

STEPPED DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:	H06 0907	PROJECT:	SOUTHERN DISTRICT
ALTERNATIVE NO.:		SITE NAME:	PHYS 6
ALTERNATIVE NO.:		CLIENT:	Research
BOREHOLE DEPTH (mbdl):	60.74	DATUM LEVEL (magl):	0.23
STATIC WATER LEVEL (mbdl):	2.33	CASING HEIGHT (magl):	0.30
DEPTH OF PUMP (mbdl):	56.67	CASING DEPTH (magl):	18.00
		PUMP INLET DIAMETER (mm):	100
		EXISTING PUMP:	no
		CONTRACTOR:	AB pumps
		PUMP TYPE USED	BP40

DISCHARGE RATE 1						DISCHARGE RATE 2						DISCHARGE RATE 3								
DATE:	17-Apr-99		TIME:			DATE:	17-Apr-99		TIME:			DATE:	17-Apr-99		TIME:					
Time	Drawdown		Yield			Time	Drawdown		Yield			Time	Drawdown		Yield					
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		2.78		1		1		12.60		1		1		27.50		1				
2		4.48		2		2		16.50		2		2		29.70		2				
3		5.58		3		3		17.60		3		3		32.23	2.14	3				
5		7.08		5		5		19.23		5		5		35.40		5				
7		8.05	0.50	7		7		20.28	1.01	7		7		38.90		7				
10		8.07		10		10		21.30		10		10		42.47		10				
15		8.10		15		15		22.32		15		15		48.90		15				
20		8.38		20		20		23.04		20		20		54.60		20				
30		8.75		30		30		23.78		30		30				30				
40		9.13		40		40		24.33		40		40				40				
50		9.30		50		50		24.71		50		50				50				
60		9.47		60		60		25.04		60		60				60				
70				70		70				70		70				70				
80				80		80				80		80				80				
90				90		90				90		90				90				
100				100		100				100		100				100				
110				110		110				110		110				110				
120				120		120				120		120				120				
				150						150						150				

DISCHARGE RATE 4						DISCHARGE RATE 5						DISCHARGE RATE 6								
DATE:	17-Apr-99		TIME:			DATE:	17-Apr-99		TIME:			DATE:	17-Apr-99		TIME:					
Time	Drawdown		Yield			Time	Drawdown		Yield			Time	Drawdown		Yield					
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		1				1		1		1		1				43.300
2				2		2				2		2		2		2				38.500
3				3		3				3		3		3		3				32.390
5				5		5				5		5		5		5				28.790
7				7		7				7		7		7		7				26.000
10				10		10				10		10		10		10				21.630
15				15		15				15		15		15		15				16.030
20				20		20				20		20		20		20				12.230
30				30		30				30		30		30		30				11.000
40				40		40				40		40		40		40				9.770
50				50		50				50		50		50		50				8.540
60				60		60				60		60		60		60				7.310
70				70		70				70		70		70		70			120	6.080
80				80		80				80		80		80		80			150	4.900
90				90		90				90		90		90		90			180	4.700
100				100		100				100		100		100		100			210	4.230
110				110		110				110		110		110		110			240	4.020
120				120		120				120		120		120		120			300	3.870
				150						150									360	3.680
																			420	3.43
																			480	3.24

COMMENTS:

540		
600		

CONSTANT DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:	H06 0907		PROJECT:	SOUTHERN DISTRICT	
ALTERNATIVE NO.:			SITE NAME:	PHYS 6	
ALTERNATIVE NO.:			CLIENT:	Research	PUMP INLET DIAMETER (mm): 100
BOREHOLE DEPTH (mbdl):	60.74	DATUM LEVEL (magl):	0.23	EXISTING PUMP:	no
STATIC WATER LEVEL (mbdl):	2.43	CASING HEIGHT (magl):	0.30	CONTRACTOR:	AB pumps
DEPTH OF PUMP (mbdl):	56.67	CASING DEPTH (magl):	18.00	PUMP TYPE USED:	BP40

TEST STARTED			TEST COMPLETED			DURATION (min):		
DATE:	26-Mar-99	TIME:		DATE:		TIME:		TOTAL TIME PUMPED (min):

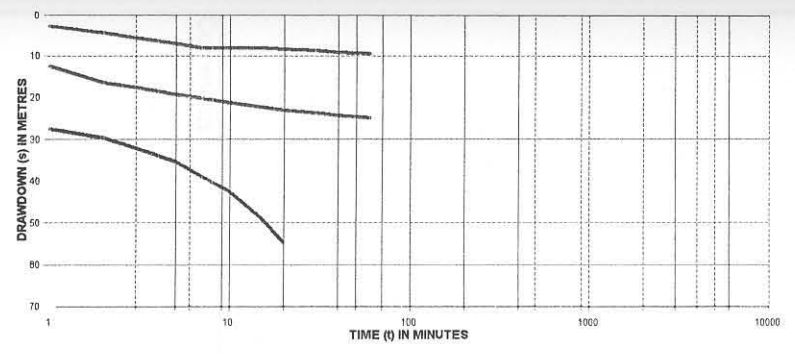
AVERAGE YIELD (l/s):	1.22	S.W.L.:	2.33	S		B		O		R		E	
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DISCHARGE BORE				B				O				R				E			
BOREHOLE 1		S.W.L.		BOREHOLE 2		S.W.L.		BOREHOLE 3		S.W.L.		No.:		Distance:					

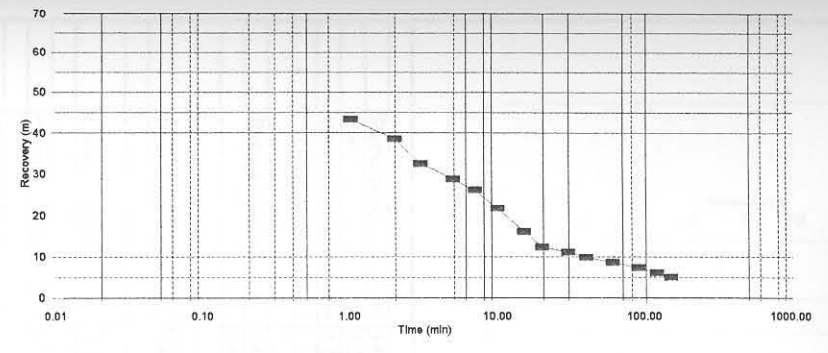
No.:			No.:	H06 1451		No.:		
Distance (m):			Distance (m):	106.85		Distance:		

