ENDOINYO ONKOPIT, OLOONTARE AND OLASENUA WASH PROJECTS

TOPOGRAPHICAL SURVEY DRAFT REPORT

Submitted to:

AMREF
Kenneth Ochieng | Edward Mukanda

Prepared by:

Surveyor Njenga Wainaina (MISK)
+254 712 909354

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1. INTRODUCTION

1.1 Background

The maps available for the Study Area from Survey of Kenya are in 1:50,000 scale that were prepared in the 1970s. 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 sub-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, Endoinyo Onkopit , Oloontera and Olasenua 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 3 sites; Endoinyo Onkopit, Oloontera and Olasenua 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	9890637.255	703584.024	1797.901	BME1	Endoinyo Onkopit - behind water kiosk 1
2	9890641.522	683510.311	1547.322	BMO1	Next to the abandoned borehole at Oloontera primary school
3	9880841.645	680255.584	1502.896	BML1	Next to the solar pump structure at Olasenua Primary school

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 Endoinyo Onkopit has an existing borehole at the end of Endoinyo Onkopit Primary school and a water kiosk under construction at the gate of the school where there is a public land. Additionally, at the market there are two spring eyes that would need to be rehabilitated due to the insufficient water from the borehole. The site had low canopy with structures within the school compound. The Oloontare site was along an existing river with spring eyes at four different locations. The site required extension of the existing pipeline routes to server additional water kiosks for the community. The site had medium canopy that meant the base had to be placed in close proximity to the site. The Olasenua site had medium canopy littered along the survey routes from the borehole to the water kiosk locations. The surveyed route followed the road well demarcated by a fence on both sides. The distance from the water kiosk is approx. 5.7 km while from the T-junction is approx. 5.2 km

The survey of the pipeline route was done on 25th to 28th August 2024.

5.1 Endoinyo Onkopit Pipeline Route

Endoinyo Onkopit Primary school is located on Geographic coordinate 0° 59' 16.6" S 34°49'46.6" E. The school shares its compound with Endoinyo Onkopit secondary school which is located on Geographic coordinates with some of its facilities such as the field being used in common. Currently, the site has a borehole and a functional water kiosk.

The site is currently using water from the borehole at the edge of Endoinyo Onkopit Secondary school with the rising main going towards the Endoinyo Onkopit centre where there is water kiosk 1. The water from the borehole is insufficient to effectively serve the schools and the adjoining communities. This has led to the need to review additional water sources within the community. Currently, there are two additional spring eyes at the edge of a stream located beyond the market area. The two springs have water that runs throughout the year with sufficient yield for additional water supply to the community. The survey was done around the spring area and at intervals of 20 metres along the route where the road features were picked. The total route surveyed is 6.9km with a proposal to have the tank site either on the hill or the edge of Kurao's farm.

The highest elevation for the entire section is located at the hill site with an elevation of 1861.8 while the lowest point is at the proposed sump site with elevation of 1776.1m ASL.

5.1.1 Spring eye 1

Spring eye 1 is located on geographic coordinate 0°59'21.4" S and 34°49' 32.4" E. The elevation at eh spring is 1777.278m ASL. It's located on a stream on the lower side of the market area. It has been a source of water during all the dry seasons. The spring has been rehabilitated and has two outlet pipes and an overflow pipe. It can be classified as an underground spring and its waters flow towards the stream. The depth of the spring box is approx. 1m. It's a permanent spring

The major design components that should be considered for the spring are

- The spring area protection using a small holding weir
- Outlet through pipes to the pipeline route

The spring eye requires adequate protection to prevent from human and animal pollution. Considering the nature of the spring the following design procedures are recommended;

i. Clearing the area with reeds after the spring
ii. A spring box made of masonry stones to be used as first collection point

Plate 1: Spring eye 1

5.1.2 Spring eye 2

The spring is located south east of spring 1 but away from the stream. It's defined by the geographic coordinates 0°59'21.7" S and 34°49' 32.9" E. It's an underground spring that has been partially rehabilitated by masonry protection.

