

ENDOINYO NARASHA AND NKAIROWUANI WASH PROJECTS

TOPOGRAPHICAL SURVEY DRAFT REPORT



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1. INTRODUCTION

The maps available for the Study Area from Survey of Kenya are in 1:50,000 scale that were prepared in the 1970s. Although 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. A pipeline route survey was carried out to collect data and information of the features and elevations along the main and minor pipeline routes. The data collected will be primarily used for the design of the pipeline routes, pipes, fittings, gravity flows, air valve and gate valve points.

The tables attached below contain the survey data collected from the field and indicate the changes in elevations throughout the entire network. In addition, graphs that indicate the pipeline system and slope are provided.

2. 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. Topographical survey of 2 sites; Nkairowuani and Endoinyo Narasha primary schools
2. Survey report to include benchmarks, levels, profile and layouts

3. SITE BENCHMARKS

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

Table 1: Site Benchmark Information

Benchmarks	Northing	Easting	Elevation	Description	Remarks
1	9869154.564	787495.107	1873.058	EK1	Nkairowuani
2	9861389.477	777933.132	1865.819	EN1	Endoinyo Narasha

4. PIPELINE ROUTE SURVEY

The survey of the pipeline route was done on 3rd and 4th December 2021,

4.1 Nkairowuani Pipeline Route

The Nkairowuani pipeline is an approximately 5km route. The line started at Nkairowuani primary school and diverted for 260m towards the Nkairowuani center kiosk. The line was then surveyed further for approx. 4.2km along the road to the site for the next kiosk. During the survey at chainage 0+620 the pipeline crosses a lagga section and this was noted.

The co-ordinates were picked in WGS84 36S system and the heights were picked as ellipsoidal with the highest elevation on Nkairowuani site being 1888.232m and the lowest elevation being 1870.581m at the lagga invert. The survey was done at an interval of approx. 20 meters. The area is generally slopping towards the lagga, then starts to rise upto chainage 2+740 where it drops gently. The data picked on site is as indicated in the table below.

Table 2: Survey Points Nkairowuani

Station	Northing (m)	Easting (m)	Elevation (m)	Description
0+000.00	9869157.075	787472.264	1873.175	Borehole
0+020.00	9869146.927	787455.036	1873.21	Spotheight
0+040.00	9869135.855	787438.381	1873.249	Spotheight
0+060.00	9869124.927	787421.633	1873.356	Spotheight
0+080.00	9869116.164	787403.667	1873.508	Spotheight
0+100.00	9869106.564	787386.122	1873.635	Spotheight
0+120.00	9869096.637	787368.763	1873.688	Spotheight
0+140.00	9869086.311	787351.638	1873.754	Spotheight
0+160.00	9869075.465	787334.854	1873.816	Spotheight
0+180.00	9869064.960	787317.854	1873.865	Spotheight
0+200.00	9869057.854	787299.181	1873.957	Spotheight
0+220.00	9869051.688	787280.178	1873.98	Spotheight
0+240.00	9869044.510	787261.517	1873.995	Spotheight
0+260.00	9869036.106	787243.398	1873.996	Nkairowuani Kiosk 1
0+280.00	9869024.202	787227.628	1873.997	Spotheight
0+300.00	9869005.532	787220.578	1873.873	Spotheight
0+320.00	9868986.057	787216.036	1873.725	Spotheight
0+340.00	9868966.555	787211.598	1873.568	Spotheight
0+360.00	9868946.954	787207.679	1873.397	Spotheight
0+380.00	9868927.191	787204.608	1873.205	Spotheight
0+400.00	9868907.747	787200.079	1873.02	Spotheight
0+420.00	9868888.518	787194.579	1872.841	Spotheight
0+440.00	9868871.444	787184.361	1872.705	Spotheight
0+460.00	9868854.600	787173.649	1872.573	Spotheight
0+480.00	9868835.744	787166.980	1872.385	Spotheight
0+500.00	9868816.562	787161.597	1872.226	Spotheight
0+520.00	9868796.775	787158.687	1872.067	Spotheight
0+540.00	9868777.858	787153.149	1871.927	Spotheight
0+560.00	9868760.725	787142.831	1871.792	Spotheight

