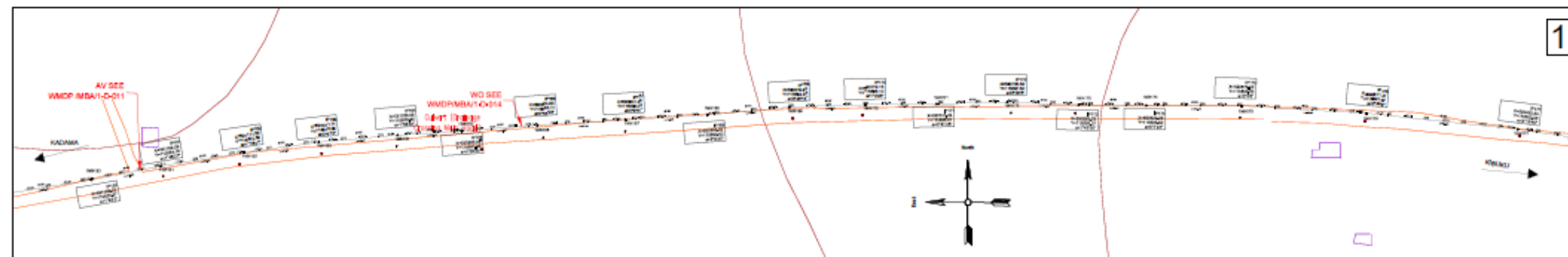




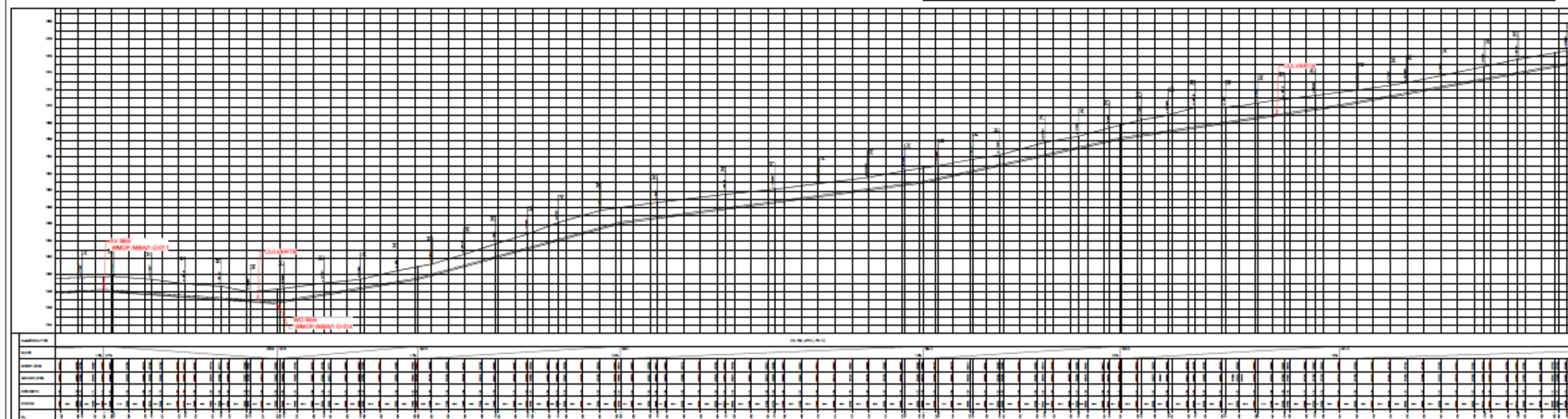








LEGEND	
	CONTOURS
	ROADS
	HOUSES
	TRANSMISSION MAIN
	STATION
	DISTANCE BETWEEN STATIONS
	REFERENCE POINT
	DISTANCE BETWEEN REFERENCE POINTS
	LANDMARKS



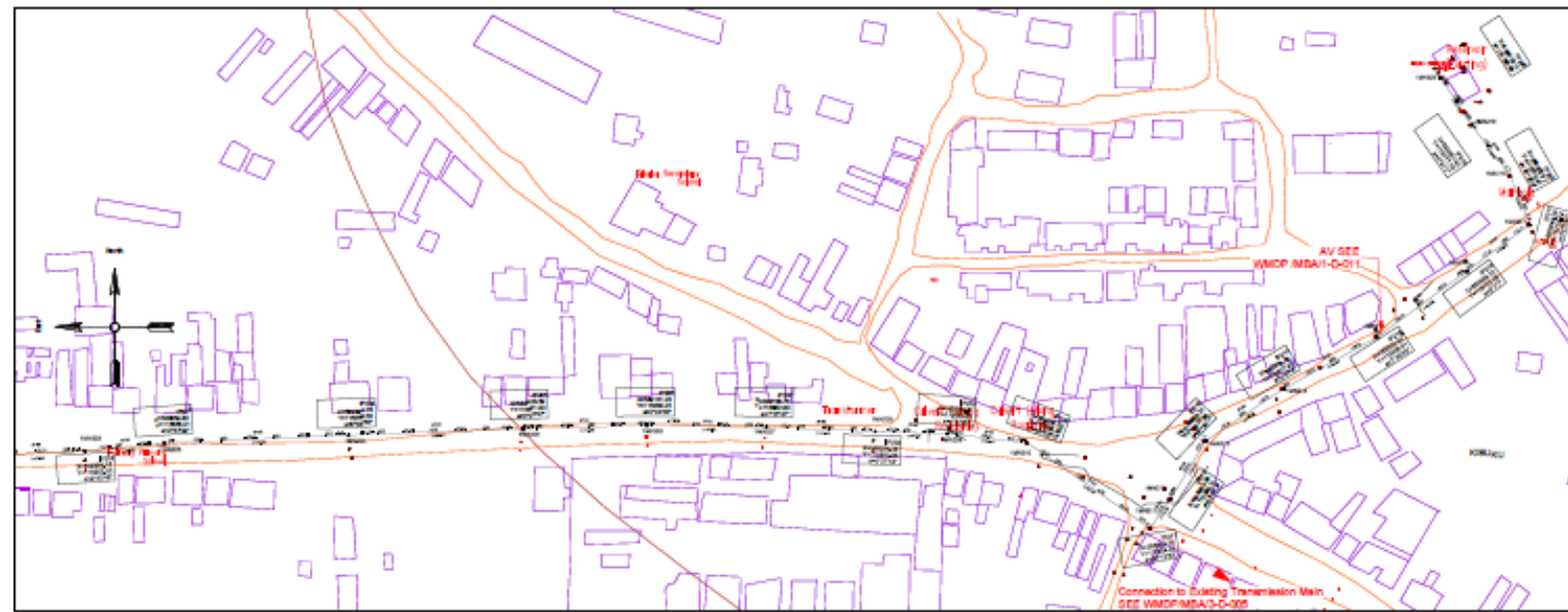
FOR TENDER PURPOSES ONLY



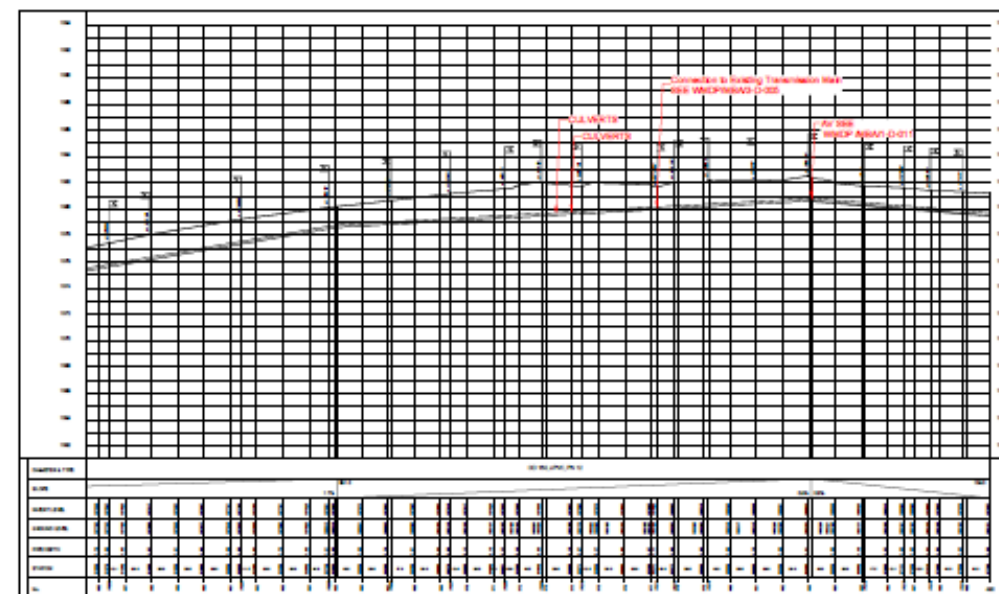
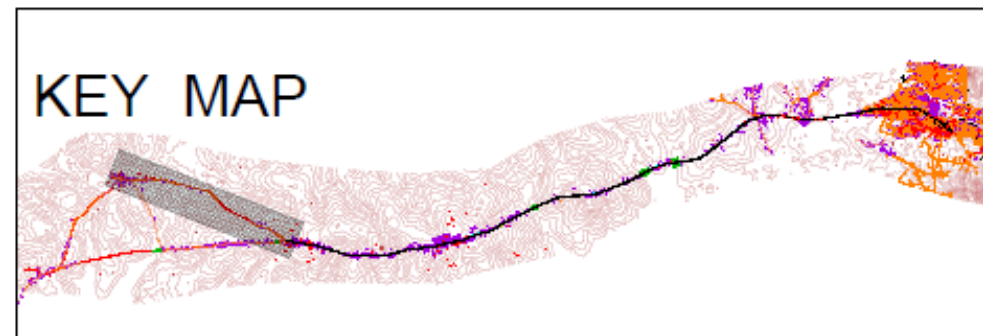
PROJECT TITLE:
WASILE WATER SUPPLY
AND SANITATION PROJECT

DRAWING TITLE:
LONGITUDINAL SECTION
TRANSMISSION MAIN TO TRUNK
ON THE SPLIT POINT TO KIBUKU

NAME	SCALE: 1:200
DESIGNED: [Name]	FORMAT: A1
DRAWN: [Name]	DATE: [Date]
APPROVED: [Name]	
DRAWING NO.: WSDP/MAU/3-P-008	
SHEET NO.: 3 of 3	REVISION: 1



LEGEND	
	CONTOURS
	ROADS
	HOUSES
	TRANSMISSION MAIN
	STATION
	DISTANCE BETWEEN STATIONS
	REFERENCE POINT
	DISTANCE BETWEEN REFERENCE POINTS
	LANDMARKS



FOR TENDER PURPOSES ONLY	
 The Republic of Uganda MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT NATIONAL WATER AND SEWERAGE CORPORATION	
 CEB Consulting Engineers Subplotter GmbH	
PROJECT TITLE: MBALE WATER SUPPLY AND SANITATION PROJECT	
DRAWING TITLE: LONGITUDINAL SECTION TRANSMISSION MAIN TO TIBETI ON THE SPIT POINT TO KIBUKU	
NAME	SCALE: 1:250
DESIGNED: Thomas Mwanza	FORMAT: A1
DRAWN: Michael Mwanza	DATE: July 2014
APPROVED: Peter Mwanza	
DRAWING NO.: WSDP/MB/5-P-008	
SHEET NO.: 8 of 8	REVISION: 1

SENIOR QUARTERS SEWERAGE



FOR TENDER PURPOSES ONLY

Legend

- Man holes
- Existing Sewer line
- Houses
- Roads
- Fences
- Contours
- Storm water lines
- Proposed raising main
- New sewer lines
- Trees

