# ANNEX

# ANNEX A

# ENGINEERING

# FEASIBILITY STUDY FOR KLIPVOOR

## ANNEX A: ENGINEERING

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### A.1.1 ASSUMPTIONS FOR PLANNING OF INFRASTRUCTURE

The following technical assumptions have been made in the planning of water supply infrastructure in this Feasibility Study.

### 1. Clear Water Pumping Stations

- At least 50 % standby equipment is provided.
- Number of pumps comprises two sets on duty and one set for standby.

### 2. Bulk and Distribution Pipeline

Flow rate and peak factors

	Flow rate
Bulk water delivery supply line to bulk reservoir which supplies a service reservoir	1.5 AADD
Bulk water delivery supply line to service reservoir which supplies a distribution network	1.5 AADD
Bulk water delivery supply line to distribution network	4.5 AADD

AADD : Annual Average Daily Demand

Type of pipe to use

Diameter range (mm)	Internal Pressure	Type of pipe
<= 400	<=1600 kPa	uPVC, Steel (API 5L Grade B), FC
<= 400	> 1600 kPa	Steel (API 5L Grade B)
> 400	<7000 kPa	Steel (API 5L Grade B)

Pipelines which will be subjected to a pressure more than 9 kg/cm2 is planned as steel; and pipelines less than 9 kg/cm2 is planned as uPVC.

### 3. Reservoirs

### Service Reservoir

Water Source	Bulk Storage Provision	Service Reservoir Storage requirement
From Magalies Water direct by gravity or		
pumped to service reservoir		
by gravity to service reservoir	-	24 h
pumped to service reservoir	-	48 h
From Bulk Reservoir of Magalies water	24 h	
by gravity to service reservoir		24 h
pumped to service reservoir	<u> </u>	48 h

Note : in hours of Annual Average Daily Demand

### **Reservoir Construction : Material**

Type of storage	Capacity	Material
Elevated Service Reservoir	0 - 0.5 Ml	Pressed Steel
Ground Regional Reservoir	0.5 MI and Larger	Concrete

### 4. Reticulation

Residual Pressures Type of connections	Minimum de	sign pressures
• J P • • • • • • • • • • • • • • • • •	For connections	For services mix
House connections	12 m	
Yard taps	10 m	12 m
Street taps*	5 m	

\*: 10 l/min of water flow from each tap should be secured

Pipe Selections for Reticulations

Pipe Diameter	Pipe material and Class
63 dia up to 250 dia	uPVC class 9 with push-fit couplings or z-lock

### Sizing of Reticulation

In order to cost the proposed infrastructure it is necessary to estimate the length of pipework and hence the cost of the reticulation in each community. With a total of 76 communities in the three Feasibility Study areas it is neither practicable nor necessary to design the reticulation in each community in detail during the feasibility

study. Therefore a methodology was developed for estimating the length of pipework and number of standpipes required.

Initially the reticulation required in each pilot project community was considered however this sample was not sufficiently representative of the entire Study Area so instead the communities in Klipvoor West were considered (a total of 6 excluding Ga Rasai). The average area of these communities is 224 ha and they include a range of different sizes of settlement so the sample is representative of the communities in the feasibility study areas. When designing RDP level reticulation systems, it is normal practise in South Africa to allow for future upgrading by designing for the higher demand but then omitting some of the pipes for the RDP case. This obviates relaying pipes with a slightly larger size when demand increases.

For each of the six communities mentioned above the reticulation system was designed in detail using the 1:10,000 scale Orthophotos for Level B and then some of the pipes were removed to represent the Level A scenario. The data obtained from this exercise was then used to investigate the correlation between various parameters. Pipe length was tested against population, population density and area and unit length (metres of pipework per capita) was tested against the same parameters; population, population density and area. It was found for both Level A and B that pipe length versus area gave the best correlation. The relationships that were established are as follows:

Level A - y = 36.657 x + 4473.8

Level B - y = 25.77 x + 155.24

where y is the total pipe length and x is the area of service (this is determined from the orthophotos and constitutes approximately 90 or 95% of the households in a given community i.e. those which are still sufficiently dense to warrant an RDP level standpipe system)

From the six communities for which the reticulation was designed in detail, a good correlation was found for Level A between the area of supply and the number of standpipes. The relationship is as follows:

### y = 0.0453 x + 2.6399

where y is the number of standpipes and x is the area of supply.

For Level B, there are still 10% of households which will remain on standpipes. It is assumed that these will be those households on the periphery of the communities where the cost of upgrading will be highest. By investigating the six typical communities in Klipvoor West it was found that the average number of standpipes per community for Level A is 13 while the average number required for Level B is still 10. This proportion was used for all of the communities.

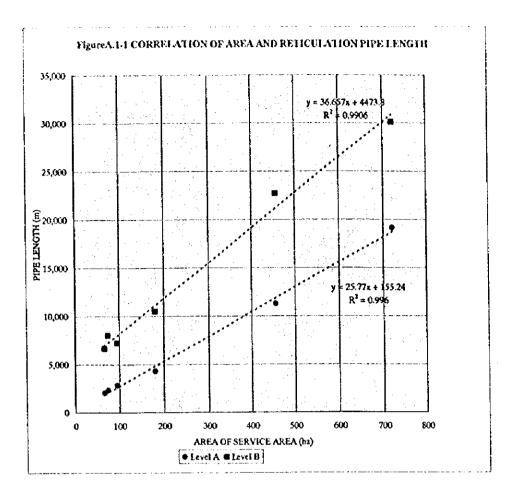
Having established the total length of pipework required to reticulate a community to each level of service, it is still necessary to determine the breakdown for each pipe size. To do this a standard reticulation design was prepared for Level B for a fictional community. The layout corresponded with the average area of the 35 communities in the Klipvoor Area and the total length of pipework corresponded to the average length for the Klipvoor Area. Each component of the network was sized for the average summer peak daily demand which gave the proportion of each size for a typical system. As the pipe sizes for Level A tend to be of larger diameter than the additional pipes added for Level B, and as the actual size is dependant on the diameter of the incoming pipeline from the service reservoir, a range of incoming sizes was considered and a series of variations from the typical case were determined to allow for variations in this key parameter.

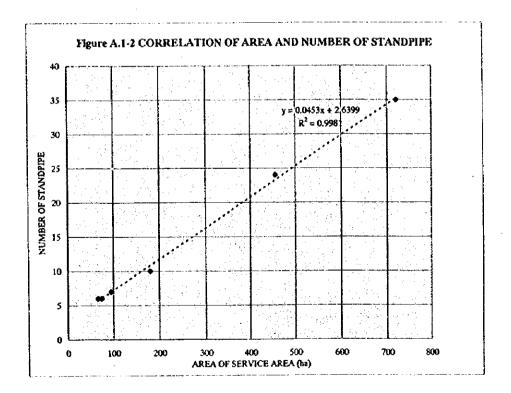
For Level A it was assumed that all pipes of 125 mm diameter and above from the Level B design will also be necessary for Level A. For pipes smaller than 125 mm diameter, the standard design amended for Level A was used to derive the distribution in pipe sizes.

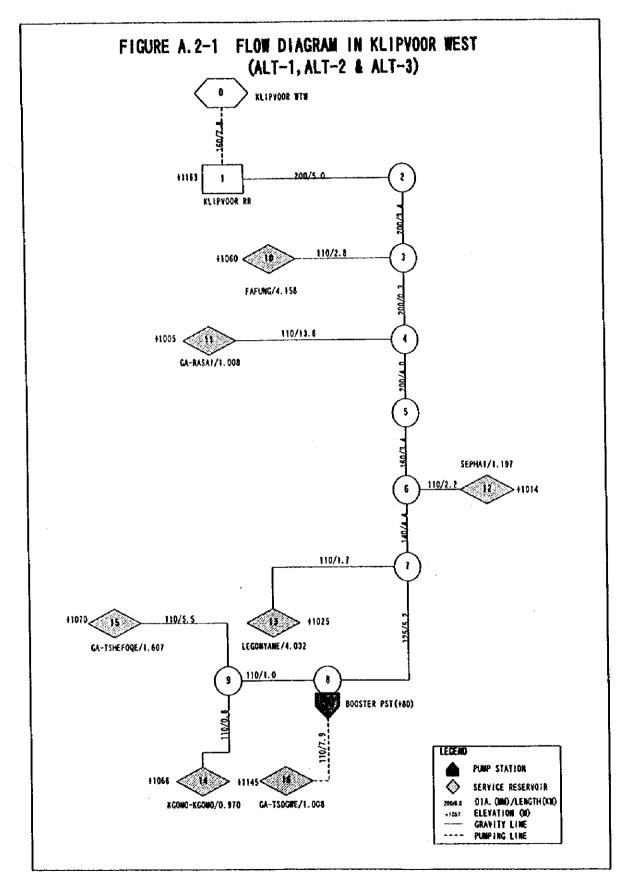
To derive the number of yard connections, 90% of households are assumed to require yard connections as is assumed for the Level B service level. For Level A, no yard connection are included.

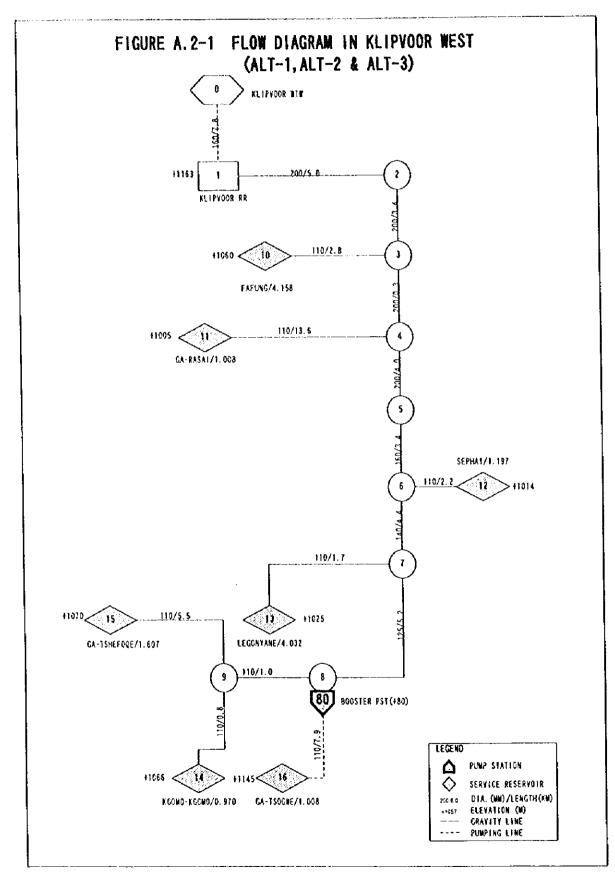
From the above methodology it is possible to determine the length of pipework of each size and the number of yard connections and standpipes in each community given the area to be supplied and the diameter of the incoming pipeline.