0+580.00	9868742.719	787134.258	1871.663	Spotheight
0+600.00	9868724.154	787126.819	1871.516	Spotheight
0+620.00	9868704.763	787122.294	1870.674	Nkairowuani lagga
0+640.00	9868685.095	787118.791	1871.618	Spotheight
0+660.00	9868665.127	787117.656	1871.598	Spotheight
0+680.00	9868645.632	787113.661	1871.616	Spotheight
0+700.00	9868626.404	787108.158	1871.653	Spotheight
0+720.00	9868607.647	787101.254	1871.7	Spotheight
0+740.00	9868588.934	787094.216	1871.749	Spotheight
0+760.00	9868569.732	787088.624	1871.806	Spotheight
0+780.00	9868550.738	787082.448	1871.907	Spotheight
0+800.00	9868532.395	787074.478	1872.147	Spotheight
0+820.00	9868513.536	787068.039	1872.325	Spotheight
0+840.00	9868494.073	787063.435	1872.442	Spotheight
0+860.00	9868474.304	787060.622	1872.6	Spotheight
0+880.00	9868454.411	787058.557	1872.818	Spotheight
0+900.00	9868434.505	787056.629	1872.957	Spotheight
0+920.00	9868414.612	787054.592	1873.117	Spotheight
0+940.00	9868394.865	787051.421	1873.392	Spotheight
0+960.00	9868375.073	787048.668	1873.659	Spotheight
0+980.00	9868355.096	787047.710	1873.884	Spotheight
1+000.00	9868335.137	787046.501	1874.113	Spotheight
1+020.00	9868315.227	787044.597	1874.354	Spotheight
1+040.00	9868295.318	787042.693	1874.552	Spotheight
1+060.00	9868275.409	787040.789	1874.701	Spotheight
1+080.00	9868255.500	787038.884	1874.908	Spotheight
1+100.00	9868235.588	787037.015	1875.164	Spotheight
1+120.00	9868215.624	787035.814	1875.371	Spotheight
1+140.00	9868195.662	787034.595	1875.588	Spotheight
1+160.00	9868175.750	787032.712	1875.835	Spotheight
1+180.00	9868155.854	787030.697	1876.093	Spotheight
1+200.00	9868136.005	787028.241	1876.398	Spotheight
1+220.00	9868116.096	787026.375	1876.613	Spotheight
1+240.00	9868096.160	787024.779	1876.833	Spotheight
1+260.00	9868076.292	787022.511	1877.068	Spotheight
1+280.00	9868056.441	787020.072	1877.328	Spotheight
1+300.00	9868036.535	787018.144	1877.547	Spotheight
1+320.00	9868016.619	787016.319	1877.752	Spotheight
1+340.00	9867996.696	787014.560	1877.925	Spotheight
1+360.00	9867976.772	787012.826	1878.105	Spotheight
1+380.00	9867956.844	787011.126	1878.325	Spotheight
1+400.00	9867937.065	787013.566	1878.432	Spotheight
1+420.00	9867917.516	787017.627	1878.519	Spotheight
1+440.00	9867898.374	787023.423	1878.589	Spotheight
1+460.00	9867879.529	787030.094	1878.669	Spotheight
1+480.00	9867860.816	787037.153	1878.753	Spotheight
1+500.00	9867841.583	787042.597	1878.876	Spotheight

1+520.00	9867822.267	787047.782	1879.003	Spotheight
1+540.00	9867803.168	787053.715	1879.077	Spotheight
1+560.00	9867783.995	787059.329	1879.153	Spotheight
1+580.00	9867764.005	787058.776	1879.261	Spotheight
1+600.00	9867744.021	787058.034	1879.376	Spotheight
1+620.00	9867724.076	787056.545	1879.523	Spotheight
1+640.00	9867704.206	787054.466	1879.674	Spotheight
1+660.00	9867684.525	787050.908	1879.834	Spotheight
1+680.00	9867664.758	787047.988	1879.991	Spotheight
1+700.00	9867644.829	787046.308	1880.144	Spotheight
1+720.00	9867624.945	787044.225	1880.287	Spotheight
1+740.00	9867605.145	787041.408	1880.412	Spotheight
1+760.00	9867585.331	787038.695	1880.538	Spotheight
1+780.00	9867565.445	787036.561	1880.673	Spotheight
1+800.00	9867545.545	787034.602	1880.804	Spotheight
1+820.00	9867525.572	787033.561	1880.92	Spotheight
1+840.00	9867505.636	787032.225	1881.038	Spotheight
1+860.00	9867486.293	787027.140	1881.192	Spotheight
1+880.00	9867467.019	787021.822	1881.345	Spotheight
1+900.00	9867448.020	787015.575	1881.495	Spotheight
1+920.00	9867429.326	787008.599	1881.641	Spotheight
1+940.00	9867411.680	786999.184	1881.777	Spotheight
1+960.00	9867393.874	786990.100	1881.923	Spotheight
1+980.00	9867375.574	786982.030	1882.1	Spotheight
2+000.00	9867357.167	786974.215	1882.264	Spotheight
2+020.00	9867338.596	786966.792	1882.407	Spotheight
2+040.00	9867320.229	786958.928	1882.556	Spotheight
2+060.00	9867302.650	786949.391	1882.724	Spotheight
2+080.00	9867284.871	786940.293	1882.894	Spotheight
2+100.00	9867266.006	786933.649	1883.071	Spotheight
2+120.00	9867247.096	786927.139	1883.232	Spotheight
2+140.00	9867228.154	786920.720	1883.382	Spotheight
2+160.00	9867210.327	786911.794	1883.589	Spotheight
2+180.00	9867192.905	786901.974	1883.813	Spotheight
2+200.00	9867175.044	786892.976	1883.966	Spotheight
2+220.00	9867157.118	786884.109	1884.124	Spotheight
2+240.00	9867138.981	786875.681	1884.294	Spotheight
2+260.00	9867121.556	786865.933	1884.492	Spotheight
2+280.00	9867104.590	786855.343	1884.708	Spotheight
2+300.00	9867086.746	786846.312	1884.816	Spotheight
2+320.00	9867068.845	786837.395	1884.928	Spotheight
2+340.00	9867050.695	786828.994	1885.077	Spotheight
2+360.00	9867032.552	786820.578	1885.246	Spotheight
2+380.00	9867014.427	786812.125	1885.464	Spotheight
2+400.00	9866996.352	786803.563	1885.657	Spotheight
2+420.00	9866978.362	786794.826	1885.81	Spotheight
2+440.00	9866961.067	786784.832	1885.976	Spotheight

