NASORETET, OLENKUYA, EMARTI AND LEKANKA WASH PROJECTS

TOPOGRAPHICAL SURVEY DRAFT REPORT

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1. INTRODUCTION

1.1 Background

The data required to properly design pipeline routes should be of high horizontal and vertical accuracy. The data available from Google Earth or maps available for the Study Area from Survey of Kenya are in 1:50,000 scale and are not suitable for the design. Although the some of the maps have been updated, the changes are limited and not appropriate for pipeline route design work especially for a gravity flow pipeline system.

The survey consultant will be responsible for conducting a detailed topographical survey capable of design and setting out of a pipeline route for the water supply for Nasoretet, Olenkuya, Emarti and Lekanka schools and villages.

The product of the survey exercise will be a topographical map and pipeline route survey data which will be useful to the water engineers for the design of the water pipeline route. A pipeline route survey is carried out to collect data and information of the features and elevations along the main and minor pipeline routes. The data collected will be primary used for the design of the pipeline routes, pipe sizes, pipe types, fittings, gravity flows, air valve and gate valve points.

1.2 Main objectives

The main objectives of the study include;

- To carry out additional topographical survey to identify highest point within the area
- To plot the surveyed data and produce topographical maps that include the main profile.
- To identify the best route for location of the pipelines

1.3 Study phases

In order to successfully meet the objectives, the survey was divided into the following phases;

- Reconnaissance -Phase 1
- Survey Control establishment- Phase 2
- Topographical survey and Data collection- Phase 3
- Data processing, Plotting and Reporting-Phase 4

2. EQUIPMENT AND SOFTWARE

2.1 Equipment

The following equipment was used during the topographical survey

- Stonex S3II GNSS Receivers RTK equipment
- Garmin Handheld GPS
- 50m Tape Measure
- Metallic tripod and Assorted staff

2.2 Software

The following software was used during the topographical survey and data processing

- Field Genius software
- MapSource
- Microsoft Excel
- AutoCAD Civil 3D
- Global Mapper

3. SCOPE OF WORK

The survey has been conducted by local consultants with proficiency in water surveys. The scope of work specified in the Technical Specification part include;

1. Reconnaissance
2. Topographical survey of 4 sites; Nasoretet, Olenkuya, Emarti and Lekanka villages
3. Survey report to include survey control points, levels, profile and layouts

4. GROUND CONTROL SURVEY

4.1 Datum

The following datum was used for the survey

The datum parameters are;

Grid: UTM Zone 36 M (South)
Projection: Transverse Mercator
Ellipsoid: WGS84
Unit of Measurement: Meter
Central Meridian: 33 Degrees East of Greenwich
Latitude of Origin: Equator 0.0000
Scale Factor at origin: 0.9996
False Coordinate of Origin:
False Easting = 500,000 m
False Northing= 10,000,000 m
Datum: WGS84

4.2 Establishment of Survey Control Points

New points are successfully selected and installed on new ground away from canopy, electric lines, structures or obstacles. This is necessary to ensure the GPS satellites signals are not obstructed during the survey. The points are established and concreted using a metallic rod and mixed concrete. The point name is inscribed on the face of the benchmark.

4.3 Survey Control Points/Benchmarks

Site Benchmarks are as shown in the Table below. Benchmarks are given in UTM coordinates with a WGS84 datum Zone 36M.

Table 1: Site Benchmark Information

Benchmarks	Northing	Easting	Elevation	Description	Remarks
1	9802067.386	783664.589	2063.267	BMN1	Nasoretet Primary School-Beacon behind the classes next to the school garden
2	9811367.756	798759.511	2042.621	BMO1	Olenkuya Primary School-at Water Tower location next to VIP Teachers
3	9835653.274	759479.313	1637.189	BME1	Emarti Primary School-behind the classrooms close to the playing field
4	9856564.394	789550.688	1874.464	BMN1	Lekanka Primary School-adjacent to the VIP Girls toilets

5. GPS DATA COLLECTION

The data was collected using GNSS Equipment that utilizes satellites for navigation. During the survey Stonex S3 II RTK equipment was used with a horizontal accuracy of 0.015 m and vertical accuracy of 0.030m. The equipment utilizes a 2Watt UHF radio that has a range of 10km for a clear site. The Nasoretet site has an existing borehole at a public utility parcel away from the school. The site had low canopy with structures within the school compound. The Olenkuya site has an existing borehole at the parcel of Mr.Joseph a community member and a proposed pipeline route to the highest elevation within the area. The site had low canopy. The Emarti site had an existing borehole that needs rehabilitation, it also has an existing pipeline route that was followed during the survey. It has heavy canopy towards the conservancy and low canopy around the school and neighbouring parcels. The Lekanka site has an existing borehole and an existing solar stand that requires improvement. The site had low canopy and was generally flat.

The survey of the pipeline route was done on 21st to 23rd February 2024.

5.1 Nasoretet Pipeline Route

Nasoretet Primary school is located on Geographic coordinate 1°47'20.258" S 35°33'00.686" E. The school has a number of classrooms with water gutters that feed to the 10000 litre tanks. The site has a borehole that is away from the school and an existing solar and generator house. The site is well fenced with concrete posts and chain link, it has a gate as an access to the site. Within the borehole site are three cattle troughs, a water point with taps and a existing tank.

