

Node No.	Net Work Analysis			Distribution Main		I	Leakage	
	Elevation of Pipe (MSL)	Demand (cum/d)	Dynamic Pressure (MSL)	Dynamic Pressure (m)	Static Pressure (m)			
1	1,881.7	189.1	1,919.6	37.9	109.3	0.0	0.0	0.0
2	1,885.1	108.5	1,924.3	39.2	105.9	0.0	0.0	0.0
4	1,881.8	117.8	1,922.1	40.3	109.2	0.0	0.0	0.0
5	1,881.3	62.0	1,921.8	40.5	109.7	0.0	0.0	0.0
6	1,883.7	117.8	1,921.5	37.8	107.3	0.0	0.0	0.0
9	1,881.2	206.2	1,916.0	34.8	109.8	0.0	0.0	0.0
10	1,903.4	38.8	1,926.2	22.8	87.6	0.0	0.0	0.0
11	1,902.1	133.3	1,943.9	41.8	88.9	0.0	0.0	0.0
12	1,880.5	102.3	1,912.3	31.8	110.5	0.0	0.0	0.0
13	1,874.2	79.0	1,912.4	38.2	116.8	0.0	0.0	0.0
14	1,865.6	102.3	1,912.7	47.1	125.4	0.0	0.0	0.0
15	1,860.5	94.5	1,918.8	58.3	130.5	0.0	0.0	0.0
16	1,860.5	131.8	1,918.1	57.6	130.5	0.0	0.0	0.0
18	1,885.1	165.8	1,915.8	30.7	105.9	0.0	0.0	0.0
19	1,885.8	131.8	1,915.7	29.9	105.2	0.0	0.0	0.0
22	1,889.4	122.5	1,916.2	26.8	101.6	0.0	0.0	0.0
23	1,887.3	127.1	1,915.4	28.1	103.7	0.0	0.0	0.0
24	1,887.7	181.3	1,915.4	27.7	103.3	0.0	0.0	0.0
25	1,887.0	79.0	1,915.4	28.4	104.0	0.0	0.0	0.0
27	1,882.3	116.3	1,921.3	39.0	108.7	0.0	0.0	0.0
28	1,879.2	40.3	1,918.3	39.1	111.8	0.0	0.0	0.0
29	1,892.4	20.1	1,910.6	18.2	98.6	0.0	0.0	0.0
30	1,882.6	124.0	1,917.6	35.0	108.4	0.0	0.0	0.0
31	1,882.0	144.2	1,923.0	41.0	109.0	0.0	0.0	0.0
36	1,889.3	79.0	1,921.7	32.4	101.7	0.0	0.0	0.0
37	1,891.4	72.8	1,921.6	30.2	99.6	0.0	0.0	0.0
38	1,893.9	65.1	1,921.6	27.7	97.1	0.0	0.0	0.0
39	1,914.9	77.5	1,929.9	15.0	76.1	0.0	0.0	0.0
41	1,899.2	68.2	1,919.3	20.1	91.8	0.0	0.0	0.0
42	1,896.1	58.9	1,919.2	23.1	94.9	0.0	0.0	0.0
43	1,894.8	62.0	1,919.1	24.3	96.2	0.0	0.0	0.0
44	1,893.4	83.7	1,919.1	25.7	97.6	0.0	0.0	0.0
45	1,884.9	103.8	1,920.9	36.0	106.1	0.0	0.0	0.0
46	1,878.2	196.8	1,921.3	43.1	112.8	0.0	0.0	0.0
47	1,880.7	55.8	1,921.1	40.4	110.3	0.0	0.0	0.0
48	1,880.2	156.6	1,919.1	38.9	110.8	0.0	0.0	0.0
49	1,881.1	248.0	1,919.1	38.0	109.9	0.0	0.0	0.0
50	1,886.3	223.2	1,935.8	49.5	104.7	0.0	0.0	0.0
51	1,895.4	72.8	1,916.1	20.7	95.6	0.0	0.0	0.0