Time (min)	Drawdown (m)	Yield (l/s)	Time (min)	Recovery (mbdl)	Recovery (m)	t/t'	S	B	O	R	E	BOREHOLE 1		BOREHOLE 2		BOREHOLE 3				
												Time (min)	Drawdown (m)	Rec (m)	Time (min)	Drawdown (m)	Rec (m)	Time (min)	Drawdown (m)	Rec (m)
1	4.48		1	28.34	1441							1	9.69	32.72	1			1		
2	6.83		2	26.02	721							2	13.17	31.02	2			2		
3	14.81		3	24.49	481							3	15.91	28.52	3			3		
5	17.28		5	22.55	289							5	18.83	27.34	5			5		
7	18.98		7	21.14	206.71							7	20.17	25.3	7			7		
10	20.56		10	19.43	145							10	21.95	23.93	10			10		
15	21.97		15	17.65	97							15	23.13	21.6	15			15		
20	22.56		20	16.49	73							20	23.17	20.08	20			20		
30	24.84		30	14.66	49							30	24.36	17.79	30			30		
40	26.04		40	13.29	37							40	24.82	16.04	40			40		
60	27.92		60	12.31	25							60	25.69	13.64	60			60		
90	28.91		90	11.17	17							90	26.33	12.68	90			90		
120	29.97		120	10.47	13							120	26.79	11.48	120			120		
150	30.12		150	10.07	10.6							150	27.26	10.88	150			150		
180	30.24		180	9.67	9							180	27.59	10.28	180			180		
210	30.47		210	9.08	7.8571							210	27.92	9.68	210			210		
240	30.60		240	8.49	7							240	28.25	9.08	240			240		
300	30.75		300	7.90	5.8							300	28.56	8.36	300			300		
360	30.80		360	7.31	5							360	28.89	7.64	360			360		
420	30.83		420	6.99	4.4286							420	29.055	7.28	420			420		
480	30.86		480	6.72	4							480	29.22	6.92	480			480		
540	30.91		540	6.44	3.6667							540	29.74	6.67	540			540		
600	30.96		600	6.13	3.4							600	30.26	6.61	600			600		
720	31.12		720	5.50	3							720	32.97	6.29	720			720		
840	31.25		840	5.27	2.7143							840	33.72	6.19	840			840		
960	31.38		960	5.03	2.5							960	34.47	6.08	960			960		
1080	31.40		1080	4.68	2.3333							1080	36.51	5.65	1080			1080		
1200	31.42		1200	4.31	2.2							1200	38.59	5.28	1200			1200		
1320	31.58		1320	3.93	2.0909							1320	40.15	4.94	1320			1320		
1440	31.74		1440	3.59	2							1440	42.73	4.38	1440			1440		
1560			1560									1560		4.04	1560			1560		
1680			1680									1680		3.7	1680			1680		
1800			1800									1800		3.36	1800			1800		
1920			1920									1920			1920			1920		
2040			2040									2040			2040			2040		
2160			2160									2160			2160			2160		
2280			2280									2280			2280			2280		
2400			2400									2400			2400			2400		
2520			2520									2520			2520			2520		
2640			2640									2640			2640			2640		
2760			2760									2760			2760			2760		
2880			2880									2880			2880			2880		
3000			3000									3000			3000			3000		
3120			3120									3120			3120			3120		
3240			3240									3240			3240			3240		
3360			3360									3360			3360			3360		
3480			3480									3480			3480			3480		
3600			3600									3600			3600			3600		
3720			3720									3720			3720			3720		
3840			3840									3840			3840			3840		
3960			3960									3960			3960			3960		
4080			4080									4080			4080			4080		
4200			4200									4200			4200			4200		
4320			4320									4320			4320			4320		
5040			5040									5040			5040			5040		
5760			5760									5760			5760			5760		
7200			7200									7200			7200			7200		
10080			10080									10080			10080			10080		

