REPORT ON A GEOHYDROLOGICAL INVESTIGATION OF THE POLFONTEIN AND ADJACENT DOLOMITIC COMPARTMENTS

October 1991

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1. ABSTRACT

This study of the Polfontein groundwater compartment which straddles the international boundary between South Africa and the Ditsobotla District of Bophuthatswana, was commissioned by the Bophuthatswana Department of Water Affairs in 1989 and is the outcome of a collaborative investigation between Consultants to this Department and the Directorate of Geohydrology of the Department of Water Affairs of South Africa.

Borehole census data from 1972, 1980, 1983 and 1990 were used to analyze changes in the water level in the Polfontein Compartment and adjacent dolomitic compartments in response to increasing abstraction from boreholes. These changes were also compared with changes in the piezometric level in the nearby undisturbed water-filled sinkhole at Wondergat, and suggest that piezometric levels in the Polfontein Compartment are declining as a result of increased groundwater utilization. This is confirmed by an analysis of the flow of the Polfontein Spring: the discharges from this and other springs in the vicinity have been found to vary in sympathy with the Wondergat water level. Thus, with the help of limited gauging records, the past flow of the Polfontein spring could be reconstructed; its average flow has been computed as 61 l/s, while the total flow in recent months was no more than about 23 l/s (compared with an expected flow, based on the Wondergat data,of about 46 l/s).

With the aid of piezometric data obtained through the sinking of 16 new boreholes, the boundaries of the Polfontein Compartment were established with certainty for the first time. Its area is some 75 km², and it is bounded to the north and south by the Matlabes and Verdwaal Compartments, both of which also straddle the South Africa/Bophuthatswana boundary, although most of the Matlabes compartment falls

in the latter country. The dyke boundaries of the compartments were accurately located by means of magnetic surveys, and the positions of the 16 new boreholes were selected with the aid of a gravity survey so as to probe possible water-bearing structures in the three compartments. The boreholes were subsequently subjected to pump testing to determine aquifer characteristics in their vicinity and to assess possible leakage across one of the boundary dykes of the Polfontein Compartment. From these results and from the piezometric data it was concluded that water movement across the various compartment boundaries was minimal. Six of the new boreholes had useful groundwater yields of 5 l/s or more.

A preliminary water balance analysis has enabled the aquifer storativity in the Polfontein Compartment to be estimated as 0,026. From previous studies in the area the average annual recharge has been estimated as 54mm (9,6% of the mean annual rainfall of 563mm).

Using existing rather imprecise abstraction data, together with projections of future water demand from the Polfontein and Verdwaal Compartments both in South Africa and in Bophuthatswana, different scenarios based on variations in recharge, storativity and abstraction have been modelled up the year 2025. In terms of the worst of these, drawdown in the Polfontein Compartment will reach 17m in the next 35 years; in terms of a more optimistic set of projections the drawdown will be no more than about 7 metres. In either event the Polfontein Spring would probably stop flowing by 1995 or sooner. Groundwater resources within the Polfontein and Verdwaal Compartments will probably be adequate up to the year 2005, depending on abstraction by farmers in South Africa. The useful life of the water resources of these compartments could, however, be significantly extended by establishing a wellfield in the Matlabes Compartment to supply Bodibe; the groundwater potential of this compartment is estimated as about 1,0x10^{6}m^3/a. Since potentially suitable drilling sites have already been delineated in this compartment from analysis of the results of the gravity survey, it is recommended that such a wellfield be established without delay. In addition, a wellfield should be established in the vicinity of Borehole 1 in the Verdwaal Compartment to reduce dependence on the wellfield at the Itsoseng reservoir. Excessive drawdown in this latter area has the potential to induce ground instability, and it is recommended that the foundation design of the existing structures be investigated with this possibility in mind.

2. INTRODUCTION

At a meeting held on 18 May 1989 between the Bophuthatswana Department of Water Affairs and Messrs. Eksteen,van der Walt and Nissen (Bophuthatswana) Pty. Ltd., Consulting Engineers, it was decided that the latter firm should investigate the existing and future water supply to the town of Itsoseng in the Ditsobotla District. The investigation was to be carried out in two separate studies:

i) A hydrogeological investigation, and

ii) An investigation to identify problem areas regarding water supply and to make recommendations on improvements.

The hydrogeological investigation which forms the subject of this report was to be carried out in two phases: a desk top study, followed by a detailed field investigation. The Project Team would consist of:

Mr. N.F. Serfontein	Project Leader (Eksteen, van der Walt and Nissen)
Prof. T.C. Partridge	Technical Consultant (Partridge Robson and Associates, now Partridge Maud and Associates)
Mr. K.U. Pelpola Mr. R. Piyasena Mr. S. Marais	Bophuthatswana Department of Water Affairs

It was noted during the above meeting that, since the Polfontein groundwater compartment from which the supplies to Itsoseng are derived straddles the boundary between Bophuthatswana and South Africa, the collaboration of the Directorate of Geohydrology of the Department of Water Affairs of the Republic of South Africa should be sought in the hydrogeological investigation.

The findings of the desk study were presented in a report dated August 1989. This report, which was prepared by Partridge, Robson and Associates following consultations with Dr. D.B. Bredenkamp of the Directorate of Geohydrology, summarized the findings of previous investigations in the vicinity contained in the following reports and theses:

- Grondwaterontwikkeling op Polfontein 4710 en De Hoop 5110, Distrik Lichtenburg, (1973). M.J. Steyn, Department van Mynwese, Geologiese Opname, Verslag nr. GH 1870.

- Summary of information presently available on the Groundwater Potential of the Dolomitic Area in the Ditsobotla District, Bophuthatswana (1980). Eksteen, van der Walt and Nissen Inc. in association with Partridge, de Villiers and Associates.

- Report on a Hydrogeological Investigation of the Ditsobotla District (1980). Eksteen, van der Walt and Nissen Inc. in association with Partridge, de Villiers and Associates.

- Ondersoek na die Lewering van die Grootfontein en Polfonteinkompartemente aan die hand van 'n Eindige Verskil Model, (1983). D.B. Bredenkamp en H.J. van Rensburg, Direktoraat Geohidrologie, Department van Waterwese, Tegniese Verslag GH 3291.

- 'n Ondersoek na die Benutting van Grondwater in die Grootfonteinkompartement (Wes-Transvaal), (1985). H. Janse van

Rensburg, Fakulteit Natuurwetenskappe, Department Geohidrologie, Universiteit van die Oranje-Vrystaat.

- Grootfonteinkompartement, Eindige Element Model (Gevolgtrekkings en Aanbeveling), 1985. H. Janse van Rensburg en G.J. van Tonder, Fakulteit Natuurwetenskappe, Department Geohidrologie, Universiteit van die Oranje-Vrystaat.

- Quantitative estimation of groundwater recharge in dolomite. D.B. Bredenkamp. Proc. Int. Workshop on the estimation of groundwater recharge, 1987, Turkey.

- Reconstruction of the flow of springs by means of annual recharge estimates. D.B. Bredenkamp and A. Zwarts, (1987), Directorate Geohydrology, S.A. Department of Water Affairs, Technical Report No. GH 3525.

- Quantitative estimation of aquifer storativity and recharge by means of a water balance and incorporating a finite element network. D.B. Bredenkamp, H.J. van Rensburg, G.J. van Tonder, V.E. Cogho (1989).

Because detailed investigations in the area had been restricted chiefly to the nearby Grootfontein Compartment in South Africa, this report attempted chiefly to determine the application of these data in assessing, in broad terms, the likely extent and groundwater potential of the Polfontein Compartment. It also contained proposals and cost estimates for Phase II investigations.

Following further liaison with the Directorate of Geohydrology, a meeting was held between the Departments of Water Affairs of Bophuthatswana and the Republic of South Africa on 6th February 1990, in which it was agreed that the investigation would be undertaken as a collaborative exercise between the Division of Geohydrology and the Consultants of the Bophuthatswana Department of Water

Affairs, under the leadership of the latter. The scope and apportionment of the work and of the costs were agreed at this meeting.

In terms of this agreement the investigations detailed in this report were carried out as follows:

i) Estimation of future water demand in Itsoseng and neighbouring villages - EVN

ii) Geohydrological census - PMA and DG

iii) Geophysical survey - DG

iv) Supervision of drilling and test pumping and interpretation of results- PMA

v) Geohydrological analysis - DG and PMA

vi) Water balance and future exploitation - DG and PMA

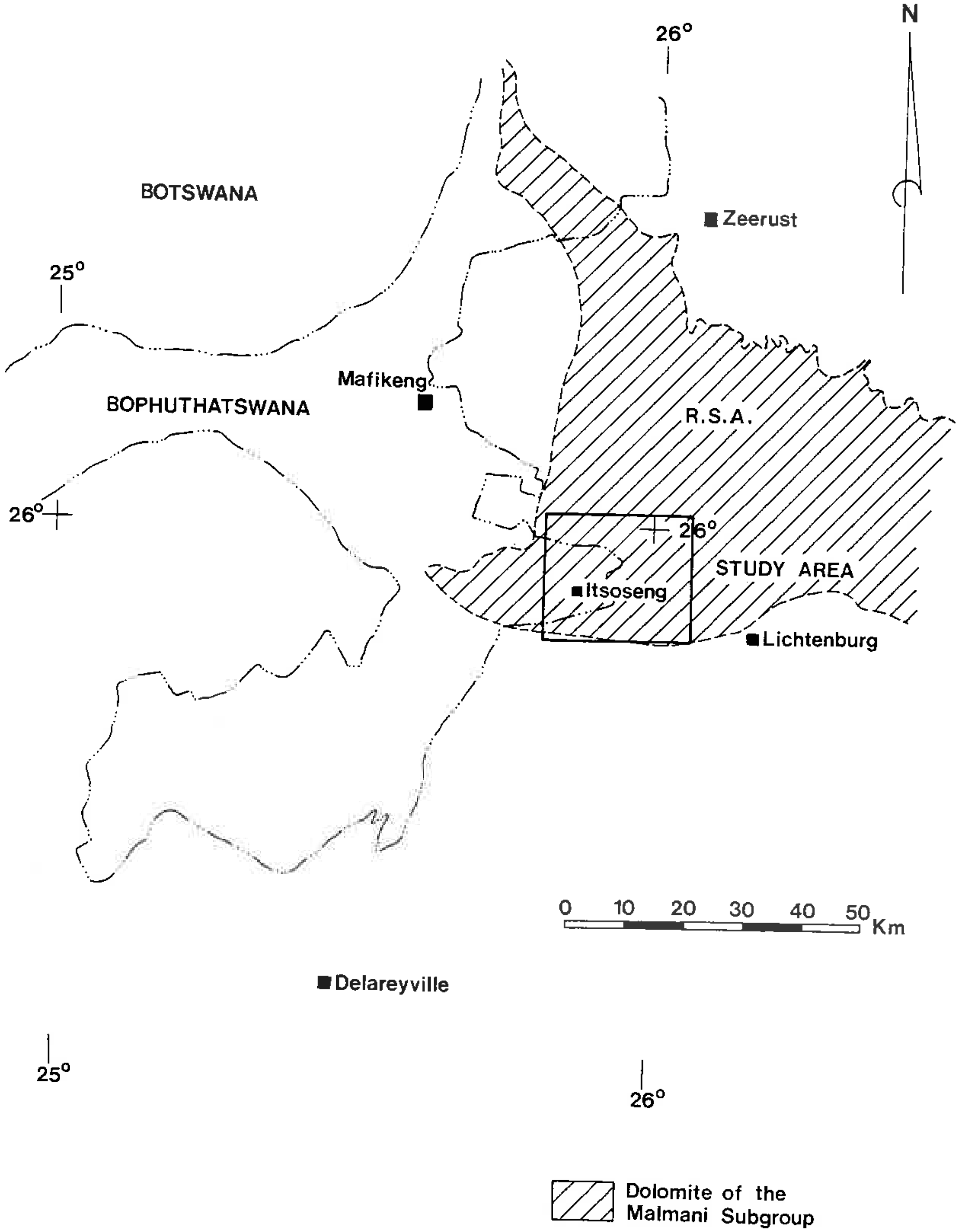
(EVN = Eksteen, van der Walt and Nissen; PMA = Partridge, Maud and Associates (assisted by E. Martinelli and Associates); DG = Directorate of Geohydrology)

The extent of the study area is shown in the locality plan comprising Figure 1.

3. WATER DEMAND PROJECTIONS

The raison d'etre for the investigation forming the subject of this report is the quantification of the groundwater resources of the area with a view to determining whether the water demand of Itsoseng and Bodibe, projected to the year 2020, can be met from underground sources.

The twin settlements of Itsoseng and Bodibe are situated approximately 40 Km south east of Mmabatho in the Ditsobotla District of Bophuthatswana. Itsoseng is well



LOCALITY PLAN

FIGURE 1

structured, with well defined plot lines and fully serviced erven, while Bodibe is a semi-rural settlement. However, the populations of the two settlements are similar, differing by no more than about 20%.

Itsoseng is situated close to the main aquifer in the Polfontein Compartment and already makes use of water drawn from a number of boreholes which tap this aquifer. Bodibe is situated around a spring where the surplus water flow from the compartment is forced to the surface. Thus, although there is no piped reticulation in Bodibe, the residents live near enough to make use of surface water drawn from the spring and shallow boreholes situated around it. A rudimentary reticulation and draw-off system, utilizing water from the spring, is planned for installation in Bodibe in the near future.

3.1 Population Numbers

A development study for the sub-region including Itsoseng and Bodibe was completed recently by town planners Messrs. Setplan. The baseline population numbers for these settlements were based on house and plot counts, together with occupancy rates commensurate with the socio-economic status of the settlements.

Population growth rates for Itsoseng and Bodibe were established, taking cognizance of growth-affecting socio-economic factors such as local and regional commercial and industrial activity, and availability of housing, schooling and medical facilities. Population growth and numbers for upper, lower and probable growth scenarios were estimated as per Table 1.

Design standards, norms and levels of service have all been based on the Bophuthatswana Department of Water Affair's Guidelines for the Selection of Design Criteria, July 1990. Demand generated by the population numbers shown above, using these standards and levels of service, is shown for the various growth scenarios, in Figures 2, 3 and 4. Note that this demand is

TABLE 1

POLFONTEIN COMPARTMENT - DEMAND CENTRES

Polpulation Figures and Growth

1. Lower Growth Scenario

Centre	1990	Growth Rate 1990-2000	2000	Growth Rate 2000-2010	2010	Growth Rate 2010-2020	2020
Itsoseng	26287	1,8%	31421	1,5%	36465	0,8%	39490
Bodibe	24445	1,6%	28650	1,4%	32924	0,7%	35320
TOTAL	50732		60071		69389		74792

2. Upper Growth Scenario

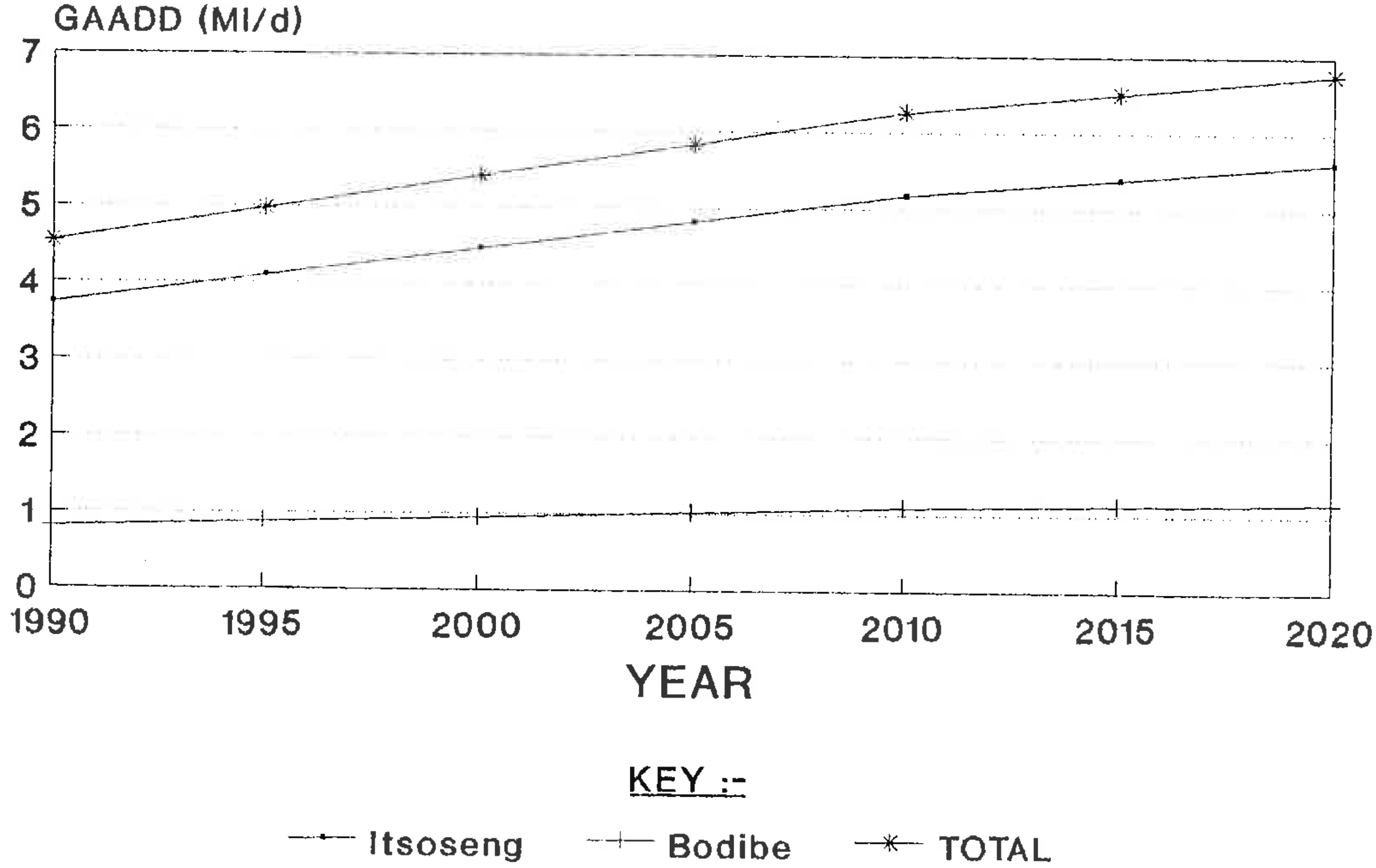
Centre	1990	Growth Rate 1990-2000	2000	Growth Rate 2000-2010	2010	Growth Rate 2010-2020	2020
Itsoseng	26287	2,8%	34648	2,6%	44786	2,0%	54594
Bodibe	24445	2,6%	31598	2,4%	40056	2,0%	48828
TOTAL	50732		66246		84842		103422

3. Probable Growth Scenario

Centre	1990	Growth Rate 1990-2000	2000	Growth Rate 2000-2010	2010	Growth Rate 2010-2020	2020
Itsoseng	26287	2,2%	32678	2,1%	40226	1,2%	45322
Bodibe	24445	2,0%	29798	1,9%	35969	1,4%	41335
TOTAL	50732		62476		76195		86657

PROJECTED WATER DEMAND (GAADD)

For :- BODIBE & ITSOSENG

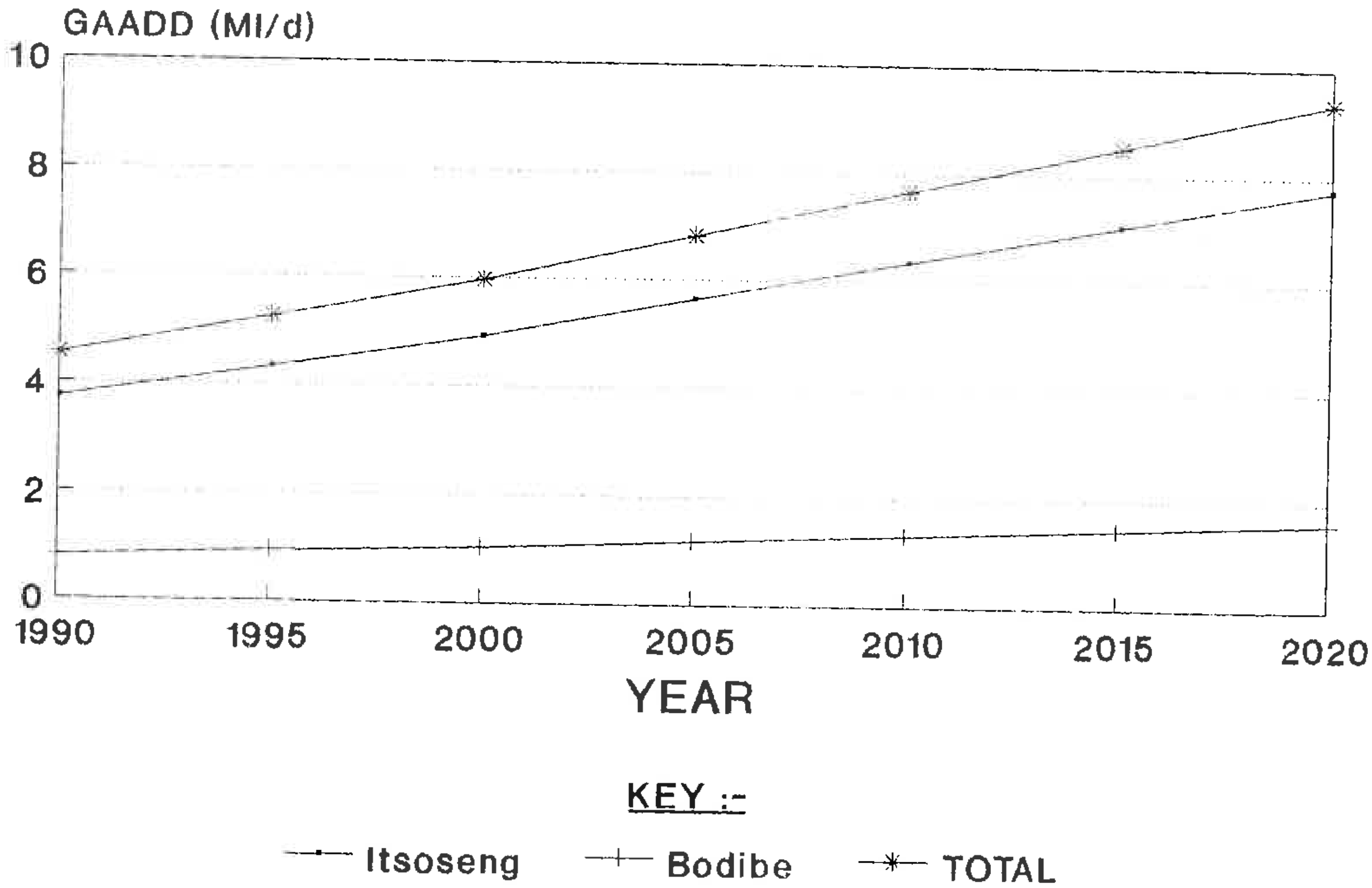


(LOWER GROWTH SCENARIO)

FIGURE 2.

PROJECTED WATER DEMAND (GAADD)

For :- BODIBE & ITSOSENG

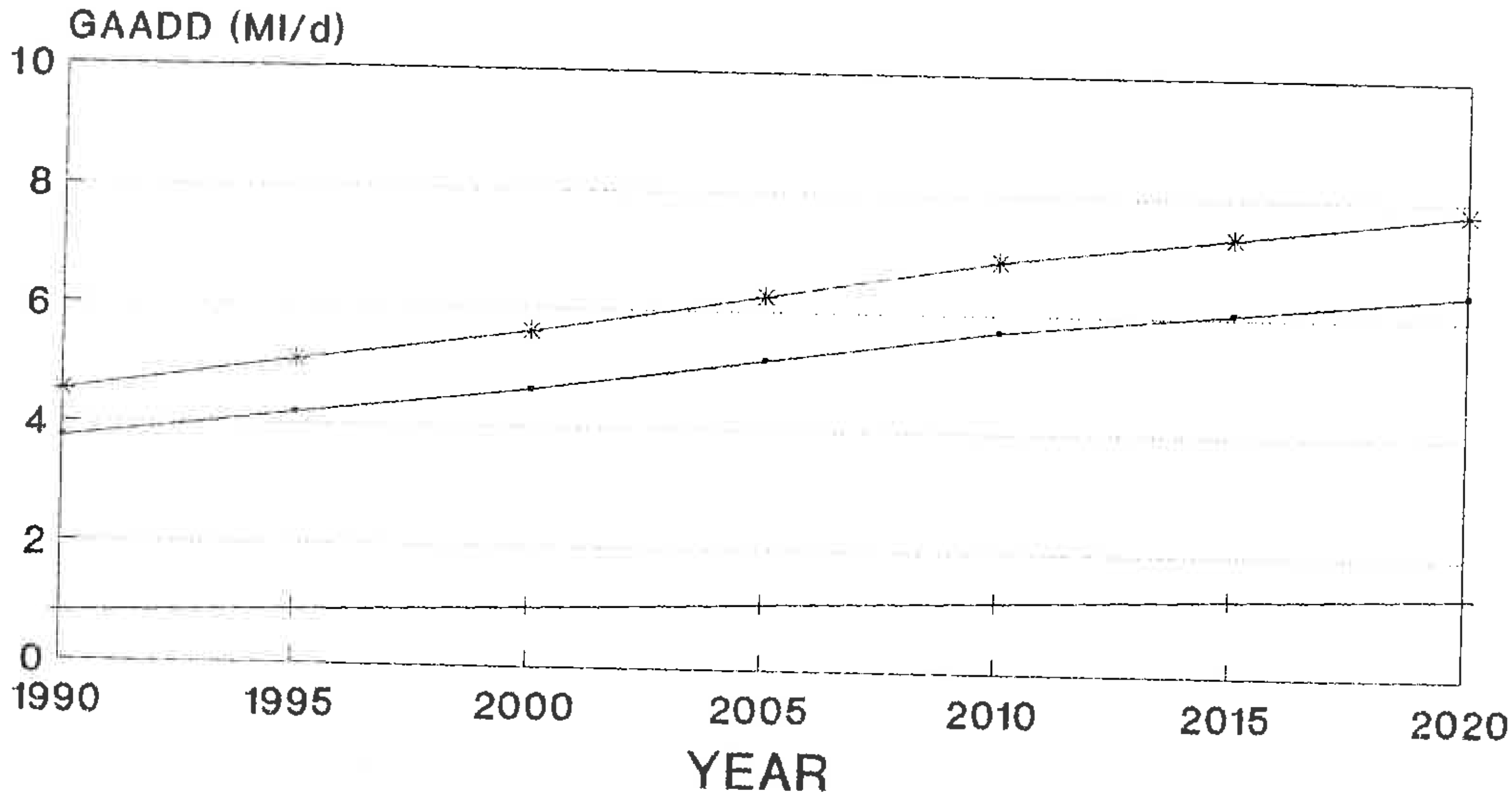


(UPPER GROWTH SCENARIO)

FIGURE 3.

PROJECTED WATER DEMAND (GAADD)

For :- BODIBE & ITSOSENG



(PROBABLE GROWTH SCENARIO)

FIGURE 4.

gross average annual daily demand (GAADD), not taking any peak flow into account but inclusive of all bulk users and wastage. From this analysis it may be concluded that the average daily demand for Itsoseng and Bodibe is likely to approach 7,8 megalitres per day by the year 2020.

4. PREVIOUS INVESTIGATIONS IN THE AREA

The findings of previous hydrogeological investigations in the vicinity of Itsoseng have been summarized in the report entitled "Report on the findings of a desk study on the hydrogeology of the Polfontein Groundwater Compartment" prepared by Partridge, Robson and Associates on behalf of Messrs. Eksteen, van der Walt and Nissen and the Bophuthatswana Department of Water Affairs in August 1989.

The area is underlain by dolomitic bedrock of the Malmani Subgroup (Figure 1) which overlies the Black Reef Quartzite Formation and lavas of the Ventersdorp Supergroup to the south and west. The dolomitic rocks dip at shallow angles to the north and east. Directly overlying the Black Reef Formation is chert poor and manganese rich dolomite of the Oaktree Formation, which is generally a poor aquifer of low transmissivity. The Oaktree Formation is overlain by chert-rich dolomite of the Monte Christo Formation, in which karst weathering and solution has resulted, at least locally, in the development of an aquifer of significantly higher transmissivity and groundwater potential. The contact between the Oaktree and Monte Christo Formations is shown on Plan 8388/100/2; beyond this contact a rapid decline in piezometric level occurs within the Oaktree Formation, and the contact has therefore been taken as the western boundary of groundwater compartments which are delineated elsewhere by dykes which have intruded the dolomite. While some of these dykes constitute effective groundwater barriers, others have been subject to fracturing and weathering which permits groundwater movement across some of them. The dolomite bedrock is covered by a variable thickness (usually less than 5m) of transported colluvium and wind-blown sand, within which calcrete has often developed to varying extents. Beneath this transported cover very variable thicknesses of residual materials are present; these chiefly comprise chert residuum and magnanimous wad. Because of the pinnacled nature of the bedrock surface resulting from preferential solution of the dolomite along joints and fractures, up to 40m of residual material may by juxtaposed with fresh dolomite. These rapid lateral transitions make water borehole siting in pinnacled dolomite especially difficult. The most favourable sites are associated with bedrock valleys (some occurring in the zones of fracturing adjacent to dykes) and with karst cavities; the former often give rise to dolines, or surface depressions, while the latter are sometimes manifested in steep sided sinkholes. Significant lowering of the piezometric surface through excessive groundwater abstraction often results in local instability which is manifested in renewed doline and sinkhole development.

5. GEOHYDROLOGICAL CENSUS

Borehole censuses have been conducted in the Polfontein Compartment on several occasions over the last 18 years; the first, in 1972, was carried out by the Geological Survey of South Africa in January/February 1972; the second was conducted by Partridge, de Villiers and Associates in August 1980, and a third by the South African Department of Water Affairs in May 1983. The results of these censuses and of the measurements conducted during 1990 as part of the present investigation are summarized in Table 2. The positions of the boreholes are shown on Plan 8388/100/1. Table 2b lists the new computer numbers allocated to the relevant boreholes by the Bophuthatswana Department of Water Affairs.

While the levels of boreholes in the Polfontein Compartment rose by about 2,2m between 1972 and 1980, they fell by some 1,8m on average between 1980 and 1983; a further fall of some 4,0m on average occurred between 1983 and 1990. Table 2a

TABLE 2: RESULTS OF BOREHOLE CENSUS CONDUCTED IN THE VICINITY OF THE POLFONTEIN COMPARTMENT

Farm name	Bore-hole number	Comp-art-ment **	Collar Elevation (mamsl)	Depth to water table (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/09/90	Water rest levels (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/9/90	Changes in water rest levels 1972/80	1980/83	1983 - 04/90	1972 - 04/90	Equipment	Use	Annual abstraction (m3)
Verdwaal 57 10	T17006	V	1493.96	12.05	9.50	9.71	13.60		13.55	1481.91	1484.46	1484.25	1480.36		1480.41	2.55	-0.21	-3.89	-1.55	Windpump	Stock & village	2 000 - 3 000
	T17055		1482.78	8.45	5.00	5.62	5.80		6.56	1474.33	1477.78	1477.16	1476.98		1476.22	3.45	-0.62	-0.18	2.65	Windpump	Stock & village	2 000 - 3 000
	V1		1496.28				24.00		24.46				1472.28		1471.82					Electric pump	Co-op & irrigation	50 000
	T17558		1464.25		6.00			7.02	7.75		1458.25			1457.23	1456.50					Windpump	Stock	2 000 - 3 000
Stiglingspan 7310	T17559				7.00	5.95											1.05			Windpump	Stock	2 000 - 3 000
	T17578			7.27	7.00	5.63										0.27	1.37			Windpump	Stock	2 000 - 3 000
Springbokpan 6110	D34				3.00															?	?	?
	T17047																			Windpump	Stock	2 000 - 3 000
	T17048				13.00	8.87											4.13			Windpump	Stock	2 000 - 3 000
	T17050				9.00	5.62											3.38			Windpump	Stock	2 000 - 3 000
	T17549				7.00	19.00											-12.00			Windpump	Village	2 000 - 3 000
	T17550		1452.17	7.41	5.00	5.93	2.40		2.16	1444.76	1447.17	1446.24	1449.77		1450.01	2.41	-0.93	3.53	5.01	Disused	--	--
	T17586		1450.08	18.60	6.00	16.39	6.80			1431.48	1444.08	1433.69	1443.28			12.60	-10.39	9.59	11.80	Disused	--	--
	T17593				8.00	8.16											-0.16			Windpump	Stock	2 000 - 3 000
	T17609					13.70														Windpump	Stock & village	2 000 - 3 000
Welverdiend 4510	P1					8.64														Windpump	Stock & village	2 000 - 3 000
	T17000			2.30	3.00	3.23										-0.70	-0.23			Windpump	Stock	2 000 - 3 000
	T17001				7.40	15.73											-8.33			Windpump	Stock & village	2 000 - 3 000
	T17598			5.36	6.00	6.20										-0.64	-0.20			Windpump	Stock & village	2 000 - 3 000
	T17653																			Windpump	Stock & village	2 000 - 3 000
Molopo Res.	T8573				5.00	5.38											-0.38			Windpump	Stock & village	2 000 - 3 000

TABLE 2 (continued)

Farm name	Bore-hole number	Comp-art-ment **	Collar Elevation (mamsl)	Depth to water table (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/09/90	Water rest levels (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/9/90	Changes in water rest levels 1972/80	1980/83	1983 - 04/90	1972 - 04/90	Equipment	Use	Annual abstraction (m3)
Shiela	P6	P	1498.32				26.10		26.53				1472.22		1471.79					Electric pump	Itsoseng water supply	1 500 000
5510	SH4	P			18.00	19.42	pump										-1.42			Electric pump	Thusong hospital	50 000
	SH5	P					pump													Electric pump	Thusong hospital	50 000
	T17004	P	1497.12	21.28	15.00	19.90	24.20		24.79	1475.84	1482.12	1477.22	1472.92		1472.33	6.28	-4.90	-4.30	-2.92	Windpump	Stock	2 000 - 3 000
	T17541	P	1495.78	18.94	17.00	18.64	23.10			1476.84	1478.78	1477.14	1472.68			1.94	-1.64	-4.46	-4.16	Electric pump	Village	12 000
	T17661	V	1491.60		8.50	8.96	11.90		12.33		1483.10	1482.64	1479.70		1479.27		-0.46	-2.94		Windpump	Stock & village	2 000 - 3 000
De Hoop	T17664	P		18.69	18.50	blocked	blocked									0.19				Blocked	--	--
5110	T17531	P	1490.89	15.82	12.50	14.42	18.25		18.32	1475.07	1478.39	1476.47	1472.64		1472.57	3.32	-1.92	-3.83	-2.43	Unequipped	--	--
	T17599			12.35		destr.	destr.													Disused	--	--
	T17002			18.86		destr.	destr.													Disused	--	--
	DH1	P	1479.34				8.10						1471.24		blocked					Unequipped	--	--
Itsoseng	D5				5.00	4.12	destr.										0.88			Disused	--	--
	T17611	P	1488.63				pump	18.40						1470.23						Electric pump	Itsoseng (standby)	100 000
Matlabes-	D27				6.00	7.23											-1.23			Handpump	Village	2 000 - 3 000
lokasie	D28	P			5.00	5.66	lost										-0.66			Electric pump	Village	--
	P		1466.29				6.70		7.19				1459.59		1459.10					?	?	?
	P10																			?	?	?
	P2					6.92														Handpump	Village	2 000 - 3 000
	P3					6.40														Windpump	Village	2 000 - 3 000
	P4					3.72														Handpump	Village	2 000 - 3 000
	P5					8.07	blocked													Blocked	--	--

TABLE 2 (continued)

Farm name	Borehole number	Compartment **	Collar Elevation (mamsl)	Depth to water table (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/09/90	Water rest levels (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/9/90	Changes in water rest levels 1972/80	1980/83	1983 - 04/90	1972 - 04/90	Equipment	Use	Annual abstraction (m3)
	P7	P				6.65														Electric pump	Village	12 000
	P8					6.12														Handpump	Village	2 000 - 3 000
	P9					9.76														?	?	?
	T17644	P	1478.23		6.00	6.46	pump	7.79			1472.23	1471.77		1470.44			-0.46			Electric pump	Itsoseng (standby)	100 000
	T17663	P	1477.14		9.00	5.95	windpump				1468.14	1471.19					3.05			Windpump	Clinic	2 000 - 3 000
	T17667				3.00	3.20											-0.20			Windpump	Village	2 000 - 3 000
	T17709		1467.45		3.40	2.87	2.35		2.92		1464.05	1464.58	1465.10		1464.53		0.53	0.52		Windpump	School	2 000 - 3 000
	T17710		1469.77		5.00	6.38	8.30		10.30		1464.77	1463.39	1461.47		1459.47		-1.38	-1.92		Windpump	Stock & village	2 000 - 3 000
Klein	KW1					5.65														Windpump	Domestic	?
Westford	KW29		1442.30						7.02						1435.28					?	?	?
Mooimeisiesfon-	MM01					2.82	2.50											0.32		Unequipped	--	--
tein (MM113)	MM02		1449.93			2.53	2.75					1447.40	1447.18					-0.22		Electric pump	Irrigation	?
	MM03						blocked													Blocked	--	--
	MM07					13.50														Windpump	Stock	?
	MM19					4.45														Windpump	Domestic	?
	MM33		1442.02				3.70						1438.32							Windpump	Stock	?
	MM36						blocked													Blocked	--	--
	MM37		1455.24				5.00						1450.24							Electric pump	Irrigation	?
	MM38					4.80														Windpump	Stock	?
	MM48		1432.89	2.30		3.71	3.50			1430.59		1429.18	1429.39					0.21	-1.20	Windpump	Stock	?
	MM50		1447.32	3.25			3.35			1444.07			1443.97						-0.10	Windpump	Stock	?

TABLE 2 (continued)

Farm name	Bore-hole number	Comp-art-ment **	Collar Elevation (mamsl)	Depth to water table (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/09/90	Water rest levels (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/9/90	Changes in water rest levels 1972/80	1980/83	1983 - 04/90	1972 - 04/90	Equipment	Use	Annual abstraction (m3)
	MM56		1434.50	6.81		7.40	6.10			1427.69		1427.10	1428.40					1.30	0.71	Disused	--	--
	MM57		1430.00	6.10		10.06	windpump			1423.90		1419.94								Windpump	Stock	?
	MM61		1445.00			5.35	windpump					1439.65								Windpump	Domestic & stock	?
	MM64		1445.00			6.37						1438.63								Unequipped	--	--
	MM74					5.45														?	?	?
Blaauwbank	BB						22.00													Electric pump	Irrigation	?
119JO (81)	BB28		1479.23				30.50		35.44				1448.73		1443.79					Unequipped	--	--
	BB29						pump													Electric pump	Irrigation	?
	BB40					26.90														?	?	?
	BB41	M	1473.45			5.83	6.30		7.44			1467.62	1467.15		1466.01			-0.47		Unequipped	--	--
(30)	BB80		1480.16				22.00		pump				1458.16							Uniquipped	--	--
(BB33 & 34)	BB108		1473.17				18.00		blocked				1455.17							Electric pump	Irrigation	?
	BB270						pump													Electric pump	Irrigation	?
Kliplaagte	KL02	P					pump													Electric pump	Irrigation	?
5210	KL04	P	1494.19			18.60	21.60		22.28			1475.59	1472.59		1471.91			-3.00		Unequipped	--	--
	KL13					23.86														?	?	?
	KL50	P	1496.43			20.00	24.00		24.63			1476.43	1472.43		1471.80					Unequipped	--	--
(KL89)	KL51	P					pump													Electric pump	Domestic	?
(KL81&82)	KL80	P					pump													Electric pump	Irrigation	?
	KL83	P					pump													Electric pump	Irrigation	?
	KL93		1490.28				30.15						1460.13							Unequipped	--	--

TABLE 2 (continued)

Farm name	Bore-hole number	Comp-art-ment **	Collar Elevation (mamsl)	Depth to water table (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/09/90	Water rest levels (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/9/90	Changes in water rest levels 1972/80	1980/83	1983 - 04/90	1972 - 04/90	Equipment	Use	Annual abstraction (m3)
	KLM						dry to 31													Unequipped	--	--
La Reysstryd	981119						31.10													Unequipped	--	--
5310 (LS 52)	LS03	P	1496.26																	Electric pump	Irrigation	?
	LS05		1492.67	19.51		26.02			31.89	1473.16		1466.65			1460.78					Windpump	Stock	?
	LS06		1493.53			26.78	windpump					1466.75								Windpump	Stock	?
	LS07	P				27.02	pump													Electric pump	Irrigation	?
	LS11					27.28	locked													Unequipped	--	--
	LS12		1496.59			18.48	dry to 40					1478.11								Dry	--	--
	LS13					20.10	locked													Unequipped	--	--
	LS14		1496.08			28.84	34.30					1467.24	1461.78					-5.46		Uniquipped	--	--
	LS16					23.29														?	?	?
	LS81	P	1497.88				pump													Electric pump	Irrigation	850 000 +
De Paarl	DP002						pump													Electric pump	Irrigation	?
5410	DP003						10.00													Electric pump	Irrigation	?
	DP004		1498.05																	?	?	?
	DP007		1504.91				pump													Electric pump	Irrigation	?
	DP008		1504.82																	?	?	?
	DP009																			?	?	?
	DP012																			?	?	?
	DP013	P	1498.78	21.25			26.75		26.89	1477.53			1472.03		1471.89					Unequipped	--	--
	DP014	P					blocked													Blocked	--	--

TABLE 2 (continued)

Farm name	Bore-hole number	Comp-art-ment **	Collar Elevation (mamsl)	Depth to water table (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/09/90	Water rest levels (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/9/90	Changes in water rest levels 1972/80	1980/83	1983 - 04/90	1972 - 04/90	Equipment	Use	Annual abstraction (m3)
	DP015																					
	DP020																			?	?	?
	DP023	P																		Unequipped	--	--
	DP051		1476.06				pump													?	?	?
	DP052						pump													Electric pump	Irrigation	500 000 ++
	DP053						closed													Electric pump	Irrigation	?
	DP100		1499.36				pump													Unequipped	--	--
	DP105	P	1496.42				25.80						1470.62							Electric pump	Irrigation	?
	DP107	P	1497.14				25.30						1471.84							?	?	?
	DP108	P	1498.05				25.00		24.36				1473.05		1473.69					?	?	?
	DP110		1503.60	18.62			pump													?	?	?
reefslaagte	GL						pump													Electric pump	Irrigation	450 000
	GL13		1507.10				19.30		19.54				1487.80		1487.56					Electric pump	Irrigation	?
	GL14		1507.00				19.10		19.77				1487.90		1487.23					Windpump	Stock	?
endriksdal	HD	P					22.75													Handpump	Domestic	?
	HD03	P	1498.54				blocked													Unequipped	--	--
	HD90	P	1494.50				pump													Blocked	--	--
	HD92	P		25.48			dry to 40													Electric pump	Irrigation	?
	HD95	P																		Windpump	Stock	?
	BM04		*1473.10	5.20		5.26				1467.90		1467.84								?	?	?
	BM05		*1473.70	4.30		6.00				1469.40		1467.70								Electric pump	Domestic	?
																				Windpump	Domestic & stock	?

TABLE 2 (continued)

Farm name	Bore-hole number	Comp-art-ment **	Collar Elevation (mamsl)	Depth to water table (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/09/90	Water rest levels (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/9/90	Changes in water rest levels 1972/80	1980/83	1983 - 04/90	1972 - 04/90	Equipment	Use	Annual abstraction (m3)
	BM11		*1465.51						4.32						1461.19					?	?	?
	BM18		*1476.69						3.95						1472.74					?	?	?
	BM24		*1488.00	4.50		5.82				1483.50		1482.18								Windpump	Domestic	?
	BM28		*1493.50	9.10		4.50				1484.40		1489.00								Electric pump	Irrigation	?
NEW BOREHOLES - DRILLED 1990																						
	1	V	1502.52					20.26	18.26					1482.26	1484.26					Unequipped	Monitoring borehole	--
	2	V	1496.56					25.08	23.69					1471.48	1472.87					Unequipped	Monitoring borehole	--
	3	P/V	1496.91					17.99	16.15					1478.92	1480.76					Unequipped	Monitoring borehole	--
	4	P	1494.97					24.01	22.47					1470.96	1472.50					Unequipped	Monitoring borehole	--
	5	P	1494.19					23.42	22.01					1470.77	1472.18					Unequipped	Monitoring borehole	--
	6	P	1493.25					23.59	22.08					1469.66	1471.17					Unequipped	Monitoring borehole	--
	7	M	1486.67					21.81	19.31					1464.86	1467.36					Unequipped	Monitoring borehole	--
	8	P	1487.75					16.53	14.91					1471.22	1472.84					Unequipped	Monitoring borehole	--
	9	P	1503.31						30.69						1472.62					Unequipped	Monitoring borehole	--
	10 A																			Unequipped		--
	10	V	1504.33						19.94						1484.39					Unequipped	Monitoring borehole	--
	11		1499.70					15.42	15.53					1484.28	1484.17					Unequipped	Monitoring borehole	--

TABLE 2 (continued)

Farm name	Bore-hole number	Comp-art-ment **	Collar Elevation (mamsl)	Depth to water table (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/09/90	Water rest levels (mamsl) 1972	1980	1983	04/1990	07/90 - 08/90	19/9/90	Changes in water rest levels 1972/80	1980/83	1983 - 04/90	1972 - 04/90	Equipment	Use	Annual abstraction (m3)
	12		1492.71					8.76	8.89					1483.95	1483.82					Unequipped	Monitoring borehole	--
	13		1488.18					5.22	5.33					1482.96	1482.85					Unequipped	Monitoring borehole	--
	14		1469.20					2.73	2.57					1466.47	1466.63					Unequipped	Monitoring borehole	--
	15		1507.10						20.53						1486.57					Unequipped	Monitoring borehole	--
	16		1499.61						14.21						1485.40					Unequipped	Monitoring borehole	--

* GROUND ELEVATION M.A.M.S.L. + TOTAL ANNUAL ABSTRACTION FOR BOREHOLES LS 81 - 85.

** M = MATLABES COMPARTMENT ++ TOTAL ANNUAL ABSTRACTION FOR BOREHOLES DP 50 - 55.
P = POLFONTEIN COMPARTMENT
V = VERDWAAL COMPARTMENT ? DATA UNAVAILABLE.

TABLE 2a

Period	Change in Wondergat level	Mean change in Polfontein level
1972-1980	+1,95m	+2,20m (approx.)
1980-1983	-1,06m	-1,80m
1983-1990	-3,72m	-4,00m
Overall 1972-1990	-2,83m	-3,60m

TABLE 2b

COMPUTER NUMBERS ALLOCATED TO BOREHOLES DRILLED DURING 1990
IN THE POLFONTEIN COMPARTMENT

ORIGINAL NUMBER	COMPUTER NUMBERS
1	10-77199
2	10-77200
3	10-77201
4	10-77202
5	10-77203
6	10-77204
7	10-77205
8	10-77206
9	10-77207
10	10-77208
11	10-77209
12	10-77210
13	10-77211
14	10-77212
15	10-77213
16	10-77214
P6*	10-77150
	10-77150B
	10-77152
	10-77152B
	10-77153

* These are the group of boreholes drilled at the Itsoseng reservoir

compares these fluctuations with the natural fluctuations in level recorded over the same period in the nearby water-filled sinkhole at Wondergat.

From these simple comparisons it is clear that, whereas both compartments showed fluctuations of much the same order in response to increased rainfall between 1972 and 1980, the Polfontein Compartment experienced a larger decline than the Wondergat between 1980 and 1990. This difference can be accounted for only by an excess of abstraction over recharge during this latter period. This conclusion is confirmed by an analysis of the flow from the Polfontein Spring discussed below.

Table 2 also lists annual abstraction from the various boreholes occurring in the Polfontein Compartment and the adjoining Matlabes and Verdwaal compartments, which also extend into Bophuthatswana (Plan 8388/100/2). Unfortunately, because of an absence of historical data, most of these figures are rough estimates based on interviews with local users. Within the Bophuthatswana portion of the Polfontein Compartment accurate pumping figures could be obtained only for borehole P6 (and nearby holes forming the wellfield at the Itsoseng reservoir), based partly on electricity consumption and partly on actual flow measurements, since April 1987. However, since abstraction from this wellfield represents by far the bulk of the usage by Bophuthatswana, the figures of Table 3 are of some importance.

Piezometric measurements made in the course of the present investigation during April 1990 were repeated in several key boreholes in September 1990 in order to better link recent responses in piezometric levels to reasonably well calibrated abstraction estimates.

Because the distribution of existing boreholes was found to be too erratic to provide a good spread of piezometric data across the Polfontein and adjacent compartments, and because some were inaccessible due to the nature of their equipment and their utilization, 16 new boreholes were drilled in the course of the present investigation, both to calibrate the results of the geophysical survey and to provide supplementary

TABLE 3

ITSOSENG RESERVOIR WELLFIELD: MONTHLY PUMING FIGURES (m^3)

	1987	1988	1989	1990
Jan.		168 837	172 846	177 132
Feb.		84 953	122 897	204 184
Mar.		158 828	139 991	166 180
Apr.	150 228	131 211	165 704	100 470
May	90 261	147 895	177 751	100 840
June	116 429	117 391	59 768	83 315
July	76 749	114 078	182 750	94 345
Aug.	105 469	90 299	57 044	103 673
Sept.	115 974	167 418	125 611	97 687
Oct.	115 020	210 287	111 358	
Nov.	98 356	95 184	103 660	
Dec.	130 734	127 420	116 191	

data on water table levels. This new information, together with the data from the existing boreholes, has permitted a contour plan of the piezometric surface to be prepared (Plan 8388/100/2); this has, in conjunction with the geophysical results, enabled the compartment boundaries to be defined with certainty for the first time.

6. GEOPHYSICAL SURVEYS

The Directorate of Geohydrology of the Department of Water Affairs conducted magnetic and gravity surveys with the objective of:

- locating major zones of leached dolomite in the Polfontein and adjacent compartments.
- evaluating structural and stratigraphic control over the dolomite leaching process.
- accurately locating the position of all major dykes.

6.1 Gravity Survey

The gravity survey was carried out during April to June 1990. During this period large areas were covered with maize and it was not possible to conduct the survey on a regular grid. Gravity lines were thus laid out along roads, tracks and fences to obtain a line spacing of about 1 Km.

A constant station interval of 100m was employed. Stations were marked with white plastic tags and fixed to the ground with 80mm nails. Stations were numbered in units of 1 Km. For each line numbering started at 0.0 or 0.1. Line numbering direction and station positions are shown on Plan 8388/100/3. A total of 2911 gravity stations were surveyed and processed.

Levelling of gravity stations was carried out by tying in to trigonometric beacon No. 2 on the farm Matlabeslokasie. The overall absolute levelling accuracy is about 0,3m and with a relative accuracy between stations of about 0,005m.

During the computation of elevations a constant error of -4,2m was introduced relative to the absolute elevation (a.m.s.l.) of beacon No. 2. These values are listed with the gravity listing in Appendix A. To obtain correct absolute elevations 4,2m must be added to the listed values. This was done during the levelling of borehole collar elevations when using gravity stations as a reference.

XY-Coordinates of gravity stations were interpolated from 1:50 000 topocadastral maps, using the 27 degree Lo system as reference. The accuracy of coordinates is about 30m.

All observed gravity values have been related to a main base, comprising a cemented bench-mark adjoining the north-east corner post of the international fence at Thusong Hospital, at which the value was taken as zero mgal.

The raw gravity data were reduced to relative Bouguer gravity values. Reduction factors used are presented with the data listed in Appendix A. Contouring of the Bouguer values of the initial survey indicated a major gravity low feature in the Verdwaal Compartment, trending in a north-east direction. Because of the presence of this feature the gravity survey was extended on the Verdwaal farm to map the south-western extension of the anomaly. Several exploratory boreholes were sited on this feature.

6.2 Magnetic Survey

Magnetic traverses were run at 10m station intervals along selected gravity lines to locate the positions of dykes accurately in relation to the gravity grid. Results of ground magnetic surveys were combined with existing aeromagnetic data and ground magnetic surveys previously conducted by the Geological Survey of South Africa.

Dyke positions are indicated on Plans 8388/100/2 and 3. On these plans a distinction is made between dykes which act, or do not act, as groundwater barriers, as well as between dyke positions inferred from aeromagnetic and from ground magnetic surveys. The existence of a NNW trending dyke north of Itsoseng was obtained from a previous report compiled for the Agricultural Development Corporation of Bophuthatswana and dated June 1984. This dyke is referred to in this report as the Itsoseng Dyke.

6.3 Siting of Exploratory Boreholes

The objectives of the exploratory drilling were:

- firstly, to establish wells to obtain piezometric information.
- secondly, to investigate gravity anomalies and calibrate the gravity data.
- thirdly, to establish wells across the Paarl Dyke for a test pumping exercise to evaluate the amount of leakage through the dyke, and
- fourthly, to site future production boreholes.

All borehole sites were selected and drilled on gravity anomalies excepting borehole 5, which was shifted 200m from the proposed gravity station on to a major air-photo feature. Borehole sites 1 - 10 were selected using a preliminary Bouguer gravity contour map and gravity profiles, whereas in the siting of boreholes 11 - 14 and 16 only gravity profiles were used as a complete Bouguer contour map was not available at that stage.

A summary of drilling results, geophysical locations, gravity values and aquifer depths is given in Table 4. Aquifer depths were determined from geological and geophysical borehole logs and used for calibrating the gravity data to obtain residual gravity values.

Boreholes 1, 9, 11 - 14 and 16 were sited on the major north-west trending gravity low feature referred to in 6.1 . Boreholes 11 - 14 and 16 were unsuccessful (yields <0,5 l/s), and solid dolomite was penetrated, in general, deeper than 26m. These results and the final Bouguer gravity contour map show that this major gravity feature is a low density feature within the basement rocks underlying the dolomite formations. The effect of this feature was removed to within 0,3 mgal during compilation of the residual gravity map (Plan 8388/100/3). Good water strikes at boreholes 1 and 9 are due to the presence of additional smaller gravity low features at these localities. A detailed discussion of drilling results is presented in Section 8 below.

6.4 Residual Gravity Map

A regional gravity contour map was constructed by hand contouring, using:

- the Bouguer gravity contour map,
- aquifer depths obtained from the exploratory drilling,
- knowledge of the distribution of outcropping dolomite and
- the criterion that the regional field must be smooth and regular.

A value of 4m aquifer depth per 0,1 mgal was used as a guide in inferring aquifer depths within leached and fractured zones of the dolomite .

Table 4 Summary of drilling results with gravity information.

Bore-hole No.	Coordinates Lo. = 27 East Y (m)	X (m)	Ground Elev. (mamsl)	Collar Elev. (mamsl)	Depth of Bh. (mbgl)	Water Struck (mbgl)	Air-lift Yield (l/s)	Static Water Level Depth (mbgl)	Elev. mamsl	Date	Borehole Construction Drill Dia. (mm)	Casing Dia. (mm)	Perforated Casing (m)	Aquifer Base Elev. (mamsl)	Aquifer Depth (mbgl)	Geoph. Peg No.	Gravity Data Bouguer (mgal)	Residual (mgal)
1	107096	2887442	1501.83	1502.52	49	26-29 35 45	0.3 3.0 10.0	20.26 18.26	1482.27 1484.26	31/07/90 19/09/90	216 (0-49m)	152 (0-49m)	30 - 49	< 1452.83	>49	104/2.3	15.96	-1.23
2	108550	2885820	1496.22	1496.56	70	26	0.1	25.08 23.56 23.69	1471.48 1473.01 1472.87	31/07/90 04/09/90 19/09/90	216 (0-70m)	152 (0-30m)	12 - 30		N/A	V1/.04	N/A	N/A
3	108525	2885875	1496.37	1496.91	63	34-36 55	1.5 4.5	17.99 16.25 16.15	1478.92 1480.66 1480.76	31/07/90 04/09/90 19/09/90	216 (0-23m) 152 (23-63m)	152 (0-23m) 128 (0-63m)	32 - 39 51 -63	1437.37	59	V1/.1	17.25	-0.69
4	107469	2883560	1494.65	1494.97	100	27 32-35 62-63	0.5 3.5 5.0	24.01 22.41 22.47	1470.96 1472.56 1472.50	07/08/90 04/09/90 19/09/90	261 (0-46m) 152 (46-100m)	152 (0-46m)	25-46	1447.65	47	114/1.1	17.63	-1.29
5	108370	2884090	1493.78	1494.19	100	28-32 34-35 38-41	1.0 3.0	23.42 21.85 22.01	1470.78 1472.34 1472.18	07/08/90 04/09/90 19/09/90	219 (0-49m) 152 (49-100m)	152 (0-47m)	25-47	1454.78	39	none	N/A	N/A
6	107789	2880672	1492.80	1493.25	81	32 55 72	0.5 1.0 2.5	23.59 21.88 22.08	1469.67 1471.37 1471.17	07/08/90 04/09/90 19/09/90	216 (0-81m)	152 (0-81m)	26-35 39-42 45-48 53-60 63-73	1414.80	78	100/12.4	18.74	-1.99
7	110501	2880743	1486.16	1486.67	54	30 35 40	0.5 3.0 7.5	21.81 19.22 19.31	1464.86 1467.45 1467.36	31/07/90 04/09/90 19/09/90	216 (0-50m) 152 (50-54m)	152 (0-50m)	30-50	1443.66	42.5	7/8.65	19.94	-0.97
8	111506	2882904	1487.28	1487.75	59	28-30 35-37 40-41	0.2 ? 0.5	16.53 14.11 14.91	1471.23 1473.64 1472.84	07/08/90 04/09/90 19/09/90	216 (0-49m) 152 (49-59m)	152 (0-59m)	None	1454.26	33	7/6.2	19.22	-0.83
9	102570	2884438	1502.91	1503.31	73	23-25	0.5	30.50 30.69	1472.81 1472.62	04/09/90 19/09/90	208 (0-42m) 152 (42-73m)	152 (0-8m)	None	1463.91	39	100/6.0	17.33	-0.88
10	101673	2885085	1503.89	1504.33	32	22-26	3.0	19.91	1484.99	19/09/90	208 (0-26m)	152 (0-26m)	16-26	1477.89	26	100/4.9	18	-0.69
11	108163	2888190	1499.35	1499.70	65	22 45-47	0.1 0.5	15.42 15.53	1484.28 1484.17	15/08/90 19/09/90	214 (0-65m)	152 (0-11m)	None	1477.35	22	203/1.4	16.36	-0.72
12	109001	2888859	1492.39	1492.71	71	12-14	0.1	8.89	1483.82	19/09/90	214 (0-71m)	152 (0-6m)	None	1469.39	23	205/1.7	16.7	-0.3
13	109295	2889493	1487.47	1488.18	99	13-14	0.3	5.22 5.33	1482.96 1482.83	15/08/90 19/09/90	214 (0-33m) 152 (33-99m)	152 (0-8m)	None	1473.47	14	207/1.2	16.48	-0.22
14	111877	2891330	1468.91	1469.20	57	12-13	0.3	2.57	1466.83	19/09/90	214 (0-57m)	152 (0-6m)	None	1455.91	13	200/5.85	14.98	-0.55
15	100078	2886050	1506.70	1507.10	52	31-48	>10	20.53	1486.57	04/09/90	215 (0-36m) 165 (36-52m)	165 (0-32m)	?	1458.70	48	100/3.0	17.97	-1.3
16	107995	2888665	1499.09	1499.61	85	21-23	0.3	14.11 14.21	1485.50 1485.40	04/09/90 19/09/90	208 (0-13m) 152 (13-85m)	152 (0-13m)	None	1476.09	23	203/.9	16.22	-0.68

The regional field, which represents gravity effects derived from basement rocks below the dolomite, was subtracted from the Bouguer data to obtain residual gravity values. The subtraction was done on a profile basis. A zero residual gravity value would indicate outcropping fresh dolomite. The regional field was fairly complex and, with the limited borehole information that could be used for calibration, an error of about 0,4 mgal (16m+-) in the residual values should be anticipated.

The residual data were contoured using a 200m x 200m grid interval and a 0,1 mgal contour interval. The residual contours, with station locations, line numbers and dyke position are shown on Plan 8388/100/3. Using a grid interval of 200m has the effect that some detail along the profiles is lost, but limits possible errors due to the contouring of false anomalies where no data exist. This residual map therefore indicates major features only, and detailed gravity information for future borehole siting should be obtained from the data listing (Appendix A).

6.5 Results

The residual gravity data positions indicate that leaching of dolomite occurs preferentially along dyke contact zones. This suggests that solution of dolomite has taken place along pre-existing fracture zones (Plan 8388/100/3). In reaching this conclusion contoured gravity low features have been carefully evaluated in relation to station positions and dyke locations.

In the siting of production boreholes drilling into the dyke should be avoided and gravity information must therefore be examined in conjunction with the magnetic profiles in order to ensure that the leached contact zone is penetrated.

In areas of chert-rich dolomite (i.e. in the Monte Christo Formation) residual gravity low anomalies have a higher amplitude and are laterally more extensive than in the Oaktree Formation. This indicates a secondary stratigraphic control over the leaching of dolomite.

A linear gravity low feature north of Sheila village and trending WSW is evident on the residual gravity map. This is a priority target for future production boreholes and its groundwater potential should be investigated by drilling.

Exploration borehole 7 in the Matlabes Compartment and 1 in the Verdwaal Compartment have good yields and new wellfields could be developed in their vicinity. In the event that the flow of the Polfontein spring needs to be supplemented by pumping, boreholes could also be sited near the northern and southern contacts of the Stryd Dyke in proximity to the spring.

Sites for standby boreholes for the southern portion of Itsoseng township can be selected on line 12 in the northern and southern contact zones of the Paarl Dyke. The present standby boreholes for Itsoseng (T17611 and T17644) are drilled in a gravity low feature associated with the Itsoseng Dyke.

7. GROUNDWATER COMPARTMENTS

With the dyke positions located accurately in relation to existing boreholes, reliable collar elevations were needed to identify steps in groundwater levels and to determine compartment boundaries.

Collar elevations for exploration and existing boreholes in which water levels could be obtained were determined by staff of the Directorate of Geohydrology and Messrs. Eksteen, van der Walt and Nissen. Gravity station elevations were used as reference and corrected by +4,2m to obtain correct absolute elevations. The overall accuracy of collar elevations is about 0,4m.

During geophysical logging of exploration boreholes in September 1990 it was noted that water levels had dropped since July of that year. Measurements of water levels in the exploration and some existing boreholes were therefore repeated on 19th September 1990 by the Directorate of Geohydrology (Table 5).

Based on the September 1990 water levels it was possible to compile a piezometric map at 0,1m contour intervals. Piezometric contours and identified compartment boundaries are shown on Plan 8388/100/2.

The three identified dolomite compartments are named Matlabes, Polfontein and Verdwaal. Groundwater flow within all of these compartments is from south-east to north-west.

General information on these compartments is listed in Table 6.

8. DRILLING PROGRAMME

Drilling of 15 of the 16 new boreholes was undertaken in July and August 1990 by Messrs. T.A. Van der Walt and Sons. This firm was appointed by the Bophuthatswana Department of Water Affairs as the annual contractor for the Molopo region for 1990/91, under Tender No. BD 643/89. The drilling was carried out using one OMM air percussion rig coupled with a 21 bar 750 cfm Atlas Copco compressor. The sixteenth borehole, designated no. 15, was drilled by a contractor appointed by the South African Directorate of Geohydrology.

The 16 exploratory/monitoring boreholes were drilled in the positions shown on Plan 8388/100/1. The drilling positions were selected on the basis of the gravity survey data and were designed to probe the various anomalies and geophysical patterns detected.

Borehole 2 was sited to intersect the Paarl Dyke. It is 42,2m south of existing borehole V1 which is in the Polfontein Compartment. Borehole 3 is sited in the Verdwaal compartment a further 59,2m south of borehole 2 and is 101,1m south of

Table 5 . Water level information of relevant existing boreholes (19 September 1990).

Compartment	Borehole	Collar elev. (mamsl)	Water depth (m)	Water elev. (mamsl)
Matlabes	BB41	1473.45	7.44	1466.01
Polfontein	DP108	1498.05	24.36	1473.69
	DP13	1498.78	26.89	1471.89
	KL4	1494.19	22.28	1471.91
	KL50	1496.43	24.63	1471.80
	P6	1498.32	26.53	1471.79
	T17004	1497.12	24.79	1472.33
	T17531	1490.89	18.32	1472.57
	V1	1496.28	24.46	1471.82
Verdwaal	T17006	1493.96	13.55	1480.41
	T17661	1491.60	12.33	1479.27
Boreholes outside identified compartments	GL13	1507.10	19.54	1487.57
	GL14	1507.00	19.77	1487.24
	BB28	1479.23	35.44	1443.80
	KL93	1490.28	30.15	1460.13
	LS5	1492.67	31.89	1460.78
	P (WP)	1466.29	7.19	1459.10
	T17055	1482.78	6.56	1476.23
	T17550	1452.17	2.16	1450.01
	T17558	1464.25	7.75	1456.51
	T17709	1467.45	2.92	1464.53
	T17710	1469.77	10.30	1459.47

Table 6. General information on dolomitic compartments.

Compartment	Average water elevation (mamsl) Sept. 1990	Surface area (square km)	Boundaries
Matlabes	App. 1467	19,34	1) Blaauwbank dyke 2) Grasfontein dyke 3) Oaktree/Monte Chtisto Formation contact
Polfontein	App. 1472	74,98	1) Grasfontein dyke 2) Blaauwbank dyke 3) Hendriksdal dyke 4) Paarl dyke 5) Oaktree/Monte Christo Formation contact
Verdwaal	App. 1483	19,62	1) Paarl dyke 2) Hendriksdal dyke 3) Oaktree/Monte Christo Formation contact

V1. Boreholes 2 and 3 were drilled to probe the boundary effect of the Paarl Dyke between the Polfontein compartment to the north and the Verdwaal compartment to the south.

Boreholes 1,3,10,11,12,13,14 and 16 are sited in the Verdwaal compartment, boreholes 4,5,8 and 9 are sited in the Polfontein Compartment and boreholes 6 and 7 are located in the Matlabes compartment as indicated in Table 7. Boreholes 9 and 10 were drilled in the Republic of South Africa.

8.1. Borehole Construction

The boreholes were drilled as exploratory/monitoring boreholes with a completed diameter of 152mm. Drilling commenced at 216mm (8 1/2") diameter to penetrate the overburden and the fractured and weathered dolomite, after which 152mm ID. 4mm wall thickness casing was inserted. The casing was slotted as necessary where the water bearing formation was found to be collapsing. In several boreholes drilling continued at 152mm after the casing was inserted to the required depth and the borehole was left open. In the case of borehole 3 a deeper fractured dolomite horizon was encountered and 128mm ID. casing was inserted for the full depth of the borehole. This casing was slotted at the required depth.

Drilling conditions ranged from mostly straightforward to very difficult with collapsing ground. Lost circulation was experienced in boreholes 1 and 10.

Where chert-poor unfractured dolomite was intersected (Oaktree Formation) drilling was relatively easy and the boreholes were entirely uncased, with the exception of a short length of surface casing. Where chert-rich dolomite with wad and large fractures was encountered (Monte Christo Formation) drilling became very difficult and the full length of the borehole was cased. The first attempt at Borehole 10 was abandoned due to collapsing conditions and the borehole was redrilled.

The depths of the boreholes ranged from 32m (borehole 10) to 104m (borehole 5). Boreholes 4 and 5 had originally been terminated at 46,5m and 49m respectively but were later deepened to 100m and 104m at the request of staff of the South African Directorate of Geohydrology to check possible deep-seated gravity effects.

Details of the borehole construction are given in Table 7, and are included in the borehole logs of Appendix B.

8.2. Drilling Results

The boreholes were sited in both the Monte Christo Formation and the Oaktree Formation. During the drilling programme the difference between these two Formations was very clear. The boreholes drilled into the Monte Christo Formation (boreholes 1,3,4,5,6,7,8,9, and 10) generally intersected massive fractured chert bands, some wad and fractured dolomite, while the boreholes drilled into the Oaktree Formation (boreholes 11,12,13,14 and 16) intersected generally solid, chert-free dolomite.

The lithological variation between the Monte Christo and Oaktree Formations is manifested by a significant difference in the groundwater occurrence. Good water strikes with blowing yields of up to 10 l/s were made in boreholes 1,3,4,5,7 and 10, while only minor water intersections were made in all the boreholes drilled into the Oaktree Formation.

A summary of the geology intersected and water strikes made is given in Table 7. Details of the geology and water strikes are given in the borehole logs of Appendix B.

MONTE CHRISTO FORMATION

The depth of the main water strikes of the boreholes drilled into the Monte Christo Formation in the Polfontein and Matlabes Compartments varied from

TABLE 7

SUMMARY OF DRILLING RESULTS - POLFONTEIN COMPARTMENT

Borehole No	D.W.A	Compartment	Borehole depth (m)	Casing (m)	Depth of water strike(s) (mbgl)	Yield of individual strike(s) (l/s)	Water Level* (mbgl)	Geology	
								Inferred Formation	Lithology
1	104/2,3	Verdwaal	49	49	29 35 45	0,3 3,0 10,0	18,29	Monte Christo	Dolomite, Chert and Wad
2	V1/0,04	Polfontein/ Verdwaal	70	30	25	0,1	23,55		Dolerite
3	V1/0,1	Verdwaal	63	63	35 55	1,5 4,5	16,01	Monte Christo	Dolomite and Chert
4	114/1,1	Polfontein	100	100	27 37 63	0,5 3,5 1,5	22,55	Monte Christo	Dolomite, Chert and Wad
5	116/1,3	Polfontein	104	104	29 41	1,0 2,0	21,76	Monte Christo	Dolomite with minor Chert

Table 7 (cont.)

6	100/12,4	Matlabes	81	81	32 55 72	0,5 0,5 1,5	22,06	Monte Christo	Dolomite, Chert and Wad
7	7/8,65	Matlabes	54	54	30 35 40	0,5 2,5 4,0	19,37	Monte Christo	Dolomite and Chert
8	7/6,2	Polfontein	50	49	28 41	0,2 0,3	14,98	Monte Christo	Dolomite
9	100/6,0	Polfontein	73	9	25	0,5	30,69+	Monte Christo	Dolomite, Chert and Wad
10	100/4,8	Verdwaal	32	26	23	3	20,4	Monte Christo	Dolomite, Chert and Wad
11	203/1,7	Verdwaal	65	11	22 45	0,1 0,5	15,64	Oaktree	Dolomite
12	205/1,7	Verdwaal	71	6	12	0,1	8,85	Oaktree	Dolomite
13	207/1.2	Verdwaal	99	4	13	0,3	5,30	Oaktree	Dolomite
14	200/5,85	Verdwaal	57	5	12	0,3	2,56	Oaktree	Dolomite
16	203/0,9	Verdwaal	85	14	23	0,3	14,18	Oaktree	Dolomite

*water level at start of step test
+measured on 14-09-90

23m to 55m with an average of approximately 40m. The main water strike in the recently drilled borehole at Itsoseng Reservoir (10-77150B) was at 40m. The main water strike in Borehole 1 in the Verdwaal Compartment was deeper at 72m. A significant water level rise was experienced in all of the boreholes.

The blowing yields of the water strikes varied from 2 to 10 l/s. It is noted, however, that the blowing yields measured from cavernous dolomite are not representative of the water quantity due to loss of air circulation.

OAKTREE FORMATION

Water in the Oaktree Formation boreholes was struck at a shallow depths of between 12 and 23m, with blowing yields of 0,1 to 0,3 l/s. This water bearing horizon is associated with near-surface weathering of the dolomite. Below the surface weathering the dolomite is solid with no evidence of fracturing, chert or cavern development. A minor strike was made in borehole 11 at 45m in an isolated fracture.

A very minor strike of 0,1 l/s was made at 25m in borehole 2 drilled into the Paarl dyke. This confirms that the permeability of the dyke itself is very low.

9. AQUIFER TESTING PROGRAMME

A programme of controlled test pumping was run on the boreholes to:

- determine the hydraulic characteristics of the aquifers,
- assist in the assessment of the influence of the dykes on the overall groundwater regime, and to
- identify areas potentially suitable for the development of future production wellfields.

The test pumping was carried out by Messrs. Honeydew Pumps, the 1990/91 annual contractor appointed by the Bophuthatswana Department of Water Affairs under Tender No. BD 639/89. Two diesel powered testing units were fielded. Power to the pump head was provided via a clutch, gearbox and angle drive. A range of pump elements were available, capable of delivering 0,2 l/s to 20 l/s.

Because blowing yields are not indicative of the pumpable yield in dolomite aquifers a step test was run on all the boreholes, including those with minor water strikes, except boreholes 2 and 9. Existing borehole V1 was included in the testing programme. This enabled an assessment of the aquifer characteristics at each borehole to be obtained.

Normally step tests are run for four hours, with four separate discharges of one hour duration each. The majority of the tests run for this programme were, however, of 3 hours duration when the capacity of the borehole exceeded the capability of the test pump. Two step tests were run on boreholes 4 and 7 when larger pumps were installed. Tests were terminated if the water level was drawn down to pump suction, and tests on the lower yielding boreholes tended to comprise 1 or 2 steps.

During each step the discharge was maintained constant. To minimize recirculation the water was discharged 100 m downslope from the pumping borehole. Measurements of the water level drawdown were made at regular intervals in the piezometer tube attached to the pump column. An electrical dip meter was used for the water level measurements.

Details of the step tests are given in Table 8 and plots of time versus drawdown for each test are given in Appendix C.