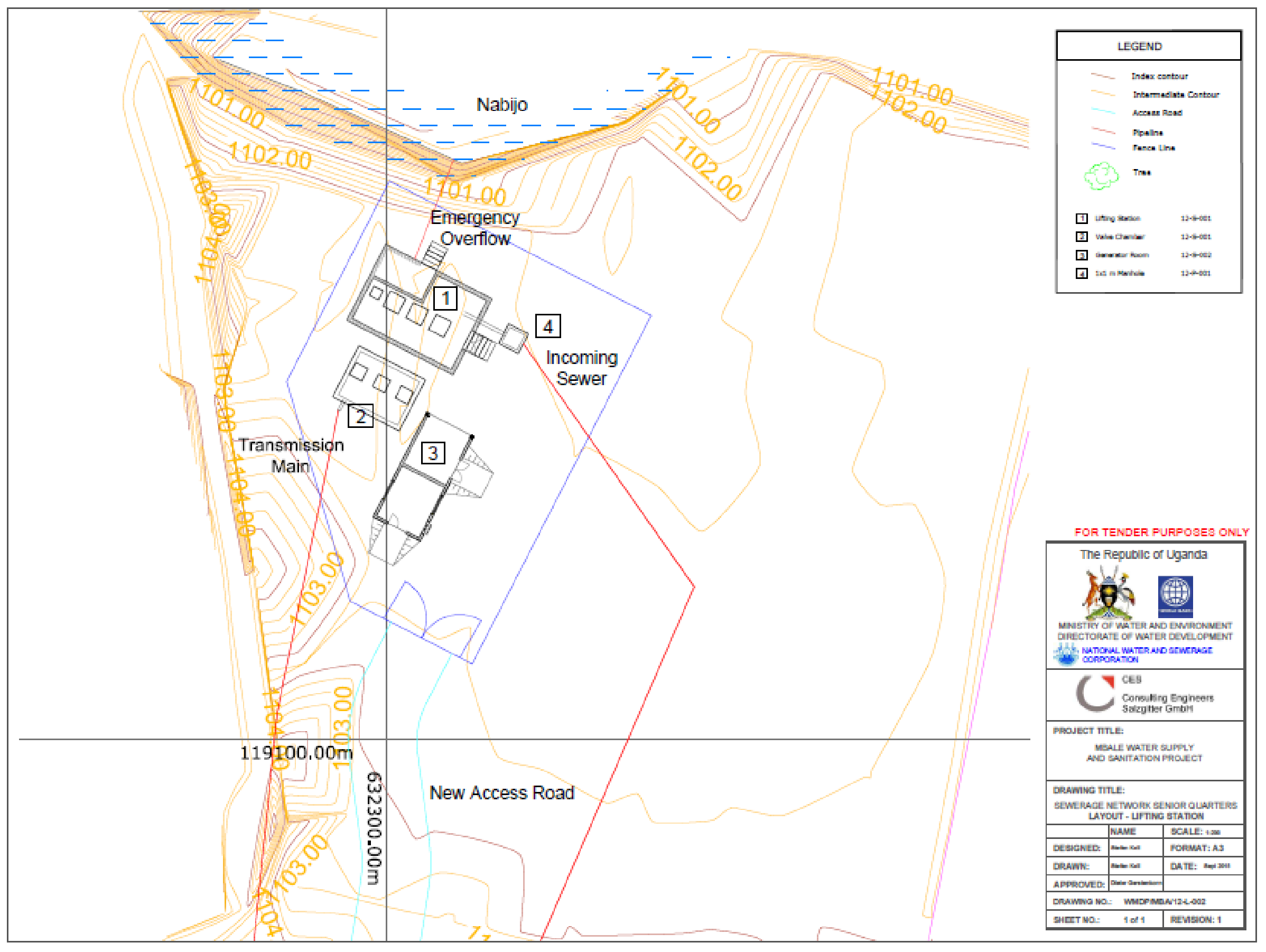
The Republic of Uganda



PROJECT TITLE:
MBALE WATER SUPPLY
AND SANITATION PROJECT

DRAWING TITLE:
SEWERAGE NETWORK SENIOR QUARTERS
GENERAL LAYOUT

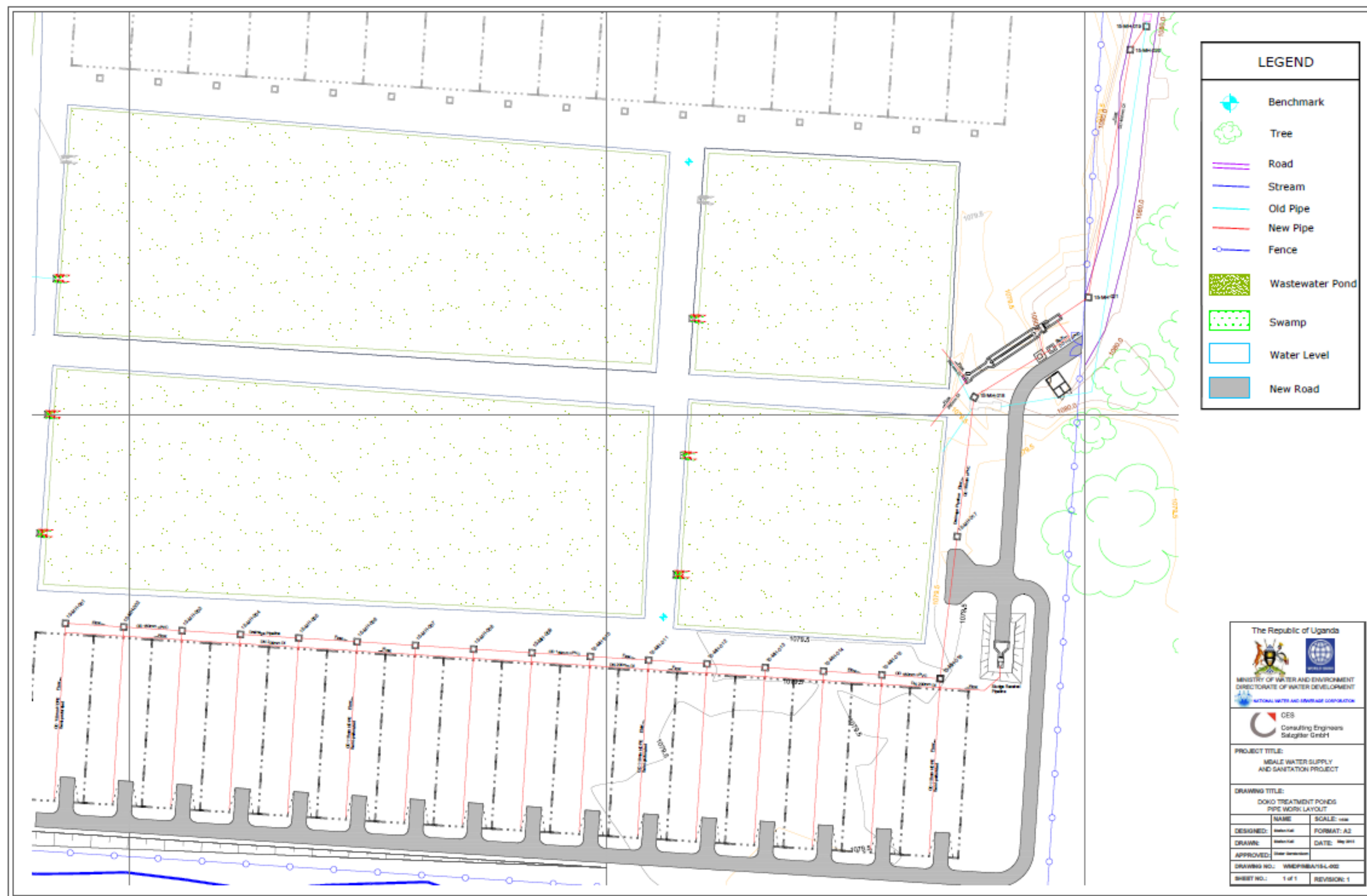
	NAME	SCALE: as indicated
DESIGNED:	Boris Hall	FORMAT: A3
DRAWN:	Boris Hall	DATE: May 2015
APPROVED:	Oliver Gerschlager	
DRAWING NO.:	WMDP/MSA/12-L-001	
SHEET NO.:	1 of 1	REVISION: 1



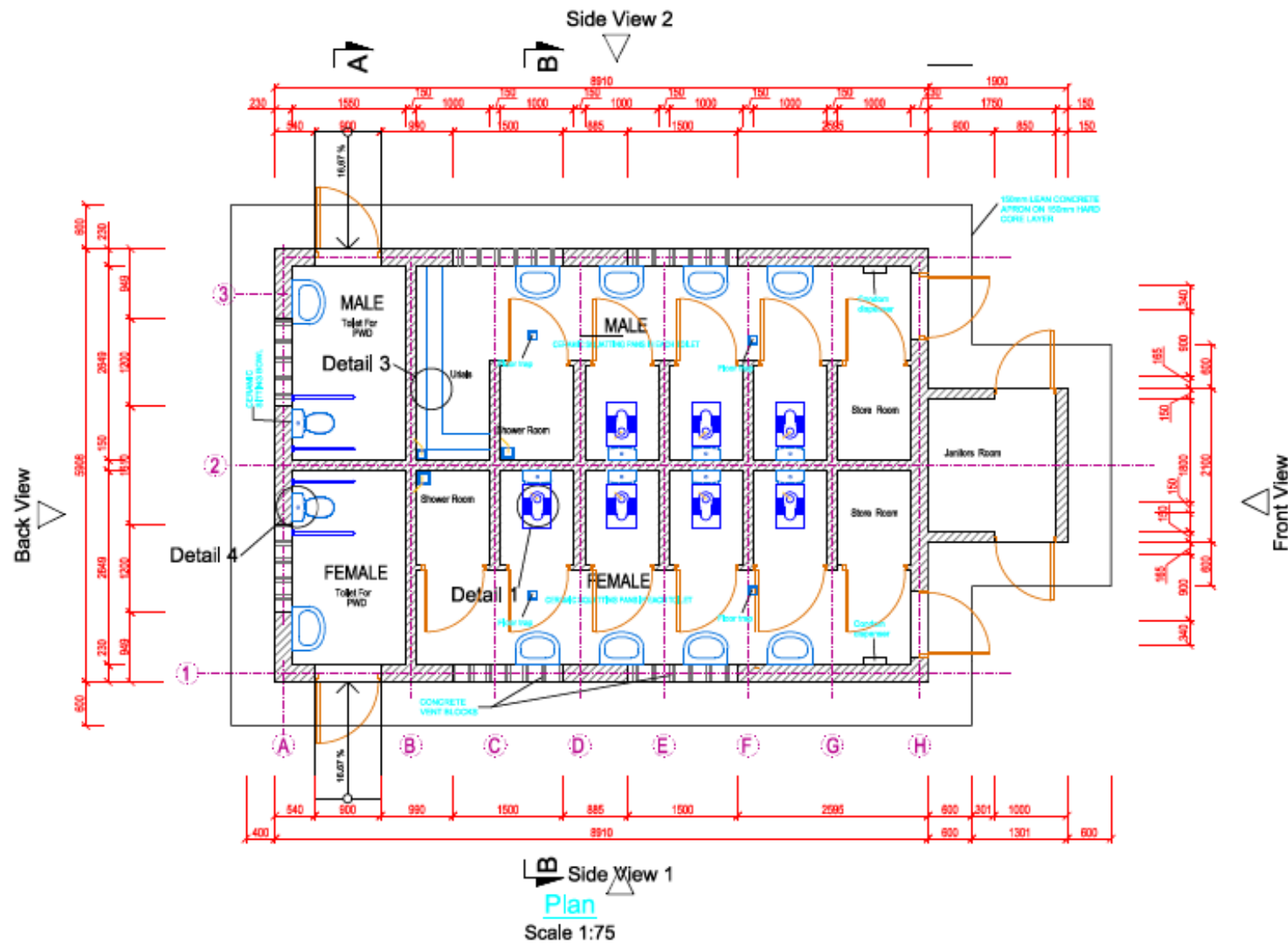
NAMATALA PONDS LAYOUT

DOKO PONDS LAYOUT

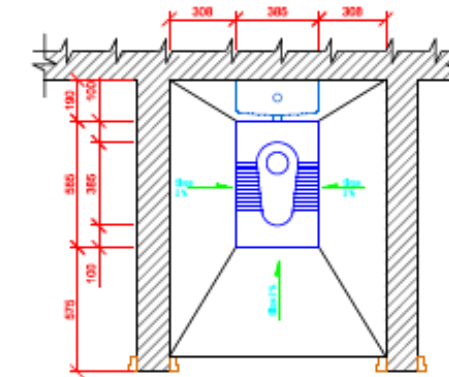




PUBLIC TOILETS





4. 30 mm BLINDING TO BE POURED BENEATH SURFACE BEDS
5. MESH REINFORCEMENT (A142, MASS 0.22 KG/M²) TO BE PLACED IN SURFACE BEDS AND APRON
6. GROUND FOR FOUNDATION TO BE INSPECTED BY ENGINEER
4. STRIP FOOTING TO BE POURED AGAINST NATURAL GROUND
5. GRAVEL UNDER SURFACE BED TO BE COMPACTED TO 95% MOD ASTHOO
6. ONLY PRE-TREATED WOOD TO BE USED FOR ROOF MEMBERS AND DOOR
7. PRE-PAINTED CORRUGATED IRON ROOF SHEETS TO BE GALVANIZED AND OF GAUGE 28
8. DPC TO BE PLACED IN FIRST BRICK COURSE OVER GROUND LEVEL
9. WALLS PLASTERED INSIDE AND OUTSIDE, CEMENT SAND RATIO 1:3
10. 150 x 150 mm WALL TILES UP TO 1800 mm ABOVE FLOOR LEVEL
11. ALL OUTLETS FOR SHOWERS, URINALS, ETC SHALL BE EQUIPPED WITH A FLOOR TRAP
12. ALL INTERNAL PLUMBING TO BE HIDDEN BEHIND THE PLASTER, MAIN INTERNAL PIPE DN 20 GL AND BRANCHES TO SINKS AND TAPS TO BE DN 15 GL
13. EVERY TOILET SHALL BE EQUIPPED WITH A TAP

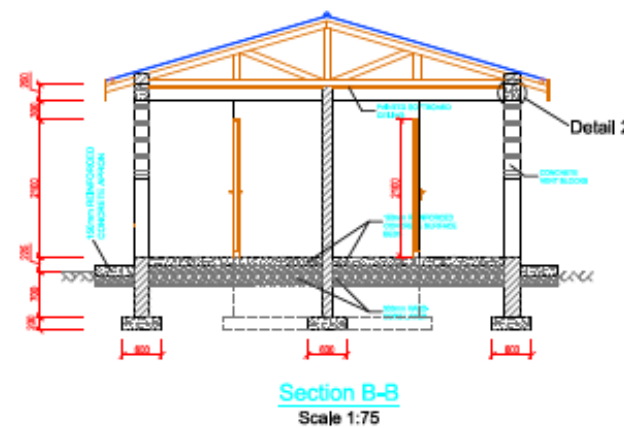
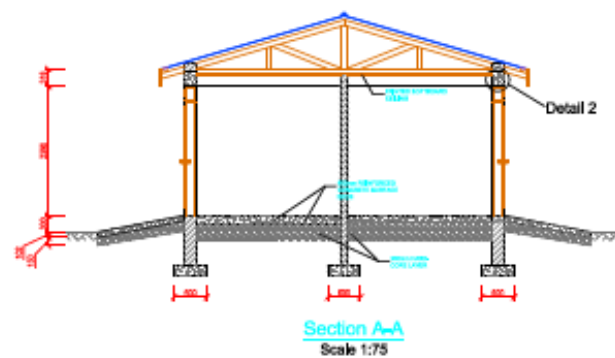


