

APPENDIX 2

TO SUPPORTING REPORT E

COMPARISON OF
ALTERNATIVE WATER
SUPPLY SCHEMES

COMPARISON OF ALTERNATIVE WATER SUPPLY SCHEMES

TABLE OF CONTENTS

KLIPVOOR EAST AND MORETELE NORTH SUPPLY BLOCKS

.....	A-1
ALTERNATIVE 1 :	
COST SUMMARY	A-4
SCHEMATICS.....	A-6
ALTERNATIVE 2 :	
COST SUMMARY.....	A-9
SCHEMATICS.....	A-11
ALTERNATIVE 3 :	
COST SUMMARY.....	A-14
SCHEMATICS.....	A-16
MORETELE 2.....	A-20
ALTERNATIVE 1 :	
COST SUMMARY.....	A-23
SCHEMATICS (EXISTING).....	A-25
SCHEMATICS (PROPOSED).....	A-31
ALTERNATIVE 2 :	
COST SUMMARY.....	A-37
SCHEMATICS (EXISTING).....	A-39
SCHEMATICS (PROPOSED).....	A-46
ALTERNATIVE 3 :	
COST SUMMARY.....	A-53
SCHEMATICS (EXISTING).....	A-55
SCHEMATICS (PROPOSED).....	A-62

NOTE : THERE ARE CURRENTLY NO SURFACE WATER INFRASTRUCTURE
IN KLIPVOOR EAST AND MORETELE NORTH SUPPLY BLOCKS.

**COMPARISON OF ALTERNATIVE SUPPLY
SCHEMES TO KLIPVOOR EAST AND
MORETELE NORTH SUPPLY BLOCKS
(KLIPVOOR SUPPLY AREA)**

KLIPVOOR SUPPLY AREA - TECHNICAL ALTERNATIVES

1 Technical Alternatives

With regard to the supply to Klipvoor East and Moretele North Supply Blocks in Klipvoor Supply Area, three technical alternatives were investigated as follows:

Alternative 1: Both Supply Blocks are supplied from a proposed new water treatment works at Klipvoor Dam.

Alternative 2: Both Supply Blocks are supplied from Temba WTW via a new pipeline laid parallel to the existing MW's Temba - Warmbaths/Nylstroom pipeline.

Alternative 3: This alternative is a combination of the above two alternatives in that the supply to the two Blocks is split between a new water treatment at Klipvoor Dam supplying the Klipvoor East Supply Block while the Moretele North Supply Block is supplied via a new pipeline branching off the existing MW's Temba - Warmbaths/Nylstroom pipeline.

Alternative 1 comprises a water treatment plant below Klipvoor Dam from which water is pumped in an easterly direction to Lebotlwane, Mokobjane, Tlhoiwe and Bollantlokwe. At Bollantlokwe the pipeline splits with water being pumped through one branch to Slagboom, Transactie/Ngobi, Swartboom, Mogholwanong and Makekeng. The other branch runs southwards under gravity to Sutelong from where it is pumped southwards to Rantebeng and Makgabelwane. At Makgabelwane, the pipeline again splits with a pumpline continuing in a south-westerly direction to Shakung, Bufflesdoorn, Moiletswane and Dipompong; and a gravity line continuing in a south-easterly direction to Rabosula, Ga-Moti, Garantlapanne and Botshabelo.

Alternative 2 has the same links as Alternative 1. The source however is Temba WTW and a new Temba - Makakeng pipeline which is connected to the Makakeng - Slagboom branch will supply water in the opposite direction up to a new regional reservoir at Bollantlokwe which then feeds the rest of the network.

2 Planning Schematics

For each of the above three alternatives, planning schematics were prepared on spreadsheets; a hydraulic analysis based on the projected 2015 primary demand was carried out; and the required capital works and their costs were estimated. The schematics are compiled for each alternative and included in this appendix. Details of the required works and costs are provided on a Cost Summary Sheet for each alternative.

3 Conclusions

A comparative summary of the capital expenditure and operation costs required for each alternative scheme is shown in the table below.

Capital/Operation Cost	Alternative 1	Alternative 2	Alternative 3
Bulk Infrastructure Cost	R37.744 million	R62.599 million	R40.272 million
Third Tier Infrastructure Cost	R27.501 million	R27.121 million	R27.686 million
Total Capital Cost	R65.245 million	R89.720 million	R67.958 million
Annual Pumping Cost	R0.120 million	R0.170 million	R0.119 million

It can be seen from the table that Alternative 1 and Alternative 3 are very close to each other. Alternative 3 however depends on the Magalies Water's existing Temba - Warmbaths/Nylstroom pipeline, and its implementation is likely to result in this pipeline reaching its full capacity and requiring augmentation earlier than planned.

Klipvoor West Supply Block is located west of Klipvoor Dam and it is proposed that it be supplied entirely from the new water treatment works at the Dam. This also gives an advantage to Alternative 1 in terms of operation and maintenance of the proposed new water works.

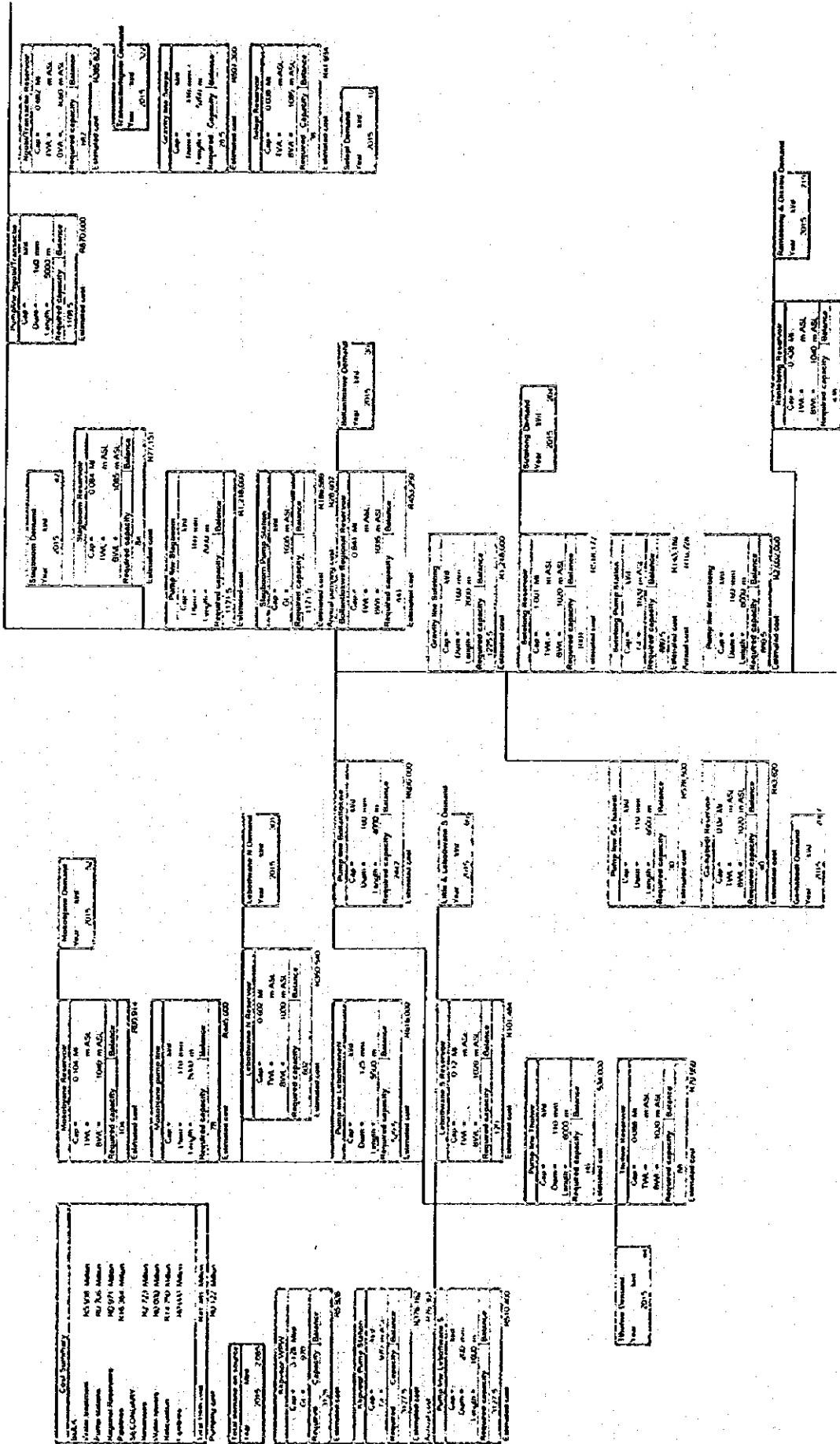
From the above considerations, Alternative 1 has been selected as the preferred alternative among the three.

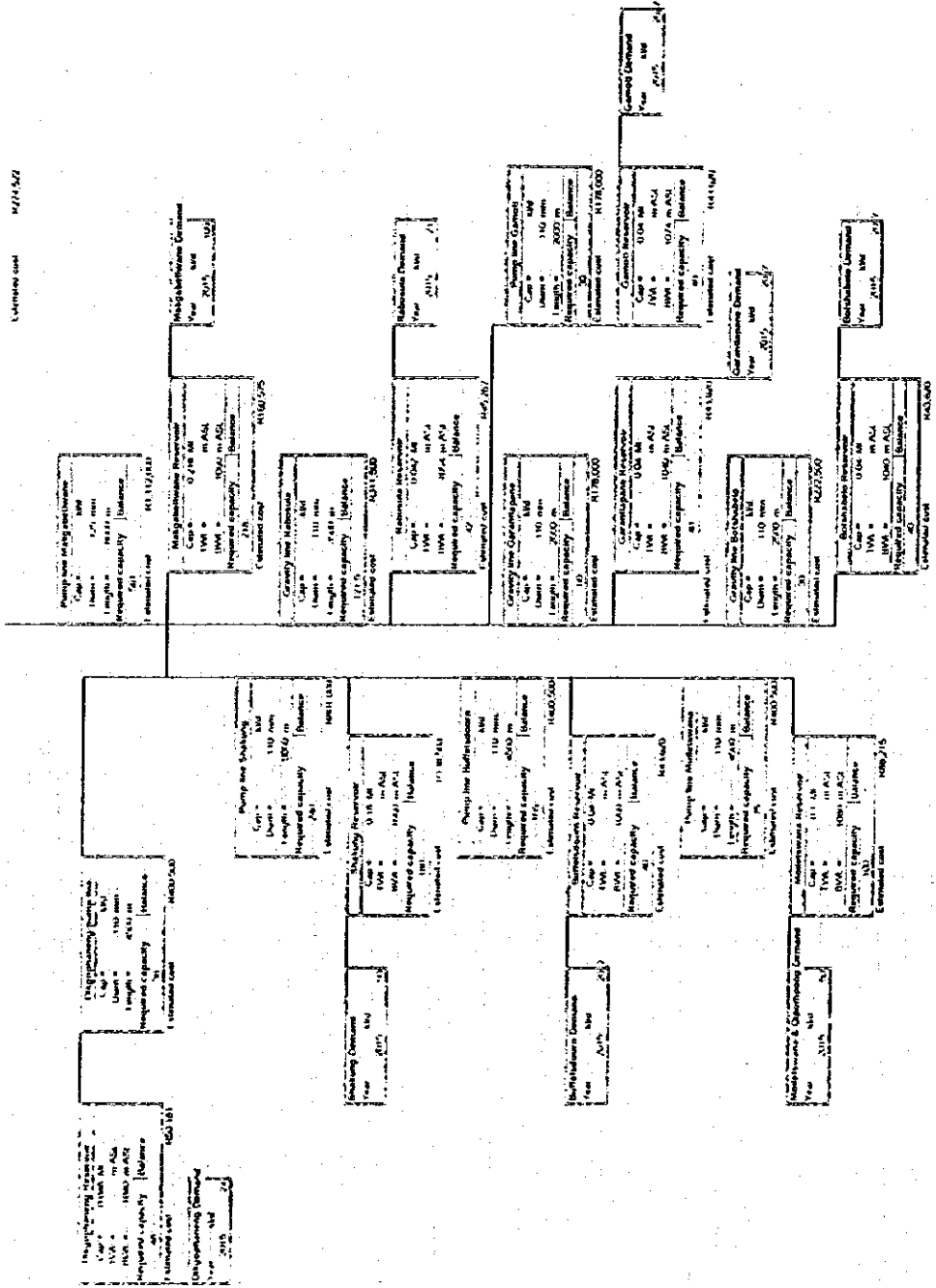
COST SUMMARY FOR INFRASTRUCTURE		
NAME OF SUPPLY AREA :	KLIPVOOR ALT 1	
	SUPPLIED FROM KLIPVOOR	
INCLUDING SUPPLY BLOCKS :	Moretele North	
	Klipvoor East	
POPULATION SERVED (2015) :	43,717	
AADD in mcm/a (2015) :	0.75	
BULK COST :	QUANTITY	COST (R million)
Water Purification Works	Kl/d (SDD)	
Klipvoor	3128	R5.938
Pump Stations	Kl/d (SDD)	
A : Capital Cost		
Klipvoor	3,127	R0.376
Slagboom	1,171	R0.186
Sutelong	0.889	R0.143
Sub-total	4,299	R0.705
B : Annual Energy Cost (Not Incl'd with Total)		
Klipvoor		R0.076
Slagboom		R0.028
Sutelong		R0.016
Sub-total		R0.120
Reservoirs (Regional)	Ml	
Sutelong	1	R0.518
Boilantlokwe	0.841	R0.453
Sub-total	1.841	R0.971
Pipelines (Bulk)	km	
110 dia	79.9	R7.108
125 dia	13.5	R1.728
140 dia	7.3	R1.000
160 dia	31	R6.032
200 dia	1.6	R0.510
Total		R16.378
Sub Total Construction Cost		R23.992
Engineering Fees (15 %)		R3.599
VAT (14 %)		R3.863
Project Contingency (20%)		R6.291
TOTAL : Bulk Cost		R37.744
Bulk Cost per Capita (Rands)		R863.376

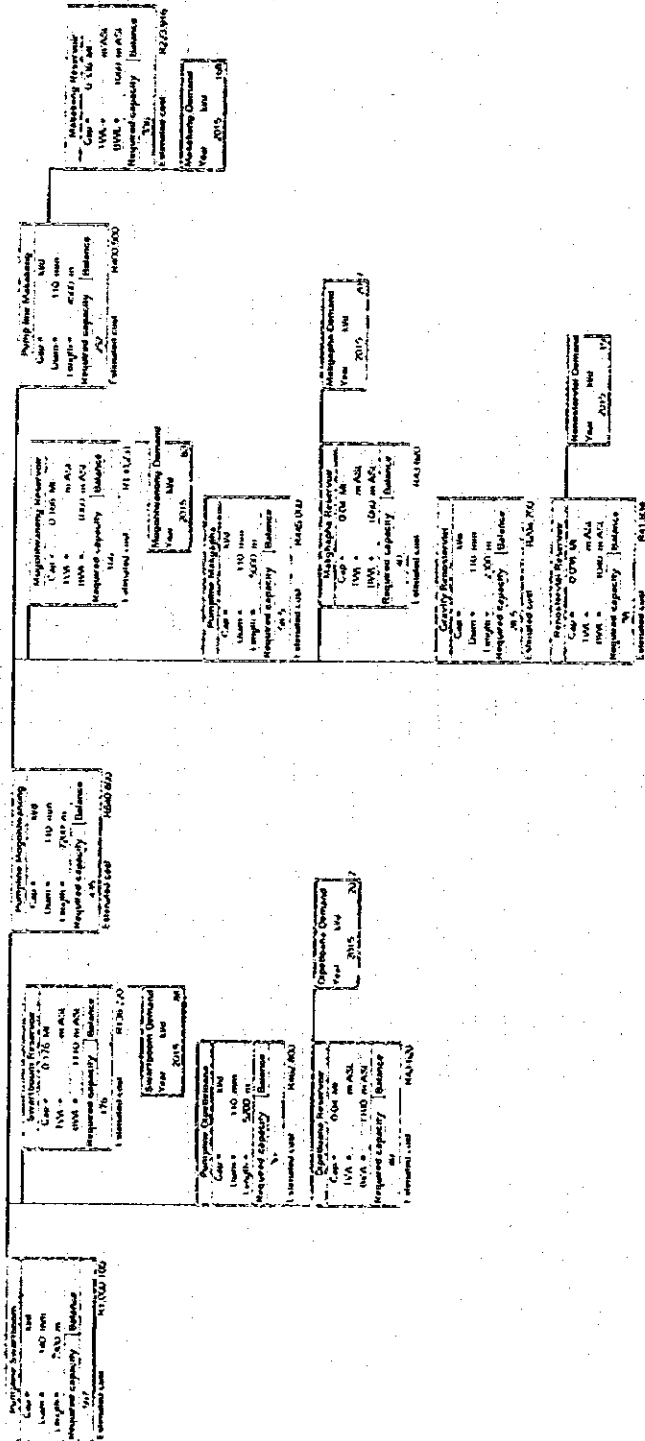
KLIPVOOR		
SECONDARY COST :	QUANTITY	COST (R million)
Reservoirs (Service)	MI	
Klipvoor North and Moretele bloc	3.74	R2.723
Water Towers	MI	
	NIL	NIL
Pump Stations (Secondary)	K/d	
A : Capital Cost	NIL	NIL
B : Annual Energy Cost (Not Incl'd with Total)	NIL	NIL
Pipelines (Secondary)	km	
Reticulation	km	
Moretele		R4.379
Klipvoor North		R10.379
Sub-total		R14.758
Sub Total Construction Cost		R17.481
Engineering Fees (15 %)		R2.622
VAT (14 %)		R2.814
Project Contingency (20%)		R4.584
TOTAL : Secondary Cost		R27.501
Secondary Cost per Capita (Rands)		R629.071
GRAND TOTAL COST		R65.245
Grand Total Cost per Capita (R)		R1,492.447

Kipcoor supplying Moretele North and Kipcoor East (proposed planning to meet 2015 demand)
 Alternative 1

107
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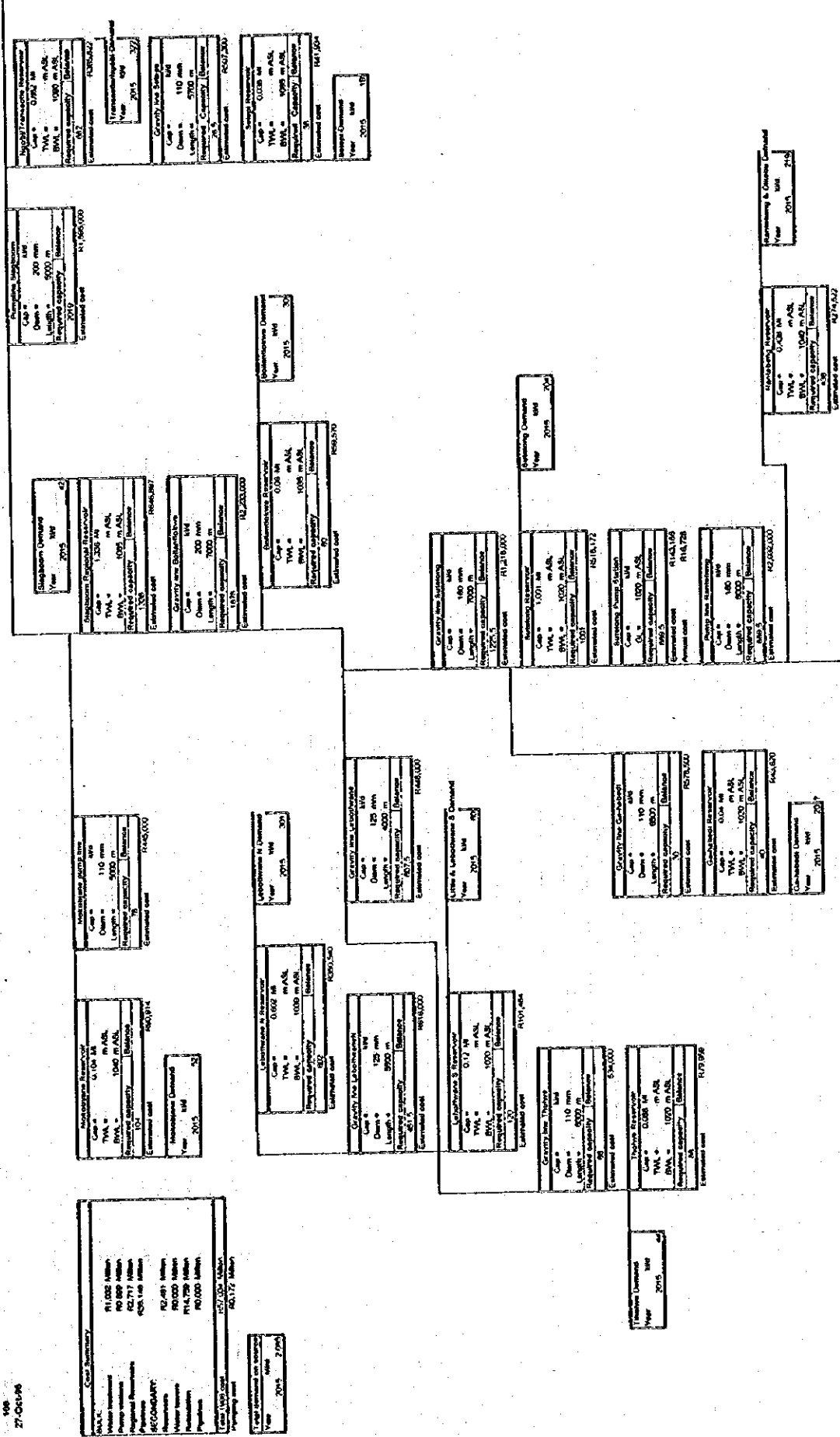
COST SUMMARY FOR INFRASTRUCTURE		
NAME OF SUPPLY AREA :	KLIPVOOR ALT 2	
	SUPPLIED FROM TEMBA	
INCLUDING SUPPLY BLOCKS :	Moretele North	
	Klipvoor East	
POPULATION SERVED (2015) :	43,717	
AADD In mcm/a (2015) :	0.75	
BULK COST :	QUANTITY	COST (R million)
Water Purification Works	Kl/d (SDD)	
Temba	3128	R1.032
Pump Stations	Kl/d (SDD)	
A : Capital Cost		
Temba	3,127	R0.317
Makakeng	2,875	R0.439
Sutelong	0.889	R0.143
Sub-total	6,003	R0.899
B : Annual Energy Cost (Not Incl'd with Total)		
Temba		R0.060
Makakeng		R0.094
Sutelong		R0.016
Sub-total		R0.170
Reservoirs (Regional)	Ml	
Makakeng	4.17	R1.551
Slagboom	1.336	R0.646
Sutelong	1.001	R0.518
Sub-total	6.507	R2.715
Pipelines (Bulk)	km	
110 dia	68.2	R6.069
125 dia	17.5	R2.176
160 dia	15	R3.250
200 dia	35.1	R23.650
Total		R35.145
Sub Total Construction Cost		R39.791
Engineering Fees (15 %)		R5.969
VAT (14 %)		R6.406
Project Contingency (20%)		R10.433
TOTAL : Bulk Cost		R62.599

Bulk Cost per Capita (Rands)		R1,431.919
KLIPVOOR ALT 2		
SUPPLIED FROM TEMBA		
SECONDARY COST :	QUANTITY	COST (R million)
Reservoirs (Service)	MI	
Klipvoor North and Moretele blocks	2.3899	R2.481
Water Towers	MI	
	NIL	NIL
Pump Stations (Secondary)	Kl/d	
A : Capital Cost		
	NIL	NIL
B : Annual Energy Cost (Not Incl'd with Total)		
	NIL	NIL
Pipelines (Secondary)	km	
Reticulation	km	
Moretele		R4.379
Klipvoor North		R10.380
Sub-total		R14.759
Sub Total Construction Cost		R17.240
Engineering Fees (15 %)		R2.586
VAT (14 %)		R2.776
Project Contingency (20%)		R4.520
TOTAL : Secondary Cost		R27.121
Secondary Cost per Capita (Rands)		R620.381
GRAND TOTAL COST		R89.720
Grand Total Cost per Capita (R)		R2,052.300

Moretele and Kijivoor Supply Blocks supplied from Tembe (proposed planning to meet 2015 demand)

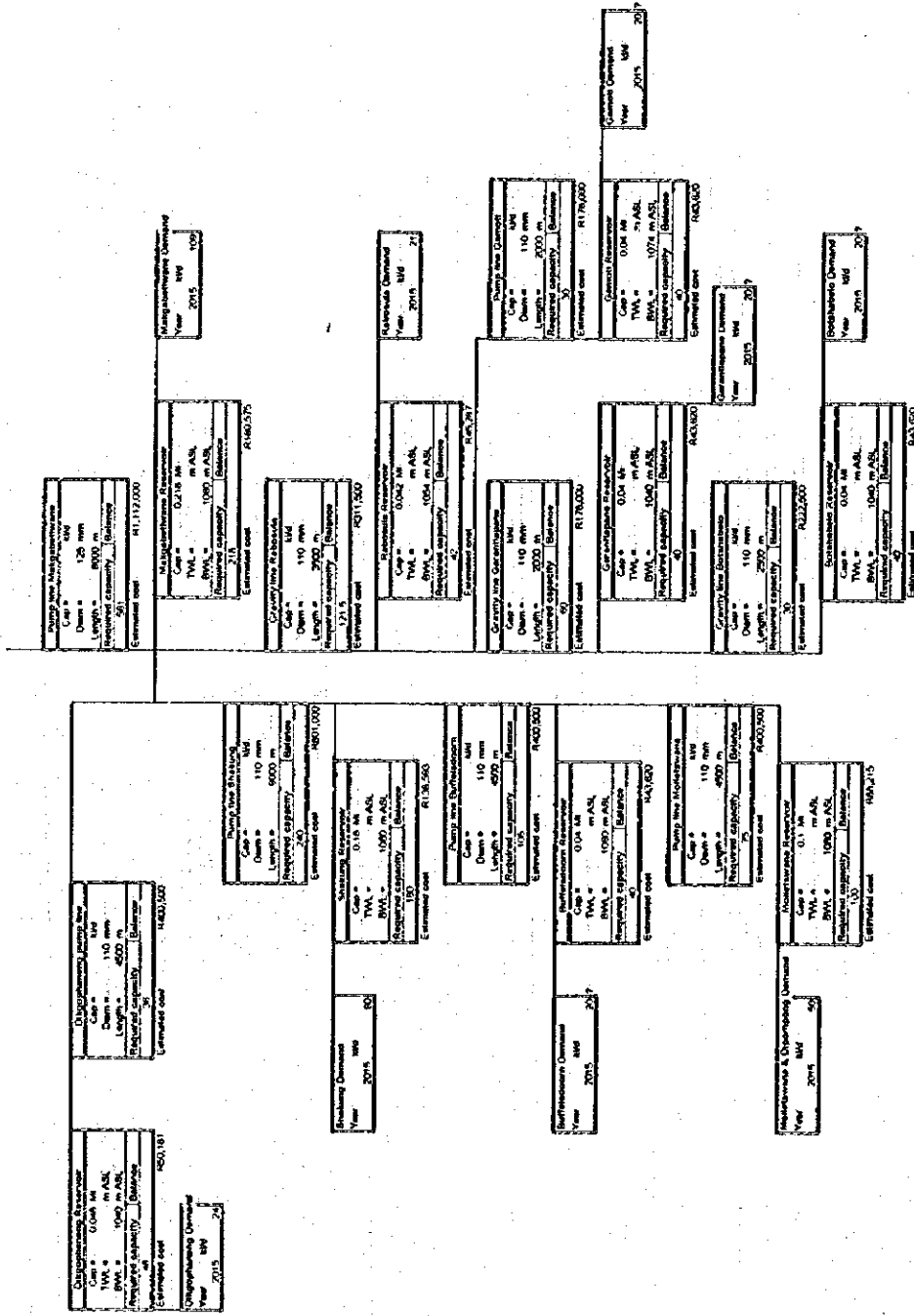
Alternative 2

98
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Cost Summary	
SALE	R1,085 Million
Water treatment	R2,787 Million
Water supply	R2,787 Million
Regional Networks	R2,787 Million
SECONDAIRY	R2,787 Million
Water supply	R2,787 Million
Water treatment	R2,787 Million
Regional Networks	R2,787 Million
Population	R2,787 Million
Total 1000 cost	R17,172 Million
Proposed cost	R17,172 Million