Constant discharge tests were run on six boreholes, namely V1,1,3,4,5 and 7. Details of these tests are given in Table 9. Although borehole 10 has a potentially high yield (Table 8) a constant discharge test was not run as it is situated in South

TABLE 8

SUMMARY OF STEP DRAWDOWN TESTS

Borehole number	Borehole depth	Date of Test	Pump setting (m)	Water level (mbgl)	Step	Duration (mins)	Yield (l/s)	Drawdown at end of each step (m)	Remarks
V1	40	05-09-90	37,7	24,16	1	60	8,6	0,27	
					2	60	12,4	0,47	
					3	60	17,9	0,83	
1	49	03-05-90	46,3	18,29	1	60	3,2	0,19	
					2	60	6,2	0,47	
					3	60	15,6	2,89	
3	63	30-08-90	60	16,01	1	60	1,5	0,325	
					2	60	2,3	0,51	
					3	60	7,4	1,73	
4	104	22-09-90	65	22,55	1	60	1,1	0,38	
					2	60	2,7	0,98	1st Test
					3	60	5,9	2,64	
		14-10-90	65	22,55	1	60	13,0	8,93	
					2	60	17,0	23,87	2nd Test
					3	60	19,8	26,65	

Table 8 (cont.)

SUMMARY OF STEP DRAWDOWN TESTS

Borehole number	Borehole depth	Date of Test	Pump setting (m)	Water level (mbgl)	Step	Duration (mins)	Yield (l/s)	Drawdown at end of each step (m)	Remarks
5	104	11-09-90	65	21,76	1	60	1,2	0,145	
					2	60	2,5	0,405	
					3	60	2,8	0,48	
					4	60	6,5	2,06	
6	81	23-09-90	65	22,06	1	12	1,88	42,60	Pump suction
7	54	21-09-90	48	19,37	1	60	6,9	1,025	
					2	60	10,4	1,99	1st Test
					3	60	11,3	2,54	
		12-10-90	48	19,37	1	60	12,8	2,98	
					2	60	18,2	5,21	2nd Test

Table 8 (cont.)

SUMMARY OF STEP DRAWDOWN TESTS

Borehole number	Borehole depth	Date of Test	Pump setting (m)	Water level (mbgl)	Step	Duration (mins)	Yield (1/s)	Drawdown at end of each step (m)	Remarks
8	59	23-09-90	50	14,98	1	60	0,3	9,16	
					2	30	0,51	22,38	Test stopped - water level going to pump suction
10	32	10-09-90	23,7	20,4	1	60	2,25	0,075	
					2	60	3,2	0,15	
					3	60	4,9	0,31	
11	65	20-09-90	59	15,64	1	60	0,19	3,33	
					2	60	0,42	8,93	
					3	60	0,78	20,81	
					4	15	1,7	39,26	Pump suction
12	71	21-09-90	59	8,85	1	60	0,18	2,18	
					2	60	0,39	17,27	
					3	30	0,79	45,90	Pump suction

Table 8 (cont.)

SUMMARY OF STEP DRAWDOWN TESTS

Borehole number	Borehole depth	Date of Test	Pump setting (m)	Water level (mbgl)	Step	Duration (mins)	Yield (1/s)	Drawdown at end of each step (m)	Remarks
13	99	23-09-90	65	5,30	1	90	0,45	15,62	Test stopped - water level going to pump suction
14	57	12-09-90	50	2,56	1	60	0,52	13,44	
					2	15	1,34	33,85	Pump suction
16	85	19-09-90	65	14,18	1	60	0,19	1,98	
					2	60	0,39	16,95	
					3	20	0,70	42,56	Pump suction

Africa. Constant discharge tests were not run on boreholes with a yield of less than 5 l/s.

The pumping rate for the constant discharge test was either selected from the step test data or was the maximum yield of the largest pump available.

At the cessation of the pumping phase the water level recovery was measured for the time specified in Table 9.

During the test on borehole V1, boreholes 2 and 3 were used as observation points. Measurements of the water level in these two boreholes were accordingly made throughout the constant discharge test. Borehole V1 was not, however, used as an observation borehole when the constant discharge test was run on borehole 3, as V1 was being pumped for water supply at the time.

Plots of the drawdown versus time for the pumping phase and residual drawdown for the recovery phase of the 6 tests are given in Appendix D.

One litre water samples for chemical analysis were collected at the end of each test and submitted to the laboratory by the contractor.

9.1 Discussion of Test Pumping Results

i) Hydraulic Data

The data obtained from the test pumping of boreholes 10-77150, 10-77150B, 10-77152, 10-77152B, and 'AB' at Itsoseng Reservoir (the area designated as P6 on Plan 8388/100/1), T17611 (the Pink Pump House at Itsoseng Township) and T17644 at Bodibe close to Polfontein Spring, in 1989 and 1990, are included in this discussion. The positions of these boreholes are shown on Plan 8388/100/1. All these boreholes are drilled into the Polfontein Compartment.

TABLE 9

SUMMARY OF CONSTANT DISCHARGE TESTS

BH No.	Obs. BH	BH depth (m)	Date of test (m)	Depth of pump (m)	Water level (mbgl)	Test duration (mins)	Test yield (l/s)	Maximum drawdown recorded (m)	Drawdown at end of test (m)	Period over which recovery measured (mins)	Residual drawdown at end of recovery period	Remarks
V1	-	40	05-09-90	37,7	24,16	2750	15,8	0,8	0,76	80	0,03	
	2	70	05-09-90	-	23,55	2750	15,8	0,05	0,03	90	0,03	Drilled into Paarl Dyke
	3	63	05-09-90	-	16,01	2750	15,8	0,07	0,00	90	0,00	
1	-	49	03-90-90	46,3	18,29	2880	15,8	6,70	6,70	60	0,07	Barrier Boundary
3	-	63	31-08-90	60	16,01	2940	7,2	2,60	2,60	300	0,55	
4	-	104	14-10-90	62	22,55	1440	12,8	13,30	13,30	300	0,67	Barrier Boundary Slight Dewatering
5	-	104	12-09-90	65	21,76	1550	6,5	2,17	2,14	90	0,095	Slight Dewatering
7	-	54	12-09-90	48	19,37	1440	11,0	3,30	3,28	60	0,17	

Interpretation of the constant discharge test data has been achieved by using either the Jacob, Theis or Recovery analytical methods. The transmissivity of the aquifer has been calculated for each borehole. Observation borehole data are available for 2 boreholes at Itsoseng reservoir and the storativity of the aquifer has been calculated using the data available from these boreholes. The observation data collected from boreholes 2 and 3 during the test on V1 are not suitable for analysis.

The analytical data are given in Table 10. These data also included the borehole specific capacity calculated after 1440 minutes of pumping.

Inspection of Table 10 reveals that the transmissivities of the boreholes drilled at and close to Itsoseng Reservoir, and borehole V1, are high and in excess of $2000m^2/d$. These boreholes are drilled close to the Paarl Dyke and it may be speculated that the zone immediately north of the Paarl Dyke is chert rich (borehole data are sparse) and is fractured as a result of the dyke intrusion. However, although the permeation properties of this zone are well developed, it is noted that 3 dry or almost dry boreholes have been drilled at the Itsoseng Reservoir, one of which is only 10m from the high yielding 10-77152. Thus, although the permeation properties of this area are high, the aquifer itself is anisotropic and pinnacled. This is, of course, typical of fractured, cavernous and karstic dolomite aquifers.

Transmissivities of 1000 - $1750m^2/d$ are recorded for boreholes T17611, T17644 and 7. Borehole T17611 is 2,5 Km east of Polfontein spring, and T17644 is drilled into the leached zone adjacent to the spring, where higher permeabilities may be expected. Borehole 7 is in the Matlabes compartment north of the Stryd dyke and close to the expected position of the Grasfontein dyke as located by the gravity and magnetic surveys. The good permeation properties around borehole 7 are likely to be

TABLE 10

SUMMARY OF HYDRAULIC PARAMETERS

Borehole Number	Analytical Method	Transmissivity (m^2/d)	Storativity	Specific Capacity* (l/s/m)
A) POLFONTEIN EXPLORATION/MONITORING BOREHOLES				
V1	Jacob Recovery	8300 8300	- -	21,9
1	Jacob	500	-	2,4
3	Jacob Recovery	250 280	- -	2,9
4	Jacob Recovery	130 110	-	1,0
5	Jacob Recovery	700 700	-	3,0
7	Jacob	1750	-	3,3
B) ITSOSENG RESERVOIR AREA (P6)				
10-77150+	Jacob Recovery	2800 2800	- -	18,2
10-77152+	Jacob Recovery	3300 3300	- -	16,7
'A'+ (observation in Pump House)	Jacob Theis	7500 9000	$1x10^{-3}$ $6x10^{-3}$	-

10-77150B	Jacob Recovery	2200 2200	- -	21,7
10-77150 (Observation)	Jacob Theis	2650 2200	$7,5x10^{-3}$ $3,6x10^{-4}$	-
´AB´	Jacob Recovery	7000 7000	- -	15,5

C) <u>ITSOSENG AND BODIBE - STANDBY BOREHOLES</u>

T17611 (Pink Pump House)	Jacob	1000	-	2,8
T17644 (IG53)	Jacob	1500	-	8,3

+ Tested in October 1989
* Calculated at 24 hours

associated with fracturing produced by the dyke, together with the abundance of chert.

The remaining boreholes subjected to a constant discharge test, ie. boreholes 1,3,4, and 5 have relatively lower transmissivities of between 100 - 700m²/d. Boreholes 1,4 and 5 are drilled away from dykes and the permeabilities are associated with fractured chert horizons within the Monte Christo Formation.

The poor aquifer properties of the Oaktree Formation are confirmed by the results of the step tests, run on boreholes 11,12,13,14 and 16, (Table 8 and Appendix C). In each case the water level was drawn down to pump suction at low yields.

The anisotropy associated with the Monte Christo Formation, and referred to above in relation to the Itsoseng reservoir, is displayed by the poor results obtained from boreholes 6,8 and 9.

The storativity of the aquifer at Itsoseng Reservoir is calculated from the data of the two observation boreholes as an average of 3×10^{-3} (0,3%). This value conforms to confined conditions, although the aquifer is probably of the water table type. It contrasts with the figure of 2,6% determined from the water balance calculations discussed in section 11.4.1.

Where the dolomite aquifer is highly permeable the drawdown response obtained in the constant discharge tests is similar in all the boreholes, ie, an instantaneous drawdown followed by a gradual to steady decline in the water level. The drawdowns recorded for the step tests on these boreholes also displayed an instantaneous drawdown at the start of each step, followed by a gradual drawdown.

This pattern is in contrast to that obtained from the step tests run on the boreholes with minor water strikes, where, after the initial decline, drawdowns increased with time, and, at the higher rates (albeit <1 l/s) rapid drawdowns were measured. The results for boreholes 6 and 8 are symptomatic of the anisotropy of the Monte Christo aquifer. The results for the Oaktree Formation boreholes are consistent with the generally poorly developed groundwater resources.

Hydraulic barrier boundaries are found in boreholes V1 and 3, probably associated with the nearby Paarl Dyke. Barrier boundaries also occur at borehole 1, and at borehole T17644. Barrier boundaries were not intersected at boreholes 4,5 and 7, nor at the high yielding boreholes at Itsoseng Reservoir. This is again typical of anisotropic fractured, cavernous karstic dolomite aquifers. All the low yielding boreholes, which only had step tests run, exhibited severe barrier boundaries, as is to be expected.

Recovery of the water level after the pumping phase of the testing was generally rapid at first, but was followed by a slow recovery towards the initial static water level. Recovery was complete in boreholes V1,1,7,AB,T17611 and T17644, with recovery trending to completion in borehole 3. Slight dewatering occurred at boreholes 4 and 5, as was noted for the boreholes at Itsoseng Reservoir. The hydraulic barrier boundaries noted at V1, 1 and T17644 do not limit exploitation of the resources at these boreholes to any large extent because of the good recovery.

The high transmissivities recorded means that the boreholes are capable of delivering large yields with relatively small drawdowns. This is reflected in the Specific Capacities given in Table 10. It is, however, noted that although the boreholes may be able to deliver very high yields, the sustainability of the yields in the long term is open to question. One of the main aims of this study is of course to determine the total volume of abstractable resources. Accordingly, conservative management recommendations have been given for the production boreholes at Itsoseng Reservoir, and at T17611 and T17644. (Ref: Report on Groundwater Supplies to Itsoseng, October 1990). These management recommendations can be reviewed once the results of this study are available. It is noted that interpretation of the test data for Itsoseng have indicated that the aquifer will suffer a gradual lowering of the water table at the proposed abstraction rate of 95 l/s.

As an exercise the theoretical drawdown produced at Polfontein Spring by the pumping of the Itsoseng reservoir wellfield has been calculated. The spring is 6 Km west of the reservoir, but the high transmissivity of the Monte Christo aquifer suggests that some drawdown effect may be felt at the Polfontein Spring as a result of this abstraction. It is assumed for the purposes of these calculations that the aquifer is of infinite areal extent, flow is always towards the boreholes and lateral recharge therefore occurs. No account is taken of direct recharge and the results are therefore conservative.

Calculations have been made for various time periods for two scenarios with the wellfield drawing 95 l/s for 24 hours per day. Scenario 1 is with $T = 3000m^2/d$ and $S = 3x10^{-3}$, (the storativity value calculated in the vicinity of the Itsoseng Reservoir wellfield). Scenario 2 is $T = 3000m^2/d$ and S = about 2,5%.

The results of these calculations are given in Table 11. It is emphasized that these calculations are entirely theoretical and could be repeated for other transmissivity and storativity values, but they probably give an indication of the likely extremes.

TABLE 11

THEORETICAL DRAWDOWNS PRODUCED AT POLFONTEIN SPRING BY ABSTRACTION FROM ITSOSENG RESERVOIR WELLFIELD AT 95 l/s

NB: The distance from the wellfield to the spring is 6000m

SCENARIO I $T = 3000 m^2/d$ $S = 3x10^{-3}$

Time (days)	Theoretical Drawdown (m)
1	$2,7x10^{-6}$
10	0,057
100	0,42
1000	0,9
10000	1,4

SCENARIO 2 $T = 3000 m^2/d$ $S = 2,47\%$

Time (days)	Theoretical Drawdown (m)
1	-
10	$1,6x10^{-5}$
100	0,076
1000	0,46
10000	0,94

The evidence gathered to date from the Itsoseng reservoir wellfield does, in fact, indicate that the piezometric level in the Polfontein Compartment aquifer is being lowered. Calculations made after the testing carried out in October 1989 suggested that a water level decline of 1,44m would be experienced after abstraction at 85 l/s for 1 year. The water level in borehole 10-77150 was measured on 19th September 1990 as 27,12m, 1,34m below the 25,78m measured on 11th October 1989. The actual abstraction from the Itsoseng Reservoir wellfield averaged 46,27 l/s over this period, 55% of that anticipated. Thus, 0,55m of the drawdown measured is the result of a general lowering of the piezometric level caused by abstraction from other boreholes within the compartment. Alternatively, this could indicate that the hydraulic parameters calculated from the most recent test pumping data could be optimistic. The transmissivity value is, however, thought to be representative as it is compatible with the high discharges obtained for the small drawdowns measured, hence it is possible that the storativity value should be somewhat lower than $3x10^{-3}$.

This water level decline at the wellfield supports the overall average decline in water levels as determined for the compartment piezometric census and confirms that pumping from the compartment will lead to a decline in the flow from the Polfontein Spring. Estimates of actual future decline are given in Section 11, which also allows for recharge.

ii) Effect of Paarl Dyke

During the test run on V1, boreholes 2 and 3 were used as observation points. No effect on boreholes 2 and 3 was recorded during the test, notwithstanding the proximity of the boreholes and the test yield of 15,8 l/s. This has proved conclusively that the Paarl Dyke, in this vicinity (where weathering appears to be relatively deep), acts as an impermeable barrier to groundwater flow between the Verdwaal Compartment and Polfontein Compartment. The lack of response in the observation boreholes is in marked contrast to the effects noted within the Polfontein Compartment at Itsoseng reservoir. Testing of individual boreholes at the reservoir provoked an immediate drawdown in observation boreholes 70m away similar to that measured in the pumping borehole (Ref: Report on Test Pumping of Boreholes in the vicinity of Itsoseng reservoir, October 1989). Further examples of the sensitivity of the dolomite aquifer is afforded by the extra drawdown produced in borehole 'AB' when a nearby pump was turned on 400 minutes into the test and subsequently switched off 1100 minutes into the test, (the plot of borehole 'AB' is included in Appendix D) and the sudden increase in drawdown in borehole 10-77150B some 50 minutes into the recovery period when borehole 10-77152 was turned on (Appendix D). Thus the result from the test on V1 should be viewed in this light.

iii) Future Development Areas

Borehole 1 in the Verdwaal Compartment and borehole 7 in the Matlabes Compartment appear particularly favourable for future development. Implementation of wellfields using boreholes 1 and 7 as the nuclei would ensure the abstraction load on the aquifer was spread across the three compartments, which should increase the long term reliability of the water supply obtained from the dolomite in this general area.

10. WATER QUALITY

The one litre samples collected at the end of the pumping test carried out on each borehole were analysed by Mclachlan and Lazar Laboratories.

The results from the 14 boreholes tested are given in Table 12, together with the chemical data for 10-771450B, 10-77152B, T17611 and T17644.

The quality of all the groundwater sampled in the Monte Christo Formation is good. The constituents are below the recommended limit set by the WHO and SABS standards although the water is hard. The Nitrate, Fluoride and Iron values are low. There are no constraints on the use of the waters from these boreholes for potable supply, and the overall chemical quality of the water does not therefore impose any limitations to the development of the Monte Christo aquifer.

With the exception of borehole 14, the quality of the Oaktree Formation groundwater is also good and suitable for human consumption. The average TDS is slightly higher than that for the Monte Christo Formation, 469 mg/l (5 samples) as against 387 mg/l (11 samples), but the waters from both formations are basically similar.

The Nitrate value in borehole 14 is 124 mg/l. This is far above the the limit set of 45 mg/l and the water is unsuitable for potable use.

11. RECHARGE AND AQUIFER CHARACTERISTICS

11.1 Introduction

In any groundwater system quantitative estimation of recharge, aquifer storativity, abstraction and lateral in- and outflow is essential to assess the exploitation prospects of the aquifer. Aquifer recharge and storativity are especially difficult to determine reliably and a degree of uncertainty is inherent in all methods used for this purpose. Much progress has, however, been made in obtaining reasonable estimates using a simplistic approach to the quantification of aquifer parameters. These methods have focused on establishing lumped parameter estimates, which, for the purpose of general water balance calculations, are completely acceptable. In the case of a

TABLE 12

CHEMICAL DATA

Bh. No	pH	Conductivity (mS/m 25°C)	TDS	Total Alkalinity (as $CaCO_3$)	Ca	Mg	Na	K	HCO_3	Cl	SO_4	NO_3	F	Total Hardness (as $CaCO_3$)	Fe
V1	7,12	71,4	360	264	60	30	5,0	1,0	322	8,0	2	15,1	0,1	273	<0,01
1	7,19	71,3	400	260	60	30	5,5	1,0	317	10,0	1	9,5	0,1	273	<0,01
3	7,06	70,9	460	270	55	35	6,0	1,3	329	10,0	1	8,0	0,1	281	<0,01
4	7,20	50,9	340	248	55	25	5,2	3,0	302	5,0	1	2,3	0,1	240	<0,01
5	7,34	55,0	440	290	57	35	6,4	1,2	354	7,0	1	10,2	0,3	286	<0,01
6	7,40	37,9	352	172	25	25	7,5	3,0	210	5,0	5	<0,1	0,2	165	<0,01
7	7,19	53,9	372	272	60	30	4,2	1,7	332	6,0	1	5,7	0,1	273	<0,01
8	7,18	54,0	376	272	60	30	7,0	2,8	332	5,0	1	1,5	0,1	273	<0,01
10	7,27	54,8	324	300	60	36	5,9	1,3	366	7,0	1	10,7	0,2	298	<0,01
11	7,11	62,9	424	300	71	35	8,6	5,2	366	12,0	2	16,6	0,2	321	<0,01
12	7,03	66,3	492	300	70	35	9,0	5,0	366	15,0	1	15,0	0,2	319	<0,01

Table 12 (cont.)

CHEMICAL DATA

Bh. No	pH	Conductivity (mS/m 25°C)	TDS	Total Alkalinity (as $CaCO_3$)	Ca	Mg	Na	K	HCO_3	Cl	SO_4	NO_3	F	Total Hardness (as $CaCO_3$)	Fe
13	7,17	67,4	468	300	80	30	13,0	4,5	366	15,0	2	24	0,2	319	<0,01
14	7,15	73,4	512	270	82	38	15,6	1,5	329	28	6	124	0,2	361	<0,01
16	7,09	63,1	448	304	75	30	10,5	4,5	371	10,0	<1	7,2	0,2	310	<0,01
10-77150B	7,11	55,9	400	260	60	32	5,0	2,0	317	5,0	<1	18,9	0,1	282	<0,01
10-77152B	7,50	50,5	428	248	53	34	3,5	1,5	303	6,0	3	16,4	0,4	272	<0,01
T17611	7,22	96,6	416	280	56	37	6,3	1,3	342	10,0	2	15,0	0,1	292	<0,01
T17644 (IG53)	7,18	76,1	368	280	55	35	6,0	1,0	342	12,0	3	6,0	0,1	281	<0,01

* Constituents are expressed in mg/l or otherwise specified.

recharge estimation it is possible to determine the annual variability around a certain average value, based on the annual rainfall.

Estimation of the following water balance components, based on this simplistic approach, has been attempted for the Polfontein Compartment. For the adjacent Matlabes Compartment estimates based on extrapolation are possible.

11.2 Flow of the Polfontein Spring

a). Flow Gaugings

The discharge rate of the Polfontein spring is governed by the piezometric level of the aquifer at any given time, which is in turn determined by recharge and inflow versus groundwater abstraction, lateral outflow and evapotranspiration losses.

Although the flow of the Polfontein spring was gauged between 1978 and 1984 by means of a Parshall flume, these measurements are subjected to some uncertainty owing to occasional submergence of the flow structure, flow bypassing and pumpage from the aquifer, which must have affected the measured outflows slightly.

According to the study of 1983 (Bredenkamp and Janse van Rensburg) the pumpage from the compartment was estimated at a continuous rate of 14 l/s. This has increased significantly in recent years (see Table 1). Partridge, Maud and Associates have estimated the evapotranspiration losses and seepage bypassing the gauging structure at about 5 l/s during the present investigation. The gauged flow values thus need to be adjusted slightly to obtain the real flow.

b) Reconstruction of the Polfontein Flow from Wondergat Levels

Bredenkamp (1990) has found that there is a linear relationship (Figure 5) between the annual average flow of three dolomitic springs in the Upper Molopo area and the groundwater level of the Wondergat sinkhole, in spite of the sinkhole being situated about 50 km from the furthest spring.

Of particular significance is the fact that, for all three cases that have been investigated, the relationship indicates that these springs (Molopo, Buffelshoek and Dinokana) will all stop flowing if the water level of the sinkhole reaches 1410,5m a.m.s.l., which is 3,5m below the zero gauge plate reading of the Wondergat level.

The reason for this rather surprising result has yet to be established, but seems to indicate that these aquifers all conform to a simple hydraulic model (Bredenkamp 1990) - also refer to Section 11.2(c). Using the few flow measurements for Polfontein that are considered reasonably reliable (the 1982 value being excluded) a linear relationship is also apparent (Figure 6), but the regression indicates that zero flow of the spring will occur when the Wondergat level reaches -2,4m. However, if the -3,5m level is accepted as the true intercept for zero flow, the line must be shifted parallel by a flow rate equalling about 10 l/s. The latter value is close to the 5 l/s estimated for evaporation and seepage losses and flow bypassing the flume.

The relationship shown in Figure 6 was used to reconstruct the annual average discharge for Polfontein for the period 1923 to 1990, for which water levels in the Wondergat are available. The time series of the simulated Polfontein flows is depicted in Figure 7 which also shows the annual rainfall for Lusthof 471/490, which is reasonably close to the recharge area. The average flow for Polfontein for the period 1923 to 1990 is thus estimated at 61 l/s.

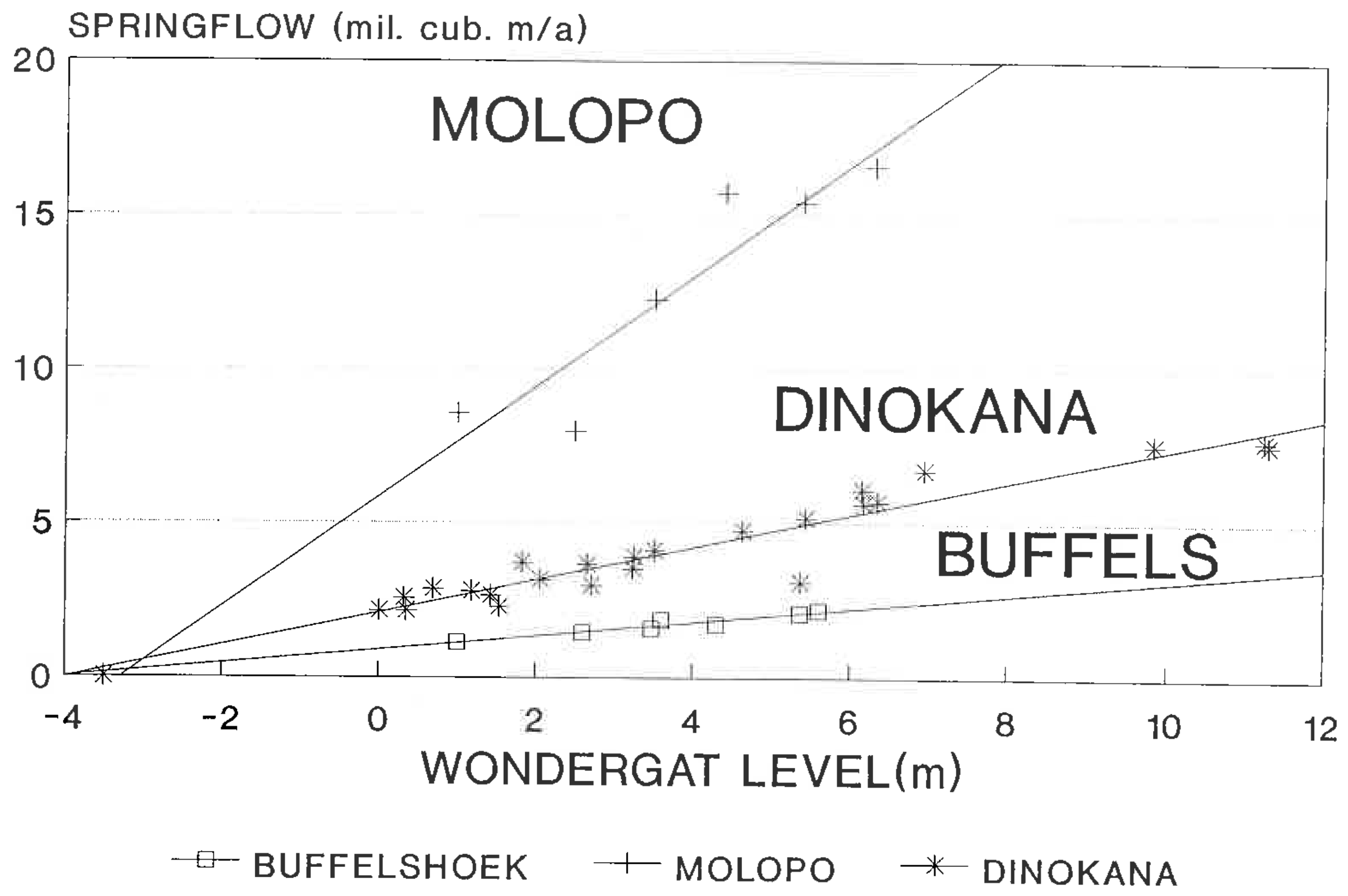


FIGURE 5

Linear relationship between the average annual flow of the three dolomitic springs and the water level of the Wondergat sinkhole. The indication is that the springs would stop flowing if the Wondergat level drops to 3,5m below zero on the gauge plate, i.e. at 1410,5 mamsl.

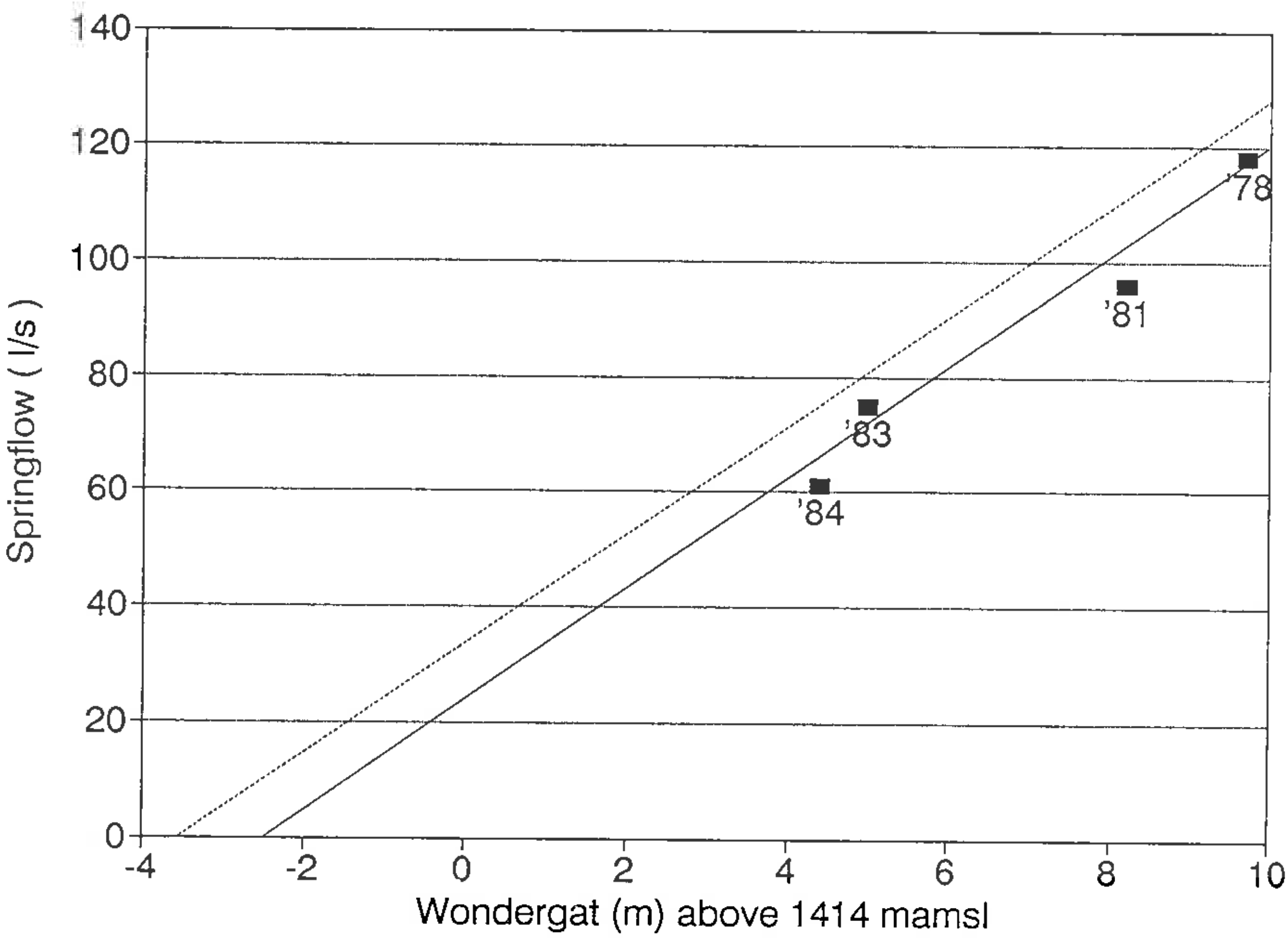


FIGURE 6

Linear relationship between the average annual flow of the Polfontein spring and the water level of the Wondergat sinkhole. The line running through the point -3,5m is assumed to be the true regression (c.f. Fig. 6).

POLFONTEIN FLOW RECONSTRUCTED from WONDERGAT LEVELS

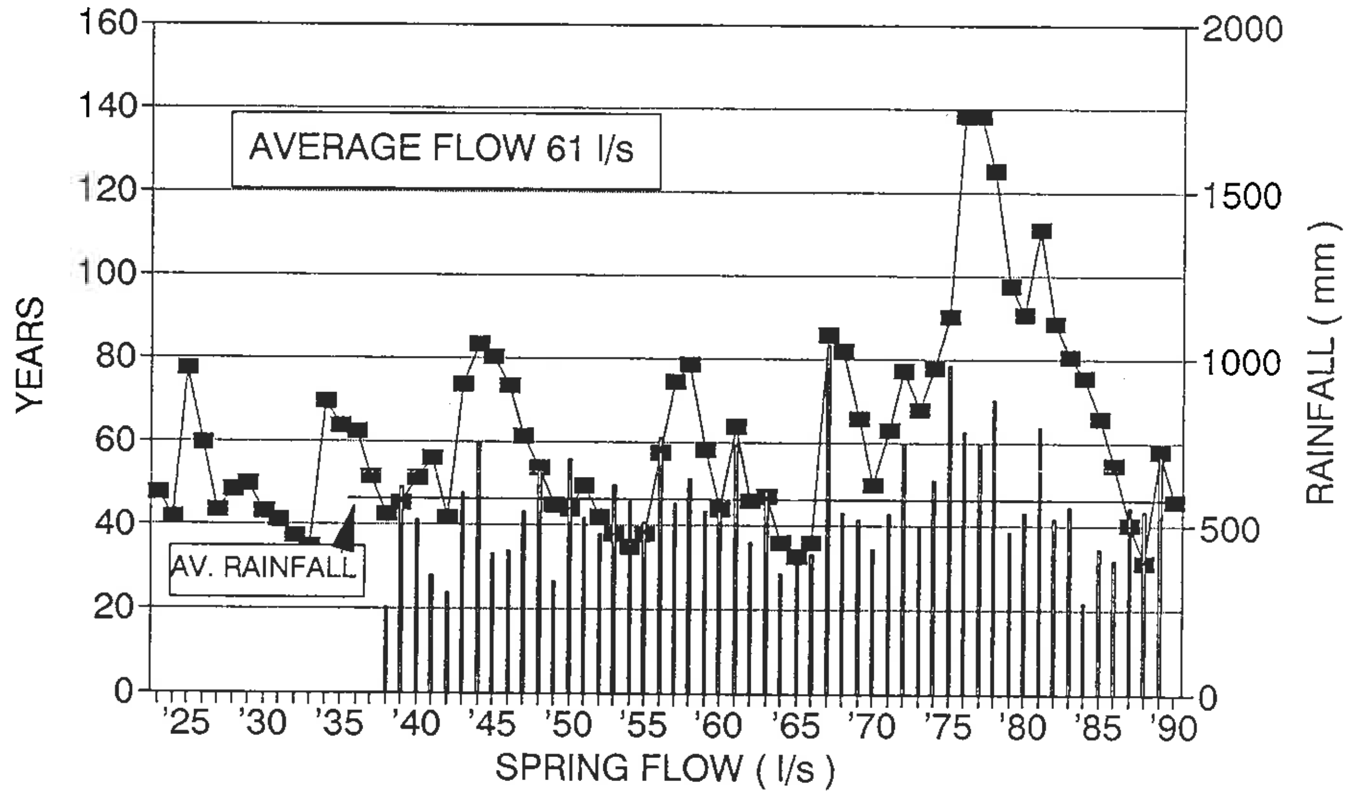


FIGURE 7

Simulated annual flows for the Polfontein spring based on the linear relationship shown in Fig. 6 and the water level record for the Wondergat. The annual rainfall for the station Lusthof is also depicted.

c) Flow of Polfontein in Terms of Average Water Level Above the Spring Outlet

According to Bredenkamp (1990) the flow of the dolomitic springs (Q) conforms to the following simplified relationship in accordance with the D'arcy flow equation:

$$Q = T \times i \times l \qquad (1)$$

where T is the average aquifer transmissivity, i the average gradient towards the spring outlet and where l is the average width of the flow cross-section transmitting the groundwater. Assuming l and T to be constant, the flow Q is determined by the gradient i, which must be proportional to the average height of the water level above the outflow level of the spring.

The average water level above the spring outflow level of 1470,4m was determined for each of the years 1972,1980, 1983 and September 1990, from the piezometric maps. If these values are plotted against the respective flow values for Polfontein, another linear relationship is obtained (Figure 8), which confirms the validity of the basic assumptions implicit to equation (1).

As is evident from Figure 8 the flow of the Polfontein spring will cease when the average groundwater level of the aquifer is the same as the outflow level of the spring (1470,4m a.m.s.l.), which corresponds to a zero gradient i. The actual flow of the spring for September 1990 is uncertain owing to damage to the flume. The flow rate could only be estimated at 15-18 l/s.

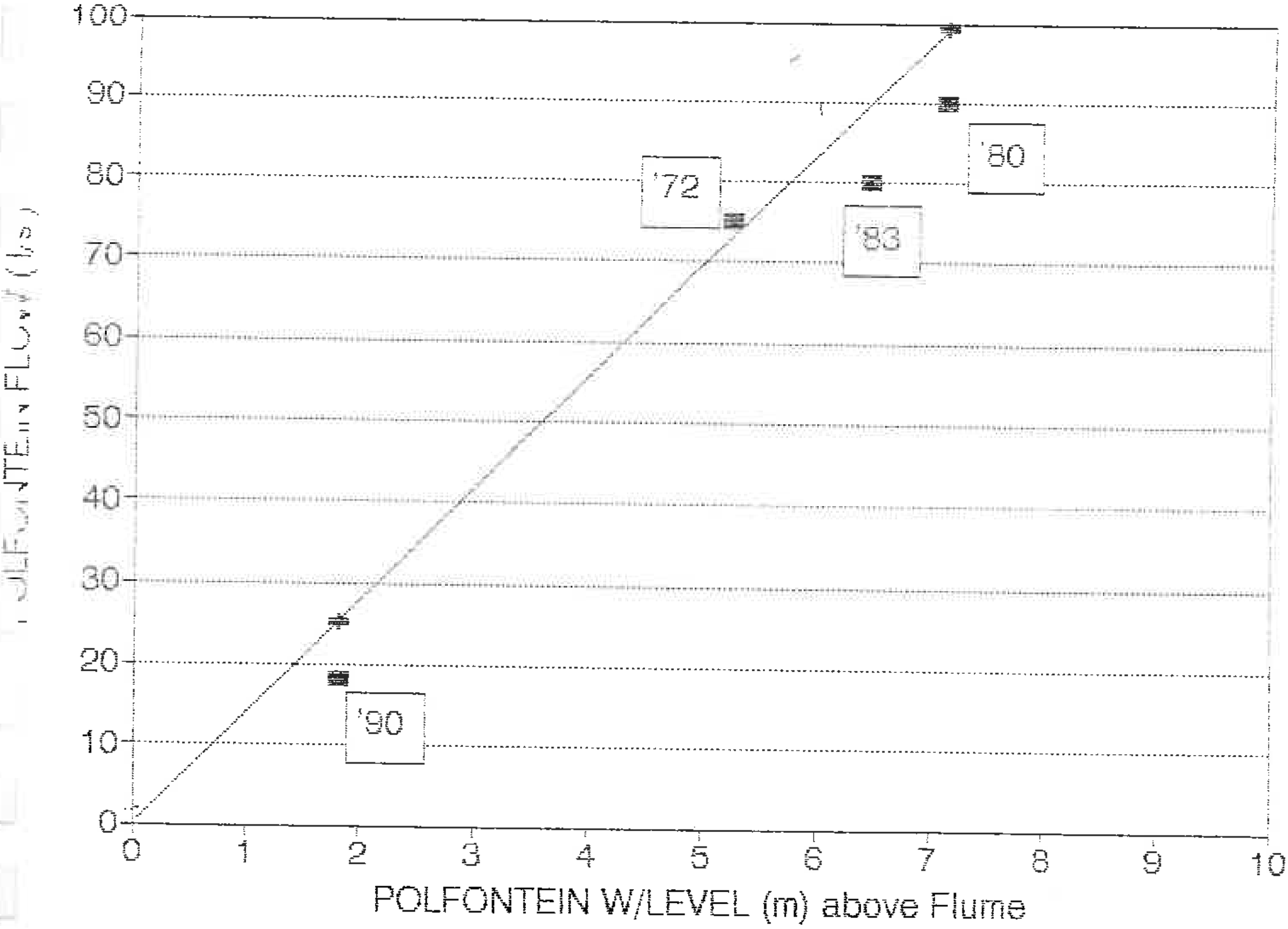


FIGURE 8

Linear relationship between the flow of the Polfontein spring and the average height of the water table in the aquifer above the outflow level of the spring.

11.3 Recharge Estimation

The recharge of the Polfontein Compartment is not easy to determine in view of the fact that both storativity and recharge determine the response of the water level to pumpage, which makes it difficult to obtain a unique solution if both these parameters are unknown.

The problem will, however, be addressed in two ways:

- Assuming the average recharge for Polfontein area to be the same as for the adjacent/surrounding area;
- Using an empirical relationship between the average spring flow and the average recharge rate (determined for the Grootfontein Compartment) as a means of assessing the recharge rate. The Grootfontein Compartment adjoins the Matlabes Compartment, which lies to the north of Polfontein Compartment (Plan 8388/100/2).

11.3.1 Recharge Estimates Based Upon the Interpretation of Tritium Profiles

Bredenkamp et al (1974) derived an independent recharge rate for the Upper Molopo dolomitic area by means of an analysis of the depth to which bomb tritium (present in the rainfall) had penetrated into the soil. This study provided an average recharge ranging between 25mm and 35mm per annum, based on the interpretation of tritium profiles. This is equivalent to 5,3% of the average rainfall of 560mm per annum.

This recharge value is regarded as too low, since the profiles only reflect the infiltration in soil covered areas, which are less conducive to recharge.

11.3.2 Extrapolation of Recharge and Storativity Based on the Grootfontein Simulation.

The Grootfontein aquifer has been monitored and was studied over a period of 30 years to estimate recharge and storativity more reliably. A detailed modelling study (Bredenkamp, Van Rensburg and Van Tonder, 1987) produced an average recharge of 50,4mm per annum and an average storativity of 0,025. On the other hand the Wondergat Compartment indicates a recharge of 50,6mm if the average porosity of the aquifer is 0,022. This represents an average recharge of 9% of the average rainfall of 560mm, which is equivalent to $8,8 \times 10^6 m^3$ per annum for the Grootfontein Compartment.

The average recharge for the Rietpoort aquifer, which supplies Zeerust with water, has been calculated at 14% of the average annual rainfall, and for the Molopo spring catchment it was estimated as 10,3% of the average rainfall of 580mm per annum.

11.3.3 Average Annual Recharge Based on the Flow of the Springs

Flow records of the Grootfontein spring (Bredenkamp and Schutte, 1970) have revealed that the average flow of the spring, under natural conditions, was about $4,4 \times 10^6 m^3$ per annum which was equivalent to about 50% of the recharge of $8,8 \times 10^6 m^3$ per annum which was inferred from the water balance study. If this empirical relationship is assumed also to apply to the Polfontein drainage, the average recharge rate for the Polfontein area is about 122 l/s, which represents an equivalent recharge of $3,8 \times 10^6 m^3$ per annum, equal to 50mm per annum per unit area, i.e. 8,9% of the average rainfall of 560mm per annum. This value includes the seepage losses from the compartment and could be assumed to be a more realistic average recharge for the Polfontein area. This is, incidentally, close to the value of 10% which was used by Bredenkamp and Van Rensburg (1983).

11.3.4 Estimation of Annual Variability of Recharge, Based Upon a Simple Rainfall/Recharge Relationship

The annual recharge for the area can be determined by means of a simple rainfall recharge equation (Bredenkamp, 1990):

$$RE(I) = ARF(1-B/RF(I)) \qquad (2)$$

where RE(I) is the recharge for year I, ARF the average rainfall and RF(I) the rainfall for year I. The value of B is fixed by the average recharge that occurs when average precipitation is experienced.

The best annual average rainfall values for the Polfontein area are derived from the nearest rainfall station Lusthof (471/490), which has an average rainfall of 563mm.

In order to obtain an average recharge of about 50mm per annum the parameters in equation 2 have to be adjusted as follows:

$$RE(I) = 563(1 - 525/RF(I)) \qquad (3)$$

Equation 3 can be used to derive the annual recharge values as listed in column 6 of Table 13; this gives an average of 54mm per annum. It is clear from this table that for several years no recharge has been experienced. On the other hand the recharge in 1975 was about 263mm, which is equivalent to 4,8 times the average recharge.

Bredenkamp (1990) has, however, shown that the effective recharge in any year is determined by the recharge experienced in that specific year and the 3 years preceding it. The ratios of the recharge contributions are 20%, 50%, 20% and 10% from year 1 to 1-3. The effective recharge calculated in this way is shown in column 7 of Table 13.

TABLE 13 RAINFALL DATA AND SIMULATED RECHARGE VALUES

Year	Wondergat Water level (m)	BB41	Simulated flow of Polfontein (l/s)	Annual Rainfall (mm)	Annual recharge (mm)	Recharge with carry over (mm)	Recharge % of rainfall	Weighted rainfall (mm)	Recharge % of weighted rainfall (2,5,2,1)
1	2	3	4	5	6	7	8	9	10
1938	1.06		42.69	252.5	0.0		0.0		
	1.35		45.40	615.0	82.5		13.4		
1940	1.98		51.30	515.6	0.0		0.0		
	2.49		56.08	347.4	0.0	16.5	0.0	475.5	3.5
	0.97		41.84	298.4	0.0	0.00	0.0	398.0	0.0
	4.37		73.68	596.6	67.0	13.53	11.3	389.6	3.5
	5.43		83.61	747.1	167.6	67.34	22.4	542.1	12.4
1945	5.07		80.24	415.7	0.0	97.32	0.0	605.9	16.1
	4.35		73.49	423.9	0.0	33.52	0.0	501.7	6.7
	3.06		61.41	538.5	14.1	2.83	2.6	477.5	0.6
	2.21		53.45	664.7	118.5	30.76	17.8	528.5	5.8
	1.31		45.03	332.4	0.0	62.06	0.0	548.9	11.3
1950	1.19		43.90	694.4	137.5	51.20	19.8	491.9	10.4
	1.77		49.33	522.6	0.0	68.76	0.0	584.7	11.8
	0.99		42.03	475.1	0.0	27.50	0.0	528.4	5.2
	0.56		38.00	616.8	83.9	16.78	13.6	534.9	3.1
	0.22		34.82	569.0	43.6	50.67	7.7	569.5	8.9
1955	0.55		37.91	508.1	0.0	38.57	0.0	557.0	6.9
	2.65		57.57	762.8	175.7	43.86	23.0	582.1	7.5
	4.47		74.62	566.4	41.2	96.11	7.3	653.2	14.7
	4.88		78.46	640.4	101.6	76.06	15.9	614.7	12.4
	2.71		58.14	544.0	19.7	62.97	3.6	618.6	10.2
1960	1.18		43.81	544.1	19.8	34.12	3.6	565.5	6.0
	3.3		63.66	738.1	162.7	46.38	22.0	592.5	7.8
	1.43		46.15	448.9	0.0	85.33	0.0	622.1	13.7
	1.54		47.18	606.7	75.9	47.73	12.5	547.8	8.7
	0.35		36.04	358.3	0.0	37.95	0.0	538.6	7.0
1965	0.01		32.85	386.6	0.0	15.18	0.0	422.7	3.6
	0.32		35.76	415.7	0.0	0.00	0.0	408.8	0.0
	5.68		85.95	1041.4	279.5	55.90	26.8	529.3	10.6
	5.25		81.92	540.6	16.3	143.01	3.0	750.6	19.1
	3.54		65.91	519.3	0.0	64.04	0.0	624.0	10.3

Year 1	Wondergat Water level (m) 2	BB41 3	Simulated flow of Polfontein (1/s) 4	Annual Rainfall (mm) 5	Annual recharge (mm) 6	Recharge with carry over (mm) 7	Recharge % of rainfall 8	Weighted rainfall (mm) 9	Recharge % of weighted rainfall (2,5,2,1) 10
1970	1.83		49.90	430.4	0.0	3.25	0.0	558.0	0.6
	3.23		63.01	536.8	12.4	2.48	2.3	480.5	0.5
	4.75		77.24	749.2	168.7	39.93	22.5	556.3	7.2
	3.73		67.69	502.4	0.0	86.82	0.0	625.5	13.9
	4.82		77.89	635.8	98.2	53.38	15.5	581.9	9.2
1975	6.16	-4.47	90.44	984.0	262.9	101.71	26.7	690.1	14.7
	11.29	-3.69 -2.53	138.48	781.2	184.9	188.09	23.7	825.6	22.8
	11.28	-2.97	138.39	742.8	165.3	178.08	22.3	799.5	22.3
	9.85	-2.75	125.00	880.6	227.6	165.14	25.8	802.2	20.6
	6.94	-3.86	97.75	484.6	0.0	146.87	0.0	763.9	19.2
1980	6.18	-4.57	90.63	541.5	17.2	48.96	3.2	601.0	8.1
	8.37	-4	111.14	795.1	191.5	46.89	24.1	614.8	7.6
	5.97	-4.9	88.66	522.1	0.0	99.18	0.0	658.7	15.1
	5.12	-5.43	80.70	556.0	31.4	44.58	5.7	585.4	7.6
	4.58	-6.42	75.65	272.65	0.0	15.71	0.0	516.5	3.0
1985	3.54	-7.3	65.91	429.8	0.0	6.29	0.0	385.7	1.6
	2.35	-7.91	54.77	398.1	0.0	0.00	0.0	404.7	0.0
	0,83	-8.01	40.53	555.5	31.0	6.19	5.6	423.4	1.5
	-0.13	-8.59 -8.46	31.54	546.6	22.3	19.93	4.1	509.7	3.9
	2.69	-7.12	57.95	722.0	153.8	48.09	21.3	568.6	8.5
1990	1.4	-7.45	45.87						
Average				563.7		54.8			

The relationship between the recharge calculated from equation 3 and the rainfall that had occurred in that year is shown in Figure 9. This shows that recharge occurs only if the annual rainfall exceeds 525mm. The recharge as a percentage of rainfall increases from zero at 525mm to about 12% at 600mm, but gradually levels off at about 27% when the annual rainfall reaches about 1000mm per annum.

If the annual effective recharge (mm) is plotted against the annual effective rainfall (i.e. the weighted rainfall according to recharge carry over), a more-or-less straight line relationship is obtained (Figure 10). In this case the minimum effective annual cut-off rainfall is about 435mm. The maximum effective annual rainfall for this rainfall station is about 840mm, in which case the recharge is about 170mm, 20% of the rainfall. This relationship could be used to obtain different recharge scenarios by stochastic simulations of rainfall sequences.

11.4 Aquifer Storativity

11.4.1 Water Balance

Aquifer storativity can be determined reliably only by applying a water balance calculation over a period for which:

- the abstraction exceeds recharge (method proposed by Bredenkamp et al, 1989);
- the recharge is zero, (which rarely occurs), or if the recharge can be estimated.

In the case of the Polfontein Compartment, the flow of the spring can be inferred from the Wondergat level fluctuations, but the abstraction and

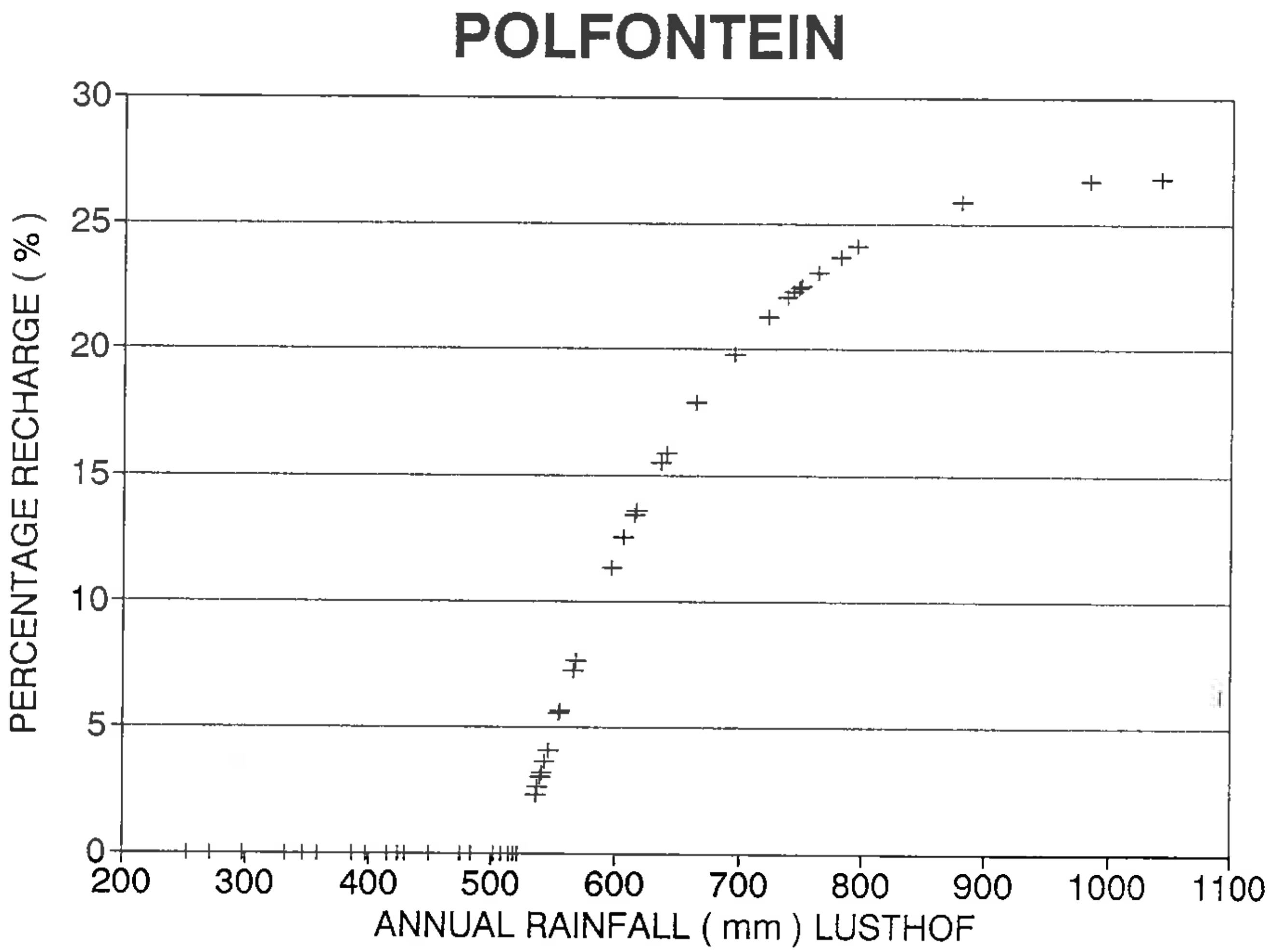


FIGURE 9

Annual recharge estimated from equation 3 expressed as a percentage of the annual rainfall and plotted against annual rainfall.

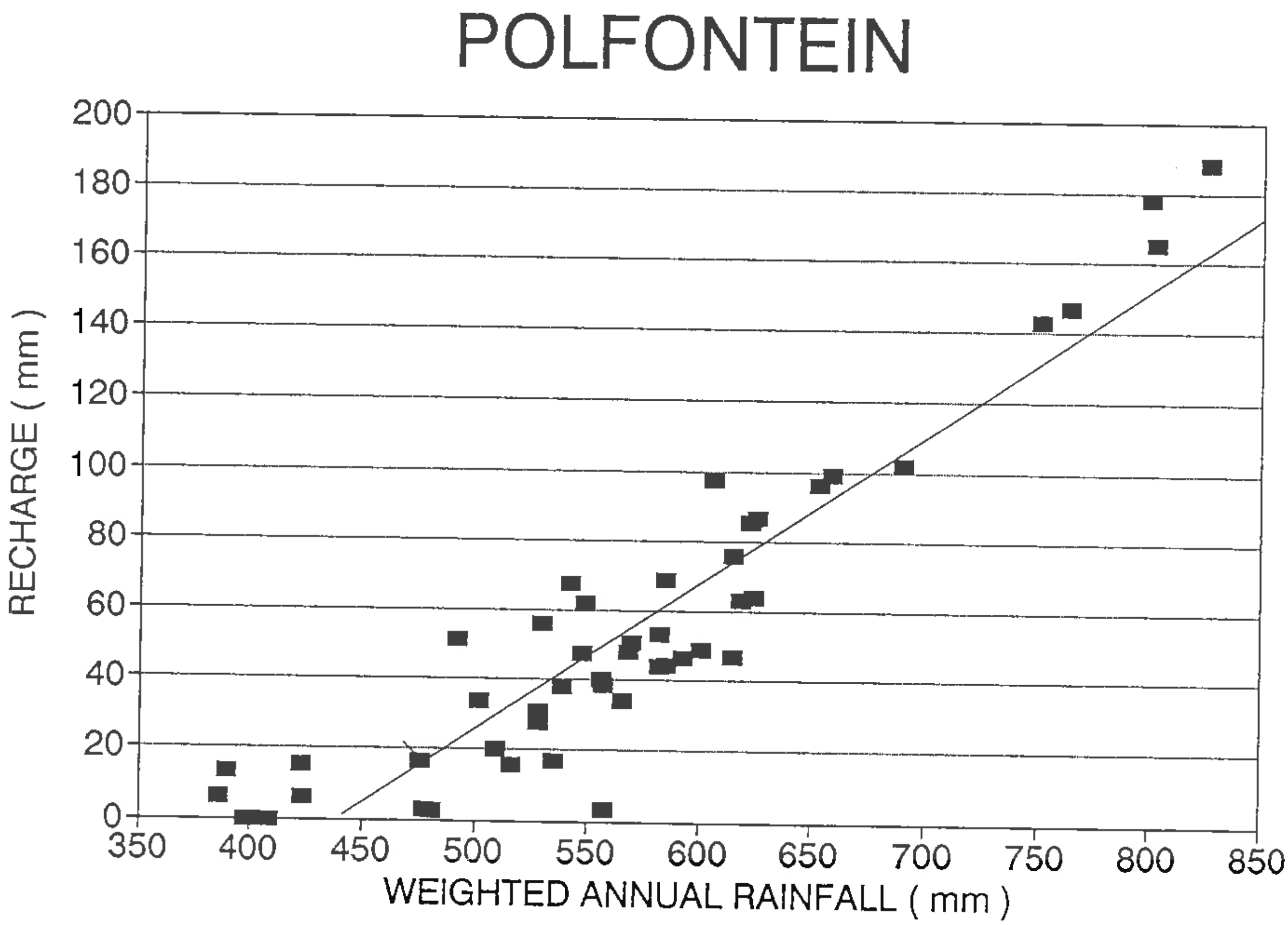


FIGURE 10

Effective annual recharge plotted against effective rainfall. The effective values where obtained by applying a weighting factor in the ratio 20%, 50%, 20% and 10% for years 1 to 1-3.

reaction of the water in the aquifer are not known. The water levels can be reconstructed only from the sparse water level data available.

The best data available cover the period 1983 to April 1990 and a water balance is thus attempted, according to the simplified equation:

Qb = Effective Recharge - total groundwater abstraction

where Qb is the balance between recharge and abstraction. The effective recharge is obtained from Table 13, while the groundwater abstractions are listed in Table 14.

By relating the accumulated values of Qb in Table 14 to the water level change in the Polfontein aquifer, the aquifer storativity S can be estimated as follows:

$$S = \frac{Qb}{\text{Average water level decline x aquifer area}}$$

The average water level change is estimated as 4,8m and the aquifer area (including the Verdwaal Compartment) as 94,6km^2. This yields a storativity of 0,026 (refer Table 14).

11.4.2 Storativity in Relation to that of the Wondergat Compartment

If the average water levels in the Polfontein Compartment for the specific years shown in Figure 7 are plotted against the corresponding water level in the Wondergat, a linear relationship should apply which should pass through the origin (Figure 11). This indicates that the Polfontein piezometric response is similar to that of the Wondergat, in which case the storativity of the Polfontein Compartment should be inversely proportional to the water level state above the respective threshold values for the two systems:

TABLE 14: GROUNDWATER ABSTRACTION FOR THE PERIOD 1983 - APRIL 1990: POLFONTEIN COMPARTMENT.

BOREHOLE NUMBER	ANNUAL ABTRACTION (CUBIC METER) 1983	1984	1985	1986	1987	1988	1989	4/1990
	PUMPING IN BOP.							
P6	101177				1342462	1613801	1534571	647966
T17644	136234	100000	100000	100000	100000	100000	100000	33333
T17611	83260	100000	100000	100000	100000	100000	100000	27753
T17541	9887	12000	12000	12000	12000	12000	12000	4000
SH4	79132	100000	100000	100000	100000	100000	100000	33333
V1			50000	50000	50000	50000	50000	16666
T17006	2500	2500	2500	2500	2500	2500	2500	833
T17559	2500	2500	2500	2500	2500	2500	2500	833
T17004	2500	2500	2500	2500	2500	2500	2500	833
T17541	12000	12000	12000	12000	12000	12000	12000	4000
T17661	2500	2500	2500	2500	2500	2500	2500	833
POLFTN	2549500	2385000	2078000	1727000	1278000	994600	1827000	210000
TOTAL(BOP)	2981190	2719000	2462000	2111000	3004462	2992401	3745571	980383
	PUMPING IN RSA.							
D4N841				148104	627912	560836	564508	77357
D4N842				128155	553720	420361	458993	57330
D4N843				162360	529470	400000	573160	191053
(5)					100000	200000	300000	150000
TOTAL(RSA)	0	0	0	438619	1811102	1581197	1896661	475740
GRAND TOTAL	2981190	2719000	2462000	2549619	4815564	4573598	5642232	1456123
Recharge(mm)	44.6	15.7	63	0	6.2	19.3	48.1	
" (cub m)	4219000	1485000	595000	0	586000	1825000	4550000	
Change in Storage(+/-) (s = 0,026)	1237810	-1234000	-1867000	-2549619	-4229564	-2748598	-1092232	-12483200

D4N841 - Refers to hour meter measuring the total hours pumped from boreholes LS 83 to LS 85 group.

D4N842 - Refers to hour meter measuring abstraction from LS 81 and LS82.

D4N843 - Refers to hour meter measuring abstraction from DP 50 to DP 55 group.

(5) - Refers to pumpage from other boreholes

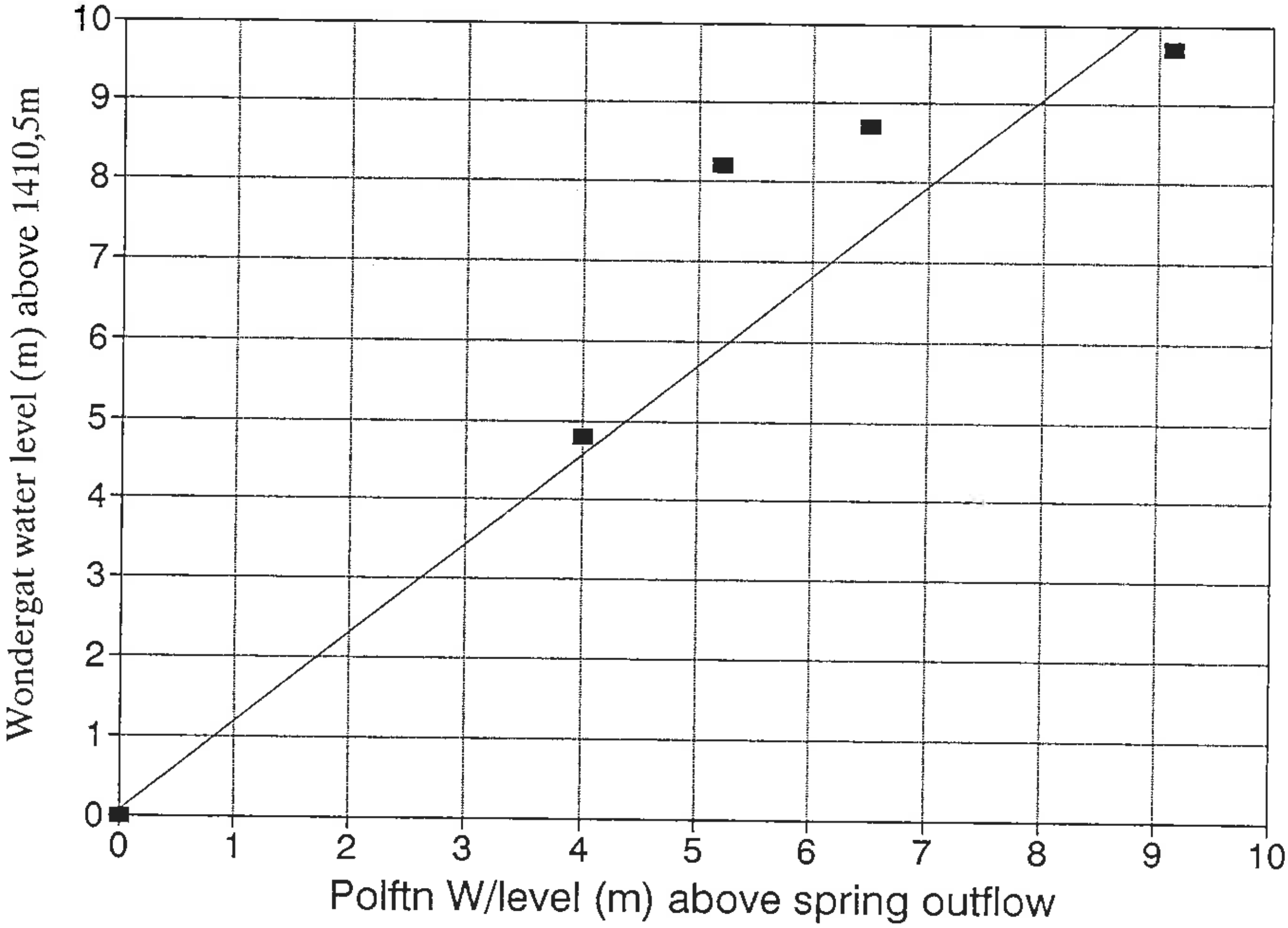


FIGURE 11

Average water level in the Polfontein Compartment plotted for the corresponding years, against Wondergat levels above 1410,5 mamsl.

$$S_p = \frac{S_w \times WL_w}{WL_p}$$

where S is the storativity and WL the water level, and where p refers to the Polfontein and w to the Wondergat Compartments.

The value for S_w, as was stated previously, is 0,022, and according to the regression line in Figure 11 the average ratio is 1,163, which yields a value of 0,0256 for the Polfontein storativity. This is almost identical to the water balance estimate of 0,026.

11.5 Groundwater in Storage

There is very little information on the volume of groundwater stored in a dolomite aquifer. Based on a water balance for the dewatering of Western Areas Gold Mine the indication is that storage extends over an aquifer thickness of 25m below the water table. As the S value is about 0,026 for Polfontein, the volume of water stored per unit area on this basis is 650mm, which is about 11 times the average annual recharge of 54,8mm. However, if the storativity decreases with depth, the water in storage would be less.

11.6 Aquifer Transmissivity and Storativity Estimated from Equation 1

The average aquifer transmissivity can be derived by means of equation 1:

$$Q = T \times i \times l$$

where l is the average width of the aquifer at the point where the average gradient i acts on the system. The value of l is 5000m.

Taking the average daily flow for 1980, equation 1 reduces to:

$$\frac{3{,}78 \times 10^6}{365} = \frac{T \times 9{,}7 \times 5000}{9250}$$

Thus $T = 1975\ m^2/d$.

This value is more or less in agreement with the average T value which has been obtained from the pumping tests (c.f. Table 10), but the pumping tests obviously only represent point values, which could be highly variable due to the heterogeneity of the aquifer.

12. WATER BALANCE AND EXPLOITATION PROSPECTS

The best way to assess groundwater potential is by means of a simulation model which incorporates the hydraulics governing groundwater flow as well as the balance between inflow and outflow components.

A first simulation of the Polfontein system was carried out by Bredenkamp and Janse van Rensburg (1983) using a finite difference model. Although this is not as good as a finite element model (FEM), very useful information was acquired on the behaviour of the system in response to recharge and abstraction.

Owing to a lack of reliable abstraction data for the period 1980 to 1990, a finite element model (FEM) of the Polfontein/Verdwaal compartment will only be compiled later. However, a simplified water balance approach was used to approximate the aquifer's response to recharge and different pumping rates so as to project the effects of utilization of the aquifer over a prolonged period at rates equalling the groundwater abstraction demand by the year 2020.

The simplified simulation of the groundwater level reactions was executed on a spread sheet. The following assumptions and management scenarios were used:

1. The annual recharge will be similar to that induced by the rainfall sequence for 1937 to 1970. Statistical analyses by Tyson et al (1975) and Tyson (1990) suggest that 1990 may represent a position similar to that of 1937 within the pattern of quasi-cyclic variations in rainfall recognized in South Africa over the last century.

2. Abstraction will take place at rates close to the requirements projected for the year 2020. This abstraction comprises:

   (i) The flow of the Polfontein Spring, which is at present very low and is not likely to recover much. If the spring-flow stops, the water demands of any downstream users would have to be met in some way.

   (ii) Abstraction for Itsoseng/Bodibe and Sheila which are estimated, respectively, as $2{,}85 \times 10^6 m^3/a$ and $0{,}5 \times 10^6 m^3/a$.

   (iii) Irrigation demand of farmers in South Africa pumping from the compartment, which is expected to amount to $2{,}25 \times 10^6 m^3$ by the year 2020. This gives a total abstraction of $5{,}6 \times 10^6 m^3/a$.

3. The following combinations of recharge and storativity were used:

   (i) A recharge of 54,8mm/a, with a corresponding storativity of 0,026, which was obtained from the 1983 to 1990 water balance. (Table 15, scenario 2).

   (ii) A higher recharge of 58mm and a storativity of 0,0234, which essentially leaves the water balance unchanged. (Table 16, scenario 4).

The abstraction scenario was also varied slightly in Tables 15 and 16 as follows:

Itsoseng, Bodibe & Sheila - $3{,}0 \times 10^6 m^3/a$

TABLE 15. SIMPLE WATER BALANCE CALCULATIONS FOR POLFONTEIN

Yr	Rainfall (mm)	Estimated Recharge (mm)	Weighted Recharge (mm)	Recharge (mil cub m)	Volume loss/gain (mil cub m)	Abstract. as equiv. w/level(m)	Scenario (1)£	Scenario (2)£
	674.8	112.9						
1	620.7	73.5	71.17	6.7330	1.1330	0.461	2.505	2.261
	634.0	83.8	76.10	7.1995	1.5995	0.650	3.399	2.911
	252.5	0.0	67.91	6.4242	0.8242	0.335	3.978	3.246
	615.0	69.0	37.91	3.5859	-2.0141	-0.819	3.403	2.427
5	515.6	0.0	42.86	4.0544	-1.5456	-0.629	3.019	1.799
	347.4	0.0	13.79	1.3046	-4.2954	-1.746	1.516	0.052
	298.4	0.0	6.90	0.6523	-4.9477	-2.012	-0.252	-1.959
	596.6	53.6	10.73	1.0149	-4.5851	-1.864	-1.872	-3.823
	747.1	156.7	58.17	5.5025	-0.0975	-0.040	-1.668	-3.863
00	415.7	0.0	89.09	8.4283	2.8283	1.150	-0.274	-2.713
	423.9	0.0	36.71	3.4728	-2.1272	-0.865	-0.895	-3.578
	538.5	0.0	15.67	1.4827	-4.1173	-1.674	-2.325	-5.252
	664.7	106.1	21.21	2.0069	-3.5931	-1.461	-3.542	-6.713
	332.4	0.0	53.04	5.0172	-0.5828	-0.237	-3.535	-6.950
5	694.4	125.7	46.36	4.3854	-1.2146	-0.494	-3.784	-7.444
	522.6	0.0	73.47	6.9498	1.3498	0.549	-2.992	-6.895
	475.1	0.0	25.14	2.3786	-3.2214	-1.310	-4.058	-8.205
	616.8	70.4	26.65	2.5212	-3.0788	-1.252	-5.065	-9.456
	569.0	28.8	40.96	3.8751	-1.7249	-0.701	-5.523	-10.158
10	508.1	0.0	28.49	2.6950	-2.9050	-1.181	-6.460	-11.339
	762.8	165.1	45.93	4.3357	-1.2643	-0.514	-6.730	-11.853
	566.4	26.4	90.72	8.5825	2.9825	1.213	-5.273	-10.640
	640.4	88.6	63.93	6.0481	0.4481	0.182	-4.847	-10.458
	544.0	4.2	66.94	6.3323	0.7323	0.298	-4.306	-10.160
5	544.1	4.3	23.29	2.2037	-3.3963	-1.381	-5.442	-11.541
	738.1	151.7	42.18	3.9898	-1.6102	-0.655	-5.853	-12.196
	448.9	0.0	77.14	7.2977	1.6977	0.690	-4.919	-11.505
	606.7	62.2	43.21	4.0874	-1.5126	-0.615	-5.290	-12.120
	358.3	0.0	46.25	4.3757	-1.2243	-0.498	-5.544	-12.618
20	386.6	0.0	12.43	1.1761	-4.4239	-1.799	-7.099	-14.417
	415.7	0.0	6.22	0.5880	-5.0120	-2.038	-8.992	-16.455
	1041.4	272.2	54.44	5.1504	-0.4496	-0.183	-8.831	-16.637
	540.6	0.6	136.24	12.8880	7.2880	2.963	-5.624	-13.674
	519.3	0.0	54.76	5.1801	-0.4199	-0.171	-5.551	-13.945
5	430.4	0.0	27.35	2.5871	-3.0129	-1.225	-6.532	-15.070

In the simulation the aquifer's response is projected from the present 1990 water level using the rainfall record from 1937-1970 to estimate recharge.The pumpage was assumed for two rates of abstraction.

Scenario 1: Pumpage (mil cub m) BOP = 3.0, farmers = 2.0, S = 0.026 recharge = 54.8 mm
Scenario 2: Pumpage (mil cub m) BOP = 3.35, farmers = 2.25, S = 0.026 recharge = 54.8 mm

BLE 16. SIMPLE WATER BALANCE CALCULATIONS FOR POLFONTEIN.

