P WMA 15/000/00/0407

DEPARTMENT OF WATER AFFAIRS AND FORESTRY

Directorate: National Water Resource Planning

ALBANY COAST SITUATION ASSESSMENT STUDY

Main Report: Volume 2

Appendices 3 to 10

Final

December 2004

Prepared by :

UWP Consulting (Pty) Ltd

PO Box 9311
CENTURION
0046

TEL: (012) 664-9232

DEPARTMENT OF WATER AFFAIRS AND FORESTRY
DIRECTORATE: NATIONAL WATER RESOURCE PLANNING

PROJECT NAME	:	Albany Coast Situation Assessment Study
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AUTHOR	:	HV Doudenski
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Submitted on behalf of UWP Consulting by:

.....
HV DOUDENSKI
Project Leader

DEPARTMENT OF WATER AFFAIRS AND FORESTRY

Directorate: National Water Resource Planning

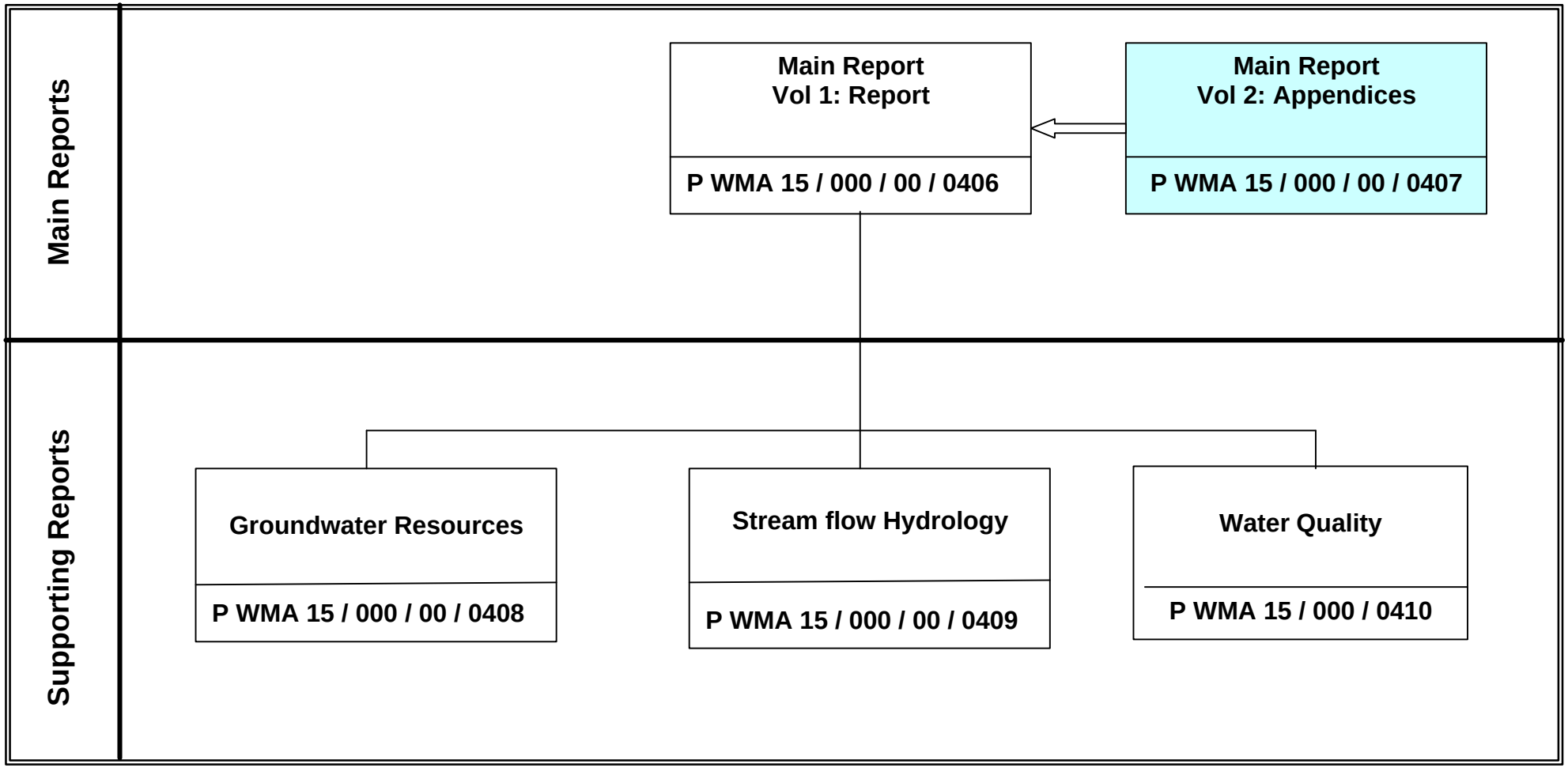
Approved for Department of Water Affairs and Forestry by:

.....
FA STOFFBERG
Chief Engineer: National Water Resource Planning

.....
JA VAN ROOYEN
Director: National Water Resource Planning

ALBANY COAST SITUATION ASSESSMENT STUDY

Structure of Reports



DEPARTMENT OF WATER AFFAIRS & FORESTRY

DIRECTORATE: NATIONAL WATER RESOURCE PLANNING

ALBANY COAST SITUATION ASSESSMENT STUDY

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APPENDIX 3. 1: CENSUS 2001 URBAN POPULATIONA NUMBERS PER QUATERNARY CATCHMENT AND PER SUBPLACE

Quaternary	Town	Water sourse	Census		Population No.		Service levels: No of households				Total	Pop No. per H. hold
			sub-place code	Sub-place Name	Sub - Place	Total town	House Connect	Yard Connect	Communal Stand pipe	No service / or other	No of H. holds	
P10B	Riebeeck East	GW P10B	20406000	Riebeeck East	517		0	136	0	3	139	3.7
			20401000	Albany	172		15	22	6	15	58	3.0
				Total		689						
P10D	Alicedale	NY dam P10B	Not listed	Alicedale		-						
P10E	Paterson	GW P10E	20609000	Paterson	671		0	126	15	0	141	4.8
			20607000	KwaZenzele SP	3,652		90	577	202	39	908	4.0
			20607001	KwaZenzele	81		3	0	26	0	29	2.8
				Total		4,404						
P10G	Kenton on sea	GW P10G	20507000	Kenton on Sea	856		377	18	9	0	404	2.1
			20505000	Ekuphumieni	2,023		12	498	3	0	513	3.9
			20505001	Ekuphumieni	1,602		0	180	334	0	514	3.1
				Tot Kenton								
			20507001	Marselle	4,399		470	413	411	0	1294	3.4
				Total		8,880						
P20A	Alexandria	GW P20A	20501000	Alexandria	1,820		357	99	18	12	486	3.7
			20501001	Wentzel Park	1,263		170	30	85	0	285	4.4
			20509000	Kwanonqubela	4,632		122	1006	81	6	1215	3.8
				Total		7,715						
	Boknes	GW P20A	20503000	Boknes	216	216	71	12	9	9	101	2.1
	Canon Rocks	GW P20A	20504000	Canon Rocks	215	215	65	22	9	3	99	2.2

P40A	Grahamstown	Milner dam P10A	20403000	Grahamstown	14,854		2614	786	149	9	3558	4.2
		Jameson dam P10A		Institutions above	751						0	
		Holson's dam P30A	20403001	Ford E Hospital	291			3			3	97.0
		Settlers dam P30A	20403002	Gr Military Base	393		61	3			64	6.1
		Glen Melville Q	20403003	Mayfield	1,728		3	3	423		429	4.0
			20403004	Rhodes university	806		0				0	
			20403005	Silvertown	541			3	167		170	3.2
			20403006	Vukani	2,061			21	447	31	499	4.1
			20402000	Fingo Village	3,072		20	706	51	18	795	3.9
			20405001	Eluxolveni	796				210		210	3.8
			20405002	Glen Graig	847				282		282	3.0
			20405003	Kopke	1,681			374	36		410	4.1
			20405004	Xolani	33,938		597	6500	1069	81	8247	4.1
				Total		61,759						
P40C	Bathurst	GW private supplies	20502000	Bathurst	597		142	21	24	79	266	2.2
		Golden ridge P40B	20512000	Freestone	3,382		38	872	12	12	934	3.6
		Mansfield dam P40C	20512001	Nolukhanyo	1,570		9	136	301	0	446	3.5
				Total		5,549						
	Port Alfred	Sarel Hayword P40C	20513000	Port Alfred	4,578		1356	169	57	6	1588	2.9
		Mansfield dam P40C	20513001	Station Hill	1,714		412	69	42	6	529	3.2
		GW P40C	20511000	Nkwenkwezi	14,673		27	1659	2042	175	3903	3.8
				Thornhil	-							
				Total		20,965						
	Kasuka	GW	20506000	Kasuka	102	102	15	6	12	12	45	2.3
P40D	Kleinmonde	Wellington dam P40D	20508000	Kleinmonde	12	12		3			3	4.0
TOTAL URBAN POPULATION					110,506	110,506	7,046	14,473	6,532	516	28,567	3.9

APPENDIX 3.2: Comparison of population data

Quaternary	Town	Pop Number Comparison				Accepted
		Mark Data	*Census*	*WSDP*	*WRSA*	*Base*
		1995	*2001*	*2001*	*1995*	*2001*
P10A						
1) Urban		-	-		-	-
2) Rural			363		246	363
	Total: Urban + Rural	-	363		246	363
P10B						
1) Urban	**Riebeeck East**	650	689	689	650	689
2) Rural			1,452		972	1,452
	Total: Urban + Rural	650	2,141		1,622	2,141
P10C						
1) Urban		-	-		-	-
2) Rural			310		282	310
	Total: Urban + Rural	-	310		282	310
P10D						
1) Urban	**Alicedale**	5,950	-	5,064	5,950	5,950
2) Rural			977		904	977
	Total: Urban + Rural	5,950	977		6,854	6,927
P10E						
1) Urban	**Paterson**	3,251	4,404	7,335	3,250	4,404
2) Rural			1,328		1,594	1,328
	Total: Urban + Rural	3,251	5,732		4,844	5,732
P10F						
1) Urban		-	-		-	-
2) Rural			1,344		2,517	1,344
	Total: Urban + Rural	-	1,344		2,517	1,344
P10G	**Kenton-on-Sea and Bushmans River Mouth**					
1) Urban		8,598	8,880	9,500	8,168	8,880
	Kenton/Ekuphuleni	4,199	4,481	5,000		4,481
	Marselle/Bushmans	4,399	4,399	4,500		4,399
2) Rural			2,488		2,497	2,488
	Total: Urban + Rural	8,598	11,368		10,665	11,368
P20A	**Alexandria, Canon Rocks, Boknesrand**					
1) Urban		7,649	8,146	8,620	8,080	8,146
	Alexandria	7,649	7,715	8,189	7,649	7,715
	Boknes	-	216	216	216	216
	Canon Rocks	-	215	215	215	215
2) Rural			3,242		3,999	3,242
	Total: Urban + Rural	7,649	11,388		12,079	11,388
P20B						
1) Urban		-	-		-	-
2) Rural			894		1,434	894
	Total: Urban + Rural	-	894		1,434	894
P30A						
1) Urban		-	-		-	-
2) Rural			484		1,119	484
	Total: Urban + Rural	-	484		1,119	484
P30B						
1) Urban		-	-		-	-
2) Rural			1,575		3,325	1,575
	Total: Urban + Rural	-	1,575		3,325	1,575
P30C						
1) Urban		-	-		-	-
2) Rural			328		562	328
	Total: Urban + Rural	-	328		562	328
P40A						
1) Urban	**Grahamstown**	59,357	61,759	81,600	59,350	61,759
2) Rural			997		2,378	997
	Total: Urban + Rural	59,357	62,756		61,728	62,756
P40B						
1) Urban		-	-		-	-
2) Rural		-	1,228		1,772	1,228
	Total: Urban + Rural	-	1,228		1,772	1,228
P40C						
1) Urban	**Port Alfred, Buthurst**	22,001	26,514	43,200	22,000	26,514
	Port Alfred	17,400	20,965	37,000	17,400	20,965
	Bathurst	4,601	5,549	6,200	4,600	5,549
2) Rural			1,511		2,014	1,511
	Total: Urban + Rural	22,001	28,025		24,014	28,025
P40D						
1) Urban	**Kleinmonde**	1,450	12	200	1,450	1,450
2) Rural			1,117		1,289	1,117
	Total: Urban + Rural	1,450	1,129		2,739	2,567
Total Urban		**108,906**	**110,404**	**156,208**	**108,898**	**117,792**
Total Rural			**19,638**		**26,904**	**19,638**
TOTAL STUDY			**130,042**		**135,802**	**137,430**

APPENDIX 3.3: Urban and rural population numbers per quaternary catchment

Quaternary	Town	Accepted	Planned new developments				MD Growth rates, % per annum			Projected population numbers			
		Base					*High scenario*						
		2001	*2001*	*2005*	*2015*	*2025*	2005	2015	2025	*2001 Base*	*2005*	*2015*	*2025*
P10A													
1) Urban		-				-				-	-	-	-
2) Rural		363					0.3718	-0.2974	-1.0859	363	368	358	321
	Total: Urban + Rural	363								363	368	358	321
P10B													
1) Urban	**Riebeeck East**	689					0.4965	-0.2218	-0.5210	689	703	687	652
2) Rural		1,452					0.3718	-0.2974	-1.0859	1,452	1,474	1,430	1,283
	Total: Urban + Rural	2,141								2,141	2,177	2,118	1,935
P10C													
1) Urban		-								-	-	-	-
2) Rural		310					0.2520	-0.9677	-1.2250	310	313	284	251
	Total: Urban + Rural	310								310	313	284	251
P10D													
1) Urban	**Alicedale**	5,950					0.5012	-0.2326	-0.5090	5,950	6,070	5,930	5,635
2) Rural		977					0.3718	-0.2974	-1.0859	977	992	963	863
	Total: Urban + Rural	6,927								6,927	7,062	6,893	6,498
P10E													
1) Urban	**Paterson**	4,404					0.4994	-0.2367	-0.5028	4,404	4,493	4,387	4,172
2) Rural		1,328					0.3715	-0.5357	-0.8486	1,328	1,348	1,277	1,173
	Total: Urban + Rural	5,732								5,732	5,840	5,665	5,345
P10F													
1) Urban		-								-	-	-	-
2) Rural		1,344					0.3718	-0.2974	-1.0859	1,344	1,364	1,324	1,187
	Total: Urban + Rural	1,344								1,344	1,364	1,324	1,187
P10G	**Kenton-on-Sea and Bushmans River Mouth**												
1) Urban		8,880								9,480	12,745	13,734	14,539
	Kenton/Ekuphuleni	4,481	300	1,200			2.3709	1.6370	1.3724	4,781	6,451	7,588	8,696
	Marselle/Bushmans	4,399	300	1,500			0.5003	-0.2376	-0.5041	4,699	6,294	6,146	5,843
2) Rural		2,488					0.3715	-0.5357	-0.8486	2,488	2,525	2,393	2,198
	Total: Urban + Rural	11,368								11,968	15,270	16,127	16,737
P20A	**Alexandria, Canon Rocks, Boknesrand**												
1) Urban		8,146								8,646	9,793	11,751	11,669
	Alexandria	7,715	0	500	1,000	-	0.5010	-0.2325	-0.5105	7,715	8,371	9,178	8,720
	Boknes	216	250	200	450	-	2.3709	1.6370	1.3724	466	712	1,287	1,475
	Canon Rocks	215	250	200	450	-	2.3709	1.6370	1.3724	465	711	1,286	1,474
2) Rural		3,242					0.3715	-0.5357	-0.8486	3,242	3,290	3,118	2,864
	Total: Urban + Rural	11,388								11,888	13,084	14,870	14,533

P20B												
1) Urban		-							-	-	-	-
2) Rural		894					0.3715	-0.5357	-0.8486	894	907	860	790
	Total: Urban + Rural	894								894	907	860	790
P30A													
1) Urban		-								-	-	-	-
2) Rural		484					0.3718	-0.2974	-1.0859	484	491	477	428
	Total: Urban + Rural	484								484	491	477	428
P30B													
1) Urban		-								-	-	-	-
2) Rural		1,575					0.3714	-0.5358	-0.8476	1,575	1,599	1,515	1,391
	Total: Urban + Rural	1,575								1,575	1,599	1,515	1,391
P30C													
1) Urban		-								-	-	-	-
2) Rural		328					0.3714	-0.5358	-0.8476	328	333	315	290
	Total: Urban + Rural	328								328	333	315	290
P40A													
1) Urban	**Grahamstown**	61,759					1.0405	0.3091	0.0306	61,759	64,370	66,387	66,591
2) Rural		997					0.3718	-0.2974	-1.0859	997	1,012	982	881
	Total: Urban + Rural	62,756								62,756	65,382	67,370	67,471
P40B													
1) Urban		-								-	-	-	-
2) Rural		1,228					0.3714	-0.5358	-0.8476	1,228	1,246	1,181	1,085
	Total: Urban + Rural	1,228								1,228	1,246	1,181	1,085
P40C													
1) Urban	**Port Alfred, Buthurst**	26,514								26,514	34,023	41,821	46,769
	Port Alfred	20,965	-	4,500	3,000		2.3716	1.6362	1.3723	20,965	27,526	35,376	40,542
	Bathurst	5,549		800			0.6605	-0.0797	-0.3438	5,549	6,497	6,445	6,227
2) Rural		1,511					0.3714	-0.5358	-0.8476	1,511	1,534	1,453	1,335
	Total: Urban + Rural	28,025								28,025	35,556	43,275	48,104
P40D													
1) Urban	**Kleinmonde**	1,450		-			2.3716	1.6362	1.3730	1,450	1,833	2,156	2,471
2) Rural		1,117					0.3714	-0.5358	-0.8476	1,117	1,134	1,074	987
	Total: Urban + Rural	2,567								2,567	2,967	3,230	3,458
Total Urban		**117,792**	**1,100**	**8,900**	**4,900**	**-**				**118,892**	**134,029**	**146,855**	**152,499**
Total Rural		**19,638**								**19,638**	**19,930**	**19,006**	**17,324**
TOTAL FOR STUDY AREA		**137,430**	**1,100**	**8,900**	**4,900**	**-**				**138,530**	**153,959**	**165,861**	**169,822**

Census 2001 - Official version

N

Blue Crane Route

20201Blue Crane Route

Makana

20404Makana

Ndlambe

20510Ndlambe

Sunday's River Valley

20510Sunday's River Valley

Nelson Mandela Metropolitan

Main Places

Albanycoaststudyarea.shp
Local municipalities.shp
20506 Kasuka Main Place - Census 2001

Census 2001 - Official version

N

Blue Crane Route

Makana

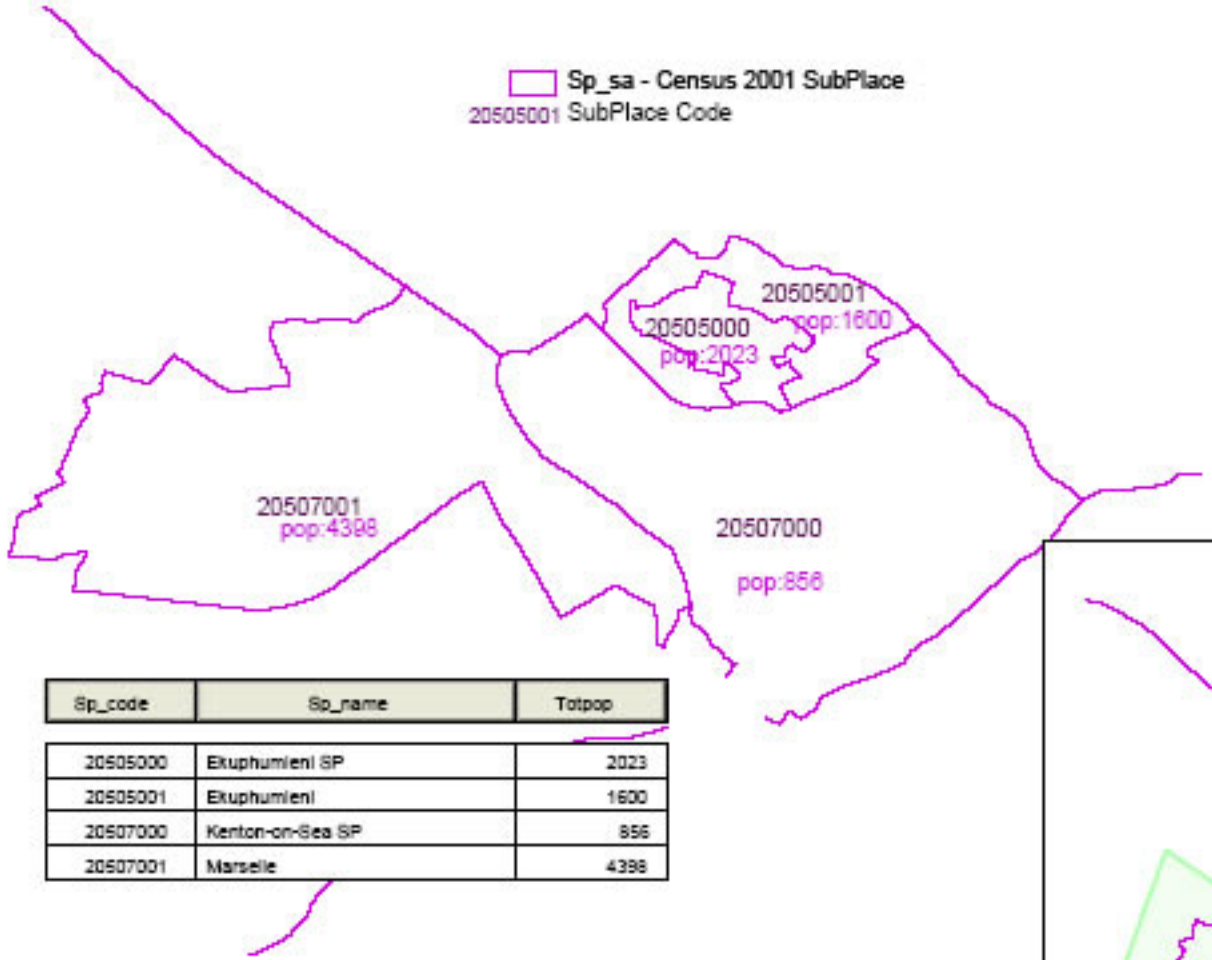
Sunday's River Valley

Ndlambe

Nelson Mandela Metropolitan

Sub-Places

- Albanycoaststudyarea.shp
- Local municipalities.shp
- 20510002 Alexandria NU — Subplace - Census 2001
- BATHURST — Communities - DWAF
- Albanycoaststudyarea.shp



Sp_code	Sp_name	Totpop
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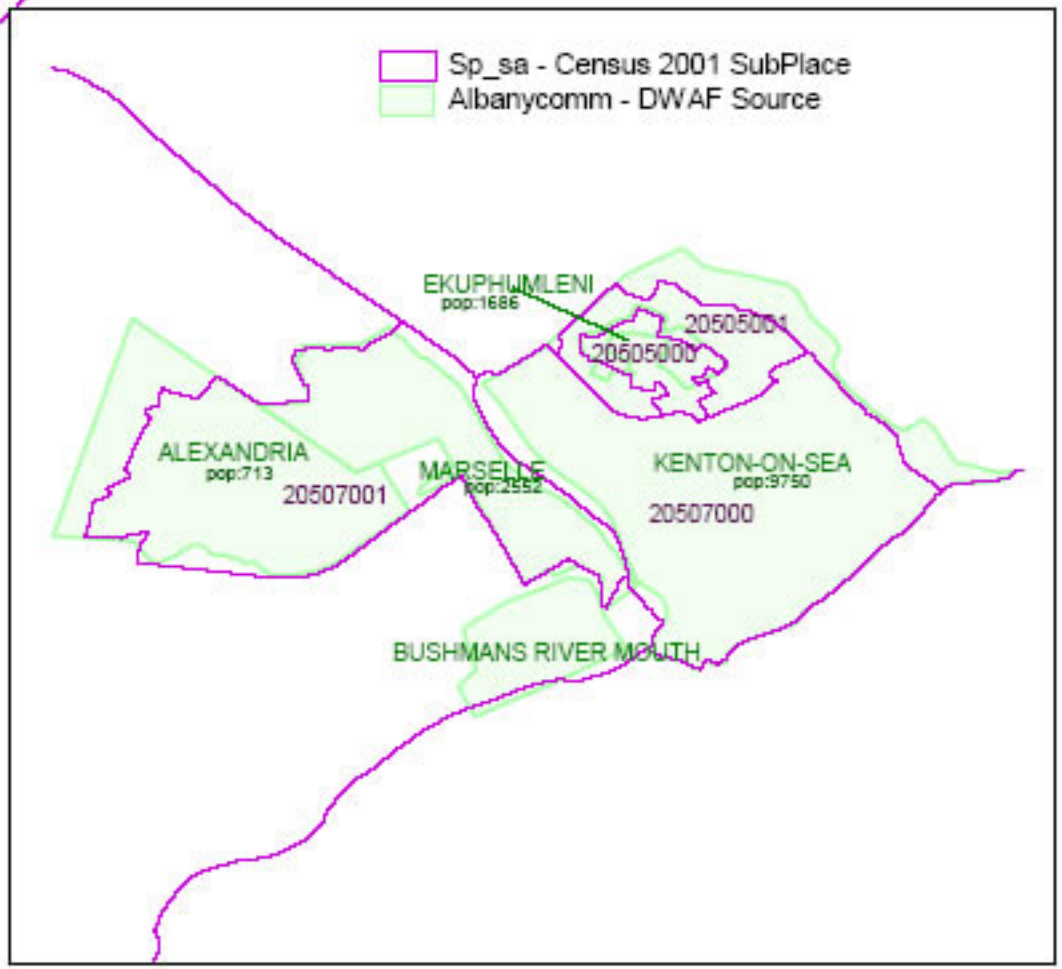
20505001	Ekuphumleni	1600
20507000	Kenton-on-Sea SP	856
20507001	Marselle	4398



Albany Coast Basin Study - Census 2001
Main Water Supply as Number of Households per SubPlace

Total for all intersecting Albany Coast Municipalities	*11,782*	*25,778*	*5,401*	*5,635*	*524*	*45*	*1,952*	*1,591*	*485*	*54*	*944*	*54,199*

Local Municipalit **EC102 - Blue Crane Route Municipality**

SubPlace Code	SubPlace Name	Piped water inside dwelling	Piped water inside yard	Piped water on community stand within 200m	Piped water on community stand not within 200m	Borehole	Spring	Rainwater tank	Dam/Pool/Stagnant water	River/Stream	Water vendor	Other	Total
20201001	Bedford NU	109	137	24	126	38	0	27	83	65	6	12	627
20201002	Pearston NU	76	236	33	9	21	0	6	6	0	0	3	391
20201003	Somerset East NU	428	675	179	211	66	3	134	123	153	9	59	2,041
20202000	NONE	306	500	21	15	0	0	0	0	0	0	26	868
20202001	Bongweni	0	146	0	0	0	0	0	0	0	0	0	146
20203000	NONE	46	85	0	0	0	0	0	0	0	0	0	131
20203001	Newtown	9	120	54	0	0	0	0	0	0	0	30	213
20204000	NONE	6	408	0	0	0	0	3	0	0	0	3	420
20205000	NONE	185	1,007	184	198	3	0	0	0	0	0	15	1,592
20205001	KwaNojoli	0	366	6	92	0	0	3	0	0	0	12	478
20206000	NONE	98	24	0	3	0	0	0	0	0	0	3	128
20206001	Nelsig	62	374	13	3	0	0	0	0	0	0	0	451
20207000	NONE	996	719	18	30	0	0	6	0	3	0	3	1,775
20207001	Clevedon	0	118	0	0	0	0	0	0	0	0	0	118
20207002	Westview	0	167	9	0	0	0	0	0	0	0	0	176

Summary for 'LM' = Blue Crane Route Municipality (15 detail records)

Total	*2,321*	*5,082*	*541*	*687*	*128*	*3*	*179*	*212*	*221*	*15*	*166*	*9,555*

Local Municipalit EC104 - Makana Municipality

SubPlace Code	SubPlace Name	Piped water inside dwelling	Piped water inside yard	Piped water on community stand within 200m	Piped water on community stand not within 200m	Borehole	Spring	Rainwater tank	Dam/Pool/Stagnant water	River/Stream	Water vendor	Other	Total
20401000	NONE	15	22	3	3	0	0	15	0	0	0	0	58
20402000	NONE	20	706	9	42	0	0	0	0	0	0	18	795
20403000	NONE	2,614	786	87	62	0	0	0	0	0	0	9	3,558
20403001	Fort England Hospital	0	3	0	0	0	0	0	0	0	0	0	3
20403002	Grahamstown Military Base	61	3	0	0	0	0	0	0	0	0	0	64
20403003	Mayfield	3	3	221	202	0	0	0	0	0	0	0	429
20403004	Rhodes University	0	0	0	0	0	0	0	0	0	0	0	0
20403005	Silvertown	0	3	91	76	0	0	0	0	0	0	0	170
20403006	Vukani	0	21	28	419	0	0	0	0	0	0	31	499
20404001	Albany NU	702	1,171	360	318	84	9	275	269	63	3	45	3,300
20405001	Eluxolweni	0	0	210	0	0	0	0	0	0	0	0	210
20405002	Glen Graig	0	0	71	211	0	0	0	0	0	0	0	283
20405003	Kopke	0	374	0	36	0	0	0	0	0	0	0	410
20405004	Xolani	597	6,500	705	364	0	0	3	0	6	0	72	8,247
20406000	NONE	0	136	0	0	0	0	0	0	0	0	3	139

Summary for 'LM' = Makana Municipality (15 detail records)

Total	*4,012*	*9,728*	*1,785*	*1,733*	*84*	*9*	*293*	*269*	*69*	*3*	*178*	*18,165*

Local Municipalit EC105 - Ndlambe Municipality

SubPlace Code	SubPlace Name	Piped water inside dwelling	Piped water inside yard	Piped water on community stand within 200m	Piped water on community stand not within 200m	Borehole	Spring	Rainwater tank	Dam/Pool/Stagnant water	River/Stream	Water vendor	Other	Total
20501000	NONE	357	99	3	15	0	0	0	3	0	0	9	486
20501001	Wentzel Park	170	30	73	12	0	0	0	0	0	0	0	286
20502000	NONE	142	21	12	12	29	3	44	0	0	0	3	265
20503000	NONE	71	12	3	6	0	0	9	0	0	0	0	101
20504000	NONE	65	22	6	3	0	0	0	0	0	3	0	99
20505000	NONE	12	498	3	0	0	0	0	0	0	0	9	522
20505001	Ekuphumleni	0	180	241	93	0	0	0	0	0	0	37	551
20506000	NONE	15	6	9	3	0	0	12	0	0	0	0	45
20507000	NONE	377	18	0	9	0	0	6	0	0	0	0	410
20507001	Marselle	470	413	94	317	0	0	6	0	0	0	6	1,306
20508000	NONE	0	3	0	0	0	0	0	0	0	0	0	3
20509000	NONE	122	1,006	18	63	0	0	0	0	0	0	6	1,215
20510001	Albany NU	27	72	12	6	0	0	45	32	18	0	0	213
20510002	Alexandria NU	113	144	325	191	30	3	280	86	6	3	33	1,214
20510003	Bathurst NU	346	315	110	321	109	3	267	286	75	3	3	1,837
20511000	NONE	27	1,659	1,261	781	0	3	30	0	0	0	142	3,904
20512000	NONE	38	872	9	3	0	0	0	0	0	0	12	934
20512001	Nolukhanyo	9	136	57	244	0	0	0	0	0	0	0	446
20513000	NONE	1,356	169	24	33	0	0	0	0	0	0	6	1,588
20513001	Station Hill	412	69	15	27	0	0	3	0	0	0	3	528

Summary for 'LM' = Ndlambe Municipality (20 detail records)

Total		*4,129*	*5,744*	*2,275*	*2,139*	*168*	*12*	*702*	*407*	*99*	*9*	*269*	*15,953*

Local Municipalit EC106 - Sunday's River Valley Municipality

SubPlace Code	SubPlace Name	Piped water inside dwelling	Piped water inside yard	Piped water on community stand within 200m	Piped water on community stand not within 200m	Borehole	Spring	Rainwater tank	Dam/Pool/Stagnant water	River/Stream	Water vendor	Other	Total
20601000	NONE	33	6	6	6	0	0	0	15	0	0	6	72
20601001	Valencia	18	180	9	122	0	0	0	0	0	0	3	332
20602000	NONE	0	18	0	0	0	0	0	0	0	0	0	18
20603000	NONE	3	104	0	0	0	0	0	0	0	0	9	116
20604000	NONE	24	922	30	79	0	0	73	6	3	0	112	1,249
20604001	Bontrug	70	236	41	0	0	0	0	0	0	0	6	353
20605000	NONE	83	64	3	9	0	0	6	0	0	0	0	166
20606000	NONE	181	152	3	0	0	0	0	0	0	0	6	342
20606001	Bergsig	55	186	0	0	0	0	3	0	0	0	12	256
20607000	NONE	90	577	64	138	21	0	0	3	0	0	15	907
20607001	KwaZenzele	3	0	26	0	0	0	0	0	0	0	0	29
20608000	NONE	9	1,647	188	325	3	3	0	98	3	0	30	2,306
20609000	NONE	0	126	9	6	0	0	0	0	0	0	0	142
20610001	Alexandria NU	243	266	166	194	84	15	228	157	24	3	0	1,381
20610002	Kirkwood NU	386	682	230	188	30	3	450	394	60	15	114	2,554
20610003	Kirkwood SH	122	58	25	9	6	0	18	30	6	9	18	303

Summary for 'LM' = Sunday's River Valley Municipality (16 detail records)

Total	*1,320*	*5,224*	*800*	*1,076*	*144*	*21*	*778*	*703*	*96*	*27*	*331*	*10,526*

Albany Coast Basin Study - Census 2001
Population per Main Place Type

Total for all intersecting Albany Coast Municipalities	*117*	*0*	*47,038*	*1,737*	*142,525*	*12,340*	*90*	*57*	*2,688*	*33*	*206,625*

Local Municipalit **EC102 - Blue Crane Route Municipality**

Main Place Code	Main Place Name	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20201	Blue Crane Route	0	0	9,196	0	0	0	0	0	0	0	9,196
20202	Bongweni	0	0	0	0	3,344	432	0	0	0	0	3,776
20203	Cookhouse	0	0	0	0	1,415	0	0	0	0	0	1,415
20204	Khayanisho	0	0	0	0	1,448	0	0	0	0	0	1,448
20205	KwaNojoli	0	0	0	0	6,442	1,690	0	0	0	0	8,132
20206	Pearston	0	0	0	0	2,596	0	0	0	0	0	2,596
20207	Somerset East	0	0	0	195	8,261	0	0	0	0	0	8,456

Summary for 'LM' = Blue Crane Route Municipality (7 detail records)

Total	*0*	*0*	*9,196*	*195*	*23,506*	*2,122*	*0*	*0*	*0*	*0*	*35,019*

Local Municipalit EC104 - Makana Municipality

Main Place Code	Main Place Name	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20401	Albany	0	0	0	0	172	0	0	0	0	0	172
20402	Fingo Village	0	0	0	0	3,072	0	0	0	0	0	3,072
20403	Grahamstown	0	0	0	604	14,244	4,318	0	0	2,237	0	21,403
20404	Makana	0	0	12,102	0	0	0	0	0	0	0	12,102
20405	Rhini	0	0	0	0	35,622	1,643	0	0	0	0	37,265
20406	Riebeeck-East	0	0	0	0	517	0	0	0	0	0	517

Summary for 'LM' = Makana Municipality (6 detail records)

Total	*0*	*0*	*12,102*	*604*	*53,627*	*5,961*	*0*	*0*	*2,237*	*0*	*74,531*

Local Municipalit EC105 - Ndlambe Municipality

Main Place Code	Main Place Name	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20501	Alexandria	0	0	0	0	3,030	0	0	57	0	0	3,087
20502	Bathurst	0	0	0	0	600	0	0	0	0	0	600
20503	Boknesstrand	0	0	0	0	216	0	0	0	0	0	216
20504	Canon Rocks	0	0	0	0	209	0	0	0	0	0	209
20505	Ekuphumleni	0	0	0	0	2,020	1,599	0	0	0	0	3,619
20506	Kasuka	0	0	0	0	96	0	0	0	0	0	96
20507	Kenton-on-Sea	0	0	0	0	4,253	1,013	0	0	0	0	5,266
20508	Kleinemonde	18	0	0	0	0	0	0	0	0	0	18
20509	Kwanonqubela	0	0	0	0	4,626	0	0	0	0	0	4,626
20510	Ndlambe	0	0	11,833	0	0	0	0	0	0	0	11,833
20511	Nkwenkwezi	0	0	0	0	14,673	0	0	0	0	0	14,673
20512	Nolukhanyo	0	0	0	0	3,382	1,579	0	0	0	0	4,961
20513	Port Alfred	0	0	0	0	6,287	0	0	0	0	0	6,287
Summary for 'LM' = Ndlambe Municipality (13 detail records)												
Total		*18*	*0*	*11,833*	*0*	*39,392*	*4,191*	*0*	*57*	*0*	*0*	*55,491*

Local Municipalit EC106 - Sunday's River Valley Municipality

Main Place Code	Main Place Name	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20601	Addo	99	0	0	0	1,653	0	0	0	0	0	1,752
20602	Addo Elephant National Park	0	0	0	0	0	0	90	0	0	0	90
20603	Barsheba	0	0	0	0	517	0	0	0	0	0	517
20604	Bontrug	0	0	0	0	6,806	0	0	0	0	0	6,806
20605	Enon	0	0	0	0	782	0	0	0	0	0	782
20606	Kirkwood	0	0	0	0	2,671	0	0	0	78	0	2,749
20607	KwaZenzele	0	0	0	0	3,634	66	0	0	0	33	3,733
20608	Nomathamsanqa	0	0	0	0	9,266	0	0	0	0	0	9,266
20609	Paterson	0	0	0	0	671	0	0	0	0	0	671
20610	Sunday's River Valley	0	0	13,907	938	0	0	0	0	373	0	15,218

Summary for 'LM' = Sunday's River Valley Municipality (10 detail records)

Total	*99*	*0*	*13,907*	*938*	*26,000*	*66*	*90*	*0*	*451*	*33*	*41,584*

Albany Coast Basin Study - Census 2001
Population per SubPlace Type

Total for all intersecting Albany Coast Municipalities	*99*	*0*	*47,034*	*1,737*	*142,532*	*12,349*	*90*	*51*	*2,707*	*33*	*206,632*

Local Municipalit **EC102 - Blue Crane Route Municipality**

SubPlace Code	SubPlace Name	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20201001	Bedford NU	0	0	1,953	0	0	0	0	0	0	0	1,953
20201002	Pearston NU	0	0	1,046	0	0	0	0	0	0	0	1,046
20201003	Somerset East NU	0	0	6,204	0	0	0	0	0	0	0	6,204
20202000	Bongweni SP	0	0	0	0	3,344	0	0	0	0	0	3,344
20202001	Bongweni	0	0	0	0	0	432	0	0	0	0	432
20203000	Cookhouse SP	0	0	0	0	499	0	0	0	0	0	499
20203001	Newtown	0	0	0	0	914	0	0	0	0	0	914
20204000	Khayanisho SP	0	0	0	0	1,445	0	0	0	0	0	1,445
20205000	KwaNojoli SP	0	0	0	0	6,436	0	0	0	0	0	6,436
20205001	KwaNojoli	0	0	0	0	0	1,687	0	0	0	0	1,687
20206000	Pearston SP	0	0	0	0	495	0	0	0	0	0	495
20206001	Nelsig	0	0	0	0	2,102	0	0	0	0	0	2,102
20207000	Somerset East SP	0	0	0	204	6,729	0	0	0	0	0	6,933
20207001	Clevedon	0	0	0	0	652	0	0	0	0	0	652
20207002	Westview	0	0	0	0	861	0	0	0	0	0	861

Summary for 'LM' = Blue Crane Route Municipality (15 detail records)

Total	*0*	*0*	*9,203*	*204*	*23,477*	*2,119*	*0*	*0*	*0*	*0*	*35,003*

Local Municipalit EC104 - Makana Municipality

SubPlace Code	SubPlace Name	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20401000	Albany SP	0	0	0	0	172	0	0	0	0	0	172
20402000	Fingo Village SP	0	0	0	0	3,075	0	0	0	0	0	3,075
20403000	Grahamstown SP	0	0	0	598	14,247	0	0	0	751	0	15,596
20403001	Fort England Hospital	0	0	0	0	0	0	0	0	291	0	291
20403002	Grahamstown Military Base	0	0	0	0	0	0	0	0	393	0	393
20403003	Mayfield	0	0	0	0	0	1,728	0	0	0	0	1,728
20403004	Rhodes University	0	0	0	0	0	0	0	0	806	0	806
20403005	Silvertown	0	0	0	0	0	541	0	0	0	0	541
20403006	Vukani	0	0	0	0	0	2,061	0	0	0	0	2,061
20404001	Albany NU	0	0	12,102	0	0	0	0	0	0	0	12,102
20405001	Eluxolweni	0	0	0	0	0	796	0	0	0	0	796
20405002	Glen Graig	0	0	0	0	0	847	0	0	0	0	847
20405003	Kopke	0	0	0	0	1,681	0	0	0	0	0	1,681
20405004	Xolani	0	0	0	0	33,938	0	0	0	0	0	33,938
20406000	Riebeeck-East SP	0	0	0	0	517	0	0	0	0	0	517

Summary for 'LM' = Makana Municipality (15 detail records)

Total	*0*	*0*	*12,102*	*598*	*53,630*	*5,973*	*0*	*0*	*2,241*	*0*	*74,544*

Local Municipalit EC105 - Ndlambe Municipality

SubPlace Code	SubPlace Name	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20501000	Alexandria SP	0	0	0	0	1,769	0	0	51	0	0	1,820
20501001	Wentzel Park	0	0	0	0	1,263	0	0	0	0	0	1,263
20502000	Bathurst SP	0	0	0	0	597	0	0	0	0	0	597
20503000	Boknesstrand SP	0	0	0	0	216	0	0	0	0	0	216
20504000	Canon Rocks SP	0	0	0	0	215	0	0	0	0	0	215
20505000	Ekuphumleni SP	0	0	0	0	2,023	0	0	0	0	0	2,023
20505001	Ekuphumleni	0	0	0	0	0	1,602	0	0	0	0	1,602
20506000	Kasuka SP	0	0	0	0	102	0	0	0	0	0	102
20507000	Kenton-on-Sea SP	0	0	0	0	856	0	0	0	0	0	856
20507001	Marselle	0	0	0	0	3,395	1,004	0	0	0	0	4,399
20508000	Kleinemonde SP	12	0	0	0	0	0	0	0	0	0	12
20509000	Kwanonqubela SP	0	0	0	0	4,632	0	0	0	0	0	4,632
20510001	Albany NU	0	0	764	0	0	0	0	0	0	0	764
20510002	Alexandria NU	0	0	4,493	0	0	0	0	0	0	0	4,493
20510003	Bathurst NU	0	0	6,570	0	0	0	0	0	0	0	6,570
20511000	Nkwenkwezi SP	0	0	0	0	14,673	0	0	0	0	0	14,673
20512000	Nolukhanyo SP	0	0	0	0	3,382	0	0	0	0	0	3,382
20512001	Nolukhanyo	0	0	0	0	0	1,570	0	0	0	0	1,570
20513000	Port Alfred SP	0	0	0	0	4,578	0	0	0	0	0	4,578
20513001	Station Hill	0	0	0	0	1,714	0	0	0	0	0	1,714

Summary for 'LM' = Ndlambe Municipality (20 detail records)

Total	*12*	*0*	*11,827*	*0*	*39,415*	*4,176*	*0*	*51*	*0*	*0*	*55,481*

Local Municipalit EC106 - Sunday's River Valley Municipality

SubPlace Code	SubPlace Name	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20601000	Addo SP	87	0	0	0	162	0	0	0	0	0	249
20601001	Valencia	0	0	0	0	1,500	0	0	0	0	0	1,500
20602000	Addo Elephant National Park SP	0	0	0	0	0	0	90	0	0	0	90
20603000	Barsheba SP	0	0	0	0	523	0	0	0	0	0	523
20604000	Bontrug SP	0	0	0	0	5,349	0	0	0	0	0	5,349
20604001	Bontrug	0	0	0	0	1,458	0	0	0	0	0	1,458
20605000	Enon SP	0	0	0	0	785	0	0	0	0	0	785
20606000	Kirkwood SP	0	0	0	0	1,144	0	0	0	78	0	1,222
20606001	Bergsig	0	0	0	0	1,536	0	0	0	0	0	1,536
20607000	KwaZenzele SP	0	0	0	0	3,619	0	0	0	0	33	3,652
20607001	KwaZenzele	0	0	0	0	0	81	0	0	0	0	81
20608000	Nomathamsanqa SP	0	0	0	0	9,263	0	0	0	0	0	9,263
20609000	Paterson SP	0	0	0	0	671	0	0	0	0	0	671
20610001	Alexandria NU	0	0	4,969	0	0	0	0	0	0	0	4,969
20610002	Kirkwood NU	0	0	8,933	0	0	0	0	0	388	0	9,321
20610003	Kirkwood SH	0	0	0	935	0	0	0	0	0	0	935

Summary for 'LM' = Sunday's River Valley Municipality (16 detail records)

Total	*87*	*0*	*13,902*	*935*	*26,010*	*81*	*90*	*0*	*466*	*33*	*41,604*

Albany Coast Basin Study - Census 2001
Population per SubPlace Type

Quaternary P10A

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20403000	Grahamstown SP	**0.29**	0	0	0	598	14,247	0	0	0	751	0	15,596
20403002	Grahamstown Military Base	**0.75**	0	0	0	0	0	0	0	0	393	0	393
20404001	Albany NU	**0.03**	0	0	12,102	0	0	0	0	0	0	0	12,102

Summary for 'QUAT' = P10A (3 detail records)

Total	*0*	*0*	*12,102*	*598*	*14,247*	*0*	*0*	*0*	*1,144*	*0*	*28,091*

Quaternary P10B

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20401000	Albany SP	**1.00**	0	0	0	0	172	0	0	0	0	0	172
20404001	Albany NU	**0.12**	0	0	12,102	0	0	0	0	0	0	0	12,102
20406000	Riebeeck-East SP	**1.00**	0	0	0	0	517	0	0	0	0	0	517

