Appendix-4 Results of Runoff Analysis

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Meta Bara Meta Meta <th< th=""><th></th><th></th><th>Current</th><th>Planned</th><th></th><th></th><th></th><th></th><th>Intercepting</th><th>Dine land</th><th>Floredon</th><th></th><th>land la</th><th>Lines Bo</th><th>land moth</th><th></th></th<>			Current	Planned					Intercepting	Dine land	Floredon		land la	Lines Bo	land moth	
(m) (m) <th>nent No.</th> <th>Length</th> <th>Flow 2DWF (2020)</th> <th>Flow SDWF (2040]</th> <th>Diameter</th> <th>Slope</th> <th>Full Velocity</th> <th>Flow Capacity</th> <th>rate (Capacity/DW F)</th> <th>Upstream</th> <th>t Elevation Downstream</th> <th>Upstream</th> <th>Downstream</th> <th>Klong Bo Upstream</th> <th>ttom Level Downstream</th> <th>Maximum Water Level</th>	nent No.	Length	Flow 2DWF (2020)	Flow SDWF (2040]	Diameter	Slope	Full Velocity	Flow Capacity	rate (Capacity/DW F)	Upstream	t Elevation Downstream	Upstream	Downstream	Klong Bo Upstream	ttom Level Downstream	Maximum Water Level
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90 0044 0.75 000 1023 1000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 <td></td> <td>470</td> <td>0.022</td> <td>0.081</td> <td>600</td> <td>1/472</td> <td>1.000</td> <td>0.283</td> <td>5.0</td> <td>-4.810</td> <td>-5.806</td> <td>0.500</td> <td>1.000</td> <td>-2.210</td> <td>-2.000</td> <td>-2.630</td>		470	0.022	0.081	600	1/472	1.000	0.283	5.0	-4.810	-5.806	0.500	1.000	-2.210	-2.000	-2.630
35 0054 0177 000 0235 50 510 510 1000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 </td <td></td> <td>90</td> <td>0.048</td> <td>0.175</td> <td>600</td> <td>1/472</td> <td>1.000</td> <td>0.283</td> <td>5.0</td> <td>-5.806</td> <td>-5.997</td> <td>1.000</td> <td>1.000</td> <td>-2.000</td> <td>-2.000</td> <td>-2.720</td>		90	0.048	0.175	600	1/472	1.000	0.283	5.0	-5.806	-5.997	1.000	1.000	-2.000	-2.000	-2.720
114 0.006 0.31 0.00 1472 10.00 0.325 64.65 64.65 10.00 10.00 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.00		75	0.054	0.197	600	1/472	1.000	0.283	5.0	-5.997	-6.156	1.000	1.000	-2.000	-2.000	-2.850
200 0050 0346 600 1472 1000 0.335 50 6487 7331 1000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000		145	0.058	0.213	600	1/472	1,000	0,283	5.0	-6.156	-6.463	1.000	1.000	-2.000	-2.000	-2.960
316 0.03 0.20 600 1472 1000 0.351 4.500 1.000 1.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 2.000 </td <td></td> <td>200</td> <td>0.066</td> <td>0.243</td> <td>009</td> <td>1/472</td> <td>1.000</td> <td>0.283</td> <td>5.0</td> <td>-6.463</td> <td>-6.887</td> <td>1.000</td> <td>1.000</td> <td>-2.000</td> <td>-2.000</td> <td>-3.070</td>		200	0.066	0.243	009	1/472	1.000	0.283	5.0	-6.463	-6.887	1.000	1.000	-2.000	-2.000	-3.070
345 0.002 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0		205	0.073	0.269	600	1/472	1.000	0.283	5.0	-6.887	-7.321	1,000	1,000	-2.000	-2.000	-3,230
		345	0.082	0.303	800	1/692	1.000	0.503	5.0	-7.521	-8.020	1.000	1.000	-2.000	-2.000	-3.940
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1 420 0.026 0.095 000 1/172 1.000 0.283 5.0 -4.70 1.70 0.261 -1.080 -2.000 -3.000 7 555 0.141 0.205 1.000 1972 1.000 0.283 5.0 -3.700 6.5.01 0.006 -1.080 -3.000 -3.000 7 555 0.141 0.200 1.000 1.923 1.000 0.785 5.0 -3.700 6.5.01 -4.200 7 0.000 0.1187 1.000 0.785 5.0 -3.700 6.5.01 0.005 -4.200 7 0.018 0.071 1.000 1.932 1.000 0.785 5.0 -3.800 0.811 0.005 -4.200 -4.200 -4.200 -4.200 -4.200 -4.200 -4.200 -4.200 -4.200 -4.200 -																
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		555	0.153	0.563	1,000	1/932	1.000	0.785	5.0	-8.794	-9.389	0.811	0.606	1	1	-4.410
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	5	135	0.009	0.037	600	1/472	1.000	0.283	5.0	-3.680	-3.966	3.692	0.607	-1.080	1	-3.500
(1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) <td></td> <td>1,290</td> <td>0.190</td> <td>0.708</td> <td>1,000</td> <td>1/932</td> <td>1,000</td> <td>0.785</td> <td>5.0</td> <td>-10,130</td> <td>-11.514</td> <td>0.607</td> <td>0.773</td> <td>I</td> <td>-3,200</td> <td>-5.520</td>		1,290	0.190	0.708	1,000	1/932	1,000	0.785	5.0	-10,130	-11.514	0.607	0.773	I	-3,200	-5.520
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8 960 0.021 0.084 600 1/472 1.000 0.283 5.0 -4.710 -6.744 1.778 1.778 2.110 2.210 -4.430 2 305 0.057 0.226 600 1/472 1.000 0.283 5.0 -6.744 7.730 1.778 2.210 -3.380 -5.400 6 410 0.345 1.200 1/189 1.000 1.131 4.5 -11.294 -1.2392 3.773 -3.380 -3.380 -5.500 6 410 0.345 1.200 1/189 1.000 1.131 4.5 -12.392 3.773 -3.380 -3.380 -5.500 6 410 0.345 1.200 1/189 1.000 1.131 4.2 -12.392 3.773 1.693 -3.380 -5.500 -5.500 7 265 0.355 1.200 1/189 1.000 1.131 4.2 -12.737 3.773 1.693 -2.130 2.130 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>																
700 700 0.021 0.004 000 $1/472$ 1.000 0.223 5.0 -7.10 1.713 1.713 2.210 -3.310 -4.120 -7.50 -4.10 -2.044 1.713 1.713 2.210 -3.310 -4.120 -7.50 -3.310 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 -7.50 <th< td=""><td></td><td>090</td><td>100.0</td><td>100.0</td><td>007</td><td>0.000</td><td>1000</td><td>200.0</td><td></td><td>012.8</td><td>6 744</td><td>010</td><td>011</td><td>011.0</td><td>0100</td><td>4.420</td></th<>		090	100.0	100.0	007	0.000	1000	200.0		012.8	6 744	010	011	011.0	0100	4.420
545 0.332 1.267 1,200 1/189 1.000 1.131 4.5 -11.934 -12.392 7.773 0.773 -3.380 -3.380 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560 -3.560		305	0.057	0.226	600	1/472	1.000	0.283	5.0	-6.744	-7.390	1.778	0.773	-2.210	-3.380	-6.420
6 410 0.345 1.319 1.200 1/189 1.000 1.131 4.3 -12.332 -12.737 3.773 1.693 -3.380 -2.130 8.310 1 265 0.355 1.359 1.200 1/1189 1.000 1.131 4.2 -12.737 3.773 1.693 -3.380 -2.130 8.950 1 265 0.355 1.359 1.7189 1.000 1.131 4.2 -12.737 -12.960 1.693 -2.130 -2.130 -2.130 -2.130 -2.130 -2.130 -2.130 -2.130 -2.130 -2.130 -2.130 -2.130 -2.130 -2.790 6 865 0.023 0.091 600 1/472 1.000 0.283 5.0 -1090 -5.923 1.100 1.693 -2.130 -2.130 -2.130 -2.130 -2.130 -2.130 -2.130 -2.130 -2.730 -2.730 -2.730 -2.730 -2.730 -2.730 -2.730 -2.730 <t< td=""><td></td><td>545</td><td>0.332</td><td>1.267</td><td>1,200</td><td>1/1189</td><td>1.000</td><td>1.131</td><td>4.5</td><td>-11.934</td><td>-12.392</td><td>0.773</td><td>0.773</td><td>-3.380</td><td>-3.380</td><td>-7.560</td></t<>		545	0.332	1.267	1,200	1/1189	1.000	1.131	4.5	-11.934	-12.392	0.773	0.773	-3.380	-3.380	-7.560
11 265 0.355 1.359 1.200 1/1189 1.000 1.131 4.2 -12.737 -12.960 1.693 -2.130 -2.130 -3.950 12 865 0.355 1.300 1/1189 1.000 1.131 4.2 -12.737 -12.960 1.693 -2.130 -2.130 -3.950 13 865 0.021 600 1/472 1.000 0.283 5.0 -4.090 -5.923 1.100 1.693 -1.490 -3.790 13 355 0.378 1.446 1.200 1/1189 1.000 1.131 3.9 -13.242 1.693 -1.490 -2.130 -3.790 11 105 0.331 1.446 1.200 1.131 3.9 -13.242 1.693 1.400 -2.130 -3.790 11 105 0.331 1.446 1.300 1.131 3.9 -13.242 1.593 2.130 2.130 -1.000 11 105 0.331	9	410	0.345	1.319	1,200	1/1189	1,000	1.131	4,3	-12,392	-12.737	0.773	1,693	-3.380	-2,130	-8.310
(i) (i) <td>_</td> <td>265</td> <td>0.355</td> <td>1.359</td> <td>1,200</td> <td>1/1189</td> <td>1.000</td> <td>1.131</td> <td>4.2</td> <td>-12.737</td> <td>-12.960</td> <td>1.693</td> <td>1.693</td> <td>-2.130</td> <td>-2.130</td> <td>-8.950</td>	_	265	0.355	1.359	1,200	1/1189	1.000	1.131	4.2	-12.737	-12.960	1.693	1.693	-2.130	-2.130	-8.950
6 865 0.023 0.091 600 1/472 1.000 0.283 5.0 4.090 -5.923 1.100 1.693 -1.490 -3.130 -3.790 3 3.35 0.378 1.450 1/200 1/1189 1.000 1.131 3.9 -13.242 1.693 -1.490 -3.130 -9.370 1 105 0.378 1.450 1.000 1.131 3.9 -13.242 1.693 -2.130 -9.370 1 105 0.3781 1.460 1.000 1.131 3.9 -13.242 1.693 -2.130 -3.130 -9.370 1 105 0.381 1.461 1.200 1/1189 1.000 1.131 3.9 -13.242 1.693 0.100 -2.130 -9.370 1 146 1.200 1/1189 1.000 1.131 3.9 -13.242 1.693 0.100 -2.130 -9.370 1 146 1.200 1.01189 1.000																
66 865 0.023 0.091 600 1/472 1.000 0.285 5.0 -4.090 -5.923 0.100 1.693 -1.490 -2.130 -3.790 1 335 0.378 1.460 1/189 1.000 1.131 3.9 -13.242 1.693 -1.490 -2.130 -3.790 1 165 0.378 1.464 1.200 1/1189 1.000 1.131 3.9 -13.242 1.693 2.130 -2.130 -3.700 1 165 0.381 1.464 1.200 1/1189 1.000 1.131 3.9 -13.242 1.693 2.130 -2.130 -3.700 1 165 0.300 1.1189 1.000 1.131 3.9 -13.242 1.5330 1.693 2.130 2.130 2.130 0.1000 1 165 0.300 1.1189 1.000 1.131 3.9 -13.242 1.503 0.1000 2.130 2.130 2.130 2.1000																
335 0.378 1.450 1.200 1/189 1.000 1.131 3.9 -12.960 -13.242 1.653 1.653 -2.130 -2.130 -3.70 1 165 0.3781 1.464 1.200 1/1189 1.000 1.131 3.9 -13.242 1.653 1.653 -2.130 -2.130 -9.000 1 165 0.381 1.464 1.200 1/131 3.9 -13.242 -13.330 1.693 -2.130 -2.000 1 165 0.300 2.134 1.3330 1.693 -2.130 -2.000 1 165 0.100 1.131 3.9 -13.242 1.563 0.100 -2.130 -0.000 1 165 0.300 2.134 1.563 0.100 -2.130 1.000 1 165 1.500 1.11180 1.000 1.131 3.8 1.13242 1.500 2.100	9	865	0.023	0.091	600	1/472	1.000	0.283	5.0	-4.090	-5.923	0.100	1.693	-1.490	-2.130	-3.790
1 105 0.381 1.464 1.200 1/118 1000 1/131 3.9 -1.532 -1.5330 1.000 -2.110 -0.000 7 445 7.200 1/1189 1.000 1.131 3.9 -1.5320 -1.5330 1.000 -2.110 -0.000 7 445 7.200 1/1189 1.000 1.131 3.8 -15.330 1.000 -2.110 -0.000 7 445 7.200 1.1189 1.000 1.131 3.8 -15.330 1.000 -2.110 -0.000		335	0.378	1.450	1,200	1/1189	1.000	1.131	3.9	-12.960	-13.242	1.693	1.693	-2.130	-2.130	-9.370
	_	105	0.381	1.464	1,200	1/1189	1.000	1.131	3.9	-13.242	-12.330	1.693 A 100	0.100	-2.130	-2.130	-10.000

