STEPPED DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:	H06 1054	PROJECT:	SOUTHERN DISTRICT		-
ALTERNATIVE NO.:		SITE NAME:	PHYS 20		
ALTERNATIVE NO.:		CLIENT:	Research	PUMP INLET DIAMETER (mm):	100
BOREHOLE DEPTH (mbdl):	126.00	DATUM LEVEL (magl):	0.22	EXISTING PUMP:	no
STATIC WATER LEVEL (mbdl):	0.00	CASING HEIGHT (magl):	0.42	CONTRACTOR:	AB pumps
DEPTH OF PUMP (mbdl):	1.22	CASING DEPTH (magl):	12.00	PUMP TYPE USED:	BP40

DISCHARGE RATE 1

DATE: 16-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		11.69		1		
2		16.57		2		
3		15.85		3		
5		14.61		5		
7		14.24	2.60	7		
10		14.26		10		
15		14.26		15		
20		14.33		20		
30		13.90		30		
40		13.76		40		
50		13.24		50		
60		13.49		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 2

DATE: 16-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		18.02		1		
2		20.33		2		
3		22.94		3		
5		26.56		5		
7		27.64	4.02	7		
10		28.71		10		
15		28.97		15		
20		29.16		20		
30		29.17		30		
40		29.68		40		
50		29.68		50		
60		29.06		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 3

DATE: 16-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		32.32		1		
2		35.75		2		
3		37.99		3		
5		51.42		5		
7		60.03	8.00	7		
10		78.34		10		
15		92.61		15		
20		101.59		20		
30		110.57		30		
40		119.48		40		
50				50		
60				60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 4

DATE: 16-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		
2				2		
3				3		
5				5		
7				7		
10				10		
15				15		
20				20		
30				30		
40				40		
50				50		
60				60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 5

DATE: 16-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		
2				2		
3				3		
5				5		
7				7		
10				10		
15				15		
20				20		
30				30		
40				40		
50				50		
60				60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 6

DATE: 16-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		89.840
2				2		56.930
3				3		38.250
5				5		16.510
7				7		2.280
10				10		0.000
15				15		
20				20		
30				30		
40				40		
50				60		
60				90		
70				120		
80				150		
90				180		
100				210		
110				240		
120				300		
				360		
				420		
				480		
				540		
				600		

COMMENTS:

CONSTANT DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:	H06 1054	PROJECT:	SOUTHERN DISTRICT
ALTERNATIVE NO.:		SITE NAME:	PHYS 20
ALTERNATIVE NO.:		CLIENT:	Research
PUMP INLET DIAMETER (mm):	100		
BOREHOLE DEPTH (mbdl):	126.00	DATUM LEVEL (magl):	0.22
EXISTING PUMP:	no		
STATIC WATER LEVEL (mbdl):	11.68	CASING HEIGHT (magl):	0.42
CONTRACTOR:	AB pumps		
DEPTH OF PUMP (mbdl):	1.22	CASING DEPTH (magl):	12.00
PUMP TYPE USED:	BP40		

TEST STARTED				TEST COMPLETED		DURATION (min):	
DATE:	16-Mar-99	TIME:	11h00	DATE:		TIME:		TOTAL TIME PUMPED (min):	
AVERAGE YIELD (l/s):	5.1	S.W.L.:	0				

DISCHARGE BOREHOLE

Time	Drawdown		Yield	Time	Recovery		
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	t/t'
1		14.00		1		42.70	4321
2		21.00		2		25.25	2161
3		27.64		3		16.60	1441
5		37.71		5		5.80	865
7		42.17		7		0.58	618.14
10		51.00	5.10	10		0.00	433
15		53.12		15			289
20		56.09		20			217
30		57.01	5.10	30			145
40		57.69		40			109
60		58.18	5.10	60			73
90		58.60		90			49
120		58.93		120			37
150		59.98	5.10	150			29.8
180		59.46		180			25
210		60.66		210			21.571
240		60.80		240			19
300		61.00	5.10	300			15.4
360		61.66		360			13
420		61.94		420			11.286
480		62.47	5.10	480			10
540		62.96		540			9
600		63.70		600			8.2
720		64.77		720			7
840		65.01		840			6.1429
960		65.86		960			5.5
1080		66.03		1080			5
1200		66.90		1200			4.6
1320		67.18		1320			4.2727
1440		67.35		1440			4
1560		67.41		1560			3.7692
1680		67.45	5.10	1680			3.5714
1800		67.35		1800			3.4
1920		67.27	5.1	1920			3.25
2040		67.26		2040			3.1176
2160		67.25		2160			3
2280		67.24	5.1	2280			2.8947
2400		67.23		2400			2.8
2520		67.22		2520			2.7143
2640		67.2		2640			2.6364
2760		67.35		2760			2.5652
2880		67.54	5.1	2880			2.5
3000		67.61		3000			2.44
3120		73.6	5.3	3120			2.3846
3240		70.9		3240			2.3333
3360		69.8		3360			2.2857
3480		69.31		3480			2.2414
3600		69.07		3600			2.2
3720		68.91		3720			2.1613
3840		68.83		3840			2.125
3960		68.61		3960			2.0909
4080		68.53		4080			2.0588
4200		68.37		4200			2.0286
4320		68.09		4320			2
5040				5040			1.8571
5760				5760			1.75
7200				7200			1.6
10080				10080			1.4286