2+460.00	9866944.129	786774.197	1886.15	Spotheight
2+480.00	9866927.238	786763.487	1886.318	Spotheight
2+500.00	9866910.371	786752.739	1886.482	Spotheight
2+520.00	9866893.938	786741.345	1886.605	Spotheight
2+540.00	9866877.585	786729.830	1886.721	Spotheight
2+560.00	9866862.046	786717.252	1886.882	Spotheight
2+580.00	9866846.674	786704.458	1887.053	Spotheight
2+600.00	9866831.063	786691.957	1887.218	Spotheight
2+620.00	9866815.410	786679.508	1887.383	Spotheight
2+640.00	9866800.111	786666.627	1887.578	Spotheight
2+660.00	9866784.782	786653.790	1887.774	Spotheight
2+680.00	9866767.495	786643.732	1887.916	Spotheight
2+700.00	9866750.254	786633.596	1888.044	Spotheight
2+720.00	9866732.482	786633.227	1888.138	Spotheight
2+740.00	9866718.944	786647.948	1888.222	Spotheight
2+760.00	9866706.768	786663.805	1888.211	Spotheight
2+780.00	9866694.739	786679.783	1888.187	Spotheight
2+800.00	9866682.376	786695.505	1888.156	Spotheight
2+820.00	9866670.000	786711.215	1888.125	Spotheight
2+840.00	9866657.587	786726.897	1888.089	Spotheight
2+860.00	9866645.157	786742.565	1888.051	Spotheight
2+880.00	9866632.726	786758.233	1888.011	Spotheight
2+900.00	9866620.294	786773.899	1887.959	Spotheight
2+920.00	9866607.861	786789.566	1887.907	Spotheight
2+940.00	9866595.464	786805.260	1887.859	Spotheight
2+960.00	9866583.072	786820.958	1887.811	Spotheight
2+980.00	9866570.785	786836.739	1887.763	Spotheight
3+000.00	9866558.567	786852.573	1887.716	Spotheight
3+020.00	9866546.332	786868.393	1887.672	Spotheight
3+040.00	9866534.089	786884.209	1887.631	Spotheight
3+060.00	9866521.820	786900.003	1887.589	Spotheight
3+080.00	9866509.511	786915.767	1887.547	Spotheight
3+100.00	9866497.206	786931.533	1887.494	Spotheight
3+120.00	9866484.906	786947.304	1887.421	Spotheight
3+140.00	9866472.572	786963.048	1887.354	Spotheight
3+160.00	9866460.206	786978.767	1887.29	Spotheight
3+180.00	9866447.729	786994.397	1887.196	Spotheight
3+200.00	9866435.208	787009.993	1887.091	Spotheight
3+220.00	9866422.798	787025.676	1886.984	Spotheight
3+240.00	9866410.502	787041.450	1886.875	Spotheight
3+260.00	9866398.064	787057.111	1886.765	Spotheight
3+280.00	9866385.490	787072.664	1886.653	Spotheight
3+300.00	9866373.125	787088.382	1886.519	Spotheight
3+320.00	9866360.879	787104.195	1886.373	Spotheight
3+340.00	9866348.553	787119.945	1886.237	Spotheight
3+360.00	9866336.210	787135.682	1886.103	Spotheight
3+380.00	9866323.804	787151.369	1885.965	Spotheight