Math. Math. <th< th=""><th>,</th><th>1</th><th>Current Flow</th><th>Flanned Flow</th><th></th><th>clane</th><th>Full</th><th>Flow</th><th>Intercepting rate</th><th>Pipe Invert</th><th>Elevation</th><th>Ground</th><th>l Level</th><th>Klong Bot</th><th>tom Level</th><th>Maximum</th></th<>	,	1	Current Flow	Flanned Flow		clane	Full	Flow	Intercepting rate	Pipe Invert	Elevation	Ground	l Level	Klong Bot	tom Level	Maximum
i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i	Catchme Area No	nt Lengin	2DWF (2020)	5DWF (2040)	Diameter	adoic	Velocity	Capacity	(Capacity/DW F)	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Water Level
3 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5		(m)	(m ³ /s)	(m ³ /s)	(mm)	(/)	(m/s)	(n ³ /s)	(-)	(m)	(m)	(m)	(III)	(m)	(m)	(m)
3 36 0.00 100 110 101 101 101 201 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010 2010																
	33	305	0.390	1.496	1,200	1/1189	1.000	1.131	3.8	-13.704	-13.961	0.100	0.100	-2.810	-2.810	-10.560
10 100 0001 0011 000 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 1001 10010 1001 1001 10																
34 103 0.037 150 1000 1000 1000 1000 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 2300 23	35	585	0.004	0.017	009	1/472	1.000	0.283	5.0	-4.220	-5.459	1.000	0.100	-1.620	-2.810	-4.100
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	34	115	0.397	1.524	1,500	1/1600	1.000	1.767	5.0	-14.261	-14.333	0.100	0.300	-2.810	-2.810	-11,000
4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0																
44 910 014 013 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 0130 01300 0130 0130 013																
45 516 0.003 0.086 490 1731 1010 0.193 453 4536 0.2400 1530 25400 21400 1130 46 1035 0.436 1037 1500 1000 1000 1000 1000 1000 1000 2000 2160 2160 1130 47 1040 065 1037 1000 1000 1000 1000 1000 2160 2160 2160 1130 47 1040 065 1477 1000 0335 50 5300 5300 5300 2300 2300 2400 1130 47 100 073 50 1373 1400 0335 50 5300 5300 2400 2400 1400 47 1000 0335 50 5300 5300 5300 5300 5300 5300 5300 5300 5300 5300 5300 5300 5300 5300 5300	44	910	0.014	0.055	450	1/321	1.00.1	0.159	5.0	-4,000	-6.835	0.800	1.955	-1.550	-1.550	-3.750
	45	545	0.023	0.088	450	1/321	1.001	0.159	5.0	-6.835	-8.533	1.955	0.300	-1.550	-2.810	-6.580
46 105 1,500 1,500 1,500 1,500 1,500 1,500 2,500 2,500 2,500 2,500 1,500 77 105 0,531 0,531 5,50 5,500 5,500 5,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500 2,500		230	0.420	1.612	1,500	1/1600	1.000	1.767	5.0	-14.333	-14.477	0.300	0.300	-2.810	-2.420	-11.290
	46	165	0.436	1.675	1,500	1/1600	1.000	1.767	5.0	-14.477	-14.580	0.300	0.300	-2.420	-2.640	-11.520
37 700 0005 0241 600 1472 1000 0335 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500 5.500																
3 760 0.054 0.044 0.044 0.044 0.244 0.040 0.345 0.240 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340 0.340		2														
	52	760	0.065	0.254	600	1/472	1.000	0.283	5.0	-5.030	-6.640	1.000	0.300	-2.430	-2.640	-4.480
	67	280	0.048	0.188	600	1/472	1 000	0.283	5.0	-5 400	-5 003	0.500	0.500	-2 800	-2.800	-4 950
73 305 0059 0228 600 1472 1000 0.33 50.0 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300 5.300	72	270	0.052	0.202	600	1/472	1.000	0.283	5.0	-5,993	-6.565	0.500	2.000	-2.800	-2.800	-5.630
	73	305	0.059	0.228	600	1/472	1.000	0.283	5.0	-6.565	-7.211	2.000	2.000	-2.800	-2.800	-6.200
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $																
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	75	210	0.019	0.075	600	1/472	1.000	0.283	5.0	-5.400	-5.845	2.000	2.000	-2.800	-2.800	-5.130
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		35	0.078	0.303	800	1/692	1.000	0.503	5.0	-7.411	-7.462	2.000	2.000	-2.800	-2.800	-7.140
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	74	140	0.088	0.343	800	1/692	1.000	0.503	5.0	-7.462	-7.664	2.000	1.000	-2.800	-2.160	-7.370
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	5	240	0.100	0.392	800	1/692	1.000	0.503	5.0	-7.664	-8.011	1.000	1.000	-2.160	-2.160	-7.750
WVIP -1092 0.010 2.338 $1,700$ 0.010 2.338 1.730 0.204 0.234 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.244 0.2440 0.2440 0.2440 0.2440 0.2440 0.2440 0.2440 0.2440 0.2840 0.2841 0.2841 0.2841 0.2841 0.2841 0.2640 0.240 0.1920 0.1920 0.1920 0.1920 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.2040 0.240 0.24	2	CI0,1	601.0	0.429	800	1/092	1,000	000	0.0	110'8-	-9.4/8 12 000	0.000	005.0	-2.160	0407-	0667-
WWIP 51 1,170 0.024 0.93 600 1/472 1000 0.183 5.140 -7.619 1.000 2.540 2.540 4.840 51 1,170 0.024 0.933 600 1/472 1000 0.183 5.0 -7.619 -7.778 1.000 2.540 2.540 -5.90 58 75 0.029 0.112 600 1/472 1.000 0.183 5.0 -7.718 1.000 1.000 2.540 2.540 -5.90 60 1/472 1.000 0.183 5.0 -7.718 5.00 -1.920 1.920 -1.920 -5.90 61 110 0.147 1.000 0.183 5.0 -8.413 8.645 1.000 1.920 -1.920 -5.90 62 0.011 1/472 1.000 0.183 5.0 -8.645 1.000 1.920 -1.920 -5.90 63 0.05 0.217 0.10 0.100		C60,2	0.610	865.2	000,1	1/1000	000.1	./07	5.7	-14.580	688.cl-	0.500	1.133	-2.640	I	00011-
88 75 0.029 0.112 600 1/472 1000 0.283 5.0 -7.519 -7.778 1.000 2.540 -2.540 -5.90 60 1/47 1000 0.183 5.0 -7.718 1.000 1.000 2.540 -5.90 -5.90 60 1/47 1.000 0.283 5.0 -8.085 -8.413 1.000 1.920 -1.920 -1.920 -5.90 61 1/10 0.141 0.181 600 1/472 1.000 0.283 5.0 -8.413 1.000 1.900 -1.920 -1.920 -6.90 61 0.011 0.181 600 1/472 1.000 0.283 5.0 -8.413 1.000 1.900 -1.920 -1.920 -6.90 62 0.05 0.217 600 1/472 1.000 0.283 5.0 -8.858 1.000 1.000 -1.620 -6.100 -6.10 -6.10 -6.10 -6.10 -6.10 -6	51	1,170	0.024	0.093	600	1/472	1.000	0.283	5.0	-5.140	-7.619	1.000	1.000	-2.540	-2.540	-4.840
59 145 0.035 0.134 600 1472 1000 0.283 5.0 -7.778 -8.085 1.000 -1.920 -1.920 -5.90 60 155 0.041 0.159 600 1472 1000 0.283 -8.413 1.000 -1.920 -1.920 -5.90 61 0.041 0.181 600 1472 1000 0.283 -8.413 -1000 -1.920 -1.920 -1.920 -5.90 62 100 0.041 0.181 600 1472 1000 0.283 -8.641 -8.838 1000 -1.920 -1.620 -6.90 63 905 0.056 0.217 600 1472 1000 0.233 800 1472 1000 0.283 10075 1000 -1.620 -6.90 63 0.056 0.217 600 1472 1000 0.232 -1.622	58	75	0.029	0.112	600	1/472	1.000	0.283	5.0	-7.619	-7.778	1.000	1.000	-2.540	-2.540	-5.840
	59	145	0.035	0.134	600	1/472	1.000	0.283	5.0	-7.778	-8.085	1.000	1.000	-2.540	-1.920	-5.990
61 110 0.047 0.181 600 1472 1000 0.183 5.0 8.413 8.646 1000 1.920 1.920 6.240 62 100 0.051 0.193 600 1472 1000 0.283 8.646 8.838 1.000 1.920 1.920 6.400 63 905 0.137 600 1472 1.000 0.283 5.0 -8.646 1.000 1.920 1.620 6.610 64 325 0.066 0.237 600 1472 1.000 0.383 5.0 -11.644 1.000 1.620 -5.00 651 650 0.74 0.237 600 1472 1.000 0.333 5.0 -11.644 1.000 1.620 -1.620 -7.610 65 0.074 0.287 800 1/692 1.000 0.333 5.0 -11.644 1.000 1.620 -1.620 -7.610 66	60	155	0.041	0.159	600	1/472	1.000	0.283	5.0	-8.085	-8.413	1.000	1.000	-1.920	-1.920	-6.080
62 100 0.051 0.198 600 1472 1.000 0.235 5.0 -8.646 -8.858 1.000 1.920 -1.620 -6.400 65 905 0.217 600 1472 1.000 0.283 5.0 -8.858 -10.75 1.000 -1.620 -6.400 64 325 0.056 0.217 600 1472 1.000 0.183 5.0 -1.624 -1.620 -1.620 -6.900 64 0.056 0.257 600 $1/472$ 1.000 0.183 -10.775 -1.000 -1.620 -5.90 660 0.074 0.287 800 $1/692$ 1.000 0.160 -1.620 -1.620 -1.620 -5.90 660 0.074 0.287 800 $1/692$ 1.000 0.100 -1.620 -1.620 -5.90 660 0.074 0.287 800 $1/692$ </td <td>61</td> <td>110</td> <td>0.047</td> <td>0.181</td> <td>600</td> <td>1/472</td> <td>1.000</td> <td>0.283</td> <td>5.0</td> <td>-8.413</td> <td>-8.646</td> <td>1.000</td> <td>1.000</td> <td>-1.920</td> <td>-1.920</td> <td>-6.240</td>	61	110	0.047	0.181	600	1/472	1.000	0.283	5.0	-8.413	-8.646	1.000	1.000	-1.920	-1.920	-6.240
63 905 0.015 6.00 $1/472$ 1.000 0.183 5.0 -8.858 -10.775 1.000 1.620 -1.620 -1.620 -6.610 64 3.25 0.066 0.237 600 $1/472$ 1.000 0.183 5.0 -10.775 -11.464 1.000 -1.620 -1.620 -6.610 65 600 0.744 0.287 800 $1/692$ 1.000 0.103 -1.620 -1.620 -1.620 -5.610 66 150 0.774 0.293 800 $1/692$ 1.000 0.103 1.620 -1.620 -1.620 -1.620 -5.610 66 150 0.774 0.233 800 $1/692$ 1.000 0.103 1.620 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210	62	100	0.051	0.198	600	1/472	1.000	0.283	5.0	-8.646	-8.858	1.000	1.000	-1.920	-1.620	-6.400
64 325 0.066 0.257 600 1/472 1.000 0.1075 1.1464 1.000 1.620 1.620 6.990 65 600 0.074 0.287 800 1/692 1.000 0.1000 1.620 1.620 7.900 66 150 0.076 0.293 800 1/692 1.000 0.103 1.000 1.000 1.620 7.930 66 150 0.076 0.293 800 1/692 1.000 0.103 1.000 1.000 1.1600 1.2100 7.130 7.130 7.930 66 155 0.094 0.564 800 1/692 1.000 0.103 5.0 -12.748 1.000 1.210 -1210 7.310 67 155 0.094 0.564 800 1/692 1.000 0.100 -1.210 7.310 -1.210 7.310 68 155 0.094 0.564 10.574 1.2972 1.000 1.2100	63	905	0.056	0.217	600	1/472	1.000	0.283	5.0	-8.858	-10.775	1.000	1.000	-1.620	-1.620	-6.610
65 600 0.074 0.287 800 1/692 1000 0.1644 -12511 1000 1.620 -1210 -7510 66 150 0.076 0.293 800 1/692 1000 0.033 5.0 -12748 -1200 -1210 -1210 -730 68 155 0.094 0.364 800 1/692 1000 0.033 5.0 -12748 -1200 1.210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210 -1210	64	325	0.066	0.257	600	1/472	1.000	0.283	5.0	-10.775	-11.464	1.000	1.000	-1.620	-1.620	-6.990
66 150 0.076 0.293 800 1/692 1.000 0.33 5.0 -12.331 -12.748 1.000 1.210 -12.10 -7.930 68 155 0.094 0.564 800 1/692 1.000 0.503 5.0 -12.748 -12.972 1.000 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210 -1.210	65	600	0.074	0.287	800	1/692	1.000	0.503	5.0	-11.664	-12.531	1.000	1.000	-1.620	-1.210	-7.610
68 155 0.094 0.364 800 1/692 1000 0.33 5.0 -12.748 -12.972 1.000 -1.210 -1.210 -8.030 69 810 0.105 0.402 800 1/692 1.000 0.500 -1.210 -1.210 -1.210 -1.210 -8.030 69 810 0.105 0.402 800 1/692 1.000 0.500 -1.210 -1.910 -8.190	99	150	0.076	0.293	800	1/692	1.000	0.503	5.0	-12.531	-12.748	1.000	1.000	-1.210	-1.210	-7.930
69 810 0.105 0.402 800 1/692 1.000 0.303 5.0 -12.972 -14.143 1.000 0.200 -1.210 -1.910 -8.190	89	155	0.094	0.364	800	1/692	1.000	0.503	5.0	-12.748	-12.972	1.000	1.000	-1.210	-1.210	-8.030
	69	810	0.105	0.402	800	1/692	1.000	0.503	5.0	-12.972	-14.143	1.000	0.200	-1.210	-1.910	-8.190

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	Maximum Water Level	(m)		-2.870	-4.200	-4.500	-5.400	-5,930	-6.540	-6.730	-8,000	-8.230	-9.040	-9.570			-3.210	-7.990	-11.560	-11.990		-4.040	-5.960	-12.390	-13.740		-2.370	-2,370	-0.150		-5.040		-5.270	-11.710	-15.360		-4.970		-4.060	00C PT
tom Level	Downstream	(m)		-1.980	-1.980	-1.980	-1.980	-1.980	-1.980	-1.670	-1,670	-1.900	-1.900	-1.610			-1.080	-1.610	-1.610	-1.730		-1.730	-1.730	I	Ι		I	I			1		1	I	I		-4.150		-1.710	4 160
Klong Rot	Upstream	(m)		-0.600	-1.980	-1.980	-1.980	-1.980	-1.980	-1.980	-1.670	-1.670	-1.900	-1.900			-1.050	-1.080	-1.610	-1.610		-1.730	-1.730	-1.730	1		-1.810	I			-2.910		-2.910	I	I		-4.150		-1.710	
AUA	Downstream	(m)		2.300	2.300	2.300	2.300	2.300	2.300	2.300	2.300	0.200	0.200	0.500			0.800	0.500	0.500	0.500		0.500	0.500	2.171	0.664		2.368	1,422	0.452		0.452		0.452	0.664	0.676		0.900		2.647	
Ground	Upstream	(III		1.000	2300	2300	2300	2300	2300	2300	2300	2300	0.200	0.200			1000	0.800	0.500	0.500		0.500	0.500	0.500	2171		1700	2368	1.422		0.452		0.452	0.452	0.664		0.900		2300	
Flavation	Downstream	(n)		-5.350	-5.689	-6.611	-7.252	-8.083	-8.235	-9.290	-9.731	-10.080	-14.879	-15.657			-8.120	-11.940	-16.226	-16.417		-6.533	-6.702	-16.626	-17.242		-9.007	-11,359	-10.254		-6.135		-6.887	-17,376	-18.392		-8.191		-5.338	2000
Pine Invert	Upstream	(III)		-3.200	-5.350	-5.689	-6.811	-7.252	-8.083	-8.235	-9,490	-9.731	-14.543	-14.879			-3.650	-8.320	-15.957	-16.226		-4.330	-6.533	-16.417	-16.626		-4.410	-9,007	600.11-		-5.510		-5.510	-16,234	-18.076		-6.750		-4310	
Intercepting	rate (Capacity/DW F)	(-)		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.8	4.3			5.0	4.7	4.6	4.5		5.0	5.0	4.2	3.8		5.0	4,3	4.8		5.0		5.0	2,9	2.8		5.0		5.0	
	Flow Capacity	(m ³ /s)		0.283	0.283	0.283	0.503	0.503	0.503	0.503	0.785	0.785	1.131	1,131			0.283	0.503	1.767	1.767		0.283	0.283	1.767	1.767		0.283	0,283	0.505		0.283		0.283	0,503	1.767		0.283		0.283	
	Full Velocity	(s/m)		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000		1.000	1,000	1.000		1.000		1.000	1,000	1.000		1.000		1.000	
	Slope	(/)		1/472	1/472	1/472	1/692	1/692	1/692	1/692	1/932	1/932	1/1189	1/1189			1/472	1/692	1/1600	1/1600		1/472	1/472	1/1600	1/1600		1/472	1/472	1/092		1/472		1/472	1/692	1/1600		1/472		1/472	
	Diameter	(mm)		600	600	600	800	800	800	800	1,000	1,000	1,200	1,200			600	800	1,500	1,500		600	600	1,500	1,500		600	600	800		600		600	800	1,500		600		600	
flanned	Flow 5DWF (2040)	(m ³ /s)		0.112	0.238	0.278	0.317	0.391	0.445	0.503	0.673	0.773	1.175	1.319			0.180	0.536	1.928	1.969		0.088	0.126	2.095	2.297		0.011	0,328	0.525		0.201		0.063	0,865	3.162		0.012		0.067	
Current	Flow 2DWF (2020)	(m ³ /s)		0.032	0.069	0.081	0.092	0.113	0.129	0.146	0,195	0.224	0.329	0.366			0.046	0.137	0.522	0.532		0.023	0.033	0.565	0.617		0.003	0,084	0.154		0.052		0.016	0,222	0.839		0.003		0.017	
	Length	(m)		1,015	160	435	305	575	105	730	225	325	400	925			2,110	2,505	430	305		1,040	80	335	985		2,170	1,110	3,252		295		650	790	505		680		485	
	Catchment Arca No.			86	88	89	90	91	92	93	87	94		77			85	84	80	79		83	78		76		50	57	90		82		55	81			24		29	
-	Line No.			86	88	89	90	91	92	93	87	94-1	94-2	77	0.80		85	84	80	79	o 78-2	83	78-1	78-2	76-1	o 76 - 2	50	57	90	10.0	82	o 81	55	81	76-2	0 53-2	24-1	To 24-2	50	16

