NILE BASIN INITIATIVE

NILE EQUATORIAL LAKES SUBSIDIARY ACTION PROGRAMME (NELSAP)

STUDY ON THE INTERCONNECTION OF THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

FEASIBILITY REPORT
VOLUME 3 C – UGANDA-RWANDA INTERCONNECTION
LINE ROUTE AND GEOTECHNICAL INVESTIGATIONS

NOVEMBER 2007
N°1 36 0300

FINAL

SOGREAH CONSULTANTS
RSW INTERNATIONAL
Hydro Québec International
Hifab

GENERAL TABLE OF CONTENTS

The feasibility report includes the following volumes:

- Volume 1: Power supply and demand analysis
- Volume 2: Uganda – Kenya interconnection
- Volume 3: Uganda – Rwanda interconnection
- Volume 4: Burundi – Rwanda interconnections
- Volume 5: Burundi – DRC – Rwanda interconnections and upgrade
- Volume 6: Power System Design

TABLE OF CONTENTS

LIST OF ABBREVIATIONS I

1. LINE ROUTE IN UGANDA 1
   - 1.1. LINE ROUTE SURVEY 1
     - 1.1.1. GENERAL 1
     - 1.1.2. SCOPE OF WORK FOR LINE ROUTE SURVEY AND SOIL INVESTIGATIONS 1
     - 1.1.3. SURVEY AND SOIL INVESTIGATION 3
   - 1.2. LINE ROUTE MAPS 3

2. LINE ROUTE IN RWANDA 4
   - 2.1. LINE ROUTE SURVEY 4
   - 2.2. LINE ROUTE DESCRIPTION AND MAPS 4

LIST OF ANNEXES

ANNEX A. SURVEY REPORT 9
ANNEX B. GEOTECHNICAL INVESTIGATION REPORT 10
ANNEX C. GENERAL MAP: MBARARA – MIRAMA 11
ANNEX D. MAP SHEETS: MBARARA – MIRAMA 12
ANNEX E. LONGITUDINAL PROFILES: MBARARA – MIRAMA 13
ANNEX F. GENERAL MAP: BIREMBO – MIRAMA 14
ANNEX G. MAP SHEETS: BIREMBO – MIRAMA 15
ANNEX H. LONGITUDINAL PROFILES: BIREMBO – MIRAMA 16

oOo

LIST OF ABBREVIATIONS

AFSEC	African Electrotechnical Standardization Commission / Commission Electrotechnique Africaine de Normalisation
BAD	Banque Africaine de Développement
PEAC	Central Africa Power Pool / Pool énergétique de l'Afrique Centrale
CEEAC	Communauté Economique des Etats de l'Afrique Centrale (ECCAS)
CEPGL	Communauté Economique des Pays des Grands Lacs
DEM	Digital Elevation Model
DRC / RDC	Democratic Republic of Congo / République Démocratique du Congo
EAPP	East African Power Pool / Pool énergétique de l'Afrique de l'Est
EGL	Energie des pays des Grands Lacs (Burundi, RDC, Rwanda)
EDF / FED	European Development Fund / Fond Européen de Développement
ERA	Electricity Regulatory Authority (Uganda)
KenGen	Kenya Electricity Generating Company Ltd
KPLC	The Kenya Power and Lighting Co. Ltd
MEM	Ministère de l'Energie et des Mines / Ministry of Energy and Mining
MoI	Ministry of Infrastructures / Ministère des Infrastructures
MNT	Modèle numérique de terrain
NBI / IBN	Nile Basin Initiative / Initiative du Bassin du Nil
NEL	Nile Equatorial Lakes
NEL-CU	Coordination unit for NELSAP
NELSAP	Nile Equatorial Lakes Subsidiary Action Programme
PAALEN	Programme Auxiliaire d'Action des pays des Lacs Equatoriaux du Nil
PPA	Power Purchase Agreement / Contrat d'achat d'énergie
PREBU	Programme de réhabilitation du Burundi
SADC	Southern Africa Development Community / Communauté pour le développement de l'Afrique Australe
SAPP	Southern Africa Power Pool / Pool énergétique de l'Afrique Australe
SINELAC	Société internationale d'électricité des pays des grands lacs
SNEL	Société National d'Electricité (RDC)
SRTM	Shuttle Radar Topography Mission
UEGCL	Uganda Electricity Generation Company Ltd
UETCL	Uganda Electricity Transmission Company Ltd
UPDEA	Union des Producteurs, Transporteurs et Distributeurs d'Energie Electrique d'Afrique / Union of Producers, Transporters and Distributors of Electric Power in Africa
USAID	Agence pour le Développement International des Etats Unis
WAPP	West Africa Power Pool

1. LINE ROUTE IN UGANDA

1.1. LINE ROUTE SURVEY

1.1.1. GENERAL

A line route survey was conducted by sub-consultants at the Uganda – Rwanda interconnection section.

The interconnection transmission line route of Uganda – Rwanda has been planned by UETCL starting from existing Mbarara North 132/33 kV substation to Rwandan Border via Mirama, where a new 132 kV substation will be constructed.

1.1.2. SCOPE OF WORK FOR LINE ROUTE SURVEY AND SOIL INVESTIGATIONS

1. Introduction

The survey and soil investigation works will be carried out on the line route Mbarara North substation - Mirama.

The proposed line route is shown on map sheets in scale of 1:50 000. The length of the proposed line is approximately 57 km in Uganda.

2. Survey

The purpose for this survey work in the feasibility study phase is to get mapped all the features along the proposed line route. Furthermore, the results of the survey will provide coordinates (UTM coordinate system) of all the features. The survey shall be carried out by means of GPS equipment.

The features to be surveyed and mapped shall include, but not being limited to:

- All kind of buildings (permanent and temporary);
- Overhead lines and cables (electric and telecommunication) crossings;
- Underground cables crossings;
- Pipelines crossings;
- Roads (paved or unpaved, including tracks and paths) crossings;
- Railways crossings;
- Walls;
- Fences;
- Tanks;
- Other firm obstacles, which differ from the general shape of the ground;
- Rivers, brooks, etc. crossings;
- Soil types (see also chapter 3);
- Protected areas;

- Vegetation (which type);
- Pasturelands;
- Cultivated (agricultural) areas: type of crops; and
- Angle points of the existing 132 kV OHTL.

The line route shall be mapped to the distance of 15 m on both sides of the centre line.

The levels (altitudes) of following objects are to be measured:

- Roads and railways;
- crossing of overhead lines and towers;
- water levels (actual water level with date and time and HW-level);
- buildings, tanks;
- fences and walls, etc.

The survey shall be based on topographical maps of scale 1:50 000 and the required map sheets for this line route are as follows:

Mbarara - Mirama

- 86/1
- 86/3
- 85/4

All the existing access roads on the line route area shall be marked on the route map. The existing roads from main road to the line route if any shall be listed with description of condition.

3. Marking

Every angle points shall be pegged out at site by using concrete pegs with numbering AP1, AP2 … etc. starting from Mbarara North substation.

4. Soil Investigation

The bearing capacity of soil and soil type shall be estimated visually at adequate intervals and soft soil areas on the right-of-way shall be mapped in order to avoid tower setting at these areas.

The areas, where there is risk of landslides above or below the tower shall be mapped as well as the areas of exposed to erosion.

Above and beyond at certain intervals and wherever the soil type changes substantially an actual soil test shall be carried out. The purpose of the soil test is to determine and verify the soil parameters for foundation design.

The sub soil conditions shall be determined by standard penetration test (SPT-probing) and laboratory analysis. Standard penetration test shall be carried out at around 10 km, or when the soil type changes dramatically, intervals according to BS or other equivalent standard. The number of blows (N-values) for every 150 mm penetration shall be recorded. The total quantity of SPT-probing shall be 20, maximum.

The geology and hazardous lands maps shall be provided.

5. Recording and Reporting

The results of the survey work shall be recorded on maps to the extent as reasonable and in separate report in all details determined, including list of coordinates.

The maps of an appropriate scale shall be in AutoCAD format.

1.1.3. SURVEY AND SOIL INVESTIGATION

At Feasibility Study phase it was conducted a field survey by a sub-consultant: Power Networks (U) Ltd. carried out the line route survey and soil investigations along the surveyed line route, both based on the Scope of Work presented in Chapter 1.2. Teclab Ltd. provided laboratory tests and analysis. The reports are in Annex 1 – Survey Report, and Annex 2 – Geotechnical Investigation Report.

1.2. LINE ROUTE MAPS

LIST OF SURVEYED MAPS: MBARARA – MIRAMA 220 (132) KV LINE

Section of Line Route	Pages
Mbarara substation – AP (=angle point) 2	1
AP 2 – Kabale–Mbarara road crossing – km 4.76	2
Km 4.76 – AP 3 – Namiyaga Village – km 8.63	3
Km 8.63 - AP 4 – km 12.04	4
Km 12.04 – km 14.68	5
Km 14.68 – AP 5 (Kashekure Village) – AP 6 – km 18.95	6
Km 18.95 – AP 7 – AP 8 – km 22.14	7
Km 22.14 – AP 9 – km 24.91	8
Km 24.91 - AP 10 – Byanamira Village – km 27.82	9
Km 27.82 – km 30.72	10
Km 30.72 – AP 11 – Nyarubare Village - km 34.83	11
Km 34.83 – AP 12 – km 37.64	12
Km 37.64 - AP 13 (Kantaama Village) – Kitonjo Village - km 40.53	13
Km 40.53 – AP 14 (Nyabugando Village) – km 43.37	14
Km 43.37 – Kakindu Village - AP 15 – km 45.98	15
Km 45.98 – Rukoni Village - Kagorotogo Village - km 48.81	16
Km 48.81 – Kabombo Village – km 51.65	17
Km 51.65 – AP 16 (Kitwe Village) – km 55.30	18
Km 55.30 – Mirama substation	19

The general map of Mbarara – Mirama line is in Annex C.

The map sheets are in Annex D.

Longitudinal profiles are in Annex E.

2.
LINE ROUTE IN RWANDA

2.1. LINE ROUTE SURVEY

A preliminary field survey was conducted during site visits at both interconnection sections, from Mbarara substation to the Uganda-Rwanda border and from this latter through Nyagatare towards Kigali.

Technical information was gathered at ELECTROGAZ, Department of Energy and NELSAP offices in Kigali.

2.2. LINE ROUTE DESCRIPTION AND MAPS

To connect the new Birembo substation located on the transmission line between Jabana and Rwinkwavu to Mirama substation which is connected to the Mbarara substation in Uganda, corridor A was selected, it is the shortest and has a good access.

The description of line A is based on geographical maps at scale of 1 : 50 000, Landsat 7 ETM satellite images (15 m resolution) as well as the SRTM digital elevation model to create a three-dimensional view of the interest zone.

Line A Sections are defined here under :

1. SECTION NEW BIREMBO SUBSTATION – A 0

Distance : 2,1 km

The new proposed 220 kV line heads towards the North avoiding habitations and arrives to angle point A. East of the village of Nyakabingo. The region crossed is mainly composed of afforestation and hill crops.

2. SECTION A0 – A1

Distance: 1,6 km

From the angle point A0, the line deviates towards the North-East in direction of the original line A and join it at the new angle point A1, north of Bumbogo village.

3. SECTION A1 – A2

Distance: 2,1 km

From the A1 angle point, the line turns northwards. The line goes parallel to the Rurambarara river where we see a valley bottom crops zone. The line follows the embankment of the hills near the river until the A2 angle point. The terrain profile is descending.

4. SECTION A2 – A3

Distance: 4,9 km

The A2 angle is situated at the west of Gikomero village. The line lines up between the Mulundi river to the East and the road to the West and continues until the A3 angle. The line is easily accessible. We encounter banana trees all along the section.

5. SECTION A3 – A4

Distance: 2,2 km

Soon after the A3 angle, the line traverses the Kajevuba river and passes through a region where the vegetation consists of banana trees and hill crops. Access is good.

6. SECTION A4 – A5

Distance: 2,1 km

The line changes slightly its direction at the A4 angle point and continues towards the North going across respectively tree plantation zone and a national road. The A5 angle is located just to the north of this road.

7. SECTION A5 – A6

Distance: 8,9 km

After the A5 angle point, the line bifurcates towards the North-West and passes between Baliza and Rurembo villages. The line goes along the national road which in turn follows the Mwange river until the A6 angle which will be situated near Akimisugi village. The line is easily accessible.

The vegetation that we find consists of hill crops (bananas, etc.) and some tree plantations near the village of Muhoroho. The terrain is mountainous (maximum altitude difference of 250 m over a distance of 700 m).

8. SECTION A6 – A7

Distance: 6,9 km

From the A6 angle, the line turns eastwards and traverses the Kigali-Gatuna main asphalted road and the Mwange river. Along the way, it crosses Ruhango and Muhama villages, passes through a plain and cuts twice a community road. Near this road will be located the A7 angle at the west of Kinyami village.

In the first part of the line, the terrain rises steeply (about 400 m over a distance of 2,5 km). Banana plantations are scattered in the region as well as wooded zones near the national roads and in the neighbourhoods of Muhama.

9. SECTION A7 – A8

Distance: 4,6 km

The line deviates more eastwards at the A7 angle point and continues its way descending towards a community road. From this road and on, the terrain becomes relatively flat. At the end, it crosses several streams including the Nyakagezi. We find the same type of vegetation as in the previous section. Access is good.

10. SECTION A8 – A9

Distance: 4 km

From the A8 angle point which will be situated north of Ruvune, the line turns slightly eastwards and goes up gradually until Kirambo, it crosses a community road and another one 750 m away. From this last point, it descends towards a valley where passes the Kamoko river and goes up until the A9 angle situated on a hill. We find the same type of vegetation as in the previous section. Access is good.

11. SECTION A9 – A10

Distance: 3,5 km

From the ridge mentioned above, the line turns slightly northwards and descends around 400 m over a distance of 3,4 km. It traverses a series of streams through a tree plantation area. The proposed A10 angle would be placed close to a road, at the north of Kagera, in a terrain used for banana plantations.

12. SECTION A10 – A11

Distance: 3,5 km

The line traverses a valley parallel to an existing road. Towards the end of the section, it follows a hill and ends at the west of Ngarama. We find the same type of vegetation than in the previous section.

13. SECTION A11 – A12

Distance: 2,1 km

The line goes on with a slight change of direction, it traverses a moist savannah zone and valley bottom crops over a distance of around 500 m parallel to Kabare stream and ends over a hill where angle A12 will be placed. Tree plantations are found on the hill.

14. SECTION A12 – A13

Distance: 3,9 km

From the A12 angle point, the line deviates more northwards and crosses the national road as well as Nyabitare stream at two distinct points. Banana plantations are encountered along the path.

15. SECTION A13 – A14

Distance: 3,6 km

The line turns even more northwards to approach an existing road. In the region, housing density is low and access is good. The A14 angle would be located close to Gikandura stream. Hill crops characterize the vegetation encountered.

16. SECTION A14 – A15

Distance: 7,8 km

From the A14 angle point, the line is aligned parallel to the national road and traverses a savannah zone at the west of a former hunting domain which is now occupied by the population. The A15 angle point would be placed on the embankment of a hill in the Kikoga region. Housing density is very low in the region covered by the line.

17. SECTION A15 – A16

Distance: 3,6 km

The line changes slightly its direction to stay close to the national road. The center line of the line is located around 1.2 km east of the road. The vegetation is the same as in the previous section. The A16 angle is situated on the embankment of a hill (altitude of about 1400 m) in the village of Bushoga.

18. SECTION A16 – A17

Distance: 4,4 km

From the A16 angle point, the line heads towards the national road and avoids two zones of low density population. The vegetation remains the same. At the A17 angle point, the distance that separates the center line of the line and the road is about 350 m.

19. SECTION A17 – A18

Distance: 4 km

From the A17 angle point, the line retakes a parallel trajectory to the national road (north-east direction) and traverses the region of Akajuka to arrive near a community road which is perpendicular to the national road. Housing density stays very low all along the line with the same type of vegetation as in the previous sections, which is a savannah.

20. SECTION A18 – A19

Distance: 3,1 km

From the A18 angle, the line turns more eastwards to avoid the chief place of the Nyagatare District and approaches around 600 m from the western limit of the former hunting domain. Many roads and paths are found along the way.

21. SECTION A19 – A20

Distance: 9,5 km

From the A19 angle, the line changes its direction and moves northwards, parallel to the national road at the west of the center line of the line and the former hunting domain to the east. It intersects several paths along its course.

The A20 angle will be placed north of the national road that deviates eastwards at the end of the section and stands in front of the line. The covered region is a savannah, except at the end of the line near Gituro village where it's a moist savannah.

22. SECTION A20 – A21

Distance: 3,8 km

From the A20 angle point, the line turns towards the North-West and heads to the east of Kanyinya village. Along the line, the population is very low. Many paths cross the section, thus access is good. We remain in a savannah zone. The A21 angle is located ath the east of Kanyinya.

23. SECTION A21 – A22

Distance: 3,2 km

The line continues in straight line northwards and follows a hill. Several roads and paths cut the proposed line. The vegetation is the same as in the previous sections.

24. SECTION A22 – A23

Distance: 7,7 km

After the A22 angle point, the line rotates slightly eastwards and continues to head towards the North in diection of the Rwanda–Uganda border. The line is easily accessible due to the roads network in the region. Housing density is low. Angle A23 is located about 1.5 km from the border with Uganda.

25. SECTION A23 – A24

Distance: 3,1 km

At the A23 angle, the line deviates eastwards, passes north of a veterinary clinic and traverses a moist savannah zone until the end of the section. The terrain is relatively flat and access is good. The A24 angle will be situated west of Kagitumba.

26. SECTION A24 – MIRAMA HILLS SUBSTATION (UGANDA)

Distance: 9,6 km

Soon after the A24 angle point, the line cuts the Kagitumba river, traverses the border and heads towards a North-East direction, directly towards the Mirama Hills substation. Thus, it passes South-East of Kafunzo region, cuts the Kafunzo river as well as the road that leads to Mirama. This road is located at the bottom of a hill. Thus, the line traverses an altitude difference of approximately 175 m over a distance of 800 m to end up at Mirama substation. The vegetation in the region consists mainly of different grass species and bushes.

Tableau n° 1 - LINE A

Section	Distance (km)	Principle angles (°)
New Birembo Substtion – A0	2,1	33°
A0 - A1	1,6	36°
A1 – A2	2,1	10°
A2 – A3	4,9	22°
A3 – A4	2,2	5°
A4 – A5	2,1	28°
A5 – A6	9	27°
A6 – A7	6,9	33°
A7 – A8	4,6	7°
A8 – A9	4	4°
A9 – A10	3,5	7°
A10 – A11	3,5	12°
A11 – A12	2,1	19°
A12 – A13	3,9	22°
A13 – A14	3,6	14°
A14 – A15	7,8	6°
A15 – A16	3,6	26°
A16 – A17	4,4	47°
A17 – A18	4	20°
A18 – A19	3,1	48°
A19 – A20	9,5	22°
A20 – A21	3,8	12°
A21 – A22	3,2	6°
A22 – A23	7,7	49°
A23 – A24	3,1	19°
A24 – Mirama Hills Substation (Uganda)	9,6	
Total :	115,9 km	

The general map of Birembo – Mirama line is in Annex F.

The map sheets are in Annex G.

Longitudinal profiles are in Annex H

ANNEX A. SURVEY REPORT

STUDY ON THE INTERCONNECTION OF ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES (NELSAP) – UGANDA – RWANDA INTERCONNECTION

Survey Report

1.1 Introduction

This interconection is one of the 3 interconnections under the project – NELSAP.
The sectoral objective of the study is to improve the rate of access to electrical power for the people of the Equatorial Nile basin. NELSAP under the Nile Basin Initiative is carrying out a study on the interconnection of the electricity Networks of the Nile Equatorial Lakes Countries. This report is part of the whole study and is restricted to the topographical survey for the feasibility study on interconnection Transmission line Uganda –Rwanda. The coverage will be from Mbarara Transmission substation upto Mirama in Uganda.

1.2 The Scope of Services

The services will generally consist of identification of line route by fixing angle points, and a topographical survey of the line route and descriptions of the line route as identified. The topographical survey will be done in the region 50 metres on either side of the centreline.

The general objectives of the study include:

- The definition of a specific line routing based on fixed angle points and a corridor width of 100 meters as specified in the Terms of Reference. The definition of the line routing shall take into consideration the issues outlined and recommendations made in the Environmental Impact Statement report.
- The optimisation of the routing taking into account the aim of avoiding dwellings and to mitigate environmental impact.

The specific objectives for the survey work in the feasibility study phase is:

a) to get mapped all the features along the proposed line routes
b) to provide UTM coordinates of all the features as measured by means of Global Positioning System(GPS)

The features captured included:

- All types of buildings (permanent and temporary)
- Overhead lines and cables(electric and telecommunication) crossings
- Underground cable crossngs
- Pipelines
- Roads(paved or unpaved, including tracks and paths)

- Walls, fences, tanks
- River brooks
- Protected areas
- Vegetation type
- Pasturelands
- Cultivated areas and type of crops

The levels of the following objects/features were measured:

- Roads
- Crossing of overhead lines
- Water levels at the time of measurement
- Buildings
- Fences and walls.

c) to identify and determine the optimum alignment of the routing within the pre-feasibility report specified transmission corridor.
d) To provide a line route description of the elaborated line routing
e) To provide other information necessary for enabling the employer to satisfy that all environmental concerns and consequences are are fully intergrated into the project.
f) Presentation of the results of the Survey work in form of maps to the extent as reasonable and in a separate report all details determined including list of coordinates.

1.3 Marking

Every angle point was marked by Concrete pegs with numbering AP ---(see photographs).

The Survey was done in an area where there was no existing Transmission line and therefore line routing survey methodology differed from the Bujagali-Tororo-Malaba line, however detail survey was similar where the line was already defined.

This report gives a line route survey methodology and the position of the fixed angle points. The points of detail within the range required in the TORs is also indicated on the survey drawings.

2.0 Line Route Survey:

2.1 Survey Methodology

Fixing angle points:

The principle was to use coordinates supplied by the consultant to fix the angle points.
The Coordinates of an angle point would be entered in a global positioning system(GPS). Using the GPS in navigation mode, the angle point would be identified. A combination of the GPS and the topographical map features would help indentify the intermediate and angle points.

Intermediate points were identified by computing points on line at particular distances. Again using the GPS in navigation mode, the intermediate points would be fixed and points of detail surveyed.

The angle points were surveyed using DATAGRID differential GPS.

A known reference point was occupied by a receiver. This is called the base.
Other receivers would be placed on the angle points to be fixed and known as rovers. A total of 3 rovers were used in the survey.

The data collected was downloaded onto a computer with specific software for downloading and derivation of resultant computed coordinates.

Detail Survey:

As for the Kenya – Uganda interconnection.

132kV Mbarara- Mirama
Route Description
Please note:

a) AP1-AP2 – Road crossing, the proposed line passes in many residential houses at Nyakanyonyi village. The area may need re-visiting after assessing compensation requirements.
b) AP2 –AP3, at Nyakayojo village, the line is passing through dormitories and classrooms.
c) AP3-AP4 Line crosses aschool
d) AP4-AP5 line partly crosses a wetland
e) AP5-AP6 hilly but cultivated
f) AP6-AP7 hilly terrain
g) AP7-AP8 hilly terrain but AP7 lies in a wetland
h) AP8-AP9 hilly terrain
i) AP9-AP10 – runs along a stream
j) AP10-AP11 – crosses a stream
k) AP11-AP12- AP13 crosses a wetland
l) AP13-AP14 (sheet 6-7, at katonjo village, there is a church nearby.
m) AP15-AP16, the line crosses a community playground.

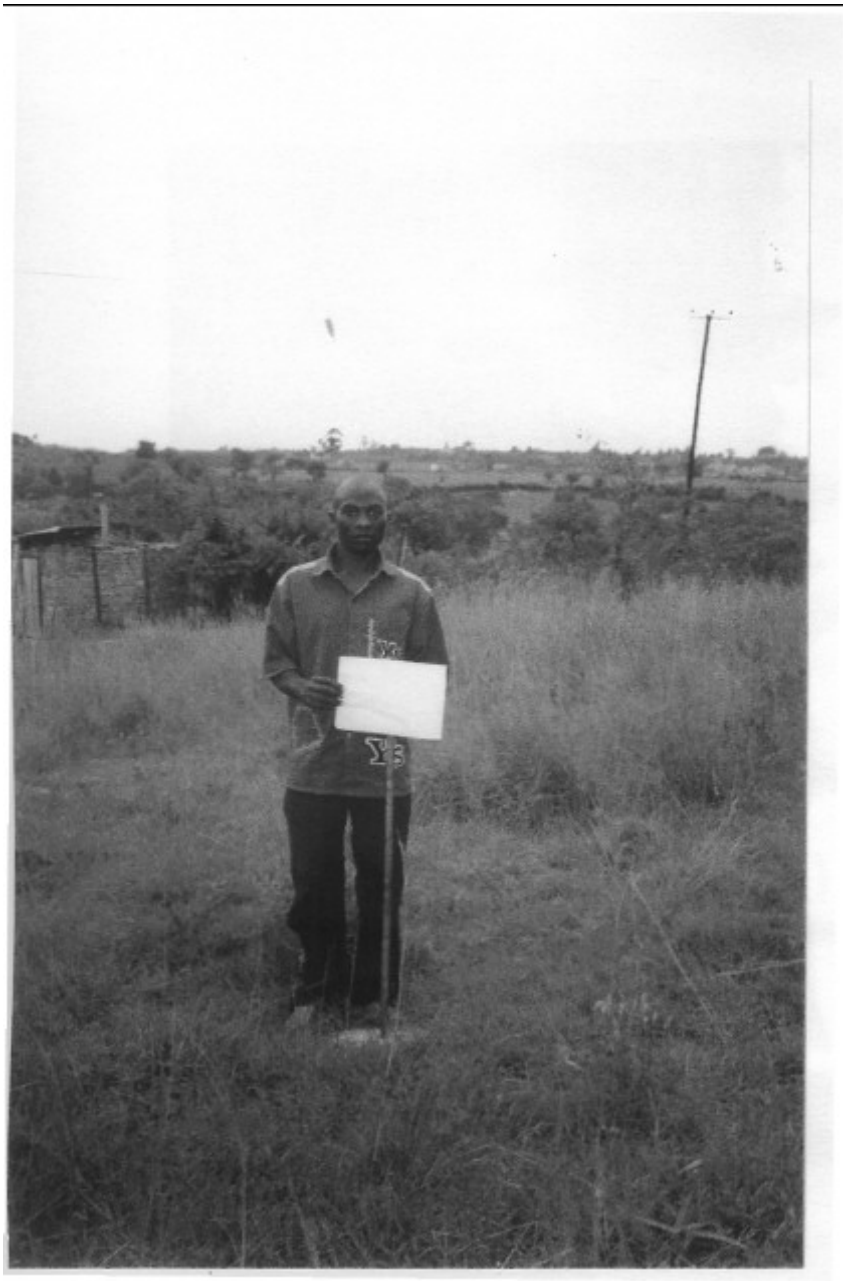
There may be a few changes during the design stage. And after considerations of the EIA and RAP reports.

132kV Mbarara-Mirama

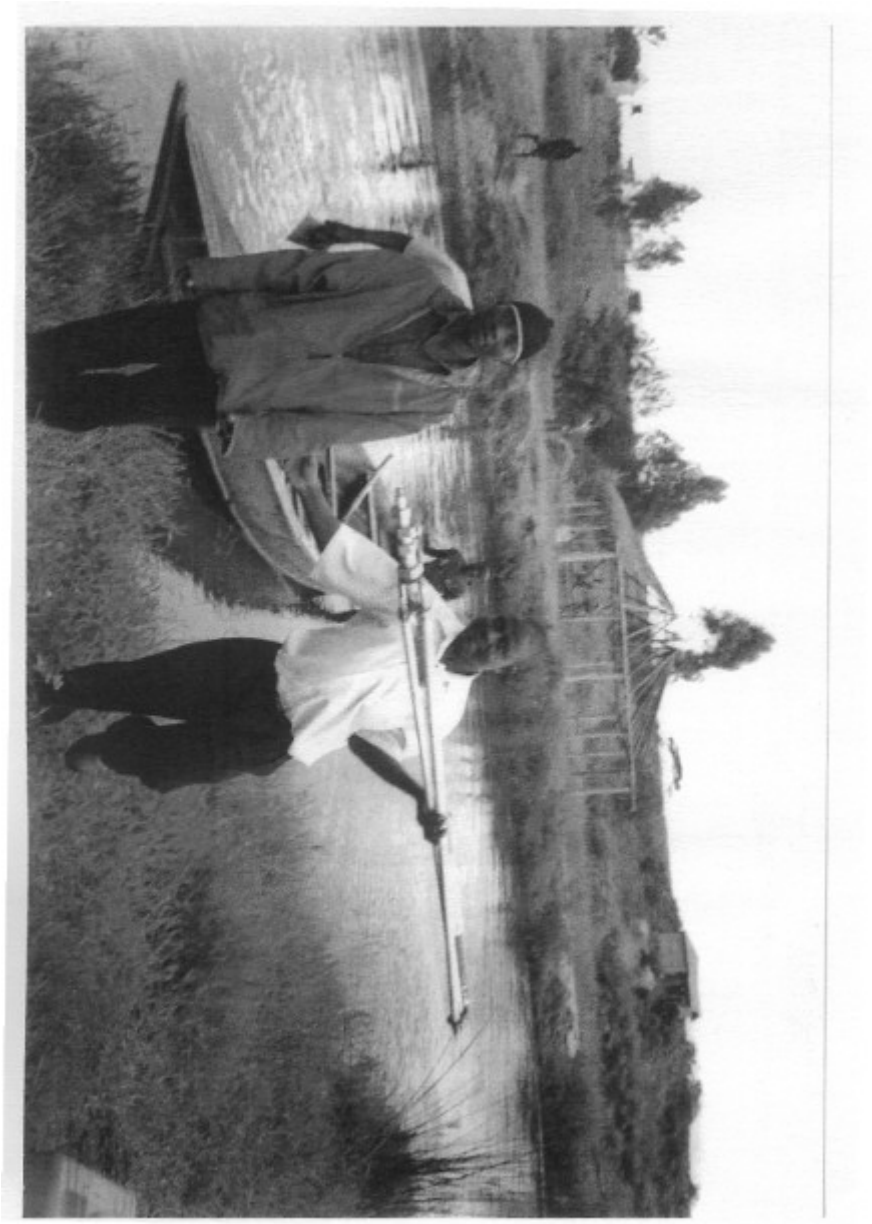
Angle Points coordinate list

System: UTM Zone 36(30 E to 36E)

Angle	Northing	Easting	Section Length	Cumulative distance	Altitude	Remarks
				(Chain age)		
AP1	234127	9933948			1430	
AP2	233849	9931904	2062.8	2063	1402	
AP2a	233496	9929904	2030.9	4094	1405	
AP3	233781	9928228	1700	5794	1404	
AP4	230120	9925480	4577.6	10371	1444	
AP5	229137	9920880	4704	15075	1439	
AP6	226010	9921468	3182	18257	1538	
AP7	224514	9920700	1682	19939	1640	
AP8	224151	9919776	993	20931	1692	
AP9	225346	9917666	2425	23356	1679	
AP10	225321	9916266	1400	24757	1506	
AP11	222222	9910330	6696	31453	1445	
AP12	225182	9908382	3543	34996	1390	
AP13	224553	9905348	3099	38095	1375	
AP14	222450	9901702	4209	42304	1368	
AP15	222525	9898640	3063	45367	1364	
AP16	219648	9892268	6991	52358	1374	
AP17	216228	9889432	4443	56801	1370	Dead end tower
			56801			



Mbarara-Mirama 132Kv LINE SURVEY ---AP/SUBSTATION AT MBARARA

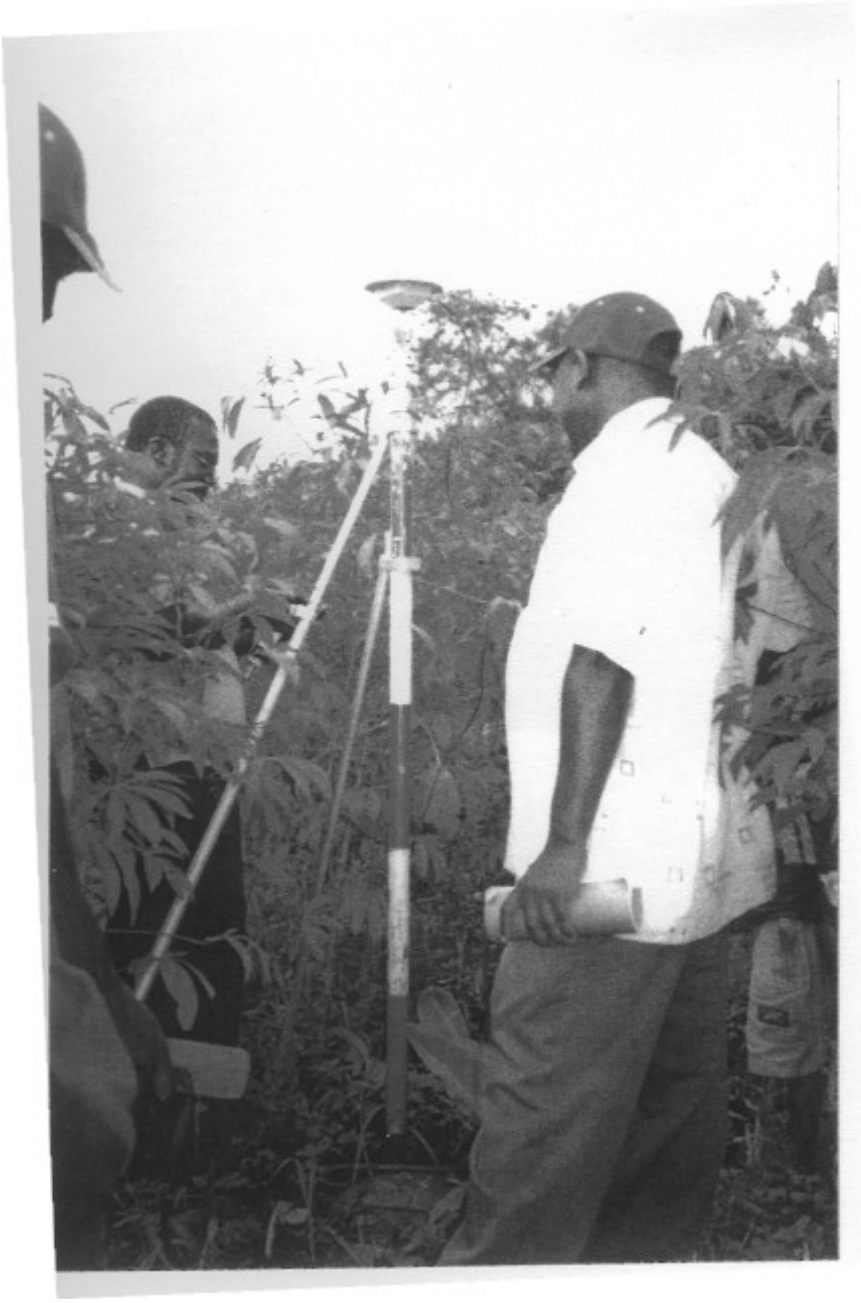


MBARARA-MIRAMA 132KV LINE SURVEY—CROSSING RIVER RWIZI TOWARDS AP1

MBARARA-MIRAMA 132KV LINE SURVEY –A DORMITORY AT NYAKAYOJO SECONDARY SCHOOL- THE PROPOSED LINE MAY AFFECT THE BUILDING.

MBARARA-MIRAMA 132KV LINE SURVEY –AP4 TAKEN FROM DIFFERENT DIRECTIONS.

MBARARA-MIRAMA 132KV LINE SURVEY –AP5.



MBARARA – MIRAMA 132KV LINE SURVEY ---AP6

MBARARA –MIRAMA 132KV LINE SURVEY AP7 A FARM OF MAIZE IS IN THE BACKGROUND

MBARARA-MIRAMA 132KV LINE SURVEY –AP8

MBARARA-MIRAMA 132KV LINE SURVEY—AP9 ON THE SLOPE OF A HILL-TYPICAL TERRAIN.

MBARARA –MIRAMA 132KV LINE SURVEY –AP12 TYPICAL CROPS ALONG THE ROUTE INCLUDE BANANAS

ANNEX B. GEOTECHNICAL INVESTIGATION REPORT

Geotechnical Investigations Report

March 2007

Feasibility Study on Interconnection Transmission Lines Uganda – Kenya and Uganda – Rwanda

POWER NETWORKS Uganda Limited

Table of Contents

1 INTRODUCTION 1
1.1 General 1
1.2 Site investigations 1
2 Bujagali – Tororo Route 2
2.1 Location and Access 2
2.2 Regional Geology 3
2.3 Site Geology 3
2.4 Construction materials 3
3 MBARARA - MIRAMA ROUTE 4
3.1 Location and Access 4
3.2 Regional Geology 4
3.3 Site Geology 4
3.4 Construction materials 5
4 BIBLIOGRAPHY 6

ANNEXES:

Annex 1 – Test pit logs and photos
Annex 2 – General terrain photos
Annex 3 – Field activity photos
Annex 4 – Drawings
Annex 5 – Laboratory Report

1 INTRODUCTION

1.1 General

This report gives a description of geotechnical conditions on the feasibility study routes for the interconnection transmission lines from; Bujagali to Tororo (Uganda - Kenya) and Mbarara to Mirama (Uganda – Rwanda).

A sites investigation programme was carried out from February 2007 to March 2007 to determine geotechnical conditions at the sites and to provide data for foundation design and construction related to civil works. More specifically, the scope of work included the following tasks: -

- Evaluating the soil bearing capacity
- Geologic mapping
- Conducting soil tests
- Compiling a technical report

1.2 Site investigations

A number of test pits were excavated and mapped. Dynamic cone penetration (DCP) tests were carried out in most test pits as well as in-situ density measurements. In summary the following activities were carried out: -

a) Excavation of 20 test pits using pick axes, hoes and spades. (13 on the proposed Bujagali - Tororo route and 7 on the proposed Mbarara – Mirama route). Locations of the test pits are shown on Drawings BT/GT/001 and MM/GT/001 in Annex 4.

b) DCP testing in 16 test pits (9 on the proposed Bujagali - Tororo route and 7 on the proposed Mbarara – Mirama route)

c) In-situ density tests in 15 test pits (10 on the proposed Bujagali - Tororo route and 5 on the proposed Mbarara – Mirama route)

d) Reconnaissance for potential construction materials

e) Geologic mapping. Geologic maps are presented on drawings BT/GT/002 and MM/GT/002 in Annex 4.

f) Laboratory testing was carried out to further identify the soils and rocks, and obtain parameters for determining their strength characteristics. The tests were done on disturbed soil samples. Laboratory testing was carried out at Teclab Ltd in Kampala. Testing procedures followed the appropriate British Standard practices. Laboratory testing included: -

- Moisture content
- Particle size distribution
- Atterberg limits

Dynamic Cone Penetration tests were carried out to derive the bearing capacities as opposed to Standard Penetration Tests (SPT) because available SPT equipment in Uganda can only be mounted on drill rigs, which would not have easily accessed most places.

General geologic maps and reports relating to the site areas were reviewed, notable among these; - The Uganda Geology 1966 by R. MacDonald.

All geotechnical data currently available, comprising laboratory test results, test pit reports, terrain photographs, and sites investigations activity photographs are presented in the Annexes.

2 Bujagali – Tororo Route

2.1 Location and Access

Bujagali is located in Eastern Uganda, near Jinja town, about 80 km from Kampala. Tororo is located about 131 km from Jinja by road. The proposed line is about 127 km in length and traverses a generally flat terrain. For most part, the proposed line runs parallel to the existing 132KV line from Jinja to Tororo sub station.

Access to most of the tower points for the proposed route is good considering that for much of the route there is already an existing access for the 132KV line. Some places, especially in swampy areas like Kibimba may not the easily accessible especially in the rainy seasons. Many of the swamps are shallow and are used for rice cultivation.

2.2 Regional Geology

The Bujagali –Tororo line traverses rock systems of the Buganda-Toro and Nyanza-Kavirondian, as well as Granitoid formations of Precambrian age. Pleistocene to recent age sediments, alluvium and black soils are also encountered in some places like at Kibimba. Karoo-Ecca shales of Paleozoic age containing Glossopteris flora occur in small apparently down faulted outliners near Bugiri, while carbonatite rocks occur in Tororo area.

2.3 Site Geology

Amphibolote rocks underly the area of Bujagali up to around Magamaga, although rock exposure is rare. Quartzite rocks outcrop at Magamaga and are belived to border the amphibolites to the east. Near Waitambogwe granite rock outcrops, and continue all the way to Busolo area near Kibimba. Some cherty quartzites outcrop near Bugiri. Kibimba area is underlain by alluvium black soils. There is a lack of rock exposure between Kibimba area and Tororo, and laterite duricrust is common. Tororo area is mainly underlain with Carbonatite rock.

In most of the area, the rocks have undergone deep tropical weathering, producing an overburden that grades from mature residual soil through completely decomposed and weathered rock to fresh bed rock with depth.

Test pits were excavated to map the subsurface conditions and the findings are presented in Annex 1, and in the laboratory report in Annex 5.

This area has no known geological hazards.

2.4 Construction materials

A brief reconnaissance was done on possible sources of coarse and fine aggregates that can be used in the construction works.

Coarse aggregates can be obtained by opening up quarries at the many granite rock occurrences, or utilizing Amphibolite rock from the Jinja Municipal quarry at Masese.

A number of beach sand deposits with sufficient quantities of good quality sand exist along the shores of Lake Victoria. Most of the deposits are privately owned and are intermittently exploited for local use. One such deposit is found in Lwanika, about 40 Km from Jinja town, in the present day Mayuge district.

3 MBARARA - MIRAMA ROUTE

3.1 Location and Access

Mbarara is located in Western Uganda, about 282 km from Kampala. The proposed line is about 60 km in length and traverses hilly rolling terrain.

Access to most of the tower points for the proposed route is fair to good as in most places the line route is not far from motorable access roads. However in some swampy areas access may be difficult as in Nyabugando village (AP14), Kitojo parish, Rukoni sub-county, Ntungamo district. See terrain photos Annex 2.

3.2 Regional Geology

Mbarara to Mirama is underlain mainly by the Karagwe ankolean system of Precambrian age and afew Granitoid formations. Pleistocene to recent age sediments, alluvium and black soils are also encountered.

The Karagwe Ankolean system (Kibaran belt) is one of the major geological features of central and eastern Africa. It stretches generally along a NNE-SSW alignment. This system represents a low grade metamorphosed sequence of sediments.

Folding is abundant in the rocks of the Karagwe Ankolean system. The folds are generally open, having wavelengths of 8 -16 km, becoming tight with synclinal keels between adjacent arena granites. Regional thrusts of large scale are not known within the Karagwe Ankolean system of Uganda. Axial plane cleavages, however, are common within these folds (King and de Swardt 1970) and might have played an important role as planes of weakness for the subsequent development of certain faults that are observed to strike parallel to and also replace or even displace the limbs of some folds (King and de Swardt 1970).

3.3 Site Geology

Most of the hills are covered by argillaceous formations, while some are capped by quartzite horizons. The valley areas are generally steep, and some valleys have small streams running at their bases.

Shales, Quartzites and Granites are the dominant rock types in the area. The area is folded and faulted giving rise to a hilly terrain.

The shales are the dominant rocks in the area and show variation in color. There are the reddish brown ferrugnised shales and gray-purple shales. The shales contain many structural features like bedding, cleavage and jointing. Due to regional metamorphism, a change from shales to phyllites can be noticed.

The quartzites are light to brown colored, and jointed.

The granite rocks are light colored, medium to coarse grained, and with a massive texture.

Test pits were excavated to map the subsurface conditions and the findings are presented in Annex 1, and in the laboratory report in Annex 5.

This area has not experienced any known geological hazards in recent times. Despite being a hilly area, landslides are unheard of in the region.

3.4 Construction materials

Coarse aggregates can be obtained by opening up a quarry at the granite rock occurrences in Kitwe.

Small sand deposits exist in some valleys but their quantities are not known and the quality may not be very good. Alternatively fine aggregate may be obtained from the crushed rock.

4 BIBLIOGRAPHY

Department of Geological Survey and Mines, Uganda Geology Map, 1966

King, B.C & Swardt, A.M.J. de. (1970: Problems of Structure and Correlation in the Precambrian Systems of Central and Western Uganda. Geological Survey of Uganda

Pallister, J.W. 'The Geology of Southern Mengo,' Report 1, Geological Survey of Uganda, 1959

Annex 1 – Test pit logs and photos

Table 1: Test pit logs and Pit photos – Bujagali Tororo route

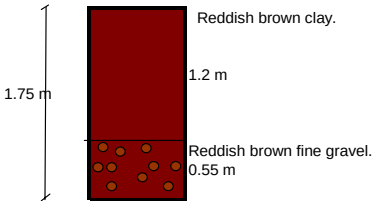
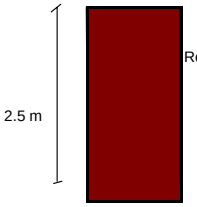
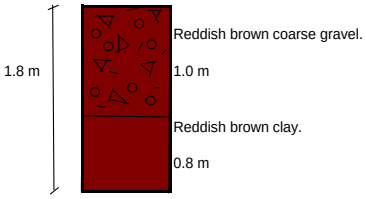
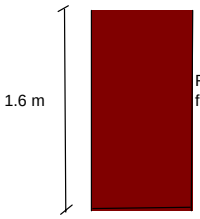
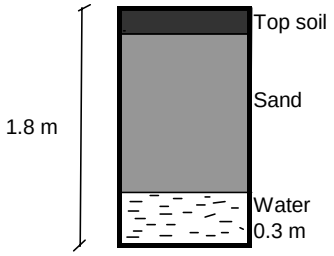
Test Pit No.	Coordinates (UTM)	Locality (Area)	Test Pit Log	Pit photo
B-TP1	N 55206 E 514780	Kikubamutwe/ Bujagali [Sub station]		
B-TP2	N 52315 E 518974	Buwenda		
B-TP3	N 53856 E 523924	Wakitaka		
B-TP4	N 53915 E 533951	Gomoja (Kakira Sugar Plantation)		
B-TP5	N 58698 E545700	Waitambogwe		

Table 1: Test pit logs and Pit photos – Bujagali Tororo route

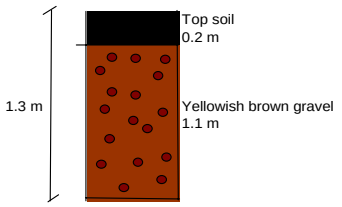
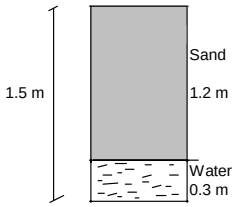
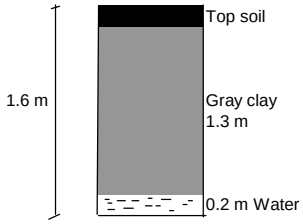
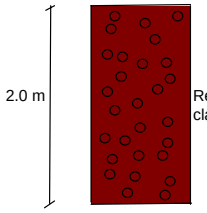
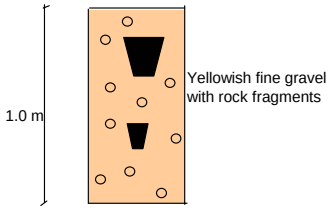
Test Pit No.	Coordinates (UTM)	Locality (Area)	Test Pit Log	Pit photo
B-TP6	N 59051 E 557300	Buwaiswa		
B-TP7	N 61700 E 567225	Nakivumbi		
B-TP8	N 62700 E 570650	Bukenke/ Bugodandala		
B-TP9	N 60676 E 577950	Magoola		
B-TP10	N 60676 E 592677	Busolo		

Table 1 (Continued): Test pit logs and Pit photos – Bujagali Tororo route

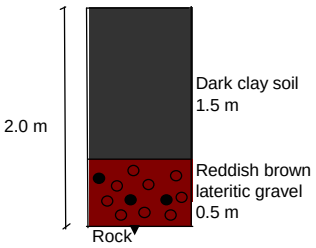
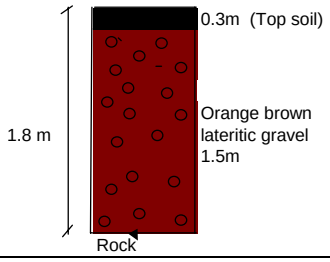
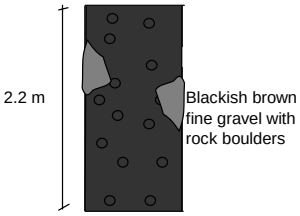
Test Pit No.	Coordinates (UTM)	Locality (Area)	Test Pit Log	Pit photo
B-TP11	N 62716 E 602698	Namuwombi		
B-TP12	N 71697 E 618880	Pimori		
B-TP13	N 69635 E 626712	Agoloto B		

Table 2: Test pit logs and Pit photos – Mbarara Mirama route

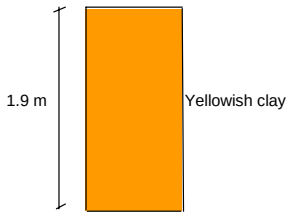
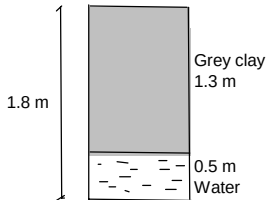
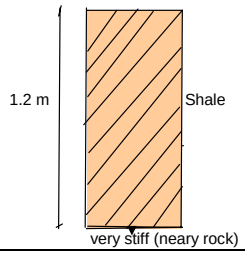
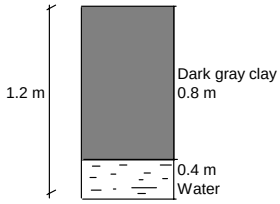
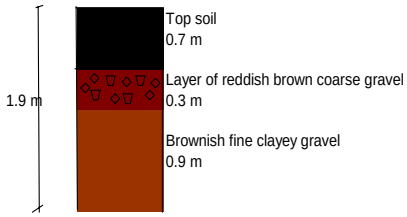
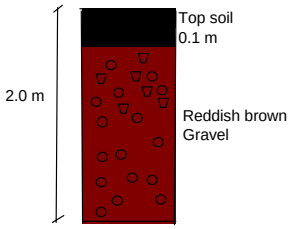
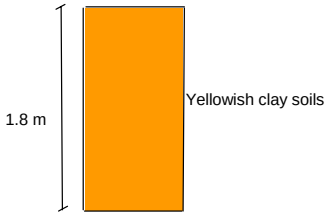
Test Pit No.	Coordinates (UTM)	Locality (Area)	Test Pit Log	Pit photo
M-TP1	N 9933947 E 234127	Mbarara Stock farm [AP1] Mbarara substation		
M-TP2	N 9925480 E 230120	Katukure/ Nyarubingo [AP4]		
M-TP3	N 9919776 E 224151	Mweya/ Kitoha [AP8]		
M-TP4	N 9910329 E 222220	Kigando/ Ngugo [AP11]		
M-TP5	N 9901700 E 222450	Nyabugando/ Kitojo [AP14]		

Table 2 (Continued): Test pit logs and Pit photos – Mbarara Mirama route

Test Pit No.	Location	Locality (Area)	Test Pit Log	Pit photo
M-TP6	N 9892269 E 219646	Kitwe [AP16]		
M-TP7	N 9889431 E 216228	Rwembogo/ Nshenyi [AP17] Mirama Substation		

Annex 2 – General terrain photos

Table 3: Terrain photos - Bujagali Tororo route

 **Bujagali site at substation area (AP1)**	 **Bujagali site general vegetation**
 **Gomoja/Kakira terrain, facing Bujagali (AP8)**	 **Gomoja/Kakira terrain, facing Tororo (AP8)**
 **Waitambogwe Terrain (AP11) facing Tororo**	 **Buwaiswa terrain (AP12), facing Tororo**