[illegible]r	Rainfall (mm)	Estimated Recharge (mm)	Weighted Recharge (mm)	Recharge (mil cub m)	Volume loss/gain (mil cub m)	Abstract. as equiv. w/level(m)	Scenario (3)£ (m)	Scenario (4)£ (m)
	674.8	117.1						
	620.7	78.1	74.18	7.0175	2.0175	0.911	2.711	2.440
	634.0	88.3	80.12	7.5791	2.5791	1.165	3.876	3.334
	252.5	0.0	71.47	6.7611	1.7611	0.796	4.672	3.859
	615.0	73.5	40.16	3.7995	-1.2005	-0.542	4.130	3.046
	515.6	0.0	45.58	4.3118	-0.6882	-0.311	3.819	2.464
	347.4	0.0	14.70	1.3906	-3.6094	-1.631	2.188	0.562
	298.4	0.0	7.35	0.6953	-4.3047	-1.945	0.244	-1.654
	596.6	58.4	11.68	1.1045	-3.8955	-1.760	-1.516	-3.694
	747.1	160.5	61.29	5.7983	0.7983	0.361	-1.155	-3.395
	415.7	0.0	91.93	8.6969	3.6969	1.670	0.515	-2.196
	423.9	0.0	37.94	3.5892	-1.4108	-0.637	-0.123	-3.104
	538.5	3.7	16.79	1.5880	-3.4120	-1.541	-1.664	-4.917
	664.7	110.3	23.90	2.2612	-2.7388	-1.237	-2.901	-6.425
	332.4	0.0	55.90	5.2879	0.2879	0.130	-2.771	-6.566
	694.4	129.8	48.39	4.5777	-0.4223	-0.191	-2.962	-7.028
	522.6	0.0	75.93	7.1826	2.1826	0.986	-1.976	-6.313
	475.1	0.0	25.96	2.4556	-2.5444	-1.149	-3.126	-7.733
	616.8	75.0	27.98	2.6465	-2.3535	-1.063	-4.189	-9.068
	569.0	33.8	44.25	4.1859	-0.8141	-0.368	-4.556	-9.706
	508.1	0.0	31.89	3.0167	-1.9833	-0.896	-5.452	-10.873
	762.8	168.8	48.03	4.5432	-0.4568	-0.206	-5.659	-11.351
	566.4	31.3	94.07	8.8992	3.8992	1.761	-3.897	-9.860
	640.4	93.1	68.05	6.4378	1.4378	0.650	-3.248	-9.482
	544.0	9.4	71.55	6.7689	1.7689	0.799	-2.449	-8.954
	544.1	9.5	28.31	2.6785	-2.3215	-1.049	-3.497	-10.274
	738.1	155.6	47.02	4.4481	-0.5519	-0.249	-3.747	-10.794
	448.9	0.0	80.62	7.6263	2.6263	1.186	-2.560	-9.879
	606.7	66.8	45.43	4.2972	-0.7028	-0.317	-2.878	-10.467
	358.3	0.0	48.97	4.6323	-0.3677	-0.166	-3.044	-10.904
	386.6	0.0	13.36	1.2642	-3.7358	-1.688	-4.731	-12.863
	415.7	0.0	6.68	0.6321	-4.3679	-1.973	-6.705	-15.107
	1041.4	274.9	54.99	5.2018	0.2018	0.091	-6.614	-15.287
	540.6	5.9	138.64	13.1153	8.1153	3.666	-2.947	-11.892
	519.3	0.0	57.92	5.4788	0.4788	0.216	-2.731	-11.947
	430.4	0.0	28.67	2.7117	-2.2883	-1.034	-3.765	-13.252

The simulated water level response is projected starting from the 1990 water level , assuming the rainfall sequence for 1937 - 1970 to determine the recharge pattern and pumpage according to the following scenarios:

Scenario 3: Pumpage(mil cub m) BOP = 3.0, farmers = 2.0 ; S=0.0234 , recharge = 58 mm
Scenario 4: Pumpage(mil cub m) BOP = 3.35, farmers = 2.25 ; S=0.0234 , recharge = 58 mm

RSA farmers	-	$2,0x10^6m^3$
Total		$5,0x10^6m^3/a$ (scenarios 1 & 3)

The results for the lower average recharge scenario as summarized in Table 15 and plotted in Figure 12; they show that provided the expected rainfall is received, the average water level in the Polfontein/Verdwaal compartments would initially rise as a result of recharge exceeding pumpage, but by about 1993 a decline will start and will continue up to the year 2025 - although small periodic rises would occur.

The pattern for the higher abstraction B ($5,6x10^6m^3/a$) is much the same, but the water level decline is steeper and would reach a minimum level of about 17m below the spring outflow level, compared to about 9 metres drawdown if the total abstraction is $5x10^6m^3/a$ (A).

The situation would improve slightly if the recharge is as little as 10% higher (58mm/a); the drawdowns in water level would then be as follows (Figure 13):

Pumping rates $5,6x10^6m^3/a$ (B) - 15m max.

Pumping rates $5,0x10^6m^3/a$ (A) - 7m max.

This indicates an improvement of about 2m in the water level response.

The lower abstraction rate would obviously represent a more acceptable management scenario, but the outcome of the water balance analysis is critically dependent on the rainfall sequence that is assumed and the actual irrigation usage by farmers in South Africa. Of significance is the fact that the present rate of abstraction more or less equals the assumed recharge sequence.

13. CONCLUSIONS AND RECOMMENDATIONS

The study has estimated the likely response of the Polfontein Spring to future groundwater abstraction from the Polfontein Compartment by means of the clear

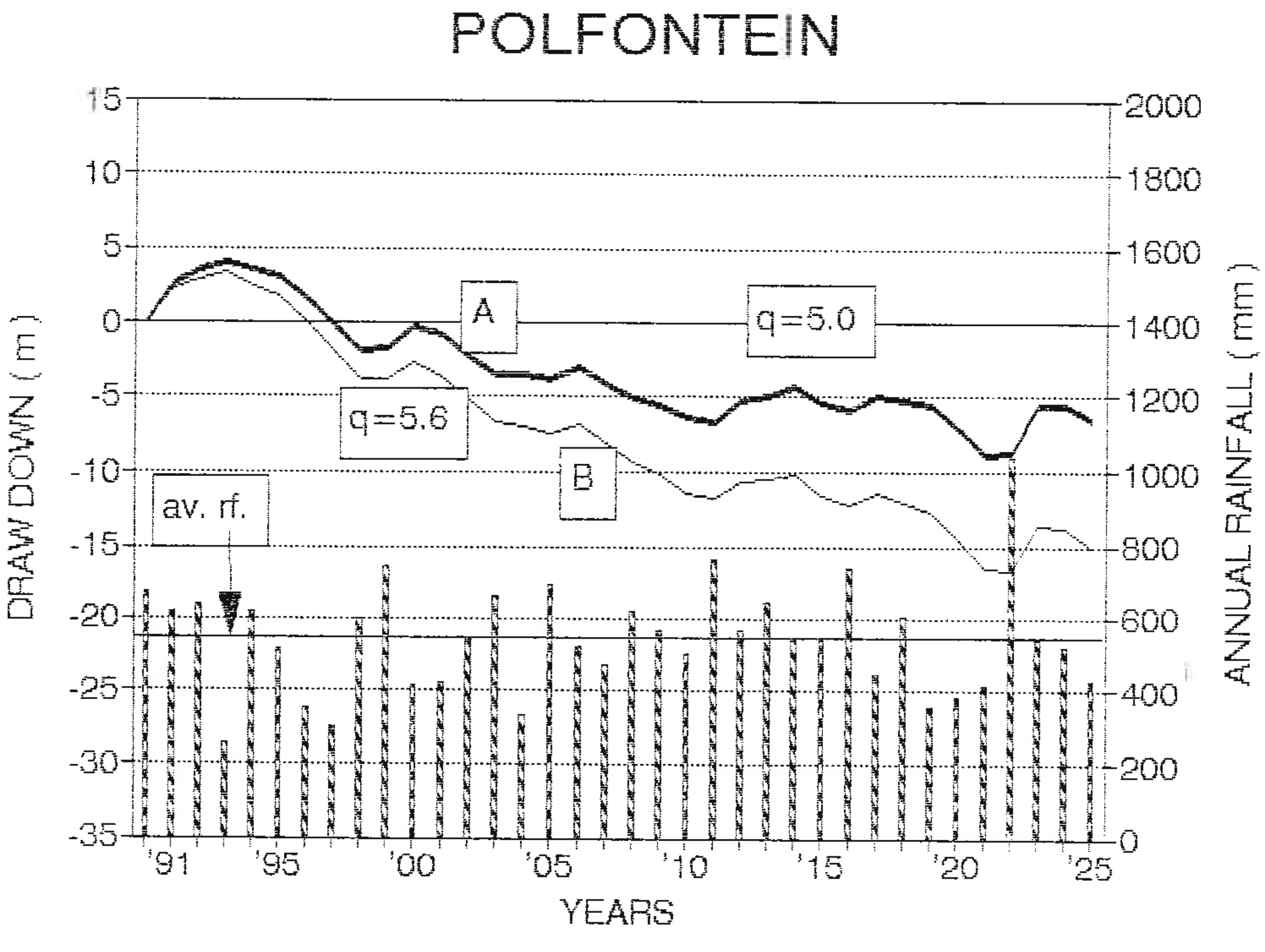


FIGURE 12

(refer Table 15)

POLFONTEIN

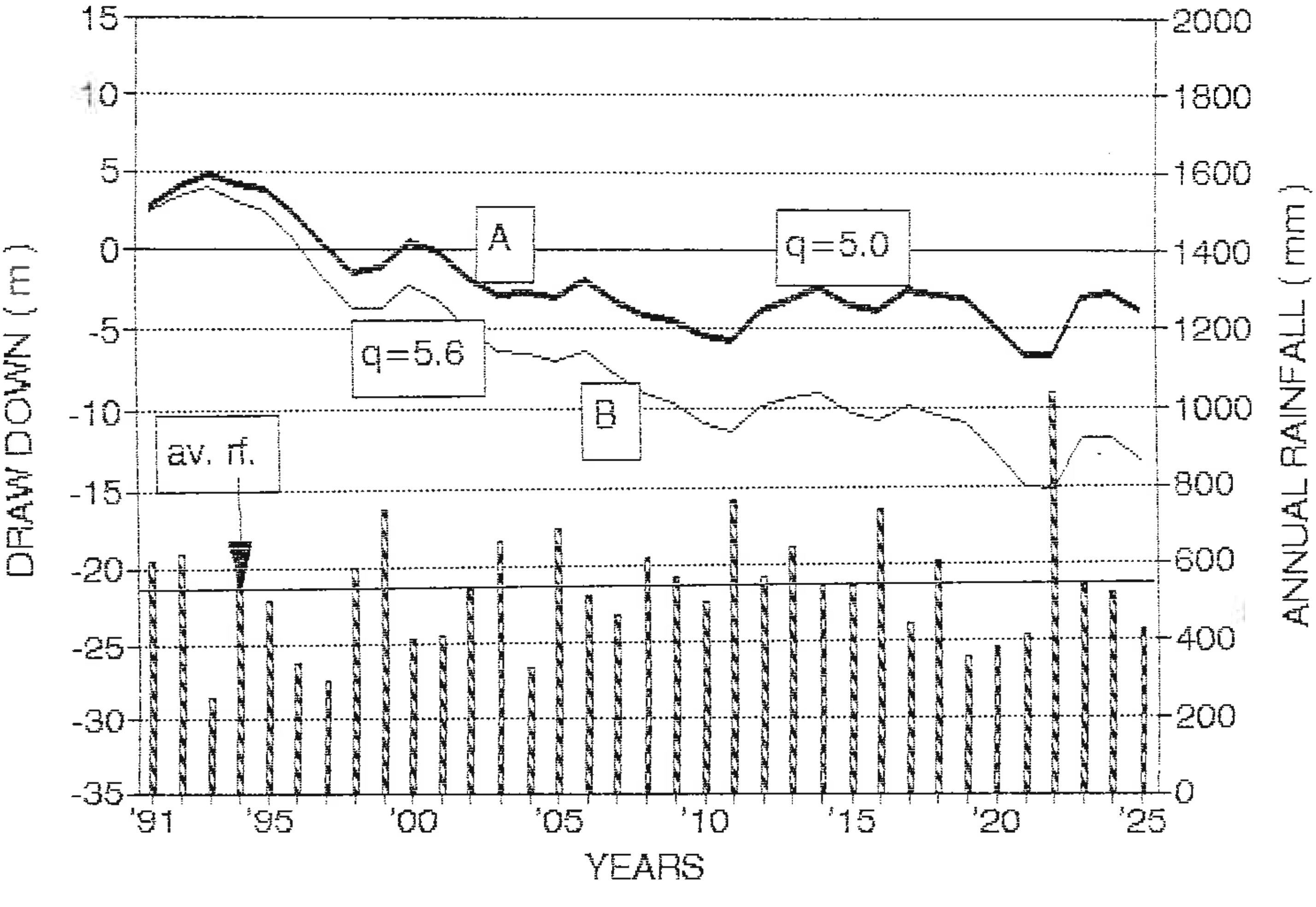


FIGURE 13

(refer Table 16)

relationship established between the flow of the Spring and the Wondergat water level.

Although the abstraction data are not considered to be very reliable and piezometric values are rather scanty, a preliminary water balance analysis has enabled the aquifer storativity to be estimated at 0,026.

The average annual recharge was inferred from quantitative assessments of recharge in nearby compartments, while the annual variability of the recharge was inferred by means of a rainfall recharge equation.

A simple management model was run using a lumped water balance approach; the output suggests that assuming the recharge as about 58mm and storativity as 0,024, the combined Polfontein/Verdwaal compartments can sustain an abstraction rate of $5{,}0 \times 10^6 m^3/a$. In this case the maximum drawdown in the Polfontein aquifer would be about 7 metres, implying that the Polfontein Spring would stop flowing. The Polfontein Spring could, in fact,stop flowing on a permanent basis about 1995, and may do so very much sooner if below average rainfall is experienced. It is not considered that any useful purpose will be served by continuing to monitor the small flow from this spring.

A more pessimistic scenario would be that the long-term average recharge only amounts to 54mm/a and that abstraction would reach $5{,}6 \times 10^6 m^3/a$. In this case the maximum drawdown in the compartment would be about 17 metres below the outflow level of the Polfontein Spring.

For both of the cases discussed above, the aquifer's response up to the year 2000 would not yet be excessive, and even up to 2005 the drawdown would be such that the water demand could probably be met.

The following recommendations are made:

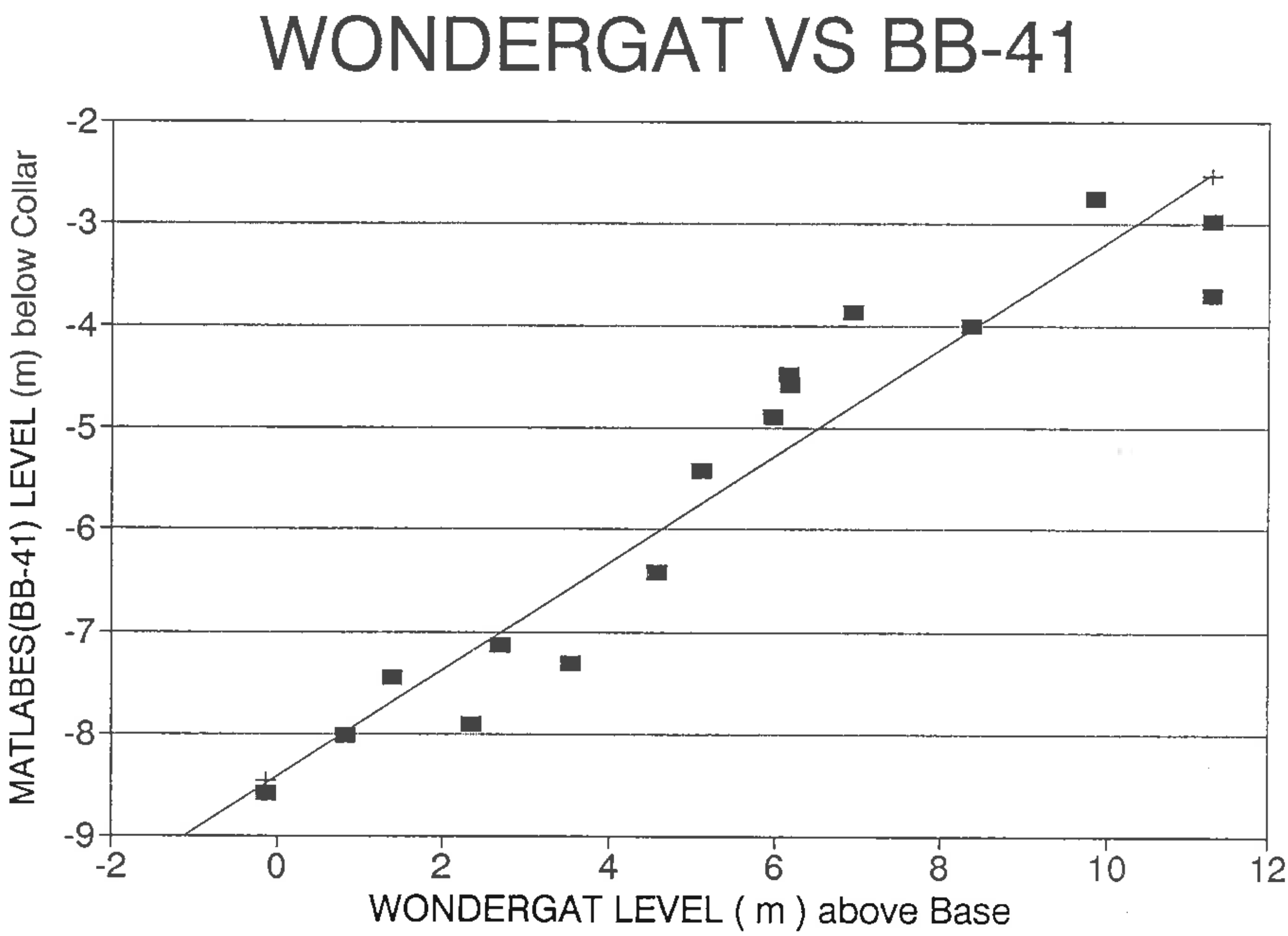


FIGURE 14

Water level in Borehole BB-41 in the Matlabes Compartment plotted, for the corresponding years, against Wondergat levels above 1410,5 mamsl.

TABLE 17

LIST OF BOREHOLES TO BE SUBJECTED TO MONITORING IN THE VICINITY OF THE POLFONTEIN COMPARTMENT

10-77199
10-77201
10-77202
10-77203
10-77204
10-77205
10-77206
10-77207
10-77208
10-77209
10-77210
10-77211
10-77214
VI
P6*
T17611
DH1
D28
P7
BB41
T17541
T17004
KL50
DP13
DP108
HD90

* Measurments to be taken in one of the unequipped boreholes in the Water Tower group.

Stephen Marais – [illegible]

082 809 0408 [illegible]

– could you co-ordinate [illegible]

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1. The abstractions and water level responses should be carefully monitored so as to improve the water balance estimates and the finite element simulation that is to be carried out; the latter can be refined at a later stage. A list of boreholes which should be monitored is given in Table 17.

2. The measurement of local rainfall would help to improve the recharge estimates.

3. Since the water potential of the Matlabes compartment is not yet being utilized, the water requirements for Bodibe should be met from this compartment. The exploitation potential of this compartment is about $1{,}0x10^6 m^3/a$. The gravity survey has indicated where additional drilling could be carried out to site production boreholes. Figure 14 shows that water levels in this compartment also fluctuate in sympathy with the Wondergat levels.

4. A production wellfield should be established in the Verdwaal Compartment in the vicinity of Borehole 1 in order to:

   - spread the pumpage over a larger area;

   - better utilize the potential of the Verdwaal Compartment;

   - limit the depth of the cone of depression in the vicinity of the water tower. Significant drawdown in this vicinity could result in instability of the ground surface; should the reservoir and water tower structures not be appropriately founded on solid bedrock, such instability could jeopardize their safety. It is recommended that 'as-built' drawings showing details of their foundations be obtained as soon as possible to determine the potential susceptibility of these structures to possible future ground movements.

5. If more water reservoirs/towers are to be built, they should be sited in relation to the gravity contours.

6. Periodic updating of the water balance calculations and of the proposed finite element model should be carried out about every 5 years.

14. ADDENDUM (SEPTEMBER 1991)

Following submission of this report in draft form in November 1990 a new survey of abstraction from the Polfontein Compartment by farmers in the RSA was carried out by the RSA Division of Geohydrology. The results of this survey, augmented by figures obtained previously (Table 14) where applicable, are presented in Table 18. The new figures indicate that, during the 1990/91 period, abstraction by farmers in the RSA totalled at least $3{,}04 \times 10^6 m^3/a$. This should be compared with the estimated abstraction of $2{,}25 \times 10^6 m^3/a$ by the year 2020 used in the water balance analysis comprising section 12 of the original report. Hence the total pumping rates assumed in the simulations presented in Tables 15 and 16 and Figures 12 and 13 are likely to underestimate the actual abstraction by at least 14%. This explains the temporary cessation of flow from the Polfontein spring during the latter months of 1990, which is considerably sooner than was predicted by the model. This underestimation is likely to have significant implications for the long-term exploitation of the groundwater resources of the area, and it is therefore important that a re-analysis is undertaken in the near future, utilizing the borehole monitoring data which is now being assembled for the area on a regular basis by the Bophuthatswana Department of Water Affairs. Such a re-analysis is planned for mid 1992.

15. ACKNOWLEDGEMENTS

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Mr. K.U. Pelpola

Mr. S.J. Marais

Division of Geohydrology, Department of Water Affairs Pretoria

TABLE 18

GROUNDWATER ABSTRACTION IN THE RSA 1990/91:

POLFONTEIN COMPARTMENT

Borehole Numbers		Abstraction (m^3/yr) Based on Electricity consumption
KL 02		2808
KL 80-84		543463
LS 03 (LS 52)		?*
LS 07/81		427047
LS 82, 83, 85		547544
DP 21		327319
DP 50-55		573160
DP 100		12800
DP 101/102		64800
DP 105, 107, 108		523364
HD 89/90		12600
HD 10/100		6480
	Total	3041485

* equipped with large pump, but no figures available.

Note: This table has been compiled from figures supplied by the RSA Division of Geohydrology and supersedes Table 14.

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APPENDIX A

DATA LISTING OF POLFONTEIN GRAVITY SURVEY

DATA LISTING OF POLFONTEIN GRAVITY SURVEY (1990)

CONSTANTS USED FOR RELATIVE GRAVITY CALCULATIONS:

REFERENCE LATTITUDE (DEC.DEG):	26.05249
REFERENCE X-COORDINATE (m):	82800
LATTITUDE CORR./M:	0.00064
COMBINED BOUGUER CORRECTION FACTOR:	0.196854
REFERENCE ELEVATION:	1400.000

NOTE: To obtain correct absolute elevations add 4.2m to listed data. Elevations are relative to trigonometric beacon no.2 on farm Matlabeslokasie.

X Coordinate = -Y (data listing)
Y Coordinate = -X (data listing)
Lo System = 27 degrees East

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
1	0.1	-79490	-116980	20.74	1440.785	20.82	-0.08
1	0.2	-79583	-117017	20.75	1441.116	20.84	-0.08
1	0.3	-79675	-117055	20.79	1440.324	20.85	-0.06
1	0.4	-79768	-117092	20.84	1439.691	20.87	-0.03
1	0.5	-79861	-117129	20.87	1439.082	20.88	-0.01
1	0.6	-79954	-117166	20.95	1438.919	20.90	0.05
1	0.7	-80046	-117204	21.00	1439.038	20.91	0.09
1	0.8	-80139	-117241	21.09	1438.889	20.93	0.17
1	0.9	-80232	-117278	21.14	1439.662	20.94	0.20
1	1	-80325	-117315	21.18	1440.390	20.96	0.22
1	1.1	-80417	-117353	21.20	1441.437	20.97	0.23
1	1.2	-80510	-117390	21.24	1441.360	20.98	0.26
2	0.1	-79793	-115808	20.13	1451.450	20.18	-0.05
2	0.2	-79886	-115846	20.17	1451.113	20.16	0.01
2	0.3	-79979	-115884	20.21	1450.160	20.14	0.07
2	0.4	-80072	-115922	20.15	1450.480	20.13	0.02
2	0.5	-80165	-115960	20.14	1451.221	20.11	0.03
2	0.6	-80258	-115998	20.08	1451.412	20.09	-0.02
2	0.7	-80351	-116036	20.04	1450.923	20.07	-0.04
2	0.8	-80444	-116074	19.97	1450.787	20.06	-0.09
2	0.9	-80537	-116112	19.99	1450.521	20.04	-0.05
2	1	-80630	-116150	20.00	1450.808	20.02	-0.02
3	0.1	-80034	-114933	20.43	1458.470	20.50	-0.07
3	0.2	-80138	-114966	20.36	1458.897	20.45	-0.09
3	0.3	-80242	-114998	20.38	1459.515	20.40	-0.02
3	0.4	-80346	-115031	20.41	1459.892	20.35	0.06
3	0.5	-80451	-115064	20.44	1459.809	20.30	0.14
3	0.6	-80555	-115097	20.29	1459.419	20.25	0.04
3	0.7	-80659	-115130	20.23	1458.814	20.20	0.03
3	0.8	-80763	-115162	20.15	1459.076	20.15	0.00
3	0.9	-80867	-115195	20.06	1459.328	20.10	-0.04
3	1	-80971	-115228	19.95	1459.633	20.05	-0.10
3	1.1	-81075	-115261	19.91	1459.677	20.00	-0.09
5	0.1	-80440	-113400	21.24	1466.103	21.38	-0.14
5	0.2	-80536	-113424	21.27	1466.324	21.35	-0.08
5	0.3	-80631	-113449	21.28	1466.504	21.32	-0.04

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
5	0.4	-80727	-113473	21.18	1466.649	21.28	-0.11
5	0.5	-80822	-113498	21.13	1466.895	21.25	-0.12
5	0.6	-80918	-113522	21.14	1467.298	21.22	-0.08
5	0.7	-81013	-113547	21.11	1467.546	21.19	-0.08
5	0.8	-81109	-113571	21.07	1467.826	21.16	-0.08
5	0.9	-81204	-113596	21.00	1468.114	21.13	-0.13
5	1	-81300	-113620	20.95	1468.287	21.09	-0.15
5	1.1	-81396	-113644	20.93	1468.303	21.06	-0.13
5	1.2	-81491	-113669	20.85	1468.638	21.03	-0.18
5	1.3	-81587	-113693	20.79	1468.797	21.00	-0.21
5	1.4	-81682	-113718	20.72	1469.043	20.97	-0.25
5	1.5	-81778	-113742	20.73	1468.802	20.95	-0.22
5	1.6	-81873	-113767	20.70	1468.883	20.92	-0.22
5	1.7	-81969	-113791	20.65	1468.861	20.89	-0.24
5	1.8	-82064	-113816	20.63	1468.851	20.87	-0.24
5	1.9	-82160	-113840	20.56	1468.961	20.84	-0.28
5	2	-82256	-113864	20.53	1468.926	20.81	-0.28
5	2.1	-82351	-113889	20.47	1468.883	20.78	-0.31
5	2.2	-82447	-113913	20.41	1468.602	20.75	-0.35
5	2.3	-82542	-113938	20.36	1468.497	20.73	-0.37
5	2.4	-82638	-113962	20.19	1468.286	20.70	-0.51
5	2.5	-82733	-113987	20.17	1468.241	20.67	-0.50
5	2.6	-82829	-114011	20.13	1468.009	20.64	-0.52
5	2.7	-82924	-114036	20.07	1468.002	20.61	-0.54
5	2.8	-83020	-114060	20.04	1468.071	20.59	-0.55
6	0.1	-83998	-113448	20.00	1474.293	20.47	-0.47
6	0.2	-83906	-113405	20.07	1474.383	20.48	-0.41
6	0.3	-83814	-113363	20.08	1474.773	20.49	-0.40
6	0.4	-83722	-113320	20.08	1475.122	20.49	-0.41
6	0.5	-83630	-113278	20.12	1474.995	20.50	-0.38
6	0.6	-83539	-113235	20.14	1475.090	20.51	-0.37
6	0.7	-83447	-113193	20.17	1474.488	20.52	-0.35
6	0.8	-83355	-113150	19.96	1474.408	20.53	-0.57
6	0.9	-83263	-113108	20.06	1474.479	20.53	-0.47
6	1	-83171	-113065	20.17	1474.594	20.54	-0.37
6	1.1	-83079	-113023	20.22	1474.830	20.55	-0.34
6	1.2	-82987	-112980	20.23	1475.503	20.56	-0.33
6	1.3	-82895	-112938	20.22	1476.079	20.57	-0.35
6	1.4	-82803	-112895	20.21	1476.661	20.58	-0.37
6	1.5	-82711	-112853	20.16	1477.559	20.58	-0.42
6	1.6	-82619	-112810	20.14	1478.254	20.59	-0.45
6	1.7	-82528	-112768	20.16	1478.721	20.60	-0.44
6	1.8	-82436	-112726	20.20	1478.785	20.63	-0.43
6	1.9	-82344	-112683	20.19	1478.803	20.66	-0.47
6	2	-82252	-112641	20.19	1478.753	20.69	-0.50
6	2.1	-82160	-112598	20.17	1478.683	20.72	-0.55
6	2.2	-82068	-112556	20.16	1478.552	20.75	-0.59
6	2.3	-81976	-112513	20.20	1478.269	20.78	-0.58
6	2.4	-81884	-112471	20.26	1477.933	20.81	-0.55
6	2.5	-81792	-112428	20.32	1477.630	20.84	-0.52
6	2.6	-81700	-112386	20.32	1477.219	20.87	-0.55
6	2.7	-81608	-112343	20.30	1476.732	20.90	-0.60
6	2.8	-81517	-112301	20.35	1476.061	20.93	-0.58
6	2.9	-81425	-112258	20.41	1475.676	20.96	-0.55
6	3	-81333	-112216	20.48	1475.378	20.99	-0.51
6	3.1	-81241	-112173	20.63	1475.240	21.02	-0.39
6	3.2	-81149	-112131	20.68	1475.262	21.05	-0.37

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
6	3.3	-81057	-112088	20.72	1475.581	21.08	-0.36
6	3.4	-80965	-112046	20.76	1475.922	21.11	-0.35
6	3.5	-80873	-112003	20.82	1476.541	21.14	-0.32
6	3.6	-80781	-111961	20.86	1477.360	21.17	-0.31
6	3.7	-80689	-111919	20.93	1477.867	21.20	-0.27
6	3.8	-80597	-111876	21.01	1478.158	21.23	-0.22
6	3.9	-80506	-111834	21.02	1478.548	21.26	-0.24
6	4	-80414	-111791	21.02	1478.924	21.29	-0.27
6	4.1	-80322	-111749	21.11	1478.980	21.32	-0.21
6	4.2	-80230	-111706	21.14	1479.021	21.35	-0.21
6	4.3	-80138	-111664	21.18	1478.889	21.38	-0.20
6	4.4	-80046	-111621	21.15	1478.785	21.41	-0.26
7	0	-88380	-114050	20.03	1461.513	20.04	-0.01
7	0.1	-88292	-114009	20.11	1461.228	20.04	0.07
7	0.2	-88203	-113968	20.04	1461.586	20.04	0.00
7	0.3	-88115	-113927	20.10	1462.001	20.04	0.06
7	0.4	-88027	-113886	20.05	1462.700	20.03	0.01
7	0.5	-87938	-113845	20.00	1463.189	20.03	-0.03
7	0.6	-87850	-113804	20.06	1463.519	20.03	0.03
7	0.7	-87762	-113763	20.17	1463.987	20.03	0.14
7	0.8	-87673	-113722	20.23	1464.342	20.03	0.20
7	0.9	-87585	-113681	20.15	1464.868	20.03	0.12
7	1	-87497	-113640	20.14	1465.179	20.03	0.11
7	1.1	-87408	-113599	20.12	1465.802	20.03	0.09
7	1.2	-87320	-113558	19.92	1466.353	20.02	-0.11
7	1.3	-87232	-113516	20.08	1466.597	20.02	0.05
7	1.4	-87143	-113475	20.12	1467.080	20.02	0.09
7	1.5	-87055	-113434	20.13	1467.942	20.02	0.11
7	1.6	-86967	-113393	20.10	1468.664	20.02	0.08
7	1.7	-86878	-113352	20.01	1469.639	20.02	-0.01
7	1.8	-86790	-113311	20.06	1470.250	20.02	0.04
7	1.9	-86702	-113270	19.96	1470.957	20.02	-0.06
7	2	-86614	-113229	19.89	1471.482	20.01	-0.13
7	2.1	-86525	-113188	19.83	1471.952	20.01	-0.18
7	2.2	-86437	-113147	19.78	1472.552	20.01	-0.23
7	2.3	-86349	-113106	19.71	1473.208	20.01	-0.30
7	2.4	-86260	-113065	19.65	1473.650	20.01	-0.35
7	2.5	-86172	-113024	19.61	1474.055	20.01	-0.40
7	2.6	-86084	-112983	19.51	1474.636	20.01	-0.50
7	2.7	-85995	-112942	19.45	1475.161	20.00	-0.56
7	2.8	-85907	-112901	19.42	1475.389	20.00	-0.59
7	2.9	-85819	-112860	19.37	1475.816	20.00	-0.63
7	3	-85730	-112819	19.34	1475.985	20.00	-0.66
7	3.1	-85642	-112778	19.39	1476.305	20.00	-0.61
7	3.2	-85554	-112737	19.26	1476.529	19.99	-0.74
7	3.3	-85465	-112696	19.32	1476.878	19.99	-0.67
7	3.4	-85377	-112655	19.35	1477.037	19.99	-0.63
7	3.5	-85289	-112614	19.29	1477.302	19.98	-0.69
7	3.6	-85200	-112573	19.34	1477.289	19.98	-0.63
7	3.7	-85112	-112532	19.36	1477.311	19.97	-0.61
7	3.8	-85024	-112490	19.38	1477.380	19.97	-0.59
7	3.9	-84935	-112449	19.30	1477.607	19.97	-0.67
7	4	-84847	-112408	19.30	1477.882	19.96	-0.67
7	4.1	-84759	-112367	19.27	1478.052	19.96	-0.69
7	4.2	-84670	-112326	19.35	1478.081	19.96	-0.61
7	4.3	-84582	-112285	19.38	1478.303	19.95	-0.57
7	4.4	-84494	-112244	19.42	1478.644	19.95	-0.53

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
7	4.5	-84405	-112203	19.46	1478.891	19.95	-0.49
7	4.6	-84317	-112162	19.35	1479.243	19.96	-0.61
7	4.7	-84229	-112121	19.29	1479.731	19.96	-0.67
7	4.8	-84140	-112080	19.12	1480.592	19.96	-0.84
7	4.9	-84052	-112039	19.31	1480.987	19.97	-0.66
7	5	-83964	-111998	19.50	1480.868	19.97	-0.47
7	5.1	-83875	-111957	19.56	1480.848	19.97	-0.41
7	5.2	-83787	-111916	19.55	1481.319	19.97	-0.43
7	5.3	-83699	-111875	19.57	1481.437	19.98	-0.41
7	5.4	-83611	-111834	19.42	1481.925	19.98	-0.56
7	5.5	-83522	-111793	19.55	1482.253	19.98	-0.43
7	5.6	-83434	-111752	19.64	1482.665	19.99	-0.35
7	5.7	-83346	-111711	19.62	1482.964	19.99	-0.37
7	5.8	-83257	-111670	19.58	1483.299	19.99	-0.41
7	5.9	-83169	-111629	19.58	1482.874	20.00	-0.42
7	6	-83081	-111588	19.54	1482.604	20.00	-0.46
7	6.1	-82992	-111547	19.36	1482.897	20.03	-0.67
7	6.2	-82904	-111506	19.22	1483.137	20.06	-0.83
7	6.3	-82816	-111464	19.32	1483.230	20.09	-0.76
7	6.4	-82727	-111423	19.45	1483.254	20.12	-0.67
7	6.5	-82639	-111382	19.47	1483.128	20.15	-0.68
7	6.6	-82551	-111341	19.44	1483.105	20.18	-0.74
7	6.7	-82462	-111300	19.52	1482.871	20.21	-0.69
7	6.8	-82374	-111259	19.55	1483.092	20.23	-0.68
7	6.9	-82286	-111218	19.63	1482.704	20.26	-0.63
7	7	-82197	-111177	19.63	1482.527	20.29	-0.66
7	7.1	-82109	-111136	19.66	1482.114	20.32	-0.66
7	7.2	-82021	-111095	19.61	1481.919	20.35	-0.74
7	7.3	-81932	-111054	19.56	1481.474	20.38	-0.82
7	7.4	-81844	-111013	19.58	1481.148	20.41	-0.83
7	7.5	-81756	-110972	19.69	1480.935	20.45	-0.76
7	7.6	-81667	-110931	19.72	1481.049	20.49	-0.78
7	7.7	-81579	-110890	19.80	1480.750	20.53	-0.73
7	7.8	-81491	-110849	19.85	1480.581	20.58	-0.73
7	7.9	-81402	-110808	19.89	1480.717	20.62	-0.73
7	8	-81314	-110767	19.93	1480.965	20.66	-0.73
7	8.1	-81226	-110726	19.98	1481.182	20.70	-0.72
7	8.2	-81137	-110685	20.01	1481.390	20.74	-0.73
7	8.3	-81049	-110644	20.08	1481.583	20.78	-0.70
7	8.4	-80961	-110603	20.08	1481.752	20.82	-0.75
7	8.5	-80872	-110562	20.01	1482.010	20.87	-0.86
7	8.6	-80784	-110521	19.94	1481.979	20.91	-0.97
7	8.7	-80687	-110481	19.97	1482.190	20.95	-0.98
7	8.8	-80582	-110444	19.99	1482.084	20.99	-1.00
7	8.9	-80477	-110406	20.03	1481.888	21.03	-1.00
7	9	-80372	-110369	20.05	1481.603	21.07	-1.03
7	9.1	-80267	-110332	20.20	1481.503	21.11	-0.91
7	9.2	-80162	-110294	20.32	1481.314	21.16	-0.84
7	9.3	-80057	-110257	20.44	1481.052	21.20	-0.76
7	9.4	-79952	-110220	20.52	1480.911	21.24	-0.72
7	9.5	-79847	-110182	20.55	1480.708	21.28	-0.73
7	9.6	-79742	-110145	20.58	1480.295	21.32	-0.74
8	0.1	-80223	-108717	19.64	1483.240	20.97	-1.33
8	0.2	-80296	-108794	19.68	1483.105	20.93	-1.25
8	0.3	-80369	-108870	19.72	1483.120	20.89	-1.16
8	0.4	-80442	-108947	19.68	1483.150	20.85	-1.17
8	0.5	-80514	-109024	19.68	1483.291	20.81	-1.13

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
8	0.6	-80587	-109101	19.61	1483.297	20.77	-1.15
8	0.7	-80660	-109178	19.57	1483.229	20.73	-1.16
8	0.8	-80733	-109254	19.50	1483.129	20.68	-1.18
8	0.9	-80806	-109331	19.51	1483.108	20.64	-1.13
8	1	-80879	-109408	19.48	1483.248	20.60	-1.13
8	1.1	-80952	-109485	19.43	1483.667	20.56	-1.13
8	1.2	-81025	-109562	19.44	1483.807	20.52	-1.08
8	1.3	-81098	-109639	19.43	1483.748	20.48	-1.05
9	0.1	-81019	-107502	18.73	1491.136	20.48	-1.75
9	0.2	-81088	-107574	18.68	1491.233	20.43	-1.75
9	0.3	-81157	-107645	18.71	1491.173	20.38	-1.68
9	0.4	-81225	-107717	18.79	1491.199	20.34	-1.55
9	0.5	-81294	-107789	18.60	1490.986	20.29	-1.69
9	0.6	-81363	-107861	18.65	1490.791	20.24	-1.59
9	0.7	-81432	-107933	18.47	1490.431	20.19	-1.72
9	0.8	-81501	-108005	18.30	1490.110	20.14	-1.84
9	0.9	-81570	-108076	18.40	1489.603	20.10	-1.70
9	1	-81639	-108148	18.60	1489.272	20.05	-1.45
9	1.1	-81707	-108220	18.58	1489.010	20.00	-1.42
9	1.2	-81776	-108292	18.59	1488.698	19.96	-1.38
9	1.3	-81845	-108364	18.65	1488.359	19.93	-1.28
9	1.4	-81914	-108436	18.64	1488.383	19.89	-1.25
9	1.5	-81983	-108507	18.53	1488.561	19.85	-1.32
9	1.6	-82052	-108579	18.59	1488.352	19.82	-1.23
9	1.7	-82121	-108651	18.59	1488.410	19.78	-1.19
9	1.8	-82189	-108723	18.52	1488.732	19.75	-1.22
9	1.9	-82258	-108795	18.54	1488.871	19.71	-1.17
9	2	-82327	-108866	18.54	1488.695	19.67	-1.13
9	2.1	-82396	-108938	18.44	1488.738	19.64	-1.19
9	2.2	-82465	-109010	18.39	1488.958	19.60	-1.21
9	2.3	-82534	-109082	18.27	1488.550	19.57	-1.30
9	2.4	-82603	-109154	18.17	1488.596	19.54	-1.37
9	2.5	-82671	-109226	18.05	1488.507	19.51	-1.46
9	2.6	-82740	-109297	18.07	1488.621	19.49	-1.41
9	2.7	-82809	-109369	18.06	1488.671	19.46	-1.39
9	2.8	-82878	-109441	18.06	1488.688	19.43	-1.37
9	2.9	-82947	-109513	17.84	1488.444	19.40	-1.56
9	3	-83016	-109585	18.07	1488.455	19.39	-1.32
9	3.1	-83085	-109656	18.17	1488.489	19.38	-1.21
9	3.2	-83153	-109728	18.31	1488.460	19.37	-1.06
9	3.3	-83222	-109800	18.24	1488.609	19.36	-1.12
9	3.4	-83291	-109872	18.25	1488.784	19.35	-1.10
9	3.5	-83360	-109944	18.16	1488.625	19.34	-1.18
9	3.6	-83429	-110016	17.82	1488.449	19.33	-1.51
9	3.7	-83498	-110087	18.08	1488.337	19.32	-1.24
9	3.8	-83567	-110159	18.37	1488.046	19.31	-0.94
9	3.9	-83635	-110231	18.45	1488.043	19.30	-0.85
9	4	-83704	-110303	18.61	1487.781	19.29	-0.68
9	4.1	-83773	-110375	18.67	1487.723	19.28	-0.61
9	4.2	-83842	-110447	18.67	1487.657	19.27	-0.60
9	4.3	-83911	-110518	18.67	1487.663	19.28	-0.60
9	4.4	-83980	-110590	18.79	1487.422	19.28	-0.49
9	4.5	-84049	-110662	18.76	1487.568	19.29	-0.53
9	4.6	-84117	-110734	18.72	1487.536	19.29	-0.58
9	4.7	-84186	-110806	18.71	1487.321	19.30	-0.59
9	4.8	-84250	-110790	18.69	1487.098	19.27	-0.58
9	4.9	-84329	-110864	18.66	1487.053	19.28	-0.62

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
9	5	-84408	-110937	18.67	1486.473	19.29	-0.62
9	5.1	-84488	-111011	18.74	1485.686	19.31	-0.57
9	5.2	-84567	-111084	18.74	1485.141	19.32	-0.58
91	0.1	-84799	-111142	18.63	1484.474	19.29	-0.66
91	0.2	-84888	-111184	18.57	1484.219	19.29	-0.72
91	0.3	-84977	-111226	18.20	1483.961	19.29	-1.08
91	0.4	-85066	-111268	18.50	1483.600	19.28	-0.79
91	0.5	-85155	-111310	18.64	1483.204	19.28	-0.64
91	0.6	-85244	-111352	18.65	1482.826	19.28	-0.63
91	0.7	-85332	-111394	18.69	1482.504	19.28	-0.59
91	0.8	-85421	-111436	18.75	1482.121	19.28	-0.53
91	0.9	-85510	-111478	18.83	1481.530	19.28	-0.45
91	1	-85599	-111519	18.87	1480.648	19.27	-0.41
91	1.1	-85688	-111561	18.82	1479.942	19.27	-0.45
91	1.2	-85777	-111603	18.84	1479.229	19.27	-0.43
91	1.3	-85866	-111645	18.77	1478.691	19.27	-0.50
91	1.4	-85955	-111687	18.83	1478.448	19.28	-0.44
91	1.5	-86044	-111729	18.86	1478.667	19.28	-0.42
91	1.6	-86133	-111771	18.94	1478.160	19.29	-0.35
91	1.7	-86222	-111813	19.02	1477.669	19.30	-0.27
91	1.8	-86311	-111855	19.02	1477.313	19.30	-0.28
91	1.9	-86400	-111897	19.13	1476.679	19.31	-0.18
91	2	-86489	-111939	19.12	1476.129	19.31	-0.19
91	2.1	-86577	-111981	19.16	1475.582	19.32	-0.16
91	2.2	-86666	-112023	19.10	1475.259	19.33	-0.23
91	2.3	-86755	-112065	19.10	1474.390	19.33	-0.23
91	2.4	-86844	-112107	18.98	1473.748	19.34	-0.36
91	2.5	-86933	-112149	19.21	1473.283	19.35	-0.14
91	2.6	-87022	-112191	19.24	1472.695	19.35	-0.11
91	2.7	-87111	-112233	19.28	1471.908	19.36	-0.08
91	2.8	-87200	-112274	19.28	1471.305	19.36	-0.08
91	2.9	-87289	-112316	19.25	1470.769	19.37	-0.12
10	0.1	-81485	-106832	18.75	1491.529	20.27	-1.52
10	0.2	-81551	-106903	18.68	1491.645	20.22	-1.55
10	0.3	-81616	-106975	18.54	1491.718	20.17	-1.63
10	0.4	-81682	-107047	18.37	1491.553	20.12	-1.75
10	0.5	-81747	-107118	18.38	1491.532	20.08	-1.70
10	0.6	-81812	-107190	18.40	1491.716	20.03	-1.63
10	0.7	-81878	-107262	18.44	1491.780	19.98	-1.53
10	0.8	-81943	-107334	18.31	1491.682	19.93	-1.62
10	0.9	-82009	-107405	17.97	1491.624	19.88	-1.91
10	1	-82074	-107477	17.95	1491.642	19.83	-1.89
10	1.1	-82139	-107549	17.98	1491.578	19.78	-1.81
10	1.2	-82205	-107620	18.10	1491.211	19.74	-1.63
10	1.3	-82270	-107692	17.85	1491.002	19.69	-1.84
10	1.4	-82336	-107764	18.00	1490.737	19.64	-1.64
10	1.5	-82401	-107835	18.00	1490.271	19.59	-1.59
11	0.1	-82151	-105934	18.53	1492.619	19.99	-1.46
11	0.2	-82223	-106007	18.42	1492.611	19.93	-1.51
11	0.3	-82294	-106081	18.28	1492.783	19.88	-1.59
11	0.4	-82366	-106155	18.03	1493.023	19.82	-1.79
11	0.5	-82437	-106229	18.01	1492.804	19.76	-1.75
11	0.6	-82509	-106302	18.15	1492.623	19.70	-1.55
11	0.7	-82580	-106376	18.28	1492.393	19.65	-1.36
11	0.8	-82651	-106450	18.31	1492.463	19.59	-1.28
11	0.9	-82723	-106523	18.27	1492.726	19.53	-1.26
11	1	-82794	-106597	18.33	1492.867	19.47	-1.15

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
11	1.1	-82866	-106671	18.09	1492.808	19.42	-1.32
11	1.2	-82937	-106745	18.04	1492.420	19.36	-1.31
11	1.3	-83009	-106818	18.06	1491.589	19.30	-1.24
11	1.4	-83080	-106892	17.96	1491.630	19.24	-1.29
11	1.5	-83151	-106966	18.21	1491.834	19.19	-0.98
11	1.6	-83223	-107039	18.10	1491.647	19.13	-1.03
11	1.7	-83294	-107113	17.90	1491.124	19.07	-1.17
12	0.1	-85055	-110129	18.05	1487.755	18.77	-0.72
12	0.2	-85139	-110179	17.98	1487.597	18.77	-0.79
12	0.3	-85224	-110228	17.97	1487.554	18.77	-0.80
12	0.4	-85308	-110277	17.97	1487.264	18.76	-0.80
12	0.5	-85393	-110327	17.99	1486.874	18.76	-0.78
12	0.6	-85478	-110376	18.06	1486.569	18.76	-0.70
12	0.7	-85562	-110425	18.22	1485.877	18.76	-0.54
12	0.8	-85647	-110475	18.27	1485.208	18.76	-0.49
12	0.9	-85731	-110524	18.31	1484.609	18.75	-0.45
12	1	-85816	-110574	18.40	1484.303	18.75	-0.35
12	1.1	-85901	-110623	18.36	1484.404	18.75	-0.39
12	1.2	-85985	-110672	18.15	1484.420	18.75	-0.60
12	1.3	-86070	-110722	18.34	1484.616	18.75	-0.42
12	1.4	-86154	-110771	18.27	1484.393	18.76	-0.48
12	1.5	-86239	-110820	18.28	1484.145	18.76	-0.48
12	1.6	-86324	-110870	18.27	1483.764	18.76	-0.49
12	1.7	-86408	-110919	18.31	1483.318	18.76	-0.45
12	1.8	-86493	-110968	18.20	1482.915	18.76	-0.57
12	1.9	-86577	-111018	18.16	1482.092	18.77	-0.61
12	2	-86662	-111067	18.37	1481.573	18.77	-0.39
12	2.1	-86747	-111116	18.58	1480.201	18.77	-0.19
12	2.2	-86831	-111166	18.63	1478.817	18.77	-0.15
12	2.3	-86916	-111215	18.64	1478.091	18.77	-0.14
12	2.4	-87000	-111264	18.61	1477.675	18.78	-0.17
12	2.5	-87085	-111314	18.66	1476.541	18.78	-0.11
12	2.6	-87170	-111363	18.61	1476.346	18.78	-0.17
13	0.1	-85254	-109341	17.80	1489.796	18.38	-0.58
13	0.2	-85337	-109402	17.79	1489.749	18.38	-0.60
13	0.3	-85421	-109463	17.84	1489.850	18.38	-0.55
13	0.4	-85504	-109523	17.95	1489.730	18.39	-0.44
13	0.5	-85588	-109584	18.04	1489.615	18.39	-0.35
13	0.6	-85672	-109645	18.00	1489.482	18.39	-0.39
13	0.7	-85755	-109706	17.95	1489.132	18.39	-0.44
13	0.8	-85839	-109767	17.98	1488.655	18.39	-0.41
13	0.9	-85922	-109828	18.03	1488.031	18.40	-0.36
13	1	-86006	-109888	18.12	1487.283	18.40	-0.28
13	1.1	-86090	-109949	18.16	1486.302	18.40	-0.24
13	1.2	-86173	-110010	18.13	1485.550	18.40	-0.27
13	1.3	-86257	-110071	17.93	1484.919	18.40	-0.48
13	1.4	-86340	-110132	18.10	1484.584	18.40	-0.31
13	1.5	-86424	-110193	18.20	1484.719	18.41	-0.21
13	1.6	-86508	-110254	18.18	1484.795	18.41	-0.23
13	1.7	-86591	-110314	18.23	1485.127	18.41	-0.18
14	0.1	-86368	-107534	17.41	1496.259	17.67	-0.26
14	0.2	-86405	-107627	17.44	1496.014	17.67	-0.23
14	0.3	-86443	-107721	17.42	1495.810	17.68	-0.26
14	0.4	-86480	-107814	17.41	1495.520	17.68	-0.27
14	0.5	-86518	-107908	17.41	1495.195	17.69	-0.27
14	0.6	-86555	-108002	17.35	1494.777	17.69	-0.34
14	0.7	-86593	-108095	17.36	1494.595	17.69	-0.34

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
14	0.8	-86630	-108189	17.41	1494.487	17.70	-0.28
14	0.9	-86668	-108282	17.25	1494.224	17.70	-0.45
14	1	-86705	-108376	17.45	1493.735	17.71	-0.26
14	1.1	-86743	-108469	17.44	1493.627	17.72	-0.28
14	1.2	-86780	-108563	17.44	1492.907	17.73	-0.29
14	1.3	-86818	-108657	17.37	1492.817	17.74	-0.37
14	1.4	-86855	-108750	17.33	1492.258	17.75	-0.42
14	1.5	-86893	-108844	17.33	1491.507	17.76	-0.43
14	1.6	-86930	-108937	17.37	1490.430	17.77	-0.40
14	1.7	-86968	-109031	17.48	1489.824	17.78	-0.30
14	1.8	-87006	-109125	17.48	1489.398	17.80	-0.32
14	1.9	-87043	-109218	17.53	1488.905	17.83	-0.30
14	2	-87081	-109312	17.49	1488.064	17.86	-0.37
14	2.1	-87118	-109405	17.90	1487.454	17.88	0.02
15	0.1	-84410	-102805	17.24	1497.875	18.18	-0.94
15	0.2	-84461	-102891	17.23	1497.857	18.17	-0.93
15	0.3	-84511	-102976	17.26	1497.668	18.15	-0.90
15	0.4	-84562	-103062	17.29	1497.545	18.14	-0.85
15	0.5	-84612	-103147	17.30	1497.420	18.12	-0.82
15	0.6	-84662	-103233	17.32	1497.126	18.11	-0.79
15	0.7	-84713	-103318	17.33	1496.643	18.10	-0.77
15	0.8	-84763	-103404	17.27	1495.983	18.08	-0.82
15	0.9	-84813	-103489	17.38	1495.060	18.07	-0.69
15	1	-84864	-103575	17.49	1493.713	18.06	-0.57
15	1.1	-84914	-103660	17.70	1492.757	18.04	-0.34
15	1.2	-84965	-103746	17.78	1491.863	18.03	-0.25
15	1.3	-85015	-103831	17.80	1492.003	18.01	-0.21
15	1.4	-85065	-103917	17.69	1491.015	18.00	-0.31
15	1.5	-85116	-104002	17.78	1491.208	18.00	-0.22
15	1.6	-85166	-104088	17.77	1491.782	18.00	-0.23
15	1.7	-85216	-104173	17.79	1491.930	18.00	-0.21
15	1.8	-85267	-104259	17.79	1492.653	18.00	-0.21
15	1.9	-85317	-104344	17.75	1493.102	18.00	-0.25
15	2	-85368	-104430	17.79	1493.846	18.00	-0.21
15	2.1	-85418	-104515	17.97	1494.765	17.99	-0.02
15	2.2	-85468	-104601	18.14	1493.859	17.98	0.16
15	2.3	-85519	-104686	17.98	1492.911	17.98	-0.00
15	2.4	-85569	-104772	18.08	1492.843	17.98	0.10
15	2.5	-85620	-104857	18.09	1493.532	17.97	0.12
15	2.6	-85670	-104943	18.00	1493.949	17.93	0.07
15	2.7	-85720	-105028	17.97	1494.377	17.88	0.09
15	2.8	-85771	-105114	18.03	1494.705	17.83	0.20
15	2.9	-85821	-105199	17.68	1495.107	17.81	-0.13
15	3	-85871	-105285	17.33	1495.227	17.80	-0.47
15	3.1	-85922	-105370	17.21	1496.103	17.78	-0.57
15	3.2	-85972	-105456	17.32	1496.571	17.75	-0.43
15	3.3	-86023	-105541	17.37	1496.685	17.71	-0.34
15	3.4	-86073	-105627	17.30	1497.013	17.69	-0.39
15	3.5	-86123	-105712	17.20	1497.223	17.66	-0.46
15	3.6	-86174	-105798	17.36	1497.433	17.62	-0.26
15	3.7	-86224	-105883	17.44	1497.595	17.60	-0.16
15	3.8	-86275	-105969	17.35	1497.706	17.59	-0.24
15	3.9	-86325	-106054	17.07	1497.923	17.56	-0.49
15	4	-86375	-106140	16.87	1497.702	17.52	-0.65
15	4.1	-86426	-106225	17.16	1497.748	17.50	-0.34
15	4.2	-86476	-106311	17.13	1497.841	17.48	-0.35
15	4.3	-86526	-106396	17.04	1497.960	17.46	-0.42

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
15	4.4	-86577	-106482	17.01	1498.040	17.45	-0.44
15	4.5	-86627	-106567	16.97	1498.023	17.43	-0.46
15	4.6	-86678	-106653	17.01	1497.996	17.42	-0.41
15	4.7	-86728	-106738	16.96	1497.857	17.42	-0.46
15	4.8	-86778	-106824	16.98	1498.046	17.41	-0.43
15	4.9	-86829	-106909	16.99	1497.968	17.41	-0.42
15	5	-86879	-106995	16.94	1497.816	17.40	-0.46
15	5.1	-86929	-107080	16.50	1497.554	17.40	-0.90
15	5.2	-86980	-107166	16.71	1497.518	17.40	-0.69
17	0.1	-84407	-101644	17.49	1499.986	18.40	-0.91
17	0.2	-84503	-101639	17.58	1500.000	18.46	-0.88
17	0.3	-84600	-101633	17.62	1500.026	18.52	-0.90
17	0.4	-84696	-101627	17.67	1500.007	18.59	-0.92
17	0.5	-84793	-101621	17.62	1499.863	18.66	-1.04
17	0.6	-84889	-101616	17.58	1499.917	18.73	-1.15
17	0.7	-84986	-101610	17.98	1499.719	18.80	-0.82
17	0.8	-85082	-101604	18.13	1499.697	18.87	-0.74
18	0.1	-86950	-101328	18.36	1498.746	19.28	-0.92
18	0.2	-86939	-101426	18.56	1498.658	19.31	-0.75
18	0.3	-86929	-101524	18.57	1498.678	19.36	-0.79
18	0.4	-86918	-101622	18.53	1498.730	19.40	-0.87
18	0.5	-86908	-101720	18.60	1499.106	19.42	-0.82
18	0.6	-86898	-101818	18.61	1499.383	19.43	-0.82
18	0.7	-86887	-101916	18.61	1499.643	19.44	-0.83
18	0.8	-86877	-102014	18.60	1499.638	19.44	-0.84
18	0.9	-86866	-102112	18.63	1499.730	19.44	-0.81
18	1	-86856	-102211	18.70	1499.882	19.43	-0.73
18	1.1	-86846	-102309	18.72	1500.119	19.41	-0.69
18	1.2	-86835	-102407	18.64	1500.611	19.40	-0.76
18	1.3	-86825	-102505	18.67	1500.185	19.37	-0.70
18	1.4	-86815	-102603	18.70	1500.023	19.32	-0.62
18	1.5	-86804	-102701	18.69	1499.781	19.26	-0.57
18	1.6	-86822	-102796	18.74	1499.233	19.23	-0.49
18	1.7	-86857	-102889	18.38	1499.107	19.21	-0.83
18	1.8	-86893	-102982	18.13	1498.934	19.18	-1.05
18	1.9	-86929	-103075	18.34	1499.230	19.17	-0.83
18	2	-86965	-103168	18.21	1499.417	19.12	-0.91
18	2.1	-87000	-103261	18.23	1499.392	19.09	-0.86
18	2.2	-87036	-103354	18.38	1499.214	19.06	-0.68
18	2.3	-87072	-103447	18.43	1499.202	19.02	-0.59
18	2.4	-87108	-103540	18.48	1499.144	19.00	-0.52
18	2.5	-87144	-103633	18.53	1498.896	18.96	-0.43
18	2.6	-87179	-103727	18.56	1498.735	18.93	-0.37
18	2.7	-87215	-103820	18.54	1498.669	18.89	-0.36
18	2.8	-87251	-103913	18.54	1498.937	18.86	-0.32
18	2.9	-87287	-104006	18.53	1499.445	18.82	-0.30
18	3	-87323	-104099	18.50	1499.774	18.79	-0.29
18	3.1	-87358	-104192	18.53	1499.791	18.75	-0.22
18	3.2	-87394	-104285	18.49	1499.953	18.72	-0.22
18	3.3	-87430	-104378	18.41	1500.006	18.68	-0.27
18	3.4	-87466	-104471	18.33	1500.110	18.65	-0.32
18	3.5	-87502	-104564	18.23	1500.133	18.61	-0.38
18	3.6	-87537	-104657	18.18	1500.034	18.54	-0.37
18	3.7	-87573	-104750	18.12	1499.888	18.48	-0.35
18	3.8	-87609	-104843	18.12	1499.738	18.41	-0.29
18	3.9	-87645	-104936	17.91	1499.704	18.34	-0.43
18	4	-87681	-105030	17.52	1499.623	18.28	-0.76

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
18	4.1	-87716	-105123	17.70	1499.421	18.21	-0.51
18	4.2	-87752	-105216	17.67	1499.121	18.14	-0.47
18	4.3	-87788	-105309	17.47	1498.492	18.08	-0.61
18	4.4	-87824	-105402	17.49	1498.664	18.01	-0.52
18	4.5	-87860	-105495	17.40	1498.783	17.94	-0.54
18	4.6	-87895	-105588	17.35	1498.674	17.88	-0.53
18	4.7	-87931	-105681	17.56	1498.353	17.81	-0.25
18	4.8	-87967	-105774	17.45	1498.356	17.74	-0.29
18	4.9	-88003	-105867	17.33	1498.486	17.70	-0.37
18	5	-88039	-105960	17.32	1498.296	17.66	-0.34
18	5.1	-88074	-106053	17.26	1498.223	17.63	-0.37
18	5.2	-88110	-106146	17.16	1498.047	17.59	-0.42
18	5.3	-88146	-106240	17.18	1497.589	17.55	-0.37
18	5.4	-88182	-106333	17.18	1497.358	17.51	-0.33
18	5.5	-88218	-106426	17.18	1497.328	17.47	-0.29
18	5.6	-88253	-106519	17.16	1496.974	17.44	-0.28
18	5.7	-88289	-106612	17.07	1496.586	17.40	-0.33
18	5.8	-88325	-106705	16.88	1496.217	17.36	-0.48
19	0.1	-84403	-100472	18.40	1496.852	19.10	-0.70
19	0.2	-84507	-100474	18.45	1497.599	19.15	-0.70
19	0.3	-84610	-100476	18.33	1498.497	19.20	-0.87
19	0.4	-84714	-100478	18.45	1499.437	19.25	-0.80
19	0.5	-84817	-100480	18.52	1500.205	19.30	-0.78
19	0.6	-84920	-100482	18.51	1500.720	19.35	-0.84
19	0.7	-85024	-100484	18.51	1501.094	19.40	-0.89
19	0.8	-85127	-100486	18.42	1501.440	19.43	-1.01
19	0.9	-85230	-100488	18.39	1501.529	19.47	-1.08
19	1	-85334	-100490	18.10	1501.790	19.50	-1.40
19	1.1	-85437	-100492	18.03	1501.889	19.51	-1.48
19	1.2	-85541	-100494	18.20	1501.813	19.52	-1.32
19	1.3	-85644	-100496	18.18	1501.939	19.52	-1.34
19	1.4	-85747	-100498	18.08	1502.032	19.51	-1.43
21	0.1	-84360	-99370	18.16	1498.890	19.60	-1.44
21	0.2	-84456	-99391	18.32	1499.935	19.60	-1.28
21	0.3	-84552	-99411	18.23	1500.592	19.61	-1.38
21	0.4	-84648	-99432	17.89	1501.021	19.61	-1.72
21	0.5	-84744	-99453	17.88	1501.234	19.62	-1.74
21	0.6	-84840	-99473	18.20	1500.970	19.61	-1.41
21	0.7	-84936	-99494	18.18	1500.888	19.61	-1.43
21	0.8	-85032	-99515	18.33	1501.229	19.60	-1.27
21	0.9	-85128	-99535	18.56	1501.645	19.55	-0.99
21	1	-85224	-99556	18.42	1501.961	19.50	-1.08
21	1.1	-85320	-99577	18.68	1502.211	19.45	-0.77
21	1.2	-85416	-99597	18.62	1502.425	19.40	-0.78
21	1.3	-85512	-99618	18.55	1502.376	19.38	-0.83
21	1.4	-85608	-99639	18.14	1502.482	19.36	-1.22
21	1.5	-85704	-99659	18.46	1502.405	19.35	-0.89
21	1.6	-85800	-99680	18.48	1502.304	19.20	-0.72
100	0.1	-87507	-97611	17.04	1506.217	17.41	-0.37
100	0.2	-87453	-97692	17.19	1506.253	17.47	-0.29
100	0.3	-87400	-97772	17.33	1505.837	17.54	-0.21
100	0.4	-87347	-97853	17.26	1505.715	17.60	-0.34
100	0.5	-87293	-97934	17.32	1505.459	17.67	-0.35
100	0.6	-87240	-98015	17.49	1505.073	17.73	-0.24
100	0.7	-87187	-98096	17.45	1504.330	17.80	-0.35
100	0.8	-87133	-98177	17.40	1503.816	17.86	-0.46
100	0.9	-87080	-98257	17.55	1503.455	17.92	-0.37

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
100	1	-87027	-98338	17.77	1503.247	17.99	-0.22
100	1.1	-86973	-98419	17.89	1502.861	18.05	-0.16
100	1.2	-86920	-98500	17.75	1502.766	18.12	-0.36
100	1.3	-86872	-98588	17.67	1502.613	18.18	-0.51
100	1.4	-86823	-98675	17.90	1502.448	18.24	-0.35
100	1.5	-86775	-98763	18.08	1502.569	18.31	-0.23
100	1.6	-86727	-98851	18.19	1502.163	18.37	-0.18
100	1.7	-86678	-98938	18.17	1502.062	18.44	-0.27
100	1.8	-86630	-99026	18.31	1501.630	18.50	-0.19
100	1.9	-86582	-99114	18.36	1502.261	18.57	-0.20
100	2	-86534	-99201	18.37	1502.401	18.63	-0.26
100	2.1	-86485	-99289	18.35	1502.201	18.69	-0.34
100	2.2	-86437	-99377	18.05	1502.594	18.76	-0.71
100	2.3	-86389	-99465	17.68	1502.762	18.82	-1.14
100	2.4	-86340	-99552	17.73	1502.720	18.89	-1.15
100	2.5	-86292	-99640	18.14	1502.867	18.95	-0.81
100	2.6	-86244	-99728	18.46	1503.099	19.02	-0.55
100	2.7	-86195	-99815	18.49	1503.115	19.08	-0.59
100	2.8	-86147	-99903	18.43	1503.028	19.14	-0.71
100	2.9	-86099	-99991	18.43	1502.691	19.21	-0.78
100	3	-86050	-100078	17.97	1502.330	19.27	-1.30
100	3.1	-86002	-100166	18.35	1501.613	19.34	-0.99
100	3.2	-85954	-100254	18.51	1501.283	19.40	-0.89
100	3.3	-85906	-100341	18.57	1501.694	19.43	-0.86
100	3.4	-85857	-100429	18.37	1501.889	19.47	-1.09
100	3.5	-85809	-100517	18.08	1501.948	19.50	-1.41
100	3.6	-85761	-100605	18.23	1501.836	19.53	-1.30
100	3.7	-85712	-100692	18.33	1501.364	19.49	-1.16
100	3.8	-85664	-100780	18.40	1500.441	19.45	-1.05
100	3.9	-85616	-100868	18.27	1500.766	19.41	-1.14
100	4	-85567	-100955	17.86	1501.182	19.34	-1.48
100	4.1	-85519	-101043	17.79	1501.288	19.27	-1.47
100	4.2	-85471	-101131	18.02	1501.138	19.19	-1.18
100	4.3	-85422	-101218	18.22	1500.904	19.12	-0.91
100	4.4	-85374	-101306	18.26	1500.850	19.05	-0.79
100	4.5	-85321	-101390	18.26	1500.833	18.98	-0.72
100	4.6	-85262	-101428	18.28	1500.262	18.91	-0.62
100	4.7	-85203	-101510	18.19	1499.666	18.83	-0.64
100	4.8	-85144	-101591	18.12	1499.019	18.76	-0.64
100	4.9	-85085	-101673	18.00	1499.251	18.69	-0.69
100	5	-85026	-101754	17.97	1499.479	18.62	-0.65
100	5.1	-84967	-101836	17.74	1499.577	18.54	-0.81
100	5.2	-84909	-101917	17.39	1499.594	18.47	-1.08
100	5.3	-84850	-101999	17.32	1499.506	18.40	-1.08
100	5.4	-84791	-102080	17.40	1499.327	18.30	-0.90
100	5.5	-84732	-102162	17.45	1499.093	18.26	-0.81
100	5.6	-84673	-102244	17.44	1498.817	18.24	-0.80
100	5.7	-84614	-102325	17.30	1498.775	18.23	-0.93
100	5.8	-84556	-102407	17.30	1498.696	18.22	-0.92
100	5.9	-84497	-102488	17.25	1498.609	18.21	-0.96
100	6	-84438	-102570	17.33	1498.528	18.21	-0.88
100	6.1	-84379	-102651	17.34	1498.186	18.25	-0.91
100	6.2	-84320	-102733	17.44	1498.140	18.30	-0.86
100	6.3	-84261	-102814	17.49	1497.795	18.43	-0.94
100	6.4	-84203	-102896	17.62	1497.631	18.57	-0.95
100	6.5	-84144	-102978	17.88	1497.847	18.70	-0.82
100	6.6	-84085	-103059	17.98	1497.597	18.83	-0.86

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
100	6.7	-84026	-103141	17.94	1497.470	18.97	-1.02
100	6.8	-83967	-103222	18.19	1497.075	19.10	-0.91
100	6.9	-83908	-103304	18.23	1497.227	19.20	-0.97
100	7	-83850	-103385	18.36	1496.784	19.26	-0.90
100	7.1	-83791	-103467	18.35	1496.599	19.33	-0.98
100	7.2	-83732	-103548	18.46	1496.605	19.40	-0.94
100	7.3	-83673	-103630	18.56	1496.527	19.45	-0.89
100	7.4	-83614	-103711	18.59	1496.267	19.50	-0.91
100	7.5	-83555	-103793	18.73	1495.986	19.55	-0.82
100	7.6	-83496	-103875	18.66	1495.958	19.60	-0.94
100	7.7	-83438	-103956	18.62	1495.846	19.63	-1.01
100	7.8	-83379	-104038	18.65	1495.489	19.67	-1.01
100	7.9	-83320	-104119	18.63	1495.238	19.70	-1.07
100	8	-83261	-104201	18.51	1495.015	19.73	-1.22
100	8.1	-83202	-104282	18.47	1494.776	19.76	-1.29
100	8.2	-83143	-104364	18.46	1494.573	19.80	-1.34
100	8.3	-83085	-104445	18.47	1494.432	19.82	-1.35
100	8.4	-83026	-104527	18.61	1494.342	19.83	-1.22
100	8.5	-82967	-104609	18.60	1494.009	19.85	-1.24
100	8.6	-82908	-104690	18.57	1493.653	19.86	-1.29
100	8.7	-82849	-104772	18.49	1493.530	19.88	-1.39
100	8.8	-82790	-104853	18.62	1493.262	19.89	-1.27
100	8.9	-82732	-104935	18.81	1493.114	19.91	-1.10
100	9	-82673	-105016	18.77	1492.831	19.92	-1.15
100	9.1	-82614	-105098	18.84	1492.731	19.94	-1.10
100	9.2	-82555	-105179	18.91	1492.706	19.95	-1.04
100	9.3	-82496	-105261	18.89	1492.789	19.97	-1.07
100	9.4	-82437	-105342	18.82	1492.725	19.98	-1.17
100	9.5	-82379	-105424	18.79	1492.886	20.00	-1.21
100	9.6	-82320	-105506	18.79	1492.574	20.02	-1.23
100	9.7	-82261	-105587	18.63	1492.563	20.04	-1.41
100	9.8	-82202	-105669	18.31	1492.396	20.06	-1.75
100	9.9	-82143	-105750	18.55	1492.460	20.08	-1.53
100	10	-82084	-105832	18.71	1492.470	20.10	-1.39
100	10.1	-82025	-105913	18.69	1492.464	20.12	-1.43
100	10.2	-81967	-105995	18.51	1492.519	20.14	-1.63
100	10.3	-81908	-106076	18.28	1492.388	20.16	-1.88
100	10.4	-81849	-106158	18.27	1492.304	20.18	-1.91
100	10.5	-81790	-106240	18.31	1492.087	20.20	-1.89
100	10.6	-81731	-106321	18.47	1491.491	20.23	-1.75
100	10.7	-81672	-106403	18.55	1491.521	20.25	-1.70
100	10.8	-81614	-106484	18.68	1491.521	20.28	-1.59
100	10.9	-81555	-106566	18.74	1491.664	20.30	-1.56
100	11	-81496	-106647	18.85	1491.591	20.33	-1.48
100	11.1	-81437	-106729	18.91	1491.726	20.35	-1.44
100	11.2	-81378	-106810	18.90	1491.879	20.38	-1.47
100	11.3	-81319	-106892	18.98	1492.128	20.40	-1.42
100	11.4	-81261	-106973	18.98	1492.150	20.43	-1.45
100	11.5	-81202	-107055	18.97	1492.136	20.46	-1.49
100	11.6	-81143	-107137	18.98	1492.036	20.49	-1.50
100	11.7	-81084	-107218	19.01	1492.055	20.51	-1.51
100	11.8	-81025	-107300	19.03	1491.996	20.54	-1.51
100	11.9	-80966	-107381	18.82	1491.441	20.57	-1.75
100	12	-80908	-107463	18.52	1490.919	20.60	-2.08
100	12.1	-80849	-107544	18.79	1490.282	20.63	-1.84
100	12.2	-80790	-107626	18.96	1489.654	20.67	-1.70
100	12.3	-80731	-107707	18.71	1489.291	20.70	-1.98

