UNIT REFERENCE VALUE CALCULATIONS AT DIFFERENT DISCOUNT RATES

Year	Net Demand	Total annual costs	Discounted Figures 6%		Discounted Figures 8%		Discounted Figures 10%	
	Mm³/a	(excl VAT)	Demand	Costs	Demand	Costs	Demand	Costs
2008	0.00	0	0.00	0	0.00	0	0.00	0
2009	12.92	0	12.19	0	11.97	0	11.75	0
2010	13.80	2,778,977,726	12.28	2,473,280,283	11.83	2,382,525,485	11.40	2,296,675,807
2011	18.70	2,741,317,247	15.70	2,301,662,822	14.84	2,176,146,014	14.05	2,059,592,222
2012	31.70	2,021,007,130	25.11	1,600,826,941	23.30	1,485,500,573	21.65	1,380,375,063
2013	40.43	2,040,755,245	30.21	1,524,971,036	27.51	1,388,903,729	25.10	1,267,148,447
2014	53.36	178,099,893	37.62	125,553,397	33.62	112,233,143	30.12	100,532,747
2015	84.81	497,446,927	56.40	330,830,618	49.49	290,255,504	43.52	255,268,929
2016	115.92	649,423,699	72.73	407,456,463	62.63	350,863,417	54.08	302,960,948
2017	135.54	816,049,722	80.23	483,018,577	67.80	408,228,031	57.48	346,084,744
2018	147.86	920,657,578	82.56	514,090,383	68.49	426,442,595	57.01	354,953,351
2019	153.54	968,914,883	80.89	510,412,274	65.85	415,550,986	53.82	339,598,756
2020	161.42	1,035,573,464	80.22	514,648,286	64.10	411,240,471	51.43	329,965,620
2021	166.50	1,078,643,761	78.06	505,710,286	61.22	396,615,072	48.23	312,444,676
2022	175.23	1,152,639,429	77.50	509,813,531	59.66	392,428,820	46.14	303,525,987
2023	183.74	1,224,798,349	76.67	511,065,557	57.92	386,107,520	43.99	293,206,987
2024	190.54	1,282,412,317	75.00	504,816,843	55.62	374,323,931	41.47	279,090,284
2025	194.11	1,312,695,559	72.09	487,488,423	52.46	354,780,852	38.40	259,709,818
2026	194.77	1,320,491,618	68.24	462,626,040	48.74	330,451,745	35.03	237,502,025
2027	194.71	1,317,774,659	64.35	435,541,670	45.12	305,344,286	31.84	215,466,687
2028	195.00	1,320,249,720	60.80	411,660,103	41.84	283,257,211	28.99	196,246,708
2029	196.24	1,345,619,906	57.73	395,821,365	38.98	267,315,128	26.52	181,834,386
2030	197.20	1,338,920,606	54.73	371,557,293	36.27	246,281,735	24.23	164,481,005
2031	198.00	1,345,631,220	51.83	352,282,568	33.72	229,181,564	22.11	150,277,616
2032	198.00	1,345,631,220	48.90	332,342,045	31.22	212,205,152	20.10	136,616,014
2033	198.00	1,345,631,220	46.13	313,530,231	28.91	196,486,252	18.27	124,196,377
2034	198.00	1,345,631,220	43.52	295,783,237	26.77	181,931,714	16.61	112,905,797
2035	198.00	1,345,631,220	41.06	279,040,790	24.79	168,455,291	15.10	102,641,634
2036	198.00	1,345,631,220	38.73	263,246,028	22.95	155,977,121	13.73	93,310,576
2037	198.00	1,345,631,220	36.54	248,345,310	21.25	144,423,261	12.48	84,827,796
2038	198.00	1,345,631,220	34.47	234,288,028	19.68	133,725,241	11.35	77,116,179
2039	198.00	1,345,631,220	32.52	221,026,441	18.22	123,819,668	10.32	70,105,617
2040	198.00	1,345,631,220	30.68	208,515,511	16.87	114,647,841	9.38	63,732,379
2041	198.00	1,347,836,546	28.94	197,035,134	15.62	106,329,384	8.53	58,033,480
2042	198.00	1,345,631,220	27.31	185,578,062	14.46	98,292,044	7.75	52,671,388
2043	198.00	1,345,631,220	25.76	175,073,644	13.39	91,011,152	7.05	47,883,080
2044	198.00	1,360,494,498	24.30	166,988,145	12.40	85,200,392	6.41	44,010,887
2045	198.00	1,345,631,220	22.93	155,814,920	11.48	78,027,394	5.82	39,572,793
2046	198.00	1,345,631,220	21.63	146,995,207	10.63	72,247,587	5.29	35,975,266
2047	198.00	1,345,631,220	20.40	138,674,724	9.84	66,895,914	4.81	32,704,788
2048	198.00	1,345,631,220	19.25	130,825,211	9.11	61,940,661	4.37	29,731,625
2049	198.00	1,345,631,220	18.16	123,420,010	8.44	57,352,464	3.98	27,028,750
2050	198.00	1,345,631,220	17.13	116,433,972	7.81	53,104,133	3.62	24,571,591
2051	198.00	1,345,631,220	16.16	109,843,370	7.23	49,170,494	3.29	22,337,810
2052	198.00	1,345,631,220	15.25	103,625,821	6.70	45,528,235	2.99	20,307,100
2053	198.00	1,345,631,220	14.38	97,760,208	6.20	42,155,773	2.72	18,461,000
2054	198.00	1,345,631,220	13.57	92,226,612	5.74	39,033,123	2.47	16,782,727
2055	198.00	1,345,631,220	12.80	87,006,237	5.32	36,141,781	2.24	15,257,025
2056	198.00	1,345,631,220	12.08	82,081,356	4.92	33,464,612	2.04	13,870,023
2057	198.00	1,345,631,220	11.39	77,435,241	4.56	30,985,752	1.86	12,609,111
2058	198.00	1,345,631,220	10.75	73,052,115	4.22	28,690,511	1.69	11,462,829
2059	198.00	1,345,631,220	10.14	68,917,089	3.91	26,565,288	1.53	10,420,753
TOTAL	**8600**	**66,382,843,000**	**2,020**	**20,460,039,000**	**1,410**	**15,947,786,000**	**1,020**	**13,026,087,000**
URV				**10.13**		**11.31**		**12.77**