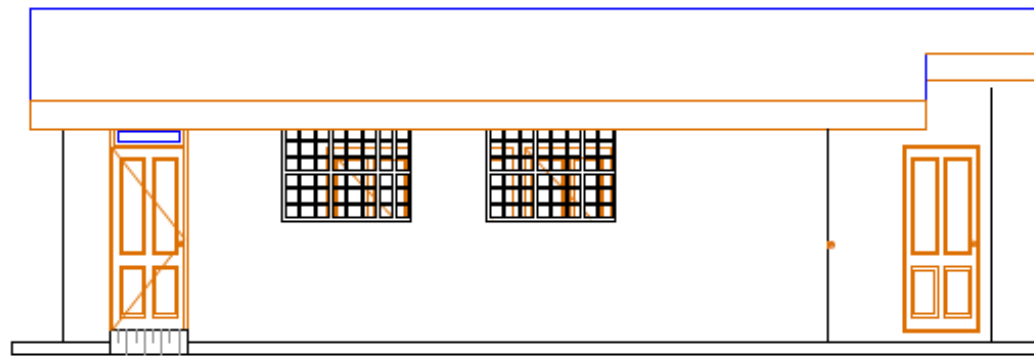
Detail 1 - Floor in Toilet and Shower

Scale 1:30

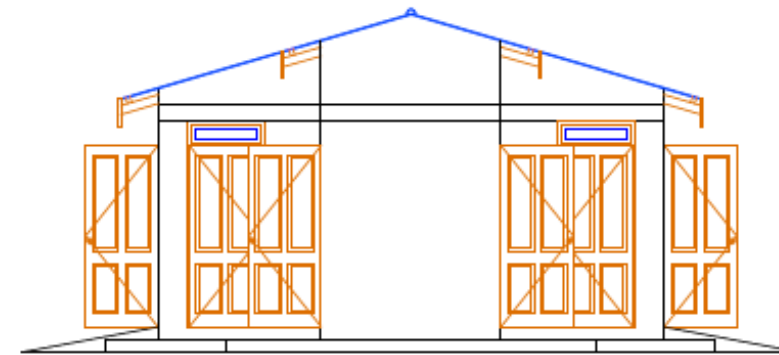
FOR TENDER PURPOSES ONLY

The Republic of Uganda	
 	
MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT NATIONAL WATER AND SEWERAGE CORPORATION	
 CES Consulting Engineers Salzgitter GmbH	
PROJECT TITLE: MBALE WATER SUPPLY AND SANITATION PROJECT	
DRAWING TITLE: PUBLIC ABLUTION BLOCK PLAN VIEW AND SECTIONS	
NAME	SCALE: as indicated
DESIGNED: Stefan Kall	FORMAT: A3
DRAWN: Stefan Kall	DATE: June 2016
APPROVED: Dieter Gerstenkom	
DRAWING NO.: WMDP/MBA/19-S-001	
SHEET NO.: 1 of 3	REVISION: 1

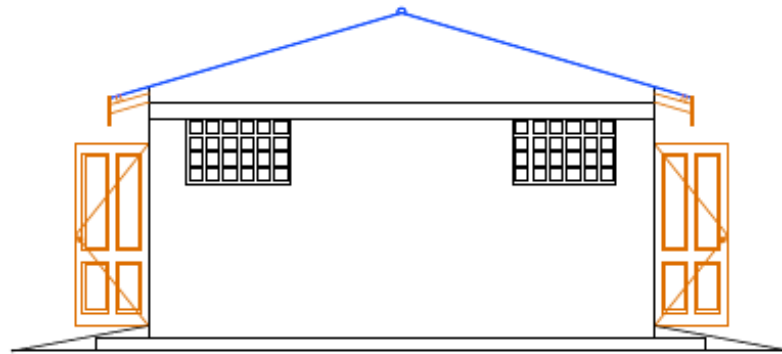




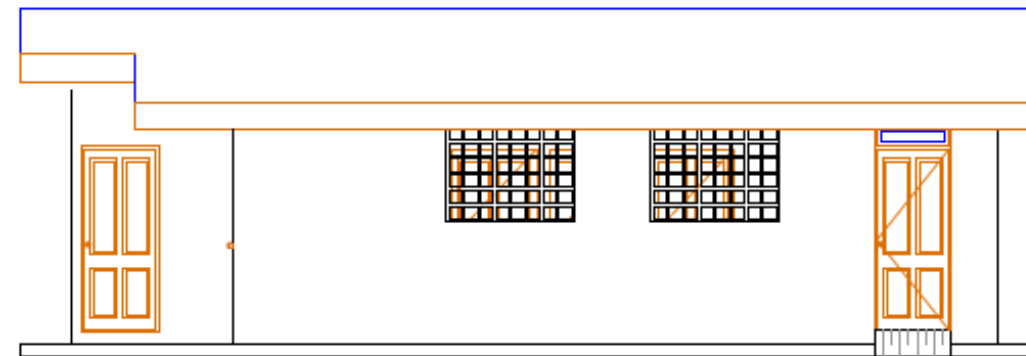
Side View 1
Scale 1:75



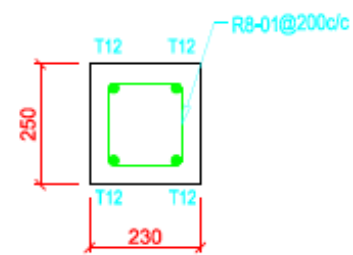
Front View
Scale 1:75



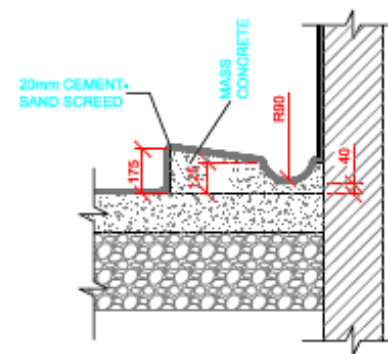
Back View
Scale 1:75



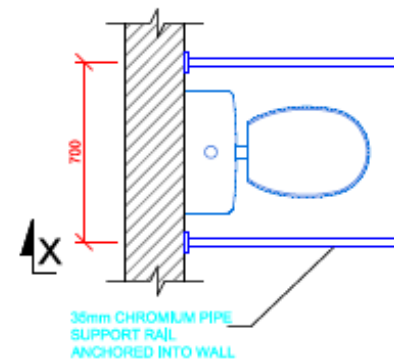
Side View 2
Scale 1:75



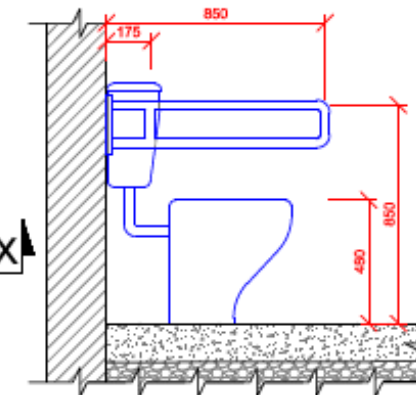
Detail 2 - Ring Beam
Scale 1:50



Detail 3 - Urinal
Scale 1:25






Plan

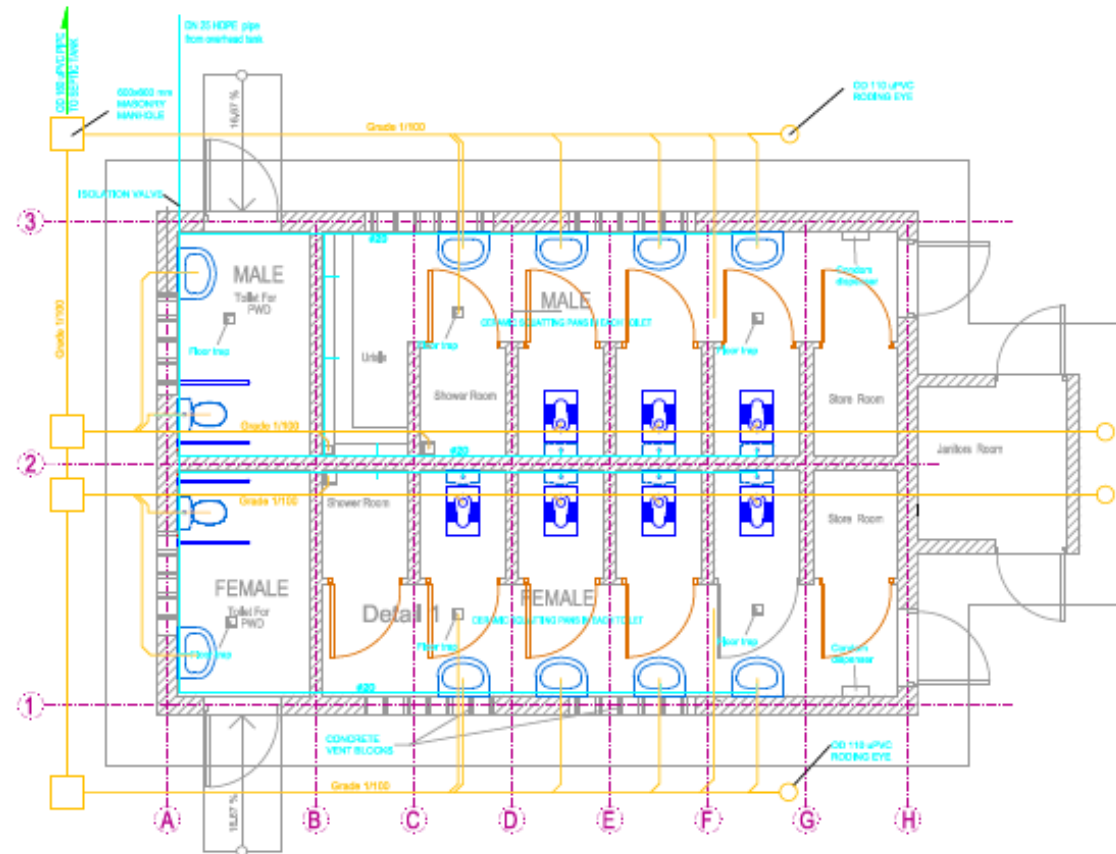


Section X-X




Detail 4 - Toilet for Disabled Person
Scale 1:25

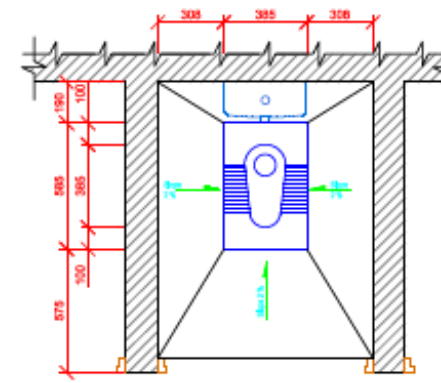
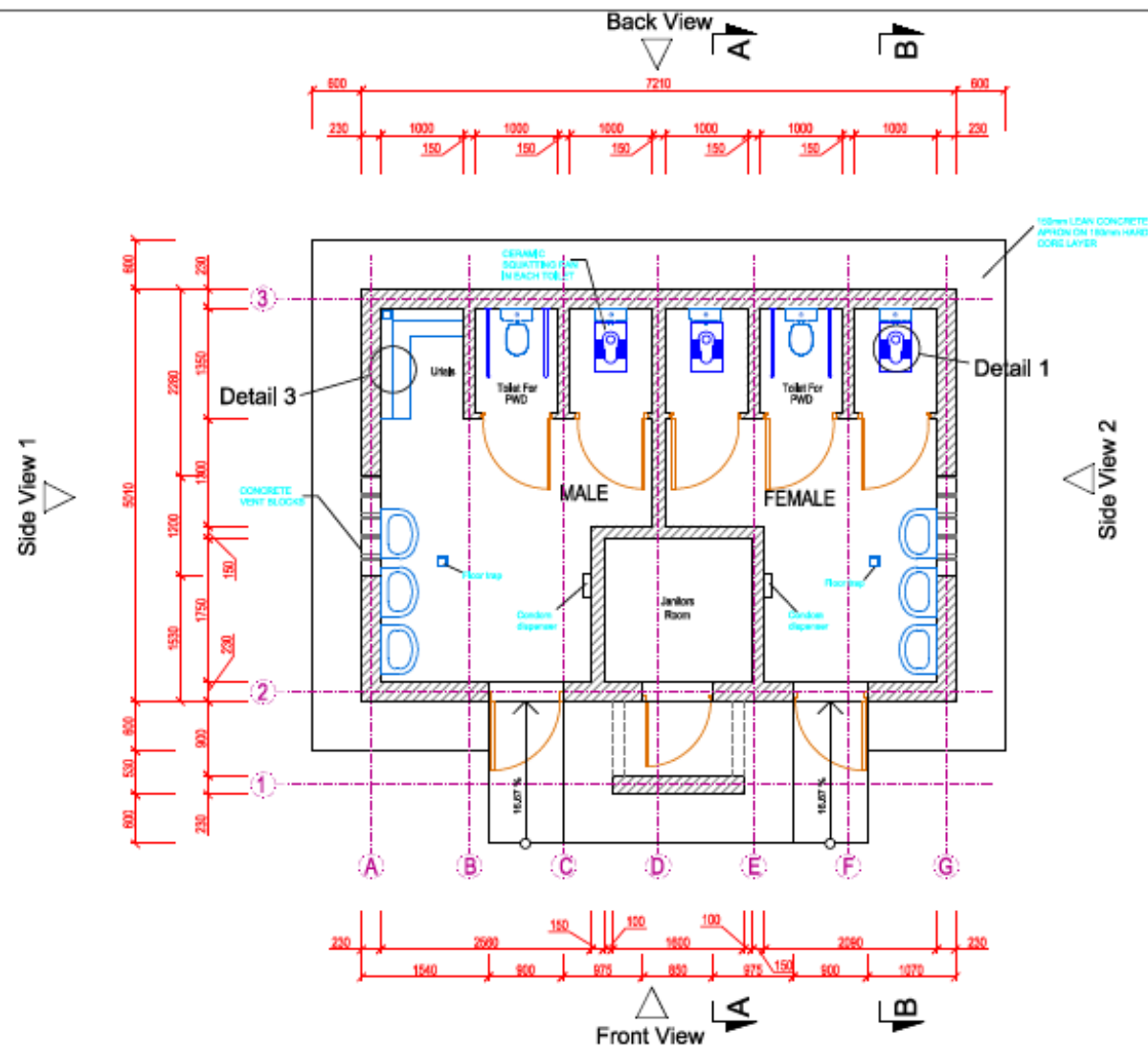
FOR TENDER PURPOSES ONLY

