Eastern Cape borehole Project: USAID

GROUNDWATER RESOURCE INFORMATION PROJECT
EASTERN CAPE PROVINCE

GROUNDWATER INFORMATION SOURCE REFERENCE SHEET

SOURCE REF NR:	KV046	Own Archive	X	Copy attached	X
		Sourced		Copy at source	

A: SOURCE DESCRIPTION

District Municipality:	Amatole		Chris Hani	X	O.R Tambo	
	Ukhahlamba		Cacadu		Alfred Nzo	
Local Municipality:	EMALAHLENI					
Institution where Information is held:	KHULANI VSA GROUNDWATER CONSULTANTS					
Branch of Institution:	DEPARTMENT OF GEOHYDROLOGY					
Contact details: Contact person:	EUNICE GOOSSENS					
Contact Tel:	043-7264176					
Contact Email:	euniceg@vsagroup.co.za					

B: TYPE OF INFORMATION

Information format:	Hard copy	X	Data Summary	X	Electronic Report	
	Specify Other:					
Report / Info Title:	EASTERN CAPE BOREHOLE PROJECT: USAID					
Report Nr:	TR/KVSA/007/02		Date:	15-Jan-02		
Author Details:						
Author's Qualification:	Hydrogeologist	X	Govt Dept		Project Manager	
	Engineer		Technician		Other	
	Specify Other:					
Captured by:	NOMSA NKOMO Date: 3-Mar-04 Signed:					

C: GEOHYDROLOGICAL CATEGORIZATION

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

Reference Co-ordinate:	Latitude	Longitude
	S 31.76530	E 27.10898

	Yes	No	Complete	Incomplete
Lithological & Construction Logs		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		X	

Comments: Only schools were targeted for a detailed borehole census.

Reviewed by: EUNICE GOOSSENS Date: 25/3/2004 Signed:

EASTERN CAPE BOREHOLE PROJECT
For: Eastern Cape Department of Education
in conjunction with
The Department of Water Affairs and Forestry
Funded By: USAID

CHRIS HANI DISTRICT MUNICIPALITY
NORTHERN PART OF THE CACADU MAGISTERIAL DISTRICT

PHASE A
DESK STUDY REPORT

REPORT: TR/KVSA/007/02
USAID\KHULANI VSA\Phase A\Desk Study

JANUARY 2002

Office 7 & 8 Beacon Park
89 Beaconhurst Drive
Beacon Bay
East London
5205

P.O. Box 15036
Beacon Bay
5205

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1. INTRODUCTION AND TERMS OF REFERENCE

The poor state of water supply at rural educational facilities compelled the Management Committee of the Eastern Cape Groundwater Forum to prepare a project proposal for USAID. The document was completed in July 2001 and reviewed by GCS for USAID.

The Government Departments involved identified the Chris Hani District Municipality – Queenstown area as the preferred starting point. The scope of the work necessitates a phased approach. The project commenced on the 4 of February 2002 with this being the first report (phase 1).

The aim of this report is to give an overview of the background research done. Hydrogeological services will be conducted in accordance to specifications as set out in the Department of Water Affairs and Forestry's document of April 1997 called "*Minimum Standards and Guidelines for Groundwater Resource Development for the Community Water Supply and Sanitation Programmes*"

2. INVESTIGATION AREA

The study area is situated approximately 40 km. northeast of Queenstown, on the Queenstown – Dordrecht road (R 392). The northern part of Cacadu Magisterial District was targeted. This area forms part of the Emalahleni Local Municipality in the Chris Hani District Municipality. The area is mainly encompassed by two 1: 50000 topographical maps namely 3126DB and 3127CA. The geology thereof is portrayed on the Queenstown (3126) Geological map.

3. METHODOLOGY

3.1 Existing Information

The aim of the desk study phase of an investigation is to collect and correlate all existing information relevant to the study area to obtain a first impression of the character of a site.

This included the study of aerial and ortho-photographs, topographical and geological maps, climatic information, reports on previous investigations (TR/VSA/2000/012 and TR/VSA/016) in or near the study area and existing borehole and spring information contained in the NGDB (National groundwater database of the Department of Water Affairs and Forestry) as well as the Kulani VSA database (Aquabase). This resulted in the compilation of a base map on a suitable scale.