OBSERVATION BOREHOLES

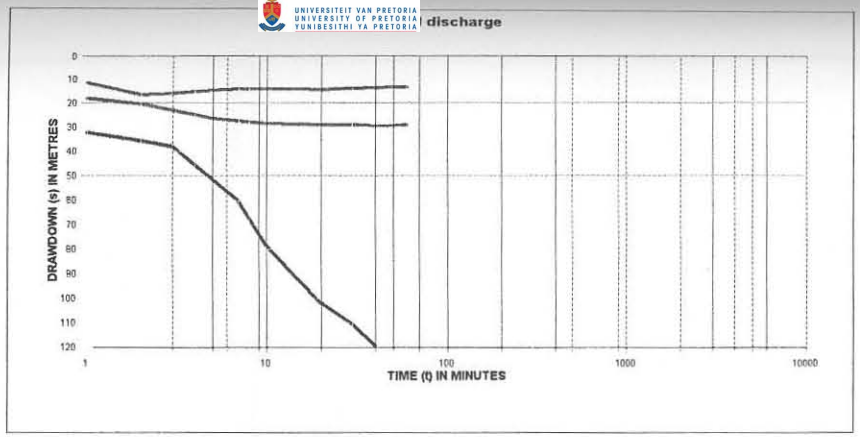
	BOREHOLE 1			S.W.L.	BOREHOLE 2			S.W.L.	BOREHOLE 3			S.W.L
	No.: H06 1048				No.: H06 1422				No.: H06 1057			
	Distance (m): 9.34			0	Distance (m): 27			0	Distance: 259			2.52
	Time	Drawdown		Rec	Time	Drawdown		Rec	Time	Drawdown		Rec
	(min)	mbdl	(m)	(m)	(min)	mbdl	(m)	(m)	(min)	mbdl	(m)	(m)
	1		0.40	5.65	1		0.00	4.13	1		0.00	1.4
	2		0.76	5.15	2		0.00	4.13	2		0.00	1.4
	3		1.27	4.8	3		0.00	4.12	3		0.00	1.4
	5		1.92	2.8	5		0.02	4.11	5		0.00	1.4
	7		2.57	1.27	7		0.04	4.07	7		0.00	1.4
	10		3.37	0.3	10		0.04	4.01	10		0.00	1.39
	15		4.09	0.1	15		0.19	3.89	15		0.00	1.39
	20		4.65	0	20		0.29	3.74	20		0.00	1.39
	30		5.04		30		0.49	3.5	30		0.00	1.39
	40		4.99		40		0.60	3.31	40		0.00	1.39
	60		4.86		60		0.86	2.96	60		0.00	1.39
	90		4.82		90		1.15	2.5	90		0.00	1.39
	120		4.73		120		1.36	2.05	120		0.01	1.39
	150		4.76		150		1.55	1.79	150		0.02	1.38
	180		4.83		180		1.70	1.61	180		0.03	1.37
	210		4.80		210		1.83	1.48	210		0.04	1.36
	240		5.34		240		1.96	1.37	240		0.04	1.35
	300		5.34		300		2.17	1.21	300		0.10	1.33
	360		5.30		360		2.26	1.13	360		0.14	1.33
	420		5.48		420		2.35	1.05	420		0.18	1.32
	480		5.62		480		2.48	0.9	480		0.22	1.3
	540		5.62		540		2.51	0.79	540		0.24	1.22
	600		5.65		600		2.54	0.62	600		0.26	1.14
	720		5.64		720		2.69	0.3	720		0.37	1.06
	840		5.64		840		2.75	0.14	840		0.42	0.98
	960		5.64		960		2.84	0	960		0.48	0.9
	1080		5.63		1080		2.95		1080		0.34	0.75
	1200		5.63		1200		3.01		1200		0.59	0.6
	1320		5.81		1320		3.06		1320		0.65	0.45
	1440		5.91		1440		3.10		1440		0.66	0.3
	1560		5.93		1560		3.43		1560		0.68	0.15
	1680		5.94		1680		3.64		1680		0.73	0
	1800		5.72		1800		3.69		1800		0.77	
	1920		5.52		1920		3.72		1920		0.82	
	2040		5.52		2040		3.73		2040		0.85	
	2160		5.5		2160		3.75		2160		0.88	
	2280		5.5		2280		3.76		2280		0.91	
	2400		5.59		2400		3.78		2400		0.94	
	2520		5.6		2520		3.79		2520		0.98	
	2640		5.61		2640		3.81		2640		1.00	
	2760		5.65		2760		3.84		2760		1.08	
	2880		5.61		2880		3.84		2880		1.08	
	3000		5.77		3000		3.88		3000		1.09	
	3120		6.2		3120		4.05		3120		1.12	
	3240		6.15		3240		4.16		3240		1.17	
	3360		6.15		3360		4.16		3360		1.22	
	3480		6.09		3480		4.15		3480		1.24	
	3600		6.02		3600		4.15		3600		1.26	
	3720		6.03		3720		4.14		3720		1.28	
	3840		5.98		3840		4.12		3840		1.30	
	3960		5.89		3960		4.13		3960		1.32	
	4080		8.84		4080		4.14		4080		1.34	
	4200		5.79		4200		4.13		4200		1.40	
	4320		5.94		4320		4.13		4320		1.47	
	5040				5040				5040			
	5760				5760				5760			
	7200				7200				7200			
	10080				10080				10080			