The Republic of Uganda		
 		
MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT NATIONAL WATER AND SEWERAGE CORPORATION		
 CES Consulting Engineers Salzgitter GmbH		
PROJECT TITLE:		
MBALE WATER SUPPLY AND SANITATION PROJECT		
DRAWING TITLE:		
PUBLIC ABLUTION BLOCK PLAN VIEW AND SECTIONS		
	NAME	SCALE: as indicated
DESIGNED:	Stefan Kall	FORMAT: A3
DRAWN:	Stefan Kall	DATE: June 2016
APPROVED:	Dieter Gerstenkom	
DRAWING NO.: WMDP/MBA/18-S-001		
SHEET NO.:	2 of 3	REVISION: 1

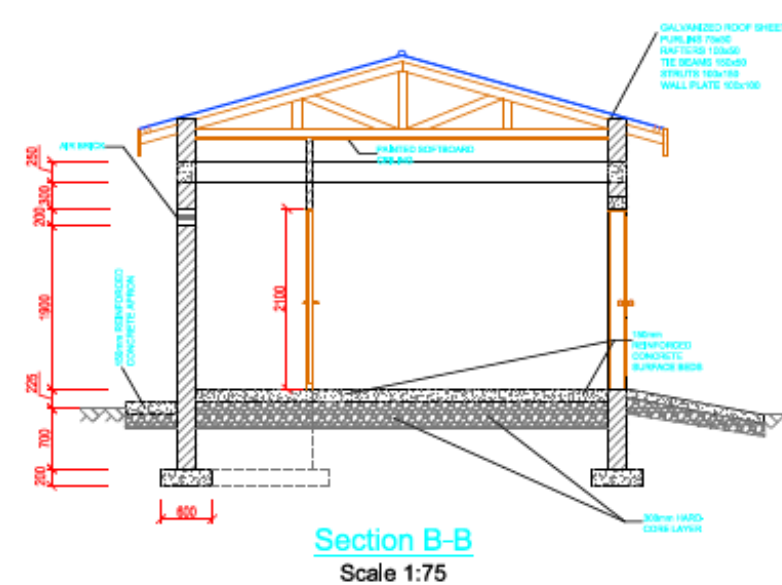
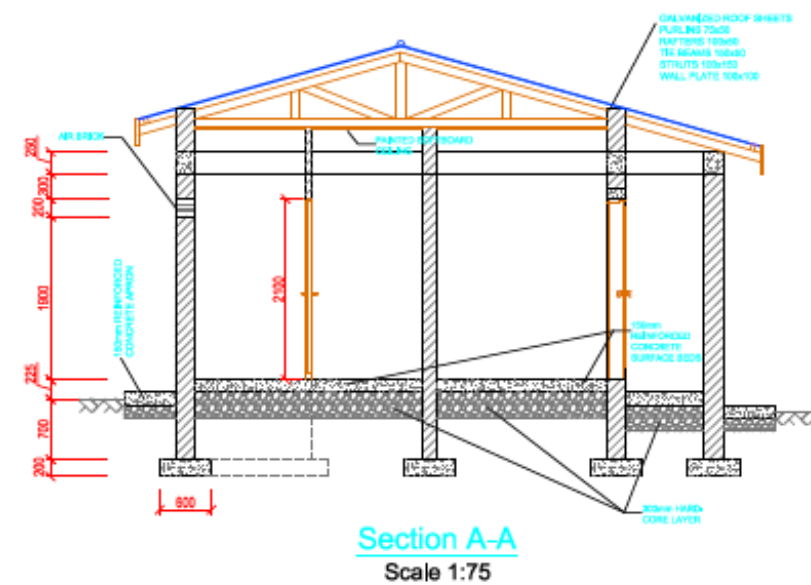


FOR TENDER PURPOSES ONLY

<p>The Republic of Uganda</p>   <p>MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT NATIONAL WATER AND SEWERAGE CORPORATION</p>		
<p> CES Consulting Engineers Salzgitter GmbH</p>		
<p>PROJECT TITLE: MBALE WATER SUPPLY AND SANITATION PROJECT</p>		
<p>DRAWING TITLE: PUBLIC ABLUTION BLOCK PLAN VIEW AND SECTIONS</p>		
	NAME	SCALE: as indicated
DESIGNED:	Stefan Kell	FORMAT: A3
DRAWN:	Stefan Kell	DATE: June 2016
APPROVED:	Dieter Gerstenkom	
DRAWING NO.: WMDP/MBA/18-S-001		
SHEET NO.:	3 of 3	REVISION: 1

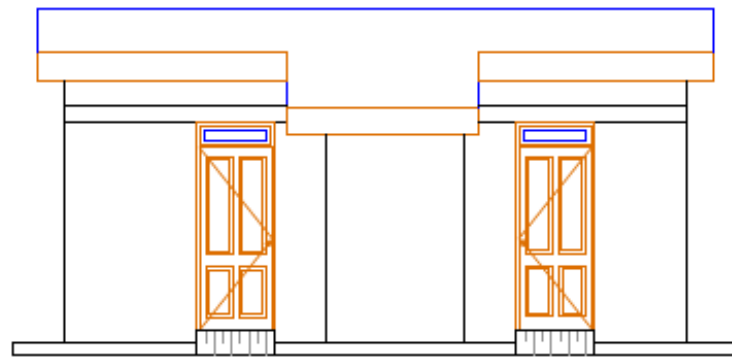


4. 50 mm BLINDING TO BE POURED BENEATH SURFACE BEDS
5. MESH REINFORCEMENT (A142, MASS 0.22 KG/M2) TO BE PLACED IN SURFACE BEDS AND APRON
6. GROUND FOR FOUNDATION TO BE INSPECTED BY ENGINEER
4. STRIP FOOTING TO BE POURED AGAINST NATURAL GROUND
5. GRAVEL UNDER SURFACE BED TO BE COMPACTED TO 95% MOD ASTHOO
6. ONLY PRE-TREATED WOOD TO BE USED FOR ROOF MEMBERS AND DOOR
7. PRE-PAINTED CORRUGATED IRON ROOF SHEETS TO BE GALVANIZED AND OF GAUGE 28
8. DPC TO BE PLACED IN FIRST BRICK COURSE OVER GROUND LEVEL
9. WALLS PLASTERED INSIDE AND OUTSIDE, CEMENT SAND RATIO 1:3
10. 150 x 150 mm WALL TILES UP TO 1800 mm ABOVE FLOOR LEVEL
11. ALL OUTLETS FOR SHOWERS, URINALS, ETC SHALL BE EQUIPPED WITH A FLOOR TRAP
12. ALL INTERNAL PLUMBING TO BE HIDDEN BEHIND THE PLASTER, MAIN INTERNAL PIPE DN 20 GI AND BRANCHES TO SINKS AND TAPS TO BE DN 15 GL
13. EVERY TOILET SHALL BE EQUIPPED WITH A TAP

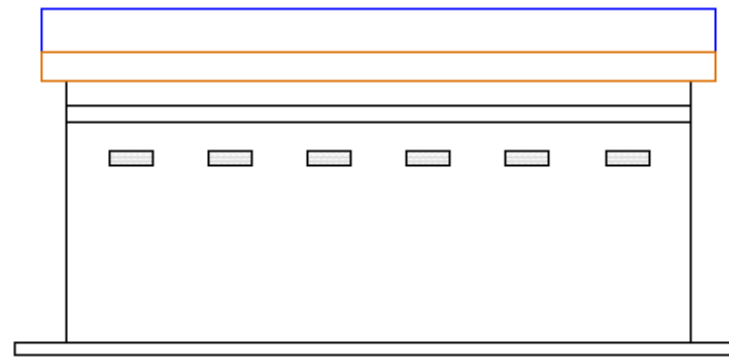


FOR TENDER PURPOSES ONLY

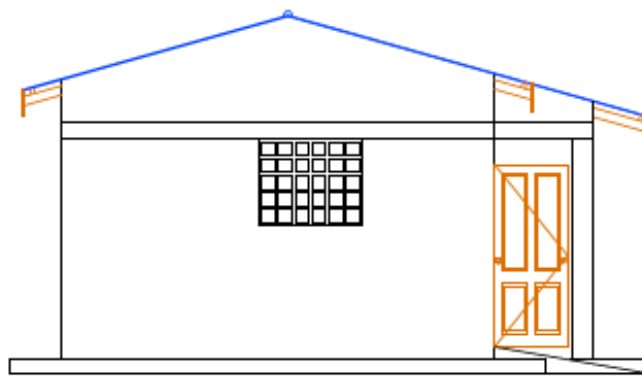
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<p>CES Consulting Engineers Salzgitter GmbH</p>		
<p>PROJECT TITLE: MBALE WATER SUPPLY AND SANITATION PROJECT</p>		
<p>DRAWING TITLE: PUBLIC TOILET PLAN VIEW AND SECTIONS</p>		
	NAME	SCALE: as indicated
DESIGNED:	Stefan Hall	FORMAT: A3
DRAWN:	Stefan Hall	DATE: June 2015
APPROVED:	Dieter Gerstenkorn	
DRAWING NO.:		WMDF/MBA/18-S-002
SHEET NO.:	1 of 2	REVISION: 1