52	1,889.1	150.3	1,915.4	26.3	101.9	0.0	0.0	0.0
55	1,886.2	137.9	1,915.5	29.3	104.8	0.0	0.0	0.0
56	1,902.7	76.0	1,946.0	43.3	88.3	0.0	0.0	0.0
57	1,884.1	144.2	1,915.6	31.5	106.9	0.0	0.0	0.0
58	1,890.9	184.4	1,915.3	24.4	100.1	0.0	0.0	0.0
60	1,889.9	155.0	1,915.4	25.5	101.1	0.0	0.0	0.0
61	1,885.4	77.5	1,920.3	34.9	105.6	0.0	0.0	0.0
62	1,890.2	117.8	1,928.8	38.6	100.8	0.0	0.0	0.0
63	1,878.7	58.9	1,923.0	44.3	112.3	0.0	0.0	0.0
64	1,876.5	68.2	1,923.0	46.5	114.5	0.0	0.0	0.0
66	1,910.0	62.0	1,931.3	21.3	81.0	0.0	0.0	0.0
67	1,921.5	58.9	1,937.7	16.2	69.5	0.0	0.0	0.0
68	1,918.6	65.1	1,943.7	25.1	72.4	0.0	0.0	0.0
69	1,879.5	77.5	1,921.2	41.7	111.5	0.0	0.0	0.0
70	1,904.5	204.6	1,926.2	21.7	86.5	0.0	0.0	0.0
71	1,894.5	134.8	1,918.8	24.3	96.5	0.0	0.0	0.0
100	1,896.6	51.1	1,919.3	22.7	94.4	0.0	0.0	0.0
101	1,885.9	38.8	1,919.7	33.8	105.1	0.0	0.0	0.0
102	1,876.7	57.4	1,919.8	43.1	114.3	0.0	0.0	0.0
103	1,883.1	77.5	1,919.2	36.1	107.9	0.0	0.0	0.0
104	1,916.3	28.4	1,927.1	10.8	74.7	0.0	0.0	0.0
105	1,903.9	26.4	1,927.7	23.8	87.1	0.0	0.0	0.0
106	1,881.3	66.7	1,918.6	37.3	109.7	0.0	0.0	0.0
107	1,880.1	49.6	1,918.3	38.1	110.9	0.0	0.0	0.0
108	1,884.1	46.5	1,918.2	34.1	106.9	0.0	0.0	0.0
109	1,884.6	31.0	1,918.1	33.5	106.4	0.0	0.0	0.0
112	1,900.7	0.0	1,910.7	10.0	90.3	0.0	0.0	0.0
113	1,878.5	45.0	1,918.0	39.5	112.5	0.0	0.0	0.0
114	1,897.3	88.3	1,918.0	20.6	93.7	0.0	0.0	0.0
117	1,907.5	91.5	1,917.9	10.4	83.5	0.0	0.0	0.0
118	1,889.0	57.4	1,914.7	25.7	102.0	0.0	0.0	0.0
119	1,889.1	99.2	1,912.3	23.2	101.9	0.0	0.0	0.0
120	1,871.2	175.2	1,911.3	40.1	119.8	0.0	0.0	0.0
121	1,862.8	168.9	1,917.0	54.4	128.4	0.0	0.0	0.0
122	1,950.0	137.9	1,943.5	-6.5	41.0	0.0	0.0	0.0
123	1,927.3	100.8	1,943.5	16.2	83.7	0.0	0.0	0.0
124	1,879.6	105.4	1,918.8	39.2	111.4	0.0	0.0	0.0
125	1,886.2	167.4	1,914.1	27.9	104.8	0.0	0.0	0.0

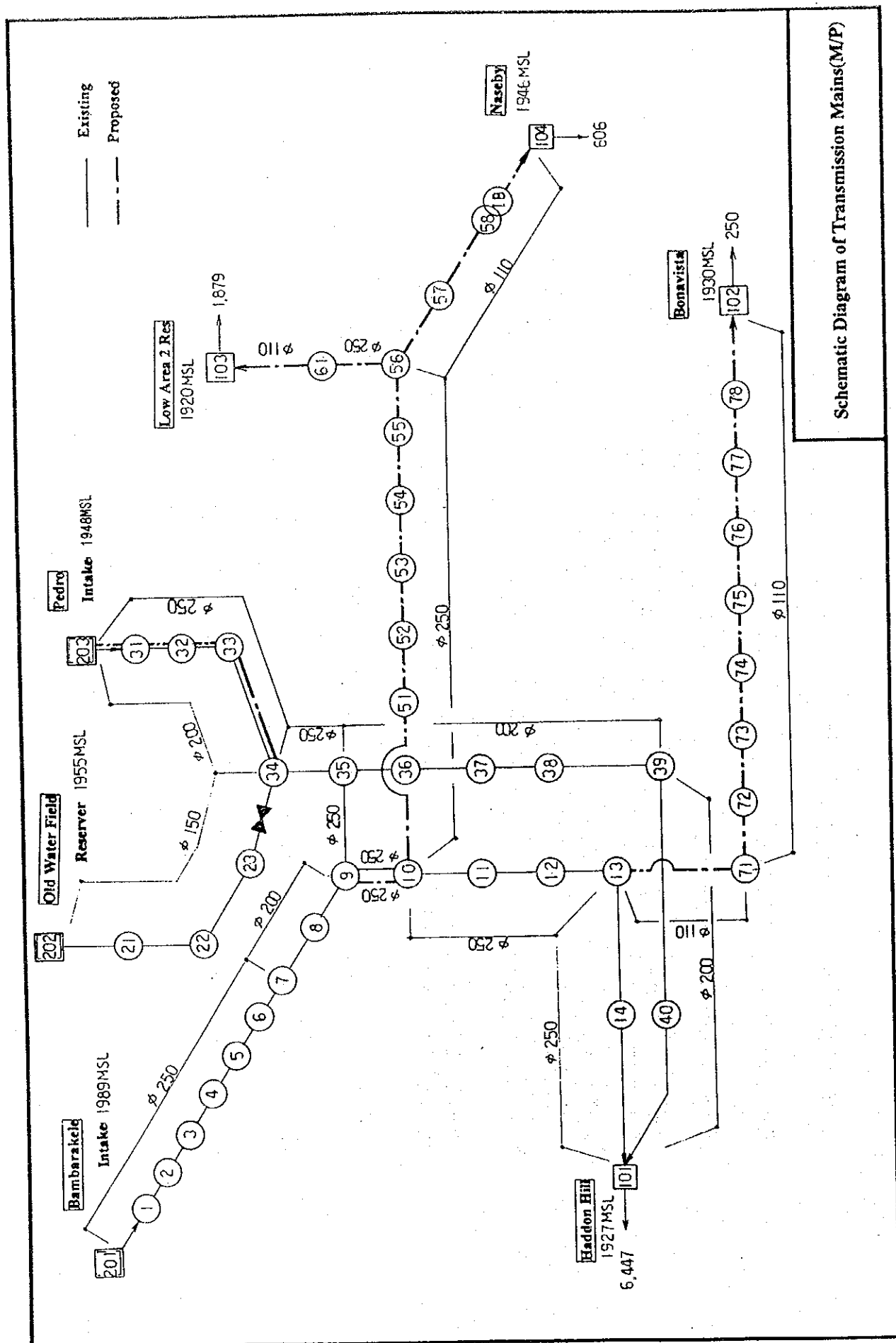
Net Work Analysis				Distribution Main		I		
Node No.	Elevation of Pipe (MSL)	Demand (cum/d)	Dynamic Pressure (MSL)	Dynamic Pressure (m)	Static Pressure (m)			Leakage (cum/d)
126	1,894.1	165.8	1,912.6	18.5	96.9	0.0	0.0	0.0