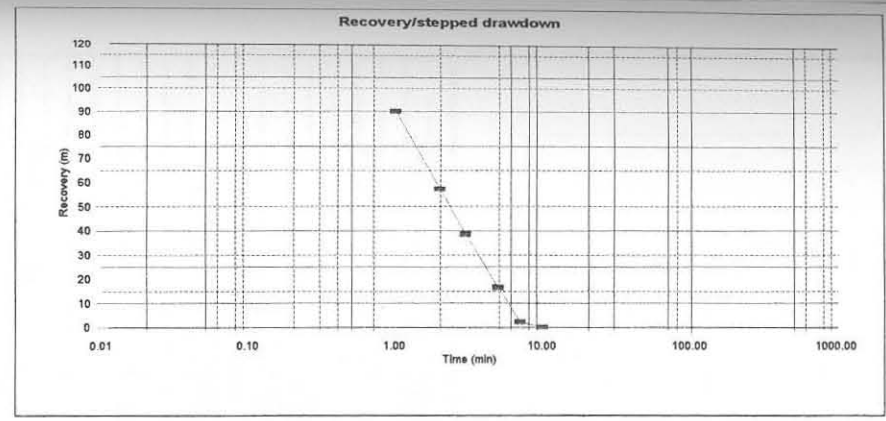
ION BOREHOLES FOR CD (4,5,6,7& 8)

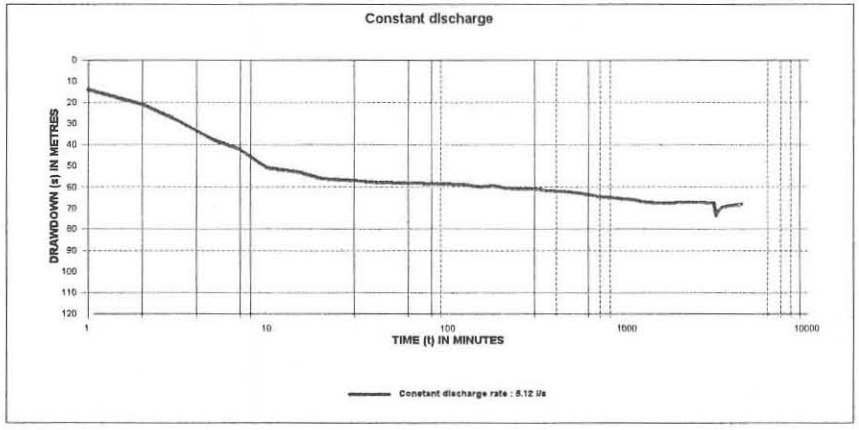
BOREHOLE NO.:	H06 1054	PROJECT:	SOUTHERN DISTRICT		
ALTERNATIVE NO.:		SITE NAME:	PHYS 20		
ALTERNATIVE NO.:		CLIENT:	Research	PUMP INLET DIAMETER (mm):	100
BOREHOLE DEPTH (mbdl):	126.00	DATUM LEVEL (magl):	0.22	EXISTING PUMP:	no
STATIC WATER LEVEL (mbdl):	11.68	CASING HEIGHT (magl):	0.42	CONTRACTOR:	AB pumps
DEPTH OF PUMP (mbdl):	1.22	CASING DEPTH (magl):	12.00	PUMP TYPE USED:	BP40

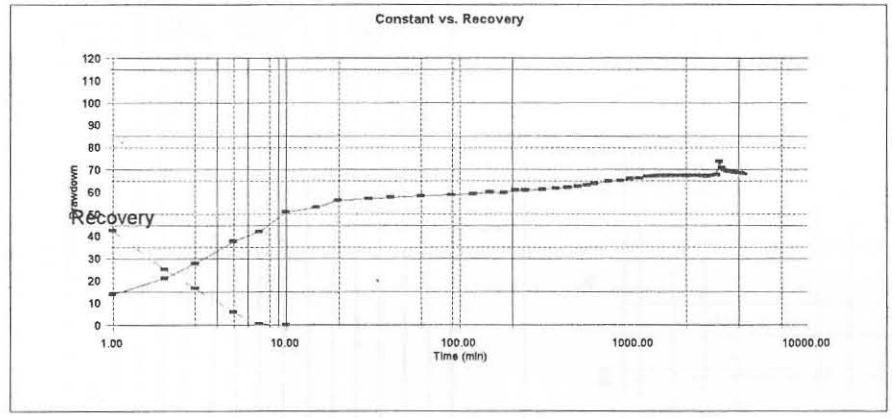
TEST STARTED		TEST COMPLETED		DURATION (min):
DATE:	TIME:	DATE:	TIME:	TOTAL TIME PUMPED (min):