The major design components that should be considered include

- The spring area protection using a holding weir
- Outlet pipes to the pipeline route
- Overflow pipes directed to the stream

5.1.3 Rising main: Springs sump to Hill Tank site

The line from the borehole to the hill tank site is approx. 1598 metres with an elevation difference of approx. 84.5 metres. The line traverses along the road from the spring towards the market area. It turns at KM0+360 towards the main road for 720 metres upto to KM1+080 where it turns towards the hill. The hill is located on land set aside for public utilities and has a well demarcated indicatory boundary.

The rising main requires water to be pumped to the tank site with a head of over 84.5 metres to the vertical difference between the elevation at the hill and that one at the spring site. The adoption of this tank site will be determined by the spring yield. It's the most suitable site for water provision to all the other water kiosks to flow via gravity due to its elevation of 1860.8 mASL.

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

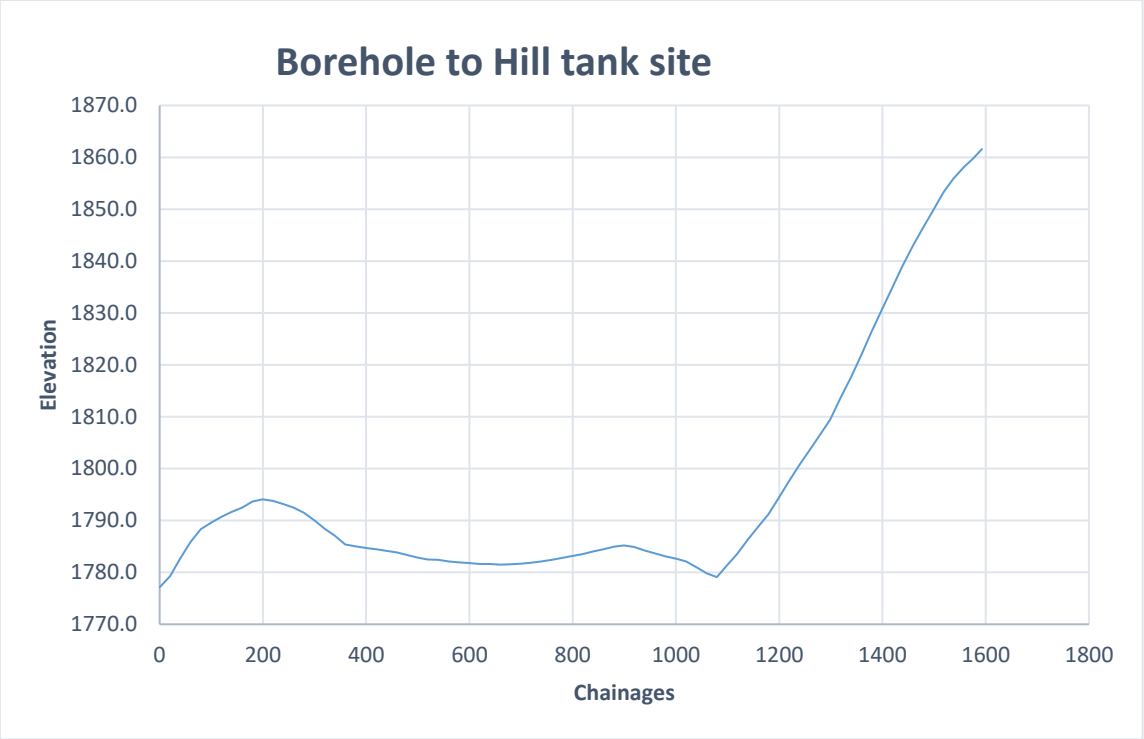

Figure 1: Rising Main: Borehole site to tank site

5.1.4 Distribution Lines

The proposed distribution line follows the same route as the rising main but veers off at the T-junction 1 towards the proposed water kiosk 1. The proposed site for location of tank site is at the hill which is the highest point within the area. The hill tank site will serve water kiosk 1, water kiosk 2, water kiosk 3 and additional feeder lines to the village.

The distribution lines are discussed below.

5.1.4.1 Tank Site to proposed water kiosk 2

The total length of the line is approx. 599 metres. It starts at the main hill tank site towards at a steep gradient up to the T-junction on the main road. It runs northward for 79 metres up to the proposed water kiosk site 2. The elevation at the proposed water kiosk 2 is 1784.3 mASL. The vertical difference between the tank site and the proposed water kiosk 2 is 77.5 metres.