Summary for 'QUAT' = P10B (3 detail records)

Total	*0*	*0*	*12,102*	*0*	*689*	*0*	*0*	*0*	*0*	*0*	*12,791*

Quaternary P10C

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20201003	Somerset East NU	**0.05**	0	0	6,204	0	0	0	0	0	0	0	6,204

Summary for 'QUAT' = P10C (1 detail record)

Total	*0*	*0*	*6,204*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*6,204*

Quaternary P10D

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20201003	Somerset East NU	**0.06**	0	0	6,204	0	0	0	0	0	0	0	6,204
20404001	Albany NU	**0.05**	0	0	12,102	0	0	0	0	0	0	0	12,102
20610001	Alexandria NU	**0.00**	0	0	4,969	0	0	0	0	0	0	0	4,969

* This ratio represents the area of the subplace which falls within the quaternary boundary:1 = 100%
This was not applied to the population figures in this report

Quaternary P10D

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
Summary for 'QUAT' = P10D (3 detail records)													
Total			*0*	*0*	*23,275*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*23,275*

Quaternary P10E

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20404001	Albany NU	**0.04**	0	0	12,102	0	0	0	0	0	0	0	12,102
20607000	KwaZenzele SP	**0.97**	0	0	0	0	3,619	0	0	0	0	33	3,652
20607001	KwaZenzele	**1.00**	0	0	0	0	0	81	0	0	0	0	81
20609000	Paterson SP	**1.00**	0	0	0	0	671	0	0	0	0	0	671
20610001	Alexandria NU	**0.17**	0	0	4,969	0	0	0	0	0	0	0	4,969
Summary for 'QUAT' = P10E (5 detail records)													
Total			*0*	*0*	*17,071*	*0*	*4,290*	*81*	*0*	*0*	*0*	*33*	*21,475*

Quaternary P10F

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20404001	Albany NU	**0.07**	0	0	12,102	0	0	0	0	0	0	0	12,102
20610001	Alexandria NU	**0.10**	0	0	4,969	0	0	0	0	0	0	0	4,969
Summary for 'QUAT' = P10F (2 detail records)													
Total			*0*	*0*	*17,071*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*17,071*

Quaternary P10G

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20404001	Albany NU	**0.01**	0	0	12,102	0	0	0	0	0	0	0	12,102
20501000	Alexandria SP	**0.08**	0	0	0	0	1,769	0	0	51	0	0	1,820
20505000	Ekuphumleni SP	**1.00**	0	0	0	0	2,023	0	0	0	0	0	2,023
20505001	Ekuphumleni	**1.00**	0	0	0	0	0	1,602	0	0	0	0	1,602
20507000	Kenton-on-Sea SP	**0.88**	0	0	0	0	856	0	0	0	0	0	856
20507001	Marselle	**0.10**	0	0	0	0	3,395	1,004	0	0	0	0	4,399
20510001	Albany NU	**0.10**	0	0	764	0	0	0	0	0	0	0	764
20510002	Alexandria NU	**0.40**	0	0	4,493	0	0	0	0	0	0	0	4,493
20510003	Bathurst NU	**0.06**	0	0	6,570	0	0	0	0	0	0	0	6,570
20610001	Alexandria NU	**0.02**	0	0	4,969	0	0	0	0	0	0	0	4,969

* This ratio represents the area of the subplace which falls within the quaternary boundary:1 = 100%
This was not applied to the population figures in this report

Quaternary P10G

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
Summary for 'QUAT' = P10G (10 detail records)													
Total			*0*	*0*	*28,898*	*0*	*8,043*	*2,606*	*0*	*51*	*0*	*0*	*39,598*

Quaternary P20A

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20501000	Alexandria SP	**0.92**	0	0	0	0	1,769	0	0	51	0	0	1,820
20501001	Wentzel Park	**1.00**	0	0	0	0	1,263	0	0	0	0	0	1,263
20503000	Boknesstrand SP	**1.00**	0	0	0	0	216	0	0	0	0	0	216
20504000	Canon Rocks SP	**1.00**	0	0	0	0	215	0	0	0	0	0	215
20507000	Kenton-on-Sea SP	**0.11**	0	0	0	0	856	0	0	0	0	0	856
20507001	Marselle	**0.90**	0	0	0	0	3,395	1,004	0	0	0	0	4,399
20509000	Kwanonqubela SP	**1.00**	0	0	0	0	4,632	0	0	0	0	0	4,632
20510002	Alexandria NU	**0.60**	0	0	4,493	0	0	0	0	0	0	0	4,493
20510003	Bathurst NU	**0.00**	0	0	6,570	0	0	0	0	0	0	0	6,570
20610001	Alexandria NU	**0.11**	0	0	4,969	0	0	0	0	0	0	0	4,969
Summary for 'QUAT' = P20A (10 detail records)													
Total			*0*	*0*	*16,032*	*0*	*12,346*	*1,004*	*0*	*51*	*0*	*0*	*29,433*

Quaternary P20B

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20610001	Alexandria NU	**0.18**	0	0	4,969	0	0	0	0	0	0	0	4,969
Summary for 'QUAT' = P20B (1 detail record)													
Total			*0*	*0*	*4,969*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*4,969*

Quaternary P30A

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20404001	Albany NU	**0.04**	0	0	12,102	0	0	0	0	0	0	0	12,102
Summary for 'QUAT' = P30A (1 detail record)													
Total			*0*	*0*	*12,102*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*12,102*

Quaternary P30B

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20404001	Albany NU	**0.05**	0	0	12,102	0	0	0	0	0	0	0	12,102
20510001	Albany NU	**0.84**	0	0	764	0	0	0	0	0	0	0	764
20510003	Bathurst NU	**0.05**	0	0	6,570	0	0	0	0	0	0	0	6,570

Summary for 'QUAT' = P30B (3 detail records)

Total	*0*	*0*	*19,436*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*19,436*

Quaternary P30C

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20510003	Bathurst NU	**0.05**	0	0	6,570	0	0	0	0	0	0	0	6,570

Summary for 'QUAT' = P30C (1 detail record)

Total	*0*	*0*	*6,570*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*6,570*

Quaternary P40A

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20402000	Fingo Village SP	**1.00**	0	0	0	0	3,075	0	0	0	0	0	3,075
20403000	Grahamstown SP	**0.71**	0	0	0	598	14,247	0	0	0	751	0	15,596
20403001	Fort England Hospital	**1.00**	0	0	0	0	0	0	0	0	291	0	291
20403002	Grahamstown Military Base	**0.25**	0	0	0	0	0	0	0	0	393	0	393
20403003	Mayfield	**1.00**	0	0	0	0	0	1,728	0	0	0	0	1,728
20403004	Rhodes University	**1.00**	0	0	0	0	0	0	0	0	806	0	806
20403005	Silvertown	**1.00**	0	0	0	0	0	541	0	0	0	0	541
20403006	Vukani	**1.00**	0	0	0	0	0	2,061	0	0	0	0	2,061
20404001	Albany NU	**0.06**	0	0	12,102	0	0	0	0	0	0	0	12,102
20405001	Eluxolweni	**0.62**	0	0	0	0	0	796	0	0	0	0	796
20405003	Kopke	**0.00**	0	0	0	0	1,681	0	0	0	0	0	1,681
20405004	Xolani	**0.60**	0	0	0	0	33,938	0	0	0	0	0	33,938
20510001	Albany NU	**0.01**	0	0	764	0	0	0	0	0	0	0	764
20510003	Bathurst NU	**0.04**	0	0	6,570	0	0	0	0	0	0	0	6,570

Summary for 'QUAT' = P40A (14 detail records)

Total	*0*	*0*	*19,436*	*598*	*52,941*	*5,126*	*0*	*0*	*2,241*	*0*	*80,342*

Quaternary P40B

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total

Quaternary P40B

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20404001	Albany NU	**0.00**	0	0	12,102	0	0	0	0	0	0	0	12,102
20502000	Bathurst SP	**0.00**	0	0	0	0	597	0	0	0	0	0	597
20510001	Albany NU	**0.06**	0	0	764	0	0	0	0	0	0	0	764
20510003	Bathurst NU	**0.18**	0	0	6,570	0	0	0	0	0	0	0	6,570
20512000	Nolukhanyo SP	**0.89**	0	0	0	0	3,382	0	0	0	0	0	3,382
20512001	Nolukhanyo	**0.39**	0	0	0	0	0	1,570	0	0	0	0	1,570

Summary for 'QUAT' = P40B (6 detail records)

Total	*0*	*0*	*19,436*	*0*	*3,979*	*1,570*	*0*	*0*	*0*	*0*	*24,985*

Quaternary P40C

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20502000	Bathurst SP	**0.76**	0	0	0	0	597	0	0	0	0	0	597
20506000	Kasuka SP	**1.00**	0	0	0	0	102	0	0	0	0	0	102
20510003	Bathurst NU	**0.23**	0	0	6,570	0	0	0	0	0	0	0	6,570
20511000	Nkwenkwezi SP	**1.00**	0	0	0	0	14,673	0	0	0	0	0	14,673
20512000	Nolukhanyo SP	**0.03**	0	0	0	0	3,382	0	0	0	0	0	3,382
20512001	Nolukhanyo	**0.61**	0	0	0	0	0	1,570	0	0	0	0	1,570
20513000	Port Alfred SP	**0.99**	0	0	0	0	4,578	0	0	0	0	0	4,578
20513001	Station Hill	**0.26**	0	0	0	0	1,714	0	0	0	0	0	1,714

Summary for 'QUAT' = P40C (8 detail records)

Total	*0*	*0*	*6,570*	*0*	*25,046*	*1,570*	*0*	*0*	*0*	*0*	*33,186*

Quaternary P40D

SubPlace Code	SubPlace Name	Area ratio in quat*	Sparce: 10 or fewer HH	Tribal settlement	Farm	Smallholding	Urban settlement	Informal settlement	Recreational area	Industrial area	Institution	Hostel	Total
20502000	Bathurst SP	**0.23**	0	0	0	0	597	0	0	0	0	0	597
20508000	Kleinemonde SP	**1.00**	12	0	0	0	0	0	0	0	0	0	12
20510003	Bathurst NU	**0.17**	0	0	6,570	0	0	0	0	0	0	0	6,570
20512000	Nolukhanyo SP	**0.08**	0	0	0	0	3,382	0	0	0	0	0	3,382
20513000	Port Alfred SP	**0.01**	0	0	0	0	4,578	0	0	0	0	0	4,578
20513001	Station Hill	**0.74**	0	0	0	0	1,714	0	0	0	0	0	1,714

Summary for 'QUAT' = P40D (6 detail records)

Total	*12*	*0*	*6,570*	*0*	*10,271*	*0*	*0*	*0*	*0*	*0*	*16,853*

Grand Total	*12*	*0*	*227,844*	*1,196*	*131,852*	*11,957*	*0*	*102*	*3,385*	*33*	*376,381*

* This ratio represents the area of the subplace which falls within the quaternary boundary:1 = 100%
This was not applied to the population figures in this report

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APPENDIX 4

WATER REQUIREMENTS

APPENDIX 4: WATER REQUIREMENTS

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APPENDIX 4.1

DIRECT WATER USE

Categories and default unit water use rates as per the National Demographic Study

CATEGORY	WATER USE *l*/c/d
1. Full service: Houses on large erven > 500m^2	320
2. Full service: Flats, Town Houses, Cluster Houses	320
3. Full service: Houses on small erven > 500m^2	160
4. Small houses, RDP houses and shanties with water connection but minimal or no sewerage service	90
5. Informal houses and shanties with service by communal tap only	10
6. No service from any water distribution system	6
7. Other/Miscellaneous (hostels, etc)	90

APPENDIX 4.2

INDIRECT WATER USE

Classification of Urban Centres as per the National Demographic Study

CLASSIFI-CATION	TYPE OF CENTRE	DESCRIPTION
1.	Long established Metropolitan centres (M)	Large conurbation of a number of largely independent local authorities generally functioning as an entity.
2.	City (c)	Substantial authority functioning as a single entity isolated or part of a regional conurbation.
3.	Town: Industrial (Ti)	A town serving as a centre for predominantly industrial activity.
4.	Town: Isolated (Tis)	A town functioning generally as a regional centre of essentially minor regional activities.
5.	Town: Special (Ts)	A town having significant regular variations of population consequent on special functions. (Universities, holiday resorts, etc.)
6.	Town: Country (Tc)	A small town serving essentially as a local centre supporting only limited local activies.
New Centres		
7.	Contiguous (Nc)	A separate statutory authority, or number of authorities adjacent to, or close to, a metropolis or city and functioning as a component part of the whole conurbation.
8.	Isolated (Nis)	A substantial authority or group of contiguous authorities not adjacent to an established metropolis or city.
9.	Minor (Nm)	Smaller centres with identifiable new or older established centres not constituting centres of significant commercial or industrial activity.
10.	Rural (Nr)	All other areas not having significant centres.

APPENDIX 4.3

INDIRECT WATER USE

Indirect Water Use as a Fraction of the Total Direct Water Use

URBAN CENTRE CLASSIFICATION	COMMERCIAL	INDUSTRIAL	INSTITUTIONAL	MUNICIPAL
Metropolitan	0.2	0.3	0.15	0.08
Cities				
Towns Industrial				
Towns Isolated				
Towns Special	0.30	0.15	0.08	0.03
Towns Country	0.10	0.15	0.03	0.10
New Centres	0.15	0.08	0.08	0.08

Population numbers per category of water use. Direct water use

Quat	Town	Town	*Population numbers*				*Water requirements, 10^6 m^3/a*				*Indirect*	
		Category	*Per category of water use*								*Instit*	*Loss*
			2001	2005	2015	2025	1995	2005	2015	2025	%	%
P10A												
P10B	Riebeeck East	Riebeeck East	689	703	687	652	0.023	0.027	0.027	0.029	18%	25%
		Category 1	-				-	-	-	-		
		Category 2	22	22	22	20	0.003	0.003	0.003	0.002		
		Category 3	22	91	120	232	0.001	0.005	0.007	0.014		
		Category 4	571	590	545	400	0.019	0.019	0.018	0.013		
		Category 5	18				0.000	-	-	-		
		Category 6	56				0.000	-	-	-		
		Category 7	-	-			-	-	-	-		
			689	703	687	652						
P10C												
P10D	Alicedale	Alicedale	5,950	6,070	5,930	5,635	0.136	0.216	0.269	0.268	18%	25%
		Category 1	307	361	390	380	0.036	0.042	0.046	0.044		
		Category 2	-	42	42	40	-	0.005	0.005	0.005		
		Category 3	570	1,570	1,980	1,860	0.033	0.092	0.116	0.109		
		Category 4	1,446	1,970	2,951	3,297	0.048	0.065	0.097	0.108		
		Category 5	3,110	1,949	450	-	0.011	0.007	0.002	-		
		Category 6	293	-	-	-	0.001	-	-	-		
		Category 7	224	178	117	58	0.007	0.006	0.004	0.002		
			5,950	6,070	5,930	5,635						

P10E	**Paterson**	**Paterson**	**4,404**	**4,493**	**4,387**	**4,172**	**0.121**	**0.138**	**0.136**	**0.130**	**18%**	**25%**
		Category 1	-				-	-	-	-		
		Category 2	-				-	-	-	-		
		Category 3	362	366	368	368	0.021	0.021	0.021	0.021		
		Category 4	2,921	3,463	3,419	3,244	0.096	0.114	0.112	0.107		
		Category 5	964	664	600	560	0.004	0.002	0.002	0.002		
		Category 6	157				0.000	-	-	-		
		Category 7					-	-	-	-		
			4,404	4,493	4,387	4,172						
P10F												
P10G	**Kenton On Sea/ Bushmans/Ekuphu**	**Kenton On Sea/ Bushmans/Ekuphu**	**4,781**	**6,451**	**7,588**	**8,696**	**0.168**	**0.257**	**0.359**	**0.482**	**38%**	**25%**
		Category 1	399	430	830	960	0.047	0.050	0.097	0.112		
		Category 2	108	242	262	382	0.013	0.028	0.031	0.045		
		Category 3	338	1,000	1,694	3,282	0.020	0.058	0.099	0.192		
		Category 4	2,563	3,500	3,900	4,000	0.084	0.115	0.128	0.131		
		Category 5	1,373	1,259	859	-	0.005	0.005	0.003	-		
		Category 6	-	-	-	-	-	-	-	-		
		Category 7	-	20	43	72	-	0.001	0.001	0.002		
			4,781	6,451	7,588	8,696						
	Marselle	**Marselle**	**4,699**	**6,294**	**6,146**	**5,843**	**0.188**	**0.238**	**0.299**	**0.329**	**38%**	**25%**
		Category 1	385	385	396	396	0.045	0.045	0.046	0.046		
		Category 2	62	62	75	86	0.007	0.007	0.009	0.010		
		Category 3	1,451	1,792	2,900	3,798	0.085	0.105	0.169	0.222		
		Category 4	1,404	2,240	2,192	1,520	0.046	0.074	0.072	0.050		
		Category 5	1,397	1,800	552	-	0.005	0.007	0.002	-		
		Category 6	-	-	-	-	-	-	-	-		
		Category 7	-	15	31	43	-	0.000	0.001	0.001		
			4,699	6,294	6,146	5,843						

P20A	**Alexandria**	**Alexandria**	**7,715**	**8,371**	**9,178**	**8,720**	**0.327**	**0.392**	**0.500**	**0.483**	**18%**	**25%**
		Category 1	520	560	882	878	0.061	0.065	0.103	0.103		
		Category 2	60	98	496	486	0.007	0.011	0.058	0.057		
		Category 3	1,931	2,950	3,260	3,200	0.113	0.172	0.190	0.187		
		Category 4	4,383	4,190	4,446	4,081	0.144	0.138	0.146	0.134		
		Category 5	753	464	-	-	0.003	0.002	-	-		
		Category 6	68	-	-	-	0.000	-	-	-		
		Category 7	-	113	94	75	-	0.004	0.003	0.002		
			7,715	8,375	9,178	8,720						
	Boknes	**Boknes**	**466**	**712**	**1,287**	**1,475**	**0.048**	**0.069**	**0.126**	**0.143**	**38%**	**25%**
		Category 1	242	408	746	867	0.028	0.048	0.087	0.101		
		Category 2	160	109	225	230	0.019	0.013	0.026	0.027		
		Category 3	-	114	164	186	-	0.007	0.010	0.011		
		Category 4	26	41	88	102	0.001	0.001	0.003	0.003		
		Category 5	19	40	64	90	0.000	0.000	0.000	0.000		
		Category 6	19				0.000	-	-	-		
		Category 7	-				-	-	-	-		
			466	712	1,287	1,475						
	Canon Rocks	**Canon Rocks**	**465**	**711**	**1,286**	**1,474**	**0.047**	**0.068**	**0.126**	**0.143**	**38%**	**25%**
		Category 1	230	400	746	867	0.027	0.047	0.087	0.101		
		Category 2	160	109	225	230	0.019	0.013	0.026	0.027		
		Category 3	-	114	164	186	-	0.007	0.010	0.011		
		Category 4	48	48	88	102	0.002	0.002	0.003	0.003		
		Category 5	20	40	63	89	0.000	0.000	0.000	0.000		
		Category 6	7				0.000	-	-	-		
		Category 7	-				-	-	-	-		
			465	711	1,286	1,474						
P20B												
P30A												

P30B												
P30C												
P40A	**Grahamstown**	**Grahamstown**	**61,759**	**64,370**	**66,387**	**66,591**	**2.868**	**3.177**	**3.594**	**3.793**	**18%**	**25%**
		Category 1	6,913	7,543	8,642	9,533	0.807	0.881	1.009	1.113		
		Category 2	4,000	4,766	5,852	6,809	0.467	0.557	0.684	0.795		
		Category 3	10,350	13,646	18,401	20,563	0.604	0.797	1.075	1.201		
		Category 4	22,280	21,959	19,809	17,024	0.732	0.721	0.651	0.559		
		Category 5	11,090	10,235	9,568	8,852	0.040	0.037	0.035	0.032		
		Category 6	569	672	899	1,086	0.001	0.001	0.002	0.002		
		Category 7	6,557	5,549	4,216	2,724	0.215	0.182	0.138	0.089		
			61,759	64,370	67,387	66,591						
P40B												
P40C	**Port Alfred**	**Port Alfred**	**20,965**	**27,526**	**35,376**	**40,542**	**0.691**	**1.173**	**1.653**	**2.119**	**38%**	**25%**
		Category 1	1,200	2,984	3,978	5,151	0.140	0.349	0.465	0.602		
		Category 2	860	1,342	2,083	2,965	0.100	0.157	0.243	0.346		
		Category 3	3,286	3,713	5,806	8,802	0.192	0.217	0.339	0.514		
		Category 4	6,947	12,325	16,903	18,396	0.228	0.405	0.555	0.604		
		Category 5	7,977	6,232	5,430	3,267	0.029	0.023	0.020	0.012		
		Category 6	694	242	255	775	0.002	0.001	0.001	0.002		
		Category 7	-	688	921	1,186	-	0.023	0.030	0.039		
			20,964	27,526	35,376	40,542						

	Buthurst	**Buthurst**	**5,549**	**6,497**	**6,445**	**6,227**	**0.165**	**0.213**	**0.249**	**0.263**	**18%**	**25%**
		Category 1	120	180	280	360	0.014	0.021	0.033	0.042		
		Category 2	60	81	91	94	0.007	0.009	0.011	0.011		
		Category 3	309	343	584	801	0.018	0.020	0.034	0.047		
		Category 4	3,683	4,823	5,173	4,925	0.121	0.158	0.170	0.162		
		Category 5	1,157	882	207	-	0.004	0.003	0.001	-		
		Category 6	220	169	76	-	0.000	0.000	0.000	-		
		Category 7	-	19	34	47	-	0.001	0.001	0.002		
			5,549	6,497	6,445	6,227						
P40D	**Kleinmonde**	**Kleinmonde**	**1,450**	**1,833**	**2,156**	**2,471**	**0.029**	**0.046**	**0.065**	**0.086**	**38%**	**25%**
		Category 1	114	139	157	174	0.013	0.016	0.018	0.020		
		Category 2	37	44	47	49	0.004	0.005	0.005	0.006		
		Category 3	90	180	289	420	0.005	0.011	0.017	0.025		
		Category 4	64	298	606	988	0.002	0.010	0.020	0.032		
		Category 5	1,113	1,078	882	568	0.004	0.004	0.003	0.002		
		Category 6	31	87	159	247	0.000	0.000	0.000	0.001		
		Category 7	1	7	15	25	0.000	0.000	0.000	0.001		
			1,450	1,833	2,155	2,471						
TOTAL STUDY AREA			**118,892**	**134,029**	**146,855**	**152,499**	**4.812**	**6.014**	**7.404**	**8.268**		

APPENDIX 4.5: Urban Water Requirements per Town

Quat	Town	2001 water requirements				2005 water requirements				2015 water requirements				2025 water requirements				Total water requirements			
		million m³/a				*million m³/a*				*million m³/a*				*million m³/a*				*million m³/a*			
		Direct	Indirect	Losses	Total	Direct	Indirect	Losses	Total	Direct	Indirect	Losses	Total	Direct	Indirect	Losses	Total	2001	2005	2015	2025
P10B	Riebeeck East	0.023	0.004	0.009	0.036	0.027	0.005	0.011	0.043	0.027	0.005	0.011	0.043	0.029	0.005	0.011	0.046	0.036	0.043	0.043	0.046
P10D	Alicedale	0.136	0.024	0.053	0.214	0.216	0.039	0.085	0.341	0.269	0.048	0.106	0.422	0.268	0.048	0.105	0.421	0.214	0.341	0.422	0.421
P10E	Paterson	0.121	0.022	0.048	0.190	0.138	0.025	0.054	0.216	0.136	0.024	0.053	0.214	0.130	0.023	0.051	0.205	0.190	0.216	0.214	0.205
P10G	Kenton On Sea/ Bushmans/Ekuphu	0.168	0.064	0.077	0.309	0.257	0.098	0.118	0.473	0.359	0.136	0.165	0.661	0.482	0.183	0.222	0.887	0.309	0.473	0.661	0.887
	Marselle	0.188	0.072	0.087	0.346	0.238	0.090	0.109	0.437	0.299	0.114	0.138	0.551	0.329	0.125	0.152	0.606	0.346	0.437	0.551	0.606
P20A	Alexandria	0.327	0.059	0.129	0.515	0.392	0.071	0.154	0.617	0.500	0.090	0.197	0.787	0.483	0.087	0.190	0.759	0.515	0.617	0.787	0.759
	Boknes	0.048	0.018	0.022	0.088	0.069	0.026	0.032	0.126	0.126	0.048	0.058	0.232	0.143	0.054	0.066	0.263	0.088	0.126	0.232	0.263
	Canon Rocks	0.047	0.018	0.022	0.087	0.068	0.026	0.031	0.125	0.126	0.048	0.058	0.232	0.143	0.054	0.066	0.263	0.087	0.125	0.232	0.263
P40A	Grahamstown	2.868	0.516	1.128	4.512	3.177	0.572	1.250	4.999	3.594	0.647	1.413	5.654	3.793	0.683	1.492	5.968	4.512	4.999	5.654	5.968
P40C	Port Alfred	0.691	0.263	0.318	1.272	1.173	0.446	0.540	2.158	1.653	0.628	0.760	3.041	2.119	0.805	0.975	3.899	1.272	2.158	3.041	3.899
	Buthurst	0.165	0.030	0.065	0.259	0.213	0.038	0.084	0.335	0.249	0.045	0.098	0.392	0.263	0.047	0.104	0.414	0.259	0.335	0.392	0.414
P40D	Kleinmonde	0.029	0.011	0.013	0.054	0.046	0.017	0.021	0.085	0.065	0.025	0.030	0.119	0.086	0.033	0.040	0.159	0.054	0.085	0.119	0.159
TOTAL STUDY AREA																		7.88	9.95	12.35	13.89

APPENDIX 4.6: Total urban water requirements per quaternary catchment

Quaternary	Urban population numbers				Total urban requirements			
	Million m^3/a				*Million m^3/a*			
	2001	***2005***	***2015***	***2025***	***2001***	***2005***	***2015***	***2025***
P10A	-	-	-	-	-	-	-	-
P10B	689	703	687	652	0.036	0.043	0.043	0.046
P10C	-	-	-	-	-	-	-	-
P10D	5,950	6,070	5,930	5,635	0.214	0.341	0.422	0.421
P10E	4,404	4,493	4,387	4,172	0.190	0.216	0.214	0.205
P10F	-	-	-	-	-	-	-	-
P10G	9,480	12,745	13,734	14,539	0.656	0.910	1.212	1.493
P20A	8,646	9,793	11,751	11,669	0.690	0.868	1.252	1.285
P20B	-	-	-	-	-	-	-	-
P30A	-	-	-	-	-	-	-	-
P30B	-	-	-	-	-	-	-	-
P30C	-	-	-	-	-	-	-	-
P40A	61,759	64,370	66,387	66,591	4.512	4.999	5.654	5.968
P40B	-	-	-	-	-	-	-	-
P40C	26,514	34,023	41,821	46,769	1.531	2.493	3.434	4.313
P40D	1,450	1,833	2,156	2,471	0.054	0.085	0.119	0.159
Total	**118,892**	**134,029**	**146,855**	**152,499**	**7.883**	**9.955**	**12.350**	**13.889**

APPENDIX 4.7: Rural water requirements

Quaternary	Accepted	MD Growth rates, % per annum			Projected population numbers				Water use	Projected domestic requirements			
	Base	*High scenario*							*l/c/d*	*Million m3/a*			
	2001	2005	2015	2025	*2001 Base*	*2005*	*2015*	*2025*	*2001*	*2001*	*2005*	*2015*	*2025*
P10A	363	0.3718	-0.2974	-1.0859	363	368	358	321	127	0.017	0.018	0.018	0.016
P10B	1,452	0.3718	-0.2974	-1.0859	1,452	1,474	1,430	1,283	47	0.025	0.026	0.027	0.024
P10C	310	0.2520	-0.9677	-1.2250	310	313	284	251	129	0.015	0.015	0.015	0.013
P10D	977	0.3718	-0.2974	-1.0859	977	992	963	863	46	0.016	0.017	0.018	0.016
P10E	1,328	0.3715	-0.5357	-0.8486	1,328	1,348	1,277	1,173	47	0.023	0.024	0.024	0.022
P10F	1,344	0.3718	-0.2974	-1.0859	1,344	1,364	1,324	1,187	120	0.059	0.062	0.064	0.057
P10G	2,488	0.3715	-0.5357	-0.8486	2,488	2,525	2,393	2,198	41	0.037	0.039	0.040	0.036
P20A	3,242	0.3715	-0.5357	-0.8486	3,242	3,290	3,118	2,864	39	0.046	0.049	0.049	0.045
P20B	894	0.3715	-0.5357	-0.8486	894	907	860	790	124	0.040	0.043	0.043	0.039
P30A	484	0.3718	-0.2974	-1.0859	484	491	477	428	118	0.021	0.022	0.023	0.020
P30B	1,575	0.3714	-0.5358	-0.8476	1,575	1,599	1,515	1,391	16	0.009	0.010	0.010	0.009
P30C	328	0.3714	-0.5358	-0.8476	328	333	315	290	119	0.014	0.015	0.015	0.014
P40A	997	0.3718	-0.2974	-1.0859	997	1,012	982	881	38	0.014	0.015	0.015	0.013
P40B	1,228	0.3714	-0.5358	-0.8476	1,228	1,246	1,181	1,085	42	0.019	0.020	0.020	0.018
P40C	1,511	0.3714	-0.5358	-0.8476	1,511	1,534	1,453	1,335	43	0.024	0.025	0.025	0.023
P40D	1,117	0.3714	-0.5358	-0.8476	1,117	1,134	1,074	987	43	0.018	0.019	0.019	0.017
Total	**19,638**				**19,638**	**19,930**	**19,006**	**17,324**		**0.396**	**0.419**	**0.424**	**0.386**

Appendix 4.8: Irrigation water requirements in 2001

Quaternary	Average area	Maximum area	Field edge req.	Net requirement	Conv. losses	Conv. losses	Gross requir.
	ha	ha	m^3/ha/a	x10^6 m^3/a	%	x10^6 m^3/a	x10^6 m^3/a
P10A	22	44	8,500	0.372	12%	0.051	0.423
P10B	83	165	8,500	1.404	12%	0.191	1.595
P10C	47	94	8,500	0.795	12%	0.108	0.903
P10D	94	187	8,500	1.590	12%	0.217	1.806
P10E	77	153	8,500	1.302	12%	0.178	1.480
P10F	77	153	8,500	1.302	12%	0.178	1.480
P10G	55	109	8,500	0.930	12%	0.127	1.057
P20A	0	0	8,500	0.000	12%	0.000	0.000
P20B	0	0	8,500	0.000	12%	0.000	0.000
P30A	53	105	8,500	0.896	12%	0.122	1.018
P30B	119	237	8,500	2.012	12%	0.274	2.287
P30C	20	40	8,500	0.338	12%	0.046	0.384
P40A	6	12	8,500	0.101	12%	0.014	0.115
P40B	3	6	8,500	0.051	12%	0.007	0.058
P40C	6	12	8,500	0.101	12%	0.014	0.115
P40D	3	6	8,500	0.051	12%	0.007	0.058
Total	**665**	**1,323**		**11.246**		**1.533**	**12.779**

Appendix 4.9: Stock Watering, Afforestation and Alien Vegetation Water Requirements

	Stock Watering		Afforestation		Alien Vegetation	
Quaternary	No. ELSU	Water requirements	Average area	Net requirement	Average area	Reduction runoff
		$x10^6$ m^3/a	km^2	$x10^6$ m^3/a	km^2	$x10^6$ m^3/a
P10A	849	0.032	2.14	0.050	5.27	0.38
P10B	3,436	0.126			4.51	0.30
P10C	822	0.032			0.00	0.00
P10D	2,535	0.095			0.26	0.04
P10E	9,982	0.158			0.78	0.06
P10F	7,392	0.126			11.20	0.51
P10G	8,851	0.126			0.41	0.04
P20A	12,476	0.189			51.10	4.60
P20B	9,812	0.152			57.19	3.64
P30A	1,188	0.032	3.40	0.090	22.12	1.64
P30B	4,082	0.095			5.49	0.29
P30C	1,861	0.032			0.38	0.01
P40A	3,211	0.063	0.75	0.020	40.11	3.22
P40B	6,994	0.126			5.62	0.32
P40C	9,469	0.158			10.98	0.69
P40D	6,797	0.126			13.51	1.07
Total	**89,757**	**1.666**	**6.29**	**0.160**	**228.93**	**16.81**

Appendix 4.10: Water requirements summary

Water requirements per user sector

User Sector	Water Requirements ($10^6 m^3/a$)				Distribution, %	
	2001	2005	2015	2025	2001	2025
Urban domestic and industrial	7.88	9.95	12.35	13.89	19.9	30.4
Rural domestic	0.40	0.42	0.42	0.39	1.0	0.8
Stock watering	1.67	1.67	1.67	1.67	4.2	3.6
Irrigation	12.78	12.78	12.78	12.78	32.2	28.0
Afforestation	0.16	0.16	0.16	0.16	0.4	0.4
Alien vegetation	16.81	16.81	16.81	16.81	42.3	36.8
Total consumptive requirements	**39.70**	**41.79**	**44.19**	**45.69**	**100.0**	**100.0**
Return Flows	-2.35	-2.69	-3.08	-3.20	-5.9	-7.0
Interbasin transfer	-2.31	-2.80	-3.45	-3.65	-5.8	-8.0
Groundwater supply	-1.97	-2.60	-2.73	-3.11	-5.0	-6.8
Total inflows	-6.63	-8.09	-9.26	-9.96	-16.7	-21.8
Total use from surface water	**33.07**	**33.70**	**34.93**	**35.73**	**83.3**	**78.2**

Water requirements per quaternary catchment

Quaternary Sub-catchment	Projected Water Requirements ($10^6 m^3/a$)				Naturalised MAR
	2001	2005	2015	2025	
P10A	0.88	0.88	0.88	0.88	4.54
P10B	2.01	2.00	2.00	2.00	12.19
P10C	0.93	0.93	0.93	0.93	2.39
P10D	2.07	2.14	2.19	2.19	6.77
P10E	1.70	1.63	1.52	1.42	8.85
P10F	2.12	2.12	2.12	2.12	13.60
P10G	1.88	2.13	2.43	2.72	9.60
P20A	4.27	3.90	4.22	3.96	30.38
P20B	3.79	3.79	3.79	3.79	15.27
P30A	2.78	2.78	2.78	2.78	6.86
P30B	2.67	2.67	2.67	2.67	11.69
P30C	0.43	0.43	0.43	0.43	1.70
P40A	3.77	3.57	3.30	3.29	13.73
P40B	0.50	0.50	0.50	0.50	8.18
P40C	1.99	2.92	3.84	4.71	14.02
P40D	1.28	1.30	1.31	1.33	13.28
TOTAL	**33.07**	**33.70**	**34.93**	**35.73**	**173.05**

APPENDIX 5

EXISTING INFRASTRUCTURE

APPENDIX 5: EXISTING INFRASTRUCTURE

Contents

Appendix 5.1: Water Services Development Plans: Extract of Infrastructure Data Sheets

Appendix 5.2: List of Registered Dams within P – Drainage Region

ALEXANDRIA
WATER SERVICES DATA SHEET

1. DESCRIPTION OF THE SUPPLY AREA

The supply area includes the town of Alexandria and the former townships of Wentzel Park and KwaNonqubela.

2. DESCRIPTION OF THE INFRASTURUCTURE

2.1 Water

Raw water is obtained from a series of coastal springs near Cape Padrone and from 2No. well points near Fishkraal. Both sources are located some 16 km south east of Alexandria near the coastline.

The water from the boreholes and the springs is pumped to a balancing reservoir located some 10km from Alexandria and then pumped to the main storage reservoir located to the west of Alexandria. Water is then gravity fed through the reticulation network to consumers.

See the layout schematic of the scheme at the end of the data sheets.

2.2 Sanitation

The wastewater from these areas drain into an oxidation pond system, complete with irrigation system.

3. DATA ON THE SUPPLY AREA

No	Name	Households	Population	Level of Service	Comment
1	Alexandria	486	1820	100% yard connection 100% sewered	40 low income households
2	Wentzel Park	285	1263	100% yard connection 80% sewered	200 low income households
3	KwaNonqubela	1215	4632	100% yard connection 40% sewered	1450 low income households
4	New Developments	500	1500	100% yard connection 100% sewered	

(Census 2001)

4. INFRASTRUCTURE COMPONENTS REF: KWEZI V3

4.1 Water

Component	Capacity	Comment
Fountains /Springs	Drought : 7l/s (24) Normal : 16 l/s (1382 m³/day)	1 x spare BH at 3 l/s (12)
Fountains pump station and pumping mains	Q=18l/s (1555 m³/day) L=2320m h= 122 m (static) Ø= 100/125mm AC	Adequate capacity
Boreholes / well points (Fishkraal)	Q=2 x 6 l/s = 12l/s (1037 m³/day)	Adequate yield if used conjunctively with the springs to beyond 2005 Qtotal = 22 l/s Qpeak = 20 l/s (2005)
Primarily pump station and pumping main	Q=15 l/s (1296 m³/day) L= ? m h= ? m (static) Ø= ? mm AC	Adequate capacity
Balancing Reservoir	265m³	4 hours of AADD $_{2000}$
Main pump station and pumping main to air vent	Q=19l/s (1642 m³/day) L= 6220 m h= ? m Q= 150 mm AC L= 900 m Ø= 150 mm (ductile iron)	Limiting factor to meet peak demands Operating in parallel with the existing main. Part of ongoing upgrade.
Gravity main air vent reservoir	Q= ? L=8500 m h= ? m Ø= 150 mm AC L=1900 m h= 66 m Ø= 200 uPVC	Limiting factor to meet peak demands Operating in parallel Part of ongoing upgrade.
Reservoirs Total	3400 m³	50 hours AADD $_{2005}$ storage

Notes:

- AADD (current) = 1380 m³/day (16 l/s)
- Peak demands 1660 m³/day (19.2 l/s) ; SPF=1.2
- Current capacity of system = 19 l/s plus spare BH at springs: 3 l/s (12)
- GAADD (2025) = 2100 m³/day (Gross Annual Average Daily Demand – including losses)
- GGSDD (2025) = 2500 m³/day
- Only chlorination takes place
- Total storage capacity of existing reservoirs: 1 x 1.5 Ml, 1 x 1.0 Ml, 2 x 0.45 Ml

4.2 Sanitation

Component	Capacity	Comments
Oxidation ponds	Primarily ponds : 5400 m ² Secondary ponds : 46 300m²	Capacity of the system is unknown

5. KEY ISSUES

5.1 Water

- The conveyance system from the balancing reservoir to the bulk storage reservoir has limited capacity and is unable to meet the peak summer demands (19 l/s (24 h))
- Low pressures are being experienced in Wentzel Park.
- 643 erven and 20 small holdings still required, access to a formal water supply in KwaNonqubeka.
- Main industry: Chicory factory

5.2 Sanitation

- The adequacy of the wastewater system is not known.
- Sewer infrastructure is required for 643 households in KwaNonqubela and 80 erven in Phokoza valley.
- 20 households in KwaNonqubela require VIP's

6. ONGOING PROJECTS

- Investigation into the capacity of the oxidation pond

7. IDENTIFIED PROJECT

7.1 Water

	excluding VAT
• In-line booster pumps for Wentzel Park :	R 80 000
• 150 mm pumping main on bulk delivery system	R 1 700 000
• 200 mm gravity main on bulk delivery system	R 3 100 000
• Extension to main pump station on bulk delivery system	R 950 000
• Reticulation to 643 erven in KwaNonqubela	R 1 050 000
• Reticulation to 20 small holdings in KwaNonqubela	R 100 000

7.2 Sanitation

	excluding VAT
• Upgrading of the oxidation pond system	R 4 800 000
• Sewer infrastructure for Phokoza Valley	R 560 000
• Sewer infrastructure for KwaNonqubela	R 2 800 000
• VIP's for KwaNonqubela	R 40 000

8. SOURCE OF INFORMATION

- Mr. G. Kruger Kwezi V3 Engineers (PE)
- Mr S. Fick P&S Consulting (Alexandria) – (046) 653 0770
- Mr W. Patterson Ndlambe Municipality – 082 572 1517
- Eastern Cape Water Resources Situation Assessment
- DWAF National Database

CANNON ROCKS / BOKNES
WATER SERVICES DATA SHEET

1. DESCRIPTION OF THE SUPPLY AREA

The supply area includes the coastal resorts of Cannon Rocks and Boknes. This area does fall within the area of jurisdiction of the Albany Coast Water Board, although they are currently not active in the area.

2. DESCRIPTION OF THE INFRASTRUCTURE

2.1 Water

Water is obtained from 3No boreholes located to the west of Cannon Rocks and pumped through the linked reticulation network, to 2No. storage reservoirs.

2.2 Sanitation

All households have septic tanks with soakaways.

3. DATA OF THE SUPPLY AREA

NO	Name	Household	Population	Level of service	Comment
1	Cannon Rocks	99	215	• 100% yard connection • 100% septic tanks	
2	Boknes	101	216	• 100% septic tanks • 100% yard connections	

Notes:

- The IDP indicates a permanent population of 372 with an additional seasonal population of 2500
- The DWAF National Database indicates a permanent population of 3873

4. DATA ON INFRASTRUCTURE

4.1 Water

Component		Capacity	Comment
3No boreholes Pumping main Reservoir	No 1&2: 10 l/s (12) No 3: 5 l/s (12) 650 m³/d	Q= 3-6l/s(±390m³/day) Into Reticulation H= 170 ' (CR), 130 ' (B) Ø=100mm(CR), 225mm(B)	Poor water quality see note 2
Cannon Rock Reservoir		470 m³	48 hours of AADD
Boknes Reservoir		530m³	48 hours of AADD

Notes:

- 1No borehole is used out of season
- **The water quality in the boreholes is unpalatable, apparently as a result of sea water intrusion due to over pumping.**
- AADD (current) : = 500 m³/day
- Current peak demands = 1300 m³/day; PF = 2.6
- AADD (2025) : = 1400 m³/day
- GSDD (2025) : = 2000 m³/day
- Water is currently used primarily for gardening.

4.2 Sanitation

All households have owner built septic tanks with soakaways.

5. KEY ISSUES

5.1 Water

- The quality of the water is poor, apparently as a result of sea water intrusion due to over pumping.
- 100 new plots at CR and a settlement of Stillwater (180 erven), in the vicinity of Boknes is currently being planned.
- Water loses could be high as water is pumped thorough the reticulation networks to the storage reservoirs.

5.2 Sanitation

- Nil

6. ONGOING PROJECTS

6.1 Water

- Although there are currently no ongoing projects, attempts are being made to utilise CDM funds to augment the supply to the area from the Fishkraal boreholes, which are currently used to supply Alexandria
- 5.5 km pipeline from Fishkraals to Cannon Rocks
- New source development at Cannon Rocks (Apies River well field)
- Proposed to secure BH's that supply farmers with irrigation to supply Cannon Rocks community

6.2 Sanitation

- Nil.

7. IDENTIFIED PROJECTS

7.1 Water

- 2 possible alternative boreholes sites have been identified to augment supply to the area.

7.2 Sanitation

- Nil

8. SOURCE OF INFORMATION

- Mr S. Fick P&S Consulting
- Mr R. Ball Albany Coast Water Board
- Mr W. Patterson Ndlambe Municipality
- Eastern Cape Water Resources Situation Assessment
- Western District Council WSDP

BUSHMANS RIVER / KENTON-ON-SEA
WATER SUPPLY DATA SHEET

1. DESCRIPTION OF THE SUPPLY AREA

The supply area includes the towns of Kenton-on-Sea and Bushmans River Mouth and the former townships of Klipfontein, Marselle and Ekuphumleni.

2. DESCRIPTION FO THE INFRASTRUCTURE

2.1 Water

Raw water is obtained from the following sources.

- 6No. boreholes near Dias Cross.
- 5No “fresh” water boreholes located near the Albany Coast Board offices.
- 8 No. sea water boreholes located near the mouth of the Bushmans River.

Water from the Dias Cross boreholes is pumped to a balancing reservoir from where it is pumped directly to the bulk supply reservoirs located at a high point behind Kenton-on-Sea (north of the R72).

Water from the other boreholes is pumped to plastic tanks near the Albany Coast Water Board Offices and then pumped through a reverse osmosis desalination plant before going into local storage. Brine from the desalination plant is returned to the sea via the Bushmans River, whilst the treated water is pumped to the bulk storage reservoirs.

Potable water from the bulk reservoirs is gravity fed directly to Kenton-on-Sea, eKuphumleni, Marselle, Klipfontein and a reservoir which feeds Bushmans River Mouth. A pumped supply system also feeds some farmers and a balancing reservoir to the north of Kenton-on-Sea.

It can be noted that most households in these areas augment their supplies with rainwater tanks.

See the layout schematic of the scheme end of the data sheets.

6 x 10 m deep boreholes are responsible for 60 % of the bulk supply – these are vulnerable during low rainfall periods.

2.2 Sanitation

Both Kenton-on-Sea and Bushmans River Mouth have septic tanks and soakaways whilst Klipfontein, Marselle and eKuphumleni have waterborne sewer systems which drain to activated sludge wastewater treatment works in Bushmans River Mouth and Kenton-on-Sea respectively.