OBSERVATION BOREHOLES	BOREHOLE 4			S.W.L.	BOREHOLE 5			S.W.L.	BOREHOLE 6			S.W.L.	BOREHOLE 7			S.W.L.	BOREHOLE 8			S.W.L.
	No.:				No.:				No.: H06 1061				No.:				No.:			
	Distance (m):			0	Distance (m):				Distance (m): 363			7.43	Distance (m):				Distance:			
	Time	Drawdown		Rec	Time	Drawdown		Rec	Time	Drawdown		Rec	Time	Drawdown		Rec	Time	Drawdown		Rec
	(min)	mbdl	(m)	(m)	(min)	mbdl	(m)	(m)	(min)	mbdl	(m)	(m)	(min)	mbdl	(m)	(m)	(min)	mbdl	(m)	(m)
	1				1				1		0.00	0	1				1			
	2				2				2		0.00		2				2			
	3				3				3		0.00		3				3			
	5				5				5		0.00		5				5			
	7				7				7		0.00		7				7			
	10				10				10		0.00		10				10			
	15				15				15		0.00		15				15			
	20				20				20		0.00		20				20			
	30				30				30		0.00		30				30			
	40				40				40		0.00		40				40			
	60				60				60		0.00		60				60			
	90				90				90		0.00		90				90			
	120				120				120		0.00		120				120			
	150				150				150		0.00		150				150			
	180				180				180		0.00		180				180			
	210				210				210		0.00		210				210			
	240				240				240		0.00		240				240			
	300				300				300		0.00		300				300			
	360				360				360		0.00		360				360			
	420				420				420		0.00		420				420			
	480				480				480		0.00		480				480			
	540				540				540		0.00		540				540			
	600				600				600		0.00		600				600			
	720				720				720		0.00		720				720			
	840				840				840		0.00		840				840			
	960				960				960		0.00		960				960			
	1080				1080				1080		0.00		1080				1080			
	1200				1200				1200		0.00		1200				1200			
	1320				1320				1320		0.00		1320				1320			
	1440				1440				1440		0.00		1440				1440			
	1560				1560				1560		0.00		1560				1560			
	1680				1680				1680		0.00		1680				1680			
	1800				1800				1800		0.00		1800				1800			
	1920				1920				1920		0.00		1920				1920			
	2040				2040				2040		0.00		2040				2040			
	2160				2160				2160		0.00		2160				2160			
	2280				2280				2280		0.00		2280				2280			
	2400				2400				2400		0.00	0.02	2400				2400			
	2520				2520				2520		0.00	0.02	2520				2520			
	2640				2640				2640		0.00	0.02	2640				2640			
	2760				2760				2760		0.00	0.02	2760				2760			
	2880				2880				2880		0.00		2880				2880			
	3000				3000				3000		0.00		3000				3000			
	3120				3120				3120		0.00		3120				3120			
	3240				3240				3240		0.00		3240				3240			
	3360				3360				3360		0.00		3360				3360			
	3480				3480				3480		0.00		3480				3480			
	3600				3600				3600		0.00		3600				3600			
	3720				3720				3720		0.00		3720				3720			
	3840				3840				3840		0.00		3840				3840			
	3960				3960				3960		0.00		3960				3960			
	4080				4080				4080		0.00		4080				4080			
	4200				4200				4200		0.00		4200				4200			
	4320				4320				4320		0.00		4320				4320			
	5040				5040				5040				5040				5040			
	5720				5720				5720				5720				5720			
	7200				7200				7200				7200				7200			
	10080				10080				10080				10080				10080			



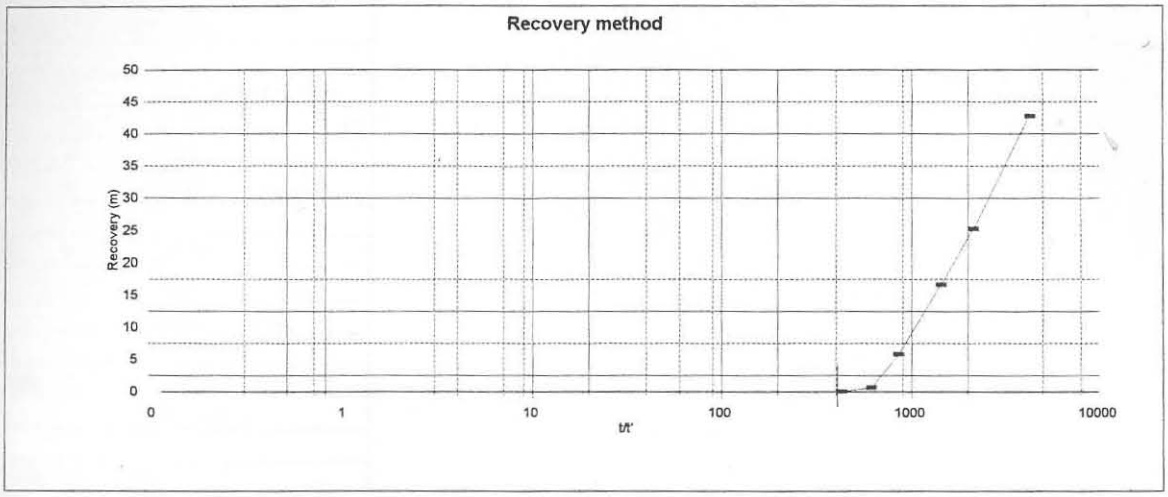






Comments:

UMBER: H06 1054



	Pump cycle =	1440	min	(24hrs)
	Yield =	5.1	l/s	
	t/t" =	433	(Graph)	
	Recovery period =	1440 /	t/t"	
		1440 /	433.00	
			3.33	min
	Pumping period =	1440 -	3.33	
			1436.67	min
	Litres pumped =	4.40E+05	L	
	Pump yield @ 24 hrs	5.09	L/s	
	Factor of safety =	0.75		
	Operating yield =	3.82	L/s for 24 hrs	

Comments:

Comments:

RULE of THUMB

Bh no.		H06 1054	
TT	=	PT + recovery time	
	=	4320	10
	=	4330	
	=	259800	seconds
TV	=	L/s*TP	
	=	5.09	4320
	=	1319328	litres
Yield	=	TV/TT	
		5.0782448	l/s
Production yield			
	=	Yield *FS	
	=	5.0782448	75%
	=	3.8086836	l/s @ 24hrs

FC-METHOD : Estimation of the sustainable yield of a borehole

Borehole:

Extrapolation time in years = (enter)	3	1576800	Extrapol.time in minutes
Effective borehole radius (r_e) = (enter)	1.9	1.9	Estimate of effective r_e
Q (l/s) from pumping test =	5.15	0.04	Estimate of t_c of WBS
s_a (available drawdown), sigma_s = (enter)	80	12	Sigma_s from risk analysis
Annual effective recharge (m) =	0.0067	74.70	s_available working drawdown(m)
t(end) and s(end) of pumping test =	4320	73.6	End time and drawdown of test
Average maximum derivative = (enter)	11.53	67.2	Estimate of average of max deriv
Average second derivative = (enter)	0.3	0.3	Estimate of average second deriv
Derivative at radial flow period = (enter)	5.13		Read from derivative graph
	T-early[m^2/d] =	15.87	
T and S estimates from derivatives	T-late [m^2/d] =	7.06	T-average = 10.59
(To obtain correct S-value, use program RPTSOLV)	S-late =	3.43E-03	S-estimate could be wrong

BASIC SOLUTION

(Using derivatives + subjective information about boundaries)

(No values of T and S are necessary)

	No boundaries	Maximum influence of boundaries at long time: 1 no-flow	2 no-flow	Closed no-flow
sWell (Extrapol.time) =	104.13	133.67	163.21	251.84
Q_sust (l/s) =	3.69	2.88	2.36	1.53
	Best case	→		Worst case

Average Q_sust (l/s) = 2.49

with standard deviation= 0.91

(If no information exists about boundaries skip advanced solution and go to final recommendation)

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STEPPED DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:	H06 1420	PROJECT:	SOUTHERN DISTRICT		
ALTERNATIVE NO.:		SITE NAME:	PHYS 21		
ALTERNATIVE NO.:		CLIENT:	Research	PUMP INLET DIAMETER (mm):	100
BOREHOLE DEPTH (mbdl):	106.00	DATUM LEVEL (magl):	0.47	EXISTING PUMP:	no
STATIC WATER LEVEL (mbdl):	11.68	CASING HEIGHT (magl):	0.26	CONTRACTOR:	AB pumps
DEPTH OF PUMP (mbdl):	96.00	CASING DEPTH (magl):	6.00	PUMP TYPE USED:	BP40

DISCHARGE RATE 1

DATE: 11-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		2.68		1		
2		3.63		2		
3		4.27		3		
5		5.15		5		
7		6.45		7		
10		7.65	1.00	10		
15		8.75		15		
20		8.68		20		
30		8.85		30		
40		9.06		40		
50		9.31		50		
60		9.42		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 2

DATE: 11-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		11.94		1		
2		15.06		2		
3		17.74		3		
5		19.06	2.06	5		
7		19.95		7		
10		20.61		10		
15		20.76		15		
20		20.89		20		
30		21.74		30		
40		22.37		40		
50		23.36		50		
60		23.75		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 3

DATE: 11-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		26.57		1		
2		31.62		2		
3		36.43		3		
5		39.84	4.02	5		
7		42.46		7		
10		44.87		10		
15		48.43		15		
20		51.93		20		
30		59.80		30		
40		64.74		40		
50		71.82		50		
60		79.15		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 4

DATE: 11-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		
2				2		
3				3		
5				5		
7				7		
10				10		
15				15		
20				20		
30				30		
40				40		
50				50		
60				60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 5

DATE: 11-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		
2				2		
3				3		
5				5		
7				7		
10				10		
15				15		
20				20		
30				30		
40				40		
50				50		
60				60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 6

DATE: 11-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		40.750
2				2		29.530
3				3		23.880
5				5		13.260
7				7		7.550
10				10		3.250
15				15		0.730
20				20		0.370
30				30		0.230
40				40		0.160
50				60		0.070
60				90		0.010
70				120		0.000
80				150		
90				180		
100				210		
110				240		
120				300		
				360		
				420		
				480		
				540		
				600		

COMMENTS:

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STEPPED DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:	H06 1420	PROJECT:	SOUTHERN DISTRICT		
ALTERNATIVE NO.:		SITE NAME:	PHYS 21		
ALTERNATIVE NO.:		CLIENT:	Research	PUMP INLET DIAMETER (mm):	100
BOREHOLE DEPTH (mbdl):	106.00	DATUM LEVEL (magl):	0.47	EXISTING PUMP:	no
STATIC WATER LEVEL (mbdl):	11.68	CASING HEIGHT (magl):	0.26	CONTRACTOR:	AB pumps
DEPTH OF PUMP (mbdl):	96.00	CASING DEPTH (magl):	6.00	PUMP TYPE USED:	BP40

DISCHARGE RATE 1

DATE: 11-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		2.68		1		
2		3.63		2		
3		4.27		3		
5		5.15		5		
7		6.45		7		
10		7.65	1.00	10		
15		8.75		15		
20		8.68		20		
30		8.85		30		
40		9.06		40		
50		9.31		50		
60		9.42		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 2

DATE: 11-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		11.94		1		
2		15.06		2		
3		17.74		3		
5		19.06	2.06	5		
7		19.95		7		
10		20.61		10		
15		20.76		15		
20		20.89		20		
30		21.74		30		
40		22.37		40		
50		23.36		50		
60		23.75		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 3

DATE: 11-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		26.57		1		
2		31.62		2		
3		36.43		3		
5		39.84	4.02	5		
7		42.46		7		
10		44.87		10		
15		48.43		15		
20		51.93		20		
30		59.80		30		
40		64.74		40		
50		71.82		50		
60		79.15		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 4

DATE: 11-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		
2				2		
3				3		
5				5		
7				7		
10				10		
15				15		
20				20		
30				30		
40				40		
50				50		
60				60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 5

DATE: 11-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		
2				2		
3				3		
5				5		
7				7		
10				10		
15				15		
20				20		
30				30		
40				40		
50				50		
60				60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 6

DATE: 11-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		40.750
2				2		29.530
3				3		23.880
5				5		13.260
7				7		7.550
10				10		3.250
15				15		0.730
20				20		0.370
30				30		0.230
40				40		0.160
50				60		0.070
60				90		0.010
70				120		0.000
80				150		
90				180		
100				210		
110				240		
120				300		
				360		
				420		
				480		
				540		
				600		