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

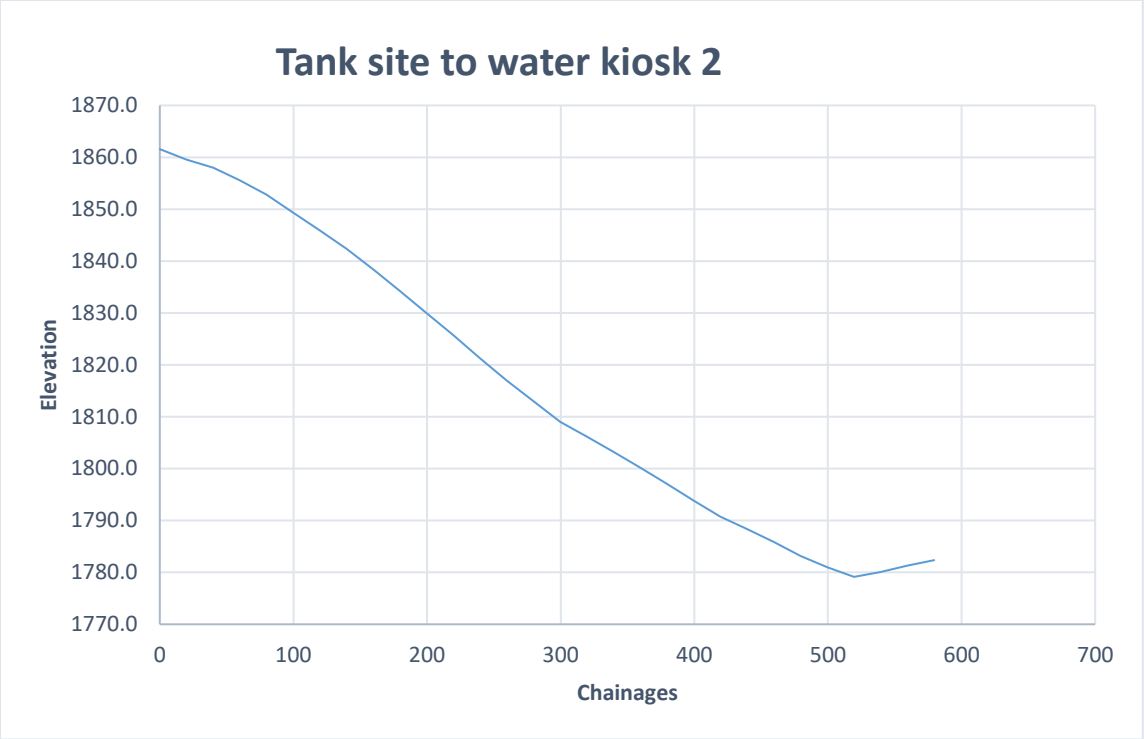

Figure 2: Tank site to water kiosk 2

5.1.4.2 T-junction 2 to water kiosk 3

The total length of the line is approx. 2016 metres. It starts at T-junction where the return line from the tank site towards water kiosk 2 meets the main road from the spring area. It's at KM0+520 and follows the main road up to the Y-junction. From the Y-junction it runs towards the location of proposed water kiosk 3.

The elevations along the route are undulating with the lowest being at 1757.2 and the highest being at 1780.6m, however, the elevation is 80.2 metres below the location of the water tanks.

Additionally, there is a line from the proposed water kiosk 3 towards the village, the line is approx. 321m in length. The elevation at the entry point is at 1787.6 m.