3. DATA ON THE SUPPLY AREA

NO	Name	Households	Population	Level of service	Comments
1	Klipfontein & Marselle	1294	4399	100% yard connections 100% water borne sewer	
2	Kenton-on-sea	404	856	100% yard connections 100% septic tanks	
3	eKuphumleni	1027	3625	100% yard connections 100% water borne sewer	
Notes: • Population figures from DWAF National database					

4. INFRASTRUCTURE DATA

4.1 Water

Component	Capacity	Comments
Dias Cross boreholes and conveyance system - 19 l/s (12) Pipeline rated: 25 l/s	Q=34 m³/h (24) 820 m³/d ø= 200 PVC	Only licensed to abstract 300 000 m³/a (average of ±34 m³ /h) (24) or 822 m³/d
Balancing reservoir	100 m³	1.3 hours storage at peak capacity
Pumping system to bulk storage reservoir	Q=90 m³/h L= ± 9000m ø= 200 PVC	
Brackish boreholes	Q=21 m³/h	
Sea water boreholes	Q=110 m³/h	Total capacity from all 3 sources = 165 m³/hour

Component	Capacity	Comment
Plastic Tanks	7 x 15 = 95m³	0.75 hours of storage at peak capacity
Desalination Plant • No.1 • No 2 • No 3 Only 2 x RO's operate simultaneously	 20m³/hour 20m³/hour 10m³/hour	Plant No1 is currently functional. Only 50% of the capacity has been installed in plant No.3. The figures quoted are the final outputs. The desalination plants are ± 38% efficient.
Storage reservoir	100 m³	
Pumping system to bulk storage reservoir	Q=58 m³/h	
Bulk Reservoir	2 x 2 Ml	64 hours of AADD at current levels.
Bushmans reservoir	100 m³	
Farmers pump system	Q=15 m³/h	
Farmers Reservoir	200 m³	

Notes:

- Current AADD = 1200 – 1500 m³/day (63m³/hour)
- Current peak demand = 2800 m³/day (117m³/hour); PF = 1.86;
- Current capacity of system = 114 m³ / hour (when plant No. 1 is functional)
- The annual average capacity of the system currently stands at 64m³/hour
- AADD (2005) = 1960 m³/day
- AADD (2005) = 3150 m³/day
- Restrictions are often imposed on garden watering during peak seasons (Dec and Jan).
- Growth is currently around 10% p.a.
- Klipfontein: 200 RDP houses with sewer services
- Marselle: 230 completed RDP houses, plus 700 planned RDP houses

4.2 Sanitation

Component	Capacity	Comments
Ekuphumleni WWTW	Q=? m³/day	
Klipfontein / Marselle WWTW	Q=? m³/day	

Notes:

5. KEY ISSUES

5.1 Water

- The peak demands can only be sustained by stress pumping the Dias Cross boreholes beyond their permitted annual average abstraction rate.
- The water quality is sub-standard (class II –see typical analysis sheet attached), (currently 1400 mg/l TDS).
- The bulk storage capacity is inadequate for the peak season (4 Ml = 1.4 days).

- The Eskom supply is erratic, which further limits the supply capacity of the scheme.
- Desalinated water is expensive.
- The brine from the desalination plant is returned to the river, near the river mouth, which may have some negative environmental impact.

5.2 Sanitation

- Some septic tanks are overloaded during peak season resulting in some spillages.

6. ONGOING PROJECTS

6.1 Water

Upgrading of bulk infrastructure R3.4 million (CMIP), which includes:

- Refurbishing plant No1 (completed in November 2003)
- Augmentation of supply via run-of-river abstraction and filtration (100m³/hour), scoping report in progress.
- Upgrading desalination plant No.3 to its full capacity.
- Upgrading the brine disposal system, scoping report in progress.
- Upgrading the Eskom supply.

6.2 Sanitation

- Nil

7. IDENTIFIED PROJECTS

1.1 Water

- Upgrading the bulk storage capacity systems – additional 2 Ml reservoir
- Develop new Kwaaihoek well field – 12 l/s (12)

1.2 Sanitation

- Nil

8. SOURCE OF INFORMATION

Mr R Ball – Albany Coast Water Board

Mr W Patteson – Ndlambe Municipality

Eastern Cape Water Resources Situation Assessment

PORT ALFRED
WATER SERVICES DATASHEET

1. DESCTIPTION OF THE SUPPLY AREA

The supply area includes the town of the Port Alfred, the former townships of Nemato and Minosa Farm and the proposed township of Thornhill.

2. DESCRIPTION OF THE INFRASTRUCTURE

2.1 Water

Raw water is obtained from a weir on the Kowie River and pumped to an off channel storage dam (Sarel Haywood Dam) on the Bathurst stream. Water is then pumped from main linking the weir pumping system to the dam, to the sump of a third pump station, from where the water is pumped to a balancing dam near the hospital. From there the water is gravity fed to the water treatment works located to north of town in the vicinity of the school.

Potable water is then pumped from the bulk storage reservoir to 4No distribution reservoirs located on the East Bank, West Bank, Nemato township and a high level supply zone reservoir. Water is then reticulated by gravity to households.

Port Alfred also used to obtain water front the Mansfield Dam located to the south of Bathurst and from coastal sand dunes near the town. The dune system is still used during the peak seasons whilst the gravity main from the Mansfield is said to be broken in many places.

See the layout schematic of the scheme at the end of the datasheets.

2.2 Sanitation

Parts of Port Alfred and parts of Nemato have waterborne sanitation, which drains into ponds treatment system, complete with an irrigation system, located on the banks of the Kowie River near, just upstream of Centenary Park.

The balance of Port Alfred has conservancy tanks whilst the balance of Nemato has pit latrines.

3. DATA ON THE SUPPLY SYSTEM

No	Name	Households	Population	Level of service	comments
1	Port Alfred	1588	4578	100% erf connections 40% water borne 60% conservancy tank	
2	Nemato: Station Hill Nkwnkwezi	4432	16387	60% yard connection 20% communal standpipe; 20% water borne 50% digestive systems with French drains 50% VIP's	Phased upgrading of digestive system to a waterborne sewer system
3	Thornhill				Proposed development to cater for over crowding in Nemato

Notes:

- Population figures from DWAF National database.

4. INFRASTRUCTURE DATA

4.1 Water

Component	Capacity	Comments
Sarel Haywood Dam	Live storage =2.5 x10^6 m³ Yield = 1.5 x 10^6 m³/a (4.1 Ml/day)	1:50 year yield
Mansfield Dam	Live storage = 0.2 x 10^6 m³	No longer used
Dune system	yield = 0.13 x 10^6 m³/a (356 m³/day)	Used in peak season
Weir abstraction system (pump system No.1)	Q=12 960 m³/day (150 l\s) L= 700 m Ø= 350 mm	Cannot abstract from the weir if the water level reaches 1.0 m below the crest of the weir
Pump system No 1	Q=4320 m³/day (50l/s) L= 4200 m Ø= 300 mm	
Pump system No 2	Q=4320 m³/day (50l/s) L= 6800 m Ø= 250 mm	
Balancing Dam	16 000 m³	± 8 days of AADD at current levels
Gravity system		Capacity recently upgraded
Water treatment works	5 Ml/day	Recently upgraded

Bulk reservoir	2 Ml	± 24 hours AADD at current demands
Distribution reservoirs		
West Bank	2.8 Ml	
East Bank	0.8 Ml	
Nemato	1.0 Ml	

Notes:

- AADD (current) = 1.8 - 2.0 Ml/day
- Current peak demand = 5 Ml/day
- Current capacity of system = 4.3 Ml/day
- AADD = (2005) = 2.3 Ml/day
- AADD = (2010) = 2.4 Ml/day

4.2 Sanitation

Component	Capacity	Comments
Ponds system	1.8 Ml/day	Average inflows = ± 94% of wwtw capacity. Peak inflows = +/- 236% of wwtw capacity

Notes:

1. The original design of the wwtw never catered for Nemato
2. The capacity of the ponds are exceeded during the summer peaks and spillage into the Kowie River probably occur

5. KEY ISSUES

5.1 Water

- The reliability (assurance of supply) of the raw water supply is questionable.
- The raw water quality is poor (high saline content) due to the marine origins of the soils underlying the dam basin. See potable water analysis sheet attached.
- The capacity of the bulk supply system needs to be upgraded to meet the peak seasonal demands.
- Bulk water supply infrastructure is required to support the proposed Thornhill development.
- Not all households in Nemato have access to yard connections.

5.2 Sanitation

- The existing oxidation ponds are inadequate to meet the current demands,
- Bulk infrastructure is required to support the proposed Thornhill development.
- Some households in Nemato do not have access to even a basic level of service.
- Not all households have access to the water borne sewer system.

6. ONGOING PROJECTS

6.1 Water

- Refurbishment of the water treatment work and gravity conveyance system R2.0 million (CMIP).

6.2 Sanitation

- None

7. IDENTIFIED PROJECTS

The following projects are recommended.

7.1 Water

- A water resources study of the area with a view to improving the assurance and quality of supply to the Ndlambe area in general and Port Alfred in particular.
- Upgrading of the bulk supply infrastructure.
- Provision of bulk water services to Thornhill and Nemato.

7.2 Sanitation

- Investigation and possible upgrading of the wastewater treatment works.
- Investigation with regard the use of partly treated sewerage to irrigate the golf course.
- Provision of services to Thornhill and sewers to the remaining portions of Port Alfred and Nemato.

8. SOURCE OF INFORMATION

- Mr. W Patterson – Ndlambe Municipality
- Eastern Cape Water Resources Situation Assessment
- Operating and Maintenance Manual for the Safety of the Sarel Hayward Dam.

KLEINENONDE /SEAFIELD
WATER SERVICES SUPPLY SHEET

1. DESCRIPTION OF THE SUPPLY SHEET

The supply area includes East Kleinemonde and Seafield. West Kleinemonde is a share block and the owners are responsible for their own services provision.

2. DESCRIPTION OF THE INFRASTRUCTURE

2.1 Water

Water is obtained from Wellington Dam (a farm dam) located some 8 km north west of the town and from 2No. coastal boreholes located in the Seafield area. The boreholes are generally used as a standby capacity and during peak seasons.

Raw water is pumped from Wellington Dam, via a balancing reservoir, to a water treatment works located on East Kleinemonde peninsula, where it is treated and pumped to a storage reservoir in Seafield. Water is also pumped from the works directly into the Peninsula and South Island reticulation networks, which are connected to the pumping main to the Seafield reservoir.

The Seafield Reservoir gravity feeds a portion of Seafield and a lower laying storage reservoir, which in turn gravity feeds a supply zone within Seafield.

The borehole located to the east of Seafield supplies the Seafield reservoir whilst the borehole near the East Kleinemonde River mouth, supplies the lower zone reservoir.

See the layout schematic of the scheme at the end of the data sheets.

2.2 Sanitation

All households have septic tanks with soakaways.

3. DATA ON THE SUPPLY AREA

NO	Name	Households	Population	Level of Service	Comments
1	East Kleinemonde Seafield	632	1450	50% yard connection 50% septic tanks	± 300 erf are developed ± 200 households are permanently occupied

Notes:

- Population figure from DWAF National database.
- Household figures from NLM

4. INFRASTRUCTURE COMPONENTS

4.1 Water

Component	Capacity	Comments
Wellington Dam		Yield of the dam has not been ascertained.
Wellington pump station and pumping main	Q=360 m³/day L= ± 2000m Ø= 75 mm uPVC	
Balancing reservoir	40 m³	5 hours of AADD at current development
Gravity main	L=± 6000 m Ø= 75mm uPVC	
Water treatment works	90 m³/day	
Pump station and pump main	Q=360 m³/day L= 2000 m Ø= 75 mm U PVC	Capacity is said to be adequate.
Reservoir	800 m³	± 106 hours AADD at current development
Seafield borehole	48 m³/day	
River mouth borehole	50 m³/day	
Zone reservoir	60 m ³	

Notes:

- Winter demand 60 – 100 m³/day
- Summer demands 100 – 150 m³/day
- December demand 360 m³/day; PF= 3.6
- Current capacity of system = 408 m³/day
- AADD (2005) @2%p.a = 268 m³/day
- AADD (2010) @2%p.a = 316 m³/day
- Development of the area is happening fast.
- System appears to be adequate to 207

4.2 Sanitation

All households have owner built septic and soakaways. A tanker service is provided by Ndlambe Municipality if required.

5. KEY ISSUES

5.1 Water

- The reliability of the yield from Wellington dam is not known.
- The frequent Eskom power outages negatively impact on the continuity of supply.
- Bulk and reticulation systems are interconnected (high possibility of water losses/unaccounted for water).
- Telemetry control system negatively impacts on the operational efficiency of the system.
- Water quality of Wellington Dam is poor after heavy rains, TDS goes up to 2500 ppm. The purification plant has a capacity of 90 m^3/d, while the Seafield Boreholes can yield 48 m^3/d. This results in a maximum system capacity of 138 m^3/d during worst case scenarios when water quality is poor.

5.2 Sanitation

- Poorly constructed soakaways result in sewerage spillage into the river during peak holiday season.

6. ONGOING PROJECTS

6.1 Water

- Nil

6.2 Sanitation

- Nil

7. IDENTIFIED PROJECTS

No projects have been identified for this area but the following are recommended:

- Assessment of the reliability of the scheme is general and the dam in particular, taking cognisance of the current growth rate.
- Installation of a dedicated bulk supply system and the upgrading of the reticulation network to ensure an equitable supply through Kleinemonde.

- Review and possible upgrade of the control system
- Establishment of design standards for septic tanks and soakaways

8. SOURCE OF INFORMATION

- Mr Lionel Wilson – Ndlambe Municipality

BATHURST
WATER SERVICES DATA SHEET

1. DESCRIPTIION OF THE SUPPLY AREA

The supply area includes the town of Bathurst and the former townships of Nolukhanyo and Freestone.

2. DESCRIPTION OF THE INFRASTRUCTURE

2.1 Water

The town of Bathurst is dependent on private supplies (boreholes) and rainwater tanks, whilst Nolukhanyo and Freestone are supplied from the Goldenridge Dam. The area used to be supplied with water from the Mansfield Dam, but it ran dry some years ago, necessitating an alternate supply. Raw water is pumped from the dam to a package treatment within the town from where potable water is pumped to the Toposcope reservoir. The reservoir then gravity feeds the respective reticulation networks.

2.2 Sanitation

Bathurst is serviced by a mixture of septic and conservancy tanks whilst Nolukhanyo and Freestone are service with septic tanks and soakaways.

3. DATA ON THE SUPPLY AREA

No	Name	Households	Population	Level of Service	Comment
1	Bathurst		5000	100% yard connections 100% septic tanks	
2	Nolukhanyo		3832	100% yard connections 100% septic tanks	
3	Freestone		1808	100% yard connections 100% septic tanks	

Notes:

- Population figures from the DWAF National Database

4. INFRASTRUCTURE COMPONENTS

4.1 Water

Component	Capacity	Comments
Goldenridge Dam	Storage=400 000 m³ Yield=0.002 x 10^6 m³/a	
Pump stations pumping main	Q=16l/s (1382m³/day) L=8000m Ø=200pVC 2 x 66 kW pumps	
Mansfield Dam	Storage = 165 000 m³ Yield=45 000 m³/a	
Pump station and pumping main	Q=5l/s	
Water treatment works	Q= 18m³/hour (432 m³/day)	Plant has been designed to be progressively upgraded to 28m³/hour and 42m³/hour.
Potable water pumping main	L=1300m Ø=110mm uPVC	
Toposcope Reservoir	1.0 Ml	
Notes: • AADD current = 710 m²/day AADD (2025) = 1134 m³/day (50 % supplied by private BH's, including Bathurst)		

4.2 Sanitation

Conservancy and septic tanks

5 KEY ISSUES

- The scheme does not service the entire area.
- The treatment work is near or at capacity.
- Inadequate bulk storage
- The Mansfield Dam is no longer in use

6 ONGOING PROJECTS

6.1 Water

- Nil

6.2 Sanitation

- Nil

7 INDENTIFIED PROJECTS

- Upgrading of the water treatment works and command reservoir.
- Investigation regarding the adequacy of the scheme to feed the entire town including the possible re-commissioning of the supply from the Mansfield Dam.
- Investigation into the adequacy of the sanitation facilities.

8 SOURCE OF INFORAMTION

Mr J. Nel – Africon (PE)

Mr W Patterson – Ndlambe Municipality

Eastern Cape Water Resources Situation Assessment

HOLIDAY RESORTS AND RURAL SETTLEMENTS WATER SERVICES DATASHEETS

Holiday Resorts

The settlements of Kasuku and Fish River Mouth are holiday resorts and it is reported that they have access to a level of service above RDP standards.

Rural Settlements

These settlements are predominantly located on privately owned farmlands to the east of Ndlambe on the banks of the Fish River.

The following settlements are reported to have access to services below RDP standards

- Glassmere (± 60 people) = have access to sub-RDP services (groundwater)
- Wilmington (±90 people)= have access to sub-RDP services (groundwater)
- Gross Roads (± 20 people) = have access to sub-RDP services (groundwater)
- Tappes Valley (± 4 people) = rain water tanks

WATER SERVICES DEVELOPMENT PLAN:
KLEINEMONDE/SEAFIELD WATER SERVICES SUPPLY SHEET

1. The above document, circulated to the Seafield Resident's and Rate Payers' Association for comments, refers.

My comments are based on a table, which was used by Haldene, Kleyn & Association in 1998, which I find fairly accurate.

2. WATER DEMAND

Year Ended	Number of Dwellings	Gross A.A.D.D.	Average Year Round Demand	Average Summer Peak Demand	Probable Maximum S.P.D.D.	Required from Wellfield	Number of BH's
1998	207	211.53	84/61	384.98	481.23	121.23	2
1999	214	218.46	88.48	395.41	494.27	134.27	2
2000	222	226.38	92.82	407.48	509.36	149.36	2
2005	264	267.96	112.54	468.93	586.16	226.16	3
2010	313	316.47	136.40	538.00	672.50	312.50	4
2015	372	374.88	165.70	618.55	773.19	413.19	5
2020	442	444.18	201.21	710.69	888.36	528.36	6
2025	525	527.35	244.23	815.84	1019.80	659.80	8
2030	623	623.37	296.72	935.06	1168.82	808.82	10

3. WATER SOURCES

3.1 Wellington Dam. Although seen as the main source, it is my contention that this source of supply is at best, a supplementary source of the other sources of supply for the following reasons:

The Wellington dam is situated in the center of pine fields some of them come to within 20 m of the high water level. This causes to soil and pesticides to wash into the dam, especially during heavy rains.

The T.D.S. then rises up to 2,500 parts per million which is too high for drinking water. In fact the water becomes so bad that normal washing of clothes is not possible without staining your clothes.

The purification plant cannot coupe with the filtration once there is a down-pour and the output is only 90 m^3 per day.

3.2 Seafield Borehole. This borehole produced 80 m^3 per day for 4 weeks then the borehole ran dry and the motor burned out.

It is felt that 48 m^3 per day is the maximum that could safely be pumped on a continuous basis.

3.3 River Mouth Borehole. This borehole supplies a zone reservoir of 60 m^3.

The borehole is:

- highly subject to contamination due to household septic tanks being on a higher level than the borehole;
- supplies 32 dwellings which could rise to 40 due to subdivisions of stands;
- a closed system and does not contribute to the current overall capacity of the system;
- is highly susceptible to saline infiltration if this system is used at its peak demand.

4. WATER SUPPLY CAPACITY

Based on the above the current supply capacity of the system is:

Best scenario:

Wellington Dam	-	360 m³
Seafield Borehole	-	48 m³
TOTAL	-	408 m³ per day

Using the above table, there will be a water shortage by 2007 and the supply will not be adequate until 2010 as indicated in the report. Based on 591 stands (632 minus 32 stands fed from River Mouth Borehole).

Worst scenario: (Refer to paragraph 3.1)

Wellington Dam	-	90 m³
Seafield Borehole	-	48 m³
TOTAL	-	138 m³ per day

In the event of such a situation occurring (heavy rainfall) – a common yearly occurrence – the system capacity will be barely adequate to supply present demand.

5. RECOMMENDATION

It is recommended that an alternative main source of water be found.

Although Wellington Dam might have the water capacity, problems mentioned in paragraph 3.1 makes this source unreliable and not worth spending money on increasing filtration capacity.

The exploitation of the Palmiet Welfield – or any closer underground source – should be developed as a matter of urgency.

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J STRYDOM (PR.ENG)
Committee Member 2004

23 January 2003

Registered Dams within P - Drainage Region

APPENDIX 5.2

Dam number	Name	Longitude			Latitude			Completion Date	Type of wall	Wall height	Capacity (1000m3)	Area (ha)
P100-01	NUWEJAARS DAM (NEW YEARS)	26	6	50	33	18	10	1959		22	4700	96
P100-02	JAMESON DAM	26	26	15	33	18	55	1906	EARTHFIL	13	575	15
P100-03	MILNER DAM	26	25	40	33	18	45	1898	EARTHFIL	13	255	7.7
P101-14	GREY DAM	26	31	45	33	19	25	1861	EARTHFIL	12	68	1
P101-17	KAREELEEGTE DAM	25	44	1	33	12	1	1962	EARTHFIL	6	64	7
P101-18	BLACKBURN DAM	26	1	5	33	11	45	1970	EARTHFIL	10	150	0
P101-19	TEAFONTEIN RESERVOIR	26	16	30	33	13	25	1906	EARTHFIL	8	204	3
P102-14	TABLE HILL BIG DAM	26	25	1	33	16	1	1951	EARTHFIL	12	364	8
P102-15	OAKWELL DAM	26	20	15	33	17	30	1969	EARTHFIL	10	82	2
P102-16	MOSSLANDS DAM	26	27	15	33	24	10	1962	EARTHFIL	15	571	18
P102-17	BRAKKLOOF RIVER DAM	26	22	50	33	13	30	1960	EARTHFIL	7	75	4
P102-18	STROWAN DAM	26	28	10	33	17	45	1950	EARTHFIL	9	139	6
P102-19	HILTON DAM	26	20	50	33	14	50	1954	EARTHFIL	6	60	3
P102-20	SHENFIELD CAMP DAM	26	12	0	33	13	35	1952	EARTHFIL	10	60	2
P102-21	MOUNTAIN VIEW DAM	26	19	40	33	28	10	1988	EARTHFIL	11	250	1
P102-22	SPRINGVALE DAM (ZUUR KLOOF 271)	26	12	40	33	21	5	1983	EARTHFIL	9	163	6
P102-23	PROCTORSFONTEIN DIPPING TANK DAM	26	11	55	33	22	28	0	EARTHFIL	9	126	3
P102-24	PROCTORSFONTEIN HOUSE DAM	26	12	23	33	22	32	1950	EARTHFIL	11	299	4
P300-01	HOWISONSPOORT DAM	26	30	57	33	23	15	1930		24	883	16.3
P300-02	SETTLERS DAM	26	31	1	33	25	1	1962		21	5620	101
P300-03	LAKE GUM TREE	26	14	55	33	23	20	1984	EARTHFIL	9	251	7
P300-04	BIRMINGHAM NEW DAM	26	25	41	33	23	55	1948	EARTHFIL	13	414	10
P300-05	DOGPLUM DAM	26	39	50	33	32	7	1986	EARTHFIL	15	101	32
P300-06	YELLOW WOOD DAM	26	40	2	33	31	35	1985	EARTHFIL	12	130	5
P300-07	NEW YEAR PARK DAM	26	26	0	33	28	0	0	EARTHFIL	8	79	0
P300-08	ARNHEM DAM	26	27	25	33	19	35	0	EARTHFIL	17	80	2
P300-09	ROCHESTER DAM	26	18	1	33	25	1	1985	EARTHFIL	8	202	0
P300-10	LINDALE DAM	26	27	20	33	26	55	1977	EARTHFIL	10	260	17
P300-11	ALL'S WELL DAM	26	20	18	33	24	49	1983	EARTHFIL	8	492	18
P300-12	ASSEGAAI DAM	26	31	50	33	29	15	1989	EARTHFIL	9	224	8
P300-13	DORINGKLOOF DAM	26	31	10	33	29	35	1988	EARTHFIL	11	198	7

P300-14	LE GRANGE DAM	26	25	5	33	29	15	1983	EARTHFIL	8	130	0
P300-16	LANGLEY PARK DAM	26	19	1	33	22	1	1979	EARTHFIL	7	90	5
P300-17	YARROW DAM	26	23	25	33	24	40	1985	EARTHFIL	11	462	8
P300-19	ENDWELL FARM DAM	26	37	30	33	28	0	1986	EARTHFIL	9	60	1
P300-20	FAIRFIELD DAM	26	19	30	33	24	40	1980	EARTHFIL	8.5	79	6
P300-21	HOPELEIGH DAM	26	29	10	33	27	25	1960		6	136	34
P300-22	HOMELEIGH DAM	26	31	25	33	30	50	1987	EARTHFIL	9	82	2
P300-23	AVONDALE DAM	26	30	45	33	29	0	1971		7	272	7
P300-24	WELTEVREDE DAM	26	27	20	33	29	1	1987	EARTHFIL	8	205	10
P400-04	ROSSLYN DAM	26	46	1	33	24	6	1983	EARTHFIL	14	150	4
P400-05	KENKELE DAM	26	46	5	33	23	3	1974	EARTHFIL	13	160	4
P400-06	PINEDALE DAM	26	45	8	33	23	5	1986	EARTHFIL	16	300	7
P400-07	MANSFIELD DAM	26	51	8	33	31	10	1942	EARTHFIL	14	165	4
P400-08	SAREL HAYWARD DAM (BATHURST STREAM I	26	46	55	33	32	25	1986	EARTHFIL	40	2522	25
P400-09	WILLOW PARK DAM	26	41	5	33	19	35	1983	EARTHFIL	11	150	4
P400-10	GLENIFFER DAM 1	26	42	28	33	31	0	1982	EARTHFIL	8	50	3
P400-11	THE HOME DAM	26	42	40	33	25	5	1985	EARTHFIL	10	110	4
P400-13	GLENIFFER DAM NO 2	26	43	25	33	30	45	1985	EARTHFIL	12	200	6
P400-14	MOUNT WELLINGTON DAM	26	58	45	33	30	18	1984	EARTHFIL	11.9	250	2
P400-15	LANPETER DAM	26	50	0	33	25	0	1988	EARTHFIL	10	120	5
P400-17	ROCKWOODVALE DAM	26	38	0	33	17	0	1985	EARTHFIL	6	135	3
P400-18	RHEMA DAM	26	42	10	33	19	0	1987	EARTHFIL	13	150	2
P400-19	FAIRVIEW DAM	26	48	1	33	24	5	1985	EARTHFIL	7.9	218	4
P400-20	THE GROVE DAM	26	57	1	33	27	1	1984	EARTHFIL	11	70	2
P400-21	OLD MILL DAM	26	38	0	33	32	10	1984	EARTHFIL	8	76	4
Q110-02	HEUNINGKRANS DAM	25	26	0	31	14	0	1956	EARTHFIL	8	220	150

Dam number	Name	Owner	Person in control	Designer
P100-01	NUWEJAARS DAM (NEW YEARS)	ALICEDALE - MUNISIPALITEIT	ALICEDALE - MUNISIPALITEIT	STEWART,SVIRIDOV & OLIVER
P100-02	JAMESON DAM	GRAHAMSTAD-MUNISIPALITEIT	GRAHAMSTAD-MUNISIPALITEIT	D. GERRAND
P100-03	MILNER DAM	GRAHAMSTAD-MUNISIPALITEIT	GRAHAMSTAD-MUNISIPALITEIT	ONBEKEND
P101-14	GREY DAM	GRAHAMSTAD-MUNISIPALITEIT	GRAHAMSTAD-MUNISIPALITEIT	ONBEKEND
P101-17	KAREELEEGTE DAM	GREEFF M.J.	GREEFF M.J.	ONBEKEND
P101-18	BLACKBURN DAM	DELPORT W.M.	DELPORT W.M.	ONBEKEND
P101-19	TEAFONTEIN RESERVOIR	POHL D.B.	POHL D.B.	UNKNOWN
P102-14	TABLE HILL BIG DAM	WHITE F.C.D. & S. ST L.	WHITE F.C.D. & S. ST L.	PALMER E.W. (DECEASED)
P102-15	OAKWELL DAM	THOMPSON P J	THOMPSON P J	R.H. STEPHENSON
P102-16	MOSSLANDS DAM	MOSS M.N. & B.E.	MOSS M.N. & B.E.	STATE (DWA)
P102-17	BRAKKLOOF RIVER DAM	BROWN G.S.	BROWN G.S.	UNKNOWN
P102-18	STROWAN DAM	PALMER M.G.	PALMER M.G.	G.W. PALMER
P102-19	HILTON DAM	WHITE T.C.	WHITE T.C.	G. PALMER
P102-20	SHENFIELD CAMP DAM	POHL J.B.	POHL J.B.	ONBEKEND
P102-21	MOUNTAIN VIEW DAM	SCHEEPERS M.E.J.	SCHEEPERS M.E.J.	MBB INC
P102-22	SPRINGVALE DAM (ZUUR KLOOF 271)	RIPPON C.P.	RIPPON C.P.	STATE - DWA
P102-23	PROCTORSFONTEIN DIPPING TANK DAM	RIPPON C.P.	RIPPON C.P.	UNKNOWN
P102-24	PROCTORSFONTEIN HOUSE DAM	RIPPON C.P.	RIPPON C.P.	UNKNOWN
P300-01	HOWISONSPOORT DAM	GRAHAMSTAD-MUNISIPALITEIT	GRAHAMSTAD-MUNISIPALITEIT	STEWART SVIRIDOV & OLIVER
P300-02	SETTLERS DAM	GRAHAMSTAD-MUNISIPALITEIT	GRAHAMSTAD-MUNISIPALITEIT	STEWART SVIRIDOV & OLIVER
P300-03	LAKE GUM TREE	ASSEGAAI RIVER TRUST	ASSEGAAI RIVER TRUST	MBB INC.
P300-04	BIRMINGHAM NEW DAM	MOSS H.C. & SONS	MOSS H.C. & SONS	STATE (DWA)
P300-05	DOGPLUM DAM	STIRK L.G.	STIRK L.G.	L G STIRK & SONS
P300-06	YELLOW WOOD DAM	STIRK L.G.	STIRK L.G.	LG STIRK & SONS
P300-07	NEW YEAR PARK DAM	EMSLIE D.W.	EMSLIE D.W.	M KOLESKY
P300-08	ARNHEM DAM	TREMEER A.R.	TREMEER A.R.	DRMIN EXISTANSTANCE
P300-09	ROCHESTER DAM	BALL V.V.	BALL H.S.	H.L.S. BALL (LATE)
P300-10	LINDALE DAM	AMM R.G.	AMM R.G.	DWA
P300-11	ALL'S WELL DAM	HOWARTH G.H.	HOWARTH G.H.	MCNICOL
P300-12	ASSEGAAI DAM	KING A.C.	KING A.C.	D.M. VAN DER BERG
P300-13	DORINGKLOOF DAM	KING A.C.	KING A.C.	D. VAN DER BERG

P300-14	LE GRANGE DAM	SCHEEPERS B.S.	SCHEEPERS A.W.	M. BRADFIELD
P300-16	LANGLEY PARK DAM	CURRIE J.	CURRIE J.	ONBEKEND
P300-17	YARROW DAM	MOSS H.S.	MOSS H.S.	STATE - DWA
P300-19	ENDWELL FARM DAM	RIGBY J.V.	RIGBY J.V.	ONBEKEND
P300-20	FAIRFIELD DAM	EMSLIE S.J.	FAIRFIELD SEVENFOUNTAINS	M. BRADFIELD
P300-21	HOPELEIGH DAM	AMM R.G.	AMM R.G.	ONBEKEND
P300-22	HOMELEIGH DAM	THOMSON E.A.	THOMSON E.A.	ONBEKEND
P300-23	AVONDALE DAM	MULLINS A.L.	MULLINS A.L.	ONBEKEND
P300-24	WELTEVREDE DAM	SCHOONBEE E.C.	SCHOONBEE E.C.	UNKNOWN
P400-04	ROSSLYN DAM	PURDON R.K.	PURDON R.K.	OWNER
P400-05	KENKELE DAM	PURDON R.K.	PURDON R.K.	OWNER
P400-06	PINEDALE DAM	PURDON R.K.	PURDON R.K.	OWNER
P400-07	MANSFIELD DAM	PORT ALFRED-MUNISIPALITEIT	PORT ALFRED-MUNISIPALITEIT	J.C. HAWKINS
P400-08	SAREL HAYWARD DAM (BATHURST STREAM I	PORT ALFRED-MUNISIPALITEIT	PORT ALFRED-MUNISIPALITEIT	NINHAM SHAND (KAAP) ING.
P400-09	WILLOW PARK DAM	HORNE D.C.	HORNE D.C.	MBB INC.
P400-10	GLENIFFER DAM 1	BLADEN G.	BLADEN G.	M. BRADFIELD
P400-11	THE HOME DAM	TIMM N.	TIMM N.	STATE (AGRICULTURE)
P400-13	GLENIFFER DAM NO 2	BLADEN G.	BLADEN G.	M. BRADFIELD
P400-14	MOUNT WELLINGTON DAM	BRADFIELD J.	BRADFIELD J.	MBB INC
P400-15	LANPETER DAM	BADENHORST B.J.	BADENHORST B.J.	M. KOLESKY - NINHAM SHAND
P400-17	ROCKWOODVALE DAM	LEACH T.R.	LEACH T.R.	ONBEKEND
P400-18	RHEMA DAM	LONG J.A.	LONG J.A.	LANDBOU TEGNIESE DIENSTE
P400-19	FAIRVIEW DAM	HANDLEY G.L.	HANDLEY G.L.	DAVE PALMER
P400-20	THE GROVE DAM	LANDBANK	LANDBANK	UNKNOWN
P400-21	OLD MILL DAM	STIRK D.N.	STIRK D.N.	OWNER
Q110-02	HEUNINGKRANS DAM	JOUBERT A.J.	JOUBERT A.J.	STATE (AGRICULTURE)

APPENDIX 6

PHOTOGRAPHS AND PLATES

Plate 1: Sarel Hayward Dam

Plate 2: Fishkraal Dune Ground Water Development

Plate 3: Diaz Cross Well Field

Plate 4: Coastal Springs at Cape Padrone

Plate 5: Coastal Springs at Cape Padrone

Plate 6: Fishkraal Dune Ground Water Development

Plate 7: Coastal Springs at Cape Padrone

Plate 8: Well Field at Coastal Dunes at Port Alfred

Plate 10: Well Fields at Cape Padrone

Plate 12: Well Field at Cape Padrone

Plate 15: Dune Aquifer Exploration Drilling

Plate 17: RO Plant at Kenton on Sea

APPENDIX 7

LEGAL ASPECTS AND INSTITUTIONAL ARRANGEMENTS FOR WATER ASPECTS

1.1 LEGAL ASPECTS AND INSTITUTIONAL ARRANGEMENTS FOR WATER ASPECTS

National Water Act

The NWA does away with and introduces some far-reaching concepts. These concepts have both economic and social features. The former to address water management by conservation and pricing strategy and the latter by ensuring that past discriminatory principles are not continued in the NWA. The most important of these can be summarised as follows:

- The riparian principle is done away with. The nation's water resources become common property, belonging to the nation as a whole. Therefore the previous concept of private ownership in water is done away with;
- The national government, through the Minister of Water Affairs and Forestry, becomes responsible as the public trustee of all water resources to ensure that water resources are protected and water allocated equitably and used beneficially in the public interest. Therefore the NWA reflects the constitutional right of access to sufficient water (Section 27 of the Constitution);
- All right to use water derives from the NWA;
- Water must be available for the Reserve. The Reserve is a new concept and consists of two legs, namely the quantity and quality of water required to satisfy basic human needs as prescribed by the Water Services Act (Act no 108 of 1997) for people who now or will in future require water and to protect the aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource. Thus environmental considerations are anchored in the NWA;
- Setting out the purposes of the Act that institutions which have appropriate community, racial and gender representation must be developed to give effect to the NWA;
- Shifts the emphasis from the traditional "supply management" approach towards "demand management", that is conservation of the nation's water resources by lessening the demand and providing for an innovative pricing system.
- Providing for extensive public participation. Virtually no decision can be made without public participation;
- The abolishment of the Water Courts and introducing a Water Tribunal where administrative final decisions can be appealed to; and
- Recognition of international obligations.

Licensing

Whereas the Water Act of 1956 divided water into different categories, in the NWA all water has the same status. Section 21 of the NWA sets out what is regarded as water use. These include, amongst other uses, taking water from a water resource, storage of water, diverting water, discharging waste into a watercourse, disposing of waste in a manner that may detrimentally impact on a water resource and recreational use.

Two new concepts of water use are created. The first is that the Minister can declare any activity to be a stream flow reduction activity, if that activity reduces the availability of water. Afforestation has already been declared a stream flow reduction activity. The second new concept is that the Minister can declare any activity to be a controlled activity if that activity impacts on a water resource. Activities such as irrigation on any land with waste, recharging of an aquifer are examples of activities that are already controlled activities.

All water use requires a licence unless it falls into a Schedule 1 use (this deals with the *de minimus* use, such as water for reasonable domestic use, small gardening and animal watering (excluding feedlots); or was permissible as an existing lawful use (water use permitted under previous laws and which were exercised during the period of two years before the date that Section 32 came into effect; namely 1 October 1998); and under a general authorisation.

An important innovation is that a licence can only be for a maximum period of 40 years and is subject to a review period, which may not be at intervals of more than five years. A licence can be increased at each review period but not for more than the review period. This is known as the "revolving licence".

If a person who has an existing lawful use applies for a licence under Section 43 of the NWA (compulsory licensing), and the application has been refused or has been granted for a lesser amount, which results in severe economic prejudice, the applicant may claim compensation. Compensation cannot be claimed if the reduction is to provide for the Reserve, rectify a previous over-allocation or a previous unfair allocation.

Compensation must be claimed from the Water Tribunal.

The Minister has the right to attach conditions to any licence as well as to make regulations on various topics set out in section 26 of the NWA.

Other Legislation

It is important to note that although the Water Services Act (Act no 108 of 1997) deals with water services, the actual water use is controlled under the NWA.

The NWA is aligned with other laws in order to prevent, for example, duplication of applications, unnecessary expenses and where possible, a "one stop" can be issued. Specific examples are as follows:

- Environment assessments in terms of the Environmental Conservation Act of 1989 can be taken into account by the responsible authority when issuing a licence;
- If a licence is issued under other acts that meet the purpose of the NWA, the responsible authority can dispense with the issuing of a licence for water under the NWA; and
- Provisions in the Constitution of the Republic of South Africa must be complied with.

Further, there is a close connection between the Water Services Act (Act no 108 of 1997) and the NWA.

The Abolition of Racially Based Land Measures Act repealed laws that previously restricted black persons from owning or occupying land. These acts had the effect of

preventing black persons from having any water rights or under certain circumstances, limited water entitlements.

Notwithstanding the NWA there are other acts to which a water user and indeed the State must comply.

These Acts are the following:

Physical Planning Act (Act No. 125 of 1991)

Under this act no land use, development or subdivision may be permitted unless in accordance with an approved plan.

Development Facilitation Act (Act No. 67 of 1995)

This act prescribes the set of principles with which all development projects and all land use and land use planning should comply, and which will serve as guidelines for the administration of land use and development schemes.

Restitution of Land Rights (Act No. 22 of 1994)

This act is aimed at the restitution of land to those who have been deprived thereof in terms of discriminatory laws. Claims are lodged with the Land Claims Commission. It is because of this act that when a transfer of water entitlements is approved in terms of the NWA an indemnity is required from the transferor that a claim was not lodged against the land in terms of the Restitution of Land Rights Act.

Environmental Conservation Act (Act No. 73 of 1989)

This act provides for the effective protection and control of the environment. It makes provision for the declaration of an environmental conservation policy.

In terms of this act the state has a responsibility to act as trustee of the natural environment and to consider all activities that may have an influence on the environment.

Activities, which may have a detrimental effect on the environment, have been published in terms of Section 21 of this act. To undertake any of these activities, authorisation is required, which can only be obtained from the Minister of Environmental Affairs and Tourism after the prescribed procedure has been complied with. The construction of various forms of water works (dams, water diversions, water transfer schemes, etc.) is subject to the new process.

Through a consultative process a White Paper for Sustainable Coaster Development in South Africa was prepared. In terms thereof it is the joint responsibility of the Departments of Water Affairs and Forestry and of Environmental Affairs and Tourism to protect the in-shore marine environment.

In terms of this act the Department of Environmental Affairs and Tourism is responsible for issuing waste permits under this act and has published a Government Notice 1986 of 24 August 1990 relating to the identification of waste. This government notice needs drastic amendment to bring it in line with the NWA.

In May 2000 the Department of Environment Affairs and Tourism published a White Paper on Integrated Pollution and Waste Management for South Africa. Aspects included water pollution; diffuse water pollution, marine pollution; and land pollution.

National Environmental Management Act (Act No. 107 of 1998)

This act lays a new foundation for environmental management. The act includes 20 principles that serve as a general framework within which environmental management and implementation plans must be formulated and guide any other law concerned with the protection or management of the environment. Environment is defined as the natural environment and the physical chemical, aesthetic and cultural properties of it that influence human well being.

To give effect to these principles this act creates the National Environmental Forum and the Committee for Environmental Co-ordination and defines the procedure for the establishment of a Coastal Management Subcommittee of the Committee for Environmental Co-ordination in order to achieve better inter-governmental co-ordination of coastal management.

This act provides for the drawing up of environmental implementation plans by certain scheduled national Government Departments and the Provinces. In addition, environmental management plans are to be drawn up by certain national Departments. The two sets of plans do not have to be drawn up by the private sector and may be consolidated. The purpose of the plans is set out in detail and must co-ordinate and harmonise environmental policies, plans, decisions of the three spheres to prevent duplication; give effect to co-operative governance and enable monitoring the achievement.

Chapter 7 of this act relates to environmental damage, duty of care, emergencies and remediation.

Conservation of Agriculture Resources Act (Act No. 43 of 1983)

This act is to provide for control over the utilisation of the natural agricultural resources in order to promote the conservation of the soil; the water resources and vegetation and the combating of weeds and invader plants. Except for weeds and invader plants, this act does not apply to land in an urban area.

Institutions Responsible for Community Water Supplies

The Water Services Act, No. 108 of 1997, deals with the provision of water supply services and sanitation services in a manner consistent with the broader goals of water resource management. The institutional structure provided for in the Act includes, in addition to the National Government, represented by the Department of Water Affairs and Forestry, the following bodies:

(i) Water Services Authorities, which are municipalities, including district or rural councils, that are responsible for ensuring access to water services.

(ii) Water Boards, which may be established by the Minister of Water Affairs and Forestry, after due consultation with stakeholders, for the primary purpose of providing water services to other water services institutions.

(iii) Water Services Committees, which may be established by the Minister of Water Affairs and Forestry to provide water services to communities within their own service area where the Water Services Authorities

having jurisdiction in the areas in question are unable to provide water services effectively.

(iv) The Provincial Government, which may take over the functions of a Water Services Committee or a Water Board, if requested to do so by the Minister of Water Affairs and Forestry.

Advisory Committees, which may be appointed by the Minister of Water Affairs and Forestry, to provide advice on matters falling within the scope of the Act.

The municipalities are the Water Services Authorities responsible for water services in the WMA. The municipalities were restructured in the year 2000. As this report deals with the period prior to that, mainly the institutional arrangements prior to the restructuring are reported on here.

The Fish to Tsitsikamma WMA was fortunate in that most of the transitional local councils had the resources and the technical skills to be Water Services Authorities. Therefore, they became the Water Service Authorities responsible for the water and sanitation services of their own towns and the surrounding areas. The areas of jurisdiction of the transitional local councils are shown on Figure 3.4.9.1.

The areas that did not fall within the jurisdiction of the transitional local council fell under the transitional regional councils that are also shown on Figure 3.4.9.1. These areas are generally nature reserves or privately owned farmland where the owners of the land are responsible for their own water supplies. In these areas, neither the transitional rural councils nor the district councils were Water Services Authorities.

In the south-eastern corner of the WMA, between the Great Fish River and the eastern boundary of the WMA, where there are areas of tribal land that were part of the former Republic of Ciskei. When the Ciskei was re-incorporated into South Africa, DWAF took over the responsibility for community water supplies in these areas, and was the Water Services Authority until the year 2001, when the responsibility passed to the new Amatole District Municipality. The boundaries of the supply area of the Amatole Water Board, which provides water services mainly in the Mzimvubu to Keiskamma WMA, have recently been extended to include this area.

APPENDIX 8

POTENTIAL FOR WATER CONSERVATION AND DEMAND MANAGEMENT

1.1 POTENTIAL FOR WATER CONSERVATION AND DEMAND MANAGEMENT

The value of water is largely unrecognised by many water users in South Africa and inefficient water usage is evident. South Africa is a developing country with relatively scarce water resources and is therefore forced to improve the management thereof. All water use sectors including agriculture, forestry, industry, recreational, ecological and water services are encouraged to conserve and manage the limited sources available.

Water conservation is the minimisation of loss or waste, the prevention, care and protection of water resources and the efficient and effective use of water. Water conservation should be both an objective in water resource and water services management as well as a strategy.

Water demand management is the adaptation and implementation of a strategy (policies and initiatives) by a water institution to influence the water requirements and use of water in order to meet any of the objectives of economic efficiency, social development, social equity, environmental protection, sustainability of water supply and services and political acceptability. Water supply institutions should set water demand goals and targets by managing the distribution system and consumer requirements in order to achieve the above objectives.

Water demand management is deemed to include the entire water supply chain – from the point of abstraction at the source to the point of use. This includes all levels of water distribution management and consumer demand management. The conservation measures related to the water resources and return flow are part of water resource management and return flow management respectively. Various obstacles and constraints have to be overcome before the full potential of water conservation and demand management can be achieved.

Existing Water Services

50% of the total quantity of water that is supplied is not accounted for in many of the urban areas. This unaccounted for water consists of a combination of reticulation system leaks, unauthorised water connections, faulty water meters and domestic plumbing leaks. These factors, combined with low level of payment and institutional problems of local authorities, affect the sustainability of water services. Current indications are that levels of unaccounted for water are growing despite the formulation of several water conservation strategies in the past.

Water Resources and Supply

The sustainability of the limited water resources is threatened in terms of quantity and quality. Unless the current water use pattern is changed, future water requirements will greatly exceed existing available fresh water resources. Frequently the water supply and quality are unreliable or improperly managed, leading to the wasteful use of water by consumers in anticipation of possible supply failure.

Environment

Environmental degradation and the prevention thereof is a key focus in the current policy and legislation. Measures such as providing for water of suitable quality in sufficient quantity in the Reserve to protect the integrity, health and productivity of the rich and diverse ecosystems have become necessary.

Basic Water Supply Needs

By the application of water demand management measures to existing water services, water resources and bulk infrastructure can be reallocated for the provision of new services where adequate services do not yet exist. Water demand management is also essential in ensuring the sustainability of the new water service delivery projects and can help to ensure that water remains affordable.