COMMENTS:

CONSTANT DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:	H06 1420	PROJECT:	SOUTHERN DISTRICT
ALTERNATIVE NO.:		SITE NAME:	PHYS 21
ALTERNATIVE NO.:		CLIENT:	Research
PUMP INLET DIAMETER (mm):	100		
BOREHOLE DEPTH (mbdl):	106.00	DATUM LEVEL (magl):	0.47
EXISTING PUMP:	no		
STATIC WATER LEVEL (mbdl):	11.68	CASING HEIGHT (magl):	0.26
CONTRACTOR:	AB pumps		
DEPTH OF PUMP (mbdl):	96.00	CASING DEPTH (magl):	6.00
PUMP TYPE USED:	BP40		

TEST STARTED				TEST COMPLETED		DURATION (min):	
DATE:	06-Mar-99	TIME:	11h00	DATE:		TIME:		TOTAL TIME PUMPED (min):	
AVERAGE YIELD (l/s):	7.2	S.W.L.:	4.58				

DISCHARGE BOREHOLE

Time	Drawdown		Yield	Time	Recovery		
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	t/t'
1		1.79		1		11.27	4321
2		6.47		2		9.39	2161
3		9.82		3		5.23	1441
5		15.70		5		2.82	865
7		18.32		7		1.65	618.14
10		19.52	2.01	10		1.03	433
15		19.97		15		0.91	289
20		20.14		20		0.71	217
30		20.31		30		0.63	145
40		20.57		40		0.54	109
60		20.82	2.08	60		0.48	73
90		21.14		90		0.45	49
120		21.29		120		0.37	37
150		21.43		150		0.33	29.8
180		21.69		180		0.24	25
210		21.93		210		0.19	21.571
240		22.12		240		0.14	19
300		22.28		300		0.12	15.4
360		22.41	2.05	360		0.10	13
420		22.60		420		0.07	11.286
480		22.78		480		0.05	10
540		22.85		540		0.04	9
600		22.95		600		0.03	8.2
720		22.98		720		0.02	7
840		22.97	2.06	840		0.02	6.1429
960		22.98		960		0.01	5.5
1080		23.07		1080		0.01	5
1200		23.13		1200		0.00	4.6
1320		23.17		1320			4.2727
1440		23.19		1440			4
1560		23.21		1560			3.7692
1680		23.29		1680			3.5714
1800		23.35		1800			3.4
1920		23.43	2.05	1920			3.25
2040		23.54		2040			3.1176
2160		23.69		2160			3
2280		23.79		2280			2.8947
2400		23.81		2400			2.8
2520		23.91	2.06	2520			2.7143
2640		23.93		2640			2.6364
2760		23.94		2760			2.5652
2880		23.95		2880			2.5
3000		23.96		3000			2.44
3120		24.02		3120			2.3846
3240		24.05		3240			2.3333
3360		24.07		3360			2.2857
3480		24.09		3480			2.2414
3600		24.11		3600			2.2
3720		24.13		3720			2.1613
3840		24.13		3840			2.125
3960		24.17		3960			2.0909
4080		24.2		4080			2.0588
4200		24.25		4200			2.0286
4320		24.28		4320			2
5040				5040			1.8571
5760				5760			1.75
7200				7200			1.6
10080				10080			1.4286

OBSERVATION BOREHOLES

	BOREHOLE 1			S.W.L.	BOREHOLE 2			S.W.L.	BOREHOLE 3			S.W.L
	No.: H06 1423				No.: H061057				No.: H06 1056			
	Distance (m): 36.4			13.72	Distance (m): 500			3.22	Distance: 501			3.2
Time	Drawdown			Rec	Time	Drawdown		Rec	Time	Drawdown		Rec
(min)	mbdl	(m)		(m)	(min)	mbdl	(m)	(m)	(min)	mbdl	(m)	(m)
1		0.01		1.3	1		0.00	0.03	1		0.00	0.03
2		0.02		1.15	2		0.00	0.03	2		0.00	0.03
3		0.05		0.93	3		0.00	0.03	3		0.00	0.03
5		0.09		0.89	5		0.00	0.03	5		0.00	0.02
7		0.13		0.85	7		0.00	0.02	7		0.00	0.02
10		0.21		0.84	10		0.00	0.02	10		0.00	0.01
15		0.29		0.83	15		0.00	0.01	15		0.00	0.01
20		0.37		0.82	20		0.00	0.01	20		0.00	0.01
30		0.04		0.81	30		0.00	0.01	30		0.00	0
40		0.45		0.79	40		0.00	0	40		0.00	
60		0.46		0.78	60		0.00		60		0.00	
90		0.47		0.71	90		0.00		90		0.00	
120		0.47		67	120		0.00		120		0.00	
150		0.51		0.61	150		0.00		150		0.00	
180		0.54		0.53	180		0.00		180		0.00	
210		0.61		0.41	210		0.00		210		0.00	
240		0.72		0.36	240		0.00		240		0.00	
300		0.79		0.27	300		0.00		300		0.00	
360		0.84		0.19	360		0.00		360		0.00	
420		0.85		0.11	420		0.00		420		0.00	
480		0.86		0.08	480		0.00		480		0.00	
540		0.89		0.04	540		0.00		540		0.00	
600		0.92		0.02	600		0.00		600		0.00	
720		0.95		0	720		0.00		720		0.00	
840		0.97			840		0.00		840		0.00	
960		0.99			960		0.00		960		0.00	
1080		1.04			1080		0.00		1080		0.00	
1200		1.08			1200		0.00		1200		0.00	
1320		1.10			1320		0.00		1320		0.00	
1440		1.11			1440		0.00		1440		0.00	
1560		1.12			1560		0.00		1560		0.00	
1680		1.14			1680		0.00		1680		0.00	
1800		1.16			1800		0.00		1800		0.00	
1920		1.19			1920		0.00		1920		0.00	
2040		1.21			2040		0.00		2040		0.00	
2160		1.25			2160		0.00		2160		0.00	
2280		1.28			2280		0.00		2280		0.00	
2400		1.3			2400		0.00		2400		0.00	
2520		1.32			2520		0.00		2520		0.00	
2640		1.35			2640		0.00		2640		0.00	
2760		1.35			2760		0.00		2760		0.00	
2880		1.35			2880		0.00		2880		0.00	
3000		1.36			3000		0.00		3000		0.00	
3120		1.38			3120		0.00		3120		0.00	
3240		1.38			3240		0.00		3240		0.00	
3360		1.38			3360		0.00		3360		0.00	
3480		1.38			3480		0.00		3480		0.00	
3600		1.39			3600		0.00		3600		0.00	
3720		1.4			3720		0.02		3720		0.00	
3840		1.4			3840		0.02		3840		0.02	
3960		1.41			3960		0.03		3960		0.02	
4080		1.4			4080		0.03		4080		0.03	
4200		1.4			4200		0.03		4200		0.03	
4320		1.39			4320		0.03		4320		0.03	
5040					5040				5040			
5760					5760				5760			
7200					7200				7200			
10080					10080				10080			

