ANNEX

ANNEX A

ENGINEERING

FEASIBILITY STUDY FOR MORETELE 2

ANNEX A: ENGINEERING

A.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		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 Ml and Larger	Concrete

4. Reticulation

Residual Pressures

Type of connections	Minimum design pressures	
	For connections	For services mix
House connections	12 m	12 m
Yard taps	10 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.

FigureA.1-1 CORRELATION OF AREA AND RETICULATION PIPE LENGTH

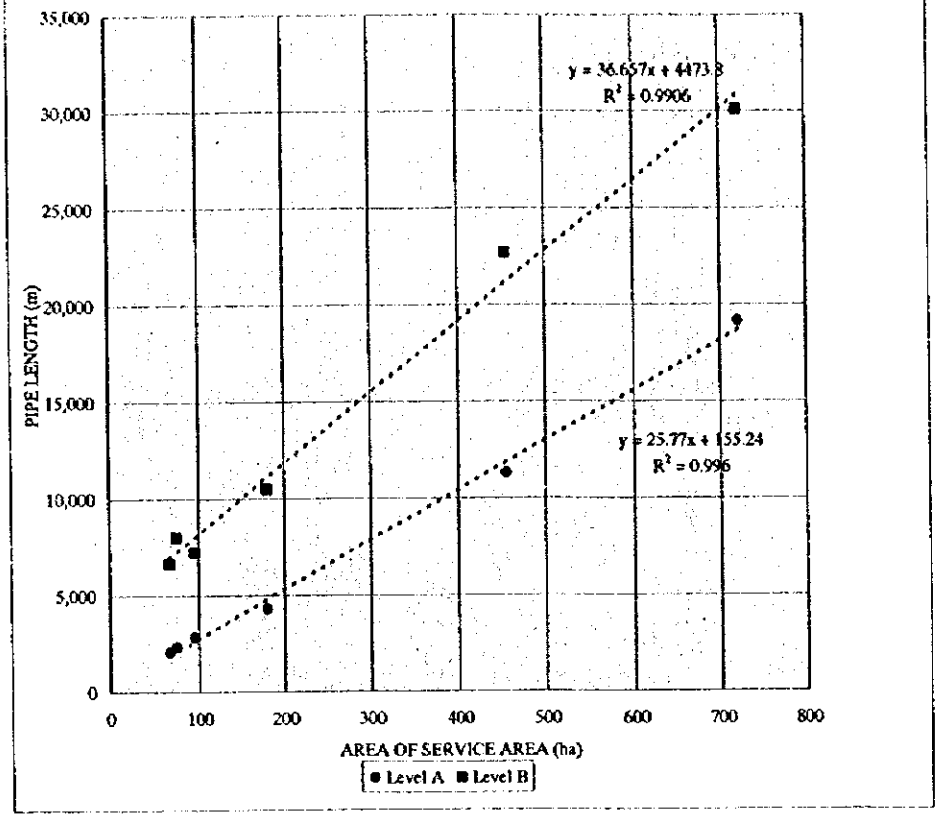
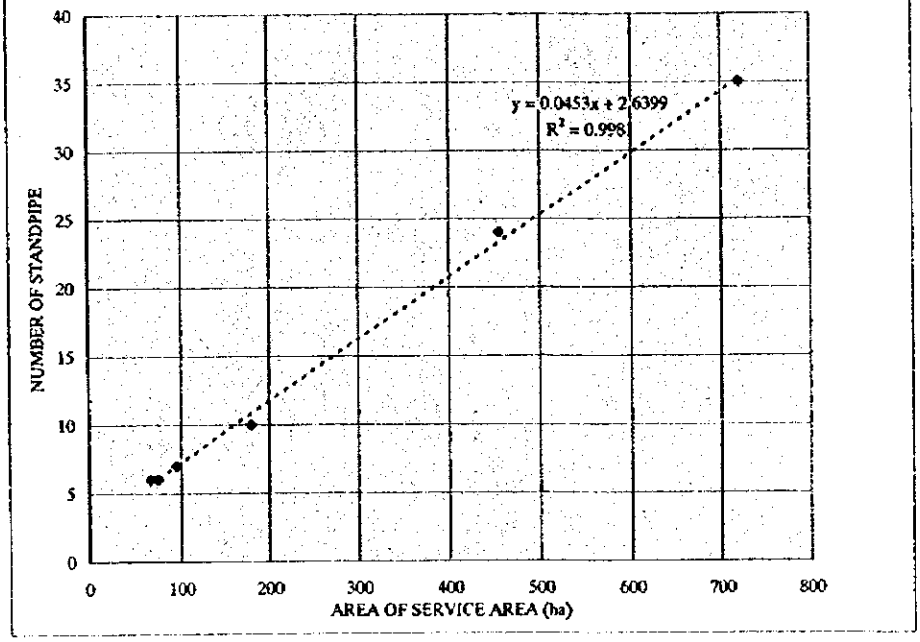


Figure A.1-2 CORRELATION OF AREA AND NUMBER OF STANDPIPE



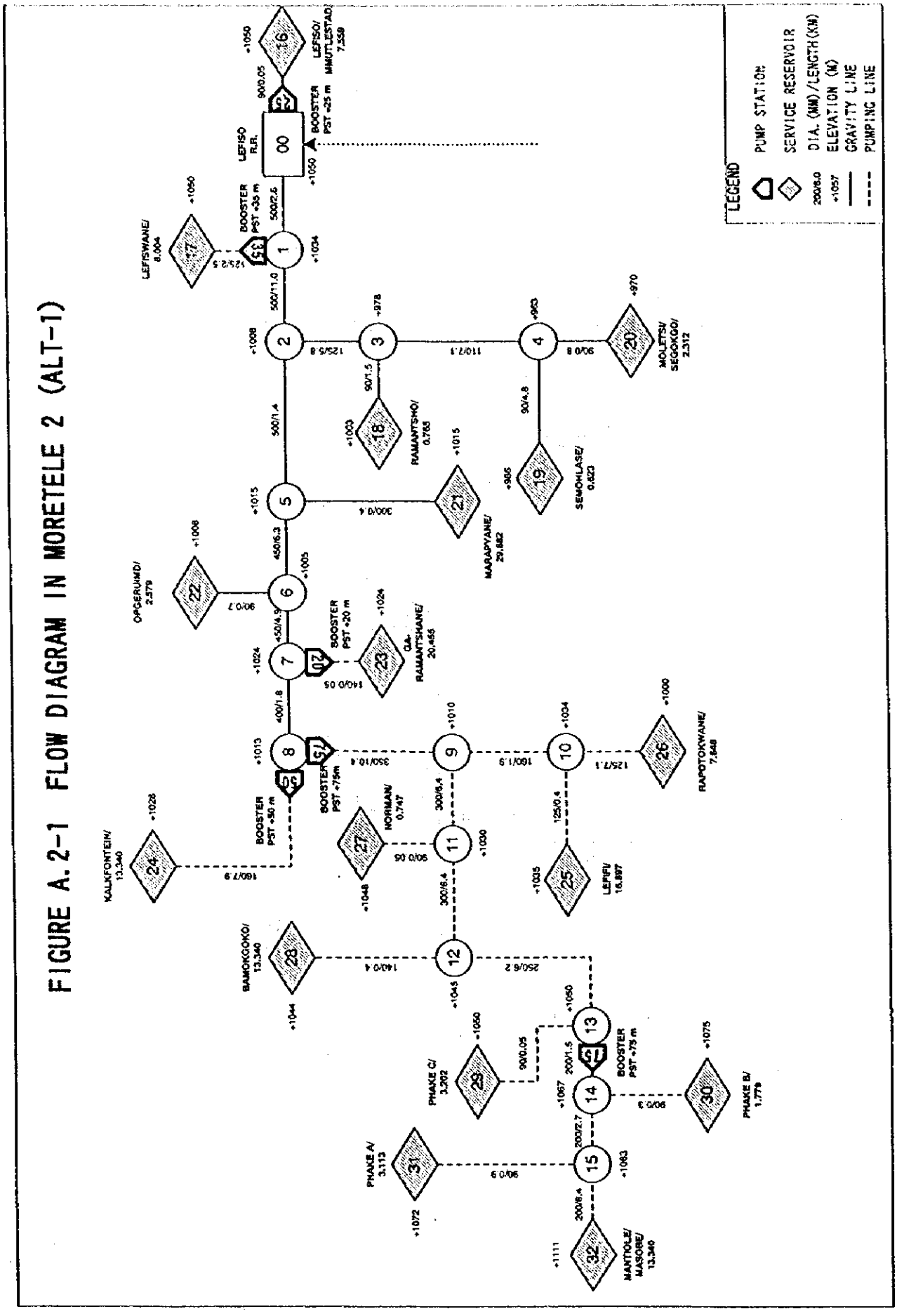
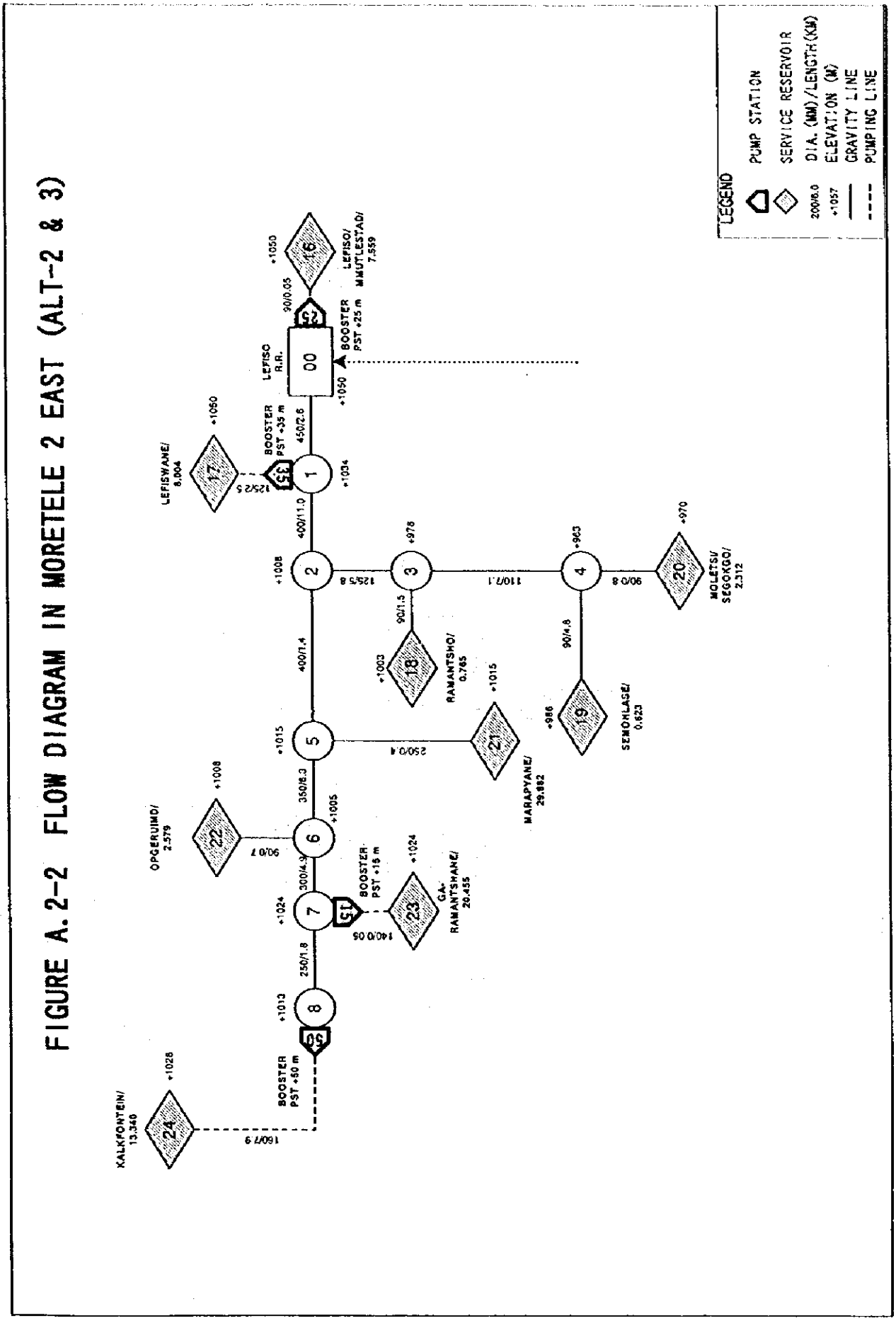


FIGURE A.2-1 FLOW DIAGRAM IN MORETELE 2 (ALT-1)
LEGEND
PUMP STATION
SERVICE RESERVOIR
DIA. (MM)/LENGTH(KM)
ELEVATION (M)
GRAVITY LINE
PUMPING LINE
LEFISO R.R.
LEFISO/ MMUTLESTAD 7.559
LEFISWANE/ 8.004
OPGERUMD/ 2.579
RAMANTSHO/ 0.765
MARAPYANE/ 29.882
SEMOHLASE/ 0.823
MOLETSI/ SEGOKGO/ 2.312
Ga-RAMANTSHANE/ 20.455
RAPOTOKWANE/ 7.848
KALKFONTEIN/ 13.340
NORMAN/ 0.747
LEFIFI 16.897
BAMOKGOKO/ 13.340
PHAKE C/ 3.202
PHAKE A/ 3.113
PHAKE B/ 1.778
MANHOLE/ MASOBE/ 13.340
BOOSTER PST +35 m
BOOSTER PST +25 m
BOOSTER PST +20 m
BOOSTER PST +75m
BOOSTER PST +50 m
BOOSTER PST +75 m

FIGURE A.2-2 FLOW DIAGRAM IN MORETELE 2 EAST (ALT-2 & 3)



FIGIRE A. 2-3 FLOW DIAGRAM IN MORETELE 2 WEST (ALT-2)

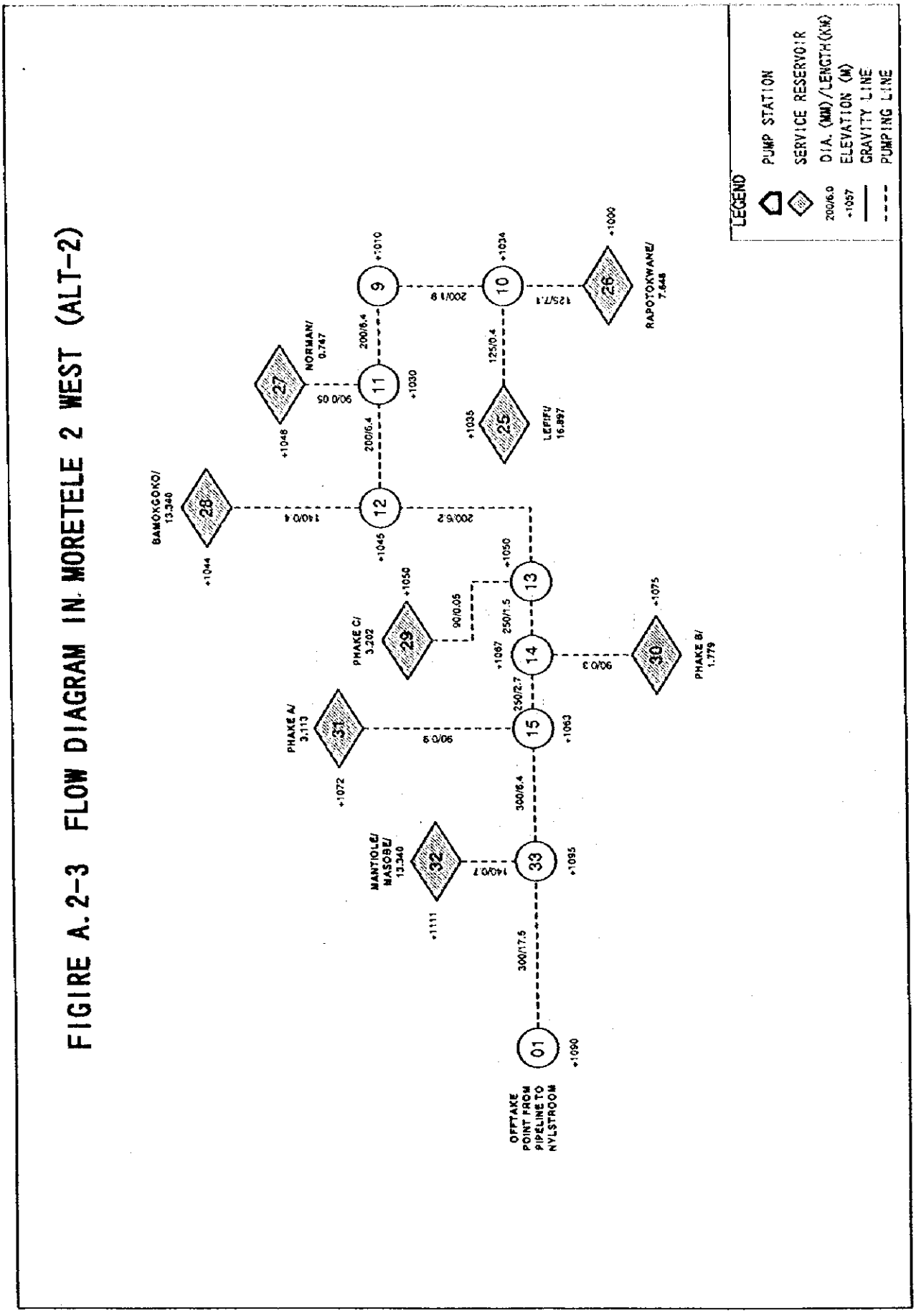


FIGURE A.2-4 FLOW DIAGRAM IN MORETELE 2 WEST (ALT-3)