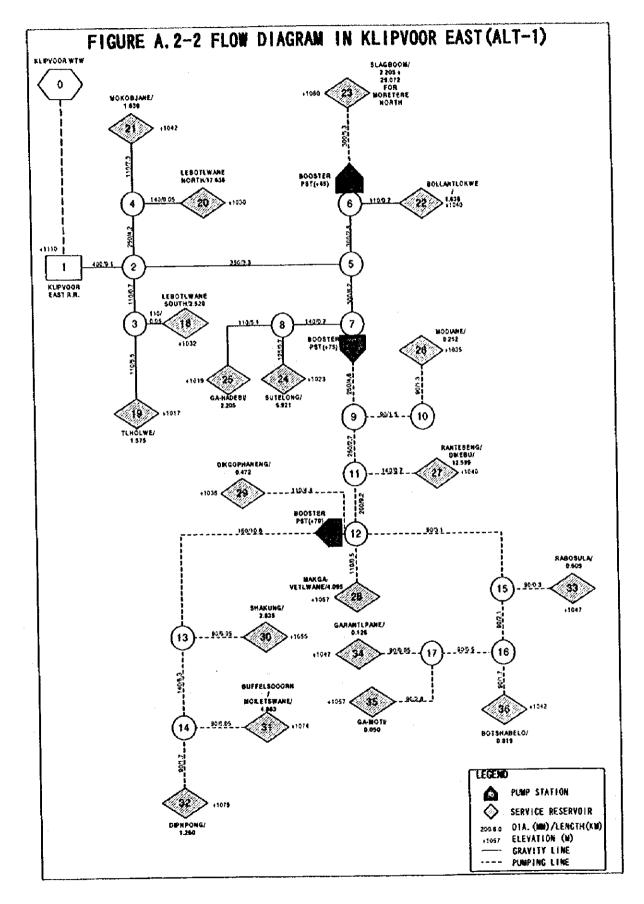
Vol.3 Klipvoor

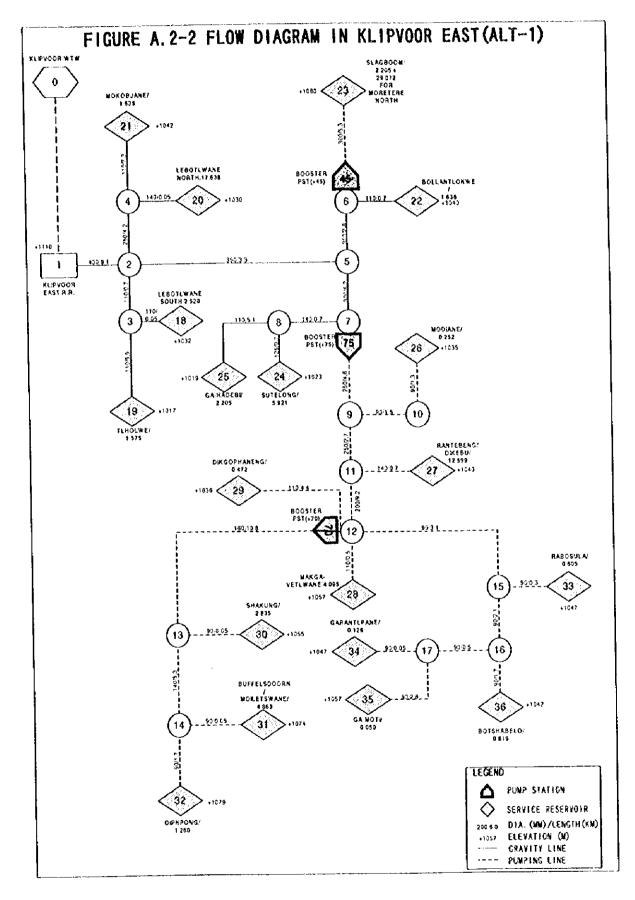


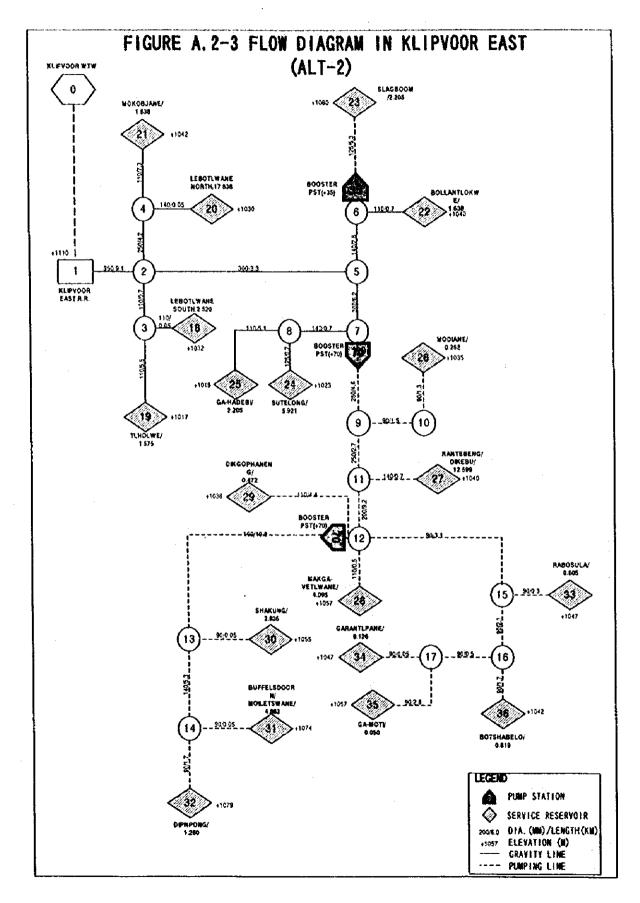


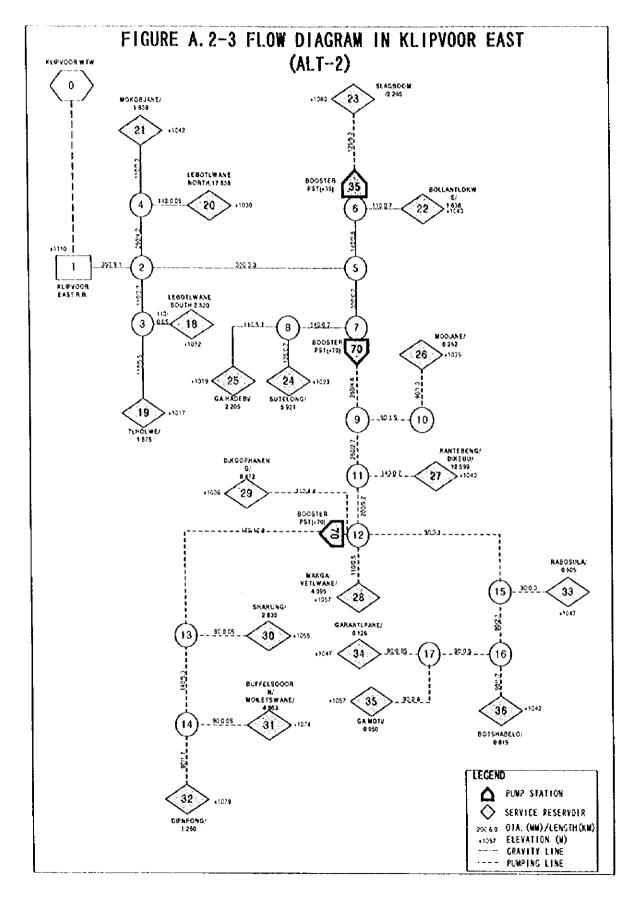


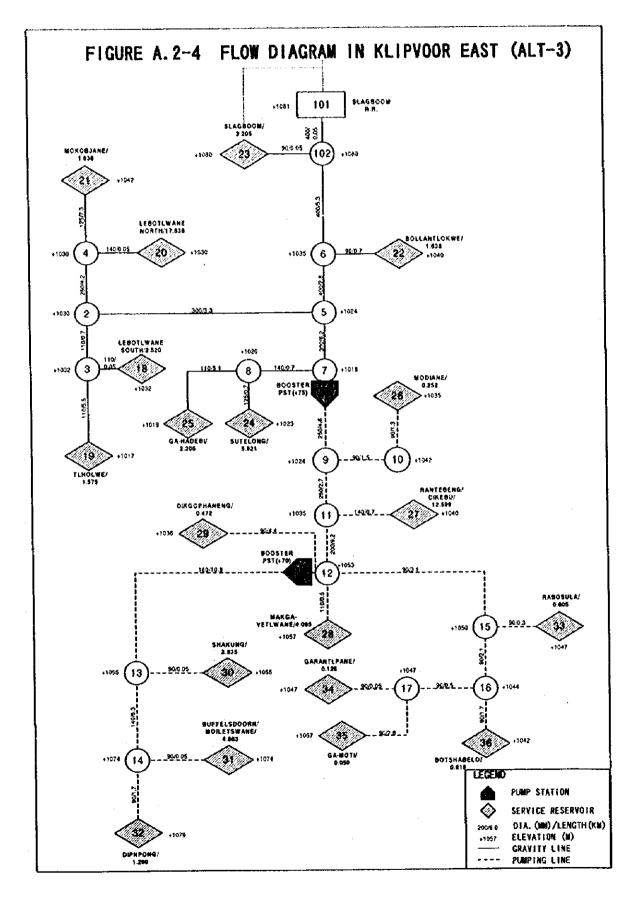


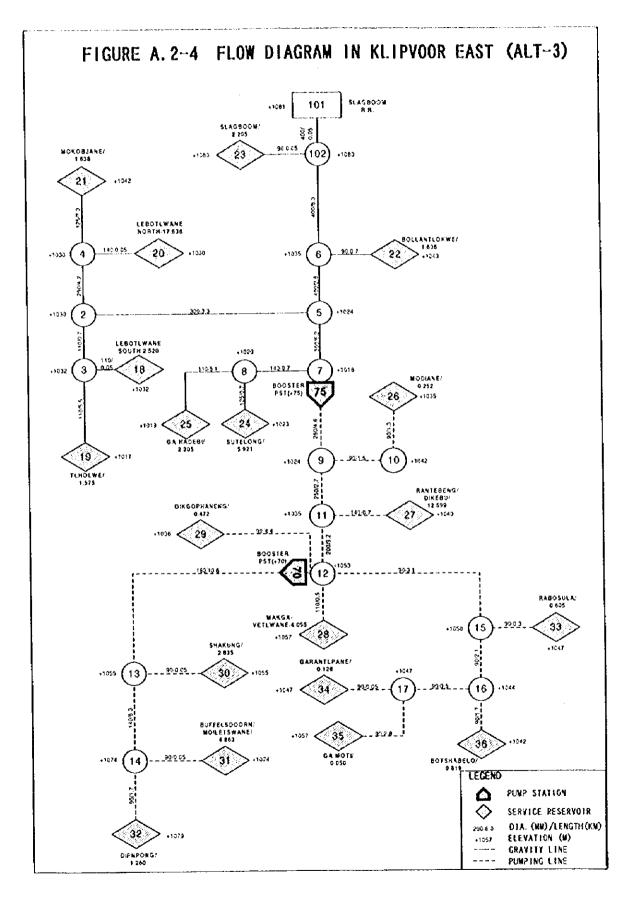


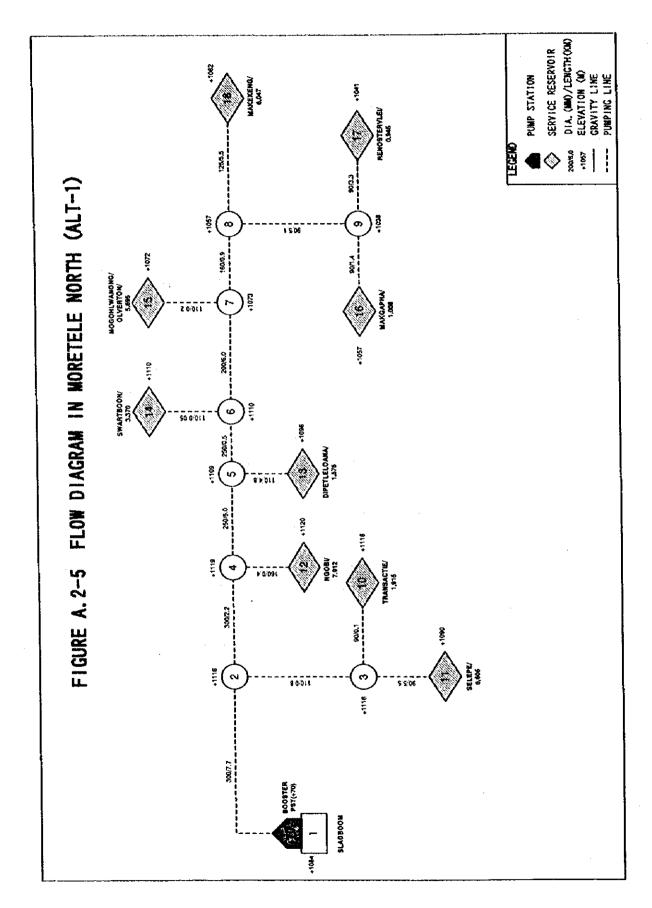


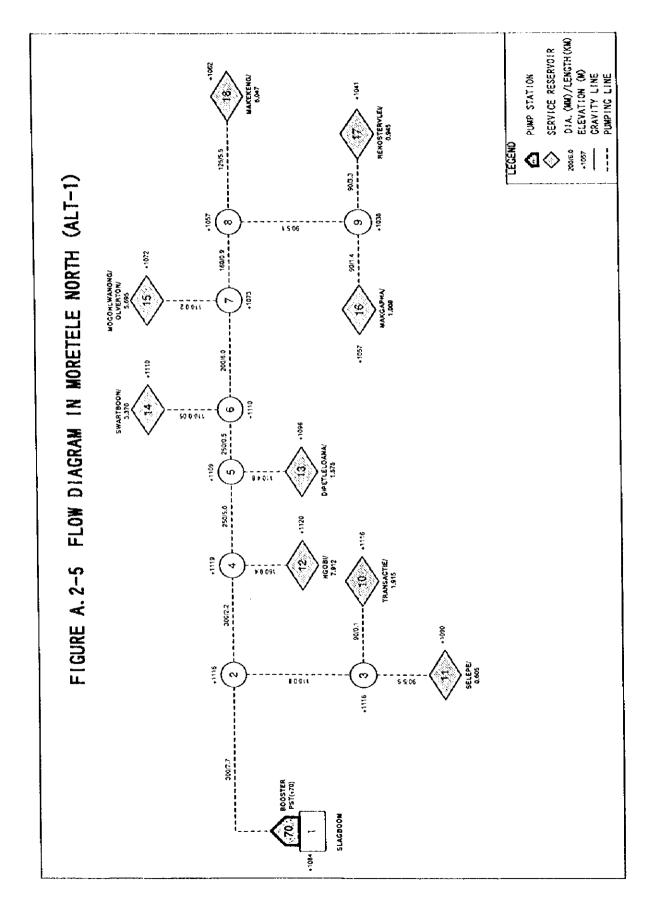




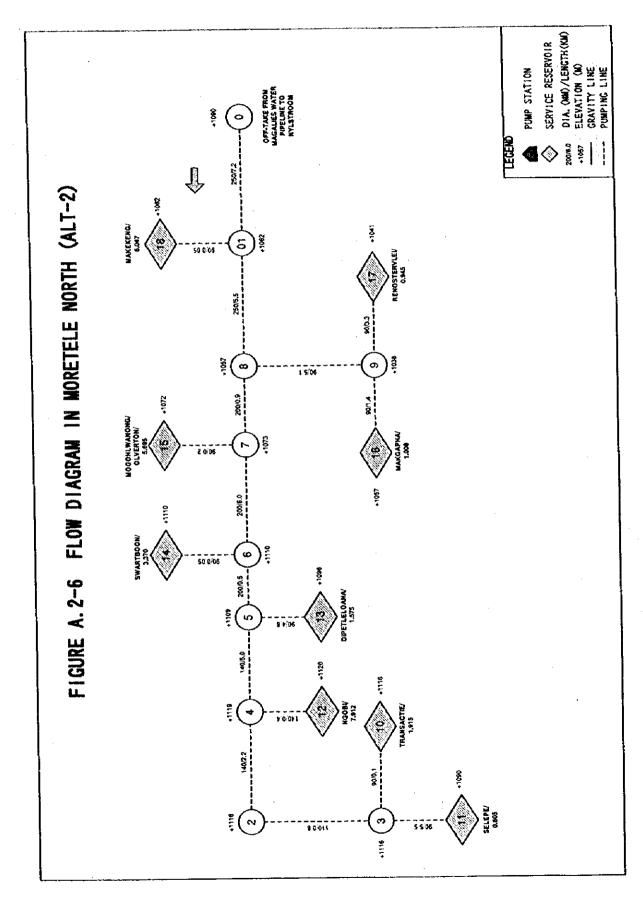


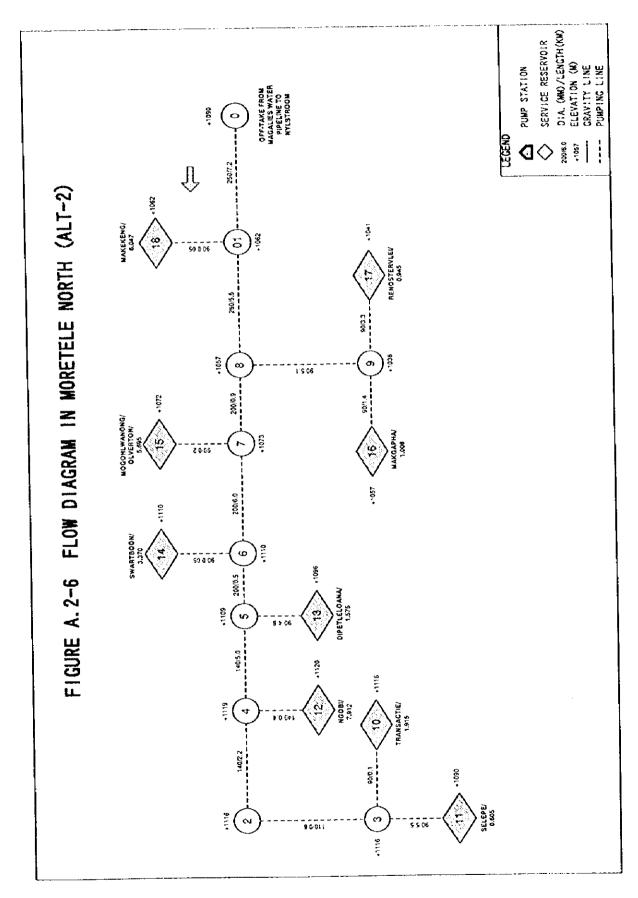


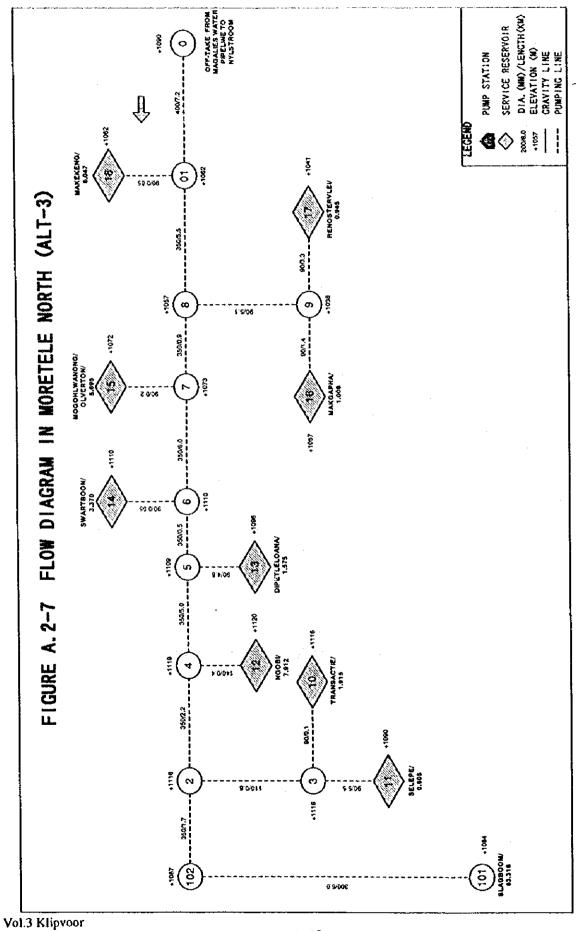




A-10







ن کارند او می او در او او او او او می می می و می و می و می	Capacity	Required	Height		Reservola	r for Level					de for Leve		
Reservoirs	Level 8	LevelA	G+Ground	Capacity		Unit Cost	1		1				Total Cost
	(m3)	(m3)	(m)	(m3)	(005)	(x1,000 R)	(x1,000 R	(m3)	(m3)	(00s)	(x1,000 R)	(1,000 R)	(11,000 R)
Klipvoor West (Alt1, 2 & 3)	T												
Regional Reservoir	1,208	453	G	469	1	300	300	743	800	1	700	700	1,000
Klipvoor	1,208	453	G	460	1	300	300		800	1	700	700	
Service Reservoir	1,295	436	80	\$30	2	670	670	765	790	7	855	855	1,525
Falung	359	135	15	140	1	145	145	219	220	<u> </u>	210	210	355
Sephai	103	39	15	40	1	75	75			)	110	h	185
Legonyane	348	131	10	140	1	135	135	208	210	<u> </u>	175	175	310
Kgomo Kgomo	84	31	10	40	1	70	7	> 44		1	75	· · · · · · · · · · · · · · · · · · ·	- 145
Ga-Tshwcc	139	52	10	60		85	8	5 79	80	)	95	95	180
Ga-Tsogwe	174	65	10	70		90	90	104	110	1	115	115	205
Ga-Rasai	87	33	1	40	1	70	7(	47	50	1	75	75	145

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		Required	Height			r for Level					ste for Leve		
Reservoirs	Level B	Level A		Capacity	Number	Unit Cost	Cost	Addition				Add. Cost	
	(m3)	<u>(m3)</u>	<u>(m)</u>	(m3)	(005)	(±1,000 R)	(1,000 R)	(m3)	(m.)	(1005)	(.1,000 R)	(1,000 R)	(11,000 F
(lipyoor East (Alternative-1)	7.045	1 001				1,500			CAAA		1		
Regional Reservoir	7,982	2,993	<u> </u>	3,000	<b>!</b>		1,500	4,982	5000	<u>-</u>	1900	1,900	3,40
Klipvoor East Service Reservoir	7,982 8,082	2,993 3,031	G 220	3,000	- 1	1,500 2,505	1,500	4,982 4,932	5000 3390	22	1900	1,900 4,080	3,40
Leboilwane South	218	3,033	10	<u>- 4,430</u> 90		105	105		130		130		7,13
Tibotwe	135	51	10	60		85	85		130 80	<u>├</u>	95	95	23
Lebothwane North	1,524	572	15	290	·;	240	480		480		315	630	1.11
Mokobjane	142	53	10	60	ī	85	85		90		105	105	19
Bolianilokwe	142	· · · · · · · · · · · · · · · · · · ·	10		1	85	85		90		105	105	1
Stagboom	381	143	10		3	140			240		185		32
Sutelong	512	192	15		1	205	205	312	320	1	260		4
Ga-Hadebi	190		10			95		110	110	1	115	115	21
Modiane	44		10			50			30	<u> </u>	60		11
Rantebeng Dikeb	2,177		15			310			460	3	310		
Makgavetiwane	708		15			230					310		1
Dikgophaneng	82		10			70			50		75		
Rabosura	105		10		1	70			70		\$0	· · · · · · · · · · · · · · · · · · ·	
Ga-Moti Garantlapane	22		10			40					+	0	
Botshabelo	142					40			20		50 105		19
Shakung	490		10						300		245		49
Buffelsdoorn/Moiletswan			15	320		203					240		
Dipompong	218		i	90		105					130		
Kilovoor East (Alternative-2)		1	<u> </u>	í í i	1	10.	1	- 120	- <u></u>	<u>'</u> †	1	1	<u> </u>
Regional Reservoir	5,470	2,051	G	2,100		1,100	1,100	3,370	3400	1	1700	1,700	2,80
Klipyoor East	5,470		G			1,100				1	1700		
Service Reservoir	8,082		220						3390				7,13
Lebothware South	218	82	[i			10				1	130		
Tibolwe	136	51	1 10		1	8					95		
Lebothwane North	1,524				); ;	24(	48	944	480		315		
Mokobjane	142				), 1	8			90	)	105	105	15
Bollantiokwe	142					8					105	105	19
Slagboom	381					140					185		
Sulclong	512					1 20					1 260		
Ga-Hadebi	190					9					115		
Modiane	44					5					60		
Rantebeng/Dikeb	2,17					2 31					310		
Makgavetiwane Dikgophaneng	82					23					310		
Rabosura	105					7					1 <u>71</u> 1 90		
Ga-Moti		· · · · · · · ·				4					)	· · · · · · · · · · · · · · · · · · ·	· • · · · · · · · · · · · · · · · · · ·
Garanilapane	2					i 4					í si		
Botshabelo	14.					1 8					1 105		1
Shakung	490					1 20					24		
Buffelsdoorn/Moiletswan			5	320	5	1 26			+		2 230		
Dipompong	212	8 82			o <u>t</u>	1 10					130		
Klipvoor East (Alternative-3)				I			1200303		T	1	1		1
Regional Reservoir	5,470		G								1700	1,700	
Slagboom	5,47					1 1,10					1700		2,80
Service Reservoir	8,082										_		7,13
Lebothwane South	21					1 10					1 130		
Tiholwe Lebotiwane North	13	6 51 4 57	1	0 6	0	1 8		5 76			l 9		
Mokobjane	1,52					2 24					2 31		
Bollantlokwe	<u>14</u> 14		3 <u>1</u>			1 8 1 8					1 10		
Slagboom											1 10		
Sutelong	51					1 14 1 20					1 18		
Ga-Hadebi	19					1		5 110			1 26		
Modiane						1 5					1 <u>11</u> 1 6		
Raniebeng/Dikeb	2,17					2 31			46	nt	3 310		
Makgavethwane	70					1 23					1 310		
Dikgophaneng	8	2 3	1			il – Ť					1 7		
Rabosura	10	5 3	1			1 7	0.7		7	ō†	1 9		
Ga-Moti		9	3 1			1 4		0 1		0		0 0	
Garantlapane	2	2 1	8 1				0 4				1 5		
Botshabelo	14	2 5				1 8			2 9		1 10		
Shakung	49		\$ <u>1</u>			1 20					1 24		5 4
Buffelsdoorn Moiletswar			5 1	5 32	0	1 26	0 26	0 520			2 23		
Dipompong	21	8, 8,	7. 1	0 9	0	1 10					1 13		+

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	Capacity		Height			r for Level		ومنتجرب			oir for Leve		
Reservoirs		LevelA			Number	Unit Cost	Cost					Add. Cost	
	<u>(m3)</u>	<u>(m3)</u>	(m)	(m3)	(11/75)	(1,000 R)	(1,000 R	(m3)	(m3)	(nos)	(11,000 R)	(x1,000 R)	(1,000)
lipycor Fast (Alternative-1)	7 0 6 3	2,993		- 1 000	·····,	1,500	1,500	4,982	5000		1900	1,900	3,40
Regional Reservoir	7,982			3,000 3,000	1	• · · · ····	1,500	4,982	5000		1900	1,900	3,4
Klipvoor Fast Service Reservoir	7,982 8,032	2,993 3,031	220	2,450	21	2,505	3,055	4,932	3390	22	2915	4,080	7,1
Lebotlwane South	218	82	10	90	L	105	105	128	130	<b>i</b>	130	130	2
Tibolwe	136	51	10	60	' i	85	85	76	80	1	95	95	
Leboliwane North	1,524	572	15	290	2	240	480	944	480	2	315	630	1,1
Makobjane	142	53	10	60	i i	85	85	82	90	1	105	105	1
Bottantickwe	142	53	10	60		85	. 85	82	90	1	105	105	1
Sizgboom	381		10			140		231	240		185		
Sutelong	512		15	200		205		312	320	÷	260	260	
Ga Hadebi	190	<b>1</b>	10			95	95	110	110		115	115	
Modiane	41		10			50			30 460		60		
Rantebeng Dikeb	2,177		15	410 270		310 230			400	<del>ا</del> ت ۱۰۰	310 310	house me an income	
Makgavetiwane Dikgophaneng	708		10			2.50	A		50	· 1	75		<u>ب</u> ر
Rabosura	105				a	70			70		90		
Ga-Moti			10	4	4	40			0	A Charles and a set		0	
Garantlapane	22					40	have been a server of the		20	} <b>1</b>	50		
Botshabelo	142	53	10	60	( · · · · · · · · · · · · · · · · ·	85	85	82	90	tin - Ti	105	105	
Shakung	490	184	15	190	1	205	205	300	300		245	245	
Buffelsdoorn/Moiletswand	840			320		260					230		
Dipompong	218	82	10	<u>90</u>	<u> </u>	105	105	128	130	<u> </u>	130	130	
lipsoor East (Alternative-2)				1						i			
Regional Reservoir	5,470		G		+	1,190		3,370	3400 3400	}	1700	1,700	2,8
Klipvoor East Service Reservoir	5,470 8,032		C 220			1,100		3,370 4,932	3400		1700		2, 7,
Lebothwane South	218			the second second		1 105			+			1 · · · · · · · · · ·	
Tholwe	136				4	1 85					95		
Lebothwane North	1,524					2 240					315		· · · · · · · · · · · · · · · · · · ·
Mokobjane	142		4			8					105		
Bollastlokwe	142	53	10	60	)	85			90	1	105		
Slagboom	381		10			140					185	185	l.
Suleiong	517					205					260		
Ga-Hadebi	190					9					115		
Modiane	44		·			<u>با</u>					60		
Rantebeng Dikeb Makgavetlwane	<u>2,17</u> 708					2 310 1 230			· · · · · · · · · · · · · · · · · · ·		310	the second second from the	
Dikgophaneng	8					1 7(					1 310 1 75		
Rabosura	10	• · · · · · • • • •				1 71			• • • • • • • • • • • • • • • • • • •		1		
Ga-Məti	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		<ul> <li></li></ul>			1 4(			<u>-</u>		)		
Garantlapane	2					1 40			· · · · · · · · ·		50		
Botshabelo	142	2 53			)	1 8					105		
Shakung	490		1	5 190	)	1 20:	20	300			245	245	
Buffelsdoorn Moiletswan						1 260			4		23(		
Dipompong	211	8 82	1	90	);	1 10	5 10	5 128	13	<u></u>	130	130	+
lipvoor East (Alternative-3)								1			1		
Regional Reservoir Slagboom	<u>5,470</u> 5,470		A							1	1700		
Service Reservoir	8,082				2	1 1,100 2,505					1 1700 2975		
Lebotiware South	21					1 10				1	130		
Tihotwe	13		• • • • • • • • · · · · · · · · · · · ·		14	1 8	·				9		
Lebothwane North	1,52		2 1			2 24		944	480		2 315	, s 630	
Mokobjane	14					1 8					105		<b> </b>
Bollantlokwe	14	2 5.			)	1 8			9	)	10		
Slagboom	38					1 14					185		
Sutclong	51					1 20					260	260	); — +—
Ga-Hadebi	19			0 8	<u>)</u>	1 9	5 9				1		
Modiane	4				<u>)</u>	1 5				),	1 60		
Rantebeng Dikeb	2,17				2	2 31					3 310		
Makgavetiwane Dikgophaneng						1 23					1 310		
Rabosura	10					1 7		0 42		., 	1 75 1 90	5' - <u>75</u>	
Ga-Moti			3 1			1 4			^	) )		· · · · · · · · · · · · · · · · · · ·	
Garantlagane	2		2, <u>1</u> 8			1 4			· · · · · · · · · · · · · · · · · · ·		1 50		
Botshabelo	14					1 8							
Shalung	49					1 20					1 24		
Buffelsdoorn Moiletswan						1 26					2 230		
		8 8		0 9		1 10					1 13		r.,