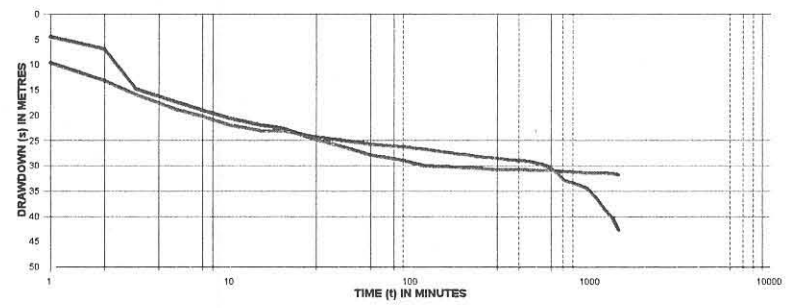
Stepped discharge



Recovery/stepped drawdown

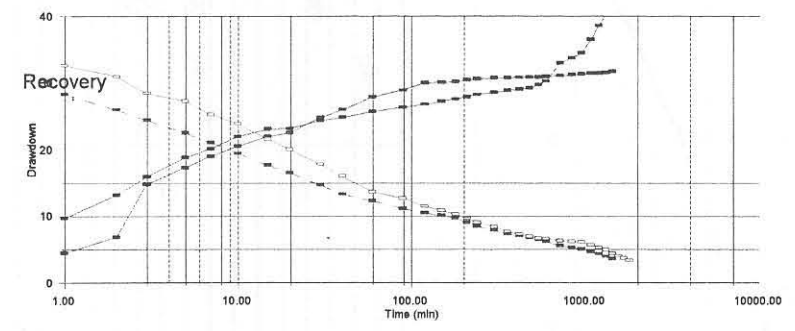


Constant discharge

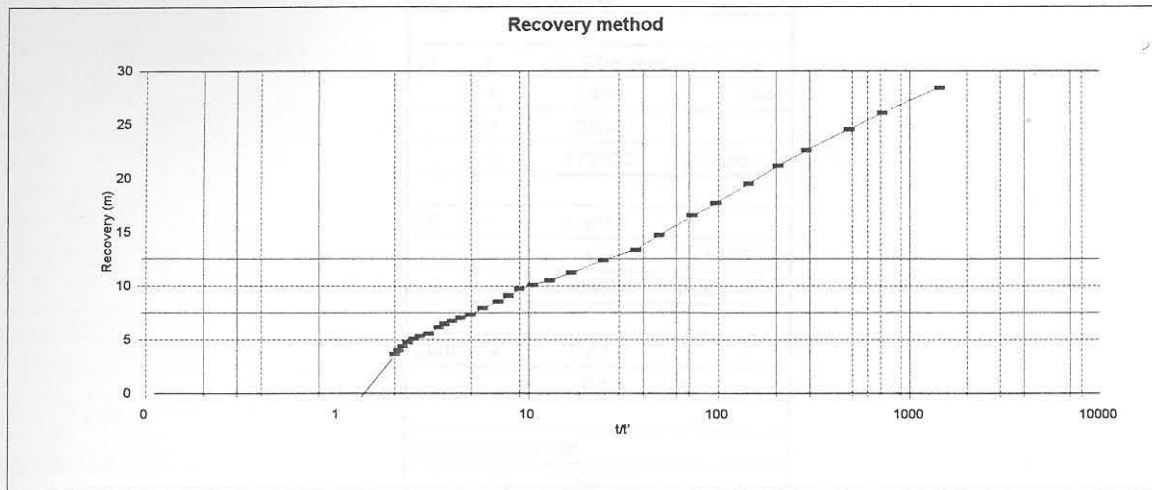


Constant discharge rate : 5.12 l/s

Constant vs. Recovery



Comments:



Pump cycle	=	1440	min	(24hrs)
Yield	=	1.22	l/s	
t/t''	=	1.5	(Graph)	
Recovery period	=	1440 / t/t''		
		1440 / 1.50		
		960.00	min	
Pumping period	=	1440 - 960.00		
		480.00	min	
Litres pumped	=	3.51E+04	L	
Pump yield @ 24 hrs		0.41	L/s	
Factor of safety	=	0.75		
Operating yield	=	0.31	L/s for 24 hrs	

Comments:

Comments:

RULE of THUMB			
Bh no.	H06 0907		
TT	=	PT + recovery time	
	=	1440	1440
	=	2880	
	=	172800	seconds
TV	=	L/s*TP	
	=	1.2	1440
	=	103680	litres
Yield	=	TV/TT	
		0.6	l/s
Production yield			
	=	Yield *FS	
	=	0.6	70%
	=	0.45	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)	0.6	0.6	Estimate of effective r_e
Q (l/s) from pumping test =	1.22	0.03	Estimate of t_c of WBS
s_a (available drawdown), σ_s = (enter)	54.34	26.04	← Sigma_s from risk analysis
Annual effective recharge (m) =	0.0067	35.00	$s_{available}$ working drawdown(m)
t(end) and s(end) of pumping test =	4320	31.74	End time and drawdown of test
Average maximum derivative = (enter)	4.9	4.9	Estimate of average of max deriv
Average second derivative = (enter)	0	0.0	Estimate of average second deriv
Derivative at radial flow period = (enter)	9.49		Read from derivative graph
T and S estimates from derivatives (To obtain correct S-value, use program RPTSOLV)	T-early [m^2/d] =	2.03	T-average = 2.83 S-estimate could be wrong
	T-late [m^2/d] =	3.94	
	S-late =	7.18E-07	

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) =	44.30	56.85	69.41	107.07
Q_sust (l/s) =	0.96	0.75	0.62	0.40

Best case

Worst case

Average Q_sust (l/s) = **0.65**

with standard deviation = 0.24

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

STEPPED DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:		H06 0910		PROJECT:		SOUTHERN DISTRICT				
ALTERNATIVE NO.:				SITE NAME:		PHYS 7				
ALTERNATIVE NO.:				CLIENT:		Research		PUMP INLET DIAMETER (mm):		100
BOREHOLE DEPTH (mbdl):		96.00		DATUM LEVEL (magl):		0.47		EXISTING PUMP:		no
STATIC WATER LEVEL (mbdl):		3.63		CASING HEIGHT (magl):		0.26		CONTRACTOR:		AB pumps
DEPTH OF PUMP (mbdl):		86.00		CASING DEPTH (magl):		6.00		PUMP TYPE USED:		BP40

DISCHARGE RATE 1						DISCHARGE RATE 2						DISCHARGE RATE 3													
DATE:		05-Mar-99		TIME:				DATE:		05-Mar-99		TIME:				DATE:		05-Mar-99		TIME:					
Time	Drawdown	Yield	Time	Recovery	Time	Drawdown	Yield	Time	Recovery	Time	Drawdown	Yield	Time	Recovery	Time	Drawdown	Yield	Time	Recovery	Time	Drawdown	Yield			
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		0.38			1			1				1			1			5.70	1						
2		0.61			2			2				2			2			6.19	2						
3		0.79	1.02		3			3				3			3			6.38	3						
5		0.90			5			5			2.09	5			5			7.15	5						
7		1.09			7			7				7			7			7.72	7						
10		1.28			10			10				10			10			8.14	10						
15		1.59			15			15				15			15			8.75	15						
20		1.77			20			20				20			20			9.37	20						
30		2.30			30			30				30			30			10.14	30						
40		2.38			40			40				40			40			10.76	40						
50		2.47			50			50				50			50			11.31	50						
60					60			60				60			60			11.66	60						
70					70			70				70			70				70						
80					80			80				80			80				80						
90					90			90				90			90				90						
100					100			100				100			100				100						
110					110			110				110			110				110						
120					120			120				120			120				120						
					150			150				150			150				150						