3.2 Geology

This summarized existing information was used to accurately determine the way forward for the field investigation.

- The aerial photographs were assessed to identify geological structures.
- An interpretation of the geology was made from the 1: 250 000 geological map of the area.
- The topography was studied from the 1: 50 000 topocadastral map to establish the rainfall runoff direction
- The geohydrological information collected from the NGDB and VSA Ground Water Data basis (Aquabase) was used to help classify the aquifer.

3.3 Hydrogeology

Groundwater occurs mainly in the rock matrix. Principal transmissivity is derived from large but infrequent fractures. These fractures have a relatively low storage capacity. Secondary transmissivity occur by numerous micro fissures with higher storativity but lower transmissivity. Hence the name dual porosity aquifers. Deeper fractures often have a higher transmissivity but lower storativity than shallow fractures.

The main scientific challenge is to reliably map the thickness variation and subsurface structural geometry of the geological formations, and to develop an in-depth scientific understanding of its fractured-rock characteristics pertinent to aquifer porosity, permeability and groundwater storage.

It is necessary to understand the process that created the fracture porosity in the rock in order to determine the storage in the aquifers. It is also necessary to understand how these cracks are connected, or not connected, and why they are connected, in order to develop a physically sound and predictable model of where the water moves through the aquifers. Thus, storage, aquifer geometry, hydraulic characterization and flow conceptualisation are considered as related key issues.

An evaluation was made of the interaction of the groundwater with primary and secondary geological structures such as:

- Weathered bedrock
- Faults and shear zones

3.4 Preliminary Target Identification and Groundwater Potential

Previous experience obtained within the area indicated that fracturing within the dykes and not the contact with the surrounding sediments form the main target. Although these contact zones do yield water strikes, it was found that the major fractures encountered within the dykes constitute the primary drilling target.

A base map was prepared containing all the interpreted structures from aerial photographs, landsat images, geological maps and previous geophysical exploration.

4. RESULTS

4.1 Existing Information

The borehole positions are plotted on Figure 1 and the school positions on Figure 2. The summarised borehole information are given in table format (Table 1) in Appendix 2.

4.2 Geology

The sedimentary rocks of the area comprise the Burgersdorp Formation of the Tarkastad Subgroup in the Beaufort Group of the Karoo Sequence. The Burgersdorp Formation is characterised by the occurrence of brownish red and grey mudstone (70-80%) with inter-layered sandstone horizons (2-10m thick). The formation reaches a thickness of 600m in the Queenstown-Lady Frere (Cacadu) District.

A high percentage of the lower lying areas are covered by Alluvium of unconsolidated Quaternary sediments, not thicker than a few meters.

Numerous intrusions of Karoo Dolerite dykes and sills of varying inclination and curvature have taken place during the Jurassic period. The orientations are variable, with a northwesterly strike prominent.

4.3 Hydrogeology

The region has a moderate to high annual precipitation level of 600-800mm. This constitutes excellent catchment for the lower lying basins and are a good indication for the groundwater recharge factor.

The overall quality of the water is acceptable with the emphasis falling on drinking quality. A number of the existing results showed marginal values for turbidity, which in itself has no negative health effects.

4.4 Preliminary Target Identification and Groundwater Potential

Localised fracturing within the dykes and host rock, along with faults, comprises the primary groundwater exploration targets.

The majority of groundwater exploration targets will be near vertical thin (<15m) dolerite dyke and their fracture contact zones in or near low-lying areas.

Previous work in the area was met with a high success rate – one dry out of a total of thirteen drilled. The average blow yield was 4.4 l/s.

Values obtained from the Explanation of the 1:500 000 General Hydrogeological Map – Queenstown 3126 (1998) gives the mean borehole blow-yield for the hydrogeological region of the project area at 1.3l/s.

The above facts give an optimistic outlook for groundwater exploration in the area.

5. CONCLUSIONS

Previous experience obtained within the area indicated that fracturing within the dykes and not the contact with the surrounding sediments form the main target. Although these contact zones do yield water strikes, it was found that the major fractures encountered within the dykes constitute the primary drilling target

Previous work in the area was met with a high success rate – one dry out of a total of thirteen drilled. The average blow yield was 4.4 l/s.