Water Restrictions

Experience from past water restrictions that have proved to be the most effective during times of drought, which are relevant to future water conservation efforts are:

- The overall reduction in water use depends on a number of factors. However, when water use is reduced beyond 30% it can be detrimental to user from a financial and motivational perspective.
- Voluntary reduction in water use fails to achieve the savings possible with mandatory steps.
- The most effective methods of reducing water use are higher tariffs, restriction of garden water times, the banning of domestic hose pipe usage and allotting quotas to industry, bulk consumers and irrigators.
- The most effective motivations are pamphlets/newsletters, higher tariffs and punitive measures.
- The major interventions required to reduce both physical and non-physical losses from pipe networks are leak detection/monitoring, replacing old plumbing and the repair/monitoring of meters.
- The most effective methods of saving water used by commerce and industry are technical adjustments, recycle/re-use and promotion campaigns.
- The ratio of return flow to water use is not materially changed by changes in water use.

APPENDIX 9

SIZING FLOWS

Appendix 9: Sizing Flows

Option No	Option Name	Towns Supplied	Water Source	Primary Conveyance System
1	Alexandria – GW (1 A : GW)	Alexandria	- Fishkraal GW	- Develop GW with 6 BH's (11 l/s, 12 hr) & 2 PS's (12,5 l/s) - CWRM of 10.5 km (12,5 l/s) - 50 m³ Bal Res, 150 m³ BPT - CWGM of 8.5 km (12,5 l/s) - 800 m³ reservoir
2	Cannon Rocks – GW (2 CR : GW)	Cannon Rocks and Boknes	- Apies River mouth GW	- Devlp GW with 12 BH's (34 l/s) - 1 PS (34 l/s) - CWRM of 2.5 km (34 l/s) - 2 town reservoirs (1 800 m³)
3	Kenton on Sea – GW (3 KOS : GW)	Kenton on Sea Boesmansriviermond	- Upgrade RO - Kwaaihoek GW - Merville GW - Bushfontein GW	- Upgrade existing RO plant to 60 m³/hr - Devlp Kwaaihoek GW with 4 BH's (6.9 l/s) - CWRM1 of 1 km to existing PS (6.9 l/s) - Devlp Merville GW with 5 BH's (18.5 l/s) - 1 CWPS & 3 km CWRM with a 100 m³ Bal Res - Devlp Bushfontein GW with 3 BH's (18.5 l/s) - 3 CWPS & 9 km CWRM with a 300 m³ Bal Res - CWGM of 13.5 km & 3 BPT's - New PE lined Bal Dam of 13 000 m³ & new Res's of 3 000 m³
4a	Kenton on Sea – RO1 (4a KOS : RO1)	Kenton on Sea Boesmansriviermond	- Upgrade existing RO - Kwaaihoek - New RO (seawater)	- Upgrade existing RO plant to 60 m³/hr - Devlp Kwaaihoek GW with 4 BH's (6.9 l/s) - CWRM1 of 1 km to existing PS (6.9 l/s) - New RO (seawater) plant – 2 400 m³/d - 1 CWPS with a 100 m³ Bal Res & CWRM of 3.5 km - New PE lined Bal Dam of 13 000 m³ & new Res's of 3 000 m³

4b	Kenton on Sea – RO2 (4b KOS : RO2)	Kenton on Sea Boesmansriviermond	- Upgrade existing RO - Kwaaihoek - New RO (brackish water)	- Upgrade existing RO plant to 60 m³/hr - Devlp Kwaaihoek GW with 4 BH's (6.9 l/s) - CWRM1 of 1 km to existing PS - Devlp brackish water source (3 800 m^3/d) & RWRM of 3.3 km - New RO (brackish) plant – 2 400 m³/d - 1 CWPS with a 200 m³ Bal Res & CWRM of 2.5 km - New PE lined Bal Dam of 13 000 m³ & new Res's of 3 000 m³
5	Kenton on Sea – SW (5 KOS : SW)	Kenton on Sea Boesmansriviermond	- SW from Glen Melville Dam	- Upgrade existing RO plant to 60 m³/hr - Devlp Kwaaihoek GW with 4 BH's (6.9 l/s) - CWRM1 of 1 km to existing PS - Surface water (2 400 m³/d) from Glen Melville Dam via PA - New PE lined Bal Dam of 13 000 m³ & new Res's of 3 000 m³
6	Port Alfred – GM 1 (6 PA : GM1: PA, BT, KoS)	Port Alfred Bathurst Kenton on Sea	- Barville / Glendower - Sunshine Coast - SW from Glen Melville Dam	- Devlp Barville/Glendower GW with 5 BH's (23 l/s) - CWRM of 2 km (30 l/s) to a 500 m³ Bal Res - Devlp Sunshine Coast GW with 9 BH's (18 l/s) - CWRM of 2 km (24 l/s) to Bal Res - CWGM of 5 km to PA (54 l/s) - WTW at Glen Melville Dam (144 l/s) & 1 CWPS - CWRM of 8.5 km & a 2 500 m³ Bal Res - CWGM of 83 km with 4 x 250 m³ BPT's - Bathurst Res 1 200 m³ & PA Res 15 000 m³
7	Port Alfred – GM2 (7 PA : GM 2: PA, BT)	Port Alfred Bathurst	- Barville / Glendower - Sunshine Coast - SW from Glen Melville Dam	- Devlp Barville/Glendower GW with 5 BH's (23 l/s) - CWRM of 2 km (30 l/s) to a 500 m³ Bal Res - Devlp Sunshine Coast GW with 9 BH's (18 l/s) - CWRM of 2 km (24 l/s) to Bal Res - CWGM of 5 km to PA (54 l/s) - WTW at Glen Melville Dam (112 l/s) & 1 CWPS - CWRM of 8.5 km & a 2 000 m³ Bal Res - CWGM of 59 km with 4 x 150 m³ BPT's - Bathurst Res 1 200 m³ & PA Res 15 000 m³

8a	Port Alfred – SH (8a PA : SH)	Port Alfred	- Barville / Glendower - Sunshine Coast - SW from Sarel Hayward Dam	- Devlp Barville/Glendower GW with 5 BH's (23 l/s) - CWRM of 2 km (30 l/s) to a 500 m³ Bal Res - Devlp Sunshine Coast GW with 9 BH's (18 l/s) - CWRM of 2 km (24 l/s) to the 500 m³ Bal Res - CWGM of 5 km to PA (54 l/s) - WTW at Port Alfred (106 l/s) - 1 RWPS (250 l/s) at river abstraction - 2 RWPS's (106 l/s) with Bal Res's - RWRM of 7.7 km (93 l/s) & a 200 m³ Bal Res - RWGM of 2.6 km (93 l/s) with a 200 m³ Bal Res - RWGM of 3 km (93 l/s) to WTW - Port Alfred Res 15 000 m³ - Raise Sarel Hayward Dam wall by 12 m, from FSL 38.9 to 50.9
8b	Port Alfred – SH & RO (8b PA : SH & RO)	Port Alfred	- Barville / Glendower - Sunshine Coast - SW from Sarel Hayward Dam - Treat 4 000m³/d by RO	- Devlp Barville/Glendower GW with 5 BH's (23 l/s) - CWRM of 2 km (30 l/s) to a 500 m³ Bal Res - Devlp Sunshine Coast GW with 9 BH's (18 l/s) - CWRM of 2 km (24 l/s) to the 500 m³ Bal Res - CWGM of 5 km to PA (54 l/s) - WTW at Port Alfred (106 l/s) - 1 RWPS (250 l/s) at river abstraction - 2 RWPS's (106 l/s) with Bal Res's - RWRM of 7.7 km (93 l/s) & 1 200 m³ Bal Res - RWGM of 2.6 km (93 l/s) with 1 200 m³ Bal Res - RWGM of 3 km (93 l/s) to WTW - Port Alfred Res 15 000 m³ - Raise Sarel Hayward Dam wall by 12 m, from FSL 38.9 to 50.9 - Treat 4 000 m³/d of SW through 14 RO units - 1 CWPS (56 l/s) with a 300 m³ Bal Res at RO plant - RWGM of 0.5 km (76 l/s) from WTW to RO plant - CWRM of 1.3 km (56 l/s) from RO to town Res

9	Port Alfred – SD (9 PA : SD)	Port Alfred	- Barville / Glendower - Sunshine Coast - SW from Settlers Dam	- Devlp Barville/Glendower GW with 5 BH's (23 l/s) - CWRM of 2 km (30 l/s) to a 500 m³ Bal Res - Devlp Sunshine Coast GW with 9 BH's (18 l/s) - CWRM of 2 km (24 l/s) to the 500 m³ Bal Res - CWGM of 5 km to PA (54 l/s) - WTW at Port Alfred (106 l/s) - 1 RWPS (106 l/s) at Settlers Dam - RWRM of 2 km (93 l/s) & 1 200 m³ Bal Res - RWGM of 42.5 km with 4 x 200 m³ BPT's - WTW at Glen Melville Dam (106 l/s) - 1 CWPS (96 l/s) with Bal Res from WTW to Botha's Hill Res - CWRM of 8.5 km (93 l/s) from GM WTW to Botha's Hill Res - CWGM of 10.5 km (93 l/s) from Botha's Hill Res to GTown Res - Port Alfred Res 15 000 m³
10	Port Alfred – RO (10 PA : RO)	Port Alfred	- Barville / Glendower - Sunshine Coast - RO plant (seawater)	- Devlp Barville/Glendower GW with 5 BH's (23 l/s) - CWRM of 2 km (30 l/s) to 1 x 500 m³ Bal Res - Devlp Sunshine Coast GW with 9 BH's (18 l/s) - CWRM of 2 km (24 l/s) to the 500 m³ Bal Res - CWGM of 5 km to PA (54 l/s) - Devlp GW source at coast with 15 BH's (155 l/s) - 1 RWPS (155 l/s) with a 250 m³ Bal Res - RWRM of 2.1 km (155 l/s) & 1 250 m³ Bal Res - New RO (seawater) plant – 7 650 m³/d - 1 CWPS (110 l/s) with a 200 m³ Bal Res - CWRM of 0.5 km (110 l/s) to the town Res - Port Alfred Res 15 000 m³

Bal Dam	balancing dam
Bal Res	balancing reservoir
BH	borehole
BPT	break pressure tank
CLRM	clean water raising main
CWGM	clean water gravity main
CWPS	clean water pump station
GW	groundwater
hr	hour
m^3	cubic metre
m^3/d	cubic metre per day
m^3/h	cubic metre per hour
km	kilometre
l/c/d	litre per capita per day
l/day	litre per day
l/s	litre per second
mamsl	metres above mean sea level
m^3/a	cubic metre per year
m^3/d	cubic metre per day
m^3/h	cubic metre per hour
ND	nominal diameter
PE	polyethylene
PS	pump station
Res	reservoir
RO	reverse osmosis
RWGM	raw water gravity main
RWPS	raw water pump station
RWRM	raw water raising main
WTW	water treatment works

APPENDIX 10

COSTING

APPENDIX 10: COSTING

Contents

Appendix 10.1: Cost Models
Appendix 10.2: Summary of Costs
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Appendix 10.4: Economic Models for NPC & URV

APPENDIX 10.1

COST MODELS

ALBANY COAST SITUATION ASSESMENT STUDY

02-Sep-04

Appendix 10.1

DESCRIPTION OF THE CONVEYANCE SYSTEM

1

ALEXANDRIA
SUPPLY FROM GW
(1 A : GW)

GAADD	2082.00	m3/d
SDD	2499.00	m3/d

Description : Develop additional Fishkraal dune GW source, upgrade conveyance to Alex Res

No	Description	unit	Quantity	Rate	Sub-tot	Total for component
1	**Ground Water Source**					**673,521**
1.1	Develop source: 11 l/s (12hr), 1.83 l/s/bh, 6 No bh	sum			196,333	
1.2	Equip bh: Q 1.83 l/s, H 70 m	no	6	50750	304,500	
1.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	1,200	89.74	107,688	
1.4	Electrical connection	m	1,000	65.00	65,000	
2	**Clear Water Raising/Gravity Mains**					**5,342,902**
2.1	CWRM 1: uPVC 110, cl 9	m	2,000	126.30	252,600	
2.2	CWRM 2: uPVC 140, cl 16	m	2,320	304.39	706,185	
2.3	CWRM 3: GMS 150, med duty	m	6,220	402.19	2,501,622	
2.4	CWGM: uPVC 160, cl 9	m	8,500	221.47	1,882,495	
3	**Pump Station**					**1,269,879**
3.1	CWPS 1: one duty, one standby	no	1	601379.00	601,379	
	WKLn 80/9, motor 37 kW (1450 RPM)					
3.2	CWPS 2: 1xduty, 1 x standby	no	1	668500.00	668,500	
	WKLn 80/13, motor 45 kW (1450 RPM)					

No	Description	unit	Quantity	Rate	Sub-tot	Total
4	**Reservoirs**					**875,000**
4.1	Balancing Reservoir and BPT 50 kl	no	2	112,000	224,000	
4.2	Additional town Res 800 kl	no	1	651,000	651,000	
	Total for scheme					**8,161,302**

BH Source				196,333
BH Equipm				369,500
CWRM				3,568,095
CWGM				1,882,495
CWPS				1,269,879
Storage				875,000
TOTAL				**8,161,302**

ALBANY COAST SITUATION ASSESMENT STUDY

02-Sep-04

DESCRIPTION OF THE CONVEYANCE SYSTEM

2

CANON ROCKS/BOKNES
SUPPLY FROM GW
(2 CR : GW)

GAADD	1420.00	m3/d
SDD	2130.00	m3/d

Description : Develop additional resources at Apies River GW source, conveyance to Res

No	Description	unit	Quantity	Rate	Sub-tot	Total for component
1	**Ground Water Source: Apies River**					**1,597,580**
1.1	Develop source: 34 l/s (12hr), 2.85 l/s/bh, 12 No bh	sum			561,404	
1.2	Equip bh: Q 2.85 l/s, H 60 m	no	12	52150	625,800	
1.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	2,400	89.74	215,376	
1.4	Electrical connection	m	3,000	65.00	195,000	
2	**Clear Water Raising/Gravity Mains**					**797,975**
2.1	CWRM 1: uPVC 200, cl 9	m	2,500	319.19	797,975	
3	**Clear Water Pump Station**					**425,000**
3.1	CWPS: one duty, one standby WKLn	no	1	425000.00	425,000	
	100/4 Motor 45 kW (1450 RPM)					

No	Description	unit	Quantity	Rate	Sub-tot	Total
4	**Reservoirs**					**1,502,000**
4.1	Town reservoir 800 kl	no	1	650,000	650,000	
4.2	Town reservoir 1000 kl	no	1	740,000	740,000	
4.3	Balancing Reservoir at CWPS 50 kl	no	1	112,000	112,000	
	Total for scheme					**4,322,555**

BH Source				561,404
BH Equipm				820,800
CWRM				1,013,351
CWGM				0
CWPS				425,000
Storage				1,502,000
TOTAL				**4,322,555**

ALBANY COAST SITUATION ASSESMENT STUDY

02-Sep-04

DESCRIPTION OF THE CONVEYANCE SYSTEM

3

For Year 2015:

GAADD	3320.00	m3/d
SDD	4980.00	m3/d

KENTON ON SEA/BUSHMANS RIVER MOUTH SUPPLY FROM GW (3 KOS : GW)

Description : Keep existing RO plant & Dias Cross well field, upgrade seawater intake and **RO**, develop **Kwaaihoek** dune source, develop **Merville** and **Bushfontein** well fields
Provide necessary conveyance, reservoirs and balancing reservoir
Prices exclude VAT and professional fees (total of 30%)

No	Description	unit	Quantity	Rate	Sub-tot	Total for component	Total for sub-system
A	**Upgrade RO plant**					**4,100,000**	**4,100,000**
	Build sea water intake and filtration	sum		1,400,000	1,400,000		
	Upgrade Eskom supply	sum		700,000	700,000		
	Upgrade brine disposal	sum		600,000	600,000		
	Expand R0 3 plant (add 10 kl/hr)	sum		1,400,000	1,400,000		
B	**Develop Kwaaihoek dune well field**						**628,372**
B1	**Ground Water Source**					**516,462**	
	Develop source: 6.9 l/s (12hr), 1.72 l/s/bh, 4 No bh	sum			178,070		
	Equip bh: Q 1.72 l/s, H 60 m	no	4	50400	201,600		
	Collector pipes, ND 75, cl 9, 200 m/bh	m	800	89.74	71,792		
	Electrical connection	m	1,000	65.00	65,000		
B2	**Clear Water Raising/Gravity Mains**					**111,910**	
	CWRM 1: uPVC 90, cl 9	m	1,000	111.91	111,910		

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
C	**Develop Merville and Bushfontein well fields**						**14,351,578**
C1	**Ground Water Source: Bushfontein**					**6,073,674**	
C1.1	Develop source: 18.5 l/s (12hr), 6.2 l/s/bh, 3 No bh	sum			776,316		
C1.2	Equip bh: Q 6.2 l/s, H 85 m	no	3	58800	176,400		
C1.3	Collector pipes, ND 90, cl 9, 300 m/bh	m	900	111.91	100,719		
C1.4	Electrical connection	m	4,000	65.00	260,000		
C1.5	Balancing Reservoir Bushfontein 300 kl	no	1	330,000	330,000		
C1.6	Balancing Reservoir at CWPS's 50kl	no	3	112,000	336,000		
C1.7	CWRM 2: uPVC 140, cl 9	m	300	204.32	61,296		
C1.8	CWRM 3: uPVC 140, cl 12	m	200	245.33	49,066		
C1.9	CWRM 4: GMS 150 Med Duty	m	500	402.19	201,095		
C1.10	CWRM 5: uPVC 200, cl 9	m	5,300	319.19	1,691,707		
C1.11	CWGM 1: uPVC 200, cl 9	m	2,500	319.19	797,975		
C1.12	CWPS 1: one duty, one standby WKLn	no	1	340100.00	340,100		
	100/3 Motor 18.5 kW (1450 RPM)						
C1.13	CWPS 2: one duty, one standby WKLn	no	1	602000.00	602,000		
	100/10 Motor 37 kW (1450 RPM)						
C1.14	CWPS 3: one duty, one standby WKLn	no	1	351000.00	351,000		
	65/4 Motor 55 kW (1450 RPM)						
C2	**Ground Water Source: Merville**					**3,187,829**	
C2.1	Develop source: 18.5 l/s (12hr), 3.7 l/s/bh, 5 No bh	sum			750,219		
C2.2	Equip bh: Q 3.7 l/s, H 135 m	no	5	56000	280,000		
C2.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	1,000	89.74	89,740		
C2.4	Electrical connection	m	2,000	65.00	130,000		
C2.5	Balancing Reservoir Merville 100 kl	no	1	176,000	176,000		
C2.6	CWRM 5: uPVC 160, cl 16	m	1,500	339.29	508,935		
C2.7	CWRM 6: uPVC 160, cl 16	m	1,500	339.29	508,935		
C2.7	CWPS 4: one duty, one standby WKLn	no	1	744000.00	744,000		
	100/8 Motor 45 kW (1450 RPM)						

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
C3	**Clear Water Raising/Gravity Mains**					**5,090,075**	
C3.1	CWGM 2: uPVC 200, cl 9	m	4,500	319.19	1,436,355		
C3.2	CWGM 3: uPVC 160, cl 12	m	2,000	266.48	532,960		
C3.3	CWGM 4: uPVC 200, cl 12	m	7,000	388.68	2,720,760		
C3.4	BPT 50kl	no	2	112,000	224,000		
C3.5	BPT 100kl	no	1	176,000	176,000		
D	**Reservoirs**					**1,946,000**	**1,946,000**
	Add capacity to town reservoirs 2 x 1500 kl	no	2	973,000	1,946,000		
E	**Balancing dam**					**600,000**	**600,000**
	PE lined dam: 13 000 kl	no	1	600,000	600,000		
	Total for scheme					**21,625,950**	**21,625,950**

RO Plant			1,400,000
BH Source			1,704,605
BH Equipm			1,113,000
CWRM			3,995,195
CWGM			5,488,050
CWPS			2,037,100
WTW (Sea water intake and filter)			2,100,000
Storage			3,788,000
TOTAL			**21,625,950**

ALBANY COAST SITUATION ASSESMENT STUDY

02-Sep-04

DESCRIPTION OF THE CONVEYANCE SYSTEM

4a

For year 2015:

GAADD	3320.00	m3/d
SDD	4980.00	m3/d

KENTON ON SEA/BUSHMANS RIVER MOUTH SUPPLY FROM GW & RO (SEAWATER) (4a KOS : RO1)

Description : Keep existing RO plant & Dias Cross well field, upgrade seawater intake and **RO**, develop **Kwaaihoek** dune source, develop additional **seawater RO** plant to make up deficit (2400 m³/d)
Provide necessary seawater intake, brine disposal, RO units and clean water pump station
Prices exclude VAT and professional fees (total of 30%)

No	Description	unit	Quantity	Rate	Sub-tot	Total for component	Total for sub-system
A	**Upgrade RO plant**					**4,100,000**	**4,100,000**
	Build sea water intake and filtration	sum			1,400,000		
	Upgrade Eskom supply	sum			700,000		
	Upgrade brine disposal	sum			600,000		
	Expand R0 3 plant (add 10 kl/hr)	sum			1,400,000		
B	**Develop Kwaaihoek dune well field**						**628,372**
B1	**Ground Water Source**					**516,462**	
	Develop source: 6.9 l/s (12hr), 1.72 l/s/bh, 4 No bh	sum			178,070		
	Equip bh: Q 1.72 l/s, H 60 m	no	4	50400	201,600		
	Collector pipes, ND 75, cl 9, 200 m/bh	m	800	89.74	71,792		
	Electrical connection	m	1,000	65.00	65,000		
B2	**Clear Water Raising/Gravity Mains**					**111,910**	
	CWRM 1: uPVC 90, cl 9	m	1,000	111.91	111,910		

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
C	**Additional RO equipment (90 m3/hr)**					**17,200,000**	**17,200,000**
	RO Unit complete	no	8	1,300,000	10,400,000		
	Housing for RO equipment	m2	800	2,000	1,600,000		
	Upgrade Eskom supply	no	8	300,000	2,400,000		
	Upgrade sea abstraction and filtration	no	8	300,000	2,400,000		
	Upgrade brine disposal	sum	8	50,000	400,000		
D	**Clear Water Pump Station**					**760,430**	**760,430**
G1.1	Pump sump / balancing reservoir (1 hr storage) (100 kl)	no	1	176,000	176,000		
G1.2	CWPS: one duty, one standby: WKLn 100/6	no	1	584,430	584,430		
	Motor 45 kW (1450 RPM)						
E	**Clear Water Raising Main**					**1,416,170**	**1,416,170**
	Pumping main to town Res: uPVC 250, cl 12	m	3,500	404.62	1,416,170		
F	**Reservoirs**					**1,946,000**	**1,946,000**
	Add capacity to town reservoirs 2 x 1500 kl	no	2	973,000	1,946,000		
G	**Balancing dam**					**600,000**	**600,000**
	PE lined dam: 13 000 kl	no	1	600,000	600,000		
	Total for scheme					**26,650,972**	**26,650,972**

RO Plant			14,900,000
BH Source			178,070
BH Equipm			266,600
CWRM			2,599,872
CWGM			0
CWPS			584,430
WTW (Sea water intake and filter)			3,800,000
Storage			4,322,000
TOTAL			**26,650,972**

ALBANY COAST SITUATION ASSESMENT STUDY

02-Sep-04

DESCRIPTION OF THE CONVEYANCE SYSTEM

4b

For year 2015:

GAADD	3320.00	m3/d
SDD	4980.00	m3/d

KENTON ON SEA/BUSHMANS RIVER MOUTH SUPPLY FROM GW & RO (BRACKISH) (4b KOS : RO2)

Description : Keep existing RO plant & Dias Cross well field, upgrade seawater intake and **RO**, develop **Kwaaihoek** dune source, develop additional **brackish water RO** plant to make up deficit (2400 m³/d)
Provide necessary brackish water intake, brine disposal, RO units and clean water pump station
Prices exclude VAT and professional fees (total of 30%)

No	Description	unit	Quantity	Rate	Sub-tot	Total for component	Total for sub-system
A	**Upgrade RO plant**					**4,100,000**	**4,100,000**
	Build sea water intake and filtration	sum			1,400,000		
	Upgrade Eskom supply	sum			700,000		
	Upgrade brine disposal	sum			600,000		
	Expand R0 3 plant (add 10 kl/hr)	sum			1,400,000		
B	**Develop Kwaaihoek dune well field**						**628,372**
B1	**Ground Water Source**					**516,462**	
	Develop source: 6.9 l/s (12hr), 1.72 l/s/bh, 4 No bh	sum			178,070		
	Equip bh: Q 1.72 l/s, H 60 m	no	4	50400	201,600		
	Collector pipes, ND 75, cl 9, 200 m/bh	m	800	89.74	71,792		
	Electrical connection	m	1,000	65.00	65,000		
B2	**Clear Water Raising/Gravity Mains**					**111,910**	
	CWRM 1: uPVC 90, cl 9	m	1,000	111.91	111,910		

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
C	**New RO equipment (2400 m3/d)**					**6,100,000**	**6,100,000**
	RO Unit complete	no	8	400,000	3,200,000		
	Housing for RO equipment	m2	800	2,000	1,600,000		
	Eskom supply	no	8	100,000	800,000		
	New brine disposal (1000m @ 200 cl 9 uPVC plus civils)	sum	1	500,000	500,000		
D1	**Ground Water Source (Brackish)**					**5,191,100**	**5,191,100**
D1.1	Develop source: 88 l/s (12hr), 4 l/s/bh, 22 No bh	sum			2,000,000		
D1.2	Equip bh: Q 4 l/s, H 50 m	no	22	54600	1,201,200		
D1.3	Collector pipes, uPVC 250, cl 9, 5000 m	m	5,000	332.98	1,664,900		
D1.4	Electrical connection	m	5,000	65.00	325,000		
D2	**Raw Water Raising Main**					**1,663,740**	**1,663,740**
D2.1	RWRM to RO: uPVC 315, cl 9	m	3,250	511.92	1,663,740		
D3	**Clear Water Pump Station**					**1,067,000**	**1,067,000**
D3.1	Pump sump / balancing reservoir (1 hr storage) (200 kl)	no	1	270,000	270,000		
D3.2	CWPS: one duty, one standby: ETA 125-200	no	1	797,000	797,000		
	Motor 11 kW (1450 RPM)						
D4	**Clear Water Raising Main**					**832,450**	**832,450**
D4.1	CWRM 2 Pumping main to town Res: uPVC 250, cl 9	m	2,500	332.98	832,450		
E	**Reservoirs**					**1,946,000**	**1,946,000**
	Add capacity to town reservoirs 2 x 1500 kl	no	2	973,000	1,946,000		

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
F	**Balancing dam**					**600,000**	**600,000**
	PE lined dam: 13 000 kl	no	1	600,000	600,000		
	Total for scheme					**22,128,662**	**22,128,662**

RO Plant			7,700,000
BH Source			2,178,070
BH Equipm			1,792,800
RWRM			4,428,640
CWRM			1,016,152
CWGM			0
CWPS			797,000
WTW (Sea water intake and filter)			1,400,000
Storage			2,816,000
TOTAL			**22,128,662**

ALBANY COAST SITUATION ASSESMENT STUDY

02-Sep-04

DESCRIPTION OF THE CONVEYANCE SYSTEM

5

For Year 2015:

GAADD	3320.00	m3/d
SDD	4980.00	m3/d

KENTON ON SEA/BUSHMANS RIVER MOUTH SUPPLY FROM GW & SW (GLEN MELVILLE) (5 KOS : SW)

Description : Keep existing RO plant & Dias Cross well field, upgrade seawater intake and **RO**, develop **Kwaaihoek** dune source, supply deficit from **Glen Melville Dam** (2300 m³/d)
Provide necessary conveyance, reservoirs and balancing reservoir
Prices exclude VAT and professional fees (total of 30%)

No	Description	unit	Quantity	Rate	Sub-tot	Total for component	Total for sub-system
A	**Upgrade RO plant**					**4,100,000**	**4,100,000**
	Build sea water intake and filtration	sum			1,400,000		
	Upgrade Eskom supply	sum			700,000		
	Upgrade brine disposal	sum			600,000		
	Expand R0 3 plant (add 10 kl/hr)	sum			1,400,000		
B	**Develop Kwaaihoek dune well field**						**628,372**
B1	**Ground Water Source**					**516,462**	
	Develop source: 6.9 l/s (12hr), 1.72 l/s/bh, 4 No bh	sum			178,070		
	Equip bh: Q 1.72 l/s, H 60 m	no	4	50400	201,600		
	Collector pipes, ND 75, cl 9, 200 m/bh	m	800	89.74	71,792		
	Electrical connection	m	1,000	65.00	65,000		
B2	**Clear Water Raising/Gravity Mains**					**111,910**	
	CWRM 1: uPVC 90, cl 9	m	1,000	111.91	111,910		

C	**Reservoirs**					**1,946,000**	**1,946,000**
	Add capacity to town reservoirs 2 x 1500 kl	no	2	973,000	1,946,000		
E	**Supply 2300 m³/d from Glen Melville Dam to KOS**					**25,127,190**	**25,127,190**
	Total sum	sum			25,127,190		
	Total for scheme					**31,801,562**	**31,801,562**

RO Plant			2,100,000
BH Source			178,070
BH Equipm			266,600
CWRM			183,702
RWRM			2,000,000
Additional costs of SW: GM Opt1 - GM 0pt 2			25,127,190
Storage			1,946,000
TOTAL			**31,801,562**

ALBANY COAST SITUATION ASSESMENT STUDY

02-Sep-04

DESCRIPTION OF THE CONVEYANCE SYSTEM

6

KENTON ON SEA & PORT ALFRED
SUPPLY FROM GW & SW (GLEN MELVILLE)
(6 PA : SW1)

GAADD	15906.00	m3/d
SDD	26724.00	m3/d

Description : Keep existing dune source. **Develop Barville / Glendower** well field, develop **Sunshine Coast** well field, develop **SW** supply from **Glen Melville Dam** to Bathurst, Port Alfred & Kenton On Sea
Provide necessary pump stations, conveyance, reservoirs and balancing reservoir
Prices exclude VAT and professional fees (total of 30%)

No	Description	unit	Quantity	Rate	Sub-tot	Total for component	Total for sub-system
(I)	**GROUND WATER SOURCE**						
A	**Develop Barville / Glendower well field**						**2,137,200**
A1	**Ground Water Source**					**2,137,200**	
A1.1	Develop source: 23 l/s (12hr), 5 l/s/bh, 5 No bh	sum			1,015,000		
A1.2	Equip bh: Q 5 l/s, H 150 m	no	5	60900	304,500		
A1.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	1,000	89.74	89,740		
A1.4	Electrical connection	m	3,000	65.00	195,000		
A1.5	Pumping main to balancing Res: uPVC 160, cl 12	m	2,000	266.48	532,960		
A2	**Develop Sunshine Coast well field**						**1,867,812**
A2	**Ground Water Source**					**1,867,812**	
A2.1	Develop source: 18 l/s (12hr), 2 l/s/bh, 9 No bh	sum			495,000		
A2.2	Equip bh: Q 2 l/s, H 145 m	no	9	52500	472,500		
A2.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	1,800	89.74	161,532		
A2.4	Electrical connection	m	2,000	65.00	130,000		
A2.6	Pumping main to balancing Res: uPVC 140, cl 16	m	2,000	304.39	608,780		
A3	**Balancing reservoir 500 kl**	no	1	**470,000**	**470,000**	**470,000**	**470,000**

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
B	**Clear Water Gravity Main from GW source to PA**						**1,664,900**
B1	**Gravity Main from Balancing Reservoir to PA**					**1,664,900**	
B1.1	CWGM 1: uPVC 250, cl 9	m	5,000	332.98	1,664,900		
(II)	**SURFACE WATER**						
C	**Water Treatment Works**					**8,784,000**	**8,784,000**
	Build new WTW with a capacity of 144 l/s	l/s	144	61,000	8,784,000		
D	**Clear Water Pump Station at WTW**					**7,592,543**	**7,592,543**
D1.1	CWPS: one duty, one standby Sulzer	no	1	7,592,543	7,592,543		
	HPH 50/20 Motor 900 kW (1450 RPM)						
E1	**Clear Water Raising/Gravity Mains**					**68,290,155**	**68,290,155**
E1.1	CWRM 1: Steel 400 ND, 6mm wall thickness	m	8,500	749.79	6,373,215		
E1.2	CWGM 1: to BT, steel 400 ND, 6 mm wall	m	10,000	749.79	7,497,900		
E1.3	CWGM 2: to BT, uPVC 400 ND, cl 12	m	35,500	976.60	34,669,300		
E1.4	CWGM 3: From BT to PA, steel 300 ND	m	14,000	591.41	8,279,740		
E1.5	CWGM 5: From PA to KOS, steel 200 ND	m	23,000	450.00	10,350,000		
E1.10	BPT 250kl	no	4	280,000	1,120,000		
G	**Reservoirs**					**9,891,000**	**9,891,000**
	Balancing reservoir at GT 1 x 2 500 kl		1	1,425,000	1,425,000		
	Add capacity at Bathurst 1 x 1200 kl		1	840,000	840,000		
	Add capacity at Port Alfred 3 x 5000 kl	no	3	2,542,000	7,626,000		
	Total for scheme					**100,697,610**	**100,697,610**

WTW				8,784,000
GW Source				1,835,000
BH Equipment				777,000
CWRM				7,766,227
CWGM				62,461,840
RWPS				0
CWPS				7,592,543
Storage				11,481,000
TOTAL				**100,697,610**

0

ALBANY COAST SITUATION ASSESMENT STUDY

02-Sep-04

DESCRIPTION OF THE CONVEYANCE SYSTEM

7

PORT ALFRED
SUPPLY FROM GW & SW (GLEN MELVILLE)
(7 PA : SW2)

GAADD	11815.00	m3/d
SDD	20587.00	m3/d

Description : Keep existing dune source. **Develop Barville / Glendower** well field, develop **Sunshine Coast** well field, develop **SW** supply from **Glen Melville Dam** to Bathurst & Port Alfred
Provide necessary pump stations, conveyance, reservoirs and balancing reservoir
Prices exclude VAT and professional fees (total of 30%)

No	Description	unit	Quantity	Rate	Sub-tot	Total for component	Total for sub-system
(I)	**GROUND WATER SOURCE**						
A	**Develop Barville / Glendower well field**						**2,137,200**
A1	**Ground Water Source**					**2,137,200**	
A1.1	Develop source: 23 l/s (12hr), 5 l/s/bh, 5 No bh	sum			1,015,000		
A1.2	Equip bh: Q 5 l/s, H 150 m	no	5	60900	304,500		
A1.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	1,000	89.74	89,740		
A1.4	Electrical connection	m	3,000	65.00	195,000		
A1.5	Pumping main to balancing Res: uPVC 160, cl 12	m	2,000	266.48	532,960		
A2	**Develop Sunshine Coast well field**						**1,867,812**
A2	**Ground Water Source**					**1,867,812**	
A2.1	Develop source: 18 l/s (12hr), 2 l/s/bh, 9 No bh	sum			495,000		
A2.2	Equip bh: Q 2 l/s, H 145 m	no	9	52500	472,500		
A2.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	1,800	89.74	161,532		
A2.4	Electrical connection	m	2,000	65.00	130,000		
A2.6	Pumping main to balancing Res: uPVC 140, cl 16	m	2,000	304.39	608,780		
A3	**Balancing reservoir 500 kl**	no	1	**470,000**	**470,000**	**470,000**	**470,000**

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
B	**Clear Water Gravity Main from GW source to PA**						**1,664,900**
B1	**Gravity Main from Balancing Reservoir to PA**					**1,664,900**	
B1.1	CWGM 1: uPVC 250, cl 9	m	5,000	332.98	1,664,900		
(II)	**SURFACE WATER**						
C	**Water Treatment Works**					**6,832,000**	**6,832,000**
	Build new WTW with a capacity of 112 l/s	l/s	112	61,000	6,832,000		
D	**Clear Water Pump Station at WTW**					**7,592,543**	**7,592,543**
D1.1	CWPS: one duty, one standby Sulzer	no	1	7,592,543	7,592,543		
	HPH 50/20 Motor 900 kW (1450 RPM)						
E1	**Clear Water Raising/Gravity Mains**					**45,339,965**	**45,339,965**
E1.1	CWRM 1: Steel 350 ND, 6 mm wall thickness	m	8,500	637.94	5,422,490		
E1.2	CWGM 1: to BT, steel 300 ND	m	10,000	591.41	5,914,100		
E1.3	CWGM 2: to BT, uPVC 315 ND, cl 12	m	35,500	631.69	22,424,995		
E1.4	CWGM 3: From BT to PA, uPVC 315 ND, cl16	m	14,000	764.17	10,698,380		
E1.5	BPT 150kl	no	4	220,000	880,000		
G	**Reservoirs**					**9,666,000**	**9,666,000**
	Balancing reservoir at GT 1 x 2 000 kl	no	1	1,200,000	1,200,000		
	Add capacity at Bathurst 1 x 1200 kl	no	1	840,000	840,000		
	Add capacity at Port Alfred 3 x 5000 kl	no	3	2,542,000	7,626,000		
	Total for scheme					**75,570,420**	**75,570,420**

WTW				6,832,000
GW Source				1,835,000
BH Equipment				777,000
CWRM				6,815,502
CWGM				40,702,375
RWPS				0
CWPS				7,592,543
Storage				11,016,000
TOTAL				**75,570,420**

ALBANY COAST SITUATION ASSESMENT STUDY

02-Sep-04

DESCRIPTION OF THE CONVEYANCE SYSTEM

8a

PORT ALFRED
SUPPLY FROM GW & SW (SAREL HAYWARD)
(8a PA : SW3)

GAADD	10682.00	m3/d
SDD	19228.00	m3/d

Description : Keep existing dune source. **Develop Barville / Glendower** well field, develop **Sunshine Coast** well field. Raise Sarel Hayward Dam and develop **SW** supply from **Sarel Hayward Dam** to Port Alfred Supply Bathurst from Golden Ridge Dam. Provide necessary PS's, conveyance, Res's and Bal Res's Prices exclude VAT and professional fees (total of 30%)

No	Description	unit	Quantity	Rate	Sub-tot	Total for component	Total for sub-system
(I)	**GROUND WATER SOURCE**						
A	**Develop Barville / Glendower well field**						**2,137,200**
A1	**Ground Water Source**					**2,137,200**	
A1.1	Develop source: 23 l/s (12hr), 5 l/s/bh, 5 No bh	sum			1,015,000		
A1.2	Equip bh: Q 5 l/s, H 150 m	no	5	60900	304,500		
A1.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	1,000	89.74	89,740		
A1.4	Electrical connection	m	3,000	65.00	195,000		
A1.5	Pumping main to balancing Res: uPVC 160, cl 12	m	2,000	266.48	532,960		

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
A2	**Develop Sunshine Coast well field**						**1,867,812**
A2	**Ground Water Source**					**1,867,812**	
A2.1	Develop source: 18 l/s (12hr), 2 l/s/bh, 9 No bh	sum			495,000		
A2.2	Equip bh: Q 2 l/s, H 145 m	no	9	52500	472,500		
A2.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	1,800	89.74	161,532		
A2.4	Electrical connection	m	2,000	65.00	130,000		
A2.6	Pumping main to balancing Res: uPVC 140, cl 16	m	2,000	304.39	608,780		
A3	**Balancing reservoir 500 kl**	no	1	**470,000**	**470,000**	**470,000**	**470,000**
B	**Clear Water Gravity Main from GW source to PA**						**1,664,900**
B1	**Gravity Main from Balancing Reservoir to PA**					**1,664,900**	
B1.1	CWGM 1: uPVC 250, cl 9	m	5,000	332.98	1,664,900		
(II)	**SURFACE WATER**						
C	**Water Treatment Works**					**6,466,000**	**6,466,000**
	Build a new WTW at PA with a capacity of 106 l/s	l/s	106	61,000	6,466,000		
D	**Develop Raw Water Pump Stations**					**1,844,000**	**1,844,000**
D1.1	RWPS 1: one duty, one standby	no	1	738000.00	738,000		
	WKLn 150/2 Motor 75 kW (1450 RPM)						
D1.2	RWPS 2: one duty, one standby WKLn	no	1	553000.00	553,000		
	100/5 Motor 45 kW (1450 RPM)						
D1.3	RWPS 3: one duty, one standby WKLn	no	1	553000.00	553,000		
	100/5 Motor 45 kW (1450 RPM)						

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
E1	**Clear Water Raising/Gravity Mains**					**8,469,285**	**8,469,285**
E1.1	RWRM 1: Steel 400 ND (PS 1 to dam)	m	700	749.79	524,853		
E1.2	RWRM 2: uPVC 315/12 (PS 2 to PS 3)	m	3,500	631.69	2,210,915		
E1.3	RWRM 3: uPVC 315/12 (PS 3 to BPT)	m	3,500	631.69	2,210,915		
E1.4	RWGM 1: uPVC 315/16	m	2,600	764.17	1,986,842		
E1.5	RWGM 2: uPVC 315/9 (BAL RES to WTW)	m	3,000	511.92	1,535,760		
F	**Reservoirs**					**8,166,000**	**8,166,000**
F1.1	Bal RES at PS 3 and at high point CH 7700 (200kl)	no	2	270,000	540,000		
F1.2	Add capacity to PA reservoirs : 3 x 5 000 kl	no	3	2,542,000	7,626,000		
G	**Raising of Sarel Hayward Dam**					**11,363,751**	**11,363,751**
	Raising of wall by 12 m	sum			11,363,751		
	Total for scheme					**42,448,948**	**42,448,948**

GW Source			1835000.00
GW Equipment			777000.00
WTW			6,466,000
CWRM			1,393,012
CWGM			1,664,900
RWGM			1,535,760
RWRM			6,933,525
RWPS			1,844,000
Storage			8,636,000
Raising Dam wall			11,363,751
TOTAL			**42,448,948**

ALBANY COAST SITUATION ASSESMENT STUDY

02-Sep-04

DESCRIPTION OF THE CONVEYANCE SYSTEM

8b

PORT ALFRED
SUPPLY FROM GW & SW (SAREL HAYWARD)
(8b PA : SW4)

GAADD	10682.00	m3/d
SDD	19228.00	m3/d

Description : Keep existing dune source. **Develop Barville / Glendower** well field, develop **Sunshine Coast** well field. Raise Sarel Hayward Dam and develop **SW** supply from **Sarel Hayward Dam** to Port Alfred **Treat 4 000 m³/d of Sarel Hayward's SW through RO,** supply Bathurst from Golden Ridge Dam.
Prices exclude VAT and professional fees (total of 30%)

No	Description	unit	Quantity	Rate	Sub-tot	Total for component	Total for sub-system
(I)	**GROUND WATER SOURCE**						
A	**Develop Barville / Glendower well field**						**2,128,226**
A1	**Ground Water Source**					**2,128,226**	
A1.1	Develop source: 23 l/s (12hr), 5 l/s/bh, 5 No bh	sum			1,015,000		
A1.2	Equip bh: Q 5 l/s, H 150 m	no	5	60900	304,500		
A1.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	900	89.74	80,766		
A1.4	Electrical connection	m	3,000	65.00	195,000		
A1.5	Pumping main to balancing Res: uPVC 160, cl 12	m	2,000	266.48	532,960		
A2	**Develop Sunshine Coast well field**						**1,813,968**
A2	**Ground Water Source**					**1,813,968**	
A2.1	Develop source: 18 l/s (12hr), 2 l/s/bh, 9 No bh	sum			495,000		
A2.2	Equip bh: Q 2 l/s, H 145 m	no	9	52500	472,500		
A2.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	1,200	89.74	107,688		

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
A2.4	Electrical connection	m	2,000	65.00	130,000		
A2.6	Pumping main to balancing Res: uPVC 140, cl 16	m	2,000	304.39	608,780		
A3	**Balancing reservoir 500 kl**	no	1	**470,000**	**470,000**	**470,000**	**470,000**
B	**Clear Water Gravity Main from GW source to PA**						**1,664,900**
B1	**Gravity Main from Balancing Reservoir to PA**					**1,664,900**	
B1.1	CWGM 1: uPVC 250, cl 9	m	5,000	332.98	1,664,900		
(II)	**SURFACE WATER**						
C	**Water Treatment Works**					**6,466,000**	**6,466,000**
	Build a new WTW at PA with a capacity of 106 l/s	l/s	106	61,000	6,466,000		
D	**Develop Raw Water Pump Stations**					**1,844,000**	**1,844,000**
D1.1	RWPS 1: one duty, one standby	no	1	738000.00	738,000		
	WKLn 150/2 Motor 75 kW (1450 RPM)						
D1.2	RWPS 2: one duty, one standby WKLn	no	1	553000.00	553,000		
	100/5 Motor 45 kW (1450 RPM)						
D1.3	RWPS 3: one duty, one standby WKLn	no	1	553000.00	553,000		
	100/5 Motor 45 kW (1450 RPM)						
E1	**Clear Water Raising/Gravity Mains**					**8,469,285**	**8,469,285**
E1.1	RWRM 1: Steel 400 ND (PS 1 to dam)	m	700	749.79	524,853		
E1.2	RWRM 2: uPVC 315/12 (PS 2 to PS 3)	m	3,500	631.69	2,210,915		
E1.3	RWRM 3: uPVC 315/12 (PS 3 to BPT)	m	3,500	631.69	2,210,915		
E1.4	RWGM 1: uPVC 315/16	m	2,600	764.17	1,986,842		
E1.5	RWGM 2: uPVC 315/9 (BAL RES to WTW)	m	3,000	511.92	1,535,760		
F	**Reservoirs**					**8,166,000**	**8,166,000**
F1.1	Bal RES at PS 3 and at high point CH 7700 (200kl)	no	2	270,000	540,000		
F1.2	Add capacity to PA reservoirs : 3 x 5 000 kl	no	3	2,542,000	7,626,000		