DISCHARGE RATE 4						DISCHARGE RATE 5						DISCHARGE RATE 6													
DATE:		05-Mar-99		TIME:				DATE:		05-Mar-99		TIME:				DATE:		05-Mar-99		TIME:					
Time	Drawdown	Yield	Time	Recovery	Time	Drawdown	Yield	Time	Recovery	Time	Drawdown	Yield	Time	Recovery	Time	Drawdown	Yield	Time	Recovery	Time	Drawdown	Yield			
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		12.69			1			1			27.64		1			1			1						52.060
2		13.27			2			2			29.53		2			2			2						41.970
3		14.30	8.45		3			3			31.42	14.62	3			3			3						30.850
5		15.17			5			5			34.86		5			5			5						24.740
7		16.09			7			7			37.87		7			7			7						22.650
10		17.14			10			10			41.61		10			10			10						21.870
15		18.58			15			15			47.23		15			15			15						18.810
20		19.61			20			20			52.04		20			20			20						16.850
30		20.98			30			30			59.03		30			30			30						14.820
40		22.42			40			40			63.98		40			40			40						13.910
50		23.75			50			50			68.89		50			50			50						9.780
60		25.06			60			60			73.87		60			60			60						6.800
70					70			70					70			70			70						3.410
80					80			80					80			80			80						3.130
90					90			90					90			90			90						2.890
100					100			100					100			100			100						2.620
110					110			110					110			110			110						2.470
120					120			120					120			120			120						2.140
					150			150					150			150			150						1.870
																									1.61
																									1.43
																									1.22

COMMENTS:

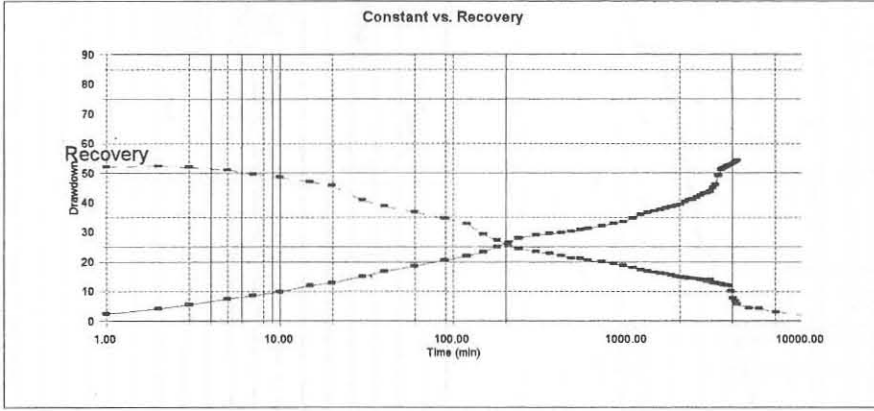
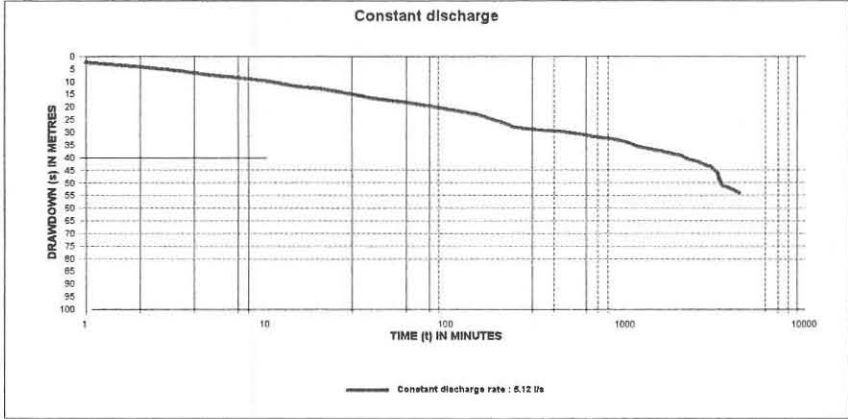
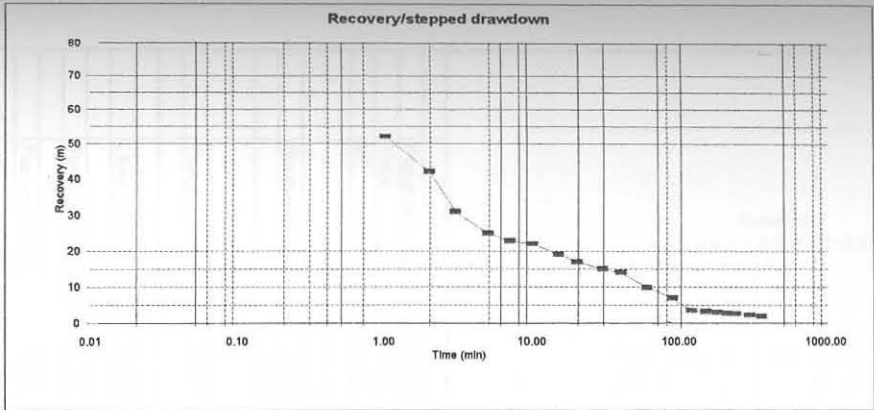
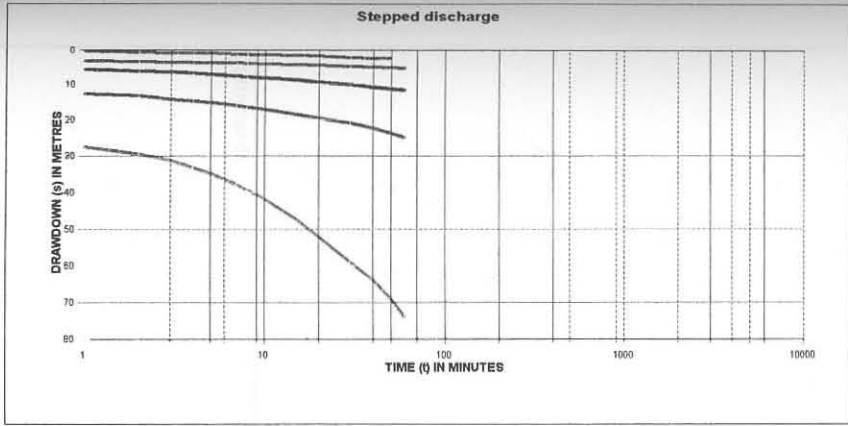
SERVATION BOREHOLES FOR CD (4,5,6,7& 8)