127	1,874.9	83.7	1,910.4	35.5	116.1	0.0	0.0	0.0
128	1,896.4	58.9	1,911.1	14.7	94.6	0.0	0.0	0.0
129	1,896.0	12.4	1,911.0	15.0	95.0	0.0	0.0	0.0
130	1,886.4	10.9	1,911.0	24.6	104.6	0.0	0.0	0.0
131	1,875.8	6.2	1,911.0	35.1	115.2	0.0	0.0	0.0
132	1,886.8	79.0	1,927.0	40.2	104.2	0.0	0.0	0.0
133	1,898.7	27.9	1,926.4	27.7	92.3	0.0	0.0	0.0
134	1,924.5	83.7	1,931.6	7.1	66.5	0.0	0.0	0.0
135	1,915.7	89.9	1,931.1	15.4	75.3	0.0	0.0	0.0
136	1,944.8	110.1	1,942.9	-1.9	46.2	0.0	0.0	0.0
137	1,905.0	182.9	1,943.6	38.6	86.0	0.0	0.0	0.0
139	1,905.8	255.8	1,925.9	20.1	85.2	0.0	0.0	0.0
140	1,899.4	48.0	1,916.1	16.7	91.6	0.0	0.0	0.0
141	1,890.2	153.4	1,914.9	24.7	100.8	0.0	0.0	0.0
142	1,883.9	159.7	1,915.0	31.1	107.1	0.0	0.0	0.0
143	1,888.7	170.5	1,915.1	26.4	102.3	0.0	0.0	0.0
144	1,907.4	60.5	1,926.2	18.8	83.6	0.0	0.0	0.0
145	1,909.3	9.3	1,926.2	16.9	81.7	0.0	0.0	0.0
146	1,876.5	83.7	1,912.3	35.9	114.5	0.0	0.0	0.0
147	1,878.9	151.9	1,912.3	33.4	112.1	0.0	0.0	0.0
148	1,889.6	97.7	1,919.9	30.3	101.4	0.0	0.0	0.0
149	1,901.1	43.4	1,921.1	20.0	89.9	0.0	0.0	0.0
150	1,899.4	182.9	1,912.2	12.8	91.6	0.0	0.0	0.0
151	1,874.4	117.8	1,912.3	38.0	116.6	0.0	0.0	0.0
152	1,865.9	102.3	1,912.5	46.6	125.1	0.0	0.0	0.0
153	1,862.7	110.1	1,913.2	50.5	128.3	0.0	0.0	0.0
154	1,864.7	102.3	1,913.0	48.3	126.3	0.0	0.0	0.0
155	1,867.6	34.1	1,912.9	45.3	123.4	0.0	0.0	0.0
156	1,884.8	62.0	1,924.0	39.2	106.2	0.0	0.0	0.0
157	1,881.9	37.2	1,923.3	41.4	109.1	0.0	0.0	0.0
158	1,880.3	37.2	1,923.1	42.8	110.7	0.0	0.0	0.0
160	1,903.2	29.4	1,943.6	40.4	87.8	0.0	0.0	0.0
161	1,905.3	17.1	1,926.1	20.8	85.7	0.0	0.0	0.0
162	1,891.8	58.9	1,916.1	24.3	99.2	0.0	0.0	0.0
163	1,899.3	10.9	1,916.0	16.7	91.7	0.0	0.0	0.0
164	1,919.8	6.2	1,931.6	11.8	71.2	0.0	0.0	0.0
165	1,962.5	156.6	1,990.5	28.0	28.5	0.0	0.0	0.0
166	1,899.0	27.9	1,922.7	23.7	92.0	0.0	0.0	0.0
169	1,917.8	34.1	1,980.0	62.2	73.2	0.0	0.0	0.0
170	1,893.3	20.1	1,923.0	29.7	87.7	0.0	0.0	0.0
171	1,909.7	29.4	1,919.5	9.8	81.3	0.0	0.0	0.0
21	1,885.1	150.3	1,915.5	30.4	105.9	0.0	0.0	0.0
