GROUNDWATER RESOURCE INFORMATION PROJECT
EASTERN CAPE PROVINCE

GROUNDWATER INFORMATION SOURCE REFERENCE SHEET

SOURCE REF NR:	AG103	Own Archive	X	Copy attached	X
		Sourced		Copy at source	

A: SOURCE DESCRIPTION

District Municipality:	Amatole		Chris Hani		O.R Tambo	X
	Ukhahlamba		Cacadu		Alfred Nzo	
Local Municipality:	Ingquza					
Institution where Information is held:	AGES EC CC					
Branch of Institution:	EAST LONDON					
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B: TYPE OF INFORMATION

Information format:	Hard copy	X	Data Summary		Electronic Report	
	Specify Other:					
Report / Info Title:	Groundwater source development for Lusikisiki town located in the O.R. Tambo District Municipality – Eastern Cape Province					
Report Nr:	EC/03/28/HG		Date:	July 2003		
Author Details:	J.A MYBURGH					
Author's Qualification:	Hydrogeologist	X	Govt Dept		Project Manager	
	Engineer		Technician		Other	
	Specify Other:					
Captured by:	A VILJOEN	Date:	23/2/2004	Signed:	A Viljoen	

C: GEOHYDROLOGICAL CATEGORIZATION

Project Type	Source development	X	Feasibility Study		Sanitation Study:	
	Specify Other:					

Reference Co-ordinate:	Latitude	Longitude
	S 31° 21' 17"	E 29° 36' 37"

	Yes	No	Complete	Incomplete
Lithological & Construction Logs	X		X	
Hydrocensus Data	X			X
Pump Testing Data		X		
Chemical Water Analysis Data		X		
Geohydrological Data	X			X
Spring Data		X		
Remote Sensing Data		X		
Map Data		X		

Comments:

Reviewed by: F. de Jager Date: 4/3/04 Signed:

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GeoCon

Project report: EC/03/28/HG

Hydrogeological investigation

GROUNDWATER SOURCE DEVELOPMENT FOR LUSIKISIKI TOWN LOCATED IN THE O. R. TAMBO DISTRICT MUNICIPALITY– EASTERN CAPE PROVINCE

July 2003

Project Team:

Lead Consultant: Kei Water Solutions - Mr B Malghas

GeoCon - Mr J Myburgh
- Me T Mafanya
- Mr Z Ngwaja

Project report: EC/03/28/HG

Hydrogeological investigation

GROUNDWATER SOURCE DEVELOPMENT FOR LUSIKISIKI TOWN LOCATED IN THE O. R. TAMBO DISTRICT MUNICIPALITY – EASTERN CAPE PROVINCE

7 July 2003

Conducted on behalf of:

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1 INTRODUCTION

1.1 Terms of reference

Kei Water Solutions cc - in a joint venture partnership with Southern Africa GeoConsultants (PTY) Ltd – hereafter referred to as GeoCon, was appointed by Thuso Development Consultants to carry out a groundwater development for Lusikisiki town, located in the Qaukeni Local Municipality of the O. R. Tambo District Municipality, Eastern Cape Province

This investigation follows an earlier phase of borehole drilling and testing for raw water augmentation into a nearby DWAF scheme on behalf of UWP Engineers – reported in August 2002 – report reference nr EC/03/05 HG with UWP. The aim of this latter project was to extend exploration drilling towards structures previously not investigated, for a possible independent groundwater supply for the Lusikisiki town.

The investigation included the involvement of sub-contractors for groundwater development and resulted in exploration boreholes being drilled in the project area.

1.2 Scope of investigation

The GeoCon / Kei Water Solutions - Joint Venture was appointed to render the following hydrogeological consultation services in the project area:

Kei Water Solutions cc:

- Project initiation, co-ordination and management
- Supervision of borehole drilling
- Supervision of pump testing – if required
- Community liaison

Southern Africa GeoConsultants (Pty) Ltd:

- Evaluation of existing and available data
- Geological & geophysical surveys
- Analyses of geophysical data
- Siting of new boreholes
- Analyses of pump testing data – if required
- Assessment of groundwater quality analyses – if required
- Reporting with rendering of borehole utilisation recommendations

1.3 Location of study area

Lusikisiki town is located along the R61 route between Port St John's and Flagstaff in what is now referred to as the Quakeni Local Municipality of the O.R Tambo District Municipality.