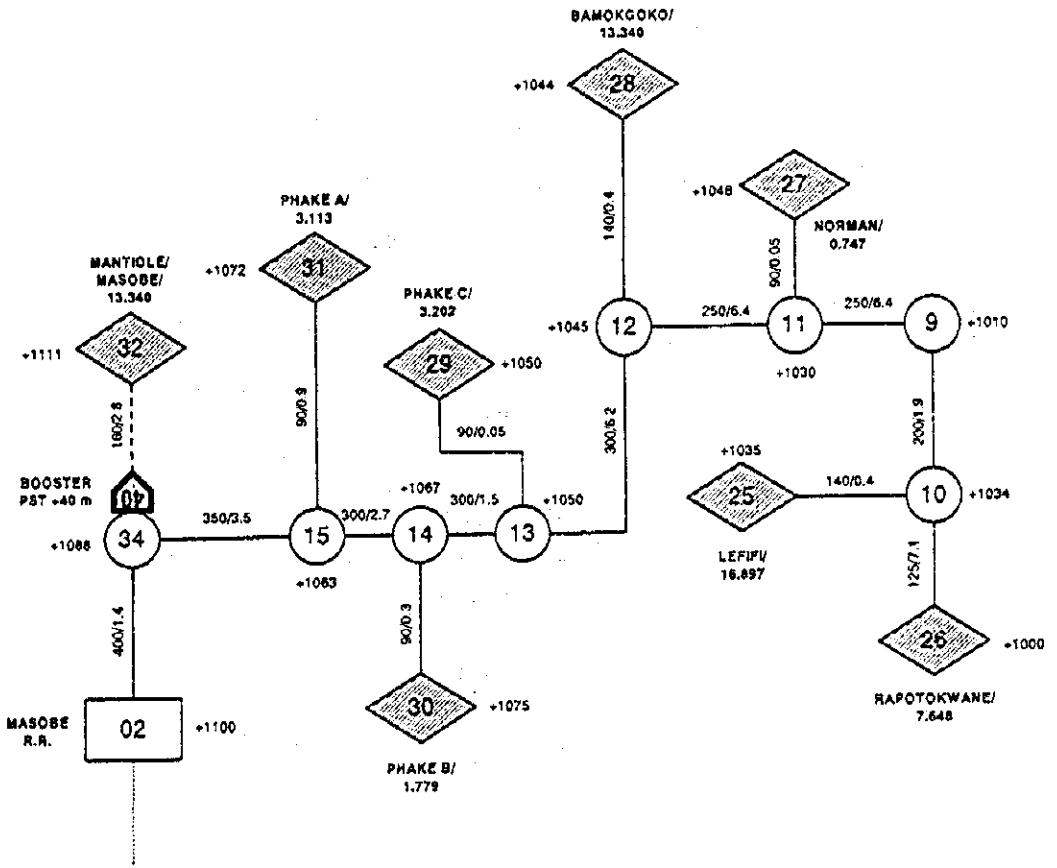


TABLE A.3-1 SUMMARY OF RESERVOIRS

Reservoirs	Capacity Required		Height	Reservoir for Level A				Reservoir for Level B					
	Level B (m3)	Level A (m3)	G=Ground (m)	Capacity (m3)	Number (nos)	Unit Cost (x1,000 R)	Cost (x1,000 R)	Addition (m3)	Capacity (m3)	Number (nos)	Unit Cost (x1,000 R)	Add. Cost (x1,000 R)	Total Cost (x1,000 R)
Alternative-1 (Moretele 2 East)													
Regional Reservoir	*8,386*	*3,145*	*G*	*3,200*	*1*	*1,600*	*1,600*	*5,186*	*5200*	*1*	*2,000*	*2,000*	*3,600*
Lefiso R.R	8,386	3,145	G	3,200	1	1,600	1,600	5,186	5200	1	2,000	2,000	3,600
Service Reservoir	*7,769*	*2,914*	*115*	*1,900*	*12*	*1,630*	*2,455*	*4,799*	*3130*	*16*	*1,710*	*3,700*	*6,155*
Lefiso/Mmutlestad	871	327	15	330	1	270	270	541	280	2	235	470	740
Lefiswane	922	346	15	350	1	275	275	572	290	2	240	480	755
Ramantsho	44	17	10	20	1	50	50	24	30	1	60	60	110
Semohlase	36	13	10	20	1	50	50	16	20	1	50	50	100
Moletsi/Segokgo	133	50	10	50	1	75	75	83	90	1	105	105	180
Marapjane	1,721	645	15	330	2	270	540	1,061	360	3	285	855	1,395
Opgeruimd	149	56	10	60	1	85	85	89	90	1	105	105	190
Ga-Ramantshane	2,356	884	15	450	2	315	630	1,456	490	3	315	945	1,575
Kalkfontein	1,537	576	15	290	2	240	480	957	480	2	315	630	1,110
Alternative-1 (Moretele 2 West)													
Regional Reservoir	*0*	*0*	*G*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
N.A.	0	0	G	0	0	0	0	0	0	0	0	0	0
Service Reservoir	*6,920*	*2,593*	*95*	*1,650*	*11*	*1,385*	*2,110*	*4,290*	*2280*	*13*	*1,660*	*3,055*	*5,165*
Lefifi	1,947	730	15	370	2	285	570	1,207	410	3	310	930	1,500
Rapotokwane	881	330	10	330	1	220	220	551	280	2	195	390	610
Norman	86	32	15	40	1	75	75	46	50	1	90	90	165
Bamokgoko	1,537	576	15	290	2	240	480	957	480	2	315	630	1,110
Phake C	369	138	10	140	1	135	135	229	230	1	180	180	315
Phake B	205	77	10	80	1	95	95	125	130	1	130	130	225
Phake A	359	134	10	140	1	135	135	219	220	1	175	175	310
Mantiole/Masabe	1,537	576	10	290	2	200	400	957	480	2	265	530	930
Alternative-1&3 (Moretele 2 East)													
Regional Reservoir	*4,926*	*1,847*	*G*	*1,900*	*1*	*1,000*	*1,000*	*3,026*	*3100*	*1*	*1,600*	*1,600*	*2,600*
Lefiso R.R	4,926	1,847	G	1,900	1	1,000	1,000	3,026	3100	1	1,600	1,600	2,600
Service Reservoir	*7,769*	*2,914*	*115*	*1,900*	*12*	*1,630*	*2,455*	*4,799*	*2130*	*16*	*1,710*	*3,700*	*6,155*
Lefiso/Mmutlestad	871	327	15	330	1	270	270	541	280	2	235	470	740
Lefiswane	922	346	15	350	1	275	275	572	290	2	240	480	755
Marapjane	1,721	645	15	330	2	270	540	1,061	360	3	285	855	1,395
Ramantsho	44	17	10	20	1	50	50	24	30	1	60	60	110
Opgeruimd	149	56	10	60	1	85	85	89	90	1	105	105	190
Ga-Ramantshane	2,356	884	15	450	2	315	630	1,456	490	3	315	945	1,575
Kalkfontein	1,537	576	15	290	2	240	480	957	480	2	315	630	1,110
Moletsi/Segokgo	133	50	10	50	1	75	75	83	90	1	105	105	180
Semohlase	36	13	10	20	1	50	50	16	20	1	50	50	100
Alternative-2 (Moretele 2 West)													
Regional Reservoir	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
N.A.	0	0		0	0		0	0	0	0		0	0
Service Reservoir	*6,920*	*2,593*	*95*	*1,650*	*11*	*1,385*	*2,110*	*4,290*	*2280*	*13*	*1,660*	*3,055*	*5,165*
Lefifi	1,947	730	15	370	2	285	570	1,207	410	3	310	930	1,500
Rapotokwane	881	330	10	330	1	220	220	551	280	2	195	390	610
Norman	86	32	15	40	1	75	75	46	50	1	90	90	165
Bamokgoko	1,537	576	15	290	2	240	480	957	480	2	315	630	1,110
Phake C	369	138	10	140	1	135	135	229	230	1	180	180	315
Phake B	205	77	10	80	1	95	95	125	130	1	130	130	225
Phake A	359	134	10	140	1	135	135	219	220	1	175	175	310
Mantiole/Masabe	1,537	576	10	290	2	200	400	957	480	2	265	530	930
Alternative-3 (Moretele 2 West)													
Regional Reservoir	*3,460*	*1,297*	*G*	*1,300*	*1*	*900*	*900*	*2,160*	*2200*	*1*	*1,200*	*1,200*	*2,100*
Masobe R.R.	3,460	1,297	G	1,300	1	900	900	2,160	2200	1	1,200	1,200	2,100
Service Reservoir	*5,201*	*1,949*	*95*	*1,320*	*10*	*1,185*	*1,670*	*3,221*	*1980*	*11*	*1,490*	*2,375*	*4,045*
Lefifi	1,947	730	15	370	2	285	570	1,207	410	3	310	930	1,500
Rapotokwane	441	165	10	170	1	150	150	271	280	1	195	195	345
Norman	43	16	15	20	1	60	60	23	30	1	75	75	135
Bamokgoko	768	288	15	290	1	240	240	478	480	1	315	315	555
Phake C	184	69	10	70	1	90	90	114	120	1	125	125	215
Phake B	102	38	10	40	1	70	70	62	70	1	90	90	160
Phake A	179	67	10	70	1	90	90	109	110	1	115	115	205
Mantiole/Masabe	1,537	576	10	290	2	200	400	957	480	2	265	530	930

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

Bulk Supplly Pipelines	Unit	Length	Unit Cost x 1000 R	Total Cost x 1000 R
Alternative - 1, Moretele 2 East				
BEFORE LEFISO REGIONAL RESERVOIR				
450 mm Dia. Steel incl. materials and construction	m	24,700	0.563	13,906
Sub-Total		24,700		13,906
AFTER LEFISO REGIONAL RESERVOIR				
500 mm Dia. Steel incl. materials and construction	m	15,000	0.582	8,730
450 mm Dia. Steel incl. materials and construction	m	11,200	0.563	6,306
400 mm Dia. Steel incl. materials and construction	m	1,800	0.495	891
350 mm Dia. Steel incl. materials and construction	m		0.428	0
300 mm Dia. Steel incl. materials and construction	m	400	0.360	144
250 mm Dia. Steel incl. materials and construction	m		0.292	0
250 mm Dia. uPVC incl. materials and construction	m		0.220	0
200 mm Dia. Steel incl. materials and construction	m		0.224	0
200 mm Dia. uPVC incl. materials and construction	m		0.166	0
160 mm Dia. Steel incl. materials and construction	m		0.170	0
160 mm Dia. uPVC incl. materials and construction	m	7,900	0.120	948
140 mm Dia. Steel incl. materials and construction	m		0.143	0
140 mm Dia. uPVC incl. materials and construction	m	50	0.108	5
125 mm Dia. Steel incl. materials and construction	m		0.123	0
125 mm Dia. uPVC incl. materials and construction	m	8,300	0.086	714
110 mm Dia. Steel incl. materials and construction	m	7,100	0.102	724
110 mm Dia. uPVC incl. materials and construction	m		0.082	0
90 mm Dia. Steel incl. materials and construction	m	5,600	0.075	420
90 mm Dia. uPVC incl. materials and construction	m	2,250	0.066	149
Sub-Total		59,600		19,031
Sub-Total of Alternative-1 (Moretele 2 East)		***84,300***		***32,937***
Alternative - 1, Moretele 2 West				
BEFORE LEFISO REGIONAL RESERVOIR				
N.A.	m	0		0
Sub-Total		0		0
AFTER Node 8				
500 mm Dia. Steel incl. materials and construction	m		0.582	0
450 mm Dia. Steel incl. materials and construction	m		0.563	0
400 mm Dia. Steel incl. materials and construction	m		0.495	0
350 mm Dia. Steel incl. materials and construction	m	10,400	0.428	4,451
300 mm Dia. Steel incl. materials and construction	m	12,800	0.360	4,608
250 mm Dia. Steel incl. materials and construction	m		0.292	0
250 mm Dia. uPVC incl. materials and construction	m	6,200	0.220	1,364
200 mm Dia. Steel incl. materials and construction	m		0.224	0
200 mm Dia. uPVC incl. materials and construction	m	10,600	0.166	1,760
160 mm Dia. Steel incl. materials and construction	m		0.170	0
160 mm Dia. uPVC incl. materials and construction	m	1,900	0.120	228
140 mm Dia. Steel incl. materials and construction	m		0.143	0
140 mm Dia. uPVC incl. materials and construction	m	400	0.108	43
125 mm Dia. Steel incl. materials and construction	m	7,100	0.123	873
125 mm Dia. uPVC incl. materials and construction	m	400	0.086	34
110 mm Dia. Steel incl. materials and construction	m		0.102	0
110 mm Dia. uPVC incl. materials and construction	m		0.082	0
90 mm Dia. Steel incl. materials and construction	m		0.075	0
90 mm Dia. uPVC incl. materials and construction	m	1,300	0.066	86
Sub-Total		51,100		13,448
Sub-Total of Alternative-1 (Moretele 2 West)		***51,100***		***13,448***

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

Bulk Supply Pipelines	Unit	Length	Unit Cost x 1000 R	Total Cost x 1000 R
Alternative - 2 & 3, Moretele 2 East				
BEFORE LEFISO REGIONAL RESERVOIR				
350 mm Dia. Steel incl. materials and construction	m	24,700	0.428	10,572
Sub-Total		24,700		10,572
AFTER LEFISO REGIONAL RESERVOIR				
500 mm Dia. Steel incl. materials and construction	m		0.582	0
450 mm Dia. Steel incl. materials and construction	m	2,600	0.563	1,464
400 mm Dia. Steel incl. materials and construction	m	12,400	0.495	6,138
350 mm Dia. Steel incl. materials and construction	m	6,300	0.428	2,696
300 mm Dia. Steel incl. materials and construction	m	4,900	0.360	1,764
250 mm Dia. Steel incl. materials and construction	m		0.292	0
250 mm Dia. uPVC incl. materials and construction	m	2,200	0.220	484
200 mm Dia. Steel incl. materials and construction	m		0.224	0
200 mm Dia. uPVC incl. materials and construction	m		0.165	0
160 mm Dia. Steel incl. materials and construction	m		0.170	0
160 mm Dia. uPVC incl. materials and construction	m	7,900	0.120	948
140 mm Dia. Steel incl. materials and construction	m		0.143	0
140 mm Dia. uPVC incl. materials and construction	m	50	0.108	5
125 mm Dia. Steel incl. materials and construction	m		0.123	0
125 mm Dia. uPVC incl. materials and construction	m	8,300	0.086	714
110 mm Dia. Steel incl. materials and construction	m	7,100	0.102	724
110 mm Dia. uPVC incl. materials and construction	m		0.082	0
90 mm Dia. Steel incl. materials and construction	m	5,600	0.075	420
90 mm Dia. uPVC incl. materials and construction	m	2,250	0.066	149
Sub-Total		59,600		15,506
Sub-Total of Alternative-2 & 3 (Moretele 2 East)		***84,300***		***26,078***

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

Bulk Supply Pipelines	Unit	Length	Unit Cost x 1000 R	Total Cost x 1000 R
Alternative - 2, Moretele 2 West				
BEFORE ======= REGIONAL RESERVOIR				
N. A. (but, share cost required)	m	0	0	6,150
Sub-Total		0		6,150
AFTER OFFTAKE POINT ON PIPELINE TO NYLSTROOM				
500 mm Dia. Steel incl. materials and construction	m		0.582	0
450 mm Dia. Steel incl. materials and construction	m		0.563	0
400 mm Dia. Steel incl. materials and construction	m		0.495	0
350 mm Dia. Steel incl. materials and construction	m		0.428	0
300 mm Dia. Steel incl. materials and construction	m	23,900	0.360	8,604
250 mm Dia. Steel incl. materials and construction	m	4,200	0.292	1,226
250 mm Dia. uPVC incl. materials and construction	m		0.220	0
200 mm Dia. Steel incl. materials and construction	m	20,900	0.224	4,682
200 mm Dia. uPVC incl. materials and construction	m		0.166	0
160 mm Dia. Steel incl. materials and construction	m		0.170	0
160 mm Dia. uPVC incl. materials and construction	m		0.120	0
140 mm Dia. Steel incl. materials and construction	m	1,100	0.143	157
140 mm Dia. uPVC incl. materials and construction	m		0.108	0
125 mm Dia. Steel incl. materials and construction	m	7,500	0.123	923
125 mm Dia. uPVC incl. materials and construction	m		0.086	0
110 mm Dia. Steel incl. materials and construction	m		0.102	0
110 mm Dia. uPVC incl. materials and construction	m		0.082	0
90 mm Dia. Steel incl. materials and construction	m	1,300	0.075	98
90 mm Dia. uPVC incl. materials and construction	m		0.066	0
Sub-Total		58,900		15,689
Sub-Total of Alternative-2 (Moretele 2 West)		***58,900***		***21,839***
Alternative - 3, Moretele 2 West				
BEFORE MASOBE REGIONAL RESERVOIR				
300 mm Dia. Steel incl. materials and construction	m	35,600	0.360	12,816
Sub-Total		35,600		12,816
AFTER MASOBE REGIONAL RESERVOIR				
500 mm Dia. Steel incl. materials and construction	m		0.582	0
450 mm Dia. Steel incl. materials and construction	m		0.563	0
400 mm Dia. Steel incl. materials and construction	m	1,400	0.495	693
350 mm Dia. Steel incl. materials and construction	m	3,500	0.428	1,498
300 mm Dia. Steel incl. materials and construction	m	10,400	0.360	3,744
250 mm Dia. Steel incl. materials and construction	m	6,400	0.292	1,869
250 mm Dia. uPVC incl. materials and construction	m	6,400	0.220	1,408
200 mm Dia. Steel incl. materials and construction	m	1,900	0.224	426
200 mm Dia. uPVC incl. materials and construction	m		0.166	0
160 mm Dia. Steel incl. materials and construction	m		0.170	0
160 mm Dia. uPVC incl. materials and construction	m	2,800	0.120	336
140 mm Dia. Steel incl. materials and construction	m		0.143	0
140 mm Dia. uPVC incl. materials and construction	m	800	0.108	86
125 mm Dia. Steel incl. materials and construction	m	7,100	0.123	873
125 mm Dia. uPVC incl. materials and construction	m		0.086	0
110 mm Dia. Steel incl. materials and construction	m		0.102	0
110 mm Dia. uPVC incl. materials and construction	m		0.082	0
90 mm Dia. Steel incl. materials and construction	m		0.075	0
90 mm Dia. uPVC incl. materials and construction	m	1,300	0.066	86
Sub-Total		42,000		11,019
Sub-Total of Alternative-3 (Moretele 2 West)		***77,600***		***23,835***

TABLE A.3-3 SUMMARY OF BOOSTER PUMP STATIONS

MORETELE 2	FLOW (l/sec)	FLOW (m3/min)	HEIGHT (m)	NO. OF UNIT Operation	Stand-by	Total	FLOW/UNIT (m3/min)	Pm REQUIRED (Kw)	TOTAL Pm (Kw)	COST OF PUMP SET (R)	PUMP STATION COST (R)
Alternative - 1 - East											*389,191*
Lefiso	7.559	0.454	25	2	1	3	0.227	3.7	11.1	19,611	56,031
Lefiswane	8.004	0.480	35	2	1	3	0.240	5.5	16.5	29,151	83,290
Ga-ramantshane 1	20.455	1.227	20	2	1	3	0.614	5.5	16.5	29,151	83,290
Ga-ramantshane 2	13.340	0.800	50	2	1	3	0.400	11.0	33.0	58,303	166,580
Alternative - 1- West											*787,468*
Ga-ramantshane 3	60.066	3.604	75	2	1	3	1.802	37.0	111.0	196,110	560,314
Phake C	18.232	1.094	75	2	1	3	0.547	15.0	45.0	79,504	227,154
Alternative - 2, 3 East											*361,932*
Lefiso	7.559	0.454	25	2	1	3	0.227	3.7	11.1	19,611	56,031
Lefiswane	8.004	0.480	35	2	1	3	0.240	5.5	16.5	29,151	83,290
Ga-ramantshane 1	20.455	1.227	15	2	1	3	0.614	3.7	11.1	19,611	56,031
Ga-ramantshane 2	13.340	0.800	50	2	1	3	0.400	11.0	33.0	58,303	166,580
Alternative - 2 West											*0*
	NO BOOSTER PUMP										
Alternative - 3 West											*113,577*
Masobe	13.340	0.800	40	2	1	3	0.400	7.5	22.5	39,752	113,577

TABLE A.3-3 SUMMARY OF BOOSTER PUMP STATIONS

MORETELE 2	FLOW (l/sec)	FLOW (m3/min)	HEIGHT (m)	NO. OF UNIT Operation	Stand-by	Total	FLOW/UNIT (m3/min)	Pm REQUIRED (Kw)	TOTAL Pm (Kw)	COST OF PUMP SET (R)	PUMP STATION COST (R)
											389,191
Alternative - 1 - East											
Lefiso	7.559	0.454	25	2	1	3	0.227	3.7	11.1	19,611	56,031
Lefiswane	8.004	0.480	35	2	1	3	0.240	5.5	16.5	29,151	83,290
Ga-ramantshane 1	20.455	1.227	20	2	1	3	0.614	5.5	16.5	29,151	83,290
Ga-ramantshane 2	13.340	0.800	50	2	1	3	0.400	11.0	33.0	58,303	166,580
											787,468
Alternative - 1- West											
Ga-ramantshane 3	60.066	3.604	75	2	1	3	1.802	37.0	111.0	196,110	560,314
Phake C	18.232	1.094	75	2	1	3	0.547	15.0	45.0	79,504	227,154
											361,932
Alternative - 2, 3 East											
Lefiso	7.559	0.454	25	2	1	3	0.227	3.7	11.1	19,611	56,031
Lefiswane	8.004	0.480	35	2	1	3	0.240	5.5	16.5	29,151	83,290
Ga-ramantshane 1	20.455	1.227	15	2	1	3	0.614	3.7	11.1	19,611	56,031
Ga-ramantshane 2	13.340	0.800	50	2	1	3	0.400	11.0	33.0	58,303	166,580
											0
Alternative - 2 West											
	NO BOOSTER PUMP										
											113,577
Alternative - 3 West											
Masobe	13.340	0.800	40	2	1	3	0.400	7.5	22.5	39,752	113,577

TABLE A.3-4 SUMMARY OF INTAKE PUMP STATIONS

Level B

INTAKE PUMP STATION	FLOW (l/sec)	FLOW (m3/min)	HEIGHT (m)	NO. OF UNIT Operation	Stand-by	Total	FLOW/UNIT (m3/min)	Pm REQUIRED (Kw)	TOTAL Pm (Kw)	COST OF PUMP SET (R)	PUMP STATION COST (R)
Alternative - 1											*454,308*
Moretele 2 (E&W)	182.292	10.938	21	2	1	3	5.469	30.0	90.0	159,008	454,308
Alternative - 2, 3											*454,308*
Moretele 2 East	182.292	10.938	21	2	1	3	5.469	30.0	90.0	159,008	454,308
Alternative - 2											*560,314*
Moretele 2 West	218.750	13.125	21	2	1	3	6.563	37.0	111.0	196,110	560,314
Alternative - 3											*166,580*
Moretele 2 West	63.069	3.784	21	2	1	3	1.892	11.0	33.0	58,303	166,580

Level A

INTAKE PUMP STATION	FLOW (l/sec)	FLOW (m3/min)	HEIGHT (m)	NO. OF UNIT Operation	Stand-by	Total	FLOW/UNIT (m3/min)	Pm REQUIRED (Kw)	TOTAL Pm (Kw)	COST OF PUMP SET (R)	PUMP STATION COST (R)
Alternative - 1											*302,872*
Moretele 2 (E&W)	68.360	4.102	21	1	1	2	4.102	30.0	60.0	106,005	302,872

TABLE A.3-4 SUMMARY OF INTAKE PUMP STATIONS

Level B

INTAKE PUMP STATION	FLOW (l/sec)	FLOW (m3/min)	HEIGHT (m)	NO. OF UNIT Operation	Stand-by	Total	FLOW/UNIT (m3/min)	Pm REQUIRED (Kw)	TOTAL Pm (Kw)	COST OF PUMP SET (R)	PUMP STATION COST (R)
Alternative - 1											*454,308*
Moretele 2 (E&W)	182.292	10.938	21	2	1	3	5.469	30.0	90.0	159,008	454,308
Alternative - 2, 3											*454,308*
Moretele 2 East	182.292	10.938	21	2	1	3	5.469	30.0	90.0	159,008	454,308
Alternative - 2											*560,314*
Moretele 2 West	218.750	13.125	21	2	1	3	6.563	37.0	111.0	196,110	560,314
Alternative - 3											*166,580*
Moretele 2 West	63.069	3.784	21	2	1	3	1.892	11.0	33.0	58,303	166,580