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

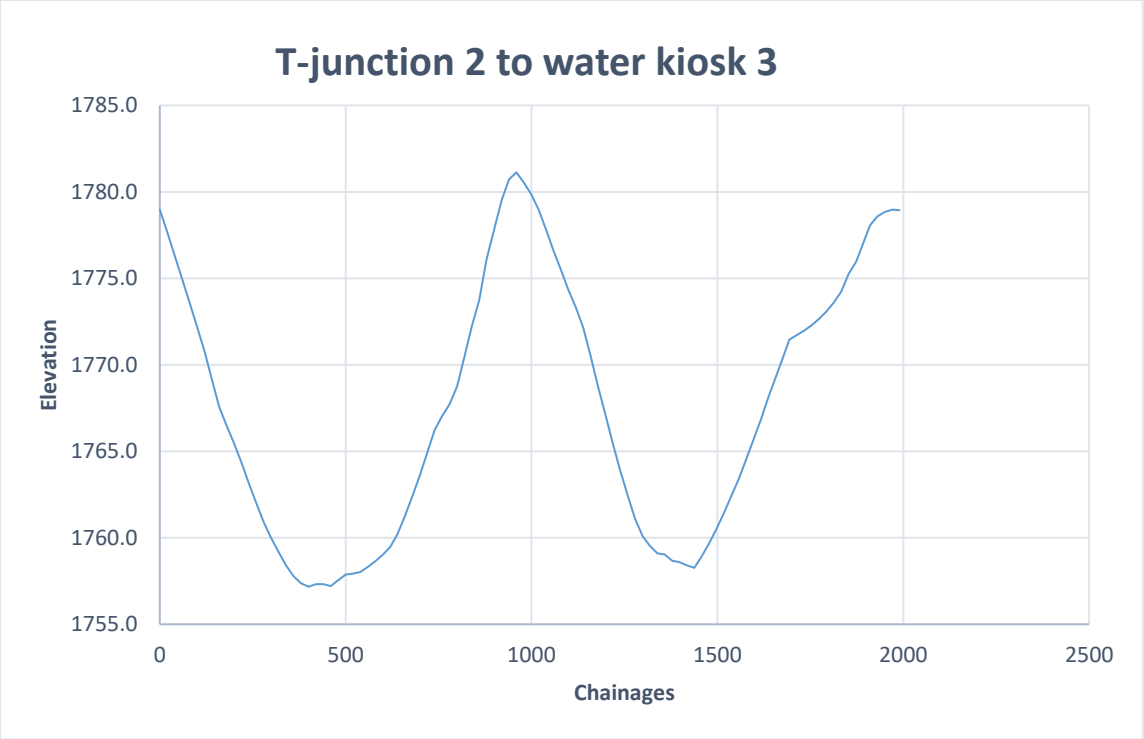

Figure 3: T-junction 2 to water kiosk 3

5.2 Oloontera Pipeline Routes Extension

Oloontera water supply project is a water supply system that supplies water to Oloontera primary school and a water kiosk for the community. The water supply intends to get water four springs that are along the Oloontera river. The spring eyes are all underground and are the most suitable for supplying water to the school.

The sub-consultant did a previous topographical survey of the spring eyes. The data collected was be used for design of spring protection works and setting out of pipeline route to the school and water kiosks. In addition, due to the sufficient water from the spring eyes, the pipeline routes will be extended towards water kiosk 2 and 3, and a junction towards Ilpashile Primary School.

5.2.1 Tank site to water kiosk 2

The line starts at the proposed tank site within the Oloontare primary school compound along the road towards Awendo. The line joins the existing return line from the tank site and runs for 1694 metres towards the proposed water kiosk 2.

The elevation at the location of water kiosk 2 is 1521.9 metres while the elevation at the tank site is 1547.0 m, this gives a vertical difference of 25 metres which is sufficient for water to flow towards water kiosk 2.

The graphical representation of the line is as below.