The borehole site being at an elevation of 2084 metres with its fence corner at 2087metres means that the elevation is the highest within the area. The tank towers will be placed within the borehole site thus no need for the rising main line. The borehole and solar stand will need to undergo rehabilitation to improve water flow to the school. The survey was done at intervals of 20 metres and features along the route were picked.

The highest elevation for the entire section is located at the borehole site with an elevation of 2088.2 m while the lowest point is an elevation of 2047.9 and located at proposed Nasoretet Centre water kiosk.

5.1.1 Borehole/Tank site to Nasoretet Primary School

The geographic coordinate of Nasoretet borehole is 1°47'32.275" S and 35°33'36.679" E.

The line from the borehole to the school tank site is approx. 1385 metres with an elevation difference of approx. 20.3 metres. The line traverses through the edge of the road up to the T-junction at KM1+170 where it crosses through the school parcels to the tank site.

The line has sufficient head for water to flow via gravity from the borehole site to the school tanks. Once within the school the water will be distributed to the handwash stand and the VIP toilets that will be within the school compound.

The line can also be plotted as a graph as shown in the figure below.

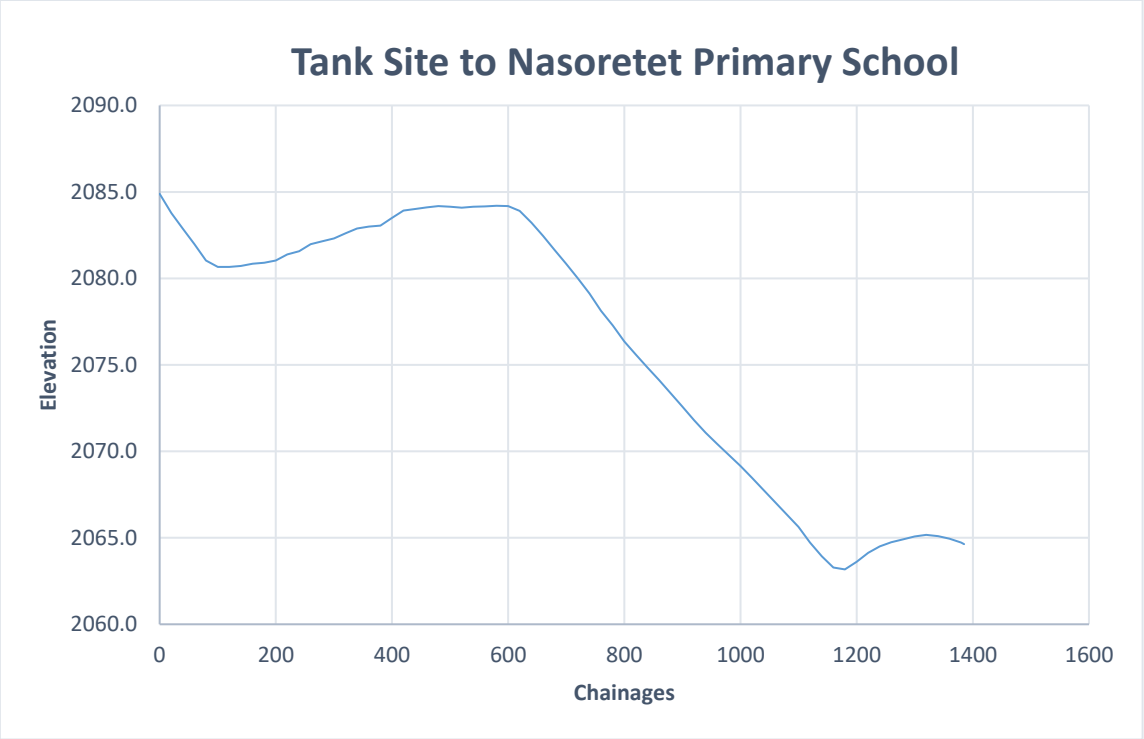

Figure 1: Borehole/Tank Site to Nasoretet Primary School

5.1.2 T-junction to Nasoretet Centre Water Kiosk

The proposed line starts at the T-junction that separates the line that goes towards the school and the line going to the water kiosk site. The line is approx. 893 metres long with and an elevation difference of 14.6 metres. The water will flow via gravity to the site of the proposed water kiosk.

The line can be plotted as the graph shown below.