Level A

INTAKE PUMP STATION	FLOW (l/sec)	FLOW (m3/min)	HEIGHT (m)	NO. OF UNIT Operation	Stand-by	Total	FLOW/UNIT (m3/min)	Pm REQUIRED (Kw)	TOTAL Pm (Kw)	COST OF PUMP SET (R)	PUMP STATION COST (R)
Alternative - 1											*302,872*
Moretele 2 (E&W)	68.360	4.102	21	1	1	2	4.102	30.0	60.0	106,005	302,872

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

Moretele 2 Settlement	Alternative Name	Number of Household	Population	Water Demand AADD (l/day) Level A	Water Demand AADD (l/day) Level B	Area (ha)	Level A Length of Reticulation Pipe (m)	Level B Length of Reticulation Pipe (m)	Level B Proportion of Pipe Diameter (%) 63	75	90	110	125	140	160	200	Tot.	Level B Length of Pipeline for Each Diameter (m) 63	75	90	110	125	140	160	200	Tot.
1 Lefiso/Mmutlestad	Mutiestad, Geelbeksvle	850	5,440	163,200	435,418	825.0	21,415	34,716	29.00	23.00	17.00	11.00	8.00	6.00	4.00	2.00	100.0	10,068	7,985	5,902	3,819	2,777	2,083	1,389	694	34,716
2 Lefiswane	Radijoko, Difihagane	900	5,760	172,800	461,030	1,647.0	42,598	64,848	29.00	23.00	17.00	11.00	8.00	6.00	4.00	2.00	100.0	18,806	14,915	11,024	7,133	5,188	3,891	2,594	1,297	64,848
3 Ramantsho		86	550	16,512	44,054	65.5	1,843	6,875	44.75	33.10	22.15						100.0	3,076	2,276	1,523	0	0	0	0	0	6,875
4 Semohlase	Roodekoppies	70	448	13,440	35,858	45.5	1,328	6,142	44.75	33.10	22.15						100.0	1,738	1,523	1,360	0	0	0	0	0	6,622
5 Moletsi	Segokgo	260	1,664	49,920	133,187	250.0	6,598	13,638	32.76	24.23	16.21	11.99	8.87	5.94			100.0	4,468	3,304	2,211	1,635	1,210	810	0	0	13,638
6 Marapyane	Schilpadfontein	3,360	21,504	645,120	1,721,180	3,054.5	78,870	116,443	29.00	23.00	17.00	11.00	8.00	6.00	4.00	2.00	100.0	33,768	26,782	19,795	12,809	9,315	6,987	4,658	2,329	116,443
7 Opgeruind		290	1,856	55,680	148,554	78.0	2,165	7,333	32.76	24.23	16.21	11.99	8.87	5.94			100.0	2,402	1,777	1,189	879	650	436	0	0	7,333
8 Ga-Ramantshane	Scabe	2,300	14,720	441,600	1,178,189	1,597.5	41,323	63,033	29.00	23.00	17.00	11.00	8.00	6.00	4.00	2.00	100.0	18,240	14,498	10,716	6,934	5,043	3,782	2,521	1,261	63,033
9 Kalkfontein		1,500	9,600	288,000	768,384	746.5	19,393	31,838	29.00	23.00	17.00	11.00	8.00	6.00	4.00	2.00	100.0	9,233	7,323	5,413	3,502	2,547	1,910	1,274	637	31,838
Sub-Total of Moretele 2 East		*9,616*	*61,542*	*1,846,272*	*4,925,854*	*8,309.5*	*215,533*	*344,866*										*101,840*	*80,382*	*59,132*	*36,711*	*26,730*	*19,898*	*12,435*	*6,218*	*343,346*
10 Lefifi	Nokaneng, Rooifontein	1,900	12,160	364,800	973,286	935.5	24,263	38,766	29.00	23.00	17.00	11.00	8.00	6.00	4.00	2.00	100.0	11,242	8,916	6,590	4,264	3,101	2,326	1,551	775	38,766
11 Rapotokwane	Willaagte	860	5,504	165,120	440,540	191.0	5,077	11,475	29.00	23.00	17.00	11.00	8.00	6.00	4.00	2.00	100.0	3,328	2,639	1,951	1,262	918	689	459	230	11,475
12 Norman		84	538	16,128	43,030	241.5	6,379	13,326	44.75	33.10	22.15						100.0	5,964	4,411	2,952	0	0	0	0	0	13,326
13 Bamokgoko	Mmamotlhake	1,500	9,600	288,000	768,384	648.5	16,867	28,246	29.00	23.00	17.00	11.00	8.00	6.00	4.00	2.00	100.0	8,191	6,497	4,802	3,107	2,260	1,695	1,130	565	28,246
14 Phake C		360	2,304	69,120	184,412	103.5	2,822	8,268	29.43	23.12	17.10	11.44	8.46	6.26	4.19		100.0	2,433	1,912	1,414	946	699	518	346	0	8,268
15 Phake B		200	1,280	38,400	102,451	63.5	1,792	6,802	36.04	24.11	17.83	13.19	8.83				100.0	2,451	1,640	1,213	897	601	0	0	0	6,802
16 Phake A	Rankaile	350	2,240	67,200	179,290	61.5	1,740	6,728	29.43	23.12	17.10	11.44	8.46	6.26	4.19		100.0	1,980	1,556	1,151	770	569	421	282	0	6,728
17 Mantiole	Pankop, Masebe	1,500	9,600	288,000	768,384	581.0	15,128	25,772	29.00	23.00	17.00	11.00	8.00	6.00	4.00	2.00	100.0	7,474	5,927	4,381	2,835	2,062	1,546	1,031	515	25,772
Sub-Total of Moretele 2 West		*6,754*	*43,226*	*1,296,768*	*3,459,777*	*2,826.0*	*74,068*	*139,383*										*43,063*	*33,498*	*24,453*	*14,081*	*10,210*	*7,194*	*4,799*	*2,085*	*139,383*
TOTAL		16,370	104,768	3,143,040	8,385,631	11,135.5	289,601	484,249										144,903	113,879	83,585	50,792	36,940	27,093	17,234	8,303	482,729

51	56	66	82	86	108	120	166	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Average Unit Cost (R/m) : 58.36

Moretele 2 East	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Moretele 2 West	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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

Moretele 2		Number of Household	Population	Water Demand AADD (l/day)		Area	Level A	Level B	Level A									Level A							
									Proportion of Pipe Diameter (%)									Length of Pipeline for Each Diameter (m)							
Settlement	Alternative Name			Level A	Level B	(ha)	Length of Reticulation Pipe (m)	Length of Reticulation Pipe (m)	63	75	90	110	125	140	160	200	Tot.	63	75	90	110	125	140	160	200	Tot.
1 Lefiso/Mmutlestac	Mutiostad, Geelhoksvle	850	5,440	163,200	435,418	825.0	21,415	34,716	6.29	30.87	32.89	29.95					100.0	910	4,468	4,760	4,334	2,777	2,093	1,389	694	21,415
2 Lefiswane	Radijoko, Ditlhagane	900	5,760	172,800	461,030	1,647.0	42,598	64,848	6.29	30.87	32.89	29.95					100.0	1,864	9,146	9,745	8,874	5,188	3,891	2,594	1,297	42,599
3 Ramantsho		86	550	16,512	44,054	65.5	1,843	6,875	31.24	39.06	29.70						100.0	576	720	547	0	0	0	0	0	1,843
4 Semohlane	Roodekoppies	70	448	13,440	35,858	45.5	1,328	6,142	31.24	39.06	29.70						100.0	0	0	0	0	0	0	0	0	0
5 Moletsi	Segokgo	260	1,664	49,920	133,187	250.0	6,598	13,638	6.87	31.75	30.59	30.79					100.0	315	1,453	1,400	1,410	1,210	810	0	0	6,598
6 Marapyane	Schilpadfontein	3,360	21,504	645,120	1,721,180	3,054.5	78,870	116,443	6.29	30.87	32.89	29.95					100.0	3,496	17,158	18,281	16,647	9,315	6,987	4,658	2,329	78,871
7 Opgeruimd		290	1,856	55,680	148,554	78.0	2,165	7,333	6.87	31.75	30.59	30.79					100.0	74	343	330	332	650	436	0	0	2,165
8 Ga-Ramantshane	Seabe	2,300	14,720	441,600	1,178,189	1,597.5	41,323	63,033	6.29	30.87	32.89	29.95					100.0	1,806	8,865	9,445	8,600	5,043	3,782	2,521	1,261	41,323
9 Kalkfontein		1,500	9,600	288,000	768,384	746.5	19,393	31,838	6.29	30.87	32.89	29.95					100.0	819	4,021	4,284	3,901	2,547	1,910	1,274	637	19,393
Sub-Total of Moretele 2 East		*9,616*	*61,542*	*1,846,272*	*4,925,854*	*8,309.5*	*215,533*	*344,866*										*9,860*	*46,174*	*48,792*	*44,098*	*26,730*	*19,898*	*12,435*	*6,218*	*214,207*
10 Lefifi	Nokaneng, Rooifontein	1,900	12,160	364,800	973,286	935.5	24,263	38,766	6.29	30.87	32.89	29.95					100.0	1,038	5,097	5,430	4,945	3,101	2,326	1,551	775	24,263
11 Rapotokwane	Witlaagte	860	5,504	165,120	440,540	191.0	5,077	11,475	6.29	30.87	32.89	29.95					100.0	175	859	915	833	918	689	459	230	5,078
12 Norman		84	538	16,128	43,030	241.5	6,379	13,326	31.24	39.06	29.70						100.0	1,993	2,492	1,894	0	0	0	0	0	6,379
13 Bamokgoko	Mmametlhake	1,500	9,600	288,000	768,384	648.5	16,867	28,246	6.29	30.87	32.89	29.95					100.0	706	3,463	3,690	3,360	2,260	1,695	1,130	565	16,869
14 Phake C		360	2,304	69,120	184,412	103.5	2,822	8,268	6.29	30.87	32.89	29.95					100.0	79	389	414	377	699	518	346	0	2,822
15 Phake B		200	1,280	38,400	102,451	63.5	1,792	6,802	7.08	29.62	31.54	31.76					100.0	84	353	376	378	601	0	0	0	1,792
16 Phake A	Rankaile	350	2,240	67,200	179,290	61.5	1,740	6,728	6.29	30.87	32.89	29.95					100.0	29	144	154	140	569	421	292	0	1,739
17 Mantiole	Pankop, Masabe	1,500	9,600	288,000	768,384	581.0	15,128	25,772	6.29	30.87	32.89	29.95					100.0	627	3,079	3,280	2,987	2,062	1,546	1,031	515	15,127
Sub-Total of Moretele 2 West		*6,754*	*43,226*	*1,296,768*	*3,459,777*	*2,826.0*	*74,068*	*139,383*										*4,731*	*15,876*	*16,153*	*13,020*	*10,210*	*7,194*	*4,799*	*2,085*	*74,069*
TOTAL		16,370	104,768	3,143,040	8,385,631	11,135.5	289,601	484,249										14,591	62,050	64,945	57,118	36,940	27,092	17,234	8,303	288,276

51	56	66	82	86	108	120	166	
744,141	3,474,800	4,586,370	4,683,676	3,176,940	2,925,936	2,068,080	1,578,298	72,738,141

Average Unit Cost (R/m) : 78.88

Moretele 2 East	502,860	2,585,744	3,220,272	3,616,036	2,298,780	2,148,984	1,492,200	1,032,188	15,897,064
Moretele 2 West	241,281	889,056	1,066,098	1,067,640	878,160	776,952	575,880	546,110	6,841,077
Total	744,141	3,474,800	4,586,370	4,683,676	3,176,940	2,925,936	2,068,080	1,578,298	72,738,141

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

Moretele 2 Settlement	Alternative Name	Number of Household	Population	Water Demand AADD (l/day) Level A	Water Demand AADD (l/day) Level B	Area (ha)	Number of Standpipes Required Level A	Number of Standpipes Required Level B
1 Lefiso/Mmutlestad	Mutlestad, Geelbeksvlei	850	5,440	163,200	435,418	825.0	40	31
2 Lefiswane	Radijoko, Ditlhagane	900	5,760	172,800	461,030	1,647.0	77	59
3 Ramantsho		86	550	16,512	44,054	65.5	6	5
4 Semohlase	Roodekoppies	70	448	13,440	35,858	45.5	0	0
5 Moletsi	Segokgo	260	1,664	49,920	133,187	250.0	14	11
6 Marapyane	Schilpadfontein	3,360	21,504	645,120	1,721,180	3,054.5	141	108
7 Opgeruimd		290	1,856	55,680	148,554	78.0	6	5
8 Ga-Ramantshane	Seabe	2,300	14,720	441,600	1,178,189	1,597.5	75	58
9 Kalkfontein		1,500	9,600	288,000	768,384	746.5	36	28
Sub-Total of Moretele 2 East		***9,616***	***61,542***	***1,846,272***	***4,925,854***	***8,309.5***	***395***	***305***
10 Lefifi	Nokaneng, Rooifontein	1,900	12,160	364,800	973,286	935.5	45	35
11 Rapotokwane	Witlaagte	860	5,504	165,120	440,540	191.0	11	8
12 Norman		84	538	16,128	43,030	241.5	14	11
13 Bamokgoko	Mmametlhake	1,500	9,600	288,000	768,384	648.5	32	25
14 Phake C		360	2,304	69,120	184,412	103.5	7	5
15 Phake B		200	1,280	38,400	102,451	63.5	6	5
16 Phake A	Rankaile	350	2,240	67,200	179,290	61.5	5	4
17 Mantiole	Pankop, Masabe	1,500	9,600	288,000	768,384	581.0	29	22
Sub-Total of Moretele 2 West		***6,754***	***43,226***	***1,296,768***	***3,459,777***	***2,826.0***	***149***	***115***
TOTAL		16,370	104,768	3,143,040	8,385,631	11,135.5	544	420

Level A

Cost of Standpipes

	Qty.	Unit Cost	Total Cost
Moretele 2 East	395	1600	632,000
Moretele 2 West	149	1600	238,400
Total	**544**		**870,400**

Level B

Cost of Standpipes

	Qty.	Unit Cost	Total Cost
Moretele 2 East	305	1600	488,000
Moretele 2 West	115	1600	184,000
Total	**420**		**672,000**

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

Moretele 2 Settlement	Alternative Name	Number of Household	Population	Water Demand AADD (l/day) Level A	Water Demand AADD (l/day) Level B	Area (ha)	Number of Yard Connection
1 Lefiso/Mmutlestad	Mutiestad, Geelbeksvlei	850	5,440	163,200	435,418	825.0	765
2 Lefiswane	Radijoko, Ditlhagane	900	5,760	172,800	461,030	1,647.0	810
3 Ramantsho		86	550	16,512	44,054	65.5	77
4 Semohlase	Roodekoppies	70	448	13,440	35,858	45.5	63
5 Moletsi	Segokgo	260	1,664	49,920	133,187	250.0	234
6 Marapyane	Schilpadfontein	3,360	21,504	645,120	1,721,180	3,054.5	3,024
7 Opgeruimd		290	1,856	55,680	148,554	78.0	261
8 Ga-Ramantshane	Seabe	2,300	14,720	441,600	1,178,189	1,597.5	2,070
9 Kalkfontein		1,500	9,600	288,000	768,384	746.5	1,350
Sub-Total of Moretele 2 East		***9,616***	***61,542***	***1,846,272***	***4,925,854***	***8,309.5***	***8,654***
10 Lefifi	Nokaneng, Rooifontein	1,900	12,160	364,800	973,286	935.5	1,710
11 Rapotokwane	Witlaagte	860	5,504	165,120	440,540	191.0	774
12 Norman		84	538	16,128	43,030	241.5	76
13 Bamokgoko	Mmametlhake	1,500	9,600	288,000	768,384	648.5	1,350
14 Phake C		360	2,304	69,120	184,412	103.5	324
15 Phake B		200	1,280	38,400	102,451	63.5	180
16 Phake A	Rankaile	350	2,240	67,200	179,290	61.5	315
17 Mantiole	Pankop, Masabe	1,500	9,600	288,000	768,384	581.0	1,350
Sub-Total of Moretele 2 West		***6,754***	***43,226***	***1,296,768***	***3,459,777***	***2,826.0***	***6,079***
TOTAL		**16,370**	**104,768**	**3,143,040**	**8,385,631**	**11,135.5**	**14,733**

Cost of Yard Connection

	Qty.	Unit Cost	Total Cost
Moretele 2 East	8,654	1050	9,086,700
Moretele 2 West	6,079	1050	6,382,950
Total	**14,733**		**15,469,650**

TABLE A.4-1 COMPARISON OF ENERGY REQUIREMENTS

	Q (l/sec)	Q (m3/sec)	H (m)	QxH (m4/sec)	Q (m3/min) AADD	kW	Cost (R/year)
Moretele 2, Alternative - 1							
Raw Water							
Moretele 2 East		0.153	21.000	3.211	6.116	30.094	29,130
Moretele 2 West				0.000			
WTW -> R.R.							
Moretele 2 East		0.146	196.000	28.538	5.824	267.469	245,371
Moretele 2 West				0.000			
Booster Pump							
East 00	7.559	0.008	25.000	0.189	0.302	1.771	3,329
East 1	8.004	0.008	35.000	0.280	0.320	2.626	4,107
East 7	20.455	0.020	20.000	0.409	0.818	3.834	5,208
East 8	13.340	0.013	50.000	0.667	0.534	6.251	7,410
East 8	60.066	0.060	75.000	4.505	2.403	42.223	40,179
West 13	18.232	0.018	75.000	1.367	0.729	12.816	13,390
Total Energy (QxH)				**39.166**			**348,123**
except raw water				**35.955**			
Moretele 2, Alternative - 2							
Raw Water							
Moretele 2 East		0.090	21.000	1.886	3.592	17.675	17,816
Moretele 2 West		0.063	21.000	1.325	2.524	12.419	13,029
WTW -> R.R.							
Moretele 2 East		0.086	209.000	17.870	3.420	167.482	154,286
Moretele 2 West		0.060	300.000	18.030	2.404	168.986	155,656
Booster Pump							
East 00	7.559	0.008	25.000	0.189	0.302	1.771	3,329
East 1	8.004	0.008	35.000	0.280	0.320	2.626	4,107
East 7	20.455	0.020	15.000	0.307	0.818	2.876	4,335
East 8	13.340	0.013	50.000	0.667	0.534	6.251	7,410
		0.000		0.000			
		0.000		0.000			
Total Energy (QxH)				**40.553**			**359,968**
except raw water				**37.342**			
Moretele 2, Alternative - 3							
Raw Water							
Moretele 2 East		0.090	21.000	1.886	3.592	17.675	17,816
Moretele 2 West		0.063	21.000	1.325	2.524	12.419	13,029
WTW -> R.R.							
Moretele 2 East		0.086	209.000	17.870	3.420	167.482	154,286
Moretele 2 West		0.060	191.000	11.479	2.404	107.588	99,724
Booster Pump							
East 00	7.559	0.008	25.000	0.189	0.302	1.771	3,329
East 1	8.004	0.008	35.000	0.280	0.320	2.626	4,107
East 7	20.455	0.020	15.000	0.307	0.818	2.876	4,335
East 8	13.340	0.013	50.000	0.667	0.534	6.251	7,410
West 34	13.340	0.013	40.000	0.534	0.534	5.001	6,271
		0.000		0.000			
Total Energy (QxH)				**34.536**			**310,307**
except raw water				**31.325**			

TABLE A.4-2 PRESENT VALUE ANALYSIS OF ALTERNATIVE PLANS

(Total 3 Sheets)