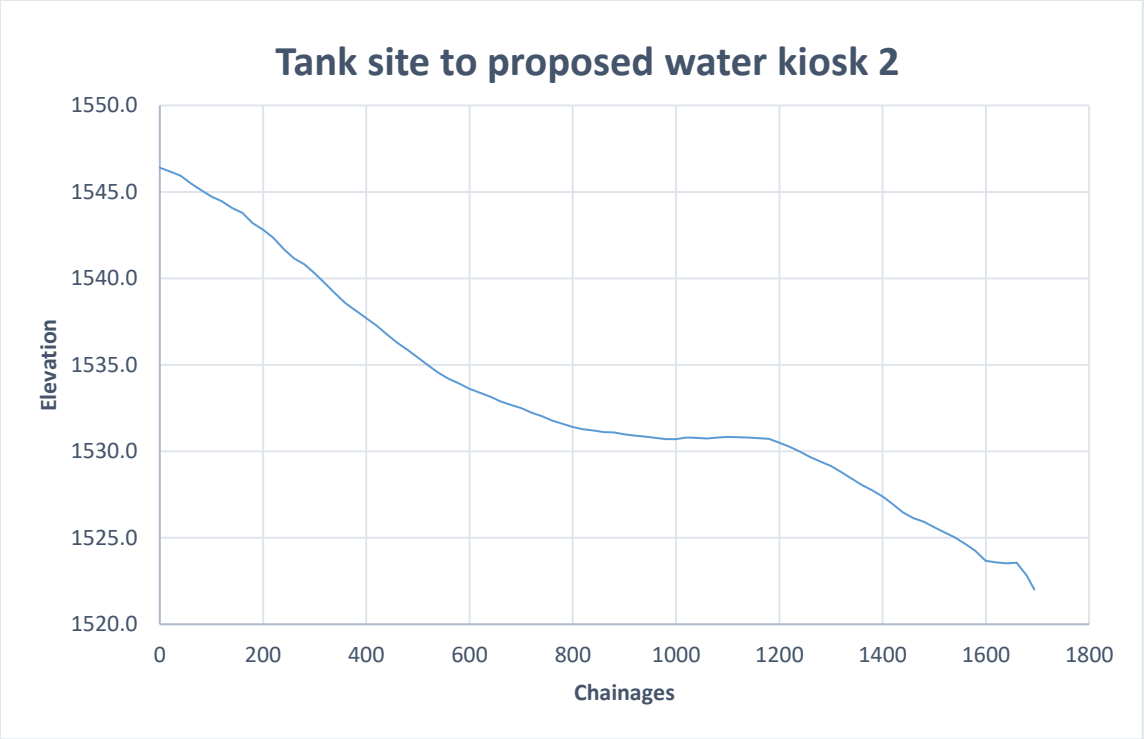

Figure 4: Tank site to water kiosk 2

5.2.2 Tank site to water kiosk 3

The line starts at the proposed tank site towards the Endonyo onkopit road. It will follow the existing pipeline route to water kiosk 1 for 220 metres. The total length of the line from the junction at water kiosk 1 is approx. 720 metres.

The elevation at water kiosk 3 is 1544.7m while at the WK1 junction is 1550.6m. The elevation difference between the location of the tank and WK3 is approx. 3 metres with a total distance of 940 metres.