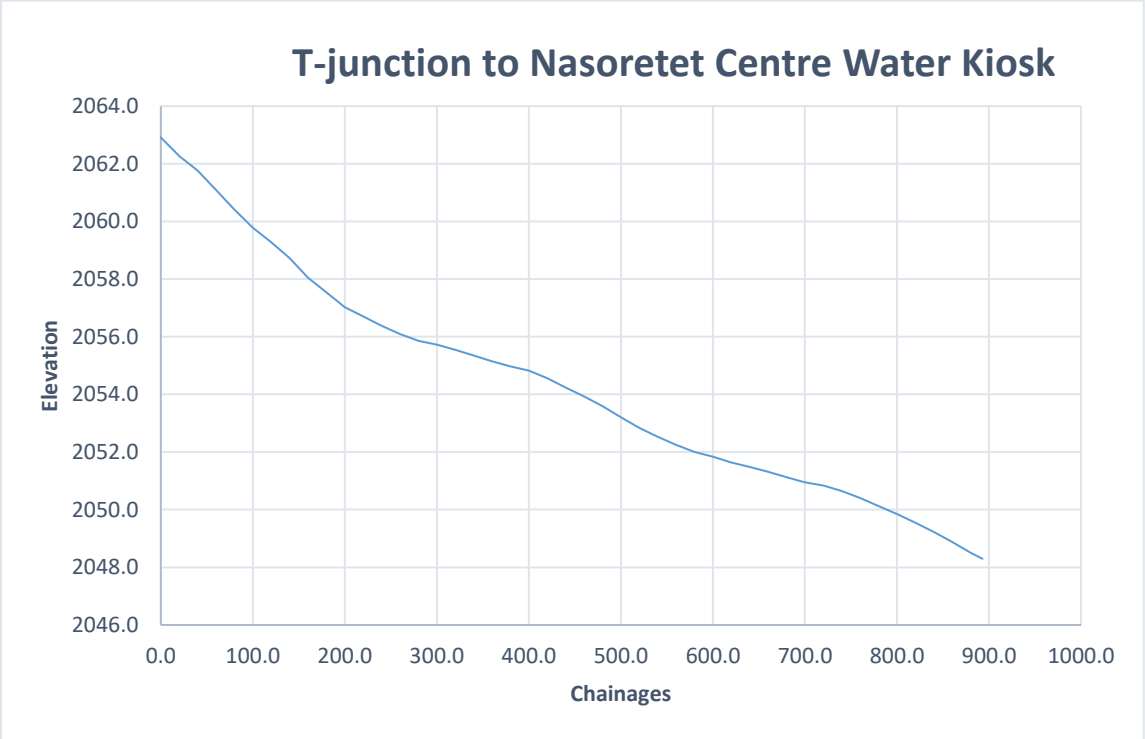

Figure 2: T-junction to Nasoretet centre water kiosk

5.2 Olenkuya Pipeline Route

Olenkuya Primary School is located at Geographic coordinates 1°42'14.6011" S and 35°41'11.388" E. The school has no reliable water source but has water gutters that fill various 10000 litre tanks within the school compound. The school is proposed to be served by the borehole that is away from the school.

The proposed tank site has the highest elevation within the area at 2071.5m, while the point at the river invert on the pipeline route towards the school and water kiosk 2 has the lowest point at 2029.4m. There is need for a rising main as the elevation at the borehole site is not sufficient for gravity flow of water to all the water points.

The location of the tank site will also have the Olenkuya water kiosk 1. The VIP latrines are under construction and will be supplied with water from a water point within the school compound.

5.2.1 Rising Main: Borehole to Tank Site/Water Kiosk 1

The length of the line from the borehole to the tank site is approx.. 667 metres. The elevation difference between the borehole and the tank is a rise of 17.4 metres. The borehole site will require installation of a water pump to push water to the tank site.

The rising main line flows from the borehole site towards the fence, it moves along the fence up to the road. The tank site location will also have the proposed water kiosk 1 to serve the community within the area. The line can be plotted as the graph shown below