Table 3 (Continued): Terrain photos - Bujagali Tororo route

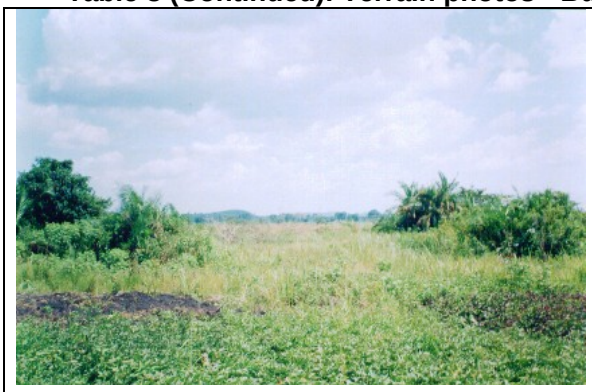
 **Bukenke/Bugodandala terrain (AP13), facing Tororo**	 **Terrain between Busolo and Bugiri area (AP16)**
 **Terrain at Busolo (AP16) area. Outcropping granite rock boulders common in the area**	 **Terrain between Busolo and Kibimba area**
 **Pimori terrain (AP18), facing Tororo**	 **Agoloto/Tororo terrain (AP20), facing Malaba**

Table 4: Terrain photos - Mbarara Mirama route

 **Terrain at Mbarara Substation area (AP1) facing old substation on Ibanda road**	 **Terrain at Mbarara substation area facing Mirama**
 **Terrain at area between AP3 and AP4**	 **Terrain at katukure (AP4) area, facing Mbarara**
 **Terrain at Mweya/Kitoha area (AP8), facing Mirama**	 **Terrain Kigando/Ngugo area (AP11)**

Table 4(Continued): Terrain photos - Mbarara Mirama route

 **Terrain Nyabugando/Kitojo area (AP14), facing Mirama**	 **Access through swamp to Nyabugando/ Kitojo (AP14)**
 **Terrain at Kitwe (AP16), facing Mbarara**	 **Terrain at Rwembogo/ Mirama substation (AP17), facing Mbarara**
 **Rock structure at Mweya**	 **Rock structure at road cutting between Mweya and Bugamba**

Annex 3 – Field activity photos

Table 5: Field activity photos

Dynamic Cone Penetration (DCP) test being carried out in one of the test pits

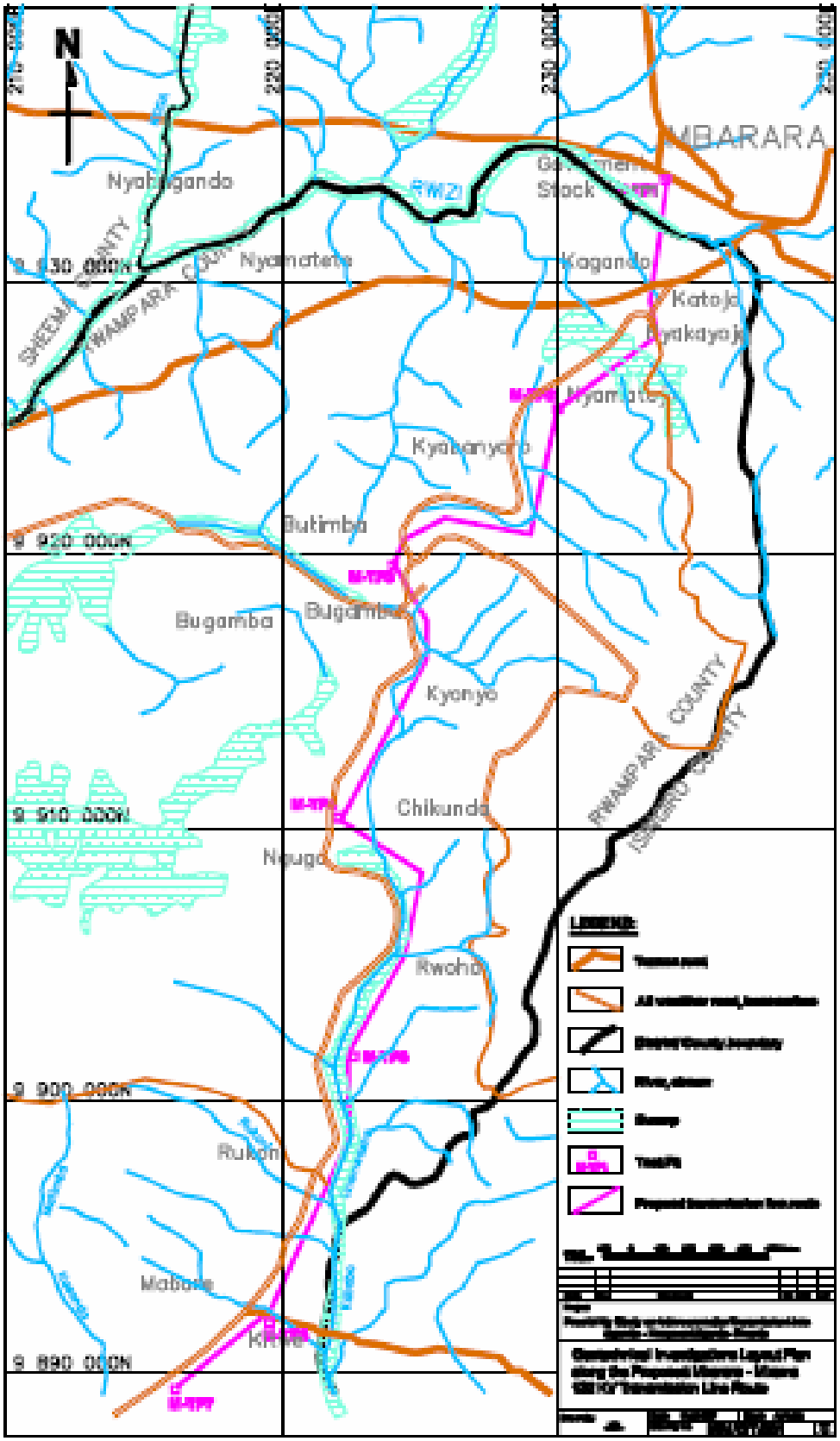
Weight measurements for in-situ density tests

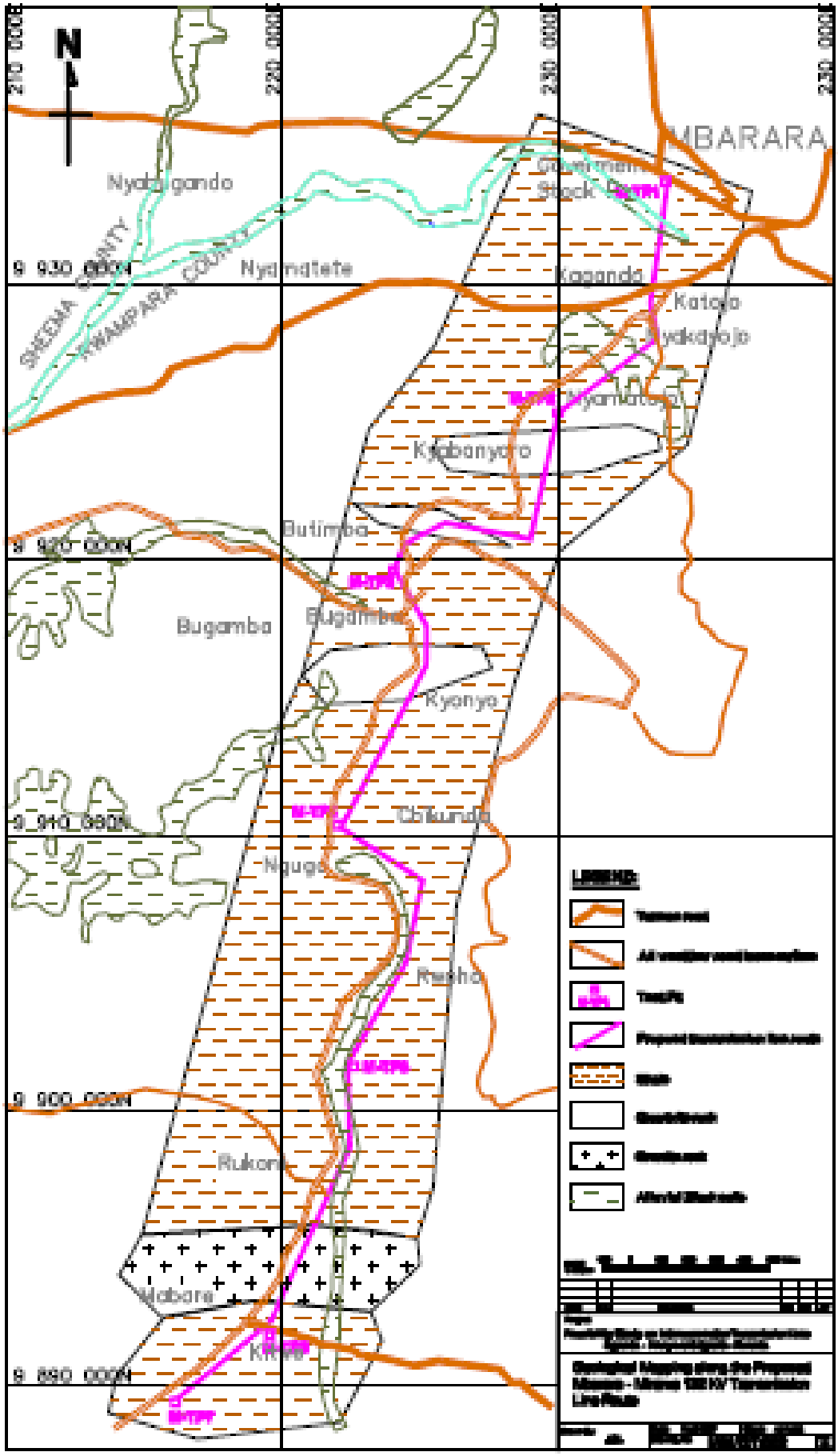
In-situ density test being conducted in one of the test pits

In-situ density test being conducted in one of the test pits

General field work activities at Bukenke/ Bugodandala

Annex 4 – Drawings


N
MBARARA
Nyabuganda
RWIZI
Stock
Nyamatera
Kagando
Kato Jc
Kyakayaja
Kyanamira
Kyabanyolo
Butimba
Bugamba
Bugamba
Kyanyo
Chikunda
Nsuga
Rwoha
Rukoni
Mabale
Khana
9 930 000N
9 920 000N
9 910 000N
9 900 000N
9 890 000N
RWAMPARA COUNTY
ISINGIRO COUNTY
LEGEND:


N
210 000E
220 000E
230 000E
230 000E
9 930 000N
9 920 000N
9 910 000N
9 900 000N
9 890 000N
Nyabugando
Nyamatete
Kagando
Katojo
Kyakayojo
Kyamatete
Kyabanyoro
Butimba
Bugamba
Bugamba
Kyanya
Tchkundo
Nguge
Rwaho
Rukoni
Kabare
Kinoni
SHEEMA COUNTY
KIRUMPARA COUNTY
MBARARA
LEGEND:

Annex 5 – Laboratory report

Project: Feasibility Study on Interconnection Transmission Lines Uganda-Kenya & Uganda-Rwanda

Client: M/s Power Networks (U) Ltd.

March 2007.

TABLE OF CONTENTS

Table Of Contents ..... Erreur ! Signet non défini.
List Of Tables **3**
1. Introduction **4**
2. The Site **6**
3. Field Work **7**
3.1 General 7
3.2 Test Pit Excavation, Sampling, In-Situ Density Tests And Dynamic Cone Penetration Tests 7
3.2.1 Test Pit Excavation 7
3.2.2 Soil And Or Rock Sampling 8
3.2.3 In-Situ Density Tests 8
3.2.4 Dynamic Cone Penetration (Dcp) Tests 8
4. Laboratory Testing **10**
5. Interpretation Of Field And Laboratory Test Results **11**
5.1 Field Results 11
5.1.1 Visual Results 11
5.1.2 Ground Water 11
5.1.3 Dynamic Cone Penetration Tests (Dcp) 11
5.2 Laboratory Test Results 13
5.2.1 Classification Test Results 13
6. Evaluation Of The Soil Bearing Capacity **14**
7. Conclusions And Recommendations **16**
8. Bibliography **17**

LIST OF TABLES

Table 4.1: Laboratory Tests and their Standard test methods..... 10
Table 5.1: In-situ description of the soil consistency along the existing Jinja – Tororo 132 KV electricity transmission line route 12
Table 5.2: In-situ description of the soil consistency along the newly proposed Mbarara – Mirama transmission line route 13
Table 6.1: Soil/rock bearing capacities along Jinja – Tororo route 15
Table 6.2: Soil/rock bearing capacities along Mbarara - Mirama route 15

1. INTRODUCTION

At the request of M/S POWER NETWORKS (U) LTD., M/S Teclab Ltd. carried out geo-technical investigations along the electricity interconnection transmission line routes linking Uganda to Kenya and Rwanda through the Jinja - Tororo existing transmission line and the newly proposed Mbarara - Mirama border transmission line respectively.

The purpose of the geo-technical investigations was to determine the nature and incidence of different soil and rock types along the routes in order to obtain suitable geotechnical data for the design of appropriate foundations and earthworks.

The scope of the investigations was as follows;

i. Excavating test pits to 1.5 and 2.5m depths at 10Km intervals to determine the soil profile along both routes,
ii. Conducting Dynamic Cone Penetration Tests at 10Km intervals along both routes,
iii. Carrying out In-situ density tests using the sand replacement method.
iv. Sampling of soils and rocks for inspection, description and laboratory analysis,
v. Using the In-situ and Penetration test results obtain a rough estimate of the bearing capacity in accordance with Jennings et al (1973),
vi. Compiling a technical report.

The site investigations were conducted from the 14th to the 19th of February 2007 and this report forms the key output of the exercise and documents the field/site and laboratory activities that were carried out and the major findings are included in the subsequent chapters. Chapter 2 describes the site, whereas chapters 3 and 4 summarize the field and laboratory work executed respectively. Discussion of the

field and laboratory results is covered in Chapter 5, and Chapter 6 details the evaluation of the bearing capacities. Chapter 7 contains the conclusions.

The detailed field records and laboratory test results are attached as Appendices herein.

2. THE SITE

The Jinja – Tororo site follows the existing 132 KV electricity transmission line that traverses a flat terrain and starts and ends at Bujagali and Tororo Boarder post respectively. The Mbarara – Mirama site in a new alignment traversing a hilly rolling terrain from Mbarara town to Mirama Boarder post.

Geologically, a Precambrian base of granite and gneisses, quartzites, schists, phylites and amphibolites underlie the Jinja – Tororo site. The soils covering the site are derived from the weathering of those underlying rocks. The Mbarara – Mirama site is underlain with Precambrian base of shales and phyllites, mica schist of the Karagwe-Ankolean system with swamp deposits and alluvium of the Holocene system.

The upper profiles of the Jinja – Tororo alignment have brown to red clayey gravels due to the presence of high contents of iron, and they attain a deeper coloration when found near more basic rocks where as the upper profiles of the Mbarara – Mirama alignment have grayish to yellowish clays with traces of brownish fine gravels.

3. FIELD WORK

3.1 General

The field exploratory activities were conducted in accordance with BS 5930: 1981 "Code of Practice for Site Investigations". These included test pit excavation, dynamic cone penetration tests, determining the level of occurrence of ground water, In-situ density tests and sampling of soils.

3.2 Test Pit excavation, Sampling, In-situ density tests and Dynamic Cone Penetration Tests

3.2.1 Test Pit excavation

The use of test pits as an investigation technique offers a quick and economical method for obtaining reliable geotechnical information for a variety of engineering solutions and was favored by the engineer during these investigations.

Twenty (20) test pits were excavated in total, thirteen (13) along Jinja – Tororo and seven (7) along Mbarara – Mirama routes using pick axes, hoes and spades. Test pits were located at 10Km intervals and were excavated to an average depth of 2.0m from the existing ground levels along both sites.

For each test pit the following was carried out:

- Soil profiling and recording the thickness of the existing soil layers.
- Sampling of the existing soil material for classification analysis
- Collecting disturbed samples from depths ranging between of 1.5 and 2.5m.

The existing soil lifts have been determined based on test pit investigations on site and are shown in the test pit excavation logs in ***appendix 1***.

3.2.2 Soil and or Rock Sampling

Soils and or rocks were retrieved from the sides of the excavated test pits, visually inspected, labeled and taken for laboratory analysis as disturbed soil samples (D-35).

3.2.3 In-situ density tests

Insitu Density Tests were included in the geotechnical investigation field work programme to determine the degree of compaction of the existing natural and fill material. The sand replacement method was used for this test in accordance with the requirements of BS 1377 Part 9.

The in place dry density was determined by forming a hole in the existing material and dividing the mass of the retrieved soil by the volume of the hole, the latter being determined by filling the hole with fine sand of a known density equal to 1.36 g/cc. The soil retrieved from the hole was dried to a constant mass in the laboratory.

The advantage of this test is that it gives an accurate value of in-situ dry density.

The dry densities were derived in KN/m^3 and used to correlate with the penetration results to obtain rough estimates of bearing capacities.

3.2.4 Dynamic Cone Penetration (DCP) Tests

DCP testing was carried out during dry conditions along both routes.

The DCP equipment used was a "Leonard Farnell and Co." Standard TRRL penetrometer having the following characteristics;

- 8kg falling hammer
- 575 mm drop height
- 60◦ cone having a diameter of 20mm

A total of twenty (20) DCP tests were carried out with one test in each test pit so as to study the behavior of the underlying soils when subjected to loads.

The penetration tests were carried out to a depth of approximately 1.0m relative to the bottom of each test pit .Generally, the route along Jinja – Tororo presented

difficulties during penetration in some areas unlike along Mbarara – Mirama route.

The results of the DCP test shown in appendix 2 have been converted to CBR values using the following empirical relationships between CBR values and penetration resistance.

Log_{10} (CBR) =2.632 -1.28 Log_{10} (Penetration resistance in mm per blow) …..[Kleyn and Van Heereden]

Log_{10} (CBR) =2.48 -1.057 Log_{10} (Penetration resistance in mm per blow) …..[TRL]

4. LABORATORY TESTING

Laboratory testing was carried out to further identify the soils and rocks, and obtain parameters for predicting their strength characteristics. Identification tests were done on disturbed soil samples. The tests were conducted according to the standard methods listed in Table 4.1 below.

Table 4.1: ***Laboratory Tests and their Standard test methods***

Name of Test	Standard Test Method	Sample Quality
Moisture content	BS 1377: Part 2: 1990	Disturbed
Particle size distribution	BS 1377: Part 2: 1990	Disturbed
Liquid limit	BS 1377: Part 2: 1990	Disturbed
Plastic limit	BS 1377: Part 2: 1990	Disturbed
Plasticity Index	BS 1377: Part 2: 1990	Disturbed

A full summary of the laboratory test results is presented herein as ***Appendix 2***.

5. INTERPRETATION OF FIELD AND LABORATORY TEST RESULTS

5.1 Field Results

5.1.1 Visual Results

Both sites were investigated up to an average depth of 3.0m with 1.0m covered using a dynamic cone penetrometer starting from the bottom of the excavated test pit. The Jinja – Tororo interconnection transmission line alignment was found to predominantly have gneiss rocks in various degrees of weathering whereas the Mbarara – Mirama interconnection transmission line alignment was found to predominantly have intrusive granites and Precambrian shales and phyllites with some alluvial swamp deposits.

5.1.2 Ground Water

Ground water was encountered in test pits 5, 7 and 8 along Jinja – Tororo route and test pits 2 and 4 along the Mbarara – Mirama route.

5.1.3 Dynamic Cone Penetration Tests (DCP)

On the basis of the DCP tests conducted in each test pit, the Jinja – Tororo and Mbarara Mirama border routes have been categorized into geotechnical units of varying strengths and stiffness as summarized in Tables 5.1 and 5.2 respectively.

Table 5.1: ***In-situ description of the soil consistency along the existing Jinja – Tororo 220KV electricity transmission line route.***

Test Pit No.	**Unit No.**	**Depth of occurrence (m)**	**Consistency**	Description
1	1	0.2-1.2	Medium dense	Weathered gneiss
	2	1.2-3.0	Very dense	Gneiss
2	1	0.2-3.5	Loose to medium dense	Gravelly Clay
3	1	0.5-1.0	Medium dense	Weathered gneiss
	2	1.0-2.8	dense	Weathered gneiss
4	1	0.5-2.6	Loose to medium dense	Gravelly Clay
5	1	0.5-3.0	Loose	Sand
6	2	0.2-1.5	Very dense	Weathered gneiss
7	1	0.2-1.5	Medium dense	Sand
8	1	0.1-1.5	Firm	Clay
9	1	0.2-3.0	Dense	Weathered gneiss
10 ***I***	1	0.1-2.0	Very dense	Weathered gneiss
11	1	0.2-1.5	Firm	Clay
	2	1.5-3.0	Medium dense	Clayey Gravel
12	1	0.5-2.6	Medium dense	Weathered gneiss
13	1	0.2-3.5	Medium dense	Gravelly Clay

Table 5.2: In-situ description of the soil consistency along the newly proposed Mbarara – Mirama transmission line route

Test Pit No.	**Unit No.**	**Depth of occurrence (m)**	**Consistency**	Description
1	1	0.2-3.0	Very Firm	Clay
2	1	0.2-2.0	Dense	Clay
	2	2.0-3.0	Loose to medium dense	Sandy Clay
3	1	0.1-1.5	Very dense	Shale
	2	+1.5	Very Stiff	Weathered Precambrian rock
4	1	0.2-1.5	Dense	Clay
	2	1.5-2.5	Loose to medium dense	Sandy Clay
5	1	0.7-1.0	Dense	Coarse grained Gravel
	2	1.0-2.0	Dense	Clayey Gravel
6	1	0.1-2.0	Very dense	Clayey Gravel
7	1	0.2-3.0	Very Firm	Clay

5.2 Laboratory Test Results

5.2.1 Classification Test Results

Laboratory classification test results identified the soils along Jinja -Tororo route as gravelly clays of low plasticity and sandy clays with high plasticity which are residual products of weathering of gneiss rock. The Mbarara – Mirama route was found to be predominantly underplayed with clays of a high plasticity. *See **Appendix 3** for detailed test results.*

6. EVALUATION OF THE SOIL BEARING CAPACITY

The maximum pressures the soils and rocks are capable of resisting have been estimated from the laboratory test results, soil consistency observations, field dry densities and the bearing ratio values computed using the penetration resistance values that were obtained in the field. In the absence of information regarding the footing dimensions, a 1.0m square footing has been adopted. Further assumptions include the following:

i) The relationship between penetration resistance values and the allowable bearing pressure of cohesionless soils is valid;
ii) A Local shear failure mechanism;
iii) The factor of safety against local shear failure is 3;
iv) The maximum allowable settlement is 25mm.

The bearing capacity evaluations for Jinja – Tororo and Mbarara – Mirama routes are summarized in Tables 6.1 and 6.2 respectively.

Table 6.1: ***Soil/rock bearing capacities along the Jinja – Tororo route***

Test Pit No.	Depths (m)	Approximate Bearing Capacity (KPa)
1	1.5	400
2	1.5	150
3	1.5	300
4	1.5	350
5	1.5	200
6	1.5	350
7	1.5	100
8	1.5	150
9	1.5	450
10	1.5	300
11	1.5	350
12	1.5	500
13	1.5	250

Table 6.2: ***Soil/rock bearing capacities along the Mbarara – Mirama route***

Test Pit No.	Depths (m)	Approximate Bearing Capacity (KPa)
1	1.5	350
2	1.5	200
3	1.5	500
4	1.5	150
5	1.5	300
6	1.5	350
7	1.5	400

The above are approximate bearing capacities at foundation depths of 1.5m.

7. CONCLUSIONS AND RECOMMENDATIONS

i. Jinja – Tororo alignment was investigated up to a maximum depth of 3.0m. It was found to contain a gneiss rock exhibiting various degrees of weathering.

ii. Water table was encountered in test pits 5, 7 and 8 at depths of 1.5m, 1.2m, and 1.4m respectively along Jinja – Tororo route and in test pits 2 and 4 at depths of 1.3m and 0.8m respectively along Mbarara-Mirama. The water table along Jinja – Tororo route is lower than the water table along Mbarara – Mirama border route.

iii. The soils along both routes are not likely to loose bearing strengths with slight moisture content increments.

iv. Evaluations indicate that the soil strata along both routes have unconfined strength values greater than 200 KPa. except for areas dominated by a high water table.

v. The recommended bearing capacity for a 1.0m square footing at a foundation depth of 1.5 m is 300 KPa.

8. BIBLIOGRAPHY

i. BRITISH STANDARDS INSTITUTION. British Standards 1377: 1995 and British Standard 1377: 1990. Methods of Test for Soils for Civil Engineering Purposes, London, 1990.

ii. BRITISH STANDARDS INSTITUTION. British Standards 5930: 1981. Code of Practice for Site Investigations, London 1981.

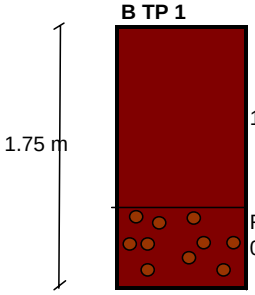
iii. BRAIN VICKERS. Laboratory work in Civil Engineering Soil Mechanics. Granada Publishers, London, 1978.

iv. G. BRYEN, J.P EVERETT and K. SCHWARTZ. A Guide to Practical Geotechnical Engineering in Southern Africa, Frankipile SA, Third Edition, 1995.

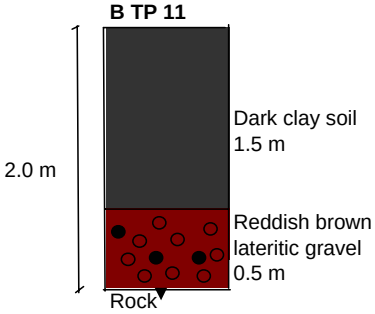
v. SHENBAGA R. KANIRAJ. Designs Aids in Soil Mechanics and Foundation Engineering. Tata McGraw Publishing Co. Ltd. New Dehli, 1995.

Appendix 1

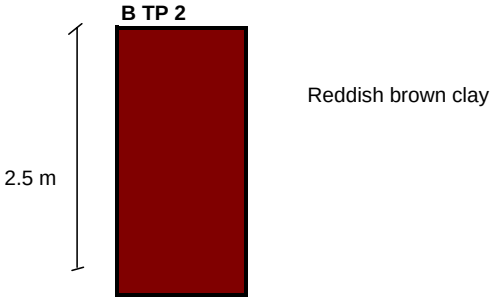
B TP 1



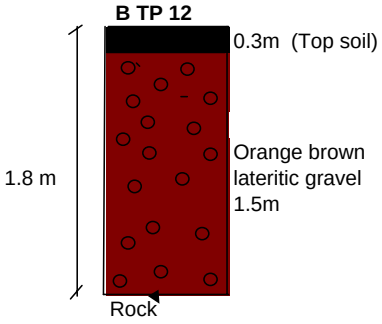
B TP 11



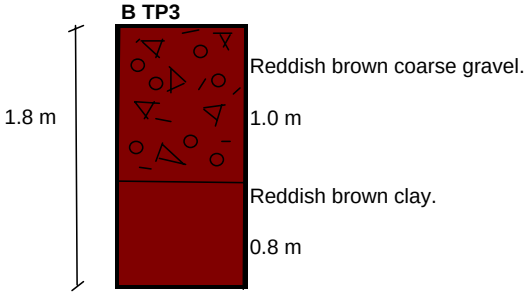
B TP 2



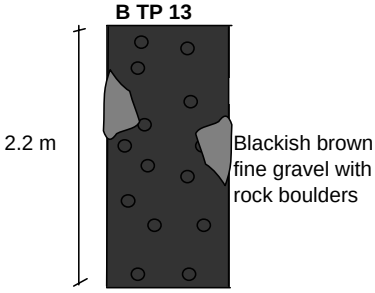
B TP 12



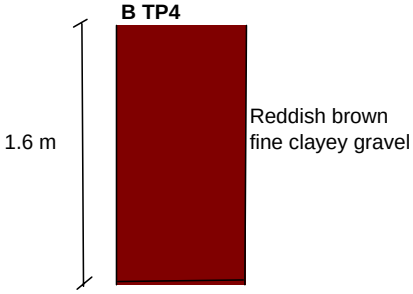
B TP3



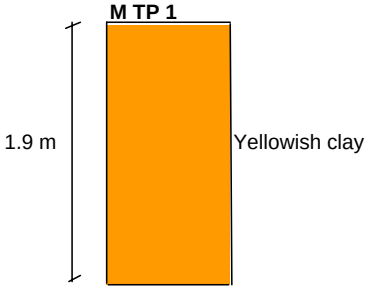
B TP 13



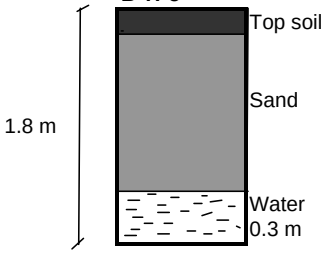
B TP4



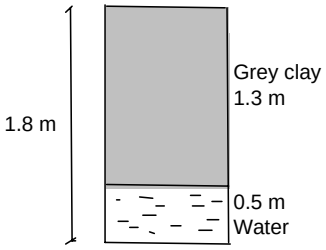
M TP 1



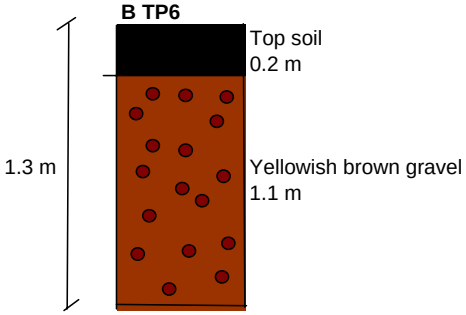
B TP5



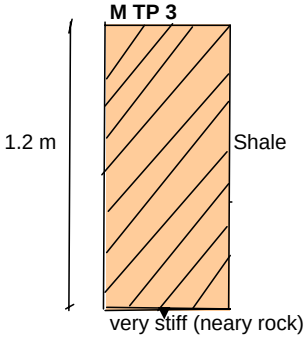
M TP 2



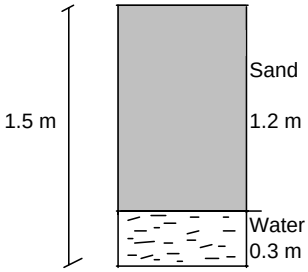
B TP6



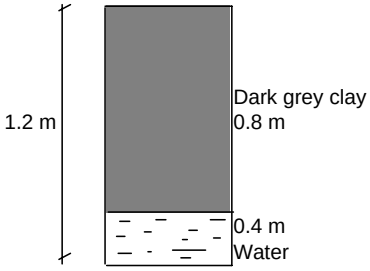
M TP 3



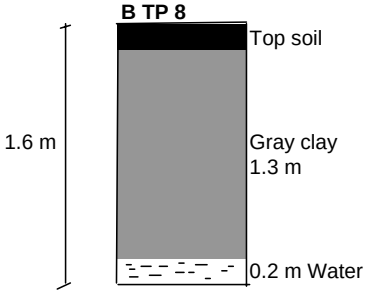
B TP7



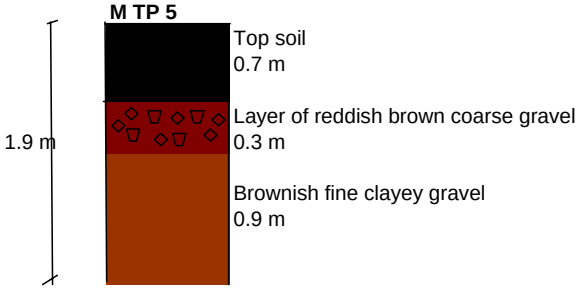
M TP 4



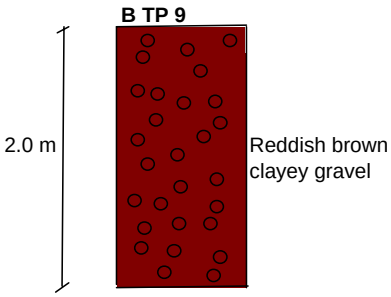
B TP 8



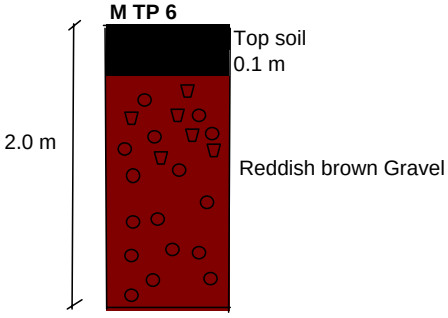
M TP 5



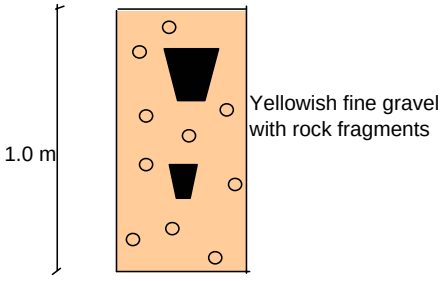
B TP 9



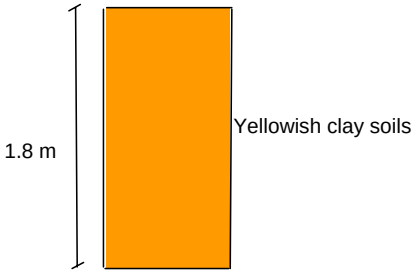
M TP 6



B TP 10



M TP 7



Appendix 2

Summary of laboratory test results for the proposed Trial pits/Areas.

Sample Identification	Sample Description	% passing the given standard sieves														GM	PM	PP	LL	PL	PI	NM	Dry Density
		75	50	38	20	10	5.0	2.0	1.18	0.600	0.425	0.300	0.212	0.150	0.075								
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm				%	%	%	%	Kg/m^3
B TP1	Reddish brown with fine gravel	100	100	100	100	99	85	53	47	44	42	41	40	39	38	1.67	622	562	38.8	24.0	14.8	11.0	1448
B TP2	Reddish brown clay soil	100	100	100	100	100	100	98	98	97	97	97	96	96	95	0.10	2548	2493	51.8	25.5	26.3	26.0	1012
B TP 3	Reddish brown clay soil	100	100	100	100	100	100	97	96	96	95	95	95	95	94	0.14	2662	2623	57.0	29.1	27.9	20.0	1478
B TP4	Reddish brown with fine gravel	100	100	100	100	98	85	68	63	60	59	58	58	57	56	1.16	1921	1824	62.3	29.9	32.4	21.0	1693
B TP5	Sand	100	100	100	100	100	100	99	95	72	57	40	29	18	6	1.37	1433	158	25.5	0.0	25.0	14.0	1431
B TP 6	Gravel: Yellowish brown	100	100	100	97	84	53	31	25	20	18	16	15	14	12	2.39	279	186	34.8	19.4	15.4	11.0	1981
B TP 7	Sand	100	100	100	100	100	100	100	98	94	91	79	52	25	3	1.06	2361	81	26.0	0.0	26.0	13.0	1015
B TP 8	Grey clay															3.00	0	0	34.7	18.1	16.6	17.5	1430
B TP 9	Gravel: Reddish brown	100	100	100	97	92	70	55	51	47	45	42	42	42	40	1.60	948	854	49.7	28.5	21.2	10.5	2024
B TP 10	Yellowish fine gravel with rock fragments	100	100	100	100	99	95	77	60	45	38	34	31	27	24	1.62	900	564	24.0	0.0	24.0	7.2	1332
B TP 11	Lateritic gravel	100	100	100	92	76	57	42	37	33	31	29	27	25	23	2.03	939	702	30.0	0.0	30.0	9.2	
B TP 12	Lateritic gravel	100	100	100	100	83	54	33	28	24	23	21	20	18	16	2.28	740	507	32.3	0.0	32.3	9.5	
B TP 13	Dark fine gravel	100	100	100	98	94	77	35	32	31	31	29	28	26	24	2.11	354	273	30.1	18.5	11.6	11.5	1627
M TP 1	Yellowish Brown clay soils	100	100	100	100	100	99	97	96	92	91	87	81	72	64	0.49	1330	938	36.0	21.3	14.7	11.0	1803
M TP 2	Grey clay															3.00	0	0	24.2	10.8	13.4	20.0	1521
M TP 3	Shale material															3.00	0	0	25.0	0.0	25.0	16.6	
M TP 4	Dark grey clay															3.00	0	0	62.5	25.0	37.5	47.2	1047
M TP 5	Brownish gravelly material	100	100	100	100	95	91	83	80	77	75	74	71	67	62	0.80	1175	969	48.3	32.7	15.6	20.0	1196
M TP 6	Gravel: reddish brown	100	100	100	97	89	77	65	61	50	42	38	36	33	31	1.62	475	350	32.8	21.6	11.3	13.0	1272
M TP 7	Yellowish brown clay soils	100	100	100	100	100	100	100	98	94	91	79	52	25	3	1.06	1044	36	27.1	15.1	11.5	11.0	1737

Key: **GM**- Grading modulus **PL**-Plastic limit **LL**-Liquid limit
PM-Plasiticity modulus **PI**-Placiticity index
PP-Plasiticity product **NM**- Natural moisture

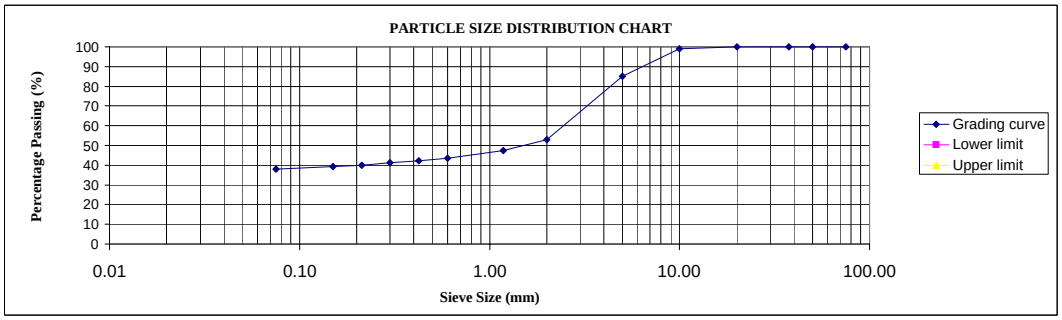
Appendix 3

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:	B TP1				
Soil Description:		**Client :**	NELSAP		
Sample Reference:		**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 1500

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	0	0.0	100		
10	10	15	1.0	99		
5.00	5.00	210	14.0	85		
2.00	2.00	480	32.0	53		
1.18	1.18	85	5.7	47		
0.60	0.60	55	3.7	44		
0.425	0.425	20	1.3	42		
0.300	0.300	15	1.0	41		
0.212	0.212	20	1.3	40		
0.150	0.150	10	0.7	39		
0.075	0.075	20	1.3	38		
Percentage Finer than 0.075 mm Sieve			38.0			



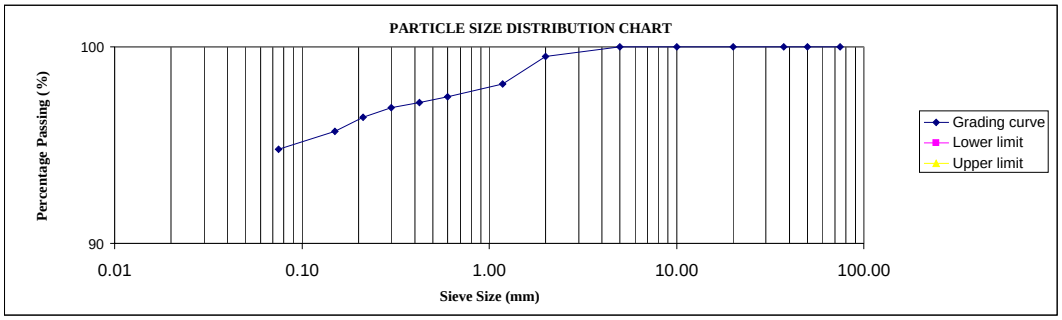
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	BT 2	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 700

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	0	0.0	100		
10	10	0	0.0	100		
5.00	5.00	0	0.0	100		
2.00	2.00	3.4	0.5	100		
1.18	1.18	9.8	1.4	98		
0.60	0.60	4.5	0.6	97.5		
0.425	0.425	2.1	0.3	97.2		
0.300	0.300	1.8	0.3	96.9		
0.212	0.212	3.4	0.5	96.4		
0.150	0.150	5	0.7	95.7		
0.075	0.075	6.4	0.9	94.8		
Percentage Finer than 0.075 mm Sieve			94.8			



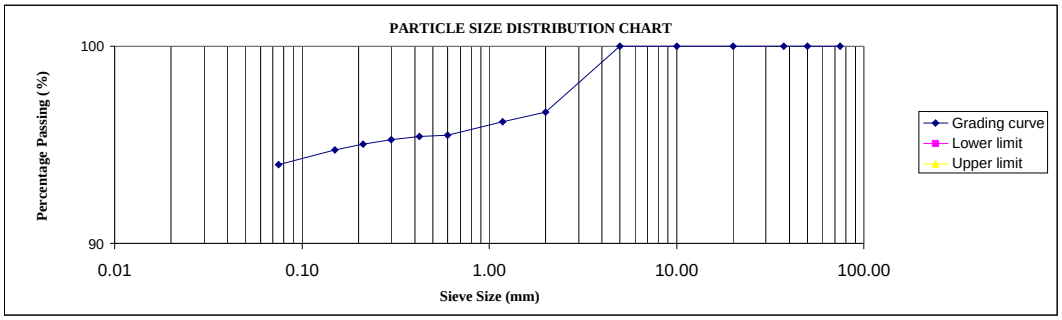
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	BT 3	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 600

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	0	0.0	100		
10	10	0	0.0	100		
5.00	5.00	0	0.0	100		
2.00	2.00	20	3.3	97		
1.18	1.18	3	0.5	96		
0.60	0.60	4	0.7	95.5		
0.425	0.425	0.5	0.1	95.4		
0.300	0.300	1	0.2	95.3		
0.212	0.212	1.3	0.2	95.0		
0.150	0.150	1.7	0.3	94.8		
0.075	0.075	4.5	0.8	94.0		
Percentage Finer than 0.075 mm Sieve			94.0			



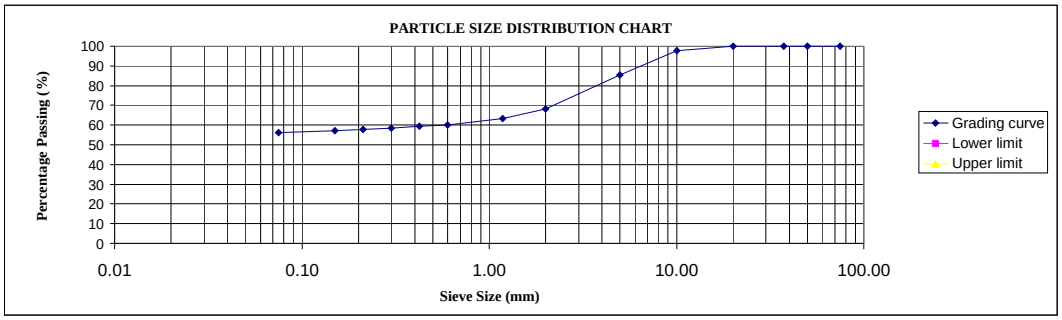
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	BT 4	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 1400

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	0	0.0	100		
10	10	30	2.1	98		
5.00	5.00	175	12.5	85		
2.00	2.00	240	17.1	68		
1.18	1.18	70	5.0	63		
0.60	0.60	45	3.2	60.0		
0.425	0.425	10	0.7	59.3		
0.300	0.300	12	0.9	58.4		
0.212	0.212	10	0.7	57.7		
0.150	0.150	10	0.7	57.0		
0.075	0.075	10	0.7	56.3		
Percentage Finer than 0.075 mm Sieve			56.3			



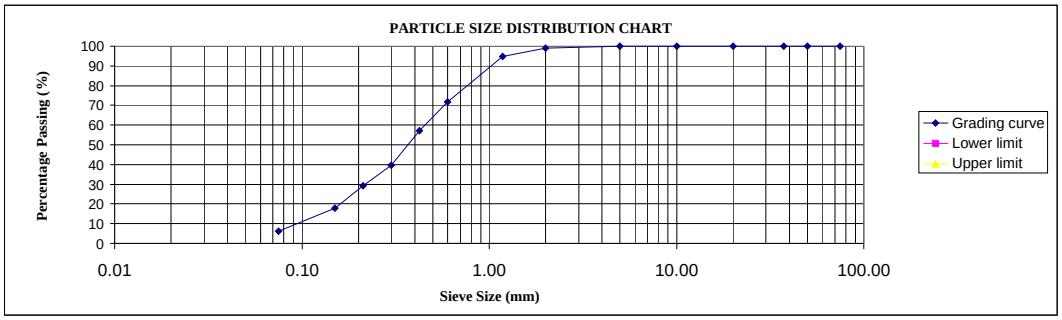
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	BT5	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 480

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	0	0.0	100		
10	10	0	0.0	100		
5.00	5.00	0	0.0	100		
2.00	2.00	5	1.0	99		
1.18	1.18	20	4.2	95		
0.60	0.60	110	22.9	71.9		
0.425	0.425	70	14.6	57.3		
0.300	0.300	85	17.7	39.6		
0.212	0.212	50	10.4	29.2		
0.150	0.150	55	11.5	17.7		
0.075	0.075	55	11.5	6.3		
Percentage Finer than 0.075 mm Sieve						



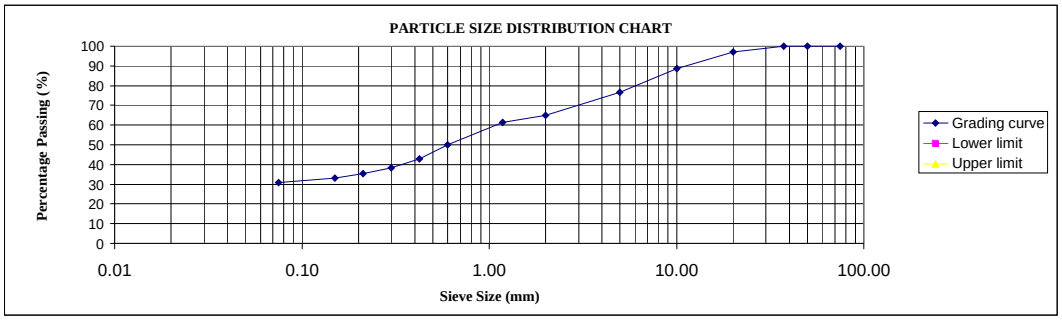
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	BT6	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 2000

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	60	3.0	97		
10	10	165	8.3	89		
5.00	5.00	240	12.0	77		
2.00	2.00	235	11.8	65		
1.18	1.18	75	3.8	61		
0.60	0.60	225	11.3	50.0		
0.425	0.425	145	7.3	42.8		
0.300	0.300	90	4.5	38.3		
0.212	0.212	55	2.8	35.5		
0.150	0.150	45	2.3	33.3		
0.075	0.075	45	2.3	31.0		
Percentage Finer than 0.075 mm Sieve						



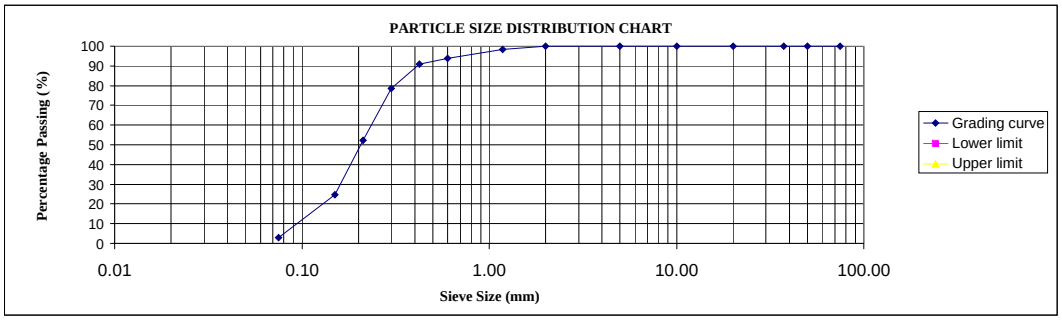
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	BT7	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 325

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	0	0.0	100		
10	10	0	0.0	100		
5.00	5.00	0	0.0	100		
2.00	2.00	0	0.0	100		
1.18	1.18	5	1.5	98		
0.60	0.60	15	4.6	93.8		
0.425	0.425	10	3.1	90.8		
0.300	0.300	40	12.3	78.5		
0.212	0.212	85	26.2	52.3		
0.150	0.150	90	27.7	24.6		
0.075	0.075	70	21.5	3.1		
Percentage Finer than 0.075 mm Sieve						



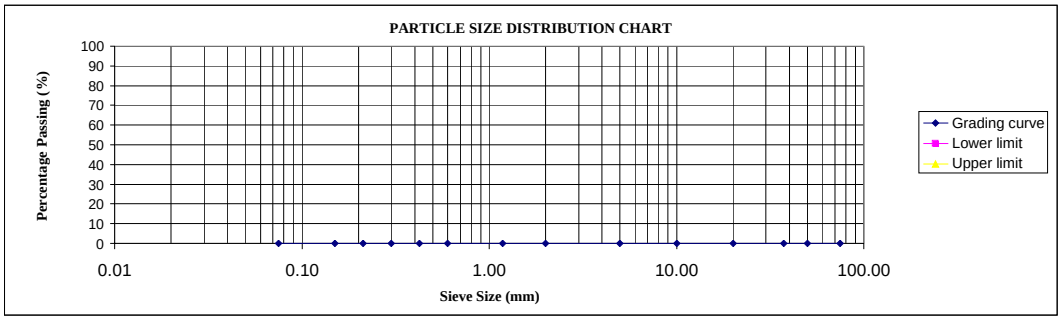
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	B TP 8	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3:

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	#DIV/0!	#DIV/0!		
50.00	50.00	0	#DIV/0!	#DIV/0!		
37.50	37.50	0	#DIV/0!	#DIV/0!		
20.00	20.00	0	#DIV/0!	#DIV/0!		
10	10	0	#DIV/0!	#DIV/0!		
5.00	5.00	0	#DIV/0!	#DIV/0!		
2.00	2.00	0	#DIV/0!	#DIV/0!		
1.18	1.18	5	#DIV/0!	#DIV/0!		
0.60	0.60	15	#DIV/0!	#DIV/0!		
0.425	0.425	10	#DIV/0!	#DIV/0!		
0.300	0.300	40	#DIV/0!	#DIV/0!		
0.212	0.212	85	#DIV/0!	#DIV/0!		
0.150	0.150	90	#DIV/0!	#DIV/0!		
0.075	0.075	70	#DIV/0!	#DIV/0!		
Percentage Finer than 0.075 mm Sieve						



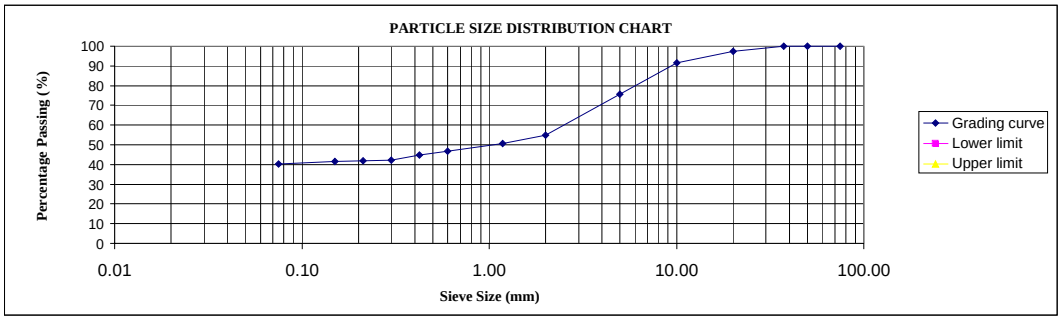
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	BT9	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 1500

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	40	2.7	97		
10	10	85	5.7	92		
5.00	5.00	240	16.0	76		
2.00	2.00	310	20.7	55		
1.18	1.18	65	4.3	51		
0.60	0.60	60	4.0	46.7		
0.425	0.425	30	2.0	44.7		
0.300	0.300	35	2.3	42.3		
0.212	0.212	5	0.3	42.0		
0.150	0.150	5	0.3	41.7		
0.075	0.075	20	1.3	40.3		
Percentage Finer than 0.075 mm Sieve						