1.4 Information sources

Community liaison was used to assess terrain conditions and obtain historical data regarding existing boreholes and terrain conditions.

- Geological information was obtained from a 1:250 000 scale geological map; 3128 Umtata
- Hydrogeological information was obtained from:
  - The 1:500 000 scale hydrogeological map; 3126 Queenstown.
  - The report *Groundwater source development for the town Lusikisiki located in the O.R. Tambo District- Eastern Cape Province*, report No. EC/03/05/HG as compiled by Southern Africa Geoconsultants.
- Remote sensing was done using:
  - The 1:50 000 scale stereoscopic air photography - Job 983 Strip 21, photos 078, 080 and 081.
  - Lusikisiki remote sensing map compiled by Toens and Partners Inc.
- Topographical information was obtained from the 1:50 000 topographical map 3129 BC LUSIKISIKI.

2 EXISTING INFORMATION

2.1 Surface water sources

Lusikisiki town mainly relies on surface water (bulk water supply from Xura River) for domestic purposes as well as cattle watering purposes. The water is purified prior to use to ensure its fitness for domestic purposes.

2.2 Groundwater sources

Existing boreholes in the project area were drilled during the raw water augmentation phase for UWP Engineers as reported in our report EC/03/05 HG. Several small springs and seepage zones from groundwater are also utilised in localised places.

2.3 Hydrogeological setting

The 1:500 000 Queenstown Hydrogeological map describes the study area as underlain by predominantly fractured diamictites and tillites of the Karoo Sequence. Groundwater is generally located in fractured zones with expected yields varying between 0.1 to 0.5 l/s at successful boreholes.

According to the 1:250 000 Geological map 3128 (Umtata) the study area is underlain on the eastern side of Lusikisiki town by the Dwyka tillites, which were deposited during the Early Permian Period (Figure 1). This Dwyka tillite is massive and structureless in nature, while the clasts of diamictite are enclosed in a fine-grained matrix. In contrast, the western side of the town Lusikisiki is underlain by shales that were deposited during the Ecca Period (Figure 1).

The Dwyka tillite has been intruded by dolerite during late Karoo volcanism. These intrusions occur as horizontal and sub-vertical tabular bodies and form the capping of several of the undulating hills that are now covered by vegetation. Dolerite dykes (sub-vertical structures) and sills (horizontal structures) occur in the study area. These dolerite intrusions tend to be associated with fracturing and alteration of the host rock, and therefore serve as important water bearing structures.

The groundwater potential in the project area can generally be described as *low* due to the nature of the underlying geology. The probability of higher groundwater potential is associated with major structures as identified from remote sensing, and was high enough in the project area so as to warrant exploration drilling.

3 METHODOLOGY

3.1 Appointment of sub-contractors

Appointment of contractor responsible for the drilling of the required boreholes was made through an informal tendering process. GeoCon gave technical inputs for the compilation of tender documentation as well as during the evaluation of these tender documents. Alderson Drilling was appointed for the drilling of the three boreholes.

Borehole drilling was done under the supervision of a geohydrological consultant with reference to the Department of Water Affairs and Forestry's Minimum Standards and Guideline Document – 1997.

3.2 Borehole siting

The methodology followed during the borehole-siting phase consisted of the following:

- Evaluation of available data - desk study
- Remote sensing analyses obtained from previous investigations of the Lusikisiki area by Toens & Partners.
- Stereoscopic aerial photo investigation and interpretation – identification of structures and target areas
- Field surveys and Hydrogeological mapping – identification of geophysical profile positions
- Geophysical profiling comprising magnetic profiling and very low frequency (VLF) electromagnetic profiling for verification
- Evaluation of geophysical data in relation to surface geological observations
- Site finalisation and marking – liaison with community regarding access of drilling rig and ownership.

4 RESULTS

4.1 Geophysical survey

Geophysical profiles were executed across identified geological structures and lineaments in higher potential zones as identified during the remote sensing phase conducted by Toens & Partners All anomalies noted were verified on terrain and drilling sites were finalised using on-site hydrogeological information in conjunction with geophysical data.