Values obtained from the Explanation of the 1:500 000 General Hydrogeological Map – Queenstown 3126 (1998) gives the mean borehole blow-yield for the hydrogeological region of the project area at 1.3l/s.

The overall quality of the water is acceptable with the emphasis falling on drinking quality. A number of the existing results showed marginal values for turbidity, which in itself has no negative health effects.

6. RECOMMENDATIONS

The aim of the desk study phase of an investigation is to collect and correlate all existing information relevant to the study area. This information indicates that groundwater represents an feasible source for water supply to the identified schools. The following schools have been targeted for a detailed borehole census.

TABLE 2: Table of schools to be targeted during Hydrocensus

Nr.	NAME	NATID	LONG	LAT	TOILET TYPE	WATER AVAIL
1	3 Grouns	ECK000112	27.10592	-31.74240	No toilets	Not within walking distance
2	Bakaneni	EC7008856	27.21153	-31.74452	No toilets	Not within walking distance
3	Bomeni J	EC7009101	27.18408	-31.64838	Pit latrine	Not within walking distance
4	Cacadu S	EC7009130	27.19942	-31.72737	Pit latrine	Not within walking distance
5	De Hoop SP	EC7008872	27.16643	-31.71315	Pit latrine	Not within walking distance
6	Duobudaka	EC27114	27.16742	-31.60623	No toilets	Not within walking distance
7	Gcinubuzwe	EC27254	27.24580	-31.67240	Pit latrine	Not within walking distance
8	Glen Adelaide	EC7008908	27.14912	-31.73260	Pit latrine	Not within walking distance
9	Julias Mbalo	EC7008762	27.19545	-31.58282	No toilets	Not within walking distance
10	Kayalethu J	EC7009208	27.20652	-31.67412	Pit latrine	Not within walking distance
11	Mckaysnek J	EC7009295	27.10898	-31.76530	Pit latrine	Not within walking distance
12	Ngangamanzi	EC7008801	27.22843	-31.50555	No toilets	Not within walking distance
13	Nobandla	EC7033313	27.16725	-31.51760	No toilets	Not within walking distance
14	Nompucuko JP	EC7033546	27.23940	-31.69657	No toilets	Not within walking distance
15	Nonesi	EC7008814	27.05898	-31.76318	Pit latrine	Not within walking distance
16	Nonkunzi J	EC7008979	27.20567	-31.72363	Pit latrine	Not within walking distance
17	Phakamani	EC5001525	26.64793	-32.37692	Pit latrine	Not within walking distance
18	Platkop JSS	EC7009431	27.23120	-31.55122	Pit latrine	Not within walking distance
19	Tembalethu	EC7037759	27.45870	-30.55380	Pit latrine	Not within walking distance
20	Uitkyk JSS F	EC7009059	27.12437	-31.44807	No toilets	Not within walking distance
21	Vulindlela S	EC27338	27.10783	-31.79265	No toilets	Not within walking distance
22	Vuyani	EC7004795	27.17830	-31.54280	No toilets	Not within walking distance
23	Yonna	EC7037128	27.23757	-31.65343	No toilets	Not within walking distance
24	Boqo PJS		26.98306	-31.63861		No information
25	Buffalo Thorns JS ✓		26.91528	-31.61500		No information
26	Dalubuzwe SP		26.90528	-31.61417		No information
27	Ecingeni SP ✓		26.93861	-31.60583		No information
28	Helushe SP ✓		26.94722	-31.57944		No information
29	Laphumilanga JP		26.88389	-31.63333		No information
30	Mcwangele JS		26.91833	-31.57556		No information
31	Mzamomhle JP		27.16667	-31.49333		No information
32	Ndimangeni JS ✓		27.00806	-31.60861		No information
33	Phumlani SS ✓		26.92389	-31.61111		No information
34	Qugqwaru PJS ✓		26.96667	-31.61472		No information
35	Sizamile SP ✓		26.91139	-31.59611		No information
36	Tsawulayo SP		27.03500	-31.57417		No information
37	Upper Ngonyama JS ✓		26.93417	-31.67417		No information
38	Zizamele SP		26.97472	-31.58528		No information

A detailed hydro-census encompasses the following aspects:

- Verification of needs;

- The names of the communities
- The boundaries representing these communities
- The names and contact numbers of the local water committee spokespersons
- The status of the existing water supply, general accessibility, the availability of electricity, etc.