The line can be represented as

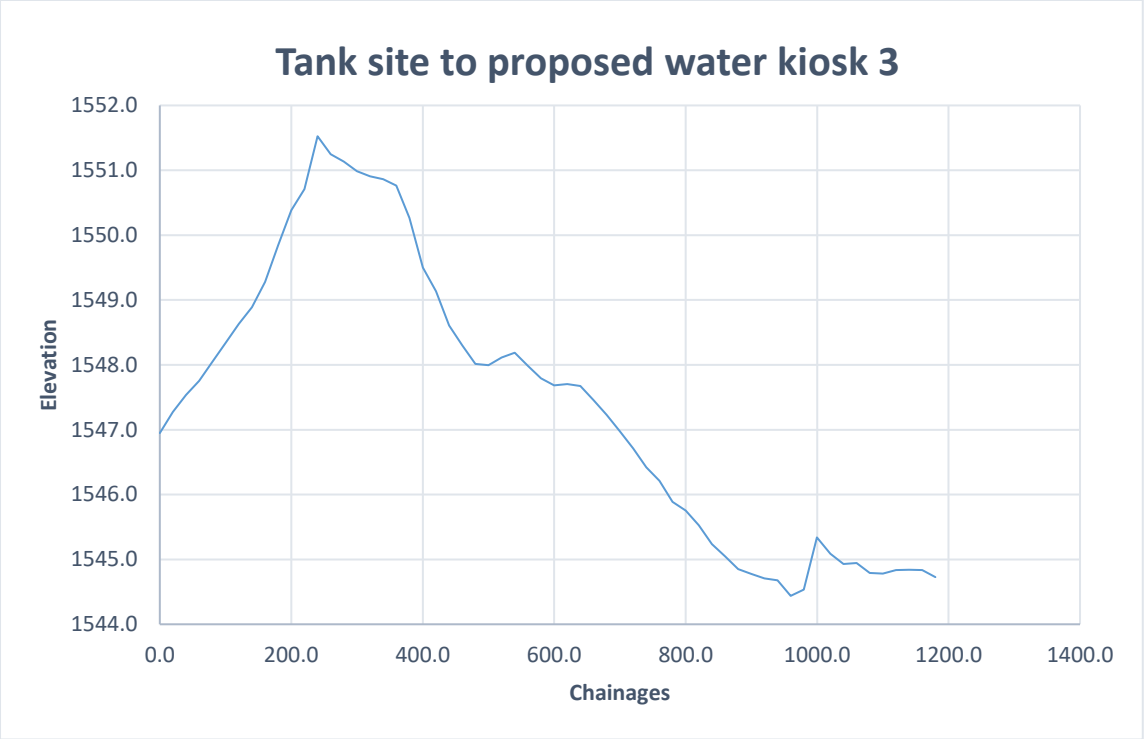

Figure 5: Tank site to Water Kiosk 3

5.2.3 T-junction to junction of Ilpashile Primary School

The line runs from the location of water kiosk 1 towards Endoinyo Onkopit. The purpose of surveying this route was to supply water to Ilpashile Primary school however, from the junction at KM2+560 there was still a distance of 2.3km to the school. Alternative water sources should be pursued at the school whose geographic coordinates are 1°00'07.8" S and 34° 40' 18.0" E.

The horizontal distance of the entire route surveyed is 2705 metres while the vertical difference with water kiosk 1 is 31 metres. Due to the vertical difference water cannot flow via gravity as the incline is very steep.

The graphical representation of the line is as below.