			Capital Costs West	Capital Costs East	Capital Costs Total		Capital Costs West	Capital Costs East	Capital Costs Total		Capital Costs West	Capital Costs East	Capital Costs Total	
			35,385,000	87,036,000	122,421,000		55,575,000	79,150,000	134,725,000		51,241,000	79,150,000	130,391,000	
			Alternative - 1				Alternative - 2				Alternative - 3			
	Discount Rate 5%		Capital Costs 1997 price	Capital Costs P. V.	O/M(Electric) 1997 price	O/M(Electric) P. V.	Capital Costs 1997 price	Capital Costs P. V.	O/M(Electric) 1997 price	O/M(Electric) P. V.	Capital Costs 1997 price	Capital Costs P. V.	O/M(Electric) 1997 price	O/M(Electric) P. V.
	Total Present Value		104,248,190				113,613,238				109,669,031			
	Total		122,421,000	100,403,877	8,703,075	3,844,313	134,725,000	109,638,121	8,999,200	3,975,117	130,391,000	106,242,319	7,757,675	3,426,712
	0	1997		0		0		0		0		0		0
	1	1998		0		0		0		0		0		0
	2	1999		0		0		0		0		0		0
E	3	2000	26,110,800	22,555,491		0	23,745,000	20,511,824		0	23,745,000	20,511,824		0
E	4	2001	60,925,200	50,123,313		0	55,405,000	45,581,831		0	55,405,000	45,581,831		0
W	5	2002	35,385,000	27,725,073		0	55,575,000	43,544,467		0	51,241,000	40,148,664		0
	6	2003		0	348,123	259,775		0	359,968	268,614		0	310,307	231,556
	7	2004		0	348,123	247,405		0	359,968	255,823		0	310,307	220,529
	8	2005		0	348,123	235,623		0	359,968	243,641		0	310,307	210,028
	9	2006		0	348,123	224,403		0	359,968	232,039		0	310,307	200,027
	10	2007		0	348,123	213,717		0	359,968	220,989		0	310,307	190,502
	11	2008		0	348,123	203,540		0	359,968	210,466		0	310,307	181,430
	12	2009		0	348,123	193,848		0	359,968	200,444		0	310,307	172,791
	13	2010		0	348,123	184,617		0	359,968	190,899		0	310,307	164,562
	14	2011		0	348,123	175,826		0	359,968	181,808		0	310,307	156,726
	15	2012		0	348,123	167,453		0	359,968	173,151		0	310,307	149,263
	16	2013		0	348,123	159,479		0	359,968	164,905		0	310,307	142,155
	17	2014		0	348,123	151,885		0	359,968	157,053		0	310,307	135,386
	18	2015		0	348,123	144,652		0	359,968	149,574		0	310,307	128,939
	19	2016		0	348,123	137,764		0	359,968	142,452		0	310,307	122,799
	20	2017		0	348,123	131,204		0	359,968	135,668		0	310,307	116,951
	21	2018		0	348,123	124,956		0	359,968	129,208		0	310,307	111,382
	22	2019		0	348,123	119,006		0	359,968	123,055		0	310,307	106,078
	23	2020		0	348,123	113,339		0	359,968	117,195		0	310,307	101,027
	24	2021		0	348,123	107,942		0	359,968	111,615		0	310,307	96,216
	25	2022		0	348,123	102,802		0	359,968	106,300		0	310,307	91,635
	26	2023		0	348,123	97,906		0	359,968	101,238		0	310,307	87,271
	27	2024		0	348,123	93,244		0	359,968	96,417		0	310,307	83,115
	28	2025		0	348,123	88,804		0	359,968	91,826		0	310,307	79,157
	29	2026		0	348,123	84,575		0	359,968	87,453		0	310,307	75,388
	30	2027		0	348,123	80,548		0	359,968	83,288		0	310,307	71,798

TABLE A.4-2 PRESENT VALUE ANALYSIS OF ALTERNATIVE PLANS

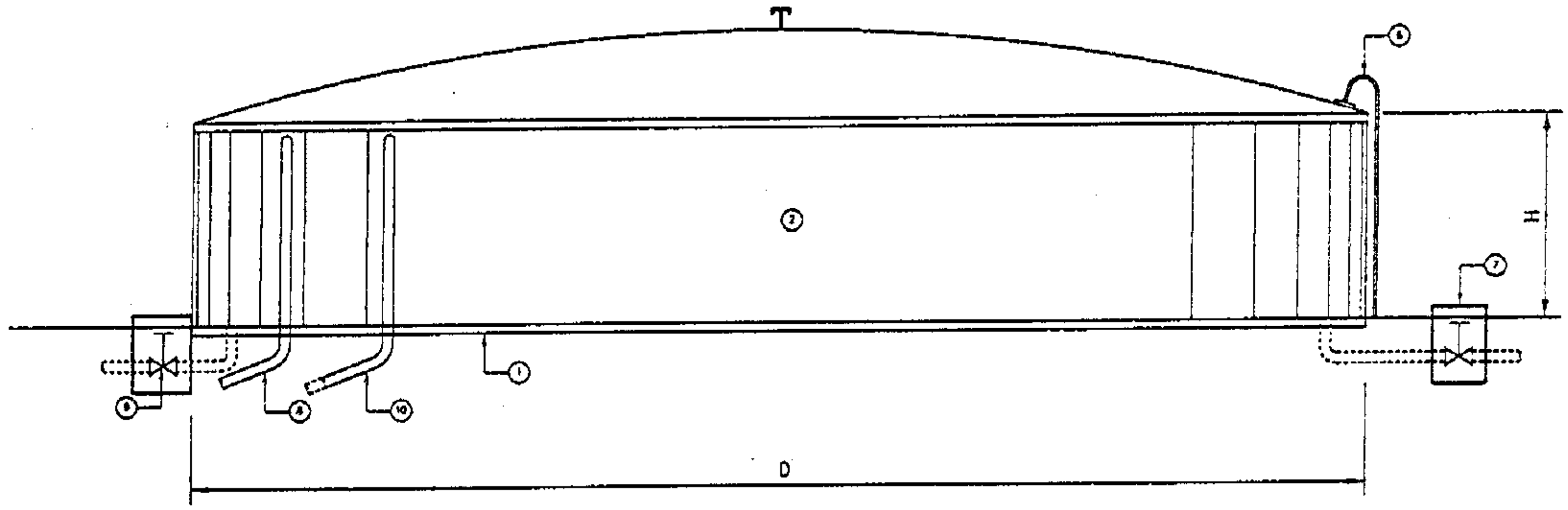
(Total 3 Sheets)

			Capital Costs West	Capital Costs East	Capital Costs Total		Capital Costs West	Capital Costs East	Capital Costs Total		Capital Costs West	Capital Costs East	Capital Costs Total	
			35,385,000	87,036,000	122,421,000		55,575,000	79,150,000	134,725,000		51,241,000	79,150,000	130,391,000	
			Alternative - 1				Alternative - 2				Alternative - 3			
	Discount Rate		Capital Costs		O/M(Electric)		Capital Costs		O/M(Electric)		Capital Costs		O/M(Electric)	
	9%		1997 price	P. V.	1997 price	P. V.	1997 price	P. V.	1997 price	P. V.	1997 price	P. V.	1997 price	P. V.
	Total Present Value		88,543,516				96,003,769				92,869,930			
	Total		122,421,000	86,321,098	8,703,075	2,222,418	134,725,000	93,705,732	8,999,200	2,298,037	130,391,000	90,888,930	7,757,675	1,981,001
	0	1997		0		0		0		0		0		0
	1	1998		0		0		0		0		0		0
	2	1999		0		0		0		0		0		0
E	30% 3	2000	26,110,800	20,162,328		0	23,745,000	18,335,497		0	23,745,000	18,335,497		0
E	70% 4	2001	60,925,200	43,160,948		0	55,405,000	39,250,299		0	55,405,000	39,250,299		0
W	100% 5	2002	35,385,000	22,997,822		0	55,575,000	36,119,937		0	51,241,000	33,303,134		0
	6	2003		0	348,123	207,574		0	359,968	214,637		0	310,307	185,026
	7	2004		0	348,123	190,435		0	359,968	196,915		0	310,307	169,749
	8	2005		0	348,123	174,711		0	359,968	180,656		0	310,307	155,733
	9	2006		0	348,123	160,285		0	359,968	165,739		0	310,307	142,874
	10	2007		0	348,123	147,051		0	359,968	152,054		0	310,307	131,077
	11	2008		0	348,123	134,909		0	359,968	139,499		0	310,307	120,254
	12	2009		0	348,123	123,770		0	359,968	127,981		0	310,307	110,325
	13	2010		0	348,123	113,550		0	359,968	117,414		0	310,307	101,216
	14	2011		0	348,123	104,175		0	359,968	107,719		0	310,307	92,858
	15	2012		0	348,123	95,573		0	359,968	98,825		0	310,307	85,191
	16	2013		0	348,123	87,682		0	359,968	90,665		0	310,307	78,157
	17	2014		0	348,123	80,442		0	359,968	83,179		0	310,307	71,704
	18	2015		0	348,123	73,800		0	359,968	76,311		0	310,307	65,783
	19	2016		0	348,123	67,706		0	359,968	70,010		0	310,307	60,352
	20	2017		0	348,123	62,116		0	359,968	64,229		0	310,307	55,368
	21	2018		0	348,123	56,987		0	359,968	58,926		0	310,307	50,797
	22	2019		0	348,123	52,282		0	359,968	54,061		0	310,307	46,602
	23	2020		0	348,123	47,965		0	359,968	49,597		0	310,307	42,755
	24	2021		0	348,123	44,004		0	359,968	45,502		0	310,307	39,224
	25	2022		0	348,123	40,371		0	359,968	41,745		0	310,307	35,986
	26	2023		0	348,123	37,038		0	359,968	38,298		0	310,307	33,014
	27	2024		0	348,123	33,980		0	359,968	35,136		0	310,307	30,288
	28	2025		0	348,123	31,174		0	359,968	32,235		0	310,307	27,788
	29	2026		0	348,123	28,600		0	359,968	29,573		0	310,307	25,493
	30	2027		0	348,123	26,238		0	359,968	27,131		0	310,307	23,388

TABLE A.4-2 PRESENT VALUE ANALYSIS OF ALTERNATIVES

(Total 3 Sheets)

	Discount Rate 17%		Capital Costs West	Capital Costs East	Capital Costs Total	O/M(Electric) 1997 price	O/M(Electric) P. V.	Capital Costs West	Capital Costs East	Capital Costs Total	O/M(Electric) 1997 price	O/M(Electric) P. V.	Capital Costs West	Capital Costs East	Capital Costs Total	O/M(Electric) 1997 price	O/M(Electric) P. V.
			35,385,000	87,036,000	122,421,000			55,575,000	79,150,000	134,725,000			51,241,000	79,150,000	130,391,000		
			Alternative - 1					Alternative - 2					Alternative - 3				
			Capital Costs			O/M(Electric)		Capital Costs			O/M(Electric)		Capital Costs			O/M(Electric)	
			1997 price	P. V.		1997 price	P. V.	1997 price	P. V.		1997 price	P. V.	1997 price	P. V.		1997 price	P. V.
	Total Present Value			**65,870,622**					**70,687,669**					**68,580,272**			
	Total		122,421,000	64,955,044	8,703,075	915,579		134,725,000	69,740,937	8,999,200	946,731		130,391,000	67,764,151	7,757,675	816,121	
	0	1997		0		0			0		0			0		0	
	1	1998		0		0			0		0			0		0	
	2	1999		0		0			0		0			0		0	
E	30% 3	2000	26,110,800	16,302,815		0		23,745,000	14,825,679		0		23,745,000	14,825,679		0	
E	70% 4	2001	60,925,200	32,512,736		0		55,405,000	29,566,881		0		55,405,000	29,566,881		0	
W	100% 5	2002	35,385,000	16,139,493		0		55,575,000	25,348,377		0		51,241,000	23,371,592		0	
	6	2003		0	348,123	135,712			0	359,968	140,329			0	310,307	120,970	
	7	2004		0	348,123	115,993			0	359,968	119,940			0	310,307	103,393	
	8	2005		0	348,123	99,139			0	359,968	102,513			0	310,307	88,370	
	9	2006		0	348,123	84,734			0	359,968	87,618			0	310,307	75,530	
	10	2007		0	348,123	72,423			0	359,968	74,857			0	310,307	64,555	
	11	2008		0	348,123	61,900			0	359,968	64,006			0	310,307	55,176	
	12	2009		0	348,123	52,906			0	359,968	54,706			0	310,307	47,159	
	13	2010		0	348,123	45,219			0	359,968	46,757			0	310,307	40,307	
	14	2011		0	348,123	38,648			0	359,968	39,963			0	310,307	34,450	
	15	2012		0	348,123	33,033			0	359,968	34,157			0	310,307	29,444	
	16	2013		0	348,123	28,233			0	359,968	29,194			0	310,307	25,166	
	17	2014		0	348,123	24,131			0	359,968	24,952			0	310,307	21,510	
	18	2015		0	348,123	20,625			0	359,968	21,326			0	310,307	18,384	
	19	2016		0	348,123	17,628			0	359,968	18,228			0	310,307	15,713	
	20	2017		0	348,123	15,067			0	359,968	15,579			0	310,307	13,430	
	21	2018		0	348,123	12,877			0	359,968	13,316			0	310,307	11,479	
	22	2019		0	348,123	11,006			0	359,968	11,381			0	310,307	9,811	
	23	2020		0	348,123	9,407			0	359,968	9,727			0	310,307	8,385	
	24	2021		0	348,123	8,040			0	359,968	8,314			0	310,307	7,167	
	25	2022		0	348,123	6,872			0	359,968	7,106			0	310,307	6,126	
	26	2023		0	348,123	5,874			0	359,968	6,073			0	310,307	5,236	
	27	2024		0	348,123	5,020			0	359,968	5,191			0	310,307	4,475	
	28	2025		0	348,123	4,291			0	359,968	4,437			0	310,307	3,825	
	29	2026		0	348,123	3,667			0	359,968	3,792			0	310,307	3,269	
	30	2027		0	348,123	3,134			0	359,968	3,241			0	310,307	2,794	



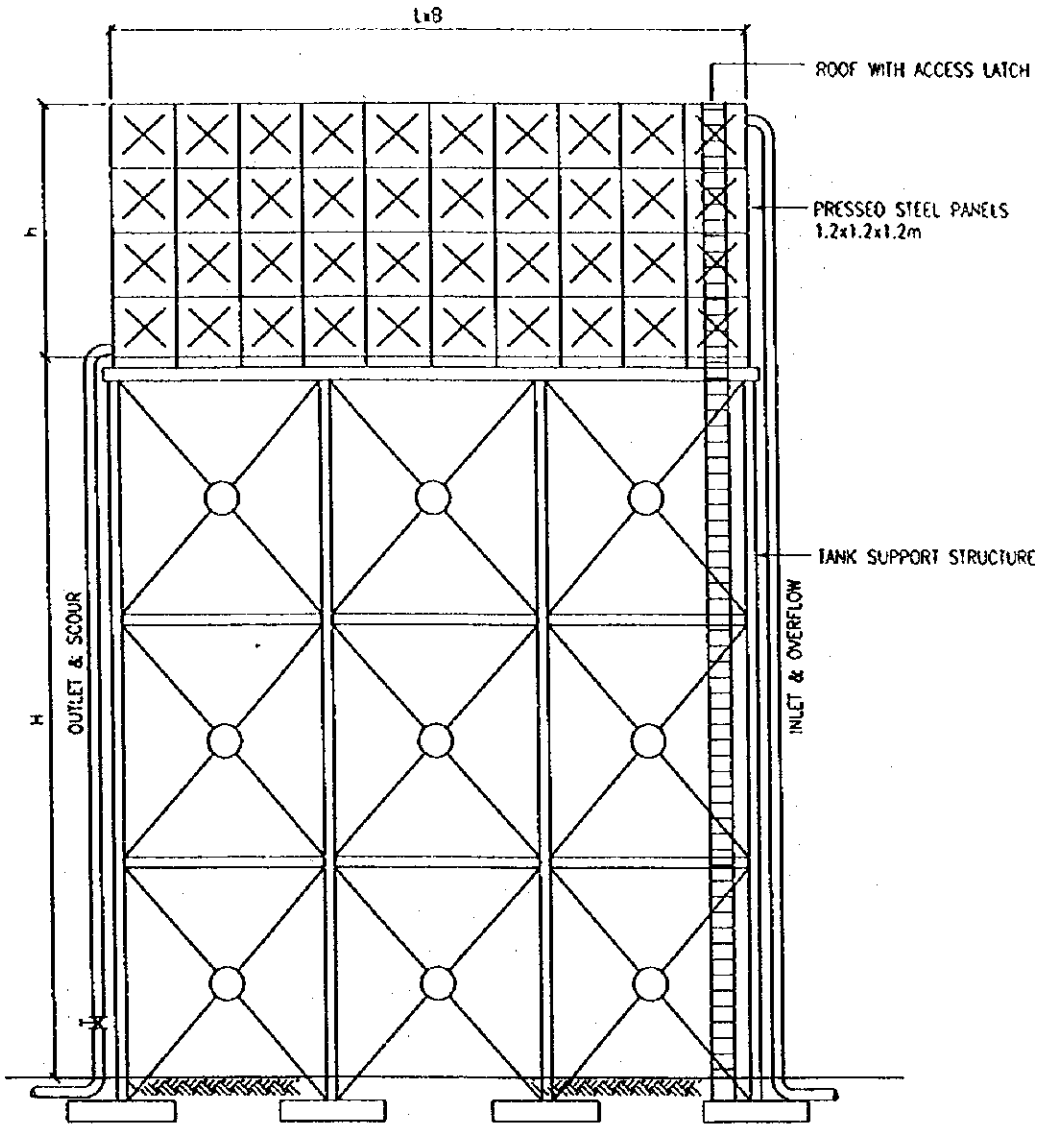
ELEVATION
1:50

LEGEND:

1. CONCRETE FLOOR 200mm THICK WITH UNDERFLOOR DRAINAGE SYSTEM: 75mm NO-FINES CONCRETE PLUS GEOPOPES NETWORK.
2. REINFORCED (POST-TENSIONED) CIRCULAR WALL: MINNIMUM THICKNESS 300mm.
3. MOVEMENT JOINTS @ 15m, SEALED INSIDE WITH BANDAGE TYPE ELASTIC SEAL.
4. DOMED ROOF (POST-TENSIONED): SEGMENTAL OR IN-SITU CONSTRUCTION: MINNIMUM THICKNESS 80mm.
5. VENTILATORS.
6. ACCESS LADDER – GALVINISED STEEL, INTERNAL STAINLESS STEEL.
7. SCOUR SUMP & PIPE 300mm dia LOCKABLE VALVE BOX.
8. TOP INLET PIPE.
9. OUTLET PIPE WITH VALVE BOX.
10. TOP OVERFLOW PIPE – 400mm dia.