A total of three drilling sites were finalised from various geological structures and geophysical anomalies.

The relevant geophysical data is attached in Appendix A for reference.

4.2 Source Development

4.2.1 Borehole Drilling

A total of three new boreholes - numbered, EC-T60-022, EC-T60-023 and EC-T60-024 were drilled in the project area under the supervision of a hydrogeological consultant. Drilling results are summarised in the Project Summary Table. Lithological and construction logs are attached in Appendix B for reference. The relative distribution of newly drilled boreholes is indicated on Figure 2.

Newly drilled boreholes yielded a maximum of 0.1 l/s. The borehole depths varied widely with an average of 70.7m drilled, with water strike depths being at 20m and 60m for both EC-T60-022 and EC-T60-024 respectively, while EC-T60-023 only had dampness at 35m. In terms of the lithology intersected, two boreholes, EC T60-022 and EC-T60-023 were drilled on the Dwyka tillite with thin clay layers intersected at shallow depths. Borehole EC-T60-024 was drilled on the Ecca shales targeting a dolerite dyke. From this borehole alternating layers of mudstone, clay and shale with dolerite were encountered.

Solid steel casing was installed to the required depths where unstable formations necessitated it. Sanitary seal was installed to prevent the ingress of surface water into the borehole. Drilling was stopped at the discretion of the hydrogeological consultant.

4.2.2 Pump Testing

No pump testing was pursued on the instruction of the project geologist. Pump testing is recommended should low volume water abstraction be considered from any of the boreholes in future. Water quality will also have to be verified through this process.

4.2.3 Water Chemistry

No water quality analysis was conducted since all the boreholes drilled had low yields and the boreholes were not pump tested. A water quality analysis is recommended if future utilization is intended from these boreholes.