UNIT REFERENCE VALUE CALCULATIONS AT DIFFERENT DISCOUNTED RATES- 30 year analysis period (2014-2044)

TOTAL	**5630**	**46,198,375,000**	**1,780**	**18,855,927,000**	**1,300**	**15,226,482,000**	**975**	**12,694,994,000**
URV				**10.59**		**11.72**		**13.01**

UNIT REFERENCE VALUE CALCULATIONS AT DIFFERENT DISCOUNTED RATES- 20 year analysis period (2014-2034)

TOTAL	**3650**	**32,724,994,000**	**1,460**	**16,676,790,000**	**1,120**	**14,004,601,000**	**873**	**12,000,661,000**
URV				**11.42**		**12.51**		**13.74**

Summary Sheet

	Component	Total (R)	Upgrade to Ultimate System Capacity (R) [1]
	Mokolo Scheme – Phase 1 [2]		
1.1	Pump Station (Maximum duty 1,5 m^3/s @ 263 m) - Civil Works - Mechanical & Electrical Work	 64,805,000 70,770,000	N/A
1.2	Rising Main - 900mm diameter (5 700 m)	 86,540,000	N/A
1.3	Gravity Mains[3] - 1900mm diameter (1 400 m) - 1100mm diameter (42 950 m) - 1000mm diameter (19 970 m) - 900mm diameter (11 770 m) - 800mm diameter (1 940 m)	 51,243,000 692,875,000 308,070,000 152,910,000 27,544,000	N/A
1.4	Eskom Electricity to Site	76,430,000	N/A
1.5	Compensation	2,170,000	N/A
1.6	Environmental and Socio-economic	1,000,000	N/A
	Sub Total – Phase 1	**1,534,357,000**	
	Crocodile River (West) Scheme - Phase 2		
2.1	Abstraction Weir and Low-Lift Pump Station Civil Works	247,983,890	
2.2	Low-Lift Pump Station M&E Works [4],[5]	74,073,110	74,073,110
2.3	Rising Main to De-silting Works	171,573,000	171,573,000
2.4	De-silting Works	86,148,000	86,148,000
2.5	High-Lift Pump Station Balancing Reservoir [6]	318,909,000	
	Sub Total – River Abstraction Works	**898,687,000**	**331,794,110**
3.1	High lift pump station (Maximum duty 6,6 m^3/s @ 255 m)	350,544,000	N/A
3.2	Rising Main[7] - 1900mm diameter (26 700 m)	 1,263,545,000	N/A
3.3	Gravity Mains (not constructed under Phase 1)[8] - 2200mm diameter (62 700 m) - 2300mm diameter (28 200 m) - 800mm diameter (1940 m)	 3,464,072,000 1,440,550,000 28,110,000	N/A
3.4	Break Pressure and Operational reservoir	118,964,000	N/A
3.5	Eskom electricity to Vlieëpoort site[9]	156,564,000	N/A
	Sub Total – Crocodile River (West) Transfer Scheme	**6,822,349,000**	
	TOTAL COMBINED CAPITAL – MOKOLO CROCODILE RIVER (WEST) WATER AUGMENTATION PROJECT	**9,255,393,000**	

Operation and Maintenance Summary Sheet

	Component	Total (R)
	Mokolo Scheme – Phase 1	
1.1	Pump Station	
	- Civil Works	141,000
	- Mechanical & Electrical	2,462,000
	- Electricity	14,131,000
1.2	Rising Main	376,000
1.3	Gravity Mains	
	- 1900mm diameter (1 400 m)	223,000
	- 1100mm diameter (42 950 m)	3,012,000
	- 1000mm diameter (19 970 m)	1,339,000
	- 900mm diameter (11 770 m)	665,000
	- 800mm diameter (1 940 m)	120,000
1.4	Raw Water Costs	58,571,000
	Existing Exxaro Pump Station	
	- Civil	6,000
	- Mechanical & Electrical	223,000
	Existing Exxaro Pipeline	165,000
	Sub Total	**81,434,000**
	Crocodile River (West) Scheme - Phase 2	
2.1	Abstraction Weir, Low-Lift Pump Station, De-silting Works and Balancing Dam	
	- Civil	995,000
	- Mechanical & Electrical	2,035,000
	- Electricity	17,336,000
	Sub Total – River Abstraction Works	**20,366,000**
3.1	High lift pump station (Maximum duty 6,6 m^3/s @ 255 m)	
	- Civil	87,000
	- Mechanical & Electrical	4,797,000
	- Electricity	76,866,000
3.2	Rising Main	3,018,000
3.3	Gravity Mains (not constructed under Phase 1)	
	- 2200mm diameter (62 700 m)	8,304,000
	- 2300mm diameter (28 200 m)	3,478,000
	- 800mm diameter (1940 m)	66,000
3.4	Break pressure and Operational Reservoirs	308,000
3.5	Raw water costs	1,142,408,000
	Sub Total – Crocodile River (West) Transfer Scheme	**1,239,332,000**
4	Annual River Management Cost	4,500,000
	TOTAL COMBINED O&M – MOKOLO CROCODILE RIVER (WEST) WATER AUGMENTATION PROJECT	**1,345,632,000**

Summary of Discounted Present Value

Discount Rate	Capital (R)	O&M (R)	Total (R)
6%	7,726,136,000	12,733,903,000	20,460,039,000
8%	7,265,744,000	8,682,042,000	15,947,786,000
10%	6,844,128,000	6,181,959,000	13,026,087,000

Unit Reference Values

Discount Rate	Discounted Present Value of Water @ R1/m^3	Discounted Present Value (R)	Unit Reference Value (R/m^3)
6%	2,020	20,460,039,000	10.14
8%	1,410	15,947,786,000	11.35
10%	1,020	13,026,087,000	12.72