- Liaison with the schools, local municipalities and communities involved;
  - Communication with the local authorities and the community ensures a clear understanding of the intent of the survey.

- Familiarisation with the project area;
  - The nature of the terrain. Is it accessible for heavy machinery?
  - The geology in relation to groundwater occurrence.
  - The possible influence on sanitation structures on the existing and/or proposed supply.

- Detail survey of all water sources, currently in use, historically used and sources with potential for future use.

- Survey of the water supply infrastructure of the community
  - Spatial positions of the water source
  - Numbering of the source (NB)
  - Depth
  - Water level
  - Current yield and pump cycle if the source is equipped
  - Datum level
  - Description of the existing infrastructure and its condition
  - Geological setting of the source

- Technical report with recommendations
  - List and map all the collected and verified data in a clear and precise manner.
  - Make recommendations regarding source potential and development possibilities/targets
  - Store all data in an appropriate database for future use and data manipulation.

7. REFERENCES:

- RDP RURAL WATER SUPPLY DESIGN CRITERIA GUIDELINE, First Edition, 1997. Department of Water Affairs and Forestry.
- MINIMUM STANDARDS AND GUIDELINES FOR GROUNDWATER RESOURCE DEVELOPMENT FOR THE COMMUNITY WATER SUPPLY AND SANITATION PROGRAMME, First Edition, 1997
- Department of Water Affairs and Forestry.
- QUALITY OF DOMESTIC WATER SUPPLIES, Volume 1, Assessment Guide, Second Edition 1998
- Department of Water Affairs and Forestry.
- Department of Health
- Water Research Commission
- STRATIGRAPHY OF SOUTH AFRICA, Handbook 8,Part 1, 1980.
- ANALYSIS AND EVALUATION OF PUMPING TEST DATA, Second edition, 1990.
- AN EXPLANATION OF THE 1:500000 GENERAL HYDROGEOLOGICAL MAP, Queenstown 3126, By MC Smart, October 1998.