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	0	urrent Flow	Planned			Full	Flw	Intercepting	Pipe Invert	t Elevation	Groun	d Level	Klong Bot	ttom Level	Maximum
gth 2		FIOW DWF 2020)	5DWF (2040)	Diameter	Slope	Velocity	Capacity	rate (Capacity/DW F)	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Water Level
	- 9	(m ³ /s)	(m ³ /s)	(mm)	(7)	(m/s)	(m ³ /s)	(-)	(m)	(m)	(m)	(m)	(m)	(m)	(m)
0		0.061	0.240	600	1/472	1.000	0.283	5.0	-8.191	-8.827	0.900	0.900	-4.150	-3.490	-4.970
•	-	0.120	0.472	800	1/692	1.000	0.505	5.0	-9.027	186.6-	0.900	0.200	-3.490	-3.490	-5.580
0		0.017	0.068	600	1/472	1.000	0.283	5.0	-6.090	-6.514	2.286	2.286	-3.490	-3.490	-5.840
5	_	0.029	0.117	600	1/472	1,000	0.283	5.0	-6.514	-7,372	2.286	2,286	-3,490	-3,490	-6,310
8	_	0.149	0.589	800	1/692	1.000	0.503	4.3	-9.981	-11.542	0.500	0.885	-3.490	-3.490	-6.830
		\dagger													
	Ľ	0.045	0.177	600	1/472	1.000	0.283	5.0	-1.524	-1.715	1.680	0.885	1.680	-3.490	-5.410
2	Ľ	0.209	0.824	1,000	1/932	1.000	0.785	4.8	-11.742	-12.059	0.885	0.885	-3.490	1	-8.800
	Ц														
20	_	0.043	0.169	600	1/472	1.000	0.283	5.0	-4.410	-9.177	1.700	1.500	-1.810	I	-3,990
8	_	0.058	0.228	600	1/472	1.000	0.283	5.0	-9.177	-11.783	1.500	0.885	I	I	-7.320
。	_	0.267	1.052	1,000	1/932	1.000	0.785	3.7	-12.183	-12.977	0.885	0.720	I	I	-9.210
	+														
4		0.078	0.116	009	0.1470	1 000	0.183	0.5	4 100	-5 50A	0.481	0.720	-1 500	1	-3 770
		0.295	1.162	1.200	1/1189	1.000	1.131	4.9	-13.177	-13.362	0.720	2.467		1	-10.850
8	Ĩ	0.322	1.267	1,200	1/1189	1.000	1.131	4.5	-13.362	-14.342	2.467	2.636	1	1	-11.320
0		0.354	1.391	1,200	1/1189	1.000	1.131	4.1	-14.342	-14.519	2.636	0.667	I		-12.470
	+														
1	+						1								
0		0,022	0.084	600	1/472	1,000	0.283	5,0	-3.800	-4,351	2.750	0,664	-1.200	I	-3.520
-	-	0.576	1.472	1,200	1/1189	1.000	1.51	5.8	-14.519	-14.84/	0.664	2.881	1		-17.800
	+														
0		0.051	0.198	600	1/472	1.000	0.283	5.0	-4.540	-6.224	0.500	2.881	-1.940		-4.080
2		0.432	1.692	1,500	L/1600	1.000	1.767	5.0	-15.147	-15.966	2.881	1.216	I		-13.590
	_														
20	_	0,015	0.059	600	1/472	1,000	0.283	5,0	-4.610	-5.235	1.000	1.000	-2.010	-2.010	-4,380
0	_	0.030	0.117	600	1/472	1.000	0.283	5.0	-5.235	-5.955	1.000	1.000	-2.010	-2.010	-4.890
	_														
9		0.041	0.150	009	1/472	1 000	0.083	0.5	-4.610	-6.623	1 000	1 000	-2 010	-2 010	4 210
		0.071	976.0	600	C74/1	1 000	0.183	50	-6.673	-7.174	1 000	1 000	010 6-	010 6-	-6 100
		0.080	0.310	800	1/692	1.000	0.03	5.0	-7.374	-7.764	1.000	1.216	-2.010		-7.130
9	ľ	0.564	2.205	1,500	1/1600	1.000	1.767	4.0	-15.966	-16.679	1.216	0.676	I	1	-14.440
10		1.403	5.367	2,000	1/2350	1.000	3.142	2.9	-18.892	-19,056	0.676	1.133	I	1	-16,100

Appendix-5 Photos and Sample Drawings of Manholes in Klong



Appendix 5-2







Appendix 5-5



Appendix 5-6









Appendix 5-10



Appendix 5-11









Appendix-6 Facility Planning for Nong Bon WWTP

Master Plan targeting 2040 Feasibility Study targeting 2020

- 1) Design Parameters and Criteria
- 2) Design Calculation of Sewage Treatment Facilities
- 3) Design Calculation of Aeration Requirement
- 4) Design Calculation of Sludge Treatment Facilities

Master Plan targeting 2040

1) Design Parameters and Criteria

> Design Flow

Daily Average DWF	135,000 m ³ /day
Daily Maximum DWF	169,000 m ³ /day
Hourly Maximum DFW	270,000 m ³ /day

> Design Water Quality

	Influent	Aeration tank	Effluent
BOD	150 mg/l	164 mg/l	20 mg/l
SS	150 mg/l	164 mg/l	30 mg/l
T-N	30 mg/l	30 mg/1	10 mg/l
T-P	8 mg/l	8 mg/l	2 mg/l

> Design Water Temperature

Average temperature	30 °C
Minimum temperature	25 °C

2) Design Calculation of Sewage Treatment Facilities

> Lift Pump

Lift pump	Double suction volute pump
Design flow in rainy weather (to facilities)	405,000 m ³ /day (3DWF)
Design flow in rainy weather (direct discharge)	270,000 m ³ /day (2DWF)
Specification of large pump	94 m ³ /min x 38 mH x 800 kW
Number of large pump	3 nos. (1 standby)
Specification of large pump	32 m ³ /min x 38 mH x 280 kW
Number of large pump	3 nos.

Specification of direct discharge pump	94 m ³ /min x 25 mH x 540 kW
Number of l direct discharge pump	3 nos. (1 standby)

> Grit Chamber

Grit chamber	Gravity settling grit chamber
Design flow in dry weather	270,000 m ³ /day (2DWF)
Design flow in rainy weather	405,000 m ³ /day (3DWF)
Hydraulic overflow rate (dry weather)	1,800 m ³ /m ² /day
Hydraulic overflow rate (wet weather)	3,600 m ³ /m ² /day
Grit chamber	2.0 mW x 9.5 mL (19.0 m ²)
Number of grit chamber	6 chan nels

Aeration Tank

Aeration tank	Anoxic tank and Aerobic tank
Number of tank	12 tanks
Capacity of tank	11,250 m ³ /day/tank
MLSS concentration	2,000 mg/l
Return sludge concentration	8,000 mg/l
Return sludge ratio	0.33
Circulation ratio	1.47
Hydraulic retention time of aerobic tank	3.0 hour
Aerobic tank	15.0 mW x 17.0 mL x 5.5 mD (1,403 m ³ /tank)
Nitrified T-N	253.1 kg/day/tank
Nitrification rate (for reference)	156.5 mg-N/carrier-L/hour (=3.76 kg/ carrier-m ³ /day)
Amount of carrier (for reference)	68 Carrier-m ³ /tank
Nitrogen loading	162 kg/day/tank
De-nitrification rate	3.27 mg-N/g-SS-hour
Hydraulic retention time of anoxic tank	2.3 hour
An oxic tank	15.0 mW x 13.0 mL x 5.5 mD (1,073 m ³ /tank)

Settling Tank

Settling tank Rectangle settling tank

Number of tank	24 tanks
Capacity of tank	5,625 m ³ /day/tank
Hydraulic surface loading	$25 \text{ m}^3/\text{m}^2/\text{day}$
Settling tank	7.5 mW x 30.0 mL x 4.0 mD (225 m ² /tank)

3) Design Calculation of Aeration Requirement

Oxygen for oxidation of organic substance	9,331 kg-O ₂ /day
Oxygen for nitrification of NH ₄	13,881 kg-O ₂ /day
Oxygen for endogenous respiration of MLSS	2,693 kg-O ₂ /day
Oxygen for endogenous respiration of carrier	1,567 kg-O₂/day
Oxygen for maintaining dissolved oxygen	1,134 kg-O2/day
Total actual oxygen requirement (AOR)	28,606 kg-O ₂ /day
Standard oxygen requirement (SOR)	50,977 kg-O ₂ /day
Aeration requirement	1,240,003 m ³ /day
Specification of Blower	160 m ³ /min x 6,500 mmAq x 260 kW
Number of blower	6 nos. (3 standby)

4) Design Calculation of Sludge Treatment Facilities

Dewatering machine	Belt press dewatering machine
Dry solid of generated sludge	23,014 kg-DS/day
Volume of generated sludge	2,877 m ³ /day
Solid concentration	0.8 %
Recovery rate of sludge	90 %
Dosing rate of coagulant	1.4 %
Filtration ration	80 kg-DS/m h
Operation rate	90 %
Operation time	24 hours
Wide of belt	3 m
Number of dewatering machine	6 nos. (1 standby)
Moisture content of sludge cake	82 %
Generation of sludge cake	117 m ³ /day

Feasibility Study targeting 2020

1) Design Parameters and Criteria

> Design Flow

Daily Average DWF	90,000 m ³ /day
Daily Maximum DWF	112,500 m ³ /day
Hourly Maximum DFW	180,000 m ³ /day

> Design Water Quality

	Influent	Aeration tank	Effluent
BOD	100 mg/l	109 mg/l	20 mg/l
SS	100 mg/l	109 mg/l	30 mg/l
T-N	20 mg/l	20 mg/l	10 mg/l
T-P	6 mg/l	6 mg/l	2 mg/l

Design Water Temperature

Average temperature	30 °C
Minimum temperature	25 °C

2) Design Calculation of Sewage Treatment Facilities

> Lift Pump

Lift pump	Double suction volute pump
Design flow in rainy weather (to facilities)	270,000 m ³ /day (3DWF)
Design flow in rainy weather (direct discharge)	180,000 m ³ /day (2DWF)
Specification of large pump	94 m ³ /min x 38 mH x 800 kW
Number of large pump	2 nos. (1 standby)
Specification of large pump	32 m ³ /min x 38 mH x 280 kW
Number of large pump	3 nos.

Specification of direct discharge pump	94 m ³ /min x 25 mH x 540 kW
Number of l direct discharge pump	3 nos. (1 standby)

> Grit Chamber

Grit chamber	Gravity settling grit chamber
Design flow in dry weather	180,000 m ³ /day (2DWF)
Design flow in rainy weather	270,000 m ³ /day (3DWF)
Hydraulic overflow rate (dry weather)	1,800 m³/m²/day
Hydraulic overflow rate (wet weather)	3,600 m ³ /m ² /day
Grit chamber	2.0 mW x 9.5 mL (19.0 m ²)
Number of grit chamber	4 channels

Aeration Tank

Aeration tank	Anoxic tank and Aerobic tank
Number of tank	8 tanks
Capacity of tank	11,250 m ³ /day/tank
MLSS concentration	2,000 mg/l
Return sludge concentration	8,000 mg/l
Return sludge ratio	0.33
Circulation ratio	1.47
Hydraulic retention time of aerobic tank	3.0 hour
Aerobic tank	15.0 mW x 17.0 mL x 5.5 mD (1,403 m ³ /tank)
Nitrified T-N	253.1 kg/day/tank
Nitrification rate (for reference)	156.5 mg-N/carrier-L/hour (=3.76 kg/ carrier-m ³ /day)
Amount of carrier (for reference)	45 Carrier-m ³ /tank
Nitrogen loading	101 kg/day/tank
De-nitrification rate	2.18 mg-N/g-SS-hour
Hydraulic retention time of anoxic tank	2.3 hour
An oxic tank	15.0 mW x 13.0 mL x 5.5 mD (1,073 m ³ /tank)

Settling Tank

Settling tank	Rectangle settling tank
---------------	-------------------------

Number of tank	16 tanks
Capacity of tank	5,625 m ³ /day/tank
Hydraulic surface loading	$25 \text{ m}^3/\text{m}^2/\text{day}$
Settling tank	7.5 mW x 30.0 mL x 4.0 mD (225 m ² /tank)