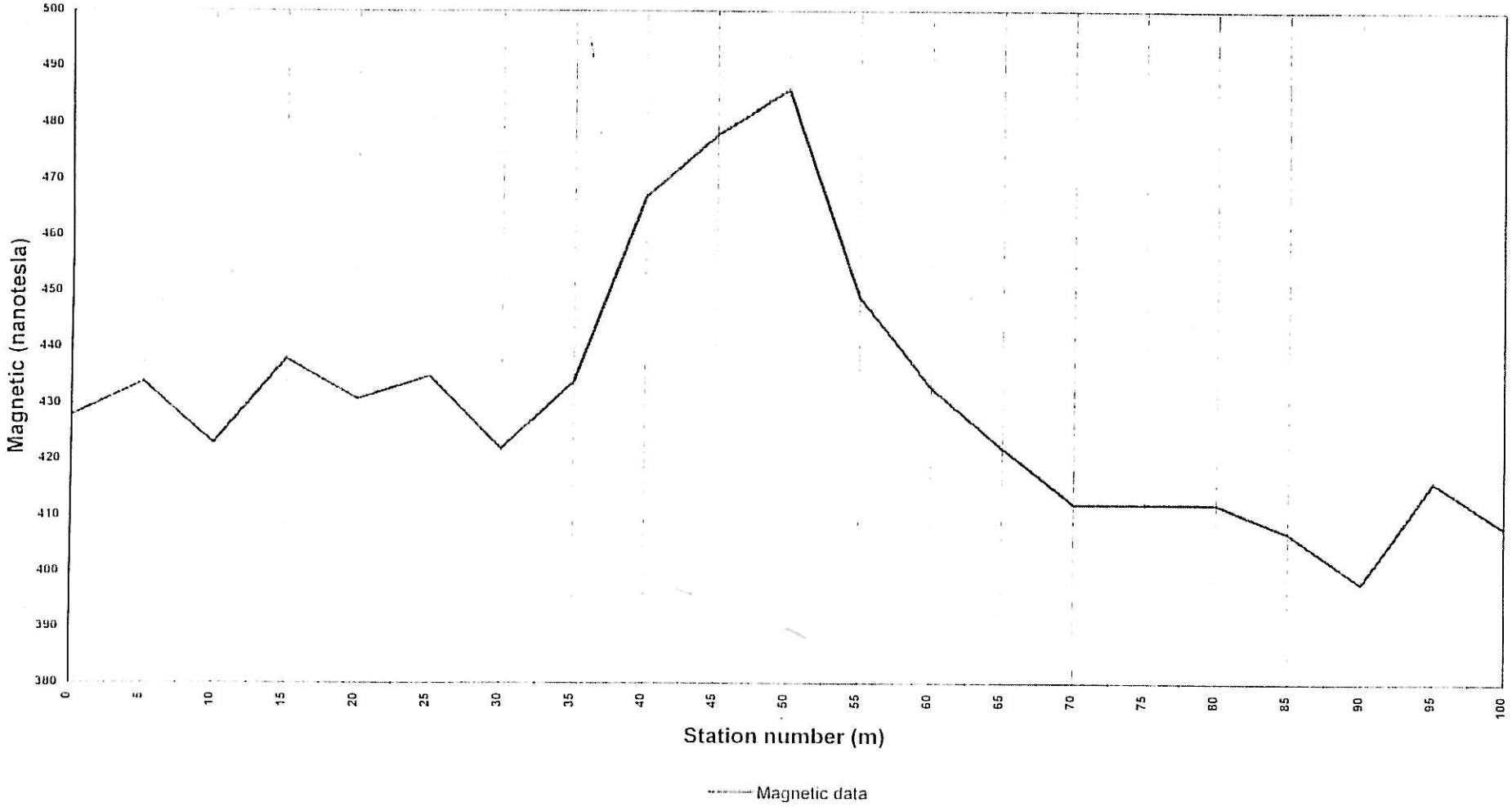
5 SUMMARY & UTILISATION RECOMMENDATIONS

- A groundwater source development for Lusikisiki town, located in the Qaukeni Local Municipality was conducted by Kei Water Solutions. The study aimed at the extension of the raw water augmentation project, by concentrating for exploration drilling purpose on the geological structures, which were not previously investigated, for a possible independent groundwater supply for Lusikisiki town.
- The groundwater potential in the project area was found to be very low based on the geological formations occurring within the project area. The presence of major geological structures identified from remote sensing suggests a higher groundwater potential that warranted exploration drilling.
- Three drilling positions were finalised by means of remote sensing, geological mapping and geophysical surveys.
- Three new boreholes were drilled throughout the project area. Boreholes drilled had low yields of ± 0.1 l/s.
- Based on our work done on both projects near Lusikisiki, the western side of the Lusikisiki town is recommended for future groundwater development, where Ecca shales are predominant compared to the western side characterized by low potential diamictite.
- Pump testing of boreholes is recommended if low volume abstraction of water from certain boreholes is required in future. Water quality will also need to be verified prior to using water from these boreholes.
- A summary of all results as well as the relevant management recommendations are indicated in the PROJECT SUMMARY TABLE