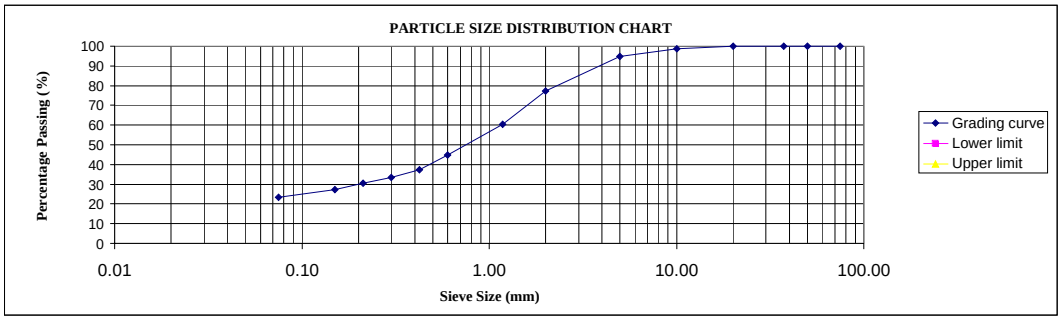
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	BT10	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 2000

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	0	0.0	100		
10	10	25	1.3	99		
5.00	5.00	80	4.0	95		
2.00	2.00	350	17.5	77		
1.18	1.18	340	17.0	60		
0.60	0.60	310	15.5	44.8		
0.425	0.425	145	7.3	37.5		
0.300	0.300	80	4.0	33.5		
0.212	0.212	60	3.0	30.5		
0.150	0.150	65	3.3	27.3		
0.075	0.075	75	3.8	23.5		
Percentage Finer than 0.075 mm Sieve						



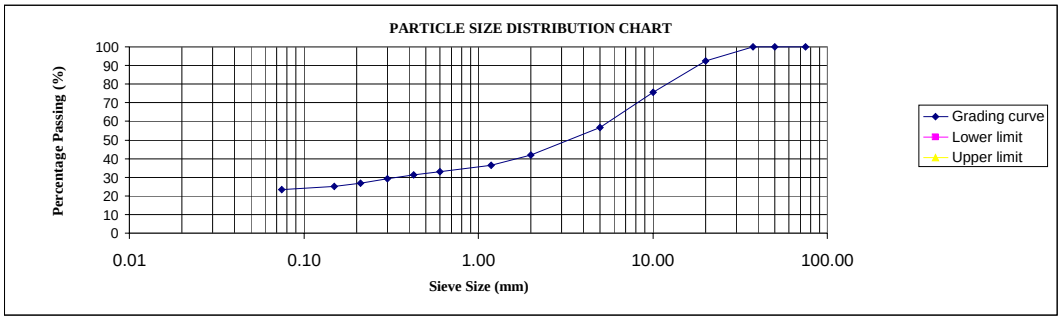
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	BT11	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 1520

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	115	7.6	92		
10	10	255	16.8	76		
5.00	5.00	290	19.1	57		
2.00	2.00	225	14.8	42		
1.18	1.18	80	5.3	37		
0.60	0.60	55	3.6	32.9		
0.425	0.425	25	1.6	31.3		
0.300	0.300	30	2.0	29.3		
0.212	0.212	35	2.3	27.0		
0.150	0.150	30	2.0	25.0		
0.075	0.075	25	1.6	23.4		
Percentage Finer than 0.075 mm Sieve						



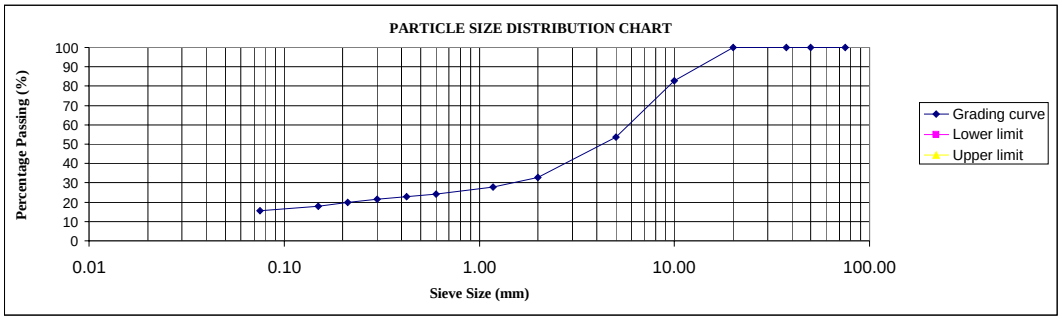
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	BT12	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 700

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	0	0.0	100		
10	10	120	17.1	83		
5.00	5.00	205	29.3	54		
2.00	2.00	145	20.7	33		
1.18	1.18	35	5.0	28		
0.60	0.60	25	3.6	24.3		
0.425	0.425	10	1.4	22.9		
0.300	0.300	10	1.4	21.4		
0.212	0.212	10	1.4	20.0		
0.150	0.150	15	2.1	17.9		
0.075	0.075	15	2.1	15.7		
Percentage Finer than 0.075 mm Sieve						



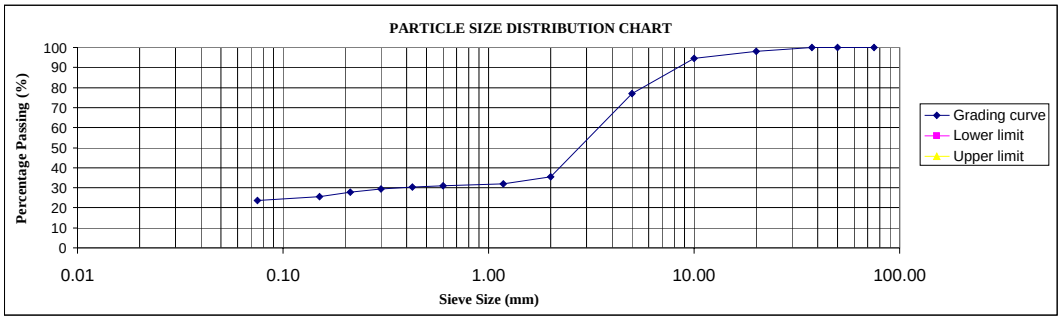
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	BT13	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 2150

B.S. sieve (mm)	Aperture size (mm)	Partial weight retained (g)	Percentage retained (%)	Percentage Passing (%)	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	40	1.9	98		
10	10	80	3.7	94		
5.00	5.00	375	17.4	77		
2.00	2.00	895	41.6	35		
1.18	1.18	70	3.3	32		
0.60	0.60	25	1.2	30.9		
0.425	0.425	10	0.5	30.5		
0.300	0.300	25	1.2	29.3		
0.212	0.212	30	1.4	27.9		
0.150	0.150	50	2.3	25.6		
0.075	0.075	45	2.1	23.5		
Percentage Finer than 0.075 mm Sieve						



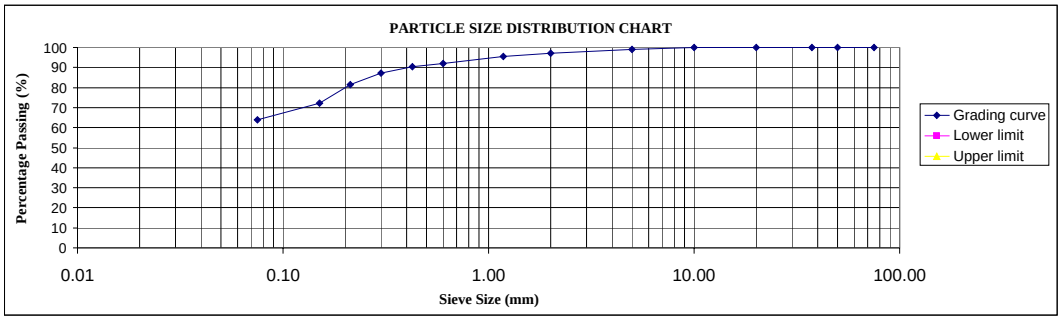
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	M TP 1	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 600

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	0	0.0	100		
10	10	0	0.0	100		
5.00	5.00	5	0.8	99		
2.00	2.00	12	2.0	97		
1.18	1.18	10	1.7	96		
0.60	0.60	20	3.3	92.2		
0.425	0.425	10	1.7	90.5		
0.300	0.300	20	3.3	87.2		
0.212	0.212	35	5.8	81.3		
0.150	0.150	55	9.2	72.2		
0.075	0.075	50	8.3	63.8		
Percentage Finer than 0.075 mm Sieve						



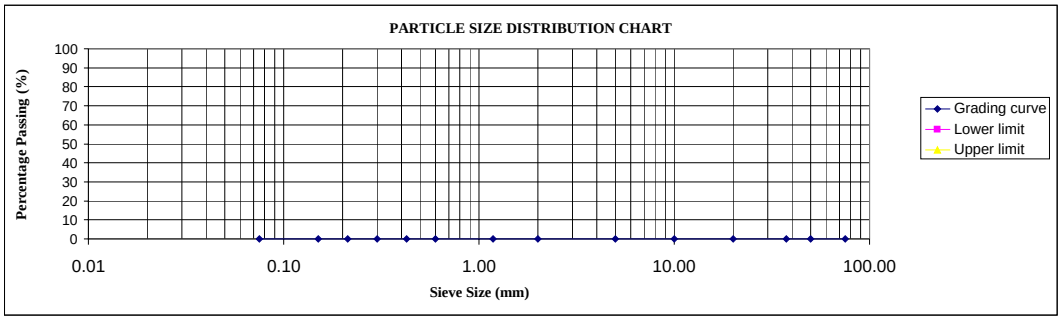
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	M TP 1	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 0

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	#DIV/0!	#DIV/0!		
50.00	50.00	0	#DIV/0!	#DIV/0!		
37.50	37.50	0	#DIV/0!	#DIV/0!		
20.00	20.00	0	#DIV/0!	#DIV/0!		
10	10	0	#DIV/0!	#DIV/0!		
5.00	5.00	5	#DIV/0!	#DIV/0!		
2.00	2.00	12	#DIV/0!	#DIV/0!		
1.18	1.18	10	#DIV/0!	#DIV/0!		
0.60	0.60	20	#DIV/0!	#DIV/0!		
0.425	0.425	10	#DIV/0!	#DIV/0!		
0.300	0.300	20	#DIV/0!	#DIV/0!		
0.212	0.212	35	#DIV/0!	#DIV/0!		
0.150	0.150	55	#DIV/0!	#DIV/0!		
0.075	0.075	50	#DIV/0!	#DIV/0!		
Percentage Finer than 0.075 mm Sieve						



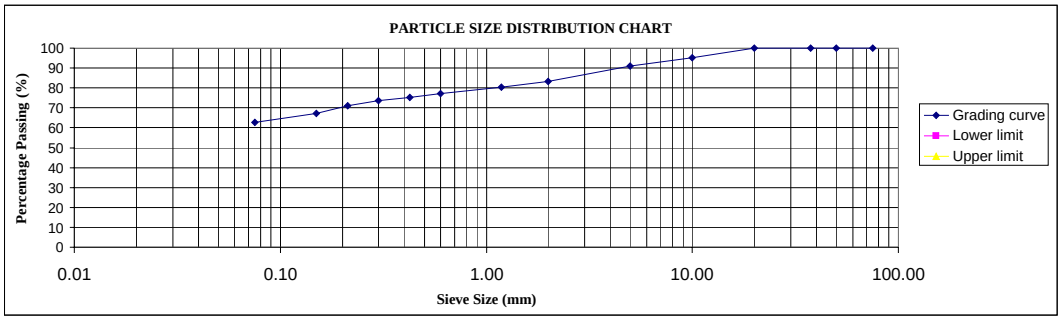
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	M TP 1	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 1475

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	0	0.0	100		
10	10	70	4.7	95		
5.00	5.00	65	4.4	91		
2.00	2.00	110	7.5	83		
1.18	1.18	45	3.1	80		
0.60	0.60	45	3.1	77.3		
0.425	0.425	30	2.0	75.3		
0.300	0.300	25	1.7	73.6		
0.212	0.212	35	2.4	71.2		
0.150	0.150	60	4.1	67.1		
0.075	0.075	65	4.4	62.7		
Percentage Finer than 0.075 mm Sieve						



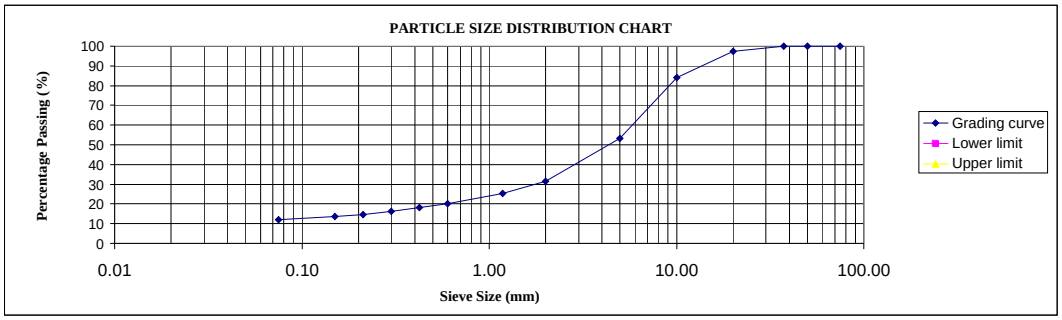
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	M TP 6	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 1770

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	45	2.5	97		
10	10	235	13.3	84		
5.00	5.00	545	30.8	53		
2.00	2.00	390	22.0	31		
1.18	1.18	105	5.9	25		
0.60	0.60	95	5.4	20.1		
0.425	0.425	35	2.0	18.1		
0.300	0.300	35	2.0	16.1		
0.212	0.212	25	1.4	14.7		
0.150	0.150	20	1.1	13.6		
0.075	0.075	25	1.4	12.1		
Percentage Finer than 0.075 mm Sieve						



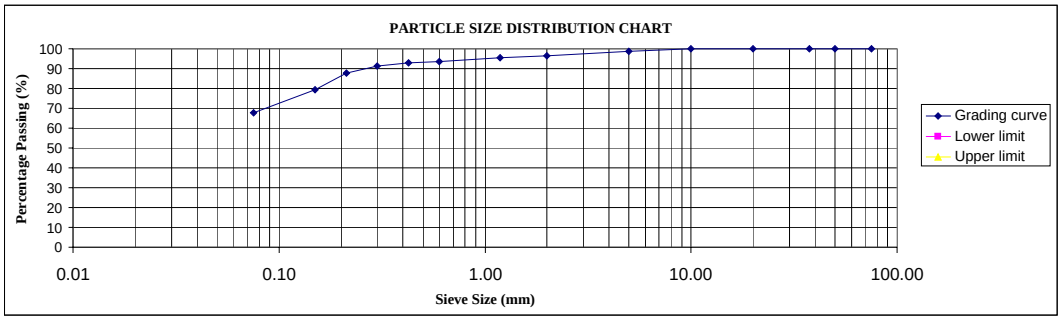
S.P Kisitu
For Teclab Ltd

PARTICLE SIZE DETERMINATION

Project:	FEASIBILITY STUDY ON INTER CONNECTION TRANSMISSION LINES UGANDA- KENYA AND UGANDA -RWANDA				
Location/Source:					
Soil Description:		**Client :**	NELSAP		
Sample Reference:	M TP7	**Sampling Date:**			
Technician:		**Testing Date:**			

Dry weight, M_3: 600

B.S. sieve (mm)	**Aperture size (mm)**	**Partial weight retained (g)**	**Percentage retained (%)**	**Percentage Passing (%)**	Specified limits (%ge passing)	
					Lower limit	Upper limit
75.00	75.00	0	0.0	100		
50.00	50.00	0	0.0	100		
37.50	37.50	0	0.0	100		
20.00	20.00	0	0.0	100		
10	10	0	0.0	100		
5.00	5.00	7.2	1.2	99		
2.00	2.00	14	2.3	96		
1.18	1.18	5	0.8	96		
0.60	0.60	13	2.2	93.5		
0.425	0.425	4	0.7	92.8		
0.300	0.300	10	1.7	91.1		
0.212	0.212	20	3.3	87.8		
0.150	0.150	50	8.3	79.5		
0.075	0.075	70	11.7	67.8		
Percentage Finer than 0.075 mm Sieve						



S.P Kisitu
For Teclab Ltd

Test Location Kikubamutwe (Bujagali- Tororo)

Test No B -TP1

Zero Reading	20						
Number of Blows	**Penetration/Depth (mm)**	**Penetration Corrected for Zero Reading (mm)**	**Penetration Depth per set of blows**	**Cummulative Blows**	**Rate of Penetration (mm/Blow)**	**CBR Value (Kleyn and Van Heereden)**	**CBR Value (TRL)**
0	20	0		0	0		
5	53	33	33	5	7	38.3	41.1
5	65	45	12	10	2	139.7	119.7
10	72	52	7	20	1	676.5	440.3
10	97	77	25	30	3	132.6	114.7
10	102	82	5	40	1	1040.7	628.3
15	111	91	9	55	1	824.1	518.2
15	120	100	9	70	1	824.1	518.2
15	125	105	5	85	0	1748.7	964.5
20	135	115	10	105	1	1040.7	628.3
20	160	140	25	125	1	322.1	238.5
15	172	152	12	140	1	570.2	382.3
15	180	160	8	155	1	958.2	586.9
15	185	165	5	170	0	1748.7	964.5
15	193	173	8	185	1	958.2	586.9
20	205	185	12	205	1	824.1	518.2
20	210	190	5	225	0	2527.2	1307.3
20	225	205	15	245	1	619.3	409.3
20	235	215	10	265	1	1040.7	628.3
20	245	225	10	285	1	1040.7	628.3
20	252	232	7	305	0	1642.8	916.1

Test Location Buwenda (Bujagali- Tororo)

Test No BTP-2

Zero Reading	50						
Number of Blows	**Penetration/Depth (mm)**	**Penetration Corrected for Zero Reading**	**Penetration Depth per set of blows**	**Cummulative Blows**	**Rate of Penetration (mm/Blow)**	**CBR Value (Kleyn and Van Heereden)**	**CBR Value (TRL)**
0	50	0		0	0		
1	118	68	68	1	68	1.9	3.5
1	170	120	52	2	52	2.7	4.6
1	230	180	60	3	60	2.3	4.0
1	289	239	59	4	59	2.3	4.1
1	356	306	67	5	67	2.0	3.5
1	397	347	41	6	41	3.7	6.0
1	440	390	43	7	43	3.5	5.7
1	498	448	58	8	58	2.4	4.1
1	553	503	55	9	55	2.5	4.4
1	607	557	54	10	54	2.6	4.5
1	660	610	53	11	53	2.7	4.5
1	718	668	58	12	58	2.4	4.1
1	763	713	45	13	45	3.3	5.4
2	845	795	82	15	41	3.7	6.0
2	900	850	55	17	28	6.2	9.1
2	950	900	50	19	25	7.0	10.1
2	1000	950	50	21	25	7.0	10.1
2	1050	1000	50	23	25	7.0	10.1
2	1103	1053	53	25	27	6.5	9.5
2	1150	1100	47	27	24	7.5	10.7

Test Location Wakitaka (Bujagali- Tororo)

Test No B TP-3

Zero Reading	**55**						
Number of Blows	Penetration/Depth (mm)	Penetration Corrected for Zero Reading	Penetration Depth per set of blows	Cummulative Blows	Rate of Penetration (mm/Blow)	CBR Value (Kleyn and Van Heereden)	CBR Value (TRL)
0	55	0		0	0		
2	93	38	38	2	19	9.9	13.4
2	125	70	32	4	16	12.3	16.1
4	193	138	68	8	17	11.4	15.1
4	245	190	52	12	13	16.1	20.1
4	293	238	48	16	12	17.8	21.8
4	342	287	49	20	12	17.3	21.4
4	399	344	57	24	14	14.3	18.2
4	450	395	51	28	13	16.5	20.5
4	497	442	47	32	12	18.3	22.3
4	552	497	55	36	14	15.0	18.9
4	607	552	55	40	14	15.0	18.9
4	651	596	44	44	11	19.9	23.9
4	692	637	41	48	10	21.8	25.8
4	738	683	46	52	12	18.8	22.8
4	780	725	42	56	11	21.1	25.2
4	827	772	47	60	12	18.3	22.3
4	868	813	41	64	10	21.8	25.8
4	907	852	39	68	10	23.2	27.2
4	947	892	40	72	10	22.5	26.5
4	994	939	47	76	11.75	18.3	22.3
4	1047	992	53	80	13.25	15.7	19.7
4	1088	1033	41	84	10.25	21.8	25.8

Test Location Gomoja (Bujagali- Tororo)

Test No B-TP 4

Zero Reading	50						
Number of Blows	Penetration/Depth (mm)	Penetration Corrected for Zero Reading	Penetration Depth per set of blows	Cummulative Blows	Rate of Penetration (mm/Blow)	CBR Value (Kleyn and Van Heereden)	CBR Value (TRL)
0	50	0		0	0		
2	97	47	47	2	24	7.5	10.7
2	135	85	38	4	19	9.9	13.4
4	207	157	72	8	18	10.6	14.2
4	300	250	93	12	23	7.6	10.9
4	367	317	67	16	17	11.6	15.4
4	443	393	76	20	19	9.9	13.4
4	512	462	69	24	17	11.2	14.9
4	572	522	60	28	15	13.4	17.3
4	653	603	81	32	20	9.1	12.6
4	780	730	127	36	32	5.1	7.8
4	845	795	65	40	16	12.1	15.9
4	890	840	45	44	11	19.3	23.4
4	915	865	25	48	6	41.0	43.5
4	965	915	50	52	13	16.9	20.9
4	1000	950	35	56	9	26.7	30.5
4	1035	985	35	60	9	26.7	30.5
4	1070	1020	35	64	9	26.7	30.5
4	1107	1057	37	68	9	24.9	28.8
2	1132	1082	25	70	13	16.9	20.9

Test Location Buwaiswa (Bujagali- Tororo)

Test No B TP-6

Zero Reading	20						
Number of Blows	Penetration/Depth (mm)	Penetration Corrected for	Penetration Depth per set of	Cummulative Blows	Rate of Penetration	CBR Value (Kleyn and Van	CBR Value (TRL)
0	20	0		0	0		
10	65	45	45	10	5	62.5	61.6
10	88	68	23	20	2	147.6	125.2
10	109	89	21	30	2	165.8	137.9
10	125	105	16	40	2	234.8	183.8
10	139	119	14	50	1	278.6	211.6
10	150	130	11	60	1	379.3	273.1
10	168	148	18	70	2	202.0	162.2
10	203	183	35	80	4	86.2	80.3
10	216	196	13	90	1	306.3	228.9
10	227	207	11	100	1	379.3	273.1
10	236	216	9	110	1	490.4	337.6
10	250	230	14	120	1	278.6	211.6
10	260	240	10	130	1	428.5	302.0
10	272	252	12	140	1	339.4	249.1
10	285	265	13	150	1	306.3	228.9

Test Location Bugodandala (Bujagali- Tororo)

Test No B -TP 8

Zero Reading	98						
Number of Blows	**Penetration/Depth (mm)**	**Penetration Corrected for Zero Reading**	**Penetration Depth per set of blows**	**Cummulative Blows**	**Rate of Penetration (mm/Blow)**	**CBR Value (Kleyn and Van Heereden)**	**CBR Value (TRL)**
0	98	0		0	0		
2	245	147	147	2	74	1.8	3.2
2	328	230	83	4	42	3.6	5.9
2	395	297	67	6	34	4.8	7.4
2	447	349	52	8	26	6.6	9.6
2	488	390	41	10	21	9.0	12.4
1	505	407	17	11	17	11.4	15.1
4	563	465	58	15	15	14.0	17.9
4	612	514	49	19	12	17.3	21.4
4	665	567	53	23	13	15.7	19.7
4	711	613	46	27	12	18.8	22.8
4	750	652	39	31	10	23.2	27.2
4	792	694	42	35	11	21.1	25.2
4	840	742	48	39	12	17.8	21.8
4	890	792	50	43	13	16.9	20.9
4	931	833	41	47	10	21.8	25.8
4	970	872	39	51	10	23.2	27.2
4	1000	902	30	55	8	32.5	35.9
2	1020	922	20	57	10	22.5	26.5
2	1040	942	20	59	10	22.5	26.5
2	1060	962	20	61	10	22.5	26.5

Test Location Magoola (Bujagali- Tororo)

Test No B- TP 9

Zero Reading	**30**						
Number of Blows	Penetration/Depth (mm)	Penetration Corrected for Zero Reading	Penetration Depth per set of blows	Cummulative Blows	Rate of Penetration (mm/Blow)	CBR Value (Kleyn and Van Heereden)	CBR Value (TRL)
0	30	0		0	0		
10	110	80	80	10	8	29.9	33.5
10	174	144	64	20	6	39.8	42.4
10	223	193	49	30	5	56.0	56.3
10	272	242	49	40	5	56.0	56.3
10	337	307	65	50	7	39.0	41.8
10	411	381	74	60	7	33.1	36.4
10	480	450	69	70	7	36.2	39.2
10	560	530	80	80	8	29.9	33.5
10	624	594	64	90	6	39.8	42.4
10	670	640	46	100	5	60.8	60.2
10	720	690	50	110	5	54.6	55.1
10	775	745	55	120	6	48.3	49.8
10	820	790	45	130	5	62.5	61.6
10	860	830	40	140	4	72.7	69.8
10	910	880	50	150	5	54.6	55.1
10	988	958	78	160	8	30.9	34.4
10	1050	1020	62	170	6	41.5	43.9

Test Location Busolo (Bujagali- Tororo)

Test No B- TP 10

Zero Reading	20						
Number of Blows	Penetration/Depth (mm)	Penetration Corrected for Zero Reading	Penetration Depth per set of blows	Cummulative Blows	Rate of Penetration (mm/Blow)	CBR Value (Kleyn and Van Heereden)	CBR Value (TRL)
0	**20**	**0**		**0**	**0**		
5	75	55	55	5	11	19.9	23.9
5	96	76	21	10	4	68.3	66.3
5	119	99	23	15	5	60.8	60.2
5	138	118	19	20	4	77.6	73.6
5	160	140	22	25	4	64.3	63.1
5	180	160	20	30	4	72.7	69.8
5	197	177	17	35	3	89.5	82.8
5	208	188	11	40	2	156.2	131.2
5	220	200	12	45	2	139.7	119.7
5	232	212	12	50	2	139.7	119.7
5	245	225	13	55	3	126.1	110.0
5	262	242	17	60	3	89.5	82.8
5	278	258	16	65	3	96.7	88.3
5	293	273	15	70	3	105.0	94.6
5	309	289	16	75	3	96.7	88.3
5	323	303	14	80	3	114.7	101.7
5	324	304	1	85	0	3362.6	1655.1

Test Location Tororo-Angoloto (Bujagali- Tororo)

Test No B-TP 13

Zero Reading	80						
Number of Blows	Penetration/Depth (mm)	Penetration Corrected for Zero Reading	Penetration Depth per set of blows	Cummulative Blows	Rate of Penetration (mm/Blow)	CBR Value (Kleyn and Van Heereden)	CBR Value (TRL)
0	80	0		0	0		
2	245	165	165	2	82.5	1.5	2.8
2	**365**	**285**	**120**	**4**	**60**	**2.3**	**4.0**
2	450	370	85	6	42.5	3.5	5.7
2	475	395	25	8	13	16.9	20.9
2	488	408	13	10	7	39.0	41.8
2	495	415	7	12	4	86.2	80.3
5	510	430	15	17	3	105.0	94.6
5	535	455	25	22	5	54.6	55.1
5	565	485	30	27	6	43.2	45.4
5	600	520	35	32	7	35.5	38.6
5	635	555	35	37	7	35.5	38.6
5	663	583	28	42	6	47.2	48.9
5	698	618	35	47	7	35.5	38.6
5	730	650	32	52	6	39.8	42.4
5	760	680	30	57	6	43.2	45.4
5	790	710	30	62	6	43.2	45.4
5	821	741	31	67	6	41.5	43.9
5	863	783	42	72	8	28.1	31.8
5	900	820	37	77	7	33.1	36.4
5	930	850	30	82	6	43.2	45.4

Test Location Mbarara stock farm (Mbarara-Mirama)

Test No M- TP 1

Zero Reading	30						
Number of Blows	Penetration/Depth (mm)	Penetration Corrected for Zero Reading	Penetration Depth per set of blows	Cummulative Blows	Rate of Penetration (mm/Blow)	CBR Value (Kleyn and Van Heereden)	CBR Value (TRL)
0	30	0		0	0		
10	**90**	**60**	**60**	**10**	**6**	**43.2**	**45.4**
10	137	107	47	20	4.7	59.1	58.8
10	184	154	47	30	5	59.1	58.8
10	239	209	55	40	6	48.3	49.8
10	291	261	52	50	5	51.9	52.9
10	343	313	52	60	5	51.9	52.9
10	393	363	50	70	5	54.6	55.1
10	436	406	43	80	4	66.2	64.6
10	482	452	46	90	5	60.8	60.2
10	533	503	51	100	5	53.2	54.0
10	588	558	55	110	6	48.3	49.8
10	640	610	52	120	5	51.9	52.9
10	689	659	49	130	5	56.0	56.3
10	743	713	54	140	5	49.5	50.8
10	797	767	54	150	5	49.5	50.8
10	848	818	51	160	5	53.2	54.0
10	897	867	49	170	5	56.0	56.3
10	945	915	48	180	5	57.5	57.5
10	992	962	47	190	5	59.1	58.8
10	1040	1010	48	200	5	57.5	57.5
5	1070	1040	30	205	6	43.2	45.4

Test Location Katukuru (Mbarara-Mirama)

Test No M -TP 2

Zero Reading	138						
Number of Blows	**Penetration/Depth (mm)**	**Penetration Corrected for Zero Reading**	**Penetration Depth per set of blows**	**Cummulative Blows**	**Rate of Penetration (mm/Blow)**	**CBR Value (Kleyn and Van Heereden)**	**CBR Value (TRL)**
0	138	0		0	0		
4	314	176	176	4	44	3.4	5.5
4	449	311	135	8	34	4.7	7.3
4	555	417	106	12	27	6.5	9.5
4	626	488	71	16	18	10.8	14.4
4	661	523	35	20	9	26.7	30.5
4	711	573	50	24	13	16.9	20.9
4	740	602	29	28	7	33.9	37.2
4	771	633	31	32	8	31.2	34.7
4	802	664	31	36	8	31.2	34.7
4	829	691	27	40	7	37.2	40.1
4	858	720	29	44	7	33.9	37.2
4	891	753	33	48	8	28.8	32.5
4	921	783	30	52	8	32.5	35.9
4	955	817	34	56	9	27.7	31.4
4	969	831	14	60	4	86.2	80.3
2	984	846	15	62	8	32.5	35.9

Test Location Mweya (Mbarara-Mirama)

Test No M- TP 3

Zero Reading	55						
Number of Blows	Penetration/Depth (mm)	Penetration Corrected for Zero Reading	Penetration Depth per set of blows	Cummulative Blows	Rate of Penetration (mm/Blow)	CBR Value (Kleyn and Van Heereden)	CBR Value (TRL)
0	55	0		0	0		
5	**65**	**10**	**10**	**5**	**2**	**176.5**	**145.1**
5	67	12	2	10	0.4	1384.7	795.5
5	68	13	1	15	0	3362.6	1655.1
10	69	14	1	25	0	8165.8	3443.5
10	70	15	1	35	0	8165.8	3443.5

Test Location Ngugo (Mbarara-Mirama)

Test No M -TP 4

Zero Reading	51									
Number of Blows	Penetration/Depth (mm)	Penetration Corrected for Zero Reading	Penetration Depth per set of blows	Cummulative Blows	Rate of Penetration (mm/Blow)	CBR Value (Kleyn and Van Heereden)	CBR Value (TRL)			
0	51	0		0	0					
2	90	39	39	2	20	9.6	13.1			
2	123	72	33	4	17	11.8	15.6			
2	175	124	52	6	26	6.6	9.6			
2	270	219	95	8	48	3.1	5.1			
2	314	263	44	10	22	8.2	11.5			
2	354	303	40	12	20	9.3	12.7			
2	391	340	37	14	18.5	10.2	13.8			
2	425	374	34	16	17	11.4	15.1			
2	454	403	29	18	14.5	14.0	17.9			
2	483	432	29	20	14.5	14.0	17.9			
2	511	460	28	22	14	14.6	18.6			
2	539	488	28	24	14	14.6	18.6			
2	570	519	31	26	15.5	12.8	16.7			
2	595	544	25	28	12.5	16.9	20.9			
2	**611**	**560**	**16**	**30**	**8**	**29.9**	**33.5**			
2	629	578	18	32	9	25.7	29.6			
2	648	597	19	34	10	24.0	28.0			
2	669	618	21	36	11	21.1	25.2			
2	690	639	21	38	11	21.1	25.2			
2	709	658	19	40	10	24.0	28.0			
4	743	692	34	44	9	27.7	31.4			
4	776	725	33	48	8	28.8	32.5			
4	807	756	31	52	8	31.2	34.7			
4	841	790	34	56	9	27.7	31.4			
4	871	820	30	60	8	32.5	35.9			
4	902	851	31	64	8	31.2	34.7			

Test Location Nyabugando (Mbarara-Mirama)

Depth of Test

Test No M- TP 5

Zero Reading	50						
Number of Blows	Penetration/Depth (mm)	Penetration Corrected for Zero Reading	Penetration Depth per set of blows	Cummulative Blows	Rate of Penetration (mm/Blow)	CBR Value (Kleyn and Van Heereden)	CBR Value (TRL)
0	50	0		0	0		
5	144	94	94	5	18.8	10.0	13.6
5	223	173	79	10	15.8	12.5	16.3
5	300	250	77	15	15.4	12.9	16.8
5	378	328	78	20	15.6	12.7	16.6
5	467	417	89	25	17.8	10.8	14.4
5	**532**	**482**	**65**	**30**	**13**	**16.1**	**20.1**
5	637	587	105	35	21	8.7	12.1
5	682	632	45	40	9	25.7	29.6
5	724	674	42	45	8	28.1	31.8
5	760	710	36	50	7	34.2	37.5
5	800	750	40	55	8	29.9	33.5
5	842	792	42	60	8	28.1	31.8
5	900	850	58	65	12	18.6	22.6
5	950	900	50	70	10	22.5	26.5
5	995	945	45	75	9	25.7	29.6
5	1033	983	38	80	8	32.0	35.4

Test Location Kitye (Mbarara-Mirama)

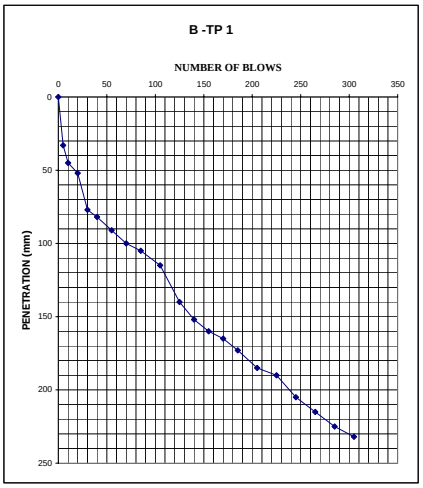
Test No M- TP 6

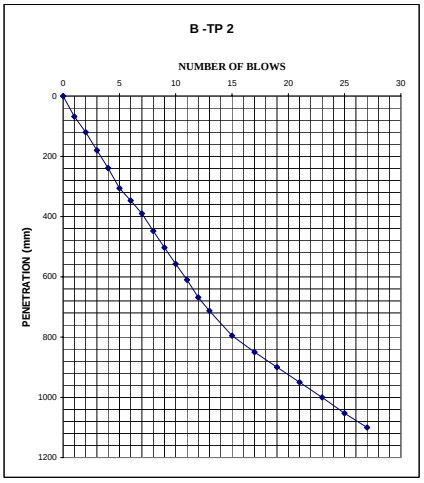
Zero Reading	44						
Number of Blows	Penetration/Depth (mm)	Penetration Corrected for Zero Reading	Penetration Depth per set of blows	Cummulative Blows	Rate of Penetration (mm/Blow)	CBR Value (Kleyn and Van Heereden)	CBR Value (TRL)
0	44	0		0	0		
10	105	61	61	10	6.1	42.3	44.7
10	142	98	37	20	3.7	80.3	75.8
10	177	133	35	30	3.5	86.2	80.3
10	200	156	23	40	2.3	147.6	125.2
10	227	183	27	50	2.7	120.2	105.7
10	250	206	23	60	2.3	147.6	125.2
10	264	220	14	70	1.4	278.6	211.6
15	**331**	**287**	**67**	**85**	**4.5**	**63.1**	**62.1**
20	378	334	47	105	2.35	143.6	122.4
20	445	401	67	125	3	91.2	84.1
20	529	485	84	145	4	68.3	66.3
20	590	546	61	165	3	102.8	92.9
20	622	578	32	185	2	234.8	183.8
20	640	596	18	205	1	490.4	337.6
20	693	649	53	225	3	123.1	107.8
20	760	716	67	245	3	91.2	84.1
20	798	754	38	265	2	188.4	153.2
20	848	804	50	285	3	132.6	114.7
20	917	873	69	305	3	87.8	81.6
20	990	946	73	325	4	81.7	76.9
10	1015	971	25	335	3	132.6	114.7

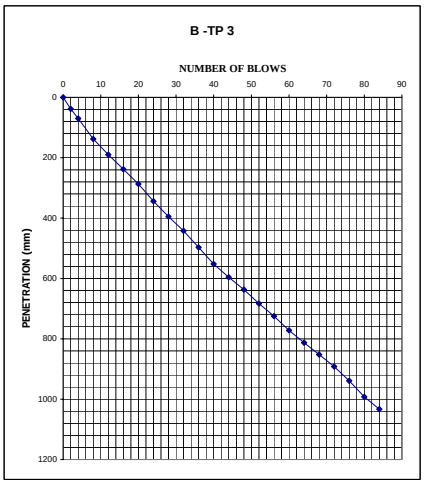
Test Location Rwembogo (Mbarara-Mirama)

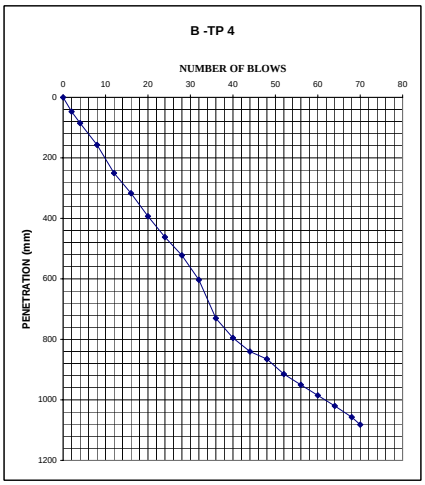
Test No M- TP 7

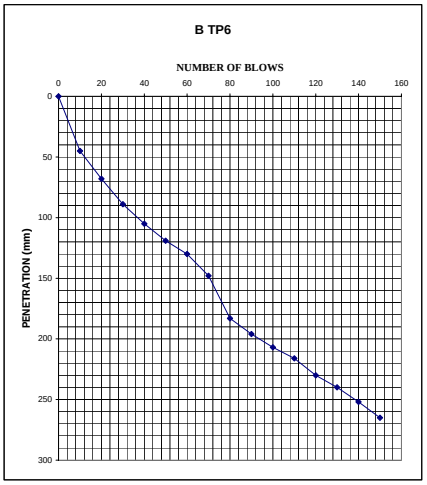
Zero Reading	30						
Number of Blows	Penetration/Depth (mm)	Penetration Corrected for Zero Reading	Penetration Depth per set of blows	Cummulative Blows	Rate of Penetration (mm/Blow)	CBR Value (Kleyn and Van Heereden)	CBR Value (TRL)
0	30	0		0	0		
10	90	60	60	10	6	43.2	45.4
10	123	93	33	20	3.3	93.0	85.5
15	146	116	23	35	1.5	248.0	192.2
10	172	142	26	45	2.6	126.1	110.0
10	**201**	**171**	**29**	**55**	**2.9**	**109.7**	**98.0**
10	231	201	30	65	3	105.0	94.6
10	262	232	31	75	3	100.7	91.3
10	290	260	28	85	3	114.7	101.7
10	320	290	30	95	3	105.0	94.6
10	350	320	30	105	3	105.0	94.6
10	380	350	30	115	3	105.0	94.6
10	410	380	30	125	3	105.0	94.6
10	440	410	30	135	3	105.0	94.6
10	466	436	26	145	3	126.1	110.0
20	525	495	59	165	3	107.3	96.2
20	585	555	60	185	3	105.0	94.6
20	642	612	57	205	3	112.1	99.8
20	694	664	52	225	3	126.1	110.0
20	745	715	51	245	3	129.3	112.3
20	790	760	45	265	2	151.8	128.2
20	845	815	55	285	3	117.4	103.7
20	900	870	55	305	3	117.4	103.7

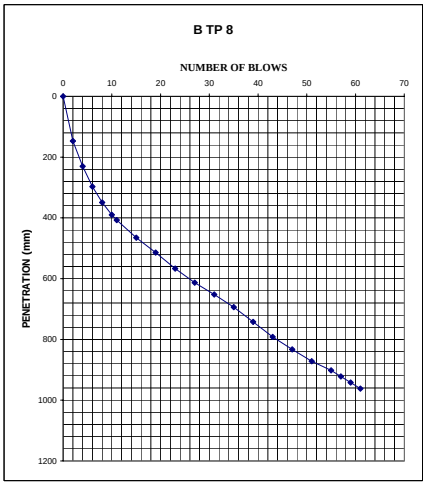

B -TP 1
NUMBER OF BLOWS
0
50
100
150
200
250
300
350
PENETRATION (mm)
0
50
100
150
200
250

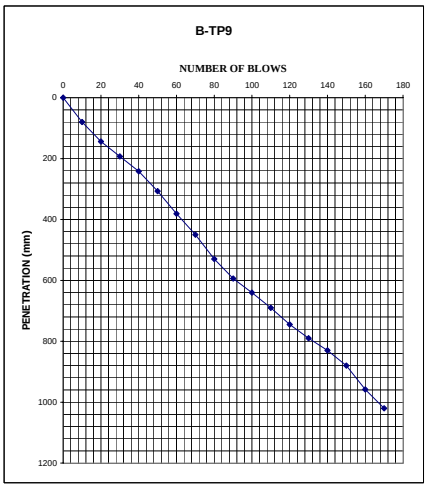

B -TP 2
NUMBER OF BLOWS
0
5
10
15
20
25
30
PENETRATION (mm)
0
200
400
600
800
1000
1200

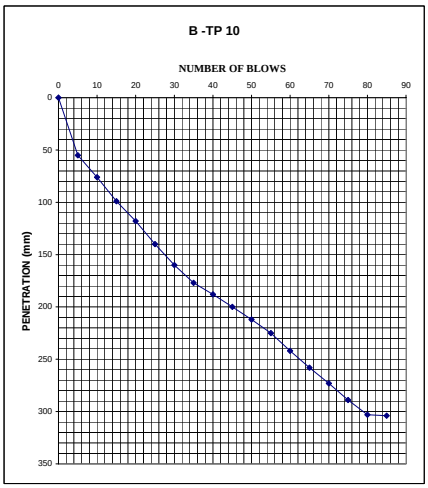

B -TP 3
NUMBER OF BLOWS
0
10
20
30
40
50
60
70
80
90
PENETRATION (mm)
0
200
400
600
800
1000
1200

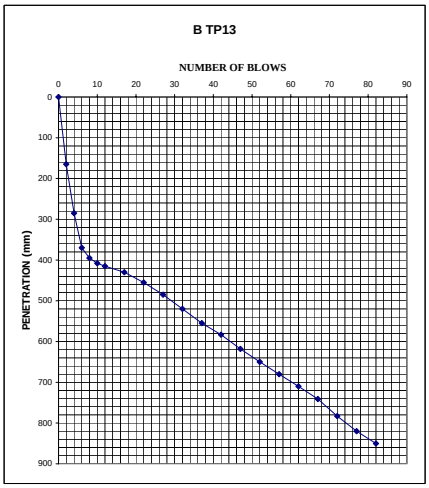

B -TP 4
NUMBER OF BLOWS
0
10
20
30
40
50
60
70
80
PENETRATION (mm)
0
200
400
600
800
1000
1200

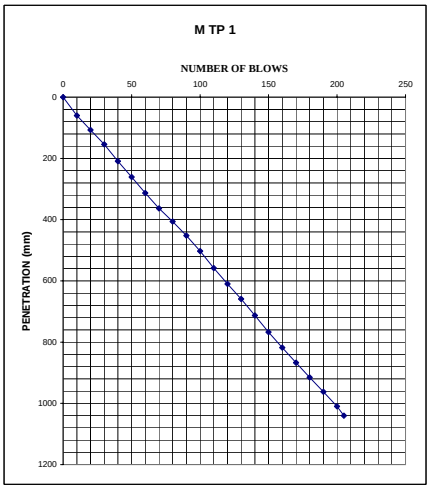

B TP6
NUMBER OF BLOWS
0 20 40 60 80 100 120 140 160
PENETRATION (mm)
0 50 100 150 200 250 300

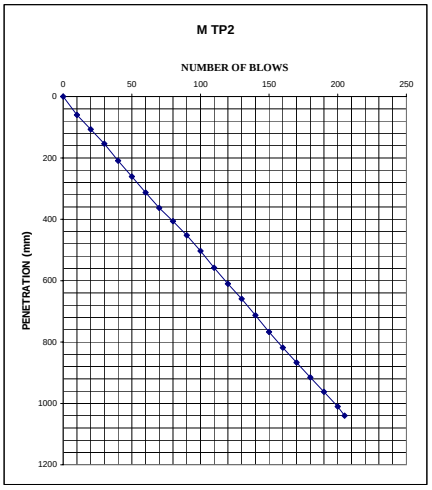

B TP 8
NUMBER OF BLOWS
0 10 20 30 40 50 60 70
PENETRATION (mm)
0 200 400 600 800 1000 1200

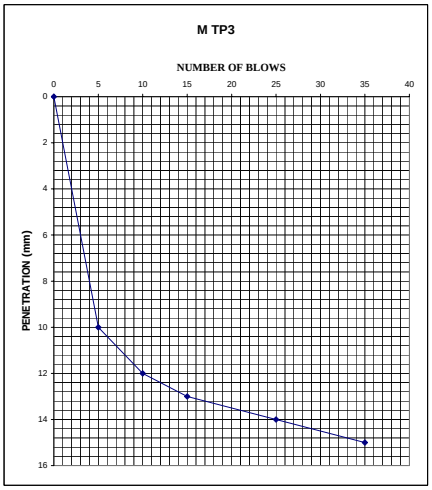

B-TP9
NUMBER OF BLOWS
0 20 40 60 80 100 120 140 160 180
PENETRATION (mm)
0 200 400 600 800 1000 1200

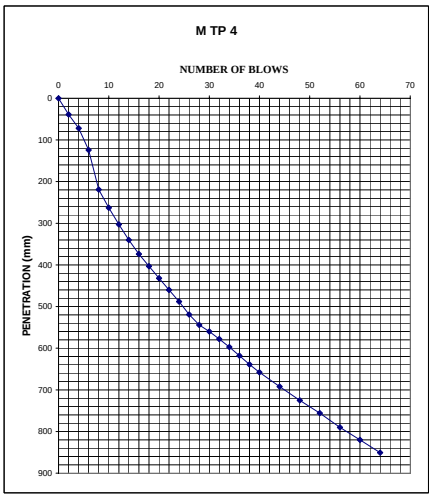

B -TP 10
NUMBER OF BLOWS
0 10 20 30 40 50 60 70 80 90
PENETRATION (mm)
0 50 100 150 200 250 300 350

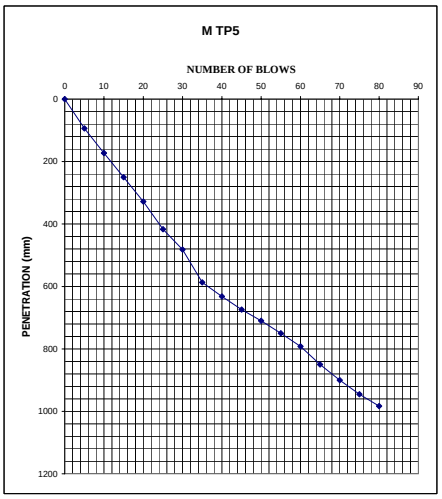

B TP13
NUMBER OF BLOWS
0 10 20 30 40 50 60 70 80 90
PENETRATION (mm)
0 100 200 300 400 500 600 700 800 900

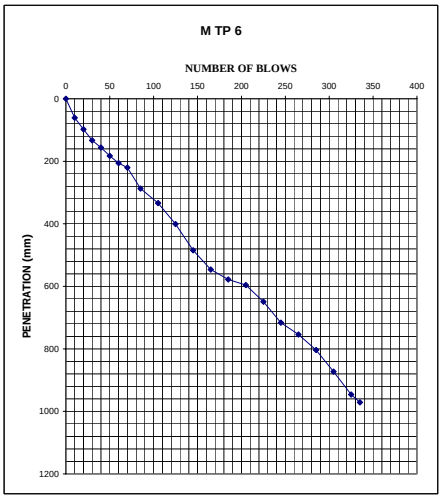

M TP 1
NUMBER OF BLOWS
0 50 100 150 200 250
PENETRATION (mm)
0 200 400 600 800 1000 1200

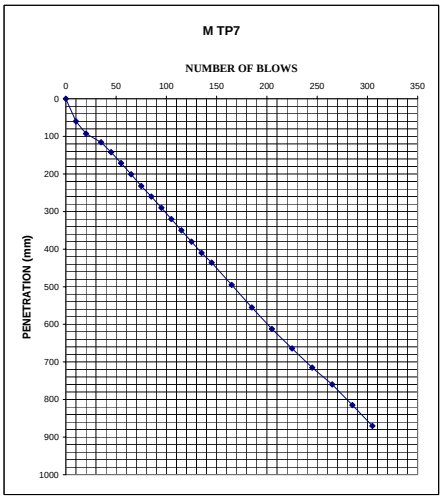

M TP2
NUMBER OF BLOWS
0 50 100 150 200 250
0 200 400 600 800 1000 1200
PENETRATION (mm)

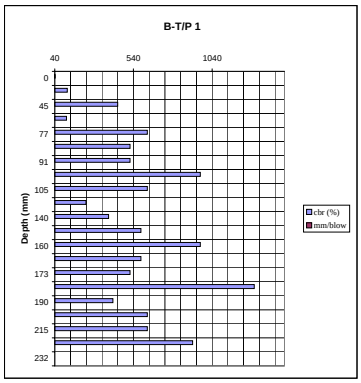

M TP3
NUMBER OF BLOWS
0 5 10 15 20 25 30 35 40
0 2 4 6 8 10 12 14 16
PENETRATION (mm)

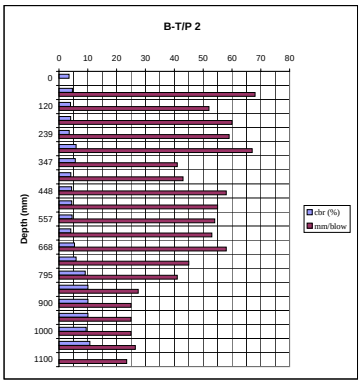

M TP 4
NUMBER OF BLOWS
0 10 20 30 40 50 60 70
0 100 200 300 400 500 600 700 800 900
PENETRATION (mm)

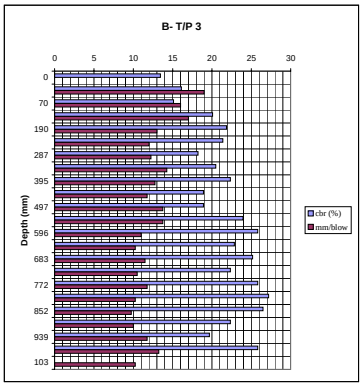

M TP5
NUMBER OF BLOWS
0 10 20 30 40 50 60 70 80 90
0 200 400 600 800 1000 1200
PENETRATION (mm)

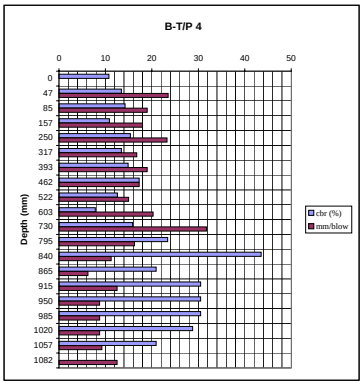

M TP 6
NUMBER OF BLOWS
0 50 100 150 200 250 300 350 400
0 200 400 600 800 1000 1200
PENETRATION (mm)