3) Design Calculation of Aeration Requirement

Oxygen for oxidation of organic substance	3,834 kg-O ₂ /day
Oxygen for nitrification of NH ₄	6,170 kg-O ₂ /day
Oxygen for endogenous respiration of MLSS	1,795 kg-O₂/day
Oxygen for endogenous respiration of carrier	691 kg-O ₂ /day
Oxygen for maintaining dissolved oxygen	756 kg-O ₂ /day
Total actual oxygen requirement (AOR)	13,245 kg-O ₂ /day
Standard oxygen requirement (SOR)	23,604 kg-O ₂ /day
Aeration requirement for treatment	574,156 m³/day
Specification of Blower	160 m ³ /min x 6,500 mmAq x 260 kW
Number of blower	4 nos. (2 standby)

4) Design Calculation of Sludge Treatment Facilities

Dewatering machine	Belt press dewatering machine		
Dry solid of generated sludge	9,107 kg-DS/day		
Volume of generated sludge	1,138 m ³ /day		
Solid concentration	0.8 %		
Recovery rate of sludge	90 %		
Dosing rate of coagulant	1.4 %		
Filtration ration	80 kg-DS/m h		
Operation rate	90 %		
Operation time	24 hours		
Wide of belt	3 m		
Number of dewatering machine	3 nos. (1 standby)		
Moisture content of sludge cake	82 %		
Generation of sludge cake	46 m ³ /day		

Appendix-7 Breakdown of Project Cost

Master Plan targeting 2040 Feasibility Study targeting 2020

Master Plan targeting 2040

1) JICA ODA Loan Version

Item Decorintion		Amount (Baht)		Total Amount
-	nem Description	 L.C	F.C	(Baht)
1	Construction Cost			
А	Wastewater treatment plant			
-A1	Lift pump facilities			
	Civil & Architecture works	114,855,000	0	114,855,000
	Mechanical works	37,474,000	253,645,000	291,422,000
	Electrical works	10,271,000	92,436,000	102,707,000
	Sub Total of -A1	162,903,000	346,081,000	508,984,000
-A2	Grit chamber facilities			
	Civil & Architecture works	34,664,000	0	34,664,000
	Mechanical works	17,474,000	117,325,000	134,799,000
	Electrical works	3,598,000	32,379,000	35,977,000
	Sub Total of -A2	55,736,000	149,704,000	205,440,000
-A3	Aeration tank facilities			
	Civil & Architecture works	157,618,000	0	157,618,000
	Mechanical works	77,478,000	693,686,000	771,164,000
	Electrical works	11,007,000	99,066,000	110,073,000
	Sub Total of -A3	246,103,000	792,751,000	1,038,855,000
-A4	Settling tank facilities			
	Civil & Architecture works	264,799,000	0	264,799,000
	Mechanical works	27,059,000	181,680,000	208,739,000
	Electrical works	7,731,000	69,580,000	77,311,000
	Sub Total of -A4	299,589,000	251,260,000	550,849,000
-A5	Effluent and recycle facilities			
	Civil & Architecture works	103,579,000	0	103,579,000
	Mechanical works	11,261,000	75,610,000	86,871,000
	Electrical works	2,989,000	26,899,000	29,888,000
	Sub Total of -A5	117,829,000	102,509,000	220,338,000
-A6	Sludge dewatering facilities			
	Civil & Architecture works	81,438,000	0	81,438,000
	Mechanical works	22,389,000	150,329,000	172,718,000
	Electrical works	6,397,000	57,573,000	63,970,000
	Sub Total of -A6	110,224,000	207,902,000	318,126,000
-A7	Administration building			
	Civil & Architecture works	176,609,000	0	176,609,000
	Mechanical works	0	0	0
	Electrical works	1,300,000	11,697,000	12,997,000
	Sub Total of -A7	176,909,000	11,697,000	189,606,000
-A8	Power facilities			
	Civil & Architecture works	0	0	0
	Mechanical works	5,992,000	40,231,000	46,223,000
	Electrical works	23,779,000	214,010,000	237,789,000
	Sub Total of -A8	29,771,000	254,241,000	284,012,000
	Sub Total of A	1,200,064,000	2,116,146,000	3,316,210,000
	Civil & Architecture works	933,562,000	0	933,562,000
	Mechanical works	199,430,000	1,512,506,000	1,711,936,000

		Itom Description		Amoun	t (Baht)	Total Amount
		nem Description	<u> </u>	L.C	F.C	(Baht)
		Electrical works		67,072,000	603,640,000	670,712,000
	В	Interceptor				
	-B1	Pipe jacking				
		Civil works		1,609,424,000	0	1,609,424,000
		Sub Total of -B1		1,609,424,000	0	1,609,424,000
	-B2	Pipe jacking shaft				
		Civil works		721,165,000	0	721,165,000
		Sub Total of -B2		721,165,000	0	721,165,000
	-B3	Interceptor chamber				
		Civil works		137,000,000	0	137,000,000
		Sub Total of -B3		137,000,000	0	137,000,000
		Sub Total of B		2,467,589,000	0	2,467,589,000
		Civil Works		2,467,589,000	0	2,467,589,000
		Sub Total of Construction Cost		3,667,653,000	2,116,146,000	5,783,799,000
		Civil & Architecture works		3,401,151,000	0	3,401,151,000
		Mechanical works		199,430,000	1,512,506,000	1,711,936,000
		Electrical works		67,072,000	603,640,000	670,712,000
2	Adm	inistration Expenses				
	-1	Administration Cost				
		Administration Cost of Item 1	2.0%	115,676,000	0	115,676,000
		Sub-Total of -1		115,676,000	0	115,676,000
3	Engi	neering Cost				
	-1	Engineering Cost				
		Engineering Cost of Item 1	10.0%	366,765,000	211,615,000	578,380,000
		Sub-Total of -1		366,765,000	211,615,000	578,380,000
4	Phys	ical Contingency				
	-1	For Local Portion of Item 1-3	10.0%	415,009,000	0	415,009,000
	-2	For Foreign Portion of Item 1-3	10.0%	0	232,776,000	232,776,000
		Sub-Total of -1+-2		415,009,000	232,776,000	647,785,000
5	Price	Contingency				
	-1	For Local Portion of Item 1-3	3.3%	713,382,000	0	713,382,000
	-2	For Foreign Portion of Item 1-3	2.4%	0	288,058,000	288,058,000
		Sub-Total of -1+-2		713,382,000	288,058,000	1,001,440,000
6	Inter	est during construction				
	-1	Interest during construction	0.65%	65,353,000	34,453,000	99,806,000
		Sub-Total of -1		65,353,000	34,453,000	99,806,000
7	Com	mitment charge				
	-1	Commitment charge	0.10%	20,813,000	11,315,000	32,128,000
		Sub-Total of -1	<u> </u>	20,813,000	11,315,000	32,128,000
8	Tax					
	-1	VAT	7%	375,526,000	202,605,000	578,131,000
	-2	Custom	5%	0	190,578,000	190,578,000
		Sub-Total of -1		375,526,000	393,183,000	768,709,000
		Total of 1+2+3+4+5+6+7+8		5 740 177 000	3 287 546 000	9 027 723 000
		(including TAX)		5,770,177,000	5,207,570,000	
		Total of 1+2+3+4+5+6+7		5.364.651.000	2.894.363.000	8.259.014.000
		(excluding TAX)				

2) DDS Budget Request Form Version

		Amount (Baht)		Total Amount
	Item Description	L.C	F.C	(Baht)
1	Construction Cost			
А	Wastewater treatment plant			
-A1	Lift pump facilities			
	Civil & Architecture works	114,855,000	0	114,855,000
	Mechanical works	37.474.000	253.645.000	291,422,000
	Electrical works	10.271.000	92,436,000	102,707,000
	Sub Total of -A1	162,903,000	346.081.000	508,984,000
-A2	Grit chamber facilities	- , ,		
	Civil & Architecture works	34,664,000	0	34,664,000
	Mechanical works	17.474.000	117.325.000	134,799,000
	Electrical works	3.598.000	32,379,000	35,977,000
	Sub Total of -A2	55,736,000	149,704,000	205,440,000
-A3	Aeration tank facilities	, ,		, ,
	Civil & Architecture works	157,618,000	0	157,618,000
	Mechanical works	77.478.000	693,686,000	771.164.000
	Electrical works	11,007,000	99,066,000	110,073,000
	Sub Total of -A3	246,103,000	792,751,000	1.038.855.000
-A4	Settling tank facilities	- , ,	. , . ,	,,,
	Civil & Architecture works	264,799,000	0	264,799,000
	Mechanical works	27.059.000	181.680.000	208.739.000
	Electrical works	7.731.000	69,580,000	77.311.000
	Sub Total of -A4	299,589,000	251,260,000	550,849,000
-A5	Effluent and recycle facilities			
	Civil & Architecture works	103,579,000	0	103.579.000
	Mechanical works	11,261,000	75,610,000	86,871,000
	Electrical works	2,989,000	26,899,000	29,888,000
	Sub Total of -A5	117,829,000	102,509,000	220,338,000
-A6	Sludge dewatering facilities	, ,		
	Civil & Architecture works	81,438,000	0	81,438,000
	Mechanical works	22,389,000	150,329,000	172,718,000
	Electrical works	6,397,000	57,573,000	63,970,000
	Sub Total of -A6	110,224,000	207,902,000	318,126,000
-A7	Administration building			· · · ·
	Civil & Architecture works	176,609,000	0	176,609,000
	Mechanical works	0	0	0
	Electrical works	1,300,000	11,697,000	12,997,000
	Sub Total of -A7	176,909,000	11,697,000	189,606,000
-A8	Power facilities			
	Civil & Architecture works	0	0	0
	Mechanical works	5,992,000	40,231,000	46,223,000
	Electrical works	23,779,000	214,010,000	237,789,000
	Sub Total of -A8	29,771,000	254,241,000	284,012,000
	Sub Total of A	1,200,064,000	2,116,146,000	3,316,210,000
	Civil & Architecture works	933,562,000	0	933,562,000
	Mechanical works	199,430,000	1,512,506,000	1,711,936,000
	Electrical works	67,072,000	603,640,000	670,712,000
В	Interceptor			
-B1	Pipe jacking			
	Civil works	1,609,424,000	0	1,609,424,000
	Sub Total of -B1	1.609.424.000	0	1.609.424.000

Item Description			Amount (Baht)		Total Amount	
		Item Description		L.C	F.C	(Baht)
	-B2	Pipe jacking shaft				
		Civil works		721,165,000	0	721,165,000
		Sub Total of -B2		721,165,000	0	721,165,000
	-B3	Interceptor chamber				
		Civil works		137,000,000	0	137,000,000
		Sub Total of -B3		137,000,000	0	137,000,000
		Sub Total of B		2,467,589,000	0	2,467,589,000
		Civil Works		2,467,589,000	0	2,467,589,000
		Sub Total of Construction Cost		3,667,653,000	2,116,146,000	5,783,799,000
		Civil & Architecture works		3,401,151,000	0	3,401,151,000
		Mechanical works		199,430,000	1,512,506,000	1,711,936,000
		Electrical works		67,072,000	603,640,000	670,712,000
2	Engi	neering Cost				
	-1	Engineering Cost				
		Engineering Cost of Item 1	3.0%	110,030,000	63,484,000	173,514,000
		Sub-Total of -1		110,030,000	63,484,000	173,514,000
3	Tax					
	-1	VAT	7%	264,438,000	152,574,000	417,012,000
	-2	Custom	5%	0	190,578,000	190,578,000
		Sub-Total of -1		264,438,000	343,152,000	607,590,000
		Total of 1+2+3		4,042,121,000	2,522,782,000	6,564,903,000
		(including TAX)				
		Total of 1+2		3,777,683,000	2,179,630,000	5,957,313,000
		(excluding TAX)				

		Amoun	t (Baht)	Total Amount
	Item Description	L.C	F.C	(Baht)
A 1	Lift Pump facilities			,
	Earth work	3,291,000	0	3,291,000
	Consecutive wall	71,293,000	0	71,293,000
	Others of foundation work	11,560,000	0	11,560,000
	Structure work	20,715,000	0	20,715,000
	Others of structure work	7,996,000	0	7,996,000
	Sub Total of –C&A	114,855,000	0	114,855,000
	Mechanical equipment	0	184,011,000	184,011,000
	Installation and others of mechanical work	32,202,000	32,202,000	64,404,000
	Electrical equipment	0	70,028,000	70,028,000
	Installation and others of electrical work	8,754,000	8,754,000	17,507,000
	Sub Total of –M&E	40,956,000	294,995,000	335,951,000
	Sub Total of –A1	155,811,000	294,995,000	450,806,000
A 2	Grit chamber facilities		, ,	, , ,
	Structure work	25,010,000	0	25,010,000
	Others of structure work	9,754,000	0	9,754,000
	Sub Total of –C&A	34,664,000	0	34,664,000
	Mechanical equipment	0	83,734,000	83,734,000
	Installation and others of mechanical work	14,653,000	14,653,000	29,307,000
	Electrical equipment	0	22,334,000	22,334,000
	Installation and others of electrical work	2,792,000	2,792,000	5,584,000
	Sub Total of –M&E	17,445,000	123.513.000	140,958,000
	Sub Total of –A2	52,109,000	123,513,000	175,622,000
A 3	Aeration tank facilities	, , , , , , , , , , , , , , , , ,	/ /	
	Structure work	113,722,000	0	113,722,000
	Others of structure work	43,897,000	0	43,897,000
	Sub Total of –C&A	157,618,000	0	157,618,000
	Mechanical equipment	0	368,934,000	368,934,000
	Installation and others of mechanical work	50,678,000	50,678,000	101,355,000
	Electrical equipment	0	58,701,000	58,701,000
	Installation and others of electrical work	7,338,000	7,338,000	14,675,000
	Sub Total of –M&E	58,016,000	485,651,000	543,667,000
	Sub Total of –A3	215,634,000	480,650,000	696,284,000
A 4	Settling tank facilities			
	Earth work	9,095,000	0	9,095,000
	Piling work	88,349,000	0	88,349,000
	Others of foundation work	14,329,000	0	14,329,000
	Structure work	114,016,000	0	114,016,000
	Others of structure work	44,010,000	0	44,010,000
	Sub Total of –C&A	264,799,000	0	264,799,000
	Mechanical equipment	0	103,081,000	103,081,000
	Installation and others of mechanical work	18,039,000	18,039,000	36,078,000
	Electrical equipment	0	41,232,000	41,232,000
	Installation and others of electrical work	5,154,000	5,154,00	10,308,000
	Sub Total of -M&E	23,193,000	167,506,000	190,700,000
	Sub Total of –A4	287,992,000	167,506,000	455,498,000
A 5	Effluent and recycle facilities			
	Earth work	440,000	0	440,000
	Piling work	8,019,000	0	8,019,000
	Others of foundation work	1,311,000	0	1,311,000