20	1,885.9	128.7	1,915.5	29.6	105.1	0.0	0.0	0.0
174	1,902.4	161.2	1,941.4	39.0	88.6	0.0	0.0	0.0
53	1,895.7	150.3	1,915.3	19.6	95.3	0.0	0.0	0.0
176	1,895.0	35.6	1,919.0	24.0	96.0	0.0	0.0	0.0
177	1,897.3	35.6	1,919.0	21.7	93.7	0.0	0.0	0.0
178	1,912.8	85.3	1,929.6	16.8	78.2	0.0	0.0	0.0
179	1,917.5	38.8	1,929.9	12.4	73.5	0.0	0.0	0.0
181	1,881.0	124.0	1,919.9	38.9	110.0	0.0	0.0	0.0
182	1,891.9	20.1	1,918.0	26.1	99.1	0.0	0.0	0.0
183	1,899.2	18.6	1,918.0	18.8	91.8	0.0	0.0	0.0
185	1,902.8	102.3	1,926.5	23.7	88.2	0.0	0.0	0.0
186	1,885.4	102.3	1,912.7	27.3	105.6	0.0	0.0	0.0
187	1,903.2	117.8	1,943.6	40.4	87.8	0.0	0.0	0.0
188	1,931.7	12.4	1,938.5	6.8	59.3	0.0	0.0	0.0
189	1,921.8	45.0	1,929.6	7.8	69.2	0.0	0.0	0.0
300	1,903.6	72.8	1,943.6	40.0	87.4	0.0	0.0	0.0
301	1,951.4	117.8	1,943.2	-8.2	39.6	0.0	0.0	0.0
59	1,900.0	189.1	1,945.5	45.5	91.0	0.0	0.0	0.0
500	1,892.8	38.8	1,912.9	20.1	98.2	0.0	0.0	0.0
501	1,886.6	117.8	1,912.9	28.3	104.4	0.0	0.0	0.0
502	1,885.6	124.0	1,934.0	48.4	105.4	0.0	0.0	0.0
503	1,884.2	117.8	1,916.1	31.9	106.8	0.0	0.0	0.0
510	1,914.5	79.0	1,925.9	11.4	78.5	0.0	0.0	0.0
511	1,892.1	31.0	1,918.0	25.9	98.9	0.0	0.0	0.0
520	1,913.6	97.7	1,928.6	15.0	77.4	0.0	0.0	0.0
304	1,900.4	108.5	1,917.6	17.2	90.6	0.0	0.0	0.0
172	1,886.0	79.0	1,915.5	29.5	105.0	0.0	0.0	0.0
173	1,916.0	79.0	1,925.9	9.9	75.0	0.0	0.0	0.0
521	1,886.0	79.0	1,910.0	24.0	105.0	0.0	0.0	0.0
522	1,880.0	79.0	1,909.3	29.3	111.0	0.0	0.0	0.0
523	1,903.0	79.0	1,944.0	41.0	88.0	0.0	0.0	0.0
524	1,887.0	79.0	1,934.3	47.4	104.0	0.0	0.0	0.0
525	1,881.0	79.0	1,917.2	38.2	110.0	0.0	0.0	0.0
526	1,882.0	79.0	1,917.4	35.4	109.0	0.0	0.0	0.0

Node No.	Net Work Analysis			Distribution Main		1	Leakage	
	Elevation of Pipe (MSL)	Demand (cum/d)	Dynamic Pressure (MSL)	Dynamic Pressure (m)	Static Pressure (m)		(cum/d)	
527	1,931.0	46.5	1,940.2	9.2	60.0	0.0	0.0	0.0
528	1,943.0	46.5	1,933.4	-9.6	48.0	0.0	0.0	0.0
33	1,867.0	79.0	1,912.3	45.3	124.0	0.0	0.0	0.0
35	1,870.0	94.5	1,912.3	42.3	121.0	0.0	0.0	0.0
40	1,920.0	62.0	1,929.6	9.6	71.0	0.0	0.0	0.0