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
100	12.4	-80672	-107789	18.74	1488.569	20.73	-1.99
100	12.5	-80613	-107871	18.89	1487.994	20.77	-1.87
100	12.6	-80554	-107952	19.00	1487.379	20.80	-1.80
100	12.7	-80496	-108034	19.11	1486.757	20.83	-1.72
100	12.8	-80437	-108115	19.16	1486.217	20.87	-1.71
100	12.9	-80378	-108197	19.32	1485.867	20.90	-1.58
100	13	-80319	-108278	19.38	1485.594	20.93	-1.55
100	13.1	-80260	-108360	19.53	1485.073	20.97	-1.44
100	13.2	-80232	-108453	19.65	1484.333	21.00	-1.35
100	13.3	-80203	-108546	19.71	1483.833	21.02	-1.30
100	13.4	-80175	-108638	19.71	1483.474	21.04	-1.33
100	13.5	-80146	-108731	19.66	1483.105	21.05	-1.40
100	13.6	-80118	-108824	19.67	1482.377	21.07	-1.40
100	13.7	-80089	-108917	19.79	1482.012	21.09	-1.30
100	13.8	-80061	-109009	19.86	1481.608	21.11	-1.25
100	13.9	-80032	-109102	19.82	1481.358	21.13	-1.31
100	14	-80004	-109195	19.98	1481.063	21.15	-1.17
100	14.1	-79975	-109288	20.11	1480.960	21.16	-1.06
100	14.2	-79947	-109380	20.21	1480.886	21.18	-0.97
100	14.3	-79918	-109473	20.23	1480.993	21.20	-0.97
100	14.4	-79890	-109566	20.26	1481.097	21.22	-0.96
100	14.5	-79861	-109659	20.30	1481.200	21.24	-0.94
100	14.6	-79833	-109751	20.41	1481.008	21.26	-0.85
100	14.7	-79804	-109844	20.50	1480.803	21.28	-0.78
100	14.8	-79776	-109937	20.59	1480.625	21.30	-0.71
100	14.9	-79747	-110030	20.65	1480.379	21.31	-0.66
100	15	-79719	-110122	20.63	1480.452	21.32	-0.68
100	15.1	-79723	-110219	20.68	1480.608	21.33	-0.64
100	15.2	-79742	-110317	20.63	1480.569	21.33	-0.70
100	15.3	-79761	-110415	20.65	1480.606	21.34	-0.69
100	15.4	-79780	-110513	20.63	1480.488	21.35	-0.72
100	15.5	-79799	-110611	20.69	1480.432	21.36	-0.66
100	15.6	-79817	-110710	20.74	1480.359	21.36	-0.62
100	15.7	-79836	-110808	20.76	1480.249	21.37	-0.61
100	15.8	-79855	-110906	20.79	1480.001	21.38	-0.58
100	15.9	-79874	-111004	20.89	1479.843	21.39	-0.49
100	16	-79893	-111102	21.01	1479.800	21.39	-0.38
100	16.1	-79912	-111200	21.09	1479.707	21.40	-0.31
100	16.2	-79930	-111299	21.15	1479.607	21.41	-0.26
100	16.3	-79949	-111397	21.16	1479.366	21.42	-0.26
100	16.4	-79968	-111495	21.12	1479.260	21.43	-0.31
100	16.5	-79987	-111593	21.18	1479.152	21.44	-0.26
100	16.6	-80006	-111691	21.15	1478.917	21.45	-0.30
100	16.7	-80025	-111790	21.24	1478.442	21.46	-0.22
100	16.8	-80044	-111888	21.27	1478.013	21.47	-0.20
100	16.9	-80062	-111986	21.26	1477.361	21.48	-0.22
100	17	-80081	-112084	21.21	1476.618	21.49	-0.28
100	17.1	-80100	-112182	21.30	1475.676	21.50	-0.20
100	17.2	-80119	-112280	21.43	1474.210	21.51	-0.08
100	17.3	-80138	-112379	21.51	1473.281	21.52	-0.01
100	17.4	-80157	-112477	21.51	1472.294	21.52	-0.01
100	17.5	-80175	-112575	21.45	1471.356	21.53	-0.08
100	17.6	-80194	-112673	21.45	1470.121	21.53	-0.08
100	17.7	-80213	-112771	21.52	1469.475	21.53	-0.01
100	17.8	-80232	-112869	21.49	1468.949	21.52	-0.03
100	17.9	-80251	-112968	21.47	1468.125	21.51	-0.04
100	18	-80270	-113066	21.41	1467.537	21.49	-0.08

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
100	18.1	-80289	-113164	21.36	1467.035	21.46	-0.10
100	18.2	-80307	-113262	21.29	1466.485	21.43	-0.14
100	18.3	-80326	-113360	21.20	1466.046	21.40	-0.20
100	18.4	-80310	-113457	21.22	1465.601	21.34	-0.12
100	18.5	-80284	-113553	21.23	1465.300	21.29	-0.06
100	18.6	-80259	-113650	21.16	1464.880	21.23	-0.08
100	18.7	-80233	-113746	21.22	1464.436	21.18	0.04
100	18.8	-80208	-113843	21.19	1464.146	21.12	0.06
100	18.9	-80183	-113939	21.18	1463.763	21.07	0.11
100	19	-80157	-114035	21.09	1463.513	21.01	0.08
100	19.1	-80132	-114132	21.04	1463.253	20.96	0.08
100	19.2	-80106	-114228	20.94	1462.998	20.90	0.04
100	19.3	-80081	-114324	20.73	1462.488	20.84	-0.11
100	19.4	-80055	-114421	20.54	1462.153	20.79	-0.25
100	19.5	-80030	-114517	20.45	1461.340	20.73	-0.29
100	19.6	-80005	-114614	20.45	1460.819	20.68	-0.23
100	19.7	-79979	-114710	20.43	1460.167	20.62	-0.19
100	19.8	-79954	-114806	20.44	1459.301	20.57	-0.13
100	19.9	-79928	-114903	20.44	1458.539	20.51	-0.07
100	20	-79903	-114999	20.36	1457.625	20.45	-0.09
100	20.1	-79877	-115095	20.33	1456.813	20.40	-0.07
100	20.2	-79852	-115192	20.26	1456.143	20.36	-0.10
100	20.3	-79827	-115288	20.16	1455.183	20.32	-0.16
100	20.4	-79801	-115384	20.17	1454.088	20.28	-0.11
100	20.5	-79776	-115481	20.08	1453.611	20.24	-0.16
100	20.6	-79750	-115577	20.10	1452.836	20.20	-0.10
100	20.7	-79725	-115674	20.08	1451.983	20.20	-0.12
100	20.8	-79699	-115770	20.06	1451.182	20.20	-0.14
100	20.9	-79674	-115866	20.09	1450.205	20.23	-0.14
100	21	-79649	-115963	20.14	1449.164	20.25	-0.11
100	21.1	-79623	-116059	20.18	1448.656	20.30	-0.12
100	21.2	-79598	-116155	20.22	1447.555	20.34	-0.12
100	21.3	-79572	-116252	20.20	1446.764	20.40	-0.20
100	21.4	-79547	-116348	20.26	1445.708	20.45	-0.19
100	21.5	-79521	-116445	20.24	1445.519	20.50	-0.26
100	21.6	-79496	-116541	20.37	1444.380	20.55	-0.18
100	21.7	-79471	-116637	20.46	1443.726	20.60	-0.14
100	21.8	-79445	-116734	20.55	1442.543	20.68	-0.13
100	21.9	-79420	-116830	20.61	1441.700	20.75	-0.14
100	22	-79394	-116926	20.69	1440.662	20.83	-0.14
100	22.1	-79369	-117023	20.77	1439.440	20.91	-0.13
100	22.2	-79343	-117119	20.90	1438.527	20.98	-0.09
100	22.3	-79318	-117215	20.96	1437.620	21.06	-0.10
100	22.4	-79293	-117312	21.01	1437.090	21.14	-0.13
100	22.5	-79267	-117408	21.15	1435.907	21.22	-0.06
100	22.6	-79242	-117505	21.15	1434.852	21.29	-0.14
100	22.7	-79216	-117601	21.17	1434.170	21.37	-0.20
100	22.8	-79191	-117697	21.27	1433.040	21.45	-0.18
100	22.9	-79165	-117794	21.36	1432.194	21.52	-0.16
100	23	-79140	-117890	21.34	1429.922	21.60	-0.26
101	0.1	-82663	-105237	18.78	1492.323	19.85	-1.07
101	0.2	-82746	-105294	18.76	1492.904	19.80	-1.04
101	0.3	-82829	-105351	18.59	1492.513	19.74	-1.15
101	0.4	-82912	-105408	18.52	1492.591	19.67	-1.15
101	0.5	-82995	-105465	18.46	1492.552	19.60	-1.14
101	0.6	-83078	-105521	18.38	1492.473	19.54	-1.16
101	0.7	-83162	-105578	18.33	1492.776	19.47	-1.14

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
101	0.8	-83245	-105635	18.35	1493.098	19.40	-1.05
101	0.9	-83328	-105692	18.20	1493.640	19.35	-1.15
101	1	-83411	-105749	18.12	1494.093	19.30	-1.18
101	1.1	-83494	-105806	18.13	1494.130	19.24	-1.11
101	1.2	-83577	-105863	18.15	1494.559	19.19	-1.04
101	1.3	-83660	-105920	18.08	1494.608	19.12	-1.04
101	1.4	-83727	-105993	18.05	1493.949	19.05	-1.00
101	1.5	-83794	-106066	18.13	1493.417	18.98	-0.85
101	1.6	-83860	-106140	18.33	1493.327	18.91	-0.58
101	1.7	-83927	-106213	18.25	1492.735	18.85	-0.60
101	1.8	-83994	-106286	18.30	1492.316	18.79	-0.49
101	1.9	-84061	-106359	18.16	1491.897	18.74	-0.58
101	2	-84128	-106432	18.20	1491.817	18.69	-0.49
101	2.1	-84194	-106506	18.04	1491.659	18.65	-0.61
101	2.2	-84261	-106579	17,96	1491.823	18.60	-0.64
101	2.3	-84328	-106652	17.93	1491.863	18.55	-0.62
101	2.4	-84395	-106725	17.93	1492.084	18.50	-0.57
101	2.5	-84462	-106798	17.82	1492.647	18.45	-0.63
101	2.6	-84528	-106871	17.87	1493.134	18.40	-0.53
101	2.7	-84595	-106945	17.78	1493.618	18.35	-0.57
101	2.8	-84662	-107018	17.76	1494.389	18.30	-0.54
101	2.9	-84729	-107091	17.74	1494.285	18.25	-0.51
101	3	-84796	-107164	17.65	1494.317	18.20	-0.55
101	3.1	-84862	-107237	17.62	1494.463	18.18	-0.55
101	3.2	-84929	-107311	17.45	1494.387	18.15	-0.70
101	3.3	-84996	-107384	17.13	1494.242	18.13	-0.99
101	3.4	-85063	-107457	17.35	1494.456	18.10	-0.75
101	3.5	-85130	-107530	17.34	1495.035	18.08	-0.73
101	3.6	-85196	-107603	17.30	1495.060	18.05	-0.75
101	3.7	-85270	-107683	17.34	1494.895	18.03	-0.68
101	3.8	-85350	-107770	17.17	1494.763	18.00	-0.83
101	3.9	-85350	-107869	17.30	1495.379	18.00	-0.70
101	4	-85350	-107967	17.35	1494.634	18.00	-0.65
101	4.1	-85350	-108066	17.44	1494.435	18.01	-0.57
101	4.2	-85350	-108164	17.44	1493.479	18.03	-0.59
101	4.3	-85350	-108263	17.48	1493.063	18.04	-0.56
101	4.4	-85350	-108361	17.63	1492.073	18.06	-0.43
101	4.5	-85350	-108460	17.52	1493.015	18.08	-0.56
101	4.6	-85326	-108557	17.49	1492.875	18.11	-0.62
101	4.7	-85302	-108654	17.41	1492.115	18.14	-0.73
101	4.8	-85278	-108750	17.49	1492.166	18.17	-0.68
101	4.9	-85254	-108847	17.59	1491.538	18.20	-0.61
101	5	-85230	-108944	17.58	1491.770	18.24	-0.66
101	5.1	-85206	-109041	17.60	1491.631	18.28	-0.68
101	5.2	-85182	-109138	17.64	1491.348	18.32	-0.68
101	5.3	-85158	-109234	17.66	1491.279	18.36	-0.70
101	5.4	-85134	-109331	17.64	1491.027	18.40	-0.76
101	5.5	-85110	-109428	17.77	1490.757	18.45	-0.68
101	5.6	-85086	-109525	17.80	1490.680	18.50	-0.70
101	5.7	-85062	-109622	17.92	1490.399	18.55	-0.63
101	5.8	-85038	-109718	17.95	1490.153	18.60	-0.65
101	5.9	-85014	-109815	17.91	1489.879	18.65	-0.74
101	6	-84990	-109912	18.00	1489.704	18.69	-0.69
101	6.1	-84966	-110009	17.93	1489.470	18.74	-0.81
101	6.2	-84942	-110106	18.00	1489.266	18.78	-0.78
101	6.3	-84918	-110202	18.05	1489.229	18.82	-0.77
101	6.4	-84894	-110299	18.11	1488.797	18.87	-0.76

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
101	6.5	-84870	-110396	18.16	1488.506	18.91	-0.75
101	6.6	-84846	-110493	18.26	1488.333	18.96	-0.70
101	6.7	-84822	-110590	18.27	1488.090	19.00	-0.73
101	6.8	-84798	-110686	18.35	1487.716	19.05	-0.70
101	6.9	-84774	-110783	18.43	1487.327	19.10	-0.67
101	7	-84750	-110880	18.56	1486.822	19.15	-0.59
101	7.1	-84726	-110977	18.64	1486.312	19.21	-0.57
101	7.2	-84702	-111074	18.68	1486.011	19.26	-0.58
101	7.3	-84678	-111170	18.64	1485.684	19.31	-0.67
101	7.4	-84654	-111267	18.65	1485.168	19.36	-0.71
101	7.5	-84630	-111364	18.67	1484.715	19.42	-0.75
101	7.6	-84606	-111461	18.43	1484.395	19.47	-1.04
101	7.7	-84582	-111558	18.25	1484.045	19.52	-1.28
101	7.8	-84558	-111654	18.64	1483.321	19.58	-0.94
101	7.9	-84534	-111751	18.94	1481.585	19.63	-0.69
101	8	-84510	-111848	19.07	1480.512	19.68	-0.61
101	8.1	-84486	-111945	19.20	1479.905	19.73	-0.53
101	8.2	-84462	-112042	19.38	1479.474	19.78	-0.40
101	8.3	-84438	-112138	19.45	1478.895	19.84	-0.39
101	8.4	-84414	-112235	19.47	1478.446	19.89	-0.42
101	8.5	-84390	-112332	19.65	1478.151	19.94	-0.29
101	8.6	-84366	-112429	19.71	1477.679	19.99	-0.28
101	8.7	-84342	-112526	19.80	1477.492	20.04	-0.25
101	8.8	-84318	-112622	19.80	1476.984	20.10	-0.30
101	8.9	-84294	-112719	19.83	1476.553	20.15	-0.32
101	9	-84270	-112816	19.90	1476.304	20.20	-0.30
101	9.1	-84246	-112913	19.90	1475.981	20.24	-0.34
101	9.2	-84222	-113010	19.91	1475.576	20.28	-0.37
101	9.3	-84198	-113106	19.97	1475.304	20.32	-0.35
101	9.4	-84174	-113203	19.99	1475.088	20.36	-0.37
101	9.5	-84150	-113300	20.00	1474.744	20.40	-0.40
101	9.6	-84110	-113395	20.03	1474.520	20.43	-0.40
101	9.7	-84070	-113490	19.97	1474.435	20.45	-0.48
101	9.8	-84012	-113562	19.99	1474.490	20.48	-0.49
101	9.9	-83954	-113634	20.00	1473.517	20.50	-0.50
101	10	-83897	-113707	19.99	1472.997	20.54	-0.55
101	10.1	-83839	-113779	19.87	1473.096	20.55	-0.68
101	10.2	-83781	-113851	19.80	1473.370	20.56	-0.76
101	10.3	-83723	-113923	19.83	1472.298	20.54	-0.71
101	10.4	-83666	-113996	19.51	1470.415	20.53	-1.02
101	10.5	-83608	-114068	19.81	1468.251	20.51	-0.70
101	10.6	-83550	-114140	19.60	1467.375	20.48	-0.88
101	10.7	-83430	-114140	19.50	1466.892	20.49	-0.99
101	10.8	-83380	-114210	19.64	1466.942	20.50	-0.86
101	10.9	-83330	-114280	19.59	1467.755	20.47	-0.88
101	11	-83280	-114350	19.68	1467.512	20.43	-0.75
101	11.1	-83230	-114420	19.72	1467.227	20.40	-0.68
101	11.2	-83153	-114487	19.68	1466.910	20.37	-0.69
101	11.3	-83077	-114553	19.66	1466.466	20.35	-0.69
101	11.4	-83000	-114620	19.67	1466.362	20.32	-0.65
101	11.5	-82900	-114665	19.68	1466.466	20.29	-0.61
101	11.6	-82800	-114710	19.73	1465.793	20.26	-0.53
101	11.7	-82720	-114773	19.76	1465.446	20.23	-0.47
101	11.8	-82640	-114835	19.75	1465.460	20.20	-0.45
101	11.9	-82560	-114898	19.78	1464.892	20.15	-0.37
101	12	-82480	-114960	19.78	1464.168	20.10	-0.32
101	12.1	-82385	-114985	19.73	1463.976	20.08	-0.35

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
101	12.2	-82290	-115010	19.64	1463.817	20.06	-0.42
101	12.3	-82195	-115035	19.65	1463.185	20.14	-0.49
101	12.4	-82100	-115060	19.74	1462.349	20.02	-0.28
101	12.5	-82010	-115110	19.74	1461.924	20.00	-0.26
101	12.6	-81920	-115160	19.75	1461.600	20.00	-0.25
101	12.7	-81820	-115183	19.78	1461.334	20.00	-0.22
101	12.8	-81721	-115205	19.77	1461.046	20.00	-0.23
101	12.9	-81621	-115228	19.76	1460.368	20.00	-0.24
101	13	-81522	-115251	19.67	1459.762	20.00	-0.33
101	13.1	-81422	-115274	19.81	1459.304	20.00	-0.19
101	13.2	-81323	-115296	19.90	1459.165	20.00	-0.10
101	13.3	-81223	-115319	19.89	1459.269	20.00	-0.11
101	13.4	-81124	-115342	19.86	1459.597	20.00	-0.14
101	13.5	-81024	-115365	19.91	1459.115	20.00	-0.09
101	13.6	-80925	-115387	19.92	1458.441	20.00	-0.08
101	13.7	-80825	-115410	19.94	1457.777	20.02	-0.08
101	13.8	-80725	-115433	20.00	1457.208	20.03	-0.03
101	13.9	-80626	-115455	20.06	1456.918	20.05	0.01
101	14	-80526	-115478	20.06	1456.863	20.07	-0.01
101	14.1	-80427	-115501	20.04	1456.670	20.08	-0.04
101	14.2	-80327	-115524	20.03	1455.943	20.10	-0.07
101	14.3	-80228	-115546	20.05	1455.345	20.12	-0.07
101	14.4	-80128	-115569	20.05	1454.640	20.14	-0.09
101	14.5	-80029	-115592	20.08	1453.996	20.16	-0.08
101	14.6	-79929	-115615	20.09	1453.487	20.17	-0.08
101	14.7	-79830	-115637	20.11	1452.652	20.19	-0.08
101	14.8	-79730	-115660	20.07	1451.875	20.21	-0.14
103	0.1	-85380	-107830	17.16	1494.472	18.00	-0.84
103	0.2	-85427	-107919	17.24	1494.314	17.99	-0.75
103	0.3	-85475	-108007	17.29	1494.233	17.98	-0.69
103	0.4	-85522	-108096	17.35	1494.201	17.97	-0.62
103	0.5	-85570	-108185	17.240	1493.890	17.97	-0.73
103	0.6	-85617	-108273	17.450	1493.714	17.97	-0.52
103	0.7	-85665	-108362	17.34	1493.103	17.97	-0.63
103	0.8	-85712	-108451	17.21	1492.359	17.98	-0.77
103	0.9	-85760	-108539	17.23	1491.827	17.99	-0.76
103	1	-85807	-108628	17.13	1491.651	17.99	-0.86
103	1.1	-85855	-108717	17.37	1491.363	17.99	-0.62
103	1.2	-85902	-108805	17.53	1491.177	18.00	-0.47
103	1.3	-85950	-108894	17.70	1490.875	18.00	-0.30
103	1.4	-85997	-108983	17.76	1490.748	18.02	-0.26
103	1.5	-86044	-109071	17.84	1490.309	18.04	-0.20
103	1.6	-86092	-109160	17.82	1489.781	18.06	-0.23
103	1.7	-86139	-109249	17.90	1489.294	18.08	-0.18
103	1.8	-86187	-109337	17.93	1488.785	18.10	-0.17
103	1.9	-86234	-109426	17.92	1488.204	18.11	-0.19
103	2	-86282	-109515	17.99	1487.506	18.13	-0.14
103	2.1	-86329	-109603	18.01	1487.063	18.15	-0.14
103	2.2	-86377	-109692	18.04	1487.037	18.17	-0.13
103	2.3	-86424	-109781	18.07	1486.813	18.19	-0.12
103	2.4	-86472	-109869	18.09	1486.718	18.22	-0.13
103	2.5	-86519	-109958	18.08	1486.344	18.24	-0.17
103	2.6	-86567	-110047	18.09	1485.972	18.27	-0.18
103	2.7	-86614	-110135	18.12	1485.402	18.30	-0.17
103	2.8	-86661	-110224	18.15	1484.882	18.32	-0.18
103	2.9	-86709	-110312	18.16	1484.390	18.35	-0.18
103	3	-86756	-110401	18.28	1483.591	18.37	-0.09

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
103	3.1	-86804	-110490	18.27	1483.055	18.40	-0.13
103	3.2	-86851	-110578	18.27	1482.495	18.43	-0.16
103	3.3	-86899	-110667	18.24	1481.813	18.47	-0.23
103	3.4	-86946	-110756	18.30	1481.300	18.50	-0.20
103	3.5	-86994	-110844	18.40	1480.640	18.53	-0.13
103	3.6	-87041	-110933	18.50	1479.973	18.57	-0.07
103	3.7	-87089	-111022	18.50	1479.186	18.60	-0.10
103	3.8	-87136	-111110	18.51	1478.784	18.63	-0.12
103	3.9	-87183	-111199	18.57	1477.908	18.66	-0.10
103	4	-87231	-111288	18.60	1477.089	18.70	-0.10
103	4.1	-87278	-111376	18.60	1476.454	18.73	-0.13
103	4.2	-87326	-111465	18.61	1475.847	18.76	-0.15
103	4.3	-87373	-111554	18.68	1475.072	18.79	-0.11
103	4.4	-87421	-111642	18.73	1474.388	18.83	-0.11
103	4.5	-87468	-111731	18.71	1474.431	18.88	-0.16
103	4.6	-87516	-111820	18.80	1473.397	18.92	-0.12
103	4.7	-87563	-111908	18.86	1472.732	18.97	-0.11
103	4.8	-87611	-111997	18.92	1471.995	19.01	-0.09
103	4.9	-87658	-112086	18.95	1471.107	19.05	-0.10
103	5	-87706	-112174	19.07	1470.544	19.10	-0.03
103	5.1	-87753	-112263	19.09	1469.989	19.14	-0.05
103	5.2	-87800	-112352	19.18	1469.653	19.19	-0.00
103	5.3	-87848	-112440	19.27	1469.060	19.23	0.04
103	5.4	-87895	-112529	19.27	1468.761	19.27	0.00
103	5.5	-87943	-112618	19.35	1468.395	19.32	0.03
103	5.6	-87990	-112706	19.39	1467.978	19.36	0.03
103	5.7	-88038	-112795	19.44	1467.578	19.40	0.04
103	5.8	-88085	-112884	19.49	1467.225	19.45	0.04
103	5.9	-88133	-112972	19.54	1466.799	19.49	0.04
103	6	-88180	-113061	19.60	1466.405	19.54	0.06
103	6.1	-88228	-113150	19.60	1465.939	19.58	0.02
103	6.2	-88275	-113238	19.68	1465.497	19.62	0.05
103	6.3	-88323	-113327	19.68	1465.139	19.67	0.01
103	6.4	-88370	-113416	19.72	1464.706	19.71	0.01
103	6.5	-88417	-113504	19.70	1464.286	19.76	-0.05
103	6.6	-88465	-113593	19.69	1463.888	19.80	-0.11
103	6.7	-88512	-113682	19.76	1463.633	19.85	-0.09
103	6.8	-88560	-113770	19.81	1463.238	19.90	-0.09
103	6.9	-88550	-113872	19.90	1462.809	19.95	-0.05
103	7	-88540	-113974	20.02	1462.038	20.00	0.02
103	7.1	-88530	-114076	20.02	1462.045	20.02	-0.00
103	7.2	-88520	-114178	20.06	1461.665	20.04	0.02
103	7.3	-88510	-114280	20.10	1461.202	20.10	0.00
103	7.4	-88505	-114380	20.08	1460.670	20.15	-0.07
103	7.5	-88483	-114480	20.15	1459.871	20.20	-0.05
103	7.6	-88460	-114580	20.18	1458.799	20.25	-0.07
103	7.7	-88494	-114674	20.23	1457.543	20.28	-0.05
103	7.8	-88528	-114769	20.25	1456.732	20.28	-0.03
103	7.9	-88563	-114863	20.22	1455.905	20.26	-0.04
103	8	-88597	-114957	20.22	1455.176	20.22	0.00
103	8.1	-88631	-115052	20.16	1454.570	20.18	-0.02
103	8.2	-88665	-115146	20.12	1454.047	20.14	-0.02
103	8.3	-88699	-115240	20.01	1453.428	20.08	-0.07
103	8.4	-88734	-115335	19.91	1452.577	20.02	-0.11
103	8.5	-88768	-115429	19.80	1451.767	19.96	-0.16
103	8.6	-88802	-115523	19.85	1451.163	19.90	-0.05
103	8.7	-88836	-115617	19.85	1450.634	19.84	0.01

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
103	8.8	-88870	-115712	19.85	1450.056	19.82	0.03
103	8.9	-88905	-115806	19.84	1449.177	19.79	0.05
103	9	-88939	-115900	19.84	1448.721	19.78	0.06
103	9.1	-88973	-115995	19.80	1448.293	19.77	0.03
103	9.2	-89007	-116089	19.76	1447.741	19.76	0.00
103	9.3	-89041	-116183	19.77	1447.210	19.75	0.02
103	9.4	-89076	-116278	19.73	1446.857	19.74	-0.01
103	9.5	-89110	-116372	19.73	1446.565	19.73	0.00
103	9.6	-89144	-116466	19.71	1446.247	19.72	-0.01
103	9.7	-89178	-116561	19.67	1445.798	19.70	-0.03
103	9.8	-89212	-116655	19.71	1445.467	19.69	0.02
103	9.9	-89247	-116749	19.66	1445.052	19.68	-0.02
103	10	-89281	-116844	19.68	1444.640	19.71	-0.03
103	10.1	-89315	-116938	19.72	1444.308	19.74	-0.02
103	10.2	-89349	-117032	19.74	1443.996	19.76	-0.02
103	10.3	-89384	-117127	19.73	1443.688	19.79	-0.06
103	10.4	-89418	-117221	19.80	1443.425	19.82	-0.02
103	10.5	-89452	-117315	19.84	1443.061	19.86	-0.02
103	10.6	-89486	-117410	19.88	1442.850	19.90	-0.02
103	10.7	-89520	-117504	19.97	1442.466	20.00	-0.03
103	10.8	-89555	-117598	20.06	1442.211	20.10	-0.04
103	10.9	-89589	-117692	20.16	1441.906	20.20	-0.04
103	11	-89623	-117787	20.26	1441.631	20.33	-0.07
103	11.1	-89657	-117881	20.39	1441.377	20.47	-0.08
103	11.2	-89691	-117975	20.58	1441.103	20.60	-0.02
103	11.3	-89726	-118070	20.75	1440.759	20.76	-0.01
103	11.4	-89760	-118164	20.92	1440.501	20.93	-0.01
103	11.5	-89794	-118258	21.03	1440.128	21.10	-0.07
103	11.6	-89828	-118353	21.19	1439.647	21.23	-0.04
103	11.7	-89862	-118447	21.31	1439.085	21.37	-0.06
103	11.8	-89897	-118541	21.49	1438.568	21.50	-0.01
103	11.9	-89931	-118636	21.60	1438.031	21.60	0.00
103	12	-89965	-118730	21.80	1437.513	21.80	0.00
104	0.1	-85400	-107780	16.99	1494.329	18.00	-1.01
104	0.2	-85493	-107749	17.32	1495.174	17.97	-0.65
104	0.3	-85586	-107718	17.18	1494.186	17.93	-0.75
104	0.4	-85679	-107687	17.22	1494.201	17.90	-0.68
104	0.5	-85771	-107656	17.57	1494.275	17.87	-0.30
104	0.6	-85864	-107625	17.62	1494.504	17.83	-0.21
104	0.7	-85957	-107593	17.61	1494.876	17.80	-0.19
104	0.8	-86050	-107562	17.56	1495.247	17.77	-0.22
104	0.9	-86143	-107531	17.53	1495.500	17.74	-0.21
104	1	-86236	-107500	17.43	1495.772	17.71	-0.28
104	1.1	-86328	-107469	17.40	1496.115	17.69	-0.29
104	1.2	-86421	-107438	17.34	1496.194	17.66	-0.32
104	1.3	-86514	-107407	17.37	1496.508	17.63	-0.26
104	1.4	-86607	-107376	17.32	1496.650	17.60	-0.28
104	1.5	-86700	-107345	17.28	1496.934	17.56	-0.28
104	1.6	-86793	-107314	17.18	1497.140	17.52	-0.34
104	1.7	-86885	-107282	17.06	1497.230	17.48	-0.42
104	1.8	-86978	-107251	16.83	1497.302	17.44	-0.61
104	1.9	-87071	-107220	16.54	1497.335	17.40	-0.86
104	2	-87164	-107189	16.23	1497.353	17.34	-1.11
104	2.1	-87257	-107158	16.06	1497.525	17.28	-1.22
104	2.2	-87350	-107127	15.79	1497.560	17.24	-1.45
104	2.3	-87442	-107096	15.96	1497.585	17.19	-1.23
104	2.4	-87535	-107065	15.96	1497.482	17.17	-1.21

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
104	2.5	-87628	-107034	16.09	1497.285	17.17	-1.08
104	2.6	-87721	-107003	15.97	1497.134	17.16	-1.19
104	2.7	-87814	-106971	15.99	1497.003	17.16	-1.17
104	2.8	-87907	-106940	16.08	1496.697	17.16	-1.08
104	2.9	-88000	-106909	16.19	1496.336	17.17	-0.98
104	3	-88092	-106878	16.19	1496.248	17.18	-0.99
104	3.1	-88185	-106847	16.65	1496.292	17.20	-0.55
104	3.2	-88278	-106816	16.77	1496.119	17.26	-0.49
104	3.3	-88371	-106785	16.91	1495.454	17.32	-0.41
104	3.4	-88464	-106754	17.03	1495.069	17.38	-0.35
104	3.5	-88557	-106723	17.14	1494.916	17.45	-0.31
104	3.6	-88649	-106692	17.30	1494.744	17.51	-0.21
104	3.7	-88742	-106660	17.40	1494.624	17.58	-0.18
104	3.8	-88835	-106629	17.43	1494.286	17.64	-0.21
104	3.9	-88928	-106598	17.56	1493.991	17.70	-0.14
104	4	-89120	-106540	17.62	1493.894	17.75	-0.13
104	4.1	-89208	-106499	17.54	1493.495	17.80	-0.26
104	4.2	-89296	-106458	17.90	1492.831	17.87	0.03
104	4.3	-89384	-106417	17.97	1492.500	17.93	0.04
104	4.4	-89472	-106376	18.05	1492.315	18.00	0.05
104	4.5	-89560	-106335	18.10	1492.201	18.07	0.03
104	4.6	-89648	-106294	18.18	1491.888	18.14	0.04
104	4.7	-89736	-106253	18.03	1491.427	18.20	-0.17
104	4.8	-89824	-106212	18.30	1490.953	18.27	0.03
104	4.9	-89912	-106171	18.39	1490.657	18.34	0.05
104	5	-90000	-106130	18.44	1490.778	18.42	0.02
105	0.1	-83338	-105587	18.31	1492.349	19.38	-1.07
105	0.2	-83415	-105524	18.30	1491.446	19.35	-1.05
105	0.3	-83493	-105462	18.21	1492.540	19.32	-1.11
105	0.4	-83570	-105399	18.08	1493.438	19.29	-1.21
105	0.5	-83648	-105336	18.18	1493.859	19.26	-1.08
105	0.6	-83726	-105273	18.34	1494.313	19.23	-0.89
105	0.7	-83803	-105211	18.31	1494.514	19.20	-0.89
105	0.8	-83881	-105148	18.39	1494.690	19.16	-0.77
105	0.9	-83958	-105085	18.39	1494.597	19.14	-0.75
105	1	-84036	-105022	18.33	1494.386	19.10	-0.77
105	1.1	-84113	-104960	18.40	1494.134	19.05	-0.65
105	1.2	-84191	-104897	18.30	1493.840	19.01	-0.71
105	1.3	-84269	-104834	18.33	1493.341	18.97	-0.64
105	1.4	-84346	-104771	18.27	1493.390	18.94	-0.67
105	1.5	-84424	-104709	18.42	1493.199	18.89	-0.47
105	1.6	-84501	-104646	18.28	1492.788	18.84	-0.56
105	1.7	-84579	-104583	18.34	1492.630	18.79	-0.45
105	1.8	-84657	-104520	18.33	1492.268	18.73	-0.40
105	1.9	-84734	-104458	18.20	1492.020	18.67	-0.47
105	2	-84812	-104395	18.20	1491.612	18.61	-0.41
105	2.1	-84889	-104332	17.95	1491.351	18.50	-0.55
105	2.2	-84967	-104269	17.78	1491.051	18.39	-0.61
105	2.3	-85044	-104207	17.81	1490.897	18.20	-0.39
105	2.4	-85122	-104144	17.78	1491.051	18.10	-0.32
105	2.5	-85200	-104081	17.78	1492.067	17.99	-0.21
105	2.6	-85277	-104018	17.72	1494.669	17.95	-0.23
105	2.7	-85355	-103956	17.81	1494.842	17.92	-0.11
105	2.8	-85432	-103893	17.88	1497.492	17.91	-0.03
105	2.9	-85510	-103830	17.91	1499.120	17.92	-0.01
106	0.2	-84674	-102456	17.27	1498.740	18.20	-0.93
106	0.3	-84760	-102409	17.33	1499.006	18.21	-0.88

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
106	0.4	-84847	-102362	17.36	1498.995	18.25	-0.89
106	0.5	-84934	-102315	17.28	1499.131	18.30	-1.02
106	0.6	-85021	-102268	17.42	1499.309	18.40	-0.98
106	0.7	-85108	-102220	17.68	1499.291	18.48	-0.79
106	0.8	-85195	-102173	17.70	1499.447	18.55	-0.85
106	0.9	-85281	-102126	17.74	1499.650	18.63	-0.89
106	1	-85368	-102079	17.85	1499.814	18.71	-0.86
106	1.1	-85455	-102032	17.94	1500.014	18.79	-0.84
106	1.2	-85542	-101985	18.11	1500.109	18.86	-0.76
106	1.3	-85629	-101938	18.24	1500.156	18.94	-0.70
106	1.4	-85716	-101891	18.45	1500.267	19.02	-0.56
106	1.5	-85802	-101844	18.38	1500.263	19.09	-0.71
106	1.6	-85889	-101797	18.01	1500.339	19.17	-1.16
106	1.7	-85976	-101750	18.40	1500.206	19.25	-0.84
106	1.8	-86063	-101703	18.72	1499.751	19.32	-0.61
106	1.9	-86150	-101656	18.57	1500.587	19.40	-0.83
106	2	-86237	-101609	18.64	1500.831	19.43	-0.79
106	2.1	-86323	-101561	18.66	1500.882	19.46	-0.80
106	2.2	-86410	-101514	18.65	1500.773	19.48	-0.83
106	2.3	-86497	-101467	18.59	1500.614	19.46	-0.87
106	2.4	-86584	-101420	18.48	1500.412	19.43	-0.95
106	2.5	-86671	-101373	18.42	1499.992	19.40	-0.98
106	2.6	-86758	-101326	18.38	1499.502	19.33	-0.95
106	2.7	-86844	-101279	18.38	1499.208	19.25	-0.87
106	2.8	-86931	-101232	18.23	1499.091	19.18	-0.95
106	2.9	-87018	-101185	18.32	1499.144	19.10	-0.78
106	3	-87105	-101138	18.41	1499.053	19.03	-0.61
106	3.1	-87192	-101091	18.63	1499.257	18.95	-0.32
106	3.2	-87279	-101044	18.53	1499.643	18.88	-0.34
106	3.3	-87365	-100997	18.02	1500.173	18.80	-0.78
106	3.4	-87452	-100950	18.16	1500.593	18.73	-0.56
106	3.5	-87539	-100902	18.06	1501.251	18.65	-0.59
106	3.6	-87626	-100855	17.84	1501.812	18.58	-0.74
106	3.7	-87713	-100808	18.02	1501.995	18.50	-0.48
106	3.8	-87800	-100761	18.17	1502.453	18.43	-0.26
106	3.9	-87886	-100714	18.13	1502.700	18.35	-0.22
106	4	-87973	-100667	18.03	1502.937	18.28	-0.25
106	4.1	-88060	-100620	17.89	1503.170	18.20	-0.31
106	4.2	-88013	-100531	17.96	1503.386	18.18	-0.22
106	4.3	-87966	-100441	17.92	1503.330	18.17	-0.25
106	4.4	-87919	-100352	17.83	1503.385	18.15	-0.32
106	4.5	-87872	-100262	18.00	1503.549	18.13	-0.13
106	4.6	-87825	-100173	17.86	1503.499	18.12	-0.26
106	4.7	-87778	-100084	17.91	1503.457	18.10	-0.19
106	4.8	-87714	-100018	17.84	1503.580	18.10	-0.26
106	4.9	-87625	-99989	17.90	1503.628	18.15	-0.25
106	5	-87535	-99960	17.89	1503.490	18.20	-0.31
106	5.1	-87446	-99931	18.01	1503.427	18.25	-0.23
106	5.2	-87356	-99902	18.15	1503.385	18.30	-0.15
106	5.3	-87267	-99872	18.18	1503.423	18.34	-0.16
106	5.4	-87178	-99843	18.12	1503.435	18.39	-0.27
106	5.5	-87088	-99814	18.12	1503.521	18.44	-0.32
106	5.6	-86999	-99785	18.18	1503.300	18.49	-0.31
106	5.7	-86909	-99756	18.09	1503.595	18.54	-0.45
106	5.8	-86820	-99726	18.16	1503.459	18.58	-0.43
106	5.9	-86730	-99697	18.02	1503.433	18.63	-0.62
106	6	-86641	-99668	18.13	1503.261	18.68	-0.55

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
106	6.1	-86551	-99639	17.96	1502.661	18.73	-0.77
106	6.2	-86462	-99610	17.79	1502.441	18.78	-0.98
106	6.3	-86373	-99580	17.76	1502.895	18.82	-1.06
107	0.1	-83746	-105867	18.05	1494.156	19.09	-1.04
107	0.2	-83823	-105803	18.17	1494.299	19.05	-0.88
107	0.3	-83899	-105740	18.02	1494.267	19.01	-0.99
107	0.4	-83975	-105677	18.15	1494.138	18.98	-0.83
107	0.5	-84051	-105613	18.27	1493.973	18.95	-0.68
107	0.6	-84128	-105550	18.33	1493.820	18.92	-0.59
107	0.7	-84204	-105487	18.37	1493.661	18.89	-0.52
107	0.8	-84280	-105423	18.49	1493.110	18.86	-0.37
107	0.9	-84356	-105360	18.30	1492.758	18.83	-0.53
107	1	-84433	-105297	18.20	1492.386	18.80	-0.60
107	1.1	-84509	-105233	18.31	1490.967	18.76	-0.45
107	1.2	-84585	-105170	18.33	1490.466	18.72	-0.39
107	1.3	-84661	-105107	18.42	1490.314	18.68	-0.26
107	1.4	-84738	-105043	18.27	1490.436	18.64	-0.37
107	1.5	-84814	-104980	18.19	1491.700	18.60	-0.41
107	1.6	-84890	-104917	18.21	1491.945	18.55	-0.34
107	1.7	-84966	-104853	18.01	1491.784	18.50	-0.49
107	1.8	-85043	-104790	17.87	1491.684	18.45	-0.58
107	1.9	-85119	-104727	17.96	1490.773	18.40	-0.44
107	2	-85195	-104663	18.04	1490.743	18.30	-0.26
107	2.1	-85271	-104600	17.87	1491.434	18.21	-0.34
107	2.2	-85348	-104537	17.88	1493.858	18.10	-0.22
107	2.3	-85424	-104473	17.82	1494.022	18.00	-0.18
107	2.4	-85500	-104410	17.85	1494.576	17.95	-0.10
108	0.1	-83546	-105717	18.18	1493.851	19.23	-1.05
108	0.2	-83622	-105653	18.23	1493.801	19.21	-0.98
108	0.3	-83698	-105590	18.10	1493.655	19.20	-1.10
108	0.4	-83775	-105526	18.13	1493.613	19.16	-1.03
108	0.5	-83851	-105463	18.23	1493.786	19.13	-0.89
108	0.6	-83927	-105399	18.32	1494.030	19.09	-0.77
108	0.7	-84003	-105336	18.29	1494.144	19.06	-0.77
108	0.8	-84079	-105272	18.23	1494.249	19.02	-0.79
108	0.9	-84155	-105209	18.26	1493.785	18.98	-0.72
108	1	-84232	-105145	18.40	1493.361	18.95	-0.55
108	1.1	-84308	-105082	18.48	1493.245	18.91	-0.43
108	1.2	-84384	-105018	18.42	1492.718	18.88	-0.45
108	1.3	-84460	-104955	18.36	1492.525	18.84	-0.48
108	1.4	-84536	-104892	18.30	1493.037	18.80	-0.51
108	1.5	-84612	-104828	18.22	1492.335	18.75	-0.53
108	1.6	-84688	-104765	18.26	1492.057	18.70	-0.44
108	1.7	-84765	-104701	18.36	1491.801	18.65	-0.29
108	1.8	-84841	-104638	18.30	1491.672	18.60	-0.30
108	1.9	-84917	-104574	18.12	1491.722	18.53	-0.41
108	2	-84993	-104511	17.94	1491.377	18.47	-0.53
108	2.1	-85069	-104447	17.91	1490.447	18.40	-0.49
108	2.2	-85145	-104384	17.94	1490.146	18.22	-0.28
108	2.3	-85222	-104320	17.91	1491.756	18.18	-0.27
108	2.4	-85298	-104257	17.93	1493.385	18.02	-0.09
108	2.5	-85374	-104193	17.92	1496.931	17.95	-0.03
108	2.6	-85450	-104130	17.88	1496.872	17.90	-0.02
109	0.1	-87535	-101352	18.14	1498.956	18.92	-0.78
109	0.2	-87451	-101393	18.25	1498.331	18.99	-0.73
109	0.3	-87366	-101435	18.10	1497.791	19.05	-0.95
109	0.4	-87282	-101477	18.59	1497.399	19.12	-0.53

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
109	0.5	-87197	-101518	18.70	1497.605	19.18	-0.48
109	0.6	-87113	-101560	18.69	1498.236	19.25	-0.56
109	0.7	-87028	-101602	18.69	1498.707	19.32	-0.62
109	0.8	-86944	-101643	18.70	1499.155	19.38	-0.68
110	0.1	-88068	-102443	18.74	1497.881	19.15	-0.41
110	0.2	-87976	-102486	18.90	1497.558	19.21	-0.31
110	0.3	-87884	-102529	18.88	1497.898	19.27	-0.39
110	0.4	-87791	-102571	18.49	1498.681	19.31	-0.82
110	0.5	-87699	-102614	18.86	1499.605	19.34	-0.48
110	0.6	-87607	-102657	18.87	1500.346	19.36	-0.49
110	0.7	-87515	-102700	18.88	1500.760	19.37	-0.49
110	0.8	-87423	-102743	18.95	1500.943	19.38	-0.43
110	0.9	-87331	-102786	18.94	1500.907	19.38	-0.44
110	1	-87239	-102829	18.87	1500.805	19.37	-0.50
110	1.1	-87146	-102871	18.83	1500.644	19.35	-0.52
110	1.2	-87054	-102914	18.72	1500.211	19.30	-0.58
110	1.3	-86962	-102957	18.79	1499.422	19.25	-0.46
110	1.4	-86870	-103000	18.52	1498.992	19.20	-0.68
111	0.1	-88459	-103342	19.08	1500.448	19.30	-0.22
111	0.2	-88368	-103383	19.15	1500.319	19.31	-0.16
111	0.3	-88277	-103425	19.04	1500.349	19.32	-0.28
111	0.4	-88186	-103466	18.87	1500.261	19.32	-0.45
111	0.5	-88095	-103508	19.14	1500.331	19.31	-0.17
111	0.6	-88004	-103549	19.08	1500.192	19.30	-0.22
111	0.7	-87913	-103591	18.98	1500.114	19.28	-0.30
111	0.8	-87822	-103632	18.91	1500.130	19.25	-0.34
111	0.9	-87731	-103674	18.86	1499.977	19.21	-0.35
111	1	-87640	-103715	18.76	1499.448	19.15	-0.39
111	1.1	-87549	-103757	18.46	1498.380	19.10	-0.64
111	1.2	-87458	-103798	18.40	1497.562	19.05	-0.65
111	1.3	-87367	-103840	18.41	1497.647	19.00	-0.59
111	1.4	-87276	-103881	18.53	1498.648	18.91	-0.38
111	1.5	-87185	-103923	18.65	1498.969	18.83	-0.18
111	1.6	-87094	-103964	18.79	1499.034	18.74	0.04
111	1.7	-87003	-104006	18.75	1498.926	18.66	0.09
111	1.8	-86912	-104047	18.71	1498.423	18.57	0.14
111	1.9	-86821	-104089	18.72	1498.186	18.48	0.24
111	2	-86730	-104130	18.55	1497.710	18.40	0.15
111	2.1	-86628	-104161	18.50	1497.626	18.28	0.22
111	2.2	-86527	-104192	18.37	1497.212	18.16	0.21
111	2.3	-86425	-104222	18.31	1497.026	18.04	0.27
111	2.4	-86324	-104253	18.13	1496.926	17.92	0.21
111	2.5	-86222	-104284	17.88	1497.213	17.80	0.08
111	2.6	-86121	-104315	17.64	1497.966	17.76	-0.12
111	2.7	-86019	-104345	17.51	1498.693	17.72	-0.21
111	2.8	-85918	-104376	17.52	1498.062	17.68	-0.16
111	2.9	-85816	-104407	17.52	1498.568	17.74	-0.22
111	3	-85715	-104438	17.57	1495.919	17.80	-0.23
111	3.1	-85613	-104468	17.57	1494.795	17.87	-0.30
111	3.2	-85512	-104499	17.78	1494.608	17.94	-0.16
111	3.3	-85410	-104530	17.97	1494.176	18.00	-0.03
112	0.1	-88858	-104272	18.95	1497.471	19.21	-0.26
112	0.2	-88766	-104314	18.96	1497.787	19.20	-0.24
112	0.3	-88674	-104355	18.82	1498.126	19.15	-0.33
112	0.4	-88581	-104397	18.81	1498.587	19.10	-0.29
112	0.5	-88489	-104439	18.82	1499.059	19.05	-0.23
112	0.6	-88397	-104481	18.72	1499.321	19.00	-0.28

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
112	0.7	-88305	-104523	18.62	1499.556	18.94	-0.32
112	0.8	-88213	-104565	18.16	1499.683	18.88	-0.72
112	0.9	-88121	-104606	18.49	1499.739	18.82	-0.33
112	1	-88029	-104648	18.41	1499.879	18.77	-0.36
112	1.1	-87936	-104690	18.44	1499.941	18.71	-0.27
112	1.2	-87844	-104732	18.39	1500.059	18.66	-0.27
112	1.3	-87752	-104774	18.18	1500.053	18.60	-0.42
112	1.4	-87660	-104816	18.24	1499.787	18.50	-0.26
112	1.5	-87568	-104857	18.15	1499.739	18.40	-0.25
112	1.6	-87476	-104899	17.98	1499.521	18.30	-0.32
112	1.7	-87384	-104941	17.79	1499.344	18.20	-0.41
112	1.8	-87292	-104983	17.63	1499.148	18.10	-0.47
112	1.9	-87199	-105025	17.42	1498.966	18.00	-0.58
112	2	-87107	-105066	17.06	1498.755	17.87	-0.81
112	2.1	-87015	-105108	16.87	1498.686	17.73	-0.86
112	2.2	-86923	-105150	16.79	1498.650	17.60	-0.81
112	2.3	-86831	-105192	16.75	1498.530	17.57	-0.82
112	2.4	-86739	-105234	16.69	1498.353	17.54	-0.85
112	2.5	-86647	-105276	16.60	1498.233	17.51	-0.91
112	2.6	-86554	-105317	16.54	1498.135	17.48	-0.94
112	2.7	-86462	-105359	16.49	1498.027	17.51	-1.02
112	2.8	-86370	-105401	16.88	1497.970	17.54	-0.66
112	2.9	-86278	-105443	17.03	1497.788	17.57	-0.54
112	3	-86186	-105485	17.20	1497.285	17.60	-0.40
112	3.1	-86094	-105527	17.60	1496.828	17.70	-0.10
113	0.1	-89286	-105277	18.45	1493.086	18.80	-0.35
113	0.2	-89192	-105313	18.39	1493.205	18.73	-0.34
113	0.3	-89098	-105350	18.31	1493.754	18.66	-0.34
113	0.4	-89004	-105387	18.15	1494.553	18.59	-0.44
113	0.5	-88910	-105424	18.35	1495.473	18.52	-0.17
113	0.6	-88815	-105460	18.12	1496.416	18.45	-0.32
113	0.7	-88721	-105497	17.92	1496.981	18.37	-0.45
113	0.8	-88627	-105534	17.92	1497.236	18.30	-0.38
113	0.9	-88533	-105570	17.91	1497.670	18.23	-0.33
113	1	-88439	-105607	17.81	1497.903	18.16	-0.36
113	1.1	-88345	-105644	17.88	1498.019	18.09	-0.21
113	1.2	-88251	-105681	17.81	1498.304	18.02	-0.21
113	1.3	-88157	-105717	17.76	1498.311	17.95	-0.19
113	1.4	-88063	-105754	17.68	1498.361	17.88	-0.19
113	1.5	-87969	-105791	17.44	1498.255	17.81	-0.36
113	1.6	-87874	-105828	17.30	1498.388	17.70	-0.40
113	1.7	-87780	-105864	17.08	1498.622	17.60	-0.52
113	1.8	-87686	-105901	17.12	1498.691	17.55	-0.43
113	1.9	-87592	-105938	17.08	1498.655	17.50	-0.42
113	2	-87498	-105974	17.02	1498.583	17.45	-0.43
113	2.1	-87404	-106011	16.88	1498.551	17.40	-0.52
113	2.2	-87310	-106048	16.78	1498.667	17.38	-0.60
113	2.3	-87216	-106085	16.63	1498.717	17.37	-0.74
113	2.4	-87122	-106121	16.45	1498.787	17.36	-0.91
113	2.5	-87028	-106158	16.39	1498.561	17.35	-0.96
113	2.6	-86933	-106195	16.43	1498.362	17.36	-0.93
113	2.7	-86839	-106231	16.68	1498.203	17.37	-0.69
113	2.8	-86745	-106268	16.72	1498.282	17.38	-0.66
113	2.9	-86651	-106305	16.91	1498.253	17.40	-0.49
113	3	-86557	-106342	17.00	1498.077	17.48	-0.48
114	0.1	-84287	-106752	17.97	1491.229	18.58	-0.61
114	0.2	-84214	-106823	17.93	1490.748	18.61	-0.68

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
114	0.3	-84142	-106895	18.17	1490.460	18.64	-0.47
114	0.4	-84069	-106967	18.05	1490.405	18.67	-0.62
114	0.5	-83996	-107039	17.87	1490.405	18.70	-0.83
114	0.6	-83923	-107110	17.78	1490.545	18.74	-0.96
114	0.7	-83851	-107182	17.89	1490.598	18.77	-0.88
114	0.8	-83778	-107254	17.91	1490.629	18.80	-0.89
114	0.9	-83705	-107326	17.90	1490.592	18.84	-0.94
114	1	-83632	-107397	17.65	1490.441	18.88	-1.23
114	1.1	-83560	-107469	17.63	1490.297	18.92	-1.29
114	1.2	-83487	-107541	17.86	1489.970	18.96	-1.10
114	1.3	-83414	-107612	17.90	1488.883	19.00	-1.10
114	1.4	-83341	-107684	17.91	1488.781	19.04	-1.13
114	1.5	-83269	-107756	18.08	1488.791	19.08	-1.00
114	1.6	-83196	-107828	18.11	1489.129	19.12	-1.01
114	1.7	-83123	-107899	18.04	1489.432	19.16	-1.12
114	1.8	-83050	-107971	18.00	1489.575	19.20	-1.20
114	1.9	-82978	-108043	17.97	1489.723	19.25	-1.28
114	2	-82905	-108114	17.96	1489.673	19.30	-1.34
114	2.1	-82832	-108186	17.94	1489.622	19.35	-1.41
114	2.2	-82759	-108258	17.96	1489.593	19.40	-1.44
114	2.3	-82687	-108330	18.00	1489.577	19.45	-1.45
114	2.4	-82614	-108401	18.06	1489.530	19.50	-1.44
114	2.5	-82541	-108473	18.01	1489.566	19.55	-1.54
114	2.6	-82468	-108545	18.23	1489.533	19.60	-1.37
114	2.7	-82396	-108617	18.41	1489.420	19.65	-1.24
114	2.8	-82323	-108688	18.55	1489.296	19.70	-1.15
114	2.9	-82250	-108760	18.59	1489.132	19.75	-1.16
115	0.1	-84598	-107071	17.88	1493.368	18.35	-0.47
115	0.2	-84526	-107141	17.70	1492.304	18.37	-0.67
115	0.3	-84454	-107212	17.55	1490.633	18.40	-0.85
115	0.4	-84383	-107282	17.64	1490.074	18.44	-0.80
115	0.5	-84311	-107353	17.70	1490.159	18.48	-0.78
115	0.6	-84239	-107423	17.69	1490.253	18.52	-0.83
115	0.7	-84167	-107494	17.47	1490.202	18.56	-1.09
115	0.8	-84095	-107564	17.37	1490.185	18.60	-1.23
115	0.9	-84023	-107635	17.30	1490.257	18.64	-1.34
115	1	-83951	-107705	17.31	1490.320	18.68	-1.37
115	1.1	-83879	-107776	17.52	1490.017	18.72	-1.20
115	1.2	-83808	-107846	17.54	1489.895	18.76	-1.22
115	1.3	-83736	-107917	17.65	1489.821	18.80	-1.15
115	1.4	-83664	-107987	17.68	1489.847	18.84	-1.16
115	1.5	-83592	-108058	17.63	1489.917	18.88	-1.25
115	1.6	-83520	-108128	17.70	1489.817	18.92	-1.22
115	1.7	-83448	-108199	17.64	1489.657	18.96	-1.32
115	1.8	-83376	-108269	17.53	1489.679	19.00	-1.47
115	1.9	-83305	-108340	17.65	1489.769	19.05	-1.40
115	2	-83233	-108410	17.72	1489.728	19.10	-1.38
115	2.1	-83161	-108481	17.86	1489.738	19.15	-1.29
115	2.2	-83089	-108551	17.87	1489.557	19.20	-1.33
115	2.3	-83017	-108622	17.95	1489.499	19.25	-1.30
115	2.4	-82945	-108692	17.92	1489.485	19.30	-1.38
115	2.5	-82873	-108763	17.89	1489.418	19.35	-1.46
115	2.6	-82802	-108833	17.74	1489.210	19.40	-1.66
115	2.7	-82730	-108904	17.91	1489.122	19.45	-1.54
115	2.8	-82658	-108974	18.11	1489.152	19.50	-1.39
115	2.9	-82586	-109045	18.19	1488.881	19.55	-1.36
116	0.1	-84887	-107390	17.03	1493.565	18.18	-1.15

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
116	0.2	-84815	-107460	17.30	1493.060	18.20	-0.90
116	0.3	-84742	-107530	17.55	1492.471	18.24	-0.69
116	0.4	-84669	-107600	17.58	1491.945	18.28	-0.70
116	0.5	-84597	-107670	17.50	1491.034	18.32	-0.82
116	0.6	-84524	-107740	17.52	1490.450	18.36	-0.84
116	0.7	-84451	-107810	17.48	1490.199	18.40	-0.92
116	0.8	-84378	-107880	17.31	1490.197	18.44	-1.13
116	0.9	-84306	-107950	17.36	1490.081	18.48	-1.12
116	1	-84233	-108020	17.35	1490.086	18.52	-1.17
116	1.1	-84160	-108090	17.30	1489.916	18.56	-1.26
116	1.2	-84088	-108160	17.24	1489.863	18.60	-1.36
116	1.3	-84015	-108230	17.10	1489.655	18.65	-1.55
116	1.4	-83942	-108300	17.21	1489.781	18.70	-1.49
116	1.5	-83870	-108369	17.38	1489.940	18.75	-1.37
116	1.6	-83797	-108439	17.50	1490.105	18.80	-1.30
116	1.7	-83724	-108509	17.53	1490.052	18.85	-1.32
116	1.8	-83651	-108579	17.52	1489.905	18.90	-1.38
116	1.9	-83579	-108649	17.62	1489.584	18.95	-1.33
116	2	-83506	-108719	17.76	1489.698	19.00	-1.24
116	2.1	-83433	-108789	17.85	1489.641	19.05	-1.20
116	2.2	-83361	-108859	17.94	1489.554	19.10	-1.16
116	2.3	-83288	-108929	18.01	1489.494	19.15	-1.14
116	2.4	-83215	-108999	17.95	1489.434	19.20	-1.25
116	2.5	-83143	-109069	17.92	1489.662	19.25	-1.33
116	2.6	-83070	-109139	17.92	1489.687	19.30	-1.38
116	2.7	-82997	-109209	17.72	1489.584	19.35	-1.63
116	2.8	-82925	-109279	17.39	1489.334	19.40	-2.01
116	2.9	-82852	-109349	17.93	1489.188	19.44	-1.51
117	0.1	-85165	-107694	17.48	1494.058	18.05	-0.57
117	0.2	-85091	-107768	17.58	1493.760	18.09	-0.51
117	0.3	-85016	-107842	17.54	1493.012	18.12	-0.58
117	0.4	-84941	-107916	17.58	1491.812	18.15	-0.57
117	0.5	-84867	-107990	17.42	1490.727	18.19	-0.77
117	0.6	-84792	-108064	17.44	1490.246	18.24	-0.80
117	0.7	-84717	-108138	17.62	1489.953	18.28	-0.66
117	0.8	-84643	-108211	17.56	1490.127	18.32	-0.76
117	0.9	-84568	-108285	17.70	1490.073	18.36	-0.66
117	1	-84494	-108359	17.65	1490.020	18.40	-0.75
117	1.1	-84419	-108433	17.67	1490.148	18.45	-0.79
117	1.2	-84344	-108507	17.67	1490.195	18.51	-0.84
117	1.3	-84270	-108581	17.61	1490.175	18.56	-0.95
117	1.4	-84195	-108655	17.54	1490.226	18.61	-1.07
117	1.5	-84120	-108729	17.70	1490.210	18.67	-0.96
117	1.6	-84046	-108803	17.68	1490.271	18.72	-1.03
117	1.7	-83971	-108877	17.70	1490.246	18.77	-1.07
117	1.8	-83896	-108951	17.69	1490.163	18.82	-1.13
117	1.9	-83822	-109025	17.73	1490.083	18.88	-1.14
117	2	-83747	-109099	17.75	1489.963	18.93	-1.18
117	2.1	-83672	-109173	17.74	1489.890	18.98	-1.24
117	2.2	-83598	-109246	17.66	1489.717	19.04	-1.37
117	2.3	-83523	-109320	17.82	1489.593	19.09	-1.27
117	2.4	-83449	-109394	17.92	1489.627	19.14	-1.22
117	2.5	-83374	-109468	17.92	1489.789	19.19	-1.27
117	2.6	-83299	-109542	17.80	1489.789	19.25	-1.45
117	2.7	-83225	-109616	17.98	1489.491	19.30	-1.32
117	2.8	-83150	-109690	18.10	1489.182	19.35	-1.25
118	0.1	-85287	-108249	17.53	1492.391	18.08	-0.55

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
118	0.2	-85214	-108318	17.60	1491.603	18.11	-0.51
118	0.3	-85141	-108388	17.70	1491.111	18.14	-0.44
118	0.4	-85068	-108457	17.68	1490.984	18.17	-0.49
118	0.5	-84995	-108526	17.63	1491.177	18.20	-0.57
118	0.6	-84922	-108595	17.50	1491.298	18.25	-0.75
118	0.7	-84849	-108664	17.46	1491.225	18.30	-0.84
118	0.8	-84776	-108734	17.52	1490.953	18.35	-0.83
118	0.9	-84703	-108803	17.49	1490.771	18.40	-0.91
118	1	-84630	-108872	17.60	1490.530	18.45	-0.85
118	1.1	-84557	-108941	17.62	1490.545	18.50	-0.88
118	1.2	-84484	-109010	17.61	1490.768	18.56	-0.94
118	1.3	-84411	-109080	17.61	1490.795	18.61	-1.00
118	1.4	-84338	-109149	17.65	1490.651	18.66	-1.01
118	1.5	-84265	-109218	17.65	1490.507	18.71	-1.07
118	1.6	-84192	-109287	17.67	1490.241	18.76	-1.10
118	1.7	-84119	-109356	17.76	1489.843	18.82	-1.06
118	1.8	-84046	-109426	17.90	1489.767	18.87	-0.97
118	1.9	-83973	-109495	17.85	1489.788	18.92	-1.07
118	2	-83900	-109564	17.92	1489.746	18.97	-1.05
118	2.1	-83827	-109633	17.76	1489.690	19.02	-1.26
118	2.2	-83754	-109702	17.82	1489.646	19.08	-1.26
118	2.3	-83681	-109772	18.04	1489.536	19.13	-1.09
118	2.4	-83608	-109841	18.12	1489.351	19.18	-1.06
118	2.5	-83535	-109910	18.17	1489.096	19.23	-1.06
118	2.6	-83462	-109979	18.22	1488.864	19.28	-1.06
119	0.1	-85147	-109063	17.60	1491.035	18.30	-0.70
119	0.2	-85073	-109136	17.63	1490.717	18.36	-0.72
119	0.3	-85000	-109209	17.51	1490.462	18.41	-0.90
119	0.4	-84926	-109282	17.48	1490.369	18.47	-0.99
119	0.5	-84853	-109355	17.55	1490.263	18.52	-0.98
119	0.6	-84779	-109428	17.64	1490.373	18.58	-0.94
119	0.7	-84706	-109500	17.78	1490.353	18.64	-0.86
119	0.8	-84632	-109573	17.87	1490.063	18.69	-0.82
119	0.9	-84559	-109646	17.95	1489.751	18.75	-0.80
119	1	-84486	-109719	18.02	1489.393	18.80	-0.78
119	1.1	-84412	-109792	18.07	1489.170	18.85	-0.78
119	1.2	-84339	-109865	18.10	1489.215	18.90	-0.80
119	1.3	-84265	-109938	18.19	1489.273	18.95	-0.76
119	1.4	-84192	-110011	18.19	1489.356	19.00	-0.81
119	1.5	-84118	-110084	18.25	1489.249	19.05	-0.80
119	1.6	-84045	-110157	18.25	1489.004	19.10	-0.85
119	1.7	-83972	-110230	18.40	1488.567	19.15	-0.75
119	1.8	-83898	-110303	18.52	1488.171	19.20	-0.68
119	1.9	-83825	-110375	18.60	1487.755	19.25	-0.65
121	0.1	-81965	-110959	19.53	1481.544	20.26	-0.73
121	0.2	-82031	-110889	19.56	1481.892	20.20	-0.64
121	0.3	-82096	-110818	19.53	1481.984	20.15	-0.62
121	0.4	-82161	-110748	19.45	1482.204	20.10	-0.65
121	0.5	-82226	-110677	19.31	1482.664	20.05	-0.74
121	0.6	-82292	-110607	18.99	1482.845	20.00	-1.01
121	0.7	-82357	-110536	19.16	1483.029	19.95	-0.79
121	0.8	-82422	-110466	19.09	1484.540	19.90	-0.81
121	0.9	-82487	-110395	19.04	1485.308	19.85	-0.81
121	1	-82553	-110325	19.00	1485.706	19.80	-0.80
121	1.1	-82618	-110254	18.86	1485.987	19.75	-0.89
121	1.2	-82683	-110184	18.85	1486.321	19.70	-0.85
121	1.3	-82748	-110113	18.65	1487.046	19.65	-1.00

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
121	1.4	-82814	-110043	18.52	1487.539	19.60	-1.08
121	1.5	-82879	-109972	18.53	1487.784	19.55	-1.02
121	1.6	-82944	-109902	18.50	1488.038	19.50	-1.00
121	1.7	-83009	-109831	18.38	1488.205	19.45	-1.07
121	1.8	-83075	-109761	18.26	1488.419	19.40	-1.14
122	0.1	-82542	-111233	19.39	1483.540	20.06	-0.67
122	0.2	-82614	-111166	19.01	1484.003	20.00	-0.99
122	0.3	-82686	-111099	19.18	1484.541	19.95	-0.77
122	0.4	-82758	-111032	19.09	1485.067	19.90	-0.81
122	0.5	-82830	-110965	19.05	1485.543	19.85	-0.80
122	0.6	-82902	-110898	18.99	1486.012	19.80	-0.81
122	0.7	-82974	-110830	18.93	1486.377	19.75	-0.82
122	0.8	-83046	-110763	18.89	1486.769	19.70	-0.81
122	0.9	-83118	-110696	18.84	1487.157	19.65	-0.81
122	1	-83190	-110629	18.63	1487.345	19.60	-0.97
122	1.1	-83261	-110562	18.65	1487.670	19.55	-0.89
122	1.2	-83333	-110495	18.59	1487.735	19.49	-0.90
122	1.3	-83405	-110428	18.54	1487.914	19.44	-0.89
122	1.4	-83477	-110361	18.52	1487.815	19.38	-0.87
122	1.5	-83549	-110294	18.47	1487.733	19.33	-0.86
122	1.6	-83621	-110227	18.44	1487.882	19.29	-0.85
123	0.1	-83480	-111649	19.61	1483.331	19.90	-0.29
123	0.2	-83541	-111578	19.52	1483.761	19.84	-0.32
123	0.3	-83601	-111507	19.46	1484.268	19.78	-0.32
123	0.4	-83661	-111436	19.46	1484.653	19.73	-0.26
123	0.5	-83722	-111365	19.36	1485.105	19.67	-0.31
123	0.6	-83782	-111294	19.21	1485.440	19.61	-0.40
123	0.7	-83842	-111223	19.05	1485.719	19.56	-0.51
123	0.8	-83902	-111152	18.94	1486.395	19.52	-0.58
123	0.9	-83963	-111081	18.94	1486.470	19.47	-0.53
123	1	-84023	-111010	18.87	1486.894	19.42	-0.55
123	1.1	-84083	-110939	18.83	1487.189	19.38	-0.55
123	1.2	-84144	-110868	18.73	1487.394	19.33	-0.59
124	0.1	-80596	-108984	19.56	1483.590	20.75	-1.19
124	0.2	-80671	-108918	19.52	1484.026	20.70	-1.18
124	0.3	-80747	-108852	19.39	1484.336	20.65	-1.26
124	0.4	-80823	-108786	19.17	1484.811	20.60	-1.43
124	0.5	-80898	-108720	19.16	1485.364	20.55	-1.39
124	0.6	-80974	-108654	19.16	1485.754	20.50	-1.34
124	0.7	-81050	-108588	19.00	1486.246	20.45	-1.45
124	0.8	-81126	-108522	18.79	1486.519	20.40	-1.61
124	0.9	-81201	-108456	18.74	1486.902	20.35	-1.61
124	1	-81277	-108390	18.62	1487.407	20.30	-1.68
124	1.1	-81353	-108324	18.83	1487.944	20.25	-1.42
124	1.2	-81428	-108258	18.77	1488.514	20.20	-1.43
124	1.3	-81504	-108192	18.72	1488.991	20.15	-1.43
124	1.4	-81580	-108126	18.59	1489.486	20.10	-1.51
125	0.1	-80864	-110673	20.06	1481.596	20.80	-0.74
125	0.2	-80827	-110766	20.06	1481.410	20.84	-0.78
125	0.3	-80791	-110860	20.07	1481.080	20.88	-0.81
125	0.4	-80755	-110953	20.10	1480.699	20.92	-0.82
125	0.5	-80718	-111046	20.14	1480.584	20.96	-0.82
125	0.6	-80682	-111139	20.22	1480.249	21.00	-0.78
125	0.7	-80645	-111232	20.31	1480.110	21.04	-0.73
125	0.8	-80609	-111325	20.47	1479.996	21.08	-0.61
125	0.9	-80573	-111419	20.59	1479.782	21.12	-0.53
125	1	-80536	-111512	20.73	1479.623	21.16	-0.43

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
125	1.1	-80500	-111605	20.90	1479.640	21.20	-0.30
125	1.2	-80464	-111698	20.97	1479.550	21.23	-0.26
125	1.3	-80427	-111791	21.04	1479.355	21.25	-0.21
126	0.1	-81510	-110984	19.91	1480.634	20.52	-0.61
126	0.2	-81480	-111078	19.95	1480.517	20.56	-0.61
126	0.3	-81450	-111172	20.01	1480.248	20.60	-0.59
126	0.4	-81419	-111266	20.06	1479.634	20.64	-0.58
126	0.5	-81389	-111361	20.11	1479.339	20.68	-0.57
126	0.6	-81359	-111455	20.19	1479.309	20.72	-0.53
126	0.7	-81329	-111549	20.16	1479.307	20.76	-0.60
126	0.8	-81299	-111643	20.26	1479.103	20.80	-0.54
126	0.9	-81269	-111737	20.37	1478.503	20.84	-0.47
126	1	-81239	-111831	20.48	1477.510	20.88	-0.40
126	1.1	-81208	-111925	20.55	1476.559	20.92	-0.37
126	1.2	-81178	-112019	20.50	1476.555	20.96	-0.46
126	1.3	-81148	-112114	20.65	1475.695	21.00	-0.35
126	1.4	-81118	-112208	20.73	1474.977	21.03	-0.31
126	1.5	-81088	-112302	20.86	1474.147	21.07	-0.21
126	1.6	-81058	-112396	20.92	1473.278	21.10	-0.18
126	1.7	-81028	-112490	21.00	1472.648	21.13	-0.13
126	1.8	-80997	-112584	21.03	1471.733	21.17	-0.14
126	1.9	-80967	-112678	21.11	1470.578	21.20	-0.08
126	2	-80937	-112772	21.12	1470.469	21.22	-0.10
126	2.1	-80907	-112866	21.10	1470.260	21.24	-0.14
126	2.2	-80877	-112961	21.13	1469.908	21.26	-0.13
126	2.3	-80847	-113055	21.11	1469.225	21.28	-0.17
126	2.4	-80816	-113149	21.21	1468.509	21.30	-0.09
126	2.5	-80786	-113243	21.23	1468.149	21.32	-0.09
126	2.6	-80756	-113337	21.21	1467.446	21.32	-0.11
126	2.7	-80726	-113431	21.18	1466.964	21.30	-0.12
127	0.1	-82315	-111335	19.54	1482.299	20.20	-0.66
127	0.2	-82280	-111429	19.67	1481.930	20.25	-0.58
127	0.3	-82246	-111524	19.76	1481.640	20.30	-0.54
127	0.4	-82211	-111618	19.79	1481.339	20.35	-0.56
127	0.5	-82176	-111713	19.83	1480.928	20.40	-0.57
127	0.6	-82141	-111807	19.83	1480.723	20.44	-0.61
127	0.7	-82107	-111902	19.84	1480.352	20.48	-0.64
127	0.8	-82072	-111996	19.84	1480.023	20.52	-0.68
127	0.9	-82037	-112091	19.93	1479.600	20.56	-0.63
127	1	-82002	-112185	20.06	1479.222	20.60	-0.54
127	1.1	-81968	-112280	20.11	1478.914	20.65	-0.54
127	1.2	-81933	-112374	20.18	1478.521	20.70	-0.52
127	1.3	-81898	-112469	20.25	1477.958	20.75	-0.50
127	1.4	-81863	-112563	20.32	1477.523	20.80	-0.48
127	1.5	-81829	-112658	20.43	1476.908	20.83	-0.40
127	1.6	-81794	-112752	20.52	1476.492	20.87	-0.35
127	1.7	-81759	-112847	20.64	1475.734	20.90	-0.26
127	1.8	-81724	-112942	20.64	1475.053	20.93	-0.29
127	1.9	-81689	-113036	20.69	1474.101	20.97	-0.28
127	2	-81655	-113131	20.76	1473.153	21.00	-0.24
127	2.1	-81620	-113225	20.81	1472.176	21.01	-0.20
127	2.2	-81585	-113320	20.83	1471.288	21.02	-0.19
127	2.3	-81550	-113414	20.86	1470.502	21.03	-0.17
127	2.4	-81516	-113509	20.92	1469.818	21.04	-0.12
127	2.5	-81481	-113603	20.90	1469.077	21.05	-0.15
128	0.1	-83045	-111675	19.47	1482.395	20.01	-0.54
128	0.2	-83009	-111770	19.38	1482.370	20.05	-0.67