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
G	**Raising of Sarel Hayward Dam**					**11,363,751**	**11,363,751**
	Raising of wall by 12 m	sum			11,363,751		
H	**New RO equipment (4000 m³/d)**					**12,900,000**	**12,900,000**
	RO Unit complete	no	14	400,000	5,600,000		
	Housing for RO equipment	m2	1,400	2,000	2,800,000		
	Supply Eskom power	no	14	300,000	4,200,000		
	Brine disposal (1200 m @ uPVC 200 cl 9 plus civils)	sum			300,000		
I	**Clear Water Pump Station**					**1,121,960**	**1,121,960**
I1.1	Pump sump/balancing reservoir (1 hr storage) (300 kl)	no	1	228,000	228,000		
I1.2	CWPS: one duty, one standby: ETA 125-250	no	1	638,000	638,000		
	Motor 15 kW (1450 RPM)						
I1.3	RWGM - uPVC 315 cl 9, PS to RO Plant	m	500	511.92	255,960		
J	**Clear Water Raising Main**					**166,490**	**166,490**
	Pumping main RO to town Res: uPVC 250, cl 9	m	500	332.98	166,490		
	Total for scheme					**56,574,580**	**56,574,580**

GW Source			1835000.00
GW Equipment			777000.00
WTW			6,466,000
RO Plant			12,600,000
CWPS			638,000
CWRM			1,496,684
CWGM			1,664,900
RWGM			1,791,720
RWRM			7,233,525
RWPS			1,844,000
Storage			8,864,000
Raising Dam wall			11,363,751
TOTAL			**56,574,580**

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ALBANY COAST SITUATION ASSESMENT STUDY

02-Sep-04

DESCRIPTION OF THE CONVEYANCE SYSTEM

9

PORT ALFRED
SUPPLY FROM GW & SW (SETTLERS)
(9 PA : SW5)

GAADD	10682.00	m3/d
SDD	19228.00	m3/d

Description : Keep existing dune source. **Develop Barville / Glendower** well field, develop **Sunshine Coast** well field. Develop **SW** supply from **Settlers Dam** to Port Alfred, supply Bathurst from **Golden Ridge Dam**. Develop **SW** supply from **Glen Melville Dam** to Grahamstown-West

Prices exclude VAT and professional fees (total of 30%)

No	Description	unit	Quantity	Rate	Sub-tot	Total for component	Total for sub-system
(I)	**GROUND WATER SOURCE**						
A	**Develop Barville / Glendower well field**						**2,137,200**
A1	**Ground Water Source**					**2,137,200**	
A1.1	Develop source: 23 l/s (12hr), 5 l/s/bh, 5 No bh	sum			1,015,000		
A1.2	Equip bh: Q 5 l/s, H 150 m	no	5	60900	304,500		
A1.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	1,000	89.74	89,740		
A1.4	Electrical connection	m	3,000	65.00	195,000		
A1.5	Pumping main to balancing Res: uPVC 160, cl 12	m	2,000	266.48	532,960		

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
A2	**Develop Sunshine Coast well field**						**1,867,812**
A2	**Ground Water Source**					**1,867,812**	
A2.1	Develop source: 18 l/s (12hr), 2 l/s/bh, 9 No bh	sum			495,000		
A2.2	Equip bh: Q 2 l/s, H 145 m	no	9	52500	472,500		
A2.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	1,800	89.74	161,532		
A2.4	Electrical connection	m	2,000	65.00	130,000		
A2.6	Pumping main to balancing Res: uPVC 140, cl 16	m	2,000	304.39	608,780		
A3	**Balancing reservoir 500 kl**	no	1	**470,000**	**470,000**	**470,000**	**470,000**
B	**Clear Water Gravity Main from GW source to PA**						**1,664,900**
B1	**Gravity Main from Balancing Reservoir to PA**					**1,664,900**	
B1.1	CWGM 1: uPVC 250, cl 9	m	5,000	332.98	1,664,900		
(II)	**SURFACE WATER**						
C	**Water Treatment Works**					**12,932,000**	**12,932,000**
	Build a new WTW at PA with a capacity of 106 l/s	l/s	106	61,000	6,466,000		
	Build new WTW at Glen Melville Dam, cap of 106 l/s	l/s	106	61,000	6,466,000		
D	**Develop Raw Water Pump Stations**					**7,784,000**	**7,784,000**
D1.1	RWPS 1: one duty, one standby WKLn	no	1	553000.00	553,000		
	100/5 Motor 45 kW (1450 RPM)						
D1.2	CWPS: Glen Melville Dam - one duty, one standby	no	1	7231000.00	7,231,000		
	Sulzer HPH 50/20 Motor 900 kW (1450 RPM)						

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
E1	**Clear Water Raising/Gravity Mains**					**41,712,153**	**41,712,153**
E1.1	RWRM 1: uPVC 315/12	m	2,000	631.69	1,263,380		
E1.2	RWGM 1: uPVC 315/9	m	7,800	511.92	3,992,976		
E1.3	RWGM 2: uPVC 355/9	m	3,100	641.38	1,988,278		
E1.4	RWGM 3: uPVC 315/16	m	4,000	764.17	3,056,680		
E1.5	RWGM 4: uPVC 315/12	m	13,100	631.69	8,275,139		
E1.6	RWGM 5: uPVC 315/16	m	14,500	764.17	11,080,465		
E1.7	CWRM 1: Steel 350, GM Dam WTW to Botha's Res	m	8,500	637.94	5,422,490		
E1.8	CWGM 8: uPVC 315/12, From Botha's Res to Gtown	m	10,500	631.69	6,632,745		
F	**Reservoirs**					**8,706,000**	**8,706,000**
F1.1	BPT 200kl	no	4	270,000	1,080,000		
F1.2	Add capacity to PA reservoir : 3 x 5 000 kl	no	3	2,542,000	7,626,000		
	Total for scheme					**77,274,065**	**77,274,065**

GW Source			1835000.00
GW Equipment			777000.00
WTW			12,932,000
CWRM			6,815,502
CWGM			8,297,645
RWGM			28,393,538
RWRM			1,263,380
RWPS			553,000
CWPS			7,231,000
Storage			9,176,000
TOTAL			**77,274,065**

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ALBANY COAST SITUATION ASSESMENT STUDY

02-Sep-04

DESCRIPTION OF THE CONVEYANCE SYSTEM

10

PORT ALFRED
SUPPLY FROM GW & RO (SEAWATER)
(10 PA : RO)

GAADD	10682.00	m3/d
SDD	19228.00	m3/d

Description : Keep existing dune source. **Develop Barville / Glendower** well field, develop **Sunshine Coast** well field. Develop **RO** plant at Port Alfred, supply Bathurst from **Golden Ridge Dam**.
Provide necessary pump stations, conveyance, reservoirs and balancing reservoir
Prices exclude VAT and professional fees (total of 30%)

No	Description	unit	Quantity	Rate	Sub-tot	Total for component	Total for sub-system
(I)	**GROUND WATER SOURCE**						
A	**Develop Barville / Glendower well field**						**2,137,200**
A1	**Ground Water Source**					**2,137,200**	
A1.1	Develop source: 23 l/s (12hr), 5 l/s/bh, 5 No bh	sum			1,015,000		
A1.2	Equip bh: Q 5 l/s, H 150 m	no	5	60900	304,500		
A1.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	1,000	89.74	89,740		
A1.4	Electrical connection	m	3,000	65.00	195,000		
A1.5	Pumping main to balancing Res: uPVC 160, cl 12	m	2,000	266.48	532,960		
A2	**Develop Sunshine Coast well field**						**1,867,812**
A2	**Ground Water Source**					**1,867,812**	
A2.1	Develop source: 18 l/s (12hr), 2 l/s/bh, 9 No bh	sum			495,000		
A2.2	Equip bh: Q 2 l/s, H 145 m	no	9	52500	472,500		
A2.3	Collector pipes, ND 75, cl 9, 200 m/bh	m	1,800	89.74	161,532		

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
A2.4	Electrical connection	m	2,000	65.00	130,000		
A2.6	Pumping main to balancing Res: uPVC 140, cl 16	m	2,000	304.39	608,780		
A3	**Balancing reservoir 500 kl**	no	1	**470,000**	**470,000**	**470,000**	**470,000**
B	**Clear Water Gravity Main from GW source to PA**						**1,664,900**
B1	**Gravity Main from Balancing Reservoir to PA**					**1,664,900**	
B1.1	CWGM 1: uPVC 250, cl 9	m	5,000	332.98	1,664,900		
C	**Reservoirs**					**7,626,000**	**7,626,000**
C1.2	Add capacity to PA reservoirs : 3 x 5 000 kl	no	3	2,542,000	7,626,000		
(II)	**RO PLANT**						
D	**GW Source Development**					**3,623,675**	**3,623,675**
D1.1	Develop a GW source, 15 x BH's total of 155 l/s	no	15	110,000	1,650,000		
D1.2	Pump sump/balancing Res (½ hr storage) (250 kl)	no	1	300,000	300,000		
D1.3	Collector pipes, ND 160, cl 9	m	2,500	221.47	553,675		
D1.4	Supply Eskom power	no	5	90,000	450,000		
D1.5	RWPS: (Beach) one duty, one standby: WKLn	no	1	670,000	670,000		
	100/7 Motor 45 kW (1450 RPM)						

No	Description	unit	Quantity	Rate	Sub-tot	Total	Total
E	**New RO equipment (2000 m³/d)**					**44,350,000**	**44,350,000**
	RO Unit complete	no	26	1,300,000	33,800,000		
	Housing for RO equipment	m2	2,600	2,000	5,200,000		
	Supply Eskom power	no	26	100,000	2,600,000		
	Brine dispsl (1200 m @ uPVC 250 cl 9 plus civils)	sum			2,750,000		
I	**Clear Water Pump Station**					**1,387,690**	**1,387,690**
I1.1	Pump sump/balancing Res (½ hr storage) (200 kl)	no	1	270,000	270,000		
I1.2	CWPS: (RO) one duty, one standby: WKLn 150/2 Motor 90 kW (1450 RPM)	no	1	797,000	797,000		
I1.3	CWRM - uPVC 355 cl 9, PS to RO Plant	m	500	641.38	320,690		
J	**Raw Water Raising Main**					**1,574,559**	**1,574,559**
	Pumping main BH's to town RO: Steel 400, 5 mm	m	2,100	749.79	1,574,559		
	Total for scheme					**64,701,836**	**64,701,836**

GW Source			3935000.00
GW Equipment			777000.00
WTW			-
RO Plant			41,600,000
CWPS			797,000
CWRM			1,713,702
CWGM			1,664,900
RWGM			-
RWRM			4,878,234
RWPS			670,000
Storage			8,666,000
TOTAL			**64,701,836**

APPENDIX 10.2

SUMMARY OF COSTS

Economic Comparison: **APPENDIX 10.2**

No.	DAM/OPTION	Capital	URV	Note
		R mil	R/kl	
1	Alexandria: Ground Water (GW)	R10.61	R15.22	Recommend
2	Canon Rocks / Boknes: GW	R5.62	R5.02	Recommend
3	KOS / Bushmans River Mouth: GW	R28.11	R10.08	Recommend: short term
4a	KOS / Bushmans River Mouth: RO sea W	R34.65	R13.56	Not recommended
4b	KOS / Bushmans River Mouth: RO brack W	R28.77	R11.33	Not recommended
5	KOS: SW from GM Dam	R41.34	R10.21	Recommended: long term
6	PA: Glen Melville Dam: Opt 1: PA, BT, KOS	R130.91	R10.68	Recommended: long term
7	PA: Glen Melville Dam: Opt 2: PA, BT	R98.24	R9.97	Comparison
9	PA: Settlers Dam: Opt 1: PA	R100.46	R10.91	Comparison
8a	PA: Sarel Hayward Dam: Opt 1: PA	R55.18	R5.70	Recommended: long term
8b	PA: Sarel Hayward Dam: Opt 1: PA and RO	R73.53	R8.27	To improve water quality
10	PA: GW and RO only	R84.11	R10.85	Comparison

ALBANY COAST SITUATION ASSESSMENT STUDY **22-Sep-04**

Cost Estimates of Bulk Conveyance Options

Notes:-
Infrastructure sized for 2025
Pipelines installed in 2005 but sized for 2025
Costs given in April 2004 Rands (millions)
PEAK SUMMER DEMAND - FULL SCHEME
INPUT DATA
Construction 2005, capital costs R million **DATA INPUT TABLE: INFO OBTAINED FROM THE COST MODEL TABLES**

Opt No	OPTION	RO PLANT	SW SOURCE	GW SOURCE	BH EQUIPMENT	RAW WATER PUMP STATION	RAW WATER GRAVITY MAIN	RAW WATER RISING MAIN	WATER TREATMENT	CLEAR WATER PUMP STATION	CLEAR WATER RISING MAIN	STORAGE	CLEAR WATER GRAVITY MAINS	TOTAL
1	Alexandria: Ground Water (GW)	R0.00	R0.00	R0.20	R0.37	R0.00	R0.00	R0.00	R0.00	R1.27	R3.57	R0.88	R1.88	R8.16
2	Canon Rocks / Boknes: GW	R0.00	R0.00	R0.56	R0.82	R0.00	R0.00	R0.00	R0.00	R0.43	R1.01	R1.50	R0.00	R4.32
3	KOS / Bushmans River Mouth: GW	R1.40	R0.00	R1.71	R1.11	R0.00	R0.00	R0.00	R2.10	R2.04	R4.00	R3.79	R5.49	R21.63
4a	KOS / Bushmans River Mouth: RO sea W	R14.90	R0.00	R0.18	R0.27	R0.00	R0.00	R0.00	R3.80	R0.58	R2.60	R4.32	R0.00	R26.65
4b	KOS / Bushmans River Mouth: RO brack W	R7.70	R0.00	R2.18	R1.79	R0.00	R0.00	R4.43	R1.40	R0.80	R1.02	R2.82	R0.00	R22.13
5	KOS: SW from GM Dam	R2.10	R0.00	R0.18	R0.27	R0.00	R0.00	R2.00	R1.95	R0.40	R0.18	R1.95	R22.77	R31.80
6	PA: Glen Melville Dam: Opt 1: PA, BT, KOS	R0.00	R0.00	R1.84	R0.78	R0.00	R0.00	R0.00	R8.78	R7.59	R7.77	R11.48	R62.46	R100.70
7	PA: Glen Melville Dam: Opt 2: PA, BT	R0.00	R0.00	R1.84	R0.78	R0.00	R0.00	R0.00	R6.83	R7.59	R6.82	R11.02	R40.70	R75.57
8a	PA: Sarel Hayward Dam: Opt 1: PA	R0.00	R11.36	R1.84	R0.78	R1.84	R1.54	R6.93	R6.47	R0.00	R1.39	R8.64	R1.66	R42.45
9	PA: Settlers Dam: Opt 1: PA	R0.00	R0.00	R1.84	R0.78	R0.55	R35.03	R1.26	R12.93	R7.23	R6.82	R9.18	R1.66	R77.27
8b	PA: Sarel Hayward Dam: Opt 1: PA and RO	R12.60	R11.36	R1.84	R0.78	R1.84	R1.54	R7.24	R6.47	R0.64	R1.97	R8.64	R1.66	R56.57
10	PA: GW and RO only	R42.60		R4.19	R1.78	R0.67		R2.32		R0.80	R2.01	R8.67	R1.66	R64.70
	Total all schemes	**R26.10**	**R11.36**	**R12.34**	**R7.74**	**R2.40**	**R36.56**	**R14.63**	**R44.27**	**R27.93**	**R35.17**	**R55.56**	**R136.63**	**R410.68**

All above costs exclude VAT (14%) and professional fees (16%). These are added into the summary tables

PEAK SUMMER DEMAND - FULL SCHEME
Construction 2005, capital costs R million

No.	OPTION	RO PLANT	SW SOURCE	GW SOURCE	BH EQUIPMENT	PUMP STATIONS	WATER TREATMENT	RESERVOIRS	PIPELINES	TOTAL
1	Alexandria: Ground Water (GW)	R0.000	R0.000	R0.255	R0.480	R1.651	R0.000	R1.138	R7.085	R10.609
2	Canon Rocks / Boknes: GW	R0.000	R0.000	R0.729	R1.067	R0.553	R0.000	R1.953	R1.317	R5.619
3	KOS / Bushmans River Mouth: GW	R1.820	R0.000	R2.217	R1.447	R2.648	R2.730	R4.924	R12.328	R28.114
4a	KOS / Bushmans River Mouth: RO sea W	R19.370	R0.000	R0.231	R0.347	R0.760	R4.940	R5.619	R3.380	R34.646
4b	KOS / Bushmans River Mouth: RO brack W	R10.010	R0.000	R2.831	R2.331	R1.036	R1.820	R3.661	R7.078	R28.767
5	KOS: SW from GM Dam	R2.730	R0.000	R0.231	R0.347	R0.520	R2.538	R2.530	R32.440	R41.335
6	PA: Glen Melville Dam: Opt 1: PA, BT, KOS	R0.000	R0.000	R2.386	R1.010	R9.870	R11.419	R14.925	R91.296	R130.907
7	PA: Glen Melville Dam: Opt 2: PA, BT	R0.000	R0.000	R2.386	R1.010	R9.870	R8.882	R14.321	R61.773	R98.241
8a	PA: Sarel Hayward Dam: Opt 1: PA	R0.000	R14.773	R2.386	R1.010	R2.397	R8.406	R11.227	R14.985	R55.184
9	PA: Settlers Dam: Opt 1: PA	R0.000	R0.000	R2.386	R1.010	R10.119	R16.812	R11.929	R58.201	R100.456
8b	PA: Sarel Hayward Dam: Opt 1: PA and RO	R16.380	R14.773	R2.386	R1.010	R3.229	R8.406	R11.227	R16.125	R73.535
10	PA: GW and RO only	R55.380	R0.000	R5.441	R2.310	R1.907	R0.000	R11.266	R7.804	R84.108
	Total all schemes	**R33.930**	**R14.773**	**R16.037**	**R10.059**	**R39.424**	**R57.546**	**R72.225**	**R289.884**	**R533.878**

Construction 2005, annual O&M costs, R million

No.	OPTION	RO PLANT	SW SOURCE	GW SOURCE	BH EQUIPMENT	PUMP STATIONS	WATER TREATMENT	RESERVOIRS	PIPELINES	TOTAL
	O&M as % of capital costs	**3.00%**	**0.85%**	**1.00%**	**5.50%**	**2.78%**	**1.73%**	**0.50%**	**1.00%**	
1	Alexandria: Ground Water (GW)	R0.000	R0.000	R0.003	R0.026	R0.046	R0.000	R0.006	R0.071	R0.151
2	Canon Rocks / Boknes: GW	R0.000	R0.000	R0.007	R0.059	R0.015	R0.000	R0.010	R0.013	R0.104
3	KOS / Bushmans River Mouth: GW	R0.055	R0.000	R0.022	R0.080	R0.073	R0.047	R0.025	R0.123	R0.425
4a	KOS / Bushmans River Mouth: RO sea W	R0.581	R0.000	R0.002	R0.019	R0.021	R0.085	R0.028	R0.034	R0.771
4b	KOS / Bushmans River Mouth: RO brack W	R0.300	R0.000	R0.028	R0.128	R0.029	R0.031	R0.018	R0.071	R0.606
5	KOS: SW from GM Dam	R0.082	R0.000	R0.002	R0.019	R0.014	R0.044	R0.013	R0.324	R0.499
6	PA: Glen Melville Dam: Opt 1: PA, BT, KOS	R0.000	R0.000	R0.024	R0.056	R0.274	R0.197	R0.075	R0.913	R1.538
7	PA: Glen Melville Dam: Opt 2: PA, BT	R0.000	R0.000	R0.024	R0.056	R0.274	R0.153	R0.072	R0.618	R1.196
8a	PA: Sarel Hayward Dam: Opt 1: PA	R0.000	R0.126	R0.024	R0.056	R0.067	R0.145	R0.056	R0.150	R0.622
9	PA: Settlers Dam: Opt 1: PA	R0.000	R0.000	R0.024	R0.056	R0.281	R0.290	R0.060	R0.582	R1.292
8b	PA: Sarel Hayward Dam: Opt 1: PA and RO	R0.491	R0.126	R0.024	R0.056	R0.090	R0.145	R0.056	R0.161	R1.148
10	PA: GW and RO only	R1.661	R0.000	R0.054	R0.127	R0.053	R0.000	R0.056	R0.078	R2.030
	Total all schemes	**R1.018**	**R0.126**	**R0.160**	**R0.553**	**R1.094**	**R0.993**	**R0.361**	**R2.899**	**R7.204**

Residual values as at 2025, R million

No.	OPTION	RO PLANT	SW SOURCE	GW SOURCE	BH EQUIPMENT	PUMP STATIONS	WATER TREATMENT	RESERVOIRS	PIPELINES	TOTAL
	Residual values after 20 years as % of capital	**40.00%**	**54.00%**	**0.00%**	**0.00%**	**43.00%**	**50.00%**	**55.00%**	**33.00%**	
1	Alexandria: Ground Water (GW)	R0.000	R0.000	R0.000	R0.000	R0.710	R0.000	R0.626	R2.338	R3.674
2	Canon Rocks / Boknes: GW	R0.000	R0.000	R0.000	R0.000	R0.238	R0.000	R1.074	R0.435	R1.746
3	KOS / Bushmans River Mouth: GW	R0.728	R0.000	R0.000	R0.000	R1.139	R1.365	R2.708	R4.068	R10.008
4a	KOS / Bushmans River Mouth: RO sea W	R7.748	R0.000	R0.000	R0.000	R0.327	R2.470	R3.090	R1.115	R14.750
4b	KOS / Bushmans River Mouth: RO brack W	R4.004	R0.000	R0.000	R0.000	R0.446	R0.910	R2.013	R2.336	R9.709
5	KOS: SW from GM Dam	R1.092	R0.000	R0.000	R0.000	R0.224	R1.269	R1.391	R10.705	R14.681
6	PA: Glen Melville Dam: Opt 1: PA, BT, KOS	R0.000	R0.000	R0.000	R0.000	R4.244	R5.710	R8.209	R30.128	R48.291
7	PA: Glen Melville Dam: Opt 2: PA, BT	R0.000	R0.000	R0.000	R0.000	R4.244	R4.441	R7.876	R20.385	R36.947
8a	PA: Sarel Hayward Dam: Opt 1: PA	R0.000	R7.977	R0.000	R0.000	R1.031	R4.203	R6.175	R4.945	R24.331
9	PA: Settlers Dam: Opt 1: PA	R0.000	R0.000	R0.000	R0.000	R4.351	R8.406	R6.561	R19.206	R38.524
8b	PA: Sarel Hayward Dam: Opt 1: PA and RO	R6.552	R7.977	R0.000	R0.000	R1.389	R4.203	R6.175	R5.321	R31.617
10	PA: GW and RO only	R22.152	R0.000	R0.000	R0.000	R0.820	R0.000	R6.196	R2.575	R31.744
	Total all schemes	**R13.572**	**R7.977**	**R0.000**	**R0.000**	**R16.952**	**R28.773**	**R39.724**	**R95.662**	**R202.660**

ALBANY COAST OPTIONS

Annual Electricity charges and chemical costs

			Op 1	Op 2					Op 3			Op 4a				Op 4b				Op 5
No	Component	Unit	Alex: GW 1	CR: GW 2	KOS: GW Kwaaihoek	KOS: GW Merville	KOS: GW Bushfontein	KOS: GW RO	KOS: GW Total	KOS: RO Kwaaihoek	KOS: RO RO Plant	KOS: RO Total	KOS: RO Kwaaihoek	KOS: RO RO sea W	KOS: RO RO brack W	KOS: RO Total	KOS: GM Dam Kwaaihoek	KOS: GM Dam RO sea W	KOS: GM Dam GM Dam	KOS: GM Dam Total
1	GAADD: min	l/s	0	0	0	0	0	0		0	0		0	0	0		0	0	0	
	: max	l/s	5.2	8.9	2.4	6.4	6.4	6.8	22	2.4	19.6	22	2.4	6.8	12.8	22	2.4	6.8	21.8	31
	SPF		1.2	1.5	1.5	1.5	1.5	1.5		1.5	1.5		1.5	1.5	1.5		1.5	1.5	1.5	
2	Design SDD: min	l/s	0	0	0	0	0	0		0	0		0	0	0		0	0	0	
	: max	l/s	6.24	13.35	3.6	9.6	9.6	10.2		3.6	29.4		3.6	10.2	19.2		3.6	10.2	32.7	
3	Static head	m	280	80	85	245	350			85			85				85		480	
4	Local losses	m	10	10	10	10	10			10			10				10		10	
5	Friction losses: min	m	0	0	0	0	0	0		0	0		0	0	0		0	0	0	
	: max	m	100	50	45	25	40			45			45				45		20	
6	Total head: min	m	290	90	95	255	360	0		95	0		95	0	0		95	0	490	
	: max	m	390	140	140	280	400	0		140	0		140	0	0		140	0	510	
7	Energy: min	kW	0	0	0	0	0	0		0	0		0	0	0		0	0	0	
	: max	kW	23	14	4	20	29	0		4	0		4	0	0		4	0	127	
8	Installed capacity: min	kW	0	0	0	0	0	0		0	0		0	0	0		0	0	0	
	: ma	kW	28	21	6	31	44	0		6	0		6	0	0		6	0	190	
9	kVA Rating: min	kVA	14	11	3	16	23	0		3	0		3	0	0		3	0	99	
	: max	kVA	29	22	6	32	46	0		6	0		6	0	0		6	0	198	
10	Energy unit cost	R/kwh	0.2222	0.2222	0.2222	0.2222	0.2222	0.2222		0.2222	0.2222		0.2222	0.2222	0.2222		0.2222	0.2222	0.2222	
11	Demand unit cost	R/kwa/m	5.43	5.43	5.43	5.43	5.43	5.43		5.43	5.43		5.43	5.43	5.43		5.43	5.43	5.43	
12	Energy charge: min	R mil	-	-	-	-	-			-			-				-		-	
	: max	R mil	0.054	0.041	0.011	0.060	0.085	0.186		0.011	0.536		0.011	0.186	0.152		0.011	0.186	0.370	
13	Demand charge: min	R mil	0.001	0.001	0.000	0.001	0.001	-		0.000	-		0.000	-	-		0.000	-	0.006	
	: max	R mil	0.002	0.001	0.000	0.002	0.003	-		0.000	-		0.000	-	-		0.000	-	0.013	
14	Chemicals unit cost	R/kl	-	-				0.63		-	0.63		-	0.63	0.63			0.63		
15	Total chem. cost: min	R mil	-	-	-	-	-	-		-	-		-	-	-		-	-	-	
	: max	R mil	-	-	-	-	-	0.135		-	0.389		-	0.135	0.254		-	0.135	-	
16	Total electr & chemicals																			
	: Min	R mil	0.001	0.001	0.000	0.001	0.001	-	0.003	0.000	-	0.000	0.000	-	-	0.000	0.000	-	0.006	0.007
	: Max	R mil	0.056	0.043	0.012	0.062	0.088	0.321	0.483	0.012	0.925	0.937	0.012	0.321	0.407	0.739	0.012	0.321	0.383	0.716

			Op 6			Op 7			Op 8			Op 9				Op 8b			Op 10
No	Component	Unit	GM Dam 1 GW	GM Dam 1 SW	GM Dam 1 Total	GM Dam 2 GW	GM Dam 2 SW	GM Dam 2 Total	GH Dam 1 GW	SH Dam 1 SW	SH Dam 1 Total	Settlers Dam GW	Settlers Dam SW	Settlers Dam Total	GH Dam 1 GW	SH Dam 1 SW	SH Dam RO brack W	SH Dam 1 Total	GW & RO GW	GW & RO RO	GM Dam 2 Total
1	GAADD: min	l/s	0	0		0	0		0	0		0	0		0	0	0		0	0	
	: max	l/s	20	71	91	20	53.5	73.5	20	49.2	69.2	20	49.2	69.2	20	49.2	25	69.2	20	49.2	69.2
	SPF		1.7	1.7		1.7	1.7		1.7	1.7		1.7	1.7		1.7	1.7	1.5		1.7	1.5	
2	Design SDD: min	l/s	0	0		0	0		0	0		0	0		0	0	0		0	0	
	: max	l/s	34	120.7		34	90.95		34	83.64		34	83.64		34	83.64	37.5		34	73.8	
3	Static head	m	120	480		120	480		120	140		120	550		120	140			120		
4	Local losses	m	10	10		10	10		10	10		10	10		10	10			10		
5	Friction losses: min	m	0	0		0	0		0	0		0	0		0	0	0		0	0	
	: max	m	30	20		30	30		30	43		30	42		30	43			30		
6	Total head: min	m	130	490		130	490		130	150		130	560		130	150	0		130	0	
	: max	m	160	510		160	520		160	193		160	602		160	193	0		160	0	
7	Energy: min	kW	0	0		0	0		0	0		0	0		0	0	0		0	0	
	: max	kW	37	413		37	317		37	108		37	338		37	108	0		37	0	
8	Installed capacity: min	kW	0	0		0	0		0	0		0	0		0	0	0		0	0	
	: ma	kW	62	702		62	539		62	184		62	574		62	184	0		62	0	
9	kVA Rating: min	kVA	32	366		32	281		32	96		32	299		32	96	0		32	0	
	: max	kVA	65	731		65	562		65	192		65	598		65	192	0		65	0	
10	Energy unit cost	R/kwh	0.2222	0.2222	0.2222	0.2222	0.2222		0.2222	0.2222		0.2222	0.2222		0.2222	0.2222	0.2222		0.2222	0.2222	
11	Demand unit cost	R/kwa/m	5.43	5.43	5.43	5.43	5.43		5.43	5.43		5.43	5.43		5.43	5.43	5.43		5.43	5.43	
12	Energy charge: min	R mil	-	-		-	-		-			-	-		-				-		
	: max	R mil	0.121	1.367		0.121	1.050		0.121	0.358		0.121	1.118		0.121	0.358	0.298		0.121	1.345	
13	Demand charge: min	R mil	0.002	0.024		0.002	0.018		0.002	0.006		0.002	0.019		0.002	0.006	-		0.002	-	
	: max	R mil	0.004	0.048		0.004	0.037		0.004	0.012		0.004	0.039		0.004	0.012	-		0.004	-	
14	Chemicals unit cost	R/kl	-	-					-			-	-		-		0.63			0.63	
15	Total chem. cost: min	R mil	-	-		-	-		-	-		-	-		-	-	-		-	-	
	: max	R mil	-	-		-	-		-	-		-	-		-	-	0.497		-	0.977	
16	Total electr & chemicals																				
	: Min	R mil	0.002	0.024	0.026	0.002	0.018	0.020	0.002	0.006	0.008	0.002	0.019	0.022	0.002	0.006	-	0.008	0.002	-	0.002
	: Max	R mil	0.125	1.414	1.539	0.125	1.087	1.212	0.125	0.371	0.496	0.125	1.157	1.282	0.125	0.371	0.795	1.290	0.125	2.322	2.447

APPENDIX 10.3

COST MODEL FOR RAISING SAREL HAYWARD DAM

RAISING OF SAREL HAYWARD DAM: COST MODEL

App. 10.3 Reconnaissance March 2004 price levels

No.	Pay ref.	Description	Unit	Rate	Quantity	Amount
1.	1.0	*Site and basin clearing*				
	1.1	(a) sparse	ha	2,980	2.0	R5,960
	1.2	(b) bush	ha	8,940	1.00	R8,940
	1.3	(c) trees	ha	14,899	0.40	R5,960
2.	2.0	*River diversion*	Sum		50,000	R50,000
3.	3.0	*Excavation*				
	3.1	(a) Bulk				
		(i) all materials	m^3	21	12,200	R259,673
		(ii) extra over for rock	m^3	38	1,220	R46,741
	3.2	(b) Confined				
		(i) all materials	m^3	32	50	R1,596
4.		*Embankment*				
	4.1	(a) Earthfill	m^3	26	195,000	R4,980,609
	4.2	(b) Filters	m^3	94	50	R4,683
	4.3	(c) Rip-rap	m^3	46	800	R37,187
	4.3	(d) Overhaul beyond 2km	m^3km	2.1	39,000	R83,010
5.		*Concrete Works*				
	5.0	(a) Formwork				
	5.1	(i) Gang formed	m^2	107	0	R0
	5.2	(ii) Intricate	m^2	170	120	R20,433
	5.3	(b) Concrete				
	5.4	(i) mass	m^3	387	250	R96,776
	5.5	(ii) structural	m^3	498	67	R33,360
	5.6	(c) Reinforcing	t	5,321	7	R36,383
6.	6.0	*Mechanical items*				
	6.1	(a) Valves & gates	Sum	8%	Civil	R423,395
	6.2	(b) Cranes & hoists				
	6.3	(c) Structural steelwork				
7.	7	*Fencing*	km	14,899	4	R59,597
		SUB TOTAL				**R6,154,303**
8.	8.0	*Landscaping (% of 1 to 7)*	%	5		R307,715
9.	9.0	*Miscellaneous (% of 1 to 7)*	%	10		R615,430
		SUB TOTAL A				**R7,077,448**

No.	Pay ref.	Description	Unit	Rate	Quantity	Amount
10.	10.0	*Preliminary & General*	%	30		R2,123,234
		(% of sub total A)				
11.	11.0	*Preliminary works*				
	11.1	(a) Access road	km	90,000	9	R810,000
	11.2	(b) Electricity to site	km	50,000	6	R300,000
	11.3	(c) Water to site - Construction	Sum			R20,000
		(included in miscellaneous)				
	11.4	(d) Railhead & materials handling	Sum		miscellan.	R0
		(included in miscellaneous)				
12.	12.0	*Accommodation*	Sum		miscellan.	R0
		(included in miscellaneous)				
		SUB TOTAL B				**R10,330,682**
13.	13.0	*Contingencies (% of sub total B)*	%	10		R1,033,068
		SUB TOTAL C				**R11,363,751**
14	14.0	*Planning, design & supervision,*	%	15		R1,704,563
		fees, time, cost & transport				
		(% of sub total C)				
		SUB TOTAL D				**R13,068,313**
15.	15.0	*VAT (% of sub total D)*	%	14		R1,829,564
		TOTAL PROJECT COST				**R14,897,877**

Current NOCL = **46.7 masl**
New proposed NOCL = **58.7 masl**
Total elevation raised = **12 m**

APPENDIX 10.4

ECONOMIC MODELS FOR NPC AND URV

ECONOMICS MODEL **Appendix 10.4**

1. A: GW

1: Alexandria Groundwater Option

Min	0.151	0	0.001	0	0
Max			0.056	0	0

YEAR	COSTS						TOTAL ANNUAL COST			NET PRESENT COST AT 4%			NET PRESENT COST AT 6%			NET PRESENT COST AT 8%		
	Capital	Maintenance	Operation	Energy Charge	Demand Charge	Chemicals	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost
SHADOW	1.00	1.00	1.00	1.00	1.00	1.00												
2003							0	0	0	0	0	0	0	0	0	0	0	0
2004							0	0	0	0	0	0	0	0	0	0	0	0
2005	10.609						10.609	0.000	0.000	9.809	0.000	0.000	9.442	0.000	0.000	9.096	0.000	0.000
2006		0.151	0.000	0.001	0.000	0.000	0.000	0.151	0.001	0.000	0.134	0.001	0.000	0.127	0.001	0.000	0.120	0.001
2007		0.151	0.000	0.004	0.000	0.000	0.000	0.151	0.004	0.000	0.129	0.003	0.000	0.120	0.003	0.000	0.111	0.003
2008		0.151	0.000	0.007	0.000	0.000	0.000	0.151	0.007	0.000	0.124	0.006	0.000	0.113	0.005	0.000	0.103	0.005
2009		0.151	0.000	0.010	0.000	0.000	0.000	0.151	0.010	0.000	0.119	0.008	0.000	0.106	0.007	0.000	0.095	0.006
2010		0.151	0.000	0.013	0.000	0.000	0.000	0.151	0.013	0.000	0.115	0.010	0.000	0.100	0.008	0.000	0.088	0.007
2011		0.151	0.000	0.015	0.000	0.000	0.000	0.151	0.015	0.000	0.110	0.011	0.000	0.095	0.010	0.000	0.082	0.008
2012		0.151	0.000	0.018	0.000	0.000	0.000	0.151	0.018	0.000	0.106	0.013	0.000	0.089	0.011	0.000	0.076	0.009
2013		0.151	0.000	0.021	0.000	0.000	0.000	0.151	0.021	0.000	0.102	0.014	0.000	0.084	0.012	0.000	0.070	0.010
2014		0.151	0.000	0.024	0.000	0.000	0.000	0.151	0.024	0.000	0.098	0.016	0.000	0.080	0.013	0.000	0.065	0.010
2015	0.000	0.151	0.000	0.027	0.000	0.000	0.000	0.151	0.027	0.000	0.094	0.017	0.000	0.075	0.013	0.000	0.060	0.011
2016		0.151	0.000	0.030	0.000	0.000	0.000	0.151	0.030	0.000	0.091	0.018	0.000	0.071	0.014	0.000	0.056	0.011
2017		0.151	0.000	0.033	0.000	0.000	0.000	0.151	0.033	0.000	0.087	0.019	0.000	0.067	0.015	0.000	0.051	0.011
2018		0.151	0.000	0.036	0.000	0.000	0.000	0.151	0.036	0.000	0.084	0.020	0.000	0.063	0.015	0.000	0.048	0.011
2019		0.151	0.000	0.039	0.000	0.000	0.000	0.151	0.039	0.000	0.081	0.021	0.000	0.059	0.015	0.000	0.044	0.011
2020		0.151	0.000	0.042	0.000	0.000	0.000	0.151	0.042	0.000	0.078	0.021	0.000	0.056	0.015	0.000	0.041	0.011
2021		0.151	0.000	0.044	0.000	0.000	0.000	0.151	0.044	0.000	0.075	0.022	0.000	0.053	0.016	0.000	0.038	0.011
2022		0.151	0.000	0.047	0.000	0.000	0.000	0.151	0.047	0.000	0.072	0.022	0.000	0.050	0.016	0.000	0.035	0.011
2023		0.151	0.000	0.050	0.000	0.000	0.000	0.151	0.050	0.000	0.069	0.023	0.000	0.047	0.016	0.000	0.032	0.011
2024		0.151	0.000	0.053	0.000	0.000	0.000	0.151	0.053	0.000	0.066	0.023	0.000	0.044	0.016	0.000	0.030	0.011
2025	-3.674	0.151	0.000	0.056	0.000	0.000	-3.674	0.151	0.056	-1.550	0.064	0.024	-1.020	0.042	0.016	-0.676	0.028	0.010
TOTAL	**6.935**	**3.020**	**0.000**	**0.570**	**0.000**	**0.000**	**6.935**	**3.020**	**0.570**	**8.258**	**1.897**	**0.311**	**8.422**	**1.541**	**0.235**	**8.420**	**1.271**	**0.180**

	NPC	NPV water	URV, R/kl
AT 4%	**10.5**	**0.9**	**11.76**
AT 6%	**10.2**	**0.7**	**15.22**
AT 8%	**9.9**	**0.5**	**19.31**

Net present value of water supplied

Low demand scenario

Min	0	l/s
Max	5.2	l/s

YEAR	TOTAL SUPPLY (x1000 m3)	NPV of water supplied at 4% (x1000 m3)	NPV of water supplied at 6% (x1000 m3)	NPV of water supplied at 8% (x1000 m3)
2003				
2004				
2005				
2006	0.000	0.000	0.000	0.000
2007	0.009	0.007	0.007	0.006
2008	0.017	0.014	0.013	0.012
2009	0.026	0.020	0.018	0.016
2010	0.035	0.026	0.023	0.020
2011	0.043	0.032	0.027	0.023
2012	0.052	0.036	0.031	0.026
2013	0.060	0.041	0.034	0.028
2014	0.069	0.045	0.036	0.030
2015	0.078	0.049	0.039	0.031
2016	0.086	0.052	0.040	0.032
2017	0.095	0.055	0.042	0.032
2018	0.104	0.058	0.043	0.033
2019	0.112	0.060	0.044	0.033
2020	0.121	0.062	0.045	0.033
2021	0.129	0.064	0.045	0.032
2022	0.138	0.066	0.046	0.032
2023	0.147	0.067	0.046	0.031
2024	0.155	0.068	0.046	0.031
2025	0.164	0.069	0.046	0.030
TOTAL	**1.640**	**0.890**	**0.670**	**0.511**

ECONOMICS MODEL

2. A: GW

2: Canon Rocks/Boknes Groundwater Option

Min	0.104	0	0.001	0	0
Max			0.043	0	0

YEAR	COSTS						TOTAL ANNUAL COST			NET PRESENT COST AT 4%			NET PRESENT COST AT 6%			NET PRESENT COST AT 8%		
	Capital	Maintenance	Operation	Energy Charge	Demand Charge	Chemicals	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost
SHADOW	1.00	1.00	1.00	1.00	1.00	1.00												
2003							0	0	0	0	0	0	0	0	0	0	0	0
2004							0	0	0	0	0	0	0	0	0	0	0	0
2005	5.619						5.619	0.000	0.000	5.195	0.000	0.000	5.001	0.000	0.000	4.817	0.000	0.000
2006		0.104	0.000	0.001	0.000	0.000	0.000	0.104	0.001	0.000	0.092	0.001	0.000	0.087	0.001	0.000	0.083	0.001
2007		0.104	0.000	0.003	0.000	0.000	0.000	0.104	0.003	0.000	0.089	0.003	0.000	0.082	0.003	0.000	0.076	0.002
2008		0.104	0.000	0.005	0.000	0.000	0.000	0.104	0.005	0.000	0.085	0.004	0.000	0.078	0.004	0.000	0.071	0.004
2009		0.104	0.000	0.008	0.000	0.000	0.000	0.104	0.008	0.000	0.082	0.006	0.000	0.073	0.005	0.000	0.066	0.005
2010		0.104	0.000	0.010	0.000	0.000	0.000	0.104	0.010	0.000	0.079	0.007	0.000	0.069	0.007	0.000	0.061	0.006
2011		0.104	0.000	0.012	0.000	0.000	0.000	0.104	0.012	0.000	0.076	0.009	0.000	0.065	0.008	0.000	0.056	0.007
2012		0.104	0.000	0.014	0.000	0.000	0.000	0.104	0.014	0.000	0.073	0.010	0.000	0.062	0.008	0.000	0.052	0.007
2013		0.104	0.000	0.016	0.000	0.000	0.000	0.104	0.016	0.000	0.070	0.011	0.000	0.058	0.009	0.000	0.048	0.008
2014		0.104	0.000	0.019	0.000	0.000	0.000	0.104	0.019	0.000	0.068	0.012	0.000	0.055	0.010	0.000	0.045	0.008
2015	0.000	0.104	0.000	0.021	0.000	0.000	0.000	0.104	0.021	0.000	0.065	0.013	0.000	0.052	0.010	0.000	0.041	0.008
2016		0.104	0.000	0.023	0.000	0.000	0.000	0.104	0.023	0.000	0.062	0.014	0.000	0.049	0.011	0.000	0.038	0.008
2017		0.104	0.000	0.025	0.000	0.000	0.000	0.104	0.025	0.000	0.060	0.015	0.000	0.046	0.011	0.000	0.035	0.009
2018		0.104	0.000	0.028	0.000	0.000	0.000	0.104	0.028	0.000	0.058	0.015	0.000	0.043	0.011	0.000	0.033	0.009
2019		0.104	0.000	0.030	0.000	0.000	0.000	0.104	0.030	0.000	0.056	0.016	0.000	0.041	0.012	0.000	0.030	0.009
2020		0.104	0.000	0.032	0.000	0.000	0.000	0.104	0.032	0.000	0.053	0.016	0.000	0.039	0.012	0.000	0.028	0.009
2021		0.104	0.000	0.034	0.000	0.000	0.000	0.104	0.034	0.000	0.051	0.017	0.000	0.036	0.012	0.000	0.026	0.009
2022		0.104	0.000	0.036	0.000	0.000	0.000	0.104	0.036	0.000	0.049	0.017	0.000	0.034	0.012	0.000	0.024	0.008
2023		0.104	0.000	0.039	0.000	0.000	0.000	0.104	0.039	0.000	0.047	0.018	0.000	0.032	0.012	0.000	0.022	0.008
2024		0.104	0.000	0.041	0.000	0.000	0.000	0.104	0.041	0.000	0.046	0.018	0.000	0.031	0.012	0.000	0.021	0.008
2025	-1.746	0.104	0.000	0.043	0.000	0.000	-1.746	0.104	0.043	-0.737	0.044	0.018	-0.485	0.029	0.012	-0.321	0.019	0.008
TOTAL	**3.873**	**2.080**	**0.000**	**0.440**	**0.000**	**0.000**	**3.873**	**2.080**	**0.440**	**4.458**	**1.307**	**0.241**	**4.516**	**1.062**	**0.182**	**4.496**	**0.875**	**0.139**

	NPC	NPV water	URV, R/kl
AT 4%	**6.0**	**1.5**	**3.94**
AT 6%	**5.8**	**1.1**	**5.02**
AT 8%	**5.5**	**0.9**	**6.30**

Net present value of water supplied

Low demand scenario

Min	0	l/s
Max	8.9	l/s

YEAR	TOTAL SUPPLY (x1000 m3)	NPV of water supplied at 4% (x1000 m3)	NPV of water supplied at 6% (x1000 m3)	NPV of water supplied at 8% (x1000 m3)
2003				
2004				
2005				
2006	0.000	0.000	0.000	0.000
2007	0.015	0.013	0.012	0.011
2008	0.030	0.024	0.022	0.020
2009	0.044	0.035	0.031	0.028
2010	0.059	0.045	0.039	0.034
2011	0.074	0.054	0.046	0.040
2012	0.089	0.062	0.052	0.044
2013	0.103	0.070	0.058	0.048
2014	0.118	0.077	0.062	0.051
2015	0.133	0.083	0.066	0.053
2016	0.148	0.089	0.069	0.054
2017	0.162	0.094	0.072	0.055
2018	0.177	0.098	0.074	0.056
2019	0.192	0.103	0.076	0.056
2020	0.207	0.106	0.077	0.056
2021	0.222	0.109	0.078	0.055
2022	0.236	0.112	0.078	0.055
2023	0.251	0.115	0.078	0.054
2024	0.266	0.117	0.078	0.053
2025	0.281	0.118	0.078	0.052
TOTAL	**2.807**	**1.524**	**1.147**	**0.875**