SIZE RANGE D x H(m)	CAPACITY kl
FROM: 10 x 5.4	400
TO: UNLIMITED D x 9	UNLIMITED

FIGURE A.5-1
REGIONAL RESERVOIR



SIZE RANGE LxBxhxH(m)	CAPACITY Kl
2,4x2,4x1,2x3,0 TO 12,2x12,2x4,8x25	6,9 650

FIGURE A.5-2
SERVICE RESERVOIR

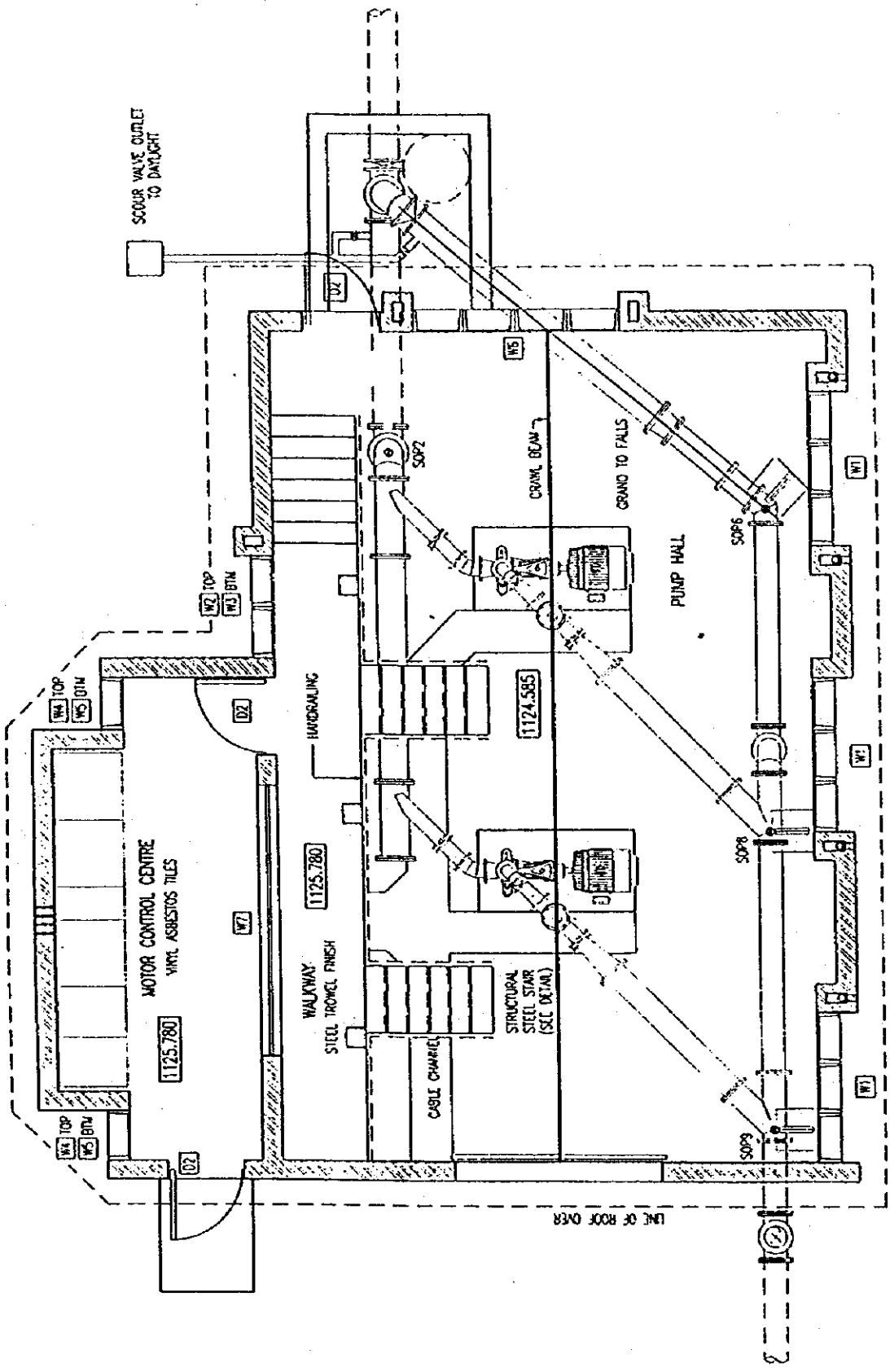


FIGURE A.5-3
PUMP STATION

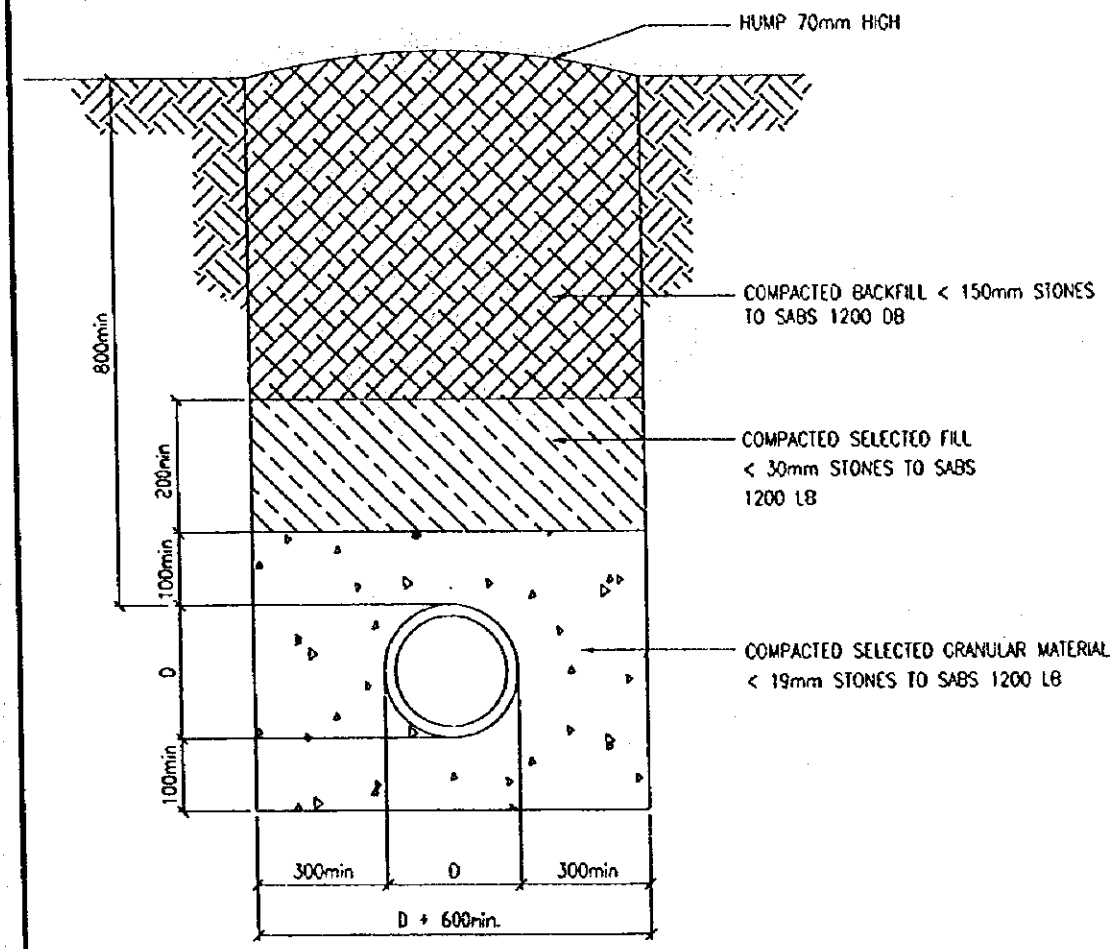
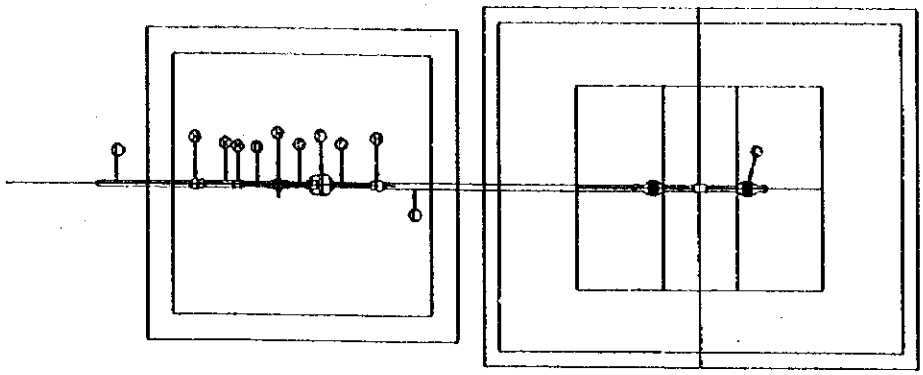
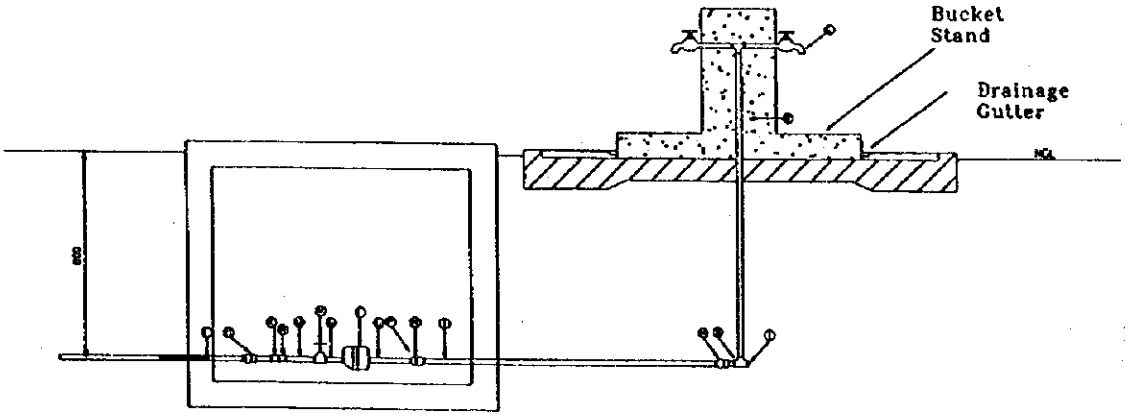


FIGURE A.5-4
PIPE TRENCH



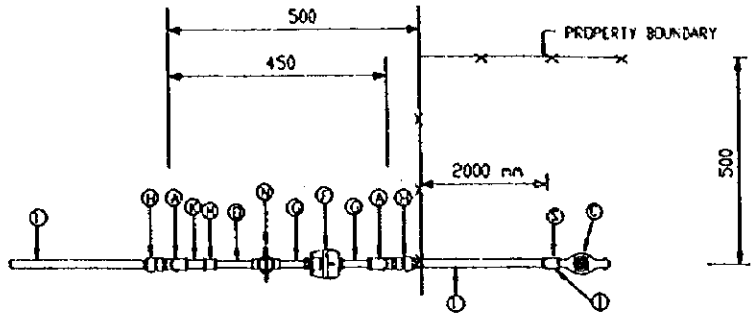
PLAN



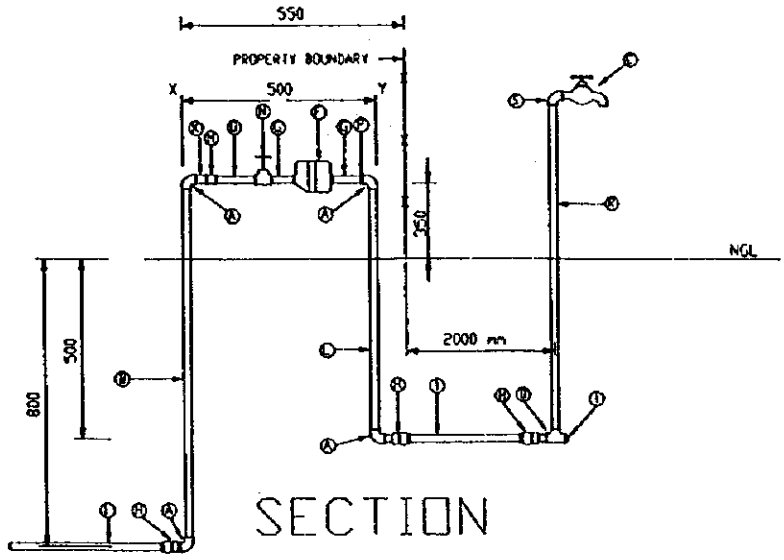
SECTION

	SINGLE OR CONN (mm) SIZE	QTY	DESCRIPTION
A	20		90 DEG MALLEABLE CAST IRON OXID FEMALE ENDED ELBOW
B	20		GMS PIPE PIECE - L=1085mm
C	15		15mm ROUGH BRASS HOSE BIB TAP WITH 20mm OUTLET
D	20x15		HDI T-PIECE
E	15		KENT PSM SIZE 3 WATER METER
F	15		GMS PIPE PIECE - L=1000mm
H	20x3/4"		PLASSON MALE COMPRESSION ADAPTOR
I	20		20 mm MALLEABLE CAST IRON PLUG
J	20		HDPE PIPE, FITTINGS NOT INCLUDED (LENGTH TO BE DETERMINED ON SITE)
L	20		GMS PIPE PIECE - L=785mm
K	20		GMS PIPE PIECE L=50mm
M	20x15		GMS REDUCING SOCKET
N	15		15mm BOSSINE BALL VALVE
O	15		GMS PIPE PIECE - LENGTH TO BE SUCH THAT DIMENSION XY= 500mm
P	15x20		GMS REDUCING BUSH
Q	15		GMS 40mm TAILPIECE WITH UNION NUT
S	15		90 DEG MALLEABLE CAST IRON OXID FEMALE ENDED ELBOW

FIGURE A.5-5
STANDPIPE



PLAN



SECTION

	SINGLE ERF CONN (mm) SIZE	QTY	DESCRIPTION
A	20		90 DEG MALLEABLE CAST IRON (MCI) FEMALE ENDED ELBOW
B	20		GMS PIPE PIECE - L=1085mm
C	15		15mm ROUGH BRASS HOSE BIB TAP WITH 20mm OUTLET
D	20x15		MCI T-PIECE
F	15		KENT PSM SIZE 3 WATER METER
R	15		GMS PIPE PIECE - L=3000mm
H	20x3/4"		PLASSON MALE COMPRESSION ADAPTOR
I	20		20 mm MALLEABLE CAST IRON PLUG
J	20		HDPE PIPE, FITTINGS NOT INCLUDED (LENGTH TO BE DETERMINED ON SITE)
L	20		GMS PIPE PIECE - L=785mm
K	20		GMS PIPE PIECE L=50mm
M	20x15		GMS REDUCING SOCKET
N	15		15mm BOSSINI BALL VALVE
O	15		GMS PIPE PIECE - LENGTH TO BE SUCH THAT DIMENSION XY= 500mm
P	15x20		GMS REDUCING BUSH
G	15		GMS 40mm TAILPIECE WITH UNION NUT
S	15		90 DEG MALLEABLE CAST IRON (MCI) FEMALE ENDED ELBOW

FIGURE A.5-6
YARD CONNECTION

ANNEX B

ENVIRONMENTAL

FESAIBILITY SUTUDY FOR MORETELE 2

ANNEX B : ENVIRONMENTAL

B.1 TOR and Scope of ROIP

1.1 Terms of Reference

This study constitutes an assessment of the potential environmental impacts which can be expected from options considered as part of the Master Plan to expand the capacity of Magalies Water. Inevitably, development leads to modifications in the environment and negative environmental impacts, which often result from inappropriate management of development activities because of a lack of appreciation of the potential problems. All components of the environment that might be involved were identified so that appropriate ameliorative actions can be integrated with the project as a whole to obtain the best possible results.

It is important to note that the environmental study at this stage of the project preparation is at a feasibility level to prepare a prognosis of relevant issues. Accent has been placed on the impacts of the proposed pipelines and other related surface structures as these were seen as the element causing greatest concern.

Relevant data from preliminary investigation reports were extracted to provide baseline information. Additional, more detailed information was obtained to update the existing information as was presented in the ROIP 1 Report.

The construction of pipelines, reservoirs and treatment works could have an impact on the socio-economic aspects, i.e land use, settlement, infrastructure and population, and the ecological aspects, i.e. the vegetation, fauna, habitat, changes in flow regime and changes in water quality. The study was undertaken on an incremental basis with the relevant environmental impact prognosis phase 2 (ROIP 2) as the second feasibility phase.

The ROIP 2 will identify the anticipated environmental impacts and state the feasibility of the proposed options from an environmental, both ecological and socio-economical, viewpoint. The socio-economical impacts are presented in another module. The need for further more detailed studies will be identified from the data available at this point. The extent of further work needed on the ecological and socio-economical aspects will be defined in the ROIP 2 report.

1.2 Scope of the ROIP 2

The ROIP 2 constitutes an assessment of the potential environmental impacts which can be expected from options for extending the water supply network in the Project Area.

The scope of this assessment is to investigate the environmental impacts associated with the proposed water treatment works, pipelines, reservoirs, elevated tanks and pump stations to increase the existing capacity of Magalies Water. This scheme is the preferred option which has been proposed to augment the water supply in the Project Area. Accent has been placed on the impacts of the proposed pipelines and the other surface structures as this is seen as the component likely to cause the greatest impact over the largest area.

Three technical alternatives were evaluated during the Master Plan stage. As part of this Feasibility Study, those alternatives were re-examined using the Case B water demand. At Service Level B (Case B) 90 % of households will be supplied through yard connections (85.6 lcd) and the remaining 10 % through stand pipes (30 lcd) in accordance with the RDP level of service, giving a weighted average per capita consumption rate of 80 litre per capita per day including an allowance of approximately 15 % for leakage.

The aspects that will be addressed in this report are:

- the effect of abstraction from Mkombo Dam and the Elands River downstream of the dam.
- the impact of the construction of pipelines, pump stations, reservoirs and elevated tanks.

The main activities to be expected during the construction of the proposed developments are the following:

- Pre-construction phase: Surveying, clearing of vegetation and construction of access routes.
- Construction phase: Typical activities will be clearing of vegetation, stripping and stockpiling topsoil, excavations, disposal of excess material, transport of pipes, drilling, blasting additions or alterations to existing infrastructure and the importation of foreign workers, including their accommodation and recreational facilities.
- Post-construction and operational phase: Rehabilitation of disturbed areas, implementation and maintenance of the pipelines, reservoirs, elevated tanks and pump stations. Also included will be the impacts on sanitation due to the increased water consumption.

B.2 Report of RIP 2

2.1 Executive Summary

2.1.1 General Project Desecription

The Moretele 2 Feasibility Study Area comprises Moretele 2 Magisterial District of Mpumalanga Province. The area is essentially rural in nature. Average annual rainfall is approximately 510 mm and summer rainfall predominates falling mainly between October and March. The area drains to the Gotwane, a tributary of the Elands River, and Mkombo Dam. Annual average evaporation is over 2,200 mm and is higher in summer than in winter and annual monthly temperatures vary from 12 to 25° C. Prevailing winds are light to moderate in a north-easterly direction and typical wind speeds are 2.5 to 3.5 m/s. The Area does not include any Nature Reserves or National Parks which merit particular consideration from an environmental perspective.

The project components are the following and describes the most feasible option from the three alternative options investigated:

As a general principle, water from a treatment works will be pumped to a regional reservoir from where it will be distributed through bulk supply pipelines to service reservoirs which will be constructed in each community.

Under the recommended scheme for the Moretele 2 Area, all communities will be served from a new extension of the existing Weltevreden Water Treatment Works. The works is supplied with raw water from Mkombo Dam on the Elands River and via transfers from Loskop Dam.

It is proposed that the process units for the extension should mirror the existing process which comprises flocculation, sedimentation and filtration. There is space at the site for up to an additional 60 Mld of treatment capacity to be provided. The existing plant does not include facilities for dissolved air flotation however based on raw water quality data obtained from the DWAF database, the risk of microcystis blooms in Mkombo Dam is medium to slight and the water body is oligotrophic therefore DAF appears to be unnecessary. Water quality data for the existing works at Weltevreden has not been made available to date so a proper assessment of the suitability of the existing process has not been possible.

Under the recommended water supply plan, a new rising main from Weltevreden Water Treatment Works will feed a regional reservoir at Lefiso. A booster pumping station will be required to supply Lefiso and Mmutlestad to the east. Most of the flow will gravitate to the west from the regional reservoir. A booster pumping station will be necessary on a branch northwards to Lefiswane. Just upstream of Marapjane a branch to the south will provide a gravity supply to Moletsi and Sehoko with sub-branches eastwards to Ramantsho and Semohlase. The gravity main from the Lefiso Regional Reservoir extends eastwards beyond Ga Ramantshane with gravity fed branches to Marapjane and Opgeruimd and pumped branches to Ga Ramantshane and Kalkfontein.

Beyond Ga Ramantshane an in-line booster pumping station is required to supply westwards to Phake C with branches to Rapotokwane and Lefifi, Norman, Bamokgoko and Phake C. A further in-line booster is required in Phake C to supply the western extremities of the system including branches to Phake A, Phake B and Mantiole and Masobe.

This ROIP 2 gives an overview of expected impacts and recommends further environmental investigations to be done during the detail design phase.

2.1.2 General Environmental Description

The dominant vegetation types in the Moretele 2 Project Area are mixed bushveld and sourish mixed bushveld.

The proposed pipelines within existing road or pipeline reserves are not seen as areas of major impact as the areas are seen as having low aesthetic values and a highly disturbed natural environment. Construction activities could cause further disturbance of the area, which could result in the infestation of invasives which could be transported to the area in a number of ways.

The conservation status of the rivers is likely to be poor in most instances, as all the rivers are regulated by dams and weirs. The impact on the rivers as a result of the proposed project is seen as negligible although it will depend on future management of the dams and future return flows from the catchments.

2.1.3. Important Environmental Impacts

(1) Negative impacts:

The list of disadvantages that could arise due to the construction of the pipelines and related surface works are presented. This is a comprehensive list and many of these

impacts are not considered to be severe.

a. The construction of the pipelines and its related infrastructure could:

- cause disturbance within the existing road reserves;
- have a negative impact on the aesthetic value of an area;
- cause erosion on the exposed slopes;
- cause/accelerate the invasion by exotic terrestrial plants;
- cause disturbance of a section of the river channels where pipelines crosses the channels;
- cause increased sediment loads within the rivers.
- noise pollution;
- water pollution;
- the introduction and encroachment of alien plants;
- inconveniences to affected local farmers and other local residents;
- social disruption;
- inconveniences to affected road users.

All these impacts are of a temporary nature during construction except for the invasion of exotic terrestrial plants.

b. Three technical alternatives were evaluated during the Master Plan stage. As part of this Feasibility Study, those alternatives were re-examined using the Case B water demand. At Service Level B (Case B) 90 % of households will be supplied through yard connections (85.6 lcd) and the remaining 10 % through stand pipes (30 lcd) in accordance with the RDP level of service, giving a weighted average per capita consumption rate of 80 litre per capita per day including an allowance of approximately 15 % for leakage.

c. At present very little information is available on the occurrence of archaeological and historical sites and a field survey is proposed before any construction is started.

In summary, the major negative impact includes the disturbance of an already highly disturbed area of low ecological value, coupled with a low conservation status and aesthetic value.

No fatal flaw has been found that renders the proposed project non-viable from an environmental impact point of view but certain aspects must be addressed in more detail in later phases of the project.

(2) Positive impacts:

a. A reliable water supply to an increased number of people in the Project Area.
b. The construction activities could cause temporary economic upliftment in the immediate vicinity.

2.1.4 Conclusion

The construction of pipelines and related infrastructure will not cause substantial disturbance. The environmental consequences associated with these impacts are not considered to be significant if managed during and after construction as stipulated in the environmental management plan.

The impacts of abstraction from dams on the dam itself and downstream of the dams are not considered to be insignificant, but with a degree of uncertainty.