Cost Summary on supply	
Year	2015
Cost	2,787



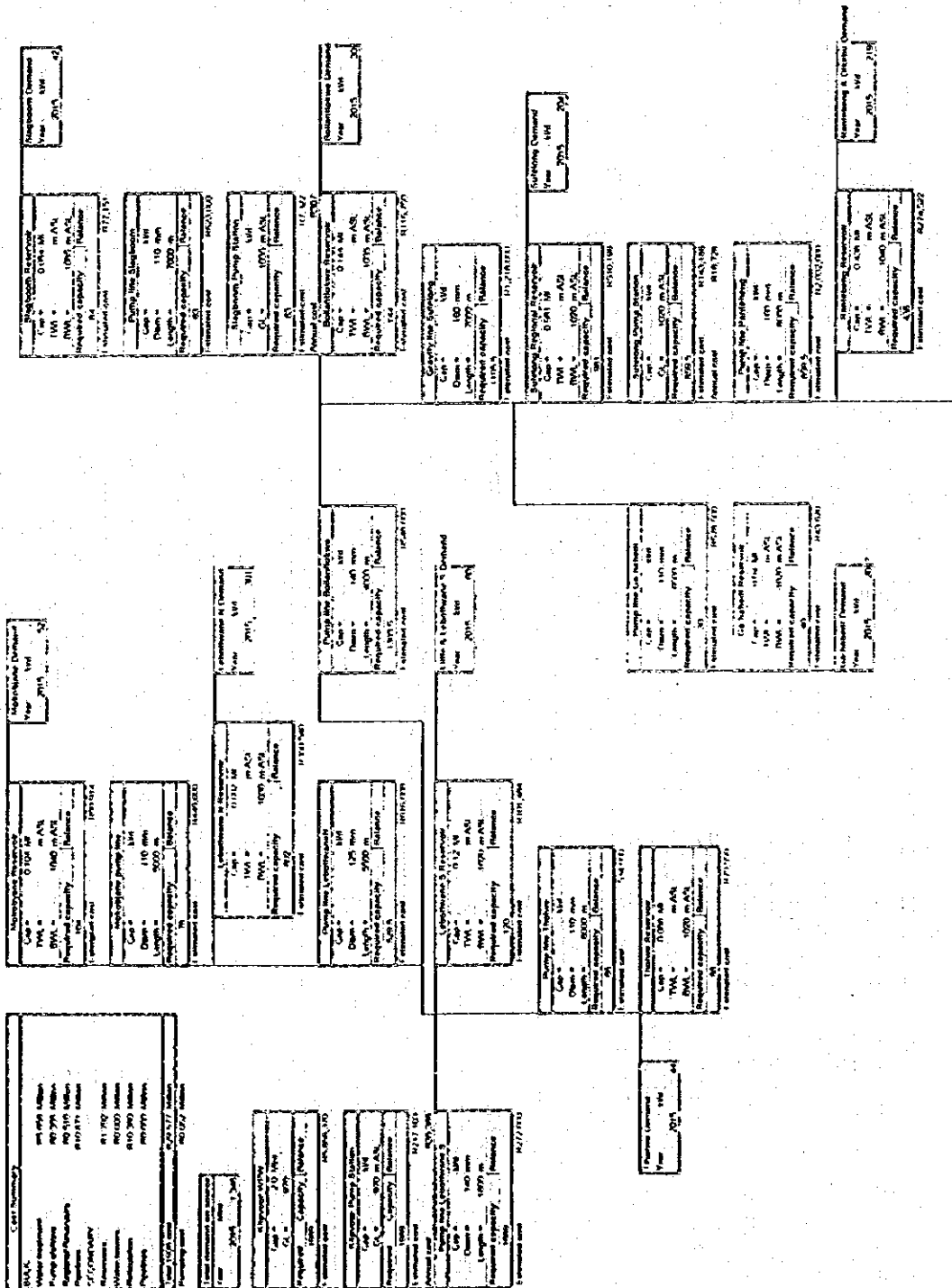
COST SUMMARY FOR INFRASTRUCTURE

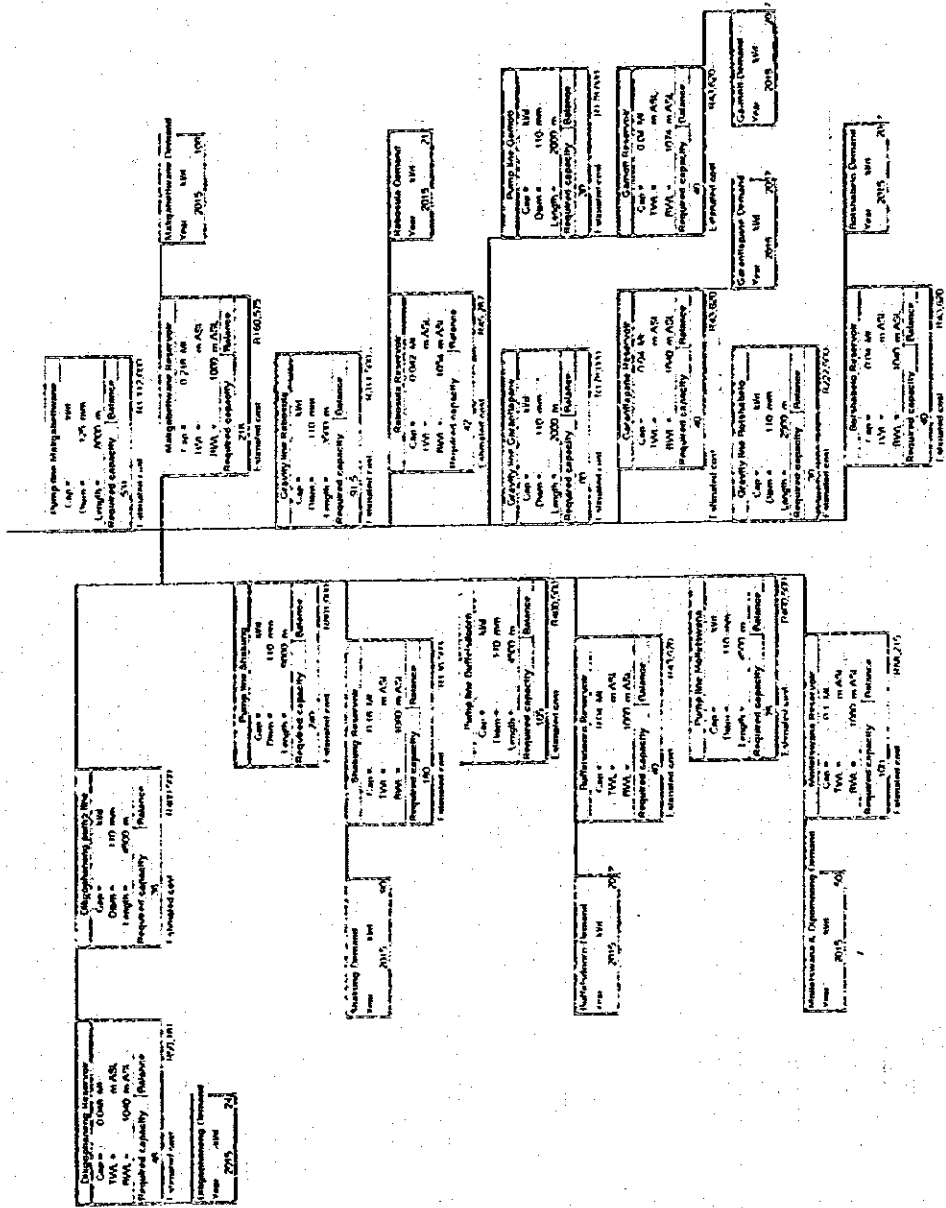
NAME OF SUPPLY AREA :	KLIPVOOR ALT 3	
INCLUDING SUPPLY BLOCK	SPLIT SUPPLY BETWEEN KLIPVOOR AND TEMBA	
	Moretele North	
	Klipvoor East	
POPULATION SERVED (2015)	43,717	
AADD in mcm/a (2015) :	0.75	
BULK COST :	QUANTITY	COST (R million)
Water Purification Works	Kl/d (SDD)	
Temba (existing)	1090	R0.360
Klipvoor (new)	1989	R5.656
		R6.016
Pump Stations	Kl/d (SDD)	
A : Capital Cost		
Moretele N	1.11	R0.588
Klipvoor	1.99	R0.217
Sutelong	0.86	R0.143
Slagboom	0.06	R0.007
Sub-total	4.02	R0.955
B : Annual Energy Cost (Not Incl'd with Total)		
Moretele N		R0.068
Klipvoor		R0.035
Sutelong		R0.016
Slagboom		R0.000
Sub-total		R0.119
Reservoirs (Regional)	Ml	
Moretele N	0.739	R0.410
Sutelong	0.981	R0.510
Sub-total	1.72	R0.920
Pipelines (Bulk)	km	
110 dia	82.5	R7.343
125 dia	20.7	R2.534
140 dia	5.6	R0.820
160 dia	15	R3.250
200 dia	13.2	R3.762
Total		R17.708
Sub Total Construction Cost		R25.599
Engineering Fees (15 %)		R3.840
VAT (14 %)		R4.121
Project Contingency (20%)		R6.712

TOTAL : Bulk Cost		R40.272
Bulk Cost per Capita (Rands)		R921.195
KLIPVOOR ALT 3		
SPLIT SUPPLY FROM KLIPVOOR AND TEMBA		
SECONDARY COST :	QUANTITY	COST (R million)
Reservoirs (Service)	MI	
Klipvoor North and Moretele blocks	3.842	R2.840
Water Towers	MI	
	NIL	NIL
Pump Stations (Secondary)	Kl/d	
A : Capital Cost	NIL	NIL
B : Annual Energy Cost (Not Incl'd with Total)	NIL	NIL
Pipelines (Secondary)	km	
Reticulation	km	
Moretele		R4.379
Klipvoor North		R10.380
Sub-total		R14.759
Sub Total Construction Cost		R17.599
Engineering Fees (15 %)		R2.640
VAT (14 %)		R2.833
Project Contingency (20%)		R4.614
TOTAL : Secondary Cost		R27.686
Secondary Cost per Capita (Rands)		R633.300
GRAND TOTAL COST		R67.958
Grand Total Cost per Capita (R)		R1,554.494

Kilbuck East supply area - Ait 3 (proposed planning to meet 2015 demand)

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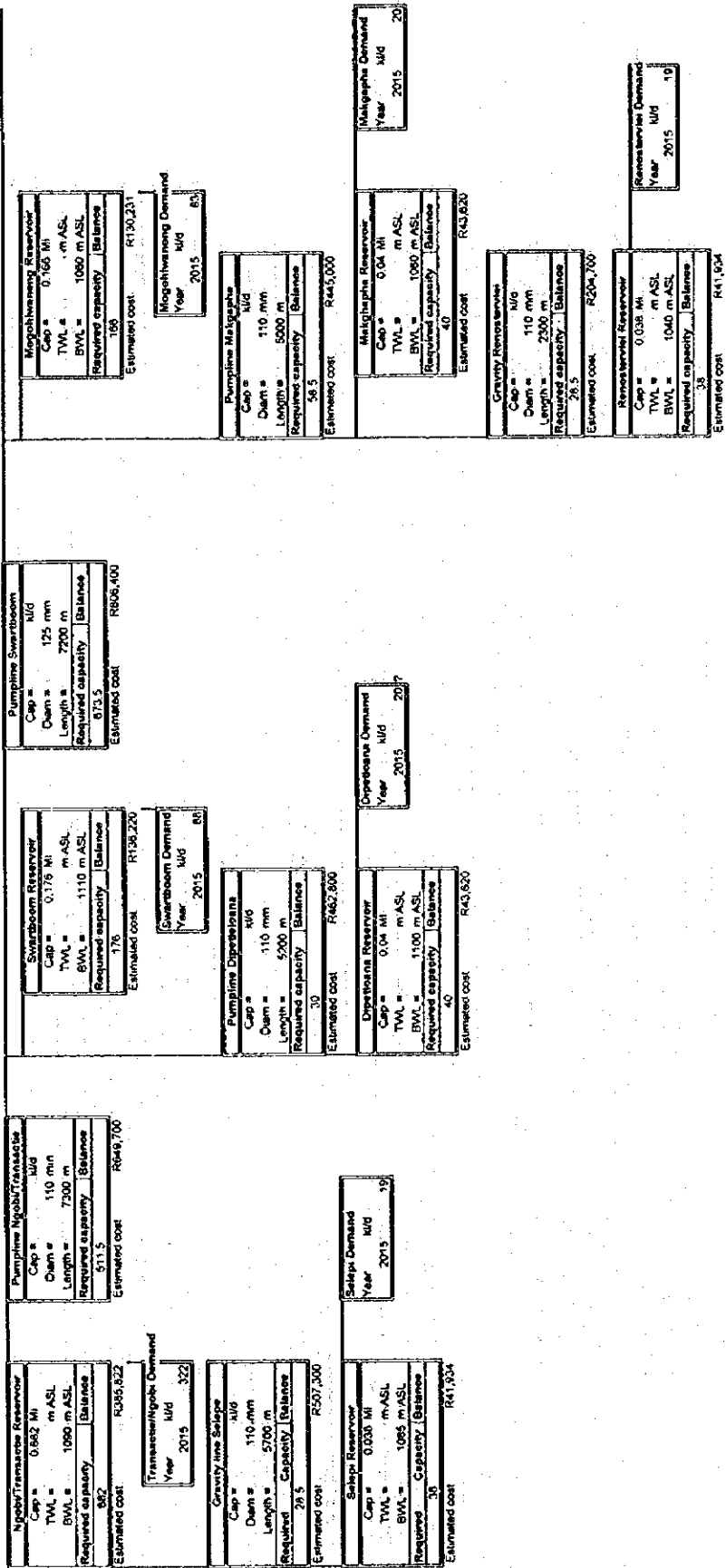
Moretele North supply area supplied out of spare capacity from Temba-Warimbaths existing pipeline (proposed planning to meet 2015 demand)
Part of Klipvoer Alternative 3

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Cost Summary	
BULK:	
Water treatment	R0,389 Million (cession to Kuvabe)
Pump stations	R0,568 Million
Reservoirs	R0,410 Million
Pipelines	R8,838 Million
SECONDARY:	
Reservoir	R1,047 Million
Water towers	R0,000 Million
Rehabilitation	R4,379 Million
Pipelines	R0,000 Million
Total 1996 cost	R13,652 Million
Pumping cost	R0,069 Million

Total demand on source	
Year	2015
M/G	0.735

Excludes Nyilroom/Warimbaths block of 18,095



Ngobu/Temba Reservoir	
Cap =	0.662 Ml
TWL =	1090 m ASL
BWL =	1090 m ASL
Required capacity	Balance
Required capacity	0.62
Estimated cost	R355,922

Transvaal/Ngobu Demand	
Year	2015
M/G	0.322

Gravity Line Salepe	
Cap =	110 m
Diam =	110 mm
Length =	5700 m
Required capacity	Balance
Required capacity	29.5
Estimated cost	R507,300

Salepe Reservoir	
Cap =	0.030 Ml
TWL =	1065 m ASL
BWL =	1065 m ASL
Required capacity	Balance
Required capacity	30
Estimated cost	R41,704

Diphoana Reservoir	
Cap =	0.04 Ml
TWL =	1100 m ASL
BWL =	1100 m ASL
Required capacity	Balance
Required capacity	40
Estimated cost	R462,800

Diphoana Demand	
Year	2015
M/G	0.207

Pumpline Swarboom	
Cap =	125 mm
Diam =	125 mm
Length =	7200 m
Required capacity	Balance
Required capacity	673.5
Estimated cost	R806,400

Mogohweng Reservoir	
Cap =	0.165 Ml
TWL =	1060 m ASL
BWL =	1060 m ASL
Required capacity	Balance
Required capacity	169
Estimated cost	R130,231

Mogohweng Demand	
Year	2015
M/G	0.83

Pumpline Maitlaphe	
Cap =	110 mm
Diam =	110 mm
Length =	5000 m
Required capacity	Balance
Required capacity	58.5
Estimated cost	R443,000

Maitlaphe Reservoir	
Cap =	0.04 Ml
TWL =	1060 m ASL
BWL =	1060 m ASL
Required capacity	Balance
Required capacity	40
Estimated cost	R43,820

Maitlaphe Demand	
Year	2015
M/G	20

Gravity Reservoir	
Cap =	110 mm
Diam =	110 mm
Length =	2300 m
Required capacity	Balance
Required capacity	28.5
Estimated cost	R204,700

Reservoir Demand	
Year	2015
M/G	19

Information/Maintenance block total
 Year: 2015 NIG 16095

Pump line from Lembah/Kuduba	
Cap	10238 MGD
Diam	450 mm
Length	30000 m
Required capacity	Balance
Estimated cost	9013.1

Tembak/Kuduba C11 Pumping Station	
Cap	1105 MGD
GL	1105 m ASL
Required capacity	Balance
Estimated cost	29251

Tembak/Kuduba Regional Reservoir	
Cap	M
TWL	1105 m ASL
BWL	1105 m ASL
Required capacity	Balance
Estimated cost	37968

Tembak/Wipiw	
Cap	1105 MGD
Required Capacity	Balance
Estimated cost	20251

M1 Mercede N Regional Reservoir	
Cap	0.739 M
TWL	m ASL
BWL	1090 m ASL
Required capacity	Balance
Estimated cost	739
Annual cost	R410,374

Mercede N P/B	
Cap	MGD
GL	1090 m ASL
Required capacity	Balance
Estimated cost	1108.5
Annual cost	R358,340
Annual cost	R68,740

Pump line Malakong	
Cap	MGD
Diam	210 mm
Length	8700 m
Required capacity	Balance
Estimated cost	1108.5
Estimated cost	R2,778,500

Malakong Reservoir	
Cap	0.338 M
TWL	m ASL
BWL	1060 m ASL
Required capacity	Balance
Estimated cost	338
Estimated cost	R233,976

Malakong Demand	
Year	2015
NIG	165

Pump line through Wipiw	
Cap	MGD
Diam	200 mm
Length	4500 m
Required capacity	Balance
Estimated cost	858.5
Estimated cost	R1,282,500

**COMPARISON OF ALTERNATIVE SUPPLY
SCHEMES TO MORETELE 2
(WELTEVREDEN SUPPLY AREA)**

WELTEVREDEN SUPPLY AREA - TECHNICAL ALTERNATIVES

1 Description of Alternatives

With regard to the supply to Weltevreden Supply Area, three technical alternatives were investigated which relate to Bloedfontein Supply Block as follows:

Alternative 1: Expand Weltevreden WTW and supply the entire Bloedfontein Supply Block from that works.

Alternative 2: Provide a pipeline from Temba WTW to supply the western end of Bloedfontein Supply Block while demands in the eastern part are met from Weltevreden as for Alternative 1.

Alternative 3: Construct a small new water treatment works at Rust de Winter Dam to supply the western end of Bloedfontein Supply Block while demands in the eastern part are met from Weltevreden as for Alternative 1.

The three other Supply Blocks in the Weltevreden Supply Area are unchanged under the three alternatives and so their schematics are not included here (see the Weltevreden Supply Area in Appendix 1). The alternatives address the Moretele 2 District which is currently unserved by a surface water system so most facilities proposed are new although the extent of the necessary strengthening of existing infrastructure will vary under the alternatives.

Under Alternative 1 it will be necessary to expand Weltevreden WTW to meet the demand in the target year, unless a significant change is made to the current demarcation between Weltevreden WTW and Bronkhorstspuit WTW. As described in Chapter 5, treated water from Weltevreden is pumped to Bloedfontein Regional Reservoir (16 MI). This supplies Spitspunt Regional Reservoir (2.7 MI) via a booster pumping station which in turn supplies the surrounding villages in western Moutse 1 by gravity. The proposed new scheme comprises strengthening the pipework and pumps supplying Bloedfontein and Spitspunt reservoirs and providing 4.7 MI of additional capacity at Spitspunt. A new 450 mm diameter gravity pipeline is proposed running in a south-westerly direction as far as Ga-Ramantshane but booster pumps will be required subsequently at Ga-Ramantshane, Nokaneng, Bamokgoko and Phake B. The new system will extend as far as Pankop at the west end of Moretele 2 and service reservoirs will be provided as required to serve the communities en route. New service reservoirs are required in the parts of Moutse 1 to be supplied from the Spitspunt system.

In the case of Alternative 2, a new pipeline would be required from Temba WTW to be laid parallel with the existing main to Wambaths. It would branch off to supply the western end of Moretele 2 and discharge into a 5.8 MI regional reservoir at Phake B. This would then supply the west end of Moretele 2 as far eastwards as Ga-Ramantshane. The infrastructure in the eastern part of Moretele 2 would be similar to Alternative 1 however the trunk mains and regional reservoirs would not be as large.

For Alternative 3, a new water treatment works would be constructed using water from Rust de Winter Dam. Previously the total yield from the dam has been allocated to Gauteng Province. Presently no water is being abstracted from the dam as all of the farms in the irrigation area have been bought out by the Government. The Gauteng Provincial Government is in the planning process for reestablishing farmers in the irrigation area. In order to utilise the water for primary

water supply, the water rights would have to be negotiated and the current planning would probably be affected.

2 Planning Schematics

For each of the above three alternatives, schematics were prepared on spreadsheets to analyse the capacity of the existing facilities and to show the new infrastructure required to meet the 2015 primary water demand. This analysis was carried out, and the required capital works were sized and the associated cost was estimated. The schematics for each alternative are compiled and included in this appendix although, as stated above, the alternatives only affect Bloedfontein Supply Block therefore schematics for the three other Blocks in the Supply Area are not included here (although the costs are included in the Cost Summary Sheets). Details of the required work and the associated costs are summarised on a Cost Summary Sheet for each alternative.

3 Conclusions

A comparison of the capital expenditure required for each of the alternatives is summarised in the following table.

Capital/Operation Cost	Alternative 1	Alternative 2	Alternative 3
Bulk Infrastructure Cost	R117.447 million	R141.261 million	R97.199 million
Third Tier Infrastructure Cost	R359.953 million	R359.127 million	R359.111 million
Total Capital Cost	R477.400 million	R500.388 million	R456.310 million
Annual Pumping Cost	R0.556 million	R0.276 million	R0.247 million

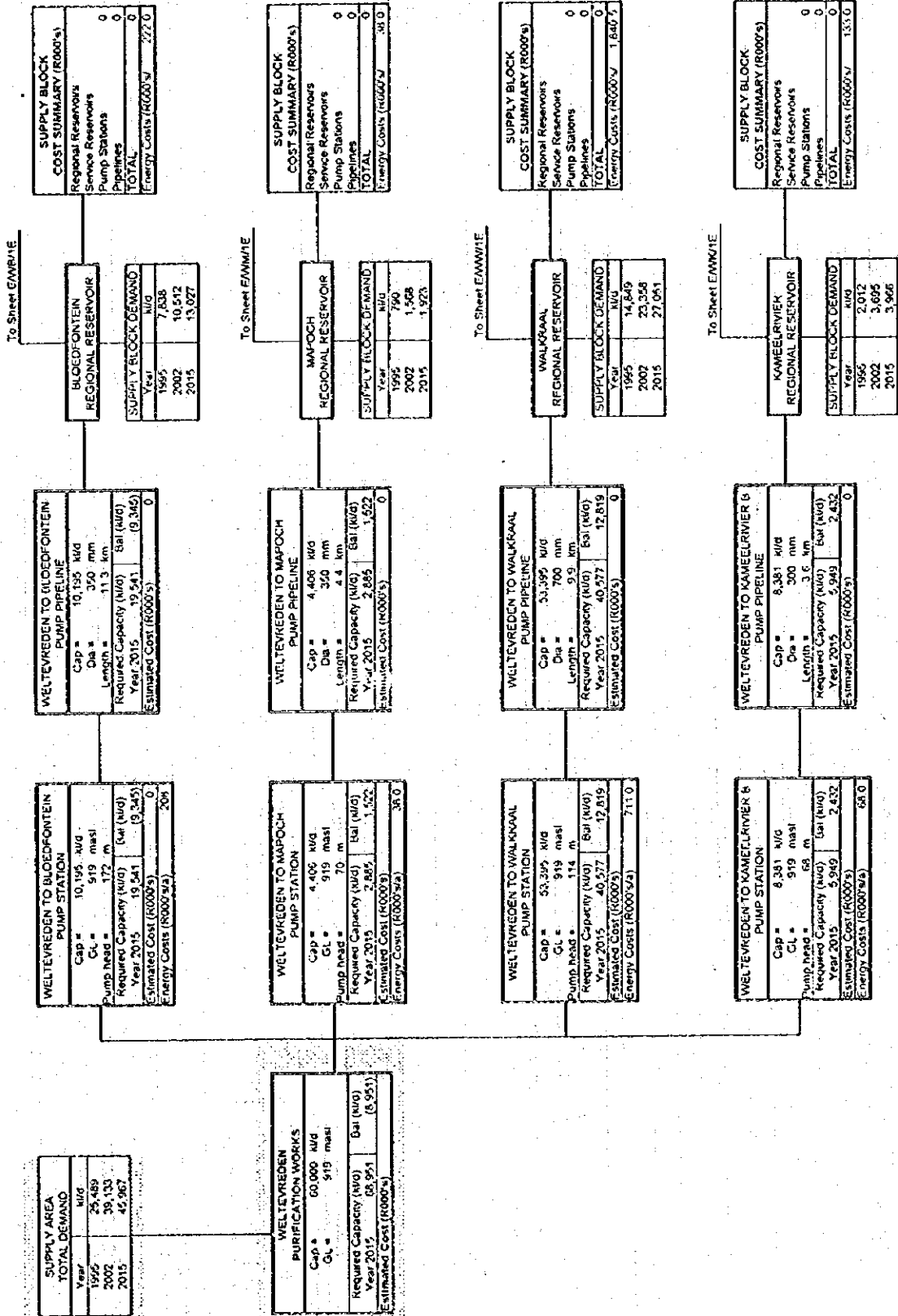
Although superficially Alternative 3 (utilising Rust de Winter Dam) appears to be the most favourable option, the operation and maintenance costs associated with constructing a new, small treatment works and the lack of existing water rights mitigate against this option. Also for the purpose of this simple comparison, the provision of treatment capacity was calculated using the same unit rate for both Weltevreden WTW and the possible Rust de Winter. In reality, the unit cost of constructing a new facility is likely to exceed that of extending an existing one where some existing parts may be utilised. For these reasons, Alternative 1 (supply the entire Block from Weltevreden WTW) is proposed.

COST SUMMARY FOR INFRASTRUCTURE		
NAME OF SUPPLY AREA :	WELTEVREDEN ALTERNATIVE 1	
INCLUDING SUPPLY BLOCKS :	1. Waalkraal Supply Block 2. Kameelrivier Supply Block	3. Mapoch Supply Block 4. Bloedfontein Supply Block
POPULATION SERVED (2015) :	631,276	
AADD in mcm/a (2015) :	19.01	
BULK COST :	QUANTITY	COST (R million)
Water Purification Works	Kl/d (SDD)	
1. Weltevreden WTW	9,000	2.984
Pump Stations	Kl/d (SDD)	
A : Capital Cost		
1. Weltevreden (Bloedfontein) CWPS	9,345	1.007
2. Leuwfontein PS	575	0.053
3. Matshipe A	362	0.059
4. Spitspunt BPS	8,848	0.382
5. Tshikanossi BPS	284	0.007
6. Mmakola BPS	323	0.020
7. Radjoko BPS	270	0.007
8. Bamokgoko PS	1,616	0.206
9. Phake B	1,277	0.148
10. Ga Ramantshane (Kalkfontein)	908	0.094
11. Ramantsho	33	0.006
12. Lefifi	2,523	0.183
13. Ga Ramantshane (Lefifi)	4,221	0.412
	Sub-Total	2.584
B : Annual Energy Cost (Not Incl'd with Total)		
1. Weltevreden (Bloedfontein) CWPS	-	0.255
2. Leuwfontein PS	-	0.059
3. Matshipe A	-	0.006
4. Spitspunt BPS	-	0.070
5. Tshikanossi BPS	-	0.002
6. Mmakola BPS	-	0.003
7. Radjoko BPS	-	0.002
8. Bamokgoko PS	-	0.029
9. Phake B	-	0.019
10. Ga Ramantshane	-	0.011
11. Ramantsho	-	0.002
12. Lefifi	-	0.025
13. Ga Ramantshane (Lefifi)	-	0.074
	Sub-Total	0.556
Reservoirs (Regional)	Ml	
1. Spitspunt Reservoir	4.7 Ml	1.605
2. Ga-Ramantshane	4.5 Ml	1.553
Pipelines (Bulk)	km	
1. 110 PVC	70.3	6.549
2. 125 PVC	10.2	1.336
3. 140 PVC	10.8	1.764
4. 150 PVC	0	0.000
5. 160 PVC	26.3	5.259
6. 200 PVC	40.1	11.087
7. 250 PVC	11.3	4.710
8. 300 PVC	3.6	2.009
9. 400 ST	31.7	30.418
10. 450 ST	2.8	2.797
	Sub-Total	65.929

Sub Total Construction Cost		74.655
Engineering Fees (15 %)		11.198
VAT (14 %)		12.019
Project Contingency (20%)		19.675
TOTAL : Bulk Cost		117.447
Bulk Cost per Capita (Rands)		186
SECONDARY COST :	QUANTITY	COST (R million)
Reservoirs (Service)	Ml	
1. Bloedfontein Supply Block	14.53 (34 No)	8.368
2. Waalkraal Supply Block	10.17 (25 No)	5.812
3. Kameelrivier Supply Block	0.92 (2 No)	0.523
4. Mapoch Supply Block	0	0.000
	Sub-Total	14.703
Water Towers	Ml	
N/A	NIL	NIL
Pump Stations (Secondary)	Kl/d	
A : Capital Cost	N/A	NIL
B : Annual Energy Cost (Not Incl'd with Total)	N/A	NIL
Pipelines (Secondary)	km	
	NIL	NIL
Reticulation	km	
1. Bloedfontein Supply Block		99.837
2. Waalkraal Supply Block		95.056
3. Kameelrivier Supply Block		12.356
4. Mapoch Supply Block		6.851
	Sub-Total	214.100
Sub Total Construction Cost		228.803
Engineering Fees (15 %)		34.320
VAT (14 %)		36.837
Project Contingency (20%)		59.992
TOTAL : Secondary Cost		359.953
Secondary Cost per Capita (Rands)		570
GRAND TOTAL COST		477.400
Grand Total Cost per Capita (R)		756

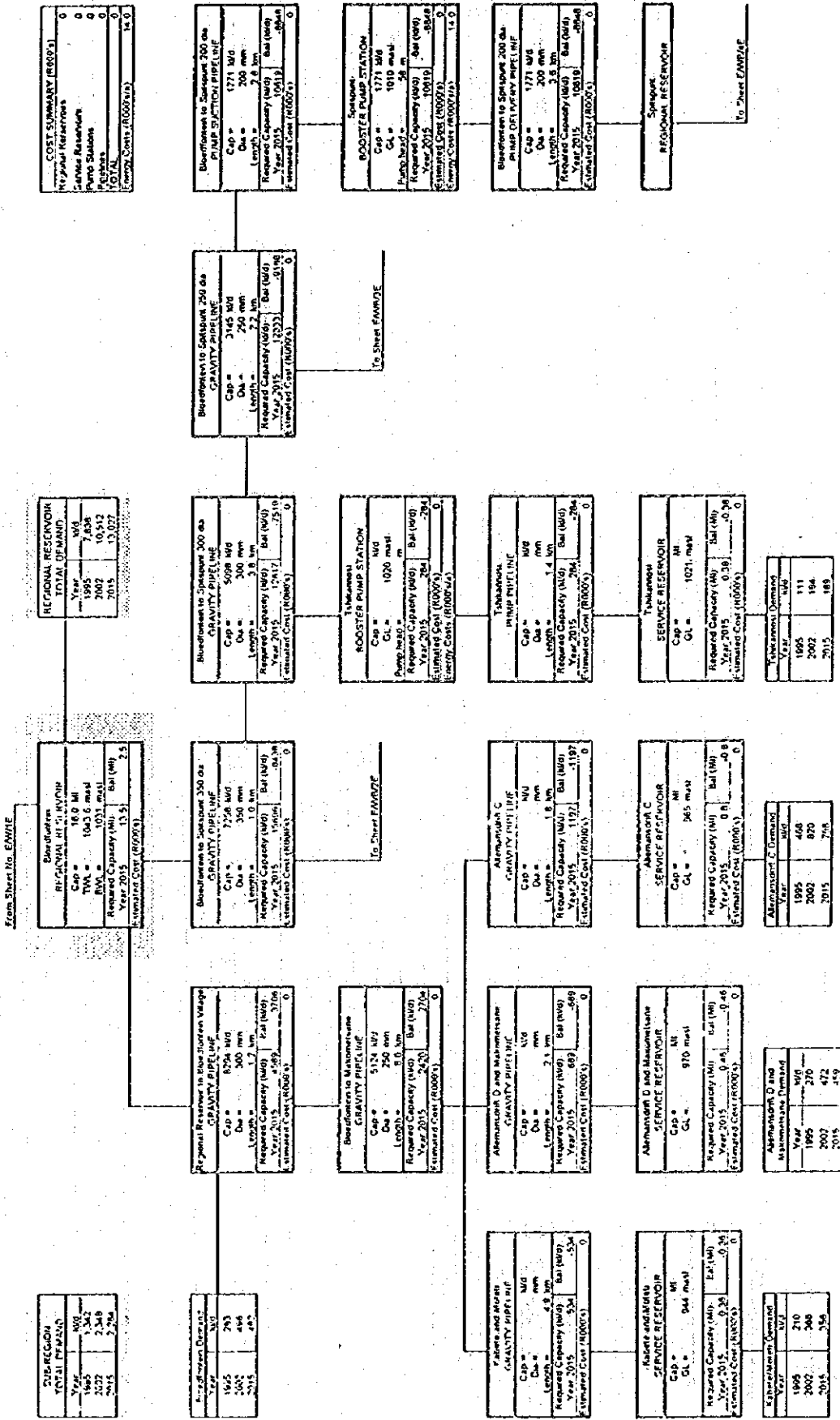
EASTERN ZONE : WELTEVREDEN SUPPLY AREA : EXISTING INFRASTRUCTURE (E/W1E)

ALTERNATIVE 1 (Moretelele 2 supplied from Weltevreden Purification Works only)



EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. EWB/1E)

BLOEDFONTEIN TO SPITSPUNT : ALTERNATIVE 1 (Moretele 2 supplied from Weltevreden Purification Works only)

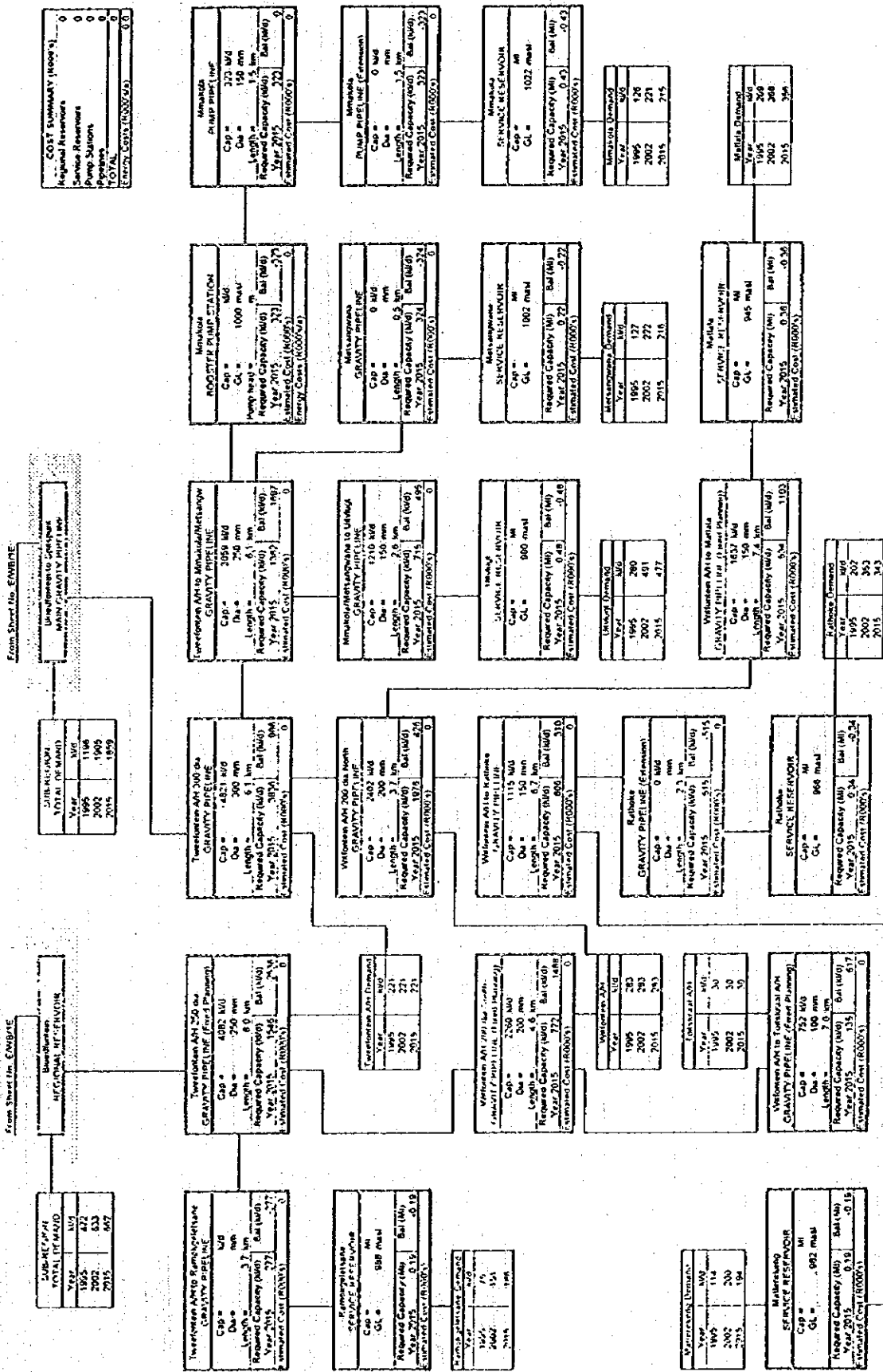


Note: Pumping energy costs for main pump stations assume 1/2 cost per kW (kVA) and 1/2 due to Energy (kWh), so that actual cost is 50% of that calculated for continuous pumping for a peak factor = 1.5 (i.e. 100% per day).