PUMP STATION, RISING MAIN AND ELECTRICITY COST CALCULATIONS

DESCRIPTION		***UNIT/RATE***	***HL PS - BPR***	***LL PS - HL PS***	***TOTAL***
Start Chainage			0	0	
End Chainage			26,735	5,000	
PUMP HEAD AND FLOW RATE					
Flow rate (duty) (Qd) 347 day average flow		m³/s	5.779	5.779	
installed capacity (Qi = Qp x (1 + Ps))		m³/s	8.24	7.42	
Required peak capacity (Qp = Q365 x Peak Refill factor)		m³/s	6.593	6.593	
Peak factor	1.20000				
Head pumped (under normal operating conditions):					
static head (Hst)		m	190.00	38.00	**228.00**
rising main friction loss(Hf)		m	44.77	4.84	**49.61**
rising main secondary losses(Hv)		m	6.68	1.25	**7.93**
pump station secondary losses(Hps)		m	4.00	4.00	**8.00**
additional pumping head		m	10.00	0.00	**10.00**
Total head (duty) (Hd = Hst + Hf + Hv + Hps)		m	255.45	48.09	**303.54**
Head pumped (under peak operating conditions):					
static head (Hst)		m	190.00	38.00	**228.00**
rising main friction loss(Hf)		m	58.14	6.28	**64.41**
rising main secondary losses(Hv)		m	6.68	1.25	**7.93**
pump station secondary losses(Hps)		m	4.00	4.00	**8.00**
additional pumping head		m	0.00	0.00	**0.00**
Total head (peak) (Hd = Hst + Hf + Hv + Hps)		m	258.82	49.53	**308.35**
All further information on this sheet is calculated for normal operating conditions					
RISING MAIN					
length (L)		m	26,735	5,000	**31,735**
nominal diameter (ND)		mm	1,900	2100	
outer diameter (OD)		mm	1,930	2,134	
inner diameter (ID)		mm	1,895	2,108	
minimum yield stress of steel		MPa	290.00	290.00	
minimum wall thickness (tmin = D/160)		mm	12.00	13.00	
required wall thickness (t)		mm	17.00	4.00	
chosen wall thickness (t)		mm	17.27	13.13	
number of pipes in parallel (n)		no	1.00	1.00	
flow per pipe (Qp)		m³/s	5.78	5.78	
velocity per pipe (Vp)		m/s	2.05	1.66	
secondary losses in rising main		m/km	0.25	0.25	
INPUT FOR COLEBROOK-WHITE & DARCY-WEISBACH					
friction coefficient (l)		-	0.01485	0.01458	
effective roughness (k)		mm	0.500	0.500	
Reynolds number (Re)		-	3,435,369	3,089,281	
pipe cross sectional area (A)		m²	2.8217	3.4894	
kinematic viscosity (nu)		m²/s	1.13E-06	1.13E-06	
gravity constant (g)		m/s²	9.81	9.81	
PUMP SET EFFICIENCIES					
Efficiency of pump (Ep)		%	90.0%	75.0%	
Efficiency of motor (Em)		%	97.0%	97.0%	
Average loss in efficiency between major overhauls (Eo)		%	1.5%	1.5%	
Overall efficiency (Et = Ep x Em x (1 - Eo))		%	86.0%	71.7%	
MW/MVA ratio (power factor Pf)		-	0.96	0.96	
Standby allowance (Ps)		%	25.0%	12.5%	

DESCRIPTION		***UNIT/RATE***	***HL PS - BPR***	***LL PS - HL PS***	***TOTAL***
PUMP STATION POWER REQUIREMENTS					
power req'd at duty point (Pd = 9.81 x 1000 x Qd x Hd / Et)		MW	16.8	3.8	**20.6**
power absorbed at Qd: (Pd / Pf)		MVA	17.5	4.0	**21.5**
power absorbed at Qi: (Pd x Pf x (1 + Ps))		MVA	21.9	4.5	**26.4**
head pumped (Hd)		m	255.45	48.09	**303.5**
Energy consumed over 24 hours (continuous use)	24	MWh	404	91	**496**
power req'd at peak point (Pp = 9.81 x 1000 x Qp x Hp / Et)		MW	19.5	4.5	**23.9**
power absorbed at Qp: (Pp / Pf)		MVA	20.3	4.7	**24.9**
ADDITIONAL PUMP STATION PARAMETERS					
Access road to pump station		km	5.00	0.00	**5.00**
PUMP STATION COST (single stage vertical)					
mechanical: pump & motor		60% of total A1	R 48,211,578	R 0	**R 48,211,578**
mechanical: valves		25% of total A1	R 20,088,158	R 0	**R 20,088,158**
mechanical: pipework		15% of total A1	R 12,052,895	R 0	**R 12,052,895**
Total mechanical cost (total A1)		67% of total A2	R 80,352,630	R 0	**R 80,352,630**
Total electrical cost		33% of total A2	R 39,576,669	R 0	**R 39,576,669**
Total civil cost		0% Estimated	R 34,800,000	R 0	**R 34,800,000**
Subtotal: elec/mech cost (total A2)			R 119,929,299	0.00	**R 119,929,299**
access road cost	R/km	R 3,000,000	R 15,000,000	R 0	**R 15,000,000**
Subtotal: (total A3)			**R 134,929,299**	**R 0**	**R 134,929,299**
landscaping		5%	R 6,746,465	R 0	**R 6,746,465**
miscellaneous		10%	R 13,492,930	R 0	**R 13,492,930**
Subtotal: (total A)			**R 155,168,694**	**R 0**	**R 155,168,694**
Preliminary and General		30%	R 46,550,608	R 0	**R 46,550,608**
Preliminary Work			R 0	R 0	**R 0**
Subtotal: (total B)			**R 201,719,302**	**R 0**	**R 201,719,302**
Contingencies		20%	R 40,343,860	R 0	**R 40,343,860**
Subtotal: (total C)			**R 242,063,163**	**R 0**	**R 242,063,163**
Planning, design and supervision fees		15%	R 36,309,474	R 0	**R 36,309,474**
Total cost excluding VAT (total D)			**R 278,372,637**	**R 0**	**R 278,372,637**
Cost of ESKOM transmission lines to site				R 0	**R 0**
Connection fee			R 152,638,967	R 3,925,000	**R 156,563,967**
Value Added Tax		14%	R 60,341,625	R 0	**R 60,341,625**
Relocations and land acquisition			R 375,000	R 0	**R 375,000**
Total cost including VAT			**R 491,728,229**	**R 3,925,000**	**R 495,653,229**