3) Breakdown of Construction Cost of Nong Bon WWTP

Itom Decominition	Amoun	Amount (Baht)	
nem Description	L.C	F.C	(Baht)
Structure work	7,725,000	0	7,725,000
Others of structure work	2,982,000	0	2,982,000
Piping work	83,102,000	0	83,102,000
Sub Total of -C&A	103,579,000	0	103,579,000
Mechanical equipment	0	46,598,000	46,598,000
Installation and others of mechanical we	rk 8,155,000	8,155,000	16,309,000
Electrical equipment	0	17,029,000	17,029,000
Installation and others of electrical worl	2,128,000	2,128,00	4,256,000
Sub Total of -M&E	10,283,000	73,907,000	84,190,000
Sub Total of –A5	113,862,000	73,907,000	187,769,000
A 6 Sludge dewatering facilities			· · ·
Earth work	970,000	0	970,000
Piling and pile wall work	24,549,000	0	24,549,000
Others of foundation work	3,955,000	0	3,955,000
Structure work	11,141,000	0	11,141,000
Others of structure work	4,300,000	0	4,300,000
Architecture work	36,522,000	0	36,522,000
Sub Total of -C&A	81,438,000	0	81,438,000
Mechanical equipment	0	68,531,000	68,531,000
Installation and others of mechanical we	rk 11,993,000	11,993,000	23,986,000
Electrical equipment	0	27,412,000	27,412,000
Installation and others of electrical worl	3,427,000	3,427,00	6,853,000
Sub Total of -M&E	15,420,000	111,364,000	126,783,000
Sub Total of -A6	96,858,000	111,363,000	208,221,000
A 7 Administration building			
Piling work	5,346,000	0	5,346,000
Others of foundation work	829,000	0	829,000
Architecture work	170,435,000	0	170,435,000
Sub Total of -C&A	176,609,000	0	176,609,000
Electrical equipment	0	10,397,000	10,397,000
Installation and others of electrical worl	1,300,000	1,300,00	2,599,00
Sub Total of –M&E	1,300,000	11,697,000	12,996,000
Sub Total of –A7	177,909,000	11,697,000	189,606,000
A 8 Power facilities			
Mechanical equipment	0	22,826,000	22,826,000
Installation and others of mechanical we	rk 3,995,000	3,995,000	7,989,000
Electrical equipment	0	130,096,000	130,096,000
Installation and others of electrical work	16,262,000	16,262,00	32,524,000
Sub Total of -M&E	20,257,000	173,179,000	193,436,000
Sub Total of –A8	20,257,000	173,179,000	193,436,000

4) Breakdown of Construction Cost of Interceptor

	Itom Decominition	Quantity	I Init mice	Amount	(Baht)	Total Amount
	ttem Description	Quantity	Unit price	L.C	F.C	(Baht)
B 1	Pipe jacking	m	Baht/m			
	Pipe jacking under road					
	Interceptor (Dia. 300mm)	480	14,200	6,816,000	0	6,816,000
	Interceptor (Dia. 450mm)	0	17,100	0	0	0
	Interceptor (Dia. 600mm)	4,970	20,000	99,400,000	0	99,400,000
	Interceptor (Dia. 800mm)	4,025	23,800	95,795,000	0	95,795,000
	Interceptor (Dia. 1,000mm)	4,240	27,700	117,448,000	0	117,448,000
	Interceptor (Dia. 1,200mm)	1,595	31,500	50,242,500	0	50,242,500
	Interceptor (Dia. 1,500mm)	4,970	37,200	184,884,000	0	184,884,000
	Interceptor (Dia. 2,000mm)	385	46,600	17,941,000	0	17,941,000
	Sub Total of –under road			572,526,500	0	572,526,500
	Pipe jacking under klong					
	Interceptor (Dia. 300mm)	0	14,900	0	0	0
	Interceptor (Dia. 450mm)	1,455	17,500	25,462,500	0	25,462,500
	Interceptor (Dia. 600mm)	24,900	20,200	502,980,000	0	502,980,000
	Interceptor (Dia. 800mm)	9,720	24,300	236,196,000	0	236,196,000
	Interceptor (Dia. 1,000mm)	755	28,800	21,744,000	0	21,744,000
	Interceptor (Dia. 1,200mm)	4,125	33,800	139,425,000	0	139,425,000
	Interceptor (Dia. 1,500mm)	2,645	42,000	111,090,000	0	111,090,000
	Interceptor (Dia. 2,000mm)	0	57,900	0	0	0
	Sub Total of –under klong			1,036,897,500	0	1,036,897,500
	Sub Total of –B1			1,609,424,000	0	1,609,424,000
B 2	Pipe jacking shaft	m	Baht/m			
	Pipe jacking under road					
	Interceptor (Dia. 300mm)	28	122,300	3,375,480	0	3,375,480
	Interceptor (Dia. 450mm)	0	127,600	0	0	0
	Interceptor (Dia. 600mm)	270	132,900	35,883,000	0	35,883,000
	Interceptor (Dia. 800mm)	402	140,000	56,322,000	0	56,322,000
	Interceptor (Dia. 1,000mm)	257	147,100	37,863,540	0	37,863,540
	Interceptor (Dia. 1,200mm)	184	154,200	28,326,540	0	28,326,540
	Interceptor (Dia. 1,500mm)	399	164,800	65,755,200	0	65,755,200
	Interceptor (Dia. 2,000mm)	62	182,500	11,278,500	0	11,278,500
	Sub Total of –under road			238,804,260	0	238,804,260
	Pipe jacking under klong					
	Interceptor (Dia. 300mm)	0	113,000	0	0	0
	Interceptor (Dia. 450mm)	86	132,300	11,351,340	0	11,351,340
	Interceptor (Dia. 600mm)	1,393	151,700	211,348,440	0	211,348,440
	Interceptor (Dia. 800mm)	500	177,500	88,750,000	0	88,750,000
	Interceptor (Dia. 1,000mm)	67	203,300	13,519,450	0	13,519,450
	Interceptor (Dia. 1,200mm)	340	229,100	77,985,640	0	77,985,640
	Interceptor (Dia. 1,500mm)	296	267,900	79,405,560	0	79,405,560
	Interceptor (Dia. 2,000mm)	0	332,400	0	0	0
	Sub Total of –under klong			482,360,430	0	482,360,430
	Sub Total of –B2			721,165,000	0	721,165,000
B 3	Interceptor chamber	Nos.	Baht/nos.			
	Interceptor chamber	136	1,004,000	137,000,000	0	137,000,000
	Sub Total of –B3			137,000,000	0	137,000,000

Itom Description	Quantity	Unit price	Amount (Baht)		Total Amount
Item Description	Quality	Our price	L.C	F.C	(Baht)
B 3 Interceptor chamber	Nos.	Baht/nos.			
Dia. 600mm	44	801,000	35,244,000	0	35,244,000
Dia. 800mm	17	882,000	14,994,000	0	14,994,000
Dia. 1,000mm	8	965,000	7,720,000	0	7,720,000
Dia. 1,200mm	62	1,082,000	67,084,000	0	67,084,000
Dia. 1,500mm	5	1,580,000	7,900,000	0	7,900,000
Sub Total of –B3	136		132,942,000	0	132,942,000

5) Comparison of Construction Cost of Interceptor Chamber

6) Unit Construction Cost of Connection pipes

Item Description	Unit price (Baht)
Connecting pipe (Dia. 150mm)	1,300 Baht/m
Connecting pipe (Dia. 200mm)	1,400 Baht/m
Manhole (Top=600mm/Bottom=900mm,Height=0.9m)	45,000 Baht/nos.
Manhole (Top=600mm/Bottom=900mm,Height=2.1m)	64,000 Baht/nos.

7) Assignments of Experts

Experts	Assignments
Project manager	Project manager is an international expert. Assignment of project manager is organize consultant team and to manage quality and schedule of consulting service. Project manager is in charge of negotiating with the Client, the Contractor and the authorities concerned as a representative of consultants.
Deputy project manager	Deputy project manager is a local expert. Assignment of deputy project manager is to organize consultant team and to manage quality and schedule of consulting service with the project manager. Deputy project manager also assist the project engineer to negotiate.
Process engineer	Assignment of process engineers is to design process of wastewater treatment and sludge treatment including mass balance calculation of pollution loading within STP, capacity calculation of treatment facilities and calculation of hydraulic profile.
Structural engineer	Assignment of structural engineers is to conduct structural calculation of civil and architectural structures and give instruction to CAD operators regarding arrangement of re-bar of structures. Structural engineers are also in charge of designing of foundations of structure.
Architect	Assignment of architects is to arrange architectural structures considering required spaces for operation and maintenance and configuration of equipment. Architects are also in charge of finishing of buildings and buildings services including ventilation, low voltage system, fire prevention and sanitary system.
Mechanical engineer	Assignment of mechanical engineers is to design mechanical equipment including process calculation of treatment process and capacity calculation of mechanical equipment. Mechanical engineers also assist process engineers to design treatment processes and capacity calculation of treatment facilities.

Electrical engineer	Assignment of electrical engineers is to design electrical equipment including power distribution system, instrumentation / monitoring system and emergency power supply system. Electrical engineers also assist architects to design low voltage system of building services.
Pipeline engineer	Assignment of pipelines engineers is to design collection system including pipe jacking and shafts of interceptors and structures of interceptor chambers. Pipelines engineers are also in charge of planning execution scheme of interceptors.
Site survey supervisor	Assignment of survey supervisors is to prepare the contract documents of survey works including geotechnical and topographic survey for outsourcing. Site survey supervisor are also in charge of manage of quality and schedule by instructing the Contractors of survey works.
Cost estimator	Assignment of cost estimators is to estimate expected cost of the project including preparation of bill of quantities, price inquiry of local market / procurement from foreign countries and pricing all items which are on the bill of quantities.
Contract specialist	Assignment of contract specialists is to prepare for the prequalification documents and tender documents including general and particular conditions of the Contract and instruction to tenderers. Contract specialists assist evaluation of prequalification and tender and negotiation with the tenderers.
Environmental expert	Assignment of environmental experts is to prepare the countermeasures to reduce negative impacts against environment and society by implementation of the project. Environmental experts also prepare monitoring plan to measure negative impacts.
Technical assistance expert	Assignment of technical assistance experts is to conduct training programs in order to develop the capacities of the responsible agencies regarding management and operation necessary to take over the newly constructed facilities smoothly.

Feasibility Study targeting 2020

1)	JICA	ODA	Loan	Version
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	Item Decemention		Amoun	t (Baht)	Total Amount
	Item Description	I	L.C	F.C	(Baht)
1	Construction Cost				
А	Wastewater treatment plant				
-A1	Lift pump facilities				
	Civil & Architecture works		114,855,000	0	114,855,000
	Mechanical works		32,202,000	216,213,000	248,415,000
	Electrical works		8,754,000	78,782,000	87,536,000
	Sub Total of -A1		155,811,000	294,995,000	450,806,000
-A2	Grit chamber facilities				
	Civil & Architecture works		34,664,000	0	34,664,000
	Mechanical works		14,653,000	98,387,000	113,040,000
	Electrical works		2,792,000	25,126,000	27,918,000
	Sub Total of -A2		52,109,000	123,513,000	175,622,000
-A3	Aeration tank facilities				
	Civil & Architecture works		157,618,000	0	157,618,000
	Mechanical works		50,678,000	414,611,000	465,289,000
	Electrical works		7,338,000	66,039,000	73,377,000
	Sub Total of -A3		215,634,000	480,650,000	696,284,000
-A4	Settling tank facilities		· · · ·		· · ·
	Civil & Architecture works		264,799,000	0	264,799,000
	Mechanical works		18,039,000	121,120,000	139,159,000
	Electrical works		5,154,000	46,386,000	51,540,000
	Sub Total of -A4		287,992,000	167,506,000	455,498,000
-A5	Effluent and recycle facilities		· · · ·	, ,	
	Civil & Architecture works		103,579,000	0	103,579,000
	Mechanical works		8,155,000	54,753,000	62,908,000
	Electrical works		2,128,000	19,154,000	21,282,000
	Sub Total of -A5		113,862,000	73,907,000	187,769,000
-A6	Sludge dewatering facilities				
	Civil & Architecture works		81,438,000	0	81,438,000
	Mechanical works		11,993,000	80,524,000	92,517,000
	Electrical works		3,427,000	30,839,000	34,266,000
	Sub Total of -A6		96,858,000	111,363,000	208,221,000
-A7	Administration building			· ·	
	Civil & Architecture works		176,609,000	0	176,609,000
	Mechanical works		0	0	0
	Electrical works		1,300,000	11,697,000	12,997,000
	Sub Total of -A7		176,909,000	11,697,000	189,606,000
-A8	Power facilities				
	Civil & Architecture works		0	0	0
	Mechanical works		3,995,000	26,821,000	30,816,000
	Electrical works		16,262,000	146,358,000	162,620,000
	Sub Total of -A8		20,257,000	173,179,000	193,436,000
	Sub Total of A		1,120,432,000	1,436,810,000	2,557,242,000
	Civil & Architecture works		933,562,000	0	933,562,000
	Mechanical works		139,715,000	1,012,429,000	1.152.144.000

		Itom Description		Amoun	t (Baht)	Total Amount
		Item Description		L.C	F.C	(Baht)
		Electrical works		47,155,000	424,381,000	471,536,000
	В	Interceptor				
	-B1	Pipe jacking				
		Civil works		1,609,424,000	0	1,609,424,000
		Sub Total of -B1		1,609,424,000	0	1,609,424,000
	-B2	Pipe jacking shaft				
		Civil works		721,165,000	0	721,165,000
		Sub Total of -B2		721,165,000	0	721,165,000
	-B3	Interceptor chamber				
		Civil works		137,000,000	0	137,000,000
		Sub Total of -B3		137,000,000	0	137,000,000
		Sub Total of B		2,467,589,000	0	2,467,589,000
		Civil Works		2,467,589,000	0	2,467,589,000
		Sub Total of Construction Cost		3,588,021,000	1,436,810,000	5,024,831,000
		Civil & Architecture works		3,401,151,000	0	3,401,151,000
		Mechanical works		139,715,000	1,012,429,000	1,152,144,000
		Electrical works		47,155,000	424,381,000	471,536,000
2	Adm	inistration Expenses				
	-1	Administration Cost				
		Administration Cost of Item 1	2.0%	100,497,000	0	100,497,000
		Sub-Total of -1		100,497,000	0	100,497,000
3	Engi	neering Cost				
	-1	Engineering Cost				
		Engineering Cost of Item 1	10.0%	358,802,000	143,681,000	502,483,000
	DI	Sub-Total of -1		358,802,000	143,681,000	502,483,000
4	Phys	ical Contingency				
	-1	For Local Portion of Item 1-3	10.0%	404,732,000	0	404,732,000
	-2	For Foreign Portion of Item 1-3	10.0%	0	158,049,000	158,049,000
		Sub-Total of -1+-2		404,732,000	158.049.000	562,781,000
5	Price	Contingency			200,0 13,000	002,102,000
-	-1	For Local Portion of Item 1-3	3.3%	696.347.000	0	696.347.000
	-2	For Foreign Portion of Item 1-3	2.4%	0	195.584.000	195,584,000
		Sub-Total of -1+-2		696,347,000	195,584,000	891,931,000
6	Inter	est during construction				
	-1	Interest during construction	0.65%	63,587,000	23,393,000	86,980,000
		Sub-Total of -1		63,587,000	23,393,000	86,980,000
7	Com	mitment charge		^		· · ·
	-1	Commitment charge	0.10%	20,320,000	7,683,000	28,003,000
		Sub-Total of -1		20,320,000	7,683,000	28,003,000
8	Tax					
	-1	VAT	7%	366,261,000	137,564,000	503,825,000
	-2	Custom	5%	0	133,223,000	133,223,000
		Sub-Total of -1		366,261,000	270,787,000	637,048,000
		Total of 1+2+3+4+5+6+7+8		5,598,567,000	2,235,987,000	7,834,554,000
		(including TAX)				
		Total of 1+2+3+4+5+6+7		5,232,306,000	1,965,200,000	7,197,506,000
		(excluding TAX)				