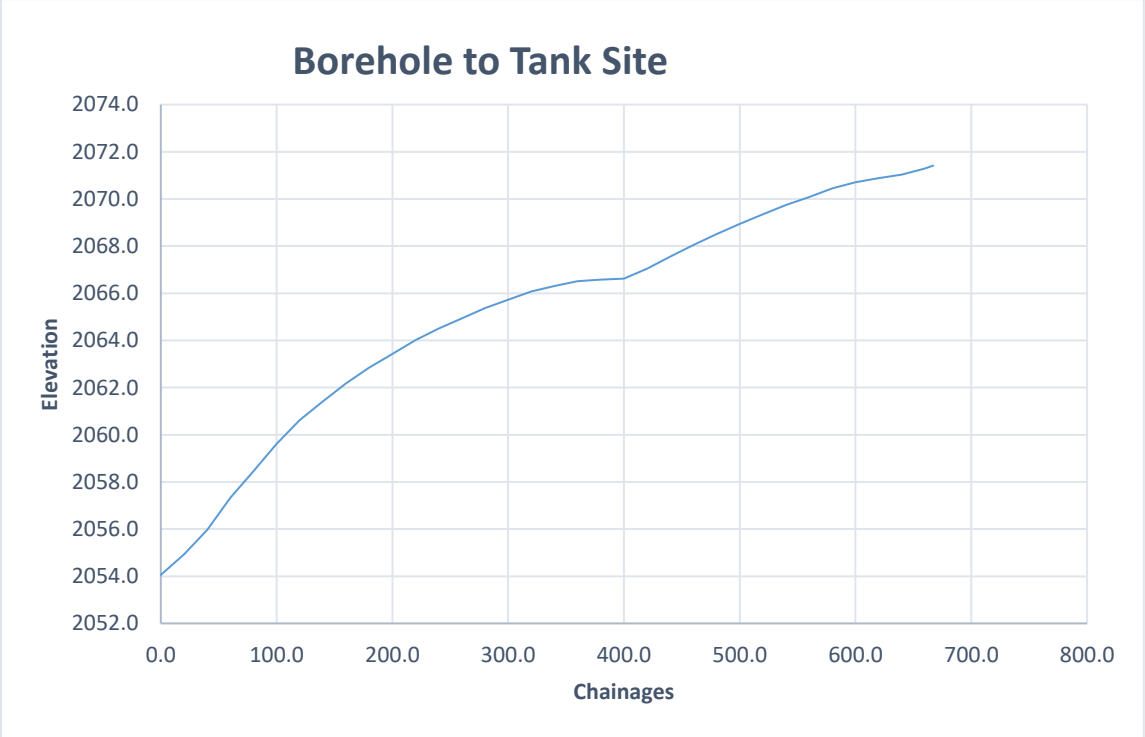

Figure 3: Rising Main:Borehole to Tank Site/Water Kiosk 1

5.2.2 Return Line: Tank Site to Water Kiosk 2

The return line is approx. 2390 metres it slopes gradually southward to the lowest point at the river crossing. The survey followed the demarcated roads according to the community water team. The roads are not well indicated on the ground and require guidance of the local community during excavation.
The point at the tank site is at an elevation of 2071.5 while the point at the water kiosk 2 is at 2064.8m. The lowest point along the route is at the river crossing at KM1+080. The line passes through a T-junction that takes water to the school. The T-junction is at KM2+120. Although most of the areas are covered with soil, certain sections such as the river area have rock outcrops that require anchor blocks and GI pipes.

The line can be plotted as the graph shown below

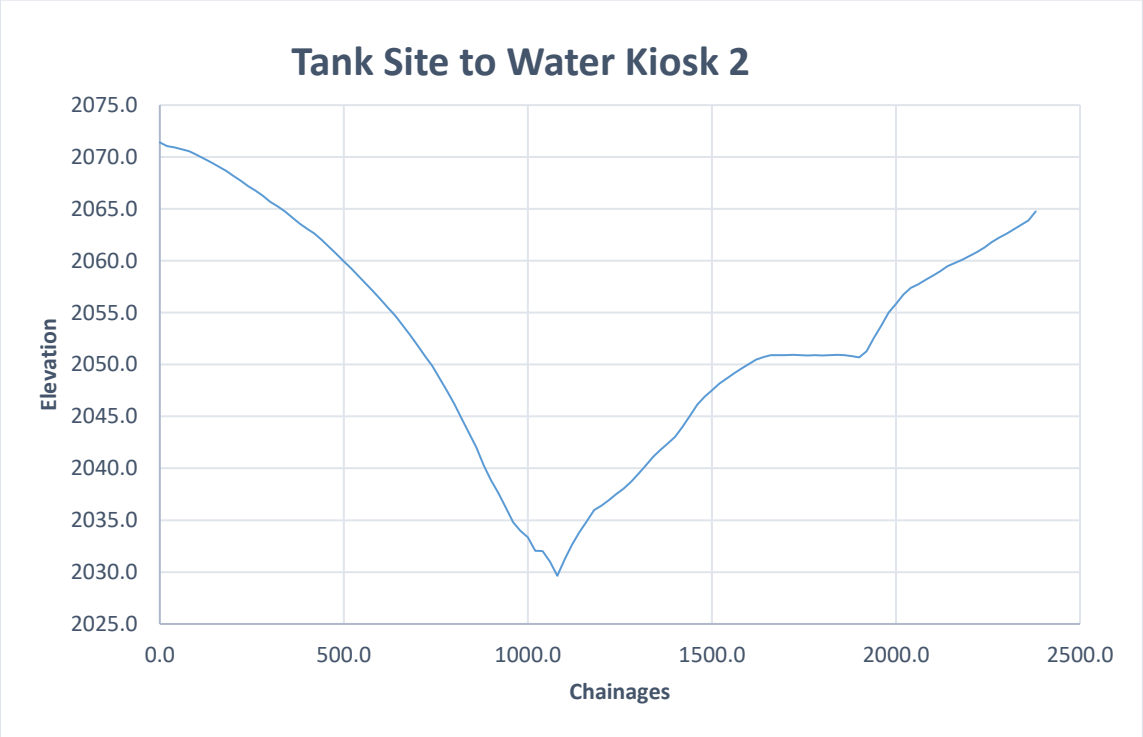

Figure 4: Return Line: Tank Site to Water Kiosk 2

5.2.3 T-junction to Olenkuya School Water Point

The line is approx. 797 metres in length. The elevation difference between the T-junction which is at 2059.2m and the school water point at 2042.5 m is a decline of 16.7m. The line follows the designated road reserve although the existing roads do not follow this demarcation yet.

The point at the school is the proposed water tower point. The point feeds to the VIP Girls latrines which are 128 metres from school water point and at an elevation 0f 2038.9. The school water point is also the Y-junction to the VIP Boys toilets which are 171m and at an elevation of 2036.3m.