ANNUAL COST OF ELECTRICITY (24 h operation @ Design Capacity)					
Network Access Charge	R/kVa/mth	R 8.40	R 1,768,387	R 399,454	**R 2,167,841**
Network Demand Charge	R/kVa/mth	R 9.50	R 1,035,694	R 233,949	**R 1,269,643**
Reactive Energy Charge	R/kVaRh	R 0.0374	R 744,119	R 168,086	**R 912,205**
Voltage Surcharge	%/R	11.00%	R 2,982,749	R 673,762	**R 3,656,511**
Annual energy Cost	R/MWh	R 173.34	R 24,311,818	R 5,491,707	**R 29,803,525**
Service & Admin Charge	R/day	R 131.66	R 48,056	R 0	**R 48,056**
Total annual cost			R 30,890,822	R 6,966,958	**R 37,857,780**

ELECTRICITY COSTS

Number of pumps	4 (excluding standby)	Down Time	18.0 days
Standby pumps	1	Down Time Peak	1.05
Flow per pump 347 days	1.445 m³/s	Refill period	90 days
Total flow 347 days	5.779 m³/s	Refill Peak	1.2000
Total flow 365 days	5.494 m³/s		
Pumps Active	347.0 days per annum		
Pumping Peak factor based on refill perioc	1.2000		

YEAR	HOURS	NUMBER OF PUMPS		MWh	ANNUAL ELECTRICITY COST FOR PUMP STATIONS					ENERGY	TOTAL
	PUMPED	INSTALLED	ACTIVE	per day	DEMAND& ACCESS	ENERGY	SERVICE	REACTIVE & SURCHARGE	TOTAL	ESCALATION FACTOR	
0	0.00			0	0	0			0	1.00	0
1	0.00			0	0	0			0	1.20	0
2	0.00			0	0	0			0	1.44	0
3	0.00			0	0	0			0	1.73	0
4	0.00			0	0	0			0	2.07	0
5	0.00			0	0	0			0	2.49	0
6	3.66	3	2	31	1,402,040	1,854,617	48,056	1,199,194	4,503,907	2.49	11,207,163
7	19.73	3	2	166	1,402,040	9,991,803	48,056	3,195,851	14,637,750	2.49	36,423,407
8	16.54	4	3	209	2,103,061	12,564,397	48,056	2,799,440	17,514,953	2.49	43,582,809
9	20.23	4	3	256	2,103,061	15,372,782	48,056	3,258,843	20,782,741	2.49	51,714,111
10	22.55	4	3	285	2,103,061	17,135,526	48,056	3,547,198	22,833,840	2.49	56,817,902
11	23.63	4	3	298	2,103,061	17,949,361	48,056	3,680,328	23,780,806	2.49	59,174,254
12	18.83	5	4	317	2,804,081	19,076,190	48,056	3,084,523	25,012,850	2.49	62,239,974
13	19.55	5	4	329	2,804,081	19,803,374	48,056	3,173,739	25,829,250	2.49	64,271,440
14	20.78	5	4	350	2,804,081	21,052,692	48,056	3,327,014	27,231,843	2.49	67,761,540
15	21.99	5	4	370	2,804,081	22,271,377	48,056	3,476,531	28,600,045	2.49	71,166,064
16	22.95	5	4	386	2,804,081	23,244,274	48,056	3,595,893	29,692,304	2.49	73,883,953
17	23.45	5	4	395	2,804,081	23,755,651	48,056	3,658,633	30,266,420	2.49	75,312,539
18	23.54	5	4	397	2,804,081	23,850,059	48,056	3,670,215	30,372,411	2.49	75,576,277
19	23.54	5	4	396	2,804,081	23,841,419	48,056	3,669,155	30,362,711	2.49	75,552,141
20	23.58	5	4	397	2,804,081	23,883,214	48,056	3,674,283	30,409,634	2.49	75,668,900
21	23.75	5	4	400	2,804,081	24,060,638	48,056	3,696,051	30,608,826	2.49	76,164,554
22	23.89	5	4	402	2,804,081	24,198,499	48,056	3,712,965	30,763,601	2.49	76,549,683
23	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
24	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
25	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
26	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
27	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
28	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
29	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
30	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
31	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
32	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
33	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
34	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
35	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
36	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
37	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
38	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
39	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
40	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
41	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
42	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
43	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
44	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
45	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
46	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
47	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
48	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
49	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
50	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
51	24.00	5	4	404	2,804,081	24,311,818	48,056	3,726,867	30,890,822	2.49	76,866,250
TOTAL					**123,379,551**	**1,028,948,590**	**2,210,571**	**164,499,014**	**1,319,037,727**		**3,282,187,956**

ELECTRICITY COSTS - LOW LIFT PUMP STATION

Number of pumps	8 (excluding standby)	Down Time	18.0 days
Standby pumps	1	Down Time Peak	1.05
Flow per pump 347 days	0.722 m³/s	Refill period	90 days
Total flow 347 days	5.779 m³/s	Refill Peak	1.2000
Total flow 365 days	5.494 m³/s		
Pumps Active	347.0 days per annum		
Pumping Peak factor based on refill perioc	1.2000		