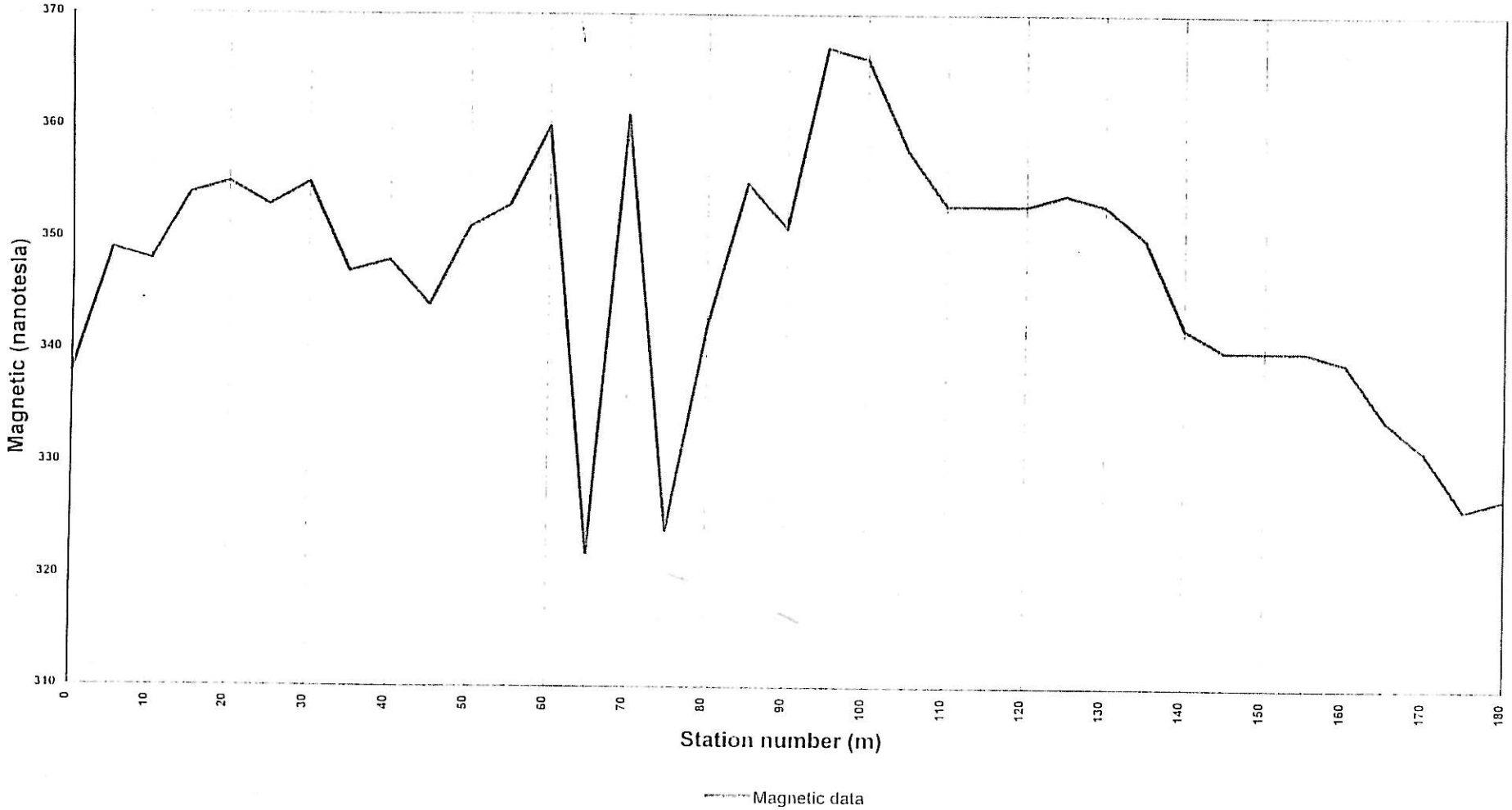
APPENDIX A

GEOPHYSICAL PROFILING DATA

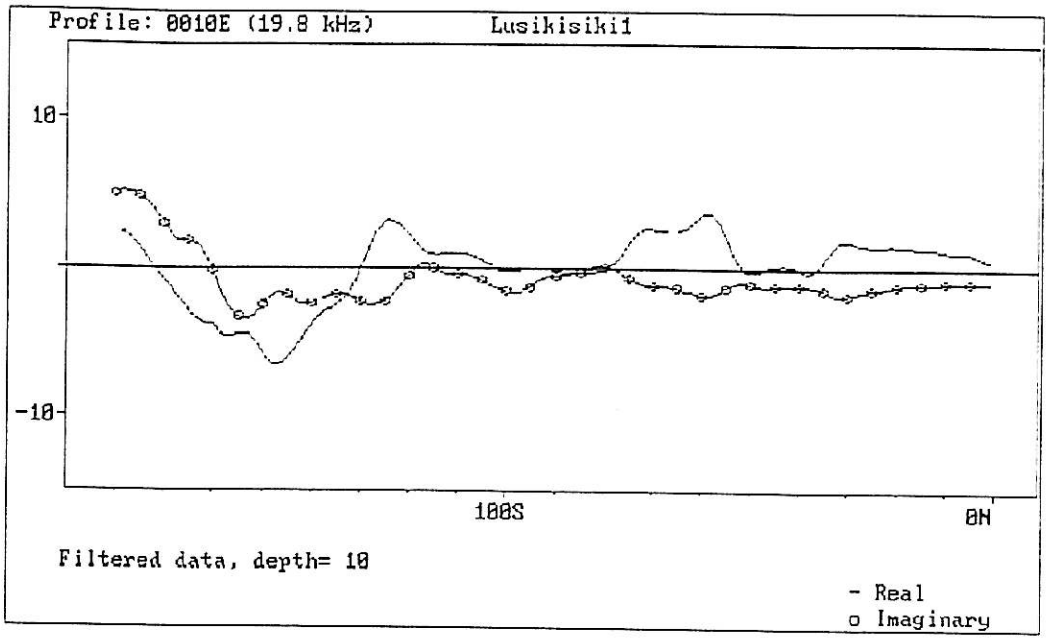
Lusikisiki Town Water Supply - Profile AB
Magnetic Profiling (Wenner Configuration)