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EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. EW/B/2/E)

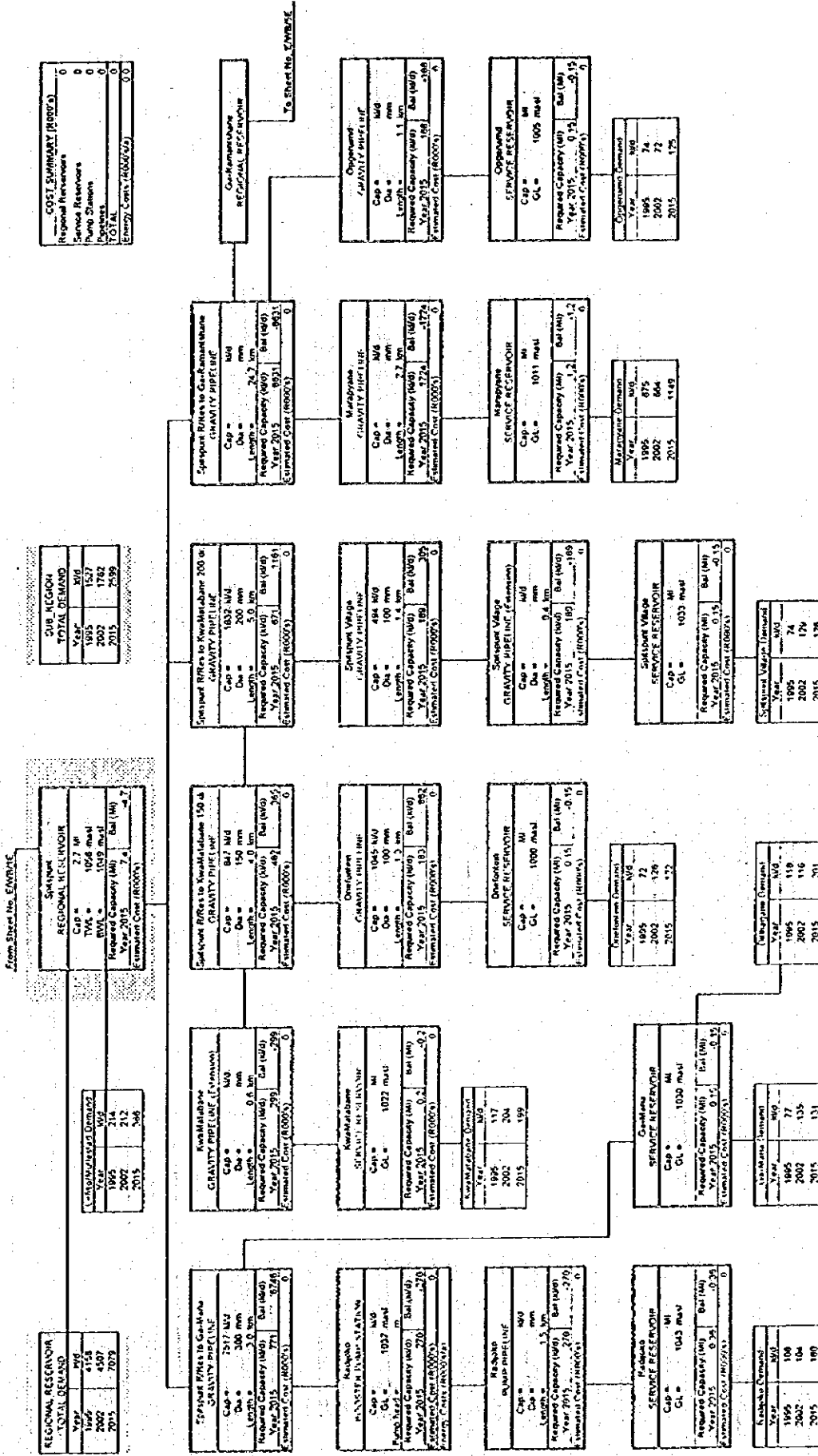
BLOEDFONTEIN TO UITVLUGT, RATHOKE AND MATLALA : ALTERNATIVES 1,2 or 3 (Moretote 2 supplied from Weltevreden Purification Works and/or Temba Purification Works or Rust De Winter Dam)



Note: Pumping energy costs for main pump stations assume 1/2 cent due to Power (kVA) and 1/2 due to Energy (kWh), so that actual cost is 50¢ of that calculated for continuous pumping for a Peak Factor = 1.5 (w 16hrs per day).

EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. EMB/4E)

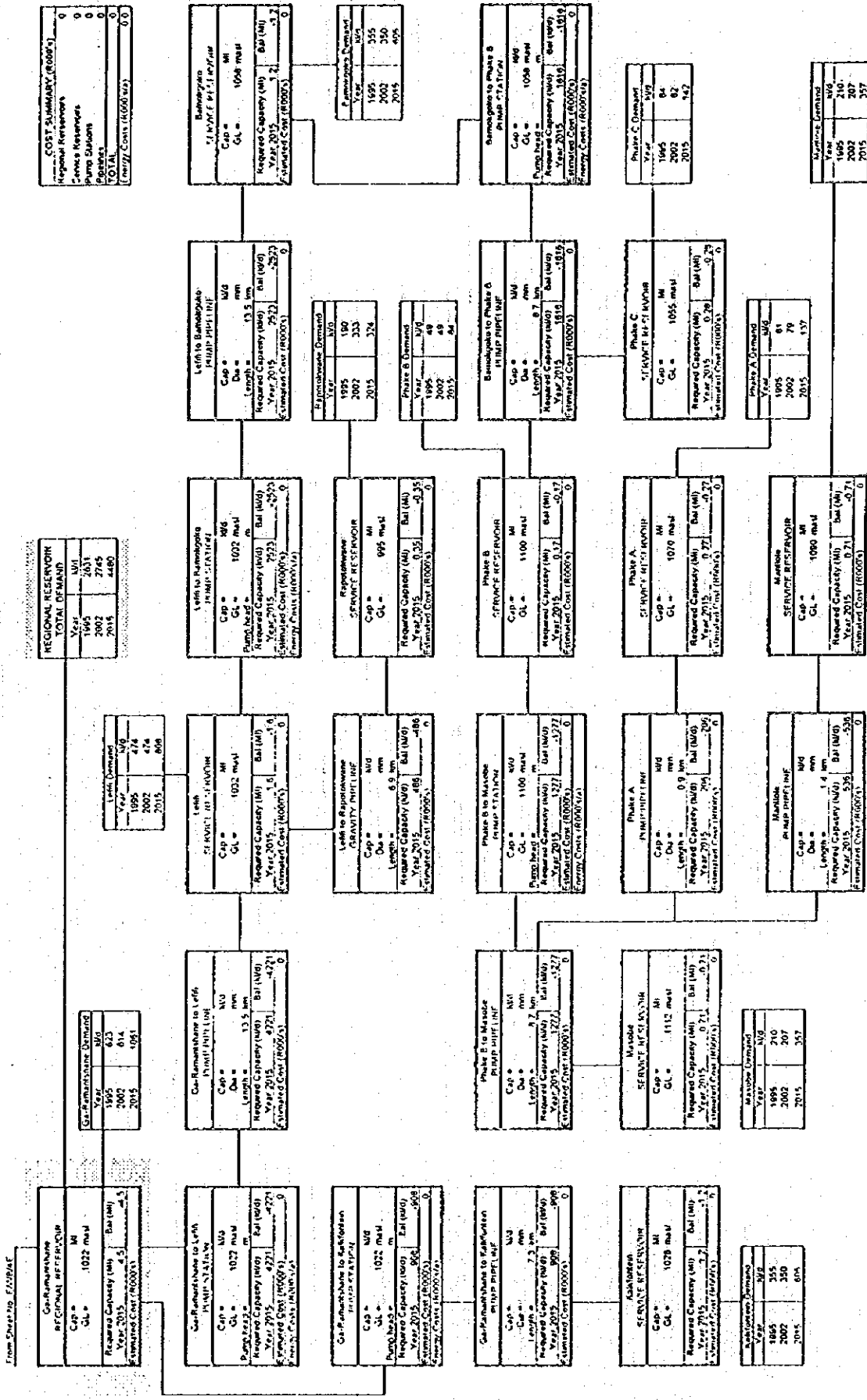
SPITSPOINT TO KWAMATABANE AND GARAMANTSHANE : ALTERNATIVE 1 (Moretele 2 supplied from Weltevreden Purification Works only)



Note : Pumping energy costs for main pump stations assume 1/2 cent per kWh and 1/2 cent per kWh (1/2 cent per kWh) so that actual cost is 5/6 of that calculated for continuous pumping (for a Peak Factor = 1.5 (ie. 16hrs per day).

EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. EWB/5E)

GA-RAMANTSHANE TO MASOBE : ALTERNATIVE 1 (Moretele 2 supplied from Weltevreden Purification Works only)



COST SUMMARY (R000's)

Regional Reservoirs	0
Service Reservoirs	0
Pump Stations	0
Pipes	0
TOTAL	0.0

REGIONAL RESERVOIR TOTAL DEMAND

Year	Ml
1995	2671
2002	7745
2015	4480

G-Ramantshane to Leth

Year	Ml
1995	623
2002	614
2015	691

G-Ramantshane to Leth PUMP STATION

Cap = 1022 megal	GL = 1022 megal
Required Capacity (ml)	Bar (M)
Year 1995	4721
Year 2002	4721
Year 2015	4721
Estimated Cost (R000's)	0

Leth to Ramantshane PUMP PIPELINE

Cap = 1022 megal	GL = 1022 megal
Length = 13.5 km	Bar (M)
Year 1995	2572
Year 2002	2572
Year 2015	2572
Estimated Cost (R000's)	0

Leth to Ramantshane SERVICE RESERVOIR

Cap = 995 megal	GL = 995 megal
Required Capacity (ml)	Bar (M)
Year 1995	2572
Year 2002	2572
Year 2015	2572
Estimated Cost (R000's)	0

Leth to Bloedfontein PUMP STATION

Cap = 1022 megal	GL = 1022 megal
Length = 13.5 km	Bar (M)
Year 1995	274
Year 2002	474
Year 2015	808
Estimated Cost (R000's)	0

Leth to Bloedfontein SERVICE RESERVOIR

Cap = 1022 megal	GL = 1022 megal
Length = 13.5 km	Bar (M)
Year 1995	4721
Year 2002	4721
Year 2015	4721
Estimated Cost (R000's)	0

Leth to Bloedfontein PUMP PIPELINE

Cap = 1022 megal	GL = 1022 megal
Length = 13.5 km	Bar (M)
Year 1995	4721
Year 2002	4721
Year 2015	4721
Estimated Cost (R000's)	0

Bloedfontein Demand

Year	Ml
1995	190
2002	333
2015	374

Bloedfontein to Phase A PUMP STATION

Cap = 1100 megal	GL = 1100 megal
Length = 0.7 km	Bar (M)
Year 1995	374
Year 2002	48
Year 2015	84
Estimated Cost (R000's)	0

Bloedfontein to Phase A SERVICE RESERVOIR

Cap = 1100 megal	GL = 1100 megal
Length = 0.7 km	Bar (M)
Year 1995	374
Year 2002	48
Year 2015	84
Estimated Cost (R000's)	0

Bloedfontein to Phase A PUMP PIPELINE

Cap = 1100 megal	GL = 1100 megal
Length = 0.7 km	Bar (M)
Year 1995	374
Year 2002	48
Year 2015	84
Estimated Cost (R000's)	0

Bloedfontein to Phase A SERVICE RESERVOIR

Cap = 1100 megal	GL = 1100 megal
Length = 0.7 km	Bar (M)
Year 1995	374
Year 2002	48
Year 2015	84
Estimated Cost (R000's)	0

Phase B Demand

Year	Ml
1995	48
2002	84
2015	84

Phase B to Phase C PUMP STATION

Cap = 1055 megal	GL = 1055 megal
Length = 0.7 km	Bar (M)
Year 1995	1815
Year 2002	1815
Year 2015	1815
Estimated Cost (R000's)	0

Phase B to Phase C SERVICE RESERVOIR

Cap = 1055 megal	GL = 1055 megal
Length = 0.7 km	Bar (M)
Year 1995	1815
Year 2002	1815
Year 2015	1815
Estimated Cost (R000's)	0

Phase B to Phase C PUMP PIPELINE

Cap = 1055 megal	GL = 1055 megal
Length = 0.7 km	Bar (M)
Year 1995	1815
Year 2002	1815
Year 2015	1815
Estimated Cost (R000's)	0

Phase B to Phase C SERVICE RESERVOIR

Cap = 1055 megal	GL = 1055 megal
Length = 0.7 km	Bar (M)
Year 1995	1815
Year 2002	1815
Year 2015	1815
Estimated Cost (R000's)	0

Phase C Demand

Year	Ml
1995	84
2002	82
2015	142

Phase C to Masobe PUMP STATION

Cap = 1070 megal	GL = 1070 megal
Length = 0.9 km	Bar (M)
Year 1995	271
Year 2002	291
Year 2015	291
Estimated Cost (R000's)	0

Phase C to Masobe SERVICE RESERVOIR

Cap = 1070 megal	GL = 1070 megal
Length = 0.9 km	Bar (M)
Year 1995	271
Year 2002	291
Year 2015	291
Estimated Cost (R000's)	0

Phase C to Masobe PUMP PIPELINE

Cap = 1070 megal	GL = 1070 megal
Length = 0.9 km	Bar (M)
Year 1995	271
Year 2002	291
Year 2015	291
Estimated Cost (R000's)	0

Phase C to Masobe SERVICE RESERVOIR

Cap = 1070 megal	GL = 1070 megal
Length = 0.9 km	Bar (M)
Year 1995	271
Year 2002	291
Year 2015	291
Estimated Cost (R000's)	0

Phase A Demand

Year	Ml
1995	81
2002	79
2015	137

Phase A to Masobe PUMP STATION

Cap = 1000 megal	GL = 1000 megal
Length = 1.4 km	Bar (M)
Year 1995	535
Year 2002	535
Year 2015	535
Estimated Cost (R000's)	0

Phase A to Masobe SERVICE RESERVOIR

Cap = 1000 megal	GL = 1000 megal
Length = 1.4 km	Bar (M)
Year 1995	535
Year 2002	535
Year 2015	535
Estimated Cost (R000's)	0

Phase A to Masobe PUMP PIPELINE

Cap = 1000 megal	GL = 1000 megal
Length = 1.4 km	Bar (M)
Year 1995	535
Year 2002	535
Year 2015	535
Estimated Cost (R000's)	0

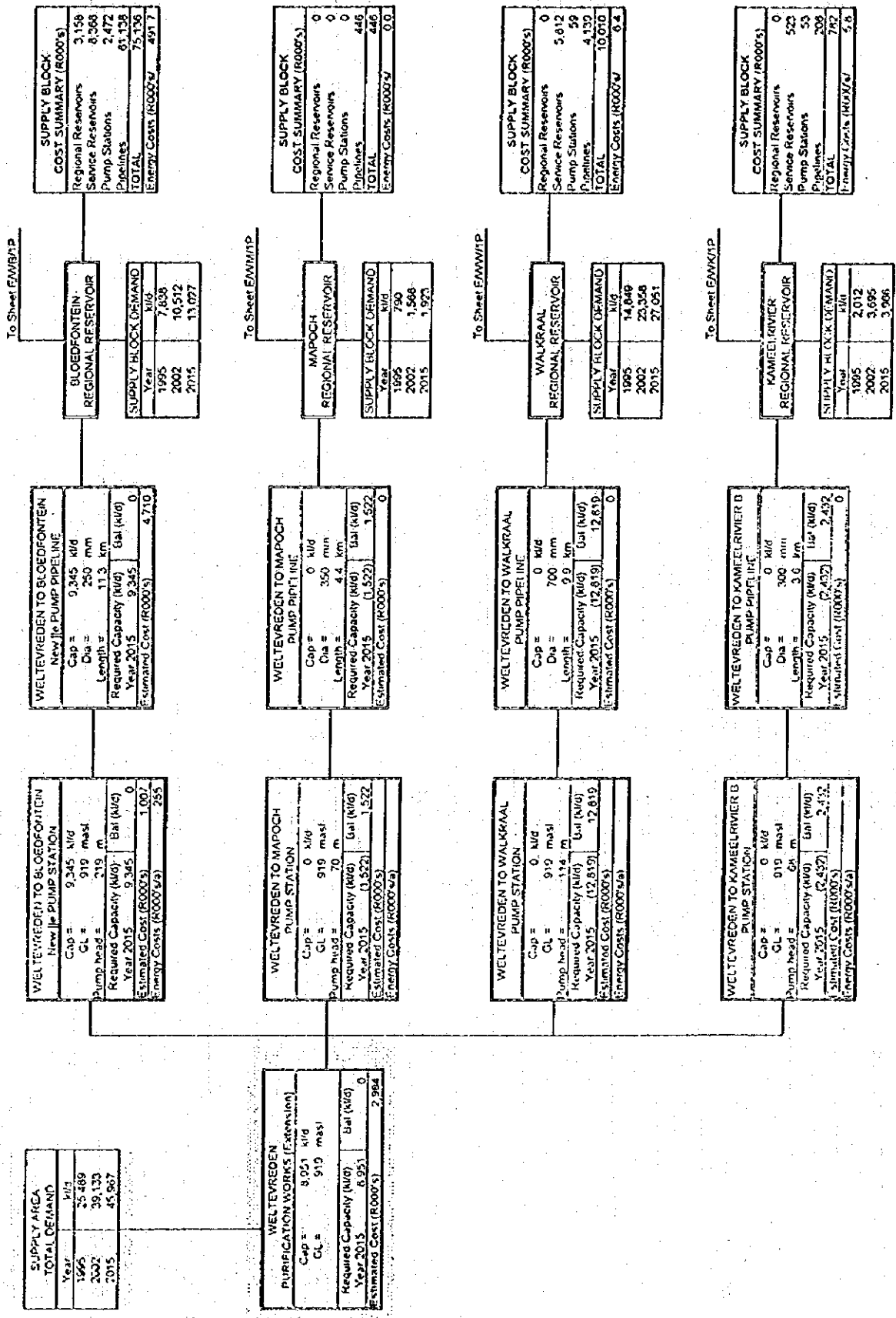
Phase A to Masobe SERVICE RESERVOIR

Cap = 1000 megal	GL = 1000 megal
Length = 1.4 km	Bar (M)
Year 1995	535
Year 2002	535
Year 2015	535
Estimated Cost (R000's)	0

Note : Pumping energy costs for main pump stations at same 1/2 cost due to Power (kVA) and 1/2 due to Energy (kWh), so that actual cost is 5/6 of that calculated for continuous pumping for a Peak Factor = 1.5 (see 10hrs per day).

EASTERN ZONE : WELTEVREDEN SUPPLY AREA : PROPOSED INFRASTRUCTURE (E/W/1P)

ALTERNATIVE 1 (Moretele 2 supplied from Weltevreden Purification Works only)



SUPPLY AREA TOTAL DEMAND	
Year	1/12
1995	25 489
2002	39 133
2015	45 367

WELTEVREDEN TO BLOEDFRONTEN New 1/2 PUMP STATION	
Cap =	9,345 kld
GL =	919 masl
Pump head =	219 m
Required Capacity (kld)	Bar (kld)
Year 2015	9,345
Estimated Cost (R000's)	1,007
Energy Costs (R000's/a)	255

WELTEVREDEN TO BLOEDFRONTEN New 1/2 PUMP PIPELINE	
Cap =	9,345 kld
Dia =	250 mm
Length =	11.3 km
Required Capacity (kld)	Bar (kld)
Year 2015	9,345
Estimated Cost (R000's)	4,710

BLOEDFRONTEN REGIONAL RESERVOIR	
Year	kld
1995	7,638
2002	10,512
2015	13,027

SUPPLY BLOCK DEMAND	
Year	kld
1995	7,638
2002	10,512
2015	13,027

SUPPLY BLOCK COST SUMMARY (R000's)	
Regional Reservoirs	3,158
Service Reservoirs	8,268
Pump Stations	2,472
Pipelines	61,138
TOTAL	75,036
Energy Costs (R000's/a)	491.7

WELTEVREDEN PURIFICATION WORKS (EXTENSION)	
Cap =	8,951 kld
GL =	919 masl
Required Capacity (kld)	Bar (kld)
Year 2015	8,951
Estimated Cost (R000's)	2,964

WELTEVREDEN TO MAPOCH PUMP STATION	
Cap =	0 kld
GL =	919 masl
Pump head =	70 m
Required Capacity (kld)	Bar (kld)
Year 2015	0
Estimated Cost (R000's)	1,522
Energy Costs (R000's/a)	0

WELTEVREDEN TO MAPOCH PUMP PIPELINE	
Cap =	0 kld
Dia =	350 mm
Length =	4.4 km
Required Capacity (kld)	Bar (kld)
Year 2015	0
Estimated Cost (R000's)	1,522

MAPOCH REGIONAL RESERVOIR	
Year	kld
1995	790
2002	1,566
2015	1,923

SUPPLY BLOCK DEMAND	
Year	kld
1995	790
2002	1,566
2015	1,923

SUPPLY BLOCK COST SUMMARY (R000's)	
Regional Reservoirs	0
Service Reservoirs	0
Pump Stations	0
Pipelines	446
TOTAL	446
Energy Costs (R000's/a)	0.0

WELTEVREDEN TO WALKRAAL PUMP STATION	
Cap =	0 kld
GL =	919 masl
Pump head =	114 m
Required Capacity (kld)	Bar (kld)
Year 2015	0
Estimated Cost (R000's)	12,819
Energy Costs (R000's/a)	0

WELTEVREDEN TO WALKRAAL PUMP PIPELINE	
Cap =	0 kld
Dia =	700 mm
Length =	9.9 km
Required Capacity (kld)	Bar (kld)
Year 2015	0
Estimated Cost (R000's)	12,819

WALKRAAL REGIONAL RESERVOIR	
Year	kld
1995	14,849
2002	23,348
2015	27,051

SUPPLY BLOCK DEMAND	
Year	kld
1995	14,849
2002	23,348
2015	27,051

SUPPLY BLOCK COST SUMMARY (R000's)	
Regional Reservoirs	0
Service Reservoirs	5,812
Pump Stations	59
Pipelines	4,139
TOTAL	10,010
Energy Costs (R000's/a)	6.4

WELTEVREDEN TO KAMEELRIVIER B PUMP STATION	
Cap =	0 kld
GL =	919 masl
Pump head =	64 m
Required Capacity (kld)	Bar (kld)
Year 2015	0
Estimated Cost (R000's)	2,432
Energy Costs (R000's/a)	0

WELTEVREDEN TO KAMEELRIVIER B PUMP PIPELINE	
Cap =	0 kld
Dia =	300 mm
Length =	3.6 km
Required Capacity (kld)	Bar (kld)
Year 2015	0
Estimated Cost (R000's)	2,432

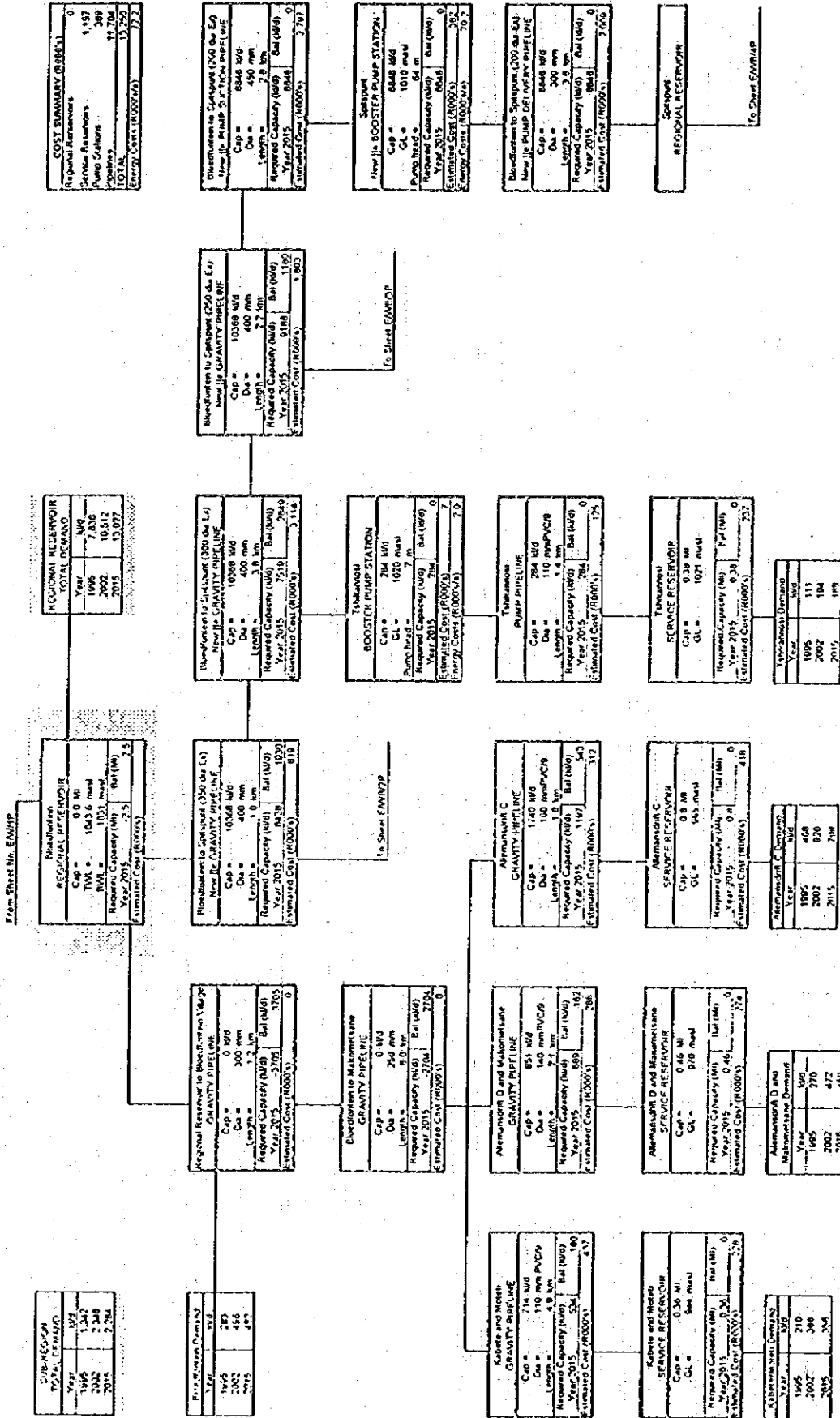
KAMEELRIVIER REGIONAL RESERVOIR	
Year	kld
1995	2,012
2002	3,695
2015	3,966

SUPPLY BLOCK DEMAND	
Year	kld
1995	2,012
2002	3,695
2015	3,966

SUPPLY BLOCK COST SUMMARY (R000's)	
Regional Reservoirs	0
Service Reservoirs	520
Pump Stations	53
Pipelines	208
TOTAL	782
Energy Costs (R000's/a)	5.6

EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. EWB/1/P)

BLOEDFONTEIN TO SPITSPUNT : ALTERNATIVE 1 (Moreteie 2 supplied from Weltevrede Purification Works only)



COSE SUMMARY (R000's)

Regional Reservoir	0
Service Reservoirs	1,157
Pump Stations	369
Pipeline	11,704
Other	13,950
Total	27,220

REGIONAL RESERVOIR TOTAL DEMAND

Year	M³/d
1995	7,830
2002	10,512
2015	13,077

Regional Reservoir

Cap	0.0 MI
TKL	1043.6 m³
TKL	1031 m³
Required Capacity (MI)	0.0 (MI)
Year 2015	2.5
Estimated Cost (R000's)	2.5