YEAR	HOURS	NUMBER OF PUMPS		MWh	ANNUAL ELECTRICITY COST FOR PUMP STATIONS					ENERGY ESCALATION FACTOR	TOTAL
	PUMPED	INSTALLED	ACTIVE	per day	DEMAND& ACCESS	ENERGY	SERVICE	REACTIVE & SURCHARGE	TOTAL		
0	0.00			0	0	0			0	1.00	0
1	0.00			0	0	0			0	1.20	0
2	0.00			0	0	0			0	1.44	0
3	0.00			0	0	0			0	1.73	0
4	0.00			0	0	0			0	2.07	0
5	0.00			0	0	0			0	2.49	0
6	14.65	2	1	7	79,175	418,933	0	579,268	1,077,376	2.49	2,680,855
7	19.73	5	4	38	316,702	2,257,011	0	721,899	3,295,612	2.49	8,200,538
8	19.85	6	5	47	395,877	2,838,125	0	725,209	3,959,211	2.49	9,851,785
9	20.23	7	6	58	475,053	3,472,501	0	736,128	4,683,681	2.49	11,654,498
10	22.55	7	6	64	475,053	3,870,681	0	801,263	5,146,997	2.49	12,807,375
11	20.25	8	7	67	554,228	4,054,515	0	736,586	5,345,329	2.49	13,300,888
12	21.52	8	7	72	554,228	4,309,050	0	772,275	5,635,553	2.49	14,023,060
13	22.34	8	7	74	554,228	4,473,311	0	795,307	5,822,846	2.49	14,489,104
14	23.75	8	7	79	554,228	4,755,515	0	834,876	6,144,619	2.49	15,289,777
15	21.99	9	8	84	633,403	5,030,799	0	785,301	6,449,503	2.49	16,048,428
16	22.95	9	8	87	633,403	5,250,563	0	812,263	6,696,230	2.49	16,662,362
17	23.45	9	8	89	633,403	5,366,076	0	826,435	6,825,915	2.49	16,985,060
18	23.54	9	8	90	633,403	5,387,402	0	829,051	6,849,856	2.49	17,044,635
19	23.54	9	8	90	633,403	5,385,450	0	828,812	6,847,665	2.49	17,039,183
20	23.58	9	8	90	633,403	5,394,891	0	829,970	6,858,265	2.49	17,065,557
21	23.75	9	8	90	633,403	5,434,969	0	834,887	6,903,259	2.49	17,177,519
22	23.89	9	8	91	633,403	5,466,110	0	838,708	6,938,221	2.49	17,264,514
23	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
24	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
25	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
26	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
27	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
28	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
29	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
30	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
31	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
32	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
33	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
34	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
35	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
36	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
37	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
38	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
39	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
40	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
41	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
42	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
43	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
44	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
45	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
46	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
47	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
48	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
49	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
50	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
51	24.00	9	8	91	633,403	5,491,707	0	841,848	6,966,958	2.49	17,336,022
TOTAL					**27,394,698**	**232,425,395**	**0**	**37,701,839**	**297,521,933**		**740,329,776**

BOQ: PIPELINES

					P1	HL PS - BPR	P2	BPR - OR	P3	OR - Steenbokpan	P4	Node 37 to 37A		
No	**Pay Ref**	**Description**	**Unit**	**Rate**	QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT	**QUANTITY**	**AMOUNT (RANDS)**
					1		1		1		1			
1.		Route Clearing & grubbing												
		(a) Sparse, bush & trees	Ha	10,300	134	1,380,200	314	3,234,200	131	1,349,300	6	61,800	585	6,025,500
2.		Road, river and rail crossings	1,900											
		(a) national & provincial road	no	2,020,000	1	2,020,000	2	4,040,000	0	0	2	2,460,000	5	8,520,000
		(b) gravel road	no	640,000	4	2,560,000	4	2,560,000	4	2,560,000	3	600,000	15	8,280,000
		(c) river	no	1,350,000	0	0	1	1,350,000	0	0	0	0	1	1,350,000
		(d) rail	no	2,020,000	0	0	0	0	0	0	0	0	0	0
3.		Trench Excvation & backfill												
		(a) Excavation												
		All materials	m^3	50	370447	18,522,363	1078013	53,900,646	471719	23,585,934	10001	500,042	1,930,180	96,508,985
		E/O Hard	m^3	100	166701	16,670,127	485106	48,510,581	212273	21,227,341	4500	450,038	868,581	86,858,086
		(b) Bedding												
		From trench	m^3	135	7050	951,741	19404	2,619,570	8317	1,122,796	317	42,734	35,088	4,736,841
		From commercial sources	m^3	235	16450	3,865,714	45277	10,639,982	19406	4,560,493	739	173,575	81,871	19,239,763
		(c) Bedding Cradle & Fill Blanket												
		From trench	m^3	210	32380	6,799,709	100254	21,053,248	44014	9,242,943	950	199,523	177,597	37,295,423
		From commercial sources	m^3	245	75552	18,510,320	233925	57,311,619	102699	25,161,344	2217	543,146	414,394	101,526,428
		(d) Main Fill												
		From trench	m^3	55	160802	8,844,137	432757	23,801,658	185210	10,186,551	4772	262,435	783,541	43,094,781
		(e) Spoil	m^3	45	170215	7,659,687	525598	23,651,897	234178	10,537,994	3963	178,319	933,953	42,027,897
4.		Pipelines												
		(a) Supply of steel pipe: D/t ratio as specified. Sintakote external coating and epoxy internal lining												
		Dia (mm) Grade D/t												
	P1	1900 API Grade X42 110	m	14,977	26,735	400,405,287							26,735	400,405,287
	P2	2200 API Grade X42 130	m	17,484			62,748	1,097,087,745					62,748	1,097,087,745
	P3	2300 API Grade X42 140	m	17,459					26,127	456,151,293			26,127	456,151,293
	P4	800 API Grade X42 130	m	2,730							1,940	5,296,200	1,940	5,296,200
		(b) Laying & jointing (% of a)		20%		80,081,057		219,417,549		91,230,259		1,059,240		391,788,105
		(c) Air valve, Isolating Valve, Scour Valve, Access All valve types, incl chamber - civil & mechanical	m	varies	26,735	18,714,275	62,748	52,708,402	26,127	22,469,220	1,940	349,200	117,550	94,241,098
		(d) Cathodic Protection	Sum			16,545,917		38,834,386		16,169,829		970,358		72,520,490
		SUB-TOTAL A				603,530,535		1,660,721,483		695,555,295		13,146,610		**2,972,953,924**
5.		Landscaping & EIA Remediation (% of Sub-total A)	%	5		30,176,527		83,036,074		34,777,765		657,331		148,647,696
6.		Miscellaneous (% of Sub-total A)	%	10		60,353,054		166,072,148		69,555,529		1,314,661		297,295,392
		SUB TOTAL B				694,060,115		1,909,829,706		799,888,589		15,118,602		**3,418,897,012**
7.		Preliminary & General (% of Sub-total B)	%	30		208,218,035		572,948,912		239,966,577		4,535,581		1,025,669,104
		To include below												
8.		Preliminary works												
		(a) Access road	km	350,000	26.73	9,357,138	62.75	21,961,834	5.00	1,750,000	1.94	679,000	96	33,747,972
		SUB TOTAL C				911,635,288		2,504,740,452		1,041,605,166		20,333,182		**4,478,314,088**
10.		Contingencies (% of Sub-total C)	%	20		182,327,058		500,948,090		208,321,033		4,066,636		895,662,818
		SUB TOTAL D				1,093,962,345		3,005,688,542		1,249,926,199		24,399,819		**5,373,976,906**
11.		Planning design & supervision (% of Sub-total D)	%	15		164,094,352		450,853,281		187,488,930		3,659,973		806,096,536
		SUB TOTAL E				1,258,056,697		3,456,541,824		1,437,415,129		28,059,792		**6,180,073,442**
12.		VAT (% of sub total E)	%	14		176,127,938		483,915,855		201,238,118		3,928,371		865,210,282
		NETT PROJECT COST				1,434,184,635		3,940,457,679		1,638,653,247		31,988,163		**7,045,283,723**
13.		Cost of relocations	Sum			2,280,000		0		0		0		2,280,000
14.		Cost of land acquisition	Sum			3,208,161		7,529,772		3,135,240		50,000		13,923,173
		TOTAL RISING MAIN COST				1,439,672,796		3,947,987,451		1,641,788,487		32,038,163		**7,061,486,897**
		TOTAL RISING MAIN COST (EXCL VAT)				**1,263,544,859**		**3,464,071,596**		**1,440,550,369**		**28,109,792**		**6,196,276,615**