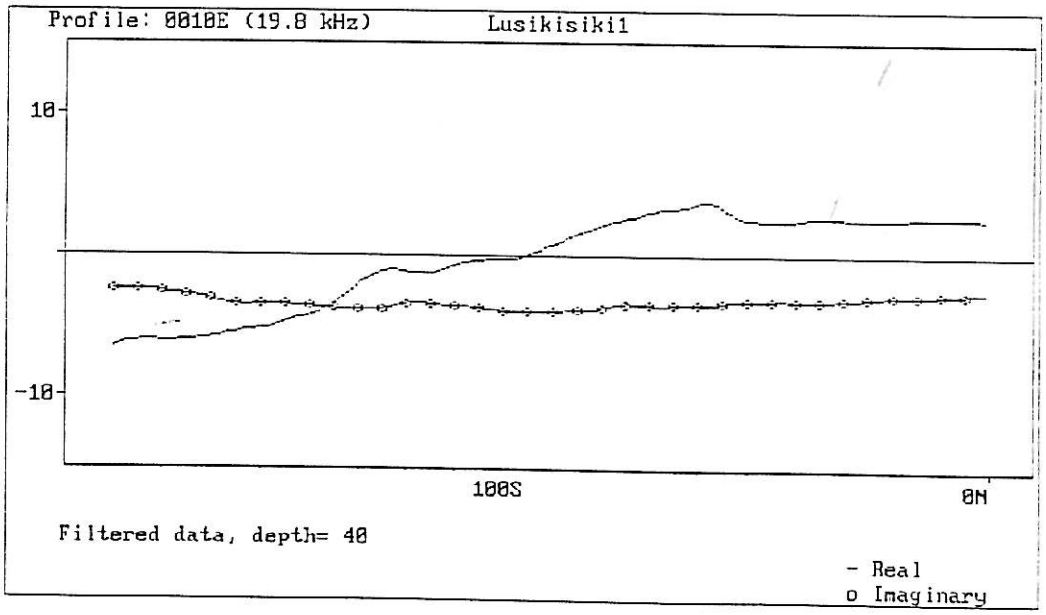
Lusikisiki Town Water Supply - Profile GH
Magnetic Profiling (Wenner Configuration)



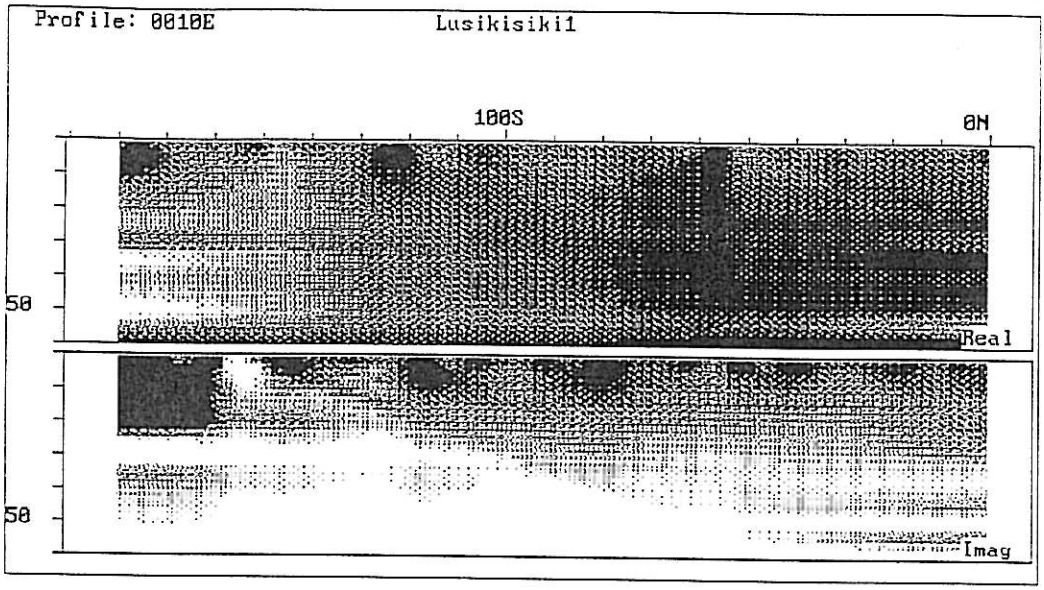
Filtered VLF data: Profile GH- depth 10m