Boosters to Spitspunt (300 dia L1) New 1/2 Gravity Pipeline

Cap	10368 M³
Dia	400 mm
Length	2.2 km
Required Capacity (MI/d)	0.0 (MI/d)
Year 2015	1188
Estimated Cost (R000's)	1,803

Boosters to Spitspunt (300 dia L1) New 1/2 Gravity Pipeline

Cap	10368 M³
Dia	400 mm
Length	2.2 km
Required Capacity (MI/d)	0.0 (MI/d)
Year 2015	1188
Estimated Cost (R000's)	1,803

Spitspunt Booster Pump Station

Cap	8848 M³
TKL	1031 m³
Required Capacity (MI/d)	0.0 (MI/d)
Year 2015	8848
Estimated Cost (R000's)	20.2

Boosters to Spitspunt (200 dia L1) New 1/2 Gravity Pipeline

Cap	8848 M³
Dia	300 mm
Length	3.6 km
Required Capacity (MI/d)	0.0 (MI/d)
Year 2015	8848
Estimated Cost (R000's)	7,000

Spitspunt Regional Reservoir

Cap	0.36 MI
TKL	864 m³
Required Capacity (MI)	0.0 (MI)
Year 2015	0.36
Estimated Cost (R000's)	0

SUB-REGION TOTAL DEMAND

Year	M³/d
1995	1,247
2002	2,340
2015	2,720

Regional Reservoir

Cap	0.0 MI
TKL	1043.6 m³
TKL	1031 m³
Required Capacity (MI)	0.0 (MI)
Year 2015	2.5
Estimated Cost (R000's)	2.5

Boosters to Mamboneane Gravity Pipeline

Cap	851 M³
Dia	260 mm
Length	2.1 km
Required Capacity (MI/d)	0.0 (MI/d)
Year 2015	2704
Estimated Cost (R000's)	0

Almonkhor D and Mamboneane Gravity Pipeline

Cap	851 M³
Dia	260 mm
Length	2.1 km
Required Capacity (MI/d)	0.0 (MI/d)
Year 2015	2704
Estimated Cost (R000's)	286

Almonkhor D and Mamboneane Service Reservoir

Cap	0.36 MI
TKL	864 m³
Required Capacity (MI)	0.0 (MI)
Year 2015	0.36
Estimated Cost (R000's)	0

Almonkhor D and Mamboneane Demand

Year	M³/d
1995	468
2002	830
2015	798

Kabele and Bore Gravity Pipeline

Cap	214 M³
Dia	110 mm PVC/CP
Length	4.8 km
Required Capacity (MI/d)	0.0 (MI/d)
Year 2015	34
Estimated Cost (R000's)	437

Kabele and Bore Service Reservoir

Cap	0.36 MI
TKL	864 m³
Required Capacity (MI)	0.0 (MI)
Year 2015	0.36
Estimated Cost (R000's)	0

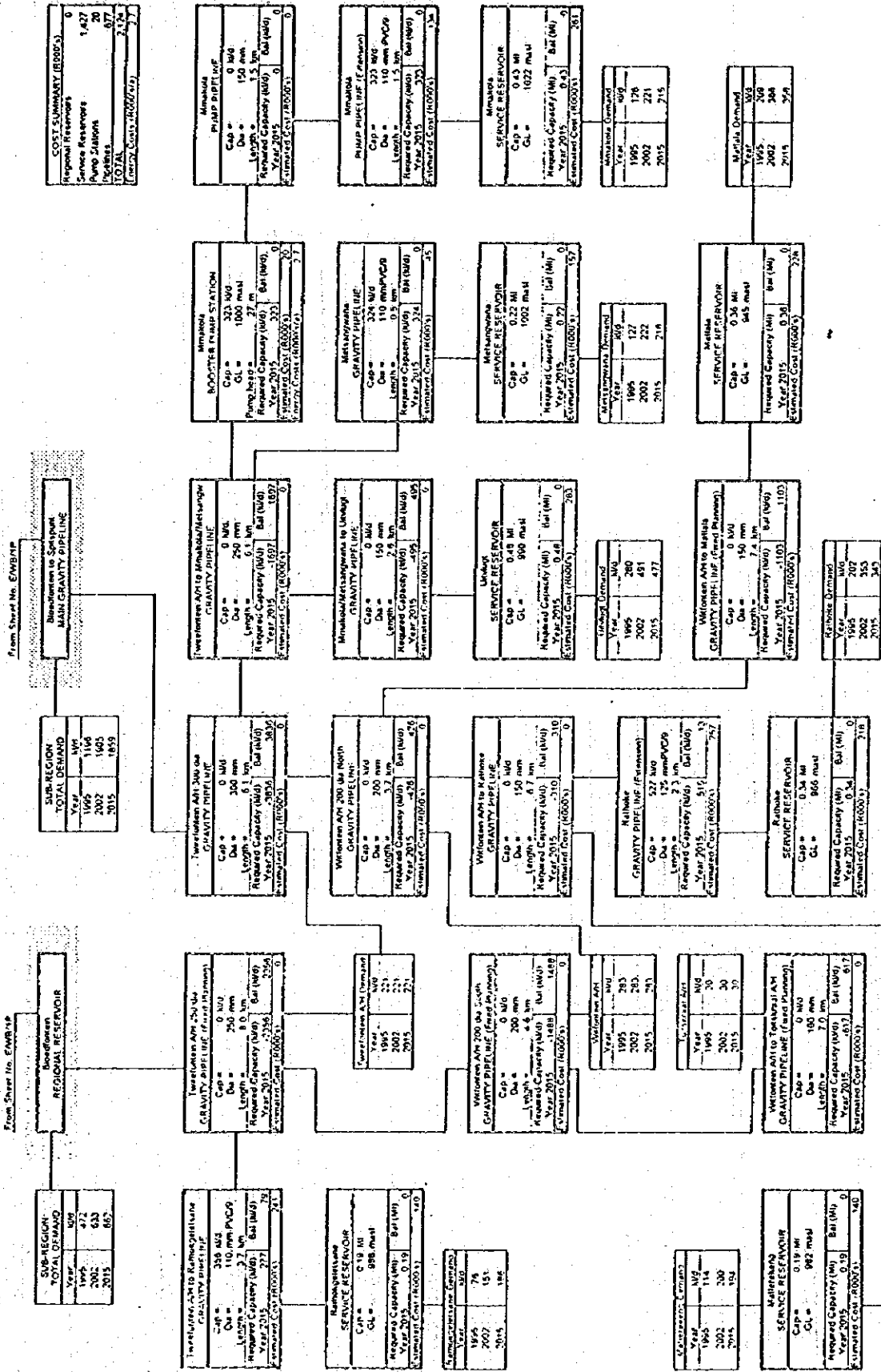
Kabele and Bore Demand

Year	M³/d
1995	210
2002	366
2015	354

Note : Pumping energy costs for these Pump Stations assume 1/2 cost due to Power (KVA) and 1/2 due to Energy (kWh), as that actual costs is 50% of that calculated for common pumpage for a Peak Factor = 1.5 (hrs per day).

EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. EWB/2P)

BLOEDFONTEIN TO UITVLUGT, RATHOKE AND MATLALA : ALTERNATIVES 1,2 or 3 (Moretele 2 supplied from Weltevreden Purification Works and/or Temba Purification Works or Rust De Winter Dam)

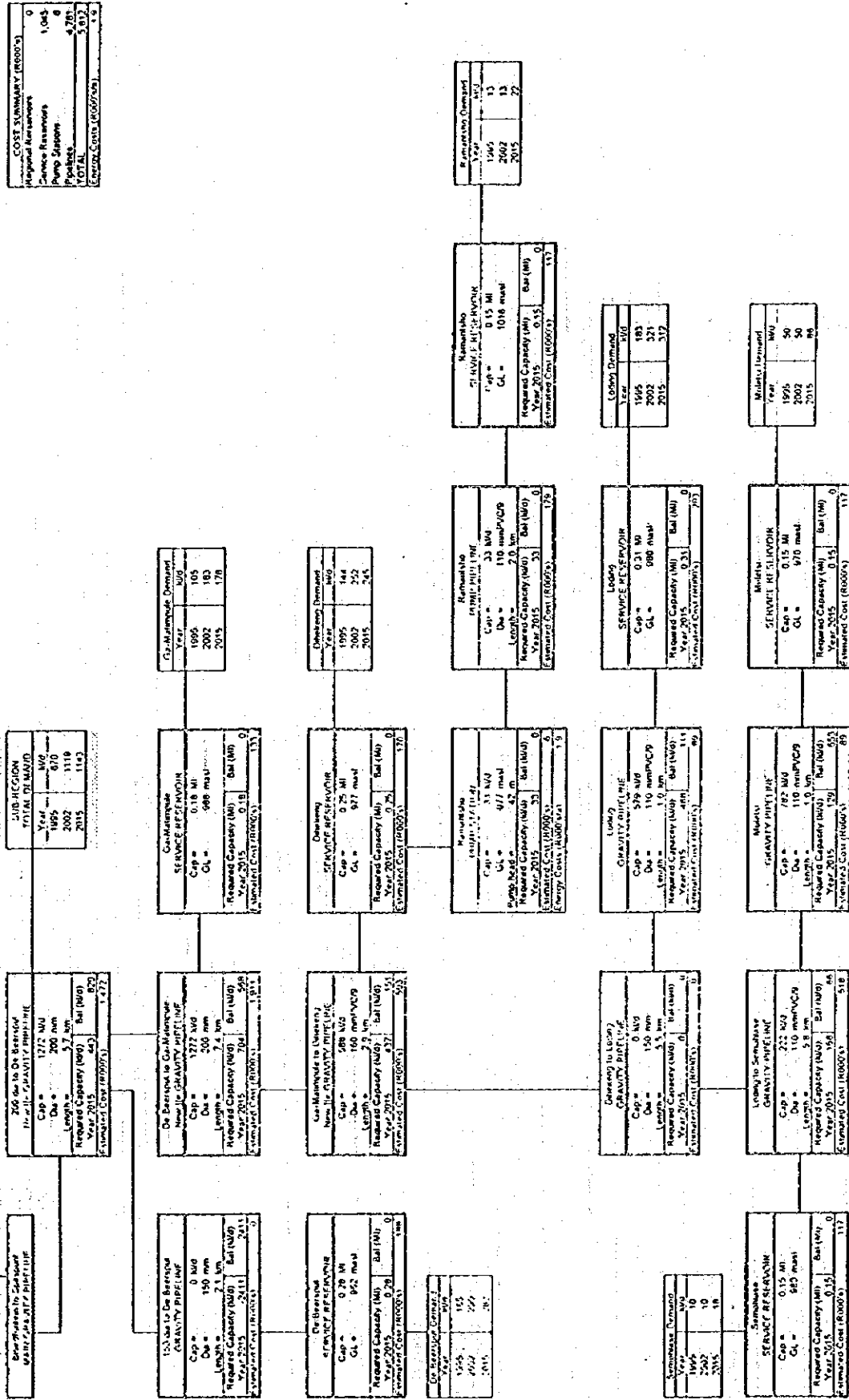


NOTE: Pumping energy costs for main pump stations assume 172 cost per kWh and 172 cost per kWh due to Energy (kWh) to that total cost is 58¢/kWh calculated for consumer pumping for a Peak Factor = 1.5 (ie. 18hrs per day)

EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. EWB/3/P)

FROM BLOEDFONTEIN/SPITSPIJNT PIPELINE TO SEMOHLASE : ALTERNATIVES 1, 2 or 3 (Moretele 2 supplied from Weltevreden Purification Works and/or Tembisa Purification Works of Rust De Winter Dam)

From Sheet No. EWB/2/P

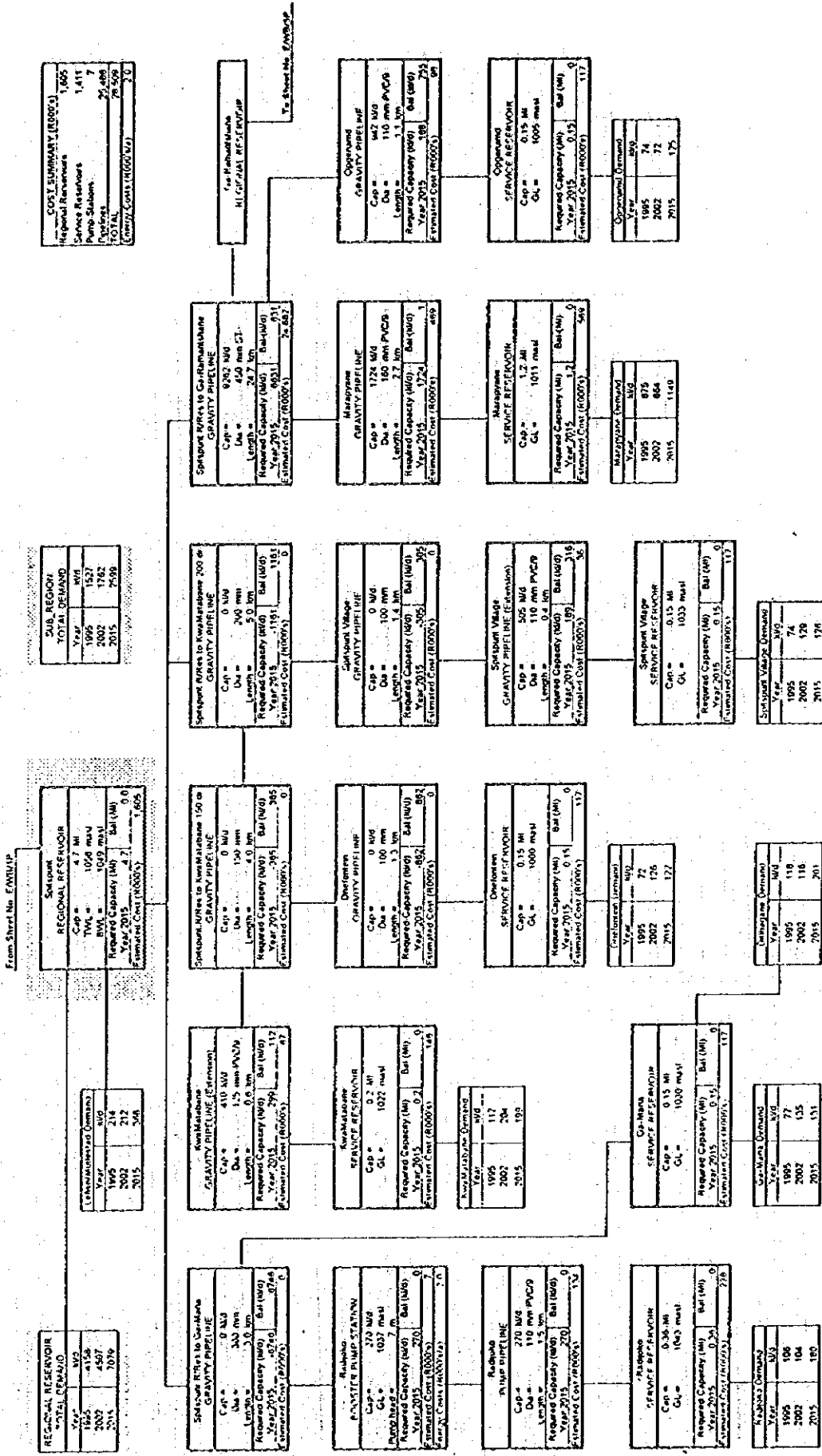


Note: Pumping energy costs for main pump stations assume 1/2 cost due to Power (MW) and 1/2 due to Energy (MWh), to that actual cost in 50% of that calculated for continuous pumping for a Peak Factor = 1.5 (ie. 100% per day)

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EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. ENWB/4P)

SPITSPUNT TO KWAMATABANE AND GA-RAMANTSHANE : ALTERNATIVE 1 (More tele 2 supplied from Weltevreden Purification Works only)



TOTAL DEMAND	
Year	ML/d
1995	1411
2002	2948
2015	7869

REGIONAL RESERVOIR	
Cap	100 ML
TL	102 m
TLH	157
TLB	126
TLCL	100
Year	ML/d
1995	1411
2002	2948
2015	7869

Spitspunt Reservoir	
Cap	100 ML
TL	102 m
TLH	157
TLB	126
TLCL	100
Year	ML/d
1995	1411
2002	2948
2015	7869

Non-Matshane Reservoir	
Cap	150 ML
TL	150 m
TLH	157
TLB	126
TLCL	100
Year	ML/d
1995	1411
2002	2948
2015	7869

Kwa-Matshane Reservoir	
Cap	100 ML
TL	102 m
TLH	157
TLB	126
TLCL	100
Year	ML/d
1995	1411
2002	2948
2015	7869

Gravity Pipeline	
Cap	0.83 ML/d
TL	300 mm
Length	28.7 km
Year	ML/d
1995	1411
2002	2948
2015	7869

Gravity Pipeline	
Cap	1.72 ML/d
TL	160 mm PVCB
Length	2.7 km
Year	ML/d
1995	1411
2002	2948
2015	7869

Gravity Pipeline	
Cap	0.34 ML/d
TL	240 mm
Length	5.0 km
Year	ML/d
1995	1411
2002	2948
2015	7869

Gravity Pipeline	
Cap	0.83 ML/d
TL	300 mm
Length	28.7 km
Year	ML/d
1995	1411
2002	2948
2015	7869

Gravity Pipeline	
Cap	0.2 ML/d
TL	150 mm PVCB
Length	0.6 km
Year	ML/d
1995	1411
2002	2948
2015	7869

Gravity Pipeline	
Cap	0.34 ML/d
TL	300 mm
Length	5.0 km
Year	ML/d
1995	1411
2002	2948
2015	7869

Service Reservoir	
Cap	0.15 ML
TL	1030 mm
Year	ML/d
1995	1411
2002	2948
2015	7869

Service Reservoir	
Cap	0.15 ML
TL	1030 mm
Year	ML/d
1995	1411
2002	2948
2015	7869

Service Reservoir	
Cap	0.15 ML
TL	1030 mm
Year	ML/d
1995	1411
2002	2948
2015	7869

Service Reservoir	
Cap	0.15 ML
TL	1030 mm
Year	ML/d
1995	1411
2002	2948
2015	7869

Service Reservoir	
Cap	0.15 ML
TL	1030 mm
Year	ML/d
1995	1411
2002	2948
2015	7869

Service Reservoir	
Cap	0.15 ML
TL	1030 mm
Year	ML/d
1995	1411
2002	2948
2015	7869

Demand	
Year	ML/d
1995	71
2002	126
2015	177

Demand	
Year	ML/d
1995	71
2002	126
2015	177

Demand	
Year	ML/d
1995	71
2002	126
2015	177

Demand	
Year	ML/d
1995	71
2002	126
2015	177

Demand	
Year	ML/d
1995	71
2002	126
2015	177

Demand	
Year	ML/d
1995	71
2002	126
2015	177

Demand	
Year	ML/d
1995	71
2002	126
2015	177

Demand	
Year	ML/d
1995	71
2002	126
2015	177

Demand	
Year	ML/d
1995	71
2002	126
2015	177

Demand	
Year	ML/d
1995	71
2002	126
2015	177

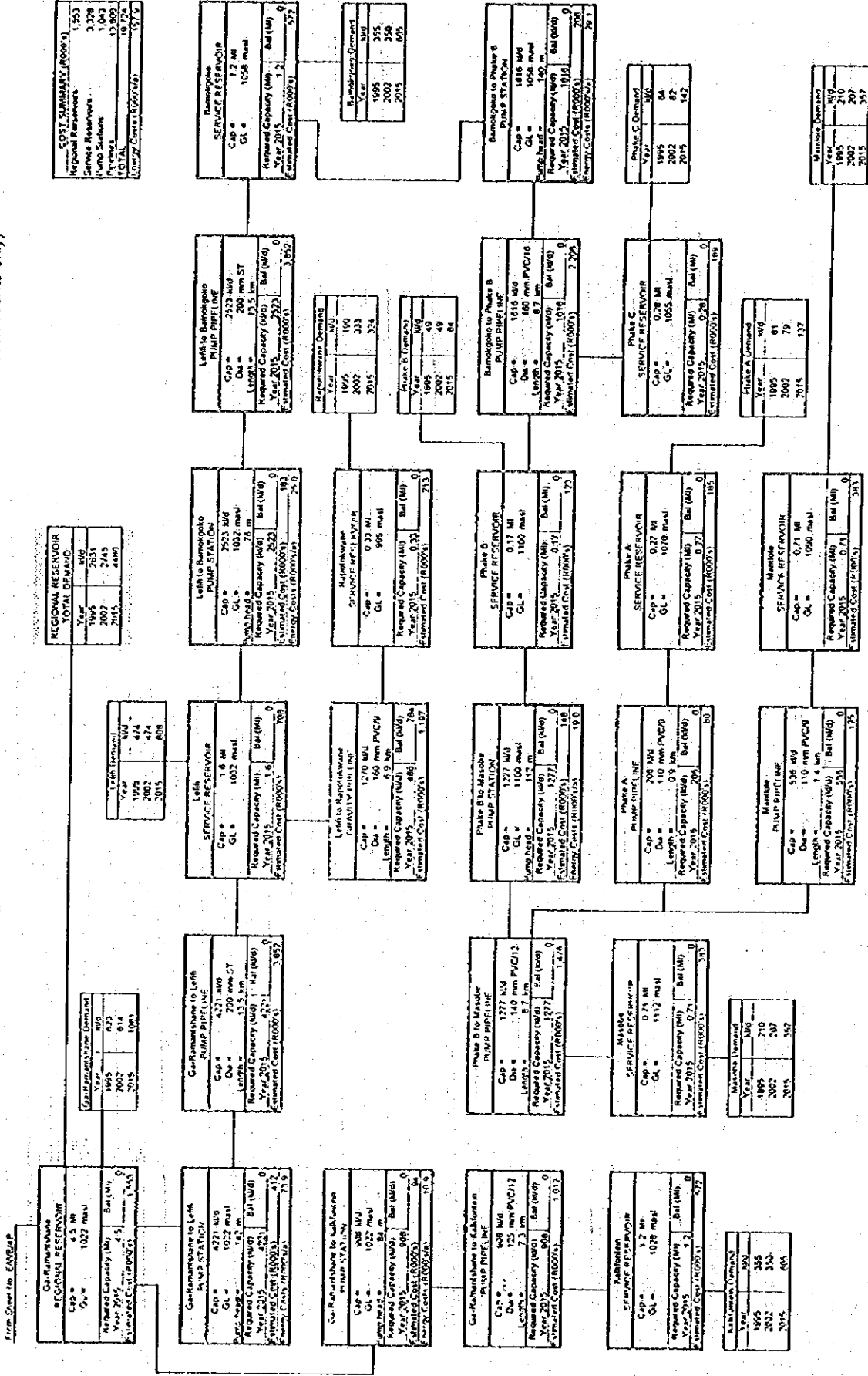
Demand	
Year	ML/d
1995	71
2002	126
2015	177

Demand	
Year	ML/d
1995	71
2002	126
2015	177

Note: Pumping energy cost for main pump station assume 1/2 cost due to Power (PVA) and 1/2 due to Energy (MWh) to full actual cost is 5/6 of that calculated for collieries pumping for a Peak Factor = 1.5 (i.e. 18hrs per day).

EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. EAWB/SP)

GA-RAMAMTSHANE TO MASOBE : ALTERNATIVE 1 (Moretele 2, supplied from Weltevreden Purification Works only)



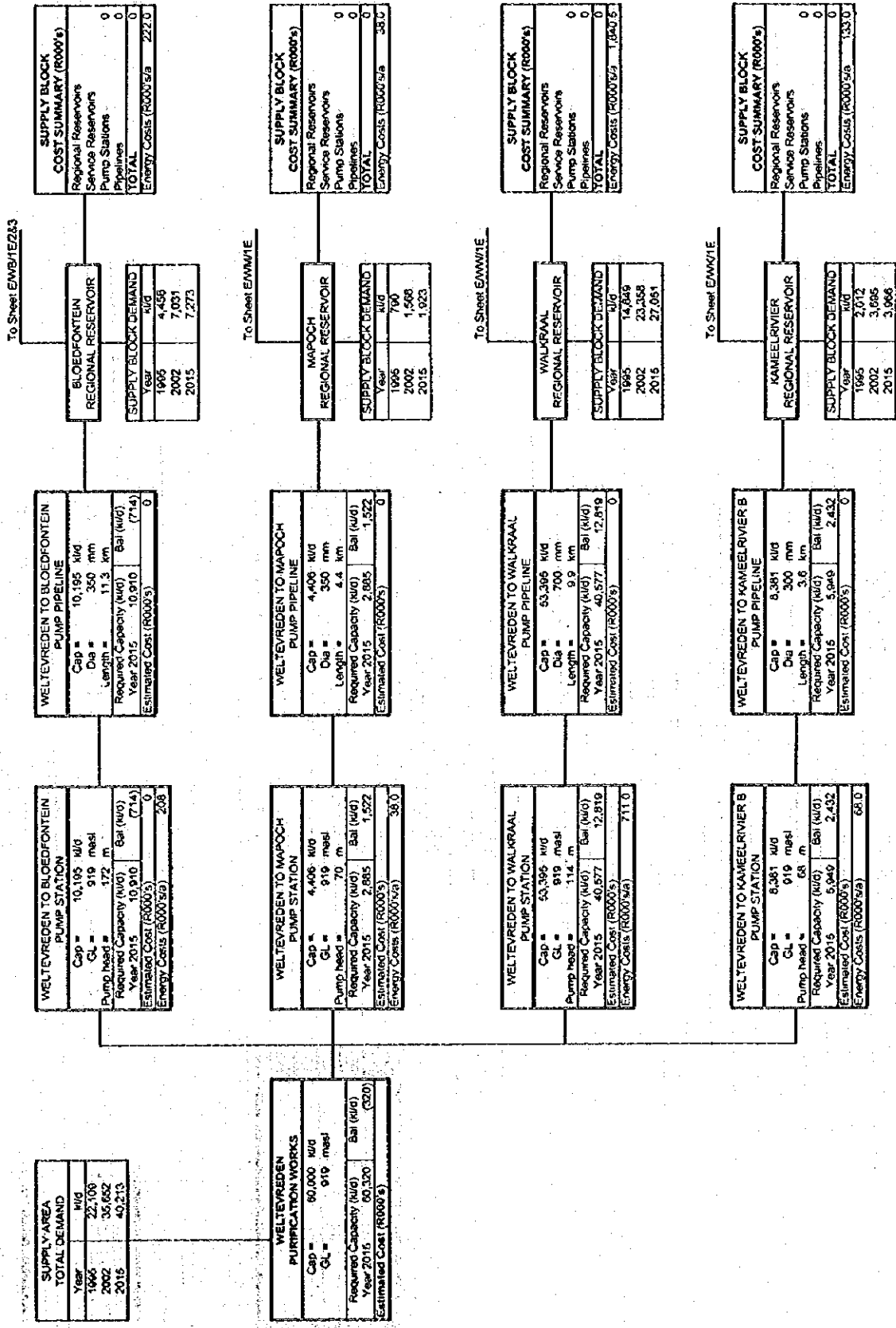
Note: Pumping energy costs for main pump at Masobane assume 1/2 cost due to Power (kWh) and 1/2 due to Energy (kWh), so that actual cost is 5/6 of that calculated for ordinary pumping for a Peak Factor = 1.5 (ie. 10hrs per day).