BOQ: RESERVOIR

No	PAY REF	DESCRIPTION	UNIT	RATE 1-Apr-08 (Rand)	QUANTITY	AMOUNT (Rand)
1	**1.0**	**Clearing**				
	1.1	a) Sparse	ha	5,533	0.6	3,255
	1.2	b) Bush	ha	16,598	1.2	19,527
	1.3	c) Trees	ha	27,664	4.1	113,911
3	**3.0**	**Excavation**				
	3.1	(a) Bulk				
	3.1.1	(i) all materials	m^3	40	70,600	2,824,000
	3.1.2	(ii) extra over for rock	m^3	71	21,200	1,505,200
	3.2	(b) Confined				
	3.2.1	(i) all materials	m^3	59	5,300	312,700
	3.2.2	(ii) extra over for rock	m^3	99	2,120	209,880
4	**4.0**	**Preparation of solum**				
	4.1	a) all materials	m^2	20	10,900	218,000
	4.2	b) extra over for rock	m^2	20	6,540	130,800
5	**5.0**	**Drilling & Grouting**				
	5.1	(a) Curtain grouting	m drill	443	-	-
	5.2	(b) Consolidation grouting	m drill	443	-	-
	5.3	(c) Jet grouting	m drill	4,370	-	-
6	**6.0**	**Embankment**				
	6.1	(a) Earthfill	m^3	47	64,300	3,022,100
	6.2	(b) Filters	m^3	174	3,600	626,400
	6.3	(c) Rip-rap	m^3	95	-	-
	6.4	(d) Overhaul beyond 5km	m^3.km	4	-	-
	6.5	(e) Waterproof Membrane	m^2	200	36,300	7,260,000
7	**7.0**	**Concrete works**				
	7.1	a) Formwork				
	7.1.1	(i) Gang formed	m^2	257	200	51,400
	7.1.2	(ii) Intricate	m^2	316	50	15,800
	7.2	(b)Concrete				
	7.2.1	(i) Mass	m^3	1,156	500	578,000
	7.2.2	(ii) Structural	m^3	1,482	600	889,200
	7.3	(c) Reinforcing	t	12,350	50	617,500
		SUB-TOTAL				**18,397,673**

BOQ: RESERVOIR

8	**8.0**	**Mechanical Items**				
	8.1	(a) Pipes, Valves & Screens	Sum	8,850,000	1	8,850,000
	8.2	(b) Cranes & hoists	Sum	600,000	1	600,000
	8.3	(c) Structural steelwork	Sum	150,000	1	150,000
9	**9.0**	**Fencing**	km	27,664	0.5	13,724
10	**10.0**	**Landscaping** (% of 1-9)	%	5		919,884
11	**11.0**	**Miscellaneous** (% of 1-9)	%	10		1,839,767
		SUB TOTAL A				**30,771,048**
12	**12.0**	**Preliminary & General** (% of sub-total A)	%	30		9,231,314
13	**13.0**	**Preliminary works**				
	13.1	(a) Access road	km	350,000	5.0	1,750,000
	13.2	(b) Electricity to site	Sum	250,000	1	250,000
	13.3	(c) Water to site-construction (not potable)	Sum	150,000	1	150,000
	13.4	(d) Railhead & materials handling	Sum	275,965	1	275,965
14	**14.0**	**Accomodation**	Sum	461,566	1	461,566
		SUB TOTAL B				**42,889,893**
15	**15.0**	**Contingencies** (% of sub total B)	%	20		8,577,979
		SUB TOTAL C (Civils Total)				51,467,872
16	**16.0**	**Planning design & supervision** (% of sub-total C)	%	15		7,720,181
		SUB TOTAL D				**59,188,053**
17	**17.0**	**VAT** (% of sub-total D)	%	14		8,286,327
		NETT PROJECT COST				**67,474,380**
18	**18.0**	Cost of relocations	Sum	-		-
19	**19.0**	Cost of land acquisition	Sum	294,120	1	294,120
		TOTAL PROJECT COST				**67,768,500**
		TOTAL PROJECT COST (excl vat)				**59,482,173**