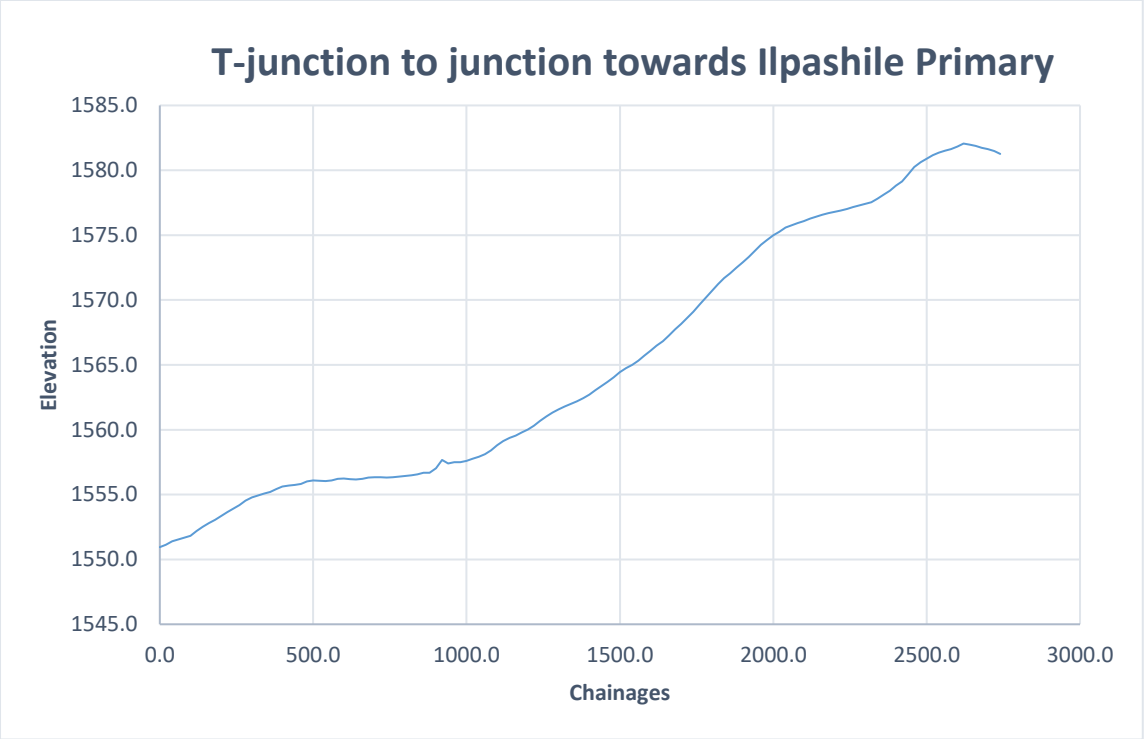

Figure 6: T-junction to junction towards Ilpashile Primary

5.3 Olasenua Pipeline Route

The geographic coordinate of Olasenua primary school is 1°04'38.5" S and 34° 37' 11.3" E. The school already has an existing borehole with a flow rate of 17 cubic metres/hour. The site has an existing solar pump system already installed.

The total distance of the distribution network that was surveyed is 2.0km. The highest elevation at the site is at the 1522.0 mASL which is at the location of proposed water kiosk 2, while the lowest is at 1494.0 mASL located at KM0+520 of the line towards proposed water kiosk 2.

5.3.1 Borehole to proposed Water Kiosk 1

The borehole is located on geographic coordinates 1°04'40.0" S and 34° 37' 11.9" E. It has an installed solar pump while its elevation is at 1503.0 mASL. The water can flow from the borehole to the proposed water kiosk 1 via gravity.

The proposed water kiosk is located on geographic coordinates 1°04'37.6" S and 34° 37' 18.8" E. The elevation at water kiosk 1 is 1502.4 mASL. The total horizontal distance from the borehole to the water kiosk is 246 metres while the vertical difference is 0.6m.

The graphical representation of the line is as below

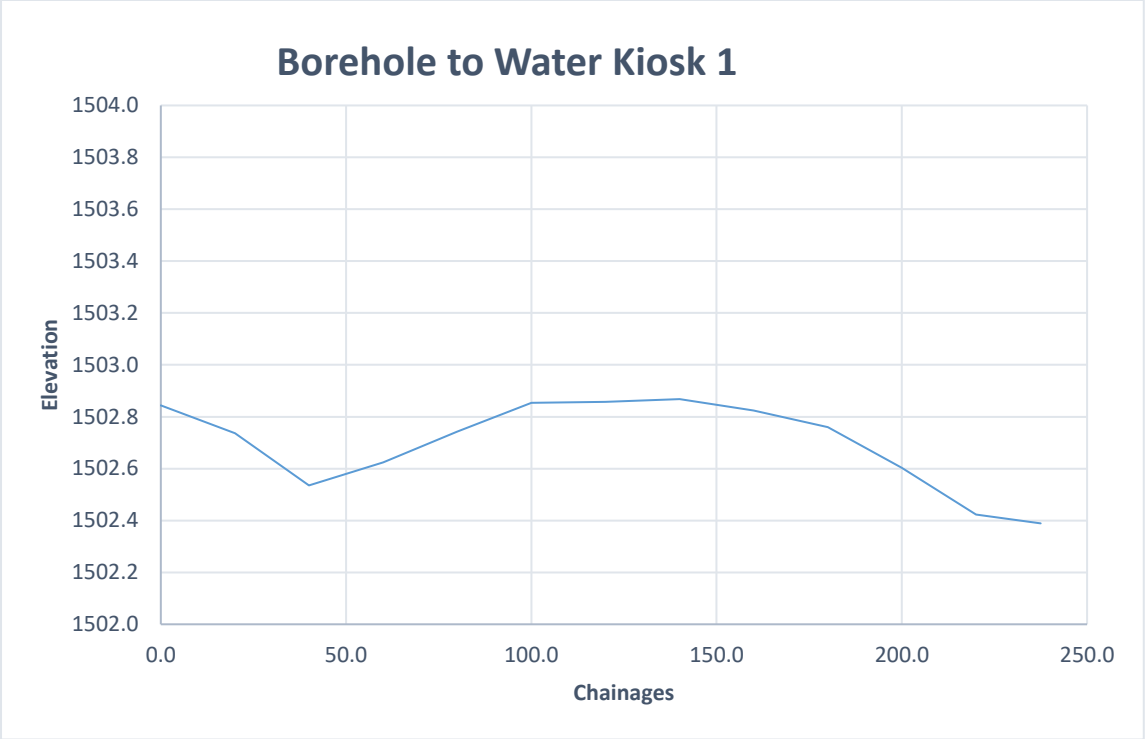

Figure 7: Water Kiosk 2 to Chief's gate Kiosk

5.3.2 T-junction (WK1) to proposed Water Kiosk 2

The proposed water kiosk 2 is located at Erenet area. The horizontal distance from water kiosk 1 junction to water kiosk 2 is 1815 metres. The elevation at the location of water kiosk 2 is approx. 1521.5 m.