54	1,886.0	79.0	1,915.6	29.6	105.0	0.0	0.0	0.0
91	1,899.4	0.0	1,926.1	26.7	91.6	0.0	0.0	0.0
92	1,895.4	0.0	1,926.3	30.9	95.6	0.0	0.0	0.0
93	1,882.0	0.0	1,926.6	44.5	109.0	0.0	0.0	0.0
540	1,930.0	644.8	1,935.0	5.0	61.0	0.0	0.0	0.0
541	1,980.0	863.4	1,985.0	5.0	11.0	0.0	0.0	0.0
542	1,889.1	0.0	1,942.0	52.9	101.9	0.0	0.0	0.0
610	1,900.0	0.0	1,930.0	30.0	91.0	0.0	0.0	0.0
611	1,884.6	0.0	1,929.9	45.3	106.4	0.0	0.0	0.0
612	1,881.3	0.0	1,929.3	48.0	109.7	0.0	0.0	0.0
205	1,960.0	-99.2	1,940.3	-19.7	31.0	0.0	0.0	0.0
206	1,955.0	-565.8	1,940.5	-14.5	36.0	0.0	0.0	0.0
215	1,979.0	-382.9	1,943.9	-35.1	12.0	0.0	0.0	0.0
209	1,960.0	-159.7	1,943.5	-16.5	31.0	0.0	0.0	0.0

Pipe No.	Net Work Analysis			Distribution Main			Velocity	Pressure Gradient	Loss
	Node A	Node B	Length (m)	Diameter (mm)	C	Flow (cum/d)			
1	139	510	800.00	225.00	120.00	79.00	0.00	0.00	0.00
2	139	304	374.00	44.00	130.00	108.00	0.80	22.30	8.30
5	51	140	228.00	150.00	120.00	48.00	0.00	0.00	0.00
6	162	163	143.00	44.00	130.00	10.00	0.10	0.30	0.00
7	51	162	20.00	150.00	120.00	69.00	0.10	0.00	0.00
9	134	135	178.00	65.00	130.00	99.00	0.30	2.80	0.50
12	134	164	84.00	44.00	130.00	6.00	0.10	0.10	0.00
13	66	135	265.00	150.00	120.00	450.00	0.30	0.90	0.20
14	50	66	530.00	100.00	120.00	512.00	0.80	8.40	4.50
15	50	67	583.00	100.00	120.00	-311.00	-0.50	-3.30	-1.90
16	67	188	165.00	100.00	120.00	-370.00	-0.60	-4.60	-0.80
20	21	54	59.00	150.00	120.00	-527.00	-0.30	-1.20	-0.10
21	21	23	88.00	100.00	120.00	187.00	0.30	1.30	0.10
22	23	24	55.00	150.00	120.00	34.00	0.00	0.00	0.00
23	20	24	90.00	100.00	120.00	174.00	0.30	1.10	0.10
24	20	21	66.00	150.00	120.00	-189.00	-0.10	-0.20	0.00
26	25	52	110.00	100.00	120.00	-26.00	0.00	0.00	0.00
27	52	53	176.00	100.00	120.00	78.00	0.10	0.30	0.10
28	53	60	100.00	100.00	120.00	-72.00	-0.10	-0.20	0.00
29	18	60	134.00	100.00	120.00	313.00	0.50	3.40	0.50
30	18	19	54.00	150.00	120.00	594.00	0.40	1.50	0.10
31	19	52	151.00	100.00	120.00	254.00	0.40	2.30	0.30
32	19	55	133.00	100.00	120.00	208.00	0.30	1.60	0.20
33	54	172	100.00	100.00	120.00	122.00	0.20	0.60	0.10