ويتبغنه الملطبة ويستعرب وينطقا والدارجني واستعرب فيراهد الملا	Capacity	Repaired	Height		Reservol	r for Level	Å	<u> </u>			ir for Leve		
Reservoirs	Level 8 (m3)	Level A (m3)			Number	Unit Cost (x1,000 R)	Cost		Capacity (m3)	Number (005)	Unit Cost (v1,000 R)	Add. Cost (x1,000 R)	Total Cost (x1,000 R)
Moretele North (Alternative-1)						I	]						2 5 6 4
Regional Reservoir	2,512	942	G	1,000	1	800	800		1600	1	1000	1,000	1,800
Stagboom	2,512	942	G		1	800			1600	1	1000	1,000	1,800
Service Reservole	5,024	1,883	115	1,670	10		1,720		2100	12	1750	2,520	4,230
Transactie	331	124	10	130	1	130			210	1	175	175	and the second second
Sciepe	105	39	10	40	1	70			70	1	90	90	
Ngobi	1,367	513	10			190			430	2	255	510	89
Swartboom	582	218	15	220	1	210				í <u>1</u>	285	285	L
Dipetle loana	272	102	15			135			170	<u> </u>	180	180	• • • • • • • • • • • • •
Magnife anong Olverian	984	369	15	370	1	285			310	2	250		
Makgapha	174	65	10	70	1	90			110	1	115	· · · · · · · · · · · · · · · · · · ·	
Repostervici	163	61	15	70	1	110		and a set of second	100	<u> </u>	135		
Makeleng	1,045	392	15	400		300	) 30	0 645	330	2	265	530	83
Moretele North (Alt2 & 3)						T					<b>!</b>		<u> </u>
Regional Reservoir	-		I .		l			2				0	
NA		1				1							
Service Reservoir	5,024	1,883	115	1,670	16	1,520			2100	12	1		
Transactic	331	124	10	130	1	1 130			210		175		
Selege	105	39				1 70					90		
Ngobi	1,367	513	K	260		2 19	Lauran				255		
Swartboom	582	218	1			1 210				A	285		
Digetleloana	272					1 13					180		
Moguhiwanong/Ol verton	984	369	1			1 28					2 250		
Makgapha	174	65	1		· · · · · · · · · · · · · · · · · · ·	1 9	·	0 104		· · · · · · · · · · · · · · · · · · ·	11		
Reposterviei	16	61				1 11		0 93			1 13		
Makeleng	1,04.	39	1	5 400	);	130	0 30	0 645	330	<u>}</u>	2 26	5] 53(	8

and an	Capacity	Required	Height		Reservol	r for Level	A	l			ir for Leve		
Reserveirs	Level B (m3)	Level A (m3)	G=Ground (rs)	Capacity (in3)	Number (605)	Unit Cost (11,000 R)	Cost (c1,000 R					Add. Cost (11,000 R)	Total Cost (11,000 R)
Moretele North (Alternative-1)							• 						
Regional Reservoir	2,512	942	G	1,000		800	800		1600	1	1000	1,000	<b>1</b> ,800
Stagboom	2,512	912	6		1	800			1600	1	1000	1,000	1,800
Service Reservoir	5,024	1,883	115	1,670	10	1,520	· · · · · · · · · · · · · · · · · · ·	1     1	2100	12	1750	2,520	4,230
Transactie	331	124	10	130	1	130	1.30	1	210	1	175		
Selepe	105	39	10	40	1	70			70		90	90	
Ngobi	1,367	513	10	260	2	190			430	2	255		\$90
Swartboom	582	218	15	220	1	210			370		285		
Dipetleloana	272	102	15	110	1	135			170		180		
MogohlwaningObiotem	984 174	369	15	370	1	285			310		250	a	••••••••••
Makgapha	174	65	IC IC	- 70	1	90	10		110	•	115		
Renostervlei	163	61	15		1	110			100		135	A 10 1 1 1	
Makekeng	1.045	392	15	400		300	) <b>.30(</b>	645	3.10	2	265	5.30	830
Moretele North (Alt2 & 3)	1		i			1	ĺ			4	4 - 14 - 14 -	,	
Regional Reservoir							0				: • · · · · · · · · ·	0	······································
N.A.	1		1									E	
Service Reservoir	5,024	1,883	115	1,670	10	1,520	1,716	3,094	2100		1750	4 2.2	
Transactie	331	124	10			130		0 201	210	i sa san s	175		
Selepe	105	39	1	40		1 70	) 70	0 65			i 90		h
Ngobi	1,367	513	10	260		2 19				£	2 255	4	
Swartboom	582		1	220		210	0 21			÷ -	1 285		
Dipetleloana	272	102	1	110		1 13	5 13		i	A	180	I = 1 = 1 = 1 = 1 = 1 = 1	
Mogahiwanara Oiserton	984	369	1			1 28:			<ul> <li></li></ul>		2 250		
Makgapha	174	65	1	່າ		9	0 9		4 · · · · · · · · · · · · · · · · · · ·		11		
Renostervici	163	61				1 11					1 13.		24
Makekeng	3,045	392	2 1	400	1	1 30	0, 30	0 645	330	)	2 26	5 530	83

# TABLE A.3-2 SUMMARY OF BULK SUPPLY PIPELINES (Total 5 Sheets)

BULK SUPPLY PIPELINE	UNIT	LENGTH	UNIT COST x 1000 R	TOTAL COST x 1000 R
LIPVOOR WEST(ALT1, ALT2 & ALT3)	1			
BEFORE KLIPVOOR REGIONAL RESERVOIR	-			
160 mm Dia, Steel incl. materials and construction	m	7,800	0.170	1,326
Sub-Total		7,800		1,320
AFTER KLIPVOOR REGIONAL RESERVOIR				
400 mm Dia, Steel incl. materials and construction	្រា	0	0.495	(
350 mm Dia. Steel incl. materials and construction	m	0	0,428	(
300 mm Dia, Steel incl. materials and construction	, m	0,	0,360	(
200 mm Dia. Steel incl. materials and construction	m	5,000	0.284	1,420
200 mm Dia. Steel incl. materials and construction	m	7,700	0.224	1,72
160 mm Dia. Steel incl. materials and construction	m	3,400	0.170	57
140 mm Dia. Steel incl. materials and construction	m	4,400	0.143	62
125 mm Dia, Steel incl. materials and construction	ា	5,200	0.123	64
110 mm Dia. Steel incl. materials and construction	m	35,500	0.102	3,62
90 mm Dia. Steel incl. materials and construction	m	0,	0.075	
Sub-Total		61,200		8,61
Sub-Total of Klipvoor West (Alt1, Alt2 & Alt3)		69,000		9,939

# TABLE A.3-2 SUMMARY OF BULK SUPPLY PIPELINES (Total 5 Sheets )

BULK SUPPLY PIPEIANE	UNIŤ	LENGTH	UNIT COST x 1009 R	TOTAL COST x 1000 R
KLIPYOOR EAST (ALTERNATIVE-1)	1			
BEFORE KLIPVOOR EAST REGIONAL RESERVOIR				
400 mm Dia, Steel incl. materials and construction	m	7,600	0,495	3,76
	···· ····	7,600	V.172	3,76
Sub-Total AFTER KUPVOOR FAST REGIONAL RESERVOIR		· · · · · · · · · · · · · · · · · · ·		
AFTER KUPVOOK PAST REGIONAL RESERVOIR	·-	9,100	0.495	4,50
400 mm Dia, Steel incl. materials and construction		3,300	0.428	1,4)
350 mm Dia. Steel incl. materials and construction	m	14,300	0.360	5,14
300 mm Dia. Steel incl. materials and construction	B	7 300	0.292	2,13
250 mm Dia. Steel incl. materials and construction	<u>m</u>	4,200	0.220	
250 mm Dia. uPVC incl. materials and construction		9,200	0.224	2,06
200 mm Dia. Steel incl. materials and construction	m	9,200	0.166	
200 mm Dia. uPVC incl. materials and construction	<u> </u>	10,800	0.100	1,83
160 mm Dia, Steel incl. materials and construction	<u>m</u>	10,500	0.120	
160 mm Dia, uPVC incl. materials and construction	<u> </u>	6,700	0.143	9
140 mm Dia. Steel incl. materials and construction	m		0.143	· · · · · · · · · · · · · · · · · · ·
140 mm Dia. uPVC incl. materials and construction	m	50		
125 mm Dia. Steel incl. materials and construction	<u> </u>	700	0.123	6 ·- ·- ·- · · · · · · · · · · · · · ·
125 mm Dia, uPVC incl. materials and construction	<u>m</u>			
110 mm Dia. Steel incl. materials and construction	m	11,300	0.102	· · · · · · · · · · · · · · · · · · ·
110 mm Dia, uPVC incl. materials and construction	<u> </u>	12,950		
90 mm Dia. Steel incl. materials and construction	<u>m</u>	1,500	0.075	
90 mm Dia, uPVC incl. materials and construction	<u>m</u>	13,650		22,2
Sub-Total	13.015	105,050	The second s	26.0
Sub-Total of Klipvoor East (Alternative-1)	1 (1 (1 (1 (1 (1 (1 (1 (1 (1 (1 (1 (1 (1	112,650	n di xa Guigi	40,0.
(LIPYOOR EAST (ALTERNATIVE-2)				
BEFORE KLIPVOOR EAST REGIONAL RESERVOIR				
300 mm Dia, Steel incl. materials and construction	តា	7,600	0.360	2,7
Sub-Total		7,600		2,7
AFTER KLIPVOOR EAST REGIONAL RESERVOIR	·		· · · · · · · · · · · · · · · · · · ·	
400 mm Dia, Steel incl. materials and construction	m		0.495	
350 mm Dia. Steel incl. materials and construction	m	9,100	0.428	3,8
300 mm Dia, Steel incl. materials and construction	m	9,500		
250 mm Dia. Steel incl. materials and construction	m	7,300		
250 mm Dia, uPVC incl. materials and construction	m	4,200		
200 mm Dia, Steel incl. materials and construction		9,200	0.224	
200 mm Dia, uPVC incl. materials and construction	m	· [	0.160	
160 mm Dia. Steel incl. materials and construction	m	10.800	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·
160 mm Dia, uPVC incl. materials and construction			0.120	
140 mm Dia. Steel incl. materials and construction	m	3,500	the second secon	
140 mm Dia, UPVC incl. materials and construction	 m	6,050		
125 mm Dia, Steel incl. materials and construction	m		0.12	
125 mm Dia, UPVC incl. materials and construction	- <u>m</u>	6.000	· · · · · · · · · · · · · · · · · · ·	
110 mm Dia. Steel incl. materials and construction	m	1	0.10	· · · · · · · · · · · · · · · · · · ·
110 mm Dia. Steel Incl. materials and construction	m	24,250		· · · · · · · · · · · · · · · · · · ·
90 mm Dia, Steel incl. materials and construction			0.07	· · · · · · · · · · · · · · · · · · ·
90 mm Dia. Steel Incl. materials and construction	-1- <u>m</u>	15,150	······································	
		105,05		18.
Sub-Total				21.0
Sub-Total of Klipvoor East (Alternative-2)	1.043	112,654		T CALENDAR

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# TABLE A.3-2 SUMMARY OF BULK SUPPLY PIPELINES (Total 5 Sheets)

BULK SUPPLY PIPELINE	UNIT	LENGTH	UNIT COST x 1000 R	TOTAL COST x 1000 R
KLIPVOOR EAST (ALTERNATIVE-3)				
BEFORE KLIPVOOR EAST REGIONAL RESERVOIR				
N.A.	តា	0	0	0
Sub-Total	1	0		
AFTER KLIPVOOR EAST REGIONAL RESERVOIR	I			
400 mm Dia, Steel incl. materials and construction	m	8,150	0.495	4,034
350 mm Dia, Steel incl. materials and construction	m		0.428	0
300 mm Dia, Steel incl. materials and construction	m	9,500	0.360	3,420
250 mm Dia. Steel incl. materials and construction	m	7,300	0.292	2,132
250 mm Dia. uPVC incl. materials and construction	m	4,200	0.220	924
200 mm Dia, Steel incl. materials and construction	m	9,200	0.224	2,061
200 mm Dia, uPVC incl. materials and construction	m		0.166	<u> </u>
160 mm Dia. Steel incl. materials and construction	m	10,800	0,170	1,836
160 mm Dia, uPVC incl. materials and construction	m		0.120	· · · · · ·
140 mm Dia. Steel incl. materials and construction	m		0.143	(
140 mm Dia, uPVC incl. materials and construction	m	6,750	0.108	729
125 mm Dia, Steel incl. materials and construction	m		0.123	(
125 mm Dia, uPVC incl. materials and construction	m	8,000		
110 mm Dia, Steel incl. materials and construction	m		0.102	
110 mm Dia, uPVC incl. materials and construction	m	11,850		972
90 mm Dia. Steel incl. materials and construction	m		0.075	L (
90 mm Dia, uPVC incl. materials and construction	m	20,300	0.066	1,34(
Sub-Total		96,050	L	18,135
Sub-Total of Klipvoor East (Alternative-3)	10.25	96,050		18,135

# TABLE A.3-2 SUMMARY OF BULK SUPPLY PIPELINES (Total 5 Sheets)

BULK SUPPLY PIPELINE	UNIT	LENGTH	UNIT COST x 1000 R	TOTAL COS x 1000 R
MORETELE NORTH (ALTERNATIVE-1)				
FROM KLIPDRIFT WTW TO OFF-TAKE POINT		• · · · · · · • • •		
N.A.	 10.	۰۰۰۰ ۳۵	0	
Sub-Total		n.		
AFTER SLAGBOOM REGIONAL RESERVOIR		· · · · · · · · · · · · · · · · · · ·		
400 mm Dia. Steel incl. materials and construction	ញា	}··· • • = ·-{	0.495	
350 mm Dia. Steel incl. materials and construction	m		0.428	
300 mm Dia. Steel incl. materials and construction	m	9,900	0,360	3,50
250 mm Dia, Steel incl. materials and construction	m		0.292	
250 mm Dia, aPVC incl. materials and construction	m	5,500	0.220	1.2
200 mm Dia. Steel incl. materials and construction	m		0.224	
200 mm Dia, uPVC incl. materials and construction	m	6,000	0.166	9
160 mm Dia. Steel incl. materials and construction	m	900	0.170	1
160 mm Dia. uPVC incl. materials and construction		400	0.120	
140 mm Dia. Steel incl. materials and construction	- 1 - <u>0</u>		0.143	
140 mm Dia, uPVC incl. materials and construction		· · · · · · · · · · · ·	0.108	
125 mm Dia. Steel incl. materials and construction		5,500	0.123	6
125 mm Dia, uPVC incl, materials and construction	m	1	0.086	· · · · · · · · · · · · · · · · · · ·
125 mm Dia, ur ve like, materials and construction	m	· · · · · · · · · · · · · · · · · · ·	0.102	•
110 mm Dia, Seet fiel, materials and construction		5.850	0.082	
90 mm Dia, Steel incl. materials and construction		5.100	0.075	the state of the s
90 mm Dia, uPVC incl. materials and construction	m	10,300	0.066	
Sub-Total		49.450		8,1
Sub-Total of Moretele North (Alternative-1)		49.450	মাহামান প্ৰায় হয	8,1
			<u></u>	
MORETELE NORTH (ALTERNATIVE-2)	21		· · · · · · · · · · · · · · · · · · ·	ļ
FROM KLIPDRIFT WTW TO OFF-TAKE POINT			······	},
Use existing MW Nylstroom Pipeline	<u>m</u>	0	(	·
Sub-Total		0		4,8
AFTER OFF-TAKE POINT				
400 mm Dia. Steel incl. materials and construction	m		0.495	
350 mm Dia. Steel incl. materials and construction	<u></u>		0.428	
300 mm Dia. Steel incl. materials and construction	<u></u>		0.360	
250 mm Dia, Steel incl. materials and construction	m	12,700	0.29	• • • • • • • • • • • • • • • • • • •
250 mm Dia, uPVC incl. materials and construction	<u>m</u>		0.22	·
200 mm Dia. Steel incl. materials and construction	្រា	7,400	0.22-	A stream start management and
200 mm Dia. uPVC incl. materials and construction	៣		0.16	- · · · · · · · · · · · · · · · · · · ·
160 mm Dia. Steel incl. materials and construction			0.170	
160 mm Dia, uPVC incl. materials and construction	m		0.12	)
140 mm Dia. Steel incl. materials and construction	m	7,600		
140 mm Dia, uPVC incl. materials and construction	m		0.10	· · · · · · · · · · · · · · · · · · ·
125 mm Dia. Steel incl. materials and construction	m		0.12	
125 mm Dia. uPVC incl. materials and construction	m		0.08	· · · · · · · · · · · · · · · · · · ·
110 mm Dia. Steel incl. materials and construction	m	800		
110 mm Dia. uPVC incl. materials and construction	m	_	0.08	
90 mm Dia. Steel incl. materials and construction	m	20,500		
90 mm Dia, uPVC incl. materials and construction	<u>m</u>	.	0.06	
Sub-Total		49,000		8,
Sub-Total of Moretele North (Alternative-2)	A State of the	49,000	小 活動 なもう	12,9

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# TABLE A.3-2 SUMMARY OF BULK SUPPLY PIPELINES (Total 5 Sheets)

BULK SUPPLY PIPELANE	UNIT	LENGTH	UNIT COST x 1000 R	TOTAL COST x 1000 R
MORETELE NORTH (ALTERNATIVE-3)				
FROM KLIPDRIFT WTW TO OFF-TAKE POINT				
400 mm Dia, Steel incl. materials and construction	m	35,000	0.495	17,325
Sub-Total		35,000		17,325
AFTER OFF-TAKE POINT				
400 mm Dia. Steel incl. materials and construction	m	7,200	0.495	3,564
350 mm Dia. Steel incl. materials and construction	m	21,800	0.428	9,330
300 mm Dia. Steel incl. materials and construction	m	6,000	0.360	2,160
250 mm Dia. Steel incl. materials and construction	m	1	0.292	(
250 mm Dia, uPVC incl. materials and construction	កា		0.220	(
200 mm Dia, Steel incl. materials and construction	m	1	0.224	(
200 mm Dia, uPVC incl. materials and construction	m		0.166	(
160 mm Dia, Steel incl. materials and construction	m		0.170	(
160 mm Dia, uPVC incl. materials and construction	m		0.120	(
140 mm Dia. Steel incl. materials and construction	m	400	0.143	51
140 mm Dia, uPVC incl. materials and construction	m		0.108	(
125 mm Dia. Steel incl. materials and construction	n		0.123	(
125 mm Dia, uPVC incl. materials and construction	m	[ ]	0.086	
110 mm Dia. Steel incl. materials and construction	m	800	0.102	8.
110 mm Dia, uPVC incl. materials and construction	m		0.082	(
90 mm Dia. Steel incl. materials and construction	m	20,500	0.075	1,538
90 mm Dia, uPVC incl. materials and construction	m	L	0.066	[
Sub-Total		56,700		16,73
Sub-Total of Moretele North (Alternative-3)	1925	91,700		34,056

TABLE A.3-3 SUMMARY OF BOOSTER PUMP STATIONS

		EV NW	THOTAH WATE THE		NO. OF UNIT		FLOW/UNIT	FLOW/UNIT Pm REQUIRED TOTAL	TOTAL	COST OF PUMP	PUMP STATION
			(m)	Oneratio	meration Stand-by	Total	(m3/min)	(Kw)	Pm (Kw) P	Pm (Kw) PUMP SET (R) CC	COST (R)
But an											166,580
Klipvoor West							0.045		33.0	- *	166.580
Ga-Tsogwe	1.512	0.091	80	2		3	CP0.0	11.0			201 045
Klinvoor East I						-					151.000
	10 222	000 0	25	2	•••	ŝ	1.450	18.5	55.5	SCU,88	1 CT-N07
BOIADUOKWC	10,000	1.				3	1.259	30.0	90.06	159,008	454,308
Surciong	407.14						0.403	110	33.0	58.303	166.580
Makgavctlwane	13.437	0.806	9	۷	-	ñ		2			616 919
Klinvoor Fact 2											
	002 5	100 U 100	35	6		E	660'0	3.7	11.1	19,611	26,051
BOJARUOKWC	500.0					6	1 750	30.0	<u>90.0</u>	159.008	454,308
Sutelong	41.904	<b>9TC7</b>	2	7	-	2	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2			50 2021	166 520
Makoaverlwane	13.437	0.806	8	61		9	0.403	11.0	0.00		000 VV
FILLER 2											000'070
C terrs Jooddiny	11 044	2 5 1 6	75	6		eri 	1.259	30.0	90.06	159,008	454,308
Suiciong	+0A-1+	1					0,402		33.0	58.303	166.580
Makgavetlwane	13,437	0.800	S	7		U.	224-22	2.4.4			454 308
Moretele North 1						-					15.0.200
Cleanorm	43 KOR	43 608 2 616	04	7		Ś	1.308	30.0	90.0	IJY,W85	
otakoonin	2002										