The vertical difference between the borehole and water kiosk 2 is approx.. 18 metres. It means water cannot flow to water kiosk 2 via gravity but would need a pump.

The graphical representation of the line is as below

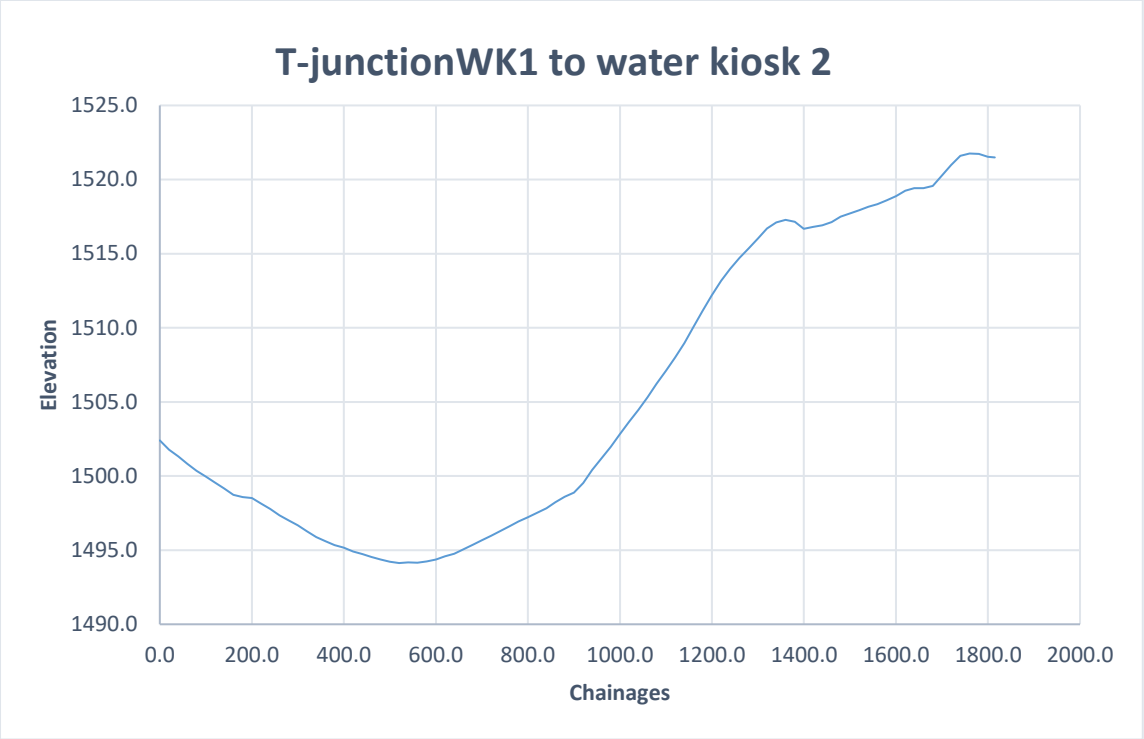

Figure 8: T-junction to water kiosk 2

6. AUTOCAD SITE LAYOUT

From source to site on Google Earth View

Figure 9 : AutoCAD maps

7. DIGITAL ATTACHMENTS

The following files are available with regards to this report

- Endoinyo Onkopit, Oloontera and Olasenua Survey Report.docx — This report;
- Endoinyo Onkopit, Oloontera and Olasenua Survey Report.pdf — This report;
- Endoinyo Onkopit Survey — AutoCAD dwg
- Oloontera Survey — AutoCAD dwg
- Olasenua Survey — AutoCAD dwg
- Endoinyo Onkopit Survey data + Graphs — Excel
- Oloontera Survey data + Graphs — Excel
- Olasenua Survey data + Graphs — Excel