BOREHOLE NO.:	H06 0910	PROJECT:	SOUTHERN DISTRICT
ALTERNATIVE NO.:		SITE NAME:	PHYS 7
ALTERNATIVE NO.:		CLIENT:	Research
BOREHOLE DEPTH (mbdl):	96.00	DATUM LEVEL (magl):	0.47
STATIC WATER LEVEL (mbdl):	4.58	CASING HEIGHT (magl):	0.26
DEPTH OF PUMP (mbdl):	86.00	CASING DEPTH (magl):	6.00
		PUMP INLET DIAMETER (mm):	100
		EXISTING PUMP:	no
		CONTRACTOR:	AB pumps
		PUMP TYPE USED:	BP40

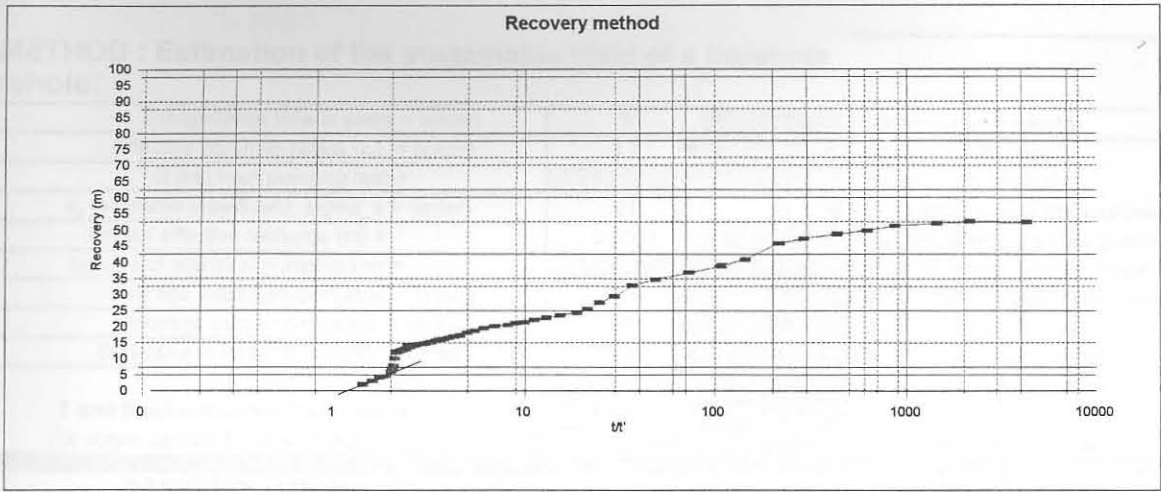
TEST STARTED				TEST COMPLETED				DURATION (min):			
DATE:	TIME:	DATE:	TIME:	DATE:	TIME:	DATE:	TIME:	DATE:	TIME:	DATE:	TIME:

O B S E R V A T I O N B O R E H O L E S	BOREHOLE 4			BOREHOLE 5			O B S E R V A T I O N B O R E H O L E S	BOREHOLE 6			BOREHOLE 7			BOREHOLE 8			
	No.:	H06 1492		No.:				No.:	H06 1061		No.:			No.:			
	Distance (m):	101	24.33	Distance (m):				Distance (m):	293	7.43	Distance (m):			Distance (m):			
	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)		
1		0.00	0.03	1				1		0.00	0	1			1		
2		0.00	0.03	2				2		0.00		2			2		
3		0.00	0.03	3				3		0.00		3			3		
5		0.00	0.03	5				5		0.00		5			5		
7		0.00	0.03	7				7		0.00		7			7		
10		0.00	0.03	10				10		0.00		10			10		
15		0.00	0.02	15				15		0.00		15			15		
20		0.00	0.02	20				20		0.00		20			20		
30		0.00	0.02	30				30		0.00		30			30		
40		0.00	0.01	40				40		0.00		40			40		
60		0.00	0.01	60				60		0.00		60			60		
90		0.00	0.01	90				90		0.00		90			90		
120		0.00	0.01	120				120		0.00		120			120		
150		0.00	0.01	150				150		0.00		150			150		
180		0.00	0.01	180				180		0.00		180			180		
210		0.00	0	210				210		0.00		210			210		
240		0.02	0	240				240		0.00		240			240		
300		0.02		300				300		0.00		300			300		
360		0.02		360				360		0.00		360			360		
420		0.02		420				420		0.00		420			420		
480		0.02		480				480		0.00		480			480		
540		0.02		540				540		0.00		540			540		
600		0.03		600				600		0.00		600			600		
720		0.03		720				720		0.00		720			720		
840		0.03		840				840		0.00		840			840		
960		0.03		960				960		0.00		960			960		
1080		0.03		1080				1080		0.00		1080			1080		
1200		0.03		1200				1200		0.00		1200			1200		
1320		0.03		1320				1320		0.00		1320			1320		
1440		0.03		1440				1440		0.00		1440			1440		
1560		0.03		1560				1560		0.00		1560			1560		
1680		0.03		1680				1680		0.00		1680			1680		
1800		0.03		1800				1800		0.00		1800			1800		
1920		0.03		1920				1920		0.00		1920			1920		
2040		0.03		2040				2040		0.00		2040			2040		
2160		0.03		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		