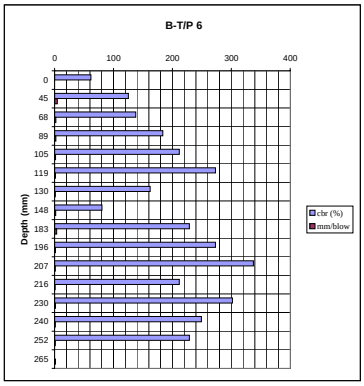

M TP7
NUMBER OF BLOWS
0 50 100 150 200 250 300 350
0 100 200 300 400 500 600 700 800 900 1000
PENETRATION (mm)

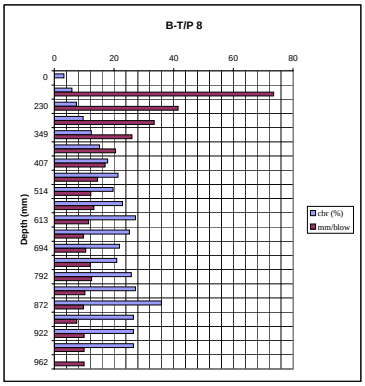

B-T/P 1
Depth (mm)
cbr (%)
mm/blow

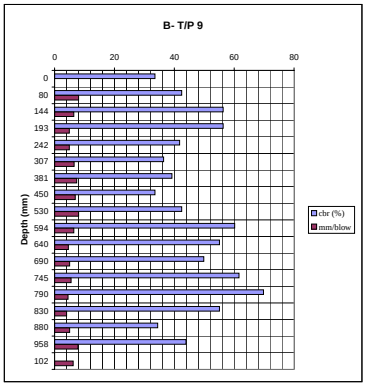

B-T/P 2
Depth (mm)
cbr (%)
mm/blow

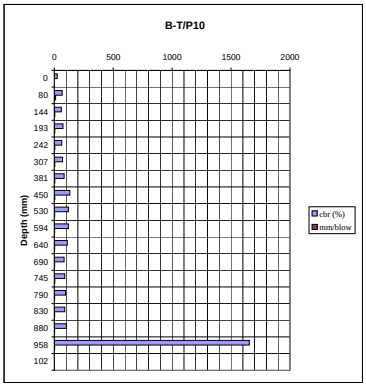

B- T/P 3
Depth (mm)
cbr (%)
mm/blow

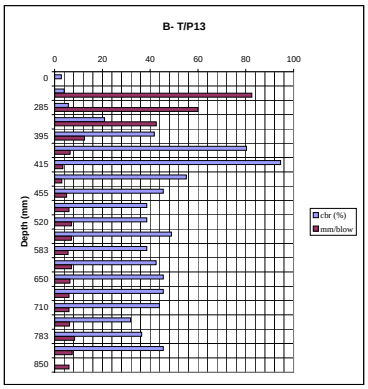

B-T/P 4
Depth (mm)
cbr (%)
mm/blow

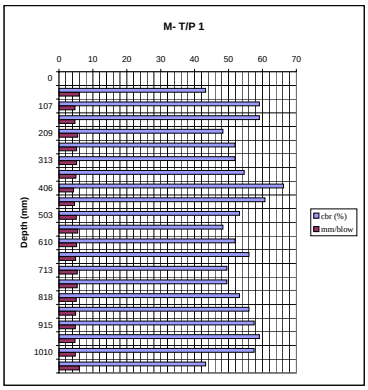

B-T/P 6
Depth (mm)
cbr (%)
mm/blow

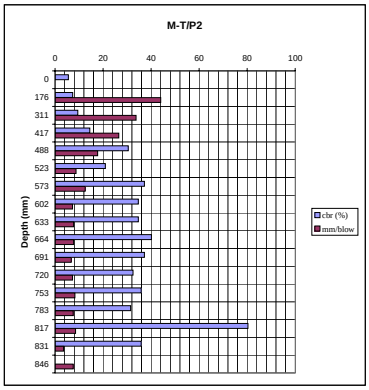

B-T/P 8
Depth (mm)
cbr (%)
mm/blow

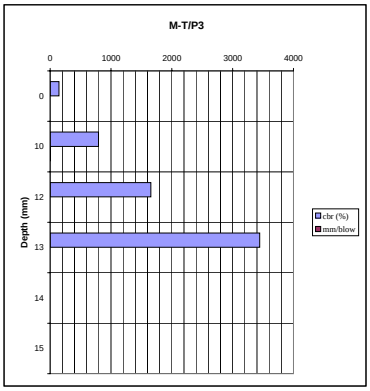

B- T/P 9
0
20
40
60
80
Depth (mm)
0
80
144
193
242
307
381
450
530
594
640
690
745
790
830
880
958
102
cbr (%)
mm/blow

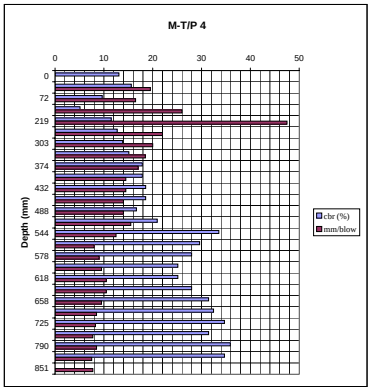

B-T/P10
0
500
1000
1500
2000
Depth (mm)
0
80
144
193
242
307
381
450
530
594
640
690
745
790
830
880
958
102
cbr (%)
mm/blow

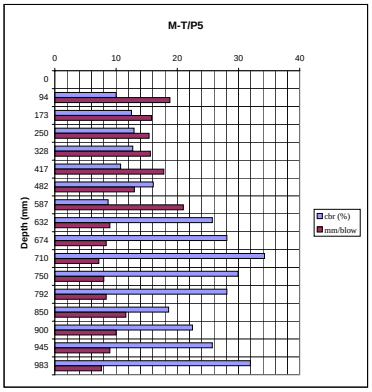

B- T/P13
0
20
40
60
80
100
Depth (mm)
0
285
395
415
455
520
583
650
710
783
850
cbr (%)
mm/blow

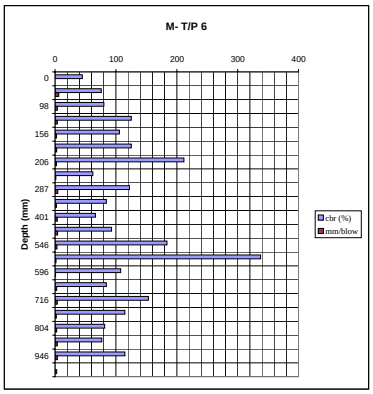

M- T/P 1
0
10
20
30
40
50
60
70
Depth (mm)
0
107
209
313
406
503
610
713
818
915
1010
cbr (%)
mm/blow

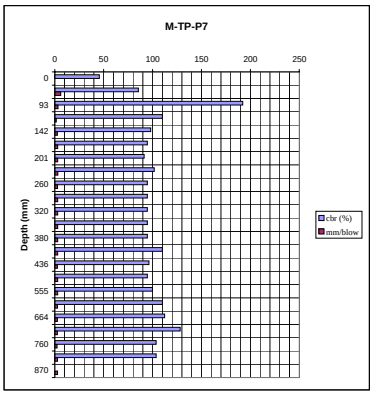

M-T/P2
0
20
40
60
80
100
Depth (mm)
0
176
311
417
488
523
573
602
633
664
691
720
753
783
817
831
846
cbr (%)
mm/blow


M-T/P3
0
1000
2000
3000
4000
Depth (mm)
0
10
12
13
14
15
cbr (%)
mm/blow


M-T/P 4
0
10
20
30
40
50
0
72
219
303
374
432
488
544
578
618
658
725
790
851
Depth (mm)
cbr (%)
mm/blow


M-T/P5
0
10
20
30
40
0
94
173
250
328
417
482
587
632
674
710
750
792
850
900
945
983
Depth (mm)
cbr (%)
mm/blow


M- T/P 6
0
100
200
300
400
0
98
156
206
287
401
546
596
716
804
946
Depth (mm)
cbr (%)
mm/blow


M-TP-P7
0
50
100
150
200
250
0
93
142
201
260
320
380
436
555
664
760
870
Depth (mm)
cbr (%)
mm/blow

Teclab ltd
THE ENGINEERS LABORATORY

EXCELLENCE THROUGH PRECISION AND INTEGRITY

DETERMINATION OF IN SITU DENSITY

Project: **Feasibility study on inteconnection transmission lines Uganda-Kenya & Uganda-Rwanda**

Client: M/s power networks (U)

Location:

Bulk Density of Sand **1.36** g/cm^3

Material Discription :

Method BS 1377- PART 9:1990

Material Source:

Date of Test

Test Pit Number		**B -1**	**B -2**	**B -3**	**B -4**	**B -5**	**B- 6**	**B- 7**	**B- 8**	**B- 9**	**B -10**
Depth of hole	(mm)	150	150	150	150		90			110	85
Mass of wet soil	(gms)	4600	3750	4580	3870	192	3240	134	198	3560	2270
Mass of sand before pouring in	(gms)	16800									
Mass of sand after pouring in hc	(gms)	11500	11430	11870	12820		13380			12370	13230
Mass of sand in hole and cone	(gms)	5300	5370	4930	3980		3420			4430	3570
Mass of sand in cone	(gms)	1402									
Mass of sand in hole	(gms)	3898	3968	3528	2578	160	2018	160	160	2168	2168
Volume of hole	(cm^3)	2866	2918	2594	1896	118	1484	118	118	1594	1594
Bulk density of soil	(Kg/m^3)	1605	1285	1766	2042	1632	2184	1139	1683	2233	1424
Moisture Content Determination											
Container Number		**PD**	**15**	**7B**	**70**	**4T**	**TI**	**5**	**WE**	109.0	10
Mass of wet soil + container	(gms)	148.8	152.2	102.8	156.5	181.5	149.3	195.8	**123.4**	71.7	116
Mass of dry soil + container	(gms)	138.6	127.3	90.0	135.2	163.0	138.4	178.9	**107.6**	66.4	111
Mass of Container		44.7	34.9	24.2	31.7	31.3	31.7	40.0	**18.3**	15.0	28
Moisture content	(%)	10.9	26.9	19.5	20.6	14.0	10.2	12.2	17.7	10.3	6.9
Dry density of soil from hole	(Kg/m^3)	1448	1012	1478	1693	1431	1981	1015	1430	2024	1332

Teclab ltd
THE ENGINEERS LABORATORY

EXCELLENCE THROUGH PRECISION AND INTEGRITY

DETERMINATION OF IN SITU DENSITY

Project: **Client:**

Location: **Bulk Density of Sand** **1.36** g/cm^3

Material Discription : **Method** BS 1377- PART 9:1990

Material Source: **Date of Test**

Test Pit Number		**B-12**	**B- 13**	**M- 1**	**M-2**	**M-3**	**M-4**	**M-5**	**M-6**	**M-7**
Depth of hole	(mm)	100	150	80				80	90	80
Mass of wet soil	(gms)	2030	5010	2730	214		180	2235	2400	2640
Mass of sand before pouring in hole	(gms)	16800								
Mass of sand after pouring in hole	(gms)	12670	11640	13535		9550		13280	13120	13525
Mass of sand in hole and cone	(gms)	4130	5160	3265		7250		3520	3680	3275
Mass of sand in cone	(gms)	1402								
Mass of sand in hole	(gms)	2728	3758	1863	160	5848	160	2118	2278	1873
Volume of hole	(cm^3)	2006	2763	1370	118	4300	118	1557	1675	1377
Bulk density of soil	(Kg/m^3)	1012	1813	1993	1819	#VALEUR!	1530	1435	1433	1917
Moisture Content Determination										
Container Number		**42**	**RI**	**AQ**	**1B**	**19**	**7**	**HP**	**BA11**	**AY**
Mass of wet soil + container	(gms)	137.1	151.8	126.5	147.0	147.5	148.1	147.4	182.8	161.3
Mass of dry soil + container	(gms)	126.9	139.7	116.1	125.4	133.3	116.0	129.2	167.7	148.9
Mass of Container		16.6	34.1	17.5	15.0	47.5	46.5	38.1	48.6	29.2
Moisture content	(%)	9.2	11.5	10.5	19.6	16.6	46.2	20.0	12.7	10.4
Dry density of soil from hole	(Kg/m^3)	926	1627	1803	1521	#VALEUR!	1047	1196	1272	1737

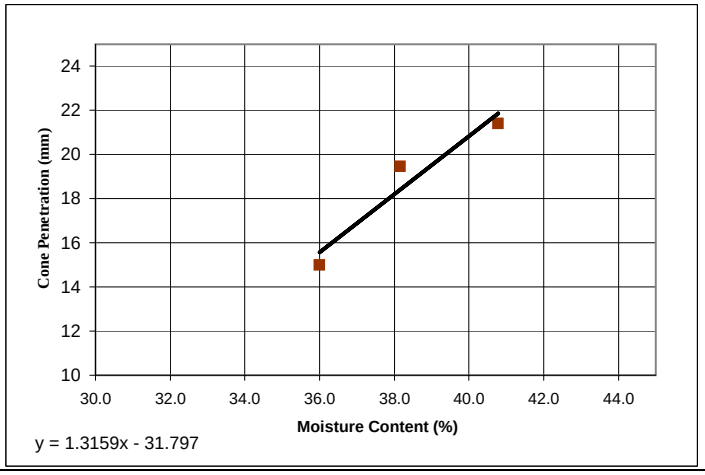
S.P. Kisitu
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	B tp 1	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		Y	KD			
Mass of wet soil + container	g	11.5	17.00			
Mass of dry soil + container	g	10.0	15.50			
Mass of container	g	3.8	9.20			
Mass of moisture	g	1.50	1.50			
Mass of dry soil	g	6.20	6.30			
Moisture content	%	24.19	23.81			24.00

LIQUID LIMIT		1		2		3		4		5	
Initial dial gauge reading	mm	0	0	0	0	0	0				
Final dial gauge reading	mm	15	15	19.5	19.4	21.3	21.5				
Cone Penetration	mm	15	15	19.5	19.4	21.3	21.5				
Average cone penetration	mm	15		19.45		21.4					
Container no.		M		702		W					
Mass of wet soil + container	g	36.7		43.90		45.30					
Mass of dry soil + container	g	29.5		34.40		34.90					
Mass of container	g	9.5		9.50		9.40					
Mass of moisture	g	7.20		9.50		10.40					
Mass of dry soil	g	20.00		24.90		25.50					
Moisture content	%	36.0		38.2		40.8					



LIQUID LIMIT	38.8	%
PLASTIC LIMIT	24.0	%
PLASTICITY INDEX	14.8	%

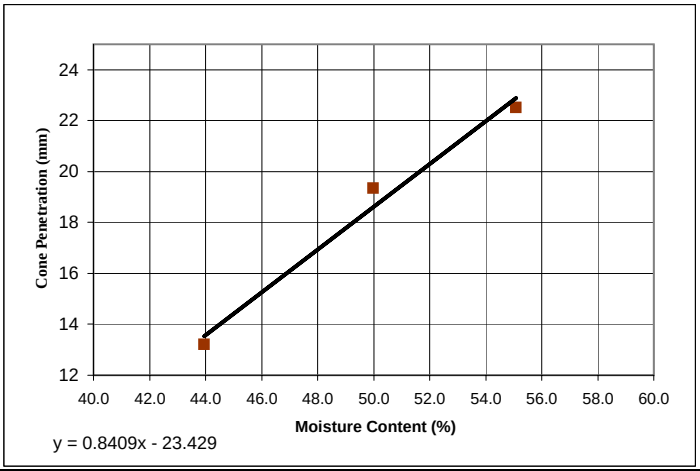
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**
Location:	B TP2
Sample Source:	
Soil Description	
Sampling Date:	
Test Method	BS1377 part 2 1990.
Testing Date:	
Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		B1	BJ			
Mass of wet soil + container	g	15.20	14.10			
Mass of dry soil + container	g	14.00	13.20			
Mass of container	g	9.50	9.50			
Mass of moisture	g	1.20	0.90			
Mass of dry soil	g	4.50	3.70			
Moisture content	%	26.67	24.32			25.50

LIQUID LIMIT		1		2		3		4		5	
Initial dial gauge reading	mm	0	0	0	0	0	0				
Final dial gauge reading	mm	13.2	13.2	19.2	19.5	22.5	22.5				
Cone Penetration	mm	13.2	13.2	19.2	19.5	22.5	22.5				
Average cone penetration	mm	13.2		19.35		22.5					
Container no.		117		702		65					
Mass of wet soil + container	g	40.9		26.90		40.70					
Mass of dry soil + container	g	32.9		21.10		31.50					
Mass of container	g	14.7		9.50		14.80					
Mass of moisture	g	8.00		5.80		9.20					
Mass of dry soil	g	18.20		11.60		16.70					
Moisture content	%	44.0		50.0		55.1					



LIQUID LIMIT	51.8	%
PLASTIC LIMIT	25.5	%
PLASTICITY INDEX	26.3	%

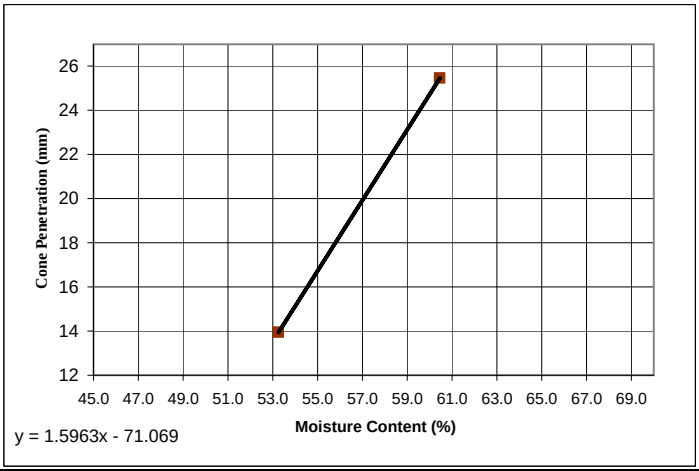
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	B TP3	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		KD	BU			
Mass of wet soil + container	g	16.20	16.00			
Mass of dry soil + container	g	14.60	14.60			
Mass of container	g	9.10	9.80			
Mass of moisture	g	1.60	1.40			
Mass of dry soil	g	5.50	4.80			
Moisture content	%	29.09	29.17			29.13

LIQUID LIMIT		1		2		3	4		5	
Initial dial gauge reading	mm	0	0	0	0					
Final dial gauge reading	mm	13.9	14	25.4	25.5					
Cone Penetration	mm	13.9	14	25.4	25.5					
Average cone penetration	mm	13.95		25.45						
Container no.		10		OO						
Mass of wet soil + container	g	42.9		43.10						
Mass of dry soil + container	g	33.1		32.70						
Mass of container	g	14.7		15.50						
Mass of moisture	g	9.80		10.40						
Mass of dry soil	g	18.40		17.20						
Moisture content	%	53.3		60.5						



LIQUID LIMIT	57.0	%
PLASTIC LIMIT	29.1	%
PLASTICITY INDEX	27.9	%

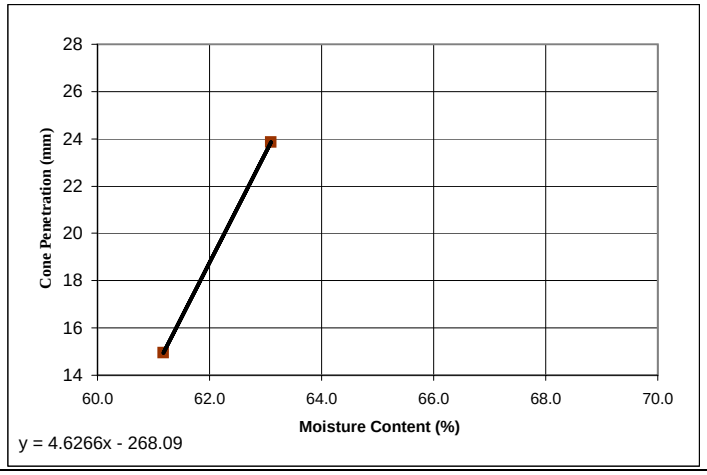
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	B TP4	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		Y	503			
Mass of wet soil + container	g	9.90	10.30			
Mass of dry soil + container	g	8.50	8.80			
Mass of container	g	3.80	3.80			
Mass of moisture	g	1.40	1.50			
Mass of dry soil	g	4.70	5.00			
Moisture content	%	29.79	30.00			29.89

LIQUID LIMIT		1		2		3		4		5	
Initial dial gauge reading	mm	0	0	0	0						
Final dial gauge reading	mm	15.0	14.9	23.8	23.9						
Cone Penetration	mm	15.0	14.9	23.8	23.9						
Average cone penetration	mm	14.95		23.85							
Container no.		642		6300							
Mass of wet soil + container	g	37		29.60							
Mass of dry soil + container	g	26.6		21.79							
Mass of container	g	9.6		9.40							
Mass of moisture	g	10.40		7.81							
Mass of dry soil	g	17.00		12.39							
Moisture content	%	61.2		63.1							



LIQUID LIMIT	62.3	%
PLASTIC LIMIT	29.9	%
PLASTICITY INDEX	32.4	%

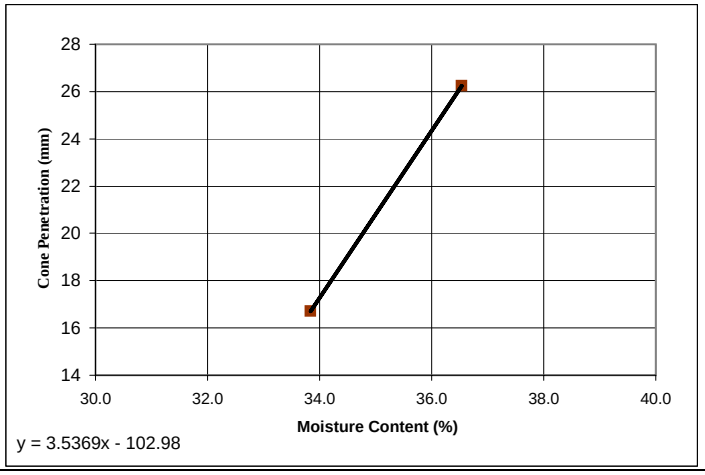
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**
Location:	B TP6
Soil Description	
Sample Source:	
Sampling Date:	
Testing Date:	
Test Method	BS1377 part 2 1990.
Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		O	PO			
Mass of wet soil + container	g	17.60	15.10			
Mass of dry soil + container	g	16.20	14.20			
Mass of container	g	9.20	9.40			
Mass of moisture	g	1.40	0.90			
Mass of dry soil	g	7.00	4.80			
Moisture content	%	20.00	18.75			19.38

LIQUID LIMIT		1		2		3	4		5	
Initial dial gauge reading	mm	0	0	0	0					
Final dial gauge reading	mm	16.7	16.7	26.3	26.2					
Cone Penetration	mm	16.7	16.7	26.3	26.2					
Average cone penetration	mm	16.7		26.25						
Container no.		BU		Y						
Mass of wet soil + container	g	36.3		37.90						
Mass of dry soil + container	g	29.6		30.30						
Mass of container	g	9.8		9.50						
Mass of moisture	g	6.70		7.60						
Mass of dry soil	g	19.80		20.80						
Moisture content	%	33.8		36.5						



LIQUID LIMIT	34.8	%
PLASTIC LIMIT	19.4	%
PLASTICITY INDEX	15.4	%

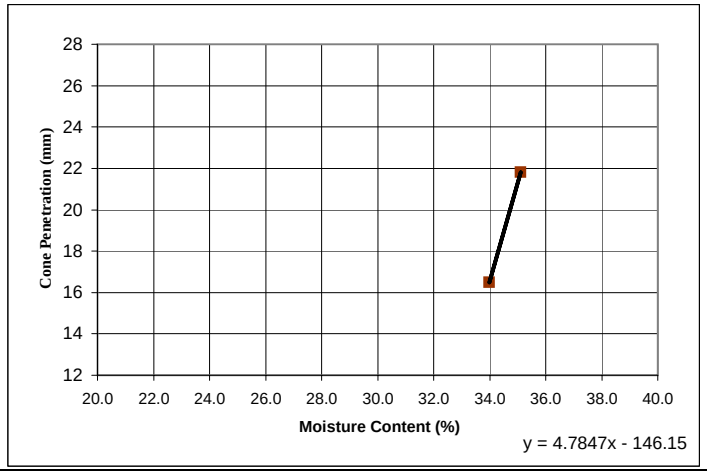
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	B TP8	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		VD	I			
Mass of wet soil + container	g	10.50	9.70			
Mass of dry soil + container	g	9.50	8.80			
Mass of container	g	4.00	3.80			
Mass of moisture	g	1.00	0.90			
Mass of dry soil	g	5.50	5.00			
Moisture content	%	18.18	18.00			18.09

LIQUID LIMIT		1		2		3		4		5	
Initial dial gauge reading	mm	0	0	0	0	0	0				
Final dial gauge reading	mm	16.5	16.5	21.8	21.8						
Cone Penetration	mm	16.5	16.5	21.8	21.8						
Average cone penetration	mm	16.5		21.8							
Container no.		Z2		6300							
Mass of wet soil + container	g	53		42.50							
Mass of dry soil + container	g	41.0		33.90							
Mass of container	g	5.7		9.40							
Mass of moisture	g	12.00		8.60							
Mass of dry soil	g	35.30		24.50							
Moisture content	%	34.0		35.1							



LIQUID LIMIT	34.7	%
PLASTIC LIMIT	18.1	%
PLASTICITY INDEX	16.6	%

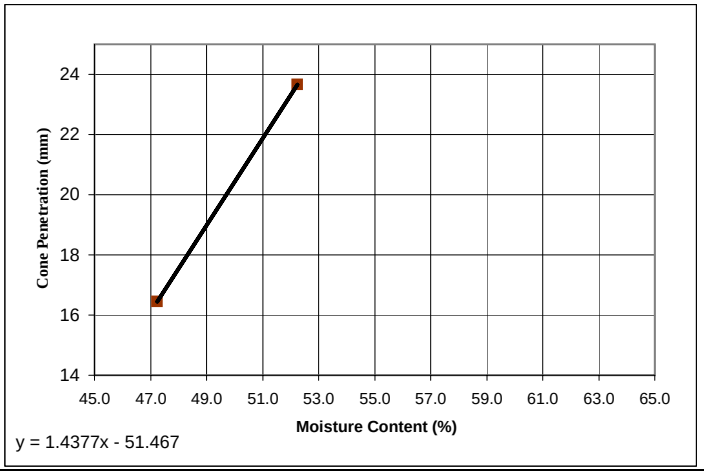
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	B TP9	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		SNO	182			
Mass of wet soil + container	g	9.50	13.20			
Mass of dry soil + container	g	8.20	11.40			
Mass of container	g	3.70	5.00			
Mass of moisture	g	1.30	1.80			
Mass of dry soil	g	4.50	6.40			
Moisture content	%	28.89	28.13			28.51

LIQUID LIMIT		1		2		3	4		5	
Initial dial gauge reading	mm	0	0	0	0					
Final dial gauge reading	mm	16.5	16.4	23.7	23.6					
Cone Penetration	mm	16.5	16.4	23.7	23.6					
Average cone penetration	mm	16.45		23.65						
Container no.		600		TU						
Mass of wet soil + container	g	33.6		36.50						
Mass of dry soil + container	g	25.9		27.20						
Mass of container	g	9.6		9.40						
Mass of moisture	g	7.70		9.30						
Mass of dry soil	g	16.30		17.80						
Moisture content	%	47.2		52.2						



LIQUID LIMIT	49.7	%
PLASTIC LIMIT	28.5	%
PLASTICITY INDEX	21.2	%

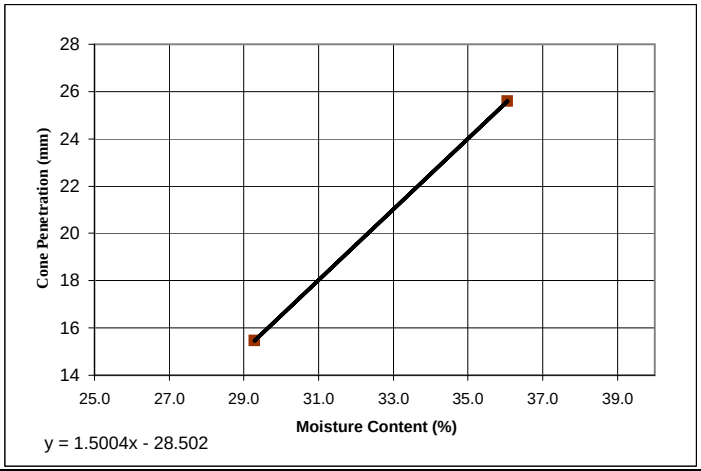
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	B TP11	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.						
Mass of wet soil + container	g					
Mass of dry soil + container	g					
Mass of container	g					
Mass of moisture	g					
Mass of dry soil	g					
Moisture content	%					#DIV/0!

LIQUID LIMIT		1		2		3		4		5	
Initial dial gauge reading	mm	0	0	0	0						
Final dial gauge reading	mm	15.5	15.4	25.7	25.5						
Cone Penetration	mm	15.5	15.4	25.7	25.5						
Average cone penetration	mm	15.45		25.6							
Container no.		L		Y							
Mass of wet soil + container	g	35.4		37.80							
Mass of dry soil + container	g	29.6		30.30							
Mass of container	g	9.8		9.50							
Mass of moisture	g	5.80		7.50							
Mass of dry soil	g	19.80		20.80							
Moisture content	%	29.3		36.1							



LIQUID LIMIT	32.3	%
PLASTIC LIMIT	#DIV/0!	%
PLASTICITY INDEX	Non plastic	%

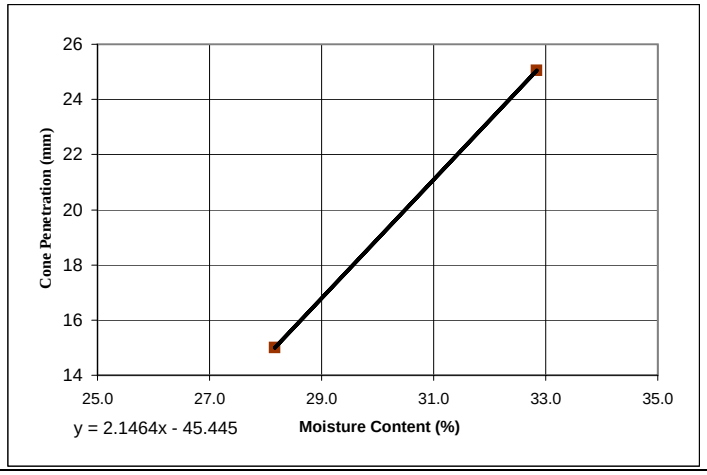
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	B TP12	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.						
Mass of wet soil + container	g					
Mass of dry soil + container	g					
Mass of container	g					
Mass of moisture	g					
Mass of dry soil	g					
Moisture content	%					#DIV/0!

LIQUID LIMIT		1		2		3	4		5	
Initial dial gauge reading	mm	0	0	0	0					
Final dial gauge reading	mm	15.0	15	25.0	25.1					
Cone Penetration	mm	15.0	15	25	25.1					
Average cone penetration	mm	15		25.05						
Container no.		SNO		TU						
Mass of wet soil + container	g	26		36.70						
Mass of dry soil + container	g	21.1		30.00						
Mass of container	g	3.7		9.60						
Mass of moisture	g	4.90		6.70						
Mass of dry soil	g	17.40		20.40						
Moisture content	%	28.2		32.8						



LIQUID LIMIT	30.5	%
PLASTIC LIMIT	#DIV/0!	%
PLASTICITY INDEX	Non plastic	%

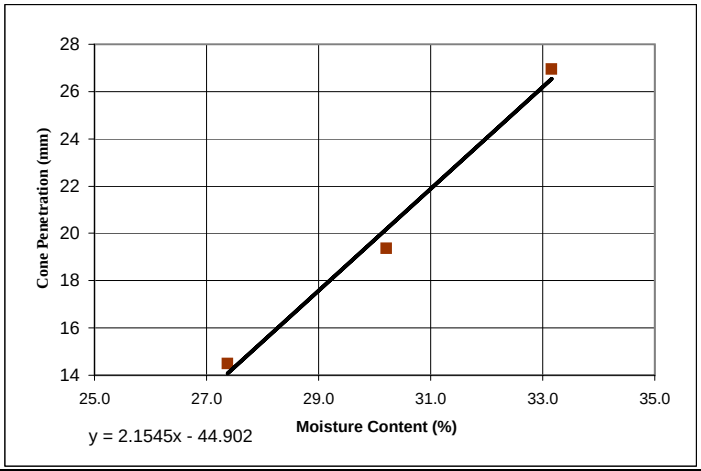
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	B TP13	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		204	182			
Mass of wet soil + container	g	12.60	11.80			
Mass of dry soil + container	g	11.50	10.70			
Mass of container	g	5.40	4.90			
Mass of moisture	g	1.10	1.10			
Mass of dry soil	g	6.10	5.80			
Moisture content	%	18.03	18.97			18.50

LIQUID LIMIT		1		2		3		4		5	
Initial dial gauge reading	mm	0	0	0	0	0	0				
Final dial gauge reading	mm	14.5	14.5	19.5	19.2	27	27				
Cone Penetration	mm	14.5	14.5	19.5	19.2	26.9	27				
Average cone penetration	mm	14.5		19.35		26.95					
Container no.		LN		I		620					
Mass of wet soil + container	g	44.3		40.00		34.60					
Mass of dry soil + container	g	36.8		32.90		28.30					
Mass of container	g	9.4		9.40		9.30					
Mass of moisture	g	7.50		7.10		6.30					
Mass of dry soil	g	27.40		23.50		19.00					
Moisture content	%	27.4		30.2		33.2					



LIQUID LIMIT	30.1	%
PLASTIC LIMIT	18.5	%
PLASTICITY INDEX	11.6	%

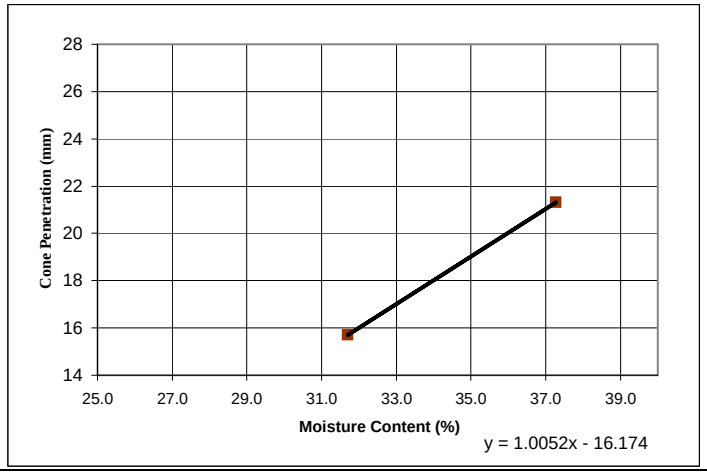
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	M TP1	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		O	W			
Mass of wet soil + container	g	16.50	18.00			
Mass of dry soil + container	g	15.30	16.40			
Mass of container	g	9.20	9.40			
Mass of moisture	g	1.20	1.60			
Mass of dry soil	g	6.10	7.00			
Moisture content	%	19.67	22.86			21.26

LIQUID LIMIT		1		2		3		4		5	
Initial dial gauge reading	mm	0	0	0	0	0	0				
Final dial gauge reading	mm	15.5	15.9	21.4	21.2						
Cone Penetration	mm	15.5	15.9	21.4	21.2						
Average cone penetration	mm	15.7		21.3							
Container no.		KA		BH							
Mass of wet soil + container	g	25.2		32.50							
Mass of dry soil + container	g	20		26.20							
Mass of container	g	3.6		9.30							
Mass of moisture	g	5.20		6.30							
Mass of dry soil	g	16.40		16.90							
Moisture content	%	31.7		37.3							



LIQUID LIMIT	36.0	%
PLASTIC LIMIT	21.3	%
PLASTICITY INDEX	14.7	%

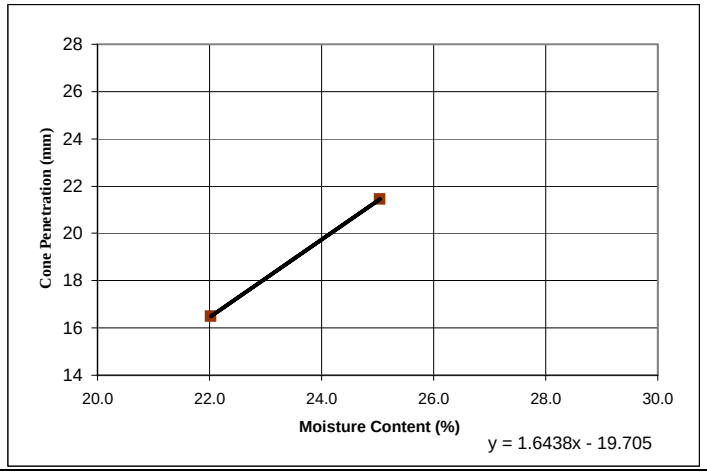
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	M TP2	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		ka	XB			
Mass of wet soil + container	g	11.70	11.40			
Mass of dry soil + container	g	11.00	10.60			
Mass of container	g	3.60	4.00			
Mass of moisture	g	0.70	0.80			
Mass of dry soil	g	7.40	6.60			
Moisture content	%	9.46	12.12			10.79

LIQUID LIMIT		1		2		3		4		5	
Initial dial gauge reading	mm	0	0	0	0	0	0				
Final dial gauge reading	mm	16.4	16.6	21.4	21.5						
Cone Penetration	mm	16.4	16.6	21.4	21.5						
Average cone penetration	mm	16.5		21.45							
Container no.		204		182							
Mass of wet soil + container	g	53.7		47.50							
Mass of dry soil + container	g	45		38.97							
Mass of container	g	5.5		4.90							
Mass of moisture	g	8.70		8.53							
Mass of dry soil	g	39.50		34.07							
Moisture content	%	22.0		25.0							



LIQUID LIMIT	24.2	%
PLASTIC LIMIT	10.8	%
PLASTICITY INDEX	13.4	%

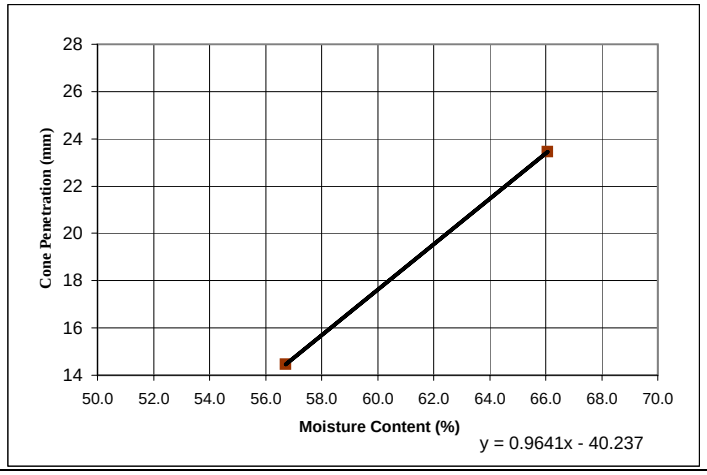
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	M TP 4	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		SNO	620			
Mass of wet soil + container	g	10.70	14.30			
Mass of dry soil + container	g	9.30	13.30			
Mass of container	g	3.70	9.30			
Mass of moisture	g	1.40	1.00			
Mass of dry soil	g	5.60	4.00			
Moisture content	%	25.00	25.00			25.00

LIQUID LIMIT		1		2		3		4		5	
Initial dial gauge reading	mm	0	0	0	0	0	0				
Final dial gauge reading	mm	14.5	14.4	23.4	23.5						
Cone Penetration	mm	14.5	14.4	23.4	23.5						
Average cone penetration	mm	14.45		23.45							
Container no.		Y		503							
Mass of wet soil + container	g	30.6		31.20							
Mass of dry soil + container	g	20.9		20.30							
Mass of container	g	3.8		3.80							
Mass of moisture	g	9.70		10.90							
Mass of dry soil	g	17.10		16.50							
Moisture content	%	56.7		66.1							



LIQUID LIMIT	62.5	%
PLASTIC LIMIT	25.0	%
PLASTICITY INDEX	37.5	%

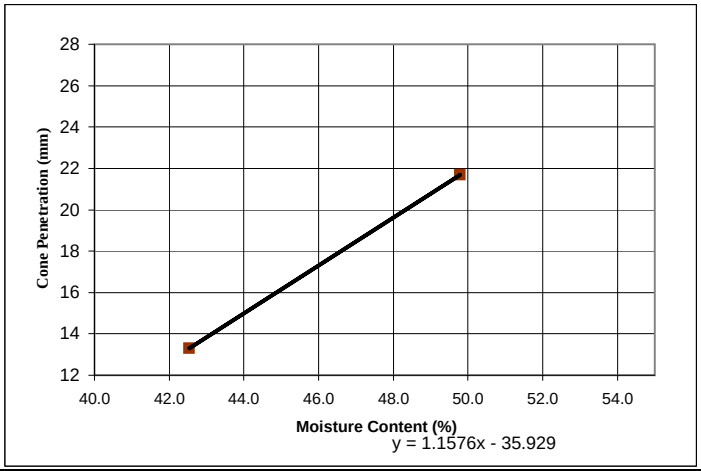
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	M TP5	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		Z	187			
Mass of wet soil + container	g	12.50	13.80			
Mass of dry soil + container	g	10.70	11.70			
Mass of container	g	5.10	5.40			
Mass of moisture	g	1.80	2.10			
Mass of dry soil	g	5.60	6.30			
Moisture content	%	32.14	33.33			32.74

LIQUID LIMIT		1		2		3		4		5	
Initial dial gauge reading	mm	0	0	0	0	0	0				
Final dial gauge reading	mm	13.4	13.2	21.7	21.7						
Cone Penetration	mm	13.4	13.2	21.7	21.7						
Average cone penetration	mm	13.3		21.7							
Container no.		642		TU							
Mass of wet soil + container	g	34.4		44.50							
Mass of dry soil + container	g	27		32.90							
Mass of container	g	9.6		9.60							
Mass of moisture	g	7.40		11.60							
Mass of dry soil	g	17.40		23.30							
Moisture content	%	42.5		49.8							



LIQUID LIMIT	48.3	%
PLASTIC LIMIT	32.7	%
PLASTICITY INDEX	15.6	%

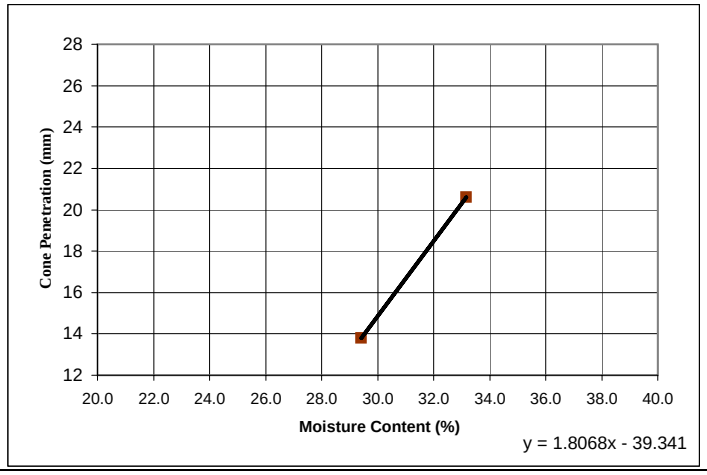
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	M-TP 6	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		503	204			
Mass of wet soil + container	g	12.80	14.90			
Mass of dry soil + container	g	11.20	13.20			
Mass of container	g	3.80	5.30			
Mass of moisture	g	1.60	1.70			
Mass of dry soil	g	7.40	7.90			
Moisture content	%	21.62	21.52			21.57

LIQUID LIMIT		1		2		3		4		5	
Initial dial gauge reading	mm	0	0	0	0	0	0				
Final dial gauge reading	mm	13.7	13.9	20.4	20.8						
Cone Penetration	mm	13.7	13.9	20.4	20.8						
Average cone penetration	mm	13.8		20.6							
Container no.		620		LN							
Mass of wet soil + container	g	44.9		37.50							
Mass of dry soil + container	g	36.9		30.50							
Mass of container	g	9.7		9.40							
Mass of moisture	g	8.00		7.00							
Mass of dry soil	g	27.20		21.10							
Moisture content	%	29.4		33.2							



LIQUID LIMIT	32.8	%
PLASTIC LIMIT	21.6	%
PLASTICITY INDEX	11.3	%

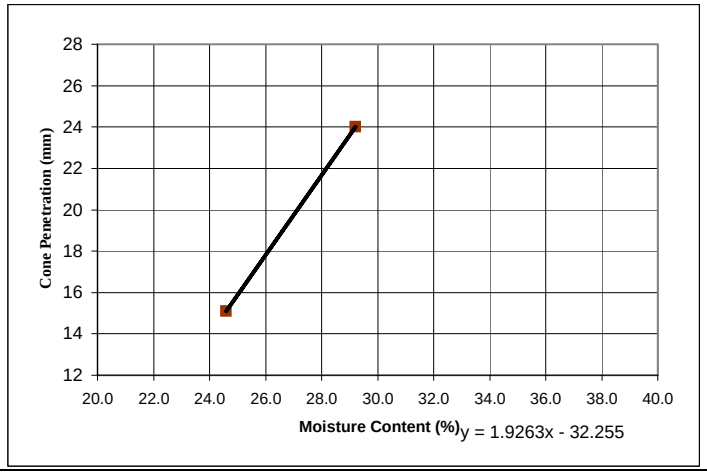
Checked by: *S.P.Kisitu*
Laboratory Engineer

PLASTIC LIMIT AND LIQUID LIMIT (CONE PENETROMETER)

Project:	**Feasibility study on inteconnection Transmission Lines Uganda-Kenya & Uganda- Rwanda**		
Location:	M TP7	Sample Source:	
Soil Description			
Sampling Date:		Test Method	BS1377 part 2 1990.
Testing Date:		Technician	Marriam.