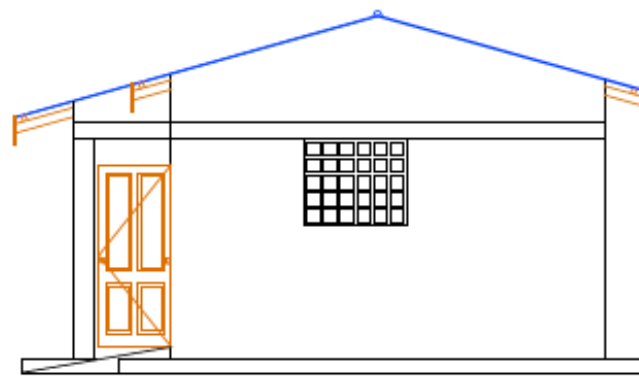
Front View
Scale 1:75



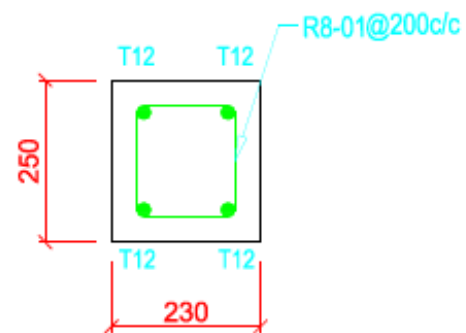
Back View
Scale 1:75



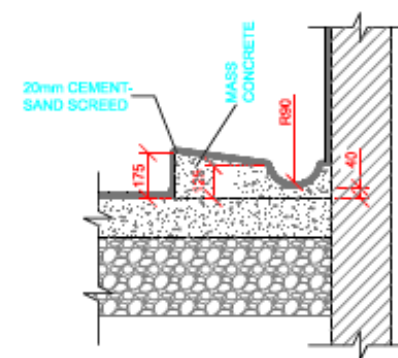
Side View 1
Scale 1:75



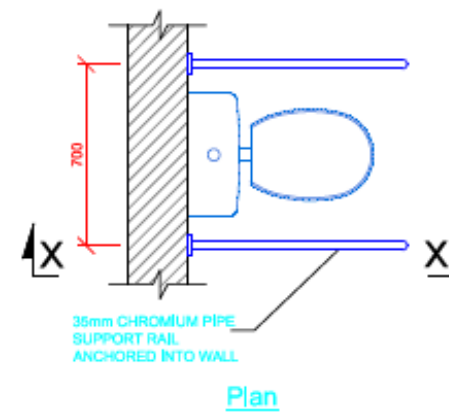
Side View 2
Scale 1:75



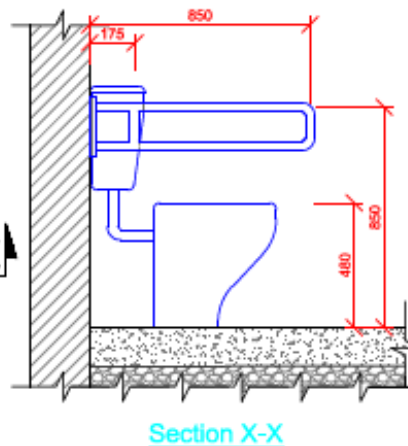
Detail 2 - Ring Beam
Scale 1:50



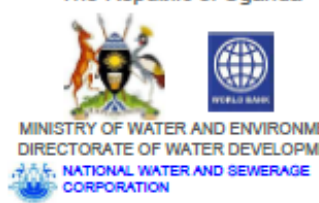

Detail 3 - Urinal
Scale 1:25

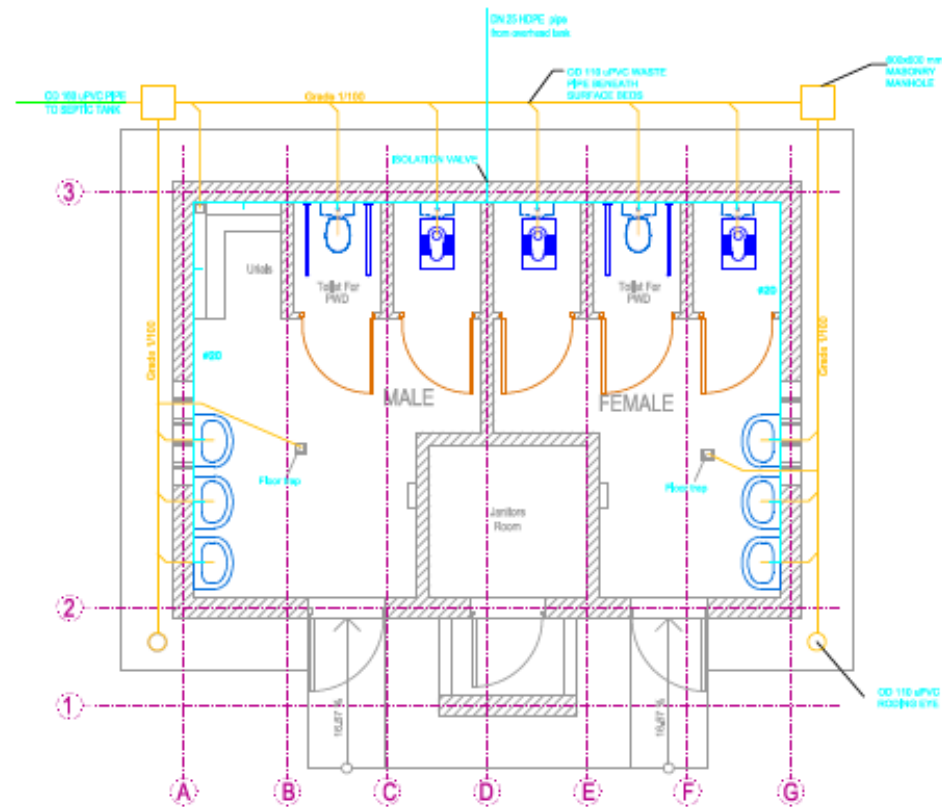


Detail 4 - Toilet for Disabled Person
Scale 1:25



FOR TENDER PURPOSES ONLY

The Republic of Uganda		
		
		
PROJECT TITLE:		
MBALE WATER SUPPLY AND SANITATION PROJECT		
DRAWING TITLE:		
PUBLIC TOILET PLAN VIEW AND SECTIONS		
	NAME	SCALE: as indicated
DESIGNED:	Stefan Kall	FORMAT: A3
DRAWN:	Stefan Kall	DATE: June 2018
APPROVED:	Dieter Gerstenkom	
DRAWING NO.:	WMDP/MBA/18-S-002	
SHEET NO.:	2 of 2	REVISION: 1

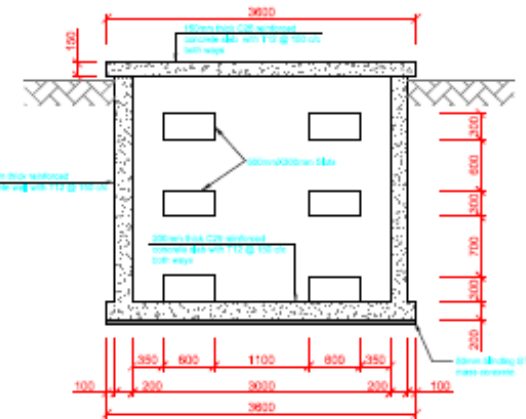


FOR TENDER PURPOSES ONLY

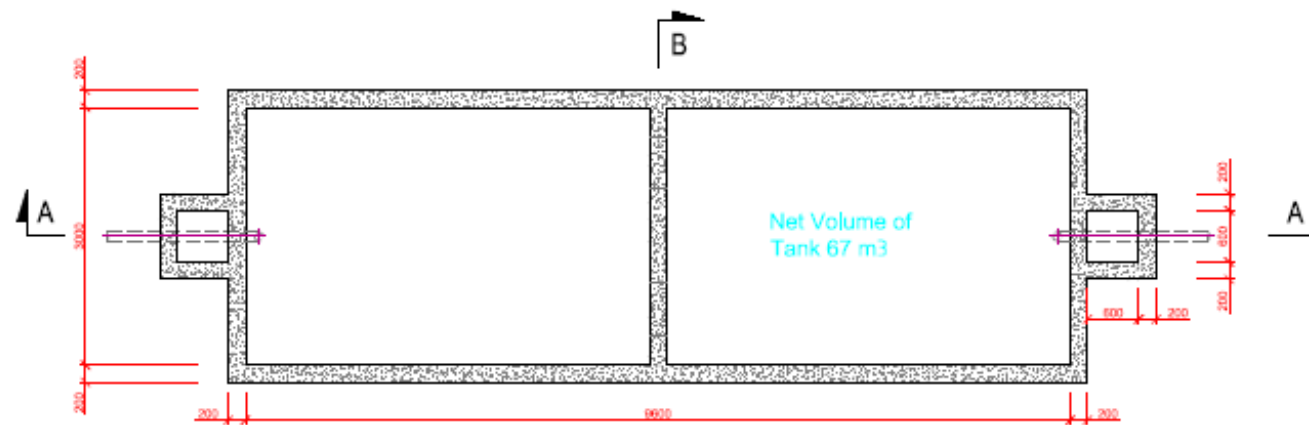
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<p> CES Consulting Engineers Salzgitter GmbH</p>		
<p>PROJECT TITLE: MBALE WATER SUPPLY AND SANITATION PROJECT</p>		
<p>DRAWING TITLE: PUBLIC TOILET PLAN VIEW AND SECTIONS</p>		
	NAME	SCALE: as indicated
DESIGNED:	Stefan Kell	FORMAT: A3
DRAWN:	Stefan Kell	DATE: June 2016
APPROVED:	Dieter Gerstenkom	
DRAWING NO.:	WMDP/MBA/18-S-002	
SHEET NO.:	3 of 3	REVISION: 1



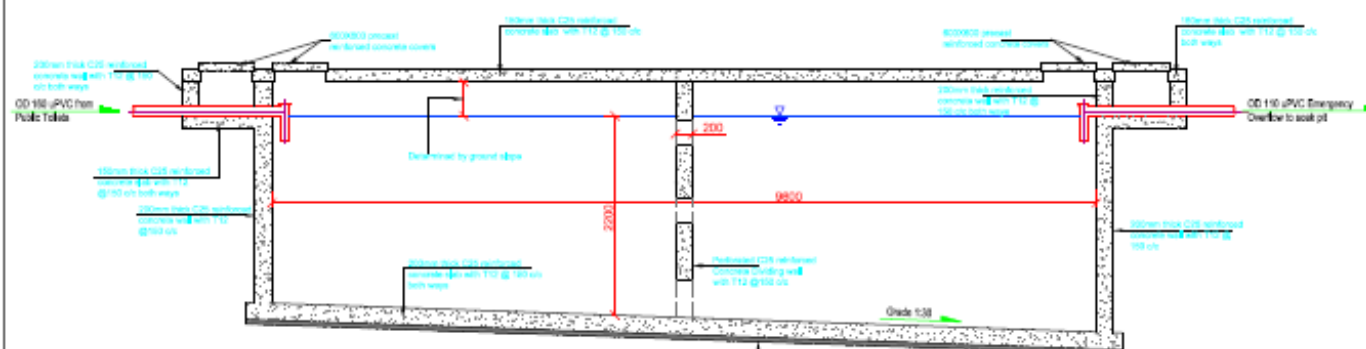
Top View



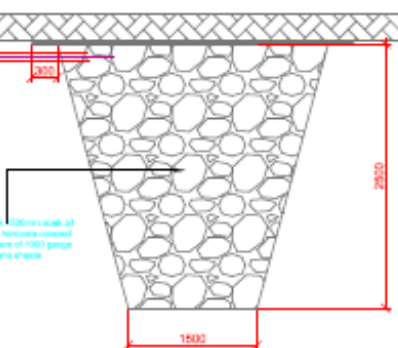
Section B-B



Plan



Section A-A







Typical section Soak Pit

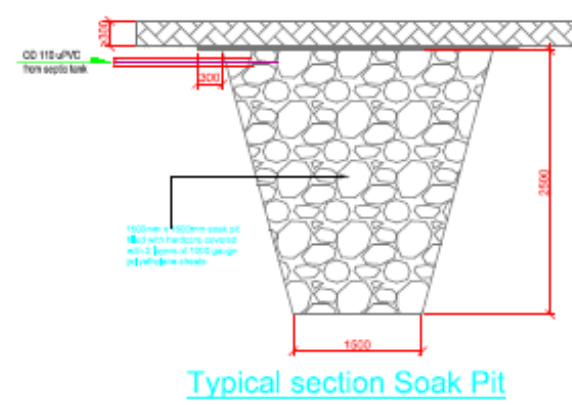
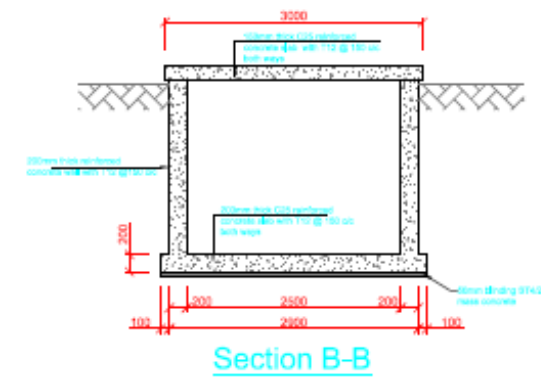
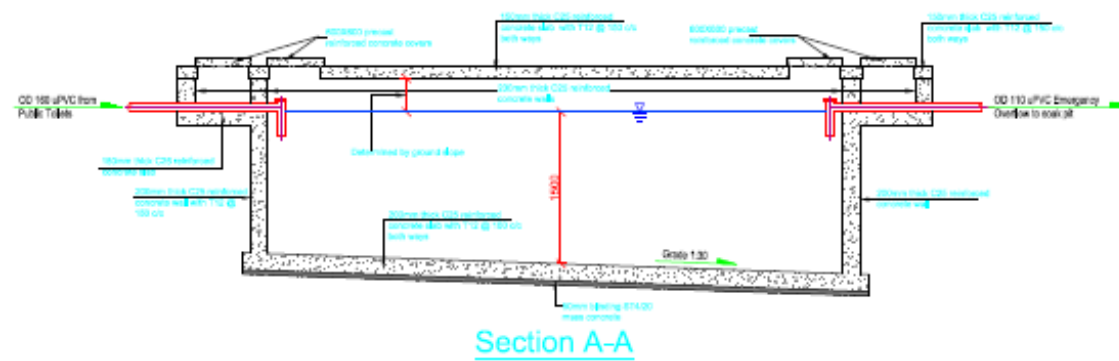
Notes

Concrete





1. ALL STRUCTURAL CONCRETE TO BE C25/29 AND ALL MASS CONCRETE TO BE ST4/20
2. ALL EXPOSED CONCRETE CORNERS TO BE CHAMFERED
3. 50 mm BLINDING TO BE POURED BENEATH EVERY STRUCTURE
4. ALL CONCRETE STRUCTURES TO BE WATER RETAINING
5. NO CONCRETE SHALL BE POURED WITHOUT THE PRIOR APPROVAL OF THE ENGINEER

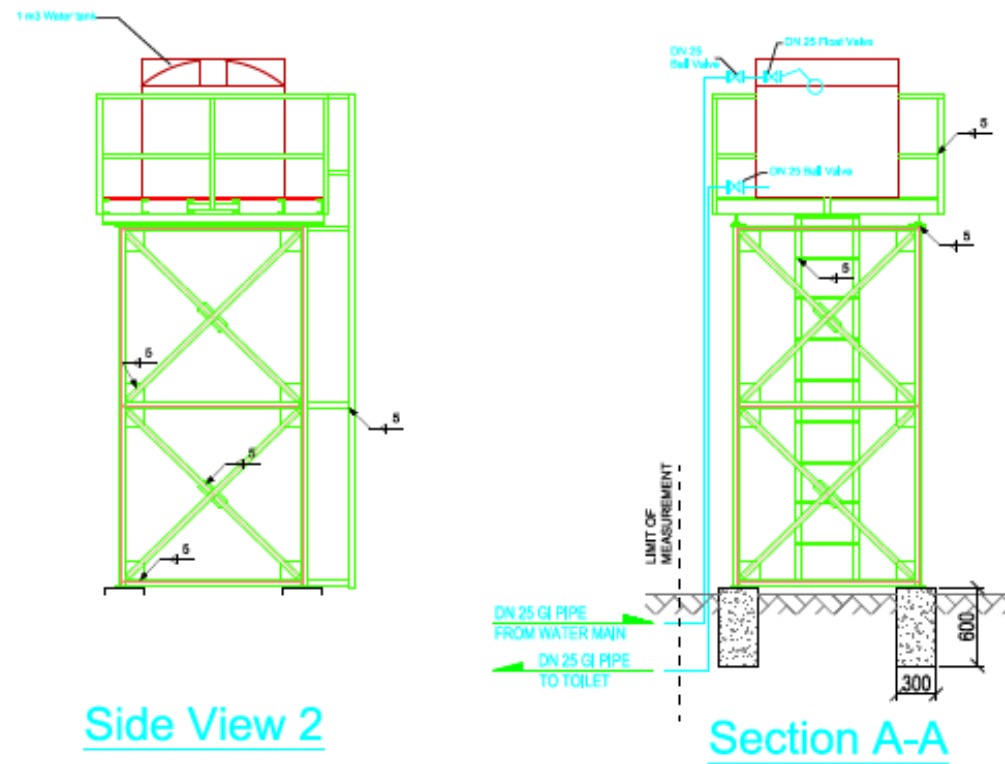
FOR TENDER PURPOSES ONLY

The Republic of Uganda		
		
		
MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT		
 NATIONAL WATER AND SEWERAGE CORPORATION		
 CES Consulting Engineers Salzgitter GmbH		
PROJECT TITLE: MBALE WATER SUPPLY AND SANITATION PROJECT		
DRAWING TITLE: SEPTIC TANKS ABLUTION BLOCK		
NAME	SCALE: 1:75	
DESIGNED: Stefan Kell	FORMAT: A3	
DRAWN: Stefan Kell	DATE: June 2015	
APPROVED: Dieter Gerstenkorn		
DRAWING NO.: WMDP/MBA/18-3-003		
SHEET NO.: 1 of 1	REVISION: 1	