2) DDS Budget Request Form Version

		A	moun	t (Baht)	Total Amount
	Item Description	L.C		F.C	(Baht)
1	Construction Cost				
А	Wastewater treatment plant				
-A1	Lift pump facilities				
	Civil & Architecture works	114,85	5,000	0	114,855,000
	Mechanical works	32,20	2,000	216,213,000	248,415,000
	Electrical works	8,75	4,000	78,782,000	87,536,000
	Sub Total of -A1	155,81	1,000	294,995,000	450,806,000
-A2	Grit chamber facilities	, í	/	, , ,	
	Civil & Architecture works	34,664	4,000	0	34,664,000
	Mechanical works	14,65	3,000	98,387,000	113,040,000
	Electrical works	2,79	2,000	25,126,000	27,918,000
	Sub Total of -A2	52,10	9,000	123,513,000	175,622,000
-A3	Aeration tank facilities		,		· · ·
	Civil & Architecture works	157,61	8,000	0	157,618,000
	Mechanical works	50,67	8,000	414,611,000	465,289,000
	Electrical works	7,33	8,000	66,039,000	73,377,000
	Sub Total of -A3	215,63	4,000	480,650,000	696,284,000
-A4	Settling tank facilities				
	Civil & Architecture works	264,79	9,000	0	264,799,000
	Mechanical works	18,03	9,000	121,120,000	139,159,000
	Electrical works	5,15	4,000	46,386,000	51,540,000
	Sub Total of -A4	287,992	2,000	167,506,000	455,498,000
-A5	Effluent and recycle facilities		,		· · · ·
	Civil & Architecture works	103,579	9,000	0	103,579,000
	Mechanical works	8,15	5,000	54,753,000	62,908,000
	Electrical works	2,12	8,000	19,154,000	21,282,000
	Sub Total of -A5	113,86	2,000	73,907,000	187,769,000
-A6	Sludge dewatering facilities				
	Civil & Architecture works	81,43	8,000	0	81,438,000
	Mechanical works	11,99	3,000	80,524,000	92,517,000
	Electrical works	3,42	7,000	30,839,000	34,266,000
	Sub Total of -A6	96,85	8,000	111,363,000	208,221,000
-A7	Administration building				
	Civil & Architecture works	176,60	9,000	0	176,609,000
	Mechanical works		0	0	0
	Electrical works	1,30	0,000	11,697,000	12,997,000
	Sub Total of -A7	176,90	9,000	11,697,000	189,606,000
-A8	Power facilities				
	Civil & Architecture works		0	0	0
	Mechanical works	3,99	5,000	26,821,000	30,816,000
	Electrical works	16,26	2,000	146,358,000	162,620,000
	Sub Total of -A8	20,25	7,000	173,179,000	193,436,000
	Sub Total of A	1,120,43	2,000	1,436,810,000	2,557,242,000
	Civil & Architecture works	933,562	2,000	0	933,562,000
	Mechanical works	139,71	5,000	1,012,429,000	1,152,144,000
	Electrical works	47,15	5,000	424,381,000	471,536,000
В	Interceptor				
-B1	Pipe jacking				
	Civil works	1,609,424	4,000	0	1,609,424,000
	Sub Total of -B1	1.609.42	4.000	0	1.609.424.000

		Item Description		Amoun	t (Baht)	Total Amount
		Item Description		L.C	F.C	(Baht)
	-B2	Pipe jacking shaft				
		Civil works		721,165,000	0	721,165,000
		Sub Total of -B2		721,165,000	0	721,165,000
	-B3	Interceptor chamber				
		Civil works		137,000,000	0	137,000,000
		Sub Total of -B3		137,000,000	0	137,000,000
		Sub Total of B		2,467,589,000	0	2,467,589,000
		Civil Works		2,467,589,000	0	2,467,589,000
		Sub Total of Construction Cost		3,588,021,000	1,436,810,000	5,024,831,000
		Civil & Architecture works		3,401,151,000	0	3,401,151,000
		Mechanical works		139,715,000	1,012,429,000	1,152,144,000
		Electrical works		47,155,000	424,381,000	471,536,000
2	Engi	neering Cost				
	-1	Engineering Cost				
		Engineering Cost of Item 1	3.0%	107,641,000	43,104,000	150,745,000
		Sub-Total of -1		107,641,000	43,104,000	150,745,000
3	Tax					
	-1	VAT	7%	258,686,000	103,594,000	362,290,000
	-2	Custom	5%	0	133,223,000	133,223,000
		Sub-Total of -1		258,696,000	236,817,000	495,513,000
		Total of 1+2+3		3,954,358,000	1,716,731,000	5,671,089,000
		(including TAX)				
		Total of 1+2		3,695,662,000	1,479,914,000	5,175,576,000
		(excluding TAX)				

Appendix-8 Economic and Financial Analysis

表8.1 羅済分析結果(ケース1:支払意思額を採用) Table 8.1 Economic Evaluation of the Project (WTP)

感度分析 Sensibility Analysis

	5		lo.	S.	S.	-	0	0	5	~1		5	<u>~</u>			5	-	0	S.	2		m		5	<u>~</u>	5	0	6		÷.	5	5	5	lo.	5	c 0	-		0	. ± 1	0	Г
D: 感度分析 CF ケース1	D: Sensibility CF Case4	-26.84	-141.75	-141.46	-2091.76	-2075.81	-2059.2	-53.53	-50.76	1107.92	521.7	1103.26	288.13	285.9	283.47	281.25	278.81	276.59	274.16	271.82	-314.17	-1107.3	265.47	263.26	261.13	-324.86	256.79	254.69	252.57	250.34	249.05	249.25	249.45	249.75	249.95	-333.73	2907.51	2,211.0	-2,769	1.7%	-2,769	0.50
C: 感度分析 CF ケース3	C: Sensibility CF Case3	-26.84	-141.79	-141.46	-2,091.76	-2,075.81	-2,059.20	-47.92	-44.53	1,243.16	657.07	1,238.66	333.36	331.16	328.86	326.67	324.36	322.17	319.87	317.56	-268.29	-1,061.38	311.43	309.36	307.27	-278.68	303.11	301.05	298.97	296.88	295.63	295.87	296.11	296.35	296.59	-287.05	2,954.23	3,781.0	-2,430	2.9%	-2,430	0.40
B: 感度分析 CF ケース2	B: Sensibility CF Case2	-24.4	-128.9	-128.6	-1,901.6	-1,887.1	-1,872.0	-44.1	-41.1	1,117.9	585.0	1,113.8	298.9	297.0	294.8	292.9	290.7	288.8	286.6	284.6	-248.1	-969.1	279.0	277.0	275.1	-257.5	271.3	269.5	267.6	265.6	264.5	264.7	264.9	265.2	265.4	-265.2	2,681.4	3,294.5	-2,240	2.8%	-2,240	0.80
ŧ	Ycar	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	Total	NPV	EIRR	NPV	212
便益 -1 0%	Benefit - 10%	0.0	0.0	0.0	0.0	0.0	0.0	50.1	55.9	1217.6	1218.3	1219	406.9	407.7	408.3	409.1	409.7	410.5	411.1	411.8	412.5	413.2	413.9	414.5	415.2	415.9	416.5	417.2	417.9	418.5	419.1	419.3	419.5	419.8	420	420.2	420.4	14,129.6	3,053.3			
☆田+1 0%	Cost +10%	-26.84	-141.79	-141.46	-2091.76	-2075.81	-2059.2	-103.63	-106.66	-109.68	-696.60	-115.74	-118.77	-121.80	-124.83	-127.85	-130.89	-133.91	-136.94	-139.98	-726.67	-1520.50	-148.43	-151.24	-154.07	-740.76	-159.71	-162.51	-165.33	-168.16	-170.05	-170.05	-170.05	-170.05	-170.05	-753.93	2487.11	-11,918.6	-5,822.3			
キャッシュ フロー	Cash Flow	-24.4	-128.9	-128.6	-1,901.6	-1,887.1	-1,872.0	-38.5	-34.8	1,253.1	720.4	1,249.2	344.2	342.2	340.2	338.3	336.3	334.3	332.3	330.3	-202.2	-923.2	324.9	323.1	321.3	-211.3	317.6	315.8	314.0	312.2	311.1	311.3	311.6	311.8	312.1	-218.5	2,728.1	4,864.6	-1,900.44	4.0%	-1,900	
便益合計	Total Economic Benefit	0.0	0.0	0.0	0.0	0.0	0.0	55.7	62.1	1,352.8	1,353.7	1,354.4	452.1	453.0	453.7	454.5	455.3	456.1	456.8	457.5	458.4	459.1	459.9	460.6	461.3	462.1	462.8	463.6	464.3	465.0	465.7	465.9	466.2	466.4	466.6	466.9	467.1	15,699.6	3,392.57		(%)	
③処理水の 再利用	3. Reuse of Troated Waste Water	0.00	0.00	0.00	0.00	0.00	0.00	13.00	19.20	19.70	20.30	20.80	21.30	21.90	22.40	23.00	23.50	24.10	24.60	25.10	25.70	26.20	26.70	27.20	27.70	28.20	28.70	29.20	29.70	30.20	30.60	30.60	30.60	30.60	30.60	30.60	30.60	772.60	131.04	EIRR	PV (D.R.=10	212
③十港価 格の上昇	2.Land Price Increase	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,290.00	1,290.00	1,290.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	387.00	13,545.00	3,000.57		z	
①支払意 思領	L. Environment al Immovement	0.00	0.00	0.00	0.00	0.00	0.00	42.71	42.93	43.14	43.37	43.60	43.83	44.06	44.29	44.52	44.75	44.98	45.21	45.44	45.68	45.92	46.16	46.40	46.64	46.88	47.12	47.36	47.60	47.84	48.08	48.32	48.56	48.80	49.04	49.28	49.52	1,382.03	260.95			
費用合計	Total Economic Cost	-24.40	-128.90	-128.60	-1,901.60	-1,887.10	-1,872.00	-94.21	-96.96	-99.71	-633.27	-105.22	-107.97	-110.73	-113.48	-116.23	-118.99	-121.74	-124.49	-127.25	-660.61	-1,382.27	-134.94	-137.49	-140.06	-673.42	-145.19	-147.74	-150.30	-152.87	-154.59	-154.59	-154.59	-154.59	-154.59	-685.39	2,261.01	-10,835	-5,293.01			
維持管理 技	O&M Cost	0.00	0.00	0.00	0.00	0.00	0.00	-94.21	-96.96	-99.71	-102.47	-105.22	-107.97	-110.73	-113.48	-116.23	-118.99	-121.74	-124.49	-127.25	-129.81	-132.37	-134.94	-137.49	-140.06	-142.62	-145.19	-147.74	-150.30	-152.87	-154.59	-154.59	-154.59	-154.59	-154.59	-154.59	-154.59	-3,935	-678.77		स	E
+ ☆ お お	Initial Construction Cost	-24.40	-128.90	-128.60	-1,901.60	-1,887.10	-1,872.00	0.00	0.00	0.00	-530.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-530.80	-1,249.90	0.00	0.00	0.00	-530.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-530.80	2,415.60	-6,900	-4,614.24	:	田贞:調金	
#	Ycar	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	Total	NPV			

費用+1 0%	Cost +10%	-26.84	-141.79	-141.46	-2091.76	-2075.81	-2059.2	-103.63	-106.66	-109.68	-696.60	-115.74	-118.77	-121.80	-124.83	-127.85	-130.89	-133.91	-136.94	-139.98	-726.67	-1520.50	-148.43	-151.24	-154.07	-740.76	-159.71	-162.51	-165.33	-168,16	-170.05	-170.05	-170.05	-170.05	-170.05	-753.93	2487.11	-11,918.6	-5.822.3			
ц.	MC	4.4	8.9	8.6	1.6	7.1	2.0	3.4	7.8	6.6	4.6	4.3	0.0	9.0	7.7	6.7	5.4	4,4	5.1	1.9	9.8	9.9	9.1	8.1	7.1	4.6	5.2	4.3	3.3	2.3	2.1	3.2	4.3	5.4	6.5	3.2	4.3	0.0	2.3	%	172	82
チャッシ	Cash Flo	-2	-12	-12	-1,90	-1,88	-1.87	11	11	1,40	87	1,40	50	49	49	49	49	49	49	49	-3	-75	48	48	48	-4	48	48	48	48	48	48	48	48	48	4-	2,90	9,78	L6-	7.2) T	0
便益合計	Total Economic Benefit	0.0	0.0	0.0	0.0	0.0	0.0	207.6	214.8	1.506.3	1.507.9	1,509.5	608.0	609.7	611.2	612.9	614.4	616.1	617.6	619.1	620.8	622.4	624.0	625.6	627.2	628.8	630.4	632.0	633.6	635.2	636.7	637.8	638.9	640.0	641.1	642.2	643.3	20,615.1	4,320.68		(º/)	
③処理水 の再利用	3. Reuse of Treated Waste Water	0.0	0.0	0.0	0.0	0.0	0.0	13.0	19.2	19.7	20.3	20.8	21.3	21.9	22.4	23.0	23.5	24.1	24.6	25.1	25.7	26.2	26.7	27.2	27.7	28.2	28.7	29.2	29.7	30.2	30.6	30.6	30.6	30.6	30.6	30.6	30.6	772.6	131.0	EIRR	V (D.R.=10	B/C
②土地価 格の上昇	2.Land Price Increase	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,290.0	1,290.0	1,290.0	387.0	387.0	387.0	387.0	387.0	387.0	587.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	13,345.0	3,000.6		ΝΡ	
①支払可能 額	Environmental Improvement	0.0	0.0	0.0	0.0	0.0	0.0	194.6	195.6	196.6	197.6	198.7	199.7	200.8	201.8	202.9	203.9	205.0	206.0	207.0	208.1	209.2	210.3	211.4	212.5	213.6	214.7	215.8	216.9	218.0	219.1	220.2	221.3	222.4	223.5	224.6	225.7	6,297.5	1,189.1			
費用습計	Total Economic Cost	-24.40	-128.90	-128.60	-1,901.60	-1,887.10	-1,872.00	-94.21	-96.96	-99.71	-633.27	-105.22	107.97	110.73	113.48	116.23	118.99	121.74	-124.49	-127.25	-660.61	-1,382.27	-134.94	-137.49	-140.06	-673.42	-145.19	-147.74	-150.30	-152.87	-154.59	-154.59	-154.59	-154.59	-154.59	-685.39	2,261.01	-10,835	-5.293.01			
維持管理 費	O&M Cost	0.00	0.00	0.00	0.00	0.00	0.00	-94.21	-96.96	-99.71	-102.47	-105.22	-107.97	-110.73	-113.48	-116.23	-118.99	-121.74	-124.49	-127.25	-129.81	-132.37	-134.94	-137.49	-140.06	-142.62	-145.19	-147.74	-150.30	-152.87	-154.59	-154.59	-154.59	-154.59	-154.59	-154.59	-154.59	-3,935	-678.77		TT.	dy Team
事業実施 費	Initial Construction Cost	-24.40	-128.90	-128.60	-1,901.60	-1.887.10	-1,872.00	0.00	0.00	0.00	-530.80	0.00	0.00	0.00	00.0	0.00	0.00	0.00	0.00	0.00	-530.80	-1,249.90	0.00	00.0	0.00	-530.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-530.80	2,415.60	-0*900	-4,614.24		出典:調査[Source: Stue
4	Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	6707	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	Tutal	VPV			