The line can be plotted as the graph shown below

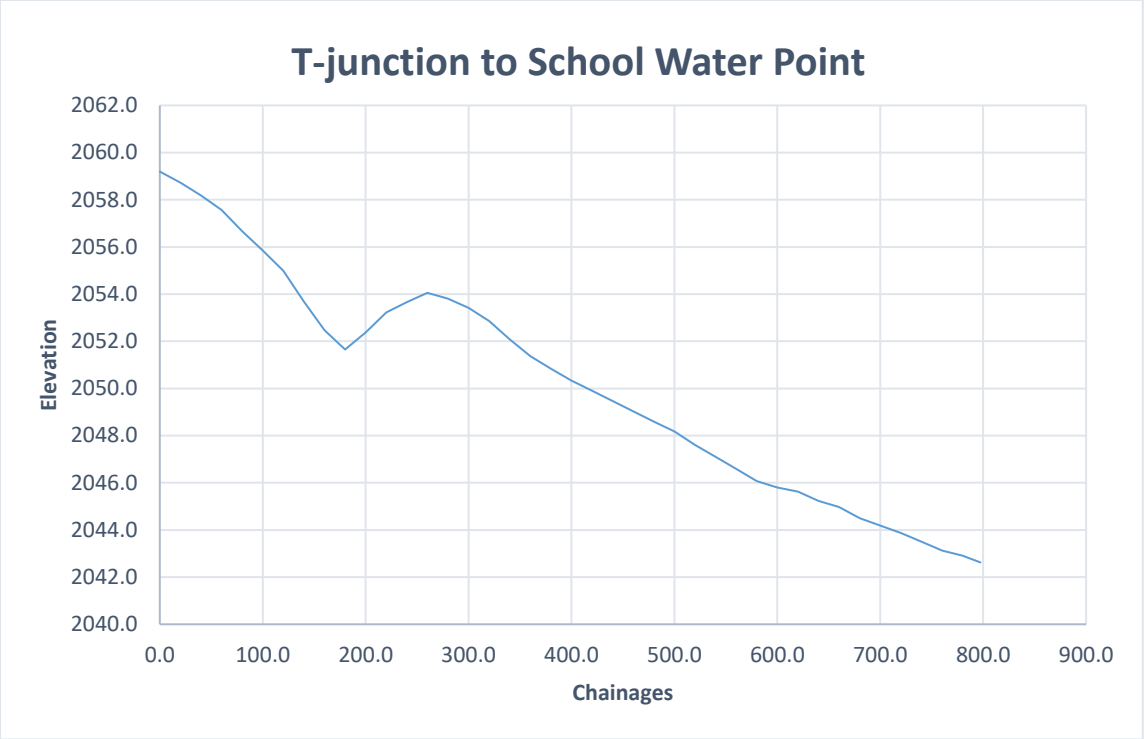

Figure 5: T-junction to school water point

5.3 Emarti Pipeline Route

Emarti water supply project is a proposed water supply system that will supply water to Emarti primary school and a water kiosk for the community. The water supply intends to get water from an existing borehole and generator house that require rehabilitation. The site also has an existing pipeline route that is located along the fence towards the existing tanks tower.

Emarti Primary School is located at Geographic coordinates 1°29'10.472" S and 35°19'55.450". The school currently relies on the river downstream of the school and the water gutters strategically placed along the classrooms and the tanks within the school.

The existing tank site at the fence corner of the school is at an elevation of 1640.7m which is not the highest point within the area surveyed. The highest elevation is at the proposed water kiosk site at 1659.9m. The lowest elevation is at the borehole which is at 1632.4m.

5.3.1 Rising Main: Borehole to Existing Tank Site

The borehole is located on Geographic coordinates 1°29'05.254" E and 35°20'00.214" S. The line from the borehole to the existing tank site is approx. 278 metres. The elevation difference between the borehole site and the existing tank site at 1640.7m is a rise of 8.3m. The borehole site will require rehabilitation and installation of solar panels.

The rising main flows from the borehole along the fence to the existing tank site. The borehole and the tank site are well enclosed within the school compound. Graphically the line is represented as below.