PLASTIC LIMIT	Test no.	1	2	3	4	Average
Contauner no.		Y	600			
Mass of wet soil + container	g	16.80	16.10			
Mass of dry soil + container	g	15.80	15.23			
Mass of container	g	9.50	9.60			
Mass of moisture	g	1.00	0.87			
Mass of dry soil	g	6.30	5.63			
Moisture content	%	15.87	15.45			15.66

LIQUID LIMIT		1		2		3		4		5	
Initial dial gauge reading	mm	0	0	0	0	0	0				
Final dial gauge reading	mm	15.0	15.2	23.9	24.1						
Cone Penetration	mm	15	15.2	23.9	24.1						
Average cone penetration	mm	15.1		24							
Container no.		36		Z2							
Mass of wet soil + container	g	44.9		49.50							
Mass of dry soil + container	g	39.0		39.60							
Mass of container	g	15.0		5.70							
Mass of moisture	g	5.90		9.90							
Mass of dry soil	g	24.00		33.90							
Moisture content	%	24.6		29.2							

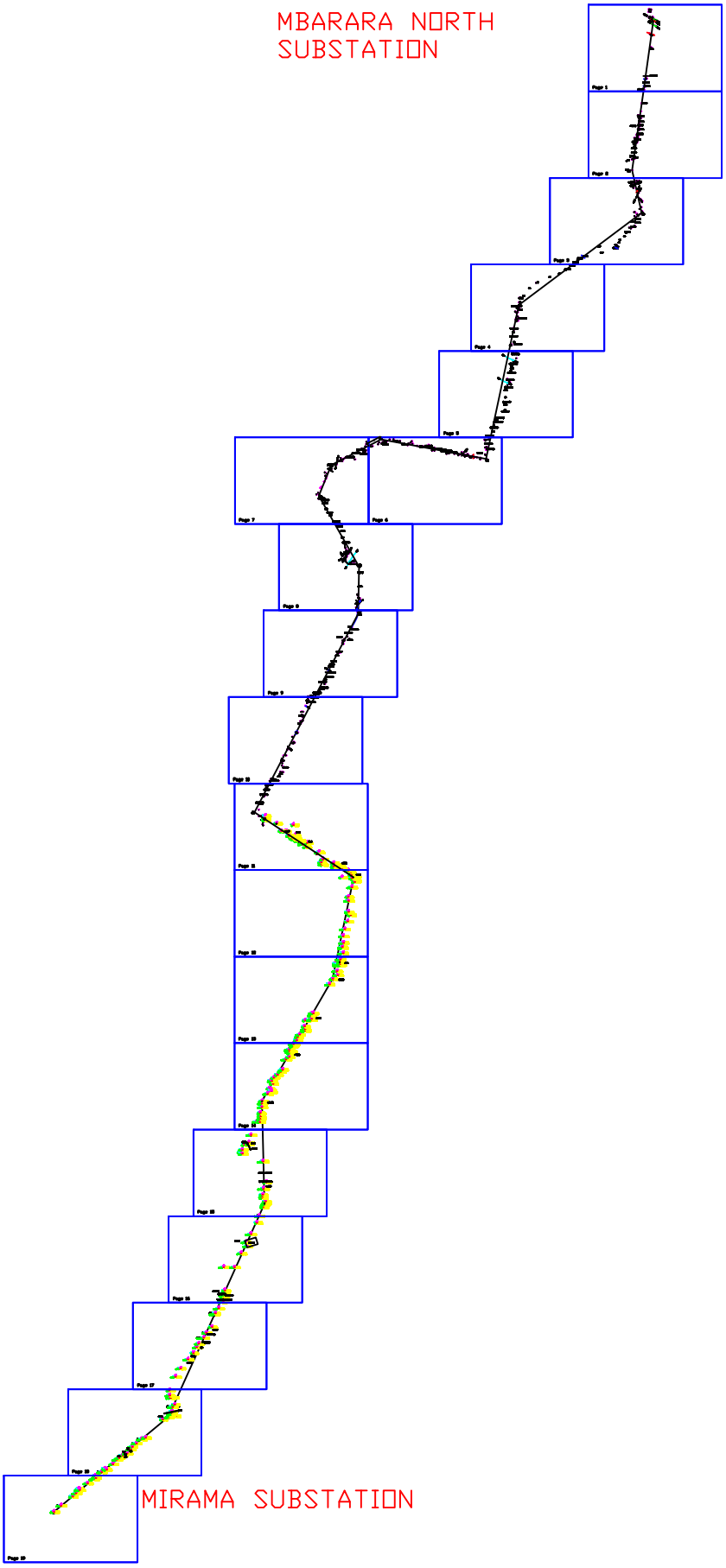


LIQUID LIMIT	27.1	%
PLASTIC LIMIT	15.7	%
PLASTICITY INDEX	11.5	%

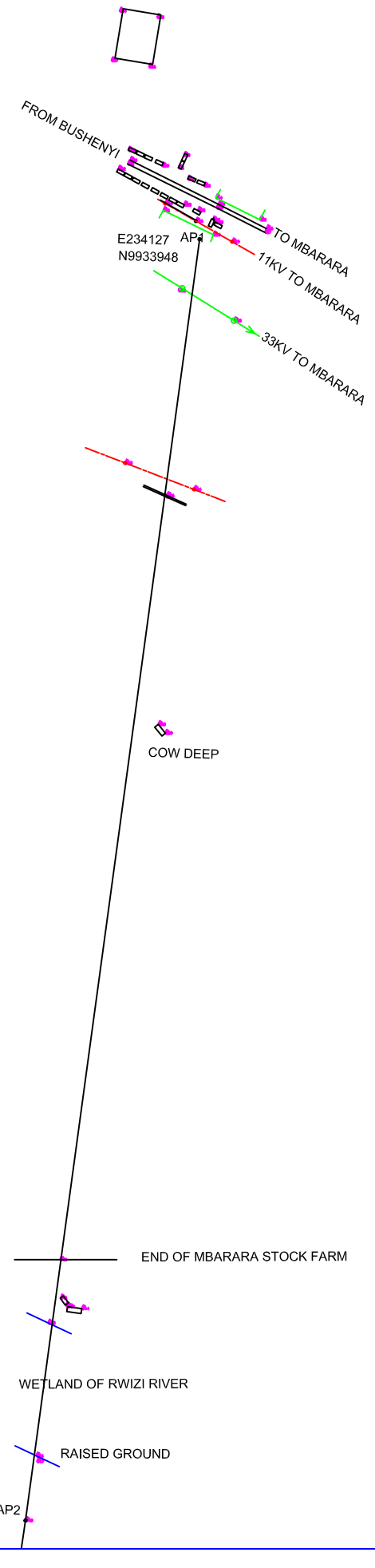
Checked by: *S.P.Kisitu*
Laboratory Engineer

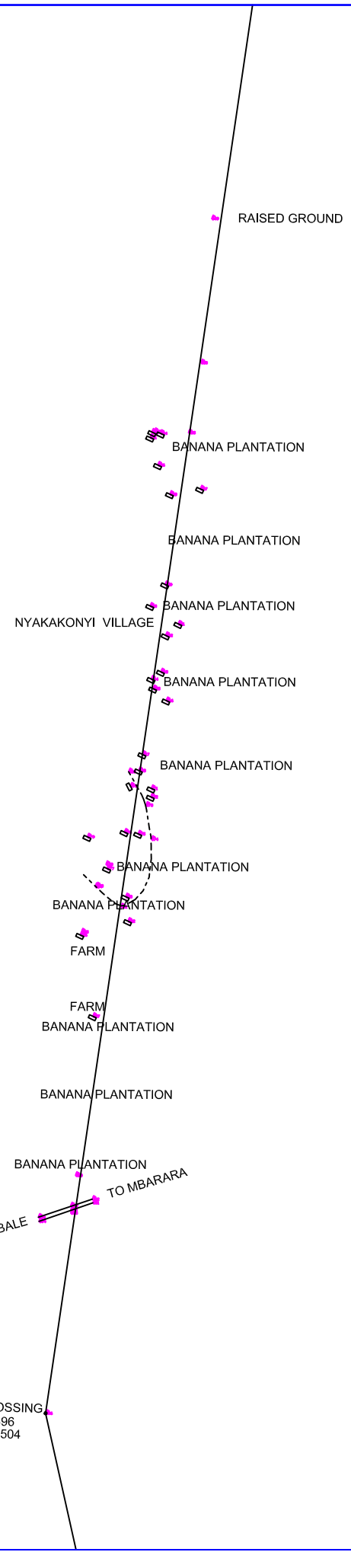
ANNEX C. GENERAL MAP: MBARARA – MIRAMA

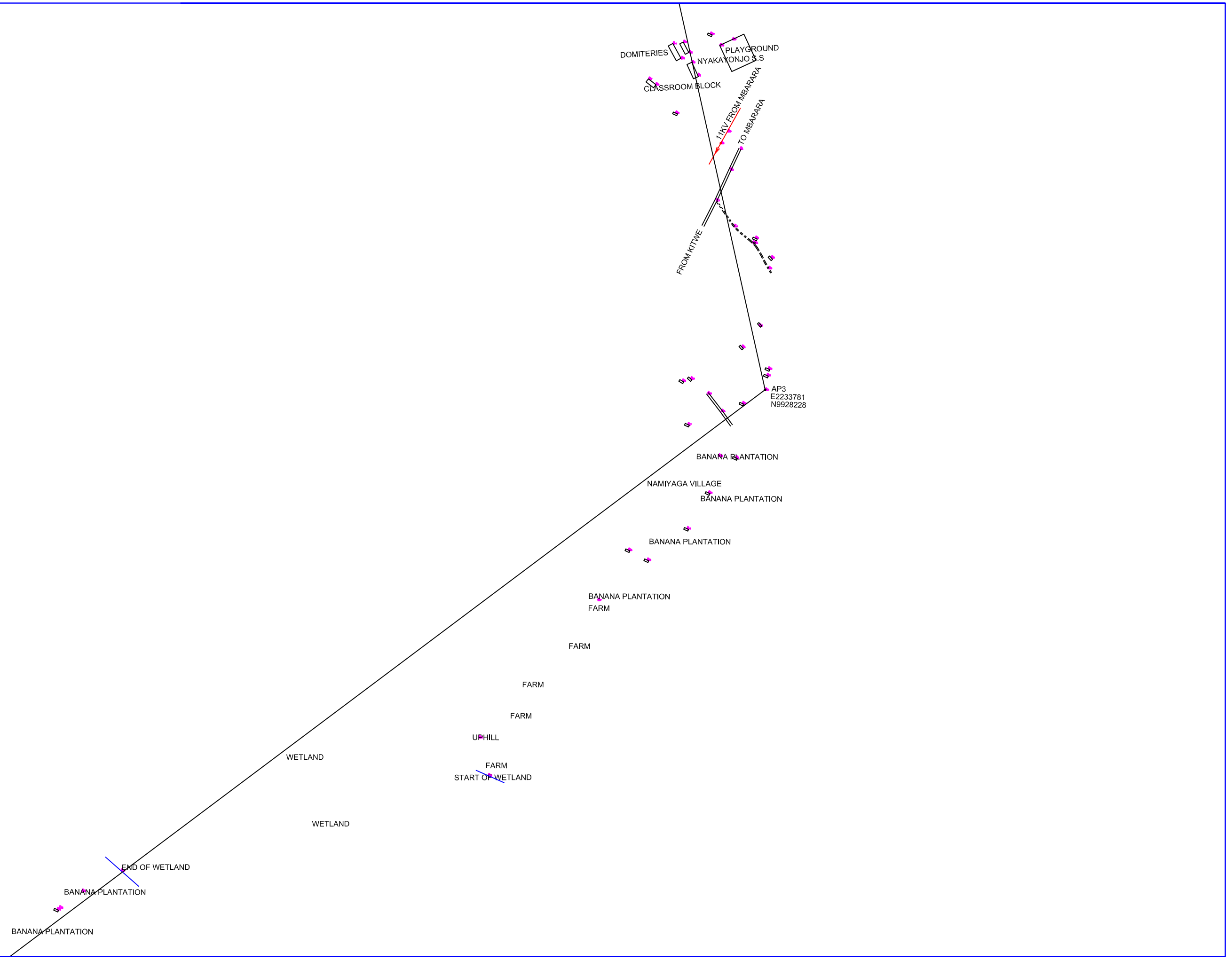
MBARARA - MIRAMA 220 kV LINE

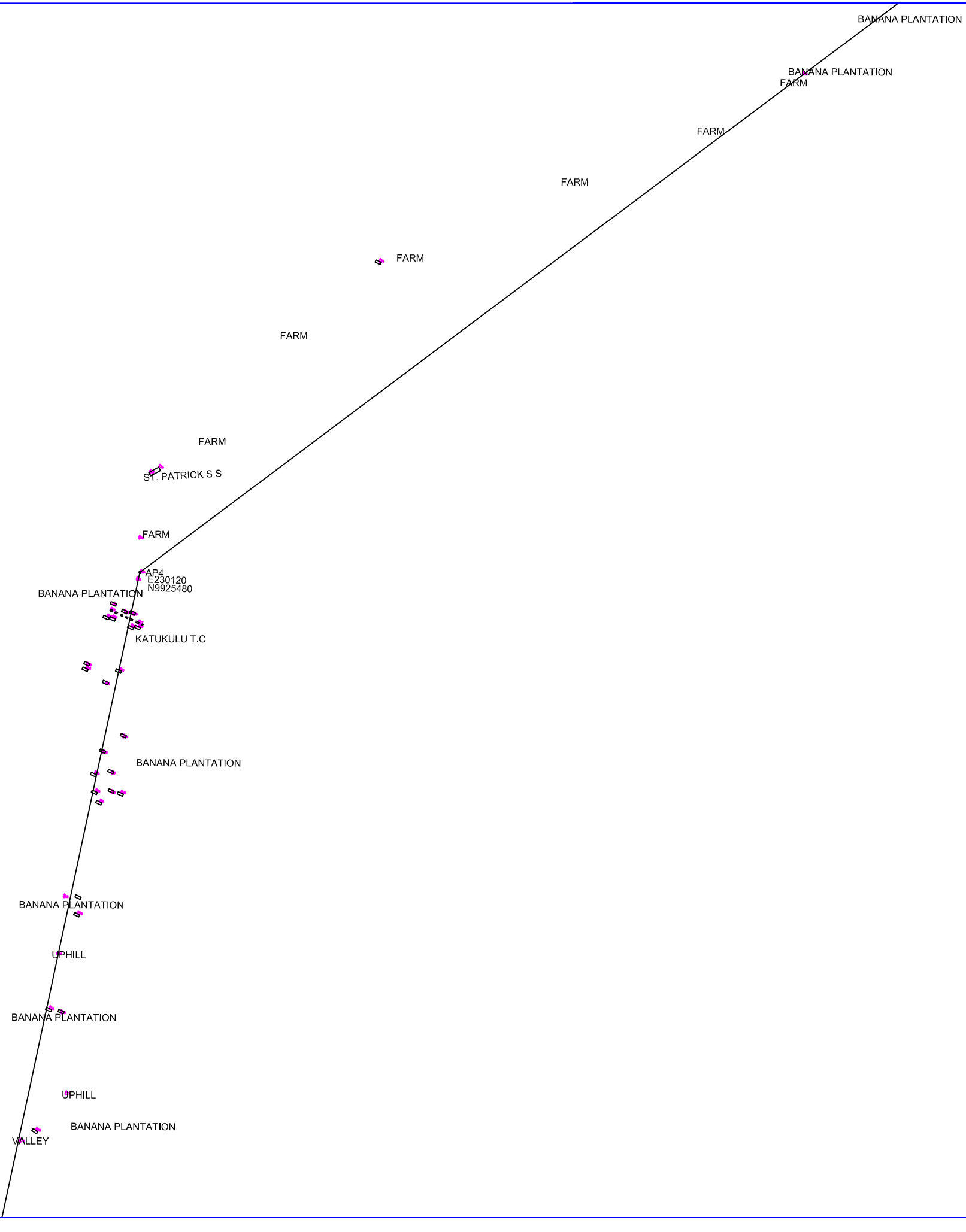


ANNEX D. MAP SHEETS: MBARARA – MIRAMA

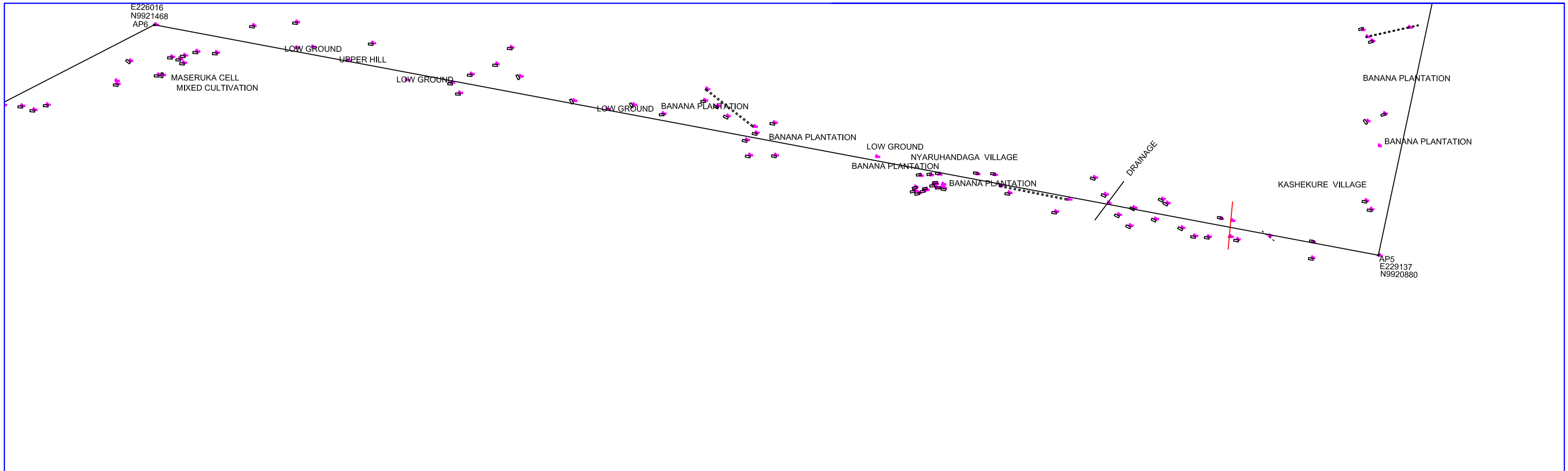

FROM BUSHENYI
TO MBARARA
11KV TO MBARARA
33KV TO MBARARA
E234127
N9933948
AP1
COW DEEP
END OF MBARARA STOCK FARM
WETLAND OF RWIZI RIVER
RAISED GROUND
E233849
N9931904
AP2

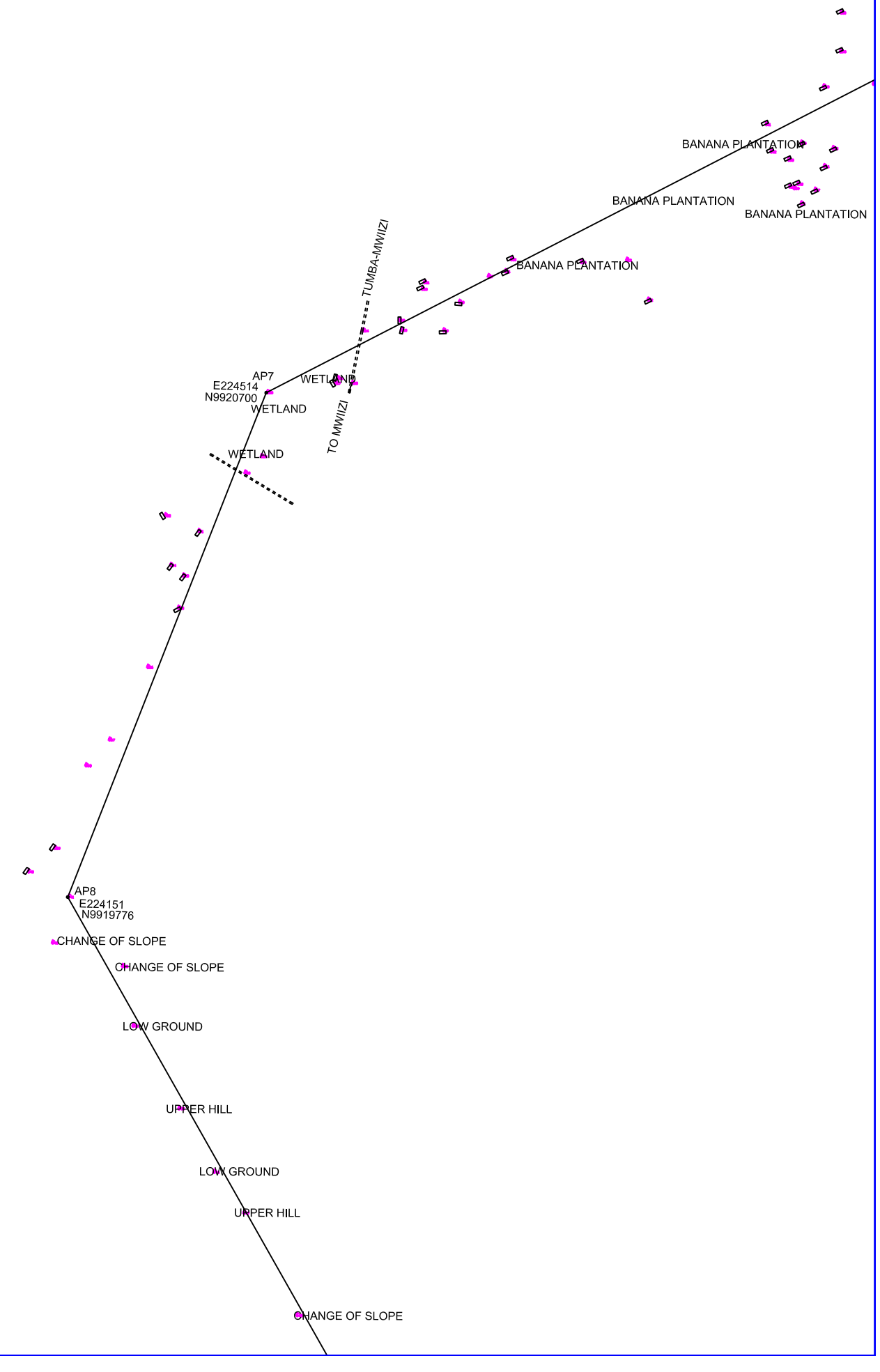

RAISED GROUND
BANANA PLANTATION
BANANA PLANTATION
BANANA PLANTATION
NYAKAKONYI VILLAGE
BANANA PLANTATION
BANANA PLANTATION
BANANA PLANTATION
BANANA PLANTATION
FARM
FARM
BANANA PLANTATION
BANANA PLANTATION
BANANA PLANTATION
TO MBARARA
FROM KABALE
ROAD CROSSING
E233496
N9929504

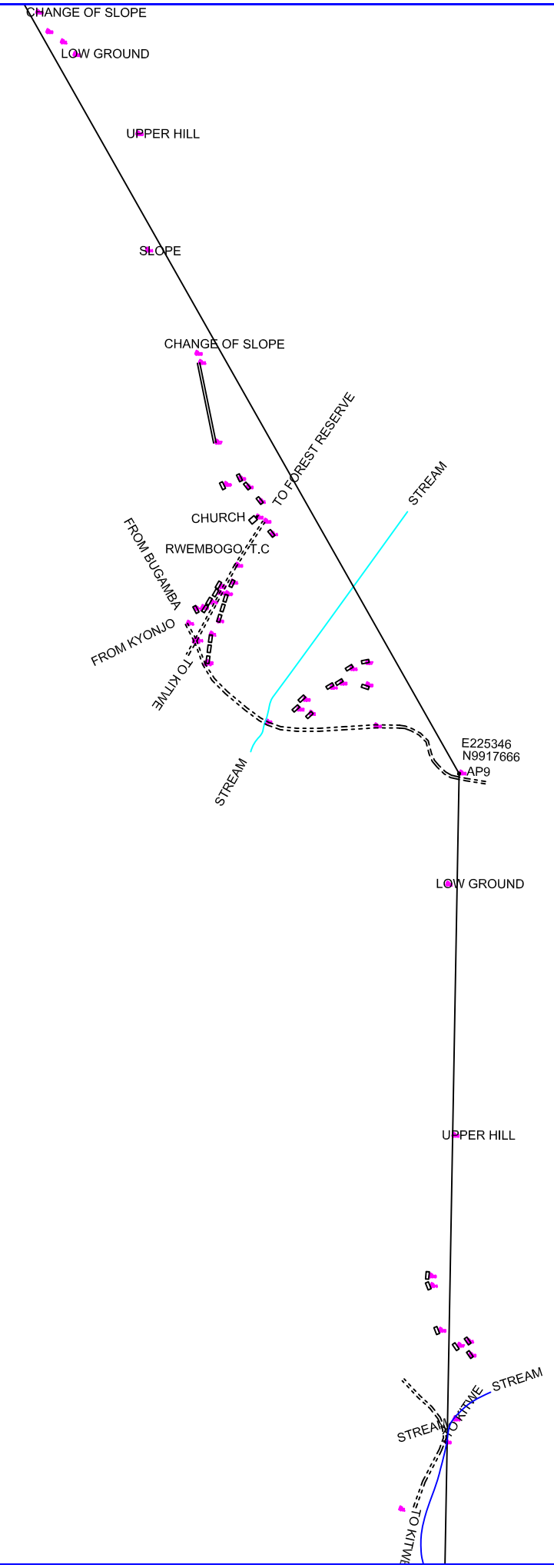

DOMITERIES
NYAKATONJO S.S
PLAYGROUND
CLASSROOM BLOCK
11KV FROM MBARARA
TO MBARARA
FROM KITWE
AP3
E2233781
N9928228
BANANA PLANTATION
NAMIYAGA VILLAGE
BANANA PLANTATION
BANANA PLANTATION
BANANA PLANTATION
FARM
FARM
FARM
FARM
UPHILL
WETLAND
FARM
START OF WETLAND
WETLAND
END OF WETLAND
BANANA PLANTATION
BANANA PLANTATION

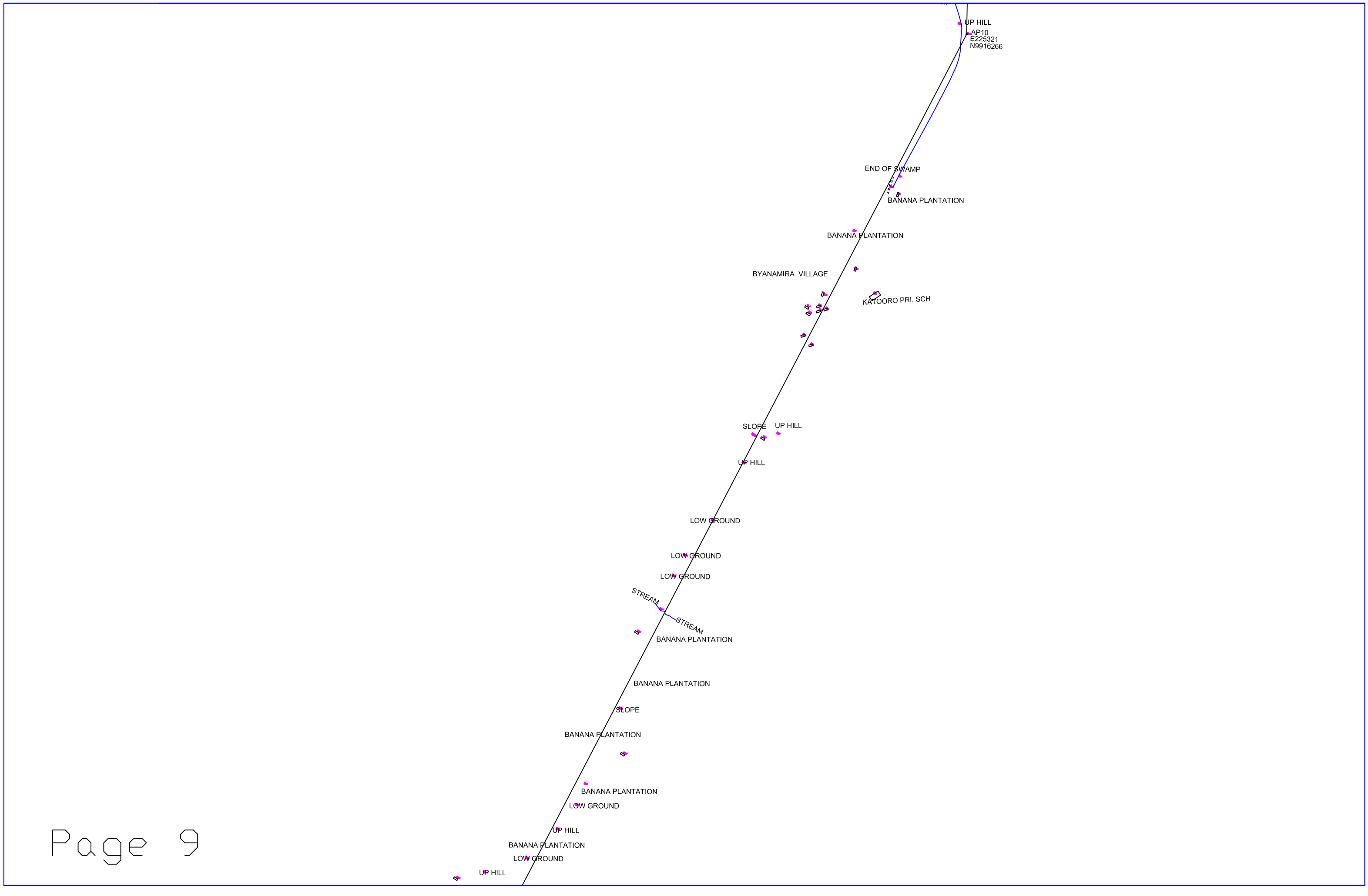

BANANA PLANTATION
BANANA PLANTATION
FARM
FARM
FARM
FARM
FARM
FARM
ST. PATRICK S S
FARM
AP4
E230120
N9925480
BANANA PLANTATION
KATUKULU T.C
BANANA PLANTATION
BANANA PLANTATION
UPHILL
BANANA PLANTATION
UPHILL
BANANA PLANTATION
VALLEY

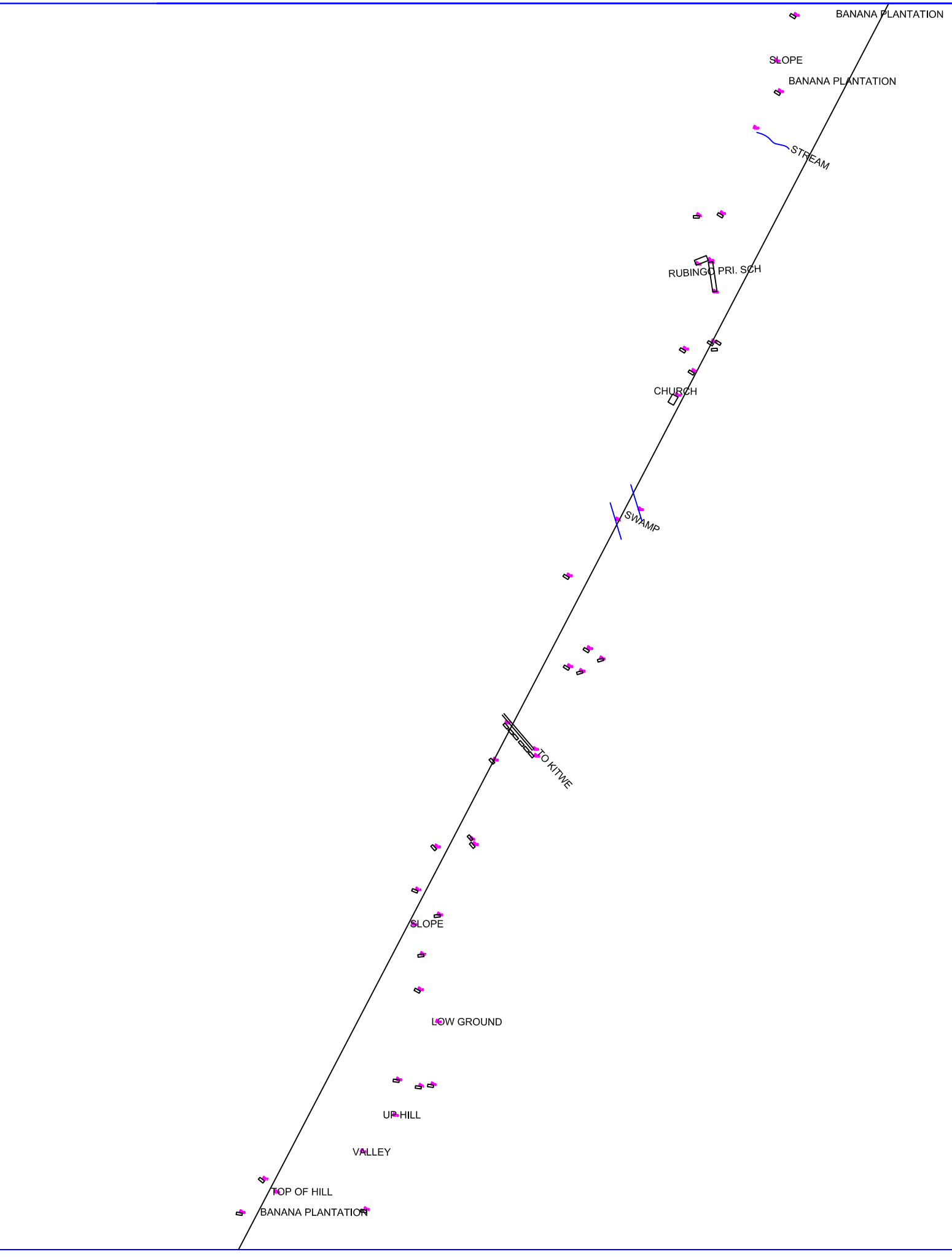
UPHILL
UPHILL
BANANA PLANTATION
STREAM
STREAM
BANANA PLANTATION
UPHILL
LOWER HILL
UPHILL
BANANA PLANTATION
STREAM
BANANA PLANTATION
STREAM
BANANA PLANTATION
UPHILL
LOWER HILL
UPHILL
BANANA PLANTATION
LOWER HILL
UPHILL
BANANA PLANTATION
BANANA PLANTATION
LOWER HILL
BANANA PLANTATION
BANANA PLANTATION
WET LAND
BANANA PLANTATION

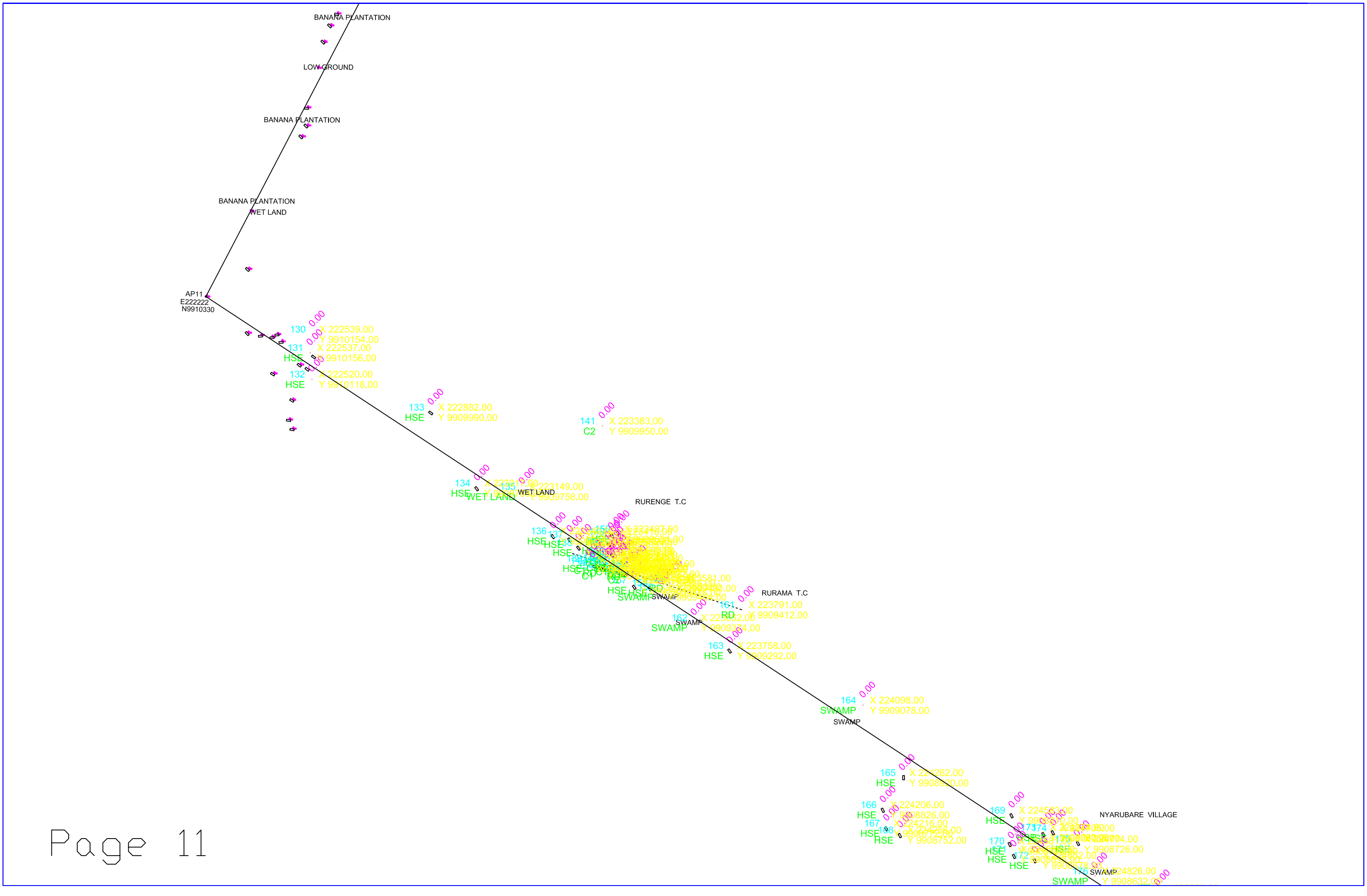

E226016
N9921468
AP6
LOW GROUND
UPPER HILL
MASERUKA CELL
MIXED CULTIVATION
LOW GROUND
LOW GROUND
BANANA PLANTATION
BANANA PLANTATION
LOW GROUND
NYARUHANDAGA VILLAGE
BANANA PLANTATION
BANANA PLANTATION
DRAINAGE
KASHEKURE VILLAGE
BANANA PLANTATION
BANANA PLANTATION
AP5
E229137
N9920880

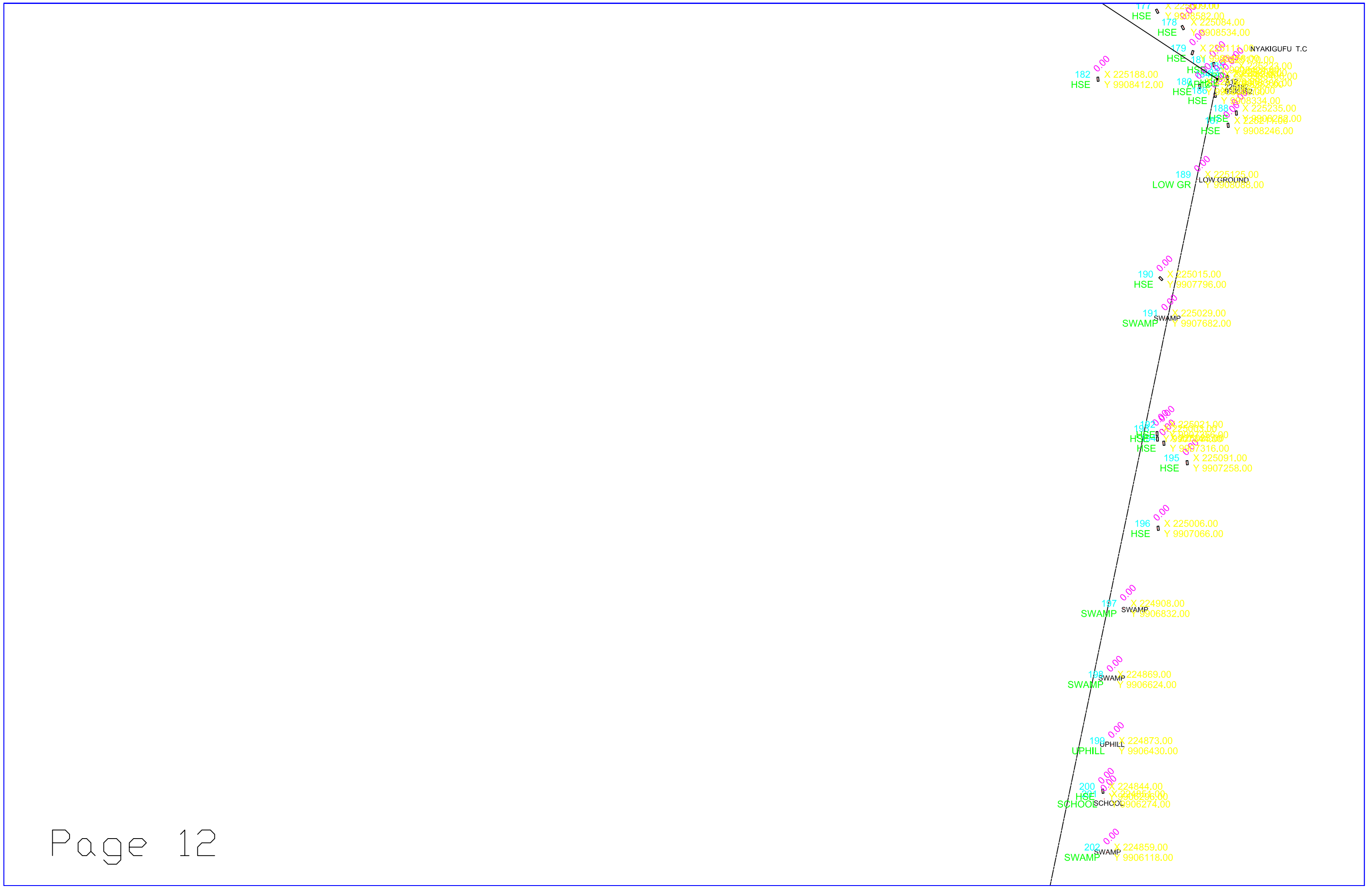

BANANA PLANTATION
BANANA PLANTATION
BANANA PLANTATION
BANANA PLANTATION
TUMBA-MWIIZI
TO MWIIZI
AP7
E224514
N9920700
WETLAND
WETLAND
WETLAND
AP8
E224151
N9919776
CHANGE OF SLOPE
CHANGE OF SLOPE
LOW GROUND
UPPER HILL
LOW GROUND
UPPER HILL
CHANGE OF SLOPE

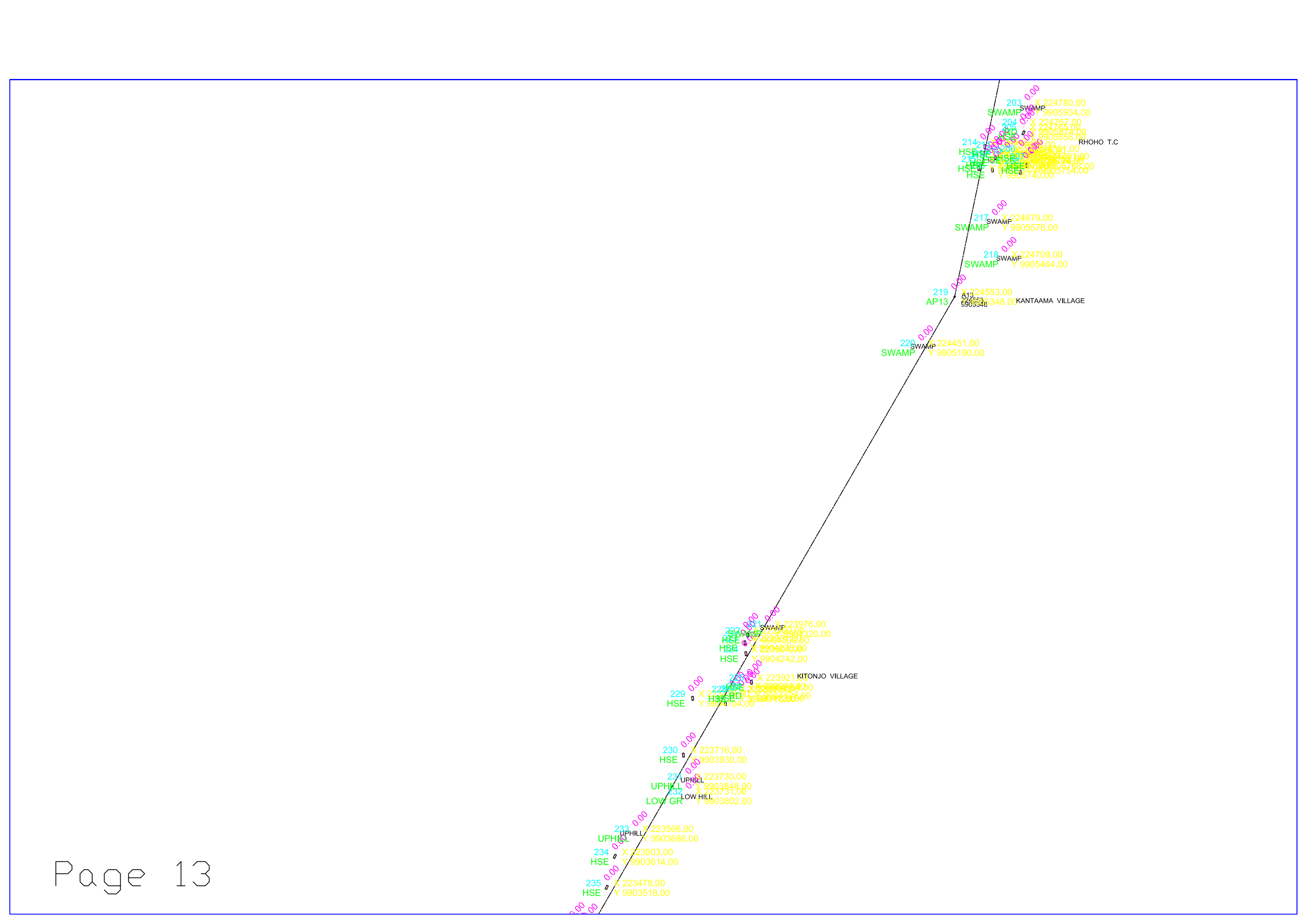

CHANGE OF SLOPE
LOW GROUND
UPPER HILL
SLOPE
CHANGE OF SLOPE
TO FOREST RESERVE
STREAM
CHURCH O
RWEMBOGO T.C
FROM BUGAMBA
FROM KYONJO
TO KITWE
STREAM
E225346
N9917666
AP9
LOW GROUND
UPPER HILL
STREAM
STREAM
TO KITWE

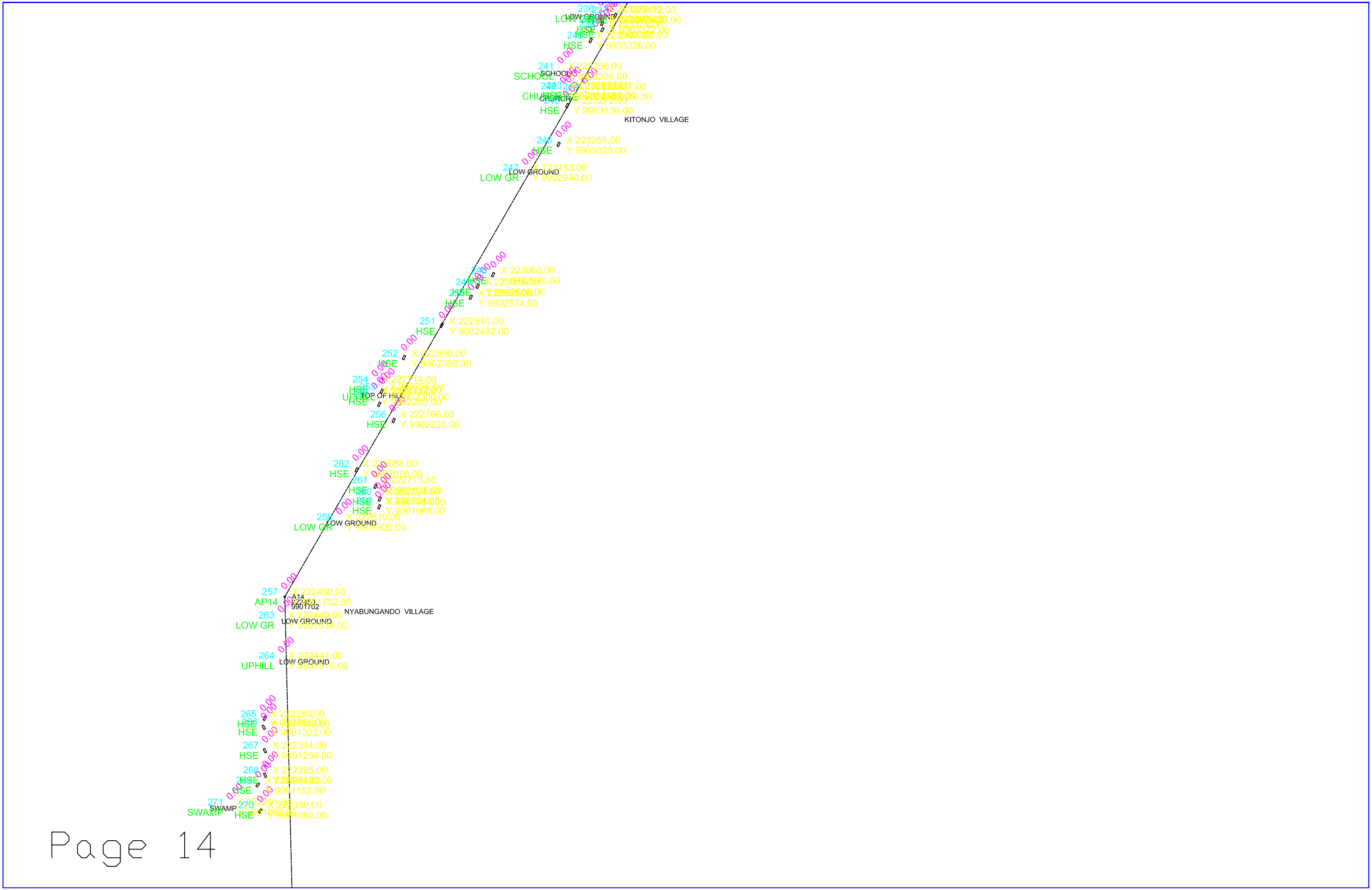

UP HILL
AP10
E225321
N9916266
END OF SWAMP
BANANA PLANTATION
BANANA PLANTATION
BYANAMIRA VILLAGE
KATOORO PRI. SCH
SLOPE
UP HILL
UP HILL
LOW GROUND
LOW GROUND
LOW GROUND
STREAM
STREAM
BANANA PLANTATION
BANANA PLANTATION
SLOPE
BANANA PLANTATION
BANANA PLANTATION
LOW GROUND
UP HILL
BANANA PLANTATION
LOW GROUND
UP HILL

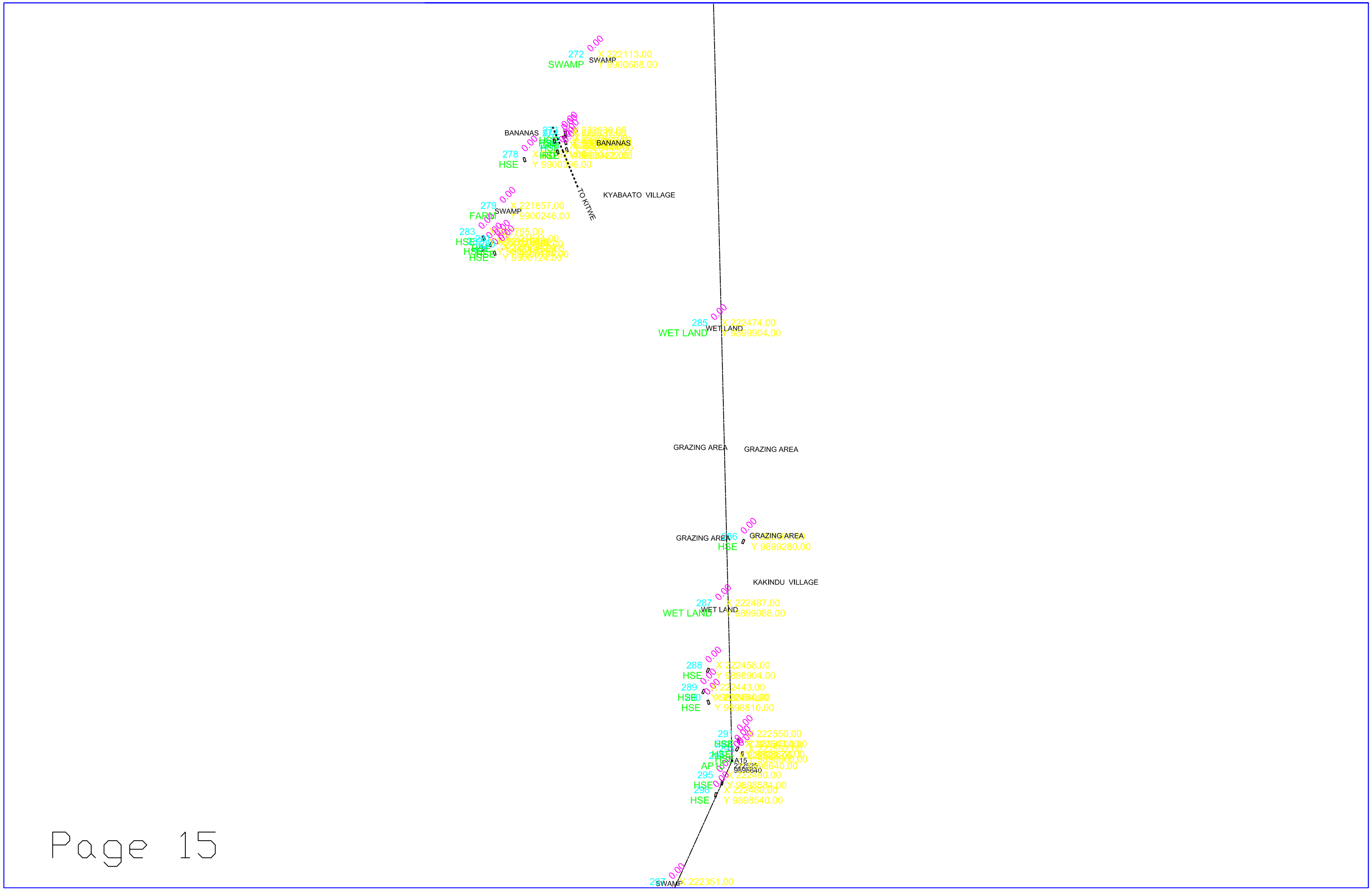

BANANA PLANTATION
SLOPE
BANANA PLANTATION
STREAM
RUBINGO PRI. SCH
CHURCH
SWAMP
TO KITWE
SLOPE
LOW GROUND
UP HILL
VALLEY
TOP OF HILL
BANANA PLANTATION

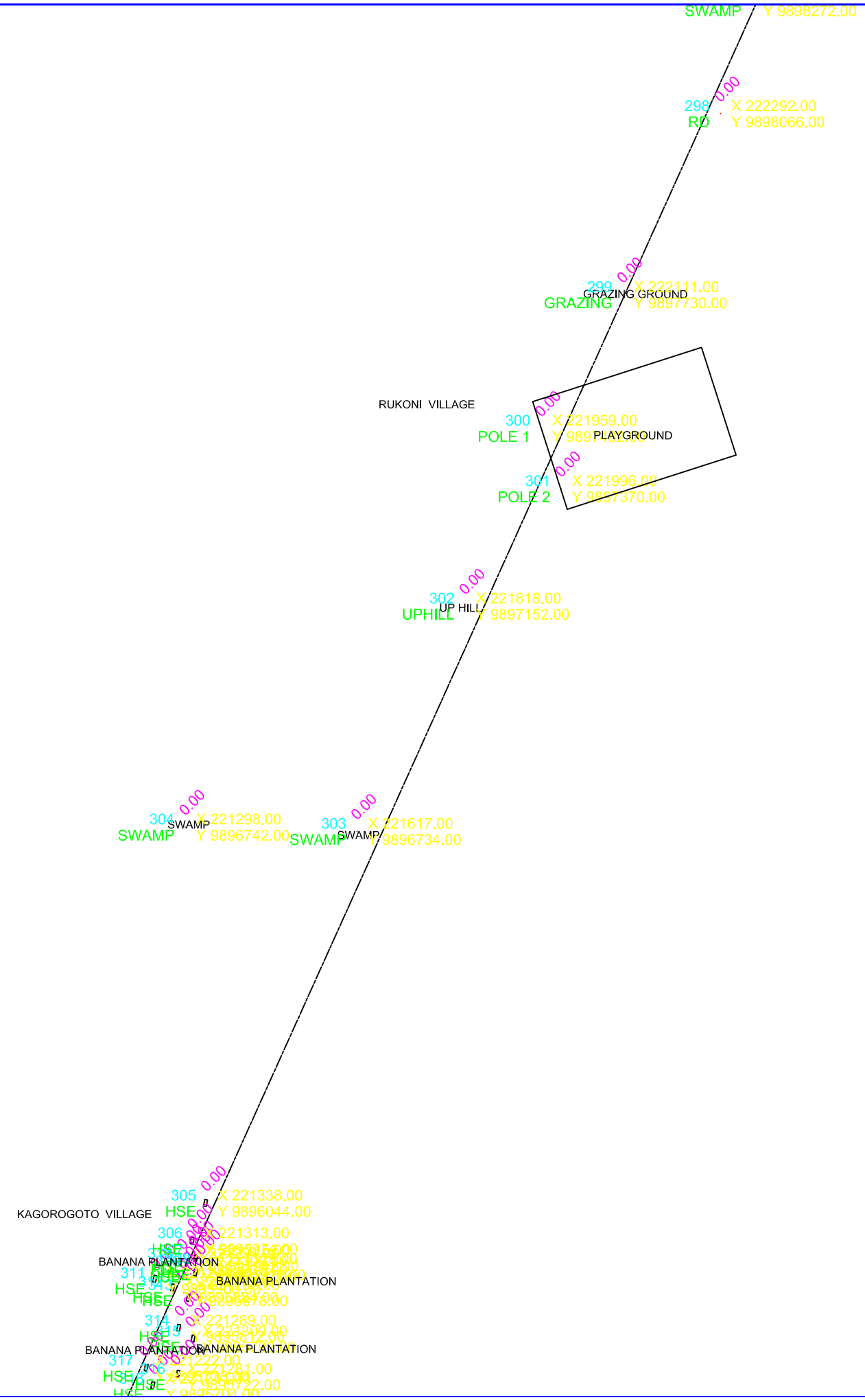

BANANA PLANTATION
LOW GROUND
BANANA PLANTATION
BANANA PLANTATION
WET LAND
AP11
E222222
N9910330
130 0.00
X 222539.00
Y 9910154.00
131 0.00
HSE
X 222537.00
Y 9910156.00
132 0.00
HSE
X 222520.00
Y 9910118.00
133 0.00
HSE
X 222882.00
Y 9909990.00
141 0.00
C2
X 223383.00
Y 9909950.00
134 0.00
HSE
135
WET LAND
X 223149.00
Y 9909758.00
RURENGE T.C
136 0.00
HSE
C1
C27
HSE
SWAMP
SWAMP
RURAMA T.C
161 0.00
X 223791.00
RD
Y 9909412.00
162
SWAMP
X 223582.00
Y 9909374.00
163 0.00
HSE
X 223758.00
Y 9909292.00
164 0.00
SWAMP
X 224098.00
Y 9909078.00
SWAMP
165 0.00
HSE
X 224262.00
Y 9908920.00
166 0.00
HSE
X 224206.00
Y 9908826.00
167 0.00
HSE
X 224216.00
Y 9908752.00
NYARUBARE VILLAGE
169 0.00
HSE
170 0.00
HSE
HSE
HSE
SWAMP
SWAMP