2.1.5 Recommendations

The issues to be determined in the detail design phase of the scheme are summarised as follows:

(1) Social impacts

- The social and economic impacts associated with construction disturbances on the farming activities along the pipeline routes.
- This investigation should include meetings with the local communities to determine the preferences of the communities to any options or alternative developments, especially in the siting of the regional and service reservoirs.
- The lack of existing sanitation facilities need to be investigated.

(2) Ecological impacts

- A Phase 1 archaeological survey of the proposed pipeline routes and especially the reservoir sites are recommended.
- General rehabilitation measures.
- Identify birds and their nesting sites where appropriate.
- Liaise with all the interested and affected parties.
- Compile an Environmental Management Plan for the construction phase and draw up appropriate rehabilitation guidelines to mitigate the disturbances and aesthetic impacts caused by the construction of the pipeline and associated infrastructure.
- Alert the contractor and labourers to the ecological and social impacts associated with the construction activities.
- Landscaping specification for the river and canal crossings as well as the permanent access roads.

2.2 Terminology

Abbreviations used in the ROIP 2 are the following (for the purpose of simplicity some Afrikaans abbreviations are used in the English version of the ROIP):

AV	AVERAGE
DCD	DATA CONFIDENCE DEGREE
EC	ELECTRICAL CONDUCTIVITY
ENDAN	ENDANGERED
IEM	INTEGRATED ENVIRONMENTAL MANAGEMENT
IMP	IMPORTANCE
INDETERM	INDETERMINATE
ISD	IMPACT SEVERITY DEGREE
MAP	MEAN ANNUAL PRECIPITATION
MAR	MEAN ANNUAL RUNOFF
MAX	MAXIMUM
MIN	MINIMUM
MCD	MITIGATION IMPACT CONFIDENCE DEGREE
MDC	MITIGATED DATA CONFIDENCE
MID	MITIGATED IMPACT DEGREE
ROIP	Relevante Omgewingsinvloedprognose - RELEVANT ENVIRONMENTAL IMPACT PROGNOSIS
SCD	SEVERITY CONFIDENCE DEGREE
SRCE	SOURCE OF INFORMATION
TDS	TOTAL DISSOLVED SALTS
VULNER	VULNERABLE

2.3 Main Report of ROIP 2

Chapter 1. Introduction

The Department of Water Affairs and Forestry (DWAF) follows a procedure of Integrated Environmental Management (IEM) for all proposed developments. This IEM procedure consists of certain successive levels of impact studies of which the Relevant Environmental Impact Prognosis 2 (ROIP - the Afrikaans acronym), which relates to a feasibility phase, is the second.

The numerical values used in the ROIP are as follows:

SOURCE (Column 3): The source of the information given in column 3 is given a letter which correlates with the source, as listed in the references.

DCD (Column 4) : Data Confidence Degree is rated on a scale from 0 to 4 from no data available with unreliable conclusions to data sufficient and adequately verified.

ISD (Column 5) : Impact Severity Degree relates to the severity of the proposed scheme on the aspect that is being evaluated and is rated on a scale from 0 to 4 with 0 being no impact and 4 being an impact of the most important significance.

SCD (Column 6) : Severity Confidence Degree of the identified impact is rated so that the reliability increases with an increase in numeric value, on a scale from 0 to 4. Source of the mitigation measure relates to the listed reference.

MDC (Column 8) : Mitigation Data Confidence is rated on a scale from 0 to 4, with totally reliable information receiving a rating of 4 and totally unreliable information receiving a rating of 0. This refers specifically to an evaluation of the suggested mitigation measure.

MID (Column 9) : Mitigated Impact Degree or impact (as determined in column 5) after mitigation is rated on a scale from 0 to 4, with a severe impact after mitigation receiving a rating of 4 and no impact after mitigation receiving a rating of 0.

MCD (Column 10) : Mitigation Impact Confidence Degree of the proposed

mitigation increases with an increase in numeric value, on a scale from 0 to 4.

ADVANTAGES:

1	:	Unimportant advantage
2	:	Medium important
3	:	High important

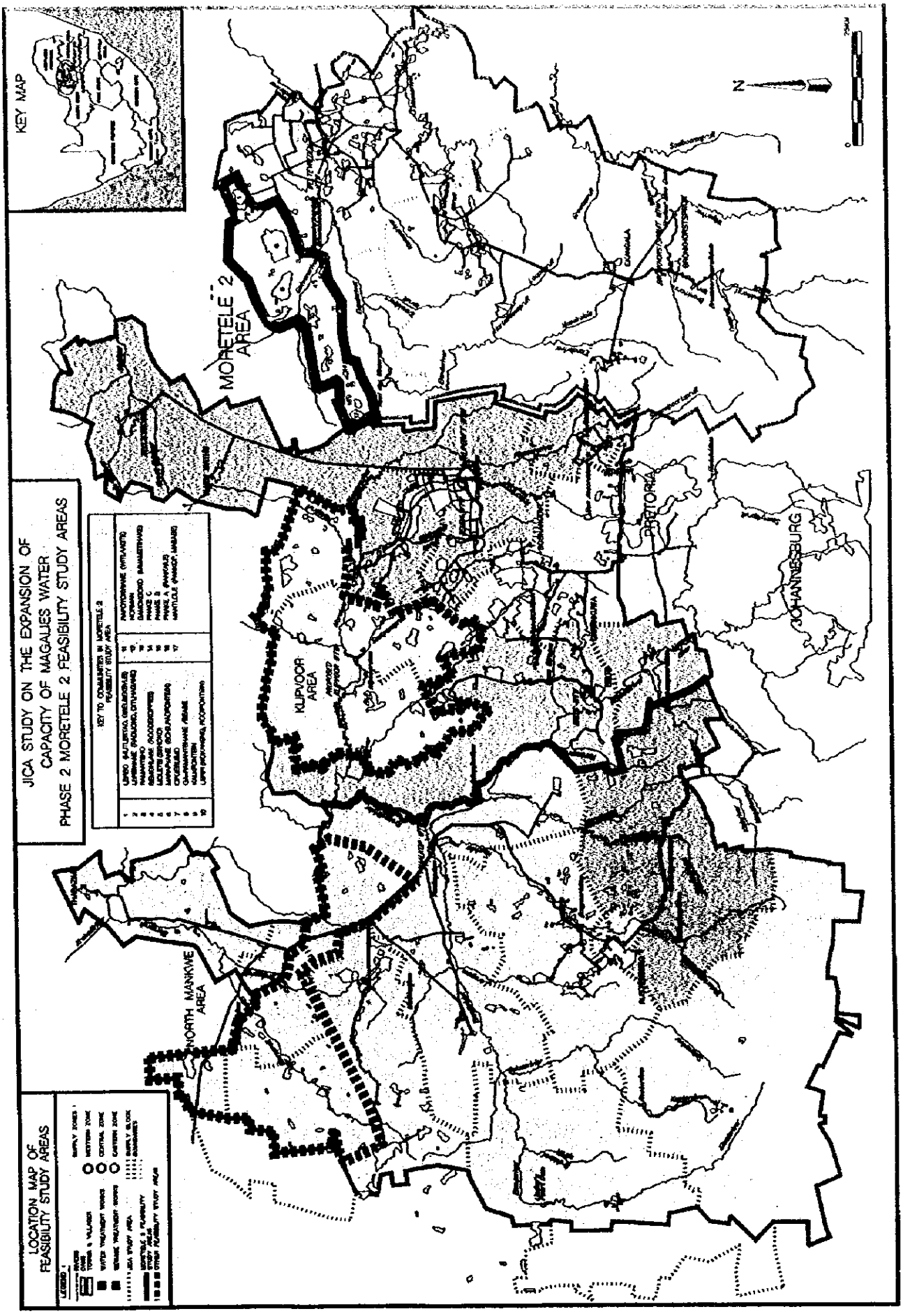
FURTHER WORK:

1	:	Necessity of work needs to be determined (low or high importance)
2	:	Medium priority work - to be undertaken after an option is deemed acceptable
3	:	High priority - to be undertaken immediately - before determining the preferred option/acceptability of any option

Chapter 2. Locality of the AREA

The attached map illustrates location of the project Area.

Figure 1 : Location Map



Chapter 3. Project Description

NO	COMPONENT	DATA DESCRIPTION	SRCE
3.1	NAME OF SCHEME	Study on the Expansion of the Capacity of Magalies Water	1
3.2	PURPOSE OF THE PROJECT	To confirm the feasibility of planning for the three selected priority areas (North Mankwe, Klipvoor and Moretele 2)	1
3.3	STARTING DATE	Moretele 2 will be discussed in this	
3.4	COMPLETION DATE	ROIP 2 document	
3.5	WHITE PAPER NO	1997	
3.6	PLANNING REPORT	1997	2
3.7	COSTS (R X 10^6)	Not applicable Interim Report, July 1997 Not applicable	-
3.8	LOCALITY		
	Province	GAUTE / MPUM / NP / NWP	
	Districts	Moretele 2, Brits, Moretele 1, Odi 1, Mankwe, Bafokeng, Rustenburg, Koster, Swartruggens, KwaNdebele, Cullinan, Bronkhorstspruit, Wonderboom, Waterberg (part), Thabazimbi (part) and Warmbathh (part)	
	Game-, Nature Reserve, Wilderness Area, National Heritage site (Study Area)	Rust de Winter Dam, Klipvoor Dam, Pilanesberg,Roodeplaat Dam and Hartbeespoort Dam	

3.1 Project Detail

Three technical alternatives were evaluated during the Master Plan stage. As part of this Feasibility Study, those alternatives were re-examined using the Case B water demand. At Service Level B (Case B) 90 % of households will be supplied through yard connections (85.6 lcd) and the remaining 10 % through stand pipes (30 lcd) in accordance with the RDP level of service, giving a weighted average per capita

consumption rate of 80 litre per capita per day including an allowance of approximately 15 % for leakage. Figures 2, 3, 4 and 5 illustrate these alternative water supply plans.

Under Alternative-1, the entire Area which consists of Moretele 2 West and Moretele 2 East Supply Blocks is assumed to be supplied from the existing Weltevreden WTW.

In Alternative-2, only Moretele 2 East Supply Block is supplied from Weltevreden WTW while Moretele 2 West Supply Block is assumed to be supplied from Klipdrift WTW either through the existing Klipdrift-Nylstroom pipeline or through a new pipeline.

Alternative-3 is similar to Alternative-2, but Moretele 2 West Supply Block is assumed to be supplied from a new water treatment works which would be built at Rust de Winter Dam.

3.2 Description of Recommended Water Supply Plan

Under the recommended scheme for the Moretele 2 Area, all communities will be served from a new extension of the existing Weltevreden Water Treatment Works. The works is supplied with raw water from Mkombo Dam on the Elands River and via transfers from Loskop Dam.

It is proposed that the process units for the extension should mirror the existing process which comprises flocculation, sedimentation and filtration. There is space at the site for up to an additional 60 Mld of treatment capacity to be provided.

Under the recommended water supply plan, a new rising main from Weltevreden WTW will feed a regional reservoir at Lefiso. A booster pumping station will be required to supply Lefiso and Mmutlestad to the east. Most of the flow will gravitate to the west from the regional reservoir. A booster pumping station will be necessary on a branch northwards to Lefiswane. Just upstream of Marapjane a branch to the south will provide a gravity supply to Moletsi and Sehoko with sub-branches eastwards to Ramantsho and Semohlase. The gravity main from the Lefiso Regional Reservoir extends eastwards beyond Ga Ramantshane with gravity fed branches to Marapjane and Opgeruimd and pumped branches to Ga Ramantshane and Kalkfontein.

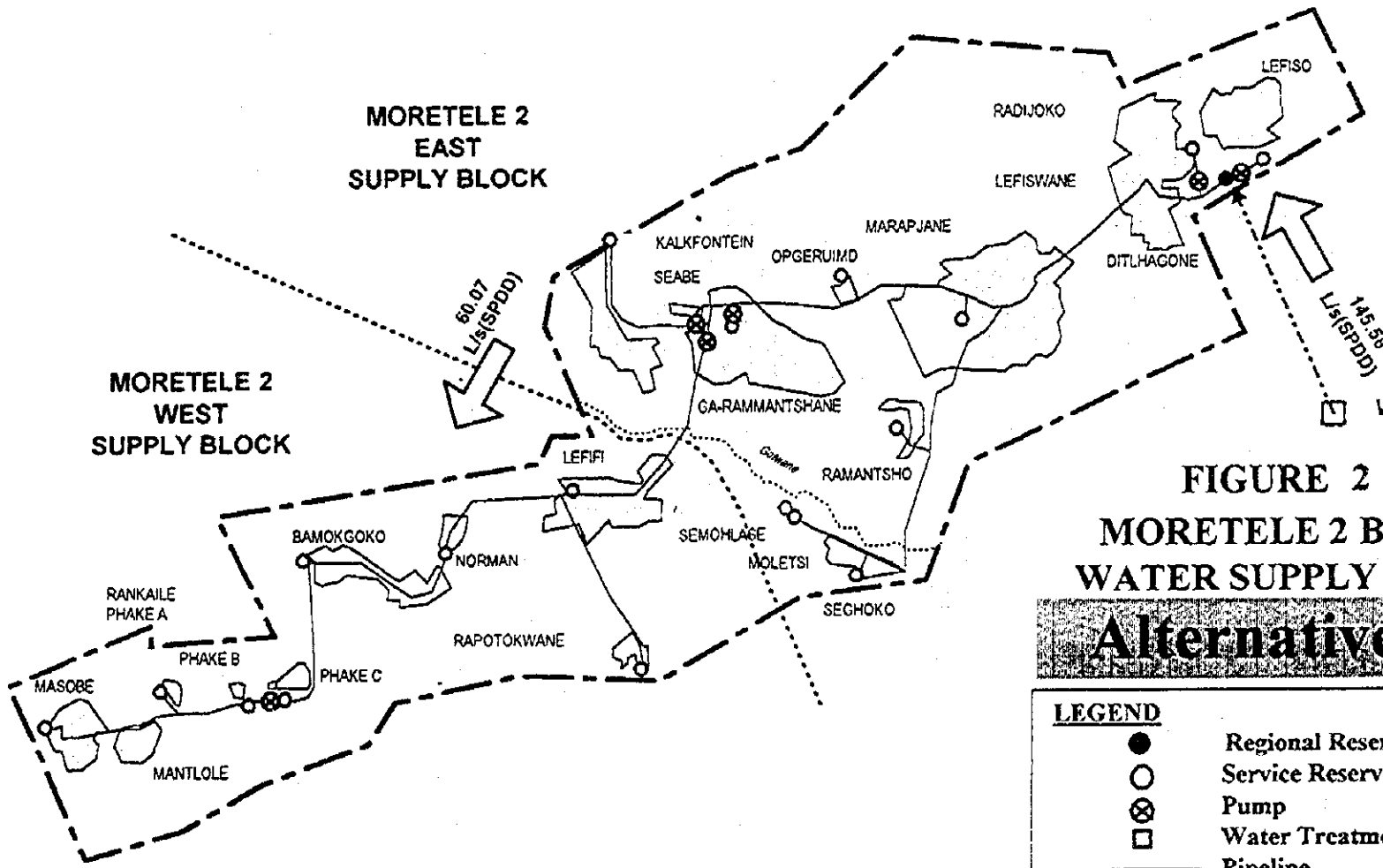


FIGURE 2 : MORETELE 2 BULK WATER SUPPLY PLAN

Alternative - 1

LEGEND

- Regional Reservoir
- Service Reservoir
- Pump
- Water Treatment Plant
- Pipeline
- Towns & Villages
- River
- Dam
- Study Area

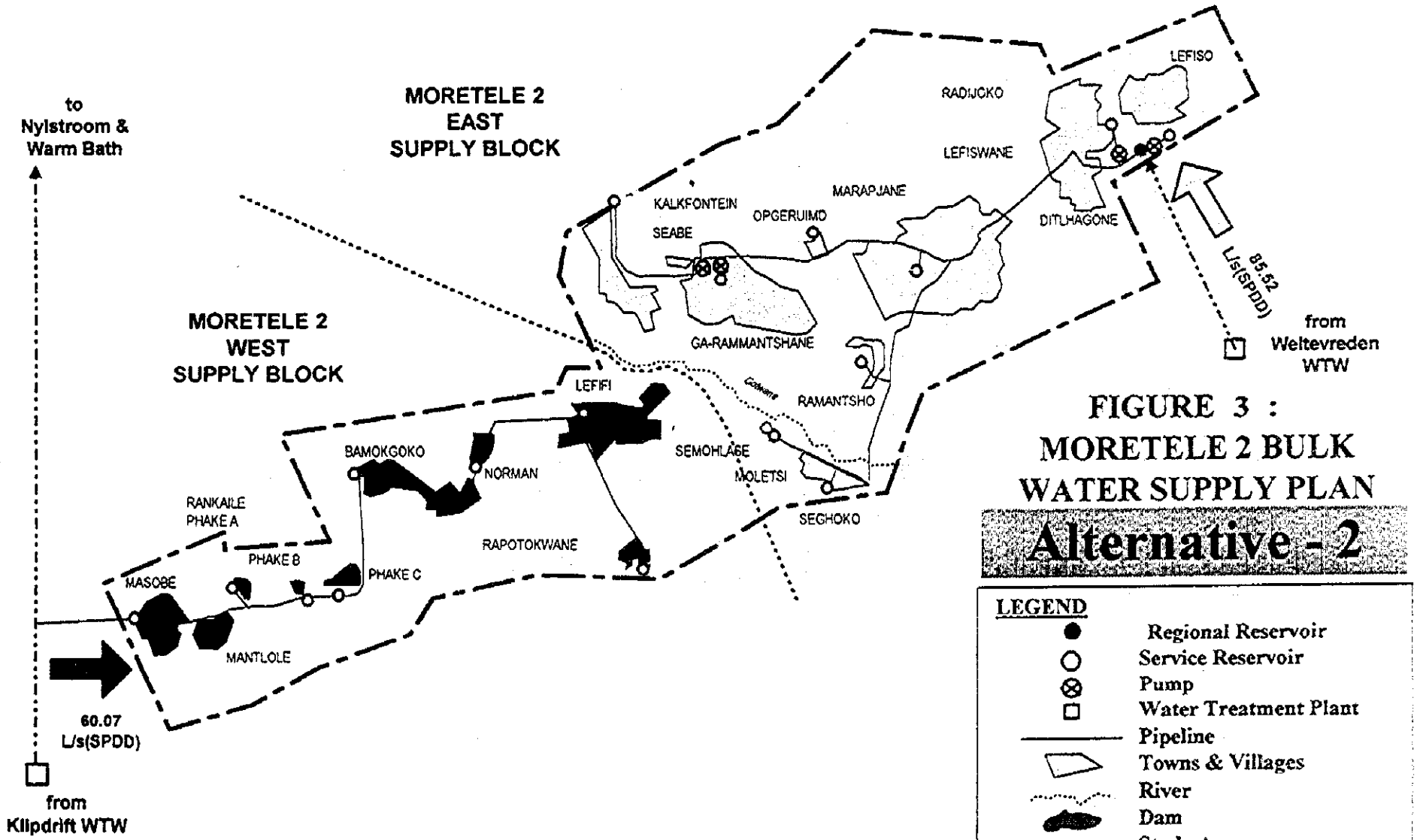
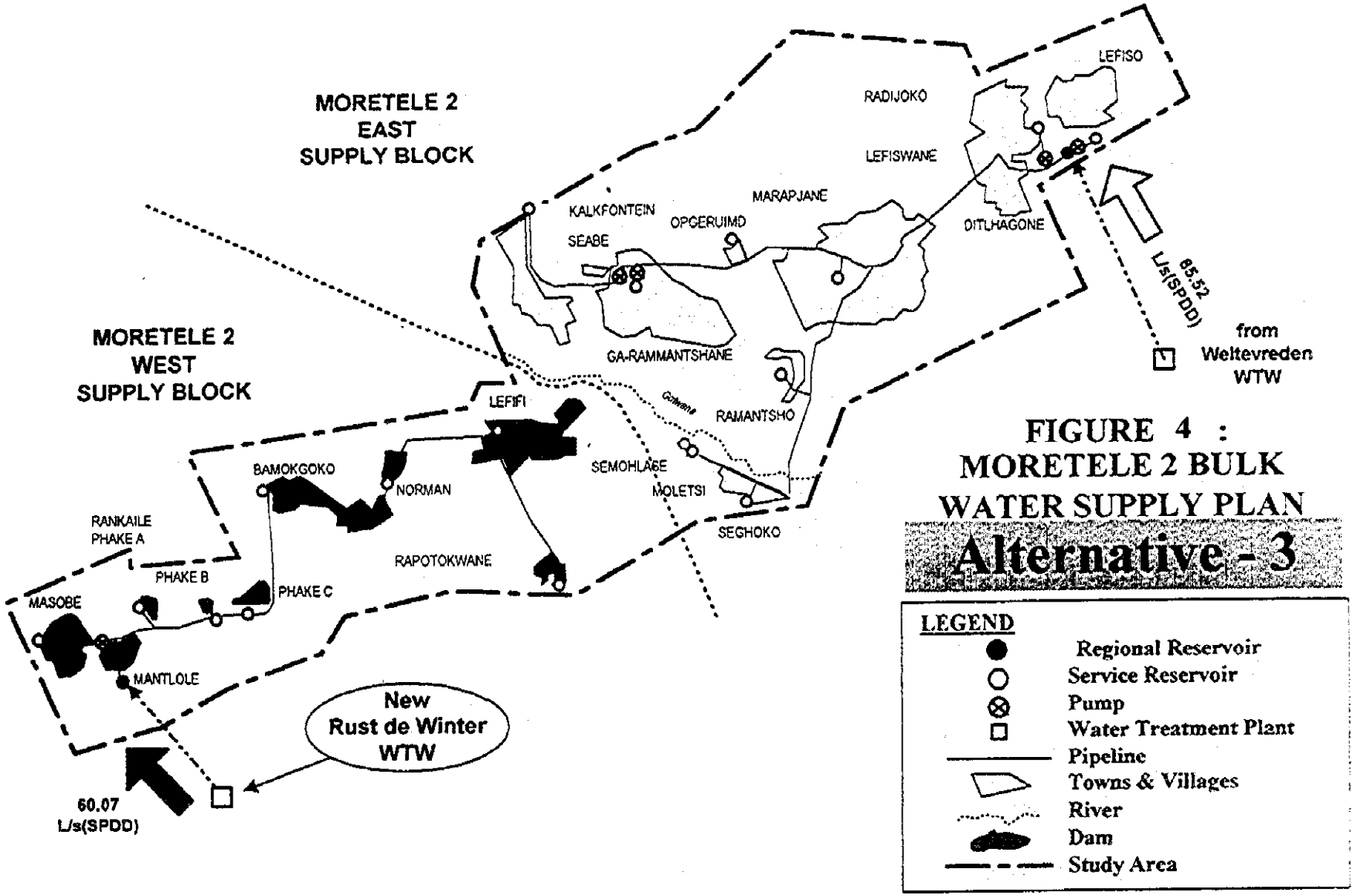