3+400.00	9866311.381	787167.043	1885.825	Spotheight
3+420.00	9866299.031	787182.774	1885.692	Spotheight
3+440.00	9866286.742	787198.553	1885.565	Spotheight
3+460.00	9866274.294	787214.204	1885.431	Spotheight
3+480.00	9866261.533	787229.604	1885.285	Spotheight
3+500.00	9866247.860	787244.130	1885.156	Spotheight
3+520.00	9866232.947	787257.457	1885.049	Spotheight
3+540.00	9866215.957	787267.801	1884.949	Spotheight
3+560.00	9866198.220	787277.043	1884.853	Spotheight
3+580.00	9866179.940	787285.135	1884.775	Spotheight
3+600.00	9866161.545	787292.987	1884.701	Spotheight
3+620.00	9866143.252	787301.071	1884.599	Spotheight
3+640.00	9866124.964	787309.166	1884.494	Spotheight
3+660.00	9866106.535	787316.936	1884.413	Spotheight
3+680.00	9866088.216	787324.955	1884.329	Spotheight
3+700.00	9866070.067	787333.358	1884.241	Spotheight
3+720.00	9866051.872	787341.661	1884.162	Spotheight
3+740.00	9866033.652	787349.909	1884.055	Spotheight
3+760.00	9866015.300	787357.857	1883.987	Spotheight
3+780.00	9865996.899	787365.692	1883.932	Spotheight
3+800.00	9865978.451	787373.417	1883.838	Spotheight
3+820.00	9865960.001	787381.137	1883.741	Spotheight
3+840.00	9865941.576	787388.917	1883.645	Spotheight
3+860.00	9865923.162	787396.722	1883.549	Spotheight
3+880.00	9865904.833	787404.724	1883.461	Spotheight
3+900.00	9865886.565	787412.865	1883.379	Spotheight
3+920.00	9865868.693	787421.767	1883.299	Spotheight
3+940.00	9865851.577	787432.113	1883.224	Spotheight
3+960.00	9865836.410	787444.894	1883.123	Spotheight
3+980.00	9865822.730	787459.483	1883.004	Spotheight
4+000.00	9865808.511	787473.540	1882.902	Spotheight
4+020.00	9865794.081	787487.389	1882.808	Spotheight
4+040.00	9865779.575	787501.157	1882.695	Spotheight
4+060.00	9865765.101	787514.956	1882.578	Spotheight
4+080.00	9865751.769	787529.864	1882.463	Spotheight
4+100.00	9865738.197	787544.539	1882.349	Spotheight
4+120.00	9865723.575	787558.184	1882.237	Spotheight
4+140.00	9865709.146	787572.029	1882.122	Spotheight
4+160.00	9865695.024	787586.191	1882.002	Spotheight
4+180.00	9865680.928	787600.380	1881.894	Spotheight
4+200.00	9865666.862	787614.597	1881.798	Spotheight
4+220.00	9865652.579	787628.594	1881.681	Spotheight
4+240.00	9865638.099	787642.390	1881.546	Spotheight
4+260.00	9865623.852	787656.424	1881.429	Spotheight
4+280.00	9865609.773	787670.628	1881.323	Spotheight
4+300.00	9865595.610	787684.749	1881.217	Spotheight
4+320.00	9865581.195	787698.612	1881.108	Spotheight

4+340.00	9865566.829	787712.527	1880.998	Spotheight
4+360.00	9865552.608	787726.589	1880.885	Spotheight
4+380.00	9865538.386	787740.652	1880.778	Spotheight
4+400.00	9865524.165	787754.714	1880.68	Spotheight
4+420.00	9865509.796	787768.624	1880.592	Spotheight
4+440.00	9865495.280	787782.382	1880.516	Spotheight
4+460.00	9865480.926	787796.309	1880.448	Spotheight
4+480.00	9865466.626	787810.291	1880.381	Spotheight
4+500.00	9865452.239	787824.184	1880.32	Spotheight
4+520.00	9865437.832	787838.057	1880.26	Spotheight
4+540.00	9865423.348	787851.847	1880.221	Spotheight
4+560.00	9865408.812	787865.584	1880.196	Spotheight
4+580.00	9865394.405	787879.455	1880.159	Spotheight
4+600.00	9865380.245	787893.579	1880.102	Spotheight
4+620.00	9865365.846	787907.456	1880.067	Spotheight
4+640.00	9865351.266	787921.146	1880.049	Spotheight
4+660.00	9865336.941	787935.102	1880.006	Spotheight
4+680.00	9865322.660	787949.104	1879.96	Spotheight
4+700.00	9865307.824	787962.516	1879.925	Spotheight
4+720.00	9865292.978	787975.917	1879.889	Spotheight
4+740.00	9865278.600	787989.819	1879.9	Spotheight
4+760.00	9865264.239	788003.739	1879.902	Spotheight
4+780.00	9865250.154	788017.938	1879.692	Spotheight
4+800.00	9865236.069	788032.137	1879.482	Spotheight
4+820.00	9865222.018	788046.370	1879.322	Spotheight
4+832.87	9865212.989	788055.536	1879.234	Nkairowuani Kiosk 2