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
128	0.3	-82974	-111865	19.63	1481.883	20.10	-0.47
128	0.4	-82938	-111960	19.82	1481.629	20.15	-0.33
128	0.5	-82903	-112055	19.79	1481.169	20.20	-0.41
128	0.6	-82867	-112150	19.96	1480.971	20.25	-0.29
128	0.7	-82832	-112245	20.02	1480.784	20.30	-0.28
128	0.8	-82797	-112340	20.07	1480.459	20.35	-0.28
128	0.9	-82761	-112435	20.10	1480.150	20.40	-0.30
128	1	-82726	-112530	20.16	1479.609	20.45	-0.29
128	1.1	-82690	-112625	20.16	1479.305	20.49	-0.33
128	1.2	-82655	-112720	20.19	1478.922	20.54	-0.35
128	1.3	-82620	-112815	20.19	1478.402	20.58	-0.39
128	1.4	-82584	-112910	20.15	1477.858	20.62	-0.47
128	1.5	-82549	-113005	20.19	1476.982	20.66	-0.47
128	1.6	-82513	-113100	20.25	1475.871	20.70	-0.45
128	1.7	-82478	-113195	20.31	1474.932	20.73	-0.42
128	1.8	-82442	-113290	20.35	1473.952	20.75	-0.40
128	1.9	-82407	-113385	20.38	1472.920	20.77	-0.39
128	2	-82372	-113480	20.48	1472.100	20.80	-0.32
128	2.1	-82336	-113575	20.49	1471.426	20.81	-0.32
128	2.2	-82301	-113670	20.50	1470.842	20.82	-0.32
128	2.3	-82265	-113765	20.55	1469.988	20.82	-0.27
128	2.4	-82230	-113860	20.56	1469.188	20.81	-0.25
129	0.1	-83811	-112015	19.62	1480.497	19.95	-0.33
129	0.2	-83772	-112109	19.67	1480.202	20.00	-0.33
129	0.3	-83732	-112204	19.67	1479.815	20.05	-0.38
129	0.4	-83693	-112298	19.64	1479.282	20.10	-0.46
129	0.5	-83654	-112393	19.41	1478.372	20.15	-0.74
129	0.6	-83615	-112488	19.68	1477.409	20.20	-0.52
129	0.7	-83575	-112582	20.00	1476.775	20.25	-0.25
129	0.8	-83536	-112677	20.09	1476.108	20.30	-0.21
129	0.9	-83497	-112772	20.13	1475.917	20.35	-0.22
129	1	-83458	-112866	20.19	1475.421	20.39	-0.20
129	1.1	-83418	-112961	20.24	1474.970	20.42	-0.18
129	1.2	-83379	-113055	20.20	1474.687	20.45	-0.25
130	0.2	-84987	-107082	17.59	1495.178	18.14	-0.55
130	0.3	-85076	-107043	17.76	1495.613	18.10	-0.34
130	0.4	-85164	-107005	17.81	1495.798	18.05	-0.24
130	0.5	-85253	-106966	17.65	1495.834	18.01	-0.36
130	0.6	-85342	-106927	17.58	1495.693	17.97	-0.39
130	0.7	-85430	-106888	17.45	1495.790	17.95	-0.50
130	0.8	-85519	-106849	17.40	1495.822	17.91	-0.51
130	0.9	-85607	-106810	17.80	1495.882	17.88	-0.08
130	1	-85696	-106771	17.71	1496.272	17.85	-0.14
130	1.1	-85785	-106733	17.68	1496.767	17.82	-0.14
130	1.2	-85873	-106694	17.70	1496.727	17.79	-0.09
130	1.3	-85962	-106655	17.49	1496.821	17.76	-0.27
130	1.4	-86050	-106616	17.34	1496.905	17.71	-0.37
130	1.5	-86139	-106577	17.38	1496.693	17.68	-0.30
130	1.6	-86228	-106538	17.40	1496.358	17.64	-0.24
130	1.7	-86316	-106499	17.31	1496.198	17.61	-0.30
130	1.8	-86405	-106461	17.19	1497.274	17.55	-0.36
130	1.9	-86493	-106422	17.10	1497.982	17.50	-0.40
133	0.1	-87037	-109441	17.67	1487.378	17.87	-0.20
133	0.2	-86944	-109472	17.69	1487.289	17.90	-0.21
133	0.3	-86851	-109503	17.77	1487.199	17.93	-0.16
133	0.4	-86759	-109534	17.73	1487.194	17.97	-0.24
133	0.5	-86666	-109565	17.81	1487.182	18.00	-0.19

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
133	0.6	-86573	-109596	17.85	1486.970	18.06	-0.21
133	0.7	-86480	-109627	17.84	1486.718	18.11	-0.27
133	0.8	-86387	-109658	18.00	1486.694	18.17	-0.17
134	0.1	-84318	-102539	17.28	1498.733	18.23	-0.95
134	0.2	-84317	-102437	17.28	1498.775	18.25	-0.97
134	0.3	-84315	-102336	17.30	1498.668	18.27	-0.97
134	0.4	-84314	-102235	17.34	1498.578	18.28	-0.94
134	0.5	-84312	-102134	17.34	1498.516	18.29	-0.95
134	0.6	-84311	-102032	17.30	1498.569	18.30	-1.00
134	0.7	-84309	-101931	17.34	1499.084	18.32	-0.98
134	0.8	-84308	-101830	17.41	1499.390	18.35	-0.94
134	0.9	-84306	-101729	17.45	1499.716	18.37	-0.92
134	1	-84305	-101627	17.50	1499.645	18.39	-0.89
134	1.1	-84303	-101526	17.36	1499.848	18.45	-1.09
134	1.2	-84302	-101425	17.37	1499.855	18.50	-1.13
134	1.3	-84300	-101323	17.33	1499.827	18.55	-1.22
134	1.4	-84299	-101222	17.59	1500.056	18.60	-1.01
134	1.5	-84297	-101121	17.76	1500.049	18.66	-0.90
134	1.6	-84296	-101020	17.85	1499.733	18.71	-0.86
134	1.7	-84294	-100918	17.95	1499.517	18.77	-0.82
134	1.8	-84293	-100817	18.00	1499.053	18.83	-0.83
134	1.9	-84291	-100716	18.09	1498.269	18.89	-0.80
134	2	-84289	-100615	18.16	1497.497	18.94	-0.78
134	2.1	-84288	-100513	18.22	1496.743	19.00	-0.78
134	2.2	-84286	-100412	18.31	1496.312	19.04	-0.73
134	2.3	-84285	-100311	18.38	1495.702	19.09	-0.71
134	2.4	-84283	-100209	18.42	1494.257	19.13	-0.72
134	2.5	-84282	-100108	18.48	1494.293	19.18	-0.70
134	2.6	-84280	-100007	18.47	1495.632	19.22	-0.75
134	2.7	-84279	-99906	18.55	1495.870	19.26	-0.71
134	2.8	-84277	-99804	18.55	1495.872	19.31	-0.75
134	2.9	-84276	-99703	18.79	1496.030	19.35	-0.56
134	3	-84274	-99602	18.75	1496.314	19.40	-0.65
134	3.1	-84273	-99501	18.48	1496.967	19.45	-0.97
134	3.2	-84271	-99399	18.48	1497.562	19.50	-1.02
134	3.3	-84270	-99298	18.90	1498.031	19.55	-0.65
134	3.4	-84268	-99197	18.92	1498.426	19.60	-0.68
134	3.5	-84267	-99095	18.79	1498.894	19.63	-0.84
134	3.6	-84265	-98994	18.67	1499.271	19.65	-0.98
134	3.7	-84264	-98893	18.73	1499.573	19.65	-0.92
134	3.8	-84262	-98792	18.95	1500.065	19.65	-0.70
134	3.9	-84260	-98690	18.96	1500.283	19.65	-0.69
135	0.1	-85033	-98983	18.86	1502.051	19.38	-0.52
135	0.2	-85037	-99087	18.91	1501.705	19.42	-0.51
135	0.3	-85040	-99190	18.96	1501.408	19.47	-0.51
135	0.4	-85043	-99293	18.78	1501.654	19.51	-0.73
135	0.5	-85046	-99396	18.54	1501.801	19.55	-1.01
135	0.6	-85050	-99500	18.21	1501.108	19.60	-1.39
136	0.1	-87718	-99938	17.77	1503.436	17.98	-0.21
136	0.2	-87676	-99846	17.72	1503.314	17.99	-0.27
136	0.3	-87635	-99755	17.73	1502.943	18.00	-0.27
136	0.4	-87593	-99663	17.76	1502.722	18.02	-0.25
136	0.5	-87551	-99571	17.75	1502.359	18.03	-0.28
136	0.6	-87509	-99479	17.75	1502.029	18.04	-0.29
136	0.7	-87467	-99387	17.52	1501.340	18.05	-0.53
136	0.8	-87425	-99295	17.31	1500.695	18.06	-0.76
136	0.9	-87384	-99204	17.44	1499.689	18.08	-0.63

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
136	1	-87342	-99112	17.78	1499.156	18.09	-0.31
136	1.1	-87300	-99020	17.92	1499.452	18.10	-0.18
137	0.1	-86734	-102621	18.76	1499.871	19.50	-0.74
137	0.2	-86638	-102663	18.32	1499.740	19.38	-1.06
137	0.3	-86541	-102704	18.27	1499.632	19.25	-0.98
137	0.4	-86445	-102745	18.63	1499.373	19.13	-0.50
137	0.5	-86349	-102786	18.57	1500.569	19.00	-0.43
137	0.6	-86253	-102828	18.39	1503.455	18.92	-0.53
137	0.7	-86156	-102869	18.34	1506.284	18.84	-0.50
137	0.8	-86060	-102910	18.26	1506.445	18.76	-0.50
137	0.9	-85974	-102957	18.14	1504.172	18.68	-0.54
137	1	-85888	-103004	18.09	1503.052	18.60	-0.51
137	1.1	-85802	-103051	18.02	1501.643	18.49	-0.47
137	1.2	-85716	-103098	17.93	1499.950	18.38	-0.45
137	1.3	-85630	-103145	17.82	1498.829	18.26	-0.44
137	1.4	-85544	-103192	17.95	1498.290	18.15	-0.20
137	1.5	-85458	-103239	18.05	1498.063	18.07	-0.02
137	1.6	-85372	-103286	17.98	1497.431	18.00	-0.02
137	1.7	-85286	-103333	17.94	1496.939	18.00	-0.06
137	1.8	-85200	-103380	17.72	1495.689	18.00	-0.28
137	1.9	-85203	-103466	17.68	1494.485	17.99	-0.31
137	2	-85205	-103553	17.62	1493.983	17.98	-0.36
137	2.1	-85208	-103639	17.65	1493.901	17.97	-0.32
137	2.2	-85185	-103718	17.56	1492.922	17.96	-0.40
137	2.3	-85103	-103779	17.69	1491.323	17.99	-0.30
20	0.1	-87511	-100974	18.03	1501.068	18.77	-0.74
20	0.2	-87552	-101067	17.81	1499.518	18.79	-0.98
20	0.3	-87594	-101161	17.55	1499.119	18.80	-1.25
20	0.4	-87635	-101255	17.55	1498.824	18.82	-1.27
20	0.5	-87676	-101348	17.71	1498.710	18.84	-1.13
20	0.6	-87717	-101442	17.75	1498.086	18.87	-1.11
20	0.7	-87758	-101536	17.50	1497.916	18.89	-1.39
20	0.8	-87799	-101630	17.52	1497.271	18.92	-1.39
20	0.9	-87841	-101723	17.78	1496.999	18.94	-1.16
20	1	-87882	-101817	18.10	1496.571	18.96	-0.86
20	1.1	-87923	-101911	18.23	1496.190	18.99	-0.76
20	1.2	-87964	-102004	18.26	1496.161	19.01	-0.75
20	1.3	-88005	-102098	17.98	1496.817	19.04	-1.05
20	1.4	-88046	-102192	18.07	1496.930	19.06	-0.99
20	1.5	-88088	-102285	18.27	1497.008	19.08	-0.82
20	1.6	-88129	-102379	18.32	1497.002	19.11	-0.79
20	1.7	-88170	-102473	18.39	1497.030	19.13	-0.74
20	1.8	-88211	-102567	18.44	1497.028	19.16	-0.72
20	1.9	-88252	-102660	18.60	1496.900	19.18	-0.58
20	2	-88294	-102754	18.66	1496.624	19.20	-0.54
20	2.1	-88335	-102848	18.72	1496.505	19.23	-0.51
20	2.2	-88376	-102941	18.86	1496.743	19.25	-0.39
20	2.3	-88417	-103035	18.90	1497.358	19.25	-0.35
20	2.4	-88458	-103129	18.87	1498.352	19.26	-0.39
20	2.5	-88499	-103222	18.89	1498.925	19.26	-0.37
20	2.6	-88541	-103316	18.89	1499.107	19.27	-0.38
20	2.7	-88582	-103410	18.87	1499.304	19.27	-0.40
20	2.8	-88623	-103504	18.91	1499.284	19.26	-0.35
20	2.9	-88664	-103597	18.88	1499.110	19.26	-0.38
20	3	-88705	-103691	18.90	1498.848	19.26	-0.36
20	3.1	-88746	-103785	18.88	1498.577	19.26	-0.38
20	3.2	-88788	-103878	18.85	1498.056	19.25	-0.40

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
20	3.3	-88829	-103972	18.81	1497.565	19.24	-0.43
20	3.4	-88870	-104066	18.76	1496.985	19.24	-0.47
20	3.5	-88911	-104159	18.74	1496.397	19.23	-0.48
20	3.6	-88952	-104253	18.95	1497.201	19.22	-0.28
20	3.7	-88994	-104347	18.85	1496.952	19.22	-0.36
20	3.8	-89035	-104440	18.78	1496.395	19.21	-0.43
20	3.9	-89076	-104534	18.75	1495.661	19.20	-0.46
20	4	-89117	-104628	18.68	1495.490	19.24	-0.56
20	4.1	-89158	-104722	18.63	1495.321	19.28	-0.65
20	4.2	-89199	-104815	18.60	1495.060	19.32	-0.72
20	4.3	-89241	-104909	18.66	1494.232	19.36	-0.70
20	4.4	-89282	-105003	18.65	1493.727	19.00	-0.35
20	4.5	-89323	-105096	18.61	1493.557	18.95	-0.34
20	4.6	-89364	-105190	18.55	1493.651	18.89	-0.35
20	4.7	-89405	-105284	18.46	1493.307	18.84	-0.38
20	4.8	-89386	-105353	18.28	1492.616	18.79	-0.51
20	4.9	-89343	-105417	18.29	1492.277	18.74	-0.45
20	5	-89370	-105510	18.32	1492.959	18.68	-0.36
20	5.1	-89480	-105490	18.26	1493.235	18.72	-0.46
20	5.2	-89517	-105581	18.25	1493.294	18.67	-0.42
20	5.3	-89554	-105673	18.17	1493.218	18.63	-0.46
20	5.4	-89591	-105764	18.06	1493.231	18.59	-0.53
20	5.5	-89628	-105855	17.95	1492.864	18.54	-0.59
20	5.6	-89665	-105947	17.91	1492.449	18.48	-0.57
20	5.7	-89702	-106038	17.90	1491.948	18.42	-0.52
20	5.8	-89739	-106130	17.83	1491.577	18.36	-0.53
20	5.9	-89776	-106221	17.63	1491.272	18.30	-0.67
102	0.1	-80540	-110321	20.01	1481.973	20.94	-0.93
102	0.2	-80609	-110251	19.97	1482.068	20.90	-0.93
102	0.3	-80679	-110182	19.91	1481.982	20.84	-0.93
102	0.4	-80749	-110113	19.84	1482.356	20.78	-0.94
102	0.5	-80818	-110044	19.70	1482.798	20.72	-1.02
102	0.6	-80888	-109974	19.65	1483.105	20.66	-1.01
102	0.7	-80958	-109905	19.61	1483.300	20.60	-0.99
102	0.8	-81027	-109836	19.55	1483.427	20.55	-1.00
102	0.9	-81097	-109767	19.46	1483.579	20.50	-1.04
102	1	-81167	-109697	19.47	1483.639	20.45	-0.98
102	1.1	-81236	-109628	19.26	1483.771	20.40	-1.14
102	1.2	-81306	-109559	19.27	1483.897	20.35	-1.08
102	1.3	-81376	-109490	19.26	1484.315	20.30	-1.04
102	1.4	-81445	-109420	19.18	1484.922	20.25	-1.07
102	1.5	-81515	-109351	19.06	1485.379	20.20	-1.14
102	1.6	-81585	-109282	18.86	1485.785	20.15	-1.29
102	1.7	-81654	-109213	18.93	1486.056	20.10	-1.17
102	1.8	-81724	-109143	18.87	1486.414	20.05	-1.18
102	1.9	-81794	-109074	18.78	1486.713	20.00	-1.22
102	2	-81863	-109005	18.64	1487.246	19.96	-1.32
102	2.1	-81933	-108935	18.37	1487.720	19.92	-1.55
102	2.2	-82003	-108866	18.60	1487.805	19.87	-1.27
102	2.3	-82072	-108797	18.54	1488.143	19.82	-1.28
102	2.5	-81940	-108430	18.64	1488.658	19.90	-1.26
102	2.6	-82010	-108362	18.56	1488.962	19.85	-1.29
102	2.7	-82080	-108294	18.44	1489.117	19.80	-1.36
102	2.8	-82150	-108226	18.35	1489.026	19.75	-1.40
102	2.9	-82220	-108158	18.19	1489.211	19.71	-1.52
102	3	-82290	-108090	17.93	1489.253	19.67	-1.74
102	3.1	-82359	-108022	17.78	1488.979	19.63	-1.85

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
102	3.2	-82429	-107954	17.80	1489.373	19.59	-1.79
102	3.3	-82499	-107886	17.88	1489.919	19.55	-1.67
102	3.4	-82569	-107818	18.04	1490.256	19.50	-1.46
102	3.5	-82639	-107750	18.04	1490.524	19.45	-1.41
102	3.6	-82750	-107700	18.05	1490.185	19.40	-1.35
102	3.7	-82827	-107627	18.07	1490.609	19.35	-1.28
102	3.8	-82905	-107553	17.95	1490.664	19.31	-1.36
102	3.9	-82982	-107480	18.07	1490.794	19.27	-1.20
102	4	-83059	-107407	18.20	1490.940	19.23	-1.03
102	4.1	-83136	-107334	17.98	1490.990	19.19	-1.21
102	4.2	-83214	-107260	17.93	1491.010	19.15	-1.22
102	4.3	-83291	-107187	17.92	1490.955	19.10	-1.18
102	4.4	-83368	-107114	17.65	1490.860	19.05	-1.40
102	4.5	-83445	-107040	17.68	1490.950	19.00	-1.32
102	4.6	-83523	-106967	17.83	1490.901	18.97	-1.14
102	4.7	-83600	-106894	17.96	1491.027	18.93	-0.97
102	4.8	-83677	-106820	18.09	1491.302	18.90	-0.81
102	4.9	-83755	-106747	18.20	1491.253	18.86	-0.66
102	5	-83832	-106674	18.27	1491.317	18.83	-0.56
102	5.1	-83909	-106601	18.18	1491.465	18.79	-0.61
102	5.2	-83986	-106527	18.18	1491.563	18.76	-0.58
102	5.3	-84064	-106454	18.15	1491.722	18.74	-0.59
22	2.2	-84310	-98660	18.40	1500.406	19.62	-1.22
22	2.3	-84214	-98669	18.33	1499.072	19.63	-1.30
22	2.4	-84122	-98688	18.73	1498.182	19.63	-0.90
22	2.5	-84030	-98707	18.89	1497.724	19.63	-0.74
22	2.6	-83938	-98725	18.89	1497.401	19.62	-0.73
22	2.7	-83846	-98744	18.85	1497.224	19.61	-0.76
22	2.8	-83754	-98763	18.81	1497.177	19.59	-0.78
22	2.9	-83662	-98781	18.77	1497.397	19.53	-0.76
22	3	-83570	-98800	18.25	1497.249	19.52	-1.27
22	3.1	-83481	-98762	18.60	1497.325	19.50	-0.90
22	3.2	-83392	-98724	18.64	1497.182	19.48	-0.84
22	3.3	-83303	-98686	18.62	1497.083	19.47	-0.85
22	3.4	-83214	-98648	18.61	1497.030	19.46	-0.85
22	3.5	-83125	-98610	18.55	1497.205	19.44	-0.89
22	3.6	-83036	-98572	18.65	1497.177	19.43	-0.78
22	3.7	-82947	-98534	18.63	1497.437	19.41	-0.78
22	3.8	-82858	-98496	18.58	1497.347	19.40	-0.82
22	3.9	-82769	-98458	18.64	1497.100	19.40	-0.76
22	4	-82680	-98420	18.69	1496.817	19.40	-0.71
22	4.1	-82590	-98377	18.69	1496.776	19.40	-0.71
22	4.2	-82500	-98334	18.75	1496.650	19.39	-0.64
22	4.3	-82410	-98291	18.74	1496.659	19.39	-0.65
22	4.4	-82320	-98249	18.72	1496.333	19.39	-0.67
22	4.5	-82230	-98206	18.70	1496.057	19.38	-0.68
22	4.6	-82140	-98163	18.72	1495.753	19.38	-0.66
22	4.7	-82050	-98120	18.69	1495.431	19.38	-0.69
23	0.1	-84240	-102579	17.41	1498.512	18.28	-0.87
23	0.2	-84159	-102518	17.30	1498.420	18.31	-1.01
23	0.3	-84079	-102456	17.40	1498.468	18.34	-0.94
23	0.4	-83998	-102395	17.60	1498.487	18.37	-0.77
23	0.5	-83918	-102333	17.70	1498.495	18.40	-0.70
23	0.6	-83838	-102272	17.80	1498.358	18.45	-0.65
23	0.7	-83757	-102211	17.82	1498.309	18.50	-0.68
23	0.8	-83677	-102149	17.87	1497.948	18.55	-0.68
23	0.9	-83596	-102088	17.93	1497.792	18.60	-0.67

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
23	1	-83516	-102026	17.93	1497.775	18.65	-0.72
23	1.1	-83436	-101965	17.98	1497.797	18.70	-0.72
23	1.2	-83355	-101904	18.05	1497.731	18.75	-0.70
23	1.3	-83275	-101842	18.11	1497.620	18.80	-0.69
23	1.4	-83194	-101781	18.18	1497.489	18.84	-0.66
23	1.5	-83114	-101719	18.21	1497.297	18.88	-0.67
23	1.6	-83034	-101658	18.20	1497.000	18.92	-0.72
23	1.7	-82953	-101597	18.16	1496.734	18.96	-0.80
23	1.8	-82873	-101535	18.31	1496.135	19.00	-0.69
23	1.9	-82792	-101474	18.19	1495.922	19.03	-0.84
23	2	-82712	-101412	17.94	1495.588	19.06	-1.12
23	2.1	-82632	-101351	18.31	1495.419	19.10	-0.79
23	2.2	-82551	-101290	18.43	1494.669	19.13	-0.70
23	2.3	-82471	-101228	18.53	1494.004	19.16	-0.63
23	2.4	-82390	-101167	18.55	1492.889	19.20	-0.65
23	2.5	-82310	-101105	18.51	1491.819	19.23	-0.72
23	2.6	-82230	-101044	18.43	1492.048	19.26	-0.83
23	2.7	-82149	-100983	18.55	1492.247	19.29	-0.74
23	2.8	-82069	-100921	18.62	1492.441	19.32	-0.70
23	2.9	-81988	-100860	18.56	1492.800	19.35	-0.79
23	3	-81908	-100798	18.65	1493.224	19.39	-0.74
23	3.1	-81828	-100737	18.85	1493.634	19.42	-0.57
23	3.2	-81747	-100676	18.79	1493.635	19.45	-0.66
23	3.3	-81667	-100614	18.86	1493.497	19.48	-0.62
23	3.4	-81586	-100553	18.92	1493.315	19.51	-0.59
23	3.5	-81506	-100491	19.06	1493.101	19.54	-0.48
23	3.6	-81426	-100430	18.82	1492.632	19.57	-0.75
23	3.7	-81345	-100369	19.16	1492.270	19.60	-0.44
23	3.8	-81265	-100307	19.18	1491.634	19.64	-0.46
23	3.9	-81184	-100246	19.53	1490.800	19.68	-0.15
23	4	-81104	-100184	19.54	1490.569	19.72	-0.18
23	4.1	-81024	-100123	19.52	1490.163	19.76	-0.24
23	4.2	-80943	-100062	19.57	1489.923	19.80	-0.23
23	4.3	-80863	-100000	19.57	1490.251	19.83	-0.26
23	4.4	-80782	-99939	19.43	1490.118	19.86	-0.43
23	4.5	-80702	-99877	19.38	1490.941	19.90	-0.52
23	4.6	-80622	-99816	19.38	1488.152	19.93	-0.55
23	4.7	-80541	-99755	19.28	1487.101	19.96	-0.68
23	4.8	-80461	-99693	19.60	1486.017	20.00	-0.40
23	4.9	-80380	-99632	19.76	1485.418	20.03	-0.27
23	5	-80300	-99570	19.72	1485.963	20.06	-0.34
24	0.1	-82886	-99841	17.62	1494.227	18.78	-1.16
24	0.2	-82801	-99781	17.68	1494.690	18.79	-1.11
24	0.3	-82717	-99722	17.74	1495.032	18.80	-1.06
24	0.4	-82633	-99663	17.79	1495.055	18.82	-1.03
24	0.5	-82549	-99604	17.81	1494.742	18.83	-1.02
24	0.6	-82464	-99544	17.90	1494.348	18.85	-0.95
24	0.7	-82380	-99485	18.08	1494.178	18.86	-0.78
24	0.8	-82296	-99426	18.09	1494.169	18.88	-0.79
24	0.9	-82211	-99366	18.17	1494.256	18.89	-0.72
24	1	-82127	-99307	18.39	1494.410	18.91	-0.52
24	1.1	-82043	-99248	18.49	1494.306	18.92	-0.43
24	1.2	-81959	-99189	18.53	1494.314	18.94	-0.41
24	1.3	-81874	-99129	18.59	1494.088	18.95	-0.36
24	1.4	-81790	-99070	18.66	1494.140	18.96	-0.30
25	0.1	-83151	-99605	17.90	1494.733	18.96	-1.06
25	0.2	-83233	-99671	17.77	1494.820	18.96	-1.19

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
25	0.3	-83314	-99736	17.62	1494.914	18.97	-1.34
25	0.4	-83395	-99801	17.87	1495.016	18.97	-1.10
25	0.5	-83477	-99867	17.98	1495.205	18.98	-1.00
25	0.6	-83558	-99932	18.04	1495.184	18.98	-0.94
25	0.7	-83639	-99997	18.08	1495.246	18.98	-0.90
25	0.8	-83721	-100063	18.01	1495.245	18.99	-0.98
25	0.9	-83802	-100128	18.00	1495.333	18.99	-1.00
25	1	-83883	-100193	18.03	1495.354	19.00	-0.97
25	1.1	-83965	-100259	18.07	1495.401	19.00	-0.93
25	1.2	-84046	-100324	18.10	1495.267	19.00	-0.90
25	1.3	-84127	-100389	18.15	1495.339	19.01	-0.86
25	1.4	-84209	-100455	18.23	1495.782	19.01	-0.79
25	1.5	-84290	-100520	18.24	1496.242	19.02	-0.78
26	0.1	-82862	-100610	17.67	1494.529	18.68	-1.01
26	0.2	-82944	-100670	17.64	1494.640	18.65	-1.01
26	0.3	-83027	-100730	17.63	1494.854	18.63	-1.00
26	0.4	-83109	-100790	17.61	1495.162	18.60	-0.99
26	0.5	-83191	-100850	17.51	1495.410	18.58	-1.07
26	0.6	-83273	-100910	17.44	1495.684	18.57	-1.12
26	0.7	-83356	-100970	17.42	1496.306	18.55	-1.13
26	0.8	-83438	-101030	17.55	1496.902	18.53	-0.98
26	0.9	-83520	-101090	17.57	1497.433	18.52	-0.94
26	1	-83602	-101150	17.50	1497.949	18.50	-1.00
26	1.1	-83684	-101210	17.40	1497.980	18.49	-1.09
26	1.2	-83767	-101270	17.38	1498.520	18.47	-1.10
26	1.3	-83849	-101330	17.45	1499.020	18.46	-1.01
26	1.4	-83931	-101390	17.27	1499.120	18.44	-1.17
26	1.5	-84013	-101450	17.44	1499.572	18.43	-0.99
26	1.6	-84096	-101510	17.37	1499.560	18.42	-1.04
26	1.7	-84178	-101570	17.45	1499.752	18.40	-0.95
26	1.8	-84260	-101630	17.37	1499.667	18.38	-1.01
27	0.1	-83715	-103477	18.59	1496.959	19.34	-0.75
27	0.2	-83640	-103414	18.65	1496.996	19.37	-0.72
27	0.3	-83565	-103350	18.71	1496.933	19.41	-0.70
27	0.4	-83490	-103287	18.75	1496.655	19.44	-0.69
27	0.5	-83415	-103224	18.85	1496.587	19.48	-0.63
27	0.6	-83340	-103160	18.89	1495.829	18.52	0.37
27	0.7	-83250	-103107	18.87	1495.008	19.56	-0.69
27	0.8	-83160	-103053	18.98	1494.520	19.60	-0.62
27	0.9	-83070	-103000	19.13	1493.950	19.62	-0.49
27	1	-83000	-102850	19.21	1494.064	19.62	-0.41
27	1.1	-82925	-102800	19.26	1494.424	19.66	-0.40
27	1.2	-82850	-102750	19.27	1494.511	19.70	-0.43
27	1.3	-82770	-102711	19.25	1494.802	19.80	-0.55
27	1.4	-82671	-102717	19.34	1494.654	19.84	-0.50
27	1.5	-82573	-102723	19.43	1494.347	19.89	-0.46
27	1.6	-82474	-102729	19.55	1494.274	19.93	-0.38
27	1.7	-82376	-102736	19.50	1494.375	19.98	-0.48
27	1.8	-82277	-102742	19.56	1494.399	20.06	-0.50
27	1.9	-82179	-102748	19.51	1494.318	20.13	-0.62
27	2	-82080	-102754	19.49	1494.180	20.20	-0.71
27	2.1	-81981	-102760	19.45	1493.990	20.28	-0.83
27	2.2	-81883	-102766	19.53	1493.779	20.35	-0.82
27	2.3	-81784	-102772	19.51	1493.565	20.43	-0.92
27	2.4	-81686	-102779	19.59	1493.321	20.50	-0.91
27	2.5	-81587	-102785	19.65	1492.824	20.58	-0.93
27	2.6	-81489	-102791	19.70	1492.728	20.64	-0.94

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
27	2.7	-81390	-102797	19.73	1492.758	20.70	-0.97
27	2.8	-81291	-102803	19.70	1492.832	20.76	-1.06
27	2.9	-81193	-102809	19.68	1492.693	20.83	-1.15
27	3	-81094	-102815	19.79	1492.482	20.89	-1.10
27	3.1	-80996	-102822	19.73	1492.352	20.95	-1.22
27	3.2	-80897	-102828	19.33	1492.019	21.01	-1.68
27	3.3	-80799	-102834	19.32	1491.421	21.07	-1.75
27	3.4	-80700	-102840	19.86	1490.984	21.12	-1.26
27	3.5	-80619	-102781	20.14	1490.789	21.15	-1.01
27	3.6	-80538	-102722	20.26	1490.150	21.17	-0.91
27	3.7	-80456	-102662	20.24	1489.399	21.20	-0.96
27	3.8	-80375	-102603	20.32	1488.815	21.23	-0.91
27	3.9	-80294	-102544	20.29	1488.227	21.25	-0.96
27	4	-80213	-102485	20.26	1487.991	21.28	-1.02
27	4.1	-80132	-102426	20.28	1488.219	21.30	-1.02
27	4.2	-80050	-102366	20.27	1488.070	21.33	-1.06
27	4.3	-79969	-102307	20.45	1487.924	21.35	-0.90
27	4.4	-79888	-102248	20.49	1487.650	21.38	-0.89
27	4.5	-79807	-102189	20.47	1487.440	21.40	-0.93
27	4.6	-79726	-102130	20.51	1487.507	21.42	-0.91
27	4.7	-79644	-102070	20.40	1487.454	21.44	-1.04
27	4.8	-79563	-102011	20.18	1487.575	21.47	-1.29
27	4.9	-79482	-101952	19.88	1488.302	21.49	-1.61
27	5	-79401	-101893	19.69	1490.739	21.51	-1.82
27	5.1	-79320	-101834	19.98	1489.275	21.53	-1.55
27	5.2	-79238	-101774	20.23	1488.811	21.56	-1.33
27	5.3	-79157	-101715	20.27	1488.171	21.58	-1.31
27	5.4	-79076	-101656	20.35	1487.021	21.60	-1.25
27	5.5	-78995	-101597	20.41	1485.491	21.61	-1.20
27	5.6	-78914	-101538	20.39	1483.413	21.63	-1.24
27	5.7	-78832	-101478	20.34	1481.455	21.64	-1.30
27	5.8	-78751	-101419	20.49	1480.025	21.66	-1.17
27	5.9	-78670	-101360	20.30	1480.004	21.67	-1.37
28	0.1	-80833	-103533	19.98	1490.557	21.13	-1.15
28	0.2	-80736	-103516	20.15	1489.796	21.17	-1.02
28	0.3	-80639	-103499	20.42	1489.350	21.21	-0.79
28	0.4	-80541	-103474	20.61	1489.390	21.25	-0.64
28	0.5	-80443	-103443	20.73	1489.085	21.30	-0.57
28	0.6	-80344	-103411	20.73	1489.030	21.35	-0.62
28	0.7	-80246	-103380	20.71	1488.932	21.40	-0.69
28	0.8	-80148	-103349	20.76	1488.577	21.45	-0.69
28	0.9	-80050	-103317	20.81	1488.065	21.49	-0.68
28	1	-79951	-103286	20.79	1487.762	21.53	-0.74
28	1.1	-79853	-103255	21.00	1487.939	21.58	-0.58
28	1.2	-79755	-103224	21.15	1488.152	21.63	-0.48
28	1.3	-79657	-103192	21.05	1487.853	21.67	-0.62
28	1.4	-79558	-103161	21.10	1488.150	21.72	-0.62
28	1.5	-79460	-103130	21.10	1487.304	21.76	-0.66
29	0.1	-81140	-101759	19.71	1492.995	20.43	-0.72
29	0.2	-81040	-101768	19.77	1492.513	20.52	-0.75
29	0.3	-80940	-101776	19.79	1492.255	20.60	-0.81
29	0.4	-80840	-101785	19.47	1491.709	20.67	-1.20
29	0.5	-80740	-101793	20.08	1490.936	20.73	-0.65
29	0.6	-80640	-101802	20.12	1490.863	20.80	-0.68
29	0.7	-80540	-101810	20.33	1490.376	20.89	-0.56
29	0.8	-80453	-101753	20.34	1490.012	20.92	-0.58
29	0.9	-80367	-101697	20.30	1489.399	20.96	-0.66

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
29	1	-80280	-101640	20.10	1489.140	20.99	-0.89
138	0.1	-81425	-100343	19.12	1492.242	19.55	-0.43
138	0.2	-81450	-100245	19.21	1492.201	19.48	-0.27
138	0.3	-81475	-100148	19.13	1492.2	19.40	-0.27
138	0.4	-81500	-100050	19.03	1492.299	19.32	-0.29
138	0.5	-81525	-99953	18.81	1492.847	19.24	-0.43
138	0.6	-81550	-99855	18.73	1493.14	19.16	-0.43
138	0.7	-81575	-99758	18.55	1493.564	19.08	-0.53
138	0.8	-81600	-99660	18.62	1493.657	19.00	-0.38
138	0.9	-81625	-99563	18.67	1493.556	18.99	-0.32
138	1	-81650	-99465	18.64	1493.34	18.98	-0.34
138	1.1	-81675	-99368	18.46	1493.41	18.98	-0.52
138	1.2	-81700	-99270	18.76	1493.298	18.97	-0.21
138	1.3	-81725	-99173	18.71	1493.656	18.97	-0.26
138	1.4	-81750	-99075	18.68	1493.996	18.96	-0.28
138	1.5	-81775	-98978	18.70	1493.999	18.97	-0.27
138	1.6	-81800	-98880	18.69	1493.711	18.98	-0.29
138	1.7	-81825	-98783	18.76	1493.965	18.99	-0.23
138	1.8	-81850	-98685	18.76	1494.045	19.04	-0.28
138	1.9	-81875	-98588	18.72	1494.009	19.09	-0.37
138	2	-81900	-98490	18.73	1494.364	19.14	-0.41
138	2.1	-81925	-98393	18.64	1494.703	19.19	-0.55
138	2.2	-81950	-98295	18.64	1494.39	19.25	-0.61
138	2.3	-81975	-98198	18.69	1494.804	19.32	-0.63
138	2.4	-82000	-98100	18.76	1495.088	19.38	-0.62
139	0.1	-83348	-98848	18.51	1497.067	19.48	-0.97
139	0.2	-83316	-98945	18.44	1496.679	19.42	-0.98
139	0.3	-83284	-99043	18.43	1496.249	19.36	-0.93
139	0.4	-83252	-99141	18.49	1495.949	19.30	-0.81
139	0.5	-83220	-99238	18.38	1495.679	19.24	-0.86
139	0.6	-83188	-99336	18.31	1495.291	19.18	-0.87
139	0.7	-83156	-99434	18.07	1495.057	19.12	-1.05
139	0.8	-83125	-99532	17.85	1494.718	19.05	-1.20
139	0.9	-83093	-99629	17.84	1494.540	18.98	-1.14
139	1	-83061	-99727	17.69	1494.297	18.92	-1.23
139	1.1	-83029	-99825	17.49	1493.85	18.86	-1.37
139	1.2	-82997	-99922	17.52	1494.099	18.80	-1.28
139	1.3	-82965	-100020	17.69	1494.223	18.78	-1.09
139	1.4	-82933	-100118	17.69	1494.446	18.75	-1.06
139	1.5	-82901	-100215	17.71	1494.353	18.72	-1.01
139	1.6	-82869	-100313	17.60	1494.299	18.70	-1.10
139	1.7	-82837	-100411	17.70	1494.358	18.69	-0.99
139	1.8	-82805	-100508	17.47	1494.443	18.68	-1.21
139	1.9	-82773	-100606	17.32	1494.791	18.69	-1.37
139	2	-82741	-100704	17.53	1495.144	18.69	-1.16
139	2.1	-82710	-100802	17.52	1495.380	18.70	-1.18
139	2.2	-82678	-100899	17.49	1495.221	18.75	-1.26
139	2.3	-82646	-100997	17.63	1495.045	18.80	-1.17
139	2.4	-82614	-101095	17.91	1494.953	18.87	-0.96
139	2.5	-82582	-101192	18.12	1494.870	18.94	-0.82
139	2.6	-82550	-101290	18.31	1494.843	19.02	-0.71
140	0.1	-83467	-101880	17.81	1497.988	18.60	-0.79
140	0.2	-83474	-101780	17.62	1498.107	18.58	-0.96
140	0.3	-83481	-101680	17.39	1498.217	18.55	-1.16
140	0.4	-83488	-101580	17.27	1498.325	18.52	-1.25
140	0.5	-83495	-101480	17.31	1498.312	18.50	-1.19
140	0.6	-83502	-101380	17.45	1498.397	18.50	-1.05

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
140	0.7	-83509	-101280	17.41	1498.347	18.50	-1.09
140	0.8	-83515	-101180	17.50	1498.398	18.51	-1.01
140	0.9	-83522	-101080	17.53	1498.008	18.53	-1.00
140	1	-83529	-100980	17.65	1497.440	18.54	-0.89
140	1.1	-83536	-100880	17.65	1496.655	18.55	-0.90
140	1.2	-83543	-100780	17.57	1495.714	18.58	-1.01
140	1.3	-83550	-100680	17.70	1495.021	18.61	-0.91
140	1.4	-83557	-100580	17.74	1494.432	18.65	-0.91
140	1.5	-83564	-100480	17.80	1494.901	18.68	-0.88
140	1.6	-83571	-100380	17.89	1495.193	18.74	-0.85
140	1.7	-83578	-100280	17.95	1495.285	18.80	-0.85
140	1.8	-83585	-100180	18.01	1495.303	18.86	-0.85
140	1.9	-83592	-100080	18.07	1495.302	18.92	-0.85
140	2	-83598	-99980	18.12	1495.287	18.97	-0.85
140	2.1	-83605	-99880	18.23	1495.401	19.02	-0.79
140	2.2	-83612	-99780	18.31	1495.405	19.07	-0.76
140	2.3	-83619	-99680	18.30	1495.459	19.12	-0.82
140	2.4	-83626	-99580	18.33	1495.349	19.17	-0.84
140	2.5	-83633	-99480	18.06	1495.671	19.22	-1.16
140	2.6	-83640	-99380	18.44	1496.13	19.27	-0.83
140	2.7	-83647	-99280	18.66	1496.512	19.32	-0.66
140	2.8	-83654	-99180	18.85	1496.749	19.37	-0.52
140	2.9	-83656	-99084	18.83	1496.990	19.41	-0.58
140	3	-83621	-99023	18.77	1496.926	19.43	-0.66
140	3.1	-83585	-98961	18.64	1496.996	19.45	-0.81
140	3.2	-83550	-98900	18.58	1497.136	19.48	-0.90
141	0.1	-81525	-100550	19.15	1493.127	19.55	-0.40
141	0.2	-81500	-100650	19.17	1493.217	19.62	-0.44
141	0.3	-81476	-100749	19.26	1493.191	19.68	-0.42
141	0.4	-81451	-100849	19.25	1493.134	19.75	-0.50
141	0.5	-81426	-100948	19.38	1492.833	19.81	-0.44
141	0.6	-81401	-101048	19.50	1492.486	19.88	-0.38
141	0.7	-81377	-101147	19.54	1492.438	19.94	-0.40
141	0.8	-81352	-101247	19.55	1492.544	20.01	-0.46
141	0.9	-81327	-101347	19.48	1492.799	20.08	-0.59
141	1	-81302	-101446	19.27	1493.100	20.14	-0.87
141	1.1	-81277	-101546	19.55	1493.166	20.21	-0.65
141	1.2	-81253	-101645	19.67	1493.384	20.27	-0.60
141	1.3	-81228	-101745	19.52	1493.184	20.34	-0.82
141	1.4	-81203	-101844	19.75	1493.175	20.41	-0.66
141	1.5	-81178	-101944	19.64	1492.959	20.47	-0.84
141	1.6	-81153	-102043	19.84	1492.799	20.54	-0.70
141	1.7	-81129	-102143	19.92	1492.619	20.60	-0.68
141	1.8	-81104	-102243	20.00	1492.188	20.67	-0.67
141	1.9	-81079	-102342	20.08	1491.668	20.73	-0.65
141	2	-81054	-102442	20.11	1491.327	20.80	-0.69
141	2.1	-81030	-102541	20.12	1491.764	20.85	-0.73
141	2.2	-81005	-102641	20.03	1492.122	20.90	-0.87
141	2.3	-80980	-102740	19.99	1492.082	20.95	-0.96
141	2.4	-80973	-102840	19.89	1491.979	21.00	-1.11
141	2.5	-80966	-102940	19.82	1492.222	21.01	-1.19
141	2.6	-80958	-103040	19.39	1492.108	21.03	-1.64
141	2.7	-80951	-103140	19.36	1491.646	21.04	-1.68
141	2.8	-80944	-103240	19.38	1491.238	21.06	-1.68
141	2.9	-80937	-103340	19.39	1491.208	21.07	-1.68
141	3	-80929	-103440	19.40	1491.230	21.09	-1.69
141	3.1	-80922	-103540	19.44	1491.514	21.10	-1.66

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
141	3.2	-80915	-103640	19.80	1491.771	21.10	-1.30
141	3.3	-80908	-103740	20.04	1491.746	21.10	-1.06
141	3.4	-80901	-103840	20.08	1491.839	21.10	-1.02
141	3.5	-80893	-103940	20.02	1491.881	21.09	-1.07
141	3.6	-80886	-104040	20.05	1491.974	21.09	-1.04
141	3.7	-80879	-104140	20.01	1492.117	21.08	-1.07
141	3.8	-80872	-104240	19.97	1491.990	21.07	-1.10
141	3.9	-80864	-104340	19.89	1492.051	21.06	-1.17
141	4	-80857	-104440	19.87	1492.033	21.05	-1.18
141	4.1	-80850	-104540	19.90	1492.016	21.05	-1.15
142	0.1	-82936	-101727	18.34	1496.340	19.03	-0.69
142	0.2	-82872	-101804	18.54	1495.874	19.13	-0.58
142	0.3	-82807	-101881	18.76	1495.733	19.23	-0.46
142	0.4	-82743	-101958	18.85	1495.675	19.32	-0.47
142	0.5	-82679	-102036	18.94	1495.556	19.42	-0.49
142	0.6	-82615	-102113	18.99	1495.524	19.52	-0.53
142	0.7	-82550	-102190	19.04	1495.304	19.62	-0.58
142	0.8	-82486	-102267	19.15	1495.263	19.69	-0.54
142	0.9	-82422	-102344	19.26	1495.015	19.76	-0.51
142	1	-82357	-102421	19.43	1494.793	19.84	-0.41
142	1.1	-82293	-102498	19.56	1494.672	19.91	-0.35
142	1.2	-82229	-102576	19.63	1494.679	19.98	-0.35
142	1.3	-82165	-102653	19.60	1494.293	20.08	-0.48
142	1.4	-82100	-102730	19.64	1494.249	20.18	-0.54
143	0.1	-83400	-102000	18.13	1497.623	18.80	-0.67
143	0.2	-83345	-102058	18.18	1497.380	18.89	-0.70
143	0.3	-83290	-102117	18.25	1497.166	18.97	-0.72
143	0.4	-83235	-102175	18.34	1496.875	19.06	-0.72
143	0.5	-83180	-102233	18.40	1496.724	19.14	-0.74
143	0.6	-83125	-102292	18.42	1496.484	19.23	-0.80
143	0.7	-83070	-102350	18.53	1496.162	19.31	-0.79
143	0.8	-83015	-102408	18.55	1495.922	19.40	-0.84
143	0.9	-82960	-102467	18.61	1495.352	19.48	-0.87
143	1	-82905	-102525	18.63	1494.682	19.57	-0.94
14	2.1	-87135	-109370	17.55	1487.454	17.85	-0.30
14	2.2	-87173	-109463	17.54	1486.749	17.87	-0.33
14	2.3	-87211	-109556	17.61	1486.217	17.90	-0.29
14	2.4	-87250	-109650	17.69	1485.437	17.92	-0.23
14	2.5	-87320	-109700	17.71	1484.796	17.91	-0.20
14	2.6	-87413	-109742	17.69	1484.552	17.91	-0.22
14	2.7	-87505	-109785	17.70	1484.379	17.90	-0.20
14	2.8	-87598	-109827	17.67	1484.035	17.89	-0.22
14	2.9	-87690	-109869	17.68	1483.860	17.87	-0.19
14	3	-87783	-109911	17.68	1483.680	17.85	-0.17
14	3.1	-87875	-109954	17.60	1483.296	17.83	-0.23
14	3.2	-87968	-109996	17.48	1483.042	17.81	-0.33
14	3.3	-88060	-110038	17.53	1482.652	17.80	-0.27
14	3.4	-88153	-110081	17.46	1482.434	17.78	-0.32
14	3.5	-88245	-110123	17.48	1482.164	17.75	-0.27
14	3.6	-88338	-110165	17.46	1481.754	17.73	-0.27
14	3.7	-88430	-110208	17.44	1481.545	17.70	-0.26
14	3.8	-88523	-110250	17.40	1481.226	17.68	-0.28
14	3.9	-88615	-110292	17.44	1480.978	17.65	-0.21
14	4	-88708	-110334	17.38	1480.745	17.63	-0.25
14	4.1	-88800	-110377	17.36	1480.370	17.60	-0.24
14	4.2	-88893	-110419	17.29	1479.915	17.56	-0.27
14	4.3	-88985	-110461	17.19	1479.590	17.52	-0.33

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
14	4.4	-89078	-110504	17.16	1479.160	17.48	-0.32
14	4.5	-89170	-110546	17.04	1478.900	17.44	-0.40
14	4.6	-89263	-110588	17.07	1478.445	17.40	-0.33
14	4.7	-89355	-110630	16.96	1477.960	17.33	-0.37
14	4.8	-89448	-110673	16.90	1477.423	17.27	-0.37
14	4.9	-89540	-110715	16.80	1476.961	17.20	-0.40
200	0.1	-89080	-106650	17.45	1493.825	17.71	-0.26
200	0.2	-89118	-106739	17.23	1493.663	17.67	-0.44
200	0.3	-89157	-106828	17.00	1493.632	17.63	-0.63
200	0.4	-89195	-106917	16.97	1493.651	17.59	-0.62
200	0.5	-89233	-107007	17.02	1493.554	17.55	-0.54
200	0.6	-89272	-107096	17.03	1493.759	17.52	-0.48
200	0.7	-89310	-107185	16.98	1493.783	17.48	-0.49
200	0.8	-89348	-107274	16.88	1493.817	17.44	-0.56
200	0.9	-89387	-107363	16.90	1493.708	17.40	-0.50
200	1	-89425	-107452	17.04	1493.744	17.36	-0.32
200	1.1	-89463	-107542	17.02	1493.709	17.32	-0.30
200	1.2	-89502	-107631	16.99	1493.510	17.28	-0.29
200	1.3	-89540	-107720	16.96	1493.075	17.24	-0.28
200	1.4	-89579	-107811	16.99	1492.945	17.20	-0.21
200	1.5	-89619	-107903	16.98	1492.570	17.15	-0.17
200	1.6	-89658	-107994	16.96	1492.033	17.10	-0.14
200	1.7	-89697	-108085	16.93	1491.699	17.05	-0.12
200	1.8	-89737	-108177	16.87	1491.192	17.00	-0.13
200	1.9	-89776	-108268	16.72	1490.878	16.95	-0.23
200	2	-89815	-108359	16.70	1490.291	16.90	-0.20
200	2.1	-89855	-108451	16.69	1489.754	16.85	-0.16
200	2.2	-89894	-108542	16.65	1488.659	16.80	-0.15
200	2.3	-89933	-108634	16.62	1488.123	16.77	-0.15
200	2.4	-89973	-108725	16.59	1487.227	16.74	-0.15
200	2.5	-90012	-108816	16.58	1486.300	16.71	-0.13
200	2.6	-90051	-108908	16.52	1485.669	16.68	-0.16
200	2.7	-90091	-108999	16.45	1484.796	16.66	-0.21
200	2.8	-90130	-109090	16.48	1484.056	16.63	-0.15
200	2.9	-90169	-109182	16.37	1483.312	16.60	-0.23
200	3	-90209	-109273	16.37	1482.507	16.57	-0.20
200	3.1	-90248	-109364	16.42	1481.497	16.54	-0.12
200	3.2	-90287	-109456	16.36	1480.799	16.51	-0.15
200	3.3	-90326	-109547	16.33	1480.113	16.48	-0.15
200	3.4	-90366	-109638	16.32	1479.233	16.46	-0.14
200	3.5	-90405	-109730	16.26	1478.427	16.43	-0.17
200	3.6	-90444	-109821	16.22	1477.841	16.40	-0.18
200	3.7	-90484	-109912	16.17	1476.961	16.36	-0.19
200	3.8	-90523	-110004	16.13	1476.565	16.33	-0.20
200	3.9	-90562	-110095	16.06	1475.804	16.29	-0.23
200	4	-90602	-110186	16.03	1475.342	16.26	-0.23
200	4.1	-90641	-110278	16.02	1474.712	16.22	-0.20
200	4.2	-90680	-110369	15.92	1474.429	16.18	-0.26
200	4.3	-90720	-110461	15.91	1473.625	16.14	-0.23
200	4.4	-90759	-110552	15.85	1473.340	16.10	-0.25
200	4.5	-90798	-110643	15.82	1472.811	16.06	-0.24
200	4.6	-90838	-110735	15.79	1472.056	16.02	-0.23
200	4.7	-90877	-110826	15.67	1471.631	15.98	-0.31
200	4.8	-90916	-110917	15.51	1471.416	15.94	-0.43
200	4.9	-90956	-111009	15.39	1470.568	15.91	-0.52
200	5	-90995	-111100	15.37	1469.989	15.87	-0.50
200	5.1	-91034	-111191	15.30	1469.290	15.84	-0.54

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
200	5.2	-91074	-111283	15.26	1468.523	15.80	-0.54
200	5.3	-91113	-111374	15.19	1467.926	15.76	-0.57
200	5.4	-91152	-111465	15.16	1467.256	15.72	-0.56
200	5.5	-91192	-111557	15.11	1466.767	15.68	-0.57
200	5.6	-91231	-111648	15.08	1466.235	15.64	-0.56
200	5.7	-91270	-111739	15.05	1465.672	15.60	-0.55
200	5.8	-91310	-111831	15.02	1465.089	15.55	-0.53
200	5.9	-91349	-111922	14.93	1464.604	15.50	-0.57
200	6	-91388	-112014	14.93	1463.899	15.40	-0.47
200	6.1	-91428	-112105	14.94	1463.149	15.40	-0.46
200	6.2	-91467	-112196	14.91	1462.626	15.40	-0.49
200	6.3	-91506	-112288	14.93	1461.738	15.40	-0.47
200	6.4	-91546	-112379	14.94	1460.987	15.47	-0.53
200	6.5	-91585	-112470	14.98	1460.467	15.53	-0.55
200	6.6	-91624	-112562	15.01	1459.586	15.60	-0.59
200	6.7	-91663	-112653	15.07	1458.757	15.70	-0.63
200	6.8	-91703	-112744	15.10	1458.678	15.80	-0.70
200	6.9	-91742	-112836	15.13	1458.659	15.87	-0.74
200	7	-91781	-112927	15.22	1458.044	15.93	-0.71
200	7.1	-91821	-113018	15.35	1457.395	16.00	-0.65
200	7.2	-91860	-113110	15.48	1456.712	16.10	-0.62
200	7.3	-91899	-113201	15.55	1456.096	16.20	-0.65
200	7.4	-91939	-113292	15.79	1455.414	16.34	-0.55
200	7.5	-91978	-113384	16.01	1454.847	16.42	-0.41
200	7.6	-92017	-113475	16.14	1454.146	16.51	-0.37
200	7.7	-92057	-113566	16.38	1453.391	16.60	-0.22
200	7.8	-92096	-113658	16.61	1452.608	16.70	-0.09
200	7.9	-92135	-113749	16.80	1452.007	16.85	-0.05
200	8	-92175	-113841	16.99	1451.342	17.00	-0.01
200	8.1	-92214	-113932	17.06	1450.961	17.20	-0.14
200	8.2	-92253	-114023	17.16	1450.489	17.30	-0.14
200	8.3	-92293	-114115	17.32	1450.064	17.40	-0.08
200	8.4	-92332	-114206	17.41	1449.627	17.50	-0.09
200	8.5	-92371	-114297	17.54	1449.095	17.60	-0.06
200	8.6	-92411	-114389	17.67	1448.495	17.70	-0.03
200	8.7	-92450	-114480	17.73	1447.784	17.80	-0.07
200	8.8	-92469	-114578	17.82	1447.307	17.90	-0.08
200	8.9	-92488	-114676	17.90	1446.755	18.00	-0.10
200	9	-92507	-114775	18.01	1446.024	18.10	-0.09
200	9.1	-92526	-114873	18.05	1445.543	18.20	-0.15
200	9.2	-92545	-114971	18.06	1444.940	18.25	-0.19
200	9.3	-92565	-115069	18.08	1444.011	18.30	-0.22
200	9.4	-92584	-115167	18.07	1443.112	18.34	-0.27
200	9.5	-92603	-115265	18.03	1441.920	18.37	-0.34
200	9.6	-92622	-115364	17.97	1441.369	18.40	-0.43
200	9.7	-92641	-115462	17.98	1440.359	18.39	-0.41
200	9.8	-92660	-115560	17.85	1440.142	18.38	-0.53
200	9.9	-92679	-115658	17.76	1439.821	18.29	-0.53
200	10	-92698	-115756	17.82	1438.898	18.20	-0.38
200	10.1	-92717	-115855	17.77	1438.017	18.10	-0.33
200	10.2	-92736	-115953	17.74	1437.319	18.00	-0.26
200	10.3	-92755	-116051	17.66	1436.381	17.90	-0.24
200	10.4	-92775	-116149	17.60	1435.235	17.80	-0.20
200	10.5	-92794	-116247	17.56	1434.475	17.70	-0.14
200	10.6	-92813	-116345	17.57	1433.881	17.59	-0.02
200	10.7	-92832	-116444	17.37	1433.179	17.50	-0.13
200	10.8	-92851	-116542	17.21	1432.596	17.40	-0.19

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
200	10.9	-92870	-116640	17.15	1432.086	17.30	-0.15
200	11	-92889	-116738	17.08	1431.176	17.23	-0.15
200	11.1	-92908	-116836	17.10	1430.330	17.22	-0.12
200	11.2	-92927	-116935	17.14	1429.560	17.24	-0.10
200	11.3	-92946	-117033	17.19	1428.805	17.31	-0.12
200	11.4	-92965	-117131	17.28	1428.141	17.38	-0.10
200	11.5	-92985	-117229	17.29	1427.490	17.43	-0.14
200	11.6	-93004	-117327	17.39	1427.069	17.54	-0.15
200	11.7	-93023	-117425	17.63	1425.835	17.67	-0.04
200	11.8	-93042	-117524	17.74	1425.859	17.78	-0.04
200	11.9	-93061	-117622	17.93	1425.633	17.89	0.04
200	12	-93080	-117720	18.14	1425.469	18.00	0.14
201	0.1	-89145	-107040	16.98	1493.746	17.49	-0.51
201	0.2	-89047	-107070	16.91	1494.019	17.42	-0.51
201	0.3	-88950	-107100	16.89	1494.020	17.36	-0.47
201	0.4	-88852	-107131	16.82	1494.632	17.30	-0.48
201	0.5	-88755	-107161	16.74	1495.053	17.22	-0.48
201	0.6	-88657	-107191	16.72	1495.561	17.19	-0.47
201	0.7	-88559	-107221	16.60	1496.008	17.15	-0.55
201	0.8	-88462	-107251	16.43	1496.318	17.10	-0.67
201	0.9	-88364	-107281	16.26	1496.312	17.09	-0.83
201	1	-88267	-107312	16.14	1496.178	17.07	-0.93
201	1.1	-88169	-107342	16.03	1496.149	17.06	-1.03
201	1.2	-88071	-107372	15.97	1496.237	17.06	-1.09
201	1.3	-87974	-107402	16.04	1496.451	17.07	-1.03
201	1.4	-87876	-107432	16.08	1496.712	17.09	-1.01
201	1.5	-87779	-107463	16.22	1496.954	17.12	-0.90
201	1.6	-87681	-107493	16.25	1497.067	17.16	-0.91
201	1.7	-87584	-107523	16.42	1496.935	17.20	-0.78
201	1.8	-87486	-107553	16.53	1496.870	17.26	-0.73
201	1.9	-87388	-107583	16.61	1496.907	17.32	-0.71
201	2	-87291	-107614	16.82	1496.974	17.40	-0.58
201	2.1	-87193	-107644	16.99	1496.879	17.44	-0.45
201	2.2	-87096	-107674	17.05	1496.761	17.48	-0.43
201	2.3	-86998	-107704	17.18	1496.754	17.52	-0.34
201	2.4	-86900	-107734	17.21	1496.699	17.56	-0.35
201	2.5	-86803	-107764	17.26	1496.506	17.60	-0.34
201	2.6	-86705	-107795	17.33	1496.473	17.63	-0.30
201	2.7	-86608	-107825	17.39	1496.180	17.65	-0.26
201	2.8	-86510	-107855	17.45	1495.675	17.68	-0.23
202	0.1	-89320	-107400	16.87	1493.875	17.34	-0.47
202	0.2	-89224	-107431	16.79	1494.441	17.27	-0.48
202	0.3	-89128	-107463	16.68	1494.745	17.20	-0.52
202	0.4	-89032	-107494	16.55	1494.908	17.14	-0.59
202	0.5	-88936	-107525	16.53	1495.031	17.08	-0.55
202	0.6	-88840	-107556	16.50	1494.450	17.02	-0.52
202	0.7	-88744	-107588	16.45	1494.112	17.00	-0.55
202	0.8	-88649	-107619	16.23	1494.815	16.98	-0.75
202	0.9	-88553	-107650	16.10	1495.477	16.98	-0.88
202	1	-88457	-107682	16.00	1495.506	16.98	-0.98
202	1.1	-88361	-107713	16.05	1495.661	16.98	-0.93
202	1.2	-88265	-107744	16.11	1495.951	16.99	-0.88
202	1.3	-88169	-107775	16.06	1496.075	17.01	-0.95
202	1.4	-88073	-107807	16.06	1496.078	17.05	-0.99
202	1.5	-87977	-107838	15.92	1496.230	17.11	-1.19
202	1.6	-87881	-107869	16.30	1496.008	17.15	-0.85
202	1.7	-87785	-107901	16.55	1495.955	17.20	-0.65

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
202	1.8	-87689	-107932	16.62	1496.075	17.29	-0.67
202	1.9	-87593	-107963	16.61	1496.060	17.38	-0.77
202	2	-87497	-107995	16.87	1495.872	17.42	-0.55
202	2.1	-87401	-108026	16.98	1495.845	17.45	-0.47
202	2.2	-87306	-108057	17.04	1495.598	17.49	-0.45
202	2.3	-87210	-108088	17.18	1495.393	17.52	-0.34
202	2.4	-87114	-108120	17.24	1495.204	17.56	-0.32
202	2.5	-87018	-108151	17.31	1494.882	17.59	-0.28
202	2.6	-86922	-108182	17.34	1494.680	17.63	-0.29
202	2.7	-86826	-108214	17.36	1494.639	17.66	-0.30
202	2.8	-86730	-108245	17.43	1494.561	17.70	-0.27
203	0.1	-89425	-107725	16.82	1493.377	17.21	-0.39
203	0.2	-89330	-107759	16.74	1493.767	17.10	-0.36
203	0.3	-89235	-107792	16.63	1494.261	17.02	-0.39
203	0.4	-89140	-107826	16.53	1494.284	16.99	-0.46
203	0.5	-89045	-107860	16.45	1494.455	16.95	-0.50
203	0.6	-88950	-107894	16.35	1494.492	16.91	-0.56
203	0.7	-88855	-107927	16.22	1494.458	16.90	-0.68
203	0.8	-88760	-107961	16.21	1494.715	16.90	-0.69
203	0.9	-88665	-107995	16.22	1494.770	16.90	-0.68
203	1	-88570	-108028	16.11	1494.941	16.92	-0.81
203	1.1	-88475	-108062	16.25	1494.936	16.94	-0.69
203	1.2	-88380	-108096	16.27	1494.866	16.96	-0.69
203	1.3	-88285	-108129	16.31	1494.806	16.99	-0.68
203	1.4	-88190	-108163	16.36	1494.880	17.08	-0.72
203	1.5	-88095	-108197	16.54	1494.590	17.14	-0.60
203	1.6	-88000	-108231	16.60	1494.303	17.21	-0.61
203	1.7	-87905	-108264	16.75	1493.983	17.30	-0.55
203	1.8	-87810	-108298	16.91	1493.619	17.39	-0.48
203	1.9	-87715	-108332	16.96	1493.421	17.42	-0.46
203	2	-87620	-108366	16.96	1493.423	17.46	-0.50
203	2.1	-87525	-108399	17.05	1493.484	17.49	-0.44
203	2.2	-87430	-108433	17.12	1493.631	17.53	-0.41
203	2.3	-87335	-108466	17.19	1493.580	17.56	-0.37
203	2.4	-87240	-108500	17.21	1493.561	17.60	-0.39
203	2.5	-87145	-108534	17.25	1493.561	17.63	-0.38
203	2.6	-87050	-108568	17.36	1493.298	17.66	-0.30
203	2.7	-86955	-108601	17.41	1493.189	17.69	-0.28
203	2.8	-86860	-108635	17.47	1493.103	17.72	-0.25
204	0	-89450	-108255	16.50	1492.312	16.84	-0.34
204	0.1	-89354	-108288	16.47	1492.131	16.83	-0.36
204	0.2	-89259	-108320	16.43	1492.256	16.82	-0.39
204	0.3	-89163	-108353	16.37	1492.384	16.82	-0.45
204	0.4	-89068	-108386	16.35	1492.539	16.83	-0.48
204	0.5	-88972	-108418	16.38	1492.613	16.84	-0.46
204	0.6	-88876	-108451	16.41	1492.488	16.87	-0.46
204	0.7	-88781	-108484	16.42	1492.317	16.89	-0.47
204	0.8	-88685	-108516	16.44	1492.032	16.91	-0.47
204	0.9	-88590	-108549	16.50	1491.733	16.97	-0.47
204	1	-88494	-108581	16.65	1491.471	17.01	-0.36
204	1.1	-88399	-108614	16.67	1491.219	17.10	-0.43
204	1.2	-88303	-108647	16.73	1491.038	17.20	-0.47
204	1.3	-88207	-108679	16.81	1490.992	17.29	-0.48
204	1.4	-88112	-108712	16.88	1490.805	17.39	-0.51
204	1.5	-88016	-108745	16.91	1490.703	17.42	-0.51
204	1.6	-87921	-108777	17.04	1490.755	17.46	-0.42
204	1.7	-87825	-108810	17.11	1490.626	17.50	-0.39

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
204	1.8	-87729	-108843	17.18	1490.618	17.55	-0.37
204	1.9	-87634	-108875	17.21	1490.808	17.59	-0.38
204	2	-87538	-108908	17.22	1490.734	17.62	-0.40
204	2.1	-87443	-108941	17.18	1490.567	17.65	-0.47
204	2.2	-87347	-108973	17.21	1490.682	17.68	-0.47
204	2.3	-87251	-109006	17.34	1490.483	17.71	-0.37
204	2.4	-87156	-109039	17.44	1489.859	17.74	-0.30
204	2.5	-87060	-109071	17.48	1489.594	17.77	-0.29
204	2.6	-86965	-109104	17.50	1489.516	17.80	-0.30
204	2.7	-86869	-109136	17.53	1489.435	17.84	-0.31
204	2.8	-86774	-109169	17.55	1489.237	17.88	-0.33
204	2.9	-86678	-109202	17.62	1488.881	17.92	-0.30
204	3	-86582	-109234	17.69	1488.452	17.95	-0.26
204	3.1	-86487	-109267	17.80	1488.115	17.99	-0.19
204	3.2	-86391	-109300	17.88	1488.335	18.02	-0.14
204	3.3	-86296	-109332	17.91	1488.360	18.06	-0.15
204	3.4	-86200	-109365	17.90	1488.674	18.10	-0.20
205	0	-87250	-109560	17.57	1486.523	17.90	-0.33
205	0.1	-87345	-109527	17.59	1486.681	17.85	-0.26
205	0.2	-87439	-109494	17.57	1486.597	17.81	-0.24
205	0.3	-87534	-109461	17.50	1486.631	17.78	-0.28
205	0.4	-87629	-109429	17.42	1486.560	17.74	-0.32
205	0.5	-87723	-109396	17.36	1486.682	17.70	-0.34
205	0.6	-87818	-109363	17.36	1486.751	17.66	-0.30
205	0.7	-87912	-109330	17.36	1486.734	17.62	-0.26
205	0.8	-88007	-109297	17.22	1486.820	17.59	-0.37
205	0.9	-88102	-109264	17.23	1486.897	17.54	-0.31
205	1	-88196	-109231	17.12	1486.665	17.50	-0.38
205	1.1	-88291	-109199	17.22	1486.279	17.45	-0.23
205	1.2	-88386	-109166	17.17	1486.513	17.40	-0.23
205	1.3	-88480	-109133	17.11	1487.417	17.33	-0.22
205	1.4	-88575	-109100	17.02	1487.748	17.27	-0.25
205	1.5	-88670	-109067	16.90	1487.875	17.20	-0.30
205	1.6	-88764	-109034	16.81	1487.771	17.10	-0.29
205	1.7	-88859	-109001	16.70	1488.025	17.00	-0.30
205	1.8	-88954	-108969	16.67	1488.228	16.90	-0.23
205	1.9	-89048	-108936	16.60	1488.400	16.81	-0.21
205	2	-89143	-108903	16.57	1488.439	16.79	-0.22
205	2.1	-89237	-108870	16.59	1488.469	16.77	-0.18
205	2.2	-89332	-108837	16.57	1488.436	16.76	-0.19
205	2.3	-89427	-108804	16.60	1488.383	16.75	-0.15
205	2.4	-89521	-108771	16.57	1488.316	16.74	-0.17
205	2.5	-89616	-108739	16.64	1488.108	16.74	-0.10
205	2.6	-89711	-108706	16.58	1488.002	16.75	-0.17
205	2.7	-89805	-108673	16.57	1487.859	16.78	-0.21
205	2.8	-89900	-108640	16.58	1487.802	16.80	-0.22
206	0.1	-87790	-109875	17.64	1483.706	17.84	-0.20
206	0.2	-87888	-109846	17.57	1483.776	17.80	-0.23
206	0.3	-87985	-109818	17.56	1484.002	17.76	-0.20
206	0.4	-88083	-109789	17.51	1484.086	17.72	-0.21
206	0.5	-88180	-109761	17.46	1484.254	17.68	-0.22
206	0.6	-88278	-109732	17.42	1484.264	17.64	-0.22
206	0.7	-88375	-109704	17.35	1484.339	17.59	-0.24
206	0.8	-88473	-109675	17.32	1484.410	17.52	-0.20
206	0.9	-88570	-109647	17.25	1484.290	17.48	-0.23
206	1	-88668	-109618	17.15	1484.521	17.42	-0.27
206	1.1	-88765	-109590	17.06	1484.276	17.34	-0.28

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
206	1.2	-88863	-109561	17.04	1483.797	17.27	-0.23
206	1.3	-88960	-109533	17.02	1483.118	17.20	-0.18
206	1.4	-89058	-109504	16.87	1483.920	17.10	-0.23
206	1.5	-89155	-109475	16.80	1483.774	16.99	-0.19
206	1.6	-89253	-109447	16.75	1483.467	16.90	-0.15
206	1.7	-89350	-109418	16.60	1483.238	16.80	-0.20
206	1.8	-89448	-109390	16.50	1483.179	16.75	-0.25
206	1.9	-89545	-109361	16.51	1482.890	16.69	-0.18
206	2	-89643	-109333	16.50	1482.902	16.65	-0.15
206	2.1	-89740	-109304	16.46	1482.995	16.61	-0.15
206	2.2	-89838	-109276	16.47	1482.980	16.60	-0.13
206	2.3	-89935	-109247	16.48	1483.113	16.59	-0.11
206	2.4	-90033	-109219	16.46	1483.288	16.59	-0.13
206	2.5	-90130	-109190	16.43	1483.408	16.60	-0.17
207	0	-89445	-108095	16.58	1492.818	16.95	-0.37
207	0.1	-89449	-108195	16.53	1492.185	16.90	-0.37
207	0.2	-89453	-108295	16.50	1491.654	16.85	-0.35
207	0.3	-89457	-108395	16.50	1490.795	16.80	-0.30
207	0.4	-89461	-108495	16.54	1490.345	16.78	-0.24
207	0.5	-89465	-108595	16.51	1490.042	16.75	-0.24
207	0.6	-89469	-108695	16.58	1489.033	16.73	-0.15
207	0.7	-89473	-108795	16.56	1488.010	16.71	-0.15
207	0.8	-89477	-108895	16.58	1486.995	16.70	-0.12
207	0.9	-89481	-108995	16.55	1486.391	16.69	-0.14
207	1	-89485	-109095	16.57	1485.344	16.69	-0.12
207	1.1	-89489	-109195	16.54	1484.474	16.69	-0.15
207	1.2	-89493	-109295	16.48	1483.521	16.70	-0.22
207	1.3	-89498	-109395	16.48	1482.670	16.71	-0.23
207	1.4	-89502	-109495	16.49	1482.125	16.74	-0.25
207	1.5	-89506	-109595	16.51	1481.602	16.78	-0.27
207	1.6	-89510	-109695	16.53	1480.908	16.80	-0.27
207	1.7	-89514	-109795	16.57	1480.442	16.81	-0.24
207	1.8	-89518	-109895	16.58	1479.934	16.84	-0.26
207	1.9	-89522	-109995	16.59	1479.342	16.91	-0.32
207	2	-89526	-110095	16.62	1479.167	16.98	-0.36
207	2.1	-89530	-110195	16.67	1478.669	17.00	-0.33
207	2.2	-89534	-110295	16.67	1478.124	17.01	-0.34
207	2.3	-89538	-110395	16.68	1477.846	17.06	-0.38
207	2.4	-89542	-110495	16.74	1477.481	17.10	-0.36
207	2.5	-89546	-110595	16.78	1477.300	17.16	-0.38
207	2.6	-89550	-110695	16.82	1477.132	17.20	-0.38
207	2.7	-89600	-110805	16.77	1476.025	17.20	-0.43
207	2.8	-89587	-110900	16.87	1475.795	17.27	-0.40
207	2.9	-89573	-110995	16.96	1475.468	17.34	-0.38
207	3	-89560	-111090	17.00	1475.430	17.41	-0.41
207	3.1	-89520	-111177	17.10	1475.203	17.50	-0.40
207	3.2	-89480	-111263	17.18	1475.308	17.59	-0.41
207	3.3	-89440	-111350	17.28	1474.699	17.67	-0.39
208	0.1	-86590	-108300	17.44	1493.909	17.72	-0.28
208	0.2	-86495	-108330	17.50	1493.817	17.75	-0.25
208	0.3	-86400	-108360	17.45	1493.598	17.78	-0.33
208	0.4	-86305	-108390	17.53	1493.542	17.81	-0.28
208	0.5	-86210	-108420	17.61	1493.292	17.84	-0.23
208	0.6	-86115	-108450	17.64	1493.005	17.88	-0.24
208	0.7	-86020	-108480	17.59	1492.675	17.91	-0.32
208	0.8	-85925	-108510	17.32	1492.439	17.94	-0.62
208	0.9	-85830	-108540	17.03	1491.797	17.97	-0.94