APPENDIX I

Locality Maps

APPENDIX II

- **Table 1: Existing Information**

Molteno District

Site Identifier:	School	Number:	District	Site name/Description	Site type:	Y Coord. [m]:	X Coord. [m]:	Altitude [m]	Col. ht. [m]	Diam. [mm]	Depth [m]	Water l. [m]	Depth to Intk. [m]	Dis. rate[l/s]	Duty c. [hrs/d]	Daily abs. [m³/d]	Water Quality	Equiment
3126DB00001		07212271	CQE0000	WELTEVREDE COLES	B	22114.265	3511176.38	9999.99	0		80.77							
3126DB00002		2	CQE0000	HALSENTON (GEB SCHIDERKRANZ)	B	20580.775	3488227.46	9999.99	0		52.34							
3126DB00003		3	CQE0000	WELTEVREDE (GED VAN WELTEVREDEN)	B	22114.263	3511177.49	9999.99	0		53							
3126DB00004		4	CQE0000	WETEVREDE (GED WELTEVREDEN)	B	22113.317	3511176.38	9999.99	0		48							
3126DB00005		5	CQE0000	WELTEVREDE (GED VAN WELTEVREDEN)	B	22114.26	3511176.6	9999.99	0		85							
3126DB00006		6	CQE0000	WETEVREDE (GED VAN WELTEVREDEN)	B	22112.37	3511176.37	9999.99	0		17.67							
3126DB00007	Buffalo Thorns JS	7	CQE0000	WELTEVREDE (GED WELTEVREDEN)	B	22114.258	3511179.7	9999.99	0		53.03							
3126DB00008		8	CQE0000	WELTEVREDE (GED WELTEVREDEN)	B	22111.422	3511176.37	9999.99	0		73.76	30.48						
3126DB00009		07312589	CQE0000	WETEVREDE (GED WELTEVREDEN)	B	22114.256	3511180.81	9999.99	0		79.85							
3126DB00010		10	CQE0000	ANNA WATER	B	17397.868	3497800.11	9999.99	0		42							
3126DB00011		11	CQE0000	ANNA WATER	B	17397.866	3497801.21	9999.99	0		48							
3127AC00049		49	CWH0000	DORDRECHT	B	-3724.268	3472659.11	9999.99	0	165								
3127AC00050		50	CWH0000	DORDRECHT	B	-3468.765	3471476.03	9999.99	0	165	24							
3127AC00051		51	CWH0000	DORDRECHT	B	-4065.426	3471115.91	9999.99	0	165								
3127AC00073		73	CWH0000	LEEUFONTEIN	B	-73.297	3465782.28	9999.99	0	165	55							
3127AC00078	Uitkyk JSS	78	CWH0000	COFFEE FONTEIN	B	-1923.349	3473436.93	9999.99	0	165	24							
3127AC00079		79	CWH0000	COFFEE FONTEIN	B	-2403.632	3473778.51	9999.99	0	165	30							
3127AC00080		80	CWH0000	NAAUWPOORT	B	-576.259	3476618.77	9999.99	0	165								
3127AC00081		81	CWH0000	NAAUWPOORT	B	-1128.736	3476693.1	9999.99	0	165	24							
3127AC00082	Nokwazi	82	CWH0000	NAAUWPOORT	B	-939.557	3476097.7	9999.99	0	165	45							
3127AC00083		83	CWH0000	NAAUWPOORT	B	-1674.602	3476437.06	9999.99	0	165								
3127AC00084		84	CWH0000	NAAUWPOORT	B	-2218.5	3476622.32	9999.99	0	165	60							
3127AC00085		85	CWH0000	DRIEFONTEIN	B	-4976.238	3476484.68	9999.99	0	165	45							
3127AC00086		86	CWH0000	DRIEFONTEIN	B	-3676.845	3474964.09	9999.99	0	165								
3127AC00087		87	CWH0000	DRIEFONTEIN	B	-3834.972	3476878.9	9999.99	0	165	24							
3127AC00088		88	CWH0000	DRIEFONTEIN	B	-3642.138	3476310.06	9999.99	0	165	24							
3127AC00089		89	CWH0000	DRIEFONTEIN	B	-4287.739	3476539.81	9999.99	0	165	6							
3127AC00090		90	CWH0000	VLAKFONTEIN	B	-7896.753	3471185.73	9999.99	0	165								
3127AC00091		91	CWH0000	VLAKFONTEIN	B	-9745.997	3472542.13	9999.99	0	165	32							
3127AC00092		92	CWH0000	VLAKFONTEIN	B	-10198.311	3471104.57	9999.99	0	165	39							
3127AC00093		93	CWH0000	VLAKFONTEIN	B	-9331.038	3472760.17	9999.99	0	165	37							
3127AC00094		94	CWH0000	VLAKFONTEIN	B	-7875.404	3473006.21	9999.99	0	165	30							
3127AC00095		95	CWH0000	GREENVALE	B	-10559.992	3470966.34	9999.99	0	165	36							
3127AC00096		96	CWH0000	GREENVALE	B	-13255.789	3466910.44	9999.99	0	165	33							
3127AC00097		97	CWH0000	GREENVALE	B	-15731.287	3470818.72	9999.99	0	165	30							
3127AC00098		98	CWH0000	GREENVALE	B	-13604.358	3471882.32	9999.99	0	165	36							
3127AC00137		137	CWH0088	SCHOEMANSHOEK GED VAN	B	-19685.726	3459553.23	9999.99	0		85							
3127AC00138		138	CWH0088	SCHOEMANSHOEK GED VAN	B	-19684.769	3459555.44	9999.99	0		61							
3127AC00147		147	CWH0118	SCHOEMANSNEK GED VAN	B	-21424.728	3463868.35	9999.99	0		49.07							
3127AC00148		148	CWH0118	SCHOEMANSHOEK GED VAN	B	-21421.865	3463871.67	9999.99	0	152	49.07							
3127CA00002		2	S 0000	TSEMBEYI (MALGAS)	B	-2187.71	3496429.75	9999.99	0	165	84							
3127CAU0959		T 45860		LUXENI - B	B	-3292.11	3507210.4	1300	0		100							
3127CAU0962		T 24298		MKAPUSI - A	B	-8725.601	3497604.3	1400	0		75							