COST SUMMARY FOR INFRASTRUCTURE		
NAME OF SUPPLY AREA :	WELTEVREDEN ALTERNATIVE 2	
INCLUDING SUPPLY BLOCKS :	SPLIT BETWEEN WELTEVREDEN AND TEMBA	
	1. Waalkraal Supply Block	3. Mapoch Supply Block
	2. Kameelrivier Supply Block	4. Bloedfontein Supply Block
POPULATION SERVED (2015):	631,276	
AADD in mcr/a (2015):	19.01	
BULK COST :	QUANTITY	COST (R million)
Water Purification Works	Kl/d (SDD)	
1. Weltevreden WTW	320	0.107
2. Temba WTW	8,631	2.877
Pump Stations	Kld (SDD)	
A: Capital Cost		
1. Weltevreden (Bloedfontein) CWPS	714	0.124
2. Lewfontein PS	575	0.053
3. Matshipe A	362	0.059
4. Spitspunt BPS	217	0.023
5. Tshikanossi BPS	284	0.007
6. Mmakola BPS	323	0.020
7. Radijoko BPS	270	0.007
8. Ramantsho	33	0.006
9. Temba CWPS	8,631	0.722
10. Phake B	1,277	0.148
11. Ga Ramantshane	908	0.094
	Sub-Total	1.263
B: Annual Energy Cost (Not Incl'd with Total)		
1. Weltevreden (Bloedfontein) CWPS	-	0.015
2. Lewfontein PS	-	0.058
3. Matshipe A	-	0.006
4. Spitspunt BPS	-	0.003
5. Tshikanossi BPS	-	0.002
6. Mmakola BPS	-	0.003
7. Radijoko BPS	-	0.002
8. Ramantsho	-	0.002
9. Temba CWPS	-	0.155
10. Phake B	-	0.019
11. Ga Ramantshane	-	0.011
	Sub-Total	0.276
Reservoirs (Regional)	Ml	
1. Phake B	5.8	1.883
2. Lefifi	4.1	1.447
Pipelines (Bulk)	km	
1. 110 PVC	76.7	7.120
2. 125 PVC	10.2	1.336
3. 140 PVC	10.8	1.764
4. 160 PVC	28.4	5.831
5. 200 PVC	13.1	3.383
6. 250 PVC	0	0.000
7. 300 PVC	19.3	11.176
8. 315 PVC	0	0.000
9. 350 ST	41.4	27.053
10. 400 ST	13.5	11.062
11. 450 ST	13.5	13.490
	Sub-Total	82.215

Sub Total Construction Cost		89.792
Engineering Fees (15 %)		13.469
VAT (14 %)		14.457
Project Contingency (20%)		23.543
TOTAL : Bulk Cost		141.261
Bulk Cost per Capita (Rands)		224
SECONDARY COST :	QUANTITY	COST (R million)
Reservoirs (Service)	MI	
1. Bloedfontein Supply Block	6.71 (23 No)	4.354
	6.55 (19 No)	3.489
2. Waalkraal Supply Block	10.17 (25 No)	5.812
3. Kameelrivier Supply Block	0.92 (2 No)	0.523
4. Mapoch Supply Block	0	0.000
	Sub-Total	14.178
Water Towers	MI	
N/A	NIL	NIL
Pump Stations (Secondary)	Kl/d	
A : Capital Cost		
N/A	NIL	NIL
B : Annual Energy Cost (Not Inc'd with Total)		
N/A	NIL	NIL
Pipelines (Secondary)	km	
	NIL	NIL
Reticalation	km	
1. Bloedfontein Supply Block		99.837
2. Waalkraal Supply Block		95.056
3. Kameelrivier Supply Block		12.356
4. Mapoch Supply Block		6.851
	Sub-Total	214.100
Sub Total Construction Cost		228.278
Engineering Fees (15 %)		34.242
VAT (14 %)		36.753
Project Contingency (20%)		69.854
TOTAL : Secondary Cost		359.127
Secondary Cost per Capita (Rands)		569
GRAND TOTAL COST		500.388
Grand Total Cost per Capita (R)		793

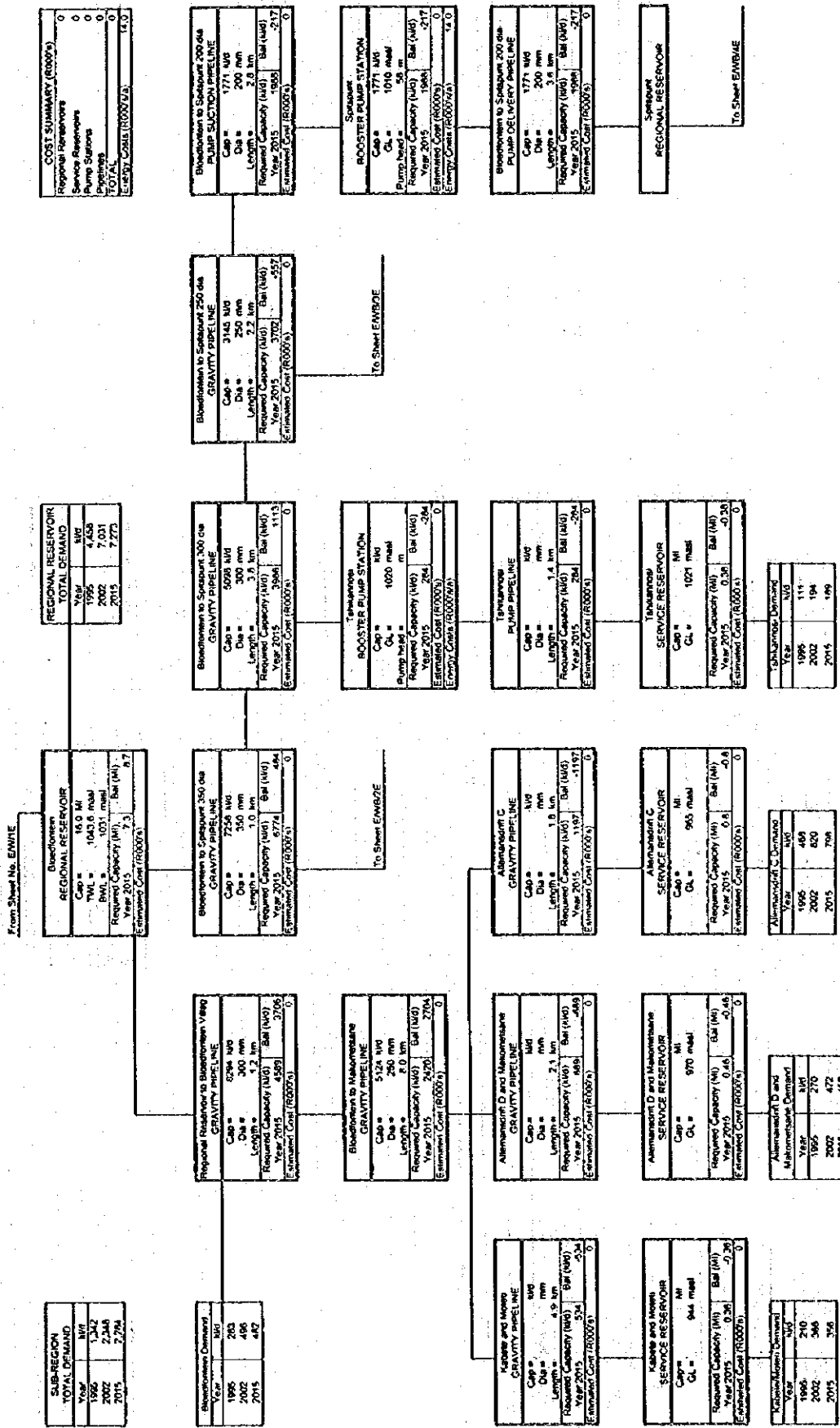
EASTERN ZONE : WELTEVREDEN SUPPLY AREA : EXISTING INFRASTRUCTURE (EW1E/2&3)

ALTERNATIVE 2 (Moretele 2 supplied from Weltevreden and Temba Purification Works)



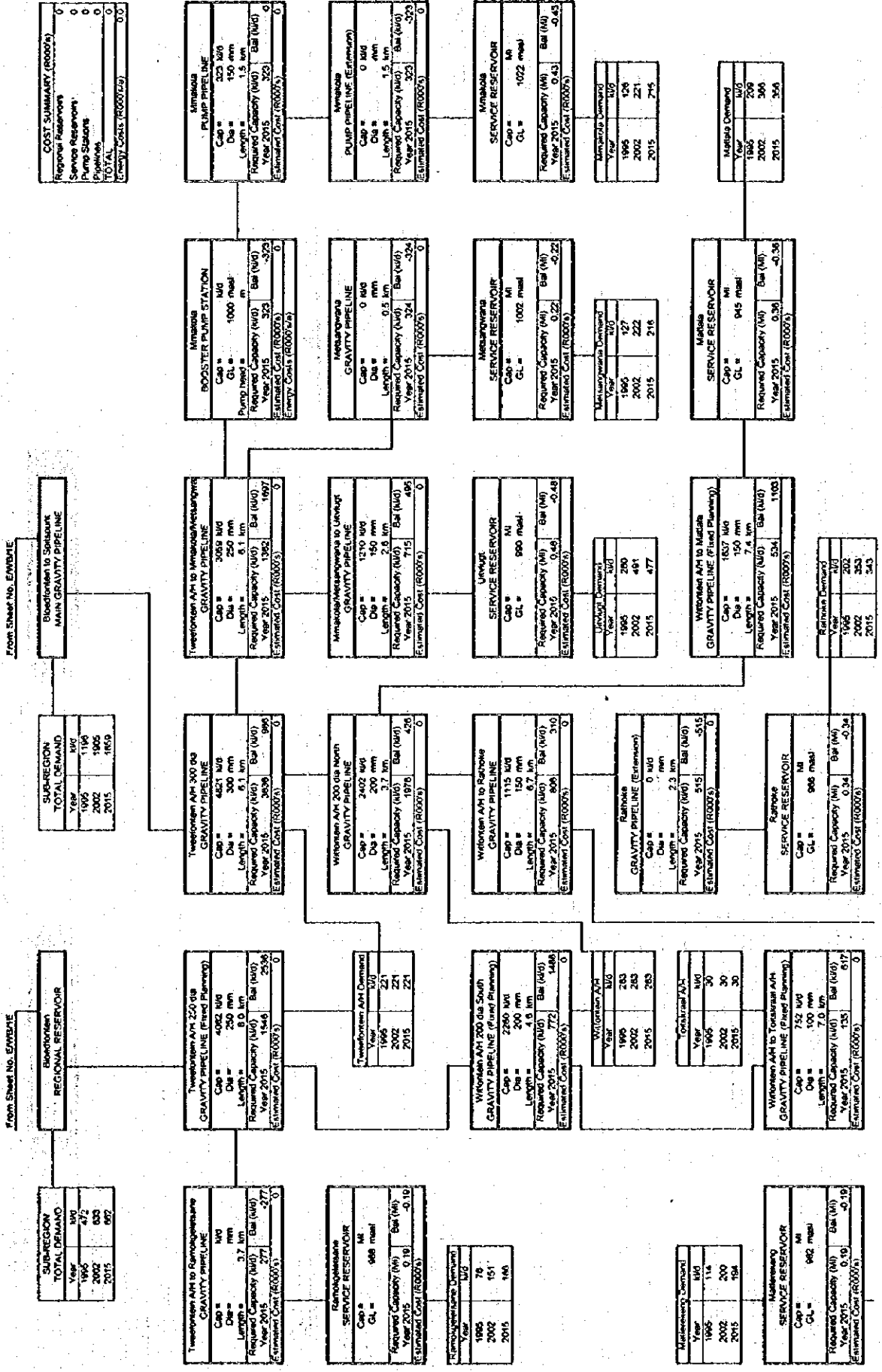
EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. EWB/1E/2&3)

BLOEDFONTEIN TO SPITSPUNT : ALTERNATIVE 2 (Moretele 2 supplied from Weltevreden and Temba Purification Works)



EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. E/WB/2E)

BLOEDFONTEIN TO UITVLUGT, RATHOKE AND MATLALA : ALTERNATIVE 2 (Moretele 2 supplied from Weltevreden Purification Works and Temba Purification Works)



From Sheet No. E/WB/1E

SUB-REGION		TOTAL DEMAND	
Year	M ³ /d	Year	M ³ /d
1995	472	1995	1190
2002	533	2002	1905
2015	697	2015	1859

From Sheet No. E/WB/1E

SUB-REGION		TOTAL DEMAND	
Year	M ³ /d	Year	M ³ /d
1995	472	1995	1190
2002	533	2002	1905
2015	697	2015	1859

From Sheet No. E/WB/1E

SUB-REGION		TOTAL DEMAND	
Year	M ³ /d	Year	M ³ /d
1995	472	1995	1190
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From Sheet No. E/WB/1E

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Year	M ³ /d	Year	M ³ /d
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From Sheet No. E/WB/1E

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Year	M ³ /d	Year	M ³ /d
1995	472	1995	1190
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Year	M ³ /d	Year	M ³ /d
1995	472	1995	1190
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From Sheet No. E/WB/1E

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Year	M ³ /d	Year	M ³ /d
1995	472	1995	1190
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From Sheet No. E/WB/1E

SUB-REGION		TOTAL DEMAND	
Year	M ³ /d	Year	M ³ /d
1995	472	1995	1190
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2015	697	2015	1859

From Sheet No. E/WB/1E

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Year	M ³ /d	Year	M ³ /d
1995	472	1995	1190
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From Sheet No. E/WB/1E

SUB-REGION		TOTAL DEMAND	
Year	M ³ /d	Year	M ³ /d
1995	472	1995	1190
2002	533	2002	1905
2015	697	2015	1859

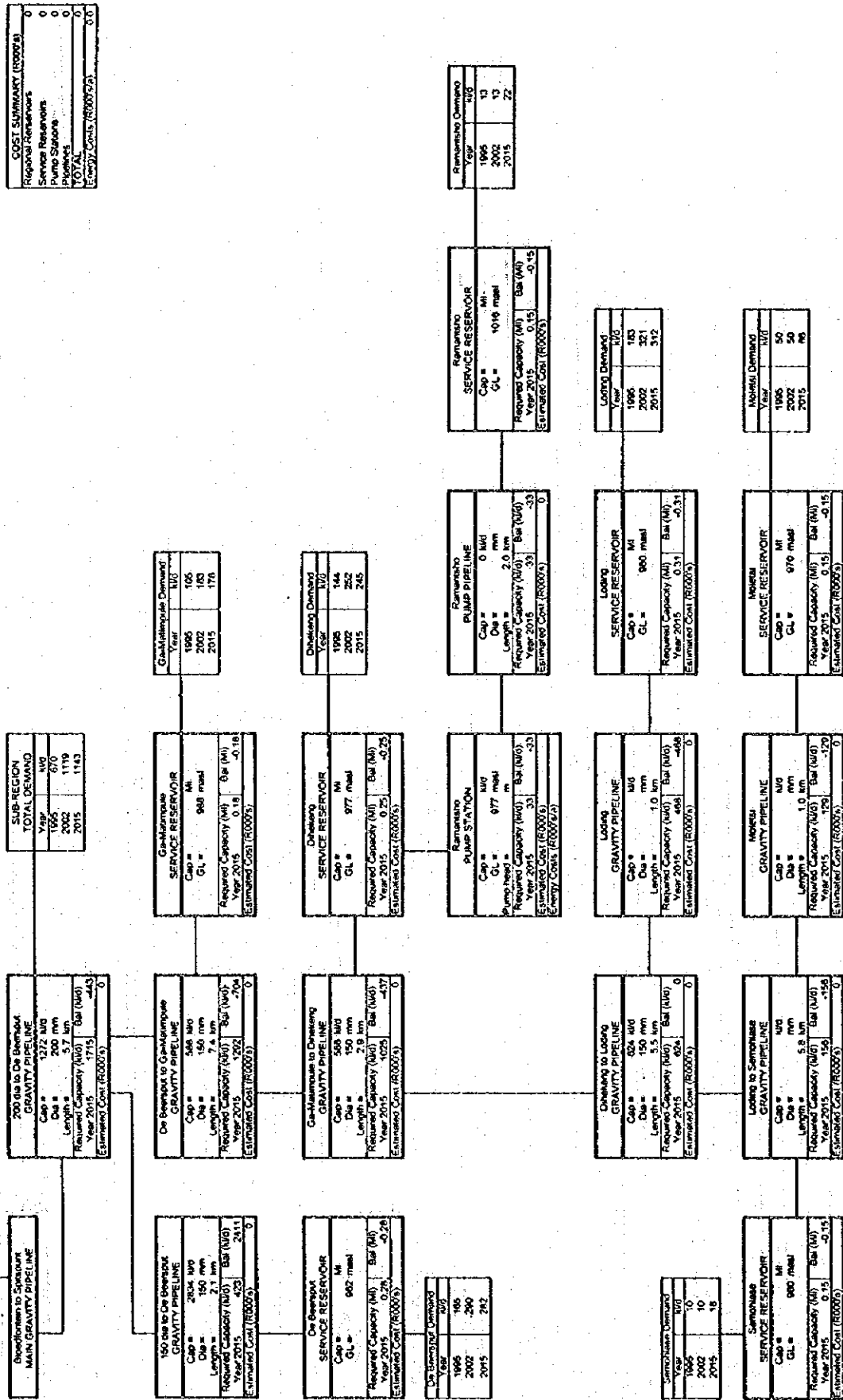
From Sheet No. E/WB/1E

SUB-REGION		TOTAL DEMAND	
Year	M ³ /d	Year	M ³ /d
1995	472	1995	1190
2002	533	2002	1905
2015	697	2015	1859

EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. EWB/3E)

FROM BLOEDFONTEIN/SPITSVUNT PIPELINE TO SEMOHASE : ALTERNATIVE 2 (Moretele 2 supplied from Weltevreden Purification Works and Temba Purification Works)

From Sheet No. EWB/4E



COST SUMMARY (R0000's)	
Regional Reservoirs	0
Service Reservoirs	0
Pump Stations	0
Pipelines	0
TOTAL	0
Energy Costs (R0000's/yr)	0.0

SUB-REGION TOTAL DEMAND	
Year	MGD
1995	670
2002	1119
2015	1143

G.M. Mankwani Demand	
Year	MGD
1995	105
2002	183
2015	178

Channing Demand	
Year	MGD
1995	145
2002	255
2015	245

Ramathoto PUMP PIPELINE	
Cap	0 MGD
Di	2.0 mm
Length	2.0 km
Required Capacity (MGD)	Bar (M)
Year 2015	33
Estimated Cost (R0000's)	-33
Energy Costs (R0000's/yr)	0

Ramathoto SERVICE RESERVOIR	
Cap	MI
GL	1016 masl
Required Capacity (MG)	Bar (M)
Year 2015	0.15
Estimated Cost (R0000's)	-0.45

Ramathoto Demand	
Year	MGD
1995	13
2002	13
2015	22

Lodging Demand	
Year	MGD
1995	183
2002	321
2015	312

Lodging SERVICE RESERVOIR	
Cap	MI
GL	980 masl
Required Capacity (MG)	Bar (M)
Year 2015	0.31
Estimated Cost (R0000's)	-0.31

Lodging GRAVITY PIPELINE	
Cap	MGD
Di	1.0 mm
Length	1.0 km
Required Capacity (MG)	Bar (M)
Year 2015	0.51
Estimated Cost (R0000's)	0

Maseka Demand	
Year	MGD
1995	50
2002	50
2015	40

Maseka SERVICE RESERVOIR	
Cap	MI
GL	676 masl
Required Capacity (MG)	Bar (M)
Year 2015	0.15
Estimated Cost (R0000's)	-0.15

Maseka GRAVITY PIPELINE	
Cap	MGD
Di	1.0 mm
Length	1.0 km
Required Capacity (MG)	Bar (M)
Year 2015	0.15
Estimated Cost (R0000's)	-0.15

Semohase SERVICE RESERVOIR	
Cap	MI
GL	980 masl
Required Capacity (MG)	Bar (M)
Year 2015	0.15
Estimated Cost (R0000's)	-0.15

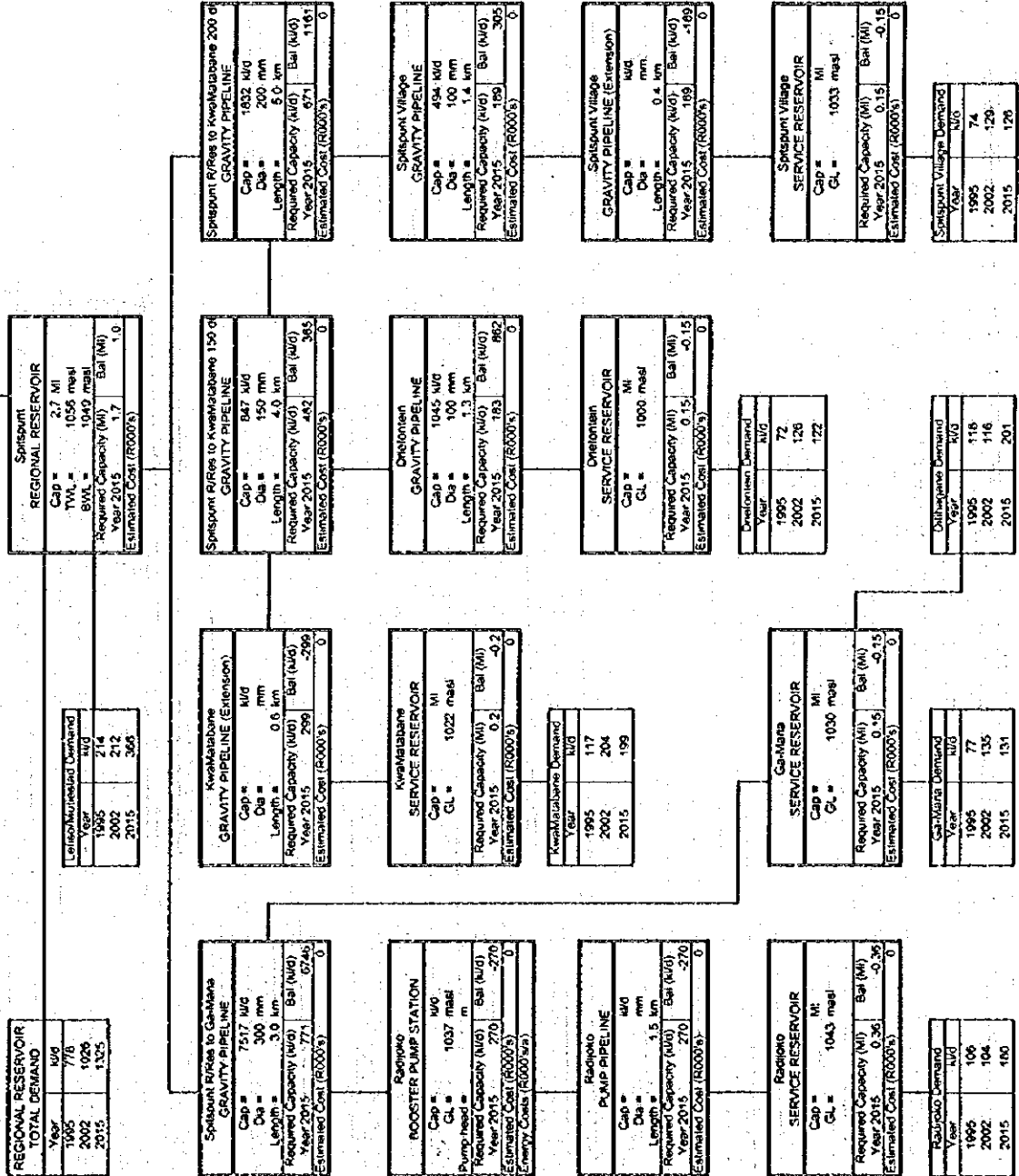
Note: Pumping energy costs for main pump stations assume 1/2 cost due to Power (KVA) and 1/2 due to Energy (KWH), so that actual cost is 5/6 of that calculated for continuous pumping for a Peak Factor = 1.5 (ie. 16hrs per day).

EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. EWB/4E/2&3)

SPITSPUNT TO KWAMATABANE AND RADJOKO : ALTERNATIVE 2 (Moretele 2 supplied from Weltevreden and Temba Purification Works)

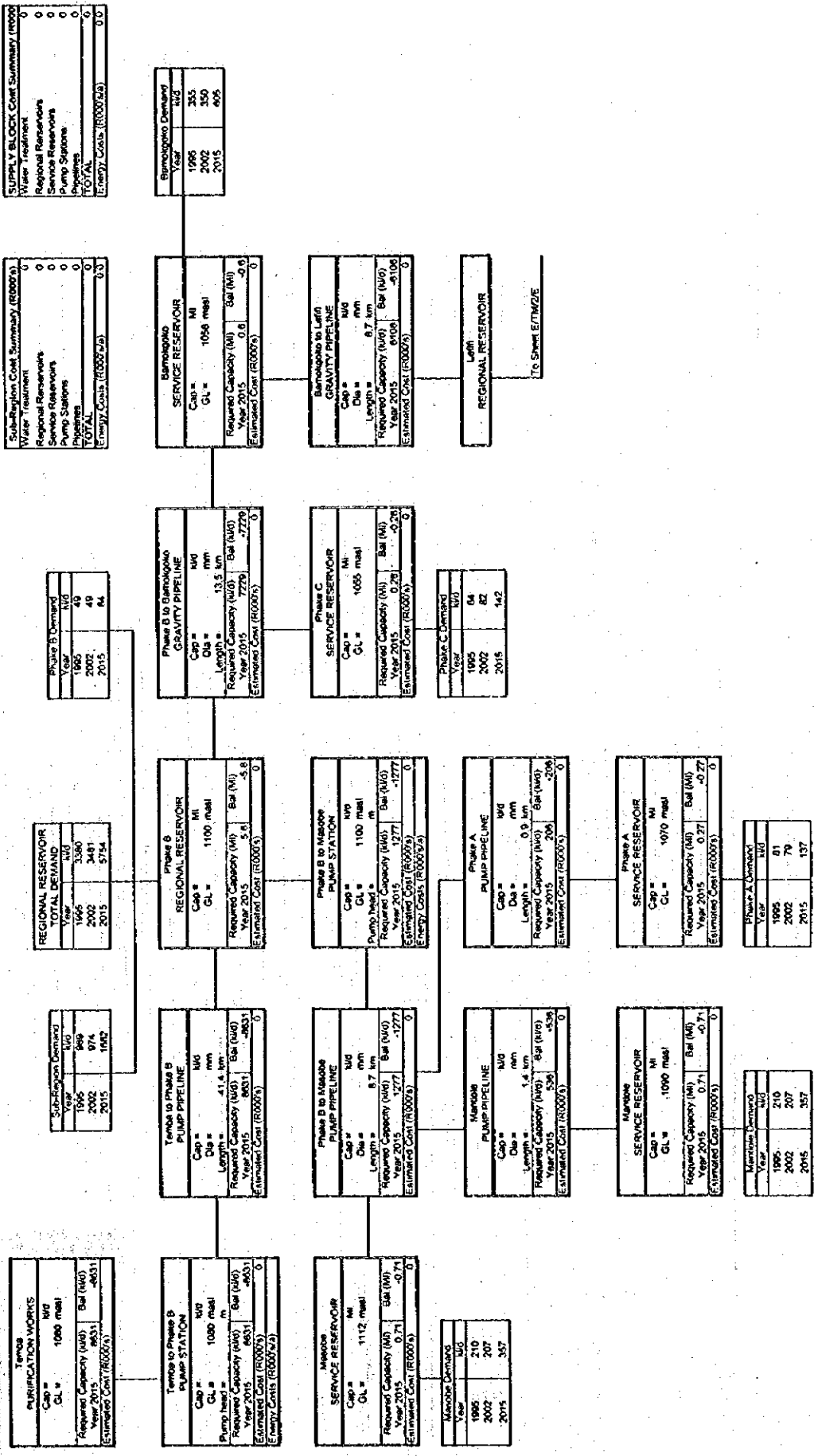
From Sheet No. EWB/4E/2

COST SUMMARY (R000's)	
Regional Reservoirs	0
Service Reservoirs	0
Pump Stations	0
Pipelines	0
TOTAL	0
Country Costs (R000's)	0.0



EASTERN ZONE : BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. E/TM/1E)

TEMBA TO LEFIFI : ALTERNATIVE 2 (Moretele 2 supplied from Weitevreden and Temba Purification Works)



Cap =	1000 megal
GL =	
Required Capacity (Ml) Bar (Ml)	
Year 2015	6031 -6031
Estimated Cost (R000's)	0

Year	Ml
1995	849
2002	974
2015	1000

Cap =	1100 megal
GL =	
Length =	13.5 km
Required Capacity (Ml) Bar (Ml)	
Year 2015	7779 -7779
Estimated Cost (R000's)	0

Cap =	3380 Ml
GL =	
Required Capacity (Ml) Bar (Ml)	
Year 2015	3481 -5.8
Estimated Cost (R000's)	0

Cap =	1100 megal
GL =	
Length =	41.4 km
Required Capacity (Ml) Bar (Ml)	
Year 2015	6031 -6031
Estimated Cost (R000's)	0

Cap =	1112 megal
GL =	
Length =	8.7 km
Required Capacity (Ml) Bar (Ml)	
Year 2015	1277 -1277
Estimated Cost (R000's)	0

Year	Ml
1995	210
2002	207
2015	357

Water Treatment	0
Regional Reservoirs	0
Service Reservoirs	0
Pump Stations	0
Gravity Pipelines	0
TOTAL	0
Energy Costs (R000's/a)	0.0

Year	Ml
1995	355
2002	350
2015	605

Cap =	1005 megal
GL =	
Length =	8.7 km
Required Capacity (Ml) Bar (Ml)	
Year 2015	6100 -6100
Estimated Cost (R000's)	0

Cap =	1070 megal
GL =	
Length =	0.9 km
Required Capacity (Ml) Bar (Ml)	
Year 2015	0.79 -0.79
Estimated Cost (R000's)	0

Cap =	1070 megal
GL =	
Length =	0.9 km
Required Capacity (Ml) Bar (Ml)	
Year 2015	0.77 -0.77
Estimated Cost (R000's)	0

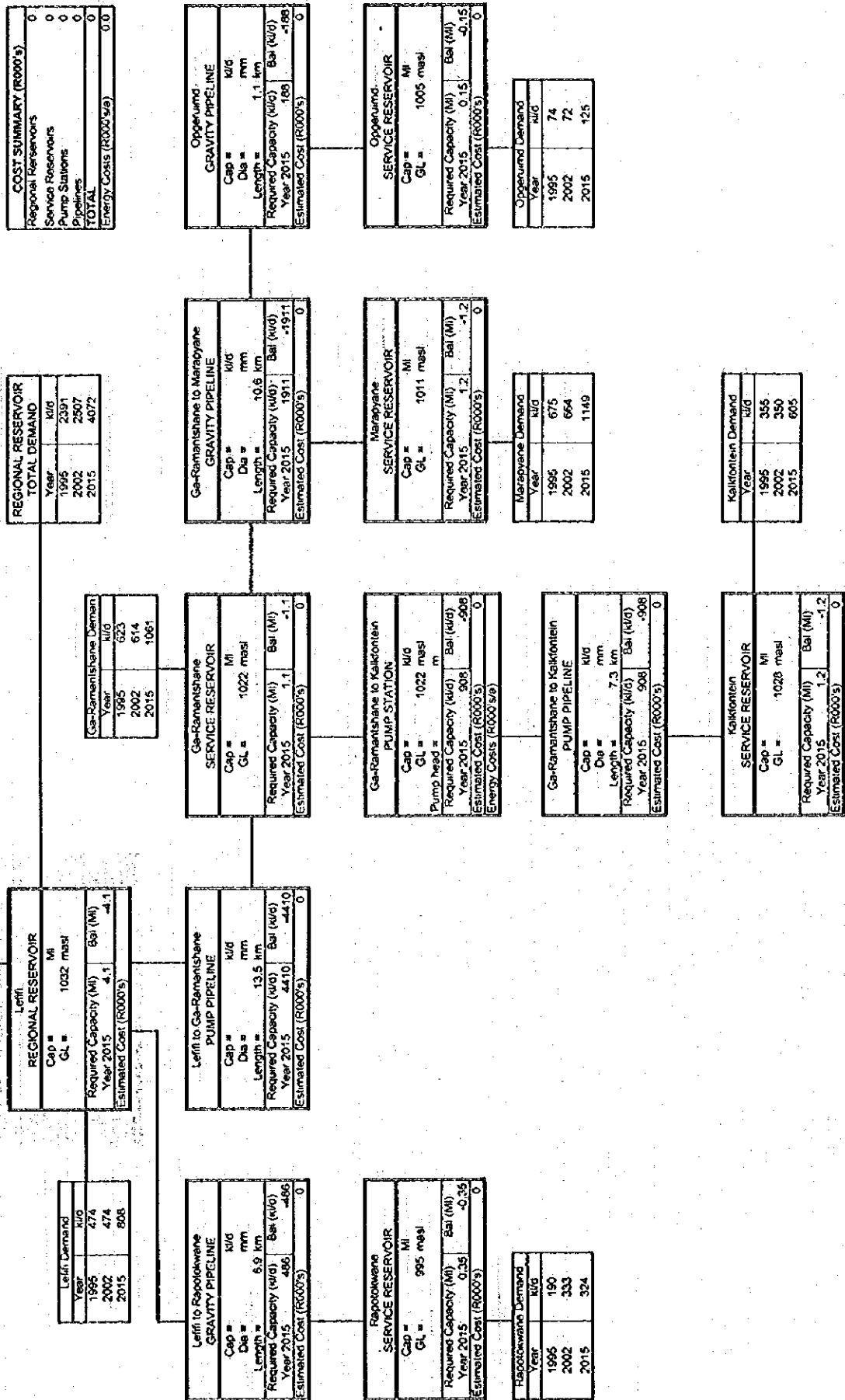
Cap =	1070 megal
GL =	
Length =	0.9 km
Required Capacity (Ml) Bar (Ml)	
Year 2015	0.77 -0.77
Estimated Cost (R000's)	0

Year	Ml
1995	81
2002	79
2015	137

EASTERN ZONE : BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. E/TM/2E)

LEFIFI TO MARAPYANE : ALTERNATIVE 2 (Moretele 2 supplied from Weltevreden and Temba Water Purification Works)

From Sheet No. E/TM/1E



COST SUMMARY (R000's)	
Regional Reservoirs	0
Service Reservoirs	0
Pump Stations	0
Pipelines	0
TOTAL	0
Energy Costs (R000/yr)	0.0

REGIONAL RESERVOIR TOTAL DEMAND	
Year	k/d
1995	2391
2002	2507
2015	4072

Lefifi Demand	
Year	k/d
1995	474
2002	474
2015	808

Lefifi REGIONAL RESERVOIR	
Cap =	1032 m ³
GL =	1032 m ³
Required Capacity (Ml)	4.1
Year 2015	4.1
Estimated Cost (R000's)	-1.1

Ga-Ramantswane Demand	
Year	k/d
1995	523
2002	614
2015	1061

Ga-Ramantswane SERVICE RESERVOIR	
Cap =	1022 m ³
GL =	1022 m ³
Required Capacity (Ml)	1.1
Year 2015	1.1
Estimated Cost (R000's)	-1.1

Lefifi to Ga-Ramantswane PUMP PIPELINE	
Cap =	13.5 km
Dia =	mm
Length =	13.5 km
Required Capacity (k/d)	4.1
Year 2015	4.1
Estimated Cost (R000's)	-4.0

Lefifi to Repotswane GRAVITY PIPELINE	
Cap =	6.9 km
Dia =	mm
Length =	6.9 km
Required Capacity (k/d)	4.1
Year 2015	4.1
Estimated Cost (R000's)	-4.6