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
209	0.1	-87695	-109940	17.70	1483.594	17.90	-0.20
209	0.2	-87602	-109981	17.76	1483.524	17.95	-0.19
209	0.3	-87509	-110022	17.77	1483.579	18.00	-0.23
209	0.4	-87416	-110063	17.86	1483.636	18.05	-0.19
209	0.5	-87323	-110104	17.92	1483.634	18.10	-0.18
209	0.6	-87230	-110145	17.89	1483.631	18.15	-0.26
209	0.7	-87137	-110186	18.01	1483.721	18.19	-0.18
209	0.8	-87044	-110227	18.04	1483.736	18.24	-0.20
209	0.9	-86951	-110268	18.11	1483.691	18.29	-0.18
209	1	-86858	-110309	18.15	1483.720	18.34	-0.19
209	1.1	-86765	-110350	18.21	1483.626	18.39	-0.18
210	0.1	-87460	-111495	18.59	1474.687	18.78	-0.19
210	0.2	-87552	-111453	18.55	1474.661	18.74	-0.19
210	0.3	-87644	-111412	18.53	1474.749	18.69	-0.16
210	0.4	-87736	-111370	18.42	1474.845	18.64	-0.22
210	0.5	-87828	-111329	18.38	1474.933	18.59	-0.21
210	0.6	-87920	-111287	18.35	1475.177	18.52	-0.17
210	0.7	-88012	-111246	18.28	1475.376	18.46	-0.18
210	0.8	-88103	-111204	18.18	1475.647	18.39	-0.21
210	0.9	-88195	-111163	18.13	1475.886	18.32	-0.19
210	1	-88287	-111121	18.06	1476.037	18.25	-0.19
210	1.1	-88379	-111080	17.96	1476.404	18.18	-0.22
210	1.2	-88471	-111038	17.88	1476.724	18.12	-0.24
210	1.3	-88563	-110997	17.76	1477.248	18.06	-0.30
210	1.4	-88655	-110955	17.69	1477.587	18.00	-0.31
210	1.5	-88694	-110856	17.57	1478.077	17.90	-0.33
210	1.6	-88733	-110757	17.53	1478.582	17.81	-0.28
210	1.7	-88772	-110658	17.44	1479.087	17.74	-0.30
210	1.8	-88811	-110559	17.40	1479.450	17.67	-0.27
210	1.9	-88850	-110460	17.34	1480.096	17.60	-0.26
211	0.1	-89050	-110575	17.18	1478.648	17.54	-0.36
211	0.2	-89013	-110667	17.26	1478.257	17.60	-0.34
211	0.3	-88976	-110759	17.32	1477.875	17.67	-0.35
211	0.4	-88938	-110852	17.42	1477.537	17.74	-0.32
211	0.5	-88901	-110944	17.47	1477.196	17.81	-0.34
211	0.6	-88864	-111036	17.53	1476.878	17.90	-0.37
211	0.7	-88827	-111128	17.68	1474.972	18.00	-0.32
211	0.9	-88752	-111313	17.84	1474.235	18.10	-0.26
211	1	-88715	-111405	17.97	1473.837	18.21	-0.24
211	1.1	-88678	-111497	18.09	1473.154	18.30	-0.21
211	1.2	-88641	-111589	18.14	1472.751	18.39	-0.25
211	1.3	-88604	-111681	18.26	1472.277	18.47	-0.21
211	1.4	-88566	-111774	18.40	1471.926	18.55	-0.15
211	1.5	-88529	-111866	18.48	1471.529	18.62	-0.14
211	1.6	-88492	-111958	18.59	1471.103	18.71	-0.12
211	1.7	-88455	-112050	18.71	1470.493	18.80	-0.09
211	1.8	-88418	-112142	18.82	1470.031	18.87	-0.05
211	1.9	-88380	-112235	18.91	1469.415	18.95	-0.04
211	2	-88343	-112327	18.96	1468.863	19.02	-0.06
211	2.1	-88306	-112419	19.06	1468.335	19.09	-0.03
211	2.2	-88269	-112511	19.18	1467.737	19.16	0.02
211	2.3	-88232	-112603	19.24	1467.343	19.24	0.00
211	2.4	-88194	-112696	19.30	1467.044	19.32	-0.02
211	2.5	-88157	-112788	19.36	1466.653	19.40	-0.04
211	2.6	-88120	-112880	19.43	1466.898	19.49	-0.06
212	0	-83550	-114130	19.37	1467.517	20.50	-1.13
212	0.1	-83560	-114230	19.36	1467.208	20.44	-1.08

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
212	0.2	-83573	-114330	19.57	1467.445	20.38	-0.81
212	0.3	-83585	-114430	19.62	1467.299	20.32	-0.70
212	0.4	-83610	-114520	19.61	1467.040	20.27	-0.66
212	0.5	-83668	-114604	19.57	1466.635	20.21	-0.64
212	0.6	-83726	-114688	19.52	1466.096	20.16	-0.64
212	0.7	-83784	-114772	19.55	1465.663	20.11	-0.56
212	0.8	-83842	-114856	19.63	1465.196	20.05	-0.42
212	0.9	-83900	-114940	19.63	1465.083	20.00	-0.37
212	1	-83933	-115030	19.64	1464.797	19.93	-0.29
212	1.1	-83967	-115120	19.64	1464.138	19.87	-0.23
212	1.2	-84000	-115210	19.62	1464.118	19.80	-0.18
212	1.3	-84005	-115310	19.60	1463.111	19.73	-0.13
212	1.4	-83990	-115410	19.55	1462.807	19.67	-0.12
212	1.5	-83949	-115502	19.49	1462.260	19.60	-0.11
212	1.6	-83908	-115593	19.44	1461.353	19.53	-0.09
212	1.7	-83867	-115685	19.34	1461.173	19.47	-0.13
212	1.8	-83825	-115776	19.25	1460.662	19.40	-0.15
212	1.9	-83784	-115868	19.19	1460.000	19.33	-0.14
212	2	-83743	-115959	19.17	1459.168	19.26	-0.09
212	2.1	-83702	-116051	19.14	1458.282	19.19	-0.05
212	2.2	-83661	-116142	19.17	1457.251	19.17	0.00
212	2.3	-83620	-116234	19.16	1456.373	19.15	0.01
212	2.4	-83578	-116325	19.15	1455.838	19.18	-0.03
212	2.5	-83537	-116417	19.19	1455.193	19.20	-0.01
212	2.6	-83496	-116508	19.18	1454.582	19.28	-0.10
212	2.7	-83455	-116600	19.23	1453.860	19.35	-0.12
212	2.8	-83414	-116692	19.32	1453.493	19.43	-0.11
212	2.9	-83373	-116783	19.41	1453.029	19.52	-0.11
212	3	-83332	-116875	19.52	1452.701	19.62	-0.10
212	3.1	-83290	-116966	19.63	1452.292	19.73	-0.10
212	3.2	-83249	-117058	19.77	1451.983	19.85	-0.08
212	3.3	-83208	-117149	19.88	1451.378	19.96	-0.08
212	3.4	-83167	-117241	19.98	1451.431	20.07	-0.09
212	3.5	-83126	-117332	20.09	1450.980	20.19	-0.10
212	3.6	-83085	-117424	20.22	1450.460	20.29	-0.07
212	3.7	-83043	-117515	20.40	1450.199	20.39	0.01
212	3.8	-83002	-117607	20.54	1449.776	20.53	0.01
212	3.9	-82961	-117698	20.73	1449.066	20.68	0.05
212	4	-82920	-117790	20.95	1448.049	20.82	0.13
212	4.1	-82891	-117886	21.12	1447.472	21.01	0.11
212	4.2	-82862	-117982	21.32	1446.845	21.21	0.11
212	4.3	-82833	-118078	21.49	1446.144	21.40	0.09
212	4.4	-82804	-118174	21.72	1445.107	21.52	0.20
212	4.5	-82775	-118270	21.91	1444.179	21.64	0.27
213	0.1	-89640	-107650	16.92	1492.788	17.31	-0.39
213	0.2	-89732	-107608	17.02	1492.227	17.36	-0.34
213	0.3	-89824	-107566	17.10	1491.814	17.42	-0.32
213	0.4	-89917	-107523	17.05	1491.292	17.48	-0.43
213	0.5	-90009	-107481	17.04	1490.694	17.54	-0.50
213	0.6	-90101	-107439	17.05	1489.831	17.60	-0.55
213	0.7	-90193	-107397	17.06	1489.154	17.65	-0.59
213	0.8	-90286	-107354	17.09	1488.363	17.70	-0.61
213	0.9	-90378	-107312	17.13	1487.604	17.75	-0.62
213	1	-90470	-107270	17.14	1486.941	17.80	-0.66
214	0.1	-90170	-108850	16.48	1486.088	16.78	-0.30
214	0.2	-90256	-108804	16.51	1485.938	16.84	-0.33
214	0.3	-90342	-108759	16.53	1486.336	16.89	-0.36

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
214	0.4	-90428	-108713	16.54	1486.178	16.95	-0.41
214	0.5	-90514	-108668	16.57	1485.853	17.00	-0.43
214	0.6	-90601	-108622	16.53	1485.561	17.05	-0.52
214	0.7	-90687	-108577	16.46	1485.085	17.10	-0.64
214	0.8	-90773	-108531	16.53	1484.333	17.15	-0.62
214	0.9	-90859	-108486	16.53	1484.127	17.20	-0.67
214	1	-90945	-108440	16.47	1483.826	17.25	-0.78
215	0.1	-90645	-110020	16.14	1476.579	16.34	-0.20
215	0.2	-90731	-109971	16.19	1476.981	16.37	-0.18
215	0.3	-90817	-109921	16.30	1477.085	16.40	-0.10
215	0.4	-90903	-109872	16.24	1477.493	16.44	-0.20
215	0.5	-90989	-109822	16.22	1477.782	16.49	-0.26
215	0.6	-91076	-109773	16.18	1477.859	16.53	-0.35
215	0.7	-91162	-109723	16.13	1477.803	16.57	-0.44
215	0.8	-91248	-109674	16.12	1477.766	16.62	-0.49
215	0.9	-91334	-109624	16.11	1477.491	16.66	-0.55
215	1	-91420	-109575	16.10	1477.206	16.70	-0.60
216	0.1	-91120	-111120	15.33	1469.204	15.81	-0.48
216	0.2	-91206	-111071	15.39	1468.980	15.80	-0.41
216	0.3	-91291	-111022	15.53	1468.826	15.81	-0.28
216	0.4	-91377	-110973	15.58	1469.571	15.82	-0.24
216	0.5	-91462	-110924	15.71	1470.051	15.91	-0.20
216	0.6	-91548	-110876	15.68	1470.430	15.99	-0.31
216	0.7	-91633	-110827	15.79	1470.486	16.04	-0.25
216	0.8	-91719	-110778	15.84	1470.337	16.10	-0.26
216	0.9	-91804	-110729	15.93	1469.918	16.15	-0.22
216	1	-91890	-110680	15.92	1469.589	16.20	-0.28
217	0.1	-91600	-112250	14.62	1461.710	15.20	-0.58
217	0.2	-91686	-112198	14.43	1461.984	14.90	-0.47
217	0.3	-91771	-112146	14.37	1461.949	14.89	-0.52
217	0.4	-91857	-112093	14.42	1462.154	14.88	-0.46
217	0.5	-91942	-112041	14.53	1461.943	14.87	-0.34
217	0.6	-92028	-111989	14.68	1461.506	14.88	-0.20
217	0.7	-92113	-111937	14.93	1460.755	15.00	-0.07
217	0.8	-92199	-111884	15.09	1461.507	15.10	-0.01
217	0.9	-92284	-111832	15.20	1461.519	15.20	0.00
217	1	-92370	-111780	15.35	1461.326	15.35	-0.00
218	0.1	-92080	-113360	15.58	1454.552	16.00	-0.42
218	0.2	-92166	-113307	15.27	1454.378	15.60	-0.33
218	0.3	-92251	-113253	15.02	1454.258	15.25	-0.23
218	0.4	-92337	-113200	14.83	1454.020	14.99	-0.16
218	0.5	-92422	-113147	14.68	1454.362	14.75	-0.07
218	0.6	-92508	-113093	14.56	1453.760	14.60	-0.04
218	0.7	-92593	-113040	14.55	1453.491	14.60	-0.05
218	0.8	-92679	-112987	14.61	1453.460	14.75	-0.14
218	0.9	-92764	-112933	14.90	1453.367	15.00	-0.10
218	1	-92850	-112880	15.11	1453.720	15.25	-0.14
219	0.1	-92540	-114455	17.53	1447.098	17.74	-0.21
219	0.2	-92622	-114400	17.24	1446.495	17.32	-0.08
219	0.3	-92704	-114345	16.92	1446.099	17.01	-0.09
219	0.4	-92787	-114290	16.63	1445.946	16.80	-0.17
219	0.5	-92869	-114235	16.34	1445.354	16.45	-0.11
219	0.6	-92951	-114180	16.00	1445.100	16.15	-0.15
219	0.7	-93033	-114125	15.82	1444.764	15.89	-0.07
219	0.8	-93116	-114070	15.76	1444.059	15.80	-0.04
219	0.9	-93198	-114015	15.82	1443.195	15.85	-0.03
219	1	-93280	-113960	15.91	1443.516	15.95	-0.04

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
220	0.1	-92750	-115515	17.88	1439.995	18.15	-0.27
220	0.2	-92835	-115464	17.80	1439.786	18.00	-0.20
220	0.3	-92920	-115414	17.70	1439.876	17.90	-0.20
220	0.4	-93005	-115363	17.54	1439.741	17.80	-0.26
220	0.5	-93090	-115313	17.49	1439.553	17.70	-0.21
220	0.6	-93175	-115262	17.37	1439.421	17.60	-0.23
220	0.7	-93260	-115212	17.36	1439.511	17.45	-0.09
220	0.8	-93345	-115161	17.28	1439.576	17.35	-0.07
220	0.9	-93430	-115111	17.16	1439.530	17.20	-0.04
220	1	-93515	-115060	16.97	1439.616	17.05	-0.08
221	0.1	-92935	-116530	17.14	1433.091	17.30	-0.16
221	0.2	-93022	-116480	17.09	1432.704	17.25	-0.16
221	0.3	-93109	-116430	17.07	1432.716	17.22	-0.15
221	0.4	-93197	-116380	17.01	1432.746	17.20	-0.19
221	0.5	-93284	-116330	17.04	1432.434	17.18	-0.14
221	0.6	-93371	-116280	17.09	1432.393	17.12	-0.03
221	0.7	-93458	-116230	17.02	1432.418	17.05	-0.03
221	0.8	-93546	-116180	16.85	1433.832	17.02	-0.17
221	0.9	-93633	-116130	16.93	1432.570	17.00	-0.07
221	1	-93720	-116080	16.90	1432.601	16.98	-0.08
222	0.1	-91375	-112160	15.08	1463.070	15.60	-0.52
222	0.2	-91282	-112125	15.28	1463.774	15.80	-0.52
222	0.3	-91189	-112089	15.60	1464.490	16.00	-0.40
222	0.4	-91096	-112054	15.85	1465.210	16.20	-0.35
222	0.5	-91004	-112018	15.92	1465.942	16.40	-0.48
222	0.6	-90911	-111983	16.15	1466.556	16.54	-0.39
222	0.7	-90818	-111947	16.31	1466.870	16.62	-0.31
222	0.8	-90725	-111912	16.40	1467.488	16.74	-0.34
222	0.9	-90632	-111876	16.51	1467.871	16.81	-0.30
222	1	-90539	-111841	16.58	1468.427	16.90	-0.32
222	1.1	-90446	-111805	16.68	1468.974	16.98	-0.30
222	1.2	-90354	-111770	16.74	1469.690	17.04	-0.30
222	1.3	-90261	-111734	16.83	1470.339	17.14	-0.31
222	1.4	-90168	-111699	16.85	1470.869	17.22	-0.37
222	1.5	-90075	-111663	16.94	1471.504	17.29	-0.35
222	1.6	-89982	-111628	16.98	1471.744	17.38	-0.40
222	1.7	-89889	-111592	17.06	1472.235	17.41	-0.35
222	1.8	-89796	-111557	17.11	1472.698	17.50	-0.39
222	1.9	-89704	-111522	17.17	1473.243	17.57	-0.40
222	2	-89611	-111486	17.21	1473.619	17.60	-0.39
222	2.1	-89518	-111451	17.24	1473.870	17.66	-0.42
222	2.2	-89425	-111415	17.28	1474.215	17.73	-0.45
223	0.1	-90730	-110735	15.70	1472.225	16.03	-0.33
223	0.2	-90640	-110779	15.71	1472.296	16.10	-0.39
223	0.3	-90550	-110824	15.74	1472.574	16.18	-0.44
223	0.4	-90460	-110868	15.86	1472.854	16.30	-0.44
223	0.5	-90370	-110912	15.99	1472.762	16.40	-0.41
223	0.6	-90280	-110956	16.15	1472.673	16.58	-0.43
223	0.7	-90190	-111001	16.29	1472.762	16.72	-0.43
223	0.8	-90100	-111045	16.45	1473.225	16.83	-0.38
223	0.9	-90010	-111089	16.56	1473.426	16.95	-0.39
223	1	-89920	-111134	16.71	1473.734	17.05	-0.34
223	1.1	-89830	-111178	16.79	1474.218	17.18	-0.39
223	1.2	-89740	-111222	16.92	1474.493	17.30	-0.38
223	1.3	-89650	-111266	16.96	1474.620	17.42	-0.46
223	1.4	-89560	-111311	17.09	1474.948	17.54	-0.45
223	1.5	-89470	-111355	17.22	1475.019	17.63	-0.41

LINE NO.	STN. NO	Y (m)	X (m)	BOUGUER (mgal)	ELEV. (mamsl)	REGIONAL (mgal)	RESIDUAL (mgal)
224	0.1	-90320	-109800	16.26	1477.853	16.41	-0.15
224	0.2	-90224	-109838	16.23	1477.627	16.43	-0.20
224	0.3	-90129	-109875	16.23	1477.046	16.45	-0.22
224	0.4	-90033	-109913	16.32	1477.415	16.47	-0.15
224	0.5	-89938	-109950	16.31	1477.603	16.52	-0.21
224	0.6	-89842	-109988	16.33	1477.809	16.60	-0.27
224	0.7	-89746	-110025	16.42	1477.845	16.70	-0.28
224	0.8	-89651	-110063	16.54	1478.197	16.80	-0.26
224	0.9	-89555	-110100	16.64	1478.589	16.90	-0.26
225	0.1	-91430	-112360	15.21	1461.696	15.80	-0.59
225	0.2	-91344	-112414	15.57	1461.951	16.10	-0.53
225	0.3	-91259	-112468	15.98	1462.199	16.42	-0.44
225	0.4	-91173	-112522	16.29	1462.717	16.70	-0.41
225	0.5	-91088	-112576	16.41	1463.005	16.90	-0.49
225	0.6	-91002	-112630	16.81	1463.604	17.14	-0.33
225	0.7	-90916	-112684	17.02	1464.147	17.36	-0.34
225	0.8	-90831	-112738	17.24	1464.415	17.58	-0.34
225	0.9	-90745	-112792	17.46	1464.540	17.77	-0.31
225	1	-90660	-112846	17.65	1463.716	17.85	-0.20
225	1.1	-90574	-112900	17.85	1464.331	18.10	-0.25
225	1.2	-90489	-112954	17.97	1464.392	18.28	-0.31
225	1.3	-90403	-113008	18.09	1464.544	18.40	-0.31
225	1.4	-90317	-113062	18.19	1464.391	18.52	-0.33
225	1.5	-90232	-113116	18.29	1464.174	18.63	-0.34
225	1.6	-90146	-113170	18.45	1464.122	18.78	-0.33
225	1.7	-90061	-113224	18.53	1463.905	18.90	-0.37
225	1.8	-89975	-113277	18.70	1463.473	19.02	-0.32
225	1.9	-89889	-113331	18.77	1463.577	19.08	-0.31
225	2	-89804	-113385	18.90	1462.977	19.16	-0.26
225	2.1	-89718	-113439	18.98	1462.858	19.22	-0.24
225	2.2	-89633	-113493	19.07	1462.474	19.30	-0.23
225	2.3	-89547	-113547	19.17	1462.313	19.39	-0.22
225	2.4	-89461	-113601	19.28	1461.955	19.47	-0.19
225	2.5	-89376	-113655	19.36	1461.519	19.54	-0.18
225	2.6	-89290	-113709	19.44	1461.217	19.61	-0.17
225	2.7	-89205	-113763	19.46	1461.121	19.68	-0.22
225	2.8	-89119	-113817	19.57	1461.222	19.77	-0.20
225	2.9	-89034	-113871	19.62	1460.920	19.81	-0.19
225	3	-88948	-113925	19.70	1460.616	19.89	-0.19
225	3.1	-88862	-113979	19.77	1460.644	19.95	-0.18
225	3.2	-88777	-114033	19.81	1461.194	20.01	-0.20
225	3.3	-88691	-114087	19.90	1460.473	20.02	-0.12
225	3.4	-88606	-114141	19.91	1461.029	20.03	-0.12
225	3.5	-88520	-114195	19.97	1461.360	20.04	-0.07
226	0.1	-92355	-114525	18.00	1447.954	18.00	0.00
226	0.2	-92258	-114552	18.14	1448.234	18.20	-0.06
226	0.3	-92161	-114579	18.28	1448.525	18.40	-0.12
226	0.4	-92063	-114605	18.42	1448.846	18.60	-0.18
226	0.5	-91966	-114632	18.60	1449.080	18.73	-0.13
226	0.6	-91869	-114659	18.79	1449.279	18.86	-0.07
226	0.7	-91772	-114686	18.94	1449.084	18.98	-0.04
226	0.8	-91674	-114713	19.02	1449.255	19.07	-0.05
226	0.9	-91577	-114739	19.03	1449.579	19.13	-0.10
226	1	-91480	-114766	19.15	1449.856	19.21	-0.06
226	1.1	-91383	-114793	19.21	1449.849	19.26	-0.05
226	1.2	-91286	-114820	19.24	1450.187	19.31	-0.07
226	1.3	-91188	-114847	19.32	1450.478	19.39	-0.07

APPENDIX B

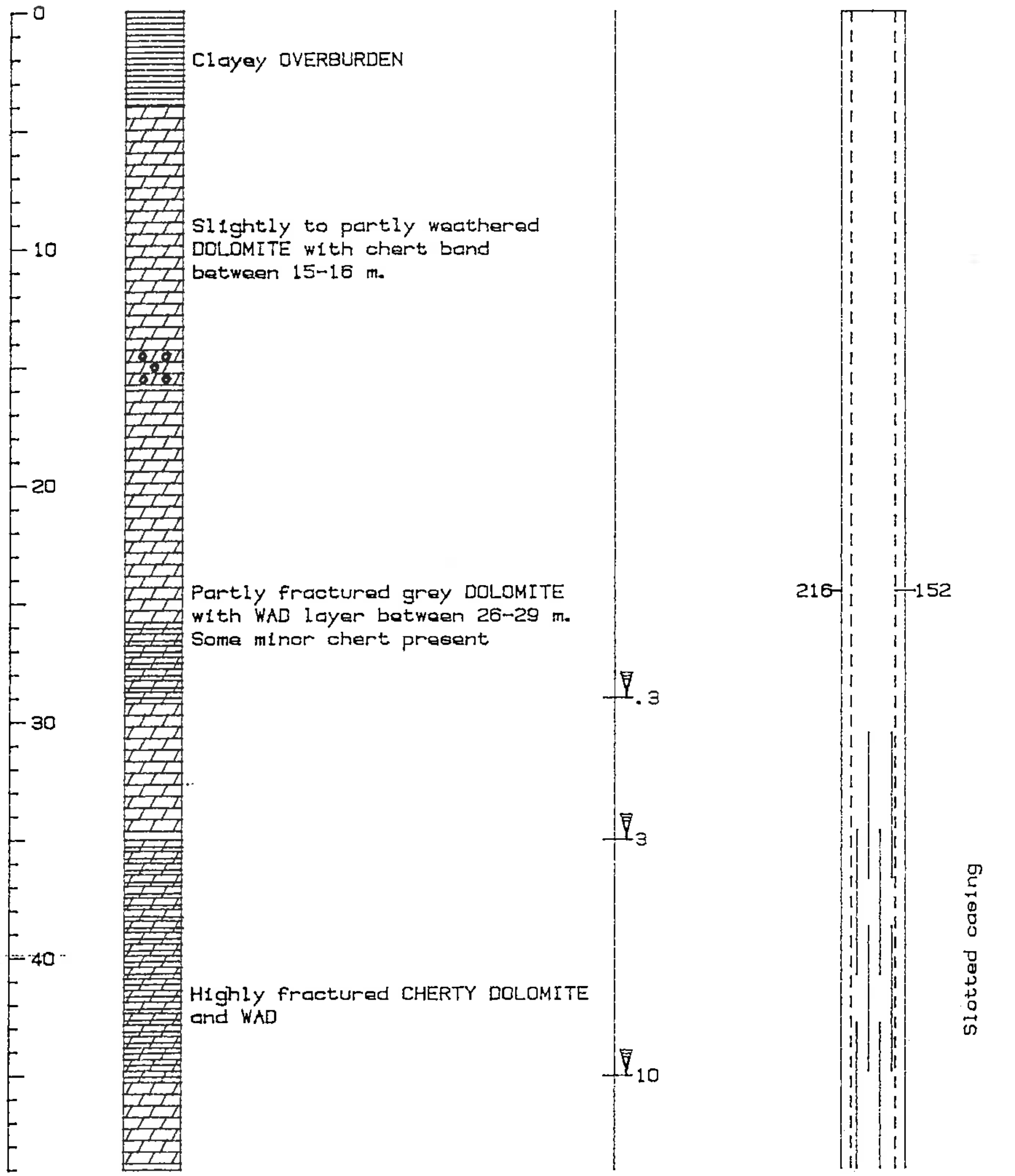
BOREHOLE LOGS

BOREHOLE LOG

DISTRICT: DITSOBOTLA LOCALITY: POLFONTEIN BH. No. 1

Geoph. Peg No. 104/2,3 Coordinates +2887775X -93100Y Elev. (m) 1503

Depth (m) | Geology | Blowing Yield l/s | Drill Dia. mm | Casing Dia. mm



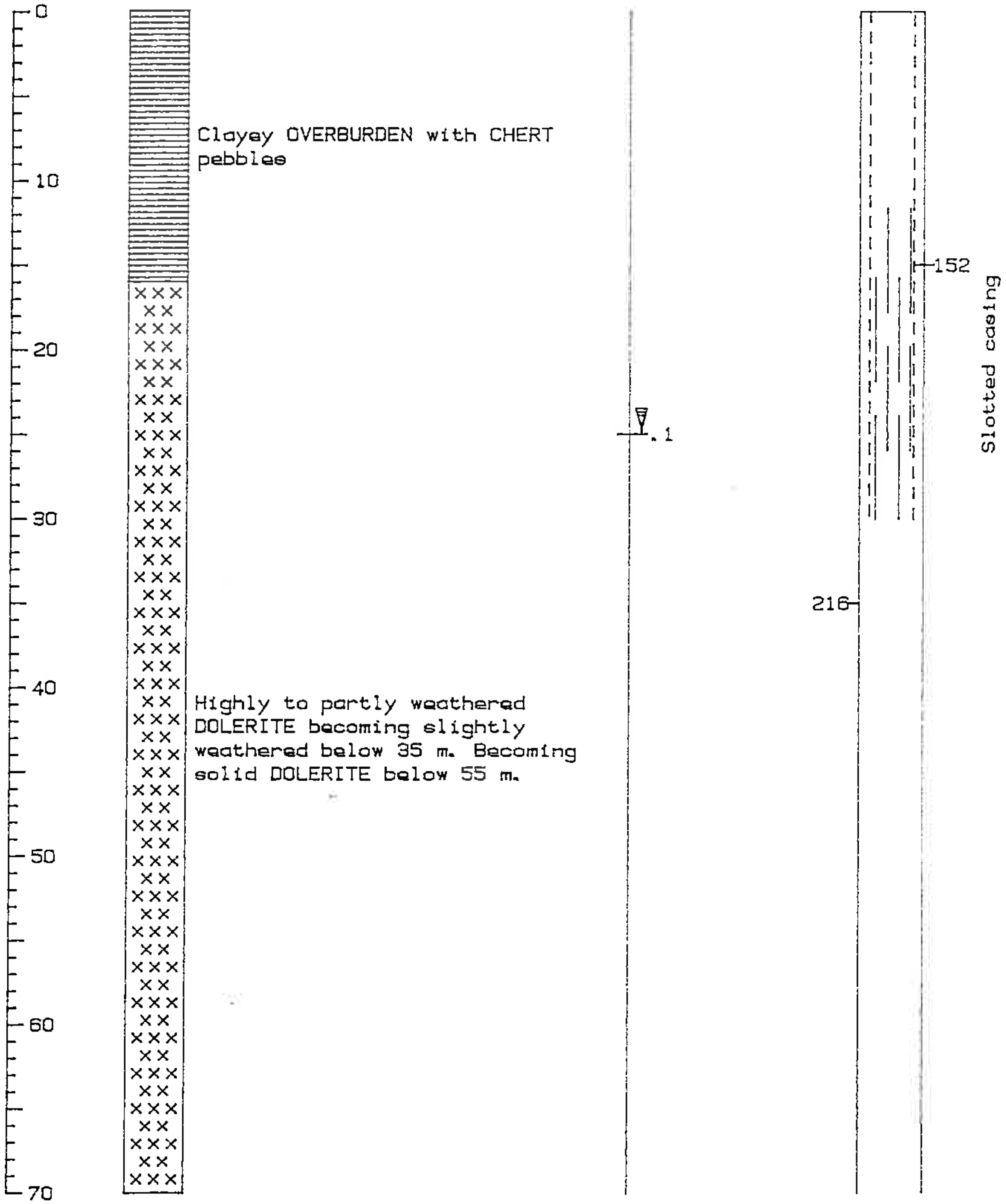
End of Hole 49

BOREHOLE LOG

DISTRICT: DITSOBOTLA LOCALITY: POLFONTEIN BH. No. 2

Geoph. Peg No. V1/0,04 Coordinates +2885750X -91725Y Elev. (m) 1497

Depth (m)	Geology	Blowing Yield l/s	Drill Dia. mm	Casing Dia. mm



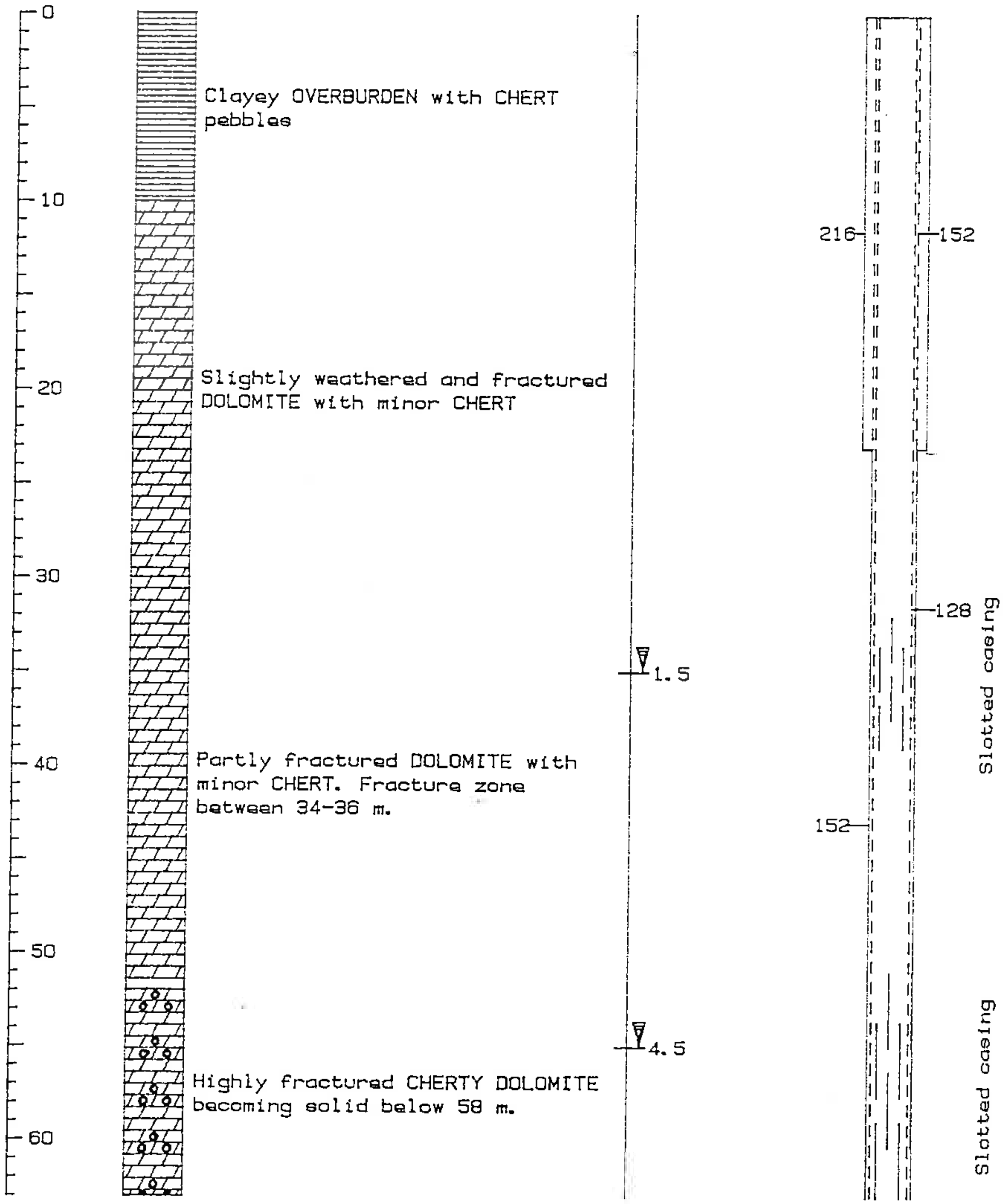
End of Hole 70

BOREHOLE LOG

DISTRICT: DITSOBOTLA LOCALITY: POLFONTEIN BH. No. 3

Geoph. Peg No. V1/0,10 Coordinates +2885800X -91725Y Elev. (m) 1497

Depth (m) | Geology | Blowing Yield l/s | Drill Dia. mm | Casing Dia. mm

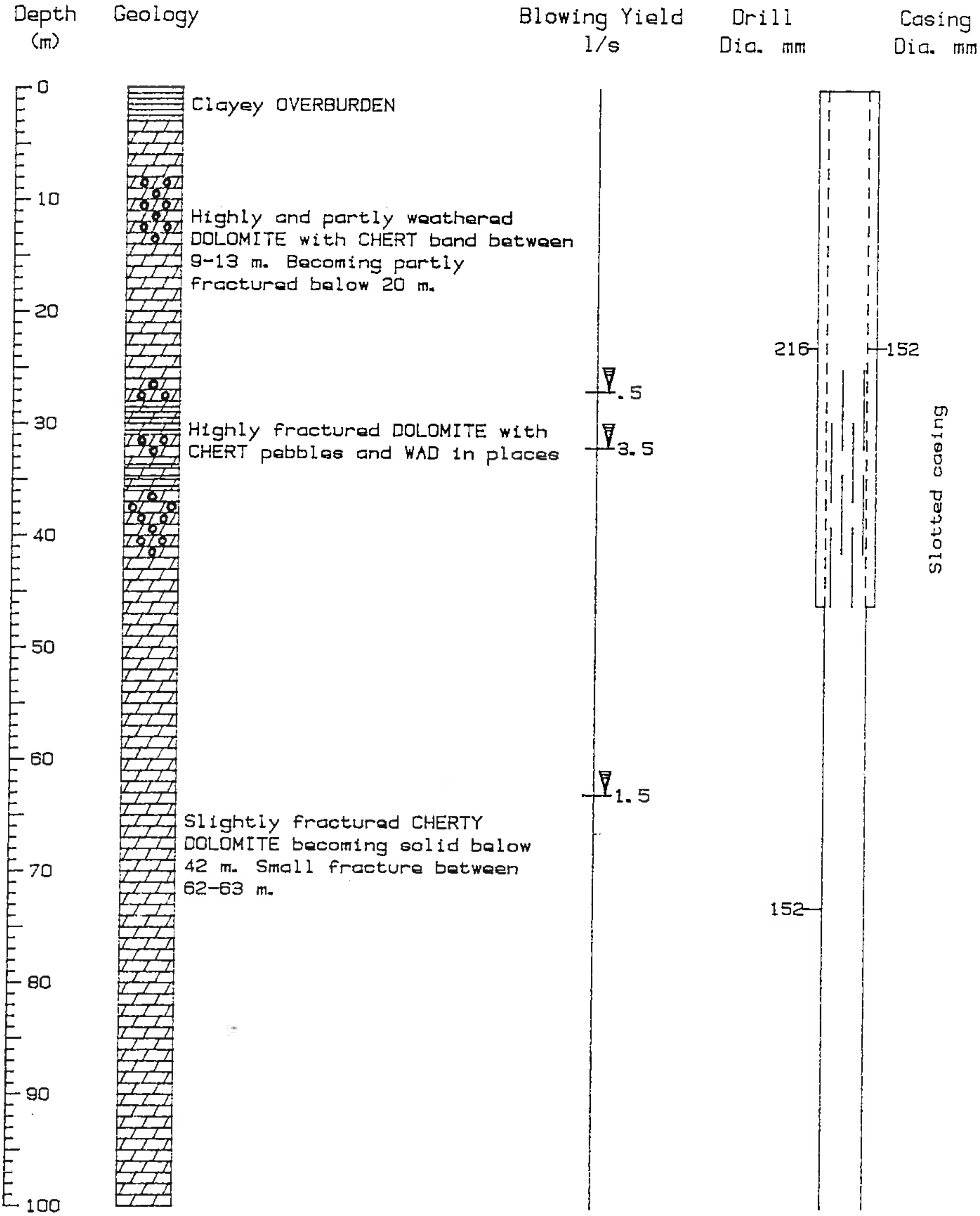


End of Hole 63

BOREHOLE LOG

DISTRICT: DITSOBOTLA LOCALITY: POLFONTEIN BH. No. 4

Geoph. Peg No. 114/1,1 Coordinates +2883375X -92500Y Elev. (m) 1495

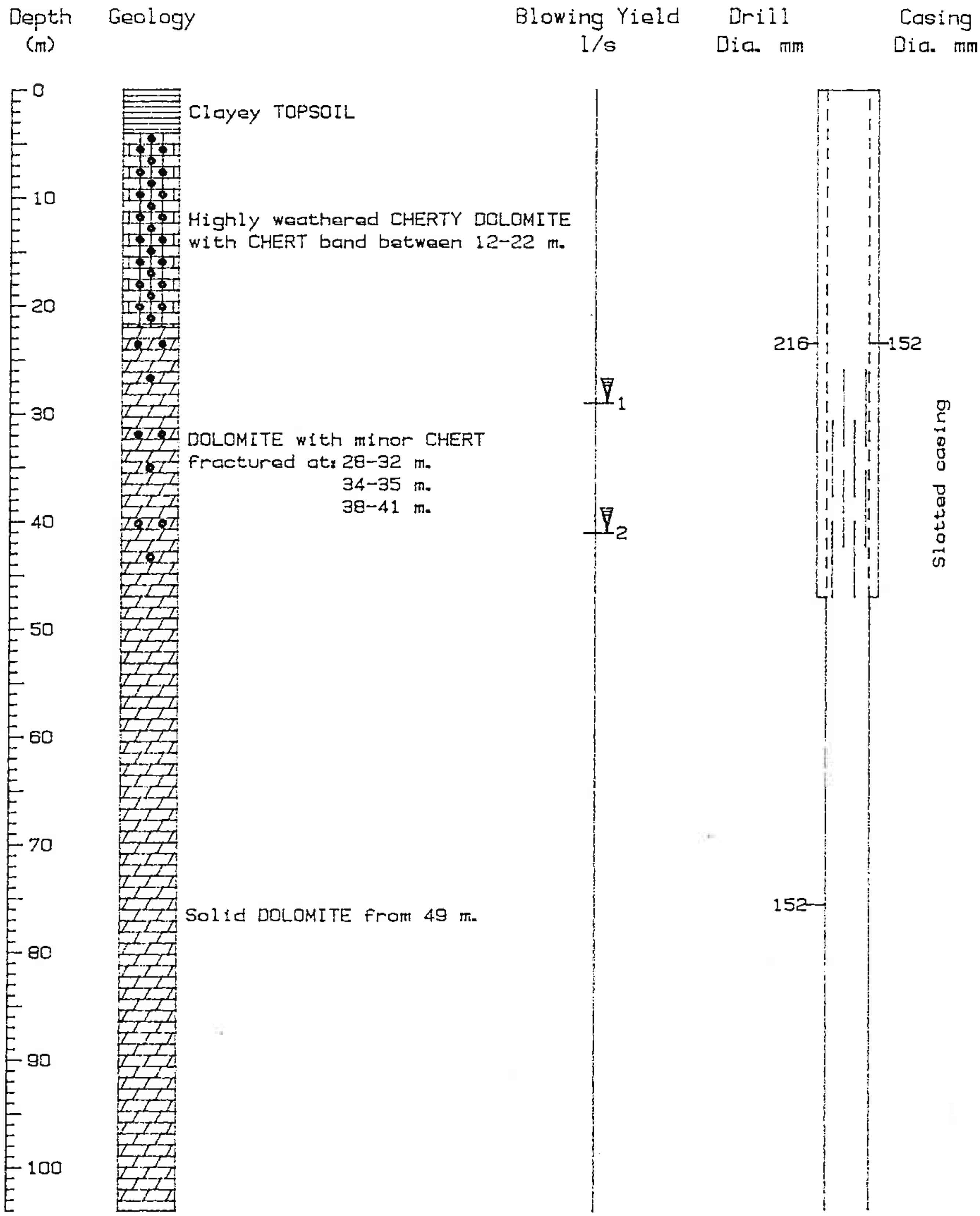


End of Hole 100

BOREHOLE LOG

DISTRICT: DITSOBOTLA LOCALITY: POLFONTEIN BH. No. 5

Geoph. Peg No. 116/1,35 Coordinates +2883750X -91025Y Elev. (m) 1495



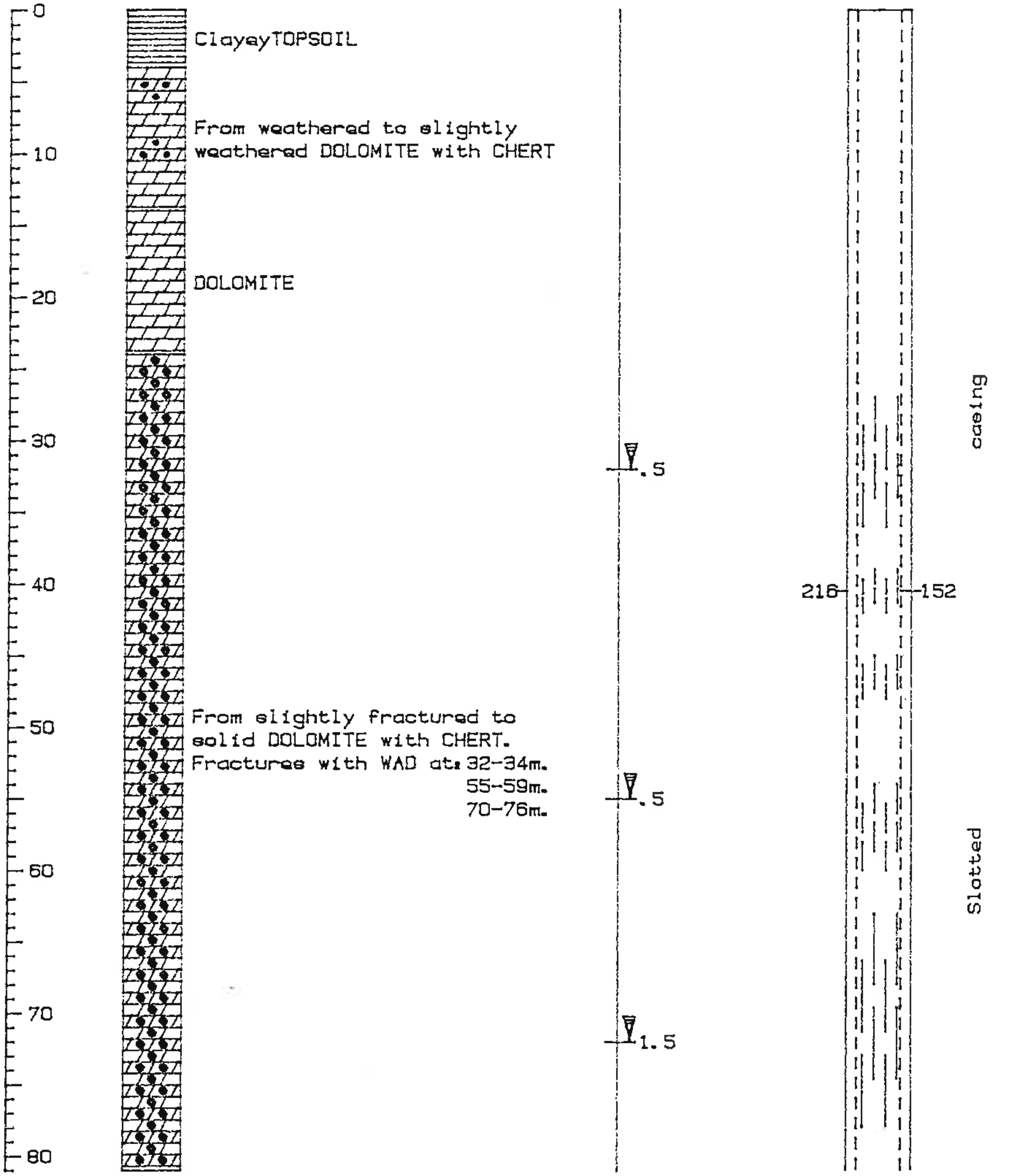
End of Hole 104

BOREHOLE LOG

DISTRICT: DITSOBOTLA LOCALITY: POLFONTEIN BH. No. 6

Geoph. Peg No. 100/12,4 Coordinates +2880050X -91725Y Elev. (m) 1486

Depth (m)	Geology	Blowing Yield l/s	Drill Dia. mm	Casing Dia. mm



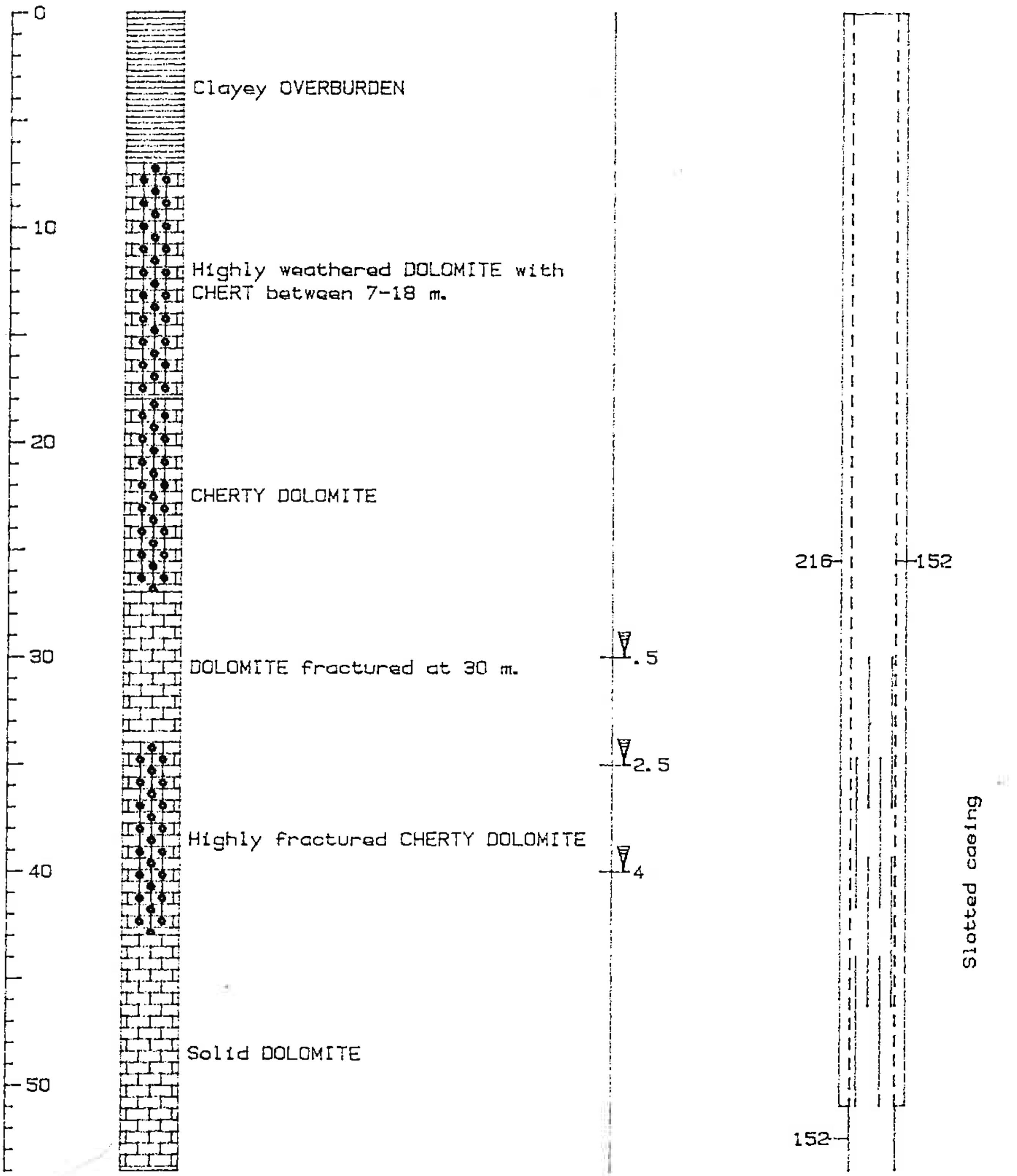
End of Hole 81

BOREHOLE LOG

DISTRICT: DITSOBOTLA *LOCALITY: POLFONTEIN* *BH. No. 7*

Geoph. Peg No. 7/8,65 *Coordinates +2880725X -89750Y* *Elev. (m) 1486*

Depth (m)	Geology	Blowing Yield l/s	Drill Dia. mm	Casing Dia. mm



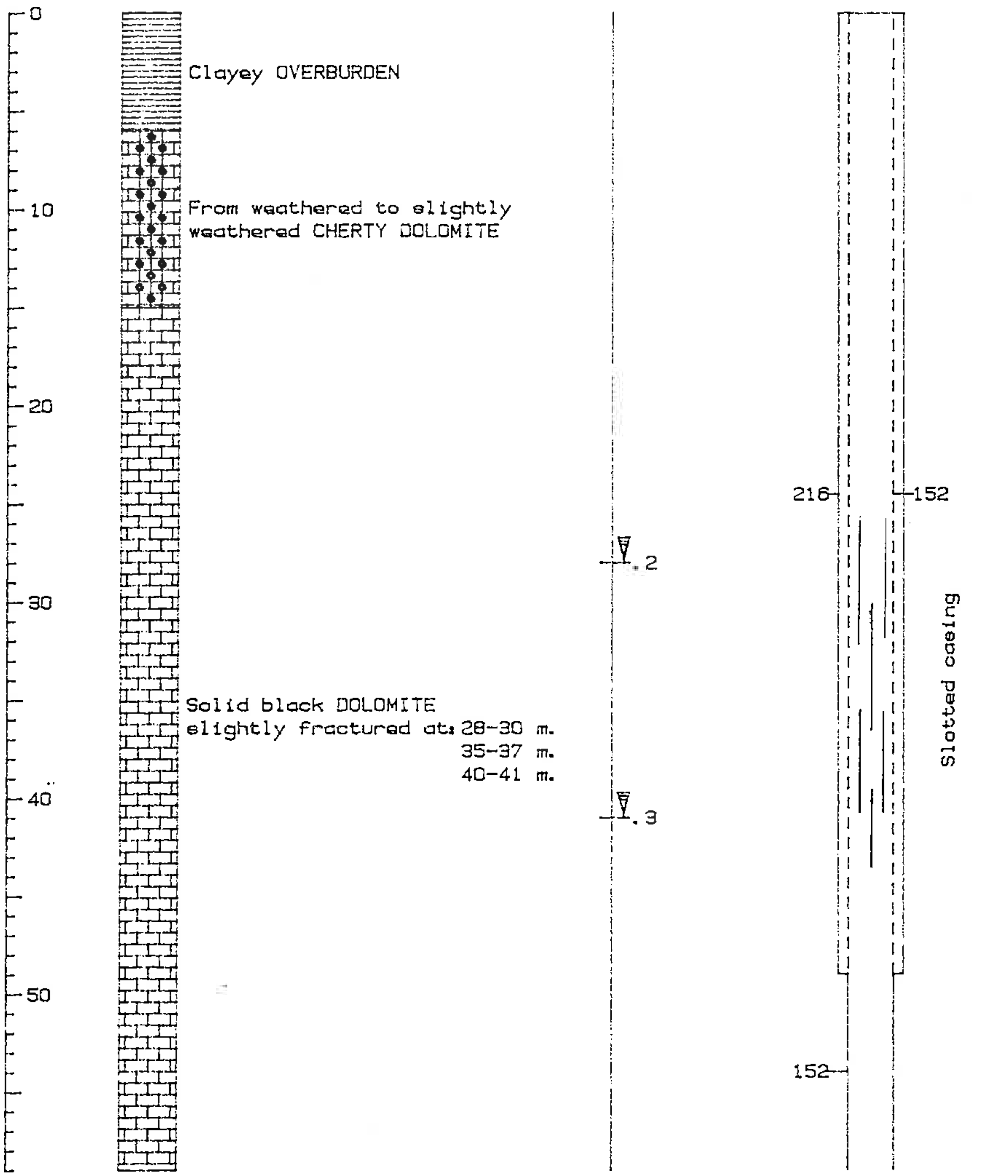
End of Hole 54

BOREHOLE LOG

DISTRICT: DITSOBOTLA   LOCALITY: POLFONTEIN   BH. No. 8

Geoph. Peg No. 7/6,2   Coordinates +2882900X -88750Y   Elev. (m) 1486

Depth (m)	Geology	Blowing Yield l/s	Drill Dia. mm	Casing Dia. mm

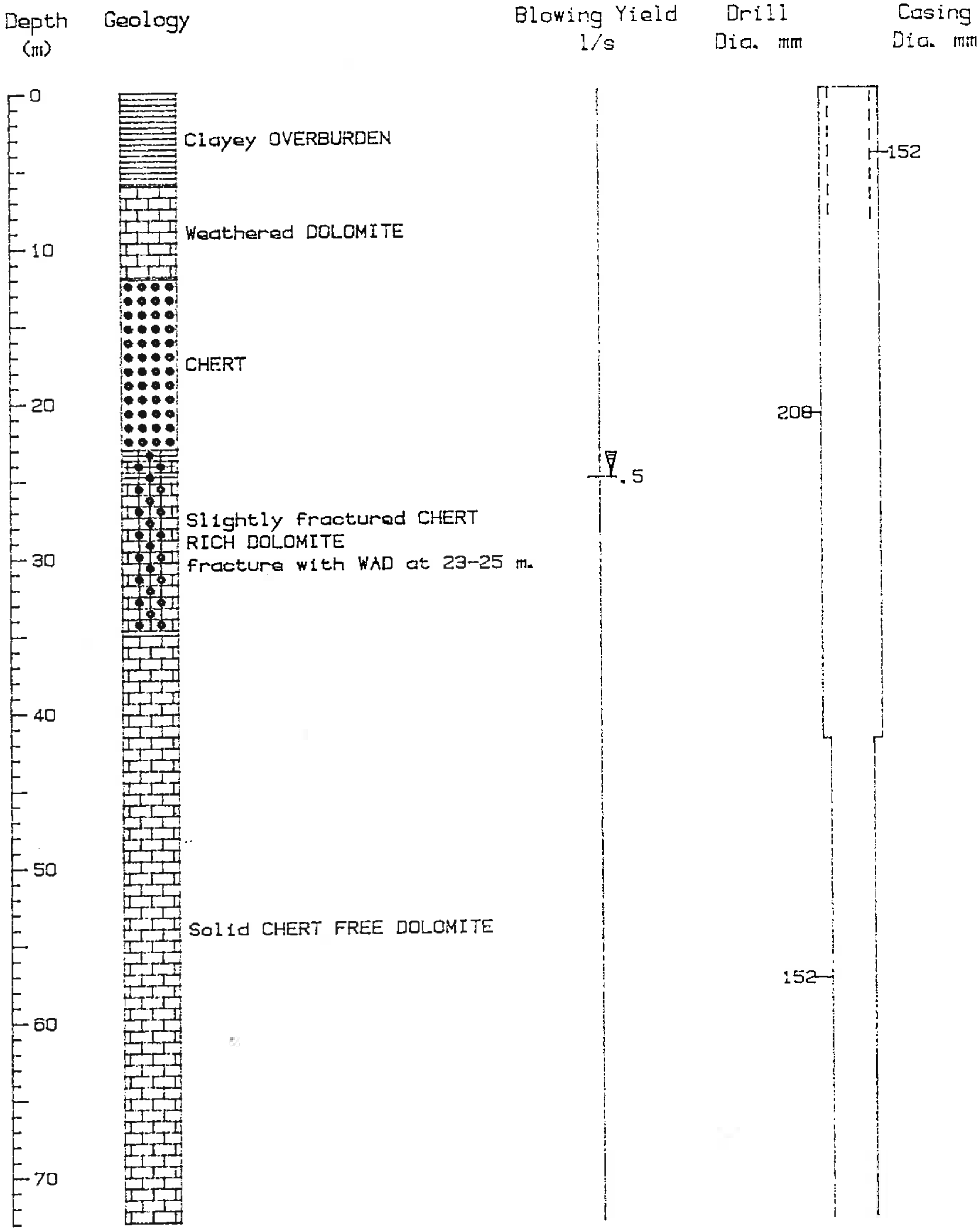


End of Hole 59

BOREHOLE LOG

DISTRICT: DITSOBOTLA LOCALITY: POLFONTEIN BH. No. 9

Geoph. Peg No. 100/6,1 Coordinates +2884250X -97400Y Elev. (m) 1503



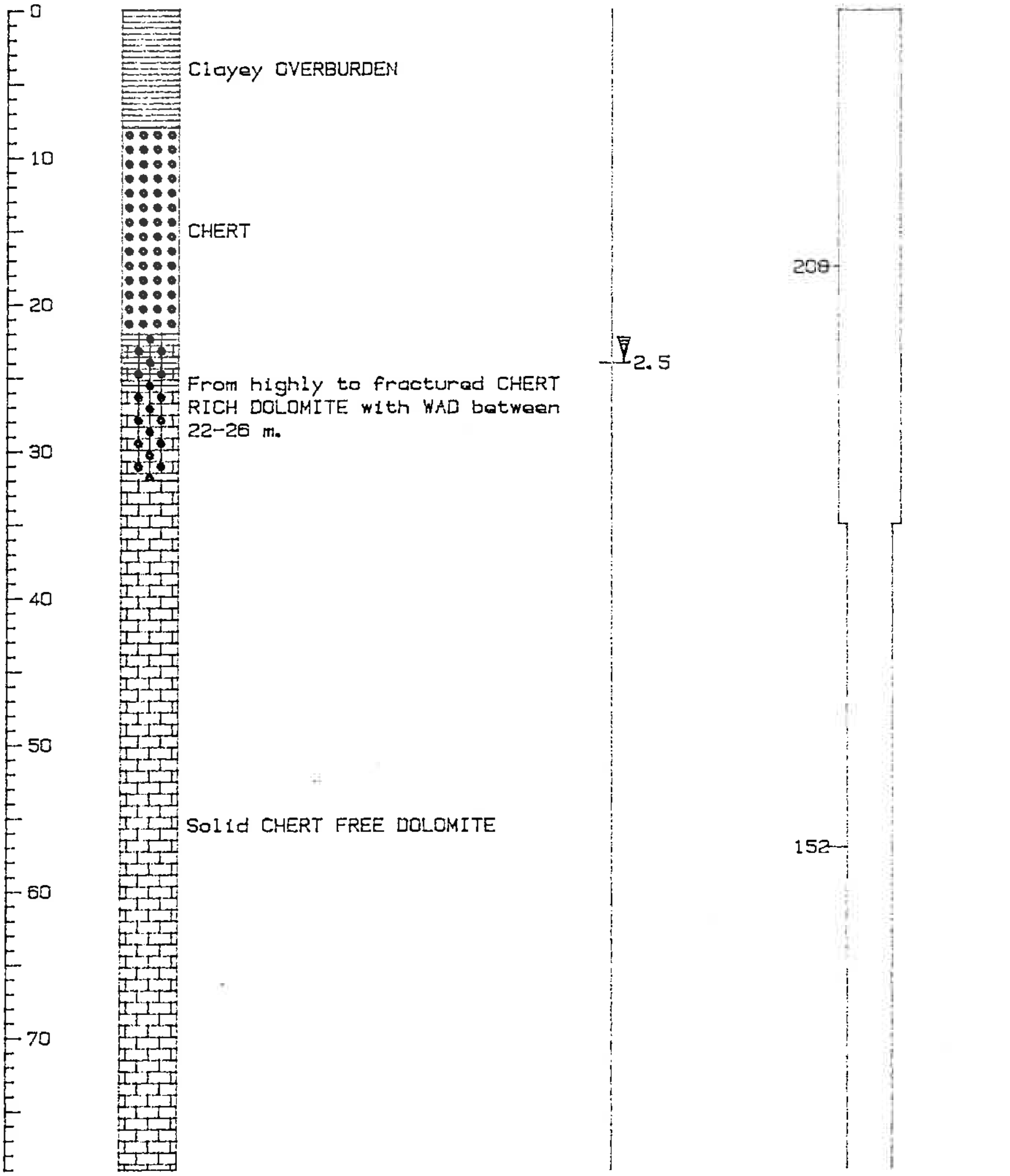
End of Hole 73

BOREHOLE LOG

DISTRICT: DITSOBOTLA LOCALITY: POLFONTEIN BH. No. 10

Geoph. Peg No. 100/4,8 Coordinates +2884925X -98350Y Elev. (m) 1505

Depth (m)	Geology	Blowing Yield l/s	Drill Dia. mm	Casing Dia. mm



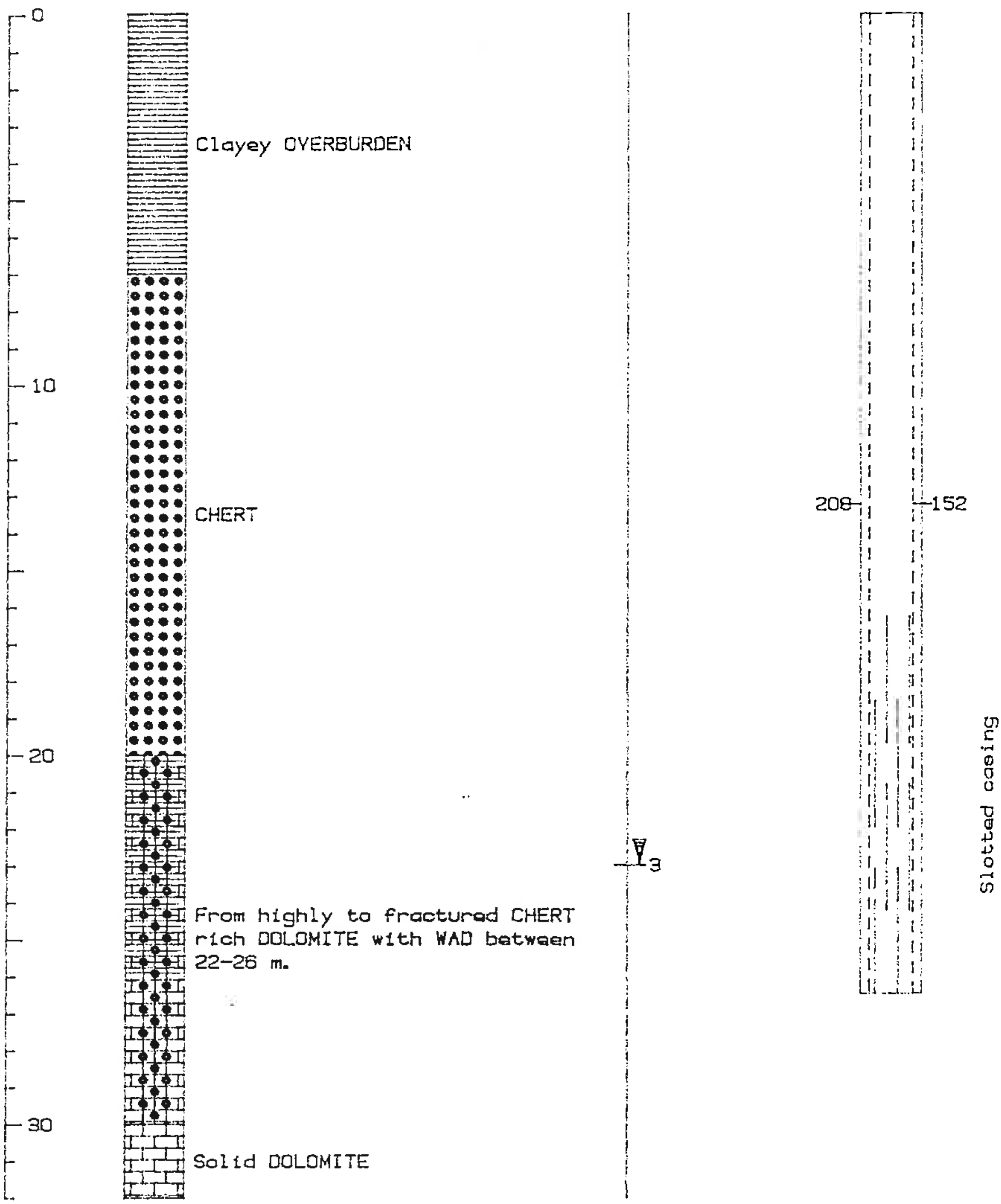
End of Hole 79

BOREHOLE LOG

DISTRICT: DITSOBOTLA LOCALITY: POLFONTEIN BH. No. 10 second at:

Geoph. Peg No. 100/4,8 Coordinates +2884925X -98350Y Elev. (m) 1505

Depth (m)	Geology	Blowing Yield l/s	Drill Dia. mm	Casing Dia. mm



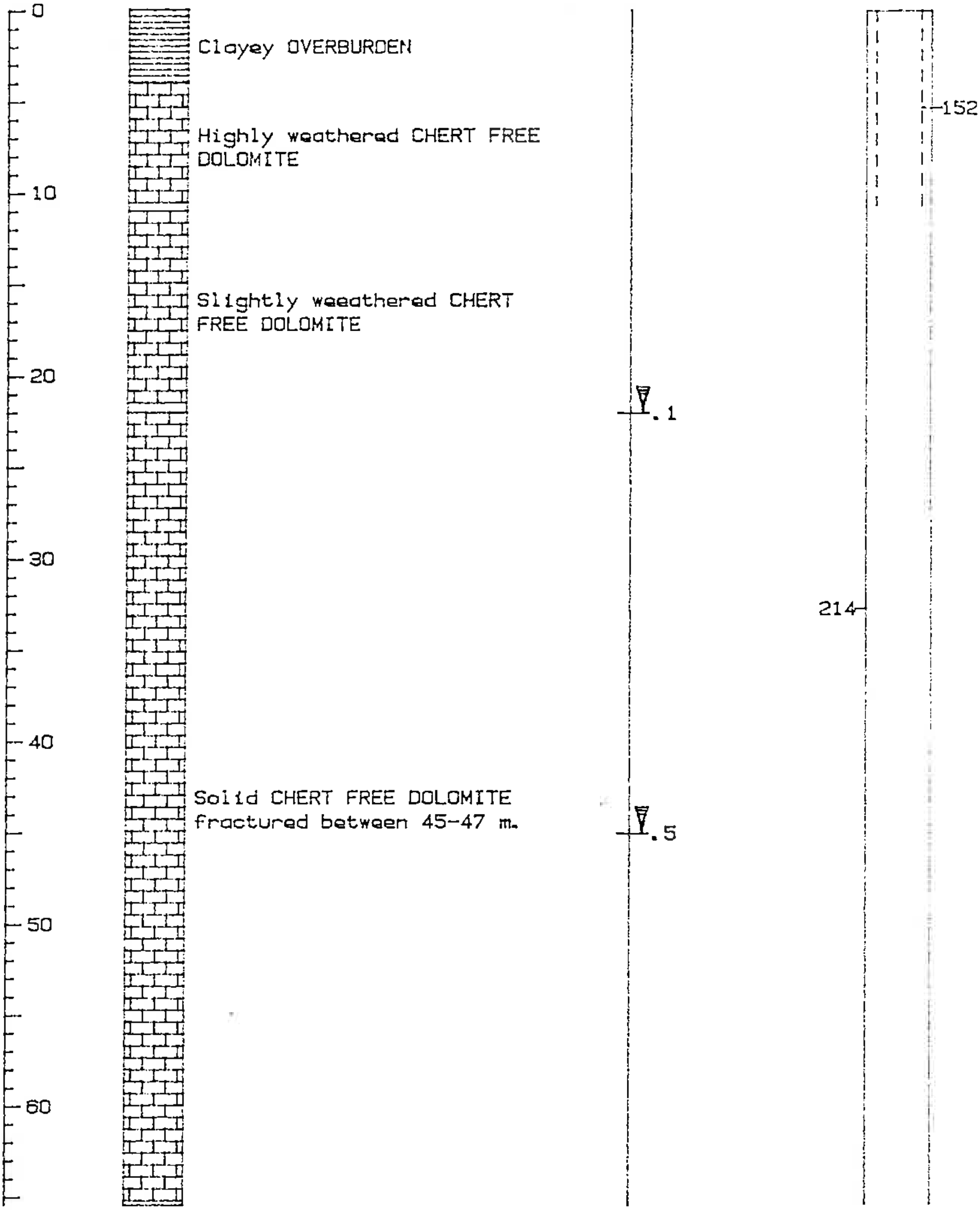
End of Hole 32

BOREHOLE LOG

DISTRICT: DITSOBOTLA   LOCALITY: POLFONTEIN   BH. No. 11

Geoph. Peg No. 203/1,7   Coordinates +2888125X -91700Y   Elev. (m) 1499

Depth (m)	Geology	Blowing Yield l/s	Drill Dia. mm	Casing Dia. mm



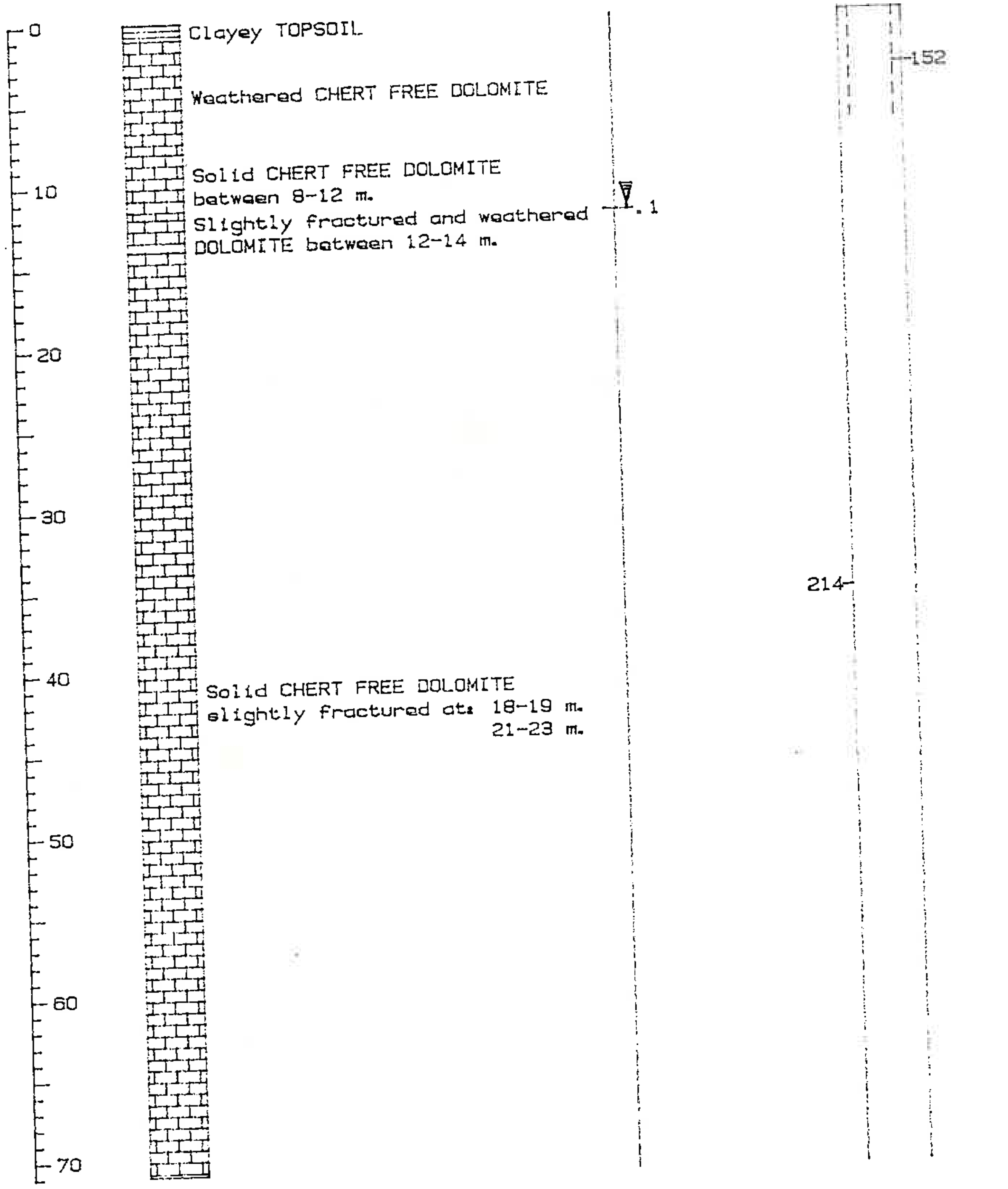
End of Hole 65

BOREHOLE LOG

DISTRICT: DITSOBOTLA   LOCALITY: POLFONTEIN   BH. No. 12

Geoph. Peg No. 205/1,7   Coordinates +2888875X -90975Y   Elev. (m) 1497

Depth (m)   Geology   Blowing Yield l/s   Drill Dia. mm   Casing Dia. mm

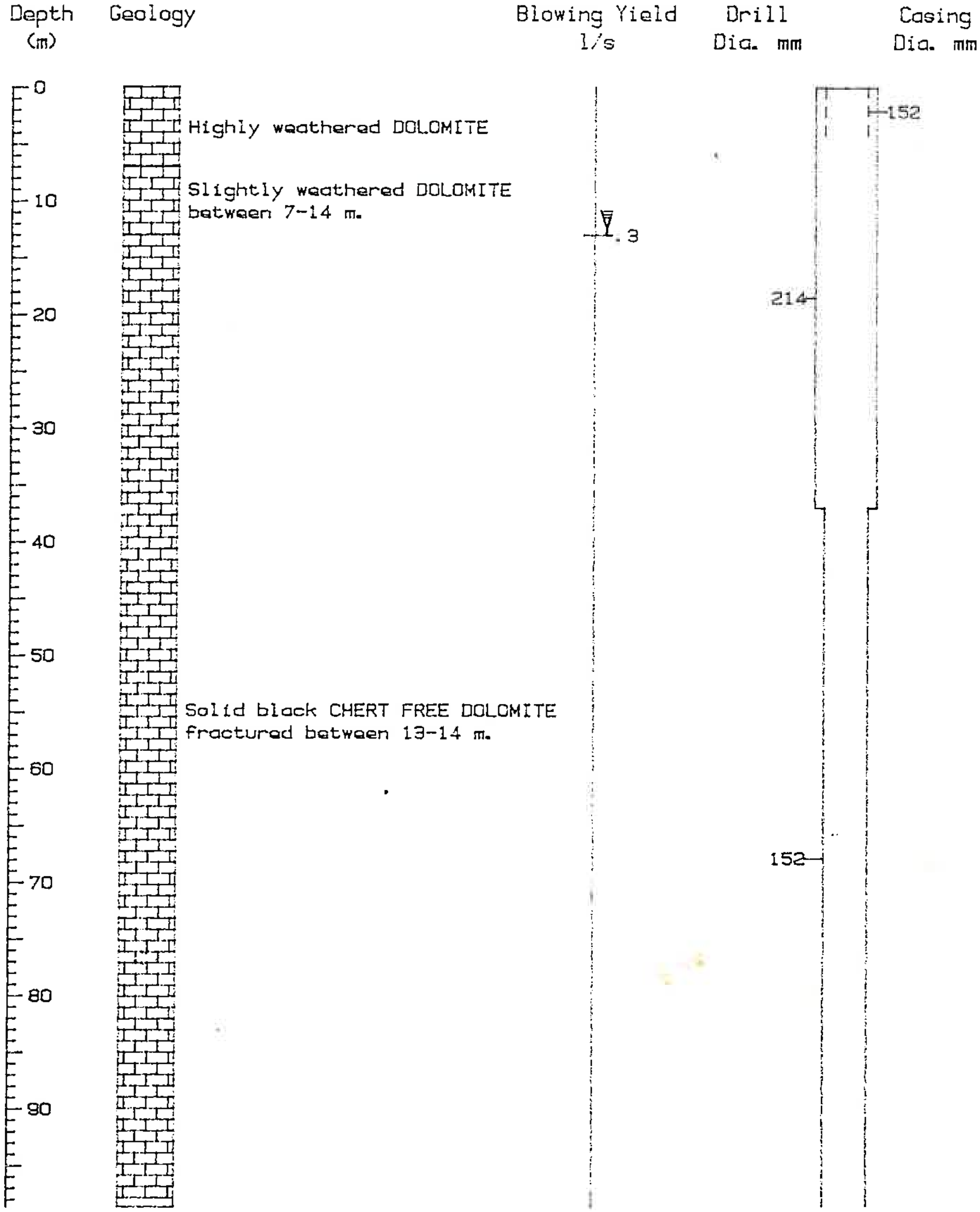


End of Hole 71

BOREHOLE LOG

DISTRICT: DITSOBOTLA   LOCALITY: POLFONTEIN   BH. No. 13

Geoph. Peg No. 207/1,2   Coordinates +2889650X -90800Y   Elev. (m) 1490



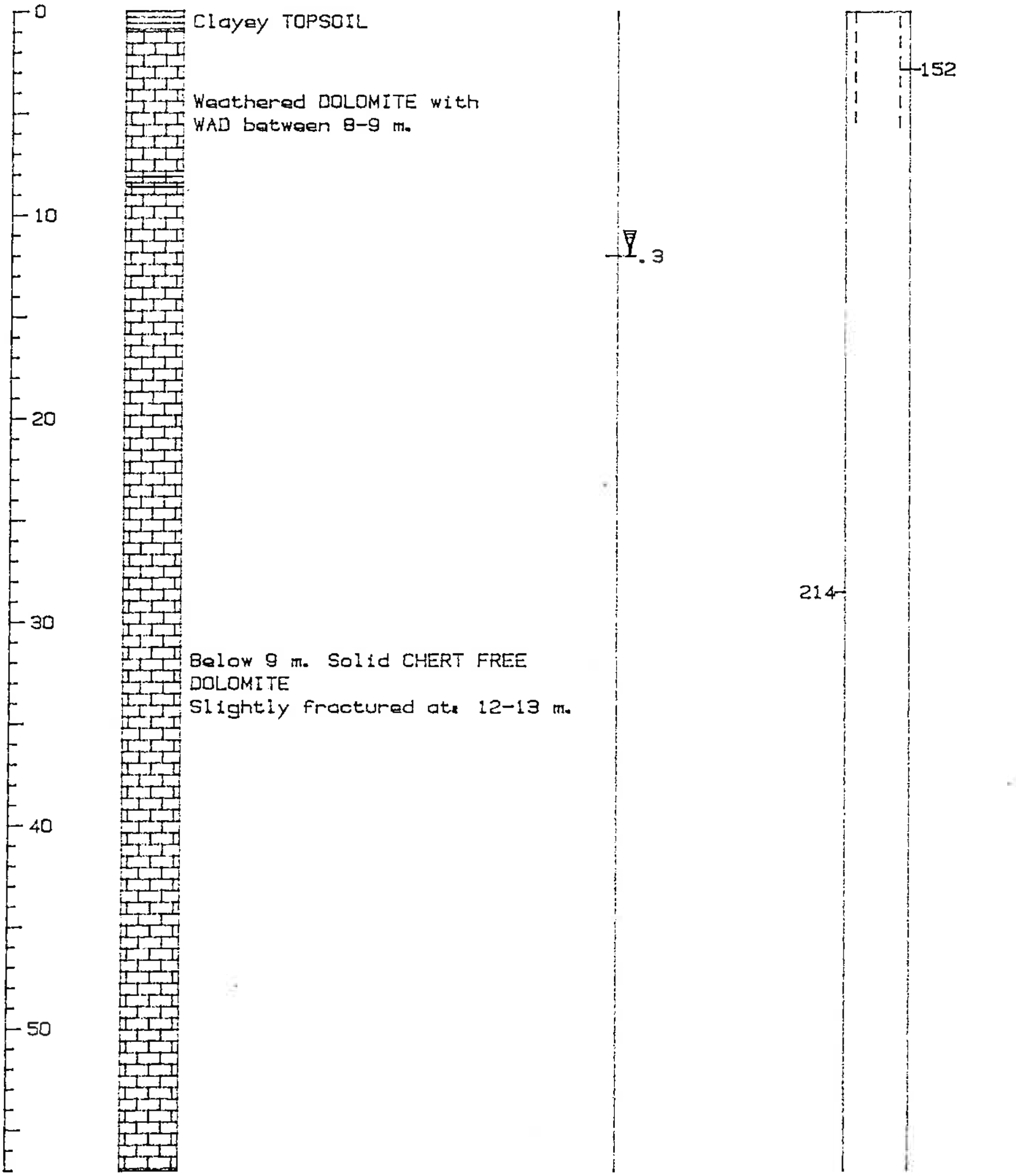
End of Hole 99

BOREHOLE LOG

DISTRICT: DITSOBOTLA LOCALITY: POLFONTEIN BH. No. 14

Geoph. Peg No. 200/8,85 Coordinates +2892250X 85600Y Elev. (m) 1458

Depth (m)	Geology	Blowing Yield l/s	Drill Dia. mm	Casing Dia. mm

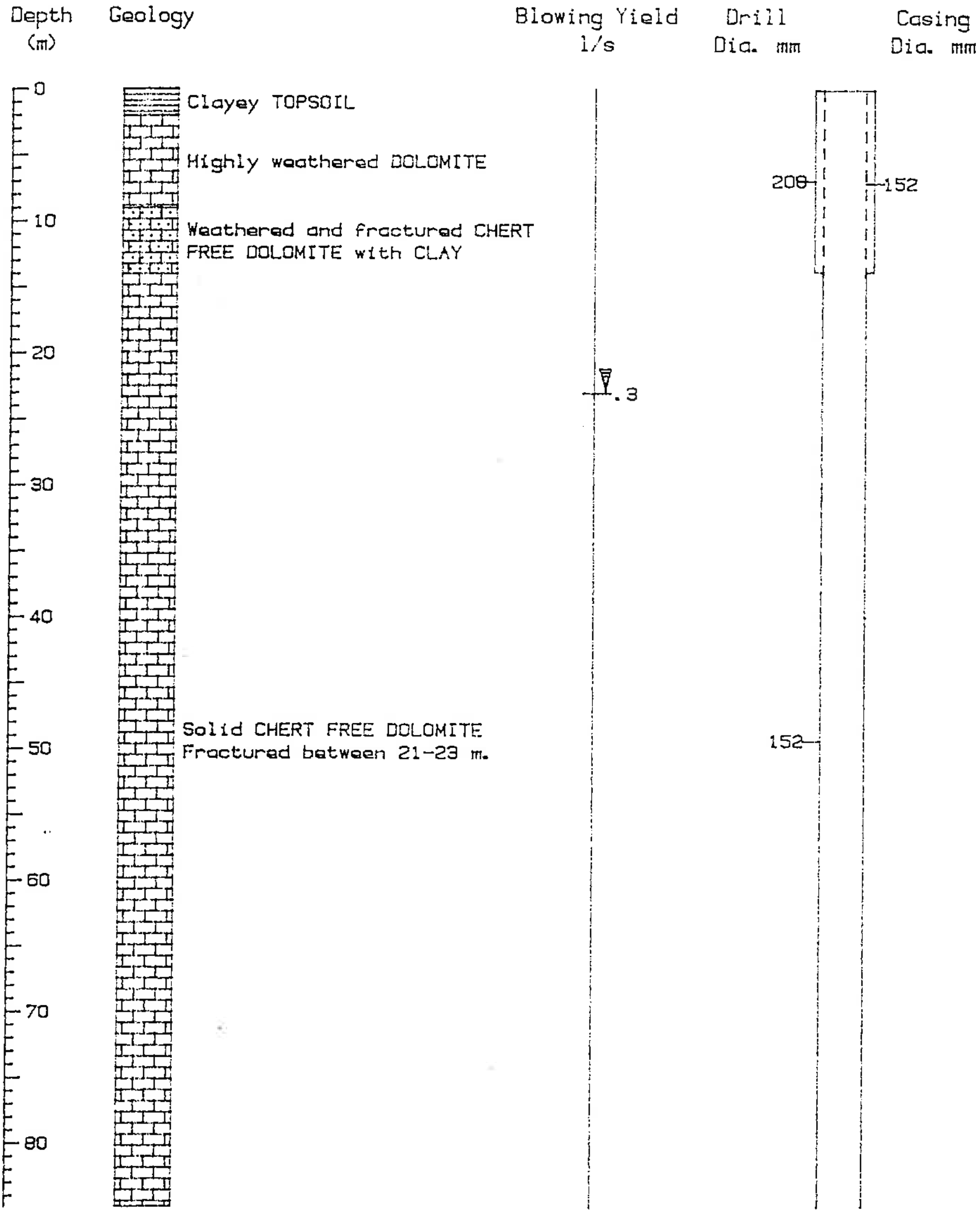


End of Hole 57

BOREHOLE LOG

DISTRICT: DITSOBOTLA   LOCALITY: POLFONTEIN   BH. No. 16

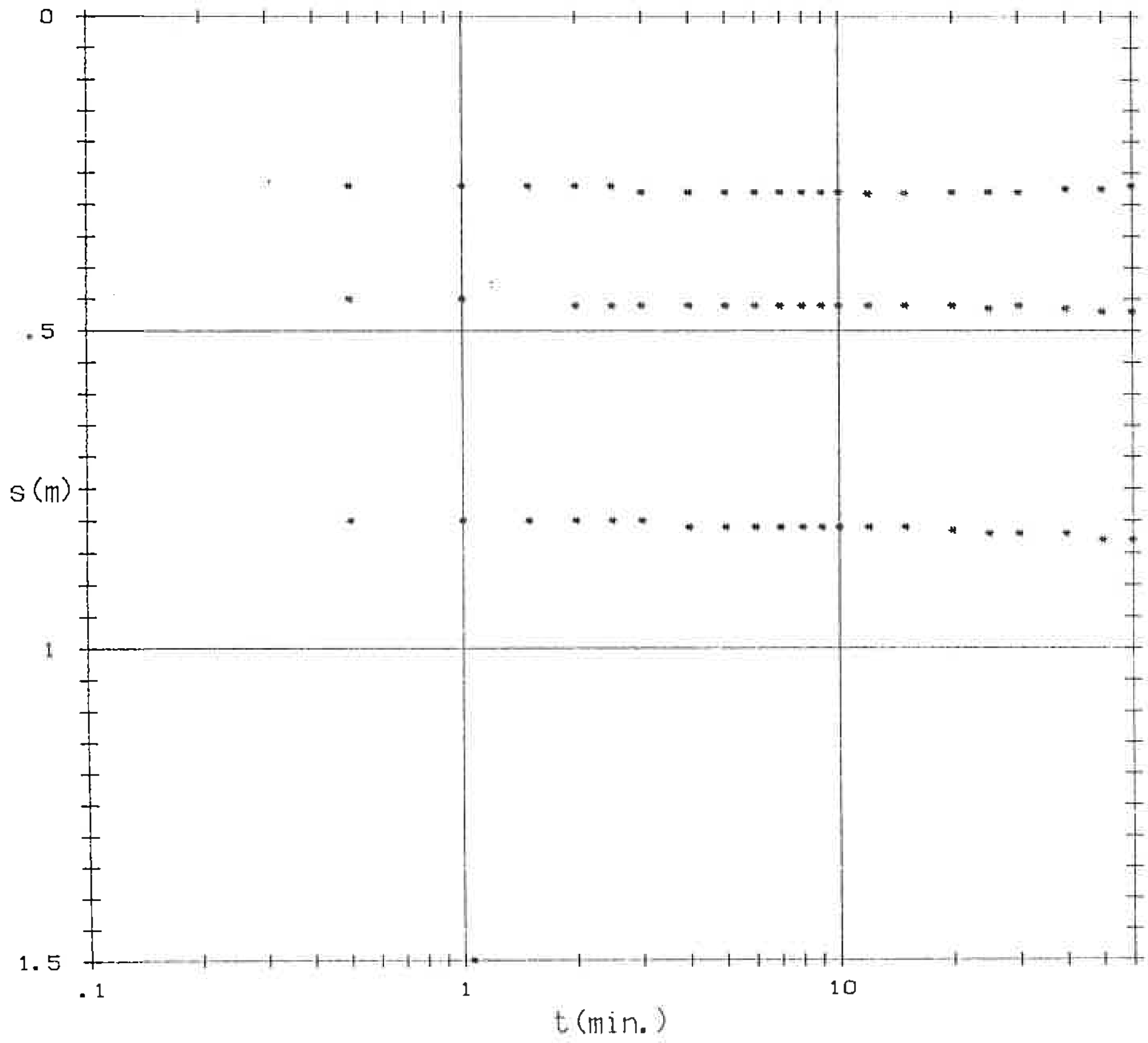
Geoph. Peg No.   Coordinates +2888650X -91950Y   Elev. (m) 1500



End of Hole 85

APPENDIX C

PLOTS OF RESULTS OF STEP DRAWDOWN TESTS



STEP DRAWDOWN TEST

POLFONTEIN

5.9.90

B.H. No. V1

Q_1 = 8.6 l/s

Q_2 = 12.4 l/s

Q_3 = 17.9 l/s

FIG.

STEP DRAWDOWN TEST

POLFONTEIN

3.9.90

B.H. No. 1

$Q_1 = 3.2$ l/s

$Q_2 = 6.2$ l/s

$Q_3 = 15.6$ l/s

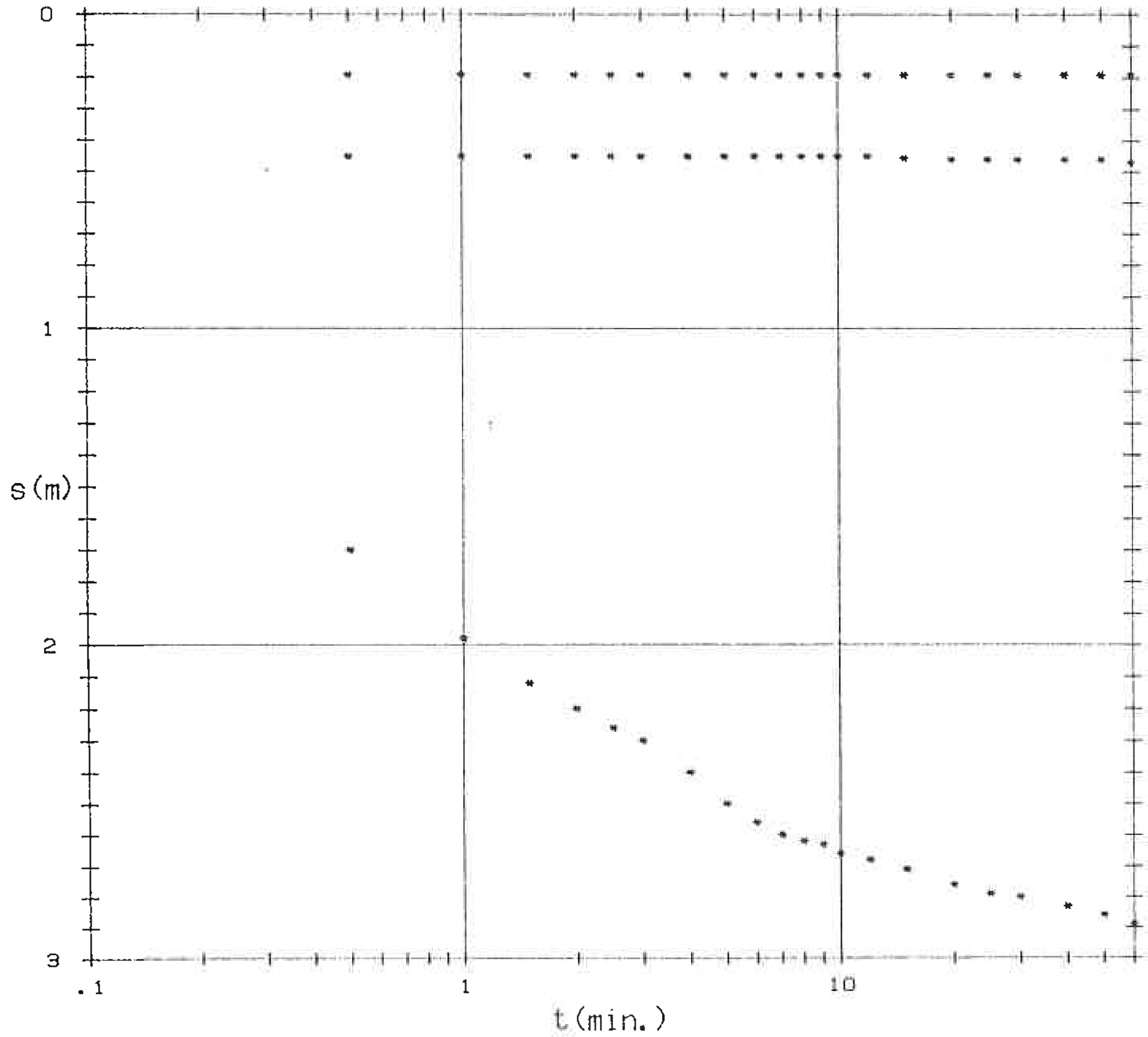


FIG.

STEP DRAWDOWN TEST

POLFONTEIN

30.8.90

B.H. No. 3

Q_1 = 1.5 l/s
Q_2 = 2.3 l/s
Q_3 = 7.4 l/s

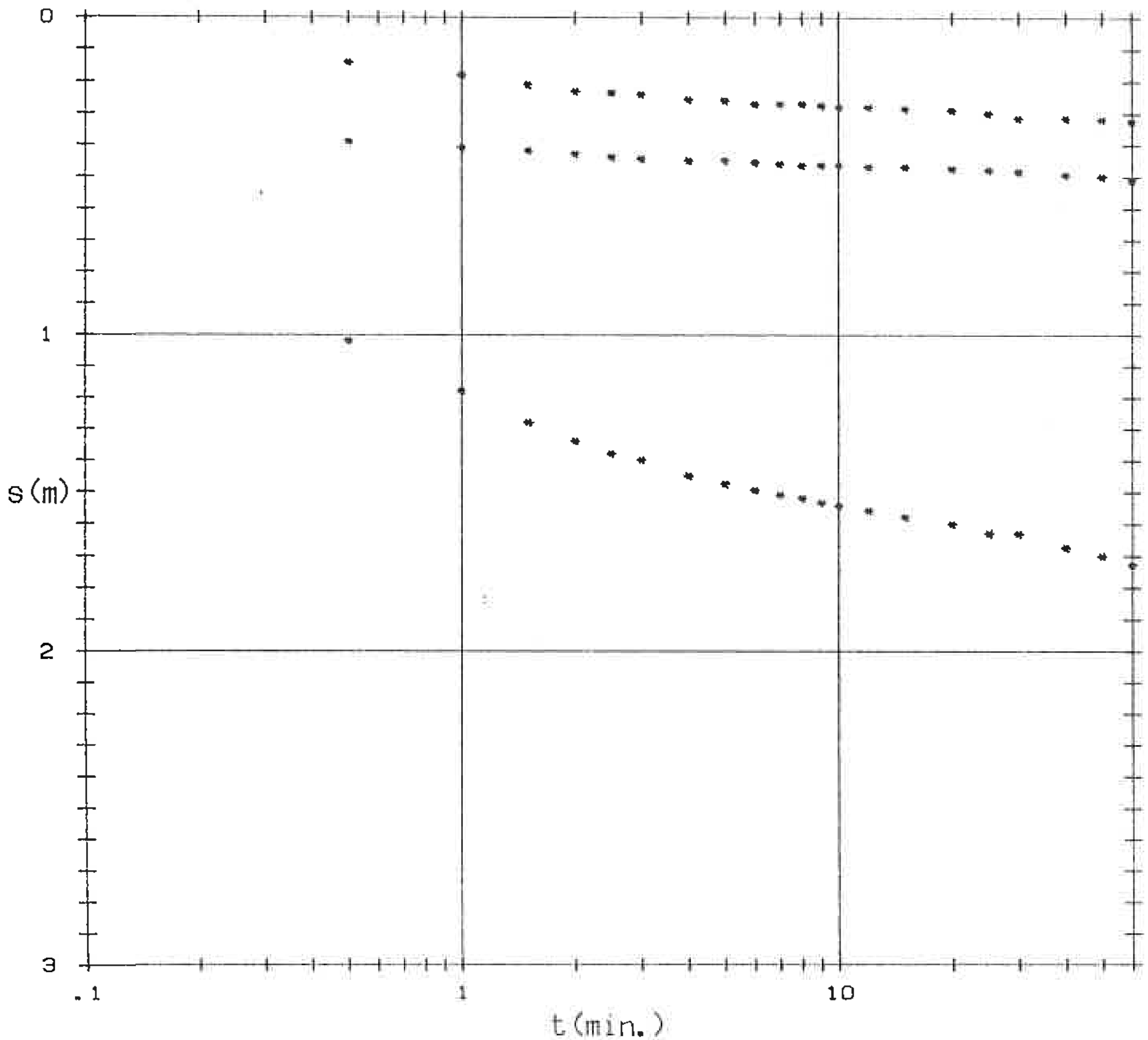


FIG.

STEP DRAWDOWN TEST

POLFONTEIN

22.9.90

B.H. No. 4

$Q_1 = 1.1$ l/s

$Q_2 = 2.7$ l/s

$Q_3 = 5.9$ l/s

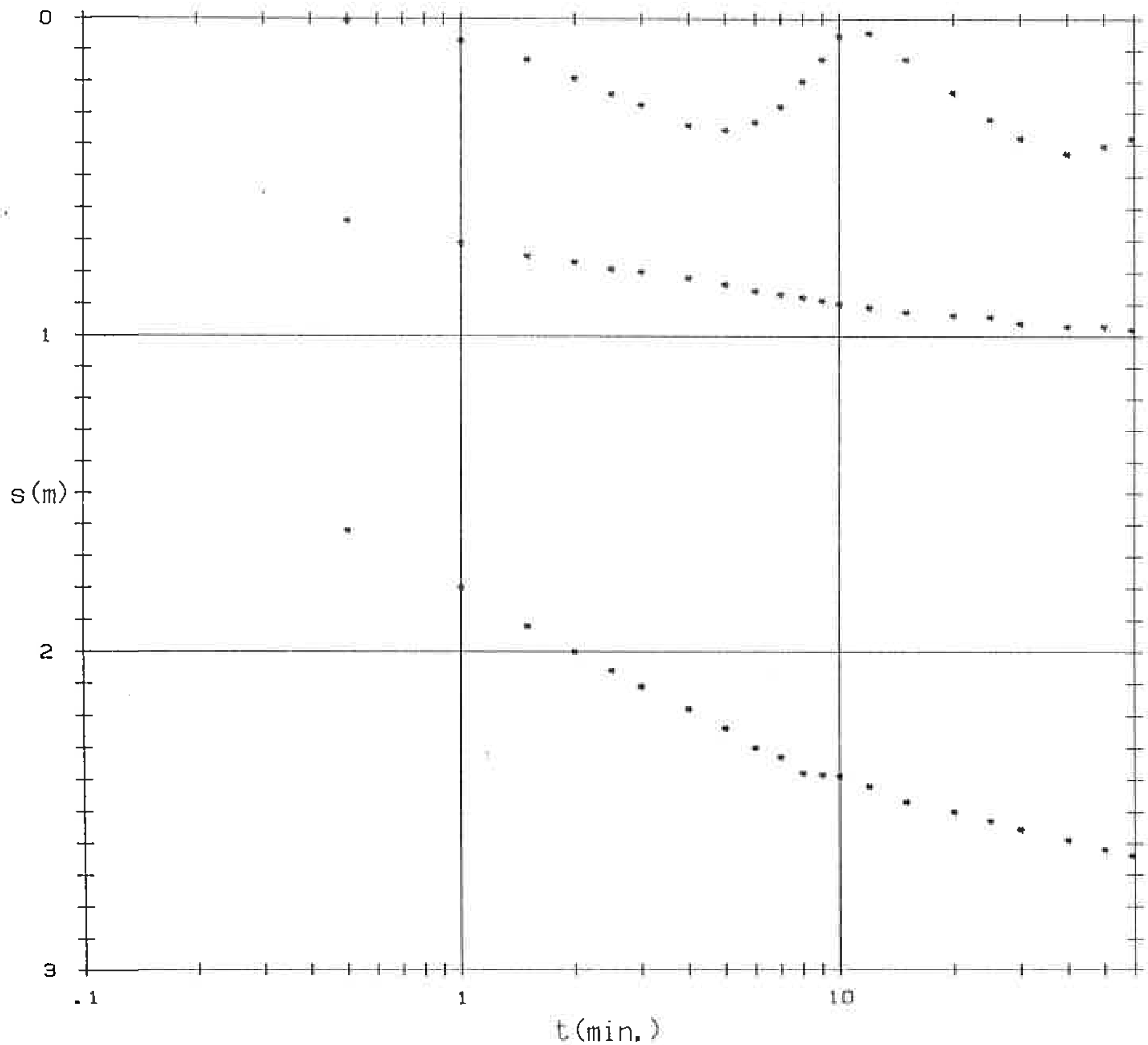


FIG.

STEP DRAWDOWN TEST

POLFONTEIN

14.10.90

B.H. No. 4

Q_1 = 12.96 l/s

Q_2 = 17 l/s

Q_3 = 19.8 l/s

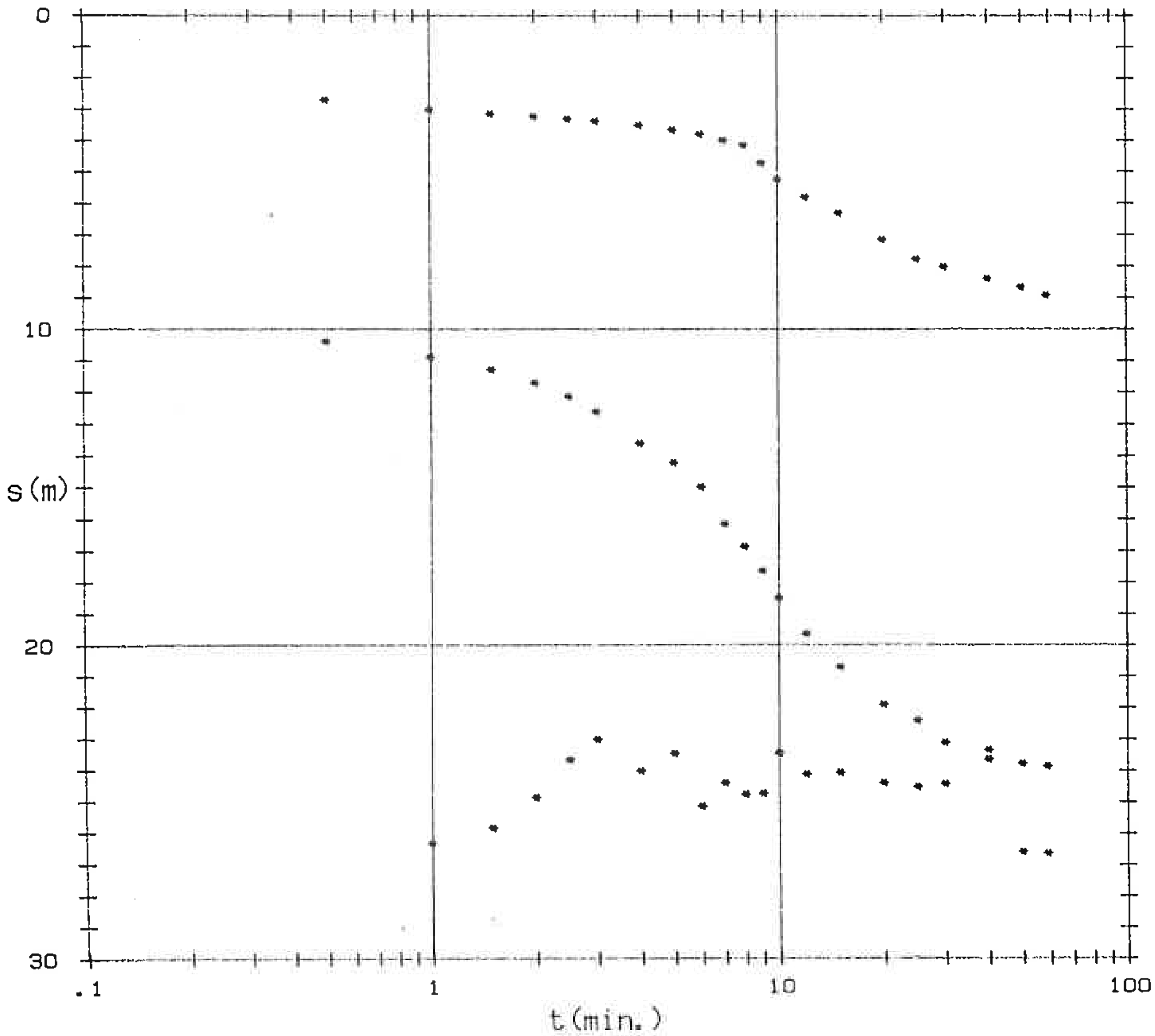


FIG.

STEP DRAWDOWN TEST

POLFONTEIN

11.9.90

B.H. No. 5

$Q_1 = 1.2$ l/s
$Q_2 = 2.5$ l/s
$Q_3 = 2.8$ l/s
$Q_4 = 6.5$ l/s

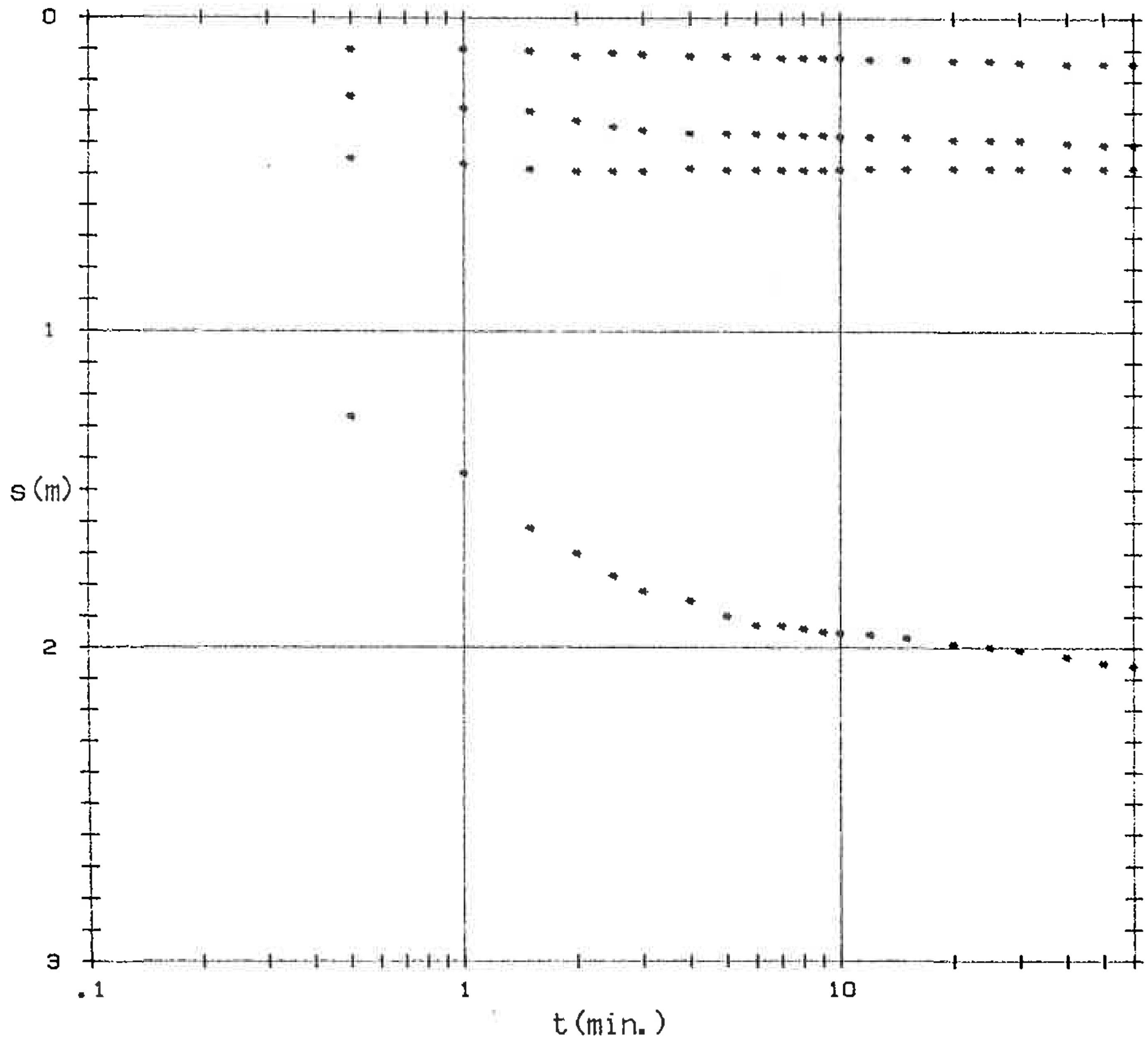


FIG.

STEP DRAWDOWN TEST

POLFONTEIN

23.9.90

B.H. No. 6

$Q_1 = 1.88$ l/s

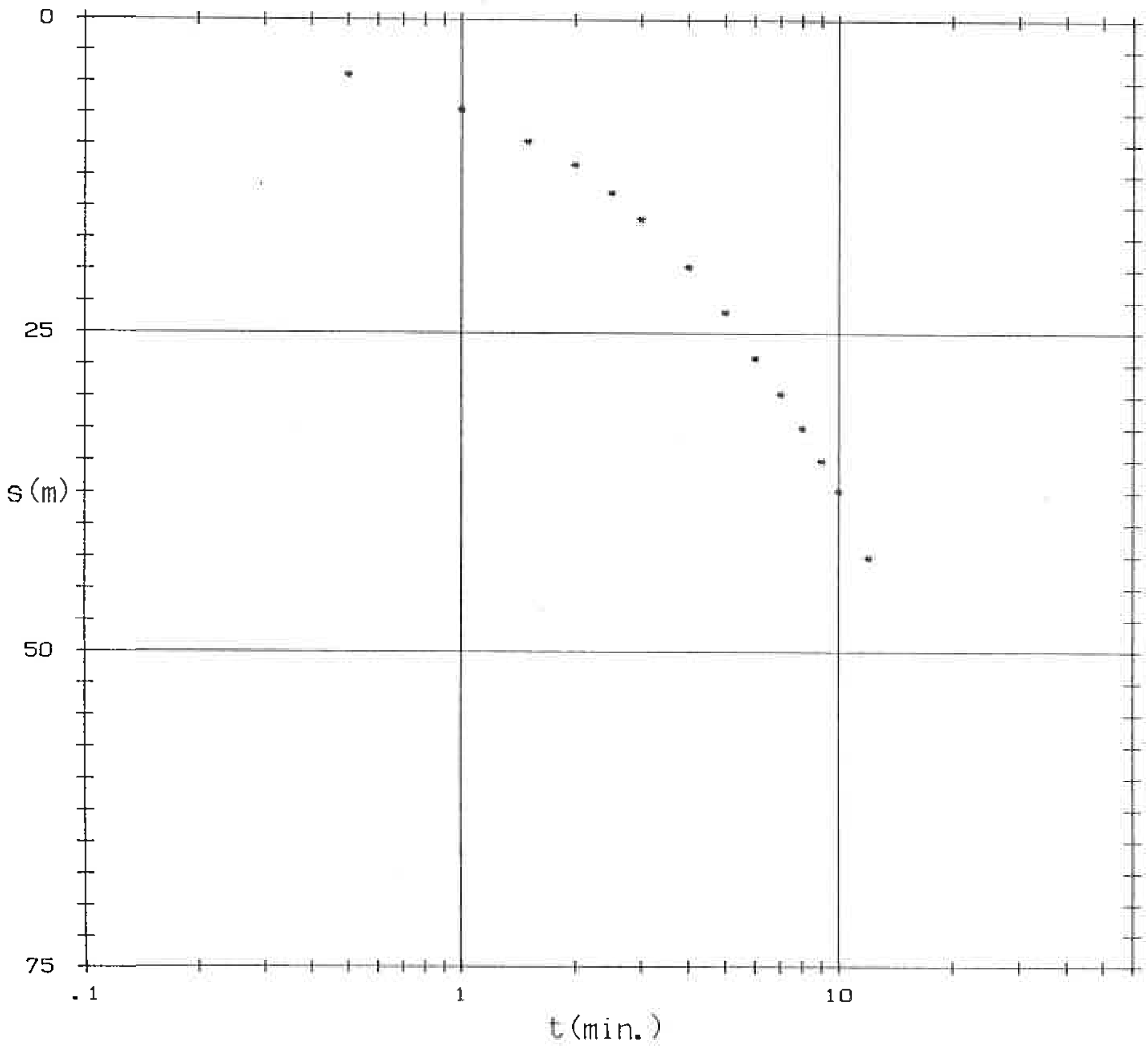
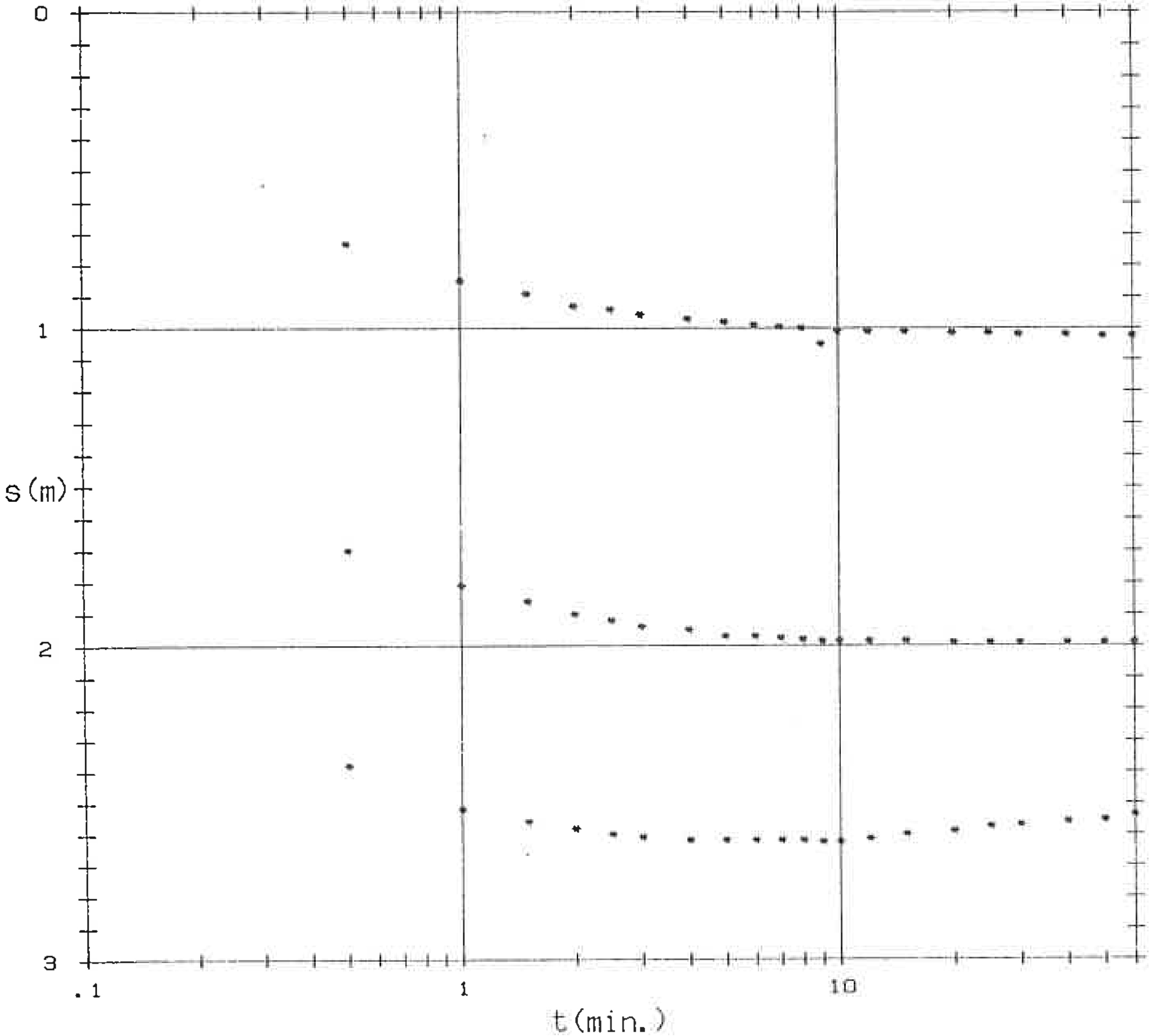


FIG.



STEP DRAWDOWN TEST

POLFONTEIN

21.9.90

B.H. No. 7

Q_1 = 6.9 l/s

Q_2 = 10.4 l/s

Q_3 = 11.3 l/s

FIG.

STEP DRAWDOWN TEST

POLFONTEIN

12.10.90

B.H. No. 7

$Q_1 = 12.8$ l/s

$Q_2 = 18.2$ l/s

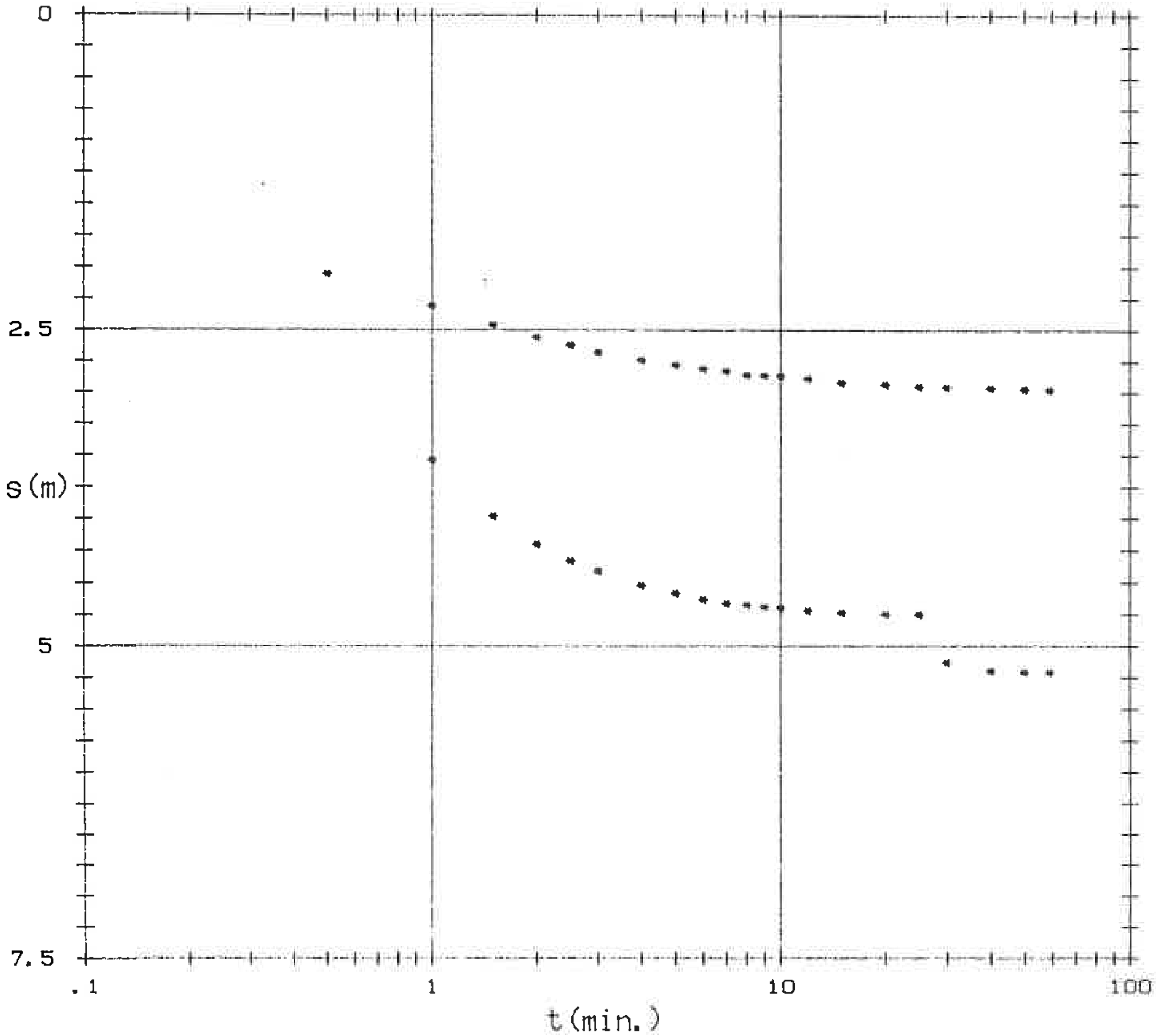
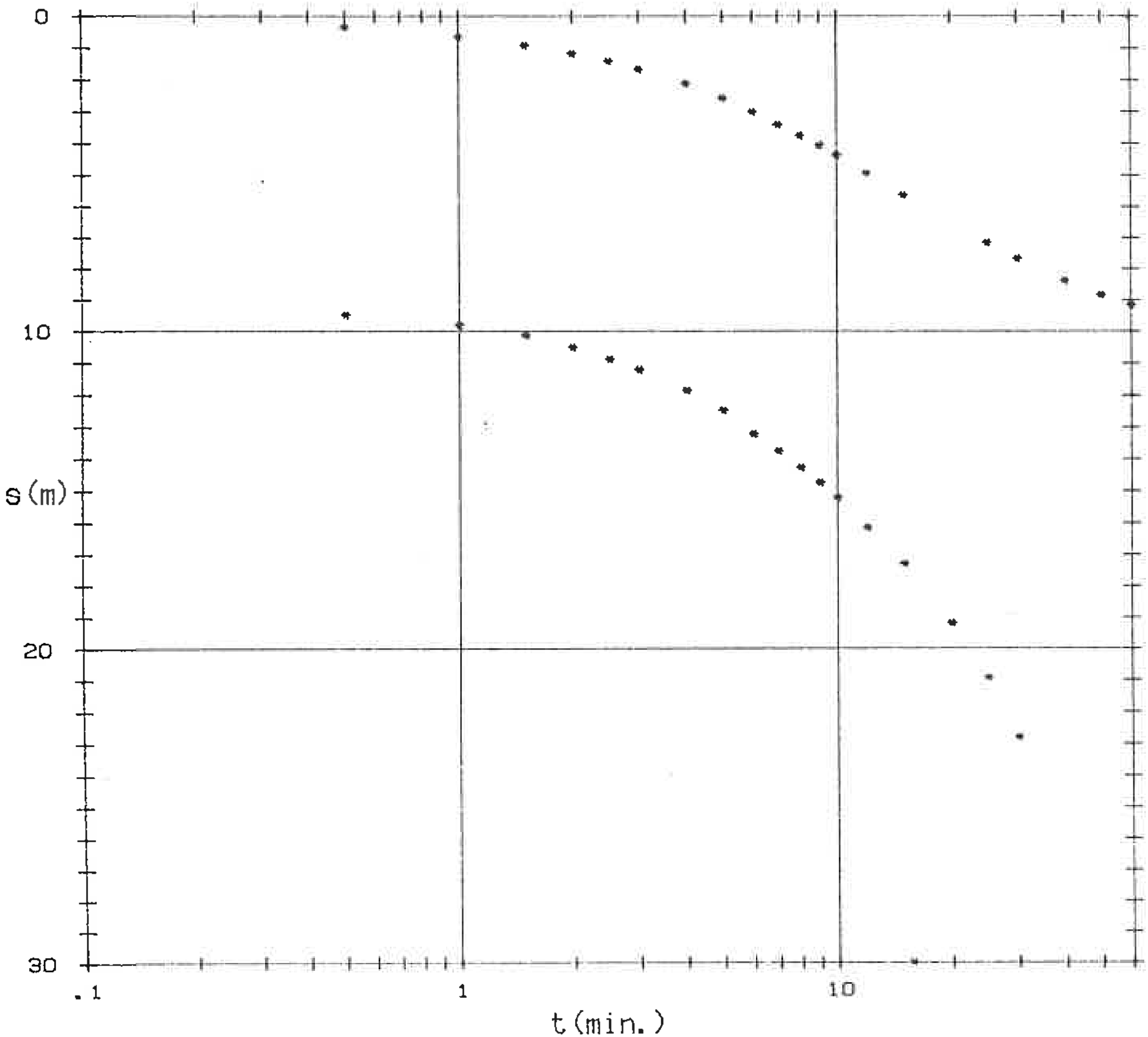


FIG.



STEP DRAWDOWN TEST

POLFONTEIN

23.9.90

B.H. No. 8

Q_1 = .3 l/s

Q_2 = .51 l/s

FIG.

STEP DRAWDOWN TEST

POLFONTEIN

10.9.90

B.H. No. 10

$Q_1 = 2.25$ l/s

$Q_2 = 3.2$ l/s

$Q_3 = 4.9$ l/s

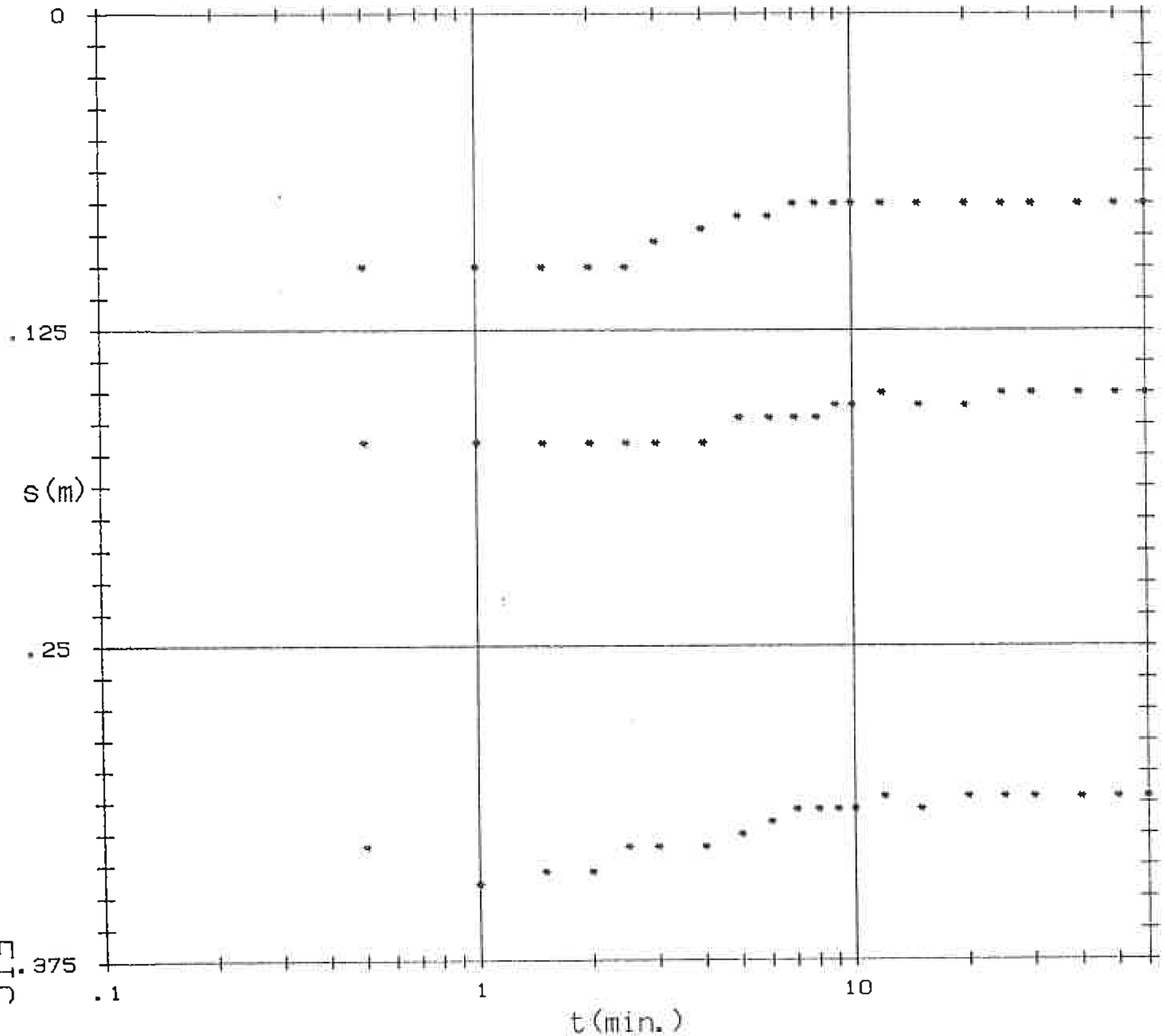


FIG.

STEP DRAWDOWN TEST

POLFONTEIN

20.9.90

B.H. No. 11

Q_1 = .19 l/s

Q_2 = .42 l/s

Q_3 = .78 l/s

Q_4 = 1.7 l/s

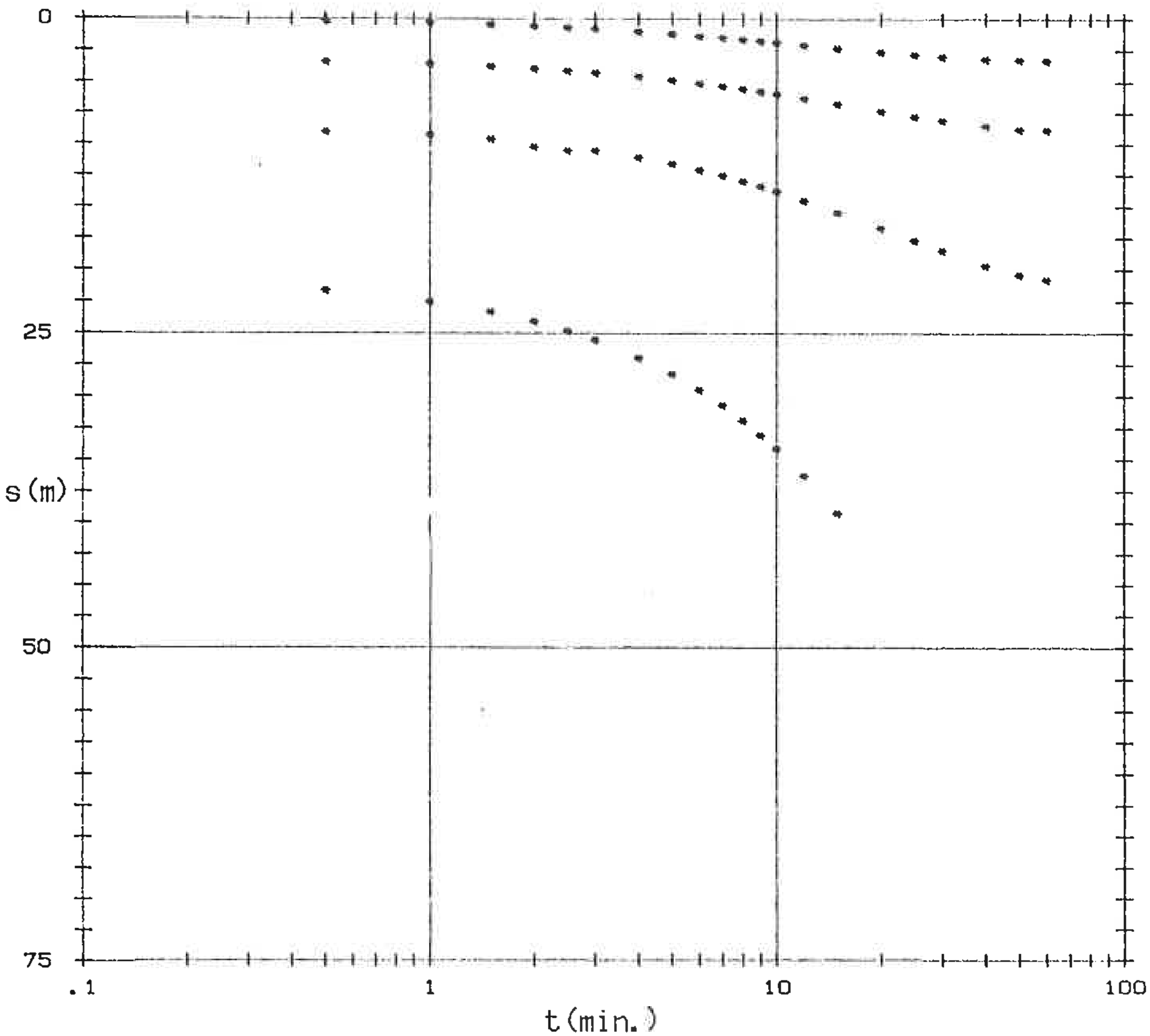


FIG.

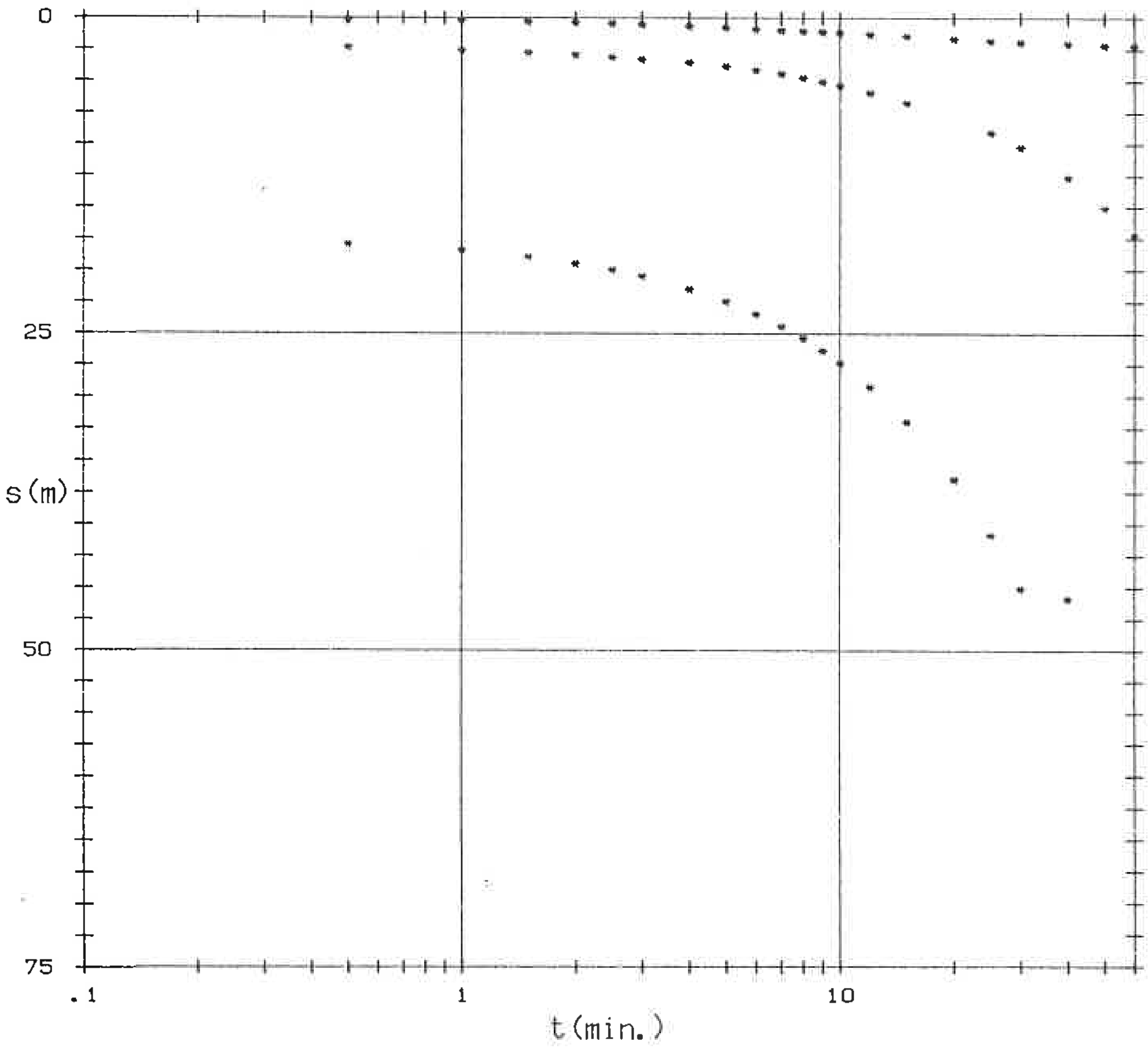


FIG.

STEP DRAWDOWN TEST

POLFONTEIN

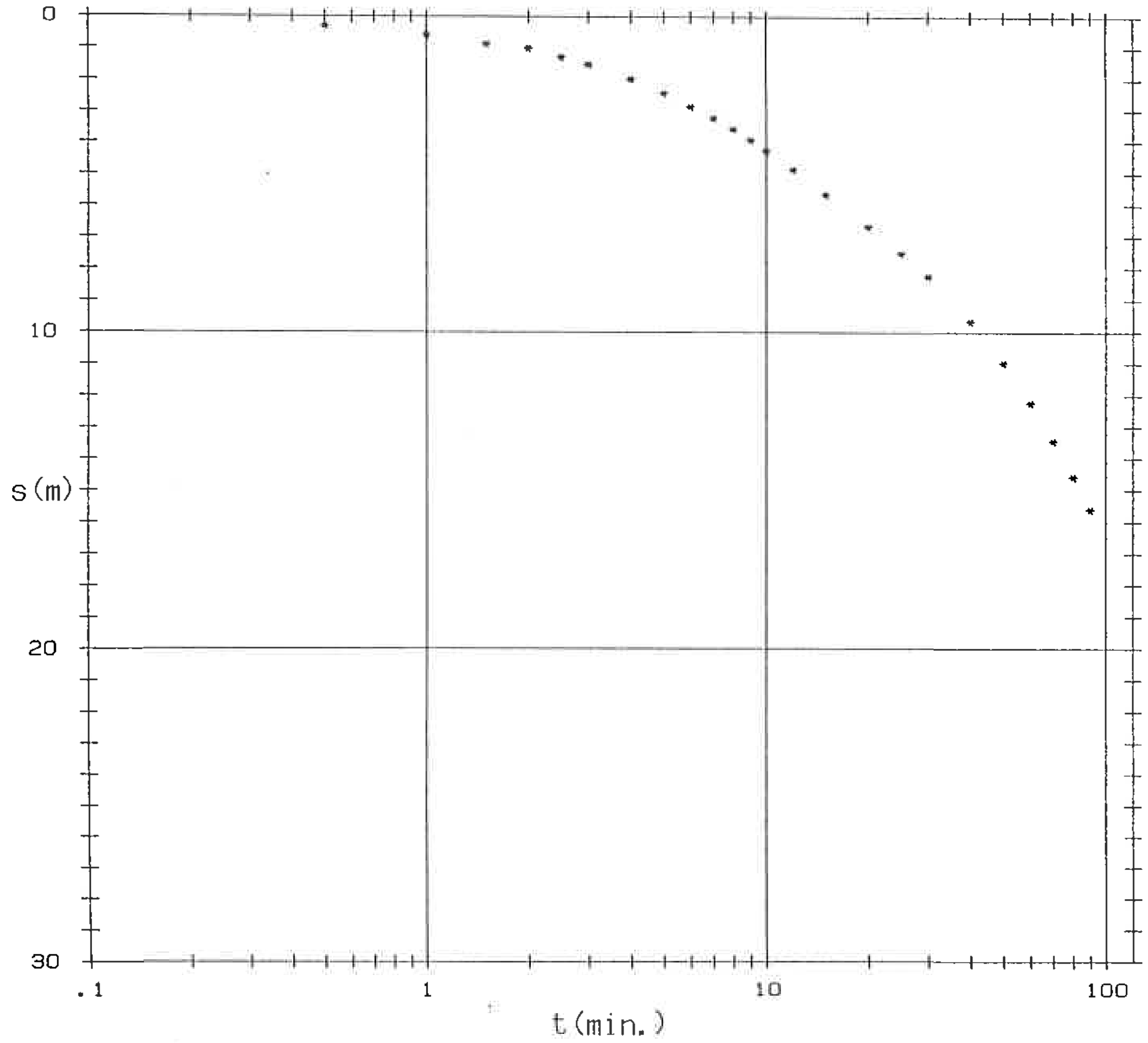
21.9.90

B.H. No. 12

Q_1 = .18 l/s

Q_2 = .39 l/s

Q_3 = .79 l/s



STEP DRAWDOWN TEST

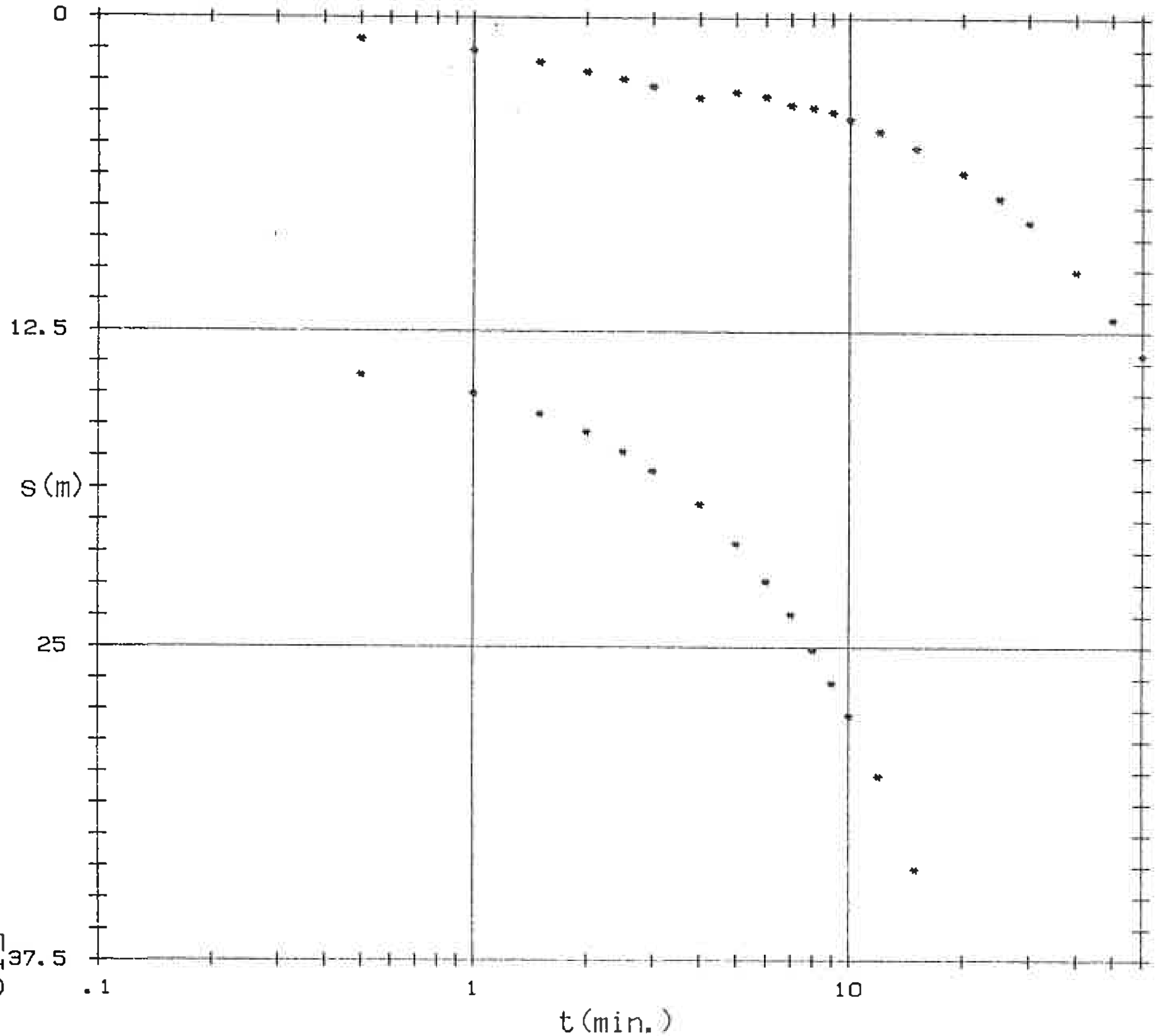
POLFONTEIN

23.9.90

B.H. No. 13

$Q_1 = .45$ l/s

FIG.



STEP DRAWDOWN TEST

POLFONTEIN

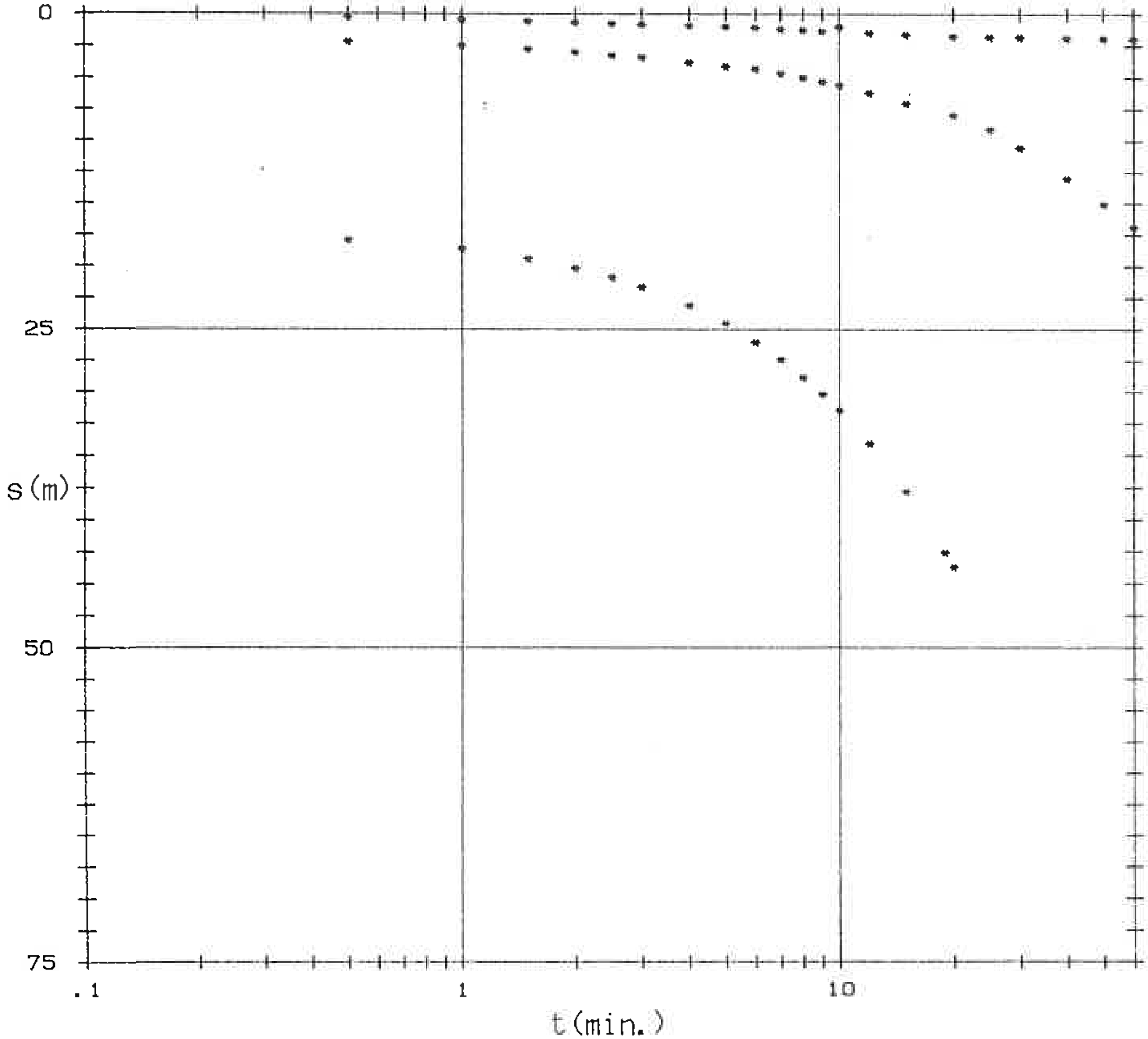
12.9.90

B.H. No. 14

Q_1 = .52 l/s

Q_2 = 1.34 l/s

FIG.