34	9	18	315.00	225.00	120.00	1,073.00	0.30	0.60	0.20
35	9	48	47.00	100.00	120.00	-1,564.00	-2.30	-66.30	-3.10
36	1	48	265.00	225.00	120.00	1,784.00	0.50	1.60	0.40
37	48	49	201.00	100.00	120.00	63.00	0.10	0.20	0.00
38	22	49	672.00	150.00	120.00	-1,041.00	-0.70	-4.30	-2.90
39	22	51	596.00	150.00	120.00	190.00	0.10	0.20	0.10
40	49	148	536.00	100.00	120.00	-207.00	-0.30	-1.60	-0.80
41	148	171	372.00	50.00	120.00	29.00	0.20	1.20	0.50
42	69	148	325.00	100.00	120.00	334.00	0.50	3.80	1.20
43	46	69	90.00	150.00	120.00	455.00	0.30	0.90	0.10
44	69	149	551.00	100.00	120.00	43.00	0.10	0.10	0.10
45	1	49	284.00	100.00	120.00	221.00	0.30	1.80	0.50
46	1	46	401.00	225.00	120.00	-2,991.00	-0.90	-4.30	-1.70
47	46	47	268.00	100.00	120.00	132.00	0.20	0.70	0.20
48	47	64	268.00	100.00	120.00	-468.00	-0.70	-7.10	-1.90
49	63	64	444.00	300.00	120.00	680.00	0.10	0.10	0.00
50	46	63	268.00	225.00	120.00	-3,776.00	-1.10	-6.50	-1.80
51	63	158	47.00	300.00	120.00	-4,516.00	-0.70	-2.20	-0.10
52	158	166	358.00	50.00	120.00	27.00	0.20	1.10	0.40
53	157	158	77.00	300.00	120.00	4,581.00	0.80	2.30	0.20
54	157	170	264.00	44.00	130.00	20.00	0.10	1.00	0.30
55	156	157	300.00	300.00	120.00	4,639.00	0.80	2.40	0.70
56	2	156	100.00	300.00	120.00	5,564.00	0.90	3.30	0.30
61	2	203	704.00	350.00	120.00	-8,982.00	-1.10	-3.80	-2.70
62	2	4	442.00	225.00	120.00	3,309.00	1.00	5.10	2.30
63	4	5	65.00	225.00	120.00	3,114.00	0.90	4.60	0.30
64	4	61	972.00	65.00	130.00	77.00	0.30	1.80	1.70
65	5	6	221.00	150.00	120.00	548.00	0.40	1.30	0.30
66	6	27	150.00	150.00	120.00	524.00	0.30	1.20	0.20
67	27	37	216.00	100.00	120.00	-184.00	-0.30	-1.30	-0.30
68	36	37	400.00	150.00	120.00	250.00	0.20	0.30	0.10
69	36	38	563.00	100.00	120.00	71.00	0.10	0.20	0.10
70	37	38	30.00	150.00	120.00	-6.00	0.00	0.00	0.00
72	27	181	1,106.00	150.00	120.00	538.00	0.30	1.30	1.40
74	39	173	320.00	44.00	130.00	79.00	0.60	12.40	4.00
76	102	181	92.00	150.00	120.00	-512.00	-0.30	-1.20	-0.10
80	39	179	125.00	150.00	120.00	-348.00	-0.20	-0.60	-0.10