BOREHOLE NUMBER:

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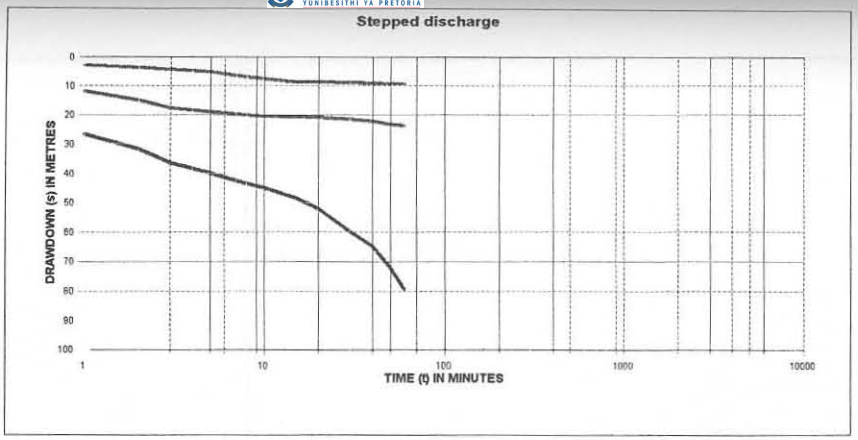
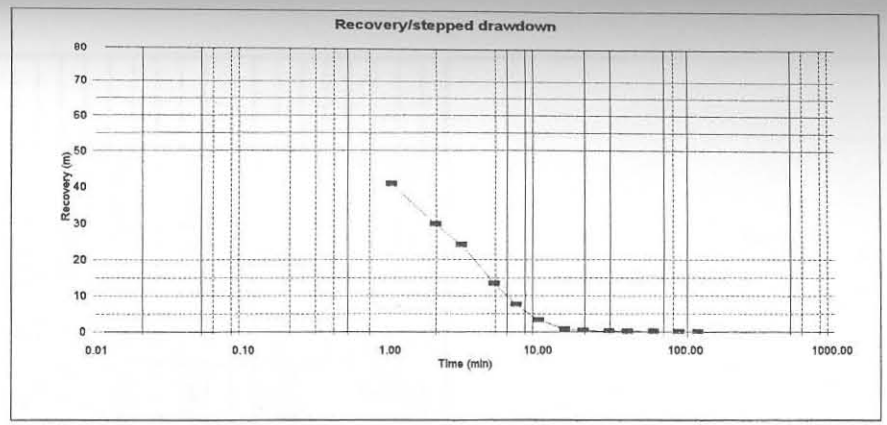
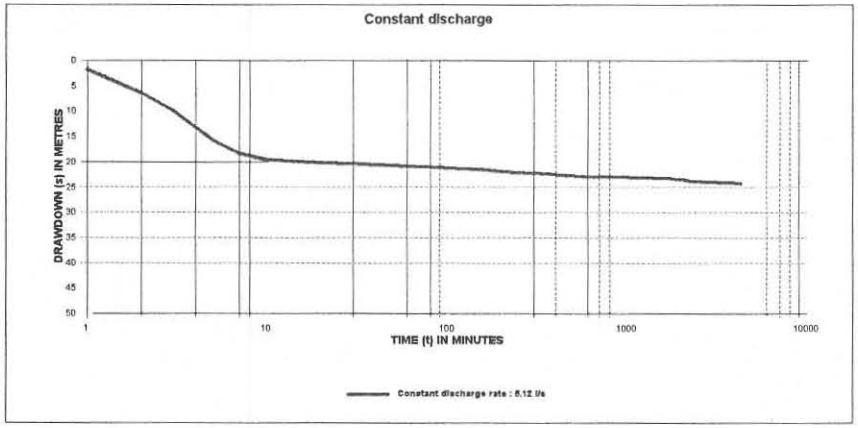
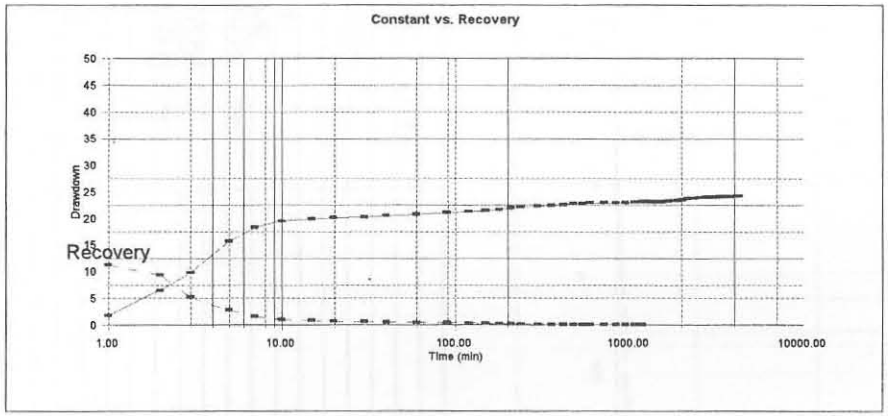