STEP DRAWDOWN TEST

POLFONTEIN

19.9.90

B.H. No. 16

Q_1 = .19 l/s

Q_2 = .39 l/s

Q_3 = .7 l/s

FIG.

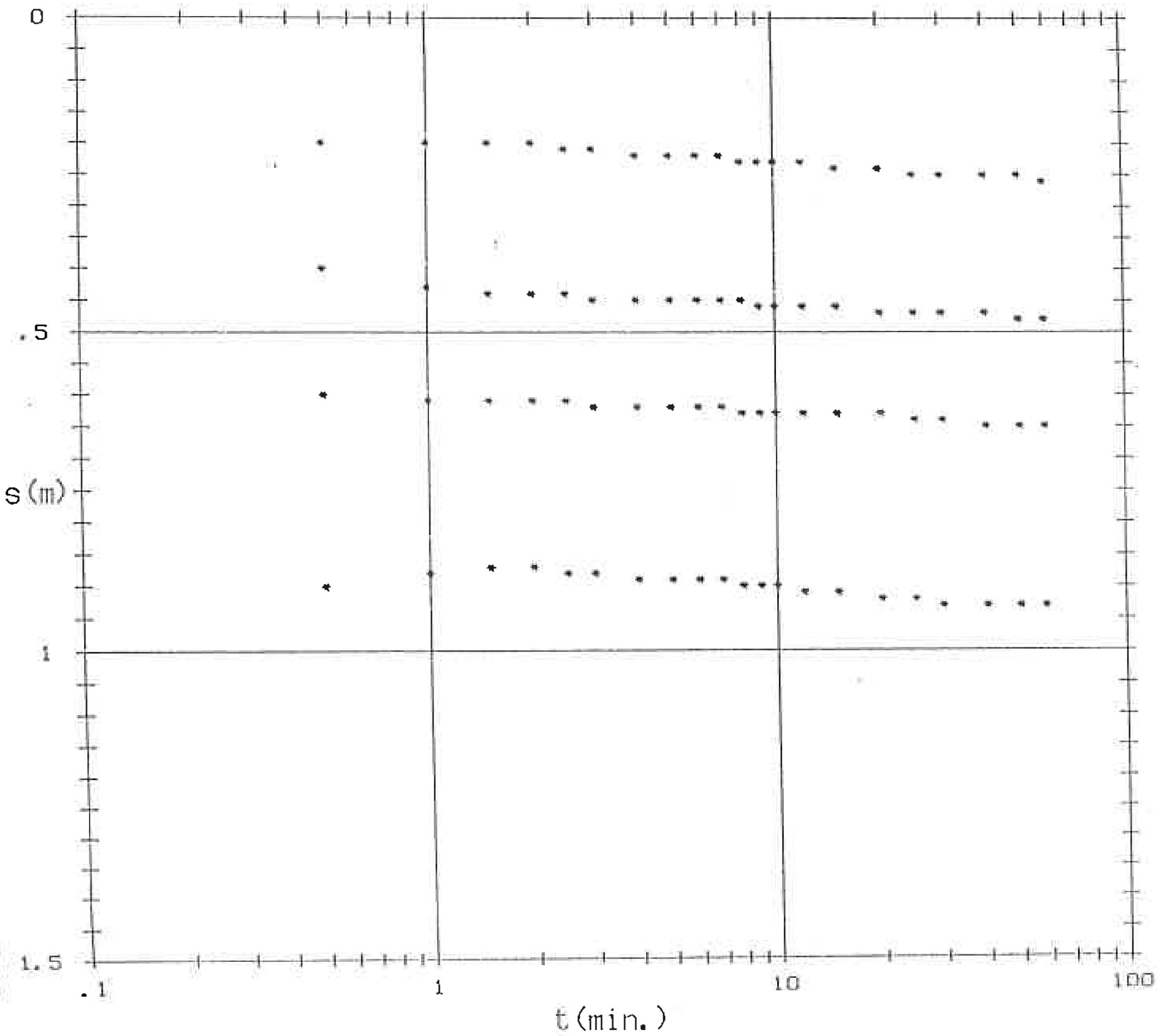


FIG.

STEP DRAWDOWN TEST

ITSOSENG

19.09.90

B.H. No. 10-77150B

Q_1 = 12 l/s

Q_2 = 17.2 l/s

Q_3 = 20.4 l/s

Q_4 = 24.8 l/s

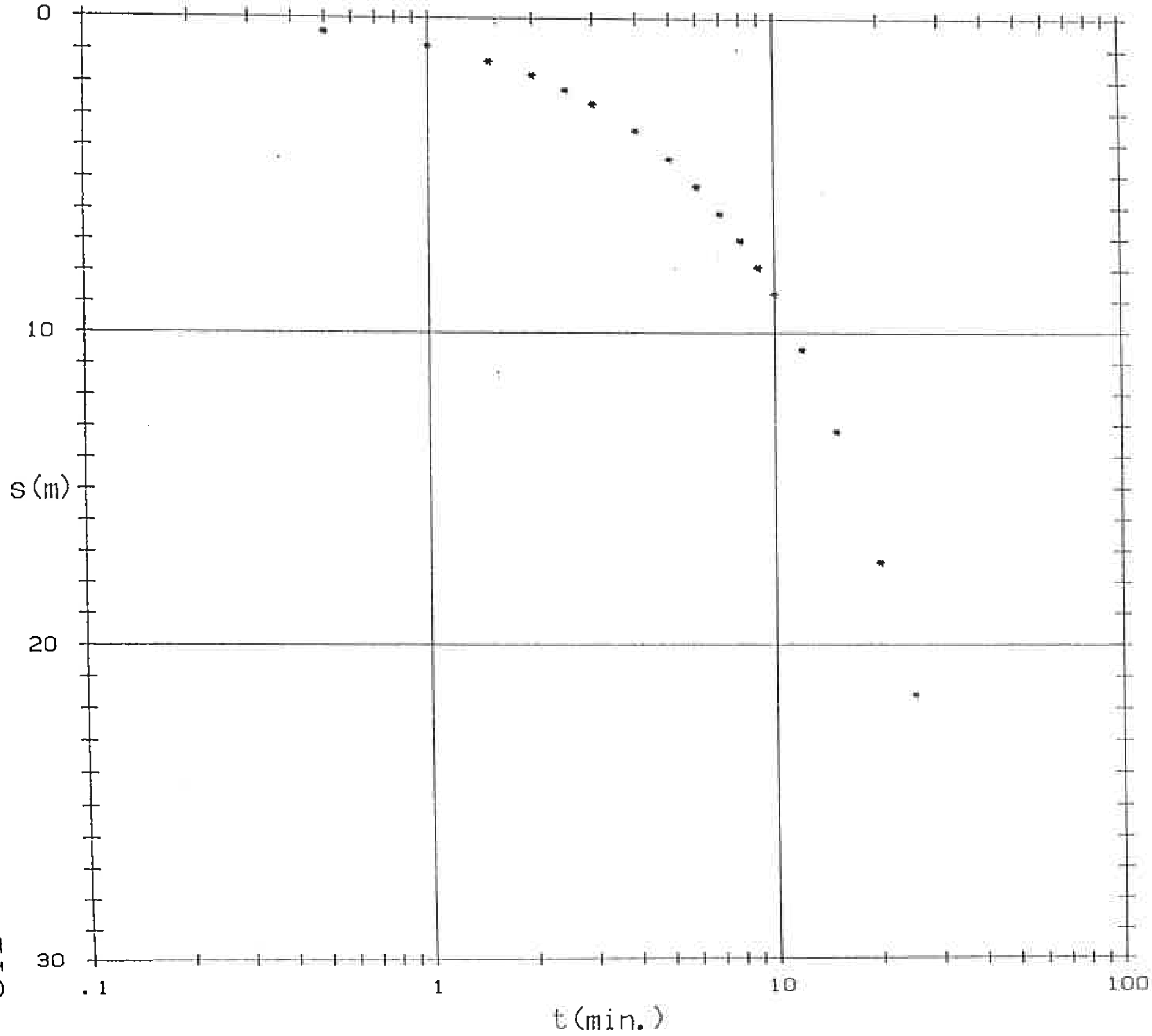


FIG.

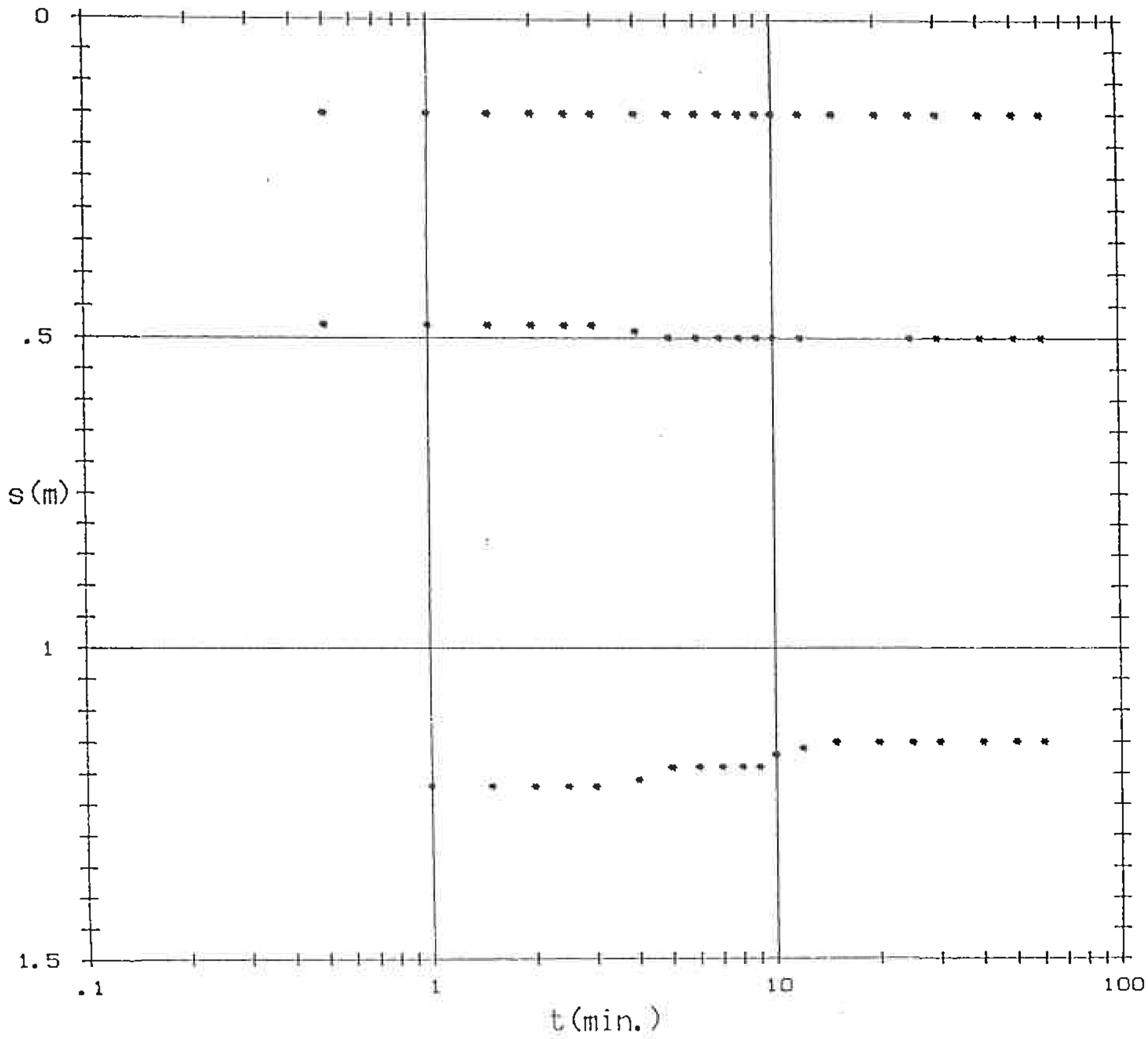
STEP DRAWDOWN TEST

ITSOSENG

22.08.90

B.H. No. 10-77152B

Q_1 = 1.1 l/s



STEP DRAWDOWN TEST

ITSOSENG

06.09.90

B.H. No. AB

$Q_1 = 3.6$ l/s
$Q_2 = 7.9$ l/s
$Q_3 = 15.6$ l/s

FIG.

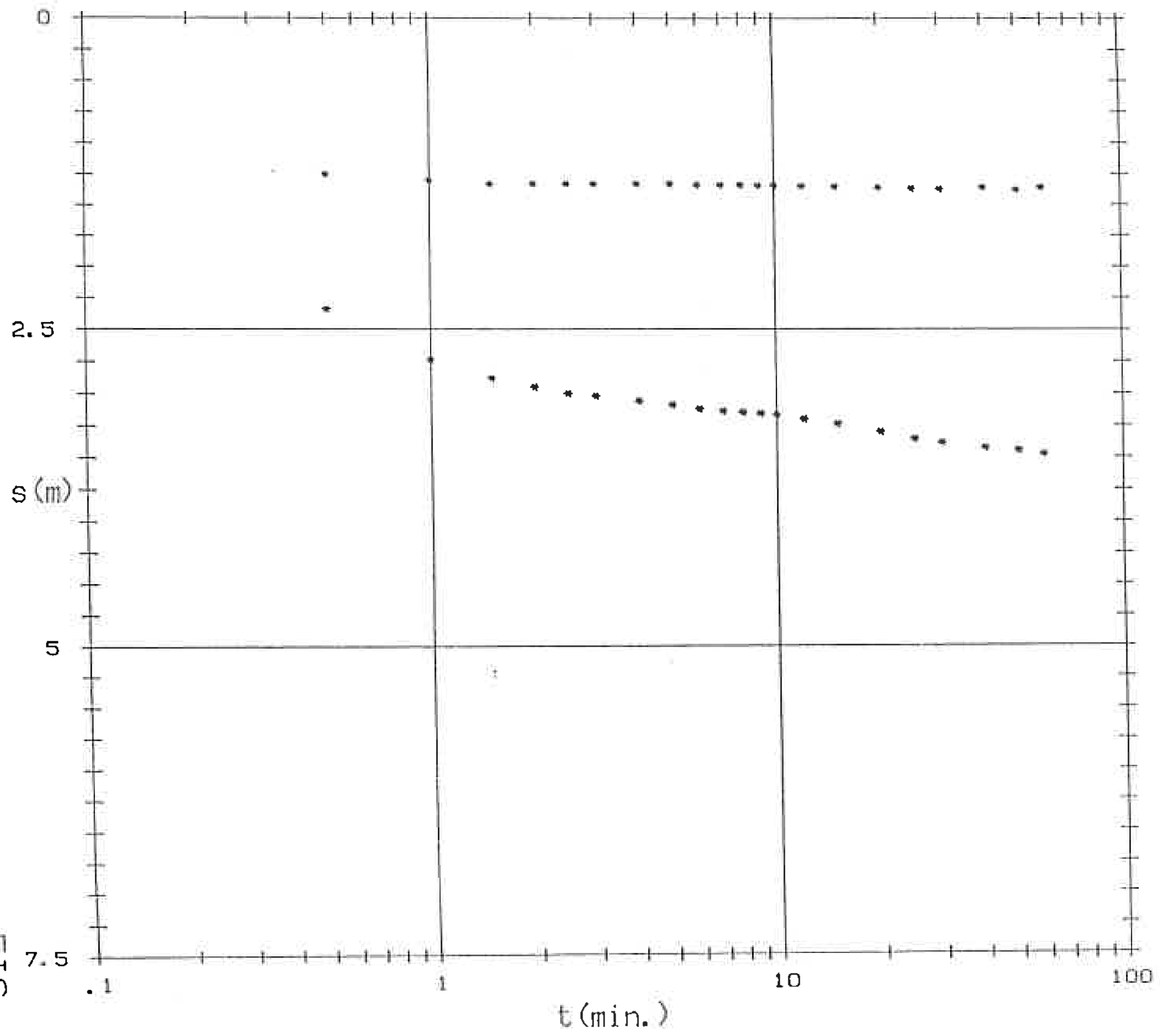


FIG.

STEP DRAWDOWN TEST

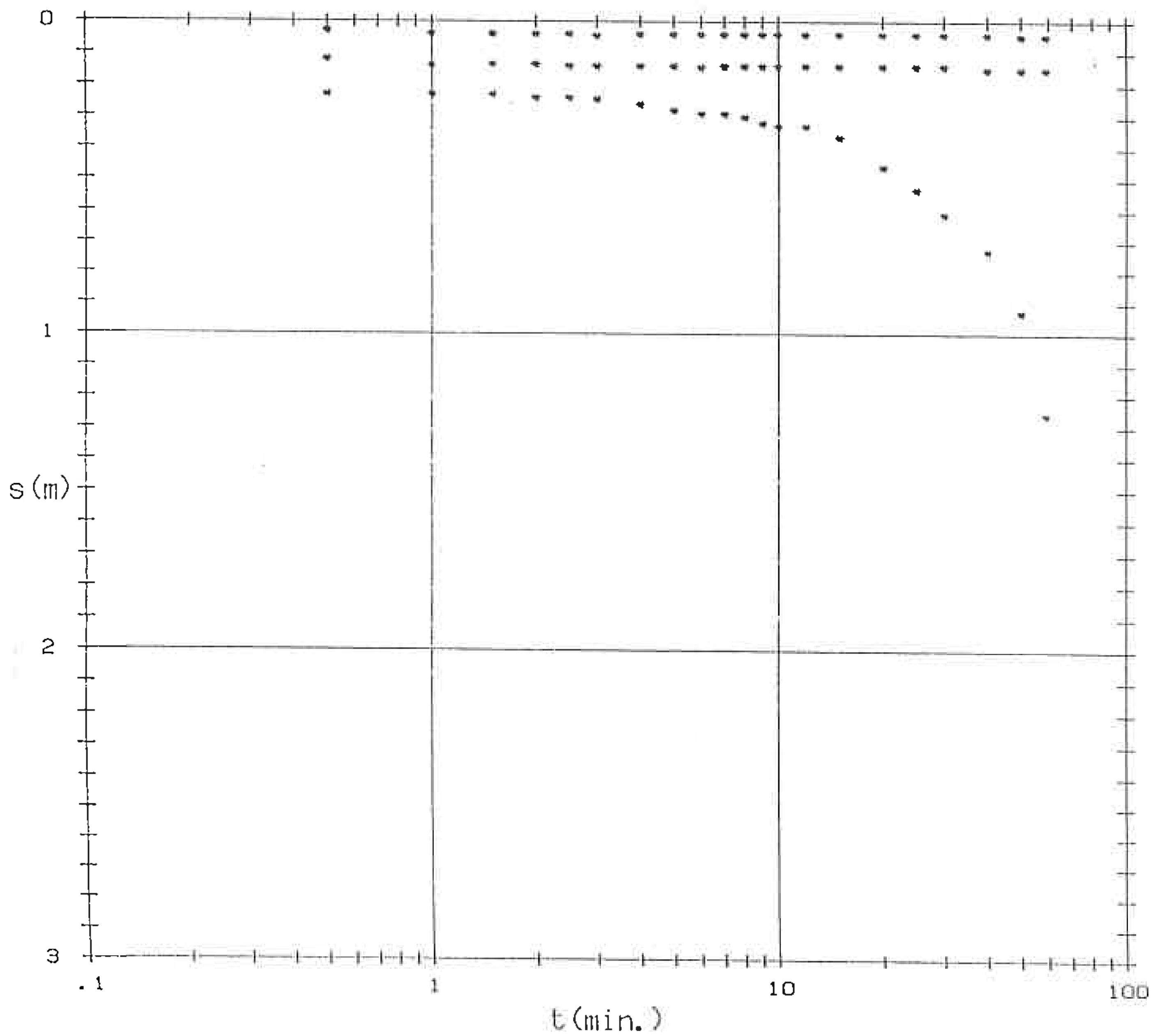
ITSOSENG

02.09.90

B.H. T17611

Q_1 = 8.5 l/s

Q_2 = 13.3 l/s



STEP DRAWDOWN TEST

BODIBE (ITSOSENG)

29.08.90

B.H. T17644

$Q_1 = 7.8$ l/s

$Q_2 = 13.9$ l/s

$Q_3 = 18$ l/s

FIG.

APPENDIX D

PLOTS OF RESULTS OF CONSTANT DISCHARGE TESTS

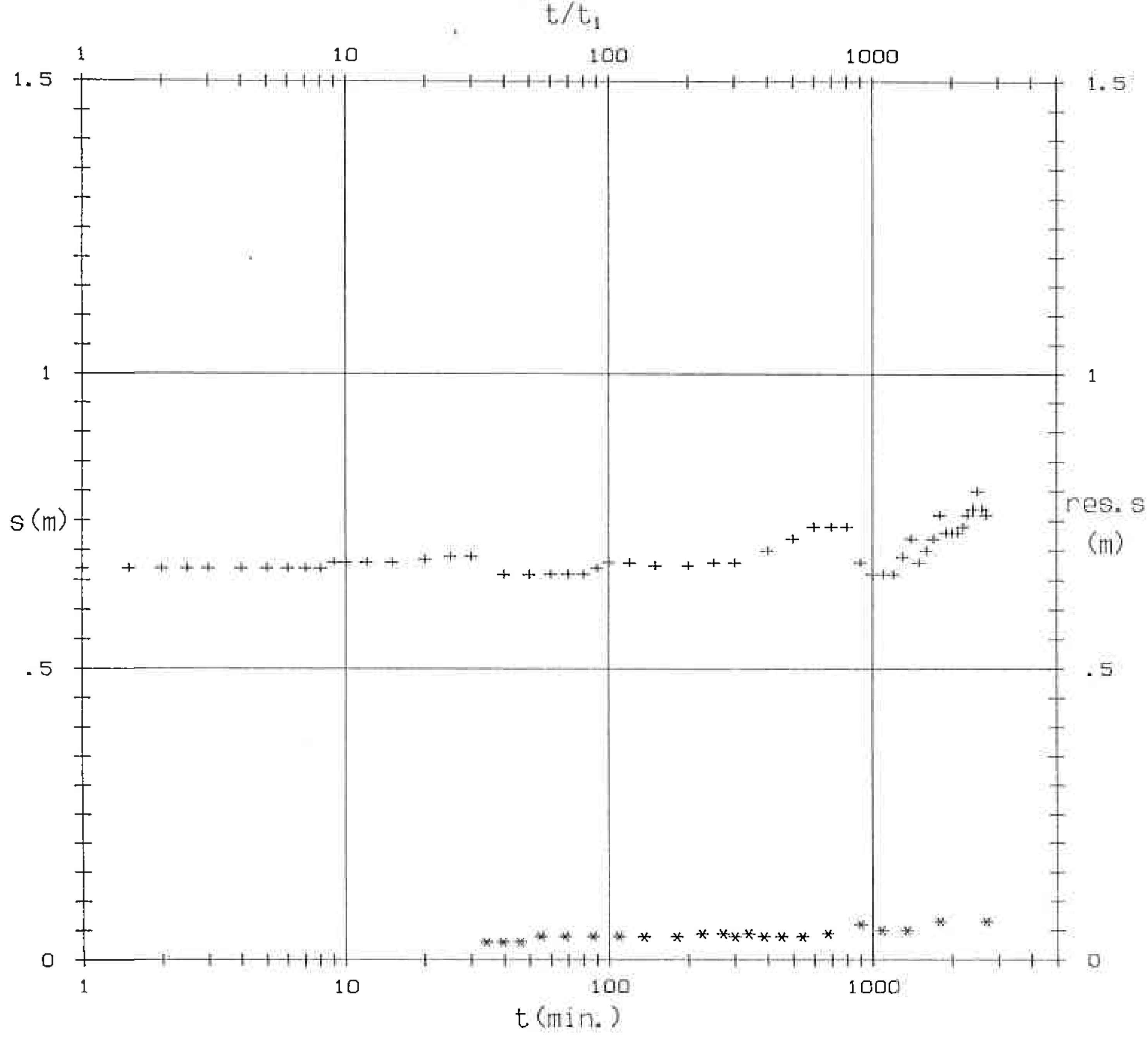


FIG.

CONSTANT DISCHARGE TEST

+ Drawdown data.

* Recovery data.

POLFONTEIN

5. 9. 90

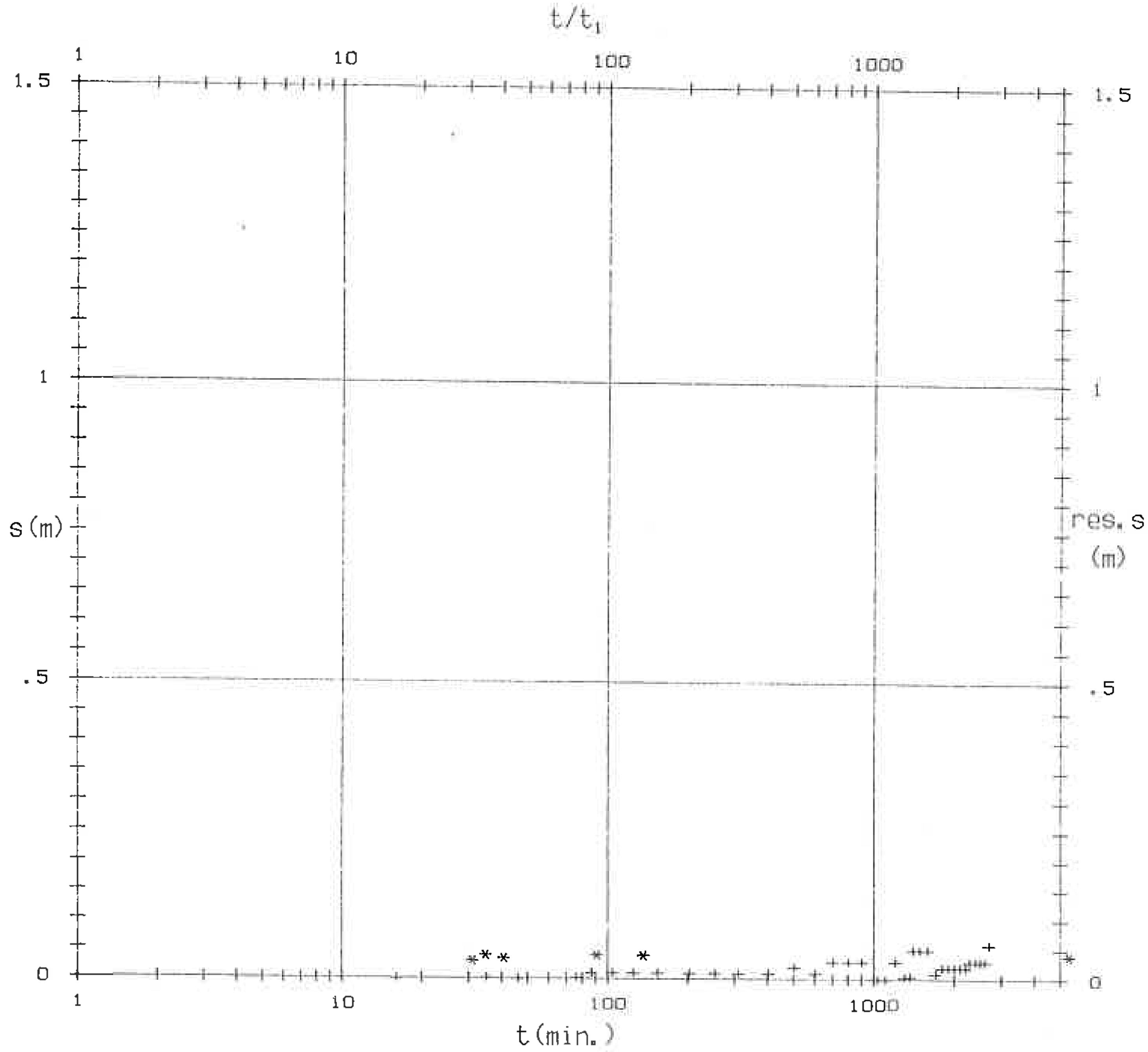
Pumped Borehole
BH V1

Observation Borehole
BH V1

Q = 15.8 l/s

S. W. L. = 24.16 m

T = 8300 m²/d



CONSTANT DISCHARGE TEST
+ Drawdown data.
* Recovery data.

POLFONTEIN

5.9.90

Pumped Borehole
BH V1

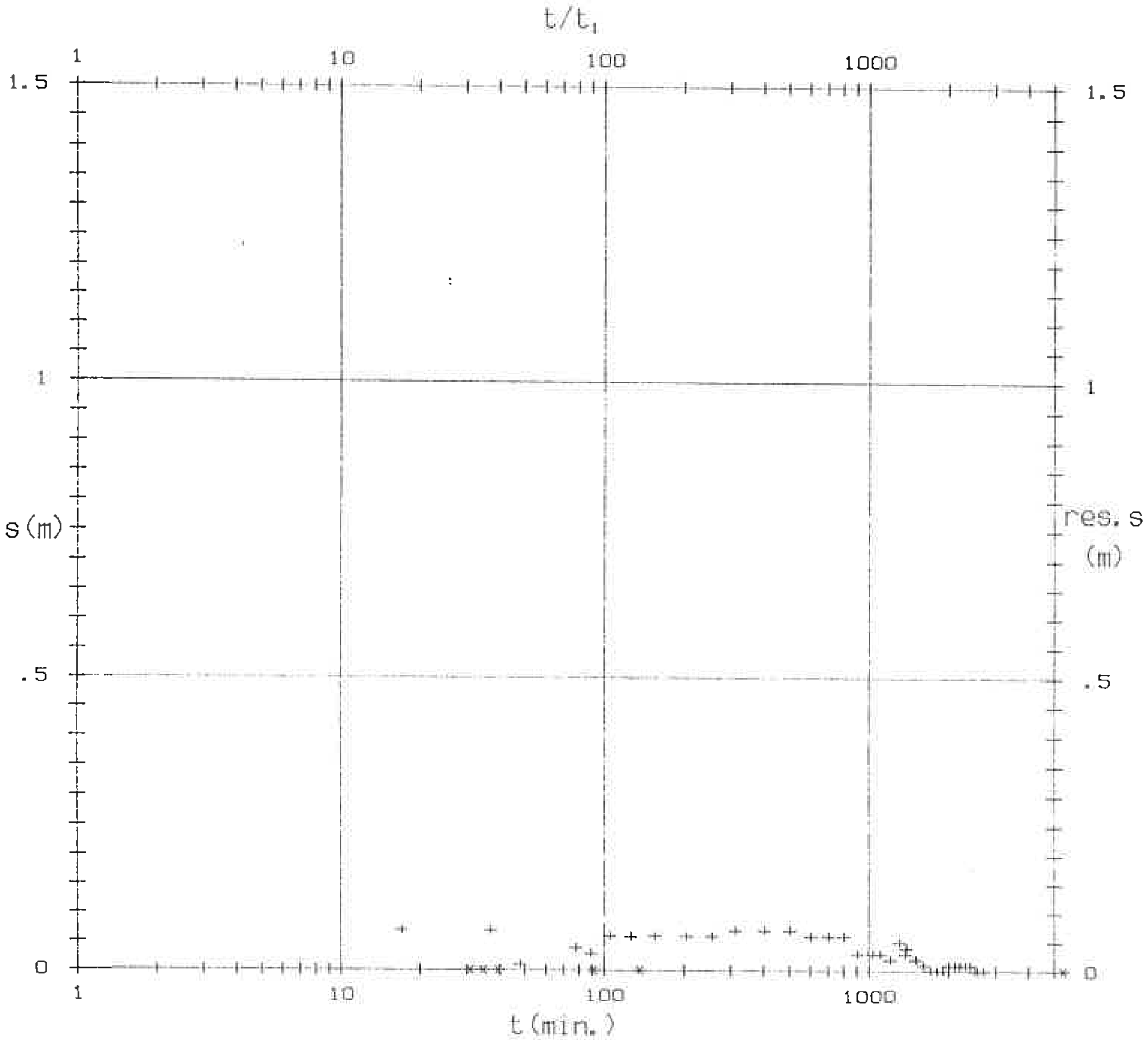
Observation Borehole
BH 2

Q = 15.8 l/s

S.W.L. = 23.55 m

T = 8300 m²/d

FIG.



CONSTANT DISCHARGE TEST
+ Drawdown data.
* Recovery data.

POLFONTEIN

5.9.90

Pumped Borehole
BH V1

Observation Borehole
BH 3

Q = 15.8 l/s

S.W.L. = 16.01 m

T = 8300 m²/d

FIG.

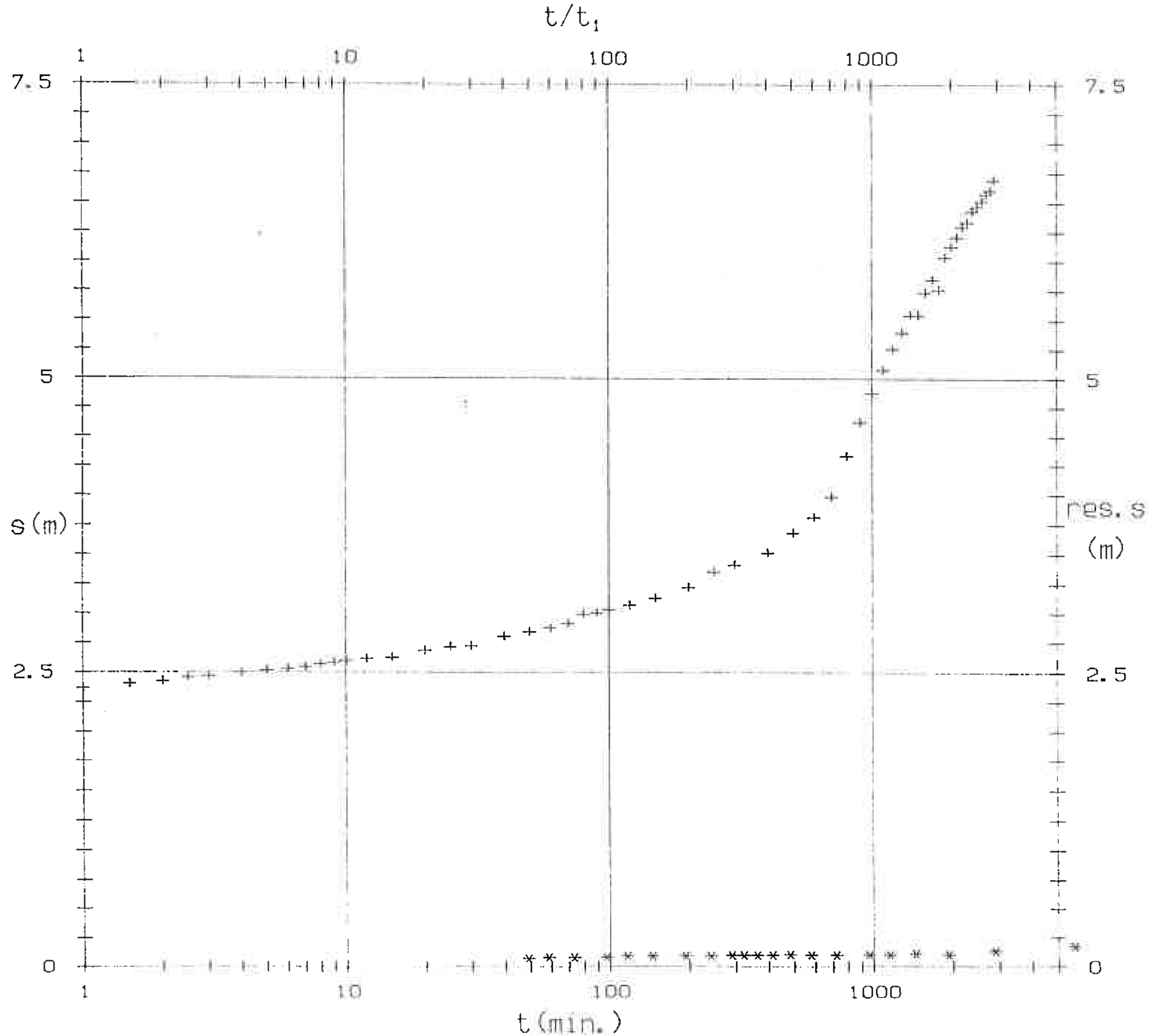


FIG.

CONSTANT DISCHARGE TEST

\+ Drawdown data.

* Recovery data.

POLFONTEIN

3.9.90

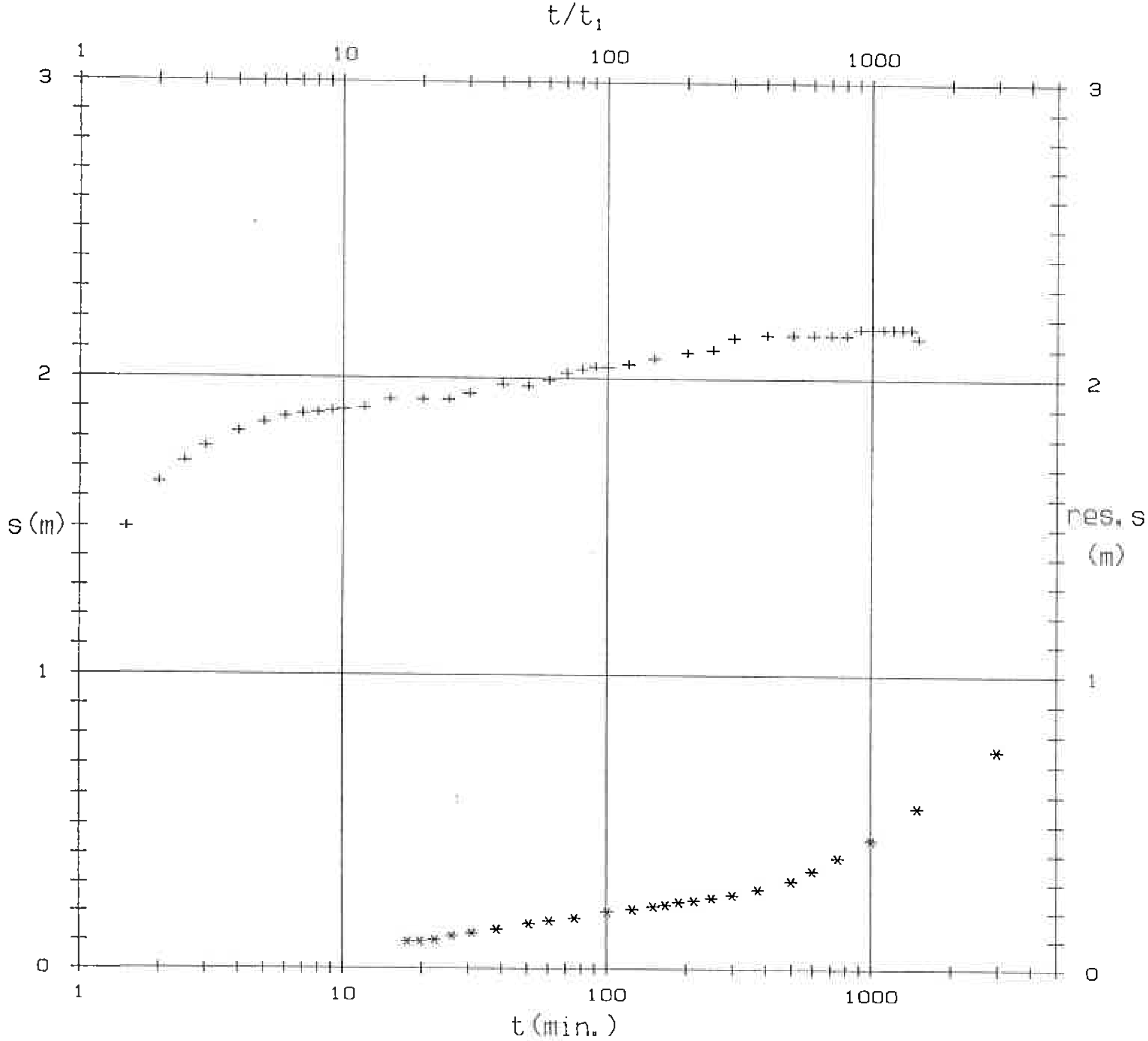
Pumped Borehole
BH 1

Observation Borehole
BH 1

Q = 15.8 l/s

S.W.L. = 18.29 m

T = 500 m^2/d



CONSTANT DISCHARGE TEST

+ Drawdown data.

* Recovery data.

POLFONTEIN

12.9.90

Pumped Borehole
BH 5

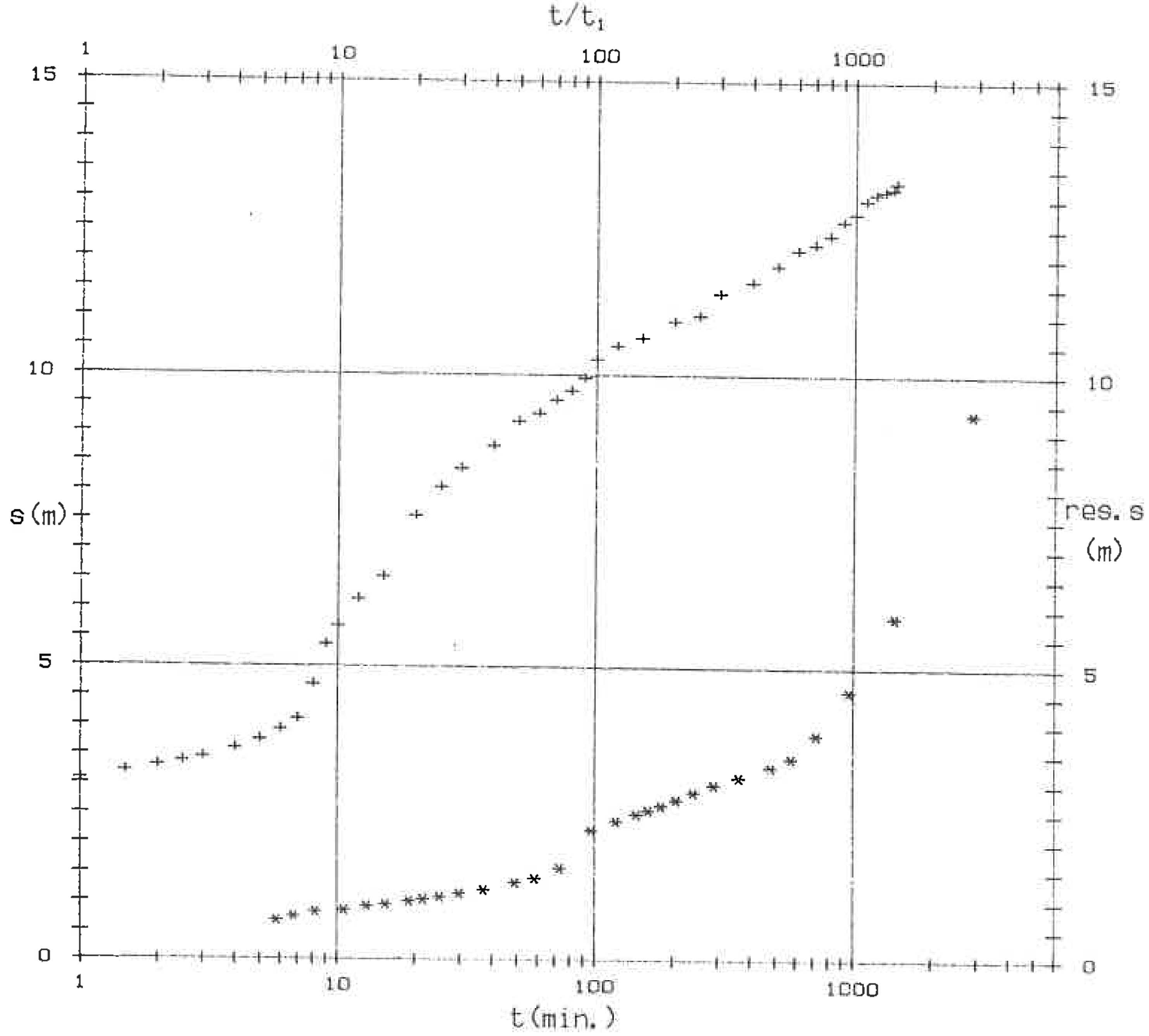
Observation Borehole
BH 5

Q = 6.5 l/s

S.W.L. = 21.76 m

T = 700 m²/d

FIG.



CONSTANT DISCHARGE TEST
+ Drawdown data.
* Recovery data.

POLFONTEIN

14.10.90

Pumped Borehole
BH 4

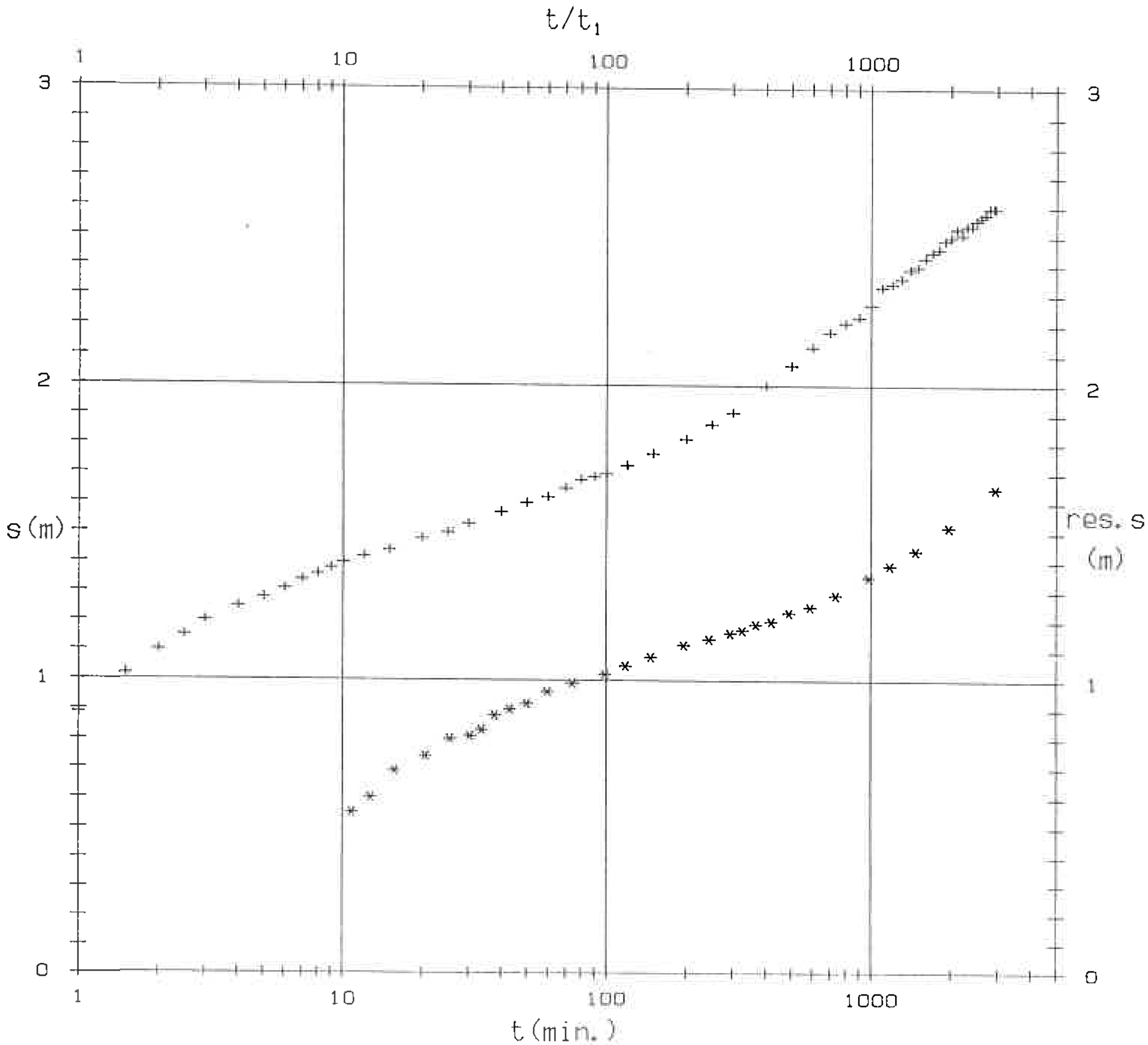
Observation Borehole
BH 4

Q = 12.8 l/s

S.W.L. = 22.55 m

T = 110 m²/d

FIG.



CONSTANT DISCHARGE TEST
+ Drawdown data.
* Recovery data.

POLFONTEIN

31.8.90

Pumped Borehole
BH 3

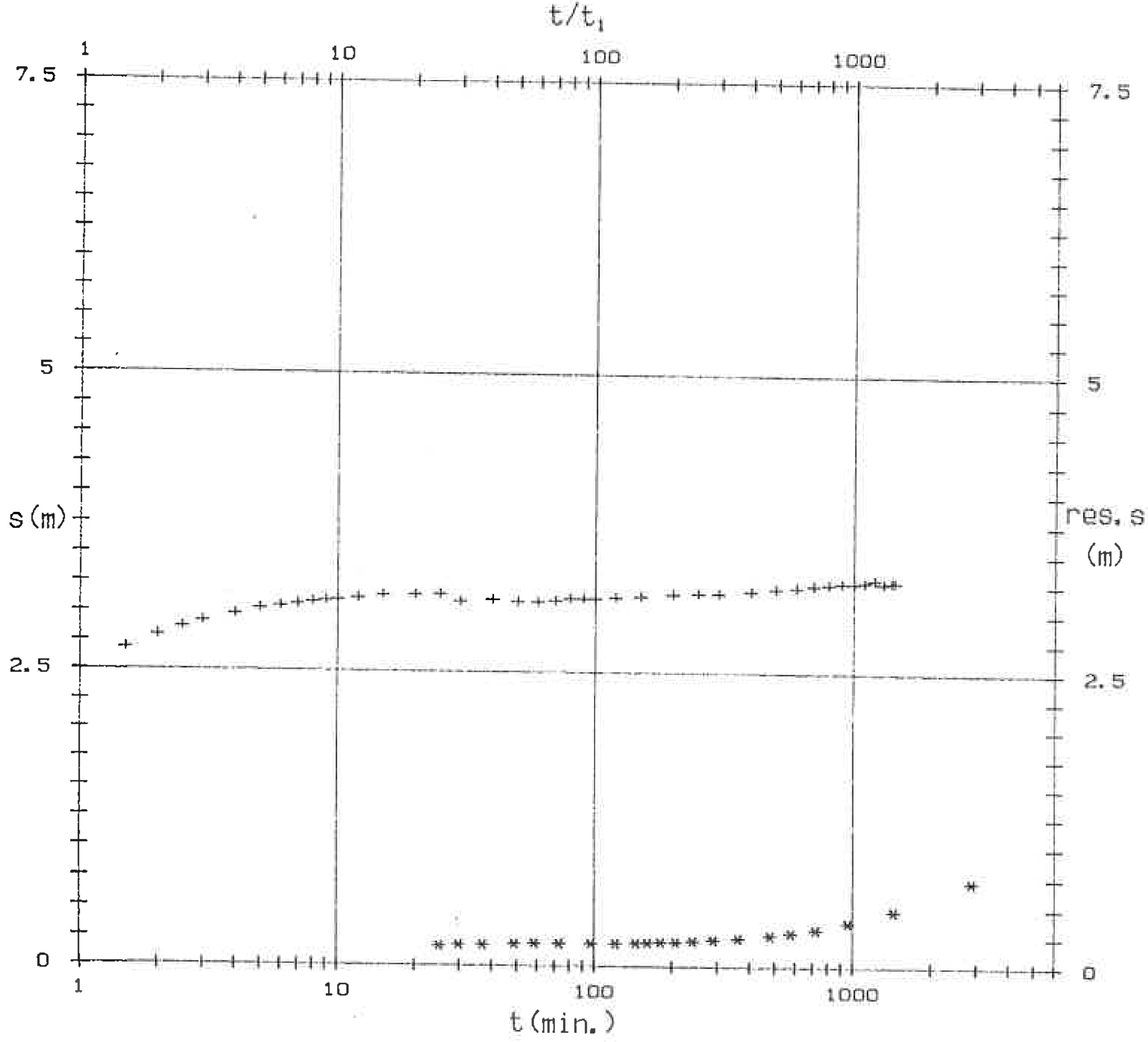
Observation Borehole
BH 3

Q = 7.2 l/s

S.W.L. = 16.01 m

T = 250 m²/d

FIG.



CONSTANT DISCHARGE TEST

+ Drawdown data.

* Recovery data.

POLFONTEIN

12. 10. 90

Pumped Borehole
BH 7

Observation Borehole
BH 7

Q = 11 l/s

S. W. L. = 19. 37 m

T = 1750 m²/d

FIG.

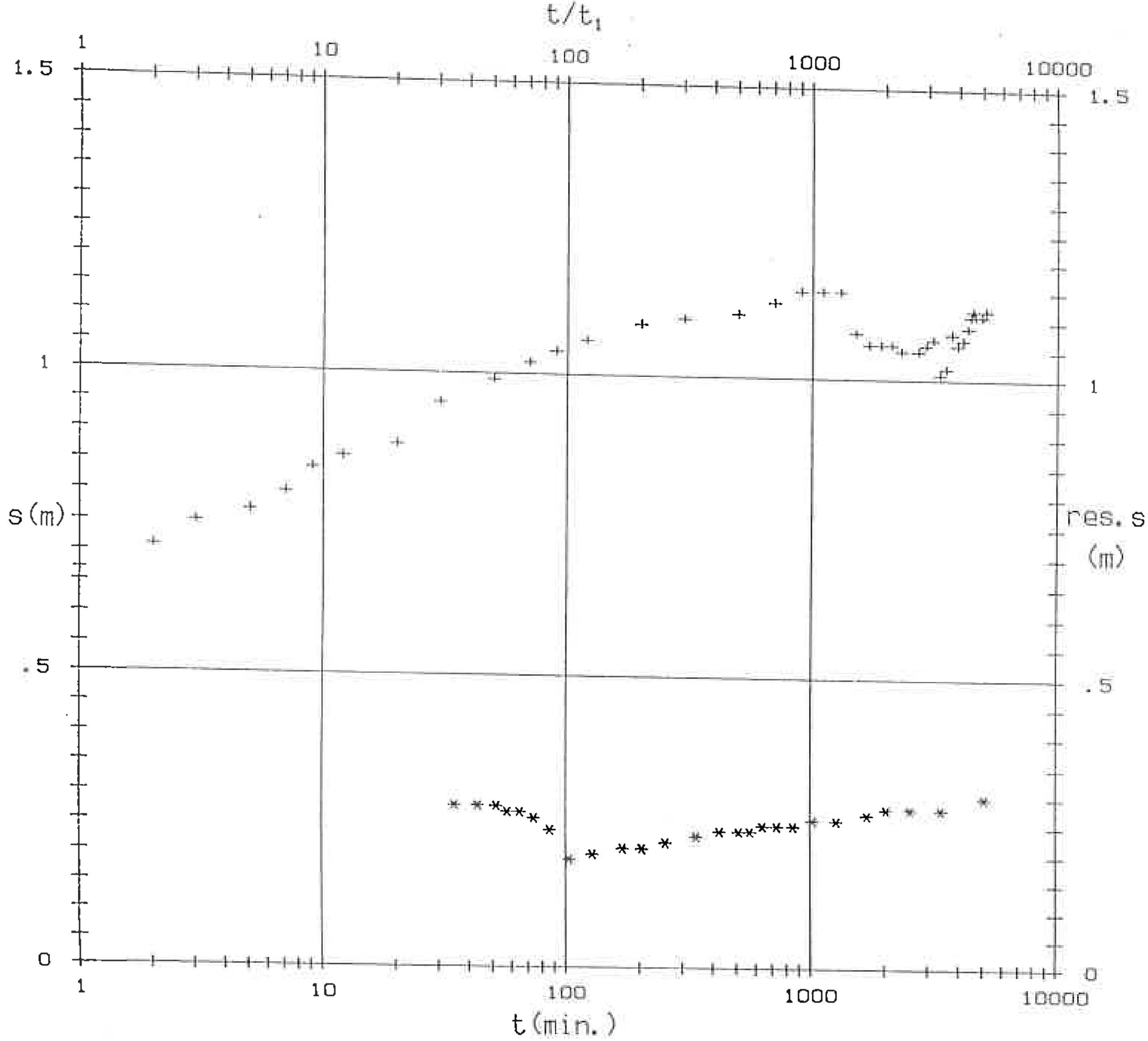


FIG.

CONSTANT DISCHARGE TEST

+ Drawdown data.

* Recovery data.

ITSOSENG

19.09.90

Pumped Borehole
10-77150B

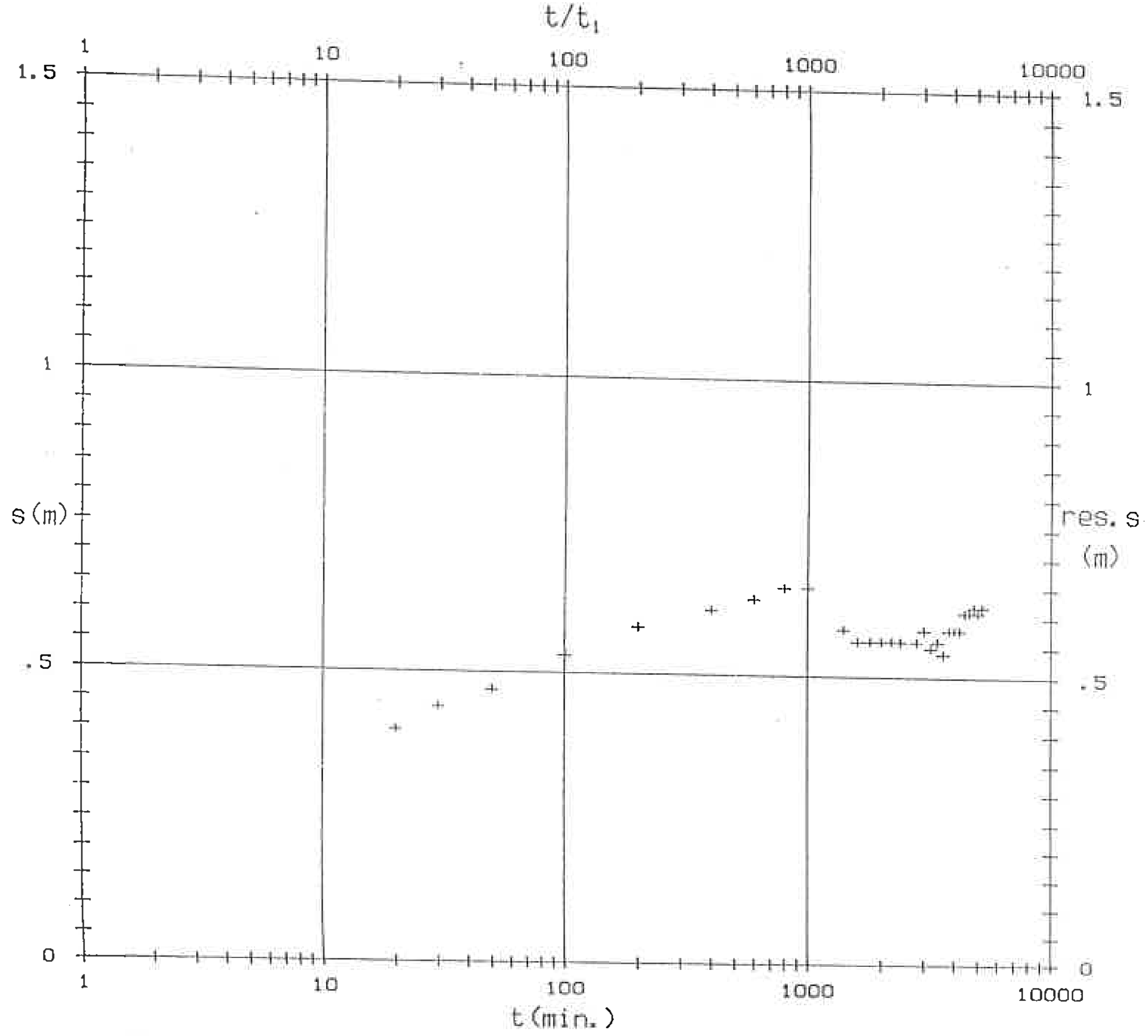
Observation Borehole
10-77150B

3627BB171

Q = 25.1 l/s

S.W.L. = 25.85 m

T = 2200 m²/d



CONSTANT DISCHARGE TEST
+ Drawdown data.
* Recovery data.

ITSOSENG

19.08.90

Pumped Borehole
10-77150B

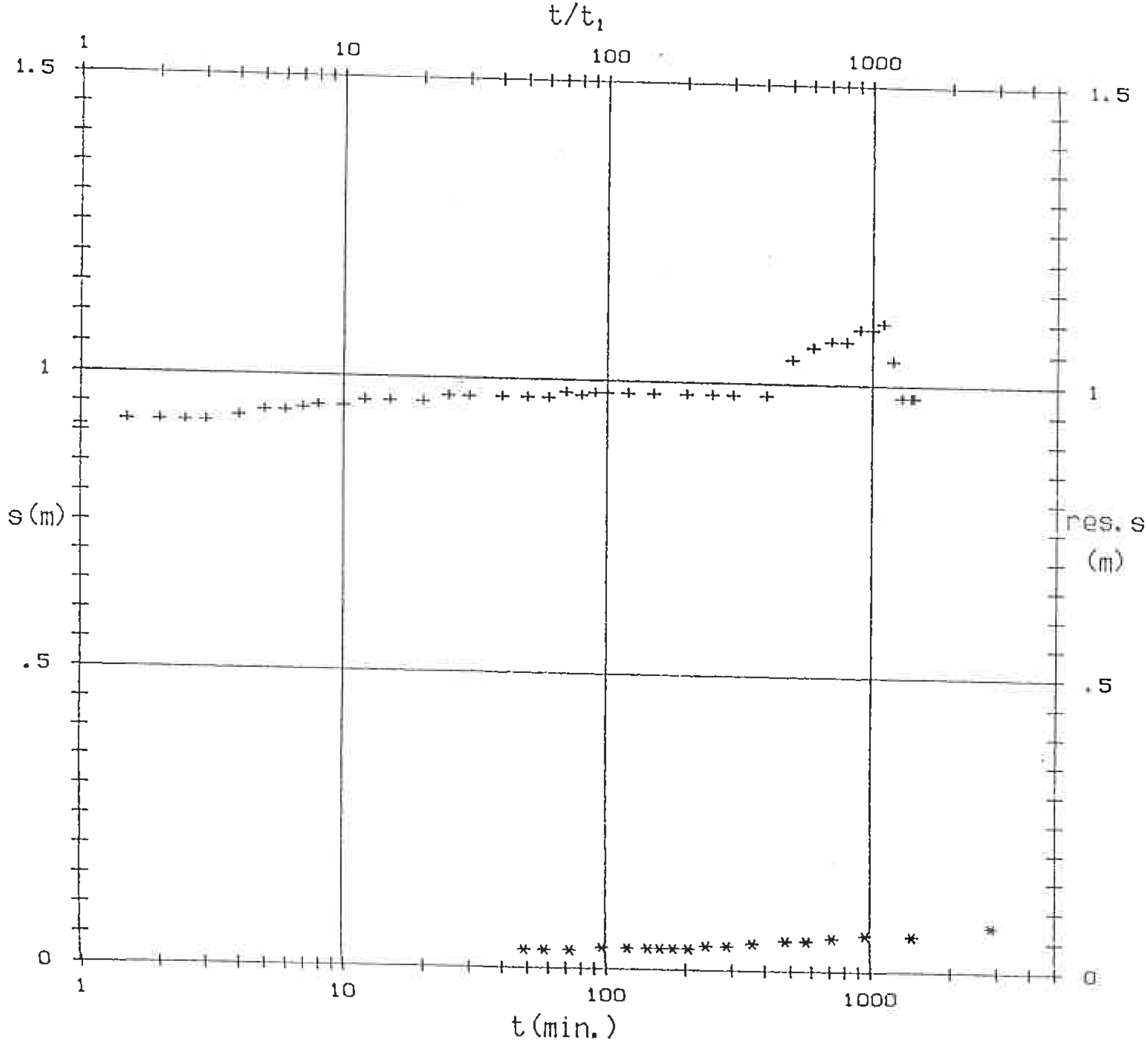
Observation Borehole
10-77150

Q = 25.1 l/s

S.W.L. = 27.12 m

T = 2650 m^2/d

FIG.



CONSTANT DISCHARGE TEST
+ Drawdown data.
* Recovery data.

ITSOSENG

08.09.90

Pumped Borehole
AB

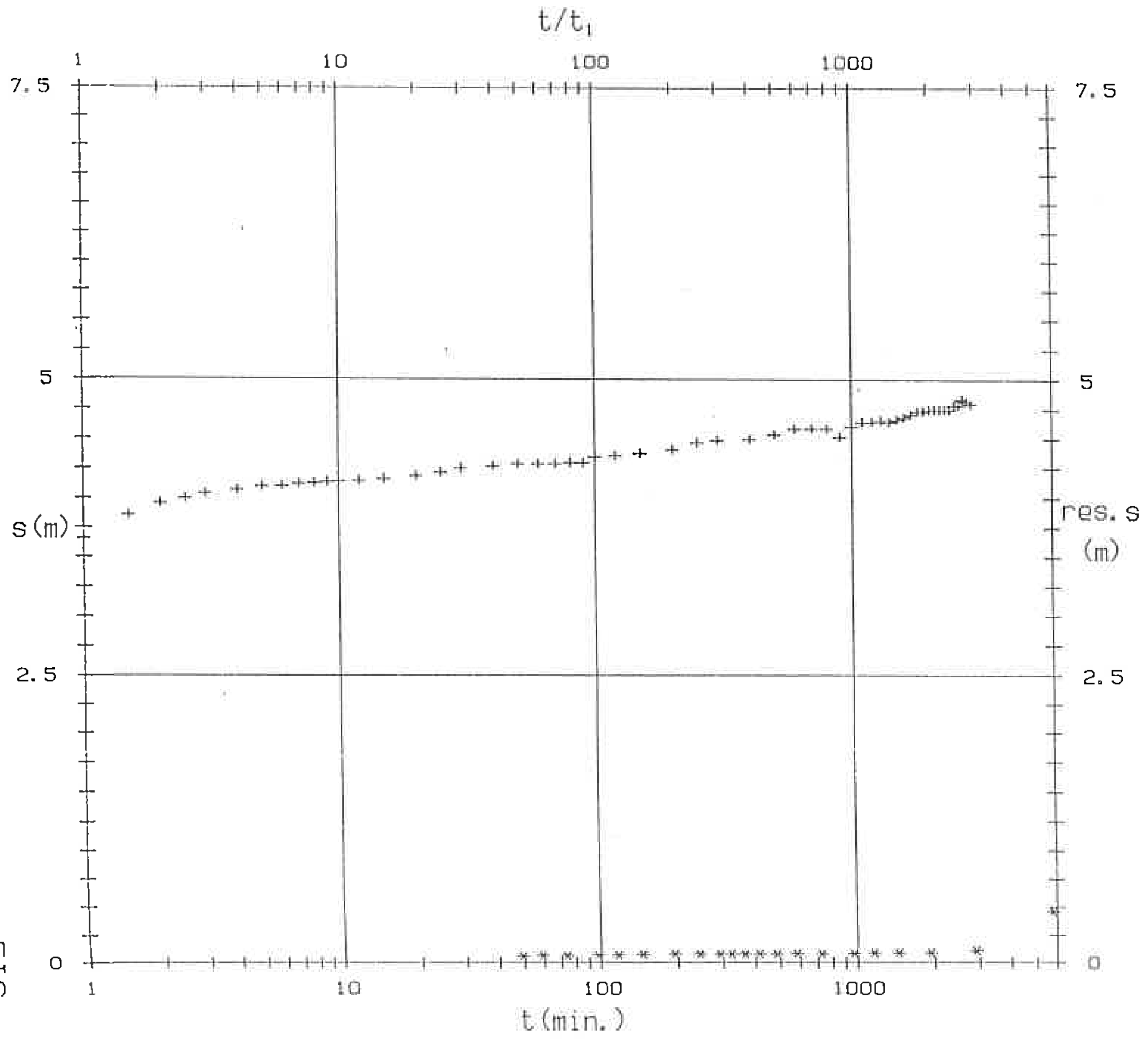
Observation Borehole
AB

Q = 15.2 l/s

S.W.L. = 26.38 m

T = 7000 m²/d

FIG.



CONSTANT DISCHARGE TEST

+ Drawdown data.

* Recovery data.

ITSOSENG

02.09.90

Pumped Borehole

T17611

Observation Borehole

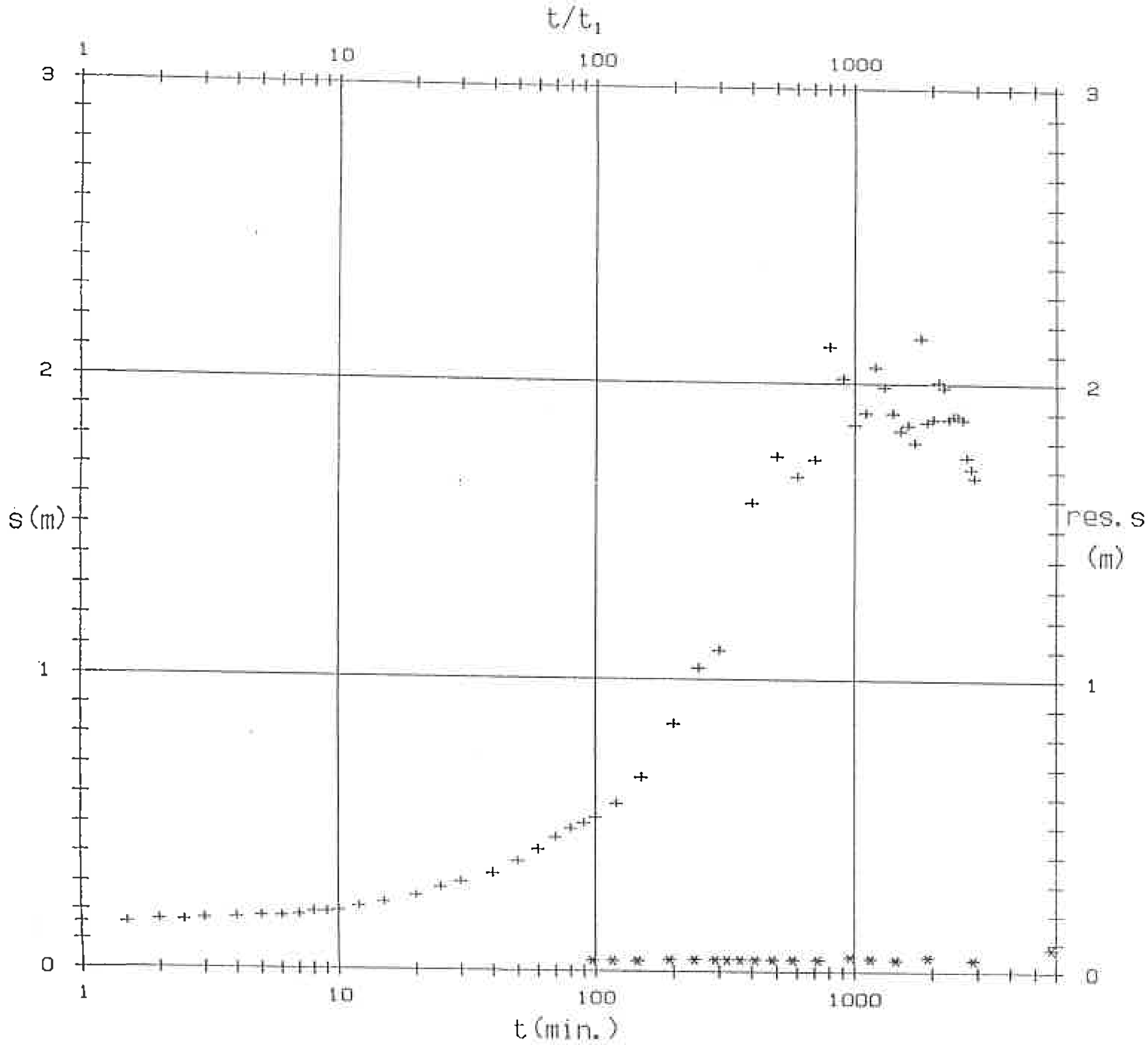
T17611

Q = 13.3 l/s

S.W.L. = 17.4 m

T = 350 m²/d

FIG.



CONSTANT DISCHARGE TEST

\+ Drawdown data.

* Recovery data.

BODIBE (ITSOSENG)

29.08.90

Pumped Borehole

T17644

Observation Borehole

T17644

Q = 15.8 l/s

S.W.L. = 6.79 m

T = 1560 m²/d

FIG.