Filtered VLF data: Profile GH- depth 40m



Vertical cross section of the VLF data: Profile GH- depth 50m



APPENDIX B

LITHOLOGICAL AND CONSTRUCTION LOGS

Not on NGDB

SOUTHERN AFRICA GEOCONSULTANTS (PTY) LTD
8 SANSOM STREET
VINCENT
EAST LONDON
TEL NO: 043 726 2070
FAX NO: 043 726 9232

BOREHOLE CONSTRUCTION & LITHOLOGY

BOREHOLE NR EC/T60/022	PROJECT :	Lusikisiki Raw Water Augmentation Phase 2	
WATER LEVEL:	DRILLER :	Alderson Drillers	LATITUDE : 29°36'37"E
BLOW YIELD: 0.1 L/s	DATE STARTED :	01/7/2003	LONGITUDE : 31°21'17"S

Apparent Water Quality: Good
Casing thickness: 177 mm
Casing depth: 17 m

BOREHOLE CONSTRUCTION

203mm
Solid 4mm steel casing
166mm
165mm
Open hole
166mm
ECH 103m

WATER STRIKE (l/s): 0.1l/s
STRIKE DEPTH (m): 20m
S.W.L (m)

PENETRATION RATE (min): 0 10 20

DEPTH (m) PROFILE

MATERIAL DESCRIPTION

CLAY Yellow weathered

TILLITE Grey

CLAY Yellow weathered
TILLITE Grey, no weathering, has white specs in places

SOUTHERN AFRICA GEOCONSULTANTS (PTY) LTD
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EAST LONDON
TEL NO: 043 726 2070
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BOREHOLE CONSTRUCTION & LITHOLOGY

BOREHOLE NR	EC/T60/023	PROJECT :	Lusikisiki Raw Water Augmentation
WATER LEVEL	Dry	DRILLER :	Alderson Drilling
BLOW YIELD:	Dry	DATE STARTED :	02/07/2003
		LATITUDE :	29°36'49.3"E
		LONGITUDE :	31°24'45.7"S

BOREHOLE CONSTRUCTION
Apparent Water Quality: Good
Casing thickness: mm
Casing depth: 12 m

Solid 4mm steel casing

12m

WATER STRIKE (l/s)

STRIKE DEPTH (m)

S.W.L (m)

PENETRATION RATE (min)

DEPTH (m)

PROFILE

MATERIAL DESCRIPTION

TILLITE Reddish (weathered)

TILLITE Yellow

CLAY Yellow

TILLITE Grey

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BOREHOLE CONSTRUCTION & LITHOLOGY

BOREHOLE NR EC/TS0/024	PROJECT :	Lusikisiki Raw Water Augmentation	
WATER LEVEL:	DRILLER :	Alderson Drilling	LATITUDE : 29°32'56.4"E
BLOW YIELD: 0.1 l/s	DATE STARTED :	03/07/2003	LONGITUDE : 31°23'0.3"S

Apparent Water Quality: Good
Casing thickness: 177 mm
Casing depth: 9 m

BOREHOLE CONSTRUCTION

Concrete collar

203mm

Solid 4mm steel casing

166mm

166mm

WATER STRIKE (l/s)

0.1L/s

STRIKE DEPTH (m)

60m

S.W.L (m)

PENETRATION RATE (min)

0 10 20

DEPTH (m)

PROFILE

MATERIAL DESCRIPTION

TOPSOIL Black

LIMESTONE Brown

CLAY Green

SHALE Black

DOLERITE Grey

SHALE Black