Repotswane SERVICE RESERVOIR	
Cap =	995 m ³
GL =	995 m ³
Required Capacity (Ml)	0.35
Year 2015	0.35
Estimated Cost (R000's)	0

Repotswane Demand	
Year	k/d
1995	190
2002	333
2015	324

Ga-Ramantswane to Marapyane GRAVITY PIPELINE	
Cap =	10.6 km
Dia =	mm
Length =	10.6 km
Required Capacity (k/d)	19.1
Year 2015	19.1
Estimated Cost (R000's)	-19.1

Marapyane SERVICE RESERVOIR	
Cap =	1011 m ³
GL =	1011 m ³
Required Capacity (Ml)	1.2
Year 2015	1.2
Estimated Cost (R000's)	-1.2

Marapyane Demand	
Year	k/d
1995	675
2002	664
2015	1149

Oppenund GRAVITY PIPELINE	
Cap =	1.1 km
Dia =	mm
Length =	1.1 km
Required Capacity (k/d)	1.68
Year 2015	1.68
Estimated Cost (R000's)	-1.68

Oppenund SERVICE RESERVOIR	
Cap =	1005 m ³
GL =	1005 m ³
Required Capacity (Ml)	0.15
Year 2015	0.15
Estimated Cost (R000's)	0

Oppenund Demand	
Year	k/d
1995	74
2002	72
2015	125

Kalkfontein Demand	
Year	k/d
1995	355
2002	350
2015	605

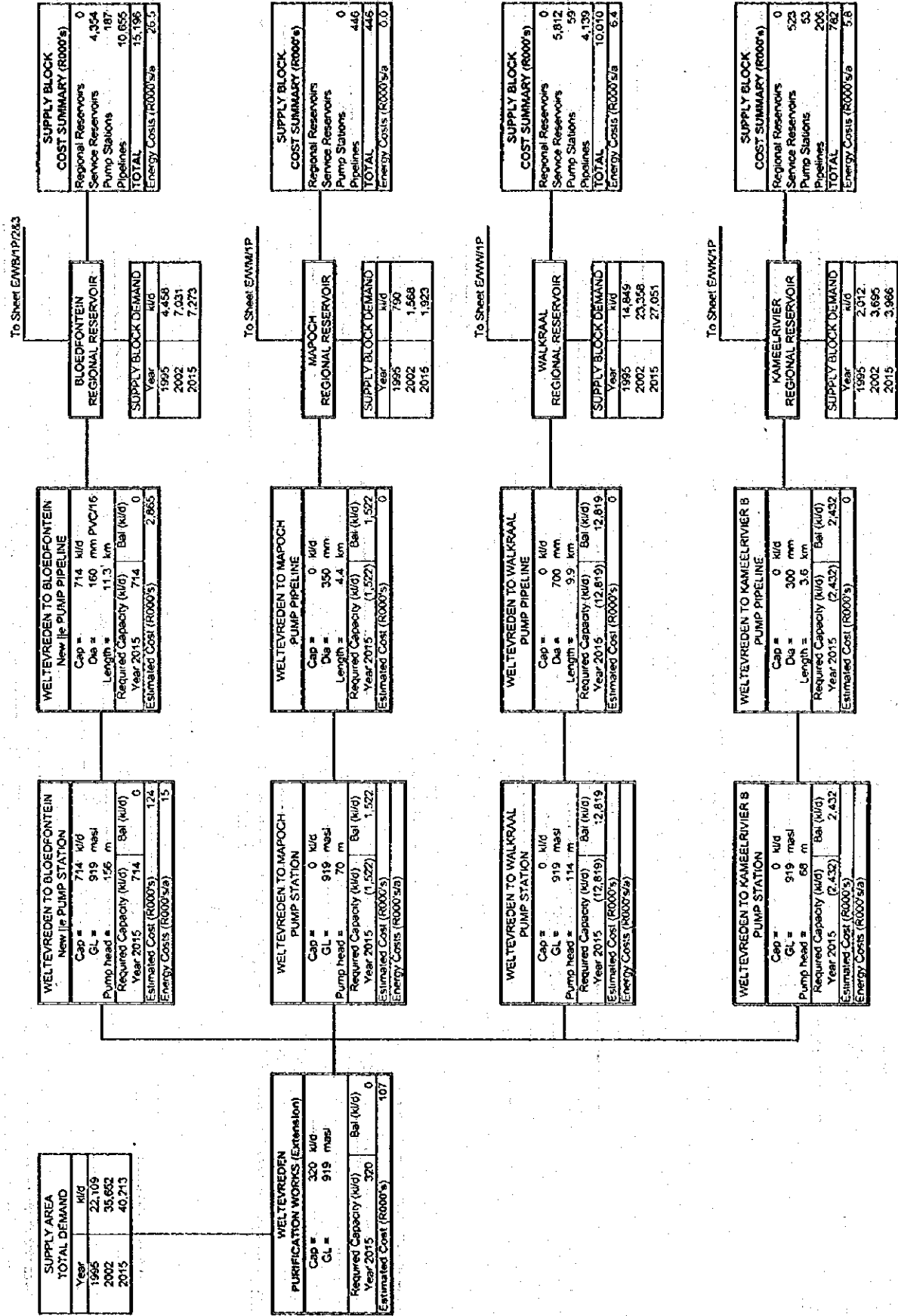
Kalkfontein SERVICE RESERVOIR	
Cap =	1028 m ³
GL =	1028 m ³
Required Capacity (Ml)	1.2
Year 2015	1.2
Estimated Cost (R000's)	-1.2

Ga-Ramantswane to Kalkfontein PUMP PIPELINE	
Cap =	7.3 km
Dia =	mm
Length =	7.3 km
Required Capacity (k/d)	908
Year 2015	908
Estimated Cost (R000's)	-908

Ga-Ramantswane to Kalkfontein PUMP STATION	
Cap =	1022 m ³
GL =	1022 m ³
Pump head =	m
Required Capacity (k/d)	908
Year 2015	908
Estimated Cost (R000's)	0
Energy Costs (R000/yr)	0

EASTERN ZONE : WELTEVREDEN SUPPLY AREA : PROPOSED INFRASTRUCTURE (EW/1P/2&3)

ALTERNATIVE 2 (Moretele 2 supplied from Weltevreden and Temba Purification Works)



EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. ENWB/1P/2&3)

BLOEDFONTEIN TO SPITSPUNT : ALTERNATIVE 3 (Moretele 2 supplied from Weltevreden and Rust De Winter Dam)

From Sheet No. ENWB

SUB-REGION TOTAL DEMAND	
Year	M3
1995	1,342
2002	2,348
2015	2,794

REGIONAL RESERVOIR TOTAL DEMAND	
Year	M3
1995	4,558
2002	7,603
2015	7,273

COST SUMMARY (R000's)	
Regional Reservoirs	0
Service Reservoirs	1,157
Pump Stations	30
Pipelines	2,115
TOTAL	3,302
Energy Costs (R000/yr)	4.5

Bloedfontein Demand	
Year	M3
1995	218
2002	418
2015	472

Regional Reservoir to Spitspunt Vals GRAVITY PIPELINE		
Cap	0 M3	
Dia	300 mm	
Length	1.2 km	
Required Capacity (M3)	Bar (M3)	
Year 2015	3708	2704
Year 2015	3708	2704
Estimated Cost (R000's)	0	

Bloedfontein to Makrofontein GRAVITY PIPELINE		
Cap	0 M3	
Dia	250 mm	
Length	2.0 km	
Required Capacity (M3)	Bar (M3)	
Year 2015	2704	2704
Year 2015	2704	2704
Estimated Cost (R000's)	0	

Kleef and Metel GRAVITY PIPELINE		
Cap	714 M3	
Dia	110 mm PVC9	
Length	0.9 km	
Required Capacity (M3)	Bar (M3)	
Year 2015	334	334
Year 2015	334	334
Estimated Cost (R000's)	233	

Kleef and Metel SERVICE RESERVOIR		
Cap	0.35 M3	
GL	944 msl	
Required Capacity (M3)	Bar (M3)	
Year 2015	0.35	0
Year 2015	0.35	0
Estimated Cost (R000's)	273	

Kleef and Metel Demand	
Year	M3
1995	210
2002	366
2015	355

Bloedfontein to Spitspunt (350 dia Ex) GRAVITY PIPELINE		
Cap	0 M3	
Dia	350 mm	
Length	1.0 km	
Required Capacity (M3)	Bar (M3)	
Year 2015	444	444
Year 2015	444	444
Estimated Cost (R000's)	464	

To Street ENWB2P

Allemansfont C GRAVITY PIPELINE		
Cap	1740 M3	
Dia	180 mm PVC9	
Length	1.8 km	
Required Capacity (M3)	Bar (M3)	
Year 2015	1137	543
Year 2015	1137	543
Estimated Cost (R000's)	312	

Allemansfont C SERVICE RESERVOIR		
Cap	0.8 M3	
GL	965 msl	
Required Capacity (M3)	Bar (M3)	
Year 2015	0.8	0
Year 2015	0.8	0
Estimated Cost (R000's)	418	

Allemansfont C Demand	
Year	M3
1995	455
2002	620
2015	766

Bloedfontein to Spitspunt (300 dia Ex) GRAVITY PIPELINE		
Cap	0 M3	
Dia	300 mm	
Length	3.1 km	
Required Capacity (M3)	Bar (M3)	
Year 2015	1413	1113
Year 2015	1413	1113
Estimated Cost (R000's)	1113	

Timmerfont BOOSTER PUMP STATION		
Cap	284 M3	
GL	1020 msl	
Pump Head	7.7 m	
Required Capacity (M3)	Bar (M3)	
Year 2015	284	0
Year 2015	284	0
Estimated Cost (R000's)	27	
Energy Costs (R000/yr)	2.0	

Timmerfont GRAVITY PIPELINE		
Cap	284 M3	
Dia	110 mm PVC9	
Length	1.4 km	
Required Capacity (M3)	Bar (M3)	
Year 2015	284	0
Year 2015	284	0
Estimated Cost (R000's)	128	

Timmerfont SERVICE RESERVOIR		
Cap	0.38 M3	
GL	1021 msl	
Required Capacity (M3)	Bar (M3)	
Year 2015	0.38	0
Year 2015	0.38	0
Estimated Cost (R000's)	237	

Timmerfont Demand	
Year	M3
1995	114
2002	194
2015	189

Bloedfontein to Spitspunt (250 dia Ex) GRAVITY PIPELINE		
Cap	702 M3	
Dia	100 mm PVC9	
Length	3.2 km	
Required Capacity (M3)	Bar (M3)	
Year 2015	597	240
Year 2015	597	240
Estimated Cost (R000's)	392	

To Street ENWB3P

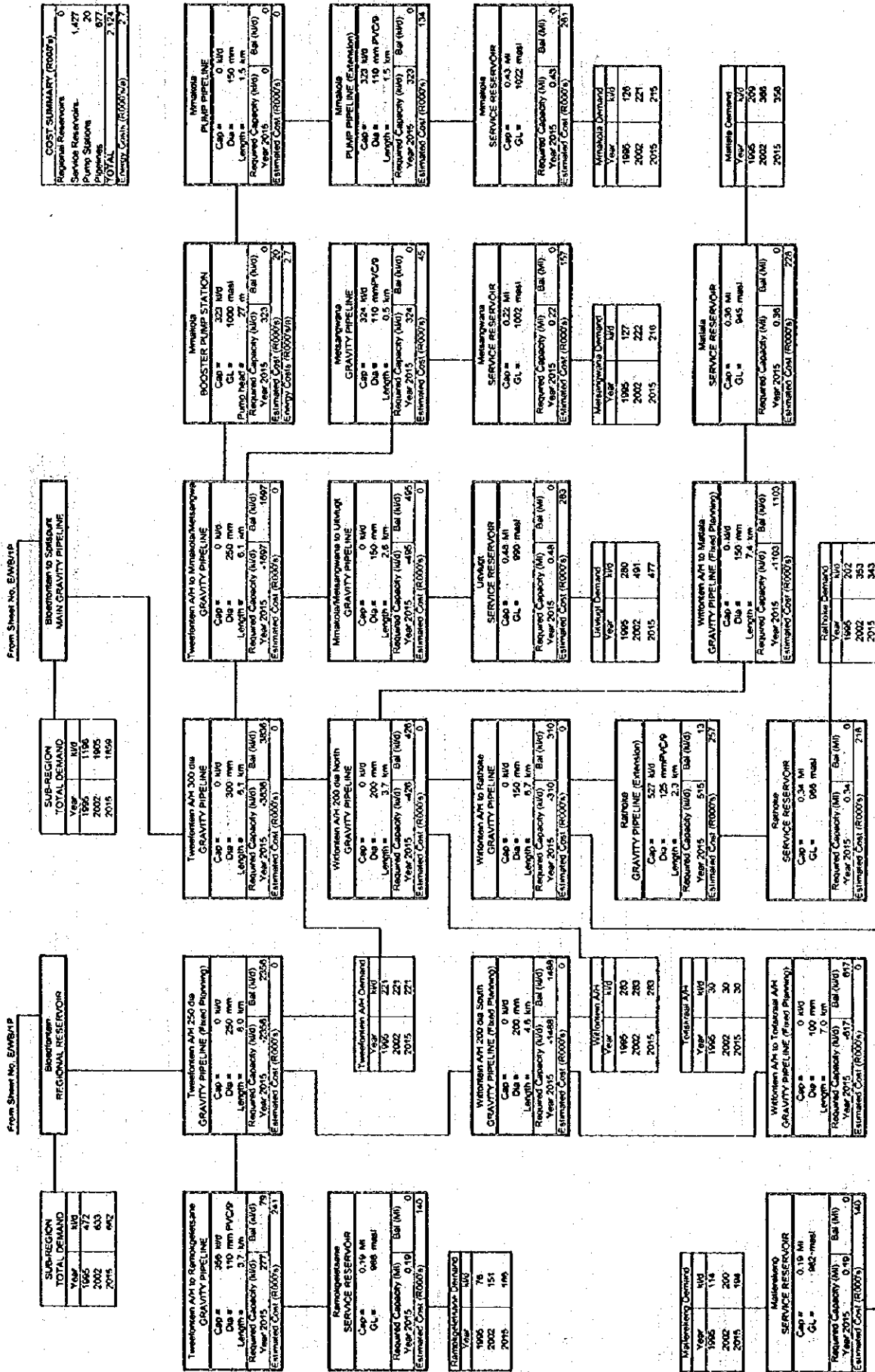
Bloedfontein to Spitspunt (200 dia Ex) New 1/2 PUMP DELIVERY PIPELINE		
Cap	217 M3	
Dia	110 mm PVC9	
Length	3.6 km	
Required Capacity (M3)	Bar (M3)	
Year 2015	217	0
Year 2015	217	0
Estimated Cost (R000's)	324	

Spitspunt REGIONAL RESERVOIR		
Cap	217 M3	
GL	1010 msl	
Required Capacity (M3)	Bar (M3)	
Year 2015	217	0
Year 2015	217	0
Estimated Cost (R000's)	324	

Spitspunt Demand	
Year	M3
1995	114
2002	194
2015	189

EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. EWB/2P)

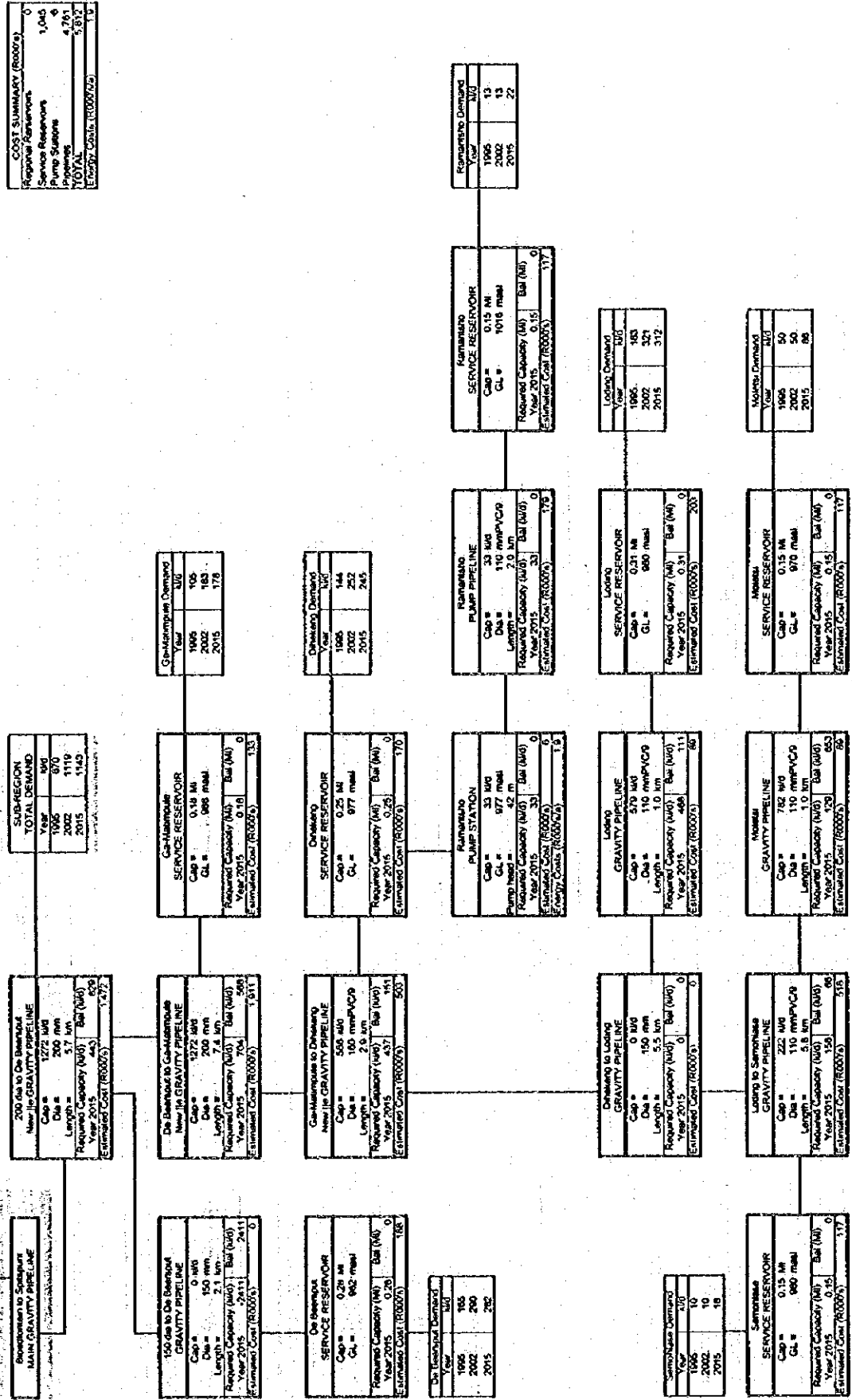
BLOEDFONTEIN TO UITYLUGT, RATHOKE AND MATLALA : ALTERNATIVE 3 (Moretele 2 supplied from Weltevreden Purification Works and Rust De Winter Dam)



EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. EWB/3P)

FROM BLOEDFONTEIN/SPITSPUNT PIPELINE TO SEMOHLASE : ALTERNATIVE 2 (Moretele 2 supplied from Weltevreden Purification Works and Tembisa Purification Works)

From Sheet No. EWB/1P



COST SUMMARY (R000's)	
Regional Network	0
Service Reservoirs	1,045
Pump Stations	4,791
TOTAL	5,836
Energy Costs (R000's/yr)	1.8

SUB-REGION TOTAL DEMAND	
Year	1996
Year	2002
Year	2015

Ge-Hlatshulu Demand	
Year	1996
Year	2002
Year	2015

Derebanko Demand	
Year	1996
Year	2002
Year	2015

Kumamano Demand	
Year	1996
Year	2002
Year	2015

Kumamano SERVICE RESERVOIR	
Cap	0.15 Ml
GL	1016 mm
Year 2015	0
Year 2015	117

Kumamano PUMP PIPELINE	
Cap	33 MGD
GL	110 mm PVC/P
Length	2.0 km
Year 2015	33
Year 2015	179

Lobosha Demand	
Year	1996
Year	2002
Year	2015

Lobosha SERVICE RESERVOIR	
Cap	0.21 Ml
GL	980 mm
Year 2015	0
Year 2015	203

Mokete Demand	
Year	1996
Year	2002
Year	2015

Mokete SERVICE RESERVOIR	
Cap	0.15 Ml
GL	970 mm
Year 2015	0
Year 2015	117

200 dia to De Beerfontein New 10 Gravity Pipeline	
Cap	172 MGD
GL	200 mm
Length	5.7 km
Year 2015	423
Year 2015	1,272

Ge-Hlatshulu SERVICE RESERVOIR	
Cap	0.18 Ml
GL	988 mm
Year 2015	0
Year 2015	133

Derebanko SERVICE RESERVOIR	
Cap	0.25 Ml
GL	977 mm
Year 2015	0
Year 2015	170

Kumamano PUMP STATION	
Cap	33 MGD
GL	977 mm
Length	4.2 m
Year 2015	33
Year 2015	179

Lobosha GRAVITY PIPELINE	
Cap	370 MGD
GL	110 mm PVC/P
Length	1.0 km
Year 2015	64
Year 2015	80

Mokete GRAVITY PIPELINE	
Cap	782 MGD
GL	110 mm PVC/P
Length	1.0 km
Year 2015	120
Year 2015	80

150 dia to De Beerfontein Gravity Pipeline	
Cap	0 MGD
GL	150 mm
Length	7.1 km
Year 2015	111
Year 2015	241

De Beerfontein SERVICE RESERVOIR	
Cap	0.26 Ml
GL	942 mm
Year 2015	0
Year 2015	168

Ge-Hlatshulu to Derebanko New 10 Gravity Pipeline	
Cap	508 MGD
GL	100 mm PVC/P
Length	2.6 km
Year 2015	437
Year 2015	507

De Beerfontein Demand	
Year	1996
Year	2002
Year	2015

Derebanko to Lobosha Gravity Pipeline	
Cap	0 MGD
GL	150 mm
Length	5.3 km
Year 2015	0
Year 2015	0

Lobosha to Semohlase Gravity Pipeline	
Cap	222 MGD
GL	110 mm PVC/P
Length	5.8 km
Year 2015	150
Year 2015	515

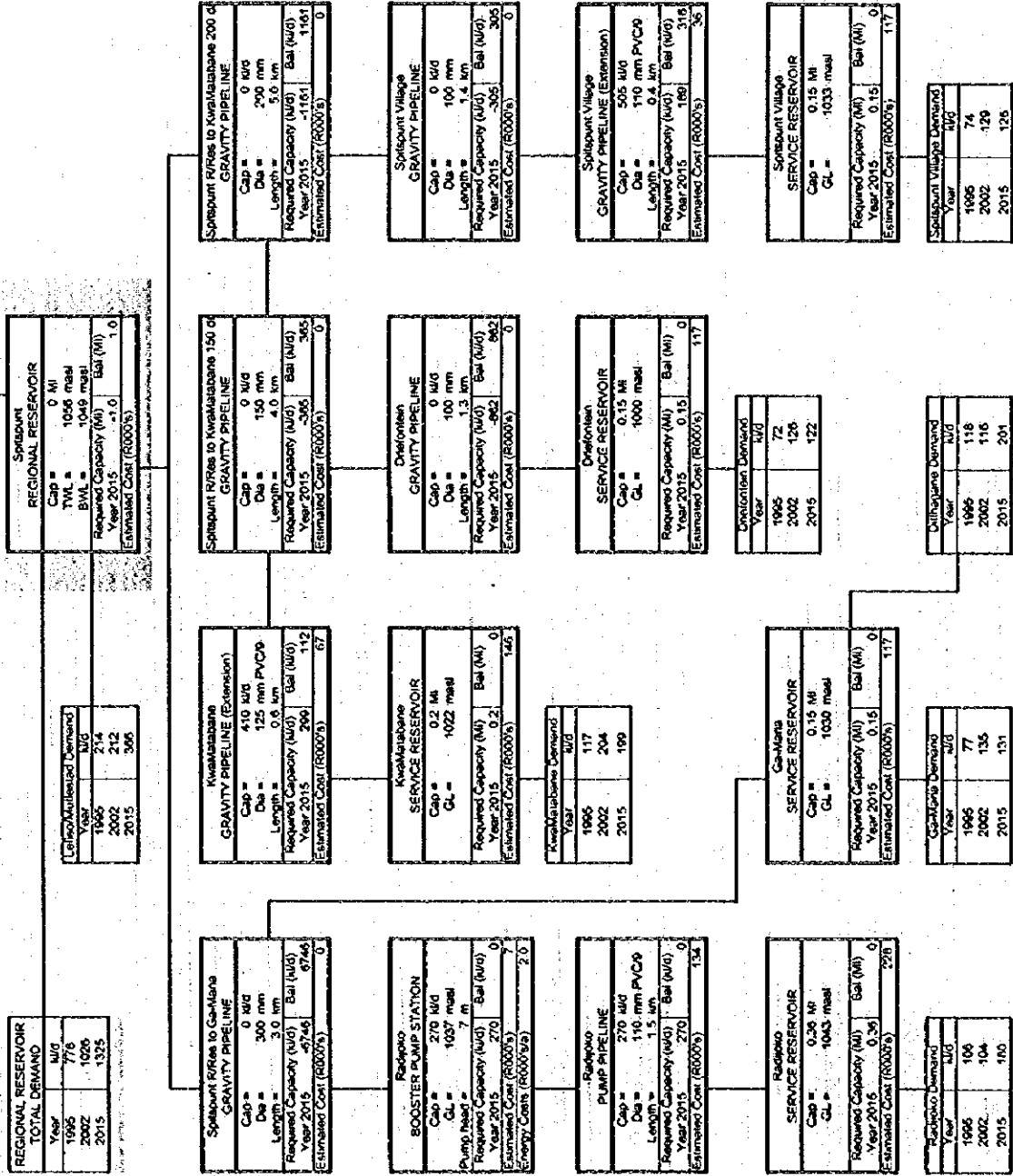
Semohlase SERVICE RESERVOIR	
Cap	0.15 Ml
GL	980 mm
Year 2015	0
Year 2015	117

Note : Pumping energy costs for main pump stations assume 1/2 cost due to Power (kVA) and 1/2 due to Energy (kWh), so that actual cost is 5% of that calculated for continuous pumping for a Peak Factor = 1.5 (ie. 16hrs per day).

EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. EWB/4P/2&3)
 SPITSPUNT TO KWAMATABANE AND RADJOKO : ALTERNATIVE 2 (Moretele 2 supplied from Weltevreden and Temba Purification Works)

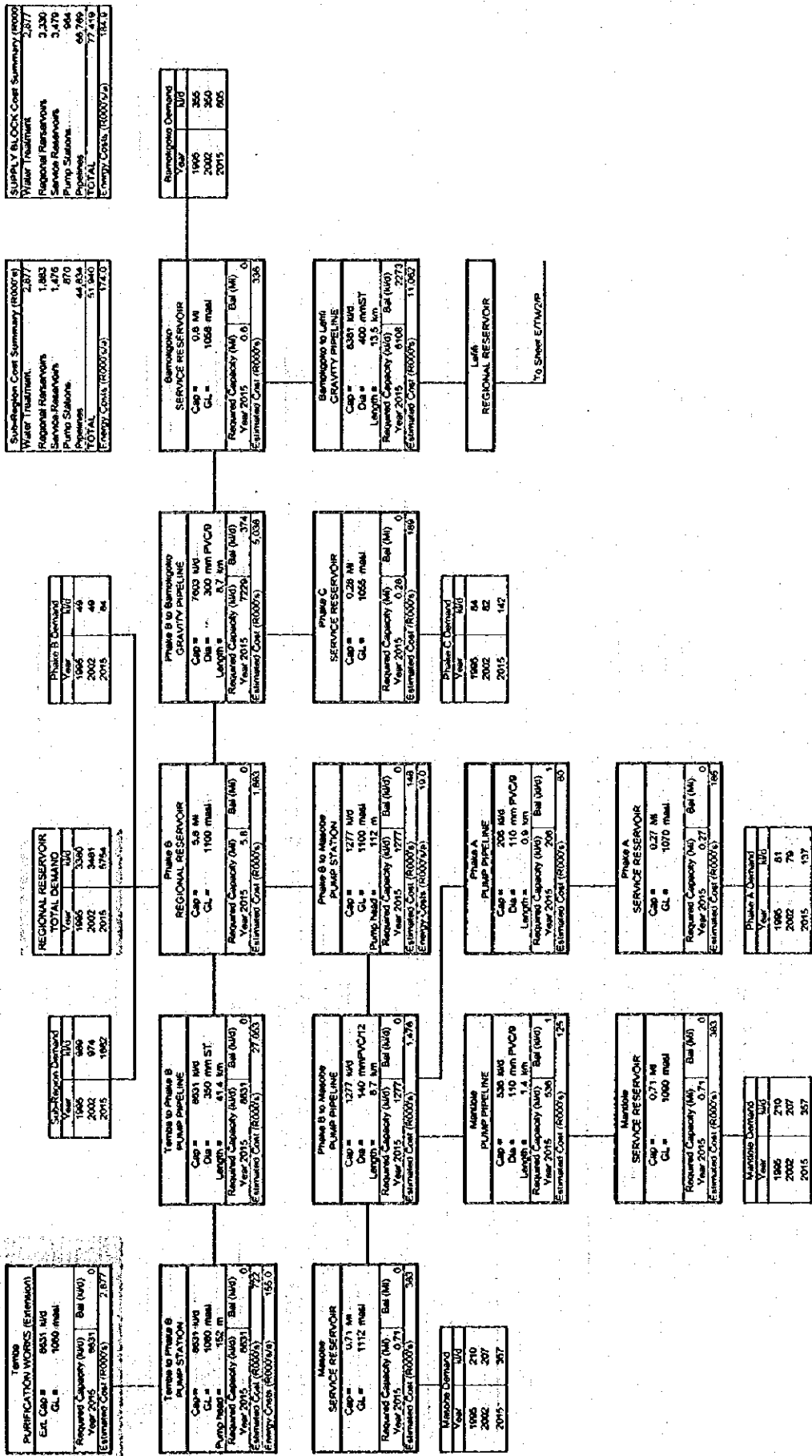
From Sheet No. EMBP/2

COST SUMMARY (R000's)	
Regional Reservoirs	0
Service Reservoirs	729
Pump Stations	237
Pipelines	689
TOTAL	1665
Energy Costs (R000/yr)	2.0



EASTERN ZONE : BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. ETM/1P)

TEMBA TO LEFIFI: ALTERNATIVE 2 (Moretele 2 supplied from Weltevreden and Temba Purification Works)



EASTERN ZONE : BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. E/TM/2P)

LEFIFI TO MARAPYANE : ALTERNATIVE 2 (Moretele 2 supplied from Weltevreden and Temba Purification Works)

From Sheet No. E/TM/1P

Lefifi REGIONAL RESERVOIR			
Cap	4.1 MI		
GL	1032 masl		
Required Capacity (M)		Bal (M)	0
Year 2015	4.1		1,447
Estimated Cost (R000's)			

REGIONAL RESERVOIR TOTAL DEMAND		
Year	k/d	
1995	2391	
2002	2507	
2015	4072	

COST SUMMARY (R000's)	
Regional Reservoirs	1,447
Service Reservoirs	2,003
Pump Stations	94
Pipelines	21,935
TOTAL	25,479
Energy Costs (R000's/a)	10.3

Lefifi Demand	
Year	k/d
1995	474
2002	474
2015	808

Ga-Ramantshane Demand	
Year	k/d
1995	623
2002	614
2015	1061

Lefifi to Rapolokwane GRAVITY PIPELINE		
Cap	1270 k/d	
Dia	160 mm PVC/9	
Length	6.9 km	
Required Capacity (k/d)		Bal (k/d)
Year 2015	466	784
Estimated Cost (R000's)		1,197