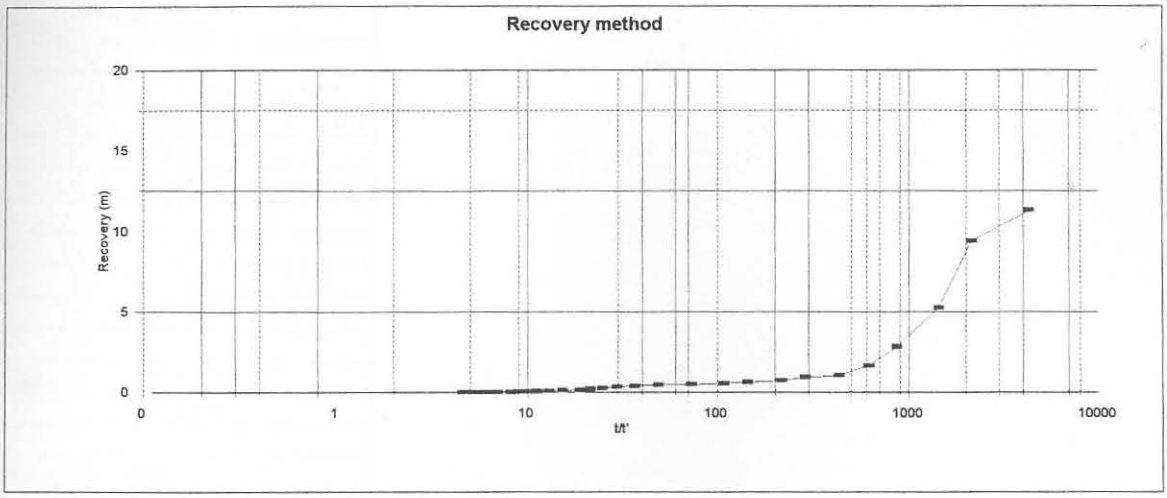






Comments:

UMBER: H06 1420



	Pump cycle =	1440	min (24hrs)	
	Yield =	2.06	l/s	
	t/t" =	4.6	(Graph)	
	Recovery period =	1440 /	t/t"	
		1440 /	4.60	
			313.04 min	
	Pumping period =	1440 -	313.04	
			1126.96 min	
	Litres pumped =	1.39E+05	L	
	Pump yield @ 24 hrs	1.61	L/s	
	Factor of safety =	0.75		
	Operating yield =	**1.21**	**L/s for 24 hrs**	

Comments:

Comments:

RULE of THUMB			
Bh no.		H06 1420	
TT	=	PT + recovery time	
	=	4320	1200
	=	5520	
	=	331200	seconds
TV	=	L/s*TP	
	=	2.06	4320
	=	533952	litres
Yield	=	TV/TT	
		1.61217391	l/s
Production yield			
	=	Yield *FS	
	=	1.61217391	75%
	=	1.20913043	l/s @ 24hrs

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FC-METHOD : Estimation of the sustainable yield of a borehole

Borehole:

Extrapolation time in years = (enter)	3	1576800	Extrapol.time in minutes
Effective borehole radius (r_e) = (enter)	3.7	3.2	Estimate of effective r_e
Q (l/s) from pumping test =	2.03	0.14	Estimate of t_c of WBS
s_a (available drawdown), sigma_s = (enter)	48.32	20	Sigma_s from risk analysis
Annual effective recharge (m) =	0.0067	35.02	s_available working drawdown(m)
t(end) and s(end) of pumping test =	4320	24.28	End time and drawdown of test
Average maximum derivative = (enter)	4.2	4.2	Estimate of average of max deriv
Average second derivative = (enter)	0	0.0	Estimate of average second deriv
Derivative at radial flow period = (enter)	2.17		Read from derivative graph
	T-early[m^2/d] =	14.79	
T and S estimates from derivatives	T-late [m^2/d] =	7.64	T-average = 10.63
(To obtain correct S-value, use program RPTSOLV)	S-late =	2.05E-06	S-estimate could be wrong

BASIC SOLUTION

(Using derivatives + subjective information about boundaries)

(No values of T and S are necessary)

		Maximum influence of boundaries at long time		
	No boundaries	1 no-flow	2 no-flow	Closed no-flow
sWell (Extrapol.time) =	35.04	45.80	56.56	88.85
Q_sust (l/s) =	2.03	1.55	1.26	0.80
	Best case	→		Worst case

Average Q_sust (l/s) = 1.33

with standard deviation= 0.52

(If no information exists about boundaries skip advanced solution and go to final recommendation)