111. 34311 Barltona 41. 31	<b>IFLOW</b>	FLOW FLOW HEIGHT	HEIGHT		NO. OF UNIT	LT T	FLOW/UNIT	FLOW/UNIT Pm REQUIRED			PUMP STATION
	(l/sec)	(I/sec) (m3/min)	( <b>B</b>	15	peration Stand-by	Total	(m3/min)	(Kw)	Pm (Kw)	Pm (Kw) PUMP SET (K)	
Plimon Weet						-		:			CC0'TT
	0 557	0.034	NN NN		1	2	0.034	11.0	22.0	38.869	111.053
Ca-1sopwe	200.0	100.0	ŝ								600,696
Klipvoor East I		-						105	57.0	65 370	186.771
Bolantlokwe	18.125	1.087	45			7	120.1				1000
CutalAnd	1< 727	0 044	75		1	2	0.944	30.0			2012/2012
Outvioug	2000	0.202				5	0.302	11.0	22.0	38,869	111,053
Makgavouwane	2.00.0	40.000									451,279
Klipvoor East 2		-								12 NTA 11	27 750
Bolantholwe	1 241	0.074	35				0.074				
Contraction of	15 727					2	0.944	30.0	60.0	106,005	302,8/2
Succous	10.01					ſ	0302	011	22.0	38.869	111,053
Makgavetiwane	5.039	0.302	N N			7	1000				413 925
Klipvoor East 3											10 000
Sutelong	15 737	0.944	75		1		0.944	30.0	0.09	-	710'700
Julian States	020 2	0300				2	0.302	11.0	22.0	38,869	111,053
Margavenwalle	2.0.2	1000									302,872
Moretele North 1	-					-				105 005	200 877
Slachoom	16.353	0.981	0 C		<u>-</u>		0.981	50.0	00.00		1049900
Olagouu	10.01			-							

Vol.3 Klipvoor

	<b>TELOW</b>	FLOW FLOW HEIGHT	HEIGHT	NO	NO. OF UNIT		FLOW/UNIT Pm REQUIRED TOTAL	m REQUIRED	TOTAL	COST OF	FUNE STALLON
	(l/sec)	(l/sec) (m3/min)		<b>Operation</b> Stand-by	stand-by	Total	(m3/min)	(Kw)	Pm (Kw)	Pm (Kw) · PU.MP SE1 (K)	
											050,001
Klipvoor West						ſ		011	0 22	58 303	166 580
Ga-Tsogwe	1.512	160.0	80	2	 rrt	3	0.040	NTT			570 100
Klipvoor East 1								·			5105 100C
Dolastichus	48 323	006 6	45	2	<del>,</del>	ų	1 450	18.5			101.102
DUIdINUAWE	20012		75	2	1	5	1.259	30.0	90.0	159,008	454.308
Suciong	105.14			i c		6		11.0	33.0	58.303	166.580
Makgavetlwane	13.437	0.806	67	4	<b>-</b>	0		× + + +			616.919
Klipvoor East 2				_							25 123
Balantakwe	3 309	0.199	35	6	-	'n	0.099	3.7			10000
Portania	11 064	Í		6	1	m	1.259	30.0		159,008	454,506
Succong	101-11-			2				011		1202 85	166.580
Makgavetlwane	13.437	0.806	70	5		ŝ	0.402	<u>0-11</u>			888 069
Klipvoor East 3											0001020
Sutelong	41.964	2.518	75	6	1	ę	1.259	30.0			404,900
9	LEV C+		5	6		5	0.403	11.0	33.0	58.303	166.580
Makgayeuwane					-						454,308
Moretele North I	-								0.00	1 40 005	454 308
Slagboom	43.608	2.616	2	2		3	1202.1	0.00			

STATIONS
<b><b><i><u>SUMMARY OF BOOSTER PUMP STATIONS</u></i></b></b>
MARY OF BO
TABLE A.3-3 SUM
TAI

	FLOW	FLOW FLOW HEIGHT	THOIL	ž	NO. OF UNIT		FLOW/UNIT Pm REQUIRED	m REQUIRED	TOTAL		PUMP STATION
	1/con)	m3/min)		neration	Oneration Stand-by	Total	(m3/min)	(Kw)	Pm (Kw) :	Pm (Kw) : PUMP SET (R)	COSI (K)
194459451450+6845845614145					1 × 1						111,053.
Klipvoor West						ſ	0.024	11.0	22.0	38.869	111.053
Ga-Tsogwe	0.567	0.034	02	-	-	7	+000				969.009
Klipvoor East I											127 781
Bolantlokwe	18125	1.087	45	1		17	1.087	C.81			1// 001
Cutelono	15 737	0.944	75		1	5	0.944	30.0			202,314
	× 010	0.500	20			2	0.302	11.0	22.0	38,869	200.111
Markavenwane	500.0			ť							451,279
Klipvoor East 2								ic c	;	12 074	27354
Bolantlokwe	1.241	0.074	35	1		2	0.0/4		<b>t</b>	10,01	202 002
Sutelong	15,737	0.944	70	1	1	61	0.944	30.0		c00,001	710'700
Outcom						2	0.302	11.0		38.869	111.053
Makgavetiwane	60.0	1700.0	2				-				413,925
Klipvoor East 3						•		0.00	202	100 001	202 872
Sutelong	15.737	0.944	75	1		7	0.744	0.00			111 003
Makanethuane	5 030	0.302	20		-1	64	0.302	11.0	22.0	20.00	CCN'TTT
INIAN KAVUWAIN	222										302,872
Moretele North 1						Ċ	A 001	0.02	VUV	106.005	302.872
Slagboom	16.353	0.981	ō2			7	106'0	0.00			

TABLE A.3-4 SUMMARY OF INTAKE PUMP STATIONS

# KLIPVOOR WTW

<b>INTAKE PUMP</b> FLOW FLOW HEIGHT	FLOW	FLOW	HEIGHT	Ź	NO. OF UNIT	F	FILOW/UNIT	Pm REQUIRED	TOTAL	FLOW/UNIT Pm REQUIRED TOTAL COST OF	Š.
STATION	(l/sec)	(m3/min)	(l/sec) (m3/min) (m) O	peratio	peration Stand-by	Total	(m3/min)	(Kw)	Pm (Kw)	PUMP SET (R)	COS
Alternative - 1. Level B											
	1167 540	167 540 10.052	20	5	1	6	5.026	30.0	0.06	159,008	e a definition de la construcción de
Alternative 2 I evel R											280,157
	1121 740	7 304	20	2	7-1	3	3.652	18.5	55.5	98,055	
Altomative - 7 - I and R											8 <b>3,29</b> 0
	22.020	1.321	201	5	1	6	0.661	5.5	16.5	29,151	
Atternative - 1. Level A											
	1 62.828	3.770	20		1	2	3.770	30.0	60.0	106,005	302,872

# KLIPDRIFT WTW

INPAKE DIMB	ILEI OW EI OI	ET OW	HEICHT		VO. OF UNIT		FLOW/UNIT	FLOWAUNIT PEREOURED TOTAL	TOTAL	COST OF	PUMP STATION
					ametion Stand-bu	Total	(mim)	(Kw)	Pm (Kw)	Pm (Kw) PUMP SET (R)	) COST (R)
	(1/360)	(num)crur) (cos)	(111)	C per auou	OLD BUT - US			( = v)			
Alternatives-2.2.5									-		454,308
	222 304	12 500	00	6		6	6.250	30.0	90.06	159,008	3 454,308
	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	>>>>									