82	179	208	104.00	65.00	130.00	-45.00	-0.20	-0.70	-0.10
83	102	103	350.00	150.00	120.00	611.00	0.40	1.60	0.60
84	101	102	120.00	44.00	130.00	-19.00	-0.10	-0.90	-0.10
86	41	100	120.00	44.00	130.00	-15.00	-0.10	-0.60	-0.10
87	100	101	312.00	37.00	130.00	-13.00	-0.10	-1.10	-0.30
88	42	43	257.00	100.00	120.00	108.00	0.20	0.50	0.10
89	42	43	257.00	100.00	120.00	108.00	0.20	0.50	0.10
90	43	44	268.00	150.00	120.00	155.00	0.10	0.10	0.00
91	44	177	391.00	100.00	120.00	35.00	0.10	0.10	0.00
92	44	176	391.00	100.00	120.00	35.00	0.10	0.10	0.00
93	176	177	90.00	100.00	120.00	0.00	0.00	0.00	0.00
99	29	112	251.00	65.00	130.00	-20.00	-0.10	-0.10	0.00
100	109	511	400.00	100.00	120.00	92.00	0.10	0.30	0.10
101	108	109	120.00	100.00	120.00	98.00	0.10	0.40	0.10
102	108	183	228.00	44.00	130.00	18.00	0.10	0.80	0.20
103	107	108	200.00	100.00	120.00	105.00	0.10	0.50	0.10

Pipe No.	Net Work Analysis			Distribution Main				I Pressure Gradient (o/oo)	Loss (m)
	Node A	Node B	Length (m)	Diameter (mm)	C	Flow (cum/d)	Velocity (m/s)		
104	107	182	253.00	44.00	130.00	20.00	0.10	1.00	0.30
105	28	107	40.00	100.00	120.00	114.00	0.20	0.50	0.00
106	28	113	66.00	150.00	120.00	939.00	0.60	3.60	0.20
107	113	114	265.00	65.00	130.00	29.00	0.10	0.30	0.10
108	114	117	500.00	65.00	130.00	19.00	0.10	0.10	0.10
109	117	118	318.00	44.00	130.00	70.00	0.50	10.10	3.20
111	118	119	248.00	75.00	120.00	257.00	0.70	9.50	2.40
113	28	106	250.00	150.00	120.00	-566.00	-0.40	-1.40	-0.30
114	103	106	400.00	150.00	120.00	587.00	0.40	1.50	0.60
116	104	105	300.00	44.00	130.00	-29.00	-0.20	-2.00	-0.60
118	30	526	210.00	100.00	120.00	158.00	0.20	0.90	0.20
119	62	132	1,500.00	150.00	120.00	522.00	0.30	1.20	1.80
120	155	500	175.00	140.00	130.00	101.00	0.10	0.10	0.00
125	132	133	363.00	44.00	130.00	27.00	0.20	1.80	0.70
127	31	64	167.00	225.00	120.00	-144.00	0.00	0.00	0.00
129	70	144	284.00	100.00	120.00	69.00	0.10	0.20	0.10
130	144	145	121.00	44.00	130.00	9.00	0.10	0.20	0.00
132	45	47	162.00	150.00	120.00	-545.00	-0.40	-1.30	-0.20
133	9	45	761.00	100.00	120.00	-441.00	-0.70	-6.40	-4.90