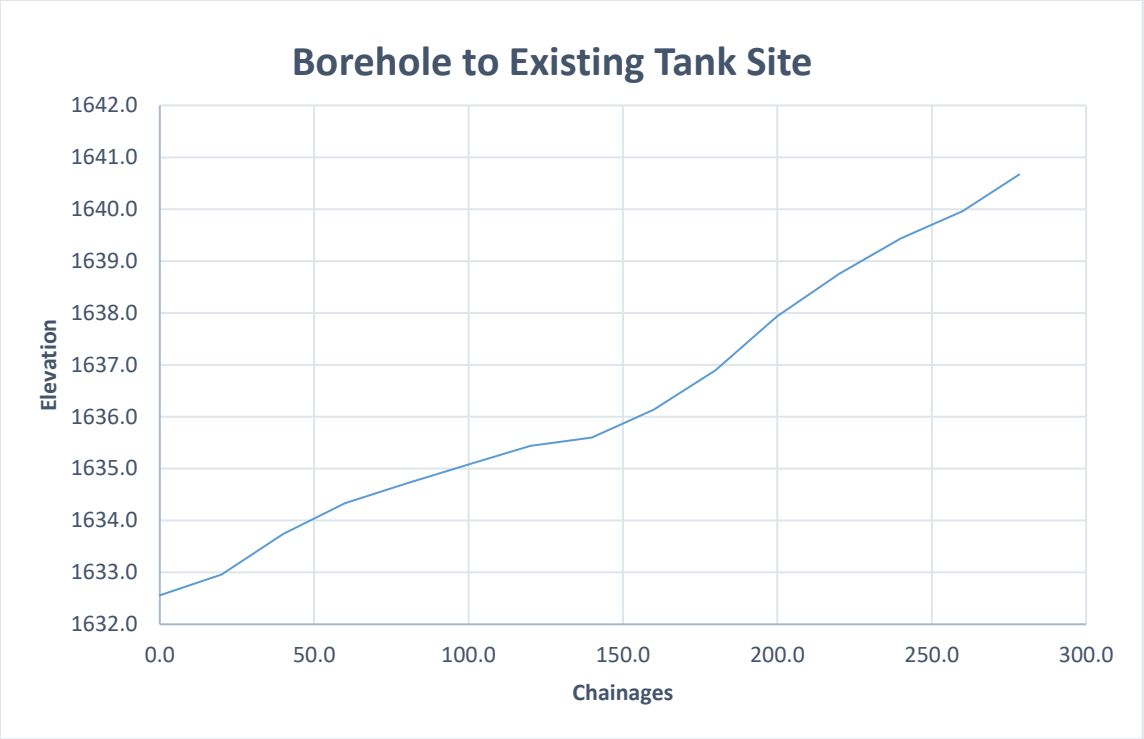

Figure 6: Rising Main: Borehole to Existing Tank Site

5.3.2 Return Line: Existing Tank Site to Y-Junction

The return line is approx. 141 metres in length. The main purpose of the return line is feed via gravity the VIP girls and VIP boys' toilets. The elevation difference between the existing tank site and the Y-junction at 1637.5m is a decline of 3.2m. Due to the small horizontal distance the difference is sufficient for water to flow once the tank are raised.

The VIP girls are approx. 27m from the Y-junction at an elevation of 1637.9 while the VIP boys are at a distance of 15 metres at elevation of 1637.2m.

The line can be plotted graphically as

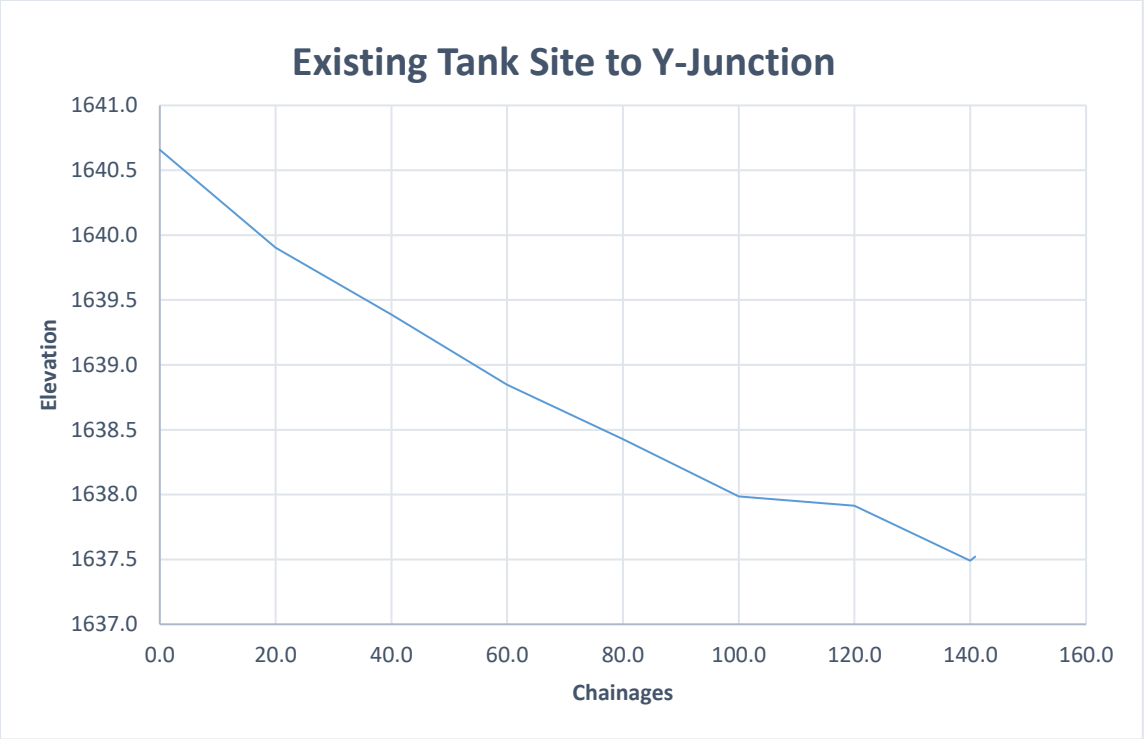

Figure 7: Return line: Existing Tank site to water kiosk

5.3.3 Existing Tank Site to Water Kiosk

The proposed water kiosk follows the power line adjacent the road towards a site that is approx. 514m away from the tank site. The elevation of the water kiosk is at 1659.9m which is 19.2 metres higher than the elevation at the location of the existing tank site.