Lefifi to Ga-Ramantshane PUMP PIPELINE		
Cap	5789 k/d	
Dia	450 mm ST	
Length	13.5 km	
Required Capacity (k/d)		Bal (k/d)
Year 2015	4410	1379
Estimated Cost (R000's)		13,490

Ga-Ramantshane SERVICE RESERVOIR		
Cap	1.1 MI	
GL	1022 masl	
Required Capacity (M)		Bal (M)
Year 2015	1.1	0
Estimated Cost (R000's)		632

Ga-Ramantshane to Marapyane GRAVITY PIPELINE		
Cap	2589 k/d	
Dia	300 mm PVC/9	
Length	10.6 km	
Required Capacity (k/d)		Bal (k/d)
Year 2015	1911	678
Estimated Cost (R000's)		6,138

Oppenung GRAVITY PIPELINE		
Cap	595 k/d	
Dia	110 mm PVC/9	
Length	3.1 km	
Required Capacity (k/d)		Bal (k/d)
Year 2015	188	400
Estimated Cost (R000's)		98

Rapolokwane SERVICE RESERVOIR		
Cap	0.33 MI	
GL	966 masl	
Required Capacity (M)		Bal (M)
Year 2015	0.33	0
Estimated Cost (R000's)		213

Ga-Ramantshane to Kalkfontein PUMP STATION		
Cap	908 k/d	
GL	1022 masl	
Pump head	84 m	
Required Capacity (k/d)		Bal (k/d)
Year 2015	908	94
Estimated Cost (R000's)		10.9
Energy Costs (R000's/a)		

Marapyane SERVICE RESERVOIR		
Cap	1.2 MI	
GL	1011 masl	
Required Capacity (M)		Bal (M)
Year 2015	1.2	0
Estimated Cost (R000's)		569

Oppenung SERVICE RESERVOIR		
Cap	0.15 MI	
GL	1005 masl	
Required Capacity (M)		Bal (M)
Year 2015	0.15	0
Estimated Cost (R000's)		117

Kalkfontein Demand		
Year	k/d	
1995	675	
2002	664	
2015	1149	

Rapolokwane Demand	
Year	k/d
1995	190
2002	333
2015	324

Ga-Ramantshane to Kalkfontein PUMP PIPELINE		
Cap	908 k/d	
Dia	125 mm PVC/12	
Length	7.3 km	
Required Capacity (k/d)		Bal (k/d)
Year 2015	908	1,012
Estimated Cost (R000's)		

Kalkfontein SERVICE RESERVOIR		
Cap	1.2 MI	
GL	1028 masl	
Required Capacity (M)		Bal (M)
Year 2015	1.2	0
Estimated Cost (R000's)		572

Marapyane Demand		
Year	k/d	
1995	675	
2002	664	
2015	1149	

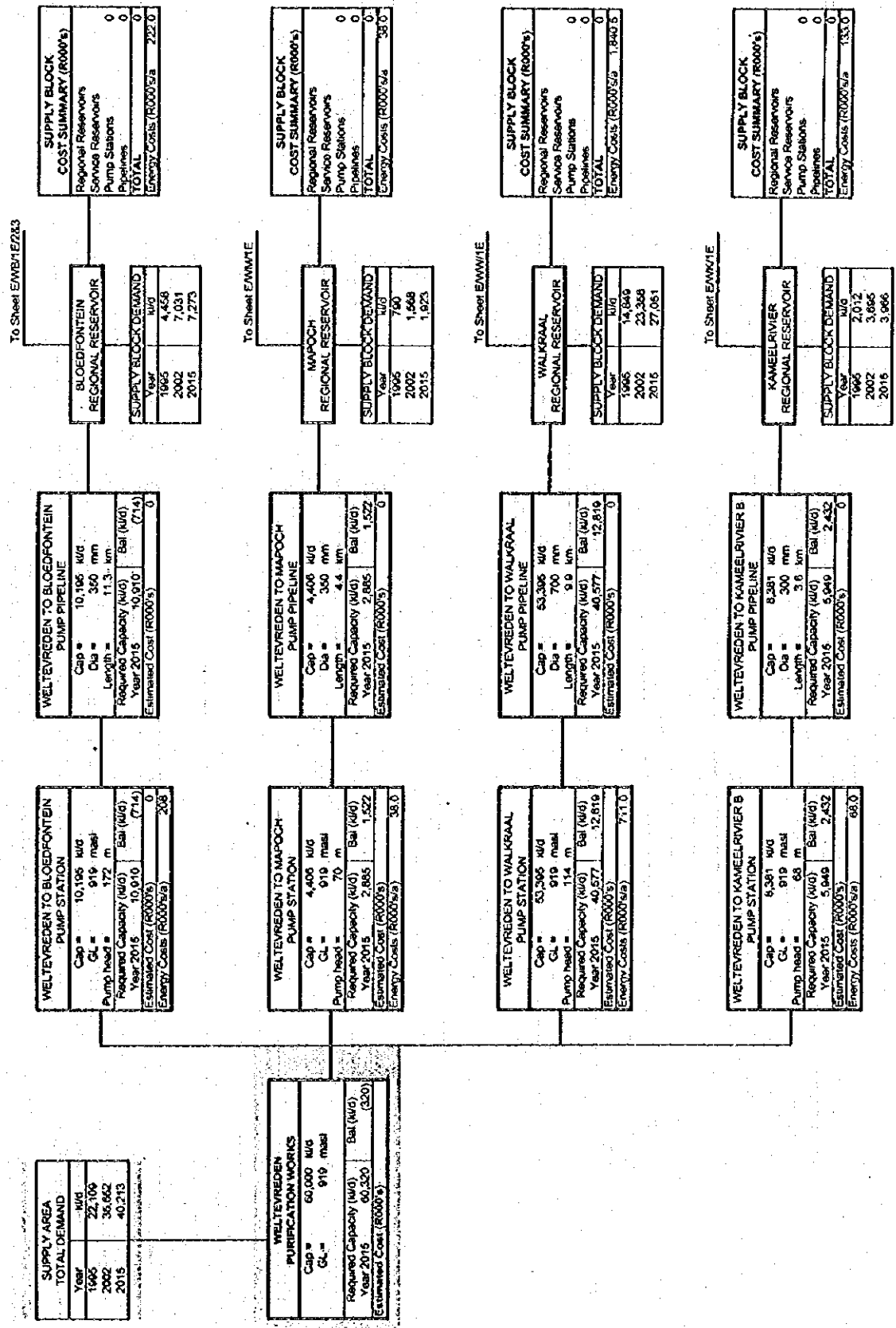
Oppenung Demand		
Year	k/d	
1995	74	
2002	72	
2015	125	

COST SUMMARY FOR INFRASTRUCTURE		
NAME OF SUPPLY AREA :	WELTEVREDEN ALTERNATIVE 3	
INCLUDING SUPPLY BLOCKS :	SPLIT BETWEEN WELTEVREDEN AND RUST DE WINTER (New treatment works)	
	1. Waalkraal Supply Block	3. Mapoch Supply Block
	2. Kameelrivier Supply Block	4. Bloedfontein Supply Block
POPULATION SERVED (2016) :	631,276	
AADD in mcm/a (2015) :	19.01	
BULK COST :	QUANTITY	COST (R million)
Water Purification Works	Kl/d (SDD)	
1. Weltevreden WTW	320	0.107
2. Rust de Winter WTW	8,631	2.877
Pump Stations	Kl/d (SDD)	
A : Capital Cost		
1. Weltevreden (Bloedfontein) CWPS	714	0.124
2. Leuwfontein PS	575	0.053
3. Matshipe A	362	0.059
4. Spitspunt BPS	217	0.023
5. Tshikanossi BPS	284	0.007
6. Mmakola BPS	323	0.020
7. Radijoko BPS	270	0.007
8. Ramantsho	33	0.006
9. Rust de Winter CWPS	8,631	0.621
10. Phake B	1,277	0.148
11. Ga Ramatshane	908	0.094
	Sub-Total	1.162
B : Annual Energy Cost (Not Incl'd with Total)		
1. Weltevreden (Bloedfontein) CWPS	-	0.015
2. Leuwfontein PS	-	0.058
3. Matshipe A	-	0.006
4. Spitspunt BPS	-	0.003
5. Tshikanossi BPS	-	0.002
6. Mmakola BPS	-	0.003
7. Radijoko BPS	-	0.002
8. Ramantsho	-	0.002
9. Rust de Winter CWPS	-	0.126
10. Phake B	-	0.019
11. Ga Ramatshane	-	0.011
	Sub-Total	0.247
Reservoirs (Regional)	Ml	
N/A	NIL	NIL
Pipelines (Bulk)	km	
1. 110 PVC	76.7	7.120
2. 125 PVC	10.2	1.336
3. 140 PVC	10.8	1.764
4. 160 PVC	28.4	5.831
5. 200 PVC	13.1	3.383
6. 250 PVC	0	0.000
7. 300 PVC	28.9	16.529
8. 315 PVC	0	0.000
9. 350 ST	0	0.000
10. 400 ST	13.5	11.062
11. 450 ST	13.5	13.490
	Sub-Total	60.515

Sub Total Construction Cost		61.784
Engineering Fees (15 %)		9.268
VAT (14 %)		9.947
Project Contingency (20%)		16.200
TOTAL : Bulk Cost		97.199
Bulk Cost per Capita (Rands)		154
SECONDARY COST :	QUANTITY	COST (R million)
Reservoirs (Service)	MI	
1. Bloedfontein Supply Block	6.71 (23 No)	4.354
	6.55 (10 No)	3.479
2. Waalkraal Supply Block	10.17 (25 No)	5.812
3. Kameelfrivier Supply Block	0.92 (2 No)	0.523
4. Mapoch Supply Block	0	0.000
	Sub-Total	14.168
Water Towers	MI	
N/A	NIL	NIL
Pump Stations (Secondary)	KVd	
A : Capital Cost		
N/A	NIL	NIL
B : Annual Energy Cost (Not Inc'd with Total)		
N/A	NIL	NIL
Pipelines (Secondary)	km	
	NIL	NIL
Reticulation	km	
1. Bloedfontein Supply Block		99.837
2. Waalkraal Supply Block		95.056
3. Kameelfrivier Supply Block		12.356
4. Mapoch Supply Block		6.851
	Sub-Total	214.100
Sub Total Construction Cost		228.268
Engineering Fees (15 %)		34.240
VAT (14 %)		36.751
Project Contingency (20%)		59.852
TOTAL : Secondary Cost		359.111
Secondary Cost per Capita (Rands)		569
GRAND TOTAL COST		456.310
Grand Total Cost per Capita (R)		723

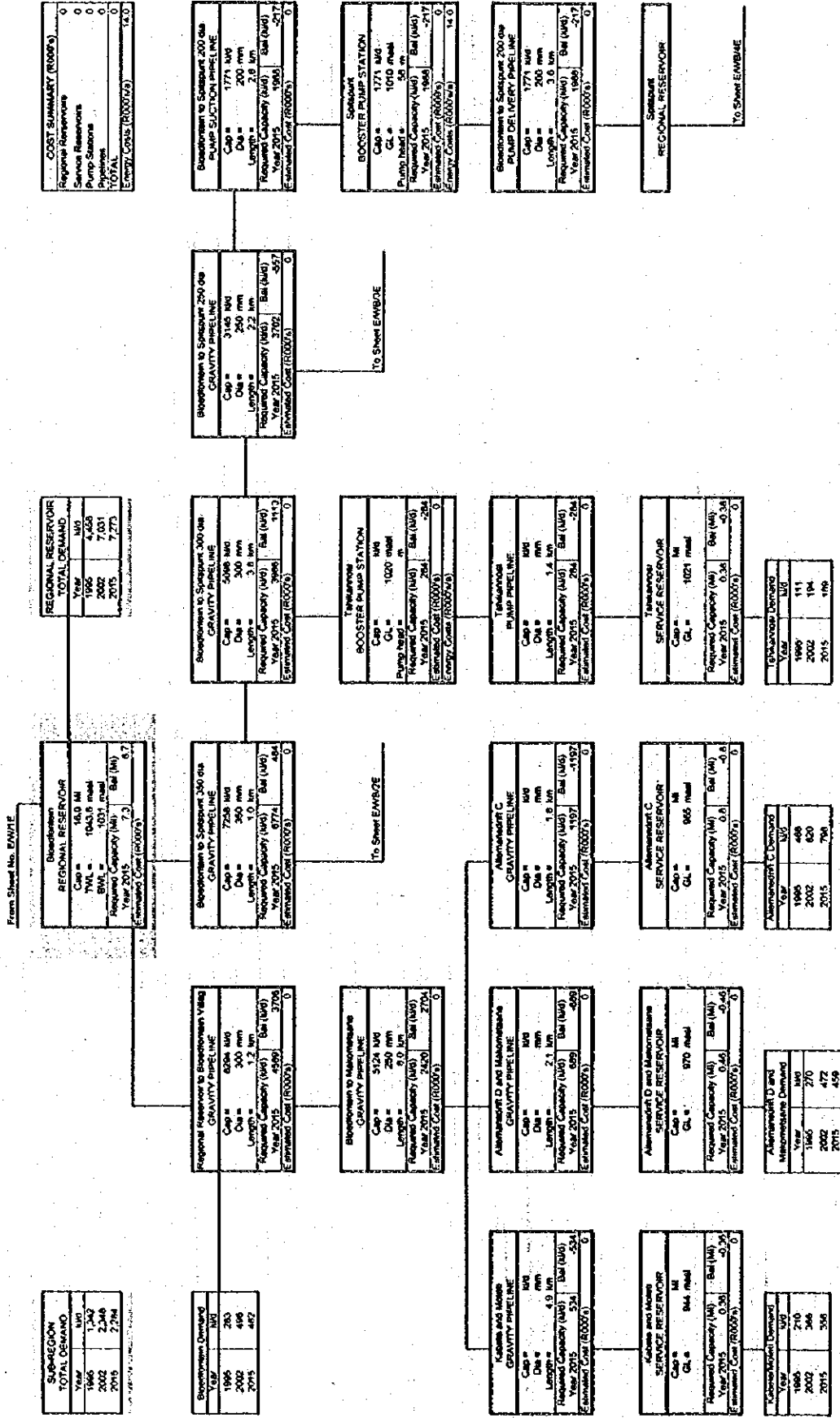
EASTERN ZONE : WELTEVREDEN SUPPLY AREA : EXISTING INFRASTRUCTURE (EW/1E/2&3)

ALTERNATIVE 3 (Moretele 2 supplied from Weltevreden and Rust De Winter Dam)



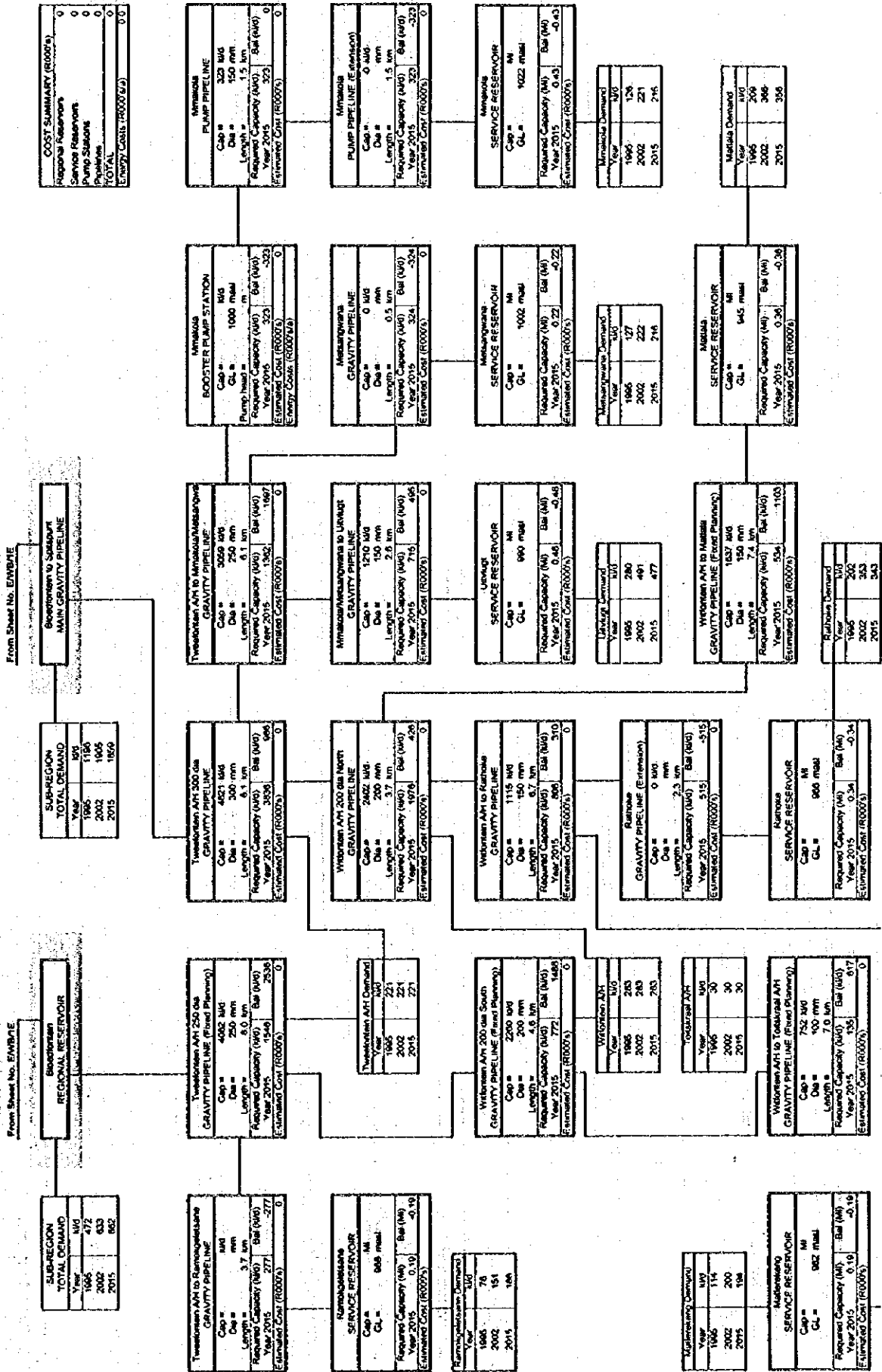
EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. E/WB/1E/2&3)

BLOEDFONTEIN TO SPITSPUNT : ALTERNATIVE 3 (Moretele 2 supplied from Weltevreden and Rust De Winter Dam)



EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. EWB/2E)

BLOEDFONTEIN TO UITYVLUGT, RATHOKE AND MATLALA : ALTERNATIVE 3 (Moretele 2 supplied from Weltevreden Purification Works and Rust De Winter Dam)

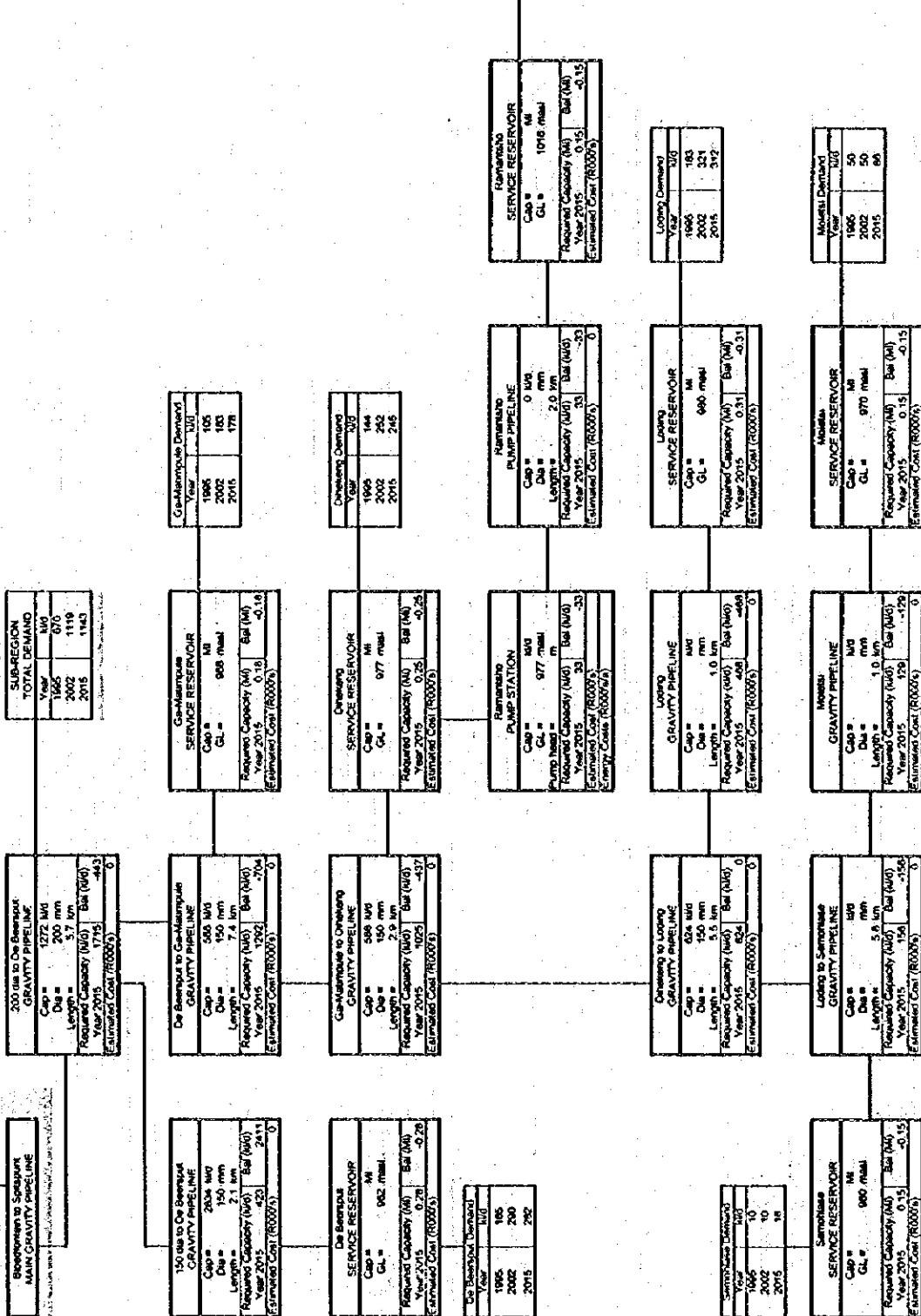


EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. EWB/3E)

FROM BLOEDFONTEIN/SPITSPIJNT PIPELINE TO SEMOHLASE 3 (Moretele 2 supplied from Weltevreden Purification Works and Rust De Winter Dam)

From Sheet No. EWB/4E

COST SUMMARY (R000's)	
Regional Reservoirs	0
Service Reservoirs	0
Pump Stations	0
Pipelines	0
TOTAL	0
ENERGY COSTS (R000's/yr)	0.0



Note : Pumped energy costs for main pump stations assume 1/2 cost due to Power (kVA) and 1/2 due to Energy (kWh), so that actual cost is 5/6 of that calculated for continuous pumping for a Peak Factor = 1.5 (ie. 16hrs per day).

EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. E/WB/4E/2&3)

SPITSPUNT TO KWAMATABANE AND RADIJOKO : ALTERNATIVE 3 (Moretele 2 supplied from Weltevreden and Rust De Winter Dam)

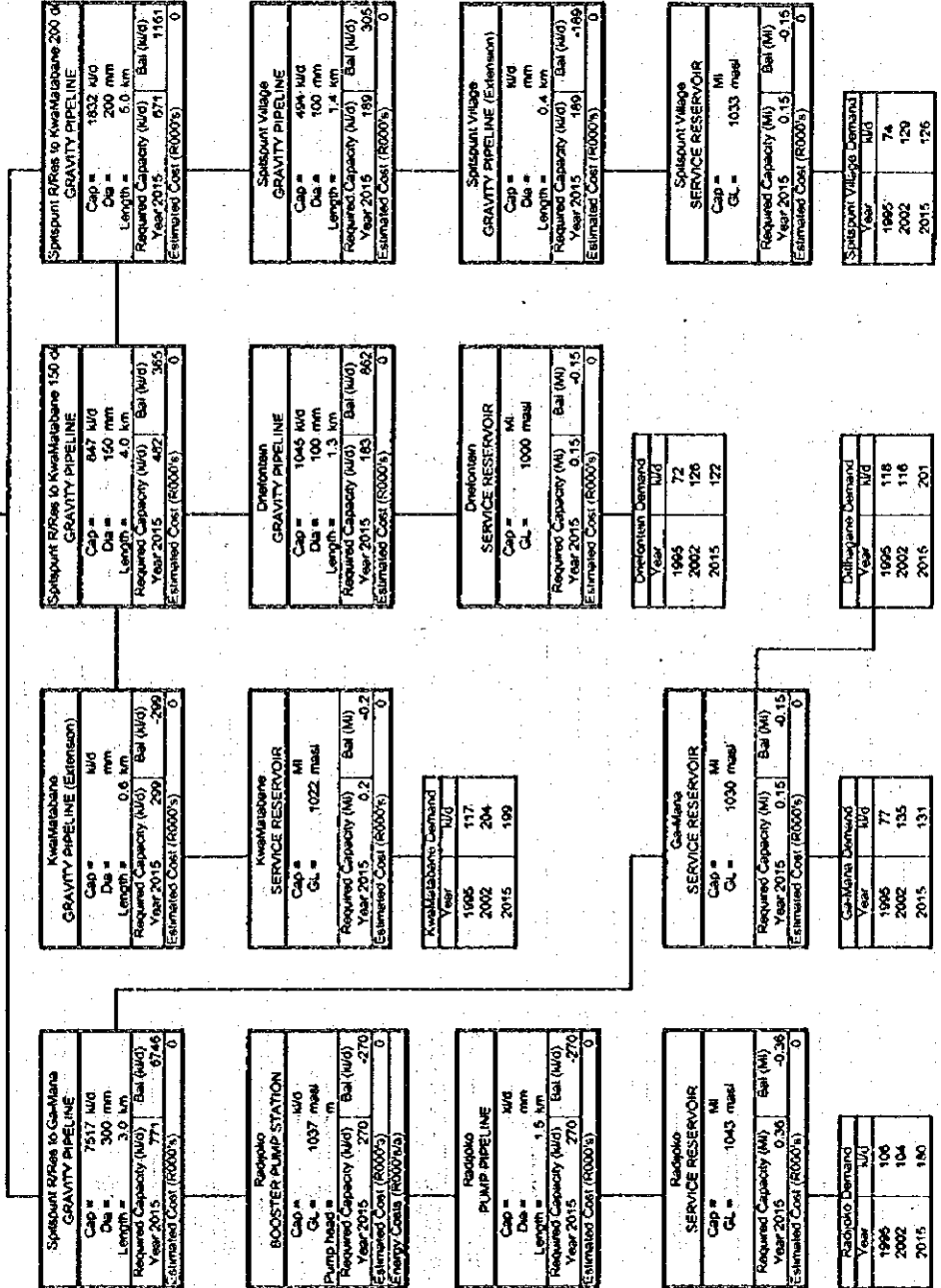
From Sheet No. E/WB/4E/2

REGIONAL RESERVOIR TOTAL DEMAND	
Year	MGD
1995	778
2002	1026
2015	1325

Letsoho/Musalele Demand	
Year	MGD
1995	214
2002	212
2015	365

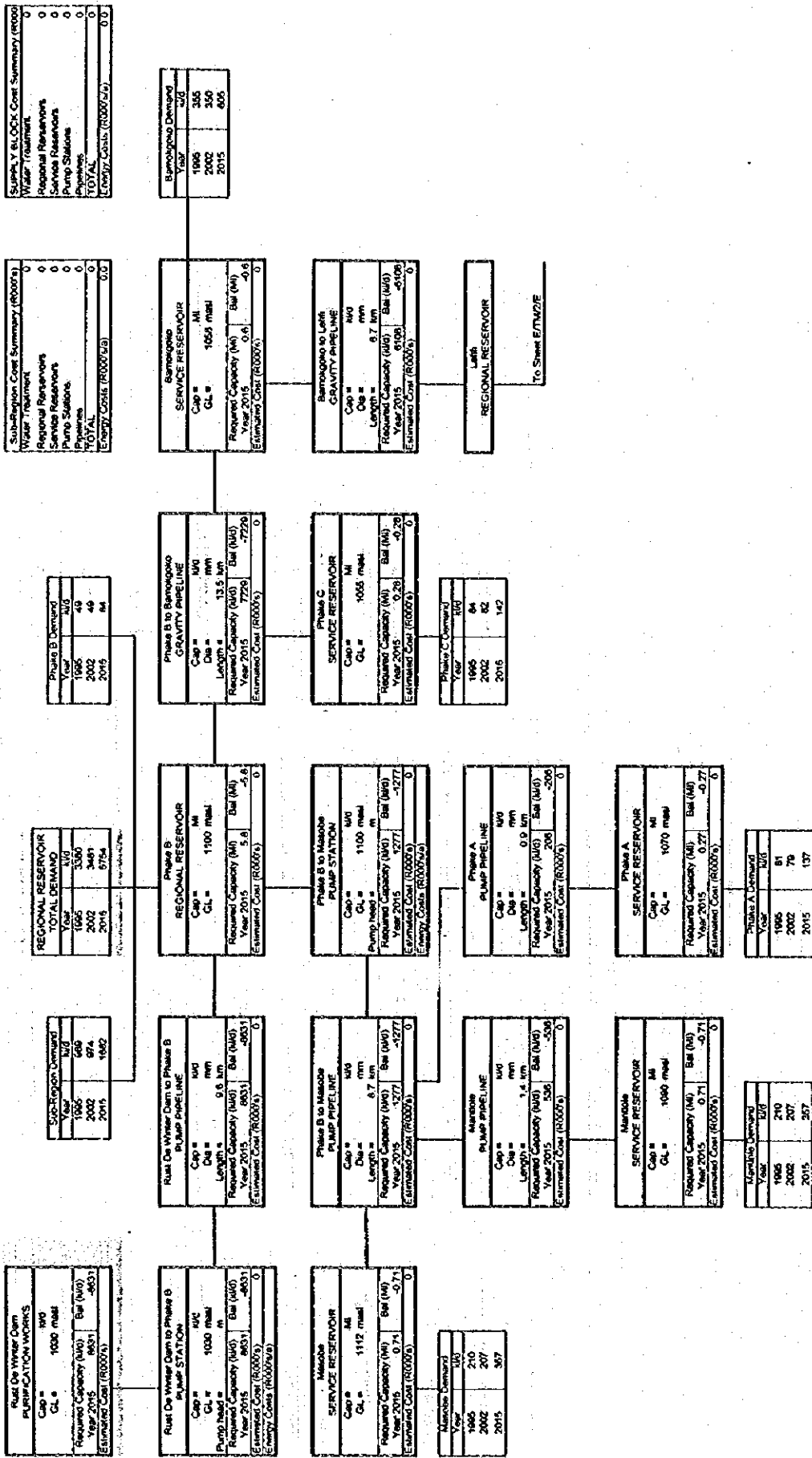
SPITSPUNT REGIONAL RESERVOIR	
Cap	2.7 MI
TWL	1955 masl
BWL	1049 masl
Required Capacity (MG)	1.0
Year 2015	1.7
Estimated Cost (R2000's)	0