感度分析 Sensibility Analysis

便益-1 0%	4	B: 感度分析 CF ケース2	C: 感度分析 CF ケース3	D: 感度分析 CF ケース1
Benefit -	Vine	B: Sensibility	C: Sensibility	D: Sensibility
10%	T CAL	CF Case2	CF Case3	CF Case4
0	2012	-24.4	-26.84	-26.84
0	2013	-128.9	-141.79	-141.79
0	2014	-128.6	-141.46	-141.46
0	2015	-1,901.6	-2,091.76	-2091.76
0	2016	-1,887.1	-2.075.81	-2075.81
0	2017	-1,872.0	-2.059.20	-2059.2
186.8	2018	92.6	103.97	83.17
193.3	2019	96.3	108.14	86.64
1355.7	2020	1,256.0	1.396.62	1246.02
1357.1	2021	723.8	811.30	660.5
1358.6	2022	1,253.4	1.393.76	1242.86
547.2	2023	439.2	489.23	428.43
548.7	2024	438.0	487.90	426.9
550.1	2025	436.6	486.37	425.27
551.6	2026	435.4	485.05	423.75
553	2027	434.0	483.51	422.11
554.5	2028	432.8	482.19	420.59
555.8	5074	431.3	480.66	418.86
557.2	2030	430.0	479.12	417.22
558.7	2031	-101.9	-105.87	-167.97
560.2	2032	-822.1	-898.10	-960.3
561.6	2033	426.7	475.57	413.17
563	2034	425.5	474.36	411.76
564.5	2035	424,4	473.13	410.43
565.9	2036	-107.5	-111.96	-174.86
567.4	2037	422.2	470.69	407.69
568.8	2038	421.1	469.49	406.29
570.2	2039	419.9	468.27	404.87
571.7	2040	418.8	467.04	403.54
573	2041	418.4	466.65	402.95
574	2042	419.4	467.75	403.95
575	2043	420,4	468.85	404.95
576	2044	421,4	469.95	405.95
577	2045	422,4	471.05	406.95
578	2046	-107.4	-111.73	-175.93
579	2047	2,840.0	3,130.41	3066.11
18,333.6	Tutal	7,718.5	8,090.5	6,633.0
3,888.6	NPV	-1,404.4	-1,501.6	-1,933.7
	EIRR	5.8%	5.9%	4.7%
	NPV	-1,404	-1,502	-1,934
	B/C	0.73	0.74	0.67

Table	8.3 Total (Cost Caluer	ulation						14 W. 41-10										
#			事業実	施費 / Initia	d Constructio	n Cost			御修* 松城	維持管理費	#			合計作	†孩費用 / T₀	tal Financial (Crist		
	Alternative 1	Alternative 2	Alternative 3	Alternative 4		Altern	ative5		All alternatives	All Alternatives		Alternative1	Alternative2	Alternative3	Alternative4	Alternative5	Alternati	ve6 (BOT se	henc)
Year	100% BMA Budget	60% BMA Budget	40% BMA Budget	0% BMA Budget	15% BMA Budget	85% ODA Loan	sra, ODA Loan Accumulate d Amount	15% BMA Budget + 85% ODA Loan Repayment	Replacemen t/Extention Cost	O&M Cost	Year	100% BMA Budget	60% BMA Budget	40% BMA Budget	0% BMA Budget	15º BVA Budgel, 85% ODA Loan Repayment	171vate Coinp Debu RR RR-15,	any, 30years -3.13%, 20% 0%, WACC5	BUT RUS Equity 50%
	0% Subsidized	40% Subsidized	60% Subsidized	100% Subsidized		0% Sub	sidized					0% Subsidized	40% Subsidized	60% Subsidized	100% Subsidizzed	0% Subsidized	Total Cost	Cash Flow Balance	Service Fee
	6	8	0	Ð	15.0%	85.0%	85.0%	0	9	Ð		(1+(0+(1)	Q+@+©	Q+@+@	Q+Q+()	(2) + (3) + (3)	Q+@+Q		
2012	28.2	28.2	28.2	28.2	51÷	24.0	24.0	4.2	0.0	0.00	2012	28.20	28.20	28.20	28.20	4.20	28.20	28.2	
2013	147.3	5/2	5771	147.3	22.1	125.2	F.021	22.1	0.0	0.00	2013	147.30	147,30	147.30	147.30	22,10	147.30	177.1	
2014	147.2	1:7.2	57741	147.2	22,1	125.1	275.4	22.1	0.0	0.00	2014	147.20	147.20	147.20	147.20	22.10	147.20	334.0	
2015	2,218,9	1,331.3	887.6	0.0	332.8	1,886.1	2, 63.3	332.8	0.0	0.00	2002	2.218.90	1.331.30	SN7.60	0.00	332.80	2.218.90	2,571.3	
2016	2,206.8	1.324.1	882.7	0.0	331.0	1.875.8	4,053.2	331.0	0.0	0.00	2016	2,206,80	1.324.10	882.70	0.00	331.00	2,206,80	4,919.5	
2017	2,194.2	1,316.5	877.7	0.0	329.1	1,865.1	5,944.6	329.1	0.0	0.00	2017	2.194.20	1.316.50	877.70	0.00	329.10	2.194.20	7,384.2	
2018							5.983.3	0.0	0.0	102.40	3018	102.40	102,40	102.40	102.40	102,40	102.40	7,892.8	710.5
2019							2777019	0.0	0.0	96.CU1	6107	102.39	105.39	96cU I	Reicut	96.201	105.59	1,682.7	2017
2020							6.061.3	0.0	0.0	108.38	3030	108.38	108.38	108.38	108.38	108.38	108.38	7,464.0	210.5
2021							6.100.7	0.0	530.8	111.38	2021	642.18	642.18	642.18	642.18	642.18	642.18	7.767.2	710.5
2022							6,140.4	224.5	0.0	114.37	2023	114.37	14.37	114.37	114.37	338.87	114.37	7,559.2	710.5
2023							5.954.3	224.5	0.0	117.36	2023	117.36	117.36	117.36	117.36	341.86	117.36	7,342.7	710.5
2024							5,767.0	224.5	0.0	120.36	2024	120.36	120.36	120.36	120.36	344.86	120.36	7,117.3	710.5
2025							5.578.6	224.5	0.0	123.35	2025	123.35	123.35	123.35	123.35	347.85	123.35	6,882.6	710.5
2026							5,388.9	224.5	0.0	126.34	2026	126.34	126.34	126.34	126.34	350.84	126.34	6,637.9	710.5
2027							5.197.9	224.5	0.0	129.34	2037	129.34	129.34	129.34	129.34	353.84	129.34	6,382.7	2.017
2028							5.005.8	2.4.5	0.0	132.33	2028	132.33	132.33	132.33	132.33	356.83	132.33	6,116.5	710.5
2029							4,812.4	224.5	0.0	135.32	000	135.32	135.32	135.32	135.32	359.82	135.32	5,838.7	710.5
2030							4.617.7	224.5	0.0	138.32	2030	138.32	138.32	138.32	138.32	362.82	138.32	5,548.5	710.5
2031							4,421.7	224.5	530.8	141.10	2031	671.90	671.90	671.90	671.90	896.40	671.90	5.776.0	710.5
2032							4,224.5	224.5	1249.9	143.88	2033	1.393.78	1.393.78	1,393,78	1.393.78	1.618.28	1.393.78	6,737.9	710.5
2033							4,026.0	224.5	0.0	146.67	2033	146.67	146.67	146.67	146.67	371.17	146.67	6,505.6	710.5
2034							3,826.2	224.5	0.0	149.45	2034	149.45	149,45	149.45	149.45	373.95	149,45	6,263.3	710.5
2035							3.625.1	224.5	0.0	152.24	2035	152.24	152.24	152.24	152.24	376.74	152.24	6,010.4	710.5
2036							3,422.7	224.5	530.8	155.02	3036	685.82	685.82	685.82	685,82	910.32	685.82	6,277.2	710.5
2037							3.219.0	224.5	0.0	157.81	2037	157.81	157.81	157.81	157.81	382.31	157.81	6,030.7	710.5
2.038							3,014.0	224.5	0.0	160.59	2038	160.59	160.59	160.59	160.59	385.09	160.59	5,773.4	710.5
2039							2,807.6	224.5	0.0	163.37	2039	163.37	163.37	163.37	163.37	387.87	163.37	5,504,7	710.5
2040							2,599.9	224.5	0.0	166.16	2040	166.16	166.16	: 66.16	166.16	390.66	166.16	5,224.1	710.5
2041							2.390.9	224.5	0.0	168.03	2041	168.03	168.03	168.03	168.03	392.53	168.03	4,979,8	710.5
2042							2.180.4	2.1.5	0.0	168.03	2042	168.03	168.03	168.03	168.03	392.53	168.03	4,619.4	710.5
2.043							1.968.6	224.5	0.0	168.03	2043	168.03	168.03	168.03	168.03	392.53	168.03	4,791.9	710.5
2044							G.661,1	C.4.2	0.0	0.001	2044	CU.801	0.501	CU.801	CU.801	CC.24C	108.03	5,940.5	710.5
2045							1,540.9	224.5	0.0	168.03	2045	168.03	168.03	168.03	168.03	392.53	168.03	3,582.0	710.5
2046							1,325.0	224.5	530.8	168.03	2046	698.83	698.83	698.83	698.83	923.33	698.83	3,728.2	710.5
2047							1,107.6	1,107.6	-2643.9	168.03	2047	-2,475.87	-2,475.87	-2,475.87	-2,475.87	-1,368.27	-2,475.87	707.8	710.5
合業	6,942.60	4,294.60	2,970.70		1,041.30	5,901.30		7,761.40	729.20	4,277.14	令辈	11,948.94	9,300.94	7,977.04	5,329.04	12,767.74	11,948.94	_	21,315.00
					_	0000		-											