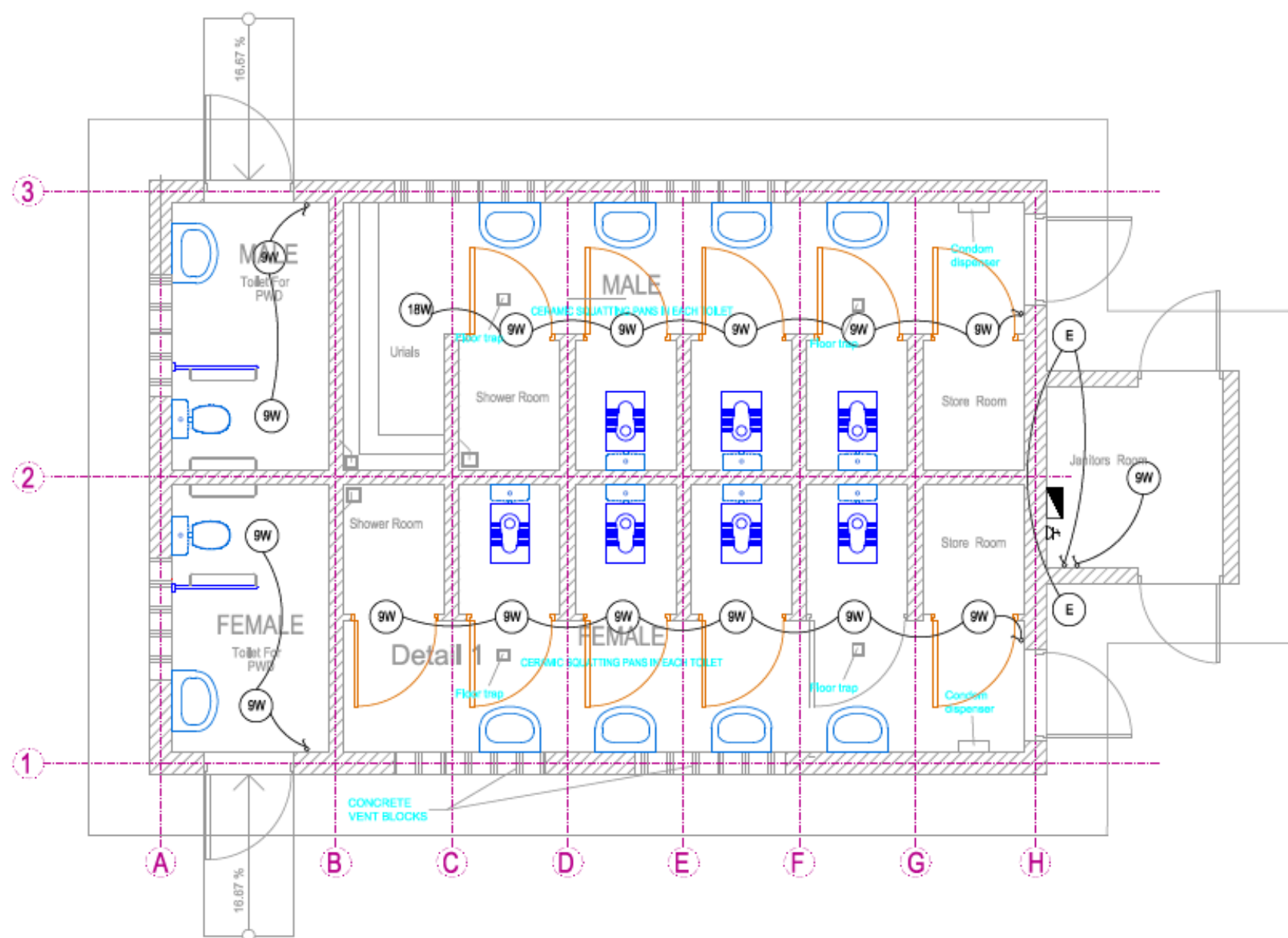
1. ALL STRUCTURAL CONCRETE TO BE C25/30
2. AND ALL MASS CONCRETE TO BE ST4/20
3. ALL EXPOSED CONCRETE CORNERS TO BE CHAMFERED
4. 50 mm BLINDING TO BE POURED BENEATH EVERY STRUCTURE
5. ALL CONCRETE STRUCTURES TO BE WATER RETAINING
6. NO CONCRETE SHALL BE POURED WITHOUT THE PRIOR APPROVAL OF THE ENGINEER

<p>The Republic of Uganda</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>NATIONAL WATER AND SEWERAGE CORPORATION</p> </div> </div>		
<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>CES</p> <p>Consulting Engineers Salzgitter GmbH</p> </div> </div>		
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<p>DRAWING TITLE:</p> <p style="text-align: center;">SEPTIC TANKS PUBLIC TOILET</p>		
	NAME	SCALE: 1:75
DESIGNED:	Stefan Kall	FORMAT: A3
DRAWN:	Stefan Kall	DATE: June 2018
APPROVED:	Dieter Gerstetmann	
DRAWING NO.: WMDP/MB/18-2-004		
SHEET NO.:	1 of 1	REVISION: 1



ITEM	Qty.	Dia.	Description
①	1	25 mm	DN 25 Float Valve, Brass
②	2	25 mm	DN 25 Ball Valve, Brass
③	4	25 mm	DN 25 Elbow, 90°, GI
④		25 mm	DN 25 GI Pipes, threaded, incl sockets, total length of tubes approximately 9 m

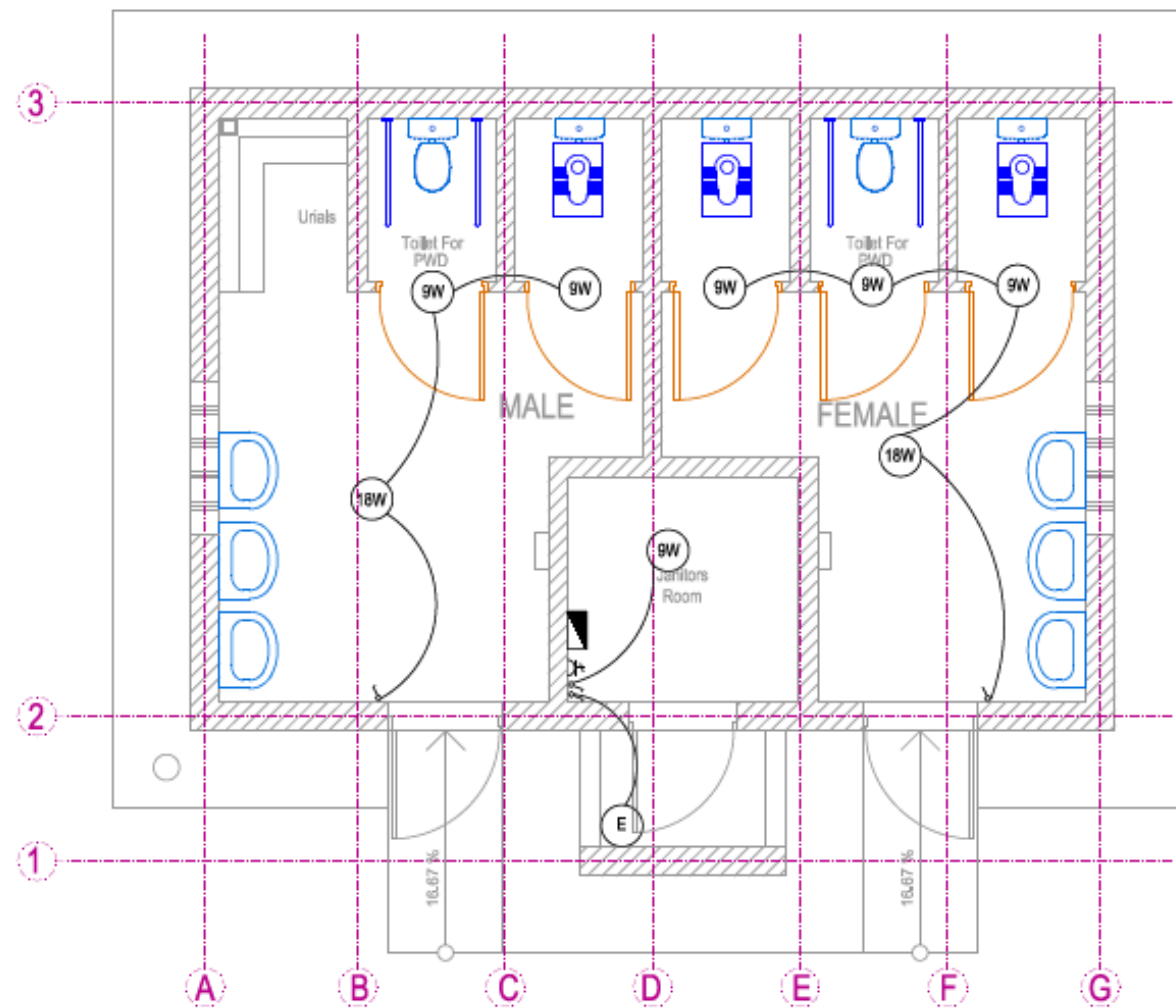
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<p>DRAWING TITLE:</p> <p style="text-align: center;">PUBLIC TOILET PLAN VIEW AND SECTIONS</p>		
	NAME	SCALE: 1:50
DESIGNED:	Zaifur Ramkhanov	FORMAT: A3
DRAWN:	Zaifur Ramkhanov	DATE: June 2018
APPROVED:	Dieter Gerstenkom	
DRAWING NO.: WMPD/MBA/19-S-006		
SHEET NO.:	1 of 1	REVISION: 1



Item	Symbol	No	Description
1		6	One Way Switch
2		1	1 Plug - 16 A Socket Outlet
3		17	Light Point with Energy Saving Bulb
4		2	20W LED Exterior Light, IP 65
5		1	Distribution Board

FOR TENDER PURPOSES ONLY

The Republic of Uganda	
MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT NATIONAL WATER AND SEWERAGE CORPORATION	
CES Consulting Engineers Salzgitter GmbH	
PROJECT TITLE: MBALE WATER SUPPLY AND SANITATION PROJECT	
DRAWING TITLE: PUBLIC ABLUTION BLOCK ELECTRICAL INSTALLATIONS	
	NAME: as indicated
DESIGNED:	Stefan Kell
DRAWN:	Stefan Kell
APPROVED:	Dieter Gerstenkorn
DRAWING NO.:	WMDP/MBA/18-E-001
SHEET NO.:	1 of 1
REVISION:	1



Item	Symbol	No	Description
1		4	One Way Switch
2		1	1 Plug = 16 A Socket Outlet
3		9	Light Point with Energy Saving Bulb
4		1	20W LED Exterior Light, IP 65
5		1	Distribution Board

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MINISTRY OF WATER AND ENVIRONMENT DIRECTORATE OF WATER DEVELOPMENT NATIONAL WATER AND SEWERAGE CORPORATION	
	CES Consulting Engineers Salzgitter GmbH
PROJECT TITLE: MBALE WATER SUPPLY AND SANITATION PROJECT	
DRAWING TITLE: PUBLIC TOILET ELECTRICAL INSTALLATIONS	
NAME	SCALE: as indicated
DESIGNED: Stefan Kall	FORMAT: A3
DRAWN: Stefan Kall	DATE: June 2018
APPROVED: Dieter Gerstenkom	
DRAWING NO.: WMDP/MBA/18-E-002	
SHEET NO.: 1 of 1	REVISION: 1

APPENDIX H: CONTRACTORS/ WORKERS' CODE OF CONDUCT

1 INTRODUCTION

Each employee including trainee or volunteer of a **Contractor** who have interaction with the project must sign this "Code of Conduct." In this Code, "Contractor" shall mean and apply to the contractor, its employees, sub-contractor, officers, agents, representative or those contracted through the Contractor to perform services authorized by the contract.

The contractor agrees to adhere to this Code of Conduct when providing services to this project. The Code of Conduct is in addition to all other contract requirements, policies, rules and regulations governing delivery of services. The purpose of the code is to protect vulnerable people from abuse, neglect, maltreatment and exploitation. It clarifies expectation of conduct of the parties and their employees, which includes administrative staff, care staff, support services staff and any others when interacting with the project.