## Vol.3 Klipvoor

TABLE A.3-4 SUMMARY OF INTAKE PUMP STATIONS

# KLIPVOOR WTW

INTAKE PUMP FLOW FLOW HEIGHT	FLOW	FLOW H	THOIAT		<b>O. OF UNIT</b>		FLOW/UNIT Pm REQUIRED TOTAL COST OF	n REQUIRED	TOTAL	COST OF	5
STATION	(1/sec) (	(1/sec) (m3/min) (m) O	<b>E</b>	0	peration Stand-by	Total	(m3/min)	(Kw)	Pm (Kw) P	UMP SET (R)	COST
Alternative - I I evel R	B										454,308
	1167 540 10 052	10.052	20	6		3	5.026	30.0	90.06	159.008	
a land C contraction	01-1011	*////T	3	1							280,157
ALLET NULLE - 2, LEVEL	4			+							
	1121.740	121.740 7.304	20	6		'n	3.652	18.5	55.5	98,055	
Alternative - 3 Level R	~										83,290
			~~~~	ſ		· · · · · · · · · · · · · · · · · · ·	0 661	2.2	2 71	151 06	83,290
	22.020 1.521	1.521	70	Y			TOO'O	0.0			
Alternative - I Level A	۲								-		
				F	-	C I	2 770	0.05	60.0	106.005	302.872
	07.828	07.828 3.1/0	ŝ	-	17	- V	0110	2.22		10000	

# KLIPDRIFT WTW

INTAKE PUMP FLOW FLOW HEIGHT	FLOW	TIOW FLOW HEIGHT	<b>IEIGHT</b>		NO. OF UNIT		FLOW/UNIT Pm REQUIRED TOTAL Treal (m3/min) (Kw) Pm (Kw) PU	m REQUIRED	TOTAL Pm (Kw)	COST OF PUMP SET (R)	Pm (Kw) PUMP SET (R) COST (R)
NUTTER		(aunit/can)	(111)	۶H.	auru-1		(and a second to be a				AGE ASA
Alternatives-2 & 3									1	000.02	
Level B 208.333 12.500	208.333	12,500	8	61		ñ	6.250	30.0	20.05	000'KCT	474-200

TABLE A.3-5 SUMMARY OF RETICULATION PIPELINES (Level B)

Length of Retentation R Pipe (m)         Length of A(0)           Pipe (m)         7,113           Pipe (m)         2,734           Pipe (m)         2,735           Pipe (m)         2,436           Pipe (m)         3,435           Pipe (m)         2,436           Pipe (m)         2,436           Pipe (m)         2,436           Pipe (m)         2,436           Pipe (m)         2,334           Pipe (m)         2,347           Pipe (m)			and share	Teres I		A 740	l avel À	H lave H								1							I
Monta         India (and bit)         Montal (and bit) <thmontal (and="" bit)<="" th=""> <thmontal (and="" bit)<="" th="">         &lt;</thmontal></thmontal>	Klinvoor			Ň	V(day)			Length of	Proport	ion of F	ipe Dia	meter	<b>5</b> 6)				Length	of Pipelin	for Each	Diameter (n	~		ت منعد د
Antonin		Household	L		Level B			teticulation		- E						li			1.000	4		212	•   
100         100 <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>Pipe (m)</th> <th>Pipe (m)</th> <th>35</th> <th></th> <th></th> <th>ļ</th> <th>- 1</th> <th>2</th> <th></th> <th>Ŷ</th> <th>9</th> <th>911</th> <th>ġ</th> <th>(#)</th> <th></th> <th>5</th> <th>Î</th>							Pipe (m)	Pipe (m)	35			ļ	- 1	2		Ŷ	9	911	ġ	(#)		5	Î
Nor         Nor <th></th> <td></td> <td>1.700</td> <td>51.000</td> <td>136.068</td> <td>176.0</td> <td>169'*</td> <td>10,925</td> <td></td> <td></td> <td></td> <td>4</td> <td></td> <td>9.01</td> <td></td> <td>1.647</td> <td>Ē</td> <td>1,310</td> <td>1055</td> <td>649</td> <td></td> <td></td> <td>ŝ</td>			1.700	51.000	136.068	176.0	169'*	10,925				4		9.01		1.647	Ē	1,310	1055	649			ŝ
min         1/m         1/m <th></th> <td>99</td> <td>MCS Y</td> <td>195 840</td> <td>10. 22</td> <td>283.5</td> <td>7.461</td> <td>14.866</td> <td>29.00 23.00</td> <td>i.</td> <td>L</td> <td></td> <td></td> <td>100.0</td> <td></td> <td>3,419</td> <td>2</td> <td>1,655</td> <td>1.149</td> <td><u>Ş</u></td> <td></td> <td></td> <td>Ş.</td>		99	MCS Y	195 840	10. 22	283.5	7.461	14.866	29.00 23.00	i.	L			100.0		3,419	2	1,655	1.149	<u>Ş</u>			Ş.
Might (Nerve         Nor         Nor <t< td=""><th></th><td>97</td><td>0.80</td><td>20 640</td><td>X7.084</td><td>102.01</td><td>2.784</td><td>8.213</td><td>37.69 27.MK 20.63</td><td>13.40</td><td></td><td></td><td></td><td>100.0</td><td></td><td>2,290</td><td>1,694</td><td>1,133</td><td>ö</td><td>-</td><td></td><td></td><td>i i</td></t<>		97	0.80	20 640	X7.084	102.01	2.784	8.213	37.69 27.MK 20.63	13.40				100.0		2,290	1,694	1,133	ö	-			i i
Thermonic         10         10		3	LVI Y	184.416	407 072	0.07.0	611-2	14.371	23.00 17.00	F ×	L	t		100.0		3,305	2,443	1,581	1,150	H62			E d
Unimate         1         0         0.00         0.	4 Mogon/Warrong mci, Uwerton		1000	009 02	1177 1.0	0.00	YKY L	0.406	77.60 27.8K 20.63	L	L			100.0		2,647	1,959	1,310	0	0	0	0	100
Optimize         1/2         0/01	3 Kenoktervici 1 Joonane	2	1070.1				513 0	HCB L	37 66	94.64		-		100.00		2182	1,615	0.01	ō	0	0		10
Turner         Turner<		\$	2	100 67	204.00	0.04	1440 D	AAC AC	00.11.00.00.00.00	1_	1_					6.956	5.141	3,327	2,419				10.24
Orientement         Distantion         Distantion <thdistantion< th="">         Distantion         Distant</thdistantion<>	7 Ngobi	1.256	Tec.X	477002	000	N.5.V	7/7/01	107 D		3	1	1	Ł	1	]_	8	1406	8	\$	8		2	ş
Montention         Open by the state         Montention	N Swaartboom Swartboom	535	3,638	109,140	291,186	103.5	7,823	N.205	00/1 00/77 00/6Z	3	.L.	_	£				100	1071 0	1.00	102			8
(Manute, total)         (4.01         (3.02         (3.14)	9 Transaksie	304		62,016		371.5	9,729	18,092	32.76 24.23	·	_1			1		_1_	<b>.</b>			1			19
Waterini         Waterininintervininterinitity and thereininterinintervinitie intervininte	Sub-Total of Moretele North	4,615		091.460		2,238.0	59,070	122,303	A State of the second s			_			_1	-L		450	.  .		Ì.	1	
Bullenen         Geo         Geo         Geo         Constrained	10 Ga-Tenene Waterval	8	NHO I	32,640	×7.084	5°99	1,869	116'9	387.12 697.18	13,80				100.0	1	1,927	1,426	8	- -		İ		
mem         100 <th></th> <td>55</td> <td>4 4300</td> <td>174 640</td> <td>159 220</td> <td>202</td> <td>18.723</td> <td>30,885</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>100.01</td> <td></td> <td>7,104</td> <td>5250</td> <td>3371</td> <td>2.471</td> <td></td> <td></td> <td>Ì</td> <td>520</td>		55	4 4300	174 640	159 220	202	18.723	30,885						100.01		7,104	5250	3371	2.471			Ì	520
Three         201         100         2000	1	3	I GRU L	10 400	K7 0K4	\$ 061	1402	102.0			-	-		100.0		َ عکا	206'1	1,272	ö	ō	0	0	3
Offlowere         131         140         1210         5200         1200         2200         2200		3			OWC NE C	74.5	0.000	2001	10.76	11.99	L	3		100.0	÷ .	1,746	1,104	<b>K64</b>	639	428	0	0	ŝ
Outworker         Out         Outs						0	774 0	144	07 14	80	L.,	 	‡	100.00		2.167	1,604	1,073	0	õ	0	0	Ē
(University         (1)         (2) <th< td=""><th>14 Kgomo-Kgor Dinaletvane</th><td>*</td><td>10.1</td><td>014/15</td><td>01010</td><td>Ň</td><td>C/#/7</td><td>C//1/</td><td>00/07 00'17 60'10</td><td>1</td><td></td><td>1</td><td>Ι_</td><td>ę.</td><td></td><td>4 840</td><td>1 400</td><td>2 720</td><td>1.694</td><td>271</td><td></td><td>n</td><td>E I</td></th<>	14 Kgomo-Kgor Dinaletvane	*	10.1	014/15	01010	Ň	C/#/7	C//1/	00/07 00'17 60'10	1		1	Ι_	ę.		4 840	1 400	2 720	1.694	271		n	E I
Metric         2110         (1.2.2)         (1.2.1)         (2	15 Legonyane	9			348.134	435.5	11,893	1/1/12	24.00 25.00 17.00	<b>N</b> 11			. Ł.,		L	1 674	100	1 463	R	C	. 	İ.	80
Weit         2.10         1.000         5.000         1.001         5.000         1.001         5.000         1.001         5.000         1.001         5.000         1.001         5.000         1.001         5.000         1.001         5.000         1.001         5.000         1.001         5.001         0.001         5.001         0.011         0	16 Sephai	8		'. <b>R</b>	103,412	180.5	4,807	11,090	36.04 24.11 17.43		2	-			4.	ł	1	3				Ĺ	3
200         1700         5500         1700         5500         1700         5500         1700	Sub-Total of Klipvoor West	2,219	15,089	452,676		1,717.0	45,334	94,257			-	[			1			70271					
1         2000         11,600         400         2000         11,600         400         2000         11,600         41,700         11,000         41,700         11,000         41,700         11,000         41,700         11,000         41,700         11,000         41,700         11,000         41,700         11,000         11,700         11,000         11,700         11,000         11,700         11,000         11,700         11,000         11,700         11,000         11,700         11,000         11,700         11,000         11,700         11,000         11,700         11,000	17 Bollantlokwe	260	1,768		141,511	166.5	4,446	772,01	32.76 24.23 16.21	11 89		z		00.00	_[	2563		1.26%	Ş	200			
2.000         1000         7700         15200         9700         1730         9700         1730         9700         1730         9700         1730         9700         1730         <	18 Dikebu incl. Ranteberg	0007	13,600	408,000	3,0KK 544	421.5	11,017	19,925	20.00					100.0		4,533	5550	2.1%	1.594	1.195			
evelo         2770         Ni.600         21770         Ni.600         21760         Ni.600         21701         Ni.600         Ni.600     <	10 Lebothene North	2,800	19.040	571.200	1.53,82	351.0	02.0	17,340	20.02					100.0		3.944	2,948	1,907	2M2	040			2
Drate         260         758         57.040         14.51         37.26         4.37         10.01         3.255         2.279         1.966         4.11         0.01         0	20.1 ittle 1 chothrane South		2.720	909'IR	217 709	26	2.719	8,121					-	100.0		1.878	1.389	8	1289	Эğ	25		8,121
We         655         19,544         75,200         1,547         1,017         7,146         2,400         1,200         1,	") Molebusine Minishuna		1 768		141 511	312.0	8.195	119.21	32.76 24.23 16.21	ί		ŧ		100.0		3,855	2.579	1,908	1.411	ŝŝ	•		6
9.00         6.90         1.700         1.000         0.00		8		1_	54.0		122	10.137	17 60 27 38 20 63	Į_	 		<u> </u>	100.0	I_	2,726	2,091	1.3%	0	0	0		0.137
220         1770         510         500         1500         500         500         1500         500<	21 Subbar Anternal	2 0	2017	974 101	212 112		102.0	17 460	74.00 21.00 17.00	1÷	1	I	L	0.001	<u> </u>	4,018	2,970	1,922	1,307	1,048	_	•	0.460
Funa         73         510         1.000					20.050	Š	205		12.35 24.25 26.21	1	L	<u> </u>		8		1.550	1,037	767.	<b>56</b> K	260	0	6	100.0
600         4,200         135,700         5,510         14,400         2,600         157,448         4,001         1,600							361	LXO X	21.2 01.02 24.14	1	<u> </u>		†	001		2.973	1,990	ö	0	- 0	0	ŀ	CHQ H
TOD         47400         2330/11         3005         8,131         15,819         2000         17,00         17,00         17,00         17,00         17,00         12,00         12,00         12,00         12,00         12,00         12,00         12,00         12,00         12,00         12,00         200         12,00         12	Suchamped and	2					DAT AT			F_	L.,		٤.	8		\$ 607	4144	2,662	1.950	1,463			24.370
350         2.300         71,400         90,455         445         1.305         6.105         6.105         6.105         1.41         1.44         4.45         4.30         1.301         2.31	20 Margapottwane		0.444	1077 101	200		10.13	15.270		1.	1.		$1 \pm 1$	0.001		3,63#	2,689	1,740	1,266	949			5,419
430         3000         71,400         74,80         2,077         2,007         1,000         1,000         2,007         1,761         1,771         0		-			Nov Vor		- CV2. I		2	.E_	Ι.		1_	8		1141	40,1	809	516	30	Ì	0	6 105
350         2300         71,400         700,405         82.5         2,231         7,400         71.3         1,701         1,721         1,720         1,720         60	AD Challenge				244 002	1.	AFC FI	100	88	<u> </u>	<u>} :</u>		1	0.00	I.	5.704	3,923	2,538	1,846	1,3%5			5
und         7773         81/160         21/771         600         1166         5900         6475         5110         2115         1         1000         2.668         1.796         1.797         0		096	NAC C	100	100 405	11	2.281	1404	2045 2132 17.10	I	Ι.	1	 	0.001		1,734	1200	8SH	634	\$	314	ō	56
R         S41         1632         4.354         2.05         664         5.225         4.75         215         1         1000         2.04         1.750         1.157         0	The second second	9	lan	091.8	121.5	0.04	1.186	2 940	4.75 33.10 22.15	L	I	L	<u></u>   	100.0		1,966	1,3:6	0	•		•	6	3
20     130     246     1,201     2,46     1,201     2,46     1,201     0	at CarMati	Ä	3	1620	4 354	1	880	5225	44.75 33.10			.  -		100.0		1,7301	1,157	0	5	Ģ	-	0	ğ
130     344     26530     70755     1395     37769     9,5871     77.66     27.86     2671     1,078     1,322     0	2. Completions	Ģ		4 000	10,885		516	5555	44.75 33.10	   :	_	-	 	100.0		1,839	1,230	0	0	6	0	0	\$.55
200     1.360     40,800     7.844     137.0     3.686     9.496     36.41     77.11     NKL     100.0     3.622     2.376     1.057     XGK     0     0     0       7.17     19.01     66.317     2.885     9.496     36.41     77.11     NKL     1.360     3.622     2.334     10.194     5.61     2.366       7.17     19.01     66.317     5.885.5     103.156     2.77.543     3.441.102     1.36.566     4.41.102     2.37.543     2.405     2.41.102     2.366     2.45.11     2.366     2.45.11     2.366     1.05.566     2.47.566       7.11     16.885     114.818     3.444.560     9.17.96.003     7.344     2.07.569     4.41.102     1.14.56     6.6     82     86     108     12.66       16.885     114.818     3.444.560     9.17.96.003     7.344     2.07.569     4.41.102     1.14.56     1.14.56     6.6     82     86     108     12.66       16.885     114.818     3.444.560     9.17.96.003     7.344     2.07.569     7.347.11     1.345.11     1.345.11       16.885     16.885     16.812     1.344.56     1.344.56     1.345.11     1.345.11     1.345.11     1.345.11		22	200	Nex Ye	201 75	1	1750	0 587	FAC 77 BU 77 PA 77			-		8	L	2.673	1.978	5271	ò	0	0	5	5
7 Klipwoor Earl 19.051 68.347 2,629.464 5,470,478 3,283.5 103,156 227,543 102,156 227,543 102,156 227,543 102,156 24,102 10,104 5,647 4,756 10,104 5,647 4,756 4,756 4,756 4,756 4,756 4,756 4,756 4,756 4,756 4,756 105 10,102 115,885 114,3118],3444,560 9,170,003 7,344 2,003 7,344 7,003 7,003 7,000 7,0	JE Distance	00		VON UN	IOX XCA	Ι.	3.686	0 406	SA.04 24.11 17.85	61.51	X.KS	-	<b> </b>	0.01	L.	2,289	1,693	1,252	XGK	0	ō		
16,285 114,318]3,444,560 9,190,003 7,844 207,560 444,102 1 4756 1 15 5 6 6 82 86 108 120 166 114,818 1,444,560 9,190,003 7,844 207,560 444,102 1 4,756 15 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Supplusion of	120.01	APE OF	ACD 404		2 2 2 2 2 5	101 156	727 547		ŀ	-		<u> </u>		I	I	- E					.	8
Japanosi Lina, Lin	DHP-10(41 0) MIDNOOL FALL	100.01					ACTION A	CUL VIV		T	$\left  \right $	-		Ī	17	I	<u> </u>	L		Í			L.
00 00 05 00 10 10 10 10 10 4444,864 4214,878 424,78 42,185,195 124,185 4444,885 4214,195 424,195 42,195 43, 195 44,195 44,195 44,195 44,195	TOTAL	10,000	114,318	inestere s	ALL VOLT	HAN'I	AD(** / A7	701 % AL	-		-			1			1			1		1.	
Landa tunte lana muse Dait Cost (D/m)															6	8							i
															LULAT 4		4,212,677 1						ļ

Vol.3 Klipvoor

A-23

201, 425 123, 421 191, 191

L.977,874 1,665,620 1,412,762 1,185,221 687,461 624,164 L.776,344 1,168,611 1,117,164 920,347 677,259 255,64 3,761,169 3,160,046 7,677,167 1,917,471 1,255,529 1,172,52 Moretele North Klipvoor West Klipvoor East

. 109, 001 6, 109, 967 76, 998, 71 14, 993, 311

TABLE A.3-5 SUMMARY OF RETICULATION PIPELINES (Level B)

			Minute Prese		I awal A	I avel R.					Level B	ا						
Klinvoor	10					Length of	Proportion of	Proportion of Pipe Diameter (%)	(%)	<del></del>		3	Length of Pipeline for Each Dismeter (m)	uline for Eac	Li Diameter	Ê		0 .A. 134
1	Household	Level A	A Level B	a l	Ē	Pire (m)	AV 75 00 1101	125 140 16	160 200 Tec		63		01 110	125	140	160.	200 Tol	
Settlement Alternative Name				ļ	Š				1			ľ	ſ		101	0	0	10.925
1 Dipetioana	20	1,700! 51,000		_ 1	4,691	10,925	32.76 24.23 16.21 11.99	8	- 1	1	1		ł		ŝ	y	5	10 March
L		6,52N 195,840	40 522,501				29.00 23.00 17.00 11.00	8.00 6.00 4.00	00:30	Ĺ		1		1 104				
[]	160 1,	1,068: 32,640	40 N7,084				37 69 27 KK 20 63 13 40						ł			2		