BOQ: HIGH LIFT PUMP STATION

No	PAY REF	DESCRIPTION	UNIT	RATE 2008 RAND	QUANTITY	AMOUNT	AMOUNT
1.		Mechanical and Electrical	Sum			119,929,299	119,929,299
2.		Civils (a) Estimated Civil Component	Sum			34,800,000	34,800,000
		(c) Permanent access road	km	3,000,000	5.00	15,000,000	15,000,000
		SUB-TOTAL A				**169,729,299**	**169,729,299**
3.	11.0	Landscaping (% of Sub-total A)	%	5		8,486,465	8,486,465
4.	12.0	Miscellaneous (% of Sub-total A)	%	10		16,972,930	16,972,930
		SUB TOTAL B				**195,188,694**	**195,188,694**
5.	13.0	Preliminary & General (% of sub-total B)	%	30		58,556,608	58,556,608
		SUB TOTAL C				**253,745,302**	**253,745,302**
6.	17.0	Contingencies (% of sub total C)	%	20		50,749,060	50,749,060
		SUB TOTAL D				304,494,363	**304,494,363**
7.	16.0	Planning design & supervision fees, time cost & transport (% of sub total D)	%	15		45,674,154	45,674,154
		SUB TOTAL E				350,168,517	**350,168,517**
8.	18.0	VAT (% of sub total E)	%	14		49,023,592	49,023,592
		NETT PUMP STATION COST				**399,192,110**	**399,192,110**
10.	20.0	Cost of land acquisition	Sum			375,000	375,000
11.	21.0	Cost of ESKOM transmission lines to site + Connection fee	Sum			178,482,923	178,482,923
		TOTAL PUMP STATION COST				578,050,032	**578,050,032**

TOTAL PUMP STATION COST (EXCL VAT)	507,107,485	**507,107,485**

Mokolo and Crocodile (West) Water Augmentation Project Feasibility Study

MCWAP Combined URV

YEAR	RAW WATER COST	RIVER MANAGEMENT COST	Environmental & Social Impacts	BREAK PRESSURE AND OPERATIONAL RESERVOIRS		RISING MAIN (VHL PS TO BPR) COSTS		GRAVITY LINE (BPR TO OR) COSTS		GRAVITY LINE (OR TO Node 54) COSTS		GRAVITY LINE (Node 37 TO Node 37A) COSTS		WEIR, ABSTRACTION WORKS, LOW LIFT PUMPSTATION, DESILTING WORKS & BALANCING DAM				HIGH LIFT PUMP STATION COSTS			
				CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE CIVIL	MAINTENANCE E&M	ELECTRICITY	CAPITAL	MAINTENANCE CIVIL	MAINTENANCE E&M	ELECTRICITY
					0.50%		0.50%		0.50%		0.50%				0.25%	4.00%			0.25%	4.00%	
2008																					0
2009																					0
2010	0	74,500,000	5,455,455	29,741,086		315,886,215		866,017,899		360,137,592		7,027,448		224,671,750				126,776,871			0
2011	0	4,500,000		29,741,086		315,886,215		866,017,899		360,137,592		7,027,448		224,671,750				126,776,871			0
2012	0	4,500,000		29,741,086		315,886,215		866,017,899		360,137,592		7,027,448		224,671,750				126,776,871			0
2013	0	4,500,000		29,741,086		315,886,215		866,017,899		360,137,592		7,027,448		224,671,750				126,776,871			0
2014	30,629,245	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	2,680,855		87,000	4,797,172	11,207,163
2015	279,691,689	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	8,200,538		87,000	4,797,172	36,423,407
2016	486,968,496	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	9,851,785		87,000	4,797,172	43,582,809
2017	643,660,504	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	11,654,498		87,000	4,797,172	51,714,111
2018	742,011,692	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	12,807,375		87,000	4,797,172	56,817,902
2019	787,419,132	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	13,300,888		87,000	4,797,172	59,174,254
2020	850,289,822	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	14,023,060		87,000	4,797,172	62,239,974
2021	890,862,608	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	14,489,104		87,000	4,797,172	64,271,440
2022	960,567,502	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	15,289,777		87,000	4,797,172	67,761,540
2023	1,028,563,247	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	16,048,428		87,000	4,797,172	71,166,064
2024	1,082,845,392	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	16,662,362		87,000	4,797,172	73,883,953
2025	1,111,377,351	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	16,985,060		87,000	4,797,172	75,312,539
2026	1,116,644,772	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,044,635		87,000	4,797,172	75,576,277
2027	1,116,162,726	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,039,183		87,000	4,797,172	75,552,141
2028	1,118,494,654	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,065,557		87,000	4,797,172	75,668,900
2029	1,128,393,946	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733	7,631,541	994,517	2,035,078	17,177,519	7,231,737	87,000	4,797,172	76,164,554
2030	1,136,085,801	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,264,514		87,000	4,797,172	76,549,683
2031	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2032	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2033	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2034	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2035	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2036	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2037	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2038	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2039	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2040	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2041	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2042	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2043	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2044	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733	7,631,541	994,517	2,035,078	17,336,022	7,231,737	87,000	4,797,172	76,866,250
2045	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2046	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2047	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2048	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2049	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2050	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2051	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2052	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2053	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2054	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2055	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2056	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2057	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2058	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
2059	1,142,408,339	4,500,000			307,710		3,017,653		8,303,607		3,477,776		65,733		994,517	2,035,078	17,336,022		87,000	4,797,172	76,866,250
TOTAL	**47,640,510,414**	**295,000,000**	**5,455,455**	**118,964,345**	**14,154,682**	**1,263,544,859**	**138,812,023**	**3,464,071,596**	**381,965,941**	**1,440,550,369**	**159,977,718**	**28,109,792**	**3,023,720**	**913,950,083**	**45,747,776**	**93,613,573**	**740,329,776**	**521,570,958**	**4,002,000**	**220,669,911**	**3,282,187,956**