ECONOMICS MODEL

3. KOS: GW

3: Kenton On Sea/Bushmans River mouth: GW

Min	0.425	0	0.003	0	0
Max			0.483	0	0

YEAR	COSTS						TOTAL ANNUAL COST			NET PRESENT COST AT 4%			NET PRESENT COST AT 6%			NET PRESENT COST AT 8%		
	Capital	Maintenance	Operation	Energy Charge	Demand Charge	Chemicals	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost
SHADOW	1.00	1.00	1.00	1.00	1.00	1.00												
2003							0	0	0	0	0	0	0	0	0	0	0	0
2004							0	0	0	0	0	0	0	0	0	0	0	0
2005	28.114						28.114	0.000	0.000	25.993	0.000	0.000	25.021	0.000	0.000	24.103	0.000	0.000
2006		0.425	0.000	0.003	0.000	0.000	0.000	0.425	0.003	0.000	0.378	0.003	0.000	0.357	0.003	0.000	0.337	0.002
2007		0.425	0.000	0.028	0.000	0.000	0.000	0.425	0.028	0.000	0.363	0.024	0.000	0.337	0.022	0.000	0.312	0.021
2008		0.425	0.000	0.054	0.000	0.000	0.000	0.425	0.054	0.000	0.349	0.044	0.000	0.318	0.040	0.000	0.289	0.036
2009		0.425	0.000	0.079	0.000	0.000	0.000	0.425	0.079	0.000	0.336	0.062	0.000	0.300	0.056	0.000	0.268	0.050
2010		0.425	0.000	0.104	0.000	0.000	0.000	0.425	0.104	0.000	0.323	0.079	0.000	0.283	0.069	0.000	0.248	0.061
2011		0.425	0.000	0.129	0.000	0.000	0.000	0.425	0.129	0.000	0.311	0.094	0.000	0.267	0.081	0.000	0.230	0.070
2012		0.425	0.000	0.155	0.000	0.000	0.000	0.425	0.155	0.000	0.299	0.109	0.000	0.252	0.091	0.000	0.213	0.077
2013		0.425	0.000	0.180	0.000	0.000	0.000	0.425	0.180	0.000	0.287	0.121	0.000	0.237	0.100	0.000	0.197	0.083
2014		0.425	0.000	0.205	0.000	0.000	0.000	0.425	0.205	0.000	0.276	0.133	0.000	0.224	0.108	0.000	0.182	0.088
2015	0.000	0.425	0.000	0.230	0.000	0.000	0.000	0.425	0.230	0.000	0.265	0.144	0.000	0.211	0.114	0.000	0.169	0.091
2016		0.425	0.000	0.256	0.000	0.000	0.000	0.425	0.256	0.000	0.255	0.154	0.000	0.199	0.120	0.000	0.156	0.094
2017		0.425	0.000	0.281	0.000	0.000	0.000	0.425	0.281	0.000	0.245	0.162	0.000	0.188	0.124	0.000	0.145	0.096
2018		0.425	0.000	0.306	0.000	0.000	0.000	0.425	0.306	0.000	0.236	0.170	0.000	0.177	0.128	0.000	0.134	0.097
2019		0.425	0.000	0.331	0.000	0.000	0.000	0.425	0.331	0.000	0.227	0.177	0.000	0.167	0.130	0.000	0.124	0.097
2020		0.425	0.000	0.357	0.000	0.000	0.000	0.425	0.357	0.000	0.218	0.183	0.000	0.158	0.132	0.000	0.115	0.096
2021		0.425	0.000	0.382	0.000	0.000	0.000	0.425	0.382	0.000	0.210	0.189	0.000	0.149	0.134	0.000	0.106	0.096
2022		0.425	0.000	0.407	0.000	0.000	0.000	0.425	0.407	0.000	0.202	0.193	0.000	0.140	0.135	0.000	0.098	0.094
2023		0.425	0.000	0.432	0.000	0.000	0.000	0.425	0.432	0.000	0.194	0.197	0.000	0.133	0.135	0.000	0.091	0.093
2024		0.425	0.000	0.458	0.000	0.000	0.000	0.425	0.458	0.000	0.187	0.201	0.000	0.125	0.135	0.000	0.084	0.091
2025	-10.008	0.425	0.000	0.483	0.000	0.000	-10.008	0.425	0.483	-4.223	0.179	0.204	-2.777	0.118	0.134	-1.841	0.078	0.089
TOTAL	**18.106**	**8.500**	**0.000**	**4.860**	**0.000**	**0.000**	**18.106**	**8.500**	**4.860**	**21.770**	**5.340**	**2.644**	**22.244**	**4.338**	**1.992**	**22.262**	**3.577**	**1.522**

	NPC	NPV water	URV, R/kl
AT 4%	**29.8**	**3.8**	**7.90**
AT 6%	**28.6**	**2.8**	**10.08**
AT 8%	**27.4**	**2.2**	**12.65**

Net present value of water supplied

Low demand scenario

Min	0	l/s
Max	22	l/s

YEAR	TOTAL SUPPLY (x1000 m3)	NPV of water supplied at 4% (x1000 m3)	NPV of water supplied at 6% (x1000 m3)	NPV of water supplied at 8% (x1000 m3)
2003				
2004				
2005				
2006	0.000	0.000	0.000	0.000
2007	0.037	0.031	0.029	0.027
2008	0.073	0.060	0.055	0.050
2009	0.110	0.087	0.077	0.069
2010	0.146	0.111	0.097	0.085
2011	0.183	0.133	0.115	0.099
2012	0.219	0.154	0.130	0.110
2013	0.256	0.173	0.143	0.118
2014	0.292	0.190	0.154	0.125
2015	0.329	0.205	0.163	0.131
2016	0.365	0.219	0.171	0.134
2017	0.402	0.232	0.178	0.137
2018	0.438	0.243	0.183	0.138
2019	0.475	0.253	0.187	0.139
2020	0.511	0.262	0.190	0.138
2021	0.548	0.270	0.192	0.137
2022	0.584	0.277	0.193	0.135
2023	0.621	0.283	0.194	0.133
2024	0.657	0.288	0.193	0.131
2025	0.694	0.293	0.193	0.128
TOTAL	**6.938**	**3.766**	**2.835**	**2.163**

ECONOMICS MODEL

4A. KOS: RO SEA WATER

4: Kenton on Sea/ Bushmans River Mouth: RO Option

Min	0.771	0	0	0	0
Max			0.937	0	0

YEAR	COSTS						TOTAL ANNUAL COST			NET PRESENT COST AT 4%			NET PRESENT COST AT 6%			NET PRESENT COST AT 8%		
	Capital	Maintenance	Operation	Energy Charge	Demand Charge	Chemicals	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost
SHADOW	1.00	1.00	1.00	1.00	1.00	1.00												
2003							0	0	0	0	0	0	0	0	0	0	0	0
2004							0	0	0	0	0	0	0	0	0	0	0	0
2005	34.646						34.646	0.000	0.000	32.032	0.000	0.000	30.835	0.000	0.000	29.703	0.000	0.000
2006		0.771	0.000	0.000	0.000	0.000	0.000	0.771	0.000	0.000	0.685	0.000	0.000	0.647	0.000	0.000	0.612	0.000
2007		0.771	0.000	0.049	0.000	0.000	0.000	0.771	0.049	0.000	0.659	0.042	0.000	0.611	0.039	0.000	0.567	0.036
2008		0.771	0.000	0.099	0.000	0.000	0.000	0.771	0.099	0.000	0.634	0.081	0.000	0.576	0.074	0.000	0.525	0.067
2009		0.771	0.000	0.148	0.000	0.000	0.000	0.771	0.148	0.000	0.609	0.117	0.000	0.544	0.104	0.000	0.486	0.093
2010		0.771	0.000	0.197	0.000	0.000	0.000	0.771	0.197	0.000	0.586	0.150	0.000	0.513	0.131	0.000	0.450	0.115
2011		0.771	0.000	0.247	0.000	0.000	0.000	0.771	0.247	0.000	0.563	0.180	0.000	0.484	0.155	0.000	0.417	0.133
2012		0.771	0.000	0.296	0.000	0.000	0.000	0.771	0.296	0.000	0.542	0.208	0.000	0.456	0.175	0.000	0.386	0.148
2013		0.771	0.000	0.345	0.000	0.000	0.000	0.771	0.345	0.000	0.521	0.233	0.000	0.431	0.193	0.000	0.357	0.160
2014		0.771	0.000	0.395	0.000	0.000	0.000	0.771	0.395	0.000	0.501	0.256	0.000	0.406	0.208	0.000	0.331	0.169
2015	0.000	0.771	0.000	0.444	0.000	0.000	0.000	0.771	0.444	0.000	0.482	0.277	0.000	0.383	0.221	0.000	0.306	0.176
2016		0.771	0.000	0.493	0.000	0.000	0.000	0.771	0.493	0.000	0.463	0.296	0.000	0.361	0.231	0.000	0.283	0.181
2017		0.771	0.000	0.542	0.000	0.000	0.000	0.771	0.542	0.000	0.445	0.313	0.000	0.341	0.240	0.000	0.262	0.185
2018		0.771	0.000	0.592	0.000	0.000	0.000	0.771	0.592	0.000	0.428	0.329	0.000	0.322	0.247	0.000	0.243	0.187
2019		0.771	0.000	0.641	0.000	0.000	0.000	0.771	0.641	0.000	0.412	0.342	0.000	0.304	0.252	0.000	0.225	0.187
2020		0.771	0.000	0.690	0.000	0.000	0.000	0.771	0.690	0.000	0.396	0.354	0.000	0.286	0.256	0.000	0.208	0.187
2021		0.771	0.000	0.740	0.000	0.000	0.000	0.771	0.740	0.000	0.381	0.365	0.000	0.270	0.259	0.000	0.193	0.185
2022		0.771	0.000	0.789	0.000	0.000	0.000	0.771	0.789	0.000	0.366	0.375	0.000	0.255	0.261	0.000	0.179	0.183
2023		0.771	0.000	0.838	0.000	0.000	0.000	0.771	0.838	0.000	0.352	0.383	0.000	0.240	0.261	0.000	0.165	0.180
2024		0.771	0.000	0.888	0.000	0.000	0.000	0.771	0.888	0.000	0.338	0.390	0.000	0.227	0.261	0.000	0.153	0.176
2025	-14.750	0.771	0.000	0.937	0.000	0.000	-14.750	0.771	0.937	-6.224	0.325	0.395	-4.093	0.214	0.260	-2.713	0.142	0.172
TOTAL	**19.896**	**15.420**	**0.000**	**9.370**	**0.000**	**0.000**	**19.896**	**15.420**	**9.370**	**25.808**	**9.688**	**5.087**	**26.742**	**7.871**	**3.829**	**26.990**	**6.490**	**2.921**

	NPC	NPV water	URV, R/kl
AT 4%	**40.6**	**3.8**	**10.77**
AT 6%	**38.4**	**2.8**	**13.56**
AT 8%	**36.4**	**2.2**	**16.83**

Net present value of water supplied

Low demand scenario

Min	0	l/s
Max	22	l/s

YEAR	TOTAL SUPPLY (x1000 m3)	NPV of water supplied at 4% (x1000 m3)	NPV of water supplied at 6% (x1000 m3)	NPV of water supplied at 8% (x1000 m3)
2003				
2004				
2005				
2006	0.000	0.000	0.000	0.000
2007	0.037	0.031	0.029	0.027
2008	0.073	0.060	0.055	0.050
2009	0.110	0.087	0.077	0.069
2010	0.146	0.111	0.097	0.085
2011	0.183	0.133	0.115	0.099
2012	0.219	0.154	0.130	0.110
2013	0.256	0.173	0.143	0.118
2014	0.292	0.190	0.154	0.125
2015	0.329	0.205	0.163	0.131
2016	0.365	0.219	0.171	0.134
2017	0.402	0.232	0.178	0.137
2018	0.438	0.243	0.183	0.138
2019	0.475	0.253	0.187	0.139
2020	0.511	0.262	0.190	0.138
2021	0.548	0.270	0.192	0.137
2022	0.584	0.277	0.193	0.135
2023	0.621	0.283	0.194	0.133
2024	0.657	0.288	0.193	0.131
2025	0.694	0.293	0.193	0.128
TOTAL	**6.938**	**3.766**	**2.835**	**2.163**

ECONOMICS MODEL

4B. KOS: RO BRACKISH WATER

4: Kenton on Sea/ Bushmans River Mouth: RO Option

Min	0.606	0	0	0	0
Max			0.739	0	0

YEAR	COSTS						TOTAL ANNUAL COST			NET PRESENT COST AT 4%			NET PRESENT COST AT 6%			NET PRESENT COST AT 8%		
	Capital	Maintenance	Operation	Energy Charge	Demand Charge	Chemicals	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost
SHADOW	1.00	1.00	1.00	1.00	1.00	1.00												
2003							0	0	0	0	0	0	0	0	0	0	0	0
2004							0	0	0	0	0	0	0	0	0	0	0	0
2005	28.767						28.767	0.000	0.000	26.597	0.000	0.000	25.603	0.000	0.000	24.663	0.000	0.000
2006		0.606	0.000	0.000	0.000	0.000	0.000	0.606	0.000	0.000	0.539	0.000	0.000	0.509	0.000	0.000	0.481	0.000
2007		0.606	0.000	0.039	0.000	0.000	0.000	0.606	0.039	0.000	0.518	0.033	0.000	0.480	0.031	0.000	0.445	0.029
2008		0.606	0.000	0.078	0.000	0.000	0.000	0.606	0.078	0.000	0.498	0.064	0.000	0.453	0.058	0.000	0.412	0.053
2009		0.606	0.000	0.117	0.000	0.000	0.000	0.606	0.117	0.000	0.479	0.092	0.000	0.427	0.082	0.000	0.382	0.074
2010		0.606	0.000	0.156	0.000	0.000	0.000	0.606	0.156	0.000	0.461	0.118	0.000	0.403	0.103	0.000	0.354	0.091
2011		0.606	0.000	0.194	0.000	0.000	0.000	0.606	0.194	0.000	0.443	0.142	0.000	0.380	0.122	0.000	0.327	0.105
2012		0.606	0.000	0.233	0.000	0.000	0.000	0.606	0.233	0.000	0.426	0.164	0.000	0.359	0.138	0.000	0.303	0.117
2013		0.606	0.000	0.272	0.000	0.000	0.000	0.606	0.272	0.000	0.409	0.184	0.000	0.338	0.152	0.000	0.281	0.126
2014		0.606	0.000	0.311	0.000	0.000	0.000	0.606	0.311	0.000	0.394	0.202	0.000	0.319	0.164	0.000	0.260	0.133
2015	0.000	0.606	0.000	0.350	0.000	0.000	0.000	0.606	0.350	0.000	0.379	0.219	0.000	0.301	0.174	0.000	0.241	0.139
2016		0.606	0.000	0.389	0.000	0.000	0.000	0.606	0.389	0.000	0.364	0.234	0.000	0.284	0.182	0.000	0.223	0.143
2017		0.606	0.000	0.428	0.000	0.000	0.000	0.606	0.428	0.000	0.350	0.247	0.000	0.268	0.189	0.000	0.206	0.146
2018		0.606	0.000	0.467	0.000	0.000	0.000	0.606	0.467	0.000	0.336	0.259	0.000	0.253	0.195	0.000	0.191	0.147
2019		0.606	0.000	0.506	0.000	0.000	0.000	0.606	0.506	0.000	0.324	0.270	0.000	0.239	0.199	0.000	0.177	0.148
2020		0.606	0.000	0.545	0.000	0.000	0.000	0.606	0.545	0.000	0.311	0.280	0.000	0.225	0.202	0.000	0.164	0.147
2021		0.606	0.000	0.583	0.000	0.000	0.000	0.606	0.583	0.000	0.299	0.288	0.000	0.212	0.204	0.000	0.152	0.146
2022		0.606	0.000	0.622	0.000	0.000	0.000	0.606	0.622	0.000	0.288	0.295	0.000	0.200	0.206	0.000	0.140	0.144
2023		0.606	0.000	0.661	0.000	0.000	0.000	0.606	0.661	0.000	0.277	0.302	0.000	0.189	0.206	0.000	0.130	0.142
2024		0.606	0.000	0.700	0.000	0.000	0.000	0.606	0.700	0.000	0.266	0.307	0.000	0.178	0.206	0.000	0.120	0.139
2025	-9.709	0.606	0.000	0.739	0.000	0.000	-9.709	0.606	0.739	-4.097	0.256	0.312	-2.694	0.168	0.205	-1.786	0.111	0.136
TOTAL	**19.058**	**12.120**	**0.000**	**7.390**	**0.000**	**0.000**	**19.058**	**12.120**	**7.390**	**22.500**	**7.614**	**4.012**	**22.908**	**6.186**	**3.020**	**22.877**	**5.101**	**2.304**

	NPC	NPV water	URV, R/kl
AT 4%	**34.1**	**3.8**	**9.06**
AT 6%	**32.1**	**2.8**	**11.33**
AT 8%	**30.3**	**2.2**	**14.00**

Net present value of water supplied

Low demand scenario

Min	0	l/s
Max	22	l/s

YEAR	TOTAL SUPPLY (x1000 m3)	NPV of water supplied at 4% (x1000 m3)	NPV of water supplied at 6% (x1000 m3)	NPV of water supplied at 8% (x1000 m3)
2003				
2004				
2005				
2006	0.000	0.000	0.000	0.000
2007	0.037	0.031	0.029	0.027
2008	0.073	0.060	0.055	0.050
2009	0.110	0.087	0.077	0.069
2010	0.146	0.111	0.097	0.085
2011	0.183	0.133	0.115	0.099
2012	0.219	0.154	0.130	0.110
2013	0.256	0.173	0.143	0.118
2014	0.292	0.190	0.154	0.125
2015	0.329	0.205	0.163	0.131
2016	0.365	0.219	0.171	0.134
2017	0.402	0.232	0.178	0.137
2018	0.438	0.243	0.183	0.138
2019	0.475	0.253	0.187	0.139
2020	0.511	0.262	0.190	0.138
2021	0.548	0.270	0.192	0.137
2022	0.584	0.277	0.193	0.135
2023	0.621	0.283	0.194	0.133
2024	0.657	0.288	0.193	0.131
2025	0.694	0.293	0.193	0.128
TOTAL	**6.938**	**3.766**	**2.835**	**2.163**

ECONOMICS MODEL

5. KOS: from GM Dam

5: Kenton on Sea/ Bushmans River Mouth: from Glen Melville dam

Min	0.499	0	0.007	0	0
Max			0.716	0	0

YEAR	COSTS						TOTAL ANNUAL COST			NET PRESENT COST AT 4%			NET PRESENT COST AT 6%			NET PRESENT COST AT 8%		
	Capital	Maintenance	Operation	Energy Charge	Demand Charge	Chemicals	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost
SHADOW	1.00	1.00	1.00	1.00	1.00	1.00												
2003							0	0	0	0	0	0	0	0	0	0	0	0
2004							0	0	0	0	0	0	0	0	0	0	0	0
2005	41.355						41.355	0.000	0.000	38.235	0.000	0.000	36.806	0.000	0.000	35.455	0.000	0.000
2006		0.499	0.000	0.007	0.000	0.000	0.000	0.499	0.007	0.000	0.444	0.006	0.000	0.419	0.006	0.000	0.396	0.006
2007		0.499	0.000	0.044	0.000	0.000	0.000	0.499	0.044	0.000	0.427	0.038	0.000	0.395	0.035	0.000	0.367	0.033
2008		0.499	0.000	0.082	0.000	0.000	0.000	0.499	0.082	0.000	0.410	0.067	0.000	0.373	0.061	0.000	0.340	0.056
2009		0.499	0.000	0.119	0.000	0.000	0.000	0.499	0.119	0.000	0.394	0.094	0.000	0.352	0.084	0.000	0.314	0.075
2010		0.499	0.000	0.156	0.000	0.000	0.000	0.499	0.156	0.000	0.379	0.119	0.000	0.332	0.104	0.000	0.291	0.091
2011		0.499	0.000	0.194	0.000	0.000	0.000	0.499	0.194	0.000	0.365	0.141	0.000	0.313	0.121	0.000	0.270	0.105
2012		0.499	0.000	0.231	0.000	0.000	0.000	0.499	0.231	0.000	0.351	0.162	0.000	0.295	0.137	0.000	0.250	0.116
2013		0.499	0.000	0.268	0.000	0.000	0.000	0.499	0.268	0.000	0.337	0.181	0.000	0.279	0.150	0.000	0.231	0.124
2014		0.499	0.000	0.306	0.000	0.000	0.000	0.499	0.306	0.000	0.324	0.198	0.000	0.263	0.161	0.000	0.214	0.131
2015	0.000	0.499	0.000	0.343	0.000	0.000	0.000	0.499	0.343	0.000	0.312	0.214	0.000	0.248	0.170	0.000	0.198	0.136
2016		0.499	0.000	0.380	0.000	0.000	0.000	0.499	0.380	0.000	0.300	0.228	0.000	0.234	0.178	0.000	0.183	0.140
2017		0.499	0.000	0.417	0.000	0.000	0.000	0.499	0.417	0.000	0.288	0.241	0.000	0.221	0.185	0.000	0.170	0.142
2018		0.499	0.000	0.455	0.000	0.000	0.000	0.499	0.455	0.000	0.277	0.253	0.000	0.208	0.190	0.000	0.157	0.143
2019		0.499	0.000	0.492	0.000	0.000	0.000	0.499	0.492	0.000	0.266	0.263	0.000	0.196	0.194	0.000	0.146	0.144
2020		0.499	0.000	0.529	0.000	0.000	0.000	0.499	0.529	0.000	0.256	0.272	0.000	0.185	0.197	0.000	0.135	0.143
2021		0.499	0.000	0.567	0.000	0.000	0.000	0.499	0.567	0.000	0.246	0.280	0.000	0.175	0.199	0.000	0.125	0.142
2022		0.499	0.000	0.604	0.000	0.000	0.000	0.499	0.604	0.000	0.237	0.287	0.000	0.165	0.200	0.000	0.116	0.140
2023		0.499	0.000	0.641	0.000	0.000	0.000	0.499	0.641	0.000	0.228	0.293	0.000	0.156	0.200	0.000	0.107	0.138
2024		0.499	0.000	0.679	0.000	0.000	0.000	0.499	0.679	0.000	0.219	0.298	0.000	0.147	0.200	0.000	0.099	0.135
2025	-14.681	0.499	0.000	0.716	0.000	0.000	-14.681	0.499	0.716	-6.195	0.211	0.302	-4.074	0.138	0.199	-2.700	0.092	0.132
TOTAL	**26.674**	**9.980**	**0.000**	**7.230**	**0.000**	**0.000**	**26.674**	**9.980**	**7.230**	**32.040**	**6.270**	**3.937**	**32.732**	**5.094**	**2.968**	**32.755**	**4.200**	**2.269**

	NPC	NPV water	URV, R/kl
AT 4%	**42.2**	**5.3**	**7.96**
AT 6%	**40.8**	**4.0**	**10.21**
AT 8%	**39.2**	**3.0**	**12.87**

Net present value of water supplied

Low demand scenario

Min	0	l/s
Max	31	l/s

YEAR	TOTAL SUPPLY (x1000 m3)	NPV of water supplied at 4% (x1000 m3)	NPV of water supplied at 6% (x1000 m3)	NPV of water supplied at 8% (x1000 m3)
2003				
2004				
2005				
2006	0.000	0.000	0.000	0.000
2007	0.051	0.044	0.041	0.038
2008	0.103	0.085	0.077	0.070
2009	0.154	0.122	0.109	0.097
2010	0.206	0.156	0.137	0.120
2011	0.257	0.188	0.161	0.139
2012	0.309	0.217	0.183	0.154
2013	0.360	0.243	0.201	0.167
2014	0.412	0.267	0.217	0.177
2015	0.463	0.289	0.230	0.184
2016	0.515	0.309	0.241	0.189
2017	0.566	0.327	0.250	0.193
2018	0.617	0.343	0.258	0.195
2019	0.669	0.357	0.263	0.195
2020	0.720	0.370	0.268	0.195
2021	0.772	0.381	0.270	0.193
2022	0.823	0.391	0.272	0.191
2023	0.875	0.399	0.273	0.188
2024	0.926	0.406	0.272	0.184
2025	0.978	0.413	0.271	0.180
TOTAL	**9.776**	**5.307**	**3.995**	**3.048**

ECONOMICS MODEL

6. GM Dam: Option 1

6: Port Alfred, Bathurts, Kenton on Sea: from Glen Melville dam

Min	1.538	0	0.026	0	0
Max			1.539	0	0

YEAR	COSTS						TOTAL ANNUAL COST			NET PRESENT COST AT 4%			NET PRESENT COST AT 6%			NET PRESENT COST AT 8%		
	Capital	Maintenance	Operation	Energy Charge	Demand Charge	Chemicals	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost
SHADOW	1.00	1.00	1.00	1.00	1.00	1.00												
2003							0	0	0	0	0	0	0	0	0	0	0	0
2004							0	0	0	0	0	0	0	0	0	0	0	0
2005	130.907						130.907	0.000	0.000	121.031	0.000	0.000	116.507	0.000	0.000	112.232	0.000	0.000
2006		1.538	0.000	0.026	0.000	0.000	0.000	1.538	0.026	0.000	1.367	0.023	0.000	1.291	0.022	0.000	1.221	0.021
2007		1.538	0.000	0.106	0.000	0.000	0.000	1.538	0.106	0.000	1.315	0.090	0.000	1.218	0.084	0.000	1.130	0.078
2008		1.538	0.000	0.185	0.000	0.000	0.000	1.538	0.185	0.000	1.264	0.152	0.000	1.149	0.138	0.000	1.047	0.126
2009		1.538	0.000	0.265	0.000	0.000	0.000	1.538	0.265	0.000	1.216	0.209	0.000	1.084	0.187	0.000	0.969	0.167
2010		1.538	0.000	0.345	0.000	0.000	0.000	1.538	0.345	0.000	1.169	0.262	0.000	1.023	0.229	0.000	0.897	0.201
2011		1.538	0.000	0.424	0.000	0.000	0.000	1.538	0.424	0.000	1.124	0.310	0.000	0.965	0.266	0.000	0.831	0.229
2012		1.538	0.000	0.504	0.000	0.000	0.000	1.538	0.504	0.000	1.081	0.354	0.000	0.910	0.298	0.000	0.769	0.252
2013		1.538	0.000	0.583	0.000	0.000	0.000	1.538	0.583	0.000	1.039	0.394	0.000	0.859	0.326	0.000	0.712	0.270
2014		1.538	0.000	0.663	0.000	0.000	0.000	1.538	0.663	0.000	0.999	0.431	0.000	0.810	0.349	0.000	0.660	0.284
2015	0.000	1.538	0.000	0.743	0.000	0.000	0.000	1.538	0.743	0.000	0.961	0.464	0.000	0.764	0.369	0.000	0.611	0.295
2016		1.538	0.000	0.822	0.000	0.000	0.000	1.538	0.822	0.000	0.924	0.494	0.000	0.721	0.386	0.000	0.566	0.302
2017		1.538	0.000	0.902	0.000	0.000	0.000	1.538	0.902	0.000	0.888	0.521	0.000	0.680	0.399	0.000	0.524	0.307
2018		1.538	0.000	0.982	0.000	0.000	0.000	1.538	0.982	0.000	0.854	0.545	0.000	0.642	0.410	0.000	0.485	0.309
2019		1.538	0.000	1.061	0.000	0.000	0.000	1.538	1.061	0.000	0.821	0.567	0.000	0.605	0.418	0.000	0.449	0.310
2020		1.538	0.000	1.141	0.000	0.000	0.000	1.538	1.141	0.000	0.790	0.586	0.000	0.571	0.424	0.000	0.416	0.308
2021		1.538	0.000	1.220	0.000	0.000	0.000	1.538	1.220	0.000	0.759	0.602	0.000	0.539	0.428	0.000	0.385	0.305
2022		1.538	0.000	1.300	0.000	0.000	0.000	1.538	1.300	0.000	0.730	0.617	0.000	0.508	0.430	0.000	0.356	0.301
2023		1.538	0.000	1.380	0.000	0.000	0.000	1.538	1.380	0.000	0.702	0.630	0.000	0.480	0.430	0.000	0.330	0.296
2024		1.538	0.000	1.459	0.000	0.000	0.000	1.538	1.459	0.000	0.675	0.640	0.000	0.452	0.429	0.000	0.306	0.290
2025	-48.291	1.538	0.000	1.539	0.000	0.000	-48.291	1.538	1.539	-20.377	0.649	0.649	-13.401	0.427	0.427	-8.883	0.283	0.283
TOTAL	**82.616**	**30.760**	**0.000**	**15.650**	**0.000**	**0.000**	**82.616**	**30.760**	**15.650**	**100.654**	**19.325**	**8.541**	**103.106**	**15.700**	**6.448**	**103.349**	**12.946**	**4.936**

	NPC	NPV water	URV, R/kl
AT 4%	**128.5**	**15.6**	**8.25**
AT 6%	**125.3**	**11.7**	**10.68**
AT 8%	**121.2**	**8.9**	**13.55**

Net present value of water supplied

Low demand scenario

Min	0	l/s
Max	91	l/s

YEAR	TOTAL SUPPLY (x1000 m3)	NPV of water supplied at 4% (x1000 m3)	NPV of water supplied at 6% (x1000 m3)	NPV of water supplied at 8% (x1000 m3)
2003				
2004				
2005				
2006	0.000	0.000	0.000	0.000
2007	0.151	0.129	0.120	0.111
2008	0.302	0.248	0.226	0.206
2009	0.453	0.358	0.319	0.286
2010	0.604	0.459	0.402	0.353
2011	0.755	0.552	0.474	0.408
2012	0.906	0.637	0.536	0.453
2013	1.057	0.714	0.590	0.490
2014	1.208	0.785	0.637	0.518
2015	1.359	0.849	0.676	0.540
2016	1.510	0.907	0.708	0.555
2017	1.661	0.959	0.735	0.566
2018	1.812	1.006	0.756	0.571
2019	1.964	1.048	0.773	0.573
2020	2.115	1.086	0.785	0.572
2021	2.266	1.118	0.794	0.567
2022	2.417	1.147	0.799	0.560
2023	2.568	1.172	0.801	0.551
2024	2.719	1.193	0.800	0.540
2025	2.870	1.211	0.796	0.528
TOTAL	**28.698**	**15.580**	**11.726**	**8.947**

ECONOMICS MODEL

7. GM Dam: Opt 2

7: Port Alfred, Bathurst: from Glen Melville dam

Min	1.196	0	0.02	0	0
Max			1.212	0	0

YEAR	COSTS						TOTAL ANNUAL COST			NET PRESENT COST AT 4%			NET PRESENT COST AT 6%			NET PRESENT COST AT 8%		
	Capital	Maintenance	Operation	Energy Charge	Demand Charge	Chemicals	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost
SHADOW	1.00	1.00	1.00	1.00	1.00	1.00												
2003							0	0	0	0	0	0	0	0	0	0	0	0
2004							0	0	0	0	0	0	0	0	0	0	0	0
2005	98.241						98.241	0.000	0.000	90.829	0.000	0.000	87.434	0.000	0.000	84.226	0.000	0.000
2006		1.196	0.000	0.020	0.000	0.000	0.000	1.196	0.020	0.000	1.063	0.018	0.000	1.004	0.017	0.000	0.949	0.016
2007		1.196	0.000	0.083	0.000	0.000	0.000	1.196	0.083	0.000	1.022	0.071	0.000	0.947	0.066	0.000	0.879	0.061
2008		1.196	0.000	0.145	0.000	0.000	0.000	1.196	0.145	0.000	0.983	0.120	0.000	0.894	0.109	0.000	0.814	0.099
2009		1.196	0.000	0.208	0.000	0.000	0.000	1.196	0.208	0.000	0.945	0.165	0.000	0.843	0.147	0.000	0.754	0.131
2010		1.196	0.000	0.271	0.000	0.000	0.000	1.196	0.271	0.000	0.909	0.206	0.000	0.795	0.180	0.000	0.698	0.158
2011		1.196	0.000	0.334	0.000	0.000	0.000	1.196	0.334	0.000	0.874	0.244	0.000	0.750	0.209	0.000	0.646	0.180
2012		1.196	0.000	0.396	0.000	0.000	0.000	1.196	0.396	0.000	0.840	0.279	0.000	0.708	0.235	0.000	0.598	0.198
2013		1.196	0.000	0.459	0.000	0.000	0.000	1.196	0.459	0.000	0.808	0.310	0.000	0.668	0.256	0.000	0.554	0.213
2014		1.196	0.000	0.522	0.000	0.000	0.000	1.196	0.522	0.000	0.777	0.339	0.000	0.630	0.275	0.000	0.513	0.224
2015	0.000	1.196	0.000	0.585	0.000	0.000	0.000	1.196	0.585	0.000	0.747	0.365	0.000	0.594	0.291	0.000	0.475	0.232
2016		1.196	0.000	0.647	0.000	0.000	0.000	1.196	0.647	0.000	0.718	0.389	0.000	0.561	0.304	0.000	0.440	0.238
2017		1.196	0.000	0.710	0.000	0.000	0.000	1.196	0.710	0.000	0.691	0.410	0.000	0.529	0.314	0.000	0.407	0.242
2018		1.196	0.000	0.773	0.000	0.000	0.000	1.196	0.773	0.000	0.664	0.429	0.000	0.499	0.322	0.000	0.377	0.244
2019		1.196	0.000	0.836	0.000	0.000	0.000	1.196	0.836	0.000	0.639	0.446	0.000	0.471	0.329	0.000	0.349	0.244
2020		1.196	0.000	0.898	0.000	0.000	0.000	1.196	0.898	0.000	0.614	0.461	0.000	0.444	0.334	0.000	0.323	0.243
2021		1.196	0.000	0.961	0.000	0.000	0.000	1.196	0.961	0.000	0.590	0.474	0.000	0.419	0.337	0.000	0.299	0.241
2022		1.196	0.000	1.024	0.000	0.000	0.000	1.196	1.024	0.000	0.568	0.486	0.000	0.395	0.338	0.000	0.277	0.237
2023		1.196	0.000	1.087	0.000	0.000	0.000	1.196	1.087	0.000	0.546	0.496	0.000	0.373	0.339	0.000	0.257	0.233
2024		1.196	0.000	1.149	0.000	0.000	0.000	1.196	1.149	0.000	0.525	0.504	0.000	0.352	0.338	0.000	0.238	0.228
2025	-36.947	1.196	0.000	1.212	0.000	0.000	-36.947	1.196	1.212	-15.590	0.505	0.511	-10.253	0.332	0.336	-6.796	0.220	0.223
TOTAL	**61.294**	**23.920**	**0.000**	**12.320**	**0.000**	**0.000**	**61.294**	**23.920**	**12.320**	**75.239**	**15.028**	**6.722**	**77.181**	**12.209**	**5.075**	**77.430**	**10.067**	**3.884**

	NPC	NPV water	URV, R/kl
AT 4%	**97.0**	**12.6**	**7.71**
AT 6%	**94.5**	**9.5**	**9.97**
AT 8%	**91.4**	**7.2**	**12.65**

Net present value of water supplied

Low demand scenario

Min	0	l/s
Max	73.5	l/s

YEAR	TOTAL SUPPLY (x1000 m3)	NPV of water supplied at 4% (x1000 m3)	NPV of water supplied at 6% (x1000 m3)	NPV of water supplied at 8% (x1000 m3)
2003				
2004				
2005				
2006	0.000	0.000	0.000	0.000
2007	0.122	0.104	0.097	0.090
2008	0.244	0.201	0.182	0.166
2009	0.366	0.289	0.258	0.231
2010	0.488	0.371	0.325	0.285
2011	0.610	0.446	0.383	0.330
2012	0.732	0.514	0.433	0.366
2013	0.854	0.577	0.477	0.396
2014	0.976	0.634	0.514	0.419
2015	1.098	0.686	0.546	0.436
2016	1.220	0.733	0.572	0.449
2017	1.342	0.775	0.594	0.457
2018	1.464	0.813	0.611	0.461
2019	1.586	0.847	0.624	0.463
2020	1.708	0.877	0.634	0.462
2021	1.830	0.903	0.641	0.458
2022	1.952	0.926	0.645	0.452
2023	2.074	0.947	0.647	0.445
2024	2.196	0.964	0.646	0.436
2025	2.318	0.978	0.643	0.426
TOTAL	**23.179**	**12.583**	**9.471**	**7.226**

ECONOMICS MODEL

8. Sarrel Hayword Dam

8: Port Alfred from Sarrel Hayword dam

Min	0.622	0	0.008	0	0	
Max			0.496	0	0	

YEAR	COSTS						TOTAL ANNUAL COST			NET PRESENT COST AT 4%			NET PRESENT COST AT 6%			NET PRESENT COST AT 8%		
	Capital	Maintenance	Operation	Energy Charge	Demand Charge	Chemicals	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost
SHADOW	1.00	1.00	1.00	1.00	1.00	1.00												
2003							0	0	0	0	0	0	0	0	0	0	0	0
2004							0	0	0	0	0	0	0	0	0	0	0	0
2005	55.184						55.184	0.000	0.000	51.021	0.000	0.000	49.114	0.000	0.000	47.311	0.000	0.000
2006		0.622	0.000	0.008	0.000	0.000	0.000	0.622	0.008	0.000	0.553	0.007	0.000	0.522	0.007	0.000	0.494	0.006
2007		0.622	0.000	0.034	0.000	0.000	0.000	0.622	0.034	0.000	0.532	0.029	0.000	0.493	0.027	0.000	0.457	0.025
2008		0.622	0.000	0.059	0.000	0.000	0.000	0.622	0.059	0.000	0.511	0.049	0.000	0.465	0.044	0.000	0.423	0.040
2009		0.622	0.000	0.085	0.000	0.000	0.000	0.622	0.085	0.000	0.492	0.067	0.000	0.438	0.060	0.000	0.392	0.054
2010		0.622	0.000	0.111	0.000	0.000	0.000	0.622	0.111	0.000	0.473	0.084	0.000	0.414	0.074	0.000	0.363	0.065
2011		0.622	0.000	0.136	0.000	0.000	0.000	0.622	0.136	0.000	0.454	0.100	0.000	0.390	0.086	0.000	0.336	0.074
2012		0.622	0.000	0.162	0.000	0.000	0.000	0.622	0.162	0.000	0.437	0.114	0.000	0.368	0.096	0.000	0.311	0.081
2013		0.622	0.000	0.188	0.000	0.000	0.000	0.622	0.188	0.000	0.420	0.127	0.000	0.347	0.105	0.000	0.288	0.087
2014		0.622	0.000	0.213	0.000	0.000	0.000	0.622	0.213	0.000	0.404	0.139	0.000	0.328	0.112	0.000	0.267	0.092
2015	0.000	0.622	0.000	0.239	0.000	0.000	0.000	0.622	0.239	0.000	0.388	0.149	0.000	0.309	0.119	0.000	0.247	0.095
2016		0.622	0.000	0.265	0.000	0.000	0.000	0.622	0.265	0.000	0.374	0.159	0.000	0.292	0.124	0.000	0.229	0.097
2017		0.622	0.000	0.291	0.000	0.000	0.000	0.622	0.291	0.000	0.359	0.168	0.000	0.275	0.129	0.000	0.212	0.099
2018		0.622	0.000	0.316	0.000	0.000	0.000	0.622	0.316	0.000	0.345	0.176	0.000	0.260	0.132	0.000	0.196	0.100
2019		0.622	0.000	0.342	0.000	0.000	0.000	0.622	0.342	0.000	0.332	0.183	0.000	0.245	0.135	0.000	0.182	0.100
2020		0.622	0.000	0.368	0.000	0.000	0.000	0.622	0.368	0.000	0.319	0.189	0.000	0.231	0.137	0.000	0.168	0.099
2021		0.622	0.000	0.393	0.000	0.000	0.000	0.622	0.393	0.000	0.307	0.194	0.000	0.218	0.138	0.000	0.156	0.098
2022		0.622	0.000	0.419	0.000	0.000	0.000	0.622	0.419	0.000	0.295	0.199	0.000	0.206	0.138	0.000	0.144	0.097
2023		0.622	0.000	0.445	0.000	0.000	0.000	0.622	0.445	0.000	0.284	0.203	0.000	0.194	0.139	0.000	0.133	0.095
2024		0.622	0.000	0.470	0.000	0.000	0.000	0.622	0.470	0.000	0.273	0.206	0.000	0.183	0.138	0.000	0.124	0.093
2025	-24.331	0.622	0.000	0.496	0.000	0.000	-24.331	0.622	0.496	-10.267	0.262	0.209	-6.752	0.173	0.138	-4.475	0.114	0.091
TOTAL	**30.853**	**12.440**	**0.000**	**5.040**	**0.000**	**0.000**	**30.853**	**12.440**	**5.040**	**40.754**	**7.815**	**2.750**	**42.362**	**6.349**	**2.076**	**42.836**	**5.236**	**1.589**

	NPC	NPV water	URV, R/kl
AT 4%	**51.3**	**11.8**	**4.33**
AT 6%	**50.8**	**8.9**	**5.70**
AT 8%	**49.7**	**6.8**	**7.30**

Net present value of water supplied

Low demand scenario

Min	0	l/s
Max	69.2	l/s

YEAR	TOTAL SUPPLY (x1000 m3)	NPV of water supplied at 4% (x1000 m3)	NPV of water supplied at 6% (x1000 m3)	NPV of water supplied at 8% (x1000 m3)
2003				
2004				
2005				
2006	0.000	0.000	0.000	0.000
2007	0.115	0.098	0.091	0.084
2008	0.230	0.189	0.172	0.156
2009	0.345	0.272	0.243	0.217
2010	0.459	0.349	0.306	0.268
2011	0.574	0.420	0.360	0.310
2012	0.689	0.484	0.408	0.345
2013	0.804	0.543	0.449	0.372
2014	0.919	0.597	0.484	0.394
2015	1.034	0.646	0.514	0.411
2016	1.149	0.690	0.538	0.422
2017	1.263	0.730	0.559	0.430
2018	1.378	0.765	0.575	0.434
2019	1.493	0.797	0.588	0.436
2020	1.608	0.826	0.597	0.435
2021	1.723	0.850	0.604	0.431
2022	1.838	0.872	0.607	0.426
2023	1.953	0.891	0.609	0.419
2024	2.067	0.907	0.608	0.411
2025	2.182	0.921	0.606	0.401
TOTAL	**21.823**	**11.847**	**8.917**	**6.803**

ECONOMICS MODEL

8. Sarrel Hayword Dam

8: Port Alfred from Sarrel Hayword dam

Min	0.622	0	0.008	0	0
Max			0.496	0	0

YEAR	COSTS						TOTAL ANNUAL COST			NET PRESENT COST AT 4%			NET PRESENT COST AT 6%			NET PRESENT COST AT 8%		
	Capital	Maintenance	Operation	Energy Charge	Demand Charge	Chemicals	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost
SHADOW	1.00	1.00	1.00	1.00	1.00	1.00												
2003							0	0	0	0	0	0	0	0	0	0	0	0
2004							0	0	0	0	0	0	0	0	0	0	0	0
2005	55.184						55.184	0.000	0.000	51.021	0.000	0.000	49.114	0.000	0.000	47.311	0.000	0.000
2006		0.622	0.000	0.008	0.000	0.000	0.000	0.622	0.008	0.000	0.553	0.007	0.000	0.522	0.007	0.000	0.494	0.006
2007		0.622	0.000	0.034	0.000	0.000	0.000	0.622	0.034	0.000	0.532	0.029	0.000	0.493	0.027	0.000	0.457	0.025
2008		0.622	0.000	0.059	0.000	0.000	0.000	0.622	0.059	0.000	0.511	0.049	0.000	0.465	0.044	0.000	0.423	0.040
2009		0.622	0.000	0.085	0.000	0.000	0.000	0.622	0.085	0.000	0.492	0.067	0.000	0.438	0.060	0.000	0.392	0.054
2010		0.622	0.000	0.111	0.000	0.000	0.000	0.622	0.111	0.000	0.473	0.084	0.000	0.414	0.074	0.000	0.363	0.065
2011		0.622	0.000	0.136	0.000	0.000	0.000	0.622	0.136	0.000	0.454	0.100	0.000	0.390	0.086	0.000	0.336	0.074
2012		0.622	0.000	0.162	0.000	0.000	0.000	0.622	0.162	0.000	0.437	0.114	0.000	0.368	0.096	0.000	0.311	0.081
2013		0.622	0.000	0.188	0.000	0.000	0.000	0.622	0.188	0.000	0.420	0.127	0.000	0.347	0.105	0.000	0.288	0.087
2014		0.622	0.000	0.213	0.000	0.000	0.000	0.622	0.213	0.000	0.404	0.139	0.000	0.328	0.112	0.000	0.267	0.092
2015	0.000	0.622	0.000	0.239	0.000	0.000	0.000	0.622	0.239	0.000	0.388	0.149	0.000	0.309	0.119	0.000	0.247	0.095
2016		0.622	0.000	0.265	0.000	0.000	0.000	0.622	0.265	0.000	0.374	0.159	0.000	0.292	0.124	0.000	0.229	0.097
2017		0.622	0.000	0.291	0.000	0.000	0.000	0.622	0.291	0.000	0.359	0.168	0.000	0.275	0.129	0.000	0.212	0.099
2018		0.622	0.000	0.316	0.000	0.000	0.000	0.622	0.316	0.000	0.345	0.176	0.000	0.260	0.132	0.000	0.196	0.100
2019		0.622	0.000	0.342	0.000	0.000	0.000	0.622	0.342	0.000	0.332	0.183	0.000	0.245	0.135	0.000	0.182	0.100
2020		0.622	0.000	0.368	0.000	0.000	0.000	0.622	0.368	0.000	0.319	0.189	0.000	0.231	0.137	0.000	0.168	0.099
2021		0.622	0.000	0.393	0.000	0.000	0.000	0.622	0.393	0.000	0.307	0.194	0.000	0.218	0.138	0.000	0.156	0.098
2022		0.622	0.000	0.419	0.000	0.000	0.000	0.622	0.419	0.000	0.295	0.199	0.000	0.206	0.138	0.000	0.144	0.097
2023		0.622	0.000	0.445	0.000	0.000	0.000	0.622	0.445	0.000	0.284	0.203	0.000	0.194	0.139	0.000	0.133	0.095
2024		0.622	0.000	0.470	0.000	0.000	0.000	0.622	0.470	0.000	0.273	0.206	0.000	0.183	0.138	0.000	0.124	0.093
2025	-24.331	0.622	0.000	0.496	0.000	0.000	-24.331	0.622	0.496	-10.267	0.262	0.209	-6.752	0.173	0.138	-4.475	0.114	0.091
TOTAL	**30.853**	**12.440**	**0.000**	**5.040**	**0.000**	**0.000**	**30.853**	**12.440**	**5.040**	**40.754**	**7.815**	**2.750**	**42.362**	**6.349**	**2.076**	**42.836**	**5.236**	**1.589**