ł	90 <del>4</del>	6,147 184,416	16 492,022		7,113			8,001 6,000 4,00	2.00		ļ		ł			1		
5 Renoviervier Thomane	150 1,	1,020 30,600	500 81,641		3,6%6		37.69 27.8K 20.63 13.40				1		i	Ì		•	- 1	
6 Solene Deputien		1	144 52,250	5.19 03	2,513	7,828	37.69 27.88 20.63 13.60			0:00		ĺ			5	5		Ş
	1.256	£.	[_			30,244	29.00 23.00 17.00 11.00	X.00 6.00 4.0	4.00 2.00	100.0			1	~	1,415	1,210	8	3
v Sumathoom Summithoom			1			8,268	29.00 23.00 17.00 11.00	8.00: 6.00 4.6	4.00 2.001	100.0	2.368 1,502		Í	3	Ş	331	3	2
			L	L	ł		32.76	N.N7 5.94		100.001	5,9271 4,344	14 2,933	- 1	160	1,075	٥	ò	120 %
C.L. There of Manual		170 CA2	e-	2 23N 0			+				38,778 29,733	33 21,409	01 1456	- 1891-	5,789	2,710	ž	F02 721
NOCTORIO NOTICE NOTICE		UTY CL NAU L	A7 084	2.00			37.69 27.88 20.63 13.401			100.0	2,605 1,927	27 1,426	8	0	0	0	0	110.9
		1		İ.			88	X.00 6.00 4.	4.00 2.00	100.0	1.7 T.P.	7,104 5,250	0 3,397	2.471	1,853	521	61K	302.02
11 Fature Builtonien	l		1						1	L	L.				ō	ō	0	
12 Ga-Rasai	Ì	- 1	ł				6 - C	0 0 1 U U					Ĺ	639	ā	0	0	1,205
13 Ga-Tweloge Tswee	Ì	- 1					2			İ.					0	•	•	1.11
14 Kgomo-Kgor Dinaletsane		- 21					6 	-	. i	1	ļ	İ	í		1.220	<b>7</b> .7	្តំដូ	21,271
15 Legonyane	640	· 1	_i		1		8.02		4.00	1		1				0	0	11.040
16 Sephai	190	1,292! 38,760	760 103,412	12 180.5		11,090	36.04 24.11 17.X3 13.19	X X3						i			1.00	ue Cer
Sub-Total of Klipvoor West	2,219 15,	15,089 452,62	452,676 1,207,740	0 1.717.0	45,334		-			1	1	1	~	ŝ.		10017	5	
17 Bollantlokwe			141,511	11 166.5			32.76	R.K7 5.94	-		į				5 	•	- -	177012 ···
18 Dikebu incl. Rantcherg				421.5		529,91	29.00 23.00 17.00 11.00	X.00 6.00 4.	4.00 2.00				ł	Í	1125	5	X	
19 Lebotwane North		i.	2001 1.523,962			17,340	29,00 23.00 17.00 11.00	K.00: 6.00: 4J	4.00 2.00	100.0	5,029 3,9	3,000 2,040	Ĩį	٦į	99.	38 		
20 Little Lebotiwane South	00 <del>4</del>	1_					29.43 23.12 17.10 11.44		4.19	100.0	2,390 1,8	2,×7× 1,3H9		682	ğ	a S	   	
- unave	99.	1					32.76	K-X7 5.94		100.0	5.212 3.8	3,455 2,579	1,90K	1.411	53	0	•	116'51
an Rabourla and and and			1	ł			37.69		-			2,426 2,091	1 1,399	3	0	0	0.	10,137
73 Sutelong Amériliural		1	1					8.00 6.00 4.	4.00 2.00	100.0	5,066 4,0	4,018 2,970	0 1.922	1.397	1,048	3	140 140	17,469
74 Theline Nink		1	Ł				32.76	3.8	1.	100.0			•-	Sok	300	•	0	NVE. 0
			002 00 100	1			44.75			0.001		2,973 1,990	o o	0	0	0	0	N.W.S.
S. Makazaharas		1		ł.				H.00: 6.00 4.	4.00 2.00			5,607 4,144	2	1.950	1.463	\$25	488	24.370
		1000 100 1000 1000 1000 1000 1000 1000	!				80%	8.6	4.00 2.00	0.00		3,63H 2,6H9	1,740	1,266	644	633	3:6	15,439
20 Elistente autorio autori							20.43	\$ 5 9				1.411 1.044		516	3	8	•	6,105
		i i	İ	507 K			20.02	89	4 00: 2:00	100.0	6,692 5,3	5,308: 3,423	3 2.538	1,846	1,365	ន្	54 54	21.077
		÷		1_			26.43	I	4.19	100.0	2.2071 1.7	1,734 1,2421		72.9	<b>\$</b> \$	314	ò	1.494
31 Modiane			i.				44 75 33 10 22 15			100.0	2.658 1,9	1,966 1,316	9	0	0	à		3
11 Ca-Moti			- E				2			100.001	7.1 XEE.2	1,730 1,157		0	0	3	ò	į.
33 Garantianano			4.0801 10.845		Ĺ		4.75		-		2,486: 1,N	1,N39 1,230	0	ö	•	0	ò	1222
14 Botchabelo	i i			1	1		37.69 27,86			100.0	3,614: 2,6	2,673 1,978	R 1.323	0	0	0		V 5K7
35 Diponoone		ţ	· ·	<u> </u>			36.04 24.11 17.X3 13.19	8.43		100.0	3	2,249 1,693	31 1.25		3 		0	¥.
Sub-Total of Klipvoor East		347 2.050.4	5	3,888.5	2	227,543					73, 748 S6, 739	105.00 05	1022		10.04		2.360	227 50
TOTAL	[	818 3,444.5	114,818 3,444,540 9,190,033	N 7.844		444,102				-	139,514 107,019	XL678L  61	19.191	24,811	19. TJA	19,61 11	4.756	40%,427
	1										ž	56 66	82	86	108	120	166	
																1		11 M. W.
													Average		Unit Cost (R/m)		l	66. 15
								:							i	1		100 001 1
								N N	Moretele North Viistiger West		1,977,674 1,665,030	030 -1,413,756 011 -1 -1 17 150	11111111111111111111111111111111111111					1. NUS. 967
								ž	Kinwoor Fact	-					N E	123 223	<b>9</b> 5. 140	14, 998, 757
																		74, 603, 511

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TABLE A.3-6 SUMMARY OF RETICULATION PIPELINES (Level A)

MitPOVDI         Name						ŀ						lava I	4						
House         Turbuilly consistential         Turbuilly consistentia <thturbuilly consistentia<="" th=""></thturbuilly>	Klibvoor		opulation		Demand		•	Level D	Proportion of Pipe	Diameter (%				Length of	Pipeline S	or Each Di	ameter (m)		
		10			T avel R		tericulation B	eticulation											
100         100 <th></th> <th>n/ollavino Li</th> <th></th> <th></th> <th></th> <th></th> <th>Pipe (m)</th> <th>P(pe (m)</th> <th>75 90 110</th> <th>4</th> <th>200 Tet.</th> <th>છ</th> <th>75. 20</th> <th>8</th> <th>110</th> <th>125</th> <th></th> <th></th> <th>ž</th>		n/ollavino Li					Pipe (m)	P(pe (m)	75 90 110	4	200 Tet.	છ	75. 20	8	110	125			ž
		000	VOL 1	200		6	1109 7	10.925	- 6.47" 31.75: 30.59		0.001	211	\$ <b>3</b> 6.	9401	ļ	969	649.	Ì	
	1 Dipetioana		1007	1	1.:	2 224	7461	14 866	1		100.0		i	Ì	Ì	.189			
0         00         000	2 Makekong		THON &		1_	10.01	1486 0	8 213			10.0	SQN	268	748	570	•	0		
	J Makgapha		141 2	Ť		270.0	1113	14.371			100.0	267		-		8			
	4 Megohiwaneng Incl. Ulverton			1	1.	1.1	Sky E	0.404		· ·	100.0	161	1,150	80	755	0	0	0	
	5 Kenostervlet Tloonane	incr	0701	1.	· ·		115 0	7 824			100.0			6751		ł	0		
1         1	Ì		200		- h		14.3	P42 (02			100.01								
With matrix ma	7 Ngobi							576.5			1000		34		350	661	Í		
m         eff         1/2	R Swaartboom Swartboom	535	101		. L	ł		100.01	- t -		100.01		1	1			.075		
Mol         100 <td>9 Transaksie</td> <td>99</td> <td>7,067</td> <td></td> <td>10,454</td> <td></td> <td>14.44</td> <td>10 2VE</td> <td>ند إي</td> <td></td> <td></td> <td>12</td> <td>17</td> <td>[]</td> <td></td> <td></td> <td></td> <td></td> <td></td>	9 Transaksie	99	7,067		10,454		14.44	10 2VE	ند إي			12	17	[]					
100         1000	Sub-Total of Moretele North	4,615	31,382	. F	2,511,815	2,Z38.0	59,070	NC 771			0.001	1	1	İ.,				Í.	
100         100 <td>10 Ga-Tsogue Watewal</td> <td>9 9 9</td> <td>1.048</td> <td>- 1</td> <td>×7,044</td> <td>- 1</td> <td>YOX I</td> <td>14,0</td> <td>- F.</td> <td></td> <td>2.00</td> <td></td> <td>i.</td> <td></td> <td></td> <td>ł</td> <td></td> <td></td> <td></td>	10 Ga-Tsogue Watewal	9 9 9	1.048	- 1	×7,044	- 1	YOX I	14,0	- F.		2.00		i.			ł			
10:         10:0 <th1< td=""><td>11 Fatung Bultfontein</td><td>.0899</td><td>4,488</td><td>- 1</td><td>359,220</td><td>- I</td><td>18.723</td><td>30,855</td><td></td><td> <b>-</b> -</td><td></td><td></td><td>E.</td><td>ţ.</td><td></td><td>İ</td><td></td><td></td><td>1</td></th1<>	11 Fatung Bultfontein	.0899	4,488	- 1	359,220	- I	18.723	30,855		<b>-</b> -			E.	ţ.		İ			1
253         1104         2000         1100         100<	<b>i</b>	160	1,048			120.5	3,4921	ឌ្	•••		10.01					200	3474	i d	
113         113 <td>13 Ga-Tsofogo Tswee</td> <td>255</td> <td>1,734</td> <td></td> <td></td> <td>245</td> <td>2,075</td> <td>2071</td> <td>. 1</td> <td></td> <td>1000</td> <td>3</td> <td>22</td> <td>1906</td> <td>010</td> <td></td> <td>5</td> <td>, - c</td> <td>ļ</td>	13 Ga-Tsofogo Tswee	255	1,734			245	2,075	2071	. 1		1000	3	22	1906	010		5	, - c	ļ
(-6)	14 Kanon-Kunt Dinalettane	2	1.047	31,416			2,475	11			100.0	531							
100         1220         5000         1200 <th1< td=""><td>14 I antovero -</td><td>3</td><td>4352</td><td></td><td></td><td>1</td><td>11,893</td><td>21,171</td><td></td><td></td><td>80</td><td>\$</td><td>i</td><td></td><td></td><td></td><td></td><td></td><td>Ì.</td></th1<>	14 I antovero -	3	4352			1	11,893	21,171			80	\$	i						Ì.
1         1219         1560         62361         6237         6239         1230         1240         2440         2410         2	1. Contraction	8	1282			١. i	4,807	11,090			18.0		ł						i.
No         1,86         1,86         5,000         1,86         0,000         1,86         0,000         1,87         2,000         1,87         2,000         1,87         2,900         1,87         2,900         1,87         2,900         1,87         2,900         1,87         2,900         1,87         2,900         1,87         2,900         1,77         2,900         1,77         2,900         1,77         2,900         1,77         2,900         1,77         2,900         1,77         2,900         1,77         2,900         1,700         2,900 <th< td=""><td></td><td>2 2 10</td><td>15 280</td><td></td><td>2.207.740</td><td>1.777.0</td><td>45.334</td><td>94.257</td><td>_</td><td></td><td>-</td><td></td><td>i</td><td>- 1</td><td></td><td>Ì</td><td></td><td></td><td>1</td></th<>		2 2 10	15 280		2.207.740	1.777.0	45.334	94.257	_		-		i	- 1		Ì			1
2.000         1.000         6.00         1.000         6.00         1.000         6.00         1.000         1.	SUP-10401 0 ALPHONO TTAN	107C	1075			13	4 446	10.577	6.871 31.75 30.59	-	100.0	3451	914		KK7		Š,	ò	
1         1	17 Bollantiokwe	202		. 1 :	1 200 10		100 FT	10.07	OX CL LCK UL IOC Y		100.0								
1         2000         1000	18 Dikebu incl. Ranteberg	2001	100,51				1000	072 21	÷.		100.0								
0.01         200         7.700         10.00         10	19 Lebothwane North		14,040	- 1	-04'5-51		107.4							i i		1	ļ	÷	
100         1700	20 Little Lebothwane South		2,720	1		~~~	AT/17				i i			ļ	İ	114		•	
90         5.30         17.00         3.00         17.0	21 Mokobyane Mmukubyane	560	1.768			312.0	C61.5							<b>.</b>		6	0	0	
300         0.200         17.000	22 Rahosula	8	63	- F			161,4				0.001	1	L		}				Ì
220         1700         5100         1500         5100         1500         5100         1500         5100         1500         5100         1500         5100         1500         5100         1500         5100         1500         5100         1500         5100         1500         5100         1500         5100         5100         5100         5100         5100         5100         510 <th< td=""><td>23 Sutelong Agricultural</td><td>940</td><td>6.392</td><td>Ξ.</td><td>511,016</td><td>n X</td><td>1.07.7</td><td></td><td></td><td></td><td></td><td></td><td>i.</td><td></td><td></td><td></td><td></td><td></td><td>İ</td></th<>	23 Sutelong Agricultural	940	6.392	Ξ.	511,016	n X	1.07.7						i.						İ
(7)         (5)         (3)         (1,2,30)         (4,2,3)         (4,3,3)         (4,3) </td <td>24 Tholwe - Flink</td> <td>200</td> <td>1,700</td> <td>- 1</td> <td></td> <td></td> <td>1900</td> <td>24.0</td> <td>11</td> <td></td> <td></td> <td>1010</td> <td></td> <td></td> <td></td> <td>0</td> <td>0</td> <td>0</td> <td>ļ</td>	24 Tholwe - Flink	200	1,700	- 1			1900	24.0	11			1010				0	0	0	ļ
600         4.400         13.510         62.713         63.74         63.75         63.74         63.75         63.74         63.75         63.74         63.75         63.74         63.75         63.74         63.75         63.74         63.75         63.74         63.75 <th< td=""><td>25 Dikgophaneng</td><td>22</td><td>510</td><td>· [</td><td>- 1</td><td>· •</td><td>3,325</td><td></td><td>•</td><td></td><td></td><td>tus,</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>	25 Dikgophaneng	22	510	· [	- 1	· •	3,325		•			tus,							
T72         5.200         17.7ml         5.200         17.7ml         5.200         17.7ml         5.200         17.7ml         5.200         17.7ml         5.200         17.7ml         5.200         17.7ml         5.200         17.7ml         5.200         17.7ml         5.200         17.7ml         5.200         17.7ml         15.7ml         2.7ml         17.7ml         "><td>26 Makgabethvane</td><td>650</td><td>4,420</td><td></td><td></td><td>5.50</td><td>14,148</td><td>24.375</td><td></td><td></td><td></td><td>2</td><td>1</td><td></td><td>I</td><td></td><td>}</td><td></td><td>1</td></t<>	26 Makgabethvane	650	4,420			5.50	14,148	24.375				2	1		I		}		1
330         2,300         71,400         1,302         6,100         5,2         3,001         7,400         1,301         5,301         1,301         2,	27 Moiletswane/Buffelsdoom	22	5,250	1	420,178		161.8	15,815				10	1				ł		
450         3000         91,400         24,001         30,400         21,301         11,324         21,001         77         620         23,001         71,100         740         620         30,101         31,101         3	28 Slagboom	350	2,380		190,495	·	1.302	6,103			10.0		ł	ł		İ			1
136         2300         71,400         190,405         82.3         23.41         7,400         6.00         23.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.76         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77         40.0         21.77 <td>29 Shakung</td> <td>450</td> <td>3,060</td> <td></td> <td>244,922</td> <td></td> <td>13,234</td> <td>10,52</td> <td>_ [</td> <td></td> <td>1000</td> <td>ž,</td> <td>ł</td> <td>1</td> <td>ł</td> <td></td> <td></td> <td>Ì</td> <td></td>	29 Shakung	450	3,060		244,922		13,234	10,52	_ [		1000	ž,	ł	1	ł			Ì	
40         277         8100         21.771         400         1.186         5.940         7.14         5.050         7.14         5.050         7.14         5.050         7.14         5.050         7.051         6.01         0	30 Ga-Hadebi	350	2,380	1	190,495	82.5	2.281	7,495			100.0	2	207			ž			,   -
R         54         1,020         3.34         200         1,020         2.34         2.07         1,000         2.34         2.07         0 <th0< th=""> <th0< th="">         0         <th0< td=""><td>31 Modiane</td><td>10<b>4</b></td><td>2</td><td></td><td>1.1</td><td>40.0</td><td>1,186</td><td>5.94</td><td>31.24 39.96 29.70</td><td></td><td>9.9 9.9</td><td>371</td><td>£¥‡</td><td></td><td></td><td>5</td><td>-</td><td>5</td><td></td></th0<></th0<></th0<>	31 Modiane	10 <b>4</b>	2		1.1	40.0	1,186	5.94	31.24 39.96 29.70		9.9 9.9	371	£¥‡			5	-	5	
20     130     4,000     10,005     29,5     3,124     3,130     2,000     2,000     2,000     2,000     2,000     0 <th0< th=""></th0<>	12 Ga-Moti	x	2	1			684	5,225	31.24 39.06 29.70		100.0	214	287	507	5		5	5	5
130     130     130     130     1300 <th< td=""><td>33 Carintlapane</td><td>30</td><td>136</td><td></td><td></td><td><math>\gamma_{i}</math></td><td>915</td><td>5,555</td><td>31.24 39.06 29.70</td><td></td><td>100.0</td><td>296</td><td>j.</td><td>717</td><td>0</td><td></td><td>5</td><td>5</td><td>5</td></th<>	33 Carintlapane	30	136			$\gamma_{i}$	915	5,555	31.24 39.06 29.70		100.0	296	j.	717	0		5	5	5
200         13-60         40,800         108/56         13,54         13,54         13,54         13,54         13,54         13,54         13,54         13,54         13,54         13,54         13,54         13,54         13,54         13,54         13,54         13,54         10,574         10,234         15,343         13,544         10,234         10,	34 Botshabelo	130	884		1.1		3,750	9,587	7 21 47 31.19 26.86 20.48		100.0	¥02:	ł	2001	8				5
9 Kijpooor East 10,051 63,347 2,050,604 5,470,478 3,384.5 103,156 227,560 443,102 10 11,714 2,2706 14,127 38,488 28,811 19,774 1,022 4,756 14,127 13,488 1,022 156 15 5 5 6 6 82 86 108 120 156 5 7 34,489 2,471 1,441 1,471 1,471 1,471 1,471 1,471 1,471 1,471 1	35 Diponeone	200	1,360	1.	1:108,854		3,686	9.9 94.0	-		100.0				È	. Ĺ	1.		1
IGARS IIARIS 3.444.569[9,190,033 7.384 207.560 444.102	Sub-Total of Kipwoor East	150'01	68,347	2,050,404	5,470,478	. m 1	103,156	227.543				. I.	_ ł	_   _	1.	. <u> </u>	1		.i_
51     56     66     82     86     108     120     166       The lange in the prime in	TOTAL	16,836	114,818	3,444,540	9,190,033			444,102			-	. 1			. 1				
THALER         LOBALMA <thlul< th="">         LOBALMA         <thlobalma< th=""> <thlobalma< th=""> <thlobalma< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>5</td><td>- 99 97</td><td>99</td><td>82</td><td></td><td></td><td></td><td>99</td></thlobalma<></thlobalma<></thlobalma<></thlul<>												5	- 99 97	99	82				99