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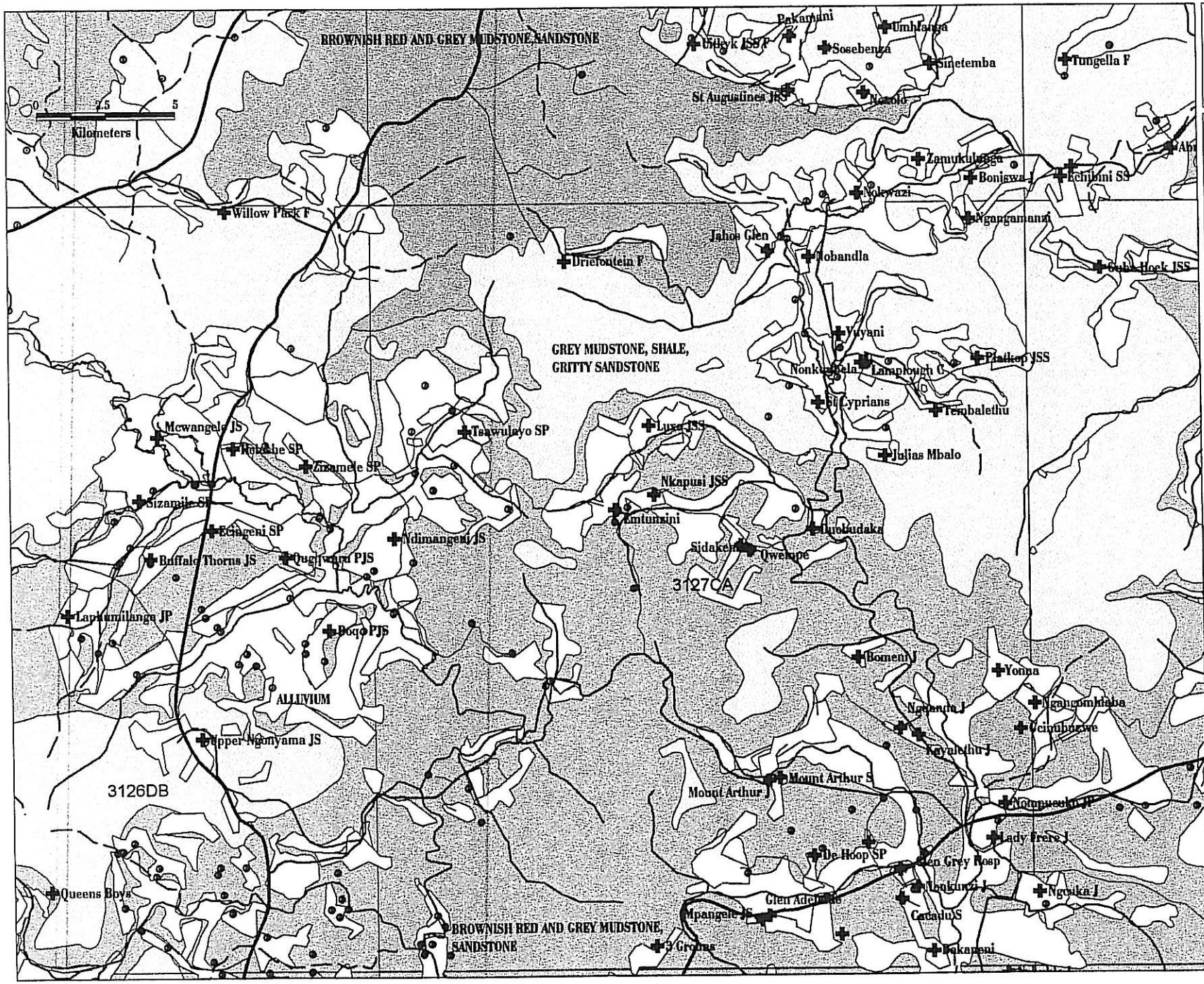


EASTERN CAPE BOREHOLE PROJECT PHASE A

Prepared for:
Eastern Cape Department of Education in conjunction with the Department of Water Affairs and Forestry

LEGEND:

- VILLAGES
- SCHOOL POSITIONS
- BOREHOLE POSITIONS
- SECONDARY ROADS
- ROADS
- RIVERS

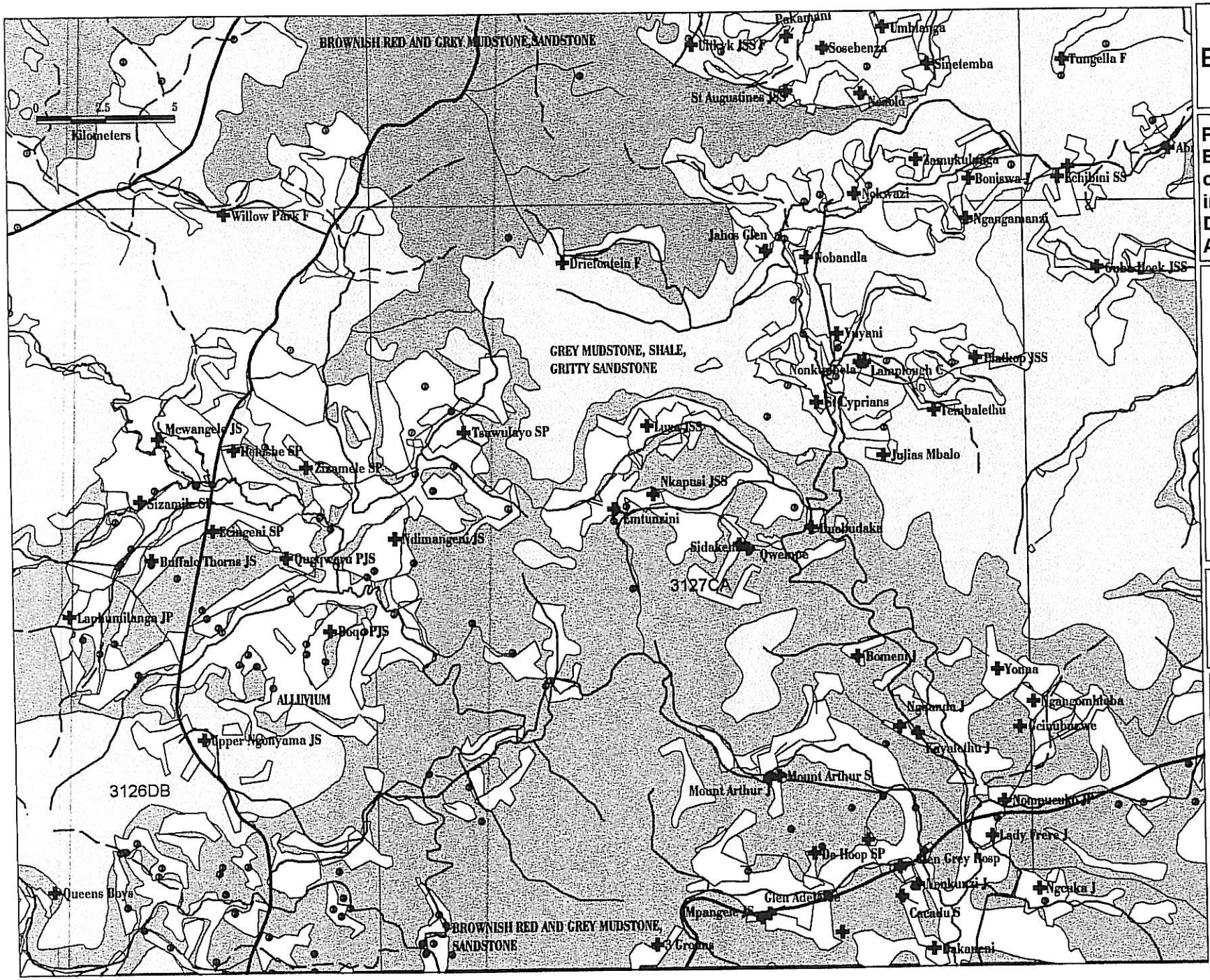
N
W E
S

PROJECTION

Transverse Mecator (Gauss-Kruger)
Clarke 1880 Spheriod
Central Meridian 29 .

Khulani VSA

KHULANI VSA Groundwater Consultants
P.O. Box 15036, Beacon Bay, 5205
Tel: +27 43 7486541
Fax: +27 43 7486542
E-mail: ecape@vsagroup.co.za



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KHULANI VSA Groundwater Consultants
P.O. Box 15036, Beacon Bay, 5205
Tel: +27 43 7486541
Fax: +27 43 7486542
E-mail: ecape@vsagroup.co.za