The water cannot flow to the kiosk, unless the location of the tanks is changed to have the tanks at the highest point within the section which is the location of the community water kiosk. Further analysis, is required to effectively supply water to the kiosk

The line can be represented graphically as;

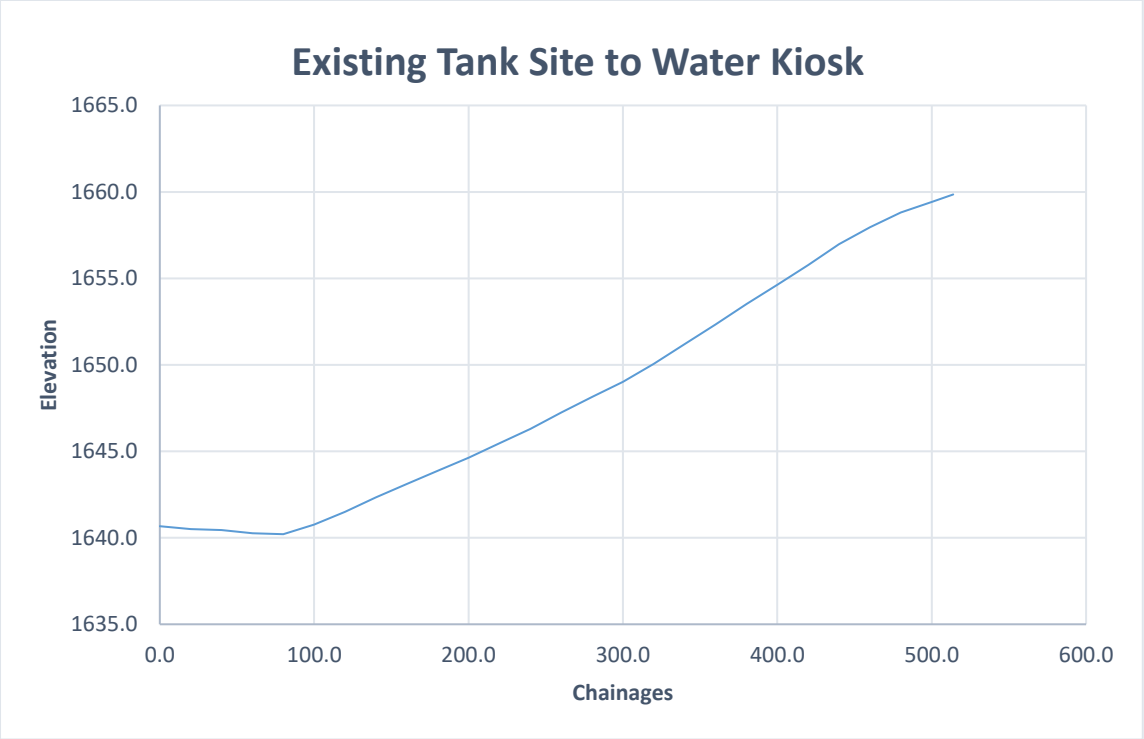

Figure 8: Existing Tank Site to Water Kiosk

5.4 Lekanka Pipeline Route

Lekanka water supply project will supply water to Lekanka primary school and a community water kiosk. The water supply will get its water from an existing borehole that needs rehabilitation. The site also has an existing generator house and a solar structure.

Lekanka Primary School is located on geographic coordinates 1°17'46.149" S and 35°36'10.206" E. The school currently relies on the borehole and water gutters during the rainy season with tank for storage within the school.

The existing borehole location site is also the proposed tank site due to its high elevation. It has the highest elevation at 1888.7m. The lowest elevation is at 1872.2m which is at the proposed water kiosk.

5.4.1 Borehole/Tank site to School water point

The pipeline route from the tank site to the school water point is approx. 1065 metres. The water flows freely via gravity as the elevation at the water point is 1874.4m a decline of 14.3m which offers sufficient head.

The T-junction that separates water that is flowing to the school from the one flowing to the community water kiosk is at KM1+020.

The school water point feeds into the VIP latrines with the VIP girls at 100m and at an elevation of 1874.5 while the VIP boys are a further distance ahead along the same line at 73m from VIP girls (173m from School water Point) at a similar elevation of 1874.5m.

The line can also be plotted as a graph as shown in the figure.