BOREHOLE NUMBER: H05 0910



Comments:



Pump cycle	=	1440	min	(24hrs)
Yield	=	7.2	l/s	
t/t''	=	1.2	(Graph)	
Recovery period	=	1440 / t/t''		
		1440 / 1.20		
		1200.00	min	
Pumping period	=	1440 - 1200.00		
		240.00	min	
Litres pumped	=	1.04E+05	L	
Pump yield @ 24 hrs		1.20	L/s	
Factor of safety	=	0.75		
Operating yield	=	0.90	L/s for 24 hrs	

Comments:

Comments:

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)	4.3	4.3	Estimate of effective r_e
Q (l/s) from pumping test =	7.2	0.36	Estimate of t_c of WBS
s_a (available drawdown), sigma_s = (enter)	81	33	Sigma_s from risk analysis
Annual effective recharge (m) =	0.0067	54.70	$s_{available}$ working drawdown(m)
t(end) and s(end) of pumping test =	10080	54.13	End time and drawdown of test
Average maximum derivative = (enter)	26	113.1	Estimate of average of max deriv
Average second derivative = (enter)	0	0.0	Estimate of average second deriv
Derivative at radial flow period = (enter)	11.24		Read from derivative graph
T and S estimates from derivatives (To obtain correct S-value, use program RPTSOLV)	T-early [m^2/d] =	10.13	T-average = 6.66 S-estimate could be wrong
	T-late [m^2/d] =	4.38	
	S-late =	5.51E-03	

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) =	111.18	168.23	225.29	396.44
Q_sust (l/s) =	3.54	2.34	1.75	0.99

Best case

Worst case

Average Q_sust (l/s) = **1.95**

with standard deviation = 1.08

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

STEPPED DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:	H06 0910	PROJECT:	Hannes Claasens		
ALTERNATIVE NO.:	W5111	SITE NAME:	Mashabela - Mohwelere		
ALTERNATIVE NO.:		CLIENT:	ERR		
BOREHOLE DEPTH (mbdl):	72.00	DATUM LEVEL (magl):	0.00	PUMP INLET DIAMETER (mm):	170
STATIC WATER LEVEL (mbdl):	2.05	CASING HEIGHT (magl):	0.20	EXISTING PUMP:	NO PUMP
DEPTH OF PUMP (mbdl):	60.00	CASING DEPTH (magl):		CONTRACTOR:	RAMOTSE
				PUMP TYPE USED:	MONO 80

DISCHARGE RATE 1						DISCHARGE RATE 2						DISCHARGE RATE 3								
DATE:	08-Sep-98		TIME:			DATE:	08-Sep-98		TIME:			DATE:	08-Sep-98		TIME:					
Time	Drawdown	Yield	Time	Recovery		Time	Drawdown	Yield	Time	Recovery		Time	Drawdown	Yield	Time	Recovery				
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(min)	mbdl	(m)	(m)			
1		7.26		1			1		24.48		1			1		42.22		1		
2		10.80		2			2		24.91		2			2		43.45		2		
3		14.33	5.44	3			3		25.27	10.13	3			3		44.60	10.45	3		
5		14.47		5			5		25.88		5			5		46.72		5		
7		14.60		7			7		26.55		7			7		47.80		7		
10		15.20		10			10		26.97		10			10		49.10		10		
15		16.12		15			15		28.37		15			15		49.90		15		
20		17.25		20			20		30.00		20			20		51.15		20		
30		18.86		30			30		32.99		30			30		53.00		30		
40		19.98		40			40		34.87		40			40		55.00		40		
50		20.78		50			50		35.67		50			50		56.70		50		
60		21.37		60			60		36.30		60			60		56.70		60		
70		21.79		70			70		37.20		70			70		56.70		70		
80		22.30		80			80		38.00		80			80		56.00		80		
90		22.80		90			90		38.96		90			90		56.70		90		
100		23.10		100			100		39.92		100			100		56.70		100		
110				110			110				110			110				110		
120				120			120				120			120				120		
				150							150							150		

DISCHARGE RATE 4						DISCHARGE RATE 5						DISCHARGE RATE 6									
DATE:	08-Sep-98		TIME:			DATE:	08-Sep-98		TIME:			DATE:	08-Sep-98		TIME:						
Time	Drawdown	Yield	Time	Recovery		Time	Drawdown	Yield	Time	Recovery		Time	Drawdown	Yield	Time	Recovery					
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	
1				1			1				1			1				1			53.000
2				2			2				2			2				2			51.300
3				3			3				3			3				3			50.200
5				5			5				5			5				5			49.350
7				7			7				7			7				7			48.300
10				10			10				10			10				10			47.560
15				15			15				15			15				15			43.370
20				20			20				20			20				20			40.550
30				30			30				30			30				30			38.740
40				40			40				40			40				40			33.630
50				50			50				50			50				50			29.270
60				60			60				60			60				60			26.930
70				70			70				70			70				70			25.040
80				80			80				80			80				80			22.230
90				90			90				90			90				90			20.080
100				100			100				100			100				100			17.760
110				110			110				110			110				110			15.910
120				120			120				120			120				120			12.320
				150							150							150			10.560
																		180			9.95
																		210			9.10

COMMENTS:

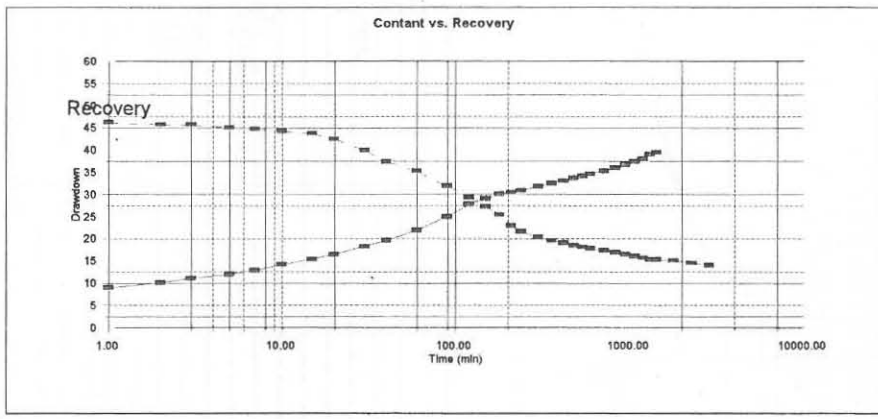
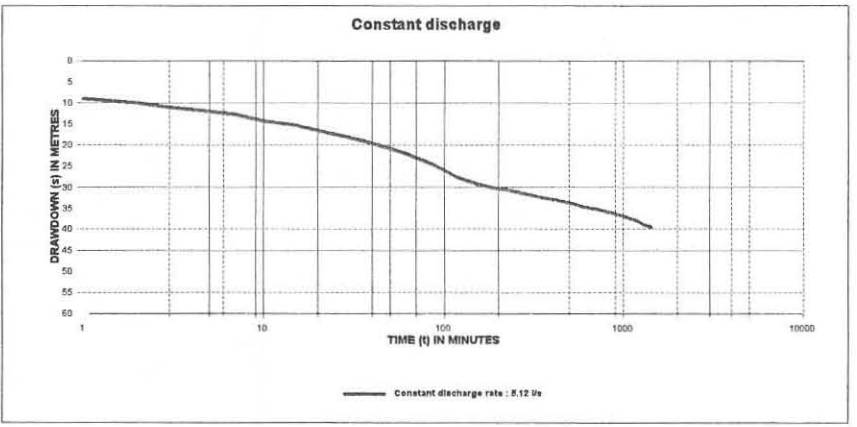
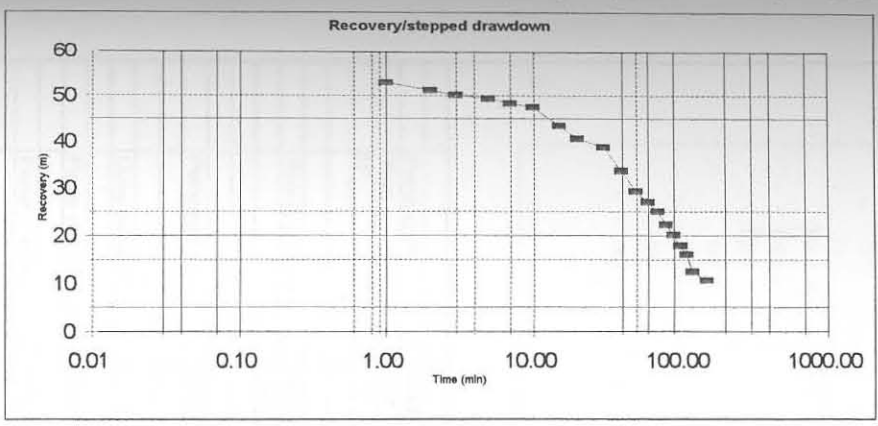
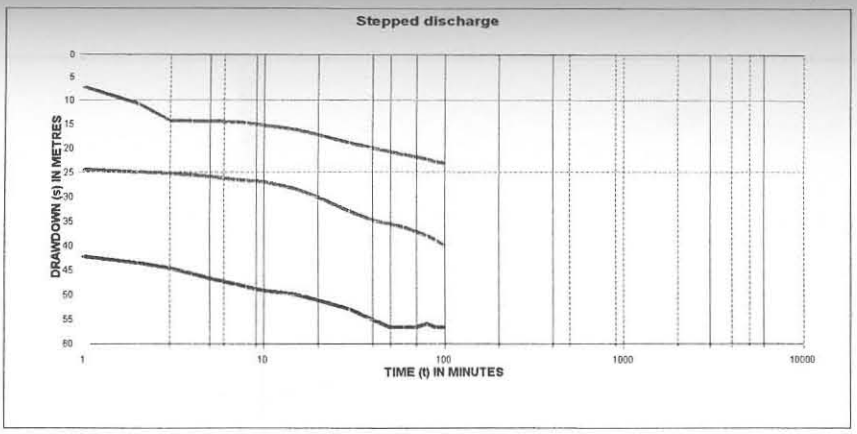
CONSTANT DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:	H06 0910	PROJECT:	Hannes Claasens		
ALTERNATIVE NO.:	W5111	SITE NAME:	Mashabela - Mohwelere		
ALTERNATIVE NO.:		CLIENT:	ERR	PUMP INLET DIAMETER (mm):	170
BOREHOLE DEPTH (mbdl):	72.00	DATUM LEVEL (magl):	0.00	EXISTING PUMP:	NO PUMP
STATIC WATER LEVEL (mbdl):	2.05	CASING HEIGHT (magl):	0.20	CONTRACTOR:	RAMOTSE
DEPTH OF PUMP (mbdl):	60.00	CASING DEPTH (magl):	0.00	PUMP TYPE USED:	MONO 80