COST SUMMARY (R2000's)	
Regional Reservoirs	0
Service Reservoirs	0
Pump Stations	0
Pipelines	0
TOTAL	0
Energy Costs (R2000's/a)	0.0



EASTERN ZONE : BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. E/RM/1E)

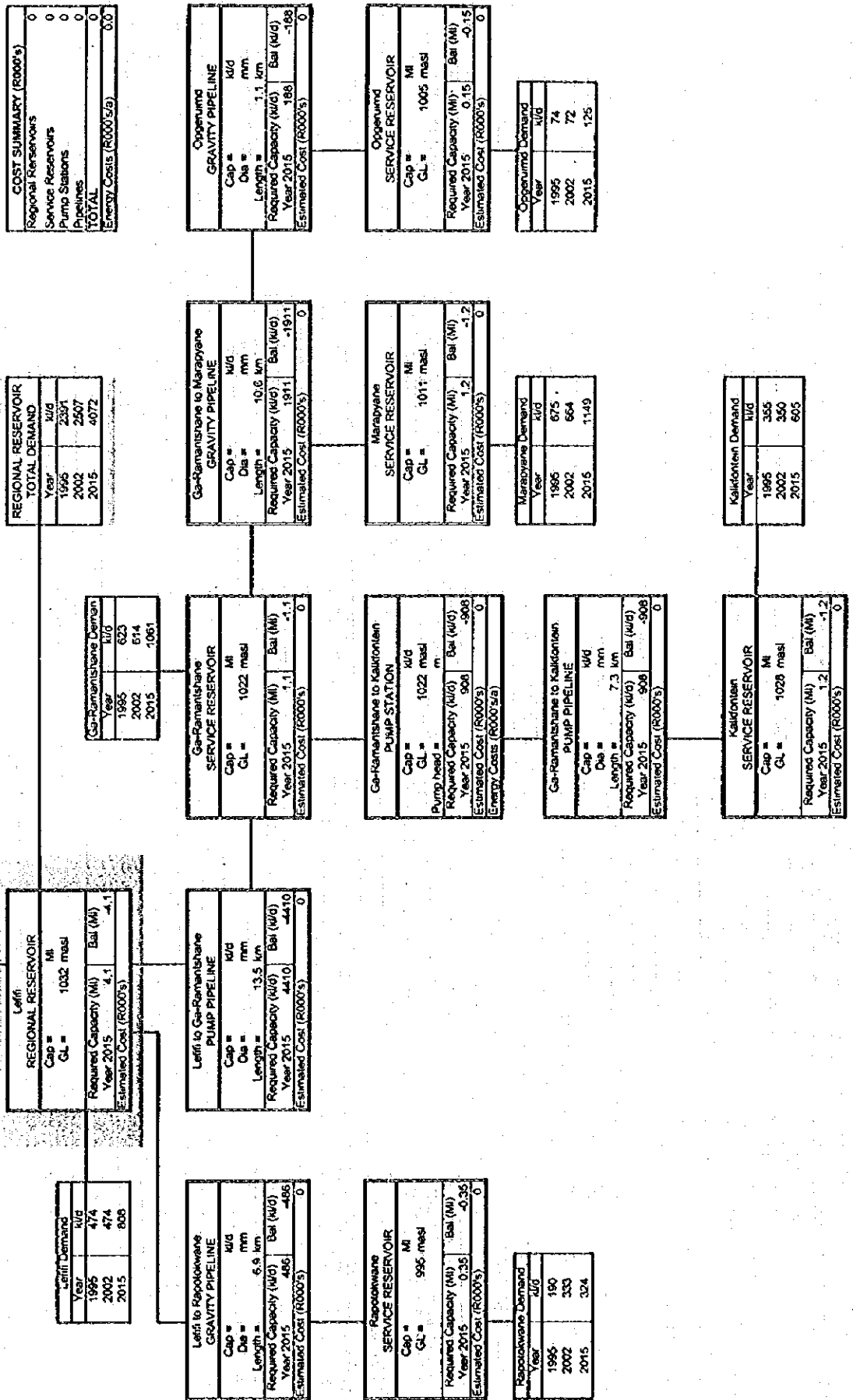
RUST DE WINTER TO LEFIFI : ALTERNATIVE 3 (Moretele 2 supplied from Weitevreeden Purification Works and Rust De Winter Dam)



EASTERN ZONE : BLOEDFONTEIN SUPPLY BLOCK : EXISTING INFRASTRUCTURE (Sheet No. E/TM/2E)

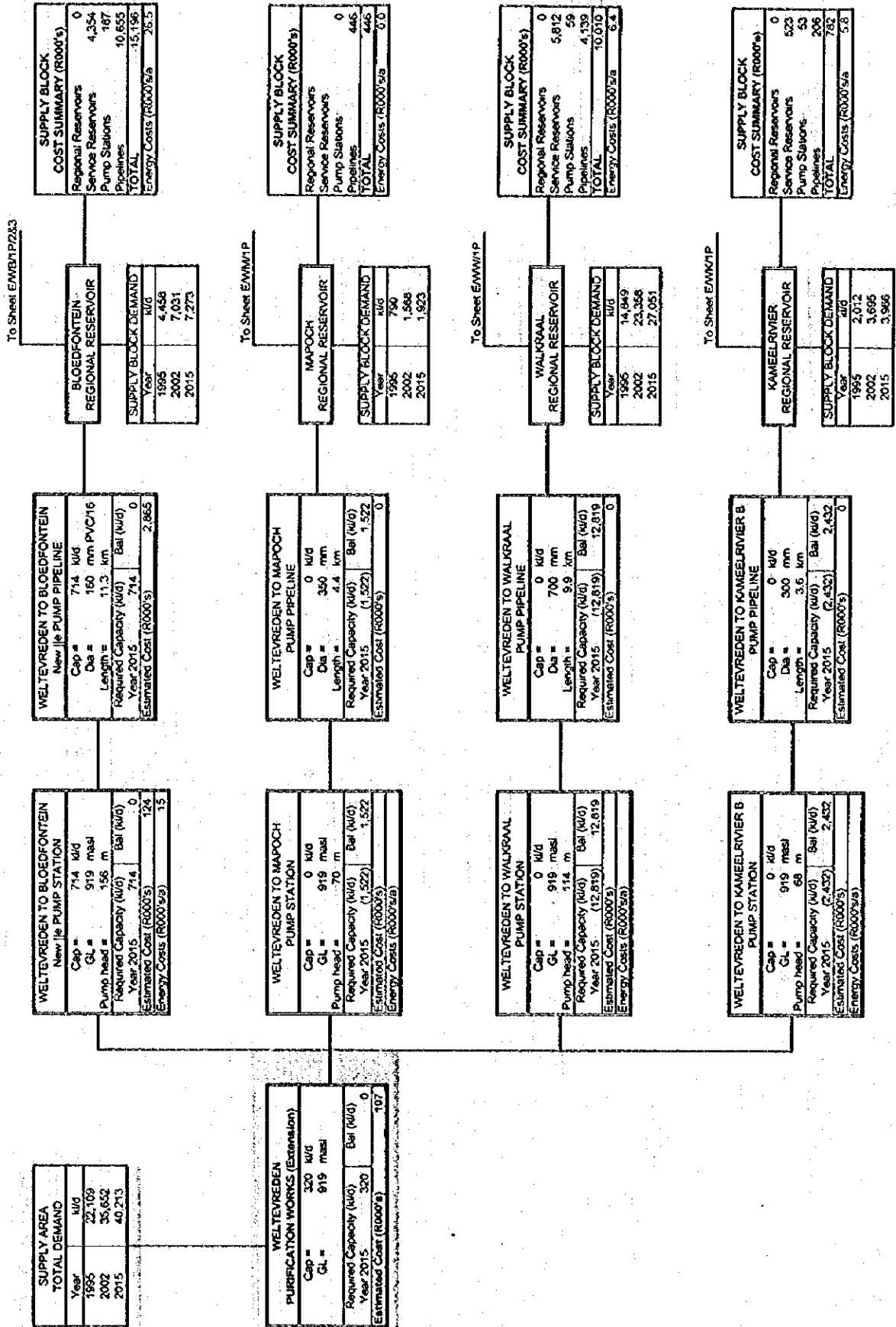
LEFIFI TO MARAPYANE : ALTERNATIVE 3 (Moretele 2 supplied from Weitevreden and Rust De Winter Dam)

From Sheet No. E/TM/1E



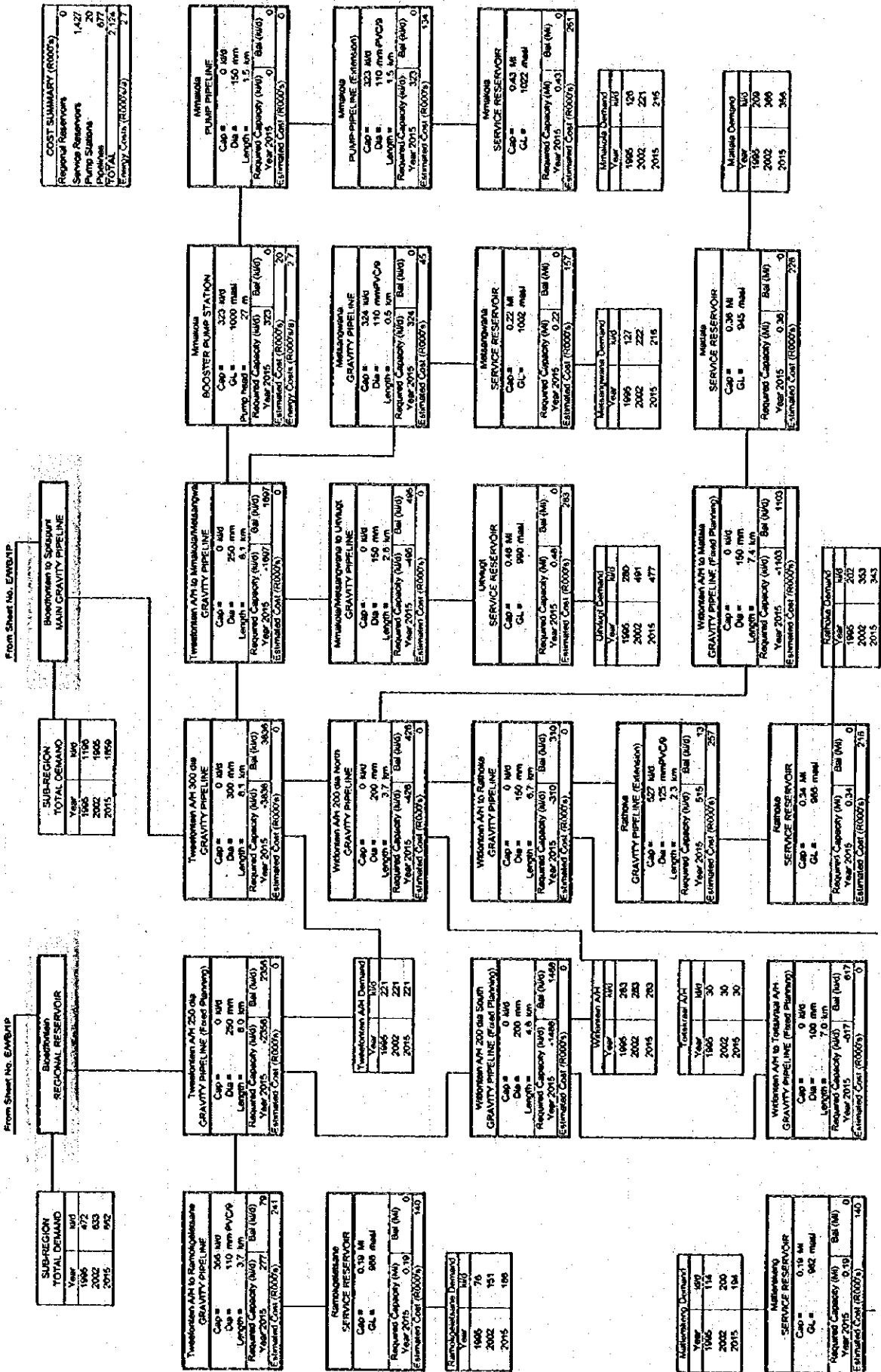
EASTERN ZONE : WELTEVREDEN SUPPLY AREA : PROPOSED INFRASTRUCTURE (EW/1P/2&3)

ALTERNATIVE 3 (Moretele 2 supplied from Weltevreden and Rust De Winter Dam)



EASTERN ZONE : WELTVEREDEN - BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. E/WB/2P)

BLOEDFONTEIN TO UITYLUGT, RATHOKE AND MATLALA : ALTERNATIVE 2 (Moretele 2 supplied from Weltvredden Purification Works and Tembisa Purification Works)



From Sheet No. E/WB/1P

SUB-REGION TOTAL DEMAND	
Year	Mld
1995	472
2002	533
2015	952

From Sheet No. E/WB/1P

Bloemfontein REGIONAL RESERVOIR	
Year	Mld
1995	1180
2002	1905
2015	1959

From Sheet No. E/WB/1P

Bloemfontein to Spiesburg MAIN GRAVITY PIPELINE	
Year	Mld
1995	1180
2002	1905
2015	1959

COST SUMMARY (R000's)	
Regional Reservoirs	0
Service Reservoirs	1427
Pump Stations	20
Pipelines	677
TOTAL	2124
Energy Costs (R000/yr)	2

Tloetseng A/H to Ramothole GRAVITY PIPELINE	
Cap	366 Mld
Di	110 mm PVC/P
Length	3.7 km
Required Capacity (Mld)	Bar (Mld)
Year 2015	277
Year 2015	255
Year 2015	250
Year 2015	250
Estimated Cost (R000's)	741

Ramothole SERVICE RESERVOIR	
Cap	0.19 M
GL	980 msl
Required Capacity (Mld)	Bar (Mld)
Year 2015	0.19
Year 2015	0.19
Year 2015	0.19
Estimated Cost (R000's)	140

Ramothole Demand	
Year	Mld
1995	76
2002	151
2015	186

Mafikeng Demand	
Year	Mld
1995	99
2002	114
2015	154

Mafikeng SERVICE RESERVOIR	
Cap	0.19 M
GL	942 msl
Required Capacity (Mld)	Bar (Mld)
Year 2015	0.19
Year 2015	0.19
Year 2015	0.19
Estimated Cost (R000's)	140

EASTERN ZONE : WELTEVREDEN - BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. E/WB/3P)

FROM BLOEDFONTEIN SPUNT PIPELINE TO SEMOHASE : ALTERNATIVE 3 (Moretele 2 supplied from Weltevreden Purification Works and Rust De Winter Dam)

From Sheet No. E/WB/2P

Blossfontein to Spontpunt MAIN GRAVITY PIPELINE	
Cap =	1272 MM
Di =	500 mm
Length =	5.7 km
Required Capacity (M3) Bar (M3)	823 (823)
Year 2015	443
Estimated Cost (R0000's)	1,872

SUP-REGION TOTAL DEMAND	
Year	1986
Year	2002
Year	2015
1986	105
2002	183
2015	178

COST SUMMARY (R0000's)	
Regional Reservoirs	1,045
Pump Stations	4,761
Pipelines	5,812
TOTAL	11,618
Energy Costs (R0000's)	1.0

150 dia to De Beersfontein GRAVITY PIPELINE	
Cap =	0.80
Di =	150 mm
Length =	2.1 km
Required Capacity (M3) Bar (M3)	2411
Year 2015	2411
Estimated Cost (R0000's)	0

De Beersfontein to G&M-Matruus New 150 GRAVITY PIPELINE	
Cap =	1272 MM
Di =	500 mm
Length =	7.4 km
Required Capacity (M3) Bar (M3)	598
Year 2015	704
Estimated Cost (R0000's)	1,511

G&M-Matruus SERVICE RESERVOIR	
Cap =	0.15 M
GL =	948 msl
Required Capacity (M3) Bar (M3)	0
Year 2015	0.18
Estimated Cost (R0000's)	1.33

G&M-Matruus Demand	
Year	1986
Year	2002
Year	2015
1986	105
2002	183
2015	178

De Beersfontein SERVICE RESERVOIR	
Cap =	0.25 M
GL =	942 msl
Required Capacity (M3) Bar (M3)	188
Year 2015	0.26
Estimated Cost (R0000's)	0

G&M-Matruus to Omsiesing New 150 GRAVITY PIPELINE	
Cap =	545 MM
Di =	180 mm PVC/Cp
Length =	2.6 km
Required Capacity (M3) Bar (M3)	151
Year 2015	437
Estimated Cost (R0000's)	503

Omsiesing SERVICE RESERVOIR	
Cap =	0.25 M
GL =	977 msl
Required Capacity (M3) Bar (M3)	0
Year 2015	0.25
Estimated Cost (R0000's)	170

Omsiesing Demand	
Year	1986
Year	2002
Year	2015
1986	144
2002	252
2015	245

De Beersfontein Demand	
Year	1986
Year	2002
Year	2015
1986	105
2002	240
2015	240

Rust de Winter PUMP STATION	
Cap =	33 MM
GL =	977 msl
Pump Head =	42 m
Length =	4.2 km
Required Capacity (M3) Bar (M3)	0
Year 2015	33
Estimated Cost (R0000's)	1.9

Rust de Winter SERVICE RESERVOIR	
Cap =	0.15 M
GL =	1019 msl
Required Capacity (M3) Bar (M3)	0
Year 2015	0.15
Estimated Cost (R0000's)	117

Rust de Winter Demand	
Year	1986
Year	2002
Year	2015
1986	13
2002	13
2015	22

Semohase SERVICE RESERVOIR	
Cap =	0.15 M
GL =	940 msl
Required Capacity (M3) Bar (M3)	0
Year 2015	0.15
Estimated Cost (R0000's)	117

Omsiesing to Loring GRAVITY PIPELINE	
Cap =	0.80
Di =	150 mm
Length =	5.5 km
Required Capacity (M3) Bar (M3)	0
Year 2015	0
Estimated Cost (R0000's)	0

Loring GRAVITY PIPELINE	
Cap =	516 MM
Di =	110 mm PVC/Cp
Length =	1.0 km
Required Capacity (M3) Bar (M3)	111
Year 2015	496
Estimated Cost (R0000's)	56

Loring SERVICE RESERVOIR	
Cap =	0.31 M
GL =	960 msl
Required Capacity (M3) Bar (M3)	0
Year 2015	0.31
Estimated Cost (R0000's)	203

Loring Demand	
Year	1986
Year	2002
Year	2015
1986	163
2002	321
2015	312

Semohase SERVICE RESERVOIR	
Cap =	0.15 M
GL =	940 msl
Required Capacity (M3) Bar (M3)	0
Year 2015	0.15
Estimated Cost (R0000's)	117

Loring to Semohase GRAVITY PIPELINE	
Cap =	222 MM
Di =	110 mm PVC/Cp
Length =	5.8 km
Required Capacity (M3) Bar (M3)	156
Year 2015	156
Estimated Cost (R0000's)	518

Omsiesing SERVICE RESERVOIR	
Cap =	0.15 M
GL =	970 msl
Required Capacity (M3) Bar (M3)	0
Year 2015	0.15
Estimated Cost (R0000's)	117

Omsiesing Demand	
Year	1986
Year	2002
Year	2015
1986	144
2002	252
2015	245

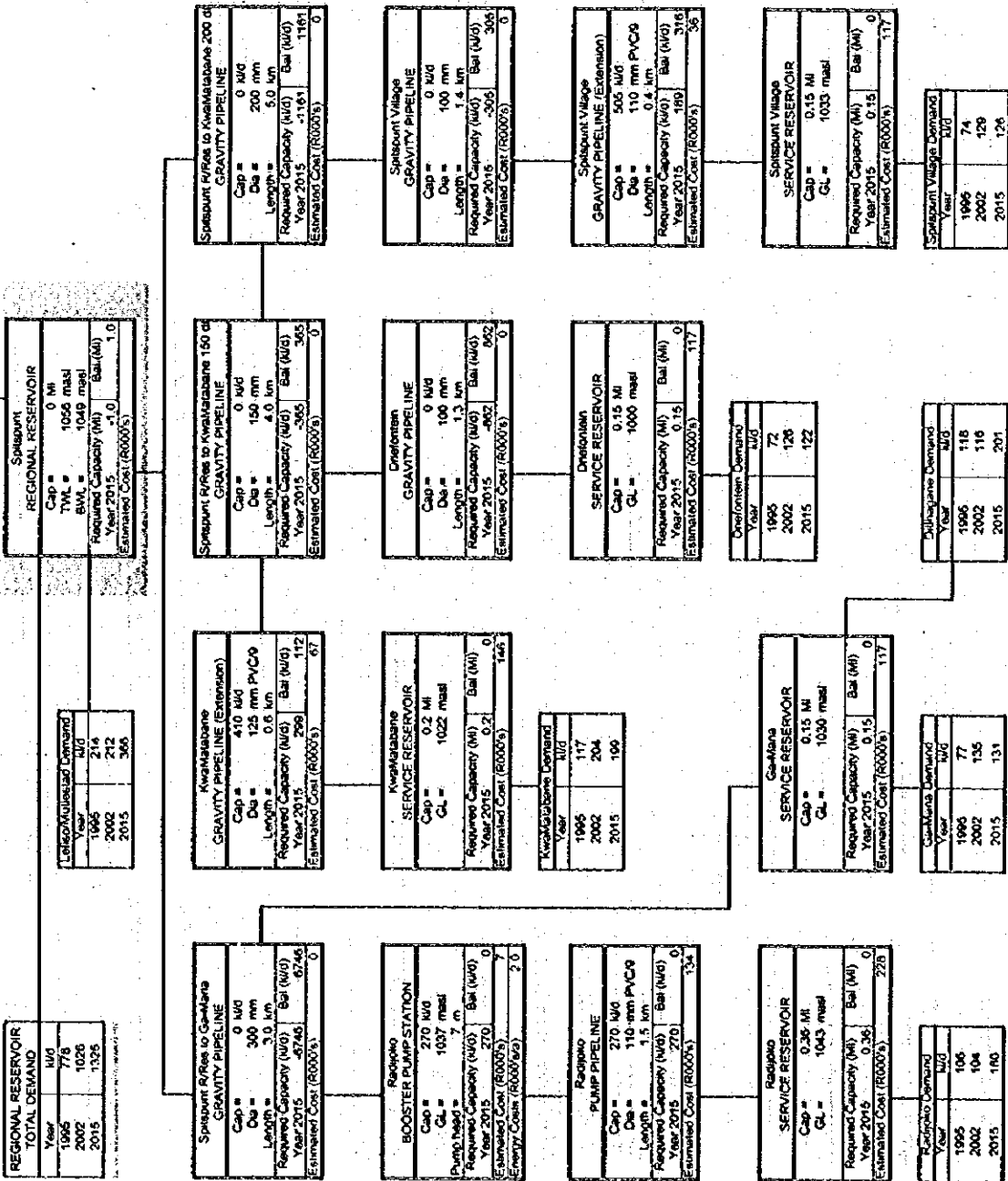
Note: Pumping energy costs for main pump stations assume 12 cost unit to Power (KVA) and 12 cost to Energy (kWh), so that total cost is 50¢/m³ that calculated for continuous pumping at a Peak Factor = 1.5 (th. ltr. per day).

EASTERN ZONE : WELTEVREDEN - BLOEDFONTAIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. EWB/4P/2&3)

SPITSPUNT TO KWAMATABANE AND RADJOKO : ALTERNATIVE 3 (Moretele 2 supplied from Weltevreden and Rust De Winter Dam)

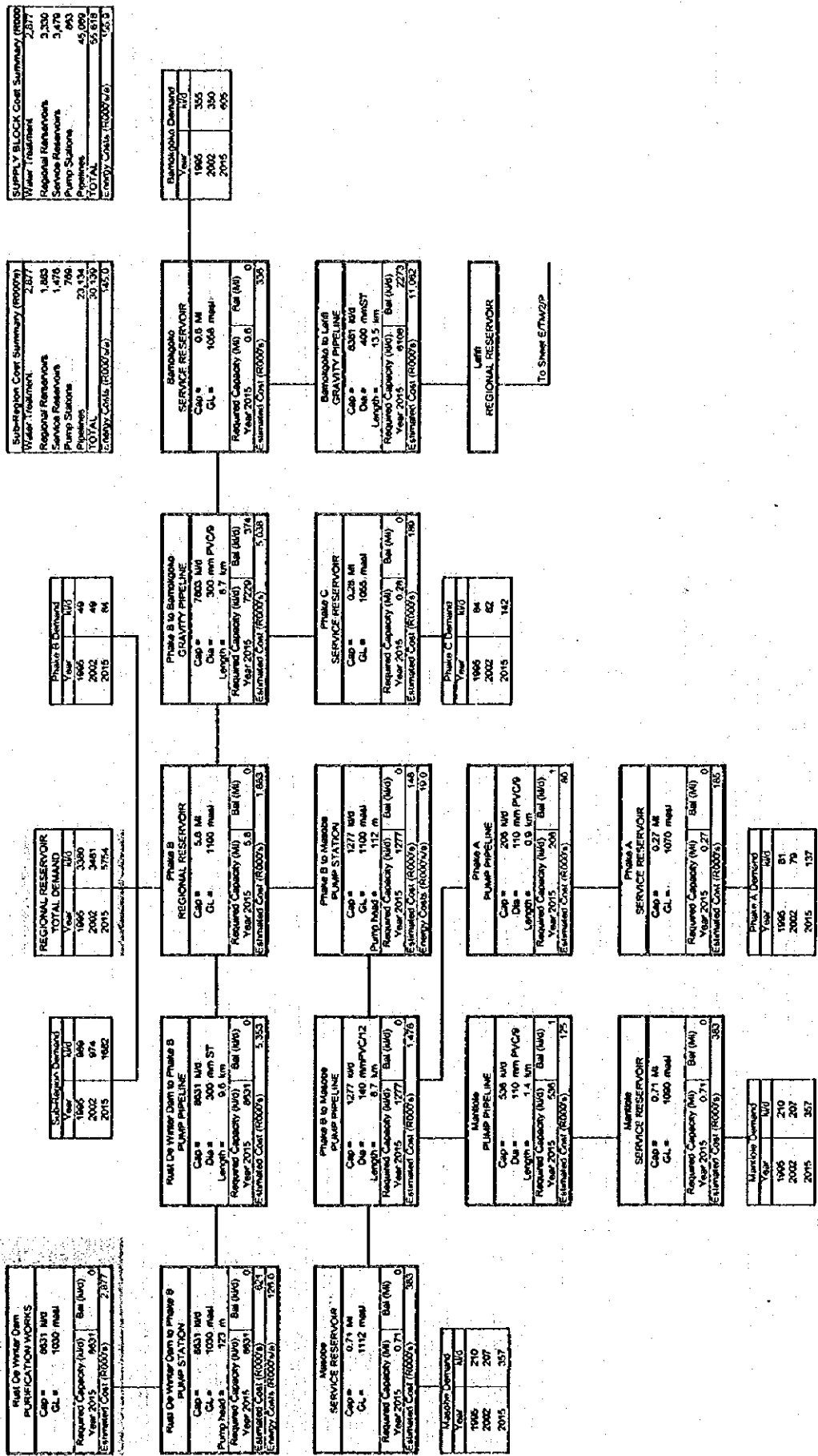
From Sheet No. EAWMEZ

COST SUMMARY (R000's)	
Regional Reservoirs	0
Service Reservoirs	725
Pump Stations	7
Pipelines	237
TOTAL	969
Energy Costs (R000's/a)	2.0



EASTERN ZONE : BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. E/RM/1P)

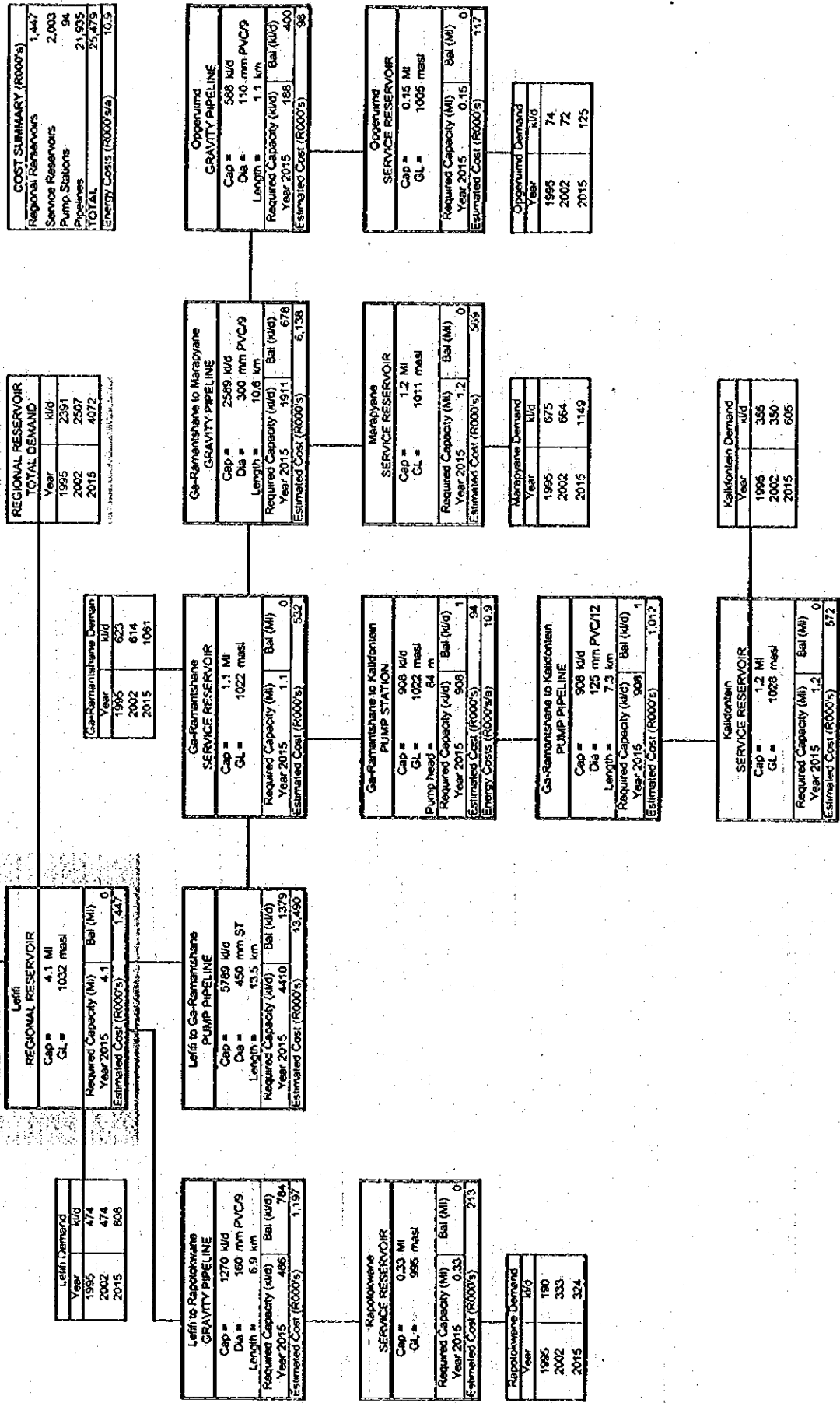
RUST DE WINTER TO LEFIFI : ALTERNATIVE 3 (Moretele 2 supplied from Weitevreden Purification Works and Rust De Winter Dam)



EASTERN ZONE : BLOEDFONTEIN SUPPLY BLOCK : PROPOSED INFRASTRUCTURE (Sheet No. E/TM/2P)

LEFIFI TO MARAPYANE : ALTERNATIVE 3 (Moretele 2 supplied from Weltevreden and Rust De Winter Dam)

From Sheet No. E/TM/1P



JICA