FIGURE 3 : MORETELE 2 BULK WATER SUPPLY PLAN

Alternative - 2

LEGEND

- Regional Reservoir
- Service Reservoir
- Pump
- Water Treatment Plant
- Pipeline
- Towns & Villages
- River
- Dam
- Study Area


MORETELE 2
EAST
SUPPLY BLOCK
MORETELE 2
WEST
SUPPLY BLOCK
LEFISO
RADIJOKO
LEFISWANE
MARAPJANE
KALKFONTEIN
OPGERUIMD
SEABE
DITLHAGONE
GA-RAMMANTSHANE
RAMANTSHO
LEFIFI
BAMOKGOKO
NORMAN
SEMOHLASE
MOLETSI
SEGHOKO
RANKAILE
PHAKE A
PHAKE B
PHAKE C
RAPOTOKWANE
MASOBE
MANTLOLE
New
Rust de Winter
WTW
60.07
L/s(SPDD)
65.52
L/s(SPDD)
from
Weltevreden
WTW
FIGURE 4 :
MORETELE 2 BULK
WATER SUPPLY PLAN
Alternative - 3
LEGEND
Regional Reservoir
Service Reservoir
Pump
Water Treatment Plant
Pipeline
Towns & Villages
River
Dam
Study Area

Beyond Ga Ramantshane an in-line booster pumping station is required to supply westwards to Phake C with branches to Rapotokwane and Lefifi, Norman, Bamokgoko and Phake C. A further in-line booster is required in Phake C to supply the western extremities of the system including branches to Phake A, Phake B and Mantiole and Masobe.

3.3 Special Remarks

This ROIP 2 gives an overview of expected impacts and recommends further environmental investigations to be done during the detail design phase.

Chapter 4. Environmental Description

NO	COMPONENT	DATA DESCRIPTION	SRCE
4.1	State of habitat disturbance	See remarks	1, 3, 4
4.2	Ground cover	See remarks	5
4.3	Game-, Nature Reserve, Wilderness Area, National Heritage Site	None	5
4.4	Aesthetic value	See remarks	1, 3
4.5	Land use	See remarks	1, 2

REMARKS

4.1 - The proposed development is within a rural development area where the roads and housing facilities have already disturbed the area from its original state.
- The route of the proposed pipelines are where possible along existing pipeline routes and road reserves. These areas are already disturbed.
- The pump stations, reservoirs, elevated tanks are also along the pipeline routes and one could assume at least some form of habitat disturbance.

4.2 - The Moretele 2 Project Area is predominantly a mixed bushveld and sourish mixed bushveld. veld type.

4.4 - Many parts have low aesthetic value due to the rural development taking place.

4.5 - The major land use in the area is agriculture, rural development and natural veld.

Chapter 5. Description of the Impacts of the Proposed Development

5.1 Physical Environment

5.1.1 Climate

NO	COMPONENT	DATA DESCRIPTION								DATA	
										SRCE	DCD
a.	**WIND** Prevailing wind directions										
	summer:	N	NE	E	SE	S	SW	W	NE	2	2
	winter:	N	NE	E	SE	S	SW	W	NW	-	-
b.	**TEMPERATURE (EC)**	Adv		Max		Min					
	Summer:										
	Winter:										
c.	**RAINFALL (mm per year)**	MAP = 510				SUMMER		WINTER		6	2

MEASURING STATION : LOCALITY

The following representative weather stations were used in the study: Marble Hall, Warmbad , Pilanesberg and Pretoria.

a. Wind: The prevailing winds are light to moderate in a north-easterly direction, and typical wind speeds are 2,5 to 3,5 m/s.

b. Temperature: The averages minimum temperature for this area is 12,2EC and the average maximum temperature is 25,3EC.

c. Rainfall: The average annual rainfall is approximately 510 mm. Annual average evaporation is over 2 200 mm and is higher in summer than in winter.

5.1.2 Geology

NO	COMPONENT	DATA DESCRIPTION	DATA	
			SRCE	DCD
	GEOLOGY	See remarks	7	2

REMARKS

- See the report on the geology for detailed information [7]. The geology will however not be impacted upon by the proposed development.

5.1.3 Topgraphy

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
	TOPOGRAPHY	8	2	0	3	Not applicable			

DATA

- The majority of the pipeline routes follow the road and existing pipeline routes and are within an existing reserves.

IMPACT

- The pipelines will be buried and therefore there will be no impact on the topography.

5.1.4 Soils

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
	SOIL SERIES/TYPE	7	2	Not applicable					

DATA

- **Soil series/type :**The soil types occurring within the Project Area are diverse and complex. This is due to the variety and the complex distribution of rock types in the Project Area and the fact that the geological substratum generally enjoys a close relationship to soil and land type. See the report on the soils for detailed information[7]. The project will not have an impact on the soils but the soils may have an impact on the project and need to be examined before detailed design takes place.

IMPACT

- Construction activities on slopes could trigger and accelerate soil erosion.

MITIGATION MEASURE

- Careful planning of construction activities accompanied by landscape rehabilitation measures in the immediate vicinity of the pipeline could minimise the problems associated with erosion.
- The topsoil which is removed during construction should be replaced after construction. The seeds in the topsoil will accelerate the rehabilitation process.

IMPACT AFTER MITIGATION

- Success of the landscape rehabilitation measures on the pipeline routes are likely to be relatively high, especially if the topsoil removed during construction is replaced with that same topsoil. The impact after mitigation is likely to be relatively low.

SOILS		SRCE	IMP
FURTHER WORK	- Landscape rehabilitation measures should be determined - Problem soil areas need to be investigated	3	2
ADVANTAGES	Not applicable	3	-

5.1.5 River Characteristics

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a1	FLOW REGIME - see data	1,8	2	3	2	3	2	2	2

DATA

- The Moretele 2 Area falls in the Olifants River catchment. The principal source of water for the proposed scheme is Weltevreden Water Treatment Works which treats water from Mkombo Dam on the Elands River. As far as is knows none of these rivers have an allocation of water on a regular basis but is dependent on overflows from the dam [2]. Water is only released from the dams for other downstream users.

IMPACT

- Dams will probably not have much less water as most of the water extracted from the dam will be from the incremental increase of return flows from the catchment to the system.

MITIGATION MEASURE

- If a situation should develop where overflow is less frequent appropriate water releases for the downstream environment may be a solution. This could however impact on the availability of water for the other downstream users.

IMPACT AFTER MITIGATION

- The impact after mitigation will be decreased, but the confidence level is low.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a2	FLOW REGIME - Pipeline	3	2	1	3	3	1	0	3

DATA

- The pipelines will have an impact on the river flows during construction as it crosses the rivers. The pipelines will be buried and will only cause a temporary obstruction of flow which is negligible.

IMPACT

- The flow in the rivers will be temporarily disrupted during construction at the site where the pipeline crosses the river. The whole river bed will not be closed off, but only half of it at any given time during construction.

MITIGATION MEASURE

- Work in the river bed should be done during low flow periods such as during the winter months. Only half of the river bed should be closed off at any given time and all obstructions cleared after construction.
- Areas of construction disturbance should be clearly defined, so as to minimise the impact on the flow regime.

IMPACT AFTER MITIGATION

- The impact after mitigation will be insignificant as after construction the flow regime should not be modified.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	SEDIMENT LOAD	9	3	2	3	3	3	0	3

DATA

- The vegetation and stone/rock cover at the site where the pipelines crosses the rivers will be removed exposing the bottom alluvium of the river bed thus potentially increasing the sediment load of the river in that particular area.

IMPACT

- Construction activities within a section of the river will disturb riverine habitats and lead to increased sediment loads entering the river. This is a short term impact.

MITIGATION MEASURE

- Work in the river bed should be done during low flow periods such as during the winter months. Only half of the river bed should be closed of at any given time.
- Disturbance within the river channel should be minimised and appropriately rehabilitated

IMPACT AFTER MITIGATION

- The impact after mitigation will be insignificant.

RIVER CHARACTERISTICS		SRCE	IMP
FURTHER WORK	Landscaping specifications required for erosion protection, specifically at the river and canal crossings	9	2
ADVANTAGES	Not applicable	3	-

5.1.6 Water Quality

REMARKS

- Based on raw water quality data obtained from the DWAF database, the risk of microcystis blooms in Mkombo Dam is medium to slight and the water body is oligotrophic. Water quality data for the existing works at Weltevreden has not been made available to date.
- The project will have no impact on the water quality but the water quality may have an impact on the project. If the water quality deteriorates, the purification costs will increase. The water quality changes that will take place will depend on the present and future land use activities.
- The increase of the availability of drinking water in the Study Area may have an impact on the sanitation of the area. As no sanitation facilities exist it is expected that the area could be negatively impacted by the increase of water. It is expected that the

waste and excess water will be discarded randomly. The areas surrounding the houses and stand pipes may become wet depending on the drainage potential of the soils in the area. This may also lead to an increase in the potential for polluting the surface water in the area. Depending on the soils and the groundwater potential of the area it may also impact the groundwater quality of the area. The lack of sanitation facilities can also have a health implication for the communities.

WATER QUALITY		SRCE	IMP
FURTHER WORK	Water quality monitoring programme should be established	3	2
ADVANTAGES	Not applicable	3	-

5.2 Aesthetics

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	EXCEPTIONAL	Not applicable							

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	HIGH	Not applicable							

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
c1	LOW : Dams	3	2	0	1	Not applicable			

DATA

- The aesthetics of the Study Area is generally low as most of the area is developed into rural settlements.

IMPACT

- The riparian vegetation will possibly be impacted by additional abstraction from dams if there are less frequent spills from the dam walls. This impact is expected to be negligibly small.

MITIGATION MEASURE

- No mitigation measures will be possible from the project point of view, except perhaps improving the operating rules of the dams.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
c2	**LOW: Pipeline routes**	3	3	2	3	3	3	0	2

DATA

- Some of the pipeline routes are in areas that have been developed and these areas are of a relatively low aesthetic value. The status of the proposed areas for reservoirs, elevated tanks and pump stations are not always low and special care should betaken in the final siting of the reservoirs.

IMPACT

- The construction of the pipeline in the road reserve will cause some disturbance and scar the roadside on a temporary basis rather than a permanent basis as the pipeline will be buried. Erosion could be accelerated during construction.
- The manholes with section, air and scour valves will be visible.
- The construction of the reservoirs, elevated tanks and pump stations will cause some disturbance and will have to be sited carefully because they will be a permanent feature on the landscape.
- The disposal of domestic and construction wastes will have a negative impact on the surrounding area.

MITIGATION MEASURE

- Appropriate rehabilitation procedures should be detailed to reduce the disturbance of the pipeline. The placing of the reservoirs, elevated tanks and pump stations should be done in such a manner as to make them as inconspicuous as possible.
- The location of waste dumps and spoil heaps, as well as the development of an appropriate protocol for the disposal of wastes, requires careful attention.

IMPACT AFTER MITIGATION

- It is likely that the disturbances associated with the construction of the pipelines can be almost totally mitigated except for the section, air and scour valves at manholes and the other surface structures.

AESTHETICS		SRCE	IMP
FURTHER WORK	- The siting of the reservoirs have to be done in consultation with the local people. - Suitable rehabilitation measures to be identified and enforced. - Remedial works for the rehabilitation of disturbed areass hould be planned as an integral part of the project.	9	2
ADVANTAGES	Not applicable	3	-

5.3 Natural Environment

5.3.1 Flora

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	VEGETATION	4.10	3	1	3	3	2	1	3

DATA

- The dominant vegetation types in the Moretele 2 Project Area are mixed bushveld and sourish mixed bushveld.

IMPACT

- The impact on the flora will be small as the proposed pipelines are along roads and other pipeline reserves where possible and this has already been disturbed from its original state.
- The impact on the flora will be more significant for the proposed reservoirs, elevated tanks and pump stations but these impacts will be localised within the construction area.

MITIGATION MEASURE

- Construction activities and disturbance should be limited to a minimum area of disturbance.
- After the pipelines have been laid the areas must be revegetated with grass, especially where there are slopes.
- Fill material or topsoil for rehabilitation purposes should be taken from areas which have an appropriate seed bank to help with the revegetation process.

IMPACT AFTER MITIGATION

- Slight to no impact as the area is already disturbed and after mitigation the area should practically be the same as before pipeline construction. The same cannot be said for the other structures but the impact is not seen as severe.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	AQUATIC FLORA	3	2	0	3	Not applicable			

DATA

- Aquatic flora will be present to a lesser or greater extent in all the dams.

IMPACT

- Aquatic flora should not be affected by the proposed developments.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
c	INVASIVE AQUATIC PLANTS	3	3	0	3	Not applicable			

DATA

- There are *Potamogeton* and *Cladophora* in some of the existing canals as a result of the nutrient enrichment of the water. These plants and other smaller unicellular algae cause problems at the purification works.

IMPACT

- The proposed development options will not be impacted upon by the invasive aquatic plants in the canals.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
d	INVASIVE TERREST. PLANTS	3.5	1	2	2	2	2	0	2

DATA

- The presence of alien plant species has a number of serious ecological implications for both indigenous vegetation and the production potential of the land. The banks of rivers are the habitats which are most affected by the presence of alien plant species. The most significant of these alien plant species are; *Syringa,* the grey poplar (*Populus canescens*) and the giant reed (*Arundo donax*). In places where the *Syringa* is present, it becomes the dominant canopy tree and is a serious threat to indigenous riverine vegetation and the associated fauna. The grey poplar occurs in dense thickets, which suppress indigenous vegetation, as well as blocking and narrowing river courses. The giant reed, invades water courses and tends to go largely unnoticed at the expense of the indigenous riparian vegetation.
- Few invasive terrestrial plants have been identified along the pipeline route.
- In roadside and veld habitats the following are potential invaders: Sweet prickly pear *(Opentia ficus-indica),* syringa *(Melia azedarach),* as well as lantana *(Lantana camara),* queen of the night *(Cereus peruvianus),* Jacaranda *(Jacaranda mimosifolia)* and sisal *(Aqave sisalana).*

IMPACT

- Construction activities could cause disturbance of the area, which could result in the infestation of invasives which could be transported to the area in a number of ways.

MITIGATION MEASURE

- Limited, well demarcated pipeline corridors and construction sites should be identified. Disturbed areas should be appropriately vegetated before aliens can become established and an ongoing programme should be implemented if aliens are identified.
- Fill material or topsoil for rehabilitation purposes should be taken from areas which have an appropriate seed bank and are free of aliens.

IMPACT AFTER MITIGATION

- The appropriate mitigation measures should minimise the impact of disturbance by construction.
- Seeds of invasive weeds that could be brought in with fill material could remain dormant in the soil for long periods. An ongoing weeding programme of the contaminated areas should be implemented to prevent aliens becoming established.

FLORA		SRCE	IMP
FURTHER WORK	- Follow an approved eradication programme for floral invasives. - Suitable landscaping specifications to be enforced.	9	2
ADVANTAGES	Not applicable	3	-

5.3.2 Fauna

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	MAMMALS	5	2	1	3	3	2	0	2

DATA

- The northern and central regions of the Project Area have a variety of rare and vulnerable mammal species. Eastwards towards the Olifants River Basin, a variety of mammal species are encountered some of which are noted as red data species.

IMPACT

- No severe impact on mammals is expected as the area is already mostly developed.
- A temporary impact could be poaching and disturbance associated with construction activities, although it is doubtful whether it will be serious as the area is already heavily utilised.

MITIGATION MEASURE

- Construction workers should be educated as regards environmental issues.

IMPACT AFTER MITIGATION

- The impact after mitigation will probably be slight to none as the impact before mitigation is also seen as slight.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	BIRDS	5	2	1	2	3	3	0	2

DATA

- Eastwards towards the Olifants River catchment, it is found that the number of bird species present in each region varies greatly. The greatest variety of bird species are found near Settlers, the Loskop Dam and the Wilge River. A large variety of bird species are found near the Elands River (250 - 300 species).

IMPACT

- The impact is relatively low as other similar habitats exist for birds in the area. A temporary impact is envisaged for birds having nesting sites within the construction area.

MITIGATION MEASURE

- No practical mitigation measures exist to minimise noise pollution and human activities associated with construction activities.
- Limit disturbance of area as far as possible.

IMPACT AFTER MITIGATION

- Once construction is completed and the road reserve rehabilitated the loss of habitat should be alleviated.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
c	REPTILES & AMPHIBIANS	5	2	1	3	3	2	0	2

DATA

- There are no endangered reptile and amphibian species within the Elands River region.

IMPACT

- A temporary impact could be poaching of tortoises and snakes and disturbance associated with construction activities, although it is doubtful whether it will be serious as the area is reasonably developed.

MITIGATION MEASURE

- Construction workers should be educated as regards environmental issues.

IMPACT AFTER MITIGATION

- The impact after mitigation will probably be slight to none as the impact before mitigation is also seen as slight.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
d	FISH	5	2	1	1	Not applicable			

DATA

- No specific data have been found for the fish species in the Elands River.

IMPACT

- The abstraction of water from the dams will probably not influence fish in the dams and downstream in the rivers even if species of conservation importance do occur.
- The construction of the pipelines, reservoirs, elevated tanks and pump stations will have no impact on fish.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
e	TERRESTRIAL INVERT	3	1	1	2	Not applicable			

DATA

- No data have been collected for terrestrial invertebrates but the project will not impact on invertebrates and this is not seen as an important component.

IMPACT

- It is envisaged that even if terrestrial invertebrates of conservation importance do occur, the impacts associated with the pipeline construction are unlikely to be significant.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
f	AQUATIC INVERT COMMUNITY	3	2	1	2	Not applicable			

DATA

- No surveys have been undertaken for this study for aquatic invertebrates within the different rivers.

IMPACT

- It is envisaged that even if aquatic invertebrates of importance do occur within the river, the impacts associated with the abstraction of water from dams are unlikely to be significant.

- There will be no impact on aquatic invertebrates due to the construction activities.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
g	EXOTIC TERRESTRIAL	3	2	1	2	3	2	0	2

DATA

- No data are available, but the project will have a negligible impact on exotic terrestrial animals.

IMPACT

- During the duration of pipeline construction, there may be a danger to goats and cattle while the trenches are open. This is not seen as a major impact as not many stray animals are expected.

MITIGATION MEASURE

- Large areas of open trenches should not be left unattended or unfenced.
- The area around open trenches should be fenced off if practical and/or filled up as soon as possible.

IMPACT AFTER MITIGATION

- The impact after mitigation will be low as the impact before mitigation is not deemed significant.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
h	EXOTIC AQUATIC	3	2	0	2	Not applicable			

DATA

- No data are available on exotic fish species or any other exotic aquatics. It is expected that exotic fish species do occur in some of the dams and probably also in the rivers. The project will however not have an impact on the exotic aquatic organisms.

IMPACT

- The abstraction of water from dams is unlikely to have an impact on exotic aquatic species.
- The construction activities are unlikely to have an impact on exotic aquatics.