Contractor, its agents or representatives authorized through it shall not abuse, sexually abuse or sexually exploit, neglect, exploit or maltreat any fellow employees or people from general public/ community. Additionally, no person shall cause physical injury to any other person.

The Contractor shall not by acting, failing to act, encouragement to engage in, or failure to deter from will cause any person to be subject to physical or mental abuse, sexual abuse or sexual exploitation, neglect, exploitation, or maltreatment. The Contractor shall not engage any person as an observer or participant in sexual acts.

Contractor understands and acknowledges that failure to comply with this Code of Conduct may result in corrective action, probation, suspension, and/or termination of contract.

Equally important to realise is that this Code also protects any person under the age of 18 years and any person 18 years of age or older who is physically or mentally **handicapped or impaired** due of mental illness, mental deficiency, physical illness or disability, or other temporary or permanent cause, to the extent that he is unable to care for his own personal safety.

2 ABUSE SHALL INCLUDE THE FOLLOWING, BUT IS NOT LIMITED TO:

- a) Any type of physical hitting or corporal punishment inflicted in any manner upon the body.
- b) Deprivation of life-sustaining treatment.
- c) Harm or threatened harm, meaning damage or threatened damage to physical or emotional health and welfare of any person.
- d) Physical injury including, but not limited to, any contusion of the skin, laceration, malnutrition, burn, fracture of any bone, subdural hematoma, injury to any internal organ, any injury causing bleeding, or any physical condition which imperils a person's health or welfare.
- e) Unlawful confinement.

3 SEXUAL MISDEMEANOR WILL INCLUDE, BUT NOT BE LIMITED TO:

- a) Engaging in exploitive or manipulative sexual intercourse with any person. There will be zero tolerance to sexual misdemeanor including rape, defilement of minors/ sexual child abuse, sexual harassment and elopement.
- b) Taking indecent liberties with a person, or causing an individual to take indecent liberties with a person, with the intent to arouse or gratify sexual desire of any person.
- c) Employing, using, persuading, inducing, enticing, or coercing a person to pose in the nude.
- d) Employing, using, persuading, inducing, enticing or coercing a person to engage in any sexual or simulated sexual conduct for the purpose of photographing, filming, recording, or displaying in any way the sexual or simulated sexual conduct. This includes displaying, distributing, possessing for the purpose of distribution, or selling material depicting nudity, or engaging in sexual or simulated sexual conduct.
- e) Use of profanities and obscene language in communities or when instructing others.

4 NEGLECT MAY INCLUDE BUT IS NOT LIMITED TO:

- a) Denial of sufficient nutrition to any person.
- b) Denial of sufficient sleep to any person.
- c) Denial of sufficient protective gear to any person.
- d) Failure to provide adequate supervision; leading to drug use in workplaces, accidents and impairment of employees.
- e) Failure to arrange for medical care and/or medical treatment for any person in an emergency.
- f) Failure to drive courteously at all times, leading to accidents.
- g) Failure to avoid damage public property.
- h) Neglecting public and employee complaints.

5 DRUG ABUSE MAY INCLUDE BUT IS NOT LIMITED TO:

- a) Smoking in public or smoking in undesignated areas
- b) Consumption of alcohol while on duty/at work
- c) Use and trading in narcotics

6 ILLEGAL TRADE ACTIVITIES WITHOUT NECESSARY LICENSES:

- a) Trade in protected fauna or flora species
- b) Trade in ivory or similar regulated wildlife products including game meat
- c) Trade in processed, semi-processed minerals and their ores

7 FINANCIAL EXPLOITATION WILL INCLUDE, BUT IS NOT LIMITED TO:

Utilizing labor of without paying for it, or at a non-commensurate financial rate/ wage.

8 MISTREATMENT WILL INCLUDE, BUT IS NOT LIMITED TO:

- a) Physical exercises, such as running laps or performing pushups,
- b) Unauthorized chemical, mechanical or physical restraints except,
- c) Assignment of unduly physically strenuous or harsh work.
- d) Failure to behave in a polite and courteous manner to the general public
- e) Requiring or forcing the individual to take an uncomfortable position, such as squatting or bending, or forcing people to repeat physical movements when used solely as a means of punishment.
- f) Group punishments for misbehavior of individuals except in accordance with the written policy.

- g) Verbal abuse: engaging in language whose intent or result is demeaning
- h) Denial of any essential service solely for disciplinary purposes
- i) Denial of visiting or communication privileges with family or significant others
- j) Requiring the individual to remain silent for long periods of time solely for the purpose of punishment.

The Contractor agrees to document and report sexual abuse / sexual exploitation, neglect, maltreatment and exploitation as outlined in this Code and cooperate fully in any resulting investigation. The Contractor shall prominently display posters, notifying employees of their responsibilities and to report violations using phone numbers thereon indicated.

Contractor/ subcontractor

Signed:

Name:

Date (dd/mm/yyyy):

APPENDIX I: PROCEDURE FOR HANDLING WASTE AC PIPES & ACCESSORIES

NWSC GENERAL PROCEDURE FOR HANDLING WASTE ASBESTOS CEMENT MATERIALS

NWSC shall make sure the Contractor shall comply with OSH Standards and shall develop a Safety and Health Plan that complies with NEMA Specification Construction Safety and Health Program requirements.

The Contractor shall uncover, dislodge, handle, remove, transport, and dispose of all AC pipe specified in the contract documents for this project using wet technique procedures.

All work involving AC pipe and other ACM products must be addressed in the Disposal Plan.

The Contractor shall take precautions to prevent damage to adjacent structures and material finished material not required for AC pipe handling Prohibited Work Practices and Engineering Controls Contractors shall not use procedures that subject the AC pipe to forces that will crumble, pulverize, or reduce to powder the AC pipe.

The following work practices and engineering controls are not be used for work related to AC pipe or for work which disturbs ACM, regardless of asbestos exposure or the results of Initial Exposure:

- A. High speed abrasive disc saws and sanders not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air;
- B. Carbide tipped cutting blades;
- C. Electrical drills, chisels, and rasps used to make field connections in AC pipe;
- D. Shell cutters used to cut entry holes in AC pipe A hammer and chisel without using wet techniques to remove pipe connections
- E. Compressed air used to remove asbestos or material containing asbestos
- F. Dry sweeping, dry shoveling or other dry clean-up of dust and AC debris
- G. Employee rotation as a means of reducing employee exposure to asbestos The Contractor is responsible for isolating the existing mains to remain in place by capping, plugging and blocking as necessary. The opening of an abandoned AC water main and all other openings or holes shall be blocked off by manually forcing cement grout or concrete into & around the openings in sufficient quantity to provide a permanent watertight seal.
- H. Abandonment of AC water mains will be considered subsidiary to the work required
- I. Abandonment of Valves that contain AC: Valves to be abandoned in the execution of the work shall have the valve box and extension packed with sand to within eight inches (8) of the street surface.

The remaining eight inches (8) shall be filled with 3,000psi concrete or an equivalent sand cement mix and finished flush with the adjacent pavement or ground surface.

The valves covers shall be salvaged & returned to Central Storage (Waste).

The abandonment of valves containing ACM will be considered subsidiary to the work required, and no direct payment will be made Verification of Removal & Clean up Procedures:

The Contractor's on site Competent Person shall inspect the work area verify and certify that no residual AC pipe fragments and debris remain.

Submission of disposal copies to NEMA and if applicable Environmental representatives of all transport manifests, and disposal receipts for all asbestos waste materials removed from the work area during the project.

APPENDIX J: NEMA ASBESTOS HANDLING AND DISPOSAL PROCEDURE



National Environment Management Authority (NEMA)

**DEPARTMENT OF ENVIRONMENTAL MONITORING
AND COMPLIANCE (EMC)**

Safe Work Procedure

Asbestos Handling and Disposal

Introduction

Asbestos dust and fibres has been found to be hazardous causing cancer and other lung related illnesses and disease.

Persons engaged in the removal, handling and disposal of materials containing asbestos should take standard precautions to avoid potential health risks.

This procedure defines the minimum precautions that shall be taken before and during the handling of asbestos.

The preferred method of handling the asbestos materials is wet them with water and dust suppressant mixture sprayed in fine mist. Time should be allowed for the material to soak thoroughly to control airborne fibres. Items containing asbestos fibre should be allowed to mechanically disintegrate or be broken into small pieces.

I. Specific Risks

- ◆ Falling through the fragile asbestos roofing sheets.
- ◆ Falls from a height
- ◆ Dust / Fibre inhalation
- ◆ Spreading the dust / fibres in the atmosphere and water streams.

II. Personnel prerequisites

- ◆ Suitable health profile (e.g. no breathing, allergic or asthmatic problems)
- ◆ Suitable physical condition
- ◆ Suitable qualification and experience for performing the work (trained to handle asbestos and work at height.)

III. Personal Protective Equipment

- ❖ Respirator – half face, air purifying dual cartridge respirators with high efficiency filters. Ensure proper fitting.
- ❖ Overalls – several pairs of disposable overalls.
- ❖ Safety boots – Rubber boots that can be washed or disposed as part of debris.
- ❖ Eye protection – each person removing should have non-fogging safety goggles.
- ❖ Hand protection – Several pairs of disposable rubber gloves should be supplied to the workers.
- ❖ Fall protection – full body safety harness plus retractable life line should be used.
- ❖ Ear protection – protect ears from dust and noise.

IV. Tools

- ❖ Appropriate work at height equipment (e. g ladders, safety harness, scaffolding may be used)
- ❖ Garden hose equipped with an automatic shutoff spray nozzle.
- ❖ Garden pump Sprayer
- ❖ Suppressant material – Liquid dish washing detergent
- ❖ Removal tools:
 - a pry bar for lifting nails. A bar equipped with a blade at least two inches wide is most recommended.
 - A nail puller or nail-head cutter or drilling (screw remover) machine.
 - A knife or scissor to cut polythene sheeting.
 - Debris containers – plastic lined containers or plastic lined metal containers provide thorough containerisation.
 - Six mm thick polyethylene plastic sheeting to cover the ground at the base of walls.
 - If waste is to be bagged, then the labelled asbestos disposable bags should be used.
 - Duct tape – several rolls are required for sealing the bags and wrapped debris.

V. Preparation

The safety objective is to keep the fibres or dust out from air by minimising breakage, keeping materials wet and containing all debris.

This will be attained by preparing as shown below:

- ◆ It is mandatory to have written authorisation from Environment Management Authority before starting demolition work
- ◆ Evacuate people from operational area, isolate area and post warning signs before start of the work.
- ◆ Make temporary enclosure to isolate work area from public.
- ◆ Lay a six foot wide strip of 6-mm plastic sheeting along the side of the house

and inside the house.

- ◆ Create an entrance / exit point to the work area by laying down an additional six by six foot piece of plastic sheet next to the plastic strip along the wall and keep a plastic disposable bag at this location.
- ◆ Mix half cup of detergent in a garden pump sprayer with water.
- ◆ The team members have to be trained before the work and risk assessment must be done. Their signature in a specific paper confirms that they properly understood the requirements of the job.
- ◆ The responsible person ensures that :
 - Workers at site have all the necessary PPE.
 - All workers have understood the procedure and risks involved.
 - work area is fully isolated from the public and un authorised persons.
 - only properly configured access equipment (scaffolding and ladders) and lifting equipment (hoists) are used;
 - all equipment associated with the work permit is inspected prior to use;
 - all the necessary permits to work are obtained and risk assessment done.

VI. Removal Work

- ◆ Remove pieces of siding or sheeting by pulling nails, cutting nail heads so as to minimise breakage. Drilling machine fitted for screw removal should be used. Do not hammer the sheets.
- ◆ If siding or sheeting begins to crack or crumble, immediately wet the cracked or broken areas with the garden sprayer. Breakage releases asbestos fibres.
- ◆ Carefully lower the siding or sheeting to the ground. Do not throw or drop it.
- ◆ Keep all debris on the plastic strips at the base of the walls and floors and keep it wet until packaged and sealed.

Note: Once removal work begins, do not leave the plastic without first removing disposable overalls and other protective equipment at the "transition zone". Each re-entry will require a new pair of overalls and gloves.

VII. Decontamination

- ❖ Ensure that the workers spray themselves with enough water to wet down any asbestos debris /fibres on the outside of their respirators and disposal overalls etc.
- ❖ Remove the boots and the rest of the PPE, and leave the contaminated items on the transition zone plastic for disposal.
- ❖ Wrap the remaining debris and disposable items in properly labelled asbestos disposal bags.
- ❖ Tightly seal each bag with duct.
- ❖ Use wet rags for any further clean up. *Do not attempt to vacuum or sweep up asbestos debris.*

VIII. Clean up and Disposal

- ❖ Load wet debris and other contaminated materials into sturdy containers then wrap the containers in layers of six mil plastic material.
- ❖ Obtain a waste disposal approval certificate from NEMA.
- ❖ Asbestos debris from the site must be disposed off at a clearly marked and well constructed disposal site approved by NEMA. Impermeable concrete protected dump site is most appropriate, such as the Kiteezi Land Site owned and operated by Kampala City Council.
- ❖ The site must be secured, marked and warning signs (Asbestos dump site) posted at the licenced dump site.
- ❖ The debris must be transported in covered truck.
- ❖ Plastics bags or wrapping must not be perforated.
- ❖ The quantity of waste generated must be weighed and documented.
- ❖ The asbestos debris must be legally disposed as per the National Environment Act Cap.153 and the National Environment (Waste Management) Regulations, 1999 and other subsidiary legislations.