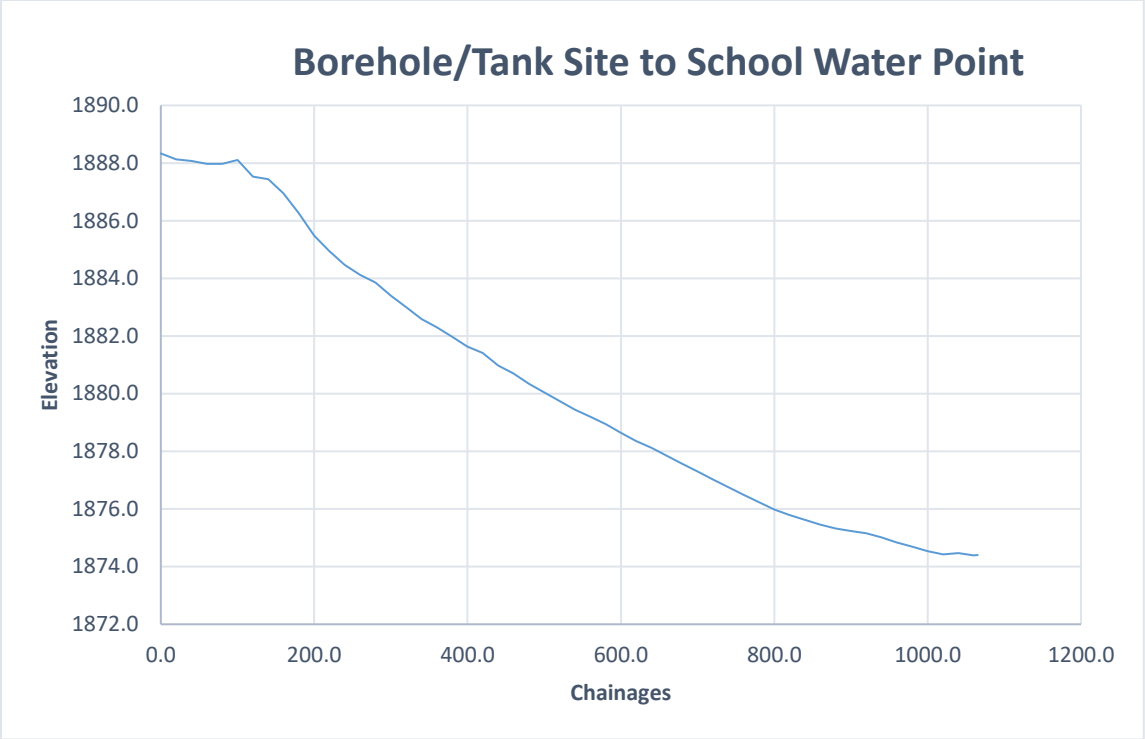

Figure 9: Borehole/Tank Site to School Water Point

5.4.2 T-junction to water kiosk

The elevation at the T-junction is 1874.4. The horizontal distance from the T-junction to the water kiosk is approx. 260m with an elevation decline towards the kiosk at 1872.9m. The difference in elevation is 1.5 metres.

The graphical representation of the line is as below

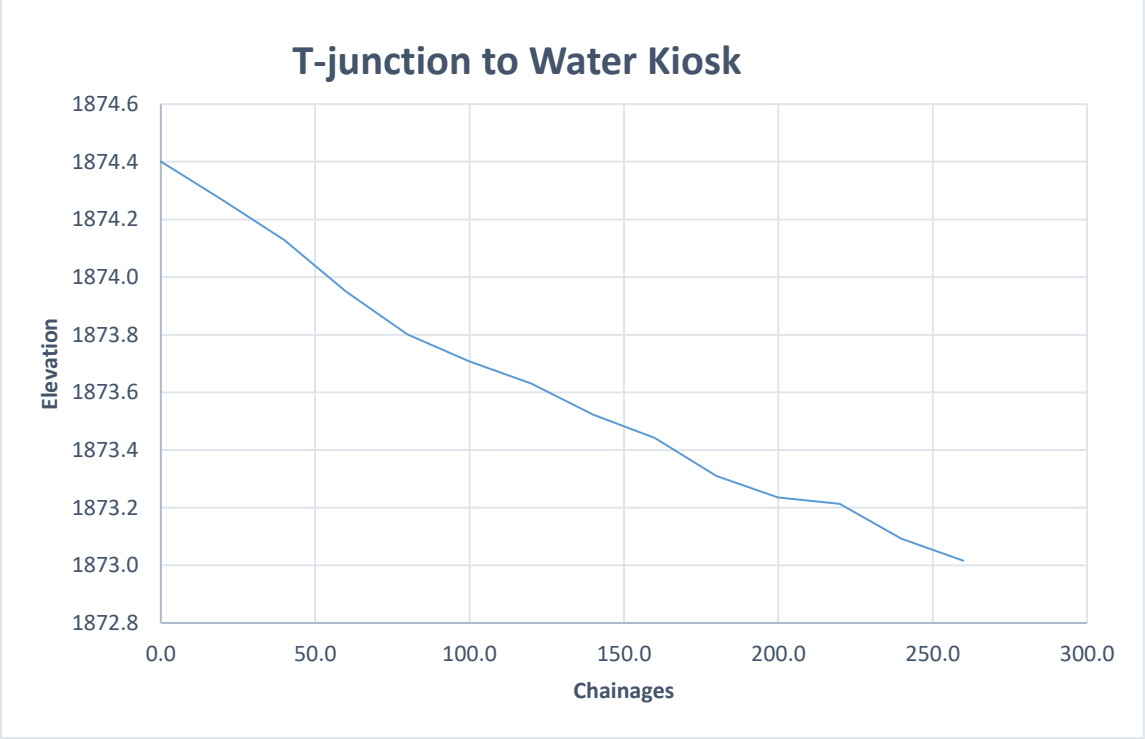

Figure 10: T-junction to water kiosk

6. AUTOCAD SITE LAYOUT

From source to site on Google Earth View

Figure 11 : AutoCAD maps

7. DIGITAL ATTACHMENTS

The following files are available with regards to this report

• Nasoretet, Olenkuya, Emarti and Lekanka Survey Report.docx	This report;
• Nasoretet, Olenkuya, Emarti and Lekanka Survey Report.pdf	This report;
• Nasoretet Layout Survey	AutoCAD dwg
• Olenkuya Layout Survey	AutoCAD dwg
• Emarti Layout Survey	AutoCAD dwg
• Lekanka Layout Survey	AutoCAD dwg
• Nasoretet Survey data + Graphs	Excel
• Olenkuya Survey data + Graphs	Excel
• Emarti Survey data + Graphs	Excel
• Lekanka Survey data + Graphs	Excel