	NPC	NPV water	URV, R/kl
AT 4%	**51.3**	**11.8**	**4.33**
AT 6%	**50.8**	**8.9**	**5.70**
AT 8%	**49.7**	**6.8**	**7.30**

Net present value of water supplied

Low demand scenario

Min	0	l/s
Max	69.2	l/s

YEAR	TOTAL SUPPLY (x1000 m3)	NPV of water supplied at 4% (x1000 m3)	NPV of water supplied at 6% (x1000 m3)	NPV of water supplied at 8% (x1000 m3)
2003				
2004				
2005				
2006	0.000	0.000	0.000	0.000
2007	0.115	0.098	0.091	0.084
2008	0.230	0.189	0.172	0.156
2009	0.345	0.272	0.243	0.217
2010	0.459	0.349	0.306	0.268
2011	0.574	0.420	0.360	0.310
2012	0.689	0.484	0.408	0.345
2013	0.804	0.543	0.449	0.372
2014	0.919	0.597	0.484	0.394
2015	1.034	0.646	0.514	0.411
2016	1.149	0.690	0.538	0.422
2017	1.263	0.730	0.559	0.430
2018	1.378	0.765	0.575	0.434
2019	1.493	0.797	0.588	0.436
2020	1.608	0.826	0.597	0.435
2021	1.723	0.850	0.604	0.431
2022	1.838	0.872	0.607	0.426
2023	1.953	0.891	0.609	0.419
2024	2.067	0.907	0.608	0.411
2025	2.182	0.921	0.606	0.401
TOTAL	**21.823**	**11.847**	**8.917**	**6.803**

ECONOMICS MODEL

9. Settlers Dam

9: Port Alfred from Settlers Dam

Min	1.292	0	0.022	0	0
Max			1.282	0	0

YEAR	COSTS						TOTAL ANNUAL COST			NET PRESENT COST AT 4%			NET PRESENT COST AT 6%			NET PRESENT COST AT 8%		
	Capital	Maintenance	Operation	Energy Charge	Demand Charge	Chemicals	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost
SHADOW	1.00	1.00	1.00	1.00	1.00	1.00												
2003							0	0	0	0	0	0	0	0	0	0	0	0
2004							0	0	0	0	0	0	0	0	0	0	0	0
2005	100.456						100.456	0.000	0.000	92.877	0.000	0.000	89.405	0.000	0.000	86.125	0.000	0.000
2006		1.292	0.000	0.022	0.000	0.000	0.000	1.292	0.022	0.000	1.149	0.020	0.000	1.085	0.018	0.000	1.026	0.017
2007		1.292	0.000	0.088	0.000	0.000	0.000	1.292	0.088	0.000	1.104	0.075	0.000	1.023	0.070	0.000	0.950	0.065
2008		1.292	0.000	0.155	0.000	0.000	0.000	1.292	0.155	0.000	1.062	0.127	0.000	0.965	0.116	0.000	0.879	0.105
2009		1.292	0.000	0.221	0.000	0.000	0.000	1.292	0.221	0.000	1.021	0.175	0.000	0.911	0.156	0.000	0.814	0.139
2010		1.292	0.000	0.287	0.000	0.000	0.000	1.292	0.287	0.000	0.982	0.218	0.000	0.859	0.191	0.000	0.754	0.168
2011		1.292	0.000	0.354	0.000	0.000	0.000	1.292	0.354	0.000	0.944	0.258	0.000	0.811	0.222	0.000	0.698	0.191
2012		1.292	0.000	0.420	0.000	0.000	0.000	1.292	0.420	0.000	0.908	0.295	0.000	0.765	0.249	0.000	0.646	0.210
2013		1.292	0.000	0.486	0.000	0.000	0.000	1.292	0.486	0.000	0.873	0.328	0.000	0.721	0.271	0.000	0.598	0.225
2014		1.292	0.000	0.553	0.000	0.000	0.000	1.292	0.553	0.000	0.839	0.359	0.000	0.681	0.291	0.000	0.554	0.237
2015	0.000	1.292	0.000	0.619	0.000	0.000	0.000	1.292	0.619	0.000	0.807	0.387	0.000	0.642	0.308	0.000	0.513	0.246
2016		1.292	0.000	0.685	0.000	0.000	0.000	1.292	0.685	0.000	0.776	0.411	0.000	0.606	0.321	0.000	0.475	0.252
2017		1.292	0.000	0.751	0.000	0.000	0.000	1.292	0.751	0.000	0.746	0.434	0.000	0.571	0.332	0.000	0.440	0.256
2018		1.292	0.000	0.818	0.000	0.000	0.000	1.292	0.818	0.000	0.717	0.454	0.000	0.539	0.341	0.000	0.407	0.258
2019		1.292	0.000	0.884	0.000	0.000	0.000	1.292	0.884	0.000	0.690	0.472	0.000	0.509	0.348	0.000	0.377	0.258
2020		1.292	0.000	0.950	0.000	0.000	0.000	1.292	0.950	0.000	0.663	0.488	0.000	0.480	0.353	0.000	0.349	0.257
2021		1.292	0.000	1.017	0.000	0.000	0.000	1.292	1.017	0.000	0.638	0.502	0.000	0.453	0.356	0.000	0.323	0.254
2022		1.292	0.000	1.083	0.000	0.000	0.000	1.292	1.083	0.000	0.613	0.514	0.000	0.427	0.358	0.000	0.299	0.251
2023		1.292	0.000	1.149	0.000	0.000	0.000	1.292	1.149	0.000	0.590	0.525	0.000	0.403	0.358	0.000	0.277	0.247
2024		1.292	0.000	1.216	0.000	0.000	0.000	1.292	1.216	0.000	0.567	0.533	0.000	0.380	0.358	0.000	0.257	0.242
2025	-38.524	1.292	0.000	1.282	0.000	0.000	-38.524	1.292	1.282	-16.255	0.545	0.541	-10.691	0.359	0.356	-7.086	0.238	0.236
TOTAL	**61.932**	**25.840**	**0.000**	**13.040**	**0.000**	**0.000**	**61.932**	**25.840**	**13.040**	**76.622**	**16.234**	**7.117**	**78.715**	**13.189**	**5.373**	**79.039**	**10.875**	**4.113**

	NPC	NPV water	URV, R/kl
AT 4%	**100.0**	**11.8**	**8.44**
AT 6%	**97.3**	**8.9**	**10.91**
AT 8%	**94.0**	**6.8**	**13.82**

Net present value of water supplied

Low demand scenario

Min	0	l/s
Max	69.2	l/s

YEAR	TOTAL SUPPLY (x1000 m3)	NPV of water supplied at 4% (x1000 m3)	NPV of water supplied at 6% (x1000 m3)	NPV of water supplied at 8% (x1000 m3)
2003				
2004				
2005				
2006	0.000	0.000	0.000	0.000
2007	0.115	0.098	0.091	0.084
2008	0.230	0.189	0.172	0.156
2009	0.345	0.272	0.243	0.217
2010	0.459	0.349	0.306	0.268
2011	0.574	0.420	0.360	0.310
2012	0.689	0.484	0.408	0.345
2013	0.804	0.543	0.449	0.372
2014	0.919	0.597	0.484	0.394
2015	1.034	0.646	0.514	0.411
2016	1.149	0.690	0.538	0.422
2017	1.263	0.730	0.559	0.430
2018	1.378	0.765	0.575	0.434
2019	1.493	0.797	0.588	0.436
2020	1.608	0.826	0.597	0.435
2021	1.723	0.850	0.604	0.431
2022	1.838	0.872	0.607	0.426
2023	1.953	0.891	0.609	0.419
2024	2.067	0.907	0.608	0.411
2025	2.182	0.921	0.606	0.401
TOTAL	**21.823**	**11.847**	**8.917**	**6.803**

ECONOMICS MODEL

10. PA: GW AND RO only

10: Port Alfred from RO

Min	2.03	0	0.002	0	0
Max			2.447	0	0

YEAR	COSTS						TOTAL ANNUAL COST			NET PRESENT COST AT 4%			NET PRESENT COST AT 6%			NET PRESENT COST AT 8%		
	Capital	Maintenance	Operation	Energy Charge	Demand Charge	Chemicals	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost	Capital	M & O	Energy cost
SHADOW	1.00	1.00	1.00	1.00	1.00	1.00												
2003							0	0	0	0	0	0	0	0	0	0	0	0
2004							0	0	0	0	0	0	0	0	0	0	0	0
2005	84.108						84.108	0.000	0.000	77.763	0.000	0.000	74.856	0.000	0.000	72.109	0.000	0.000
2006		2.030	0.000	0.002	0.000	0.000	0.000	2.030	0.002	0.000	1.805	0.002	0.000	1.704	0.002	0.000	1.611	0.002
2007		2.030	0.000	0.131	0.000	0.000	0.000	2.030	0.131	0.000	1.735	0.112	0.000	1.608	0.104	0.000	1.492	0.096
2008		2.030	0.000	0.259	0.000	0.000	0.000	2.030	0.259	0.000	1.669	0.213	0.000	1.517	0.194	0.000	1.382	0.177
2009		2.030	0.000	0.388	0.000	0.000	0.000	2.030	0.388	0.000	1.604	0.307	0.000	1.431	0.274	0.000	1.279	0.245
2010		2.030	0.000	0.517	0.000	0.000	0.000	2.030	0.517	0.000	1.543	0.393	0.000	1.350	0.344	0.000	1.184	0.302
2011		2.030	0.000	0.645	0.000	0.000	0.000	2.030	0.645	0.000	1.483	0.472	0.000	1.274	0.405	0.000	1.097	0.349
2012		2.030	0.000	0.774	0.000	0.000	0.000	2.030	0.774	0.000	1.426	0.544	0.000	1.202	0.458	0.000	1.016	0.387
2013		2.030	0.000	0.903	0.000	0.000	0.000	2.030	0.903	0.000	1.371	0.610	0.000	1.134	0.504	0.000	0.940	0.418
2014		2.030	0.000	1.031	0.000	0.000	0.000	2.030	1.031	0.000	1.319	0.670	0.000	1.069	0.543	0.000	0.871	0.442
2015	0.000	2.030	0.000	1.160	0.000	0.000	0.000	2.030	1.160	0.000	1.268	0.725	0.000	1.009	0.577	0.000	0.806	0.461
2016		2.030	0.000	1.289	0.000	0.000	0.000	2.030	1.289	0.000	1.219	0.774	0.000	0.952	0.604	0.000	0.746	0.474
2017		2.030	0.000	1.418	0.000	0.000	0.000	2.030	1.418	0.000	1.172	0.819	0.000	0.898	0.627	0.000	0.691	0.483
2018		2.030	0.000	1.546	0.000	0.000	0.000	2.030	1.546	0.000	1.127	0.859	0.000	0.847	0.645	0.000	0.640	0.487
2019		2.030	0.000	1.675	0.000	0.000	0.000	2.030	1.675	0.000	1.084	0.894	0.000	0.799	0.659	0.000	0.593	0.489
2020		2.030	0.000	1.804	0.000	0.000	0.000	2.030	1.804	0.000	1.042	0.926	0.000	0.754	0.670	0.000	0.549	0.487
2021		2.030	0.000	1.932	0.000	0.000	0.000	2.030	1.932	0.000	1.002	0.954	0.000	0.711	0.677	0.000	0.508	0.484
2022		2.030	0.000	2.061	0.000	0.000	0.000	2.030	2.061	0.000	0.964	0.978	0.000	0.671	0.681	0.000	0.470	0.478
2023		2.030	0.000	2.190	0.000	0.000	0.000	2.030	2.190	0.000	0.926	0.999	0.000	0.633	0.683	0.000	0.436	0.470
2024		2.030	0.000	2.318	0.000	0.000	0.000	2.030	2.318	0.000	0.891	1.017	0.000	0.597	0.682	0.000	0.403	0.461
2025	-31.744	2.030	0.000	2.447	0.000	0.000	-31.744	2.030	2.447	-13.395	0.857	1.033	-8.809	0.563	0.679	-5.839	0.373	0.450
TOTAL	**52.364**	**40.600**	**0.000**	**24.490**	**0.000**	**0.000**	**52.364**	**40.600**	**24.490**	**64.368**	**25.507**	**13.299**	**66.047**	**20.723**	**10.011**	**66.270**	**17.087**	**7.639**

	NPC	NPV water	URV, R/kl
AT 4%	**103.2**	**11.8**	**8.71**
AT 6%	**96.8**	**8.9**	**10.85**
AT 8%	**91.0**	**6.8**	**13.38**

Net present value of water supplied

Low demand scenario

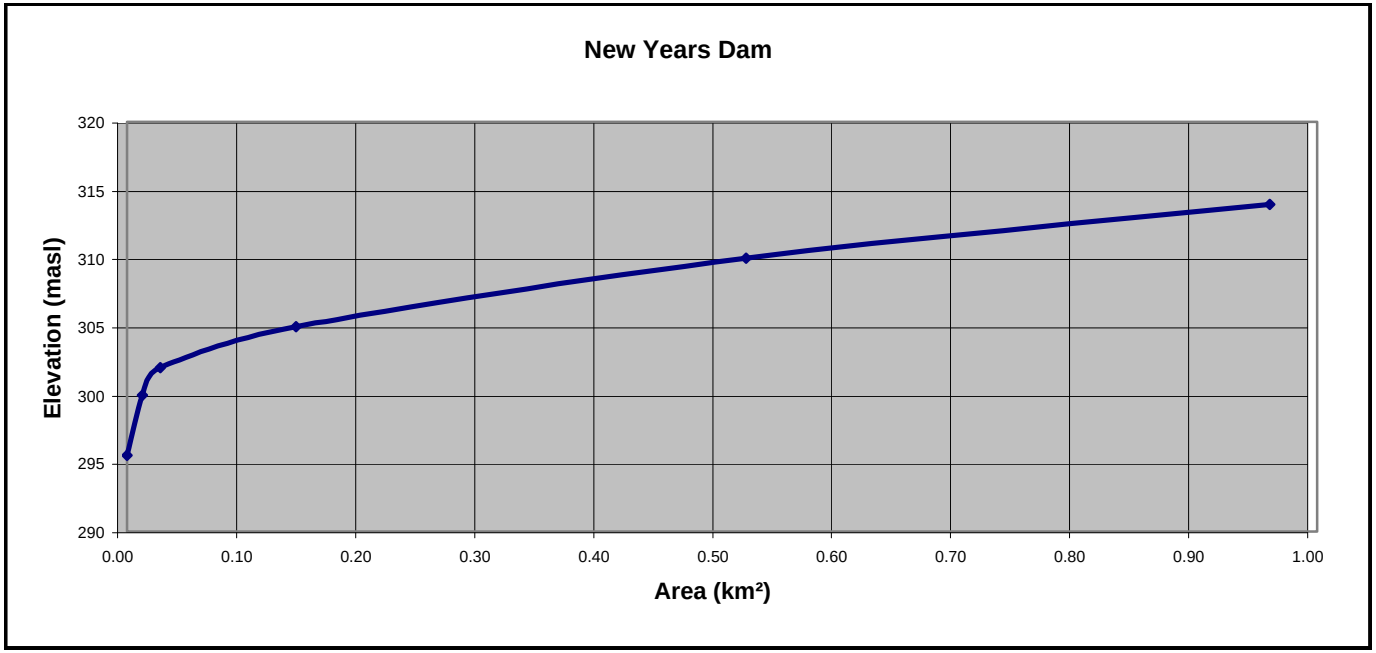
Min	0	l/s
Max	69.2	l/s

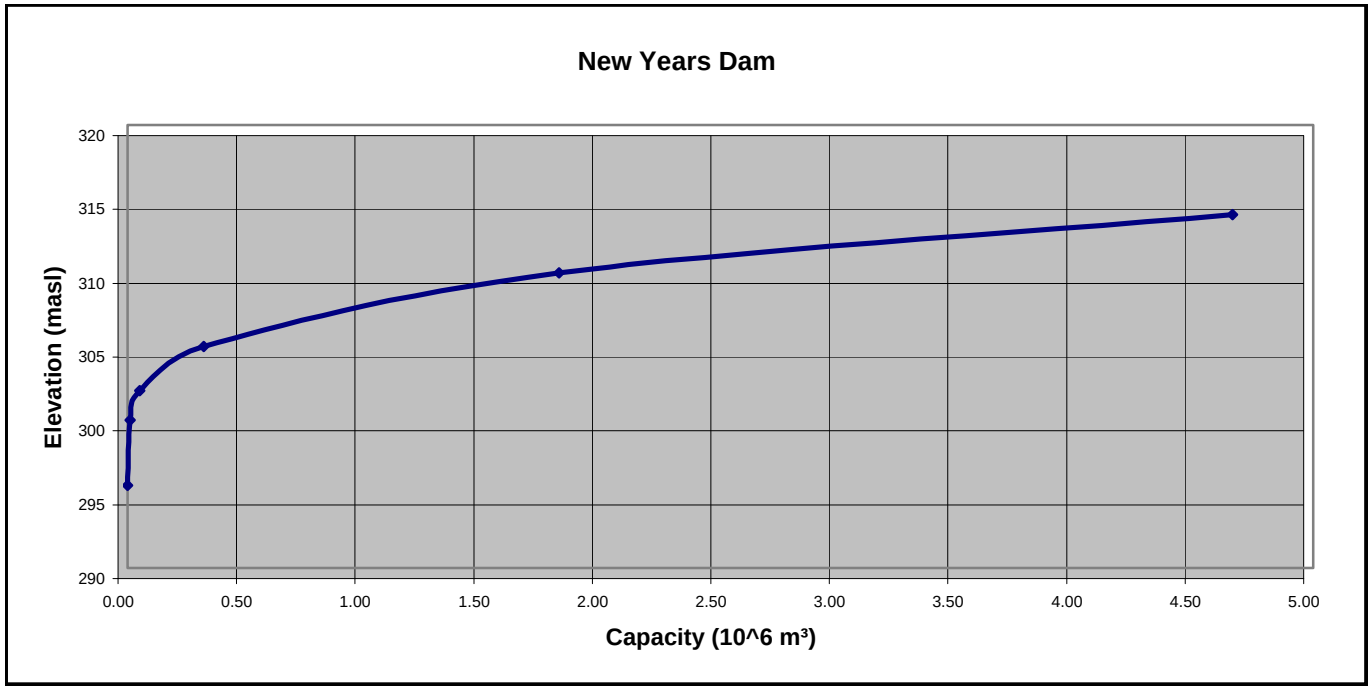
YEAR	TOTAL SUPPLY (x1000 m3)	NPV of water supplied at 4% (x1000 m3)	NPV of water supplied at 6% (x1000 m3)	NPV of water supplied at 8% (x1000 m3)
2003				
2004				
2005				
2006	0.000	0.000	0.000	0.000
2007	0.115	0.098	0.091	0.084
2008	0.230	0.189	0.172	0.156
2009	0.345	0.272	0.243	0.217
2010	0.459	0.349	0.306	0.268
2011	0.574	0.420	0.360	0.310
2012	0.689	0.484	0.408	0.345
2013	0.804	0.543	0.449	0.372
2014	0.919	0.597	0.484	0.394
2015	1.034	0.646	0.514	0.411
2016	1.149	0.690	0.538	0.422
2017	1.263	0.730	0.559	0.430
2018	1.378	0.765	0.575	0.434
2019	1.493	0.797	0.588	0.436
2020	1.608	0.826	0.597	0.435
2021	1.723	0.850	0.604	0.431
2022	1.838	0.872	0.607	0.426
2023	1.953	0.891	0.609	0.419
2024	2.067	0.907	0.608	0.411
2025	2.182	0.921	0.606	0.401
TOTAL	**21.823**	**11.847**	**8.917**	**6.803**

APPENDIX 11

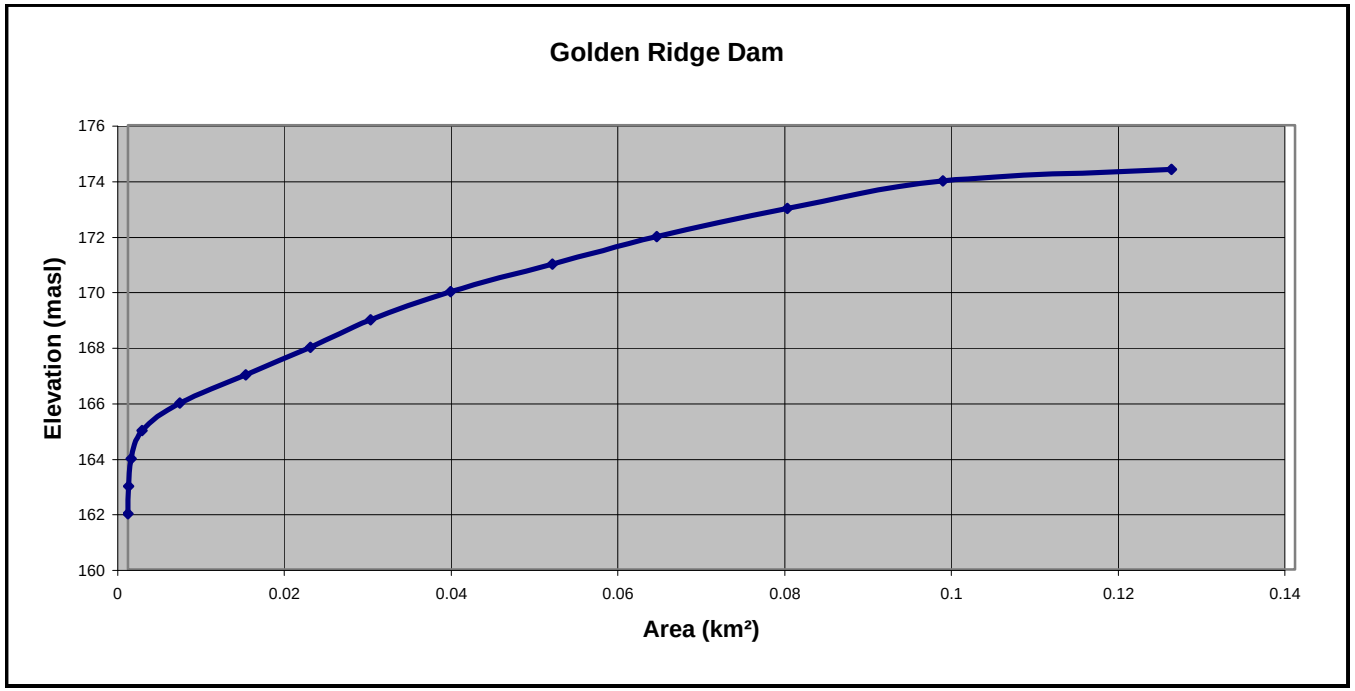
ELEVATION – AREA/CAPACITY CURVES FOR DAMS

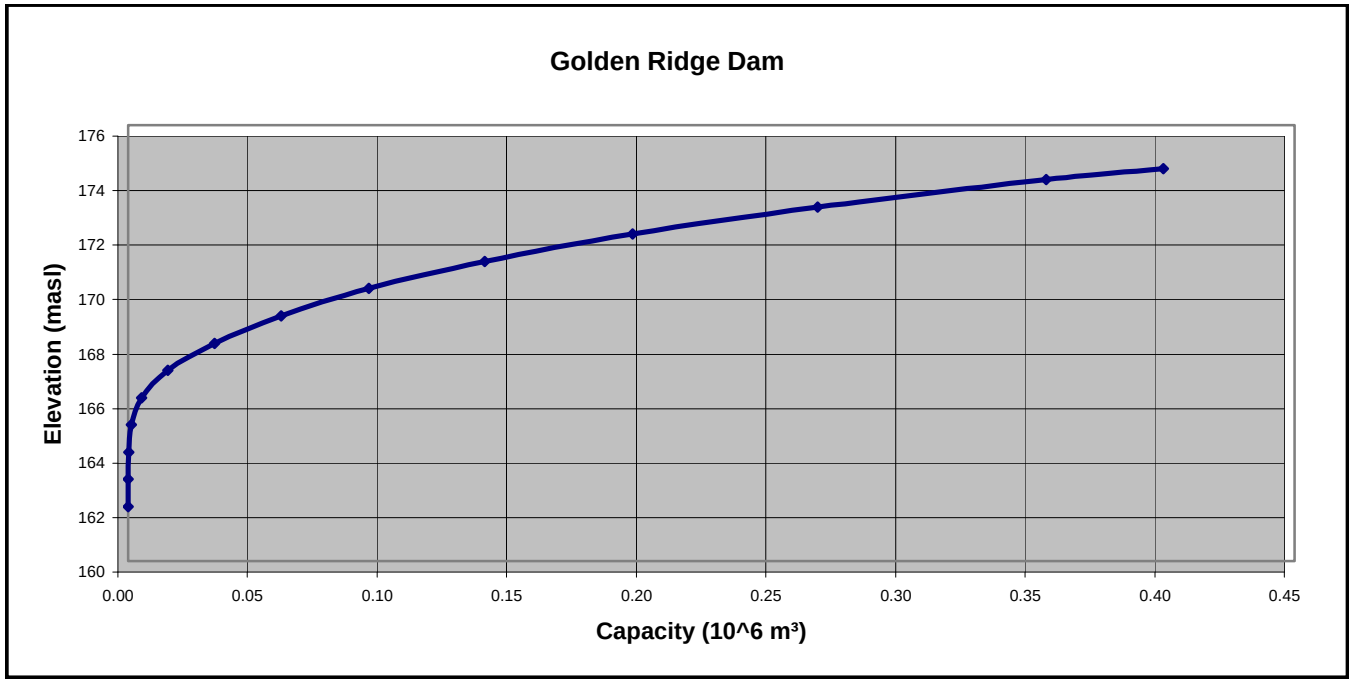
Elevation (masl)	Area (km²)	Capacity (10^6 m^3)
New Years Dam		
295.6	0	0.000
300	0.013	0.010
302	0.028	0.050
305	0.142	0.320
310	0.520	1.820
313.94	0.960	4.660



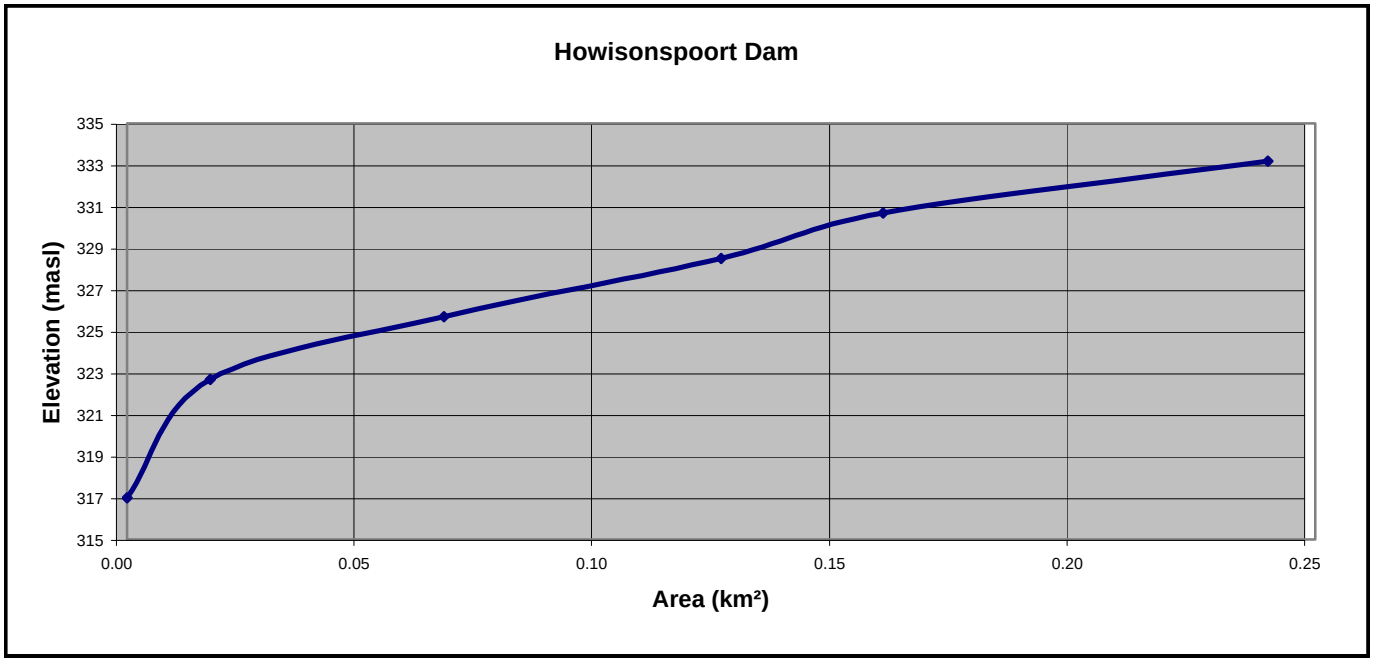


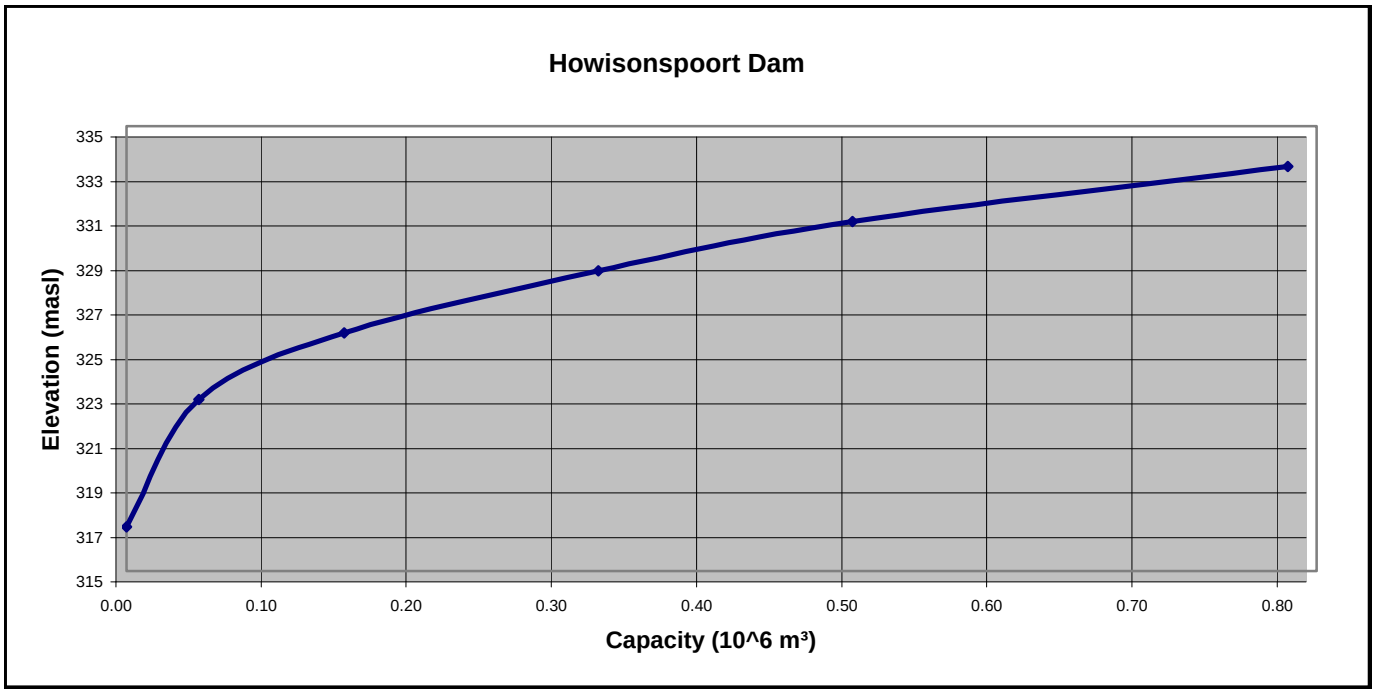
Elevation (masl)	Area (km^2)	Capacity (10^6 m^3)
Golden Ridge Dam		
162	6.10E-07	0.000
163	9.27E-05	0.000
164	0.0004	0.000
165	0.0017	0.001
166	0.0062	0.005
167	0.0141	0.015
168	0.0219	0.033
169	0.0291	0.059
170	0.0387	0.093
171	0.0509	0.138
172	0.0634	0.195
173	0.0791	0.266
174	0.0978	0.354
FSL 174.41	0.1252	0.399



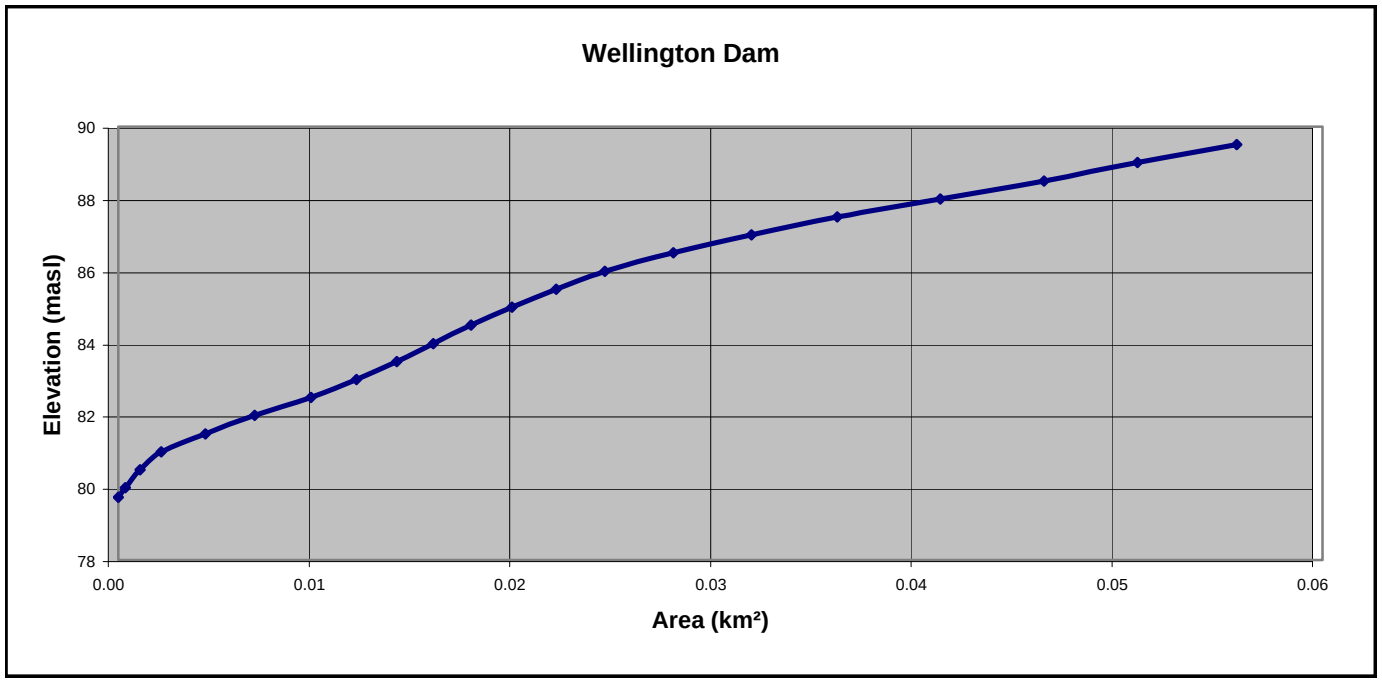


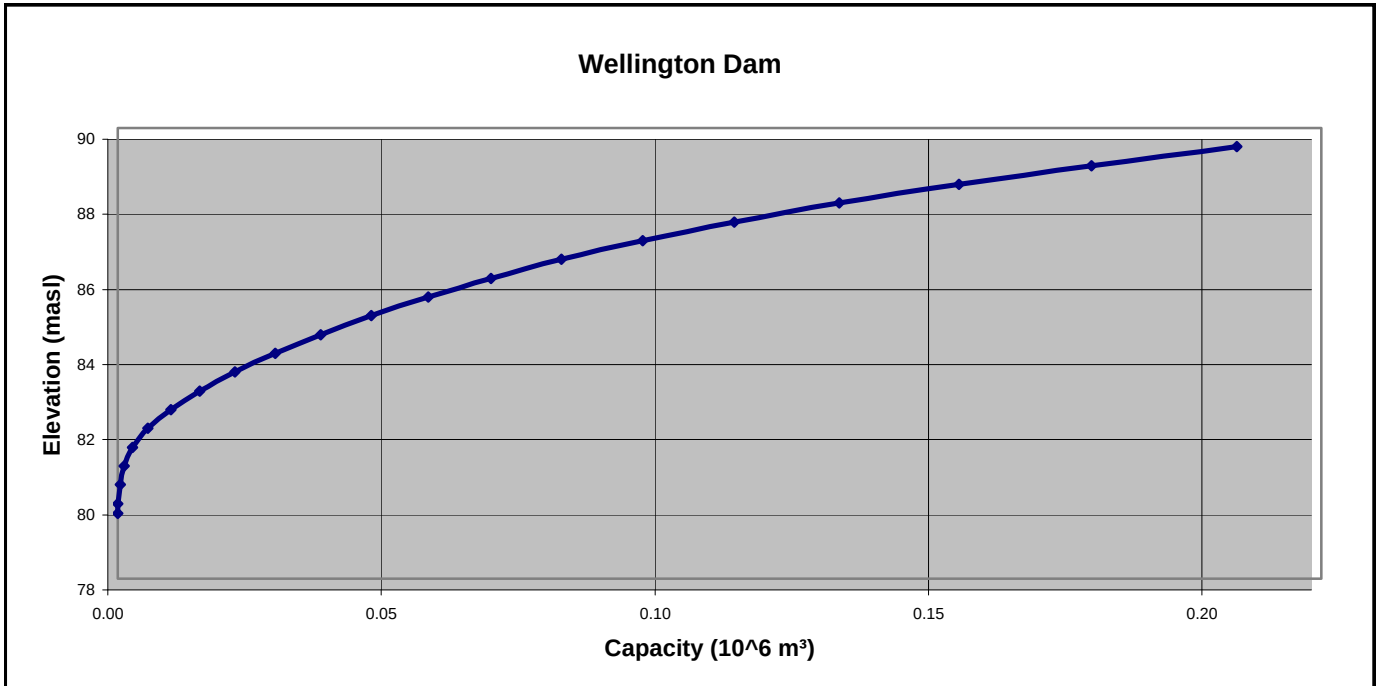
Elevation (masl)	Area (km²)	Capacity (10^6 m^3)
Howisonspoort Dam		
317	0	0.0000
322.7	0.0175	0.0500
325.7	0.0667	0.1500
328.5	0.1250	0.3250
330.7	0.1591	0.5000
333.2	0.2400	0.8000



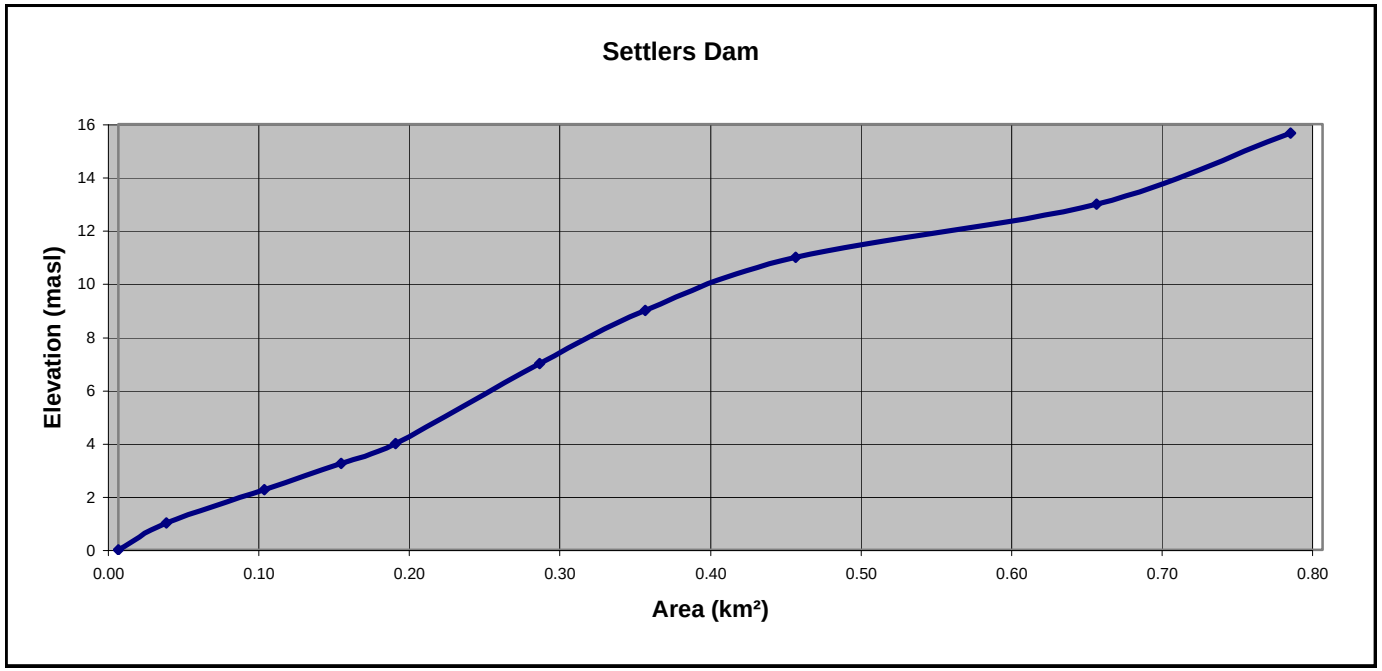


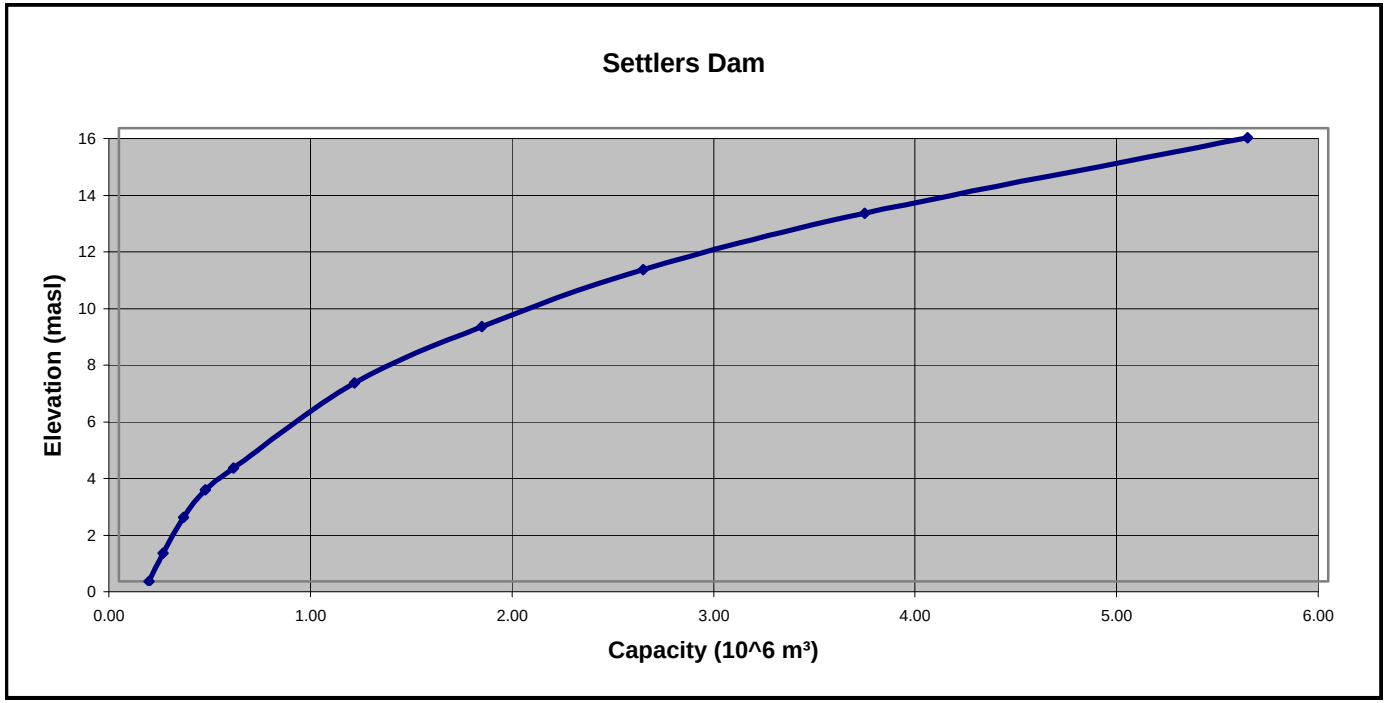
Elevation (masl)	Area (km^2)	Capacity (10^6 m^3)
Wellington Dam		
79.74	0	0.000
80.0	0.000	0.000
80.5	0.001	0.000
81.0	0.002	0.001
81.5	0.004	0.003
82.0	0.007	0.005
82.5	0.010	0.010
83.0	0.012	0.015
83.5	0.014	0.021
84.0	0.016	0.029
84.5	0.018	0.037
85.0	0.020	0.046
85.5	0.022	0.057
86.0	0.024	0.068
86.5	0.028	0.081
87.0	0.032	0.096
87.5	0.036	0.113
88.0	0.041	0.132
88.5	0.046	0.154
89.0	0.051	0.178
89.5	0.056	0.205