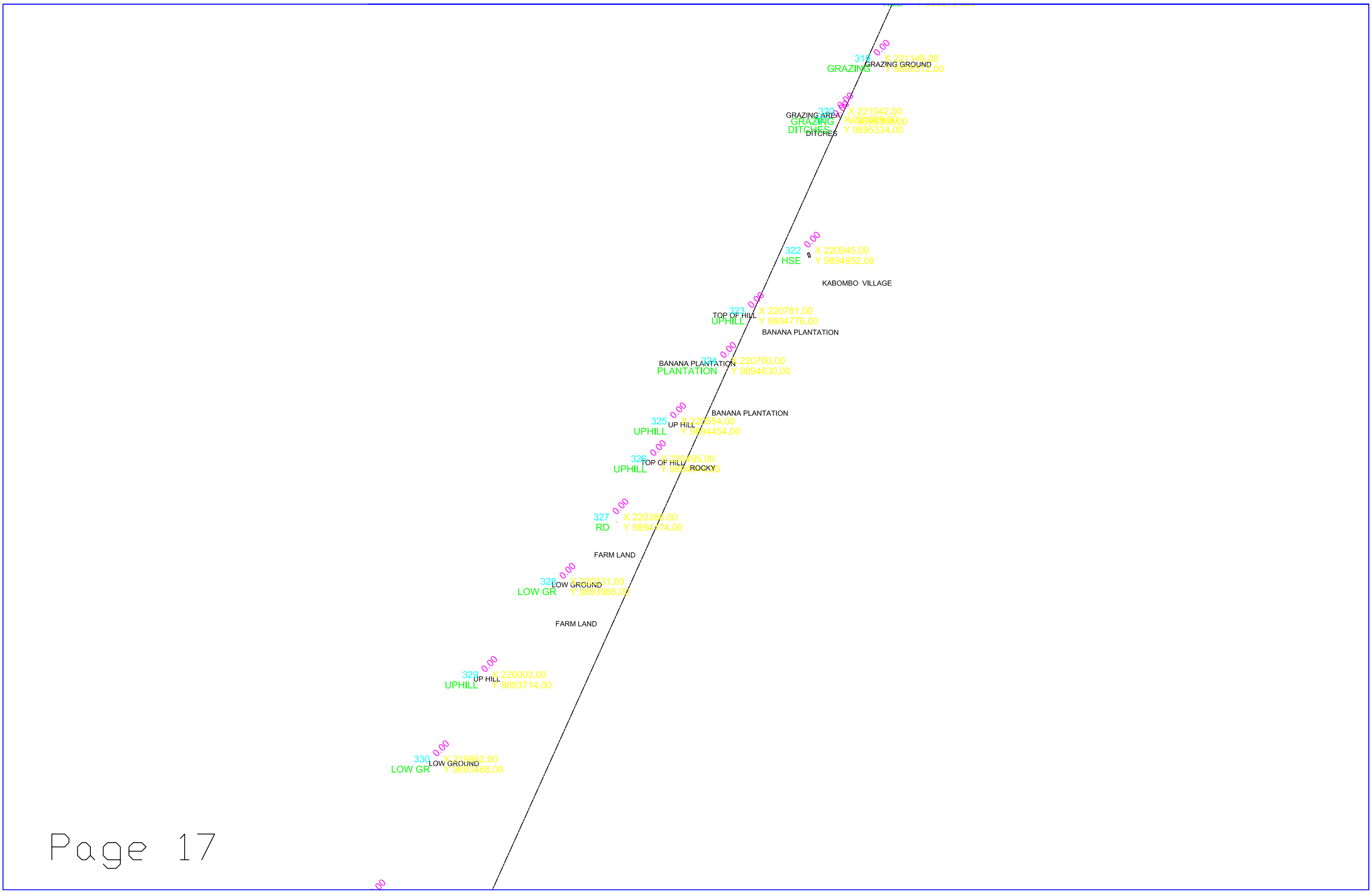

177
HSE
X 225009.00
Y 9908582.00
0.00
178
HSE
X 225084.00
Y 9908534.00
0.00
179
HSE
X 225114.00
NYAKIGUFU T.C
0.00
182
HSE
X 225188.00
Y 9908412.00
0.00
HSE
HSE
HSE
HSE
X 225235.00
HSE
Y 9908246.00
0.00
189
LOW GR
X 225125.00
LOW GRO
0.00
190
HSE
X 225015.00
Y 9907796.00
0.00
191
SWAMP
X 225029.00
SWAMP
Y 9907682.00
0.00
HSE
HSE
Y 9907316.00
195
HSE
X 225091.00
Y 9907258.00
0.00
196
HSE
X 225006.00
Y 9907066.00
0.00
197
SWAMP
X 224908.00
SWAMP
Y 9906832.00
0.00
198
SWAMP
X 224869.00
SWAMP
Y 9906624.00
0.00
199
UPHILL
X 224873.00
UPHILL
Y 9906430.00
0.00
200
HSE
SCHOOL
SCHOOL
0.00
202
SWAMP
X 224859.00
SWAMP
Y 9906118.00
0.00

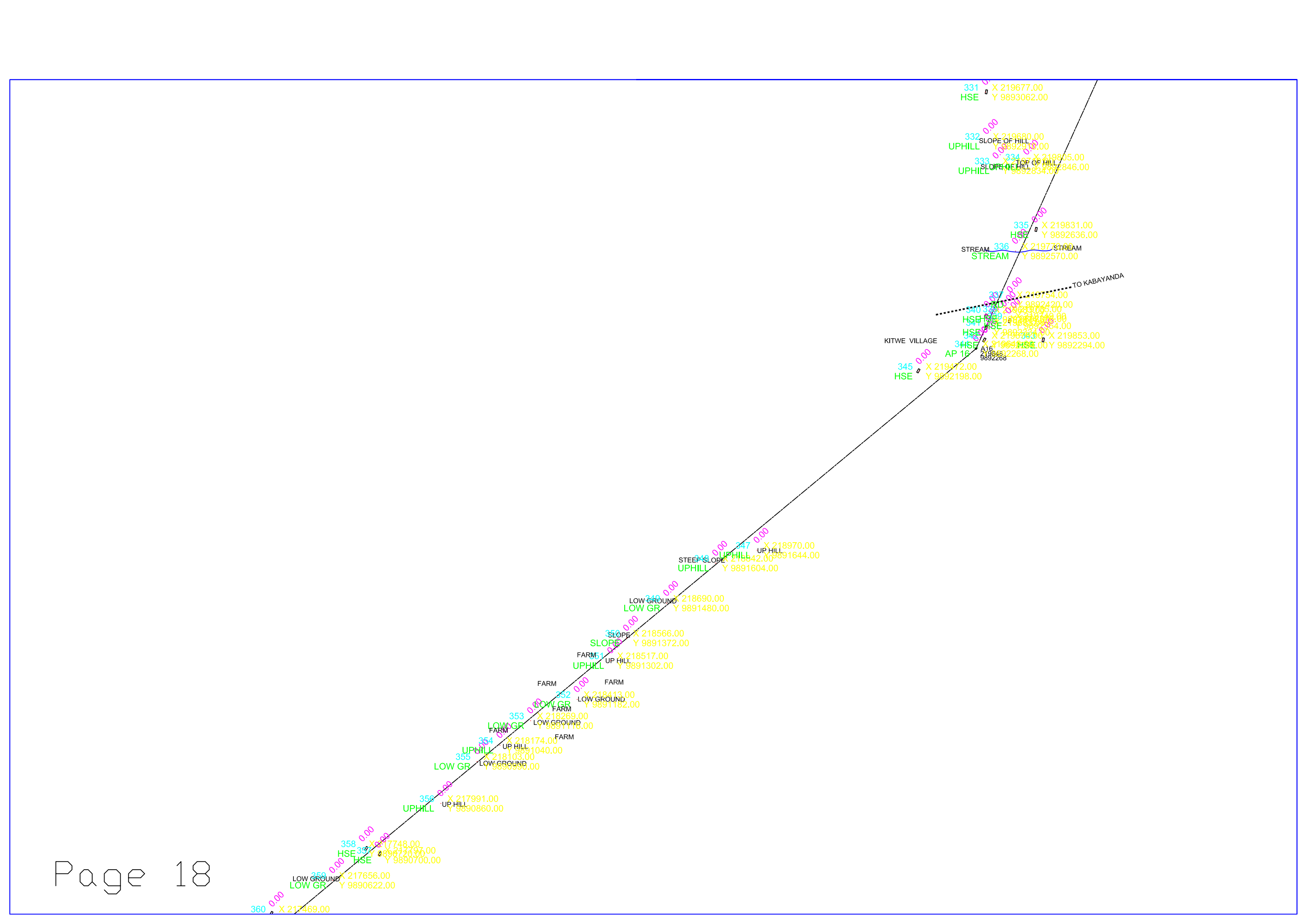

203 SWAMP
X 224780.00
Y 9905934.00
RHOHO T.C
217 SWAMP
X 224679.00
Y 9905578.00
218 SWAMP
X 224709.00
Y 9905464.00
219 AP13
X 224553.00
Y 9905348.00
KANTAAMA VILLAGE
220 SWAMP
X 224451.00
Y 9905190.00
KITONJO VILLAGE
229 HSE
230 HSE
X 223716.00
Y 9903930.00
231 UPHILL
X 223730.00
Y 9903848.00
232 LOW GR
X 223731.00
Y 9903802.00
233 UPHILL
X 223566.00
Y 9903686.00
234 HSE
X 223503.00
Y 9903614.00
235 HSE
X 223478.00
Y 9903518.00

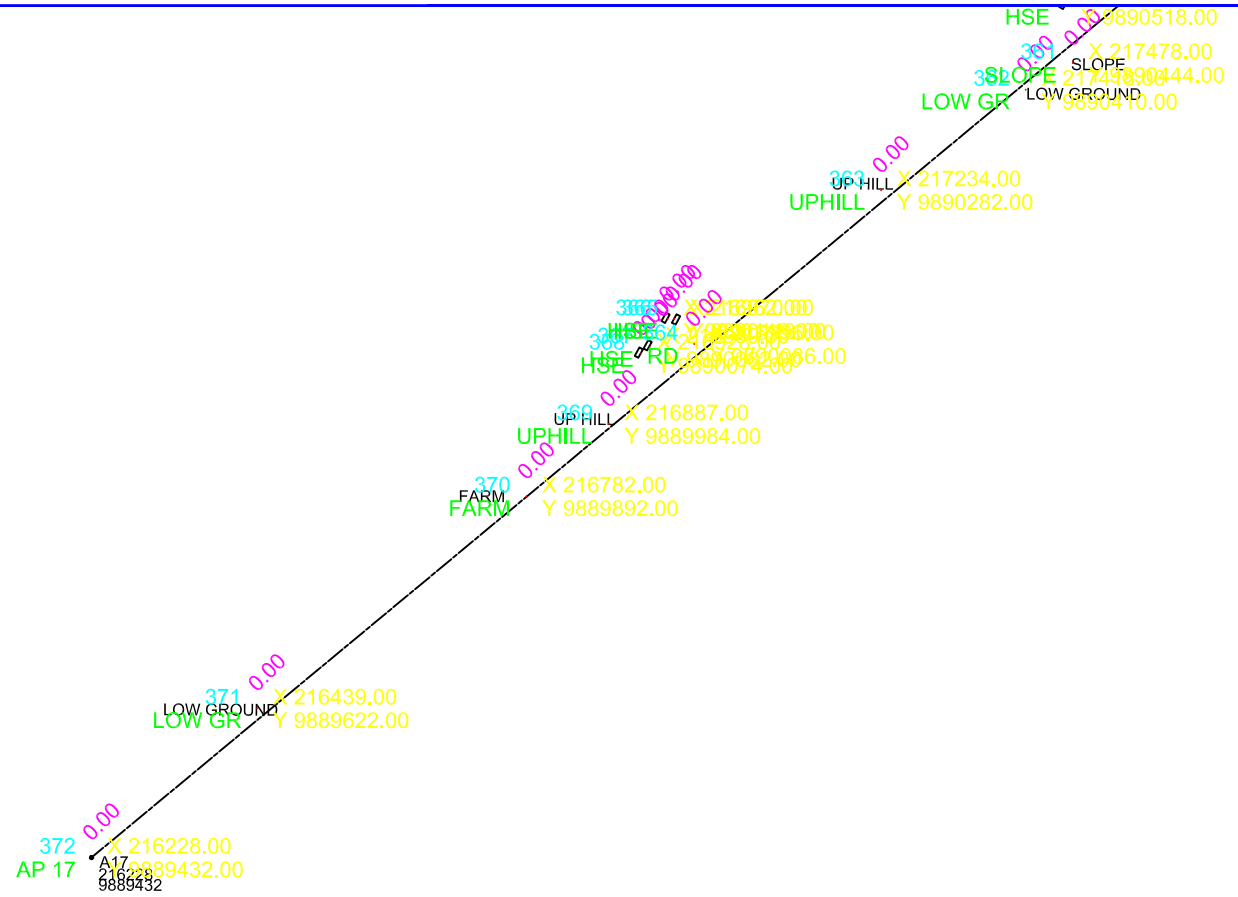

LOW GROUND
HSE
Y 9903326.00
241
X 223256.00
SCHOOL
SCHOOL
CHURCH
CHURCH
HSE
Y 9903136.00
KITONJO VILLAGE
245
X 223251.00
HSE
Y 9903020.00
247
LOW GR
LOW GROUND
Y 9902940.00
X 223060.00
HSE
Y 9902574.00
251
X 222910.00
HSE
Y 9902492.00
252
X 222800.00
HSE
Y 9902398.00
254
HSE
UPHILL
TOP OF HILL
HSE
256
X 222766.00
HSE
Y 9902220.00
262
HSE
261
HSE
HSE
HSE
HSE
Y 9901968.00
259
LOW GROUND
LOW GR
Y 9901920.00
257
X 222450.00
AP14
A14
9901702
NYABUNGANDO VILLAGE
263
LOW GR
LOW GROUND
264
UPHILL
LOW GROUND
265
HSE
HSE
Y 9901322.00
267
HSE
Y 9901254.00
268
HSE
HSE
Y 9901152.00
271
SWAMP
SWAMP
270
HSE
Y 9901080.00


272 0.00
X 222113.00
SWAMP
SWAMP
Y 9900688.00
BANANAS
BANANAS
278 0.00
HSE
TO KITWE
KYABAATO VILLAGE
279 0.00
X 221857.00
FARM
SWAMP
Y 9900246.00
283
HSE
HSE
285 0.00
X 222474.00
WET LAND
WET LAND
Y 9899904.00
GRAZING AREA
GRAZING AREA
GRAZING AREA
286 0.00
GRAZING AREA
HSE
Y 9899280.00
KAKINDU VILLAGE
287 0.00
X 222487.00
WET LAND
WET LAND
Y 9899086.00
288 0.00
X 222458.00
HSE
Y 9898904.00
289 0.00
HSE
HSE
Y 9898810.00
AP
295
X 222490.00
HSE
Y 9898584.00
296
X 222480.00
HSE
Y 9898540.00
297 0.00
X 222351.00
SWAMP


SWAMP
Y 9898272.00
298
RD
0.00
X 222292.00
Y 9898066.00
299
GRAZING
0.00
X 222111.00
GRAZING GROUND
Y 9897730.00
RUKONI VILLAGE
300
POLE 1
0.00
X 221959.00
PLAYGROUND
301
POLE 2
0.00
X 221996.00
302
UPHILL
0.00
X 221818.00
UP HILL
9897152.00
304
SWAMP
0.00
X 221298.00
SWAMP
Y 9896742.00
303
SWAMP
0.00
X 221617.00
SWAMP
Y 9896734.00
305
KAGOROGOTO VILLAGE
HSE
0.00
X 221338.00
Y 9896044.00
306
X 221313.00
BANANA PLANTATION
BANANA PLANTATION
314
X 221289.00
BANANA PLANTATION
BANANA PLANTATION


0.00
316 X 221148.00
GRAZING GROUND
GRAZING Y 9895542.00
0.00
320 X 221042.00
GRAZING AREA
GRAZING Y 9895359.00
DITCHES Y 9895334.00
DITCHES
0.00
322 X 220945.00
HSE Y 9894952.00
KABOMBO VILLAGE
0.00
323 X 220781.00
TOP OF HILL
UPHILL Y 9894776.00
BANANA PLANTATION
0.00
324 X 220700.00
BANANA PLANTATION
PLANTATION Y 9894630.00
BANANA PLANTATION
0.00
BANANA PLANTATION
325 X 220554.00
UP HILL
UPHILL Y 9894454.00
0.00
326 X 220495.00
TOP OF HILL ROCKY
UPHILL Y 9894
0.00
327 X 220386.00
RD Y 9894174.00
FARM LAND
0.00
328 X 220231.00
LOW GROUND
LOW GR Y 9893986.00
FARM LAND
0.00
329 X 220003.00
UP HILL
UPHILL Y 9893714.00
0.00
330 X 219862.00
LOW GROUND
LOW GR Y 9893468.00


331
X 219677.00
HSE
Y 9893062.00
0.00
332
X 219680.00
UPHILL
SLOPE OF HILL
Y 9892900.00
0.00
334
X 219995.00
333
TOP OF HILL
SLOPE OF HILL
UPHILL
Y 9892834.00
335
X 219831.00
HSE
Y 9892636.00
STREAM
336
STREAM
STREAM
Y 9892570.00
TO KABAYANDA
KITWE VILLAGE
AP 16
A16
219845
9892268
345
X 219472.00
HSE
Y 9892198.00
347
X 218970.00
UP HILL
UPHILL
STEEP SLOPE
Y 9891644.00
Y 9891604.00
340
X 218690.00
LOW GROUND
LOW GR
Y 9891480.00
SLOPE
X 218566.00
SLOPE
Y 9891372.00
351
X 218517.00
FARM
UP HILL
UPHILL
Y 9891302.00
FARM
FARM
352
X 218413.00
LOW GROUND
LOW GR
Y 9891182.00
FARM
353
X 218269.00
LOW GROUND
LOW GR
FARM
FARM
354
X 218174.00
UP HILL
UPHILL
355
X 218103.00
LOW GROUND
LOW GR
356
X 217991.00
UP HILL
UPHILL
358
HSE
HSE
Y 9890700.00
359
X 217656.00
LOW GROUND
LOW GR
Y 9890622.00
360
X 217469.00


HSE
X 217478.00
SLOPE
LOW GROUND
LOW GR
UP HILL
X 217234.00
UPHILL
Y 9890282.00
HSE
RD
UP HILL
X 216887.00
UPHILL
Y 9889984.00
FARM
X 216782.00
FARM
Y 9889892.00
X 216439.00
LOW GROUND
LOW GR
Y 9889622.00
X 216228.00
AP 17
A17
9889432

ANNEX E. LONGITUDINAL PROFILES: MBARARA – MIRAMA

UGANDA - RWANDA INTERCONNECTION:
MBARARA NORTH – MIRAMA S/S
LIST OF PLAN AND PROFILE SHEETS 1 – 10

Sheet No.	Stretch in Metres	Tower Numbers	Quantity of Towers
1	0 – 6 032	1 – 19	19
2	6 032 – 12 948	19 – 41	22
3	12 948 – 19 050	41 – 60	19
4	19 050 – 24 339	60 – 80	20
5	24 339 – 30 978	80 – 101	21
6	30 978 – 37 002	101 – 119	18
7	37 002 – 43 565	119 – 138	19
8	43 565 – 49 856	138 – 156	18
9	49 856 – 54 780	156 – 170	14
10	54 780 – 59 514	170 – 184	14

Dessiné par: ALX Controlé par: XDS
Référence informatique:P:\BRC\ENE\

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

UGANDA - RWANDA - INTERCONNECTION
PLAN AND PROFILE
MBARARA - MIRAMA: SHEETS 1 - 10

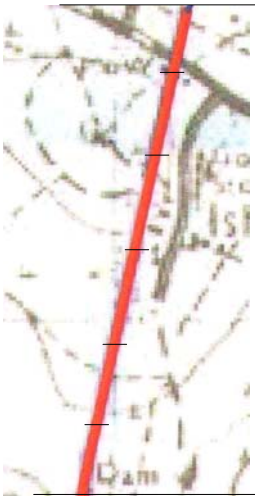
SOGREAH RSW INTERNATIONAL Hydro Québec International