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

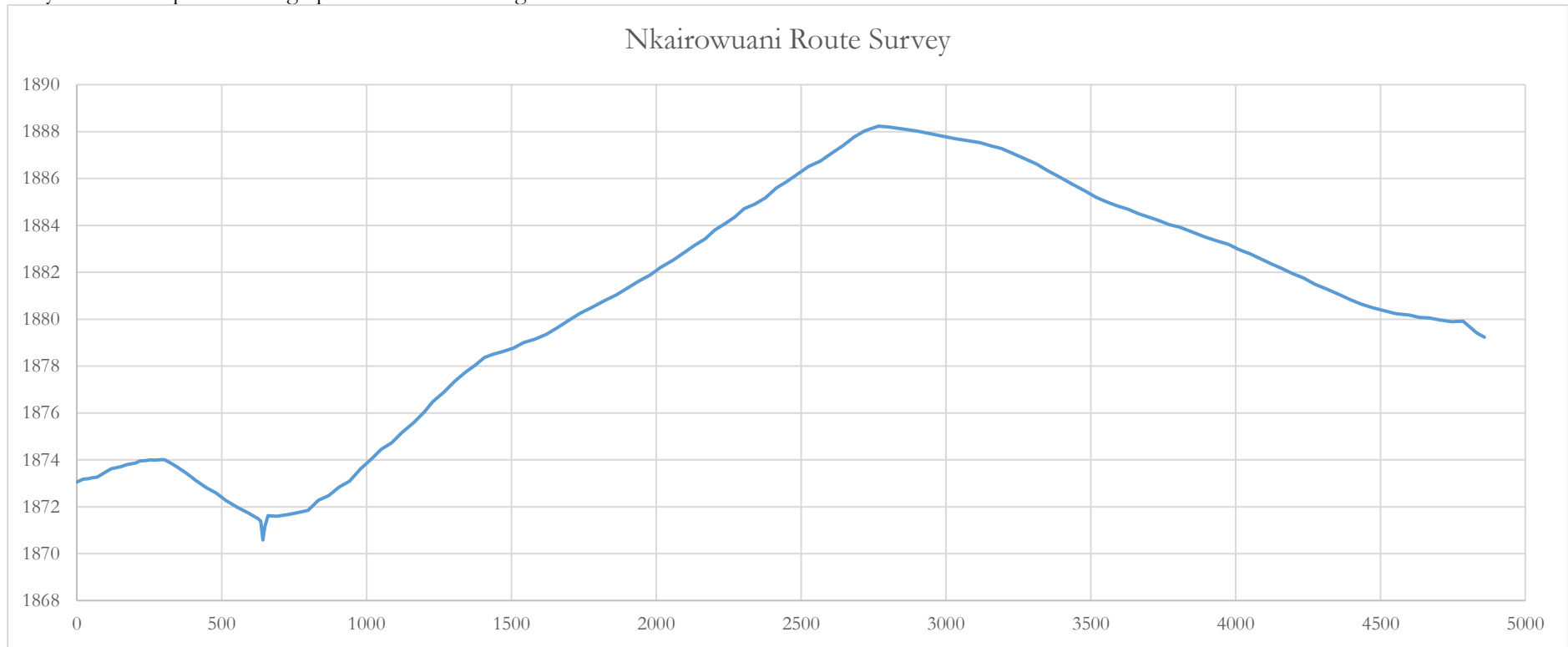


Figure 1: Nkairowuani Pipeline system water flow curve

4.2 Endoinyo Narasha Pipeline Route

The Endoinyo Narasha line was located in close proximity to the Endoinyo Narasha primary school, dispensary and center. There was an existing 10,000 litre tank and a borehole within the school compound. The line was surveyed from the borehole to flow by gravity to the dispensary. It was proposed that water would be flow to the tank site from where it would flow by gravity towards a kiosk at the Narasha center. Additionally, there was a proposed line to the VIP toilets under construction within the school. During the survey some section of Endoinyo Narasha area were rocky and this was noted for changes in type of pipes to be placed.