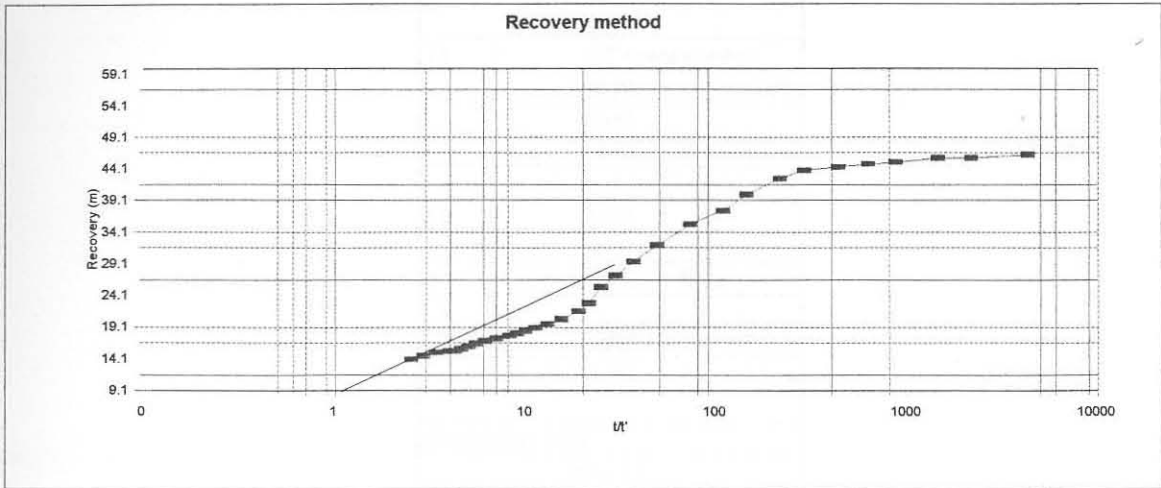
TEST STARTED			TEST COMPLETED			DURATION (min):		
DATE:	08-Sep-98	TIME:	DATE:		TIME:	TOTAL TIME PUMPED (min):		
AVERAGE YIELD (l/s): 4.97								

DISCHARGE BOREHOLE							O B S E R V A T I O N B O R E H O L E S	BOREHOLE 1			BOREHOLE 2			BOREHOLE 3		
								No.:			No.:			No.:		
								Distance (m):			Distance (m):			Distance (m):		
Time (min)	Drawdown (m)	Yield (l/s)	Time (min)	Recovery (m)	t/t'			Time (min)	Drawdown (m)	Time (min)	Drawdown (m)	Time (min)	Drawdown (m)	Time (min)	Drawdown (m)	
1	9.00		1	46.30	4321		1		1		1		1			
2	10.15	5.10	2	45.79	2161		2		2		2		2			
3	11.05		3	45.78	1441		3		3		3		3			
5	12.00		5	45.10	865		5		5		5		5			
7	12.85		7	44.79	618.14		7		7		7		7			
10	14.20		10	44.32	433		10		10		10		10			
15	15.39	5.10	15	43.80	289		15		15		15		15			
20	16.50		20	42.50	217		20		20		20		20			
30	18.28		30	40.00	145		30		30		30		30			
40	19.60		40	37.40	109		40		40		40		40			
60	21.90	5.10	60	35.31	73		60		60		60		60			
90	24.89	5.10	90	32.00	49		90		90		90		90			
120	27.80	5.14	120	29.40	37		120		120		120		120			
150	29.06	5.12	150	27.20	29.8		150		150		150		150			
180	30.05	5.13	180	25.40	25		180		180		180		180			
210	30.43		210	22.85	21.571		210		210		210		210			
240	30.90	5.11	240	21.60	19		240		240		240		240			
300	31.86		300	20.32	15.4		300		300		300		300			
360	32.50	5.12	360	19.55	13		360		360		360		360			
420	33.05	5.16	420	19.00	11.286		420		420		420		420			
480	33.66	5.12	480	18.50	10		480		480		480		480			
540	34.13	5.10	540	18.10	9		540		540		540		540			
600	34.65		600	17.72	8.2		600		600		600		600			
720	35.25	5.12	720	17.30	7		720		720		720		720			
840	36.00	5.14	840	16.90	6.1429		840		840		840		840			
960	36.72	5.10	960	16.45	5.5		960		960		960		960			
1080	37.36	5.18	1080	16.00	5		1080		1080		1080		1080			
1200	38.00		1200	15.65	4.6		1200		1200		1200		1200			
1320	39.04	5.12	1320	15.30	4.2727		1320		1320		1320		1320			
1440	39.50	5.13	1440	15.30	4		1440		1440		1440		1440			
1800	40.10		1800	15.09	3.4		1800		1800		1800		1800			
2280	41.35		2280	14.54	2.8947		2280		2280		2280		2280			
2880	44.25		2880	13.96	2.5		2880		2880		2880		2880			
3600	44.65		3600	12.54	2.2											
4320	47		4320	11.69	2											

COMMENTS:



Comments:



Pump cycle	=	1440	min
Yield	=	4.97	l/s
t/t''	=	1.2	(Graph)
Recovery period	=	1440 / t/t''	
		1440 / 1.20	
		1200.00	min
Pumping period	=	1440 - 1200.00	
		240.00	min
Litres pumped	=	7.16E+04	L
Pump yield @ 24 hrs		0.83	L/s
Factor of safety	=	0.75	
Operating yield	=	0.62	L/s for 24 hrs

Comments: Bad recovery.

Comments:

RULE of THUMB		
Bh no.	H06 0882DJA	
TT	=	PT + recovery time
	=	4320 4320
	=	8640
	=	518400 seconds
TV	=	L/s*TP
	=	4.97 4320
	=	1288224 litres
Yield	=	TV/TT
		2.485 l/s
Production yield		
	=	Yield *FS
	=	2.485 70%
	=	1.86375 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)	1.5	1.7	Estimate of effective r_e
Q (l/s) from pumping test =	4.97	0.07	Estimate of t_c of WBS
s_a (available drawdown), σ_s = (enter)	51.8	5	σ_s from risk analysis
Annual effective recharge (m) =	0.007	53.80	$s_{available}$ working drawdown(m)
t(end) and s(end) of pumping test =	4320	47	End time and drawdown of test
Average maximum derivative = (enter)	16.6	16.6	Estimate of average of max deriv
Average second derivative = (enter)	0	0.0	Estimate of average second deriv
Derivative at radial flow period = (enter)	9.22		Read from derivative graph
T and S estimates from derivatives (To obtain correct S-value, use program RPTSOLV)	T-early[m ² /d] =	8.52	T-average = 6.35 S-estimate could be wrong
	T-late [m ² /d] =	4.73	
	S-late =	6.90E-04	

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) =	89.53	132.07	174.60	302.20
Q_sust (l/s) =	2.99	2.02	1.53	0.88
	Best case		Worst case	
Average Q_sust (l/s) =	1.69			
with standard deviation =	0.89			

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