表8.3 财務費用計算 Table**8**3 Total Cost Calm

Appendix 8-4

1 Jo	otal Rever	nue	Revenue of h	Basic Plan	(Baht/Year)	Total Revenu	IC				(Baht/Year)	1 0131	NOW ADDRAG	CONCEPTION	
<u>t(m3/年)</u> 5月 日台	計給水		13/ 生活用	収入額(Baht/年 業務用	9 迫加収入	移金领 被 後後 が が	₩ 数 数 10°	入試算1 平核 %/5Year 金		[2 對 對 一 一 一	収入試算3 30%/5Year	年	収入試算1 10%/5Year	収入試算2 20%/5Year	収入試算3 30%/5Year
mount	(m3/yea	r) Daily Usage(n	Incom	ae Amount (Bal	ıt/year)	Collection Fee to	age Alte	ernative1 Ave	ra Alternati	ve2 rage	Alternative3	Year	Alternative1	Alternative2	Alternative3
nerci Jse	Total	/day)	Living Use	Commercial Use	Total	MWA	fari ff 10%	%/5Year	iff 20%/5Ye	ar ff	30%/5Year		10%/5Year	20%/5Year	30%/5Year
Keport 1	able I.I	9.	2.00	2.37	2.22	3 Shahr /Month						L'hit Cost			
0		0	0	0	0	0	2.22	сі 0	22	0 2.22	0	2012	0.0	0.0	0.0
Ċ		0	0	0	0	0	2.22	0	22	0 2.22	0	2013	0.0	0.0	0.0
0		0	0	0	0	0	2.22	0 2	22	0 2.22	0	2014	0.0	0.0	0.0
Ċ		0	0	0	0	0	2.22	ci O	22	0 2.22	0	2015	0.0	0.0	0.0
0		0	0 0	0	0	0	2.22	0 2	22	0 2.22	0	2016	0.0	0.0	0.0
0		0	0	0	0	0	2.44	رز 0	66	0 2.89	0	2017	0.0	0.0)'0
3,526	39,595,	331 108,4	80 31,683,610	56,295,857	87,979,467	3,498,160	2.44 9.	5,839,707 2.	66 104,480,	992 2.89	113,515,063	2018	92.3	101.0	110.(
9,070	40,068,	177 109,7	76 32,058,214	4 56,972,596	89,030,810	3,044,496	2.44 90	5,984,221 2.	66 105,728,	700 2.89	114,870,655	2019	93.9	102.7	111.8
4,614	40,541,	023 111,0	171 32,432,618	3 37,649,334	90,082,132	3,039,700	2.44 91	5,126,735 2.	00 106,976,	407 2.89	116,226,247	2020	9.5.1	103.9	113.2
0,158	41,013,	869 112,3	67 32,807,422	2 58,326,074	91,133,496	3,074,988	2.44 9.	9.273,250 2.	66 108,224,	116 2.89	117,581,841	2021	96.3	2 105.1	114.5
5,702	41,486.	715 113,6	62 33,182,026	5 59,002,814	92,184,840	3,090,360	2.68 111	0,294,921 3.	19 131,283,	880 3.76	154,742,128	2022	107.2	2 128.2	151.3
1,246	41,959,	561 114,9	58 33,556,630	0 59,679,553	93,236,183	3,105,816	2.68 11	1,552,010 3.	19 132,780,	192 3.76	156,505,806	2023	108.4	1 129.7	153.4
6.790	42,432.	407 116,2	23 33,931,234	4 60,356,292	94,287,526	3,121,356	2.68 112	2,809,100 3.	19 134,276,	503 3.76	158,269,484	2024	109.7	7 131.2	155.1
2,554	42,905	C'/11 CC7	149 54,505,858	5 61,033,032	0/8,855,64	5,156,980	2.68 114	4,066,189 5.	19 155,112,	815 5.70	160,033,161	\$707	2011	0.251	S-0C1
1,878	43,378	099 118,8	(44 34,680,442 10 25 655 645	61,709,771	96,390,213	3,152,646	2.68 11:	0,323,279 3.	19 137,269,	127 3.76	161,796,839	2026	112.5	134.1	158.6
0,422 0,026	42,000	701 120,1	40 33,033,040	010,080,20 0	000 104 00	2,108,390 2,104,320	21 20 0	.c c0+;c7c;c	200,001 C0 22 1 C0 102 C0	020 4.89	210,011,212	1707	2,621	4.C01 521	5116
002.9	11 707 11	121 16/	152 53,429,030	00,000,249	90,544,047	3,164,230	21 54.2	7, /09, 142 5.	02 100,402,002,002,002,002,002,002,002,002,0	70.4 400 400 400 400 400 400 400 400 400	146,600,612	9707	1071	0.501	2117
4,210 0.055	45 269	483 124.0	758 371 35 307-234	+ 03,739,989 7 64 416 730	100 595 587	3,200,148	2.95 13	2476.616 3	K3 171 995 (001 4.09	011, cuc, / 12	2030	c 6c	168.8	214.
2.518	45.576.	649 124.8	68 36.428.262	64,849,168	101.277.430	3.232.236	2.95 13.	3.375.506 3	83 173,162,	097 4.89	221.086,855	2031	130.1	169.9	217.5
4,981	45.883.	815 125,7	09 36,677,668	8 65,281,605	101,959,273	3,248,406	3.25 14	7,929,420 4.	60 209,377,	025 6.36	289,486,495	2032	144.3	7 206.1	286.2
7,444	46,190	981 126,5	51 36,927,074	4 65,714,042	102,641,116	3,264,660	3.25 14	3.919,723 4.	60 210,778,	684 6.36	291,424,442	2033	145.3	7 207.5	288.2
9,907	46,498,	147 127,3	92 37,176,480	0 66,146,480	103,322,960	3,280,998	3.25 149	9.910,026 4.	60 212,180,	344 6.36	293,362,389	2034	146.6	5 208.9	290.1
2,370	46,805,	313 128,2	34 37,425,886	66,578,917	104,004,803	3,297,420	3.25 15(0.900,329 4.	60 213,582,0	004 6.36	295,300,336	2035	147.(5 210.3	292.(
4,833	47,112,	479 129,0	175 37,675,292	2 67,011,354	104,686,646	3,313,926	3.25 15	1,890,632 4.	60 214,983,	664 6.36	297,238,284	2036	148.6	5 211.7	293.5
7,296	47,419,	645 129,9	17 37,924,698	8 67,443,792	105,368,490	3,330,516	3.58 16	8,404,230 5.	52 259,662;	389 8.27	389,023,180	2037	165.1	256.3	385.7
9,759	47,726.	811 130,7	58 38,174,104	4 67,876,229	106,050,333	3,347,148	3.58 169	9,495,088 5.	52 261,344;	381 8.27	391,543,121	2038	166.1	258.0	388.2
2,222	48,033	977 131,6	00 38,423,510	0 68,308,666	106,732,176	3,363,864	3.58 170	0,585,945 5.	52 263,026,	373 8.27	394,063,062	2039	167.2	259.7	390.7
4,689	48,341	148 152,4	42 38,6/2,918	5 68,/41,112	10/,414,030	5,580,064	1 80.5	.0/0,818 D.	22 264,/08,	289 8.27	396,385,040	2040	108.2	č.102 č	595.2
7,152	48,648	314 133,2	83 38,922,324	1 69,173,550	108,095,874	3,397,548	3.58 17.	2,767,676 5.	52 266,390,	384 8.27	399,102,984	2041	169.4	1 263.0	395.
/,152	48,648	<u>514 155,7</u>	283 38,922,324 22 20 20 20 20 20 20 20 20 20 20 20 20 2	1 69,1/3,550	108,092,874	5,414,516	5.94 191	<u>3,140,962</u> 6.	62 519,475,	##### +7+	518,785,620	2042	180.	316.1	2.616
7,152	48,648	314 133,2	83 38,922,324	1 69,173,550	108,095,874	3,431,568	3.94 190	0,140,962 6.	62 319,475,	424 ####	518,785,620	2043	186.7	316.0	515.4
7.152	48.648	314 133.2	83 38.922.324	1 69.173.550	108.095.874	3.448.746	3.94 190	<u>0.140.962 6.</u>	<u>62 319.475.</u>	424 ####	518.785.620	2044	186.7	316.0	515.2
21×	40,040	214 122,4	02 20 000 204	1 60 172 550	100,005,074	2,400,000 2,402,254	2.04 10/	0,140,902 0. 0,140,062 6	C12-210-472	474 FCF	070,001,010	2046	1.00	216.0	212
7 152	48.648	314 133.2	83 38 922 324	1 69 173 550	108 095 874	3 500 784	433 208	8 962 022 7	04 383 177	井井井 ししま	674 662 602	2047	202	2.016	2129
			Collection Ra	ate = 99.2%			Coll	ection Rate = 6	0.2%			Total	4.273.2	6.205.4	8.946
							,					1	1.		- 4 -

Appendix 8-5

Table8.5 Cash	Flow of A	II Altern	atives (Co	ost, Kever	(ani													
Cost		Alternativel		<	lternative2		~	Nternative3		<	Iternative4			Alternative5			Alternative6	
Alternative	[]u]]	Cost Reco	/ory	40	% Subsidize	ę	60	% Subsidizo		PO	y O&M Co	5	Full Cost	Recovery, J Loan 85%	ICA ODA	Private Co	mpany, 30y	cars BOT
Kevenue Alternative	Viernels ef	Weither V 62	Viterate. V e3	Variation V	V., P. (R. (N	Alternal A	Vietne V el	V. comp. V.	1. m. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	Vue per A	Vietnar V 62	V. et ha. V 3	Vure A	Vurna A	Vieres's e3	Wietrach eI	V., emic. is 62	Autoria e3
	10%/5y	20%/5y	30%/5y	10%/5y	20%/5y	30%/5y	10%/5y	20%/5y	30%/5y	10%/5y	20%/5y	30%/5y	10%//5y	20%/5y	30%/5y	10%/5y	20%//5y	30%/5y
2012	-28.20	-28.20	-28.20	-28.20	-28.20	-28.20	-28.20	-28.20	-28.20	-28.20	-28.20	-28.20	-4.20	-4.20	-4.20	0.00	0.00	0.00
2013	-147.30	-147.30	-147.30	-147.30	-147.30	-147.30	-147.30	-147.30	-147.30	-147.30	-147.30	-147.30	-22.10	-22.10	-22.10	0.00	0.00	0.00
2014	-147.20	-147.20	-147.20	-147.20	-147.20	-147.20	-147.20	-147.20	-147.20	-147.20	-147.20	-147.20	-22.10	-22.10	-22.10	0.00	0.00	0.00
2015 2016	-2,218.90	-2,218.90	-2,218.90	-1,331.30	-1,331.30	-1,331.30	-887.60 887.60	-887.60 ××^ 70	-887.60	0.00	0.00	0.00	-332.80	-332.80	-332.80	0.00	0.00	0.00
2017	02,191,12	-2,194,20	-2,194,20	- 3 6.50		-1.316.50	-877.70	-877.70	-871.70	0.00	0.00	0.00	-319,10	-329.10	-379.10	0.00	00.0	0.00
2018	:0.10	1.40	7.60	10.10	1.46	7.60	16.10	020	7.60	: 0.10	1.40	7.60	10.10	1.40	7.60	618.20	609.50	600.50
2019	64111-	-2.69	6.41	6	-7,69	6.41	-11,49	69101	6.41	615.1.1	-2.69	6.41	671.1	0.03	6.41	-616,60	-607/80	-5.98.70
2020	-13.28	-1.48	4.82	-13.28	-1.48	4,82	-13.28	-4/38	4.82	-13.28	-1.48	4.82	-13.28	-1,48	4.82	-615.40	-606.60	-597.30
2021	-545.98	-537,08	-527.68	-545.98	-537.08	-577.68	-545.98	-537.08	-527.68	-545,98	-537.08	-527.68	-545.98	-537.08	-577.68	-614.30	-605,40	-596,60
2022	7.1.7	13.83	37.33	100 C	13.83	37.33	272	13.83	37.33	-7.12	13.83	37.33	-231.67	-210.67	-187.17	-603.30	-582.30	-558.80
2023	20.4	12.34	36.01	8.06	12.34	26.04	9.06	12.3 1	36,04	8.0.6	12.34	36.04	277.76	2:2.56	188.46	600.10	5×0.40	557.10
2024	-10.66	10.84	34.74	-10.66	10.84	34.74	-10.66	10.84	34.74	-10.66	10.84	34.74	-235.16	-213.66	-1.89.76	-600.80	-579.30	-555.40
2025	51-02	9.25	33.55	3.5	9.25	33.55	12.45	9.25	33.55	:245	9.25	33.55	236.95	215.25	100.05	599.60	\$77.90	553.60
2026	÷1,2,14	7.76	32.26	-14,14	7.76	32.26	-14.14	7.76	32.26	-14.14	7.76	32.26	-2.38.04	-216.74	-192,24	-598.30	-576.40	-551.90
2027	4.14	34.06	80.16	4.14	34.06	80.16	4.14	34.06	80.16	4.14	34,06	80.16	228.64	190.44	144,34	585.30	547.10	501.00
2028	-5.83	32.87	79.47	5.83	32.87	79.47	-5.8.2	32.87	79.47	-5.83	32.87	79.47	-2.30.33	- 9: 63	-145,03	-584.00	-545.30	-498.70
2029	-7.42	31.68	78.78	-7.72	31,68	78.78	-7.42	31.68	78.78	-7.42	31.68	78.78	-231.92	-192.82	-145.72	-582.60	-543.50	-496.40
2030	9.03	30.48	78.08	0.02	30.48	78.08	0.02	30,48	78.08	9.02	30.48	78.08	333.52	194,02	146.42	581.20	541.70	494,10
2031	-541.80	-502.00	-454.00	-541.80	-502.00	-154,00	-541.80	-502.00	-454,00	-541.80	-502.00	-454.00	-766.30	-726.50	-678.50	-580.40	-540.60	-492.60
2032	80.040.0	1.187.68	1.107.58	1.2.49.0N	1.1.NT.68	1.107.58	1.249.08	1, 1.87.68	1.107.58	1.249.08	:.187.68	1.107.5N	1,473.5N	1.412.18	1.332.08	565.80	504.40	404.30
2033	10.07	60.83	141.53	-0.97	60.83	141.53	76.0-	60.83	141.53	10.01	60.83	141.53	12,200-	- 63.67	-82.97	-564.80	-503.00	-492.30
2034	2.N.C	59.45	140.65	2.8.5	59.45	140.65	2.85	59.45	140.65	2.85	59.45	140.65	227.35	165.05	83.85	563.90	501.60	40.040
2035	÷9°	58.06	139.76	-4.64	58.06	139.76	+9'+-	58.06	139.76		58.06	139.76	-339.14	- ' 6ts.÷4	FV. F8-	-562,90	-500,20	14.8.50
2036	-537.22	-174.12	-341.92	-537.22	-474.12	-391.92	-537.33	-474.02	-391.92	-537.22	- 74, 12	-3992	-761.72	-698.62	-616.42	-561.90	-198.80	-416.60
2037	7.29	98.49	227.89	7.29	98.49	227.89	7.29	98.49	227.89	7.29	98.49	227.89	-217.21	- 26.01	3.39	-545.40	-454,20	-324,80
2038	5.51	97.41	227.61	5.51	97,41	227.61	5.51	97.41	227.61	5.51	97.41	227.61	218.99	127.09	3,11	544.40	+52.50	322.30
2039	3.83	96.33	227.33	3.83	96.33	227.33	3.83	96.33	227.33	3.83	96.33	227.33	220.67	128.17	2.83	543,30	150.80	319,80
2040	2.14	95.14	227.04	2,14	95.14	227.04	2.14	95.14	227.04	2.14	95.14	227.04	-222.36	- 79.36	2.54	-542,20	-449,20	-3^{+7} , 30
2041	1.37	94.97	227.67	1.37	94.97	227.67	1.37	94.97	227.67	1.37	94.97	227.67	203.13	129,53	3.17	541.00	47.50	3.14.80
2042	18.67	148.07	347.37	18.67	148.07	347.37	18.67	148.07	347.37	18.67	148.07	347.37	-205.83	-76.43	122.87	-573.80	-394,40	- 95,10
2043	18.67	147.97	347.37	18.67	147.97	347.37	18.67	147.97	347.37	18.67	147.97	347.37	-205.83	-76.53	122.87	-523.80	-394.50	-195.10
2044	18.67	147.97	347.27	18.67	147.97	347.27	18.67	147.97	347.27	18.67	147.97	347.27	-205.83	-76.53	122.77	-573.80	-394.50	- 95.20
2045	18.67	147.97	347.27	18.67	147.97	347.27	18.67	147.97	347.27	18.67	147.97	347.27	-205.83	-76.53	122.77	-523.80	-394.50	-195.20
2046	-512.13	-382.83	-183.53	-512.13	-382.83	-183.53	-512.13	-382.83	-183.53	-512.13	-382.83	-183.53	-736.63	-607.33	-408.03	-523.80	-394.50	-195.20
2047	2,681.37	2.855.57	3,147.07	2,681.37	2,855.57	3.147.07	2.681.37	2,855.57	3,147.07	2.681.37	2.855.57	3,147.07	1.573.77	1,747.97	2.039.47	-505.00	-330.80	-39.30
NPV (DR=0%)	-7,675.7	-5,743.5	-3,002.2	-5,027.7	-3,095.5	-354.2	-3,703.8	-1,771.6	969.7	-1,055.8	876.4	3,617.7	-8,494.5	-6,562.3	-3,821.0	-17,(141.8)	-15,109.6	-12,368.3
FIRR	-5.7%	-3.8%	-1.7%	-4.8%	-2.6%	-0.3%	-4.2%	-1.8%	0.8%	-2.1%	$1.6^{0/6}$	5.9%	-17.7%	-11.7%	-5.5%	D. a.	n.a.	n.a.
NPV (DR=3.13%)	-7,125	-6,247	-5,033	-4,783	-3,906	-2,692	-3,613	-2,735	-1,521	-1,271	-393	821	-5,182	-4,304	-3,090	-9,527	-8,649	-7,435

表8.5 費用・収入の代替案毎のキャッシュフロー Table8 5 Cash Flow of All Alternatives (Cost Bev

Appendix-9 Pamphlet of Nong Bon Wastewater Treatment Project





Appendix-10 Presentation Materials for Stakeholder Meetings

- 1) First stakeholder meeting held on 17th February,
- 2) Second stakeholder meeting held on 29th March

English version and Thai version

1)-1 First stakeholder meeting held on 17th February (English version)



















































































Appendix 10-8









Nong Bon Wastewater Treatment Plant

- Location: Near Rama IX Park, Next to Storm Water Reservoir
- Design Capacity: 135,000 m³/day (daily average)
- Treatment Process: Carrier added activated Sludge



Parameter Influent Effluent					
arameter	Influent	Effluent			
pН	-	55-90			
BOD	150 mg/l	20 mg/l			
SS	150 mg/1	30 mg/l			
T-N	30 mg/l	10 mg/l			
NH4		5 mg/l			
T-P	8 mg/1	2 mg/1			
DO	-	5 mg/l			
Oil & Grease	-	5 mg/l			