Average Unit Cost (R/m) : 204.777 114.735 44.735 544.86 487.444 254.312 224.700 234.920 134.775 204.544 11.500 64.255 477.314 22.165 749.540 172.66 264.700 (1277,646 1,451,054 1,512.053 1,372.574 1,122.152 673.720 341.700						•								•			-	_	_
049-1472 0407-1474 511-456 040-7149 639-1449 6477-146 6477-149 049-141 040-1415 0401-1416 0401-149 149-149 040-145 047-1476 521-1415 0401-149-149-149-149-149-149-149-149-149 047-145 047-1476 521-1421-14974-1491-1491-1491-1491-1491-1491-14													_		rage Un	it Cost	(a/a)		
194,729 004,844 015,620 054,295 047,314 047,314 040,202 041,840 041,7400 054,420 151,420 041,140 042,420 041,141 040,424 040 041,141 040 041,141 040,424 040 041,141 040,424 040 041,141 040,424 040 041,141 040 040 041,141 040,424 040 041,141 040,424 040 041,141 040,424 040 040						÷				here.h	ale North								
366,430 4,237,444 1,453,034 1,512,033 1,292,274 1,122,122 673,720 391,780										Klipvo	or West								
										Klipvo	or East								
																			15.

# TABLE A.3-7 SUMMARY OF STANDPIPES (Level A & Level B)

		Number	Calculated	Water D	emand	Area	No. of Standpic	es Required
Klinva	or	ot	Population	AADD	(l'day)		1	
Klipvo	UI	Household		LevelA	Level B	(ha)	Level A	Level B
Settlement	Alternative Name	1						
1 Dipetloana		250		51,000	136,068	176.0	11	8
2 Makekeng		960		195,840	522,501	283.5	15	12
3 Makgapha		160		32,640	87,084	102.0	7	5
4 Mogohlwaneng inc	s. Olverton	904		184,416	492,022	270.0	15	12
5 Renostervlei	Tloonane	150	1,020	30,600	81,641	137.0	9	7
6 Selepe	Deputten	96	653	19,584	52,250	91.5	7	5
7 Ngodi		1,256	8,541	256,224	683,606	703.0	34	26
8 Swaartboom	Swartboom	\$35	3,638	109,140	291,186	103.5		5
9 Transaksie		304	2,067	62,016	165,459	371.5	19	15
Sub-Total of More	tele North	4,615	31,382	941,460	2,511,815	2,238.0	124	95
10 Ga Tsogwe	Waterval	160		32,640	87,084	66.5	6	5
11 Fafung	Bultfontein	660	4,488	134,640	359,220	720.5	35	27
12 Ga-Rasai		160		32,640	87,084	129.5	0	C
13 Ga-Tseloge	Tswee	255	1,734	52,020	138,789	74.5	6	5
14 Kgomo-Kgomo	Dinaletsane	15		31,416	83,818	90.0	7	
15 Legonyane		64(	4,352	130,560	348,334	455.5	23	18
16 Sephai		190	1,292	38,760	103,412	180.5	11	8
Sub-Total of Klip	woor West	2,219	15,089	452,676	1,207,740	1,717.0	88	68
17 Bollantlokwe		260		53,040	141,511	166.5	10	<b>{</b>
18 Dikebu incl. Rante	berg	2,000	0 13,600	408,000	1,088,544	421.5	22	17
19 Lebothwane North		2,80	0 19,040	571,200	1,523,962	351.0	19	15
20 Little	Lebotiwane South	40	0, 2,720	81,600	217,709	99.5	7	
21 Mokobyane	Mmukubyane	26	0 1,768	53,040	141,511	312.0	17	1.
22 Rabosula		9	6 653	19,584	52,250	154.5	10	
23 Sutelong Agricult	ural	94	6,392	191,760	511,616	354.5	19	3
24 Tihohwe	Flink	25	0, 1,700	51,000		52.5	5	
25 Dikgophaneng		7	5 510	15,300	40,820	123.0	8	
26 Makgabetlwane		65				· 543.0	27	2
27 Moiletswane/Buff	elsdoorn	77				309.5	. 17	1
28 Slagboom		35	0 2,380			44.5	5	
29 Shakung		45				507.5	26	2
30 Ga-Hadebi		35		71,400		82.5	6	
31 Modiane		4	0 272	8,160		40.0	4	
32 Ga-Moti			8 54			20.5	4	
33 Garantlapane			0, 130			29.5	4	·
34 Botshabelo		13				139.5	9	
35 Diponpong		20				137.0		
Sub-Total of Klip	woor East	10,05				3,888.5	228	17
TOTAL		16,88	114,81	3,444,54(	9,190,033	7,843.5	440	34

Average	482	3, 281 98, 415 262, 572	224 13	10
Cost of Standpipe	Unit Cost	Quantity	Cost	÷
Total				
Level A	1,600	440	704,000	
Level B	1,600	340	544,000	
Moretele North	1			
Level A	1,600	124	198,400	
Level B	1,600	· 95	152,000	
Klipvoor West				
Level A	1,600	88	140,800	
Level B	1,600	68	108,800	
Klipvoor East	, ,			
Level A	1,600	228	364,800	
Level B	1,600	177	283,200	

## TABLE A.3-8 SUMMARY OF YARD CONNECTIONS (Level B)

		Number	Calculated	Water E	emand	Area	No. of
Klipvoc	<b>\</b> "	lo	Population	AADD	(l'day)		Yard
iziihaoc		Household		Level A	Level B	(ha)	Connection
Settlement	Alternative Name		i				(nos)
1 Dipetioana		250	1,700	51,000	136,068	176.0	223
2 Makekeng		960		195,840	522,501	283.5	864
3 Makgapha		160	1,088	32,640	87,084	102.0	144
4 Mogohlwaneng incl.	Olverton	904	6,147	184,416	492,022	270.0	814
5 Renostervici	Tioonane	150	h	30,600	81,641	137.0	13
6 Selepe	Deputien	96	+	19,584	52,250	91.5	8
7 Ngobi		1,256	8,541	256,224	683,606	703.0	1,13
8 Swaartboorn	Swartboom	535	+	109,140	291,186	103.5	48
9 Transaksje		304		62,016		371.5	27
Sub-Total for More	ele North	4.615		941.460	2,511,815	2,238.0	4.15
10 Ga-Tsogwe	Waterval	160		32,640	87,084	66.5	14
11 Fafung	Bultfontein	- 660		134,640	359,220	720.5	59
12 Ga-Rasai		160		32,640	87.084	129.5	14
13 Ga-Tsefoge	Tswee	255		52,020		74.5	23
14 Kgomo-Kgomo	Dinaletsane	154		31,416		90.0	13
15 Legonyane		640		130,560		455.5	57
16 Sephai		190		38,760	· · · · · · · · · · · · · · · · · · ·	180.5	17
Sub-Totel for Klipv	or West	2.219		452,676		1.717.0	22. 1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.
17 Bollantlokwe		260		53,040		166.5	23
18 Dikebu incl. Ranteb	C/9	2.000	- <u>i</u>	· · · · · · · · · · · · · · · · · · ·	······································	421.5	1,80
19 Lebotlwane North	<u></u>	2,800		*		351.0	2,5
20 Liule	Lebotlwane South	400		t- <u> </u>		99.5	34
21 Mokobyane	Mmukubyane	260	· · · · · · · · · · · · · · · · · · ·			312.0	2
22 Rabosula		90				154.5	
23 Sutelong Agricultur	al	940	·	<u> </u>		354.5	8
24 Tholwe	Flink	250				52.5	2
25 Dikgophaneng		7				123.0	
26 Makgabeilwane		- 65				543.0	5
27 Moiletswane/Buffel	sdoom	77				309.5	6
28 Slagboom		35		and a second second second	the state of the second second second	44.5	3
29 Shakung		454	L	1		507.5	
30 Ga-Hadebi		35				82.5	3
31 Modiane					· • — — — · — ·	40.0	
32 Ga-Moti			8 54	a server a facture a	· · · · · · · · · · · · · · · · · · ·	20.5	· · · · · · · · · · · · · · · · · · ·
33 Garantlapane		2	T f			•	· · · · · · · · · · · · · · · · · · ·
34 Botshabelo		13		· • · · · · · · · · ·		139.5	•
35 Diponpong		- 20					•
Sub-Total for Klip	oor East	10.05	4		······································	3.868.5	9.0
TOTAL		16,88		وتساملتكم وترتد ورتداري			
	Average	48	2 3.281	98, 415	5 262,572	224	43

Cost of Yard Connection	Quantity	Unit Cost	Cost
Total	15,198	1,050	15,957,900
Moretele North	4,154	1,050	4,361,700
Klipvoor West	1,998	1,050	2,097,900
Klipvoor East	9,046	1,050	9,498,300

# TABLE A.4-1 COMPARISON OF ENERGY REQIREMENTS

ITEM	Q		H	QxH
	(l/sec)	(m3/sec)	(m)	(m4/sec)
lipvoor, Alternative - 1	T T			
Raw Water			Ţ	
Klipvoor West		0.168	21.000	3.518
Klipvoor East				0.000
Moretele North				0.000
WTW -> R.R.				· · · · · · · · · · · · · · · · · · ·
Klipvoor West		0.021	273.297	5.73
Klipvoor East		0.139	177.759	24.63
Moretele North			···   ··	0.00
Booster Pump				
West 8	1.512	0.002	80.000	0.12
	46.916	0.047	45.000	2.11
East 6	41.964	0.042	75.000	3.14
East 7	13.437	0.013	70.000	0.94
East 12	43.608	0.044	70.000	3.05
North 1	43.000	0.044	10.000	43.25
Total Energy (QxH)				39.73
except raw water				
Klipvoor, Alternative - 2		····		
Raw Water				
Klipvoor West		0.122	21.000	2.5
Klipvoor East				0.0
Moretele North		0.046	21.000	0.9
WTW -> R.R.				
Klipvoor West		0.021	273.297	5.7
Klipvoor East		0.095	201.574	19.1
Moretele North		0.044	300.000	13.0
Booster Pump				
West 8	1.512	0.002	80.000	0.1
East 6	3.308	0.003	35.000	0.1
East 7	41.964	0.042	70.000	2.9
East 12	13.437	0.013	70.000	0.9
				0.0
Total Energy (QxH)				45.5
except raw water				42.0
Klipvoor, Alternative - 3				
Raw Water	·			
Klipvoor West	-	0.022	22.000	0.4
		0.022		0.0
Klipvoor East	. 🕴	0.146	21.000	3.0
Moretele North	·	V.140		
WTW -> R.R.		0.021	273.297	5.7
Klipvoor West		0.021	£13,471	0.0
Klipvoor East		0.130	300.000	41.5
Moretele North		0.139	500.000	41.3
Booster Pump	_	0.000	00 000	
West 8	1.512	0.002	80.000	\$
			az 000	0.0
East 7	41.964	· · · · · · · · · · · · · · · · · · ·	75.000	+ /·· •• •• ··· · · · · · · · · · · · · ·
East 12	13.437	0.013	70.000	· · · · · · · · · · · · · · · · · · ·
				0.0
Total Energy (QxH)				55.
except raw water				51.

### A.5 COMPARISON OF COSTS FOR ALTERNATIVE TREATMENT WORKS AND REGIONAL RESERVOIR SITES

As a result of concerns expressed by the Parks Board of North West Province concerning the original proposal to locate the intake, water treatment works and one regional reservoir within the Borakalalo Nature Reserve, two alternative locations have been considered outside the Park to the north.

The three options considered are:

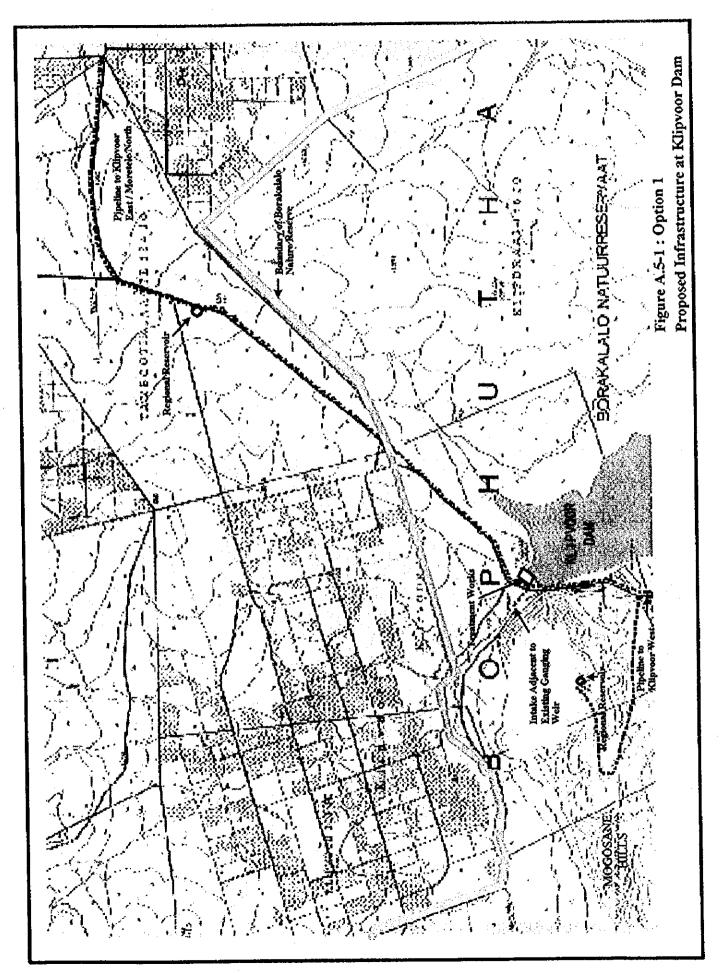
- Siting the treatment works close to the dam (Option 1)
- Locating the treatment works close to the Klipvoor East RR (Option 2)
- Locating the treatment works imeediately ouside the park towards the Klipvoor East RR (Option 3)

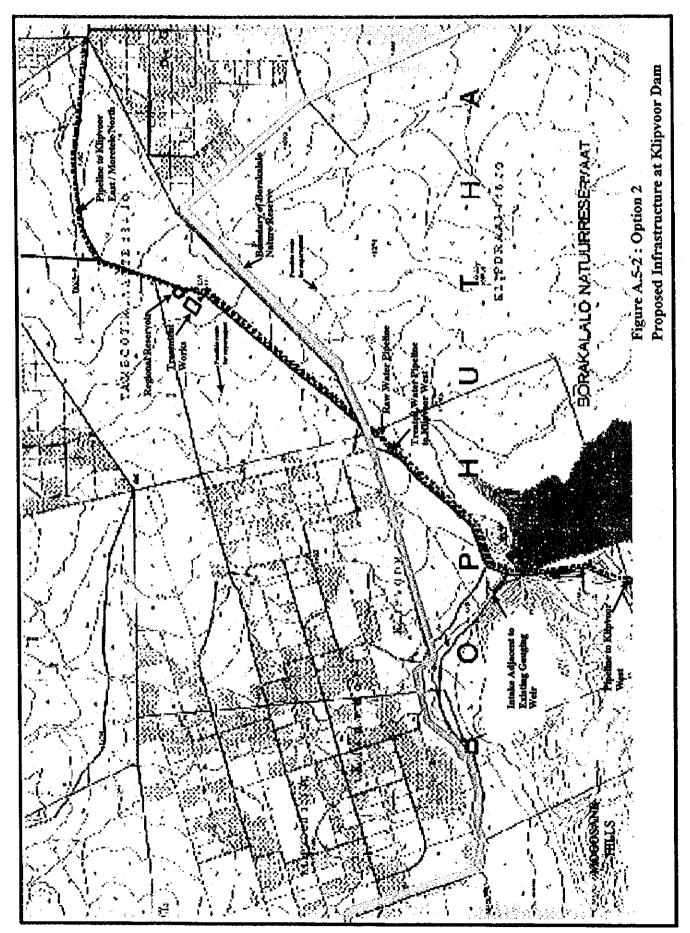
For all three cases a comparison of construction and operating costs has been prepared for the Case B Service Level. The costs relate only to the parts of the Feasibility Study scheme which are directly affected by the alternatives. Other costs are as shown in the Final Report.

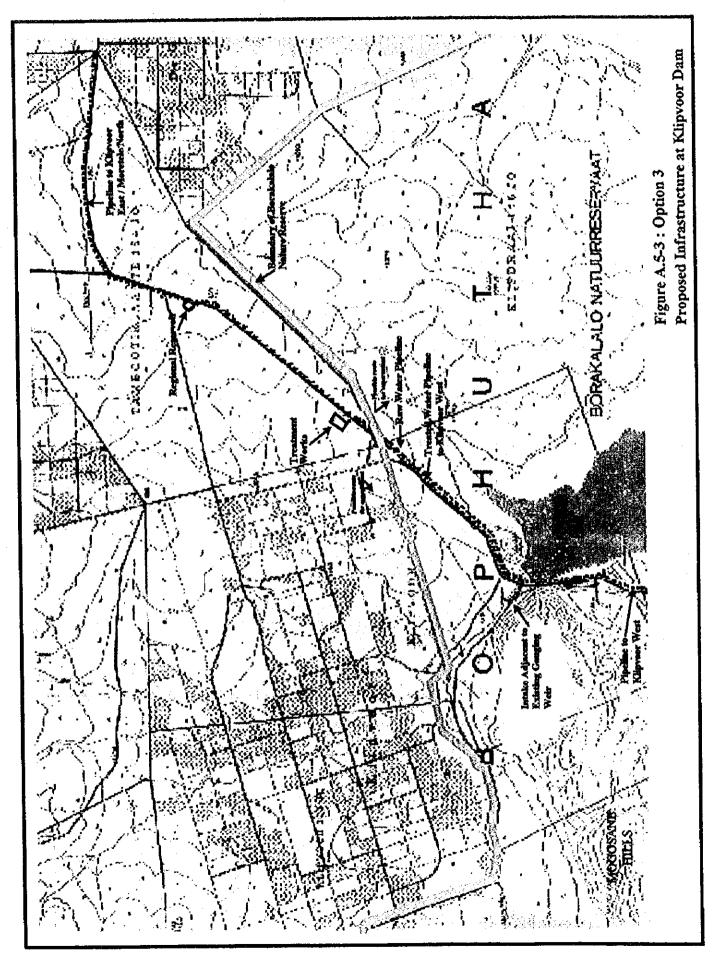
The results of the analysis are summarised as shown:

Cost	Option 1	Option 2	Option 3
Construction Cost (R)	10,252,396	10,755,065	10,288,858
Annual Energy Cost (R)	293,734	328,914	_316,740

It can be seen that the construction costs are similar but operating costs will be higher for the alternatives.







Vol.3 Klipvoor

#### **INFRASTRUCTURE SIZING - OPTION 1**

Raw Wat	er Pumps (co		æ <b>vel B d</b> ævel B	emand)	
Water den	and (AADD		9.65	Mld	(allow 5% for
	5 x AADD) x		0.168	m³/s	treatment losses)
	capacity (duty	y)	33.5		
Provide 3	units of:		16.8	kW	(2 duty / 1 standby)
Raw Wat	er Main (siz			and)	
117. A J			leve] B	хnа	Collow Kit For
	nand (AADD	•	9.650		(allow 5% for
SPDD (1.	5 x AADD)x	1.05	0.168	m"/s	treatment losses)
Weir leve	on Moretel	e River		960	m
WL in rec	civing well			980	m
		Ass	sume $C =$	130	ļ .
Q (m <sup>3</sup> /s)	D (m) V	/(m/s)	l (m/m)	L (km)	HL (m)
0.168		1.054	0.0023	0.1	*
0.168	0.400	1.334	0.0041	0.1	0.414
0.168	0.350	1.742		0.1	0.792
0.168	0.300	2.371	0.0168	0.1	1.676
0.168	0.250	3.415	0.0407	0.1	4.071
				0.1	12.055
0.168 0.160 8.336 0.168 0.150 9.485			0.3570	0.1	35.701
0.168 0.160 8.336 0.168 0.150 9.485			0.4887	0.1	48.871
0.168 0.150 9.485 0.168 0.140 10.888			0.6837	0.1	68.366
0.168	0.125	13.658	1.1866	0.1	118.662
Select	400 r	nm diame	ter		
Pumping	Head =	20.414	m		
Klipvoor	West Clear		umps (co Level B	nsider L	evel B demand)
Water der	mand (AADI	))	1.21	Mld	(allow 5% for
SPDD (1	.5 x AADD)	-	0.021	m³/s	treatment losses)
Required	capacity (du	ty)	53.4	kW	
Provide 3	units of:		26.7	kW	(2 duty / 1 standby)

Bulk Supply Line to Klipvoor West Regional Reservoir (size for Level B demand)

Level B water demand (AADD)	1.208 Mld
Level B SPDD (1.5 x AADD)	0.021 m <sup>3</sup> /s
Clear Water Tank BWL	970 m
Regional Reservoir TWL	1170 m

$Q(m^3/s)$	D (m)	V (m/s)	l (m/m)	L (km)	HL (m)
0.021	0.450	0.132	0.0000	7.8	0.389
0.021	0.400	0.167	0.0001	7.8	0.690
0.021	0.350	0.218	0.0002	7.8	1.322
0.021	0.300	0.297	0.0004	7.8	2.799
0.021	0.250	0.427	0.0009	7.8	6.796
0.021	0.200	0.668	0.0026	7.8	20.126
0.021	0.160	1.044	0.0076	7.8	59.603
0.021	0.150	1.187	0.0105	7.8	81.590
0.021	0.140	1.363	0.0146	7.8	114.136
0.021	0.125	1.710	0.0254	7.8	198.105

Select 160 mm diameter Pumping Head = 259.603 m

### Klipvoor East Clear Water Pumps (consider Level B demand)

Water demand (AADD)	Level B 7.98 Mld	(allow 5% for
SPDD (1.5 x AADD)	0.139 m <sup>3</sup> /s	treatment losses)
Required capacity (duty)	229.9 kW	
Provide 3 units of:	114.9 kW	(2 duty / 1 standby)

Bulk Supply Line to Klipvoor East Regional Reservoir (size for Level B water demand)

Level B w	ater deman	d (AADD)	)	7.983		
Level B S	PDD <b>(1</b> .5 x	(AADD)		0.139	m³/s	
Clear Water Tank BWL				970 m		
	Reservoir T			1117		
a second a second second second second second second second second second second second second second second s						
Q (m³/s)	D (m)	<b>V (m/s)</b>	l (m/m)	L (km)	HL (m)	
0.139	0.450	0.872	0.0016	7.6	12.477	
0.139	0.400	1,103	0.0029	7.6	22.130	
0.139	0.350		· · · · · · · · · · · · · · · · · · ·		42.379	
0.139	0.300	1.962	0.0118	7.6	89.718	
0.139	0.250	2.825	0.0287	7.6	217.839	
0.139	0.200	4.414	0.0849	7.6	645.136	
0.139	0.160	6.897	0.2514	7.6	1910.588	
0.139	0.150	7.847	0.3441	7.6	2615.416	
0.139	0.140	9.008	0.4814	7.6	3658.700	
0.139	0.125	11.299	0.8356	7.6	6350.342	

Select 400 mm diameter Pumping Head = 169.130 m

Summary						
Raw water main		400	mm	Length	0.1 km	h = 20.414  m
WTW to Klipvoor We	est RR		៣៣	Length	7.8 km	h = 259.603 m
WTW to Klipvoor Ea		400	៣ឆា	Length	7.6 km	h = 169.130 m
•				·		
		Level A	_	Level B (addition		
Klipvoor West RR		460	m³	800 m	3	
Klipvoor East RR		3,000	m <sup>3</sup>	5,000 m	3	
Capital Costs - Pipework						
	Dia	Length	Rate	Cost		
160mm steel	160	7,800		1,326,000		
400mm steel	400					
- Pumping Stations						
- I truping stations	Pump	No	Installed	Cost		
	Rating	110	Capacity			
Raw Water Pumping Station	•	3				
Klipvoor W CWPS	26.7	3	80.1	404,262		
Klipvoor E CWPS	114.9	3	344.8	3 736,707		
- Service Reservoirs						
	•	Capacity		Cost		
Service Level A		460		300,000		
Reservoirs		3000		•		
Reservoirs		3000	m	1,200,000		
Level B		800	m <sup>3</sup>	440,000	(ad	ditional)
		5000	m <sup>3</sup>	1,780,000	•	ditional)
C						
Summary Total Level B				10,252,396		
				_0,002,00U		

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Energy Requirement - (Level B)							
	Flow (m³/s)	SPDD (Mid)	Head (H) (m)	SPDD x H (Mid.d)	Inst Power (kW) (1)	Power Use (kW/h) (2)	
Intake PS	0.168	14.474	20.414	295.5	33.536	36.031	
WTW to Klipvoor West RR	0.021	1.812	259.603	470.4	53,390	57.3627	
WTW to Klipvoor East RR	0.139	11.975	169.130	2025.3	229.866	246.969	
Total					316.792	340.363	

(1) Maximum flowrate plus 50% standby, 1 kW = Q (Mld) x h

(2) Power used at average rate assuming 0.73 efficiency and 0.85 power factor

	Inst Power (kW)	Duty Only (kW)	Energy Ch. (R/yr) (1)	Demand Ch (R/yt) (2)	Basic Ch (R/yr) (3)	Total Ch (R/yr)
Intake PS	50.304	33.5359	17,450	13,100	1,715	32,265
WTW to Klipvoor West RR	80.086	53.3904	27,781	20,856	1,715	50,352
WTW to Klipvoor East RR	344.799	229.866	119,609	89,791	1,715	211,116

#### Total

(1) Energy charge based on 5.94 c/kWh

(2) Demand charge based on R31.25 / kVA/month demand for 500V to 66kV and 0.96 power factor

(3) Basic charge based on R142.93 /month

293,734

#### **INFRASTRUCTURE SIZING - OPTION 2**

## Raw Water Pumps (consider Level B demand)

L.	Level B	
Water demand (AADD) x 1.5	9.65 Mid	(allow 5% for
SPDD (1.5 x AADD) x 1.05	0.168 m <sup>3</sup> /s	treatment losses)
Required capacity (duty)	315.2 kW	
Provide 3 units of:	157.6 kW	(2 duty / 1 standby)

#### Raw Water Main (size for Level B demand)

Level B w	ater dema	nd (AADE	))	9.65	Mld	(allow 5% for
Level B S	PDD (1.5	x AADD))	c 1.05	0.168	m³/s	treatment losses)
Weir leve	on More	tele River		960	m	
WL in rec	eiving wel	1		1120	m	
		As	sume C =	130		
Q (m <sup>3</sup> /s)	D (m)	V (m/s)	I (m/m)	L (km)	HL (m)	
0.168	0.450	1.054	0.0023	7.7	17.954	
0.168	0.400	1.334	0.0041	7.7	31.845	
0.168	0.350	1.742	0.0079	7.7	60.981	
0.168	0.300	2.371	0.0168	7.7	129.100	1
0.168	0.250	3.415	0.0407	7.7	313.459	<b>)</b> .
0.168	0.200	5.336	0.1206	7.7	928.318	:
0.168	0.160	8.337	0.3570	7.7	2749.238	<b>t</b>
0,168	0.150	9.485	0.4888	7.7	3763.450	•
0.168	0.140	10.889	0.6837	7.7	5264.682	2

Select 400 mm diameter Pumping Head = 191.845 m

#### Clear Water Pumps (consider Level B demand)

	Level B	
Water demand (AADD)	9.19 Mid	(allow 5% for
SPDD (1.5 x AADD)	0.160 m <sup>3</sup> /s	treatment losses)
Required capacity (duty)	11.5 kW	
Provide 3 units of:	5.8 kW	(2 duty / 1 standby)

#### Bulk Supply Line to Regional Reservoir (size for Level B water demand)

Level B water demand (AADD)	9.19 Mid
Level B SPDD (1.5 x AADD)	0.160 m <sup>3</sup> /s