Mokolo and Crocodile (West) Water Augmentation Project Feasibility Study

MCWAP Combined URV

YEAR	TOTAL ANNUAL COST CROCODILE TRANSFER SYSTEM		TOTAL ANNUAL COST MOKOLO TRANSFER SYSTEM		TOTAL ANNUAL COST COMBINED SCHEME		NET PRESENT COST (2008) AT 6%		NET PRESENT COST (2008) AT 8%		NET PRESENT COST (2008) AT 10%	
	CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION	CAPITAL	MAINTENANCE & OPERATION
								6.00%		8.00%		10.00%
2008	0	0			0	0	0	0	0	0	0	0
2009	0	0			0	0	0	0	0	0	0	0
2010	1,935,714,316	74,500,000	768,763,410	0	2,704,477,726	74,500,000	2,406,975,548	66,304,735	2,318,653,743	63,871,742	2,235,105,559	61,570,248
2011	1,930,258,861	4,500,000	806,558,386	0	2,736,817,247	4,500,000	2,297,884,535	3,778,287	2,172,573,769	3,572,245	2,056,211,305	3,380,917
2012	1,930,258,861	4,500,000	0	86,248,268	1,930,258,861	90,748,268	1,528,945,812	71,881,128	1,418,797,887	66,702,686	1,318,392,775	61,982,288
2013	1,930,258,861	4,500,000	0	105,996,384	1,930,258,861	110,496,384	1,442,401,710	82,569,326	1,313,701,747	75,201,982	1,198,538,886	68,609,561
2014	0	72,103,509	0	105,996,384	0	178,099,893	0	125,553,397	0	112,233,143	0	100,532,747
2015	0	351,901,881	64,110,684	81,434,363	64,110,684	433,336,243	42,637,266	288,193,351	37,407,968	252,847,536	32,898,918	222,370,011
2016	0	567,989,336	0	81,434,363	0	649,423,699	0	407,456,463	0	350,863,417	0	302,960,948
2017	0	734,615,360	0	81,434,363	0	816,049,722	0	483,018,577	0	408,228,031	0	346,084,744
2018	0	839,223,215	0	81,434,363	0	920,657,578	0	514,090,383	0	426,442,595	0	354,953,351
2019	0	887,480,521	0	81,434,363	0	968,914,883	0	510,412,274	0	415,550,986	0	339,598,756
2020	0	954,139,102	0	81,434,363	0	1,035,573,464	0	514,648,286	0	411,240,471	0	329,965,620
2021	0	997,209,398	0	81,434,363	0	1,078,643,761	0	505,710,286	0	396,615,072	0	312,444,676
2022	0	1,071,205,066	0	81,434,363	0	1,152,639,429	0	509,813,531	0	392,428,820	0	303,525,987
2023	0	1,143,363,986	0	81,434,363	0	1,224,798,349	0	511,065,557	0	386,107,520	0	293,206,987
2024	0	1,200,977,954	0	81,434,363	0	1,282,412,317	0	504,816,843	0	374,323,931	0	279,090,284
2025	0	1,231,261,196	0	81,434,363	0	1,312,695,559	0	487,488,423	0	354,780,852	0	259,709,818
2026	0	1,236,851,930	2,205,326	81,434,363	2,205,326	1,318,286,293	772,622	461,853,418	551,881	329,899,865	396,647	237,105,377
2027	0	1,236,340,297	0	81,434,363	0	1,317,774,659	0	435,541,670	0	305,344,286	0	215,466,687
2028	0	1,238,815,357	0	81,434,363	0	1,320,249,720	0	411,660,103	0	283,257,211	0	196,246,708
2029	14,863,278	1,249,322,265	0	81,434,363	14,863,278	1,330,756,628	4,372,114	391,449,252	2,952,676	264,362,453	2,008,483	179,825,903
2030	0	1,257,486,244	0	81,434,363	0	1,338,920,606	0	371,557,293	0	246,281,735	0	164,481,005
2031	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	352,282,568	0	229,181,564	0	150,277,616
2032	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	332,342,045	0	212,205,152	0	136,616,014
2033	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	313,530,231	0	196,486,252	0	124,196,377
2034	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	295,783,237	0	181,931,714	0	112,905,797
2035	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	279,040,790	0	168,455,291	0	102,641,634
2036	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	263,246,028	0	155,977,121	0	93,310,576
2037	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	248,345,310	0	144,423,261	0	84,827,796
2038	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	234,288,028	0	133,725,241	0	77,116,179
2039	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	221,026,441	0	123,819,668	0	70,105,617
2040	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	208,515,511	0	114,647,841	0	63,732,379
2041	0	1,264,196,858	2,205,326	81,434,363	2,205,326	1,345,631,220	322,388	196,712,746	173,976	106,155,408	94,954	57,938,526
2042	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	185,578,062	0	98,292,044	0	52,671,388
2043	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	175,073,644	0	91,011,152	0	47,883,080
2044	14,863,278	1,264,196,858	0	81,434,363	14,863,278	1,345,631,220	1,824,330	165,163,815	930,806	84,269,585	480,815	43,530,072
2045	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	155,814,920	0	78,027,394	0	39,572,793
2046	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	146,995,207	0	72,247,587	0	35,975,266
2047	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	138,674,724	0	66,895,914	0	32,704,788
2048	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	130,825,211	0	61,940,661	0	29,731,625
2049	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	123,420,010	0	57,352,464	0	27,028,750
2050	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	116,433,972	0	53,104,133	0	24,571,591
2051	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	109,843,370	0	49,170,494	0	22,337,810
2052	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	103,625,821	0	45,528,235	0	20,307,100
2053	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	97,760,208	0	42,155,773	0	18,461,000
2054	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	92,226,612	0	39,033,123	0	16,782,727
2055	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	87,006,237	0	36,141,781	0	15,257,025
2056	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	82,081,356	0	33,464,612	0	13,870,023
2057	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	77,435,241	0	30,985,752	0	12,609,111
2058	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	73,052,115	0	28,690,511	0	11,462,829
2059	0	1,264,196,858	0	81,434,363	0	1,345,631,220	0	68,917,089	0	26,565,288	0	10,420,753
TOTAL	**7,756,217,456**	**53,019,995,491**	**1,643,843,131**	**3,962,787,351**	**9,400,060,587**	**56,982,782,843**	**7,726,136,326**	**12,733,903,130**	**7,265,744,452**	**8,682,041,594**	**6,844,128,342**	**6,181,958,864**