FAUNA		SRCE	IMP
FURTHER WORK	Not applicable	3	2
ADVANTAGES	Not applicable	3	-

5.3.3 Habitat

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	CURRENT DISTURBANCE : BADLY DISTURBED	3	3	1	3	3	3	1	2

DATA

- Some of the proposed pipeline routes are within a badly disturbed area, i.e. in an existing road or pipeline reserve.

IMPACT

- The pipelines will represent a temporary disturbance of the road or pipeline reserves which should revegetate and hardly leave any scar.

MITIGATION MEASURE

- Appropriate rehabilitation procedures should be followed.

IMPACT AFTER MITIGATION

- Hardly any impact will be noticeable after rehabilitation except for manholes along the pipeline route.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	CURRENT DISTURBANCE : DISTURBED	3	3	2	2	3	2	1	2

DATA

- All the rivers within the Project Area are regulated by dams and weirs and as such are disturbed systems.

IMPACT

- Dams will probably not have much less water as most of the water extracted from the dams will be from the incremental increase of return flows from the catchment to the system. If there is less water in the dam overflow from the dam will be less frequent. The proposed project would probably not disturb the rivers downstream of the dams any further.

MITIGATION MEASURE

- If a situation should develop where overflow is less frequent, appropriate water releases for the downstream environment may be a solution.

IMPACT AFTER MITIGATION

- The impact after mitigation will be decreased, but the confidence level is low.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
c	CURRENT DISTURBANCE: HARDLY ANY DISTURBANCE	Not applicable							

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
d	CONSERVATION STATUS OF RIVER	4	2	1	2	Not applicable			

DATA

- Changes are apparent, such as locally severe pollution, dominant alien species, major water regulations etc. in most of the Project Area. More specific data are not available at present and very little can be said about the conservation status of the specific rivers.

IMPACT

- The impact of the pipelines and other surface structures on the rivers will be negligible as the construction activities and structures will not constitute a permanent disturbance to the river.
- The dams will probably not have much less water, as most of the water extracted from the dam will be from the incremental increase of return flows from the catchment to the system. If there is less water in the dam overflow from the dam will be less frequent.

MITIGATION MEASURE

- If a situation should develop where overflow is less frequent appropriate water releases for the downstream environment may be a solution. This could however impact on the availability of water for the other downstream users.

IMPACT AFTER MITIGATION

- The impact after mitigation will be decreased, but the confidence level is low.

HABITAT		SRCE	IMP
FURTHER WORK	- Define a suitable operating rule for dams taking into account the recreation and tourism activities as well as the downstream ecological requirements.	9	2
ADVANTAGES	The river stretches downstream of dams may improve ecologically if the instream flow requirements are met.	3	3

5.4 Socio-Economic/Political

5.4.1 Recreation

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
	RECREATION	8	2	1	2	Not applicable			

DATA

- There are no recreational facilities that will be influenced by the proposed development

.

IMPACT

- The pipelines and other surface structures will have no impact on recreation.

RECREATION		SRCE	IMP
FURTHER WORK	Not applicable	3	2
ADVANTAGES	Not applicable	3	2

5.4.2 Land Use

(Grazing, Agronomy, Mining, Industrial, Tourism, Rural, Forestry, Conservation/Wilderness etc)

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	TYPE : AGRICULTURE	1,2	1	2	2	3	2	1	2

DATA

- Parts of the pipelines may cross small areas of agricultural land.

IMPACT

- Some agricultural land will be lost if pipelines pass through it. Non-permanent crops can still be cultivated within the pipeline servitudes.

MITIGATION MEASURE

- The pipelines should be aligned so that they cross as small as possible areas of cultivated land. The area should be appropriately rehabilitated after construction.
- Appropriate compensation should be made to the land owners for the loss of crop and/or lands. This compensation should probably take the form of financial compensation.

IMPACT AFTER MITIGATION

- The impact after mitigation is small, as cultivation can continue as long as it is not permanent crops.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	TYPE : RURAL	1,2	2	1	2	Not applicable			

DATA

- Parts of the pipelines and the reservoirs, elevated tanks and pump stations will be situated close to existing rural development.

IMPACT

- The construction sites will have to be acquired and some land loss will occur.
- During construction there will be an impact on the local residents of the rural areas. These impacts will be of a temporary nature and include noise and dust pollution and the safety of the local residents.
- A danger of physical injury exists for people and animals during construction, especially where housing is close to the construction activities.

MITIGATION MEASURE

- Appropriate compensation should be made to the land owners for the loss of land. This compensation should probably take the form of financial compensation.
- The construction activities should be such as to minimize disturbances to the local communities.
- Proper supervision on the construction site, especially during excavations, is essential in safeguarding people and animals as the trenches may sometimes be as deep as 2,5m.
- If any blasting is needed, careful planning is essential, and even more so where work is done close to housing or grazing areas.

IMPACT AFTER MITIGATION

- The impacts should be small after mitigation but the confidence degree is low.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
c	TYPE : MINING AND INDUSTRIAL	1,2	2	0	2	Not applicable			

DATA

- There are limited industrial activities within the Project Area.

IMPACT

- The proposed extension of Magalies Water will not influence the industrial activities in the Project Area. The proposed development will enhance the potential for industrial activities by creating amore assured water supply.

LAND USE		SRCE	IMP
FURTHER WORK	- Work out suitable compensation measures with the affected parties for the land and/or agricultural loss. - Identify appropriate measures for minimizing impacts on the local communities.	3	2
ADVANTAGES	Not applicable	3	-

5.4.3 Cultural/Historical

(Archaeology, national monuments, historical areas, areas of special significance, etc.)

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	TYPE : ALL	11	3	2	1	3,11	2	1	1

DATA

- Archaeological research consisting of surveys and extensive excavations of Stone Age and Iron Age sites as well as of the recording of rock art sites has been conducted in the Magaliesberg Valley and in the Central Bankeveld during the past three decades. This region, which ecologically speaking, is situated between the Highveld in the south and the Bushveld in the north, has a rich archaeological heritage comprised of remains dating from both the prehistoric and the colonial periods of South Africa. These archaeological and historical remains include:
  - ※ Stone Age sites which may be associated with the San people and which date back thousands of years;
  - ※ Iron Age sites occupied by Bantu Groups during the past two millennia; and
  - ※ Remains dating from the previous century when the first Colonists settled in various places to the north and the west of the Magaliesberg.
- The Project Area is part of the spheres of influence of Iron Age and historical Batswana and Ndebele clans who occupied these areas for the last half a millenniam.
- In order to comply with legislation knowledge is required of the presence and of the significance of any archaeological or historical remains which may occur in these development areas and if such remains could be affected, damaged or destroyed by the proposed development activities.

IMPACT

- From this study on the basis of the available data it cannot be stated whether or not the proposed development will have a negative impact on any cultural resources.

MITIGATION MEASURE

- Mitigation may be necessary and measures will be determined by archaeological and historical experts.

IMPACT AFTER MITIGATION

- If mitigation measures are satisfactory the impact after mitigation is low. The confidence level is not high.

CULTURAL/HISTORICAL		SRCE	IMP
FURTHER WORK	Before any construction activities can commence a Phase 1 archaeological survey of the proposed development areas should be commissioned in order to establish the nature, the extent and the significance of any archaeological or historical remains in these areas.	11	2
ADVANTAGES	Not applicable	3	-

5.4.4 Infrastructure

(Roads, Railways, Power lines, Telephone lines, pipelines, dams, canals, etc)

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
a	TYPE : ROADS	3	2	2	2	3	2	1	2

DATA

- Some entrance roads may be temporarily closed as the trenches are dug and the pipeline installed.
- Where the proposed pipelines are within a road reserve there will be temporary disruptions to the road users.

IMPACT

- Access to secondary roads may be temporarily disrupted.
- Traffic will probably be inconvenienced during some stages in the construction of the pipelines if the road is blocked for whatever reason. This is a temporary impact.
- The construction activities may also result in the premature degradation of the existing road surface due to the increase in heavy vehicle traffic.
- Fences may be temporarily broken during construction and local residents should be aware of this in good time, in order to remove any live stock and children in those particular areas.
- It was assumed that the proposed pipelines will cross roads in certain instances. Temporary traffic deviations will be necessary and will cause traffic hazards. The road surface will have to be retarred as soon as possible after the pipes have been laid.

MITIGATION MEASURE

- Warning of the day on which the entrance roads will be blocked should be given to affected parties. Work should be expedited. Any broken fences should be replaced as soon as possible.
- No mitigation is possible for inconveniences caused to other road users.
- Degradation of the existing road should be avoided where possible, and mended where necessary.

IMPACT AFTER MITIGATION

- Inconveniences should be minimised.
- The road should be in an acceptable condition after construction.

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
b	TYPE: POWER& TELEPHONE LINES	3	2	2	2	3	2	0	2

DATA

- Power, telephone and railway lines are within the proposed area of development and need to be considered during the final placing of the proposed developments.

IMPACT

- Disturbance of any existing infrastructure will have a temporary disruptive impact.

MITIGATION MEASURE

- Work at the construction sites should be expedited.

IMPACT AFTER MITIGATION

- The appropriate mitigation measures should minimise the impact of disturbance during and after construction.

INFRASTRUCTURE		SRCE	IMP
FURTHER WORK	- Determine the exact route of the pipelines and location of other surface structures in relation to existing infrastructure - Specify suitable measures to inform the users of secondary roads timeously of the possibility of blocked access roads and broken fences.	3 3	2 3
ADVANTAGES	Not applicable	3	-

5.4.5 Population

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
	POPULATION	2	2	2	1	3	1	1	2

DATA

- A comprehensive study on demographic and socio-economic conditions in the Master Plan Study Area was conducted during Phase 1 of the JICA Study. With regard to the three feasibility Project Areas, the Study concluded that there will be no future growth in population. It is foreseen that the natural growth of population in the areas will be offset by migration of an approximately equal number of people to urban areas.

IMPACT

- The construction activities will cause some disturbance and inconvenience to the people.
- Construction activities will cause a temporary influx of people which could lead to an artificial economic boom for the area. The influx of people could also lead to poaching and littering. These impacts could also include increased pressure on local resources for food and for accommodation and on community life. This impact is temporary and may not present a large impact.
- There will be some employment opportunities for local people.
- Apart from the visual impacts of construction work, there will also be a considerable level of noise, dust, vibrations and increased traffic. This could have an adverse effect

on the inhabitants of the area close to the construction activities, as well as on the aesthetics of the area. These effects are temporary.

MITIGATION MEASURE

- The pipeline route should be aligned so as to minimise disturbances to the local population.
- Appropriate information and educational aspects regarding environmental issues should be conveyed to the workforce.
- Negotiations between the local population and the construction team should be appropriately and timeously organised.

IMPACT AFTER MITIGATION

- The social structure of the surrounding population is unlikely to be severely disrupted.

POPULATION		SRCE	IMP
FURTHER WORK	- The specific people along the pipeline routes and other surface structures that will be impacted must be identified. - The anticipated impact with reference to a temporary economic boost to the local people should be addressed.	3	2
ADVANTAGES	- The people in the Project Area will have a more assured supply of water. - Local people could get work during construction.	3 3	3 3

5.4.6 Interested and Affected Parties

NO	COMPONENT	DATA		IMPACT		MITIGATION			
		SRCE	DCD	ISD	SCD	SRCE	MDC	MID	MCD
	INTERESTED AND AFFECTED PARTIES	2	1	2	1	3	1	1	1

DATA

- The current stakeholders in the Moretele 2 area are the Highveld District Council, the Highveld Water & Sanitation Authority, Magalies Water, Department of Water Affairs and Forestry and the local authorities. No formal local authorities are yet in

place.

IMPACT

- The impacts of the project on the interested and affected parties are uncertain, however by not involving the necessary people the project could be detrimentally influenced.

MITIGATION MEASURE

- Identify and involve the interested and affected parties.

IMPACT AFTER MITIGATION

- The impact after mitigation should be negligible.

INTERESTED AND AFFECTED PARTIES		SRCE	IMP
FURTHER WORK	The interested and affected parties must be involved in the project in a public participation programme.	3	3
ADVANTAGES	More assured water supply to the Project Area.	3	3

Appendix ; References

1. Consultburo and EVN, September 1996. 1:250 000 scale map on: Existing Infrastructure. Study on the expansion of the capacity of Magalies Water.

2. JICA Study Team, July 1997. The study on the expansion of capacity of Magalies Water in the Republic of South Africa (Phases 2 & 3). Interim Report.

3. MetsiQual cc, 1997. Environmental Scientist; Linda Rossouw

4. O'Keefe, J.H., 1985. The Conservation Status of South African Rivers. 1:250 000 Map, Ecosystems Programme.

5. EVN and Consultburo, June 1996. Inventory survey on the water supply sector within the area of supply of Magalies Water. Appendix A. Background study: Part 1. Climate, topography and environment. For: Japan International Cooperation Agency and the Department of Water Affairs and Forestry.

6. EVN/Consultburo Joint Venture, March 1996. Study on the expansion of Magalies Water. Engineering Group Inventory Survey (Data collection phase). Appendix A. Climate, topography and environment.

7. EVN and Consultburo, June 1996. Inventory survey on the water supply sector within the area of supply of Magalies Water. Appendix C. Background study: Part 3. Geology and hydrogeology. For: Japan International Cooperation Agency and the Department of Water Affairs and Forestry.

8. EVN and Consultburo, June 1996. Inventory survey on the water supply sector within the area of supply of Magalies Water. Main Report. For: Japan International Cooperation Agency and the Department of Water Affairs and Forestry. 1:250 000 Topographical sheet 2528 Pretoria, 1984, third edition.

9. Consultburo, November 1994. KwaNdebele Water Augmentation Feasibility Study. The relevant environmental impact prognosis of the proposed Roodeplaat Dam option. Department of Water Affairs and Forestry, Directorate Project Planning

10. Acocks, J.P.H. 1988. Veld Types of South Africa. Memoirs of the Botanical Survey of South Africa No 57. O.A. Leistner (ed), third edition. Botanical Research Institute, Department of Agriculture and Water Supply.

11. Pistorius, J.C.C.1997. Motivation for Phase I archaeological survey in Magalies Waters intended development areas.

B.3 Minutes of Meeting

STUDY ON THE EXPANSION OF CAPACITY OF MAGALIES WATER
ENVIRONMENTAL STUDY

MINUTES OF THE SECOND ECOLOGICAL TASK GROUP MEETING

MONDAY 20 OCTOBER 1997

AT 07:30 IN ROOM 344 RESIDENSIE BUILDING

185 SCHOEMAN STREET, PRETORIA

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1. WELCOME AND OPENING

The Chairman, Mr C Mannall, welcomed all the participants to the meeting.

2. ATTENDANCE AND APOLOGIES

Attendance

S Kadowaki	JICA Study Team, Team Leader
B Sawara	JICA Study Team
C Mannall	JICA Study Team
G V Munro	Department of Water Affairs and Forestry: Environmental Studies
S C Vogel	Department of Water Affairs and Forestry: Project Planning
J J de Vries	North West Parks Board
J de Vries	North West Parks Board
L Rossouw	MetsiQual cc

Apologies

S Davis	Department of Environment Affairs & Tourism: Mpumalanga
K R Legge	Department of Water Affairs and Forestry: Environmental Studies
D Swart	Department of Environment Affairs & Tourism: North West
R Strydom	Magalies Water

3. ACCEPTANCE OF MINUTES

The Minutes of the First Ecological Task Group Meeting were accepted.

4. ACCEPTANCE OF AGENDA

The Agenda was accepted. One additional issue was raised, that of the concerns of North West Park Board regarding development in Borakalalo National Park.

5. FEEDBACK ON STUDY ACTIVITIES

5.1 Technical component

Initially in Phase 1 of the JICA study a large area was investigated at a Master Plan level for water supply up to 2015. The villages in the Study Area were mostly unserved and relied on poor quality groundwater for potable water. Three areas were identified as priority areas to supply surface water to. They were North Mankwe, Moretele 2 and the Klipvoor Water Supply Areas. These priority areas were investigated in Phase 2, the feasibility phase, of the project. A pilot project was conducted in each of the priority areas during the current study.

Three alternative supply options were investigated for both Moretele 2 and Klipvoor Water Supply Areas. The options were briefly discussed. The most viable option for Klipvoor Water Supply Area is from a new Water Treatment Plant downstream of Klipvoor Dam. The best option for supplying water to the Moretele 2 Water Supply Area was from the Weltevreden Water Treatment Works at Mkombo Dam. Only one option was viable to supply water to the North Mankwe Water Supply Area, that of supplying water to the area from Vaalkop Water Treatment Works at Vaalkop Dam.

5.2 Environmental component

A ROIP 2 feasibility study was completed for Klipvoor FS Area. This project area was found to include an environmentally sensitive area, Borakalalo National Park, and more detailed studies were required to determine the expected impacts.

The Environmental Impact Assessment as described in the ROIP 1 Report was sufficient for the expected impacts in the Moretele 2 and North Mankwe FSAreas and no further work was done after the site investigations. More detailed project descriptions of these two areas were presented in short reports summarising the expected impacts from the proposed development.

Comments from North West Parks Board

- The Parks Board do not object to the construction of an intake pump station at the

existing weir downstream of Klipvoor Dam. However, they do object to any further development within the Park Boundaries. They appreciate the need to supply drinking water to the communities in the area, but propose that the water treatment works and regional reservoir be constructed outside the Park boundaries. Negotiations are ongoing.

Mr Vogel explained that Klipvoor Dam is a water resource that has been reserved for future use depending on economic development. It is expected that further abstractions will be made from Klipvoor Dam in future. A pump station in the Park in the short term will probably serve its purpose. It is expected that further water resource development will take place probably requiring infrastructure within the Park in future.

- There are land claims for areas of the Borakalalo National Park. This may have implications for the future development of the National Park as well as the proposed water project. The three communities involved are Bultfontein 2, Klipvoorstad and Jonathan. This issue is being investigated.

  It was pointed out that possibly the proposed water supply scheme could alleviate some of the problems with the communities by ensuring a more assured drinking water supply.

- Concern was expressed as to the draw down level of the dam during drought conditions. During droughts some of the exposed areas around the dam become muddy and can trap animals. There was an agreement between the Department of Water Affairs and Forestry and the former Bophuthatswana Government not to release water for irrigation if there is 10% water in the dam. The operating rule of the dam will have to be evaluated for the future water resource management of the system to ensure sufficient water is released for most of the time for primary use.

- Concern was also expressed regarding the danger posed by fences around the proposed infrastructure to the animals in the Park especially during game counting drives.

6. REVIEW OF ENVIRONMENTAL REPORTS

The three Project Area reports were distributed to the ETG Members for comment.

Comment was received from Mpumalanga Department of Environment Affairs & Tourism.

Their main comment was that an acceptable Environmental Management Plan for the Construction and Operational Phases should be produced, before any construction commences.

Ms Munro, DWAF: Environmental Studies, raised the following issues:

- It was stated that the impact of the abstraction for drinking water on the river downstream of the dam would be minimal. The motivation for this statement was absent.

  Motivation:
  The mean annual runoff in the catchment is 80,7 million m^3. The full supply volume of Klipvoor Dam is 43,8 million m^3. The irrigation demand from the dam is 62 million m^3per annum. The total drinking water demand can range from 1,3 to 3,4 million m^3per annum depending on the level of service supplied. This drinking water supply will be abstracted downstream of the dam and the percentage is relatively small compared to the irrigation demand.

- A commitment was required that the expected negative impacts should be mitigated and during both the detailed design stage and construction due cognisance of the need to minimise adverse impacts is required.

7. FURTHER ACTIONS

- A Project Steering Committee need to be formalised before the necessary funding becomes available. Once funding is available it is foreseen that the projects will progress rapidly.

  A meeting between all the stakeholders in the Borakalalo National Park will be organised by Ms Munroe as soon as possible. Stake holders involved include North West Parks Board, North West Province Department of Environment Affairs and Tourism, Department of Water Affairs and Forestry: Environmental Studies and Project Planning. These stakeholders will also be part of the Project Steering Committee. Issues to be addressed at this proposed meeting should include the land claims on the Park as well as future development in the Park. The issue of land claims should involve legal expertise.

- It was recommended by Mr Vogel that the environmental impact assessment reports be accepted as a basis to move forward.

- The following recommendations were made in the reports and need to be addressed before and during the detailed design phases of the project:

    1. This investigation should include meetings with local communities to determine the preferences of the communities to any options or alternative developments, especially in the siting of the regional and service reservoirs.
    2. The lack of sanitation facilities and the impact of increased water usage needs to be investigated.
    3. Investigate the land claims issues at Borakalao National Park.
    4. Liaise with all the interested and affected parties.
    5. A Phase 1 archaeological survey of the proposed pipeline routes and especially the reservoir sites is recommended.
    6. Compile an Environmental Management Plan for the construction phase and draw up appropriate rehabilitation guidelines to mitigate the disturbances and aesthetic impacts caused by construction of the pipelines and associated infrastructure.
    7. Alert the contractor and labourers to the ecological and social impacts associated with construction activities.

8. CLOSURE

The meeting was closed at 9:00 and the Chairman thanked everyone for their attendance.