The survey data collected during the survey is as shown

Table 3: Survey Points Endoinyo Narasha

Point Number	Northing (m)	Easting (m)	Elevation (m)	Description
1	9861365.003	777774.128	1858.346	Borehole
2	9861354.657	777763.489	1857.534	Spotheight
3	9861342.842	777753.301	1856.838	Spotheight
4	9861328.918	777743.215	1856.047	Spotheight
5	9861316.901	777732.753	1855.242	Spotheight
6	9861305.202	777722.811	1854.564	Spotheight
7	9861302.849	777720.460	1854.361	Spotheight
8	9861288.937	777728.284	1854.094	Spotheight
9	9861275.870	777734.443	1853.858	Spotheight
10	9861264.381	777740.160	1853.730	Spotheight
11	9861252.980	777728.042	1853.127	Spotheight
12	9861242.033	777714.112	1852.368	Spotheight
13	9861230.174	777705.683	1851.930	Spotheight
14	9861213.962	777699.621	1851.465	Spotheight
15	9861198.221	777694.122	1850.864	Spotheight
16	9861180.945	777688.249	1850.007	Spotheight
17	9861165.271	777682.829	1849.324	Spotheight
18	9861160.780	777681.092	1849.127	Spotheight
19	9861158.501	777668.240	1848.792	Spotheight
20	9861158.817	777654.928	1848.801	Spotheight
21	9861156.886	777656.074	1848.741	Spotheight
22	9861160.128	777656.990	1848.788	Spotheight
23	9861151.969	777638.338	1848.185	Spotheight
24	9861154.221	777635.670	1848.063	dispensary
25	9861152.035	777629.782	1847.992	dispensary
26	9861134.717	777636.460	1847.850	dispensary
27	9861137.038	777642.337	1847.812	dispensary
28	9861361.616	777790.935	1858.436	dispensary
29	9861361.612	777790.907	1858.434	Spotheight
30	9861357.983	777806.184	1859.056	Spotheight
31	9861354.193	777822.217	1859.526	Spotheight
32	9861351.748	777841.207	1860.504	Spotheight
33	9861352.808	777841.843	1860.554	Spotheight

34	9861351.564	777857.922	1861.269	Spotheight
35	9861351.577	777872.454	1861.848	Spotheight
36	9861351.382	777885.306	1862.446	Spotheight
37	9861350.746	777903.083	1863.443	Spotheight
38	9861349.161	777917.289	1864.026	Spotheight
39	9861348.895	777935.535	1865.004	Spotheight
40	9861350.037	777945.834	1865.593	Spotheight
41	9861352.602	777959.468	1866.160	t-junction rock
42	9861355.711	777974.137	1867.283	Spotheight
43	9861355.924	777990.302	1868.534	Spotheight
44	9861356.571	778007.250	1869.606	Spotheight
45	9861358.330	778020.852	1870.390	Spotheight
46	9861358.452	778036.611	1871.681	Spotheight
47	9861360.053	778052.742	1872.769	Spotheight
48	9861357.610	778068.255	1874.148	Spotheight
49	9861356.432	778085.276	1875.820	Spotheight
50	9861356.189	778096.797	1877.174	10K litres tank
51	9861357.398	778098.787	1877.404	10K litres tank
52	9861356.073	778100.213	1877.494	10K litres tank
53	9861374.035	777956.602	1866.591	Spotheight
54	9861388.845	777953.363	1866.675	Spotheight
55	9861403.621	777949.365	1866.681	Spotheight
56	9861417.240	777942.665	1866.857	Spotheight
57	9861431.382	777933.788	1866.779	Spotheight
58	9861442.354	777932.825	1866.807	Spotheight
59	9861460.718	777932.958	1866.972	Spotheight
60	9861477.094	777931.943	1867.151	Spotheight
61	9861491.993	777930.631	1867.280	Spotheight
62	9861506.379	777930.045	1867.598	girls vip
63	9861510.909	777913.274	1866.720	Spotheight
64	9861517.195	777898.309	1866.183	Spotheight
65	9861521.183	777887.032	1865.721	boys vip
66	9861342.112	777960.856	1866.039	Spotheight
67	9861328.556	777965.931	1866.045	Spotheight
68	9861317.571	777972.697	1866.066	Spotheight
69	9861302.573	777980.401	1865.915	Spotheight
70	9861292.802	777984.268	1865.919	Spotheight
71	9861278.867	777989.247	1865.907	Spotheight
72	9861263.550	777996.867	1866.003	Spotheight
73	9861249.566	778005.457	1865.760	Spotheight
74	9861228.364	778009.706	1865.280	Spotheight
75	9861211.091	778006.627	1864.596	Spotheight
76	9861193.594	778001.330	1863.256	Spotheight
77	9861175.639	777998.253	1862.408	Spotheight
78	9861160.033	777991.883	1861.379	Spotheight

79	9861143.633	777989.635	1860.801	Spotheight
80	9861127.938	777990.535	1860.381	Spotheight
81	9861114.015	777990.230	1859.793	Spotheight
82	9861103.085	777980.647	1858.856	Spotheight
83	9861093.665	777977.290	1858.163	narasha kiosk

4.2.1 Line from Borehole to Dispensary

The line from the borehole to the dispensary is approximately 296 metres long with the highest elevation being at the borehole at 1857.534 while lowest point being at the dispensary at 1848.063. For this section water will easily flow by gravity.