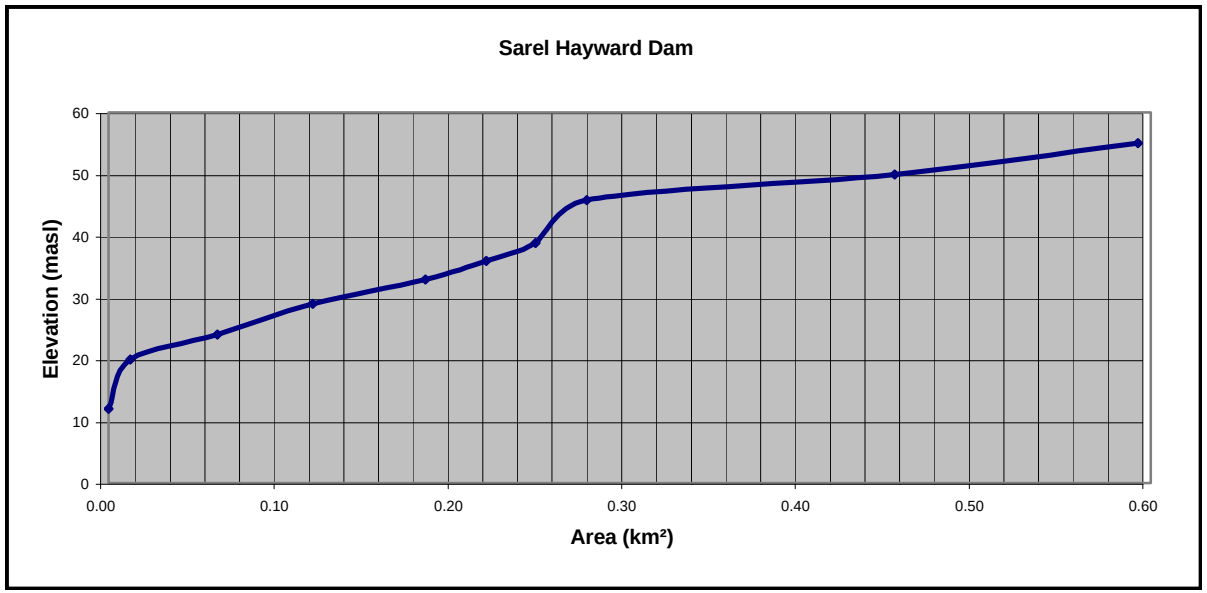


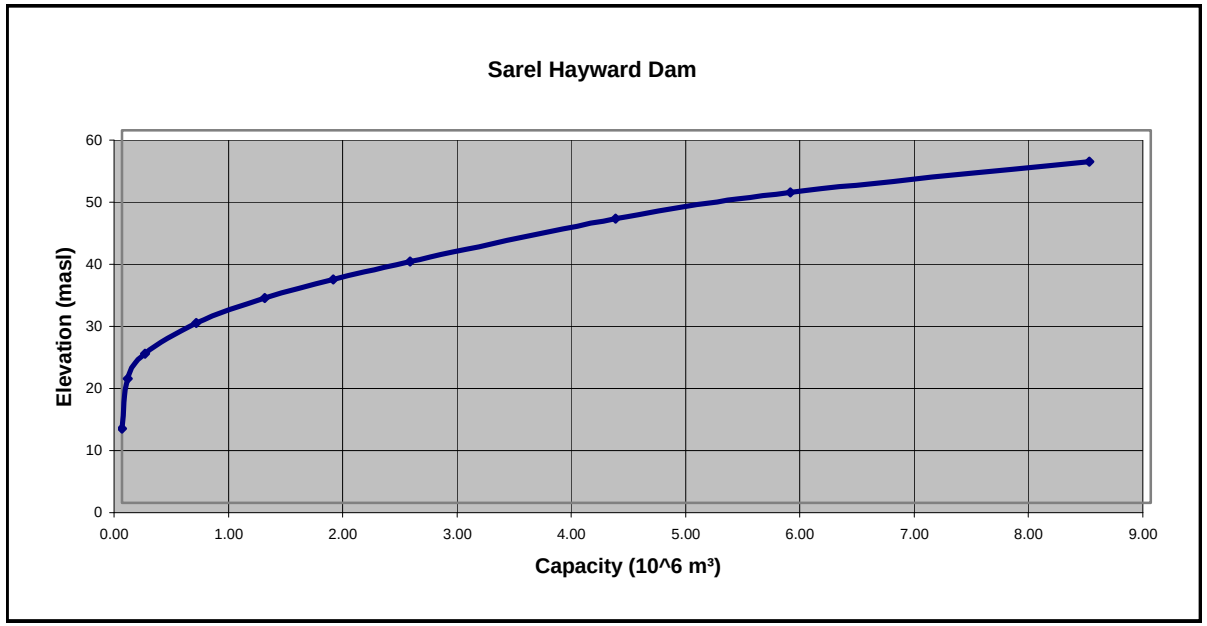
Elevation (masl)	Area (km²)	Capacity (10^6 m^3)
Settlers Dam		
0	0	0.150
1	0.032	0.220
2.25	0.097	0.320
3.24	0.148	0.430
4	0.184	0.570
7	0.280	1.170
9	0.350	1.800
11	0.450	2.600
13	0.650	3.700
15.66	0.779	5.600



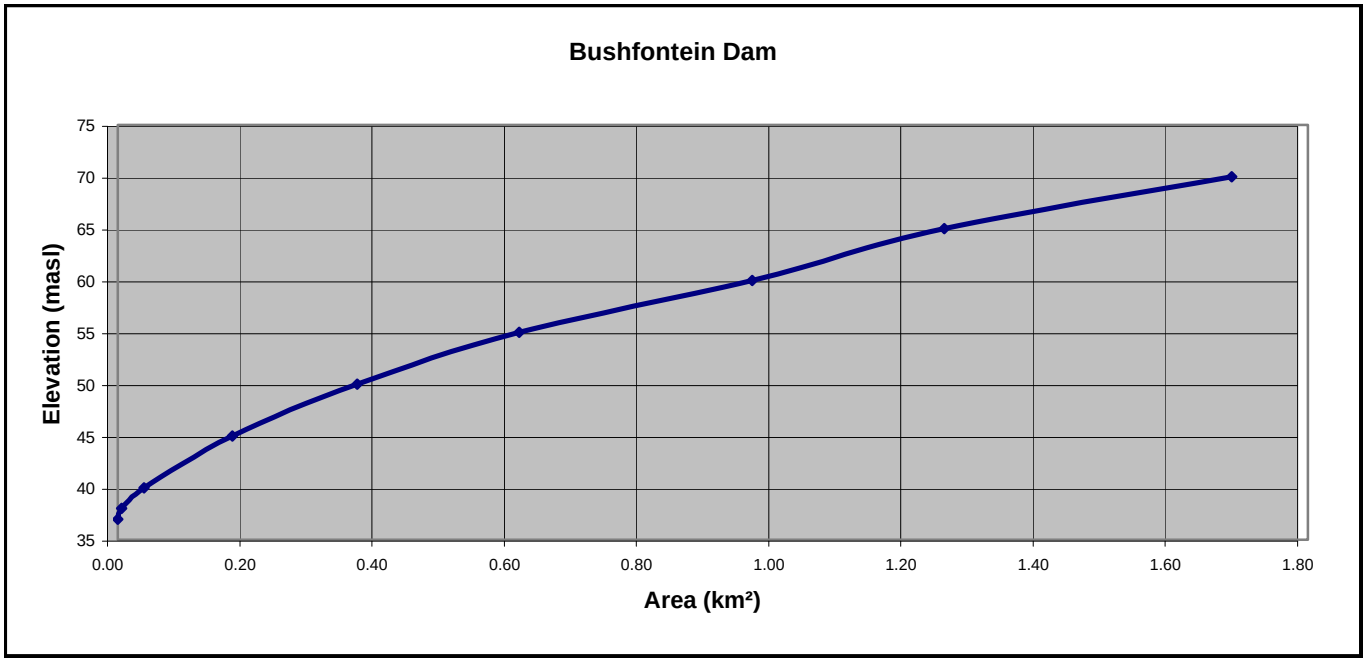


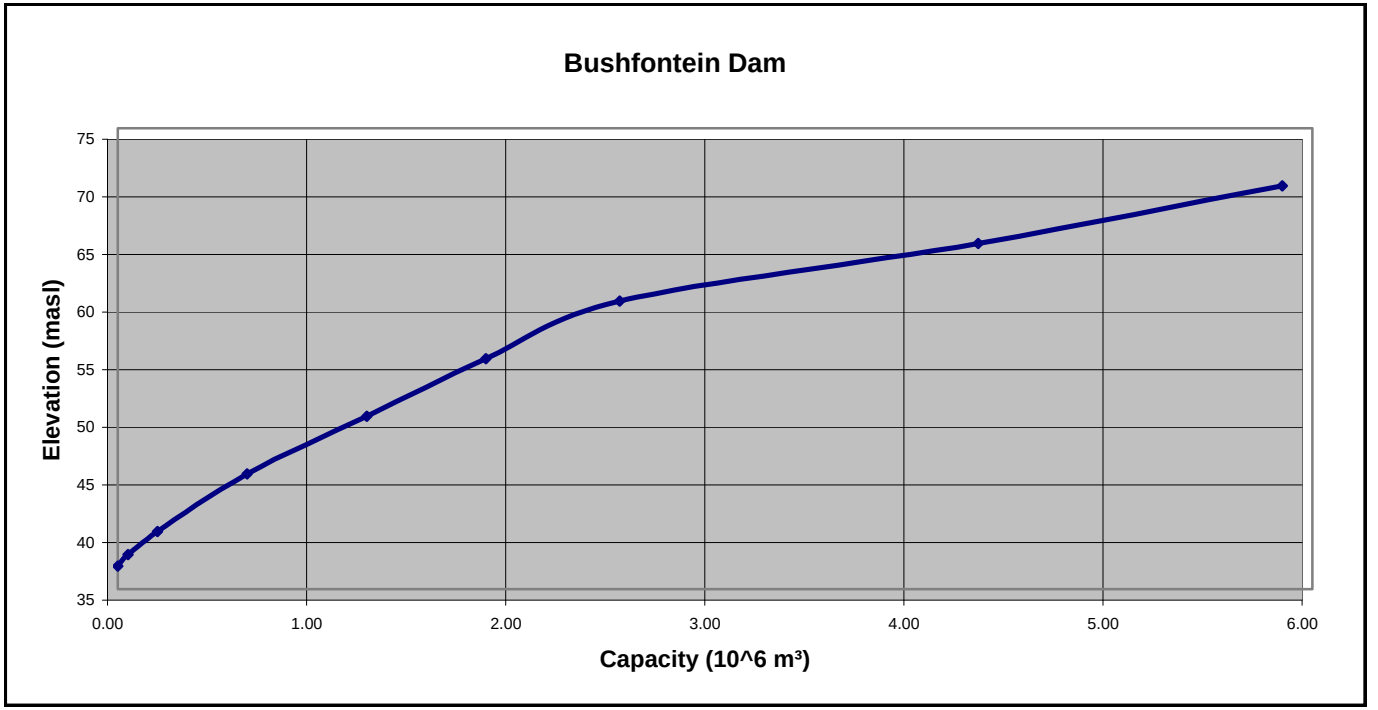
	Elevation (masl)	Area (km²)	Capacity (10^6 m^3)
	Sarel Hayward Dam		
	12	0	0.0000
	20	0.0125	0.0500
	24	0.0625	0.2000
	29	0.1175	0.6500
	33	0.1825	1.2500
	36	0.2175	1.8500
FSL	38.9	0.2459	2.5220
	45.8	0.2752	4.3200
	50	0.4524	5.8480
	55	0.5926	8.4600





Elevation (masl)	Area (km²)	Capacity (10^6 m^3)
Bushfontein Dam		
37	0	0.000
38	0.006	0.050
40	0.040	0.200
45	0.173	0.650
50	0.362	1.250
55	0.607	1.850
60	0.960	2.522
65	1.250	4.320
70	1.685	5.848





APPENDIX 12

STAKEHOLDER MEETINGS

Department of Water Affairs & Forestry
Directorate Water Resources Planning

Albany Coast Situation Assessment Study

Stakeholder Meeting

30 October 2003

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Agenda

- Introduction by DWAF: TG
- Project team
- Scope of study
- Lines of communication
- Inputs by stakeholders
- Closure

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Purpose of meeting

- To launch the study
- To introduce the stakeholders
- To present the scope of services and program
- To obtain inputs from the stakeholders
- To establish the channels for communication

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Study Team

Client - DWAF

- Directorate : Water Resources Planning
- Chief Directorate : EC Region

Consultants

UWP Consulting - lead consultant

In association with:

Water Systems Management
DMM Development Consultants

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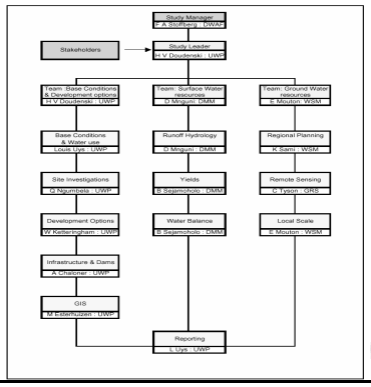
Study organisational chart



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Main Stakeholders

- DWAF
- Cacadu DM
- Ndlambe LM
- Albany Coast Water Board
- Department of Environmental Affairs
- Various consultants and service providers
- Beneficiaries: DM, LM, water users

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Purpose of study

- To provide a solution to the water supply problems of the coastal towns:

  Port Alfred, Bathurst, Kleinemonde, Kenton-on-Sea, Bushmans River Mouth, Boknes, Cannon Rock, and Alexandria

- Problems currently experienced relate to:

  Inadequate water sources, or poor water quality, and/or infrastructure capacity

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Scope of services

- Investigate at reconnaissance level the water supply problems in the study area
- Consider relevant conditions in catchment
- Consider possible solutions suitable for immediate implementation
- Compile an implementation strategy
- If necessary, outline the scope of further investigations or studies

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Study area

- Focus on coastal belt (Ndlambe)
- But, consider water resources situation in entire P catchment

9

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Methodology

- Study to be undertaken in two phases:
  - Situation assesment study
  - Development option study

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Situation Assessment

- Obtain and collate information
- Overview of water supply at coastal towns
- Surface water resources for P catch.
- Ground water resouces
- Conceptual level development options for coastal belt
- Presentation of interim results

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Development Options

- More detailed studies on development options
  - Water requirements
  - Demand management and conservation
  - Water sources: surface and ground
  - Infrastrure
  - Evaluate options
- Implementation strategy
- Recommendations and reports

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Base Conditions: General

- Study and verify information
- Development status of study area
- Water supply infrastructure
- Agricultural developments and afforestation
- Overview of water conservation and demand management measures

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Water Requirements

- Urban and industrial
- Rural domestic
- Agricultural
- Afforestation and alien vegetation
- Ecological
- Return flows

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Surface Water Resources

- Stream flow hydrology for the entire catchment based on WR90
- Base flows hydrology for specific development sites
- Yield analysis for selected dam development sites

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Ground Water Resources

- Regional scale study (desk study)

  Estimate reserve, use, assess option for development
- Local scale study: hydrocensus

  Field work, local scale exploration potential, siting of potential targets
- GIS and remote sensing

  Assessment of seepage and fructured zones exploration potential based on satellite immagery

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Development Options

- Estimate and project requirements
- Assess existing water sources and bulk infrastructure
- Review previously identified options
- Identify new development options
- Consider water demand mnmgt
- Conceptual sizing and costing
- Evaluate options and select best
- Compile implementation strategy

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Study programme

- Study staretd in October 2003
- Situation assessment and interim results - end February 2004
- Development options study and draft report – end May 2004
- Copmletion of study – end Sep 2004

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Stakeholder Imputs

- Imputs and co-operation from stakeholders will be very valuable
- Consultants to approach stakeholders for information and comments
- Channels of communication

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Thank you

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ALBANY COAST WATER RESOURCE SITUATION ASSESSMENT: STAKEHOLDER MEETING, 30 OCTOBER 2003, NLAMBE MUNICIPALITY COUNCIL CHAMBERS, PORT ALFRED

	NAME	ORGANISATION	TEL. No.	FAX No.	E-MAIL	SGN/INIT.
	T.J. GELDENHUYS	DWAF, S. REGION	048-881 3005	048-881 3545	geldent@dwaf.gov.za	
1	W.R. PATTERSON	NDLAMBE MUNICIPALITY	046-6241140	046-6242669	wpatterson@ndlambe.co.za	
2	P. FICK.	P&S CONS. ENG	046-6530682	046-6530682	paul-fick@intekom.co.za	
3	S. FICK.	" " "	046-653 1055	046-6521055	sfick@intekom.co.za.	
4	B.B. SWAYENA	D.W.A.F (K.W.T)	043-604 5451	043-604 5587	swayenb@dwaf.gov.za	
5	H.H. GOOSSENS	DWAF (KWT)	043-6045445	043-6045587	GOOSSENH@KWT.dwaf.gov.za	
6	F.S. Botha	DWAF (H.O.)	012 336 8835	012 336 7749	IFK@dwaf.gov.za	
7	ZT Peteni-Kave	DWAF (HO)	(012) 3368526	(012) 3368295	ifj@dwaf.gov.za	
8	F.A. SOOFFBERG	DWAF - NWRP (South)	012. 336. 8319	012. 336. 8295	ica@dwaf.gov.za	
9	P SNYMAN	CDM	041-5087335	041-5087276	psnyman@cocadu.co.za	
10	V. RAPIYA	CDM (CMIP)	041-5087264	041-5087276	cmip@cacadu.co.za	
11	E. MOUTON	WSM (Pty) Ltd	(043)573-5805 (046)648-1181	(046)648-1181	WSMec@MWeb.co.za	
12	R. BALL	ALBANY COAST WATER	046-6481233	046 6461552	ALBWATER@BORDER.CO.ZA	
13	W. KETTERINGHAM	UWP - EERST LANDDAG	043-7030186	043-7030288	wayne.k@uwp.co.za	
14	D. Behrmann	DWAF (Pty) Ltd NWRP	012-3368195	012-3368295	icf@dwaf.gov.za	D Behrmann
15	Christo Doudenski	UWP Consulting	012 6649232	012 6647870	christo.d@uwp.co.za	
16						

→ 23 21 / 4 @

Rudi Louwrens

From: Geldenhuys Theo (CDK) [GeldenT@dwaf.gov.za]

Sent: 28 July 2004 16:04

To: psnyman@cacadu.co.za; crenze@cacadu.co.za; dcockcroft@ndlambe.co.za; bpatterson@ndlambe.co.za; dklassen@ndlambe.co.za; gngesi@ndlambe.co.za; Coetzee Dewald (KWT); Botha Fanie; Peteni-Kave Zimkitha; Baron Jane (PLZ); Cobban Dale (KWT); Van Vliet Henk (KWT); Mbambisa Galelo (KWT); Behrmann Dennis; Keke Zolile Hamilton (KWT); KETTERINGHAM WAYNE (wayne.k@uwp.co.za); Lucas Andrew (East London); Stoffberg Frans; ALBANY COAST WB (albwater@border.co.za); MOUTON ETIENNE (wsmec@telkomsa.net); sfick@intekom.co.za; deedeejp@telkomsa.net; agouws@ndlambe.co.za; mktshungu@makana.gov.za; Goossens Herman (KWT); luciusm@sanparks.org; luciusm@parks-sa.co.za; nollieb@parks-sa.co.za; nollieb@sanparks.org; sholness@upe.ac.za; coastal@upe.ac.za; tom.bornman@upe.ac.za; scarrn@eetrepc.ecape.gov.za

Cc: christo.d@uwp.co.za; rudi.l@uwp.co.za

Subject: ALBANY COAST WATER RESOURCES SITUATION ASSESSMENT STUDY: STAKEHOLDER MEETING, REPORT BACK

ALBANY COAST WATER RESOURCES SITUATION ASSESSMENT STUDY: STAKEHOLDER MEETING, REPORT BACK

1. **BACKGROUND**: - Consultants for the Department of Water Affairs and Forestry (DWAF) are in the process of completing a water situation assessment study of the Albany Coast Region to identify, for further detailed investigation by the Ndlambe Local and/or Cacadu District Municipality, the best possible options for augmenting the water supplies t the coastal towns in the area. This study has been necessitated as a result of the periodic shortages in an acceptable quality of water, especially during the holiday seasons and particularly during summer. The area identified for investigation stretches from Kleinemonde to Cannon Rocks/Alexandria … the Albany Coast.

2. This proposed meeting, to be held with all the relevant stakeholders in the study area, is in order to inform those involved persons on, and to present, the results of the study and to accept for consideration any final comments.

3. The **meeting of stakeholders** is to be held in the **NDLAMBE MUNICIPAL COUNCIL CHAMBERS, BERGAM BUILDING, PORT ALFRED on Thursday 26 August 2004 at 10:00** and should be completed by 13:00.

4. Travel arrangements to and from the meeting will be each attendees own responsibility.

5. **RSVP** to e-mail: - christo.d@uwp.co.za or to Tel. No. 012-664 9232 or to Fax 012-664 7870 … **by Friday 13 August 2004**.

6. All are also requested to accordingly inform, or invite, any other person who may be interested and/or affected by the outcomes of this study.

Theo Geldenhuys, Water Use Management
Department of Water Affairs & Forestry, Eastern Cape Region
Private Bag X 68, CRADOCK, 5880
Fax:- 048-881 3545 Tel.:- 048-881 3005
Cell.:- 082-808 0499 E-mail:- geldent@dwaf.gov.za

Department of Water Affairs & Forestry
Directorate National Water Resources Planning

Albany Coast Situation Assessment Study

Presentation to Stakeholders

26 August 2004

UWPEngineers

Agenda

- Introduction
- Presentation of interim results
- Inputs by stakeholders
- Way forward

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Study Team

Client - DWAF

- Directorate : Water Resources Planning
- Chief Directorate : EC Region

Consultants

UWP Consulting - lead consultant

In association with:

Water Systems Management (Geohydrology)
DMM Development Consultants (Hydrology)

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Purpose of study

- To provide a solution to the severe water supply problems at certain coastal towns:
  Alexandria, Boknes, Canon Rocks, Kenton-on-Sea, Port Alfred, Kleinemonde and Bathurst
- Current problems relate to:
  - High growth rates in coastal areas
  - High holiday peak water usage
  - Inadequate sources: quality and quantity
  - Limited infrastructure capacity

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Scope of Study

- Water resources situation assessment for the entire P drainage region
- Assess in detail the water supply situation at the coastal towns
- Evaluate possible solutions that can lead to fast-track implementation

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Purpose of presentation

- To present the interim results from this reconnaissance study
- To obtain guidance and input from the stakeholders in terms of the way forward

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WATER RESOURCES SITUATION ASSESSMENT

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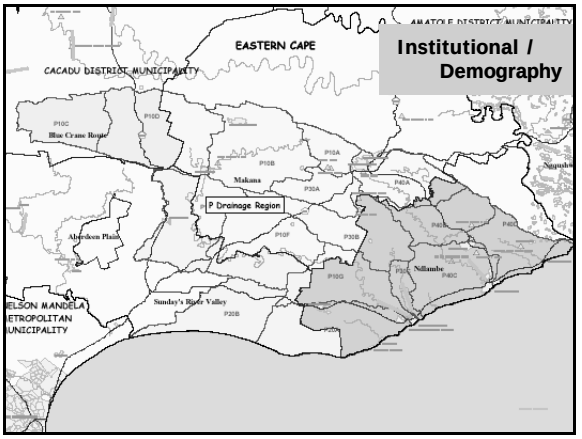

Basic info

- Total area of P region is 5 300 km^2.
- Elevation from 0 to 1000 m amsl
- MAP from 400 to 715 mm/a
- 3 main rivers and 4 main dams
- Geology: saline shales affect quality
- Land use: dry land agric and grazing
- Population 140 000 growing to 170 000 in 20 years, mostly urban
- Coastal areas of high ecological value

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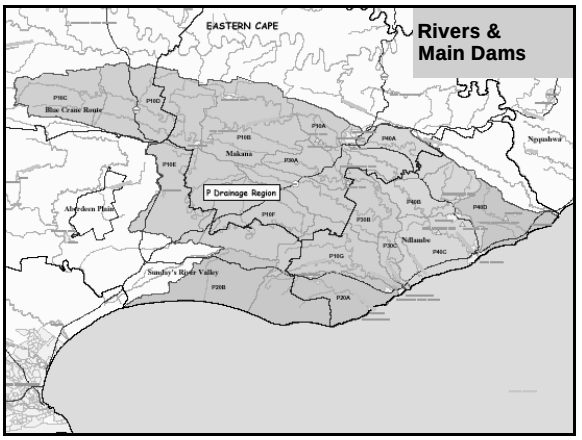

Water requirements per user sector in P drainage region

User Sector	Water Requirements ($10^6 m^3/a$)				Distribution, %	
	2001	2005	2015	2025	2001	2025
Urban domestic and industrial	7.88	9.95	12.35	13.89	34.7	48.4
Rural domestic	0.40	0.42	0.42	0.39	1.7	1.3
Stock watering	1.67	1.67	1.67	1.67	7.3	5.8
Irrigation	12.78	12.78	12.78	12.78	56.2	44.5
Total consumptive requirements	**22.73**	**24.82**	**27.22**	**28.72**	**100.0**	**100.0**
Total usage from inter basin transfers, return flows & GW	-6.63	-8.09	-9.26	-9.96	-29.2	-34.7
Total use from surface water	**16.10**	**16.73**	**17.96**	**18.76**	**-70.8**	**-65.3**

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Surface Water yield per tertiary catchment

Tertiary Catchment	River	Area	Naturalised MAR	Yield	
				no prov for ER	prov for ER
		km^2	$x10^6 m^3$	$x10^6 m^3$	$x10^6 m^3$
P10	Bushmans	2757	57.94	2.740	0.570
P20	Boknes	754	45.64	0.103	0.006
P30	Karlega	647	20.25	0.000	0.000
P40	Kowie	1164	49.21	4.170	4.050
TOTAL		**5322**	**173.04**	**7.013**	**4.626**

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Surface Water Resources

- The total natural MAR is 173 x10^6 m^3/a
- Area has a positive water balance, but total available yield is only 4 x10^6 m^3/a
- Surface water quality in middle / lower reaches is poor: TDS 1000 to 2500
- RoR schemes not feasible due to low yield and poor water quality
- Development of local SW is not favourable

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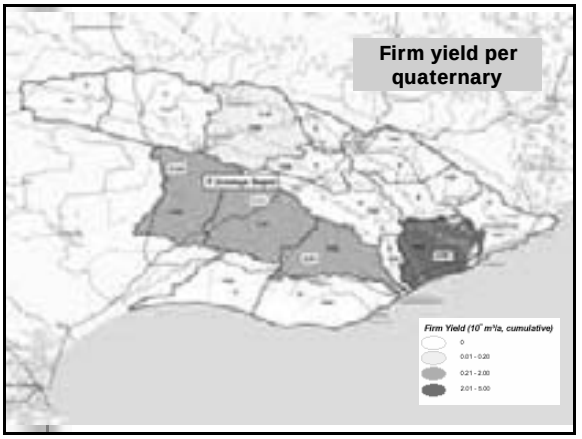

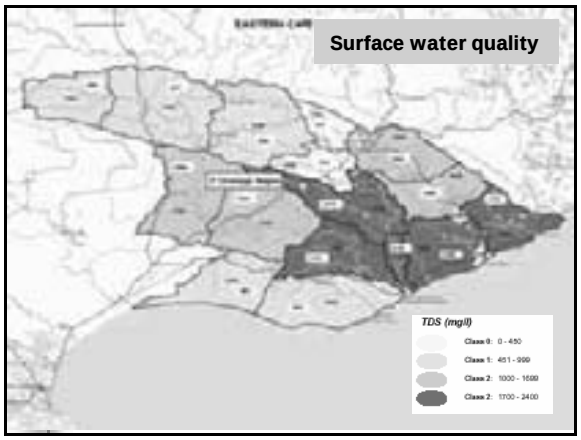

Ground Water

- Existing use of groundwater is low
- Coastal aquifers are currently used. Yields are low to moderate 3 l/s to 5 l/s
- Drilling depths vary 100 m to 180 m
- Success rates 30% to 60%
- Water quality varies: TDS 700 to 2000
- Areas with high potential for GW development identified during study and exploration drilling done
- In cases GW development is favourable

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DEVELOPMENT OPTIONS

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Water requirements per affected town

- Based on the Mark Data methodology
- Population data as per Census 2001
- Known new developments accounted for
- No data about losses in the distribution systems is available
  - Due to source deficit water is being used wisely: rainfall harvest tanks, etc
  - Assumed best water demand management practices

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Population numbers per town

Quaternary	Town	Urban Population			
		2001	2005	2015	2025
P10B	Riebeeck East	689	703	687	652
P10D	Alicedale	5,950	6,070	5,930	5,635
P10E	Paterson	4,404	4,493	4,387	4,172
P10G	Kenton/Bushmans	9,480	12,745	13,734	14,539
P20A	Alexandria	7,715	8,371	9,178	8,720
	Canon Rocks/ Boknes	931	1,422	2,573	2,949
P40A	Grahamstown	61,759	64,370	66,387	66,591
P40C	Port Alfred	20,965	27,526	35,376	40,542
	Bathurst	5,549	6,497	6,445	6,227
P40D	Kleinmonde	1,450	1,833	2,156	2,471
Total urban population		**118,892**	**134,029**	**146,855**	**152,499**

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Water requirements per town

Town	Total gross water requirements				Exist. source	Growth	Deficit
	million m³/a				mil m³/a	%	%
	2001	2005	2015	2025	2005	05 to 25	in 2005
Kenton On Sea/ Bushmans	0.66	0.91	1.21	1.49	0.58	64%	-56%
Alexandria	0.52	0.62	0.79	0.76	0.60	23%	-3%
Canon/Boknes	0.18	0.25	0.46	0.53	0.24	109%	-5%
Port Alfred	1.27	2.16	3.04	3.90	1.73	81%	-25%
Buthurst	0.26	0.34	0.39	0.41	0.30	23%	-12%
Kleinmonde	0.05	0.08	0.12	0.16	0.11	88%	23%
SUBTOTAL	**2.93**	**4.36**	**6.02**	**7.25**	**3.56**	66%	-22%
Grahamstown	4.51	5.00	5.65	5.97	8.60	19%	42%
TOTAL STUDY AREA	**7.44**	**9.35**	**11.67**	**13.22**	**12.16**	41%	23%

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Development Options: Assumptions

- Existing source and infrastructure used
- New infrastructure includes: source, bulk conveyance system, WTW, and reservoirs
- System sized to supply summer peaks
- System has not been optimised (conveyance – balancing reservoirs)
- Where possible all development options based on conjunctive GW/SW use
- This will allow the necessary time for further studies related to larger SW development

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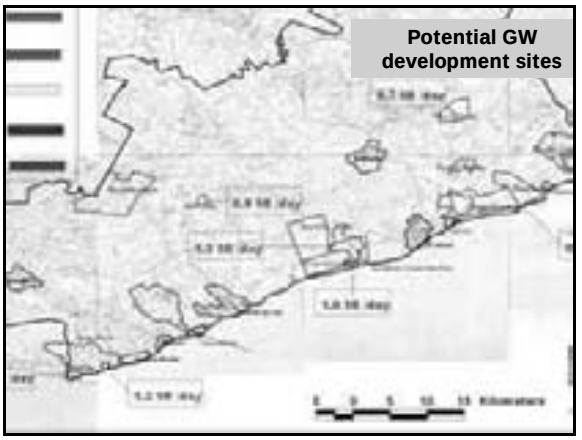

Alexandria

- Moderate growth in water use
- Situation is not critical yet
- Existing source (Fishkraal) and conveyance adequate until 2007
- Additional GW source can be developed and used for future. Environmental constraints
- Conveyance system needs to be upgraded
- SW scheme not required
- EIA has been done, outcome awaited

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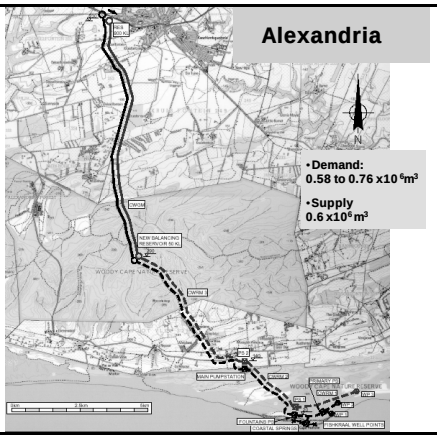

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Coastal Springs at Cape Padrone

Dune GW development at Fishkraal

Canon Rocks & Boknes

- High growth in water use is expected
- Situation critical during peak
- Sufficient GW resources at the Apies River mouth are available, but
- Environmental constraints to be resolved with Sandpark
- New conveyance system to be built
- SW resources not favourable
- EIA has been prepared, results pending
- Implementation can start

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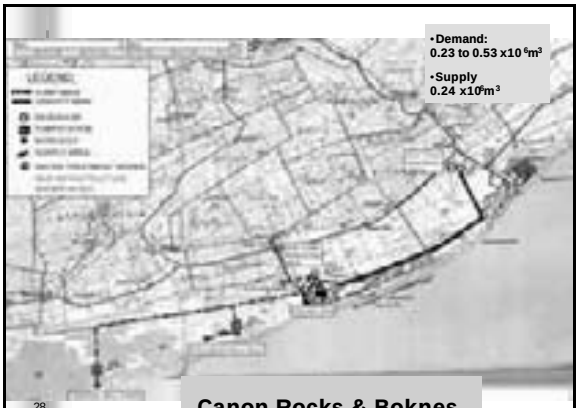

- Demand: 0.23 to 0.53 x10 ^{6}m^{3}
- Supply 0.24 x10^{6}m^{3}

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Canon Rocks & Boknes

Kenton on Sea / Bushmans

- High growth in water use is expected
- Situation critical even during low demand
- Additional dune GW source at Kwaaihoek can be developed subject to EIA
- Potential GW sources at Merville and Bushfontein can be explored
- Alternatively expansion of the RO plant or supply from SW can be considered
- A problem with the position with the RO plant being experienced
- EIA for Kwaaihoek well field to be done

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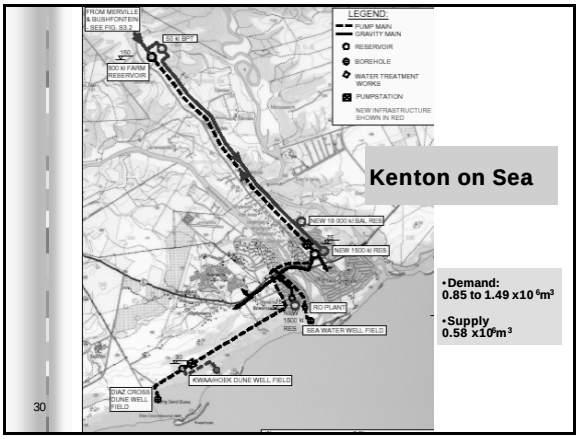

Kenton on Sea

- Demand: 0.85 to 1.49 x10 ^{6}m^{3}
- Supply 0.58 x10^{6}m^{3}

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Kenton on Sea

- **Demand: 0.85 to 1.49 x10 ^{6}m^{3}**
- **Supply 0.58 x10^{6}m^{3}**

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Kleinemonde

- High growth in water use is expected
- Situation not critical yet
- Supply from Wellington dam has poor water quality TDS up to 2 500
- Source has sufficient capacity until 2007
- Additional GW sources investigated and should be developed

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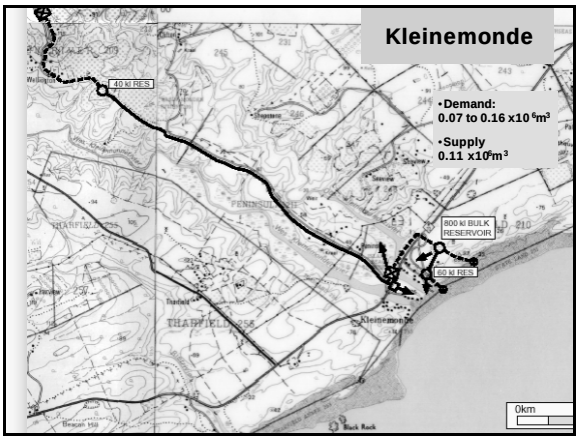

- **Demand: 0.07 to 0.16 x10 ^{6}m^{3}**
- **Supply 0.11 x10^{6}m^{3}**

Port Alfred

- High growth in water use is expected
- Situation is critical during peak. Available sources will be adequate until 2005
- Existing source: poor water quality tds 1700
- GW resources not sufficient to supply full future requirement, but can postpone development until 2011
- SW scheme is required: Sources considered: Glen Melville, Settlers, Sarel Hayword, New Years dam, all in conjunction with GW

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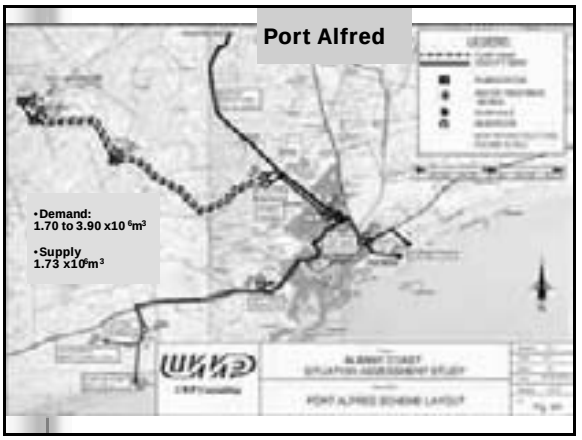
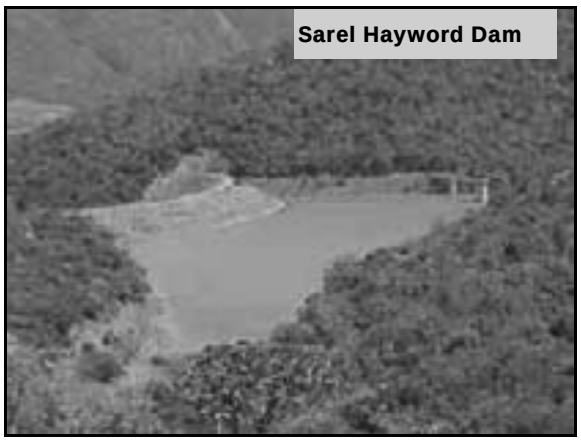
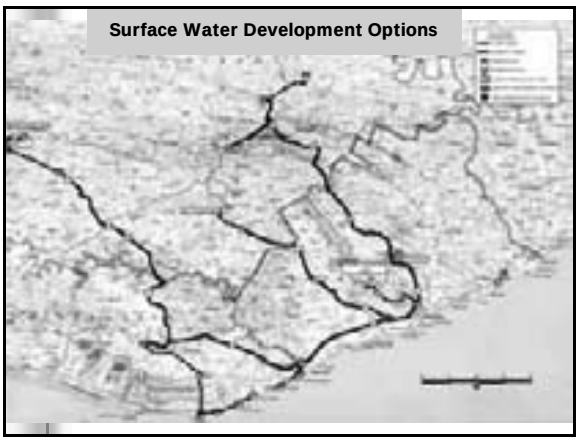


- **Demand: 1.70 to 3.90 x10 ^{6}m^{3}**
- **Supply 1.73 x10^{6}m^{3}**





Bathurst

- Moderate growth is expected
- Portions of town rely on private sources– not reticulated.
- Existing sources: Golden Ridge (a private dam) will be adequate until 2006
- A study on the IFR releases from the dam needs to be done
- No feasible GW resources identified yet.
- Sources can be augmented as follows:
  - Supply from GM Dam if considered for PA
  - Investigate GW sources

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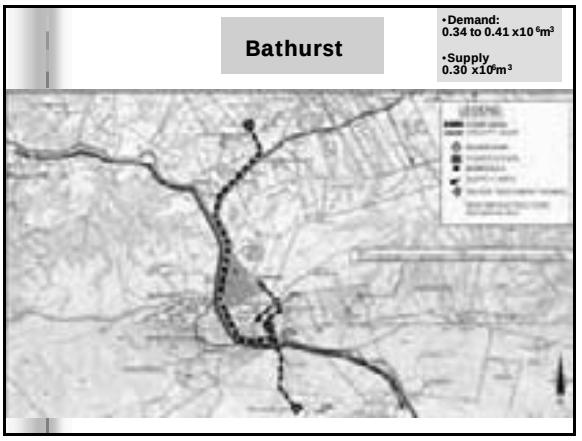

Development Options

- Water source
  - Ground water stand alone
  - Conjunctive use of surface and ground water
  - Surface water storage schemes
  - Sea and brackish water desalination plants
- Conveyance systems
  - Pump stations
  - Mains
  - Treatment plants
  - Bulk storage

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Summary Options

- Ground water stand alone schemes:
  - Alexandria, Canon Rocks and Kleinemonde
- Conjunctive GW, RO or SW scheme
  - Kenton on Sea/Bushmans River
- Conjunctive GW and SW scheme
  - Port Alfred and Bathurst: Supply from G Melville, or Settlers, or Sarel Hayward

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Economic Evaluation
Selected Schemes

No.	DAM/OPTION	Capital	URV	Note
		R mil	R/kl	
1	Alexandria: Ground Water (GW)	R10.61	R15.22	Recommend
2	Canon Rocks / Boknes : GW	R5.62	R5.02	Recommend
3	KOS / Bushmans River Mouth: GW	R28.11	R10.08	Recommend: short term
4a	KOS / Bushmans River Mouth: RO sea W	R34.65	R13.56	Not recommended
4b	KOS / Bushmans River Mouth: RO brackW	R28.77	R11.33	Not recommended
5	KOS: SW from GM Dam	R41.34	R10.21	Recommended: long term
6	PA: Glen Melville Dam: Opt 1: PA, BT, KOS	R130.91	R10.68	Recommended: long term
7	PA: Glen Melville Dam: Opt 2: PA, BT	R98.24	R9.97	Comparison
9	PA: Settlers Dam: Opt 1: PA	R100.46	R10.91	Comparison
8a	PA: Sarel Hayward Dam: Opt 1: PA	R55.18	R5.70	Recommended: long term
8b	PA: Sarel Hayward Dam: Opt 1: PA and RO	R73.53	R8.27	To improve water quality
10	PA: GW and RO only	R84.11	R10.85	Comparison

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CONCLUSIONS

- **Alexandria, Canon Rocks and Boknes** can be supplied with GW from additional sources at Cape Padrone, Fish Kraals and Apies River:
  - Ecological sensitivity is an issue
  - EIA report has been prepared
  - If ecological impact is unacceptable, further GW investigations to be done
  - DWAF to be approached for assistance
- If this is not acceptable a regional scheme should be developed

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CONCLUSIONS

- **Kenton on Sea and Bushmans River Mouth.** Water source to be augmented in the following sequence:
  - Produce EIA report and develop Kwaaihoek well field subject to acceptance of EIA
  - Upgrade supporting infrastructure for the existing RO plant: electrical, intake, disposal
  - Develop GW sources at Merville and Bushfontein together with conveyance system
  - Furthers studies to confirm the anticipated yields of the GW sources are recommended, but implementation process can commence
- Regional scheme will be the solution in long term

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CONCLUSIONS

Port Alfred

- Develop GW resources at Sunshine coast and Glendour to postpone SW scheme
- SW development would possibly be required in long term. Available GW resources would probably not be sufficient
- Undertake further studies to determine best surface water scheme: Glen Melville, Settlers, or Sarel Hayward
- Sarel Hayward water quality is poor
- Undertake further GW studies to firm up on GW development potential of the Witteberg

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CONCLUSIONS

- **Bathurst**
  - carry out Reserve determination study for Golden Ridge dam. Supply from this source can continue
  - Commence GW investigation to identify GW sources for augmentation of the source
- **Kleinemonde**
  - Water supply situation is not critical
  - Identify suitable GW resources for future augmentation

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Recommendations

- The results of the reconnaissance study indicate that most of the towns in the coastal area can be supplied from GW (Alex, CR/B, KoS/Bush, KIM) in short tem
- Possible positions for GW development sites have been identified
- EIA studies need to be done for proposed sites to confirm acceptability
- LA to commence implementation process

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Recommendations

- For Port Alfred: develop GW resources at Sunshine Coast and Glendour, subject to acceptable EIA
- The GW resources in the region are not sufficient in long term. A SW scheme would eventually be required
- Undertake further studies to finalise the best regional scheme option

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Thank you

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DEPARTMENT OF WATER AFFAIRS AND FORESTRY

ALBANY COAST SITUATION ASSESSMENT STUDY

STAKEHOLDER MEETING NO 2

Date: 26 August 2004 **Time:** 10:00 **Venue:** Port Alfred

LIST OF ATTENDANTS

No	Initials and surname	Organisation/position	E-mail address	Tel. No.	Fax No.
1	Christo Doudenski	UWP Consulting / Director	christo.d@uwp.co.za	0126649232	0126647870
2	Frans Stoffberg	DWAF / Snr Specialist	see my contacts		
3	C. BEZUIDENHOUT	KLEINEMOND RATE PAYERS	CHRISBEZ@TELKOMSA.NET	046 6751128 (T)	
4	CECIL JONES-PHILLIPSON	Ndlambe Ward 7 Cr.	deedeejp@telkomsa.net	046 6245267	SAME
5	Gillian Fogarty	Ndlambe Councillor	tellyfog@telkomsa.net	046-6481203	046-6481016
6	ROB SPEEDIE	KENTON RATEPAYERS	r.speedie@telkomsa.net	046 648 2282	—
7	WALTER KITCAT	KENTON CHAMBER of BUSINESS	seacottage@border.co.za	046 648 1510	SAME

26/8/04

8	P.G. RETIEF	DWAF, Pollution Contr. Off.	retiefp@dwaf.gov.za	041-586 4884	041-586 4210
9	J.A. MYBURGH	AGES - Cent London	jmyburgh@ages-group.com	045-7262070	083-7269232
10	B.B. SWAYENA	D.W.A.F (K.W.T) P.O.I	swayenbp@dwaf.gov.za	043-6045451	043-6045587
11	ER SUTTON	BRM Ratepayer Ch. man	Suttons@border.co.za	046 6482617	046 6482617
12	R.A. POTE (Richard)	NDLAMBE MUNICIPALITY	rpote@ndlambe.co.za	046-624 1140	046 6482118.
13	R. BALL	ALBANY COAST WATER	ALBWATER@Border.co.za	046-6481233	
14	E. Mouton	WSM-Leshika	WSMec@telkomsa.net	046-624-1400	083-573-5895
15	A.B. LUCAS	DWAF, WQM	lucasa@dwaf.gov.za	043 7223805	043 7433910
16	ZT PETENI-KAVE	DWAF, NWRP	PeteniKaveZ@dwaf.gov.za	012-3368526	012-336 8295
17	FRANS STOFFBERG	DWAF, NWRP, Pretoria	ica@dwaf.gov.za	012. 336 8319	012 336 8295
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