APPENDIX K: ENVIRONMENTAL FLOW ASSESSMENT-RIVER NAMATALA

1 APPROACH AND METHODOLOGY

1.1 National Guidelines

Uganda had no guidelines for determination for environmental flow. The Directorate of Water Resources Management hence advised the project to establish acceptable environmental flow based on the site-specific socio-environmental characteristics. Determination of environmental flow has been based on baseline aquatic flora and fauna information and water needs by riparian communities for both domestic and livestock needs. In absence of national guidelines, use has been made of international practices as discussed in the sections below.

1.2 Different Methodologies of Environmental Flow

There is no single best way to do an environmental flow assessment. The choice of methodology depends on the availability of resources, i.e. data, time, funds, etc. The major criteria for determining environmental flows should include the conservation of the variability of the natural flow. Besides lack of national guidelines the concept of environmental flows is complicated by the poor understanding of the relationship between river flows and river ecology. A database of various methodologies for environmental flow assessment, established in 2003, contains useful information on 134 methodologies with key references. This database is a valuable source of different environmental methodologies. The methodologies can be sorted by type, region or country where they have been applied.

There are four categories of environmental flow methodologies, which are recognized by most scientists in the environmental flow field (Tharme, 2008). These four levels are listed in table below.

Table 1: The four significant different types of environmental flow methodologies

Environmental Flows Methodology	Description
Hydrological (Desktop Estimates, Look Up Table)	This is a simple and rapid method that uses hydrological data to derive the environmental flow requirement. A “minimum flow” often represents the flow intended to maintain the recommended river condition. Hydrological methodologies are generally used for the planning level and have been applied widely, both in developed and developing countries. These methods rely on examination of stream flow statistics and typically based on mean annual flow (MAF) or monthly median flows. The Tennant Method is the most widely used hydrological method.
Hydraulic Rating (Rapid Determinations)	These type of methodologies measure changes in various single river hydraulic variables (e.g. depth and velocity) to develop a simple relationship between biota habitat availability and river flow. A common methodology is the Wetted Perimeter Method, developed in Australia.
Habitat Simulation (Habitat Rating, Expert Panels, Intermediate)	The Habitat Simulation methodology provides links between discharge and available habitat conditions. It uses key target biota to predict habitat discharge curves or habitat time and exceedence services. PHABSIM, developed in U.S.A. is the most commonly applied methodology.
Holistic (Holistic Approaches, Frameworks, Comprehensive)	In a holistic approach all important flow characteristics (high floods, base flows, etc.) are identified. These methodologies incorporate hydrological, hydraulic and habitat simulation models. The Building Block Methodology (BBM) is a holistic methodology and was developed in South Africa.

EF determination for this project chose to use a hydrological method. They are often referred to as desktop models and rely primarily on the use of hydrological data, usually in the form of historical flow records. The results are often presented as a minimum required flow to maintain the ecological status at some acceptable level.

The Tennant Method (or Montana Method) and the Range of Variability Approach (RVA), both developed in USA are the most frequent used hydrological methods on a global perspective (Tharme, 2008). The Tennant Method (Tennant, 1976) differs from most other hydrological methodologies because it included expert opinions and detailed field studies when it was developed. Tennant findings are summarised as follows:

- a) 10% of the average flow is a minimum flow recommended to sustain short-term survival habitat for most aquatic life forms;
- b) 30% is recommended as a base flow to sustain good survival conditions for most aquatic forms and general recreation; and
- c) 60% provides excellent to outstanding habitat for most aquatic life forms and for the majority of recreational uses.

The recommended percentage of natural flow regime may also be varied during the seasons to satisfy the need during more sensitive times such as while fish is spawning.

The Tennant's approach either uses mean annual discharge (MAD) or Median Monthly Flows for Determining Instream Flow Needs. The use of monthly median flows for recommending minimum instream flows is based on the principle that fish in a particular stream have adapted to the historic streamflow regime, which, at least for base flows, is best defined by median rather than mean flows.

In determining the environmental flow for this project, a key guiding principle was to ensure that there is no risk of critical lack of water in the river even during low flows to ensure the sustenance of river health and aquatic life therein. This is because even if higher flows ensued after a period of flows that are below *environmental flows*, irreparable damage would already have occurred (due to lack of water or drying up of aquatic habitats. This situation needs to be avoided by both design and operation of the proposed project.

2 BASELINE, ECOLOGICAL STATUS AND USE OF THE RIVER

Domestic water demand: Although users exist, the amount of water used would not readily be quantified. The domestic water demand was based on the population census of the sub-counties bordering River Namatala (Table 2) assuming that under the worst case scenario, they all depended on it for supply.

Table 2: Population in sub-counties bordering River Namatala

Sub-county	Population
Kamonkoli	24764
Kachonga	25340
Naboa	13945
Budaka	11074
Lyama	19188
Butaleja	15846
Nawanjofu	19621
Kadama	19974
Kirika	23542
Tirinyi	31431
Namanyonyi	30754
Bukonde	10102
Bungokho Mutoto	34,747
Nakaloke	22,694

Sub-county	Population
Industrial Division	42,310
Northern Division	39,076
TOTAL	384,408

Source: UBOS, 2016

Aquatic biota water needs: The River has no notable fisheries and fishing is generally limited to household consumption during the rainy season. Fish groups occurring in River Namatala documented in survey were *Mormyrus* spp. and *Clarias* spp. The fish is especially abundant in the rainy seasons when the river banks flood. None of the fish groups identified in the area were identified as rare or endangered. From the local knowledge survey and interaction with the local authorities (District Fisheries Officer of Sironko and community leaders, they confirmed that fisheries activities are almost non-existent in the downstream project area part of the river.

Livestock: Although information on livestock population would not be readily available, activities of livestock watering at River Namatala were reported. The livestock population in Mbale District according to the Uganda Livestock Census carried out in 2008 is indicated in the Table 3.

Table 3: Livestock population in Mbale District

Livestock	Number	Standard Error	Coefficient of Variation
Cattle	63,826	3973.9	6.2
Goats	96,617	5293.9	3.4
Sheep	5,108	938.3	18.4
Pigs	23,315	2844.7	12.2
Chicken	459,868	28275.6	6.1
Ducks	13,100	2025.3	15.5
Turkeys	26,162	3596.7	13.7

Source: UBOS, 2009

The livestock numbers reported for the Namatala sub-catchment, M-1(667 km²) (MWE, 2017) are presented in Table 4. However, the values include population in the part of the catchment (81.7 km²) upstream of the proposed intake point.

Table 4: Livestock population in the Namatala Sub-catchment

Sub-Catchment	Cattle	Sheep	Goats	Pigs	Chicken
Namatala	74,964	7,073	98,503	19,464	422,592

Source: MWE, 2017

Assuming uniform distribution per square kilometre, the values in Table 4 will be multiplied by 585/667.

Present ecological status: Quantifying the environmental flow for rivers involves determining the water quantity and quality requirements that will ensure that they are sustained in a pre-determined condition. To determine this condition the first step is to establish the *present ecological status* (PES) of the river. The process of determining the present ecological status (PES) is called *Eco Classification*. The objective of Eco Classification is to decide the ecological state of various components of a river relative to its natural (pristine) condition.

The components are drivers (physico-chemical, geomorphological and hydrological) and biological responses (fish, riparian vegetation and aquatic invertebrates). The ecological state of the drivers and responses are then integrated using rule-based models to form the Ecological Status, or simpler the Eco Status.

Due to the absence of EF guidelines in Uganda, a comparison has been made with South Africa's guidelines, in which the Eco Status classification system is built up of six main levels (A-F) where "A" refers to habitats are largely unmodified (reference conditions) and "F" refers to habitats that have modifications that have caused almost complete loss of natural habitat and biota (Table 5). The river categories E and F can describe the PES of the river, but are never used as a recommended ecological category because the philosophy is that no river should be allowed to degrade to such an extent. The recommended ecological category is a target level for the desired state of the river, based on the PES and the ecological importance and sensitivity (EIS).

Table 5: Ecological class for ecological status components

Ecological Class	Description
A	Unmodified , largely natural.
B	Largely natural with few modifications . A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	Moderately modified . A loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.
D	Largely modified . A large loss of natural habitat, biota and basic ecosystem functions has occurred.
E	Seriously modified . The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	Critically/Extremely modified . Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.

Biological baseline surveys for the ESIA showed considerable modification of the catchment and riparian areas by cultivation. Based on those finding and information in table above, the River Namatala has "Ecological Class C" classification.

River discharge: The hydrograph for river Namatala indicate two peaks in April, May and November. The flows in wet season vary between 2.15 m³/s to 15 m³/s with maximum flow close to 40 m³/s. In the dry season the flows reduce significantly and range from 0.326 m³/s to 1 m³/s. The flow data statistics of the proposed site are provided in Table 6.

Table 6: Monthly flow rate exceedance probability (1997 – 2014)

Exceedance Probability (%)	Flow rate (m ³ /s)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10	0.40	0.38	0.45	1.18	0.98	0.85	0.92	0.96	0.93	0.97	0.82	0.72
25	0.60	0.46	0.73	1.41	1.31	1.07	1.10	1.14	1.80	1.31	1.06	0.80
50	0.80	0.58	0.98	2.64	2.04	1.41	1.60	2.11	2.34	2.57	1.27	1.01
75	1.17	1.15	1.97	4.32	2.89	2.84	2.77	2.79	3.34	3.39	2.37	1.51

Exceedance Probability (%)	Flow rate (m3/s)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
90	1.65	2.57	2.68	5.73	4.99	3.33	5.62	4.40	4.01	3.96	7.26	2.79
(75-25)/50	0.72	1.18	1.26	1.10	0.77	1.25	1.04	0.78	0.66	0.81	1.03	0.70

3 ENVIRONMENTAL FLOW

Environmental flow has been determined by consideration of water needs as detailed in the sections below.

3.1 Domestic Water Needs

Baseline information used is indicated in Table where it is assumed that all sub-counties bordering River Namatala rely on it for domestic water supply. This is due to unavailability of village level information on households bordering the River. Thus a population of 384,408 has been adopted. This reflects the worst case scenario.

Based on the national average per capital water consumption prescribed by the Directorate of Water Development (DWD 2013: Water Supply Design Manual 2013), total domestic water D_w is:

$$D_w = 25 \text{ (l/person/day)} \times 384408 = 9,610,200 \text{ litres/day or } \underline{111.23 \text{ l/s}} \text{ (1)}$$

3.2 Livestock Water Needs

Total livestock water is derived as shown in Table 7.

Table 7: Livestock water needs in the Namatala Sub-catchment

Livestock Type	Water needs (l/day)	Number	Sub-total (l/day)
Cattle	55	74964	4,123,020
Goats	12	98503	1,182,036
Sheep	10	7037	70,370
Chickens	0.20*	422592	84,518
Pigs	9	19464	175,176
TOTAL			5,635,120
			4,944,881

(Source: King J.M, 1983, Ward D., 2007)

* Estimated from 250 l/day per 1000 chicken of free range

Thus livestock water need is:

$$L_w = 4,944,881 \text{ litres/day or } \underline{575.2 \text{ l/s}} \text{ (2)}$$

It is also noted that at intervals along the canal, if needed, the project will provide troughs for watering livestock. These troughs will be supplied with pipes originating from the canal.

3.3 Fish / Aquatic Life Water Needs

The significance of minimum flow is that it is needed to keep the streambed wet to an acceptable depth to support fish life. To maintain the fish population, all parameters related to flow are equally important for fishes living in flowing river conditions. The river flow should be of appropriate velocity in relation to the different life stages (e.g. egg, fry, juvenile, and adult) of fish.

Four main types of flow can be listed depending on how they interact with the fish fauna:

- i) **Population flows** influence biomass through density dependent interactions with individual population parameters such as growth and mortality. Major criteria here are the magnitudes of the high and low season flows.
- ii) **Critical flows** trigger events such as migration and reproduction. Here the main criteria are timing and quantity.
- iii) **Stress flows** endanger fish because of excess velocity at high water or through desiccation at low water. These are typically extreme flows occurring as isolated peaks in an irregular hydrograph.
- iv) **Habitat flows** are needed for the maintenance of environmental quality including temperature, dissolved oxygen levels or sediment transport.

Management of environmental flows for sustainability of fish stocks requires an understanding of all four types of flow. Tennant proposed a 10% Median Annual Discharge (MAD) or monthly median flows as a lower tolerance limit for many aquatic organisms and a 30% MAD for good to optimal water depths and velocities. Based on baseline studies, no critical or endangered species were encountered in this stretch of 1000 m. It is therefore concluded that the 10% MAD would be acceptable for the kind of aquatic life in the river.

Allowing for a minimum 10% of the monthly median flow of 1490 l/s, the water need for aquatic life, Fw is:

$$Fw = 10\% \times 1490 \text{ l/s} = 149 \text{ l/s} = 0.149 \text{ m}^3/\text{s} \quad (3)$$

3.4 Minimum Environmental Flow recommended

From values of Dw, Lw and Fw calculated in equations 1, 2 and 3 above, environmental flow recommended is:

$$\begin{aligned} EF &= (Dw + Lw + Fw) \\ &= 111.23 + 575.2 + 149 \text{ [l/s]} \\ &= 835.43 \text{ l/s (equivalent to 0.835 m}^3/\text{s)} \end{aligned}$$

Therefore, minimum Environmental Flow requirement, EF = 0.835 m³/s

4 CONCLUSIONS

The minimum Environmental Flow has been derived as **0.835 m³/s** based on domestic water needs, livestock and aquatic environment water requirements. It has been calculated basing on estimated data which is most likely higher than the actual situation. Therefore, this amount of water should allow the river to sustain river health as well as meet the needs of riparian communities. This minimum environmental flow also optimally uses the water as required by Section 8 of The Water Act, Cap. 152. of the laws of Uganda.

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