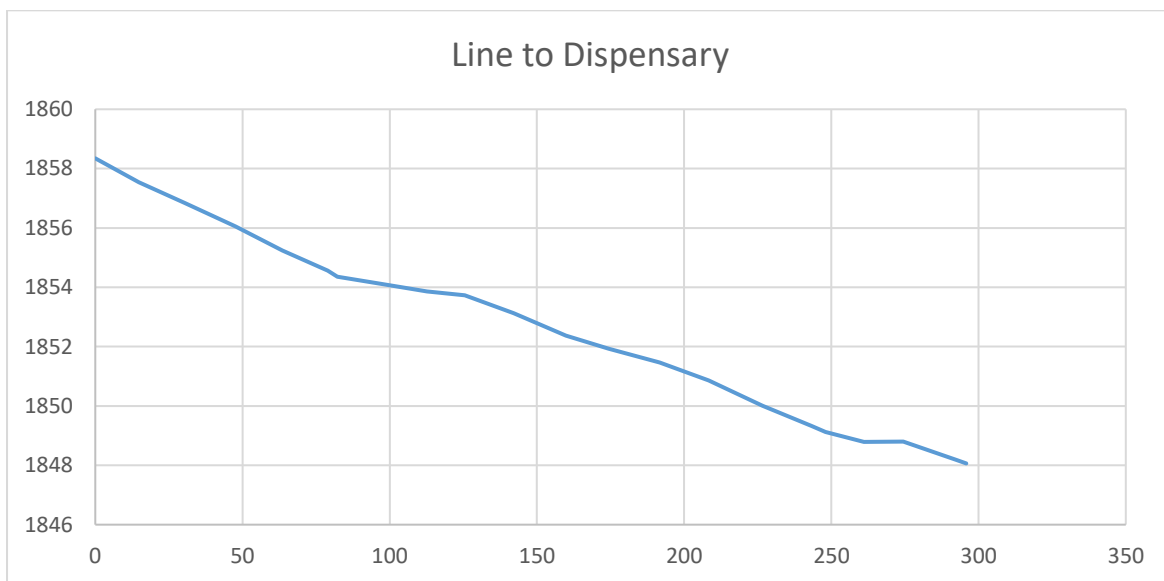


Figure 2: Line from Borehole to Dispensary

4.2.2 Main Line to the Tanks

The main line starts at the borehole and traverses to a T junction along the road to the 10,000 litres tank at an elevation of 1877.174. The tanks are approximately 326 metres from the borehole and at a vertical difference of approx.. 20 metres. At the area around the T-junction there is a rocky patch with a thin layer of soil, dredging in rock to achieve the desired pipe depth should be considered.