N° H L Ur 121 a

Date : November 2, 2007

Dessiné par: ALX Controlé par: XDS

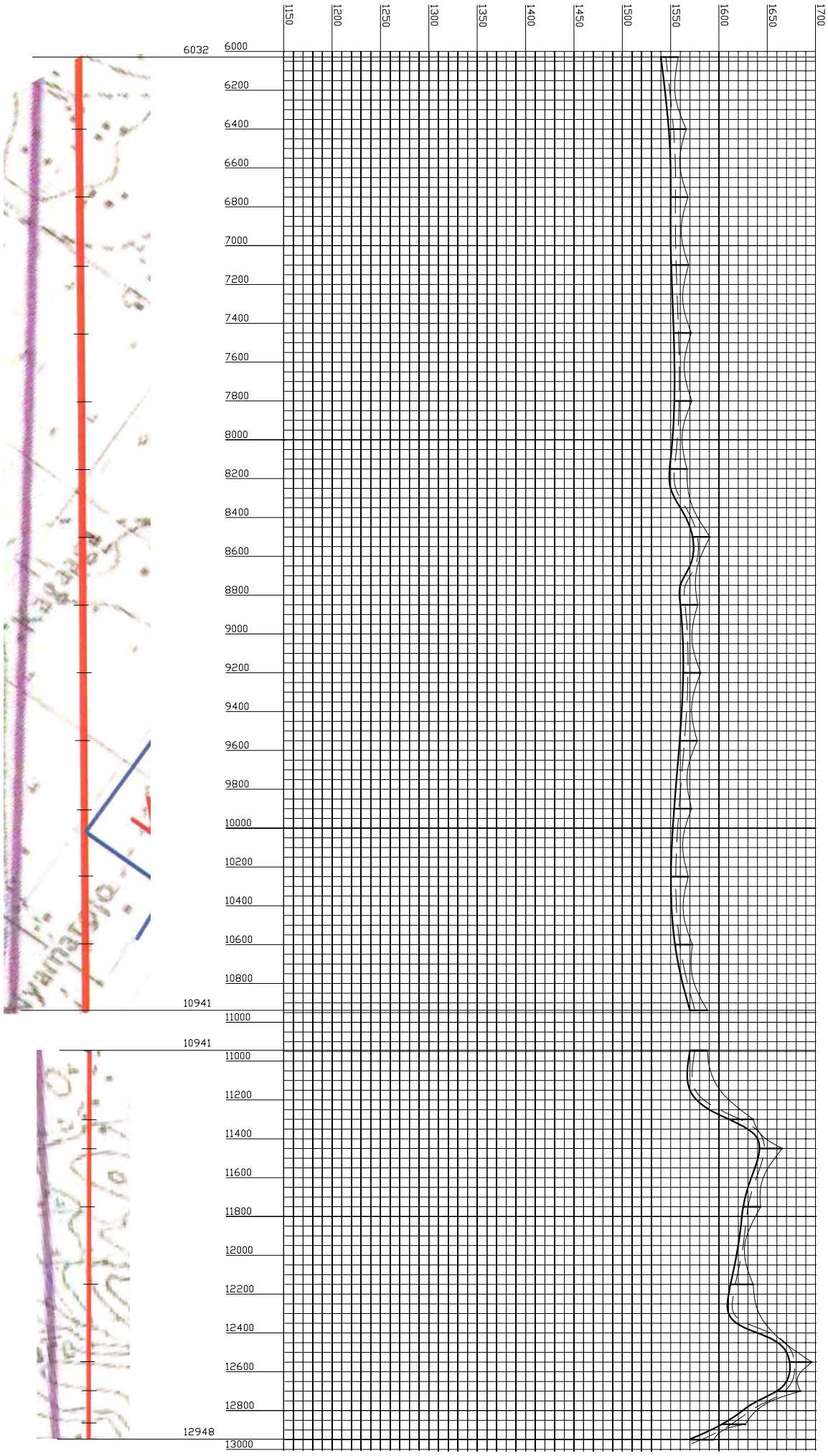
Référence informatique:P:\BRC\ENE\



Drawing No. HL UR 121 - Sheet 1

Dessiné par: ALX Controlé par: XDS

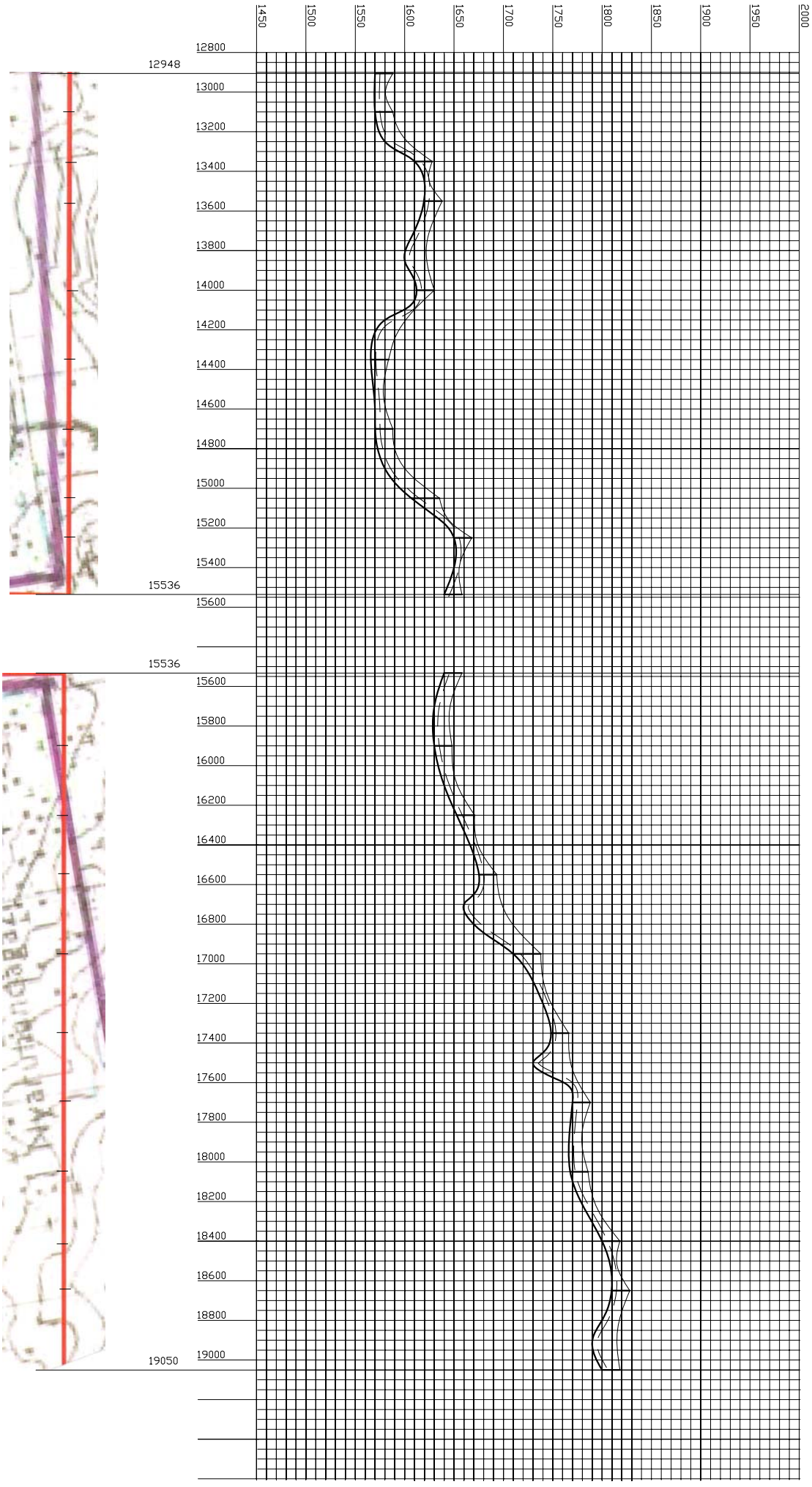
Référence informatique:P:\BRC\ENE\



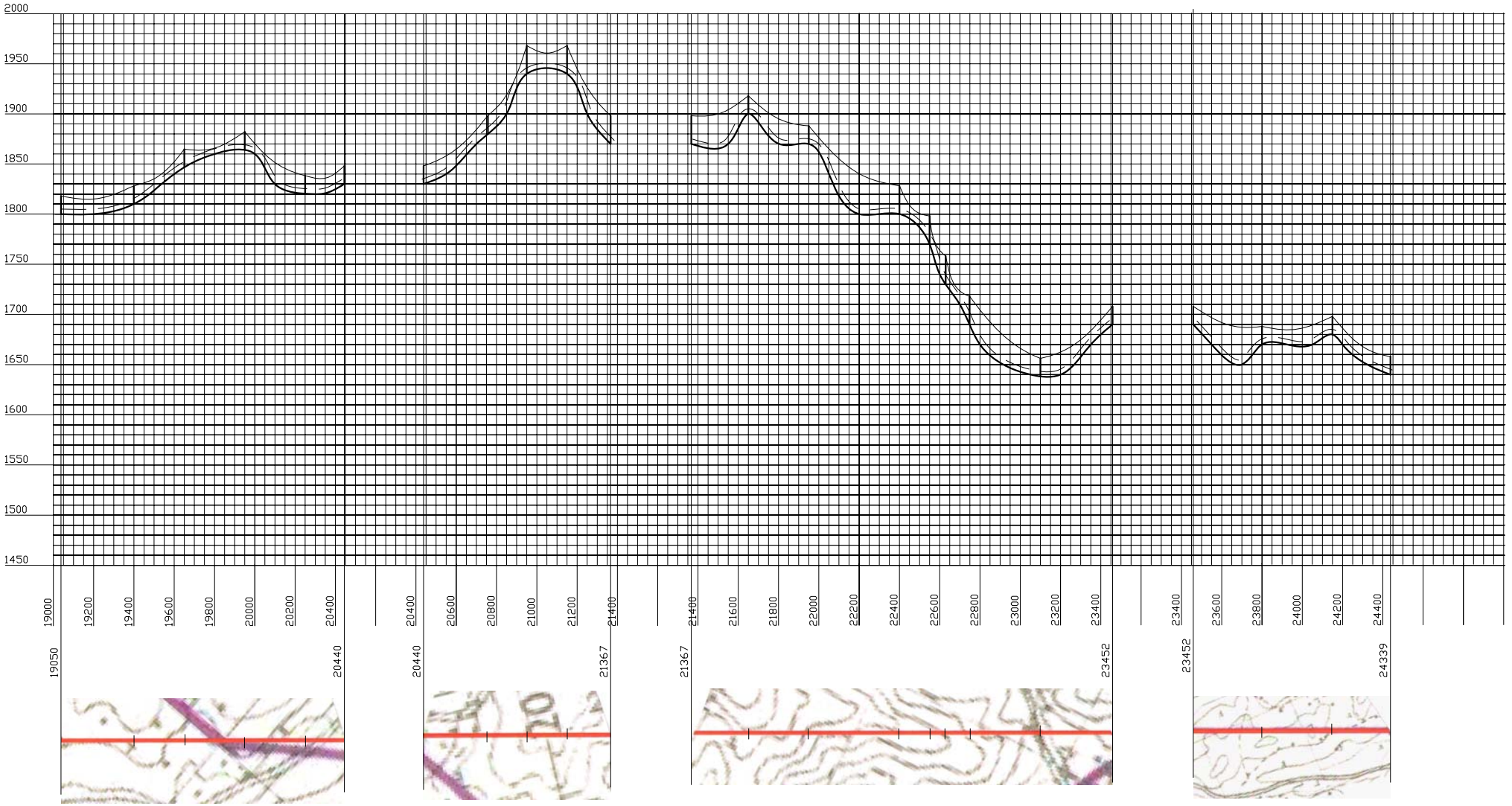
Drawing No. HL UR 121 - Sheet 2

Dessiné par: ALX Controlé par: XDS

Référence informatique:P:\BRC\ENE\



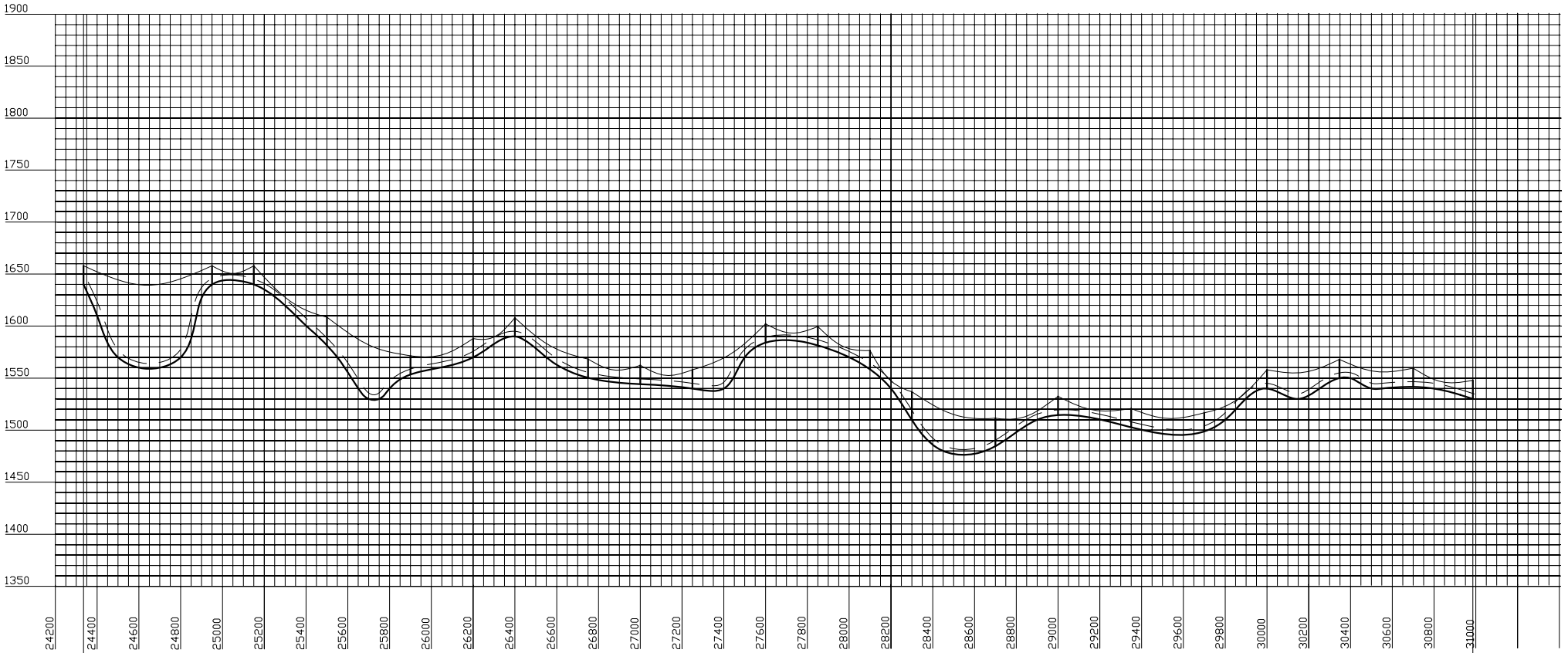
Drawing No. HL UR 121 - Sheet 3



Dessiné par: ALX Controlé par: XDS

Référence informatique:P:\BRC\ENE\

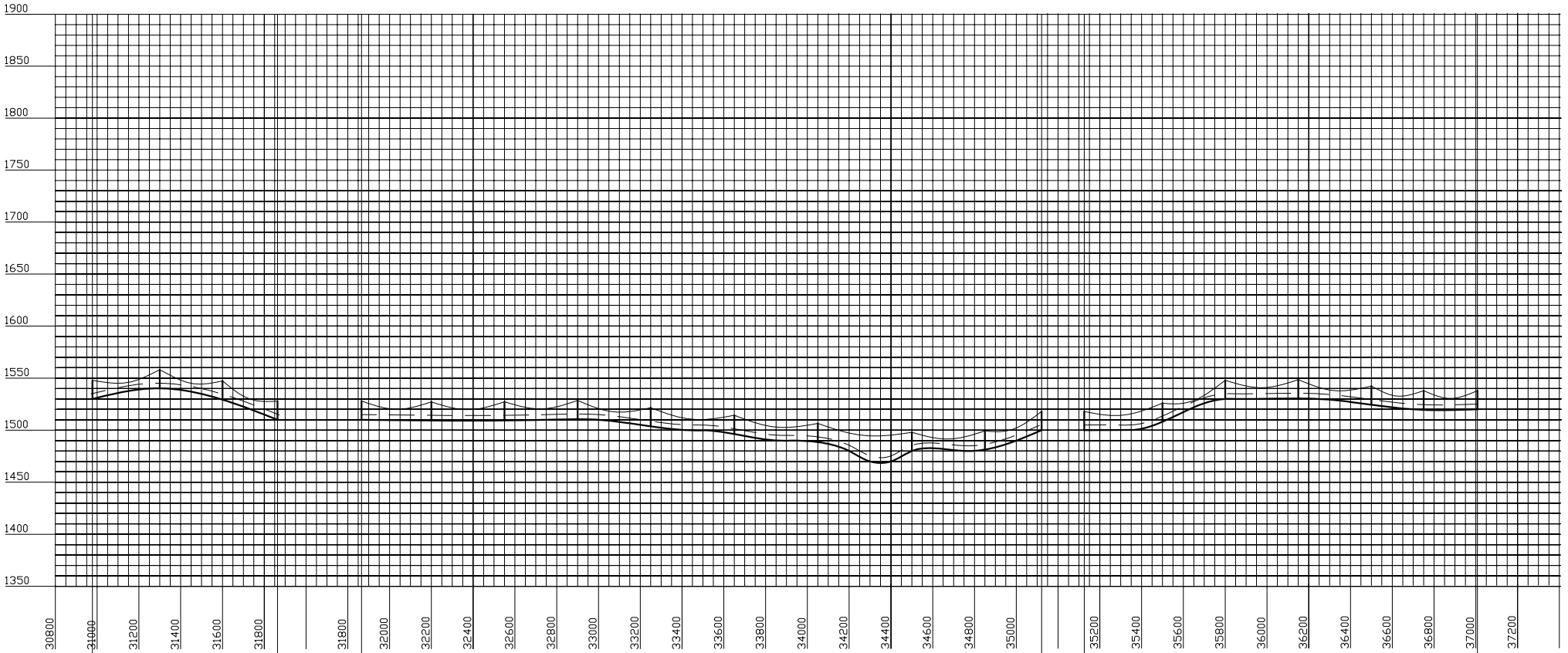
Drawing No. HL UR 121 - Sheet 4

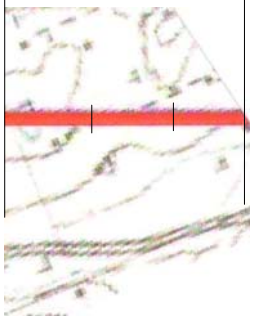


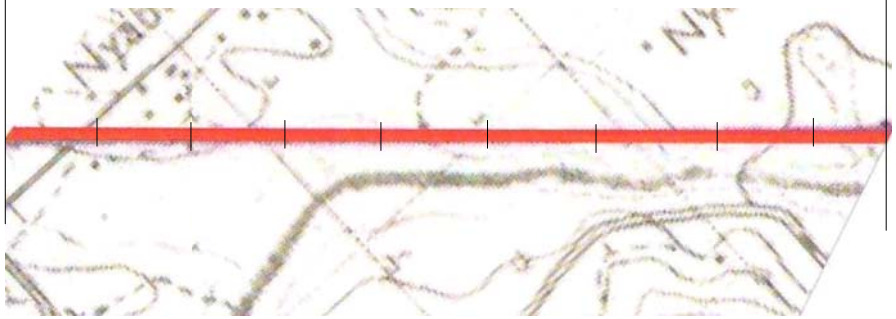
Dessiné par: ALX Controlé par: XDS

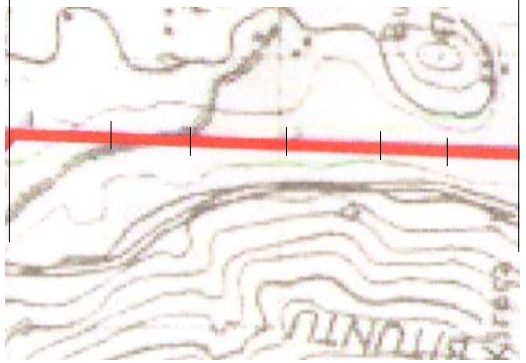
Référence informatique:P:\BRC\ENE\

Drawing No. HL UR 121 - Sheet 5





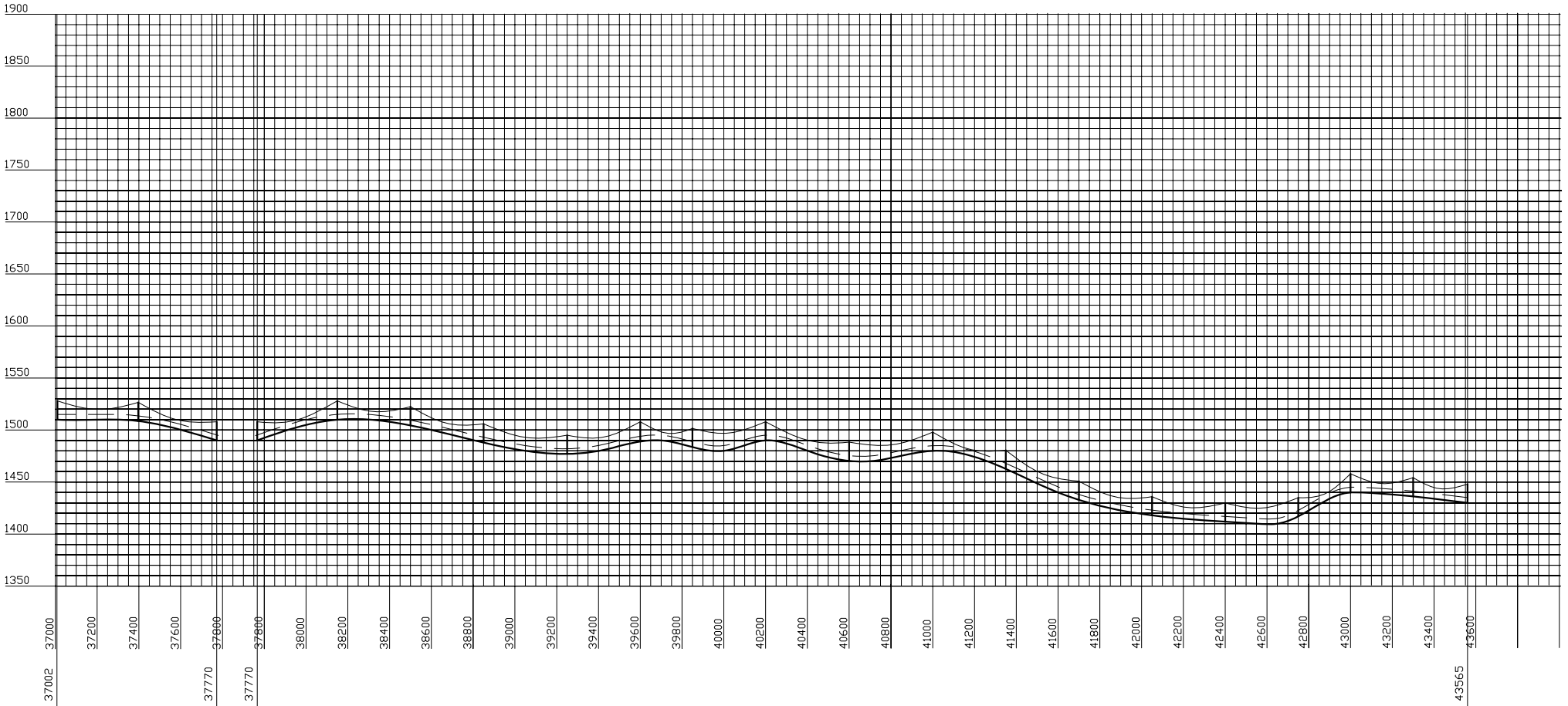


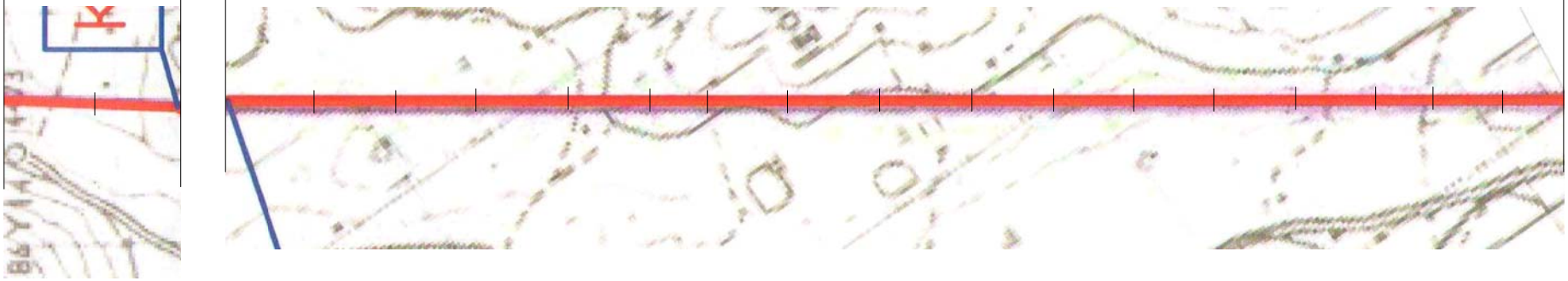


Dessiné par: ALX Controlé par: XDS

Référence informatique:P:\BRC\ENE\

Drawing No. HL UR 121 - Sheet 6

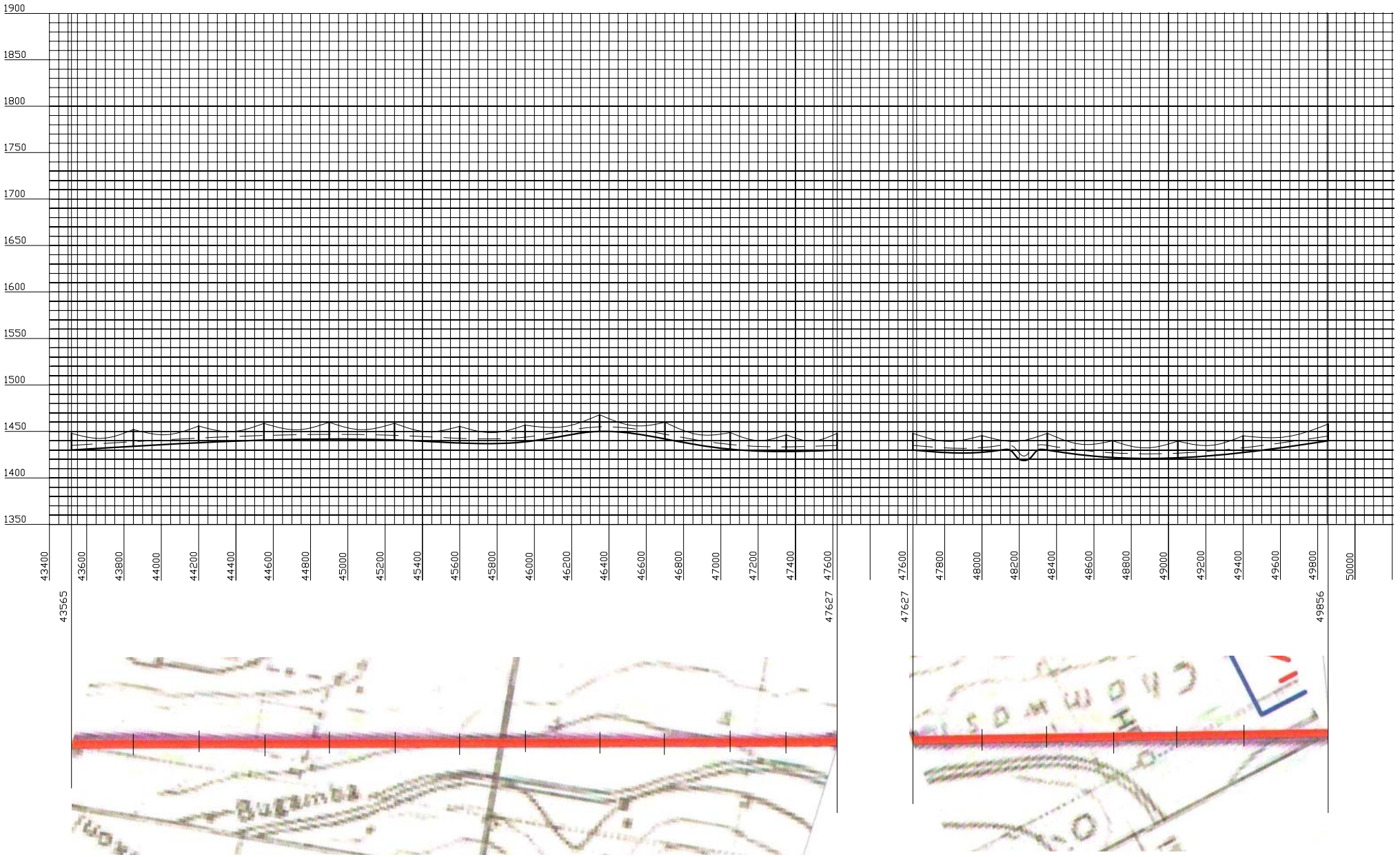




Dessiné par: ALX Controlé par: XDS

Référence informatique:P:\BRC\ENE\

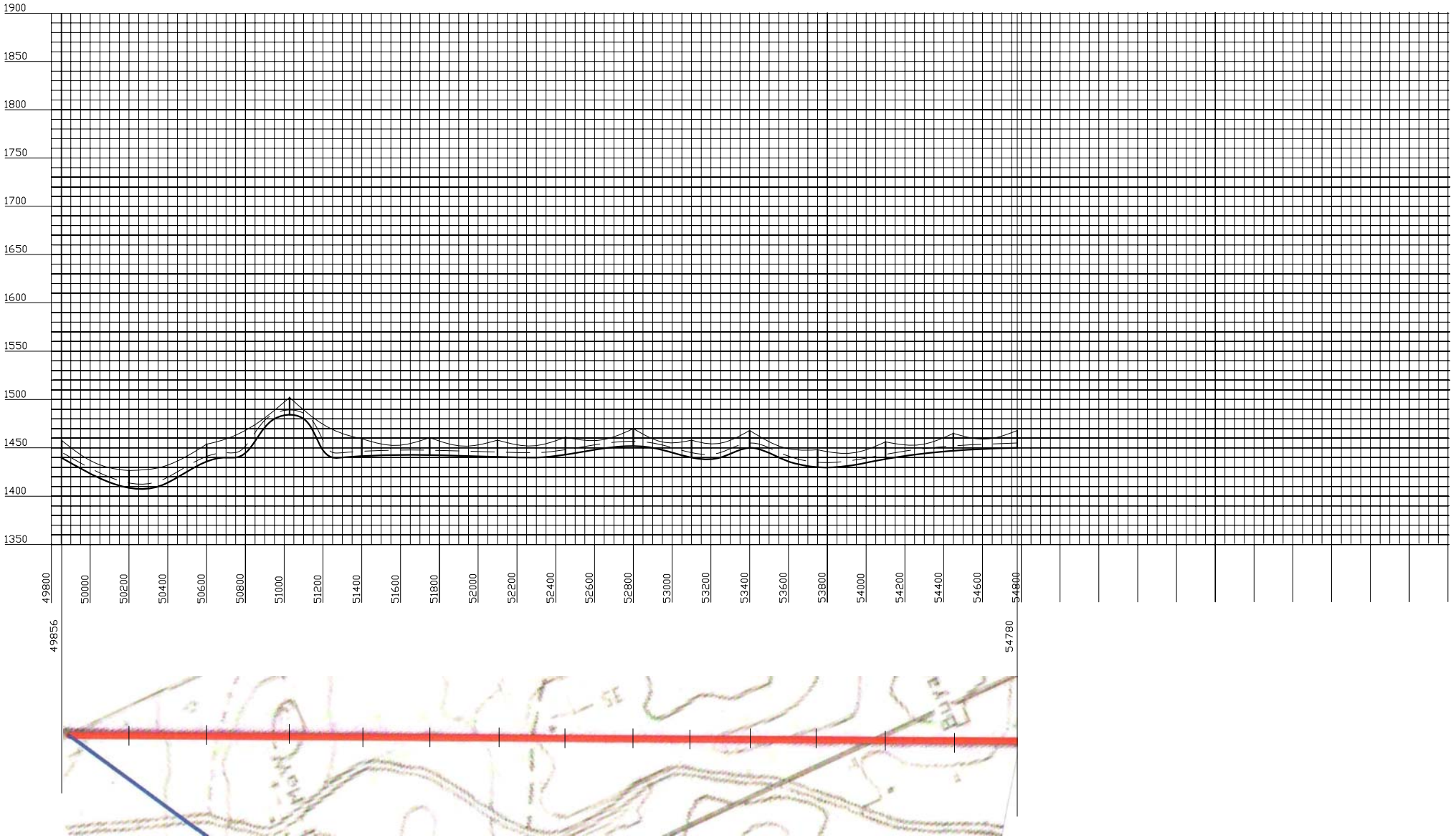
Drawing No. HL UR 121 - Sheet 7



Dessiné par: ALX Controlé par: XDS

Référence informatique:P:\BRC\ENE\

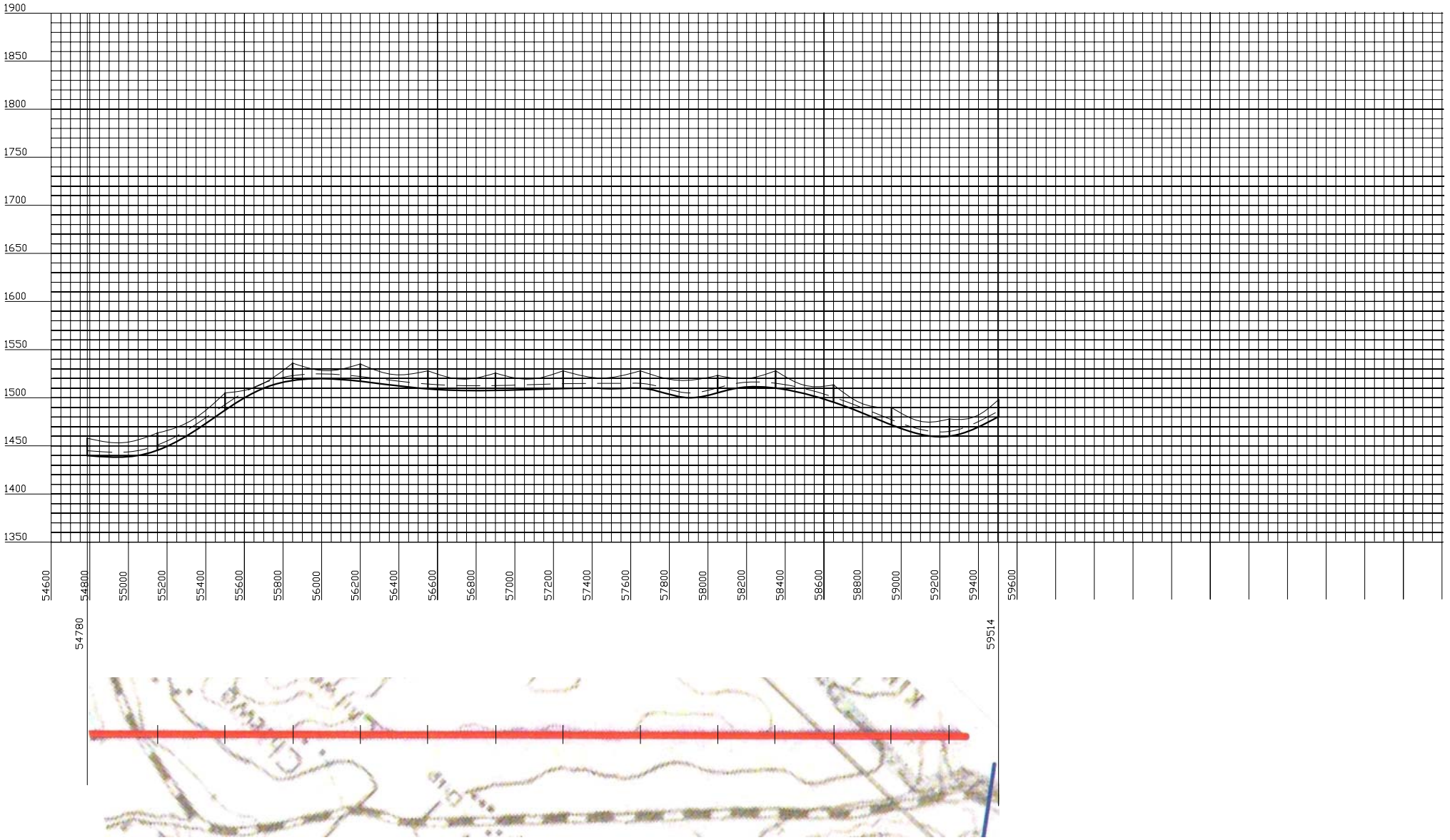
Drawing No. HL UR 121 - Sheet 8



Dessiné par: ALX Controlé par: XDS

Référence informatique:P:\BRC\ENE\

Drawing No. HL UR 121 - Sheet 9

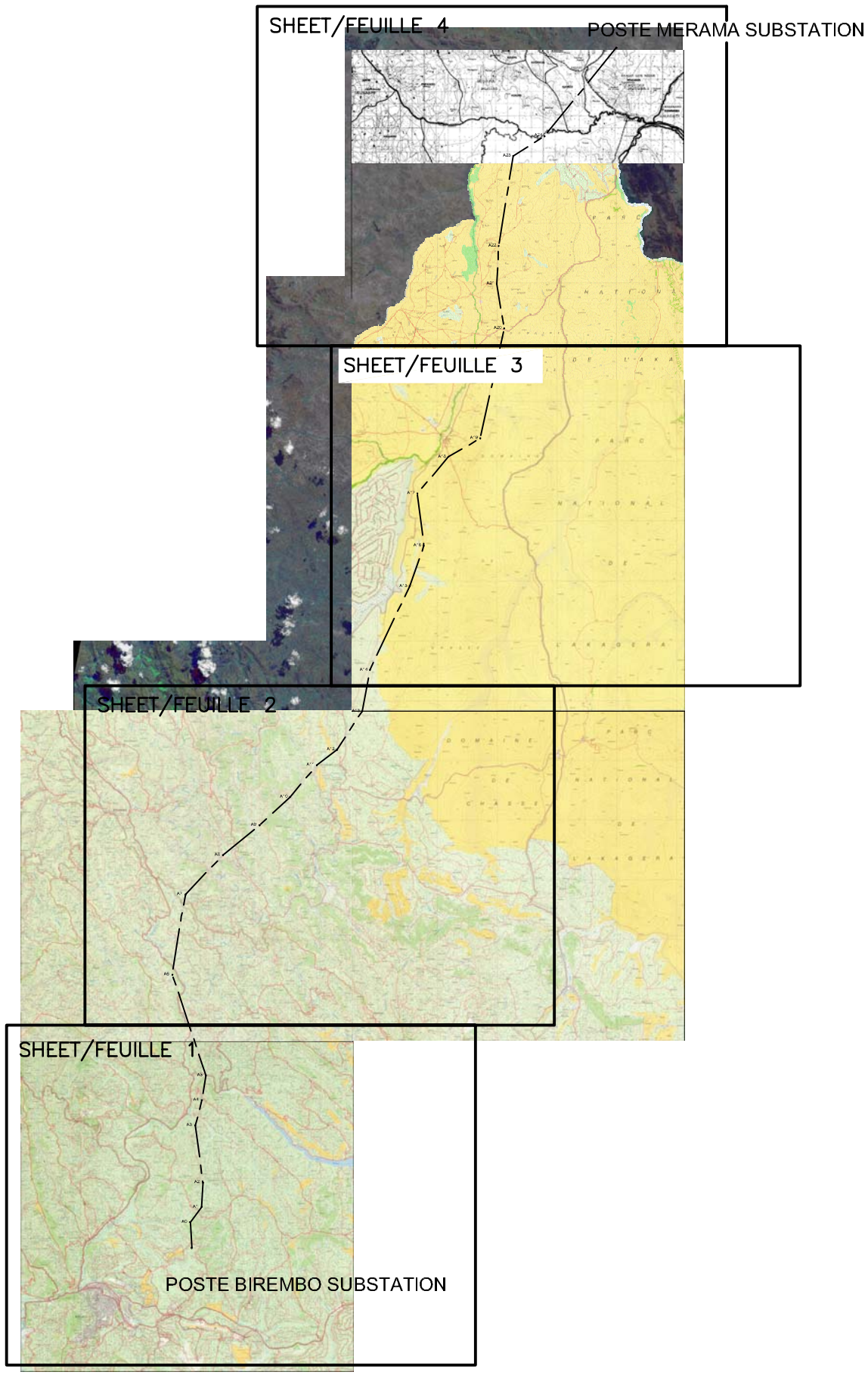


Dessiné par: ALX Controlé par: XDS

Référence informatique:P:\BRC\ENE\

Drawing No. HL UR 121 - Sheet 10

ANNEX F. GENERAL MAP: BIREMBO – MIRAMA



Dessiné par: T. Shalman Controlé par: XDS

Référence informatique: P:\Secteur_36\P36_3020\Dao\Dessins pour rapport\Interconnexion Ouganda Rwanda\R L UR 001 0.dwg

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA

TRACÉ

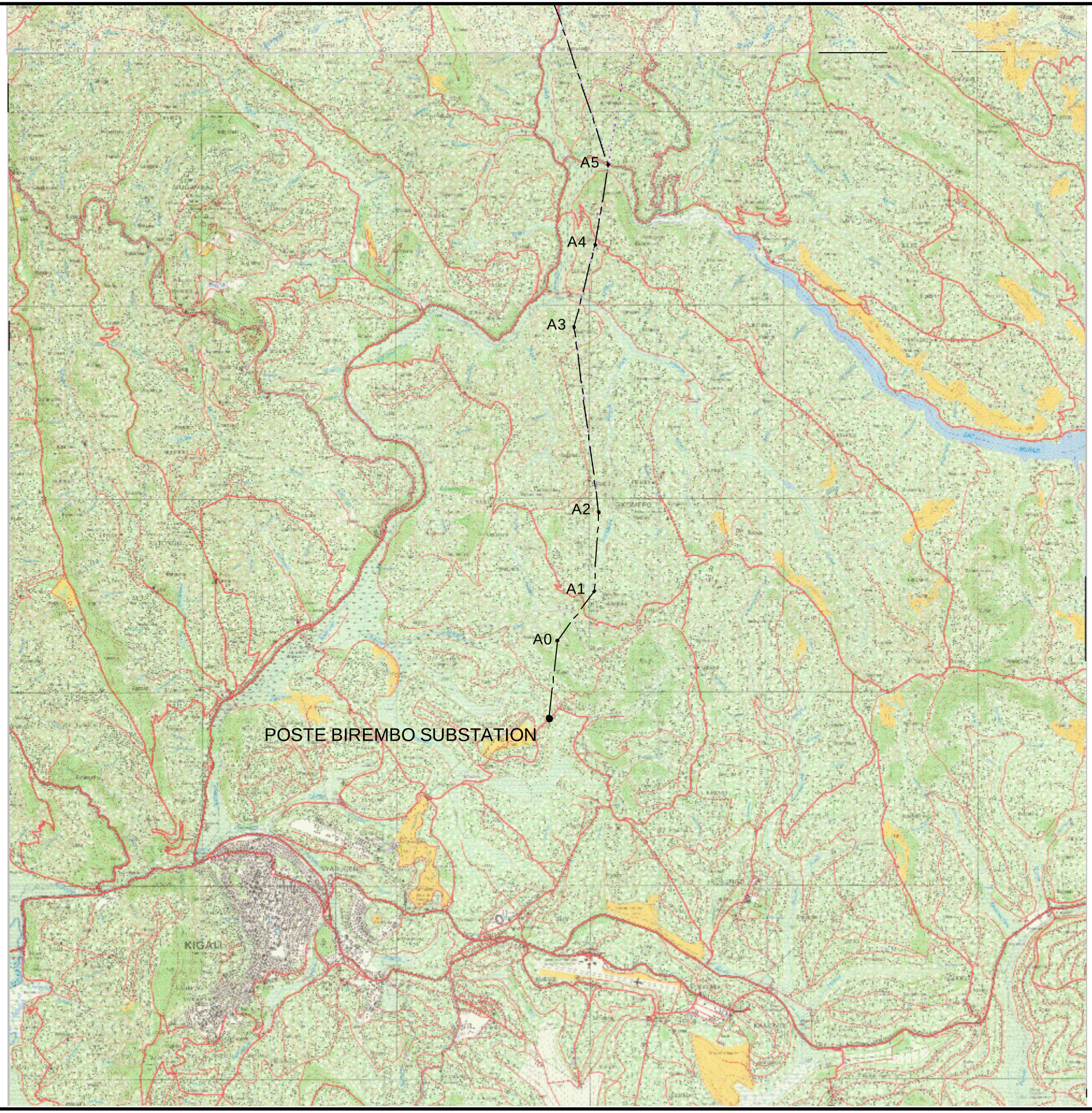
PLAN CLÉ

SOGREAH · RSW INTERNATIONAL · Hydro Québec International · Ebfab

N° R L UR 001 0

Date : June / Juin 2007

ANNEX G. MAP SHEETS: BIREMBO – MIRAMA



LEGEND / LÉGENDE

A1 — PRINCIPAL ANGLE / ANGLE PRINCIPAL

SCALE / ÉCHELLE 0 1 2 3 4 5 km

NELSAP	PAALEN
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES	ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITÉ

INTERCONNEXION OUGANDA-RWANDA

TRACÉ

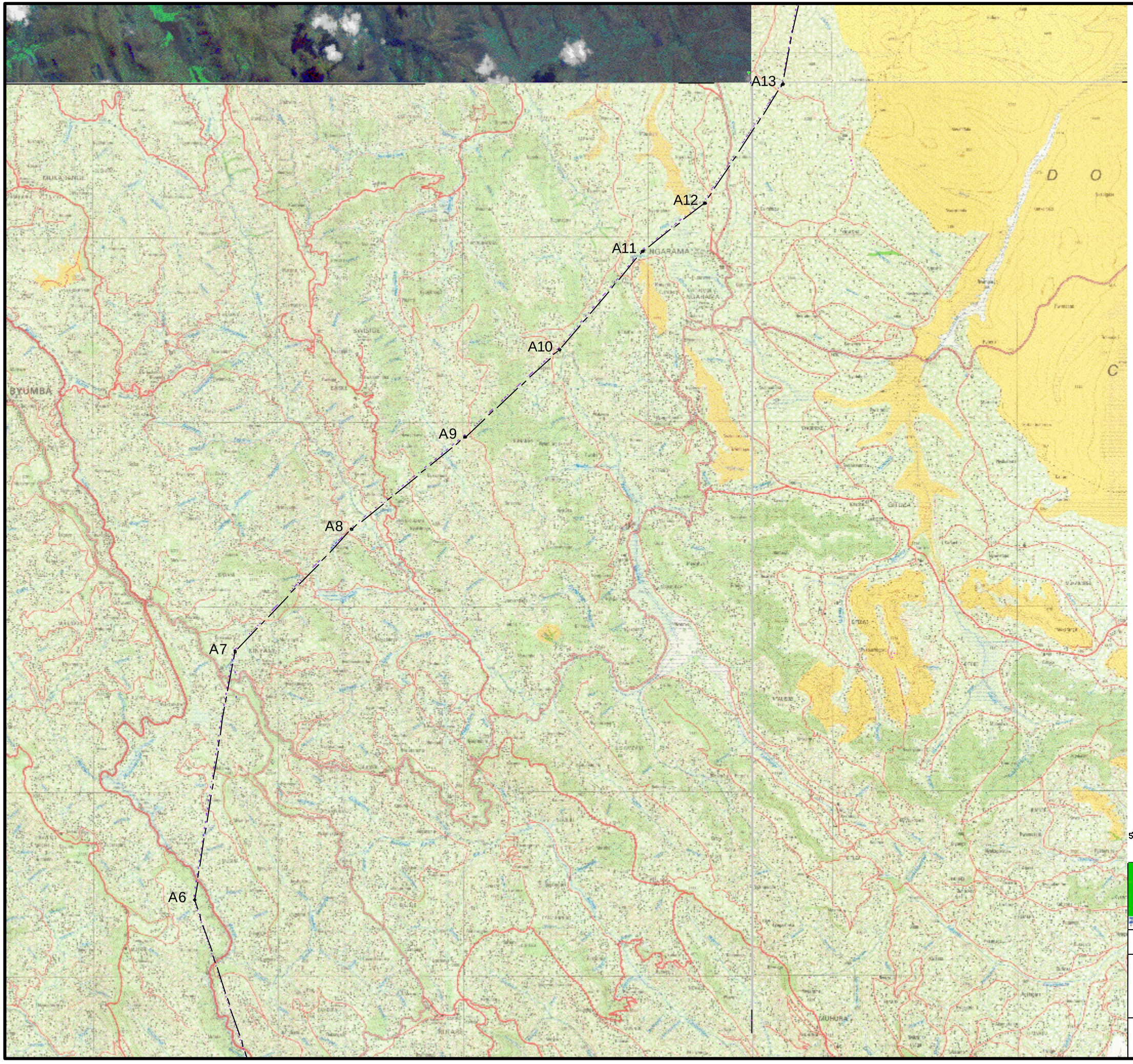
FEUILLE 1 DE 4

N° R L UR 002 0

Date : June / Juin 2007

Dessiné par: T. Shalman Controlé par: XDS

Référence informatique: P:\Secteur_36\P36_3020\Dao\Dessins pour rapport\Interconnexion Ouganda Rwanda\R L UR 002 0.dwg



LEGEND / LÉGENDE

A1 — PRINCIPAL ANGLE / ANGLE PRINCIPAL

SCALE / ÉCHELLE 0 1 2 3 4 5 km

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITÉ

INTERCONNEXION OUGANDA-RWANDA

TRACÉ

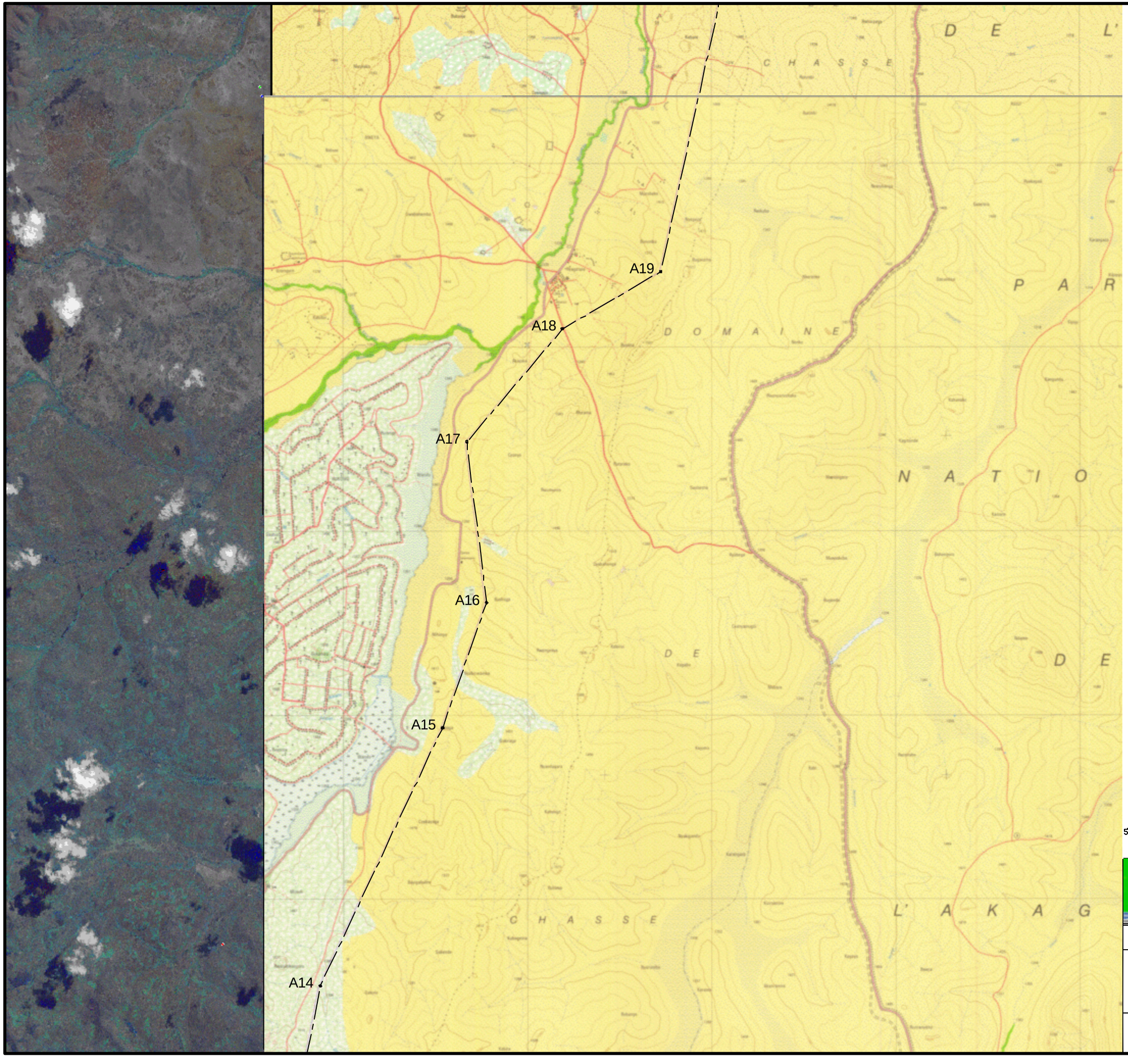
FEUILLE 2 DE 4

N° R L UR 003 0

Date : June / Juin 2007

Dessiné par: T. Shalman Contrôlé par: XDS

Référence informatique: P:\Secteur_36\P36_3020\Dao\Dessins pour rapport\interconnexion Ouganda Rwanda\R L UR 003 0.dwg



LEGEND / LÉGENDE

A1 — PRINCIPAL ANGLE / ANGLE PRINCIPAL

SCALE / ÉCHELLE 0 1 2 3 4 5 km

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITÉ

INTERCONNEXION OUGANDA-RWANDA

TRACÉ

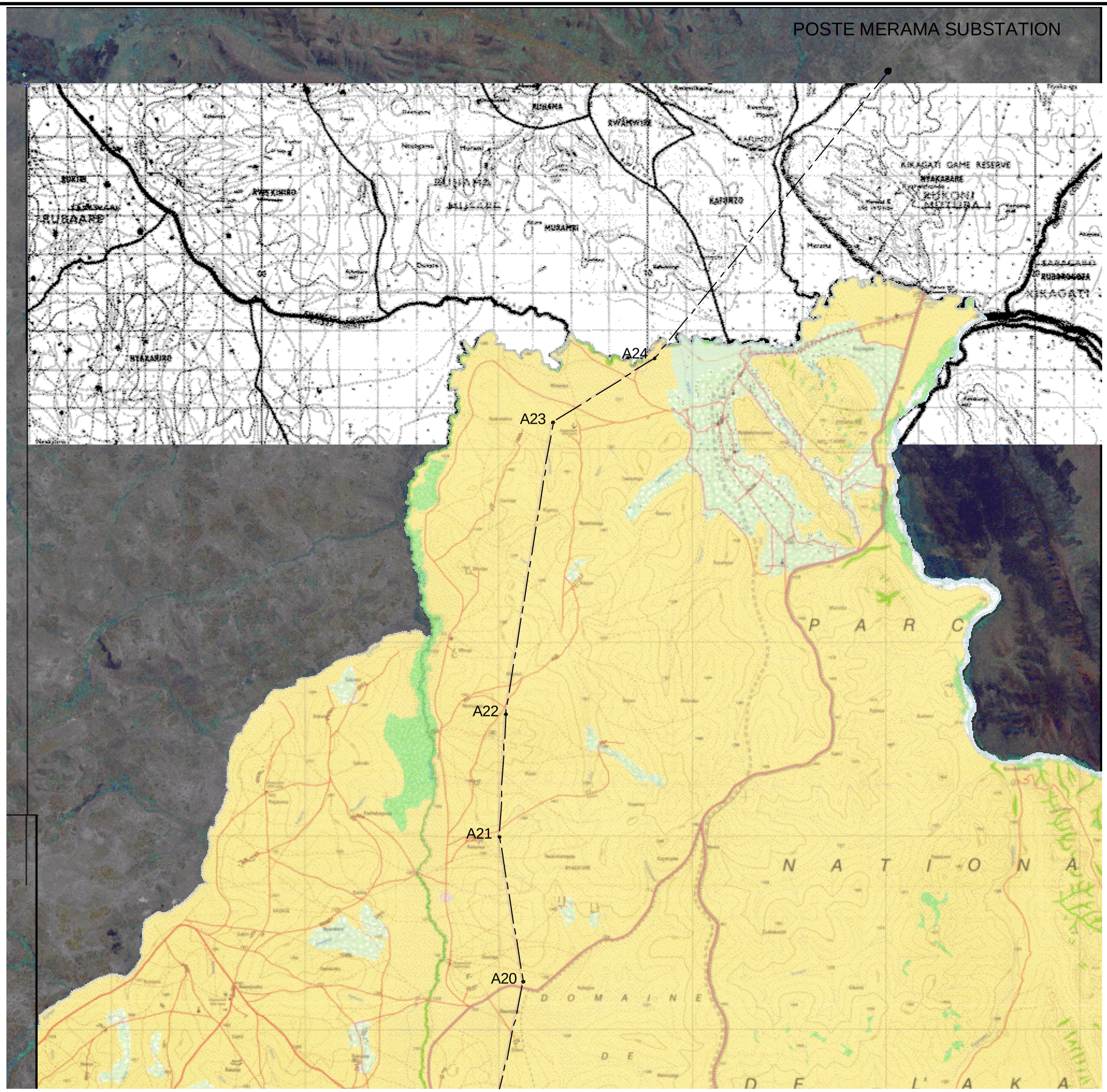
FEUILLE 3 DE 4

N° R L UR 004 0

Date : June / Juin 2007

Dessiné par: T. Shalman Controlé par: XDS

Référence informatique: P:\Secteur_36\P36_3022D\Dao\Dessins pour rapport\Interconnexion Ouganda Rwanda\R L UR 004 0.dwg



LEGEND / LÉGENDE

A1 — PRINCIPAL ANGLE / ANGLE PRINCIPAL

SCALE / ÉCHELLE 0 1 2 3 4 5 km

NELSAP	PAALEN
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES	ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITÉ

INTERCONNEXION OUGANDA-RWANDA

TRACÉ

FEUILLE 4 DE 4

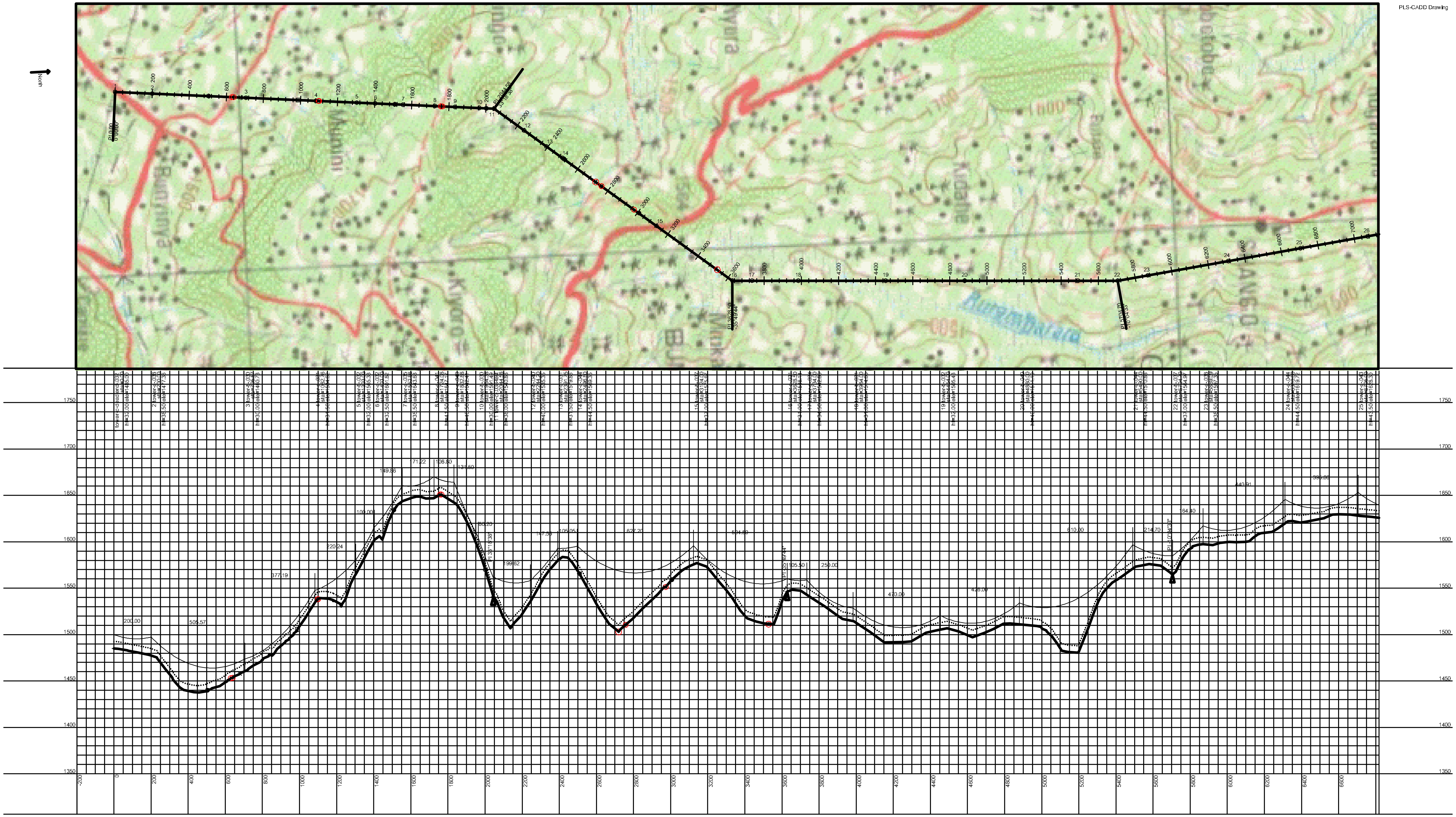
N° R L UR 005 0

Date : June / Juin 2007

Dessiné par: T. Shalman Controlé par: XDS

Référence informatique: P:\Secteur_36\P36_3020\Dao\Dessins pour rapport\Interconnexion Ouganda Rwanda\R L UR 005 0.dwg

ANNEX H. LONGITUDINAL PROFILES: BIREMBO – MIRAMA



ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP	PAALEN
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES	ETUDE D'INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

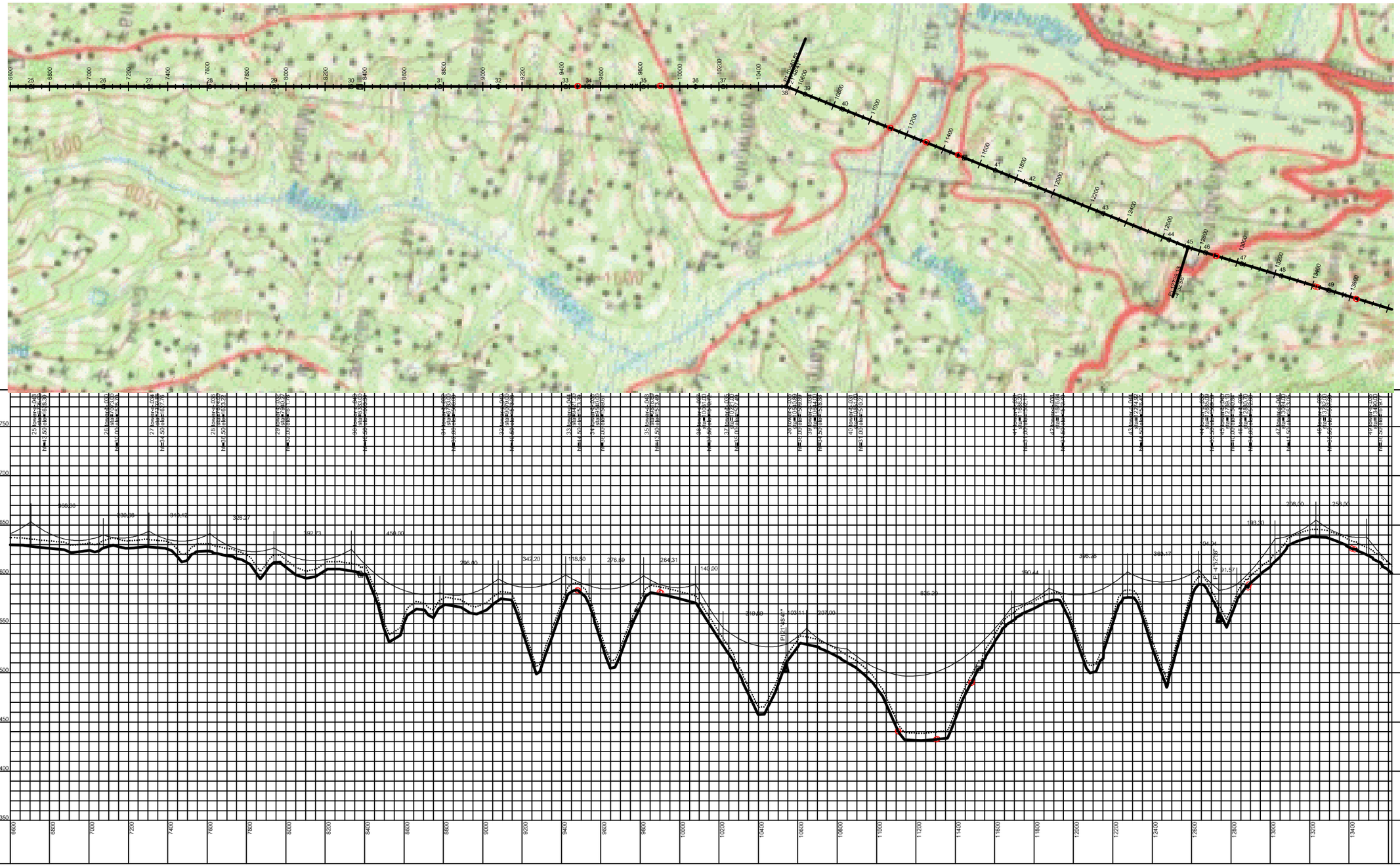
INTERCONNEXION OUGANDA-RWANDA
PLAN ET PROFIL
FEUILLE 1 DE 18

N° R L UR 015 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing



NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D'INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA

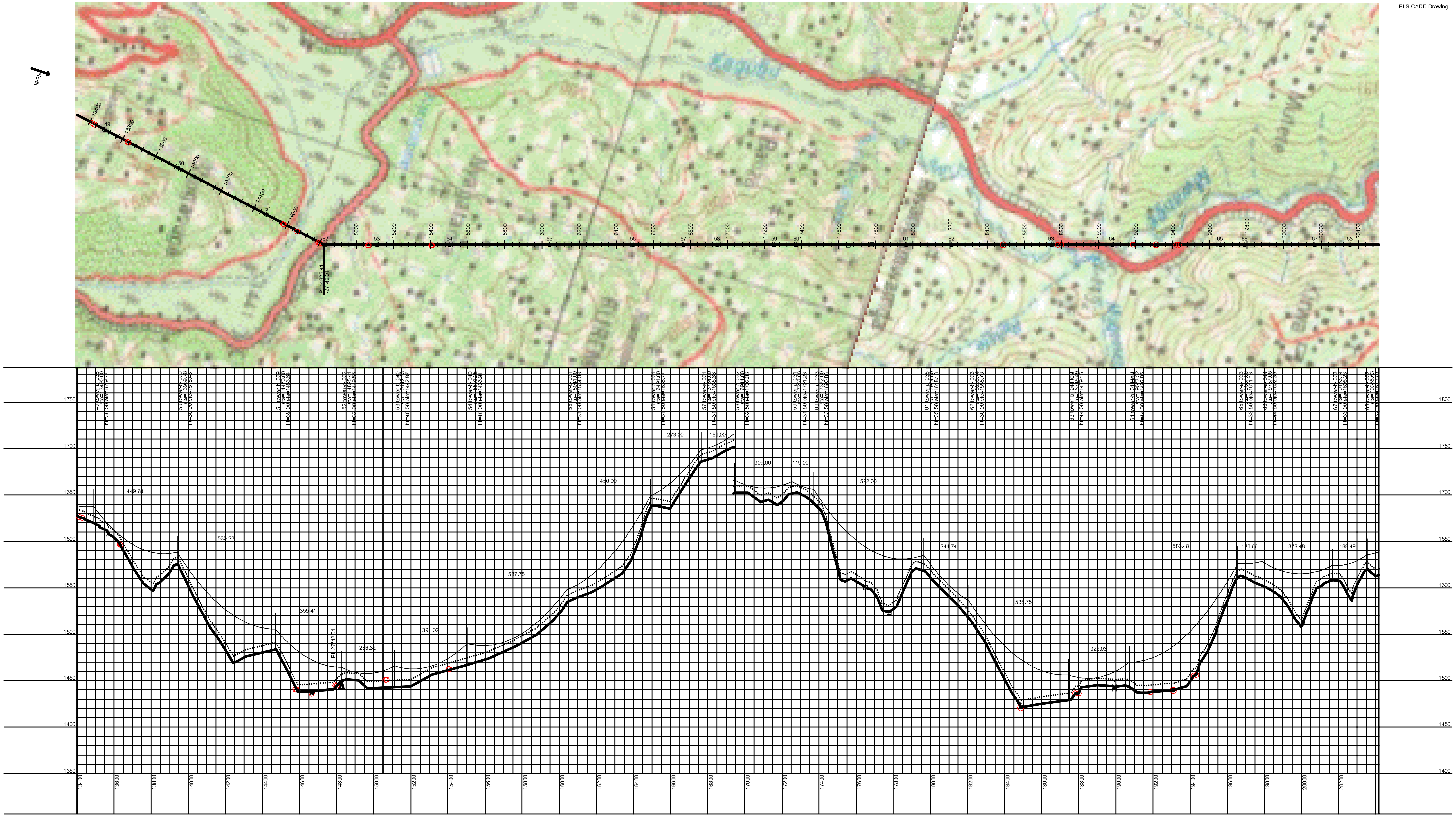
PLAN ET PROFIL
FEUILLE 2 DE 18

[redacted] RSW INTERNATIONAL Hifab Hydro Québec International

N° R L UR 016 0

Date : June / Juin 2007

A1 841 x 594



ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP

STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN

ETUDE D'INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA

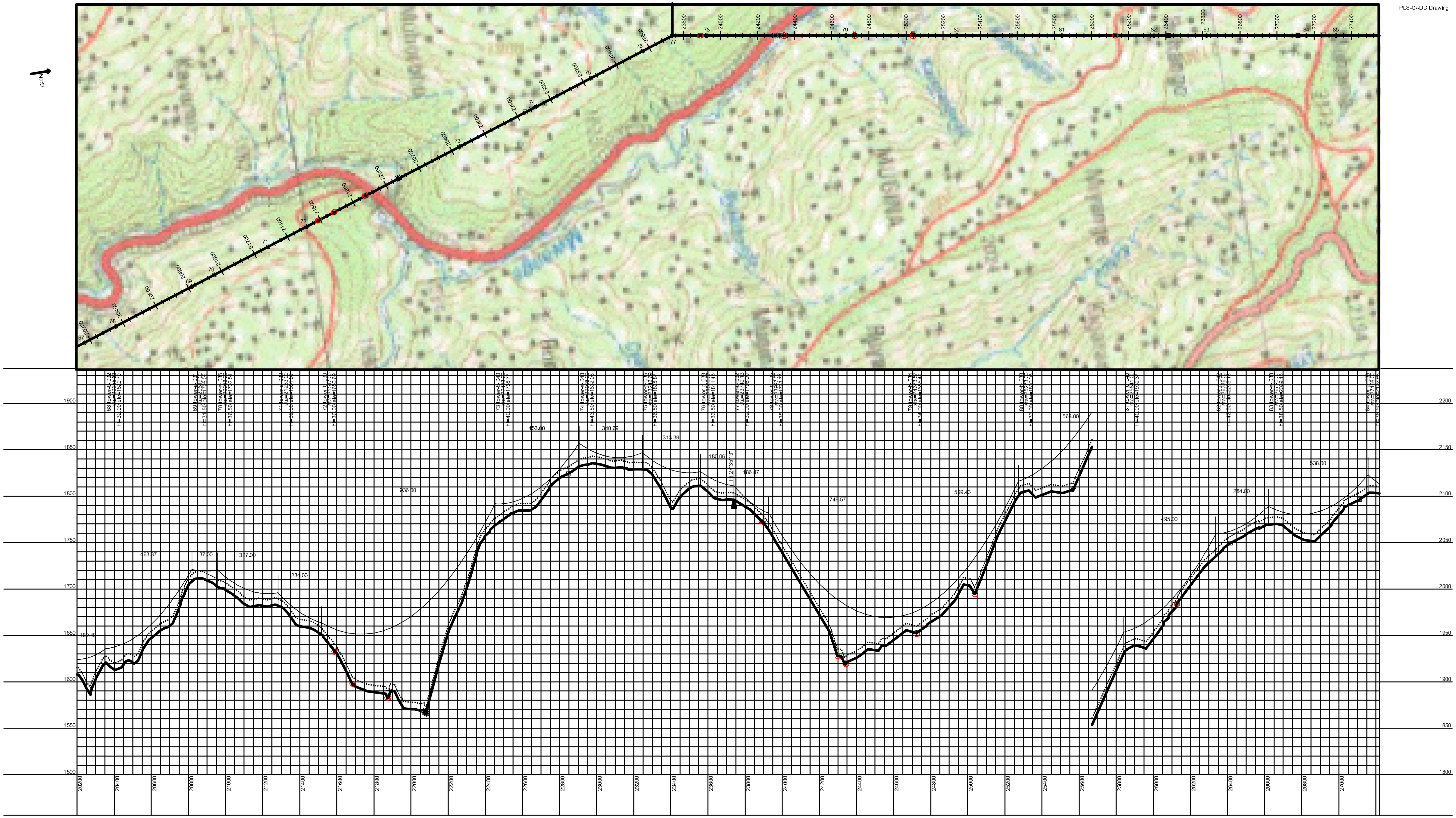
PLAN ET PROFIL

FEUILLE 3 DE 18

N° R L UR 017 0

Date : June / Juin 2007

A1 841 x 594



ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D'INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

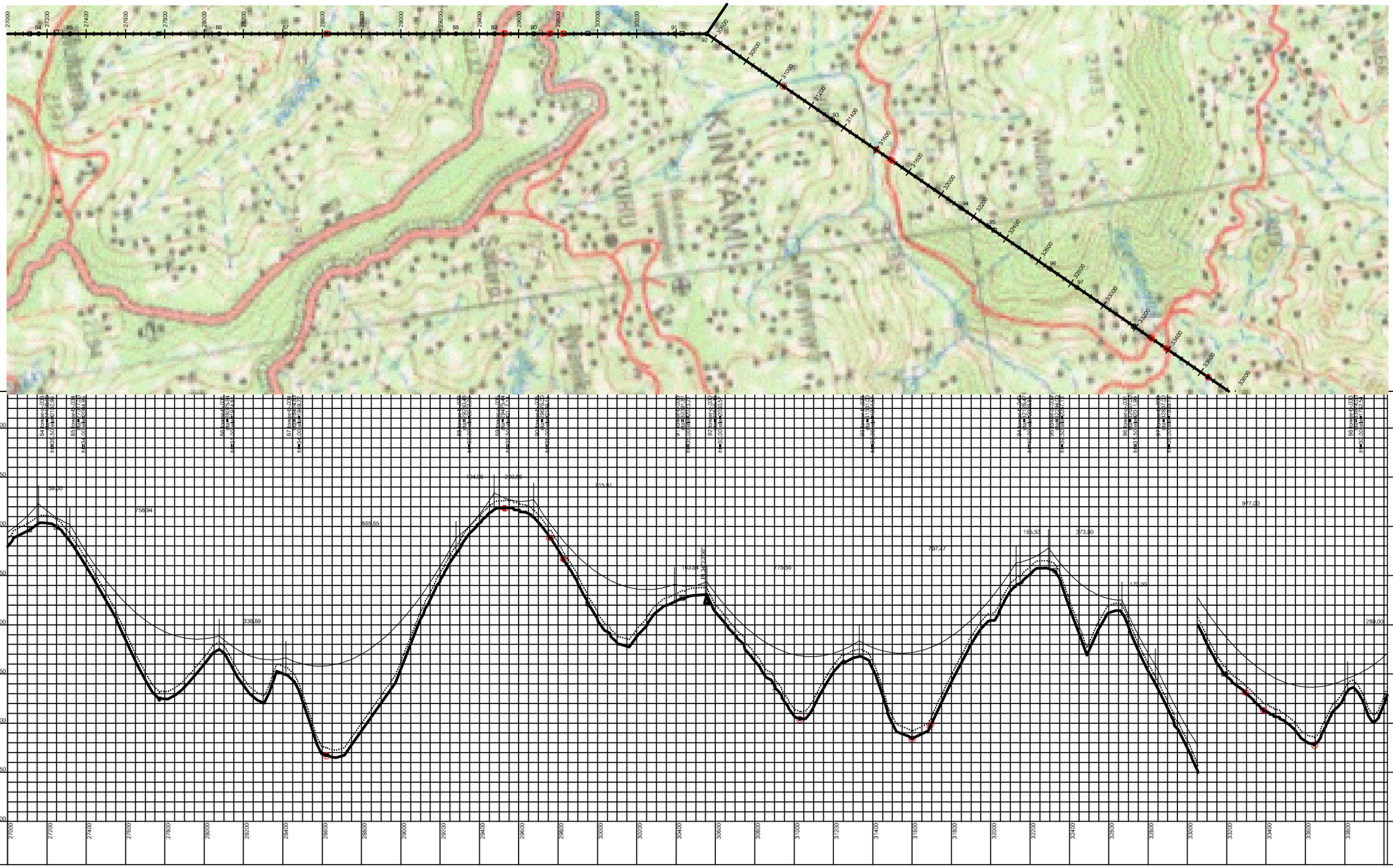
INTERCONNEXION OUGANDA-RWANDA
PLAN ET PROFIL
FEUILLE 4 DE 18

N° R L UR 018 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing



ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D'INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA

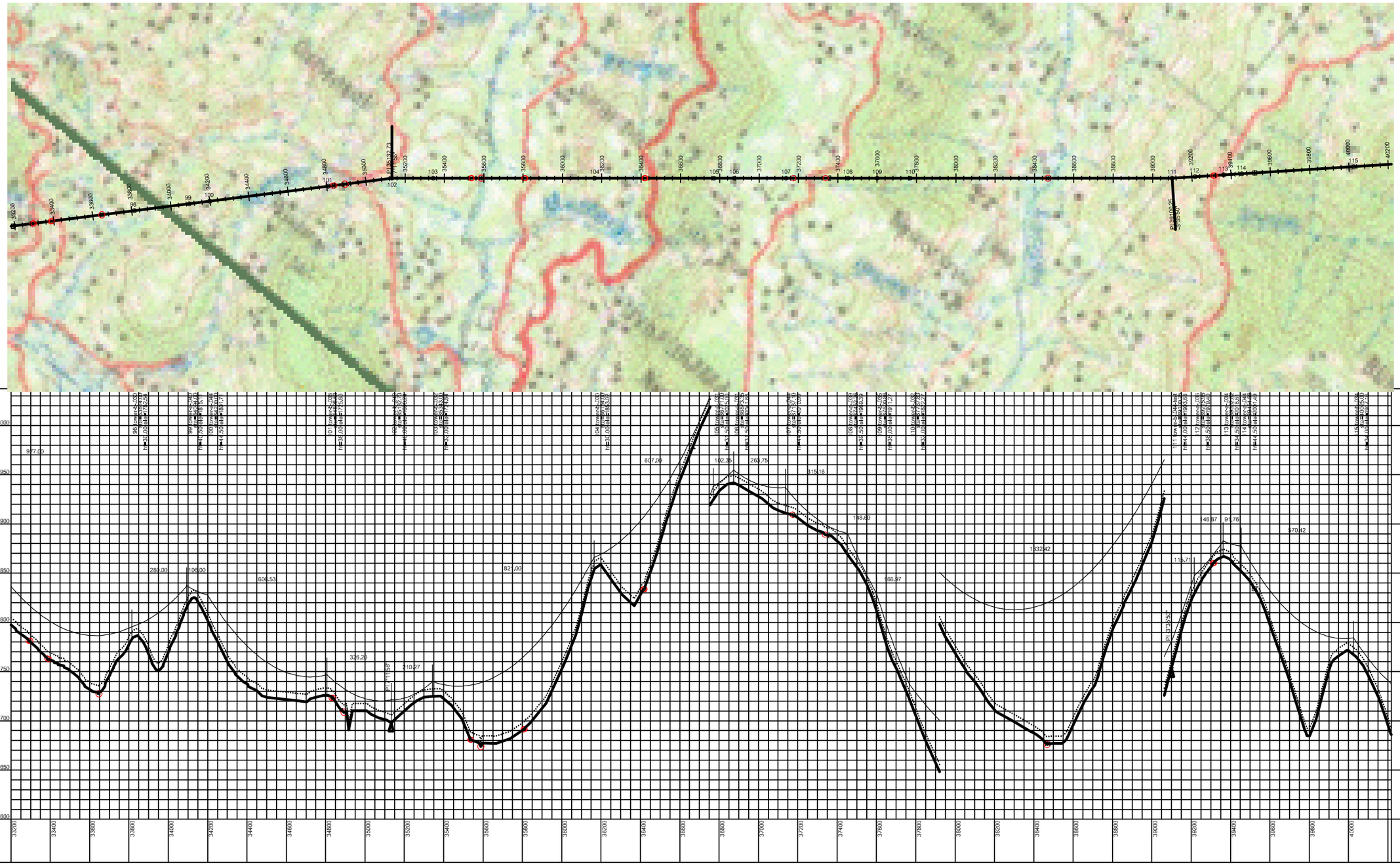
PLAN ET PROFIL
FEUILLE 5 DE 18

N° R L UR 019 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing



ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA

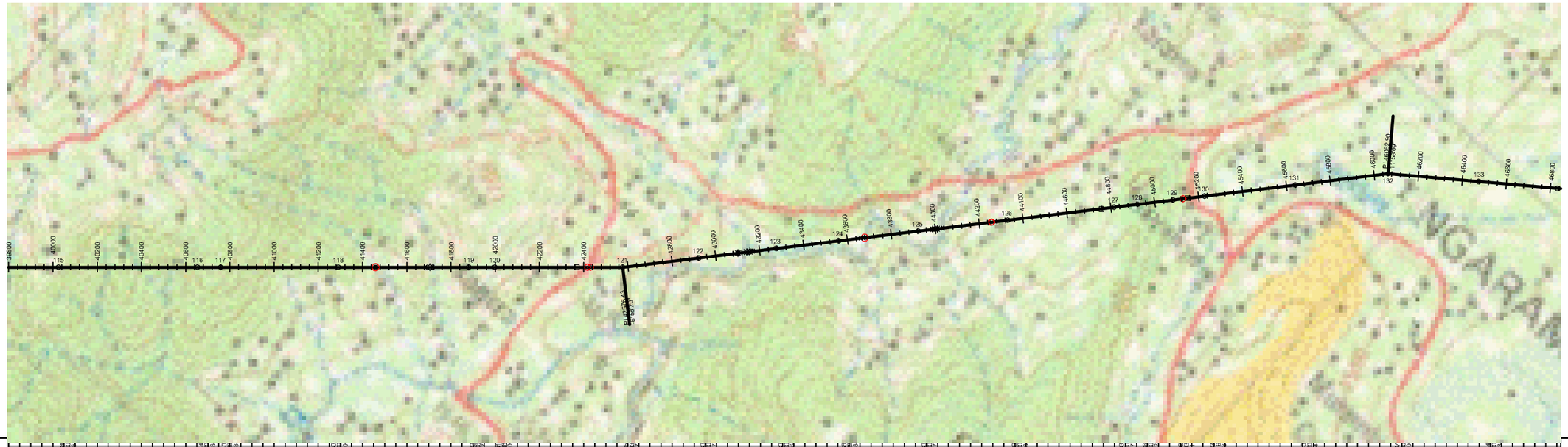
PLAN ET PROFIL
FEUILLE 6 DE 18

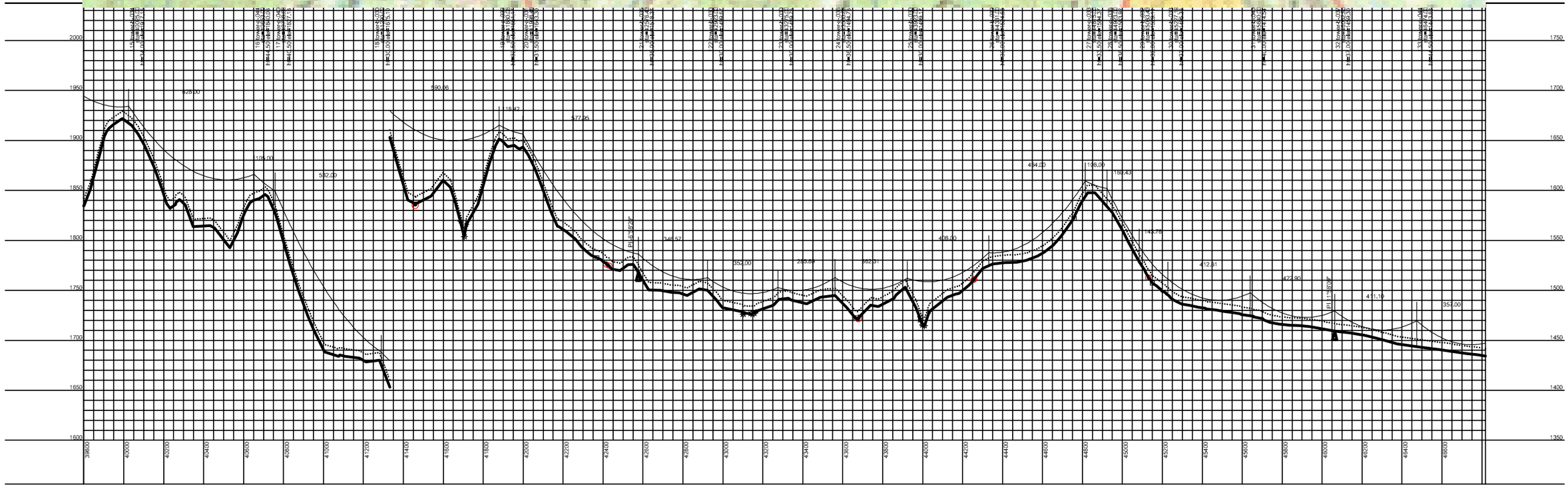
N° R L UR 020 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing





ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA

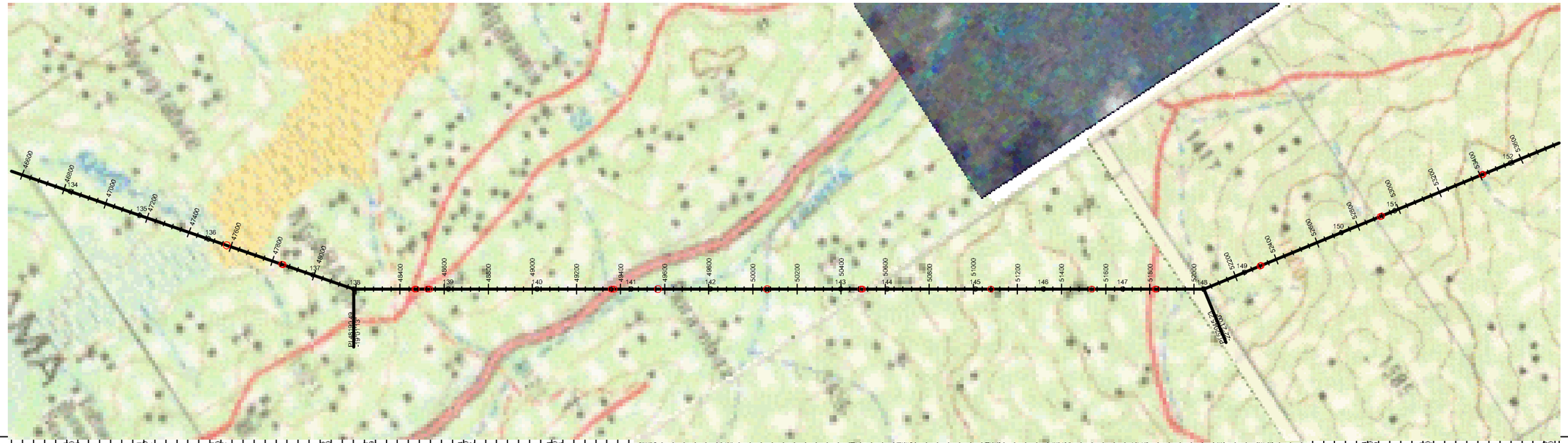
PLAN ET PROFIL
FEUILLE 7 DE 18

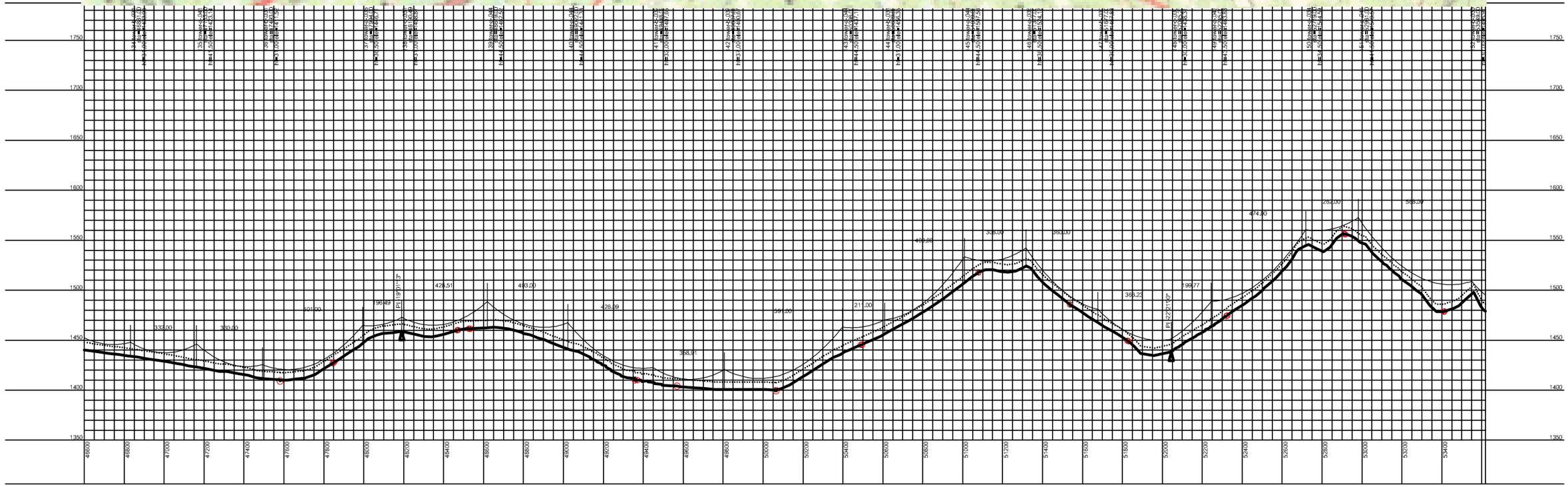
N° R L UR 021 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing





ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA

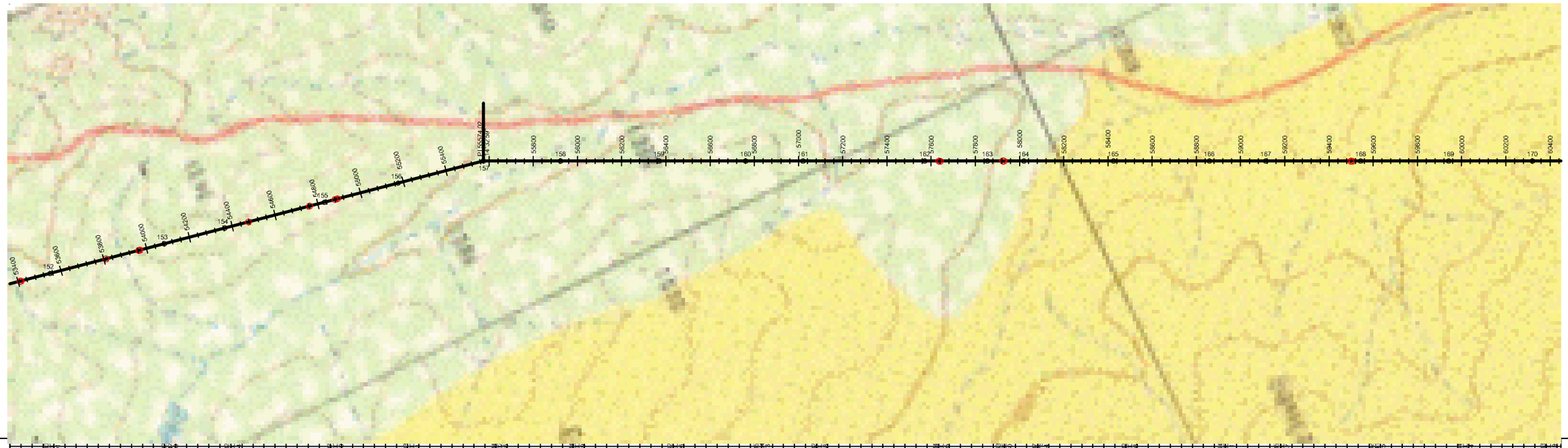
PLAN ET PROFIL
FEUILLE 8 DE 18

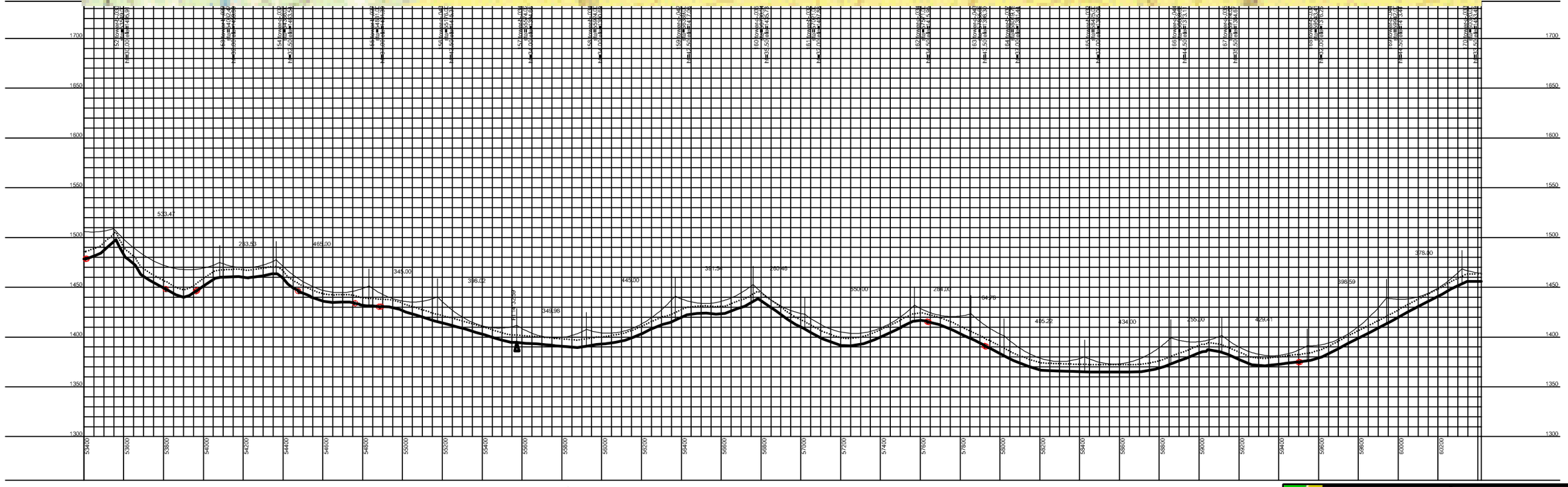
N° R L UR 022 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing





ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

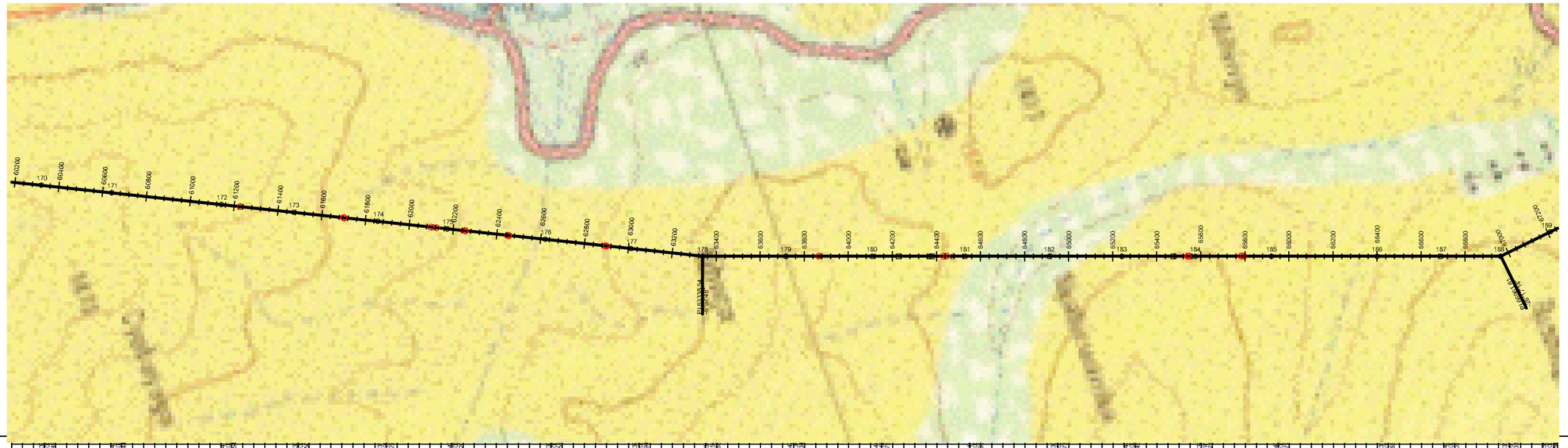
INTERCONNEXION OUGANDA-RWANDA

PLAN ET PROFIL
FEUILLE 9 DE 18

N° R L UR 023 0

Date : June / Juin 2007

A1 841 x 594



ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D'INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA

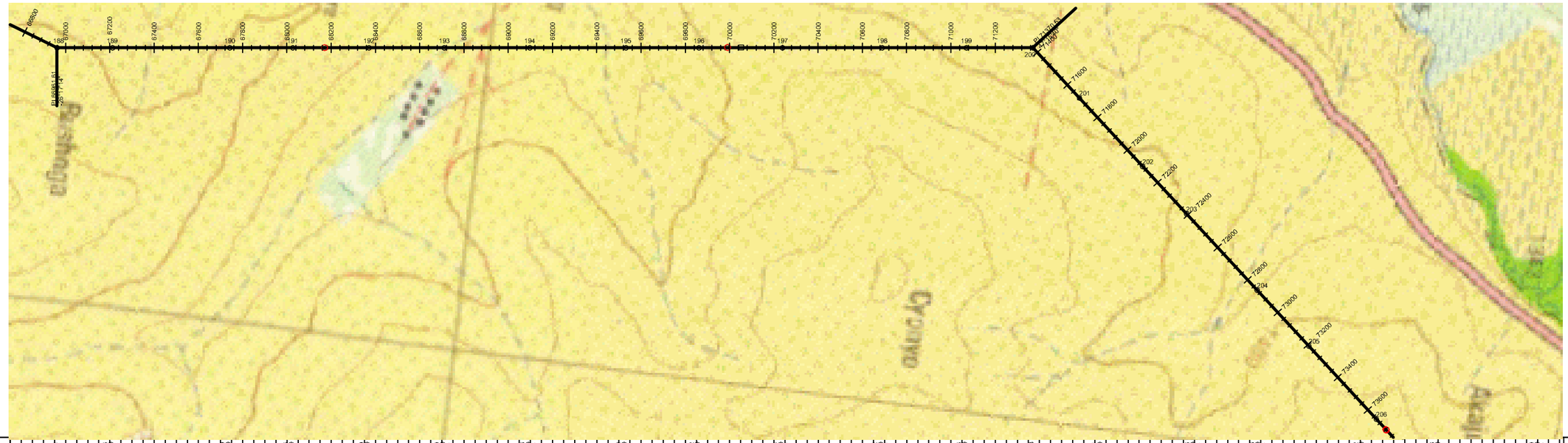
PLAN ET PROFIL
FEUILLE 10 DE 18

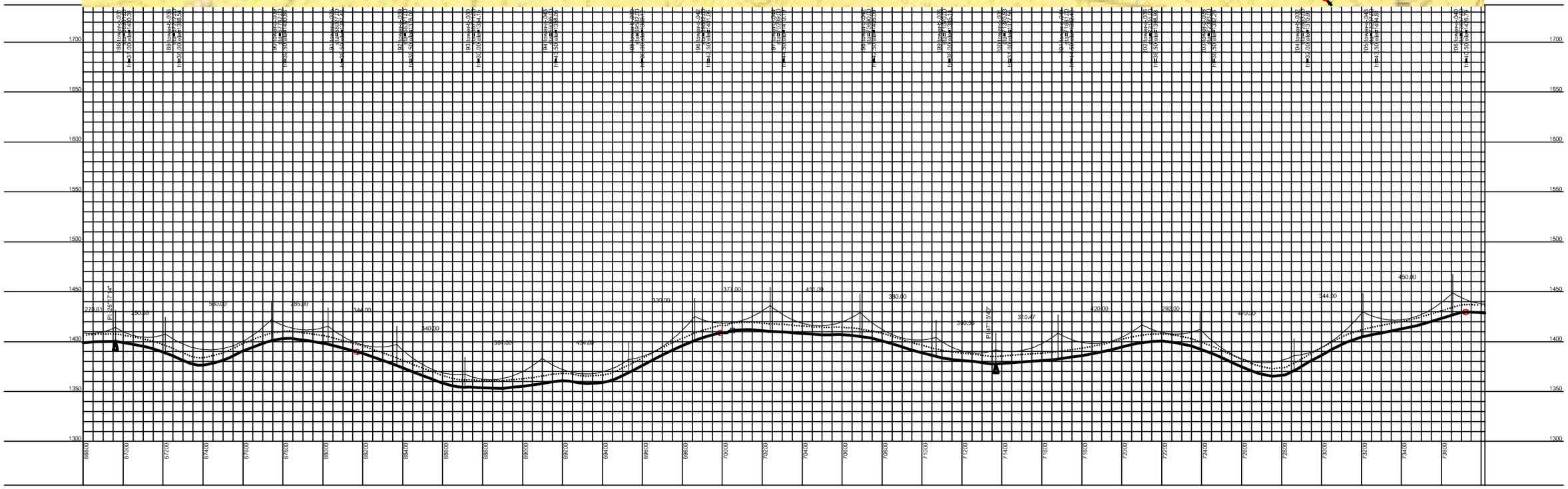
N° R L UR 024 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing





ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA

PLAN ET PROFIL
FEUILLE 11 DE 18

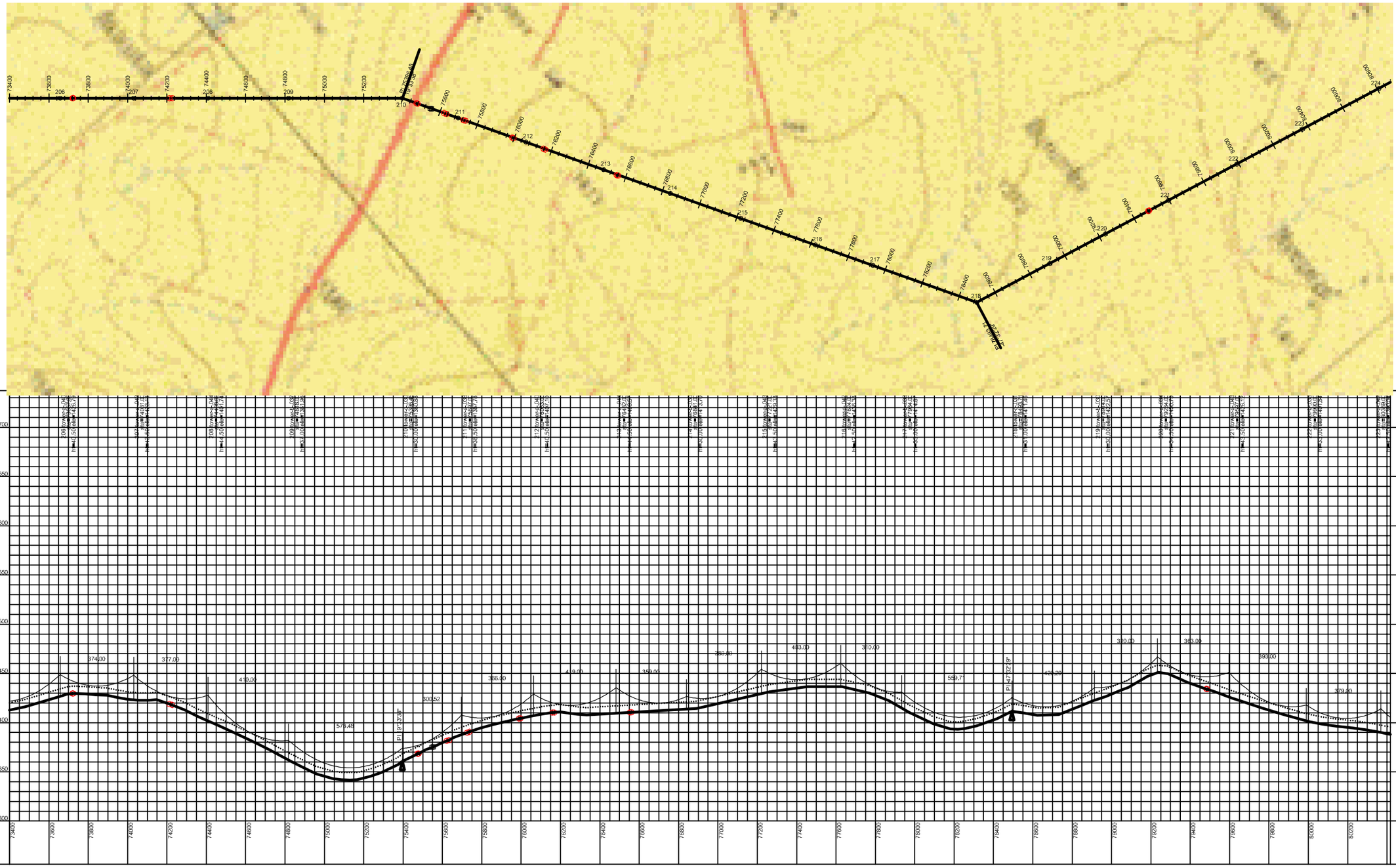
[redacted] RSW INTERNATIONAL HEBEN Hydro Québec International

N° R L UR 025 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing



ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA

PLAN ET PROFIL
FEUILLE 12 DE 18

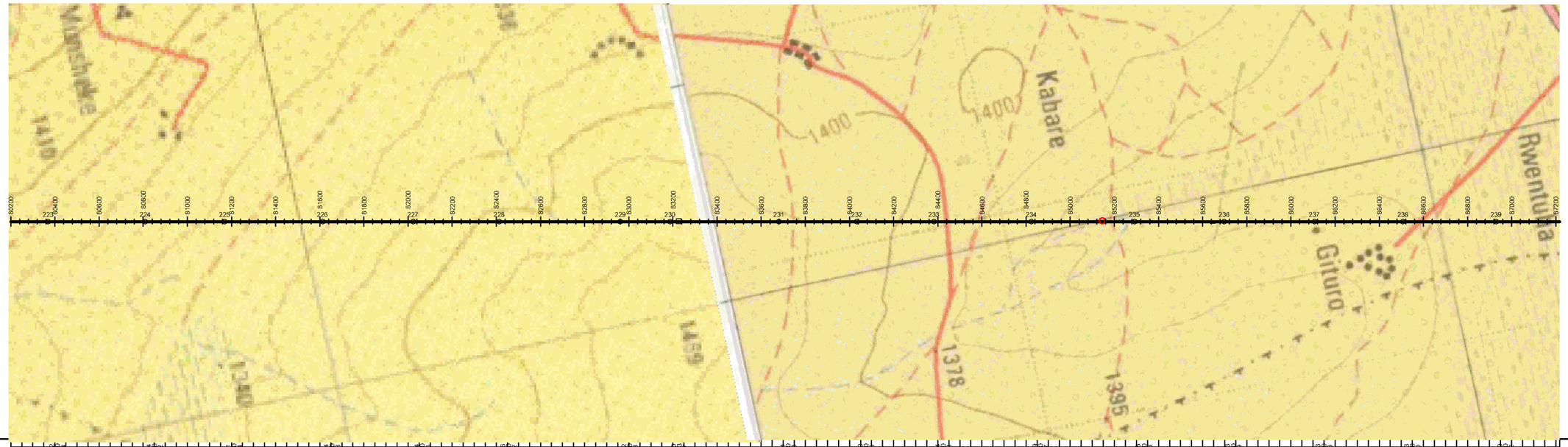
[redacted]

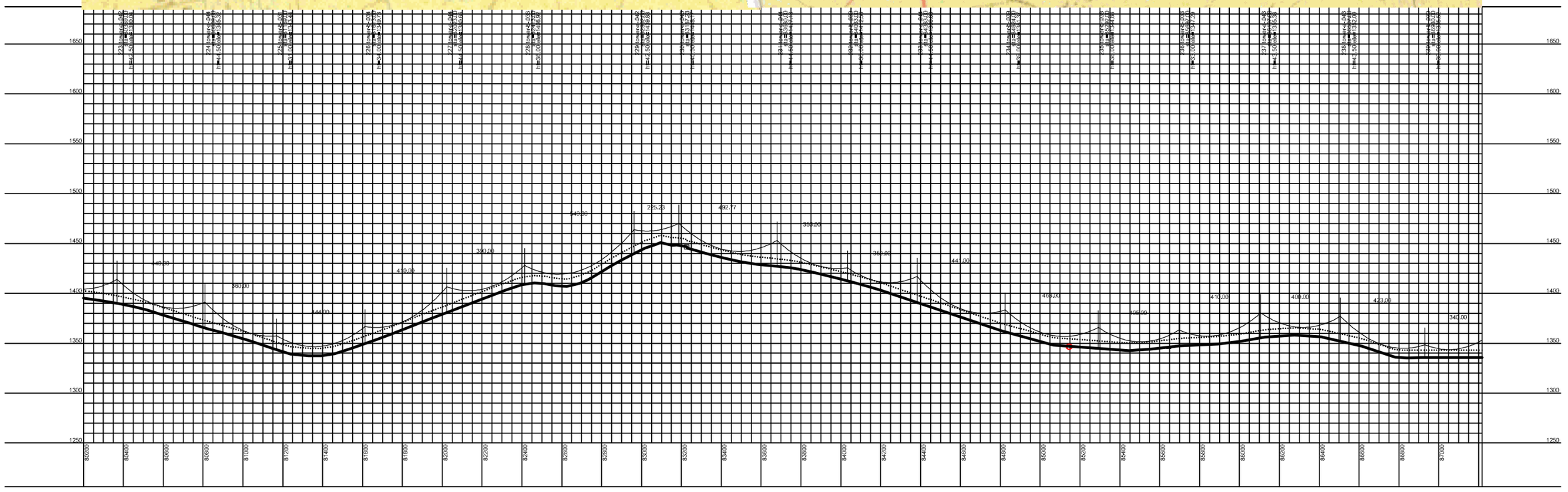
N° R L UR 026 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing





ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA
PLAN ET PROFIL
FEUILLE 13 DE 18

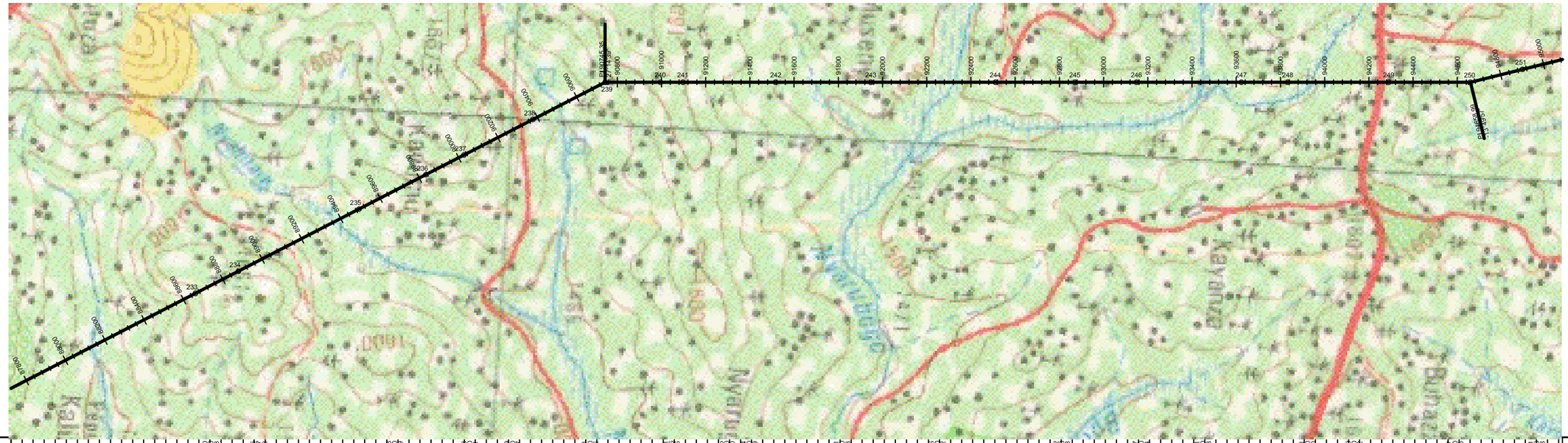
[redacted] RSW INTERNATIONAL HEBEI Hydro Québec International

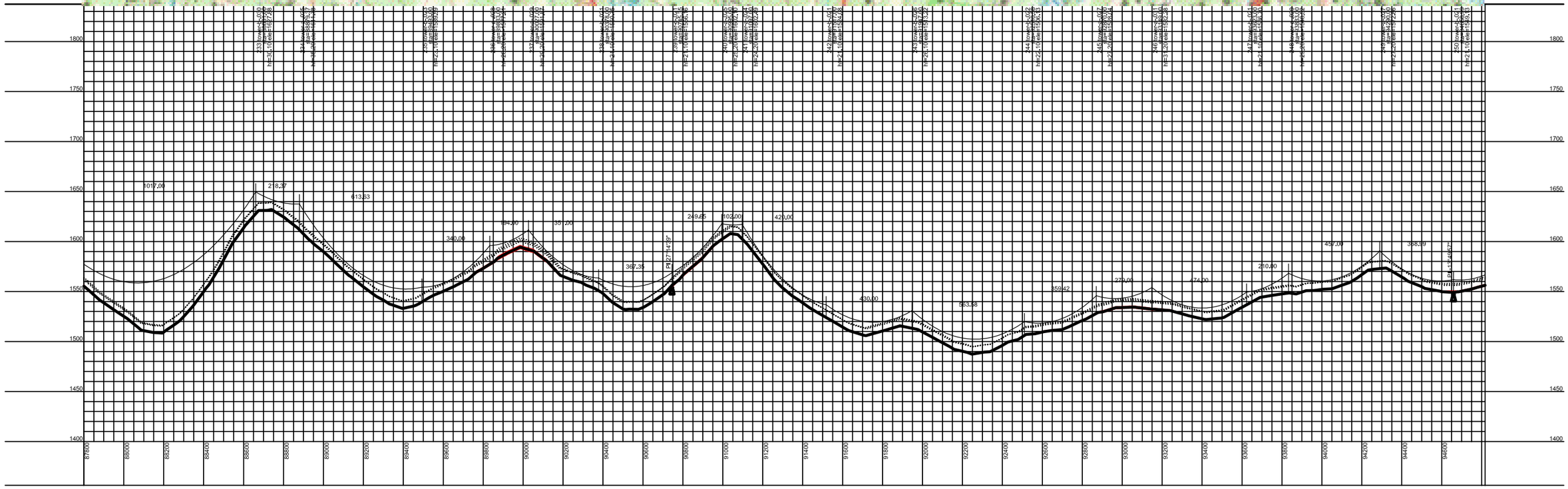
N° R L UR 027 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing





ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

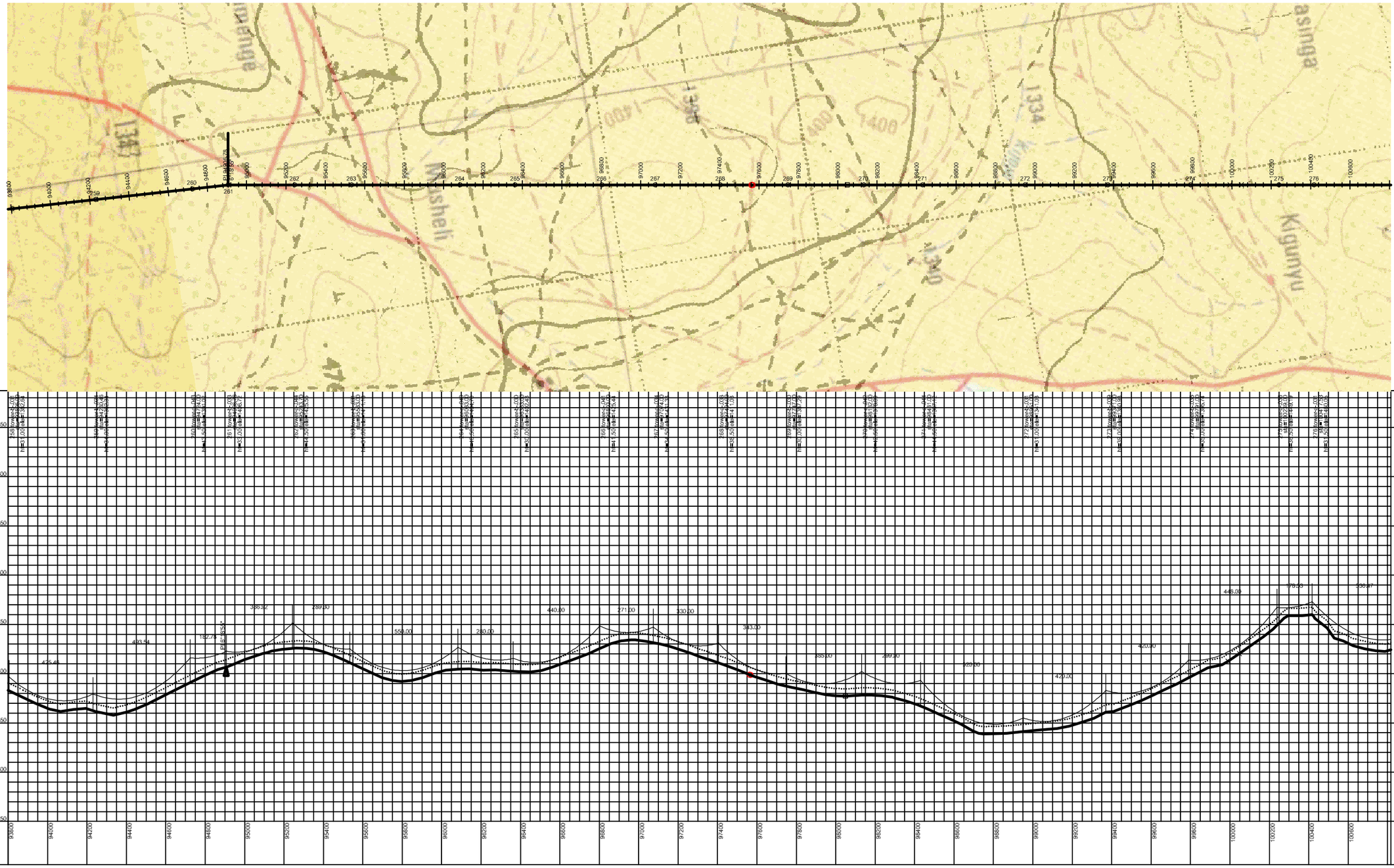
INTERCONNEXION BURUNDI-RWANDA
PLAN ET PROFIL
FEUILLE 14 DE 16

N° R L BR 028 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing



ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D'INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA
PLAN ET PROFIL
FEUILLE 15 DE 18

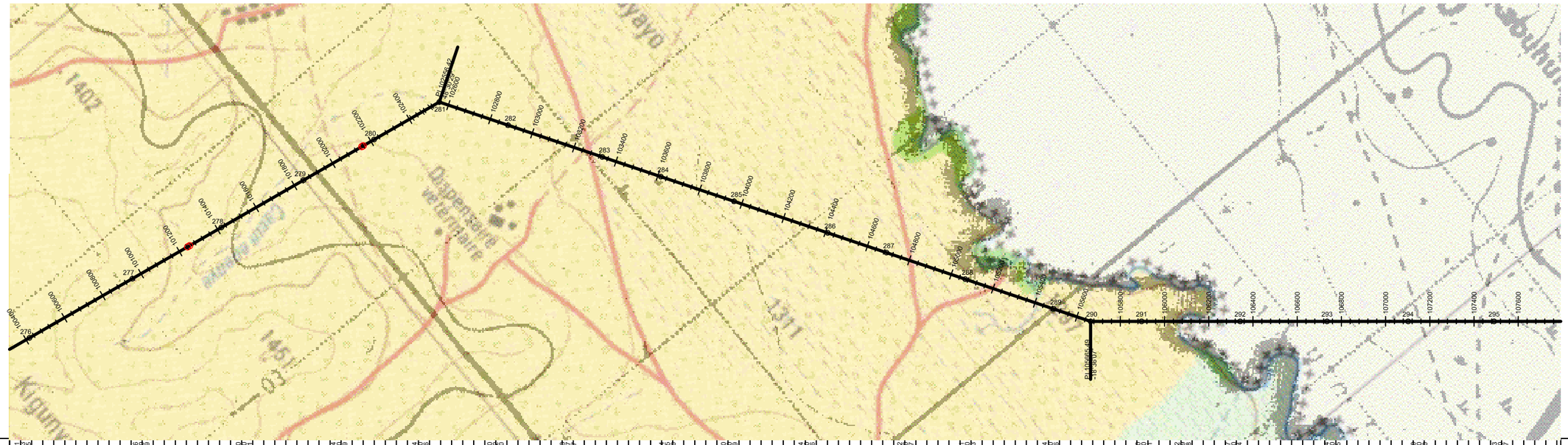
[redacted] RSW INTERNATIONAL UEGL Hydro Québec International

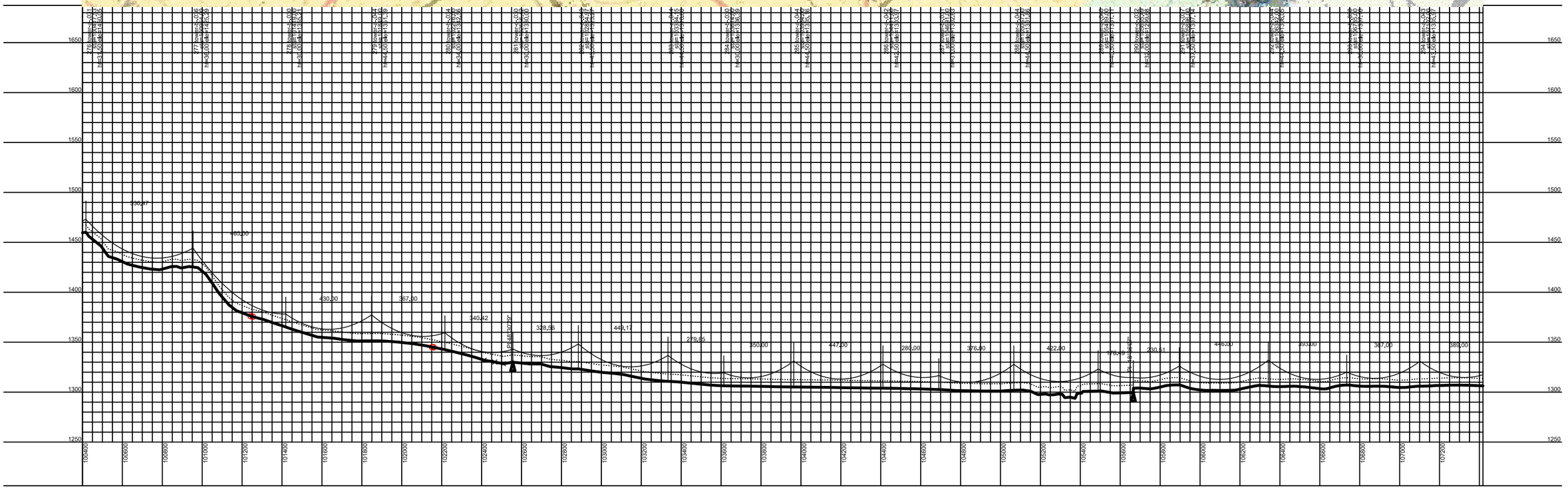
N° R L UR 029 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing





ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA

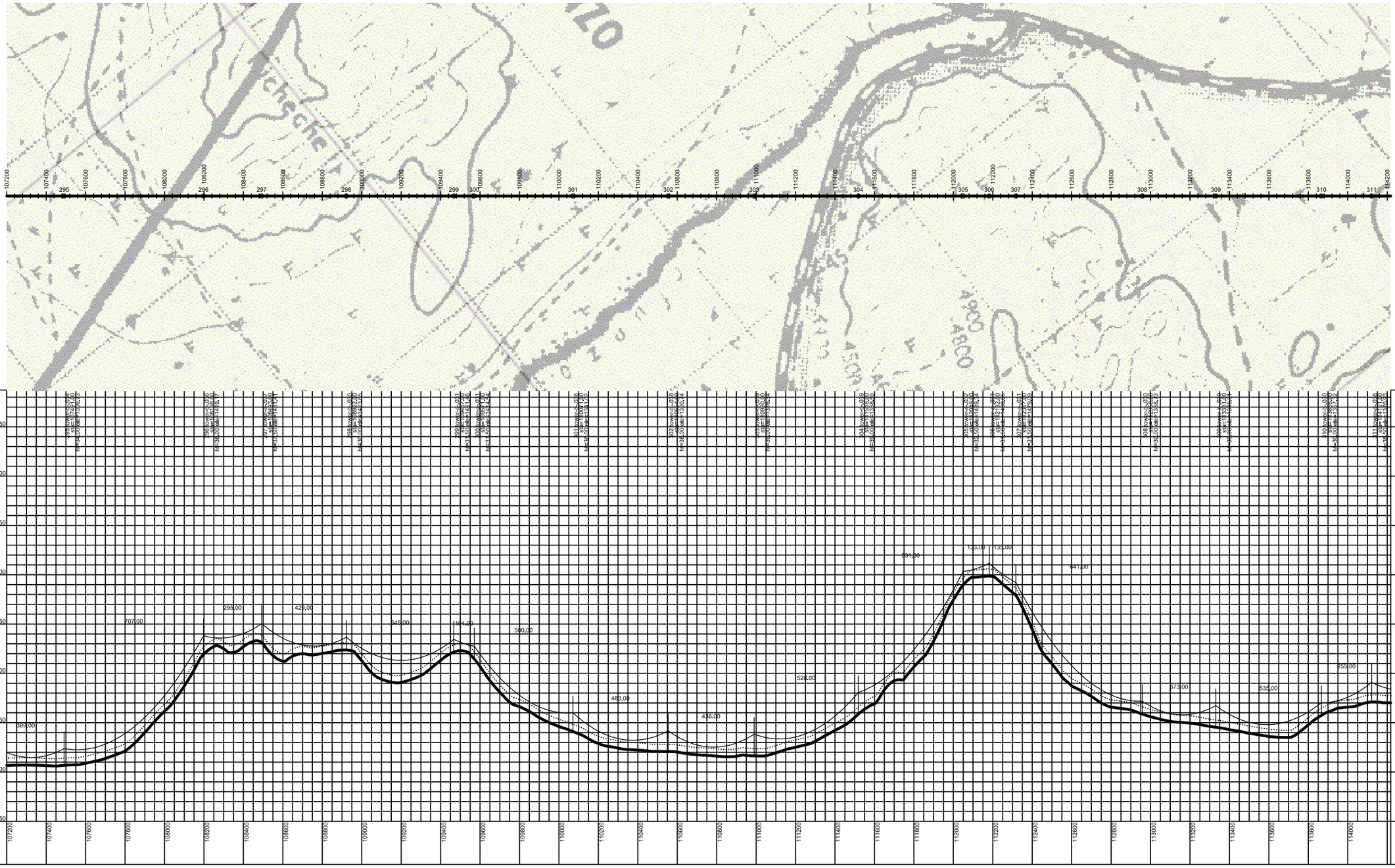
PLAN ET PROFIL
FEUILLE 16 DE 18

N° R L UR 030 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing



ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA

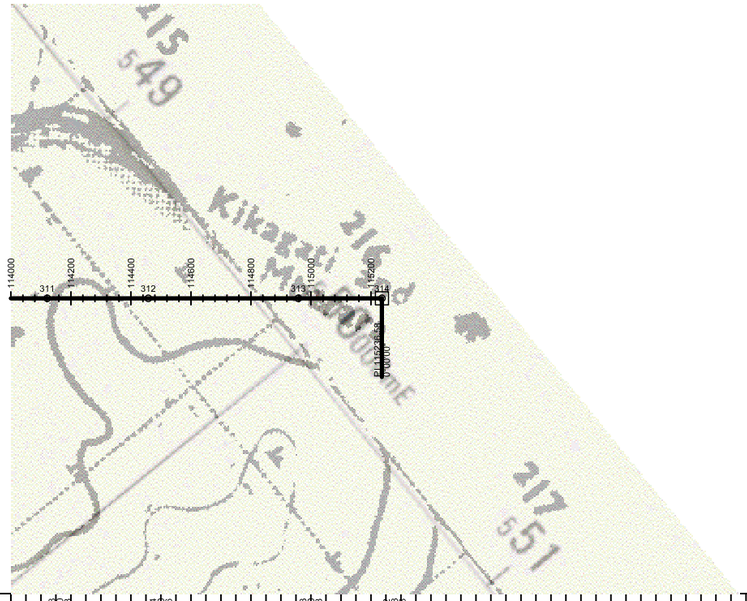
PLAN ET PROFIL
FEUILLE 17 DE 18

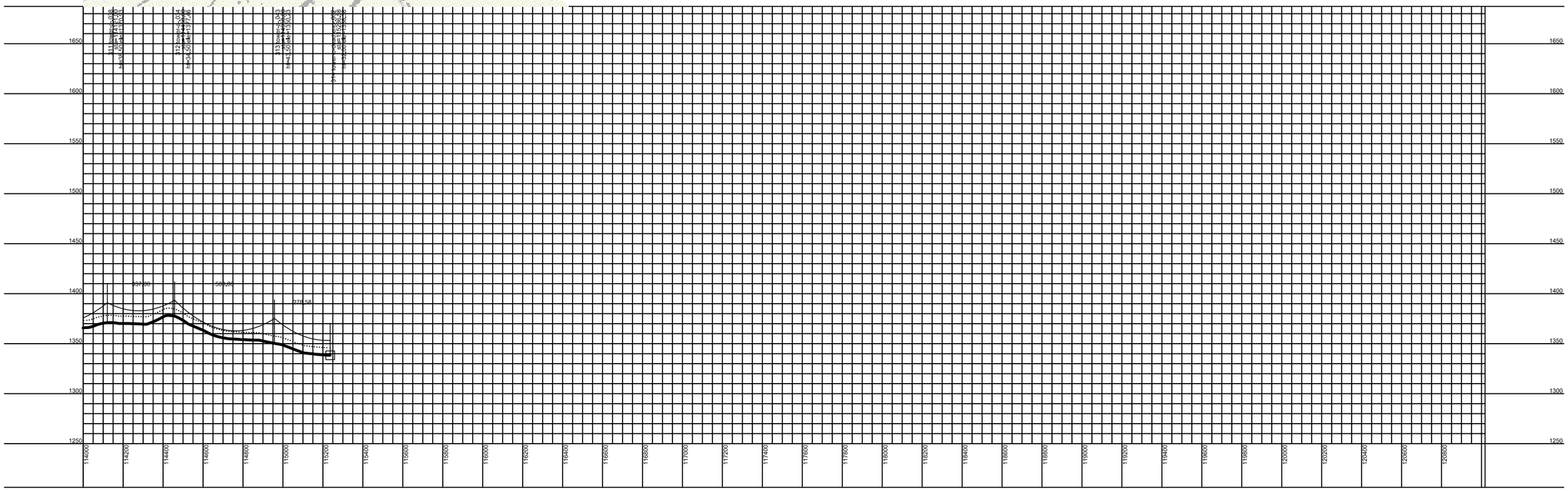
N° R L UR 031 0

Date : June / Juin 2007

A1 841 x 594

PLS-CADD Drawing





ÉCHELLE : HORIZONTALE 1 : 10 000
VERTICALE 1 : 2 000

NELSAP
STUDY ON THE INTERCONNECTION THE ELECTRICITY NETWORKS OF THE NILE EQUATORIAL LAKES COUNTRIES

PAALEN
ETUDE D' INTERCONNECTION DES RESEAUX ELECTRIQUES DES PAYS DES LACS EQUATORIAUX DU NIL

FEASIBILITY REPORT / RAPPORT DE FAISABILITE

INTERCONNEXION OUGANDA-RWANDA
PLAN ET PROFIL
FEUILLE 18 DE 18

[redacted] RSW INTERNATIONAL Hifab Hydro Québec International

N° R L UR 032 0

Date : June / Juin 2007

A1 841 x 594