Clear Water Tank BWL	1110 m
Regional Reservoir TWL	1117 m

$Q(m^3/s)$	D (m)	V (m/s)	l (m/m)	L (km)	HL (m)
0.160	0.450	1.004	0.0021	0.1	0.213
0.160	0.400	1.270	0.0038	0.1	0.378
0.160	0.350	1.659	0.0072	0.1	0.724
0.160	0.300	2.258	0.0153	0.1	1.532
0.160	0.250	3.252	0.0372	0.1	3.719
0.160	0.200	5.081	0.1101	0.1	11.014
0.160	0.160	7.939	0.3262	0.1	32.620
0.160	0.150	9.033	0.4465	0.1	44.653
0.160	0.140	10.370	0.6247	0.1	62.465
0.160	0.125	13.008	1.0842	0.1	108.420
Select	400	mm diam	eter		

Pumping Head = 7.378 m

Bulk Supply Line to Klipvoor West (size for Level B water demand)

Level B water demand (AADD)	1.208 Mld
Level B SPDD (1.5 x AADD)	0.021 m <sup>3</sup> /s
Clear Water Tank BWL	1110 m
GL at foot of Mogosane Hills	1010 m
Regional Reservoir BWL	1170 m

$Q(m^3/s)$	D (m)	V (m/s)	<b>I (</b> m/m)	L (km)	HL (m)
0.021	0.450	0.132	0.0000	10.4	0.519
0.021	0.400	0.167	0.0001	10.4	0.921
0.021	0.350	0.218	0.0002	10.4	1.763
0.021	0.300	0.297	0.0004	10.4	3.732
9.021	0.250	0.427	0.0009	10.4	9.061
0.021	0.200	0.668	0.0026	10.4	26.834
0.021	0.160	1.044	0.0076	10.4	79.470
0.021	0.150	1.187	0.0105	10.4	108.787
0.021	0.140	1.363	0.0146	10.4	152.182
0.021	0.125	1.710	0.0254	10.4	264.140

Select	160 mm diam	eter
<b>Residual Head</b>	=	1030.530 m
<b>Required Head</b>	l =	1170.000 m
Booster Pumpi	ng required =	139.470 m

# Klipvoor West Booster Pumping Station (consider Level B demand)

Water demand (AADD) SPDD (1.5 x AADD)	Level B 1.21 Mid 0.021 m <sup>3</sup> /s	(allow 5% for treatment losses)
Required capacity (duty) Provide 3 units of:	28.7 kW 14.3 kW	(2 duty / 1 standby)

Vol.3 Klipvoor

Summary Raw water main WTW to Klipvoor RR RR to Klipvoor West		400	ាកា លាកា ពាពា	Length Length Length	7.7 km 0.1 km 10.4 km	h = 191.845 m h = 7.378 m h = 139.470 m
55		Level A 3500	3	Level B (additient 5800 m <sup>3</sup>		
RR		3200	m	5800 m		
Capital Costs • Pipework						
		Length	Rate	Cost		
160mm steel	160	-		1,768,000		
400mm steel	400	7,800	495	3,861,000		
- Pumping Stations						
	ump	No	Installed	Cost		
	ating		Capacity			
Raw Water Pumpinj Station	157.6	3	472.8	846,474		
Clear Water Pumpir Station	5.8	3	17.3	87,404		
Klipvoor West BPS	14.3	3	3 43.0	) 217,187		
- Service Reservoirs						
• • • • • • • • • • • • • • • • • • • •		Capacity		Cost		
Service Level A Reservoirs		3500	) m <sup>3</sup>	1,360,000		
Level B		5800	) m <sup>3</sup>	2,000,000	(ad	lditional)
Downstream	m SR Ca	apacity (ad	ljustment)	615,000	(ad	lditional)
<b>6</b>						
- Summary Total Level B				10,755,065		
TOTAL LEVELD				10,755,005		

Energy Requirement - (Level B)								
	Flow (m³/s)	SPDD (MIJ)	Head (H) (m)	SPDD x H (Mld.d)	Inst Power (kW) (1)	Power Use (kW/h) (2)		
Intake PS	0.168	14.475	191.845	2,777.0	315.184	338.634		
WTW to RR	0.160	13.785	7.378	101.7	11.543	12.4022		
Klipvoor West BPS	0.021	1.812	139.470	252.7	28.684	30.8178		
Total					355.411	381.854		

(1) Maximum flowrate plus 50% standby. 1 kW = Q (Mld) x h

(2) Power used at average rate assuming 0.73 efficiency and 0.85 power factor

	Inst Power (kW)	Duty Only (kW)	Energy Ch. (R/yr)	Demand Ch (R/yr)	Basic Ch (R/yr)	Total Ch (R/yr)	
		. ,	(1)	(2)	(3)		
Intake PS	472.776	315.184	164,004	123,119	1,715	288,838	
WTW to Klipvoor West RR	17.315	11.5433	6,007	4,509	1,715	12,231	
WTW to Klipvoor East RR	43.026	28.6837	14,925	11,205	1,715	27,845	

Total

328,914

(1) Energy charge based on 5.94 c/kWh

(2) Demand charge based on R31.25 / kVA/month demand for 500V to 66kV and 0.96 power factor

(3) Basic charge based on R142.93 /month

#### **INFRASTRUCTURE SIZING - OPTION 3**

## Raw Water Pumps (consider Level B demand)

<b>L</b>	evel B	
Water demand (AADD) x 1.5	9.65 Mld	(allow 5% for
SPDD (1.5 x AADD) x 1.05	0.168 m <sup>3</sup> /s	treatment losses)
Required capacity (duty)	176.4 kW	
Provide 3 units of:	88.2 kW	(2 duty / 1 standby)

#### Raw Water Main (size for Level B demand)

Level B w	ater demai	nd (AADD	)	9.65	Mld		(allow 5% for
Level B S	PDD (1.5 :	x AADD)x	1.05	0.168	m³/s		treatment losses)
Weir level	on More	tele River		960	m		
WL in rec	eiving wel	1		1050	m		
	-	As	sume C =	130			
$Q(m^3/s)$	D (m)	V (m/s)	I (m/m)	L (km)	HL(	m)	
0.168	0.450	1.054	0.0023	4.2		9.793	
0.168	0.400	1.334	0.0041	4.2		17.370	
0.168	0.350	1.742	0.0079	4.2		33.262	
0.168	0.300	2.371	0.0168	4.2		70.418	
0.168	0.250	3.415	0.0407	4.2		170.978	
0.168	0.200	5.336	0.1206	4.2		506.355	
0.168	0.160	8.337	0.3570	4.2	. 1	1499.584	
0.168	0.150	9.485	0.4888	4.2		2052.791	
0.168	0.140	10.889	0.6837	4.2		2871.645	

Select 400 mm diameter Pumping Head = 107.370 m

#### Klipvoor West Clear Water Pumps (consider Level B demand)

Water demand (AADD) SPDD (1.5 x AADD)	Level B 1.21 Mld 0.021 m <sup>3</sup> /s	(allow 5% for treatment losses)
Required capacity (duty) Provide 3 units of:	47.2 kW 23.6 kW	(2 duty / 1 standby)

#### Bulk Supply Line to Klipvoor West Regional Reservoir (size for Level B demand)

Level B water demand (AADD)	1.208 Mld
Level B SPDD (1.5 x AADD)	0.021 m <sup>3</sup> /s
Clear Water Tank BWL	1040 m
Residual head required	1170 m

$Q(m^3/s)$	D (m)	V (m/s)	l (m/m)	L (km)	HL (m)
0.021	0.450	0.132	0.0000	6.8	0.339
0.021	0.400	0.167	0.0001	6.8	0.602
0.021	0.350	0.218	0.0002	6.8	1.153
0.021	0.300	0.297	0.0004	6.8	2.440
0.021	0.250	0.427	0.0009	6.8	5.924
0.021	0.200	0.668	0.0026	6.8	17.545
0.021	0.160	1.044	0.0076	6.8	51.961
0.021	0.150	1.187	0.0105	6.8	71.130
0.021	0.140	1.363	0.0146	6.8	99.504
0.021	0.125	1.710	0.0254	6.8	172.707

Select 140 mm diameter Pumping Head = 229.504 m

## Klipvoor East Clear Water Pumps (consider Level B demand)

	Level B	
Water demand (AADD)	7.98 Mid	
SPDD (1.5 x AADD)	0.139 m <sup>3</sup> /s	
Required capacity (duty)	118.4 kW	
Provide 3 units of:	59.2 kW	(2 duty / 1 standby)

Bulk Supply Line to Klipvoor East Regional Reservoir (size for Level B water demand)

Level B water demand (AADD)	7.98 Mld
Level B SPDD (1.5 x AADD)	0.139 m <sup>3</sup> /s
Clear Water Tank BWL	1040 m
Regional Reservoir BWL	1117 m

#### $Q(m^3/s) D(m) = V(m/s) I(m/m) L(km) HL(m)$

· · · · · · · · · · · · · · · · · · ·	~ \				
0.139	0.450	0.872	0.0016	3.5	5.742
0.139	0.400	1.103	0.0029	3.5	10.185
0.139	0.350	1.441	0.0056	3.5	19.503
0.139	0.300	1.961	0.0118	3.5	41.289
0.139	0.250	2.824	0.0286	3.5	100.251
0.139	0.200	4.412	0.0848	3.5	296.896
0.139	0.160	6.894	0.2512	3.5	879.264
0.139	0.150	7.844	0.3439	3.5	1203.631
0.139	0.140	9.004	0.4811	3.5	1683.757
0.139	0.125	11.295	0.8350	3.5	2922.467

Select 400 mm diameter Pumping Head = 87.185 m

Level ALevel B (additional)Klipvoor West RR460 m <sup>3</sup> 800 m <sup>3</sup> Store Fast RR3,000 m <sup>3</sup> 5,000 m <sup>3</sup> Capital Costs- PipeworkDiaLengthRateCost140mm steel1406,800143972,400400mm steel4007,7004953,811,500- Pumping StationsPumpNoInstalled CostRatingCapacityCapacityRaw Water Pumpinj88.23264.6655,698StationKlipvoor W23.6370.8StationService ReservoirsCostService Level A3000 m <sup>3</sup> 1,200,000ReservoirsCapacity (adjustment)615,000Level B5000 m <sup>3</sup> 1,780,000Mathematication SR Capacity (adjustment)615,000Summary TotalLevel B10,288,858	Summary Raw water main WTW to Klipvoor <sup>1</sup> WTW to Klipvoor 1		400 mr 140 mr 400 mr	n .	Length Length Length	4.2 km 6.8 km 3.5 km	h = h = h =	107.370 m 229.504 m 87.185 m
Klipvoor East RR       3,000 m <sup>3</sup> 5,000 m <sup>3</sup> Capital Costs       - Pipework       Dia       Length       Rate       Cost         140mm steel       140       6,800       143       972,400         400mm steel       140       6,800       143       972,400         400mm steel       400       7,700       495       3,811,500         - Pumping Stations       Pump       No       Installed       Cost         Rating       Capacity       Capacity       Rating       Capacity         Raw Water Pumping       88.2       3       264.6       655,698         Station       -       -       -       -         Klipvoor W       23.6       3       70.8       357,391         CWPS       -       -       Service Reservoirs       Capacity       Cost         Service Level A       3000 m <sup>3</sup> 1,200,000       (additional)       Downstream SR Capacity (adjustment)       615,000       (additional)         Downstream SR Capacity (adjustment)       615,000       (additional)       -		L			· · ·	al)		
Capital Costs • Pipework Dia Length Rate Cost 140mm steel 140 6,800 143 972,400 400mm steel 400 7,700 495 3,811,500 • Pumping Stations Pump No Installed Cost Rating Capacity Raw Water Pumpinj 88.2 3 264.6 655,698 Station Klipvoor W 23.6 3 70.8 357,391 CWPS Klipvoor E 59.2 3 177.7 896,869 CWPS • Service Reservoirs Capacity Cost Service Level A 3000 m <sup>3</sup> 1,200,000 Reservoirs Level B 5000 m <sup>3</sup> 1,780,000 (additional) Downstream SR Capacity (adjustment) 615,000 (additional)	Klipvoor West RR							
Pipework       Dia       Length       Rate       Cost         140mm steel       140       6,800       143       972,400         400mm steel       400       7,700       495       3,811,500         Pumping Stations       Pump       No       Installed       Cost         Raw Water Pumping       88.2       3       264.6       655,698         Station       -       -       -       -         Klipvoor W       23.6       3       70.8       357,391         CWPS       -       -       Service Reservoirs       -         Capacity       Cost       -       Service Level A       3000 m <sup>3</sup> 1,200,000         Reservoirs       -       -       Cost       -       -       -         Level B       5000 m <sup>3</sup> 1,780,000       (additional)       -       -       -         Downstream SR Capacity (adjustment)       615,000       (additional)       -       -       -	Klipvoor East RR		3,000 m <sup>3</sup>	9	5,000 m <sup>3</sup>			
140mm steel       140       6,800       143       972,400         400mm steel       400       7,700       495       3,811,500         Pump No Installed Cost Rating Capacity         Raw Water Pumping 88.2       3       264.6       655,698         Station         Klipvoor W       23.6       3       70.8       357,391         CWPS         Service Reservoirs         Capacity       Cost         Service Level A       3000 m <sup>3</sup> 1,200,000         Reservoirs         Level B       5000 m <sup>3</sup> 1,780,000       (additional)         Downstream SR Capacity (adjustment)       615,000       (additional)         - Summary								
100       7,700       495       3,811,500         • Pumping Stations       Pump       No       Installed Cost         Raw Water Pumping       88.2       3       264.6       655,698         Station       88.2       3       264.6       655,698         Klipvoor W       23.6       3       70.8       357,391         CWPS       59.2       3       177.7       896,869         CWPS       Service Reservoirs       Capacity       Cost         Service Level A       3000 m <sup>3</sup> 1,200,000         Reservoirs       Level B       5000 m <sup>3</sup> 1,780,000       (additional)         Downstream SR Capacity (adjustment)       615,000       (additional)	_				-			
Pumping Stations     Pump No Installed Cost     Rating Capacity Raw Water Pumping 88.2 3 264.6 655,698 Station      Klipvoor W 23.6 3 70.8 357,391     CWPS      Klipvoor E 59.2 3 177.7 896,869     CWPS      Service Reservoirs     Capacity Cost Service Level A 3000 m <sup>3</sup> 1,200,000 Reservoirs      Level B 5000 m <sup>3</sup> 1,780,000 (additional)     Downstream SR Capacity (adjustment) 615,000 (additional)      Summary								
PumpNoInstalledCost CapacityRaw Water Pumpini88.23264.6655,698Station88.2370.8357,391Klipvoor W23.6370.8357,391CWPS59.23177.7896,869CWPSCostCostService ReservoirsCapacityCostService Level A3000 m³1,200,000ReservoirsLevel B5000 m³1,780,000Level B5000 m³1,780,000(additional)Downstream SR Capacity (adjustment)615,000(additional)	400mm steel	400	7,700	473	3,011,300			
Rating Raw Water PumpiniCapacity 88.2Capacity 264.6655,698Station88.23264.6655,698Klipvoor W CWPS23.6370.8357,391Klipvoor E CWPS59.23177.7896,869Capacity CWPSCapacity Cost Service Level A ReservoirsLevel B 5000 m³1,200,000(additional) Downstream SR Capacity (adjustment)615,000(additional)- Summary	- Pumping Station				<b>.</b> .			
Raw Water Pumpini       88.2       3       264.6       655,698         Station       23.6       3       70.8       357,391         Klipvoor W       23.6       3       70.8       357,391         Klipvoor E       59.2       3       177.7       896,869         CWPS       - Service Reservoirs       Cost         Service Level A       3000 m <sup>3</sup> 1,200,000         Reservoirs       Level B       5000 m <sup>3</sup> 1,780,000         Downstream SR Capacity (adjustment)       615,000       (additional)         - Summary       - Summary       - Summary								
CWPS Klipvoor E 59.2 3 177.7 896,869 CWPS • Service Reservoirs Capacity Cost Service Level A 3000 m <sup>3</sup> 1,200,000 Reservoirs Level B 5000 m <sup>3</sup> 1,780,000 (additional) Downstream SR Capacity (adjustment) 615,000 (additional) - Summary	•	-						
CWPS • Service Reservoirs Capacity Cost Service Level A 3000 m <sup>3</sup> 1,200,000 Reservoirs Level B 5000 m <sup>3</sup> 1,780,000 (additional) Downstream SR Capacity (adjustment) 615,000 (additional) • Summary	•	23.6	3	70.8	357,391			
Capacity Cost Service Level A 3000 m <sup>3</sup> 1,200,000 Reservoirs Level B 5000 m <sup>3</sup> 1,780,000 (additional) Downstream SR Capacity (adjustment) 615,000 (additional) - Summary		59.2	3	177.7	896,869			
Service       Level A       3000 m³       1,200,000         Reservoirs       Level B       5000 m³       1,780,000       (additional)         Downstream SR Capacity (adjustment)       615,000       (additional)         - Summary       -       -       -	- Service Reservo							
Reservoirs Level B 5000 m <sup>3</sup> 1,780,000 (additional) Downstream SR Capacity (adjustment) 615,000 (additional) - Summary		1						
Downstream SR Capacity (adjustment) 615,000 (additional)			3000 m	13	1,200,000			
• Summary	Level B	3	5000 п	3	1,780,000	(ad	dition	al)
	Downsl	iream SR Cap	acity (adjus	stment)	615,000	(ac	idition	al)
	- Summary							ŀ
	•	3			10,288,858			

Energy Requirement - (Level B)							
		Flow	SPDD	Head (H)	SPDD x H	Inst Power	Power Use
		(m³/s)	(MId)	(11)	(Mld.d)	(kW) (1)	(k₩/ħ) (2)
	Intake PS	0.168	14.475	107.370	1,554.2	176.399	189.524
	WTW to Klipvoor West RR	0.021	1.812	229.504	415.9	47.200	50.712
	WTW to Klipvoor East RR	0.139	11.970	87.185	1,043.6	118.449	127.261
	Total					342.048	367.497

(1) Maximum flowrate plus 50% standby. 1 kW = Q (Mid) x h

(2) Power used at average rate assuming 0.73 efficiency and 0.85 power factor

÷.,	Inst Power (kW)	Duty Only (kW)	Energy Ch. (R/yt) (1)	Demand Ch (R/yr) (2)	Basic Ch (R/y1) (3)	Total Ch (8/yr)
Intake PS	264.599	176.399	91,788		1,715	162,409
WTW to Klipvoor West RR	70.800	47.2002	24,560	18,438	1,715	44,713
WTW to Klipvoor East RR	177.673	118.449	61,634	46,269	1,715	109,618
Total						316,740

#### Total

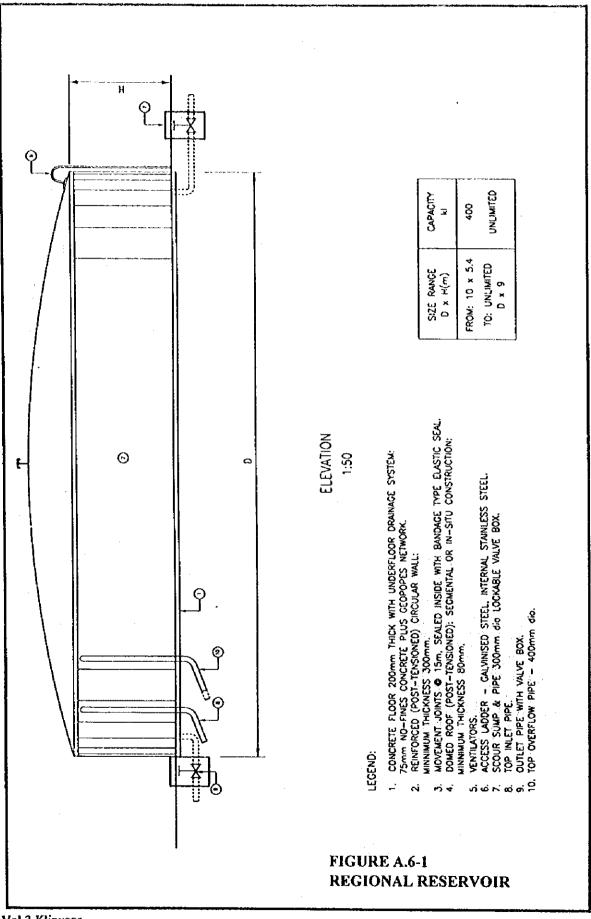
(1) Energy charge based on 5.94 c/kWh

(2) Demand charge based on R31.25 / kVA/month demand for 500V to 66kV and 0.96 power factor

(3) Basic charge based on R142.93 /month

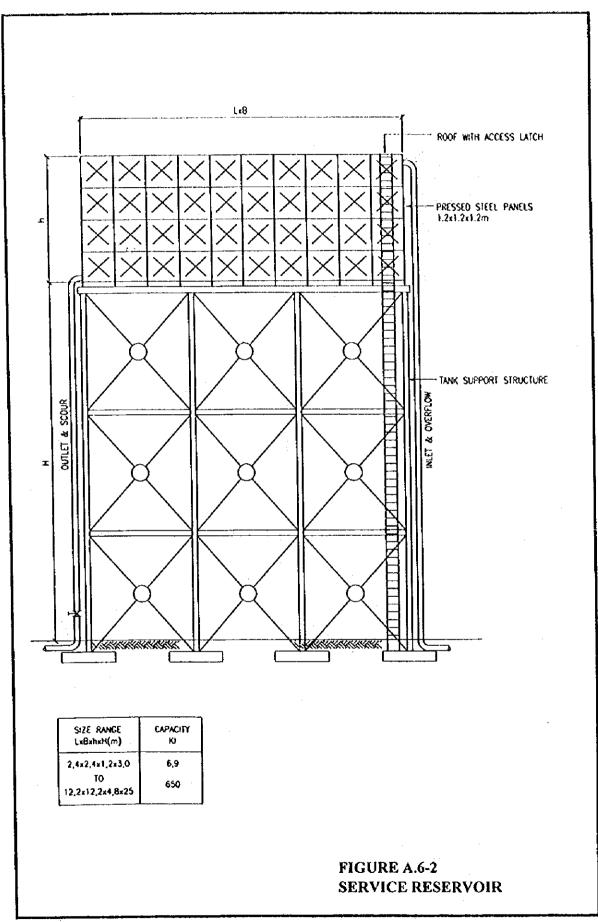
Vol.3 Klipvoor

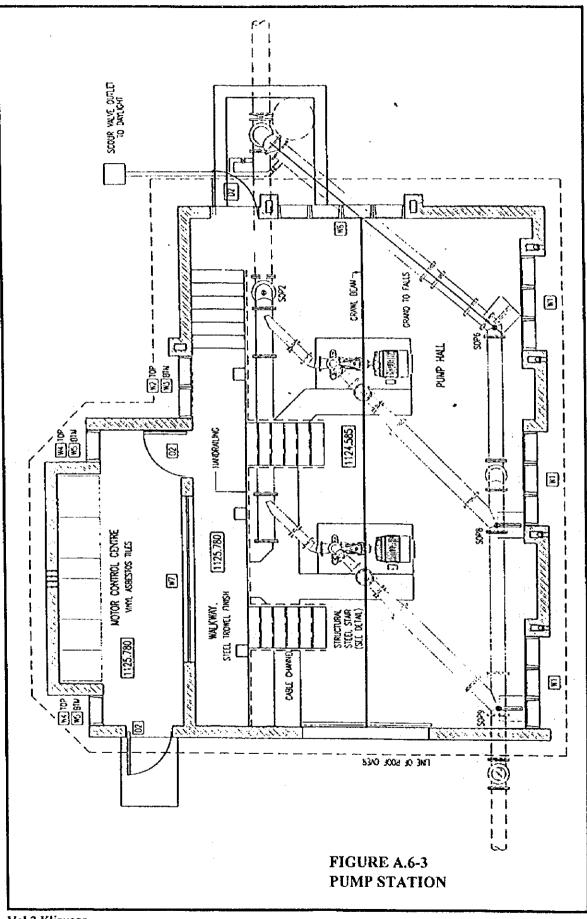
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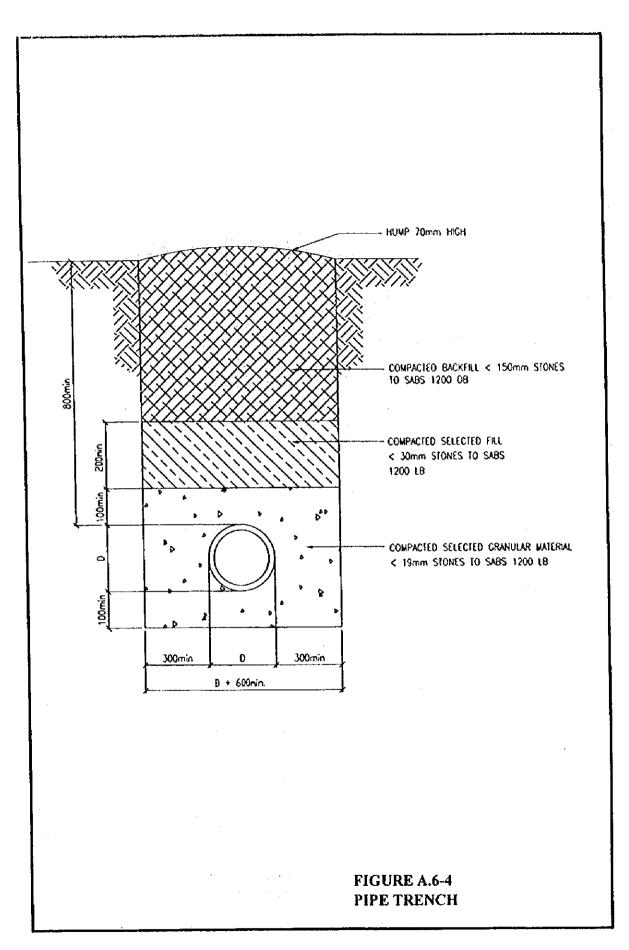


Vol.3 Klipvoor

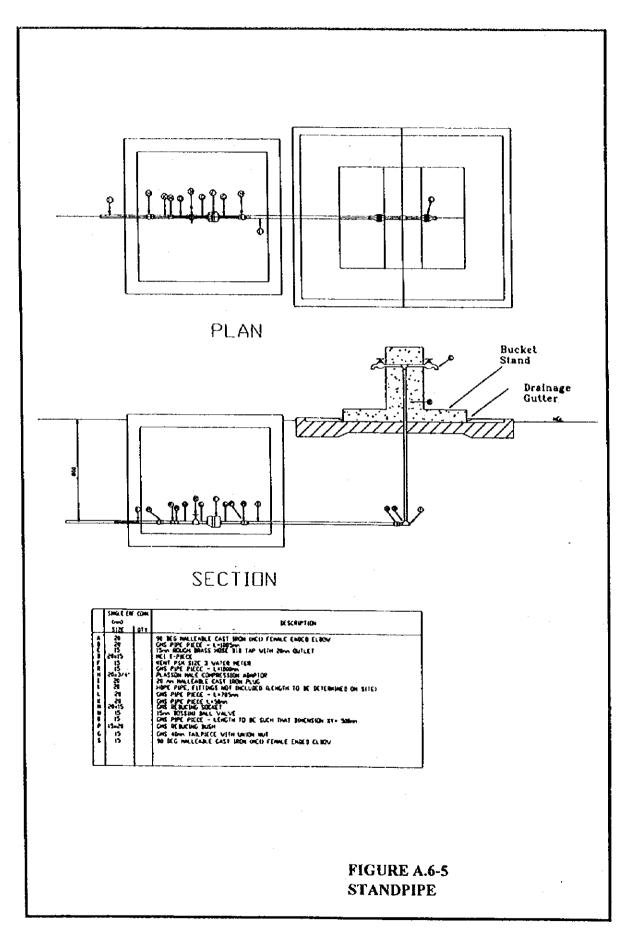
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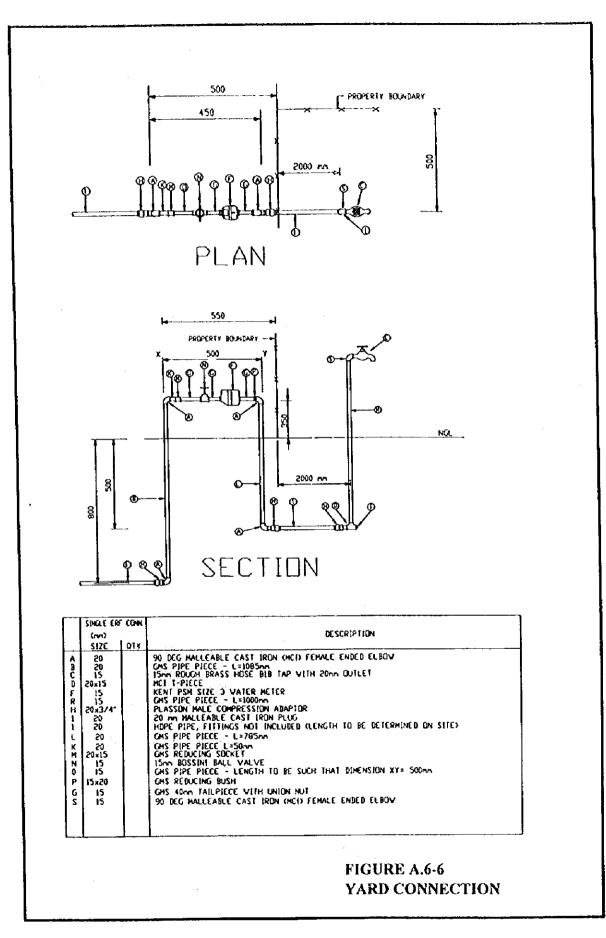






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Vol.3 Klipvoor

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