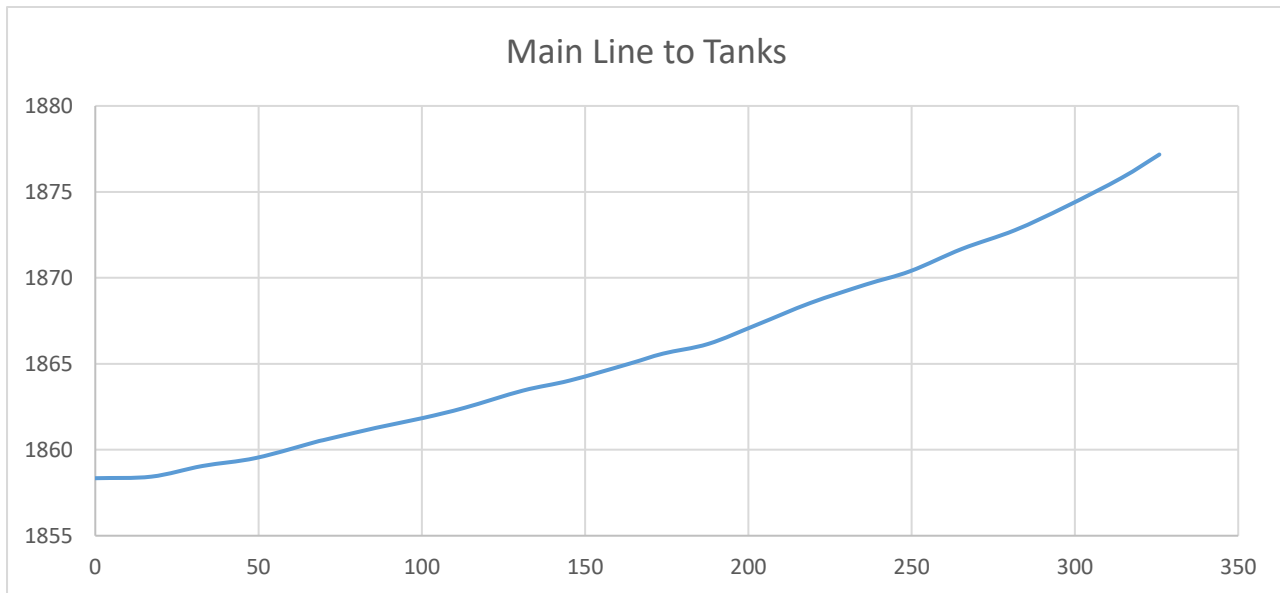


Figure 3: Main Line to the Tanks

4.2.3 Main line to Endoinyo Narasha Center Kiosks

The line starts at the 10,000 litre tanks and follows the main line to the tanks upto the T-junction where the main line flows to the kiosks at the Endoinyo Narasha center while the minor line flows to the VIP toilets. The length of the line is approximately 415 meters and covers a rocky patch after the t-junction towards the Narasha Primary School gate. The lowest point is at the center kiosks with an elevation of 1858.163m.

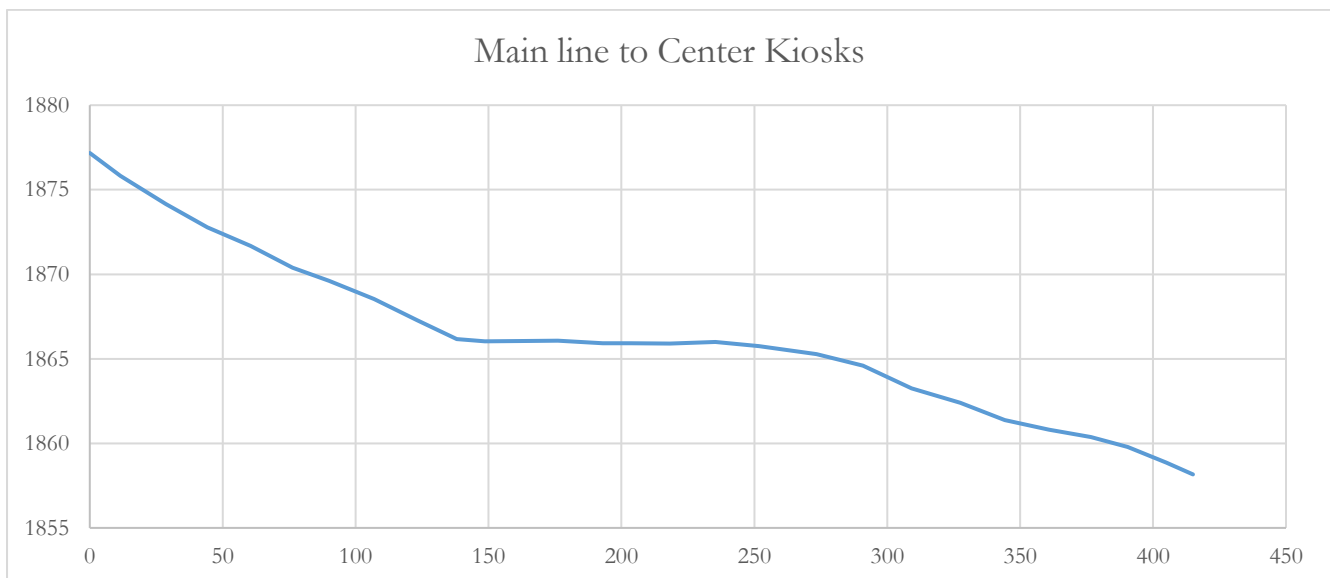


Figure 4: Main Line to Center Kiosks

5. AUTOCAD SITE LAYOUT

From source to site on Google Earth View

Figure 5 : AutoCAD map

6. DIGITAL ATTACHMENTS

The following files are available with regards to this report

- | | |
|--|----------------------|
| • Nkairowuani and Endoinyo Narasha Survey Report.docx | This report; |
| • Nkairowuani and Endoinyo Narasha Survey Report.docx .pdf | This report; |
| • Nkairowuani.dwg: | AutoCAD site layout |
| • Narasha.dwg: | AutoCAD site layout; |
| • Survey Data.xls | excel |