134	9	57	25.00	100.00	120.00	726.00	1.10	16.00	0.40
135	57	58	120.00	100.00	120.00	282.00	0.40	2.80	0.30
136	58	60	262.00	100.00	120.00	-86.00	-0.10	-0.30	-0.10
138	56	59	352.00	97.00	130.00	195.00	0.30	1.40	0.50
140	58	143	168.00	100.00	120.00	184.00	0.30	1.30	0.20
141	142	143	264.00	50.00	120.00	-13.00	-0.10	-0.30	-0.10
142	57	142	202.00	100.00	120.00	299.00	0.40	3.10	0.60
143	141	142	99.00	100.00	120.00	-153.00	-0.20	-0.90	-0.10
146	12	150	360.00	150.00	120.00	182.00	0.10	0.20	0.10
147	12	151	163.00	150.00	120.00	-285.00	-0.20	-0.40	-0.10
148	13	151	35.00	150.00	120.00	64.00	0.00	0.00	0.00
149	151	186	450.00	140.00	130.00	-338.00	-0.30	-0.70	-0.30
151	154	155	132.00	100.00	120.00	135.00	0.20	0.70	0.10
160	153	154	165.00	100.00	120.00	202.00	0.30	1.50	0.30
161	14	153	236.00	150.00	120.00	-757.00	-0.50	-2.40	-0.60
162	13	14	475.00	150.00	120.00	-379.00	-0.30	-0.70	-0.30
163	13	146	35.00	150.00	120.00	235.00	0.10	0.30	0.00
164	146	147	137.00	150.00	120.00	151.00	0.10	0.10	0.00
167	11	137	663.00	150.00	120.00	305.00	0.20	0.50	0.30
168	14	152	66.00	100.00	120.00	275.00	0.40	2.70	0.20
170	33	152	150.00	100.00	120.00	-173.00	-0.30	-1.10	-0.20
175	56	68	165.00	100.00	120.00	672.00	1.00	13.90	2.30
176	68	136	726.00	44.00	130.00	21.00	0.20	1.10	0.80
177	136	137	512.00	44.00	130.00	-22.00	-0.20	-1.20	-0.60
178	137	187	277.00	140.00	130.00	100.00	0.10	0.10	0.00
182	71	124	400.00	225.00	120.00	-134.00	0.00	0.00	0.00
183	15	124	441.00	225.00	120.00	240.00	0.10	0.00	0.00
184	15	16	177.00	150.00	120.00	981.00	0.60	3.90	0.70
185	16	121	286.00	100.00	120.00	344.00	0.50	4.00	1.10
186	120	121	1,210.00	75.00	120.00	-175.00	-0.50	-4.70	-5.70
187	16	125	850.00	100.00	120.00	374.00	0.60	4.70	4.00
191	122	209	120.00	225.00	120.00	-159.00	-0.10	0.00	0.00
193	125	126	396.00	100.00	120.00	337.00	0.50	3.90	1.50
194	126	128	668.00	65.00	130.00	88.00	0.30	2.30	1.50
195	126	127	1,047.00	65.00	130.00	83.00	0.30	2.10	2.20
196	128	129	90.00	65.00	130.00	29.00	0.10	0.30	0.00
197	129	130	60.00	44.00	130.00	17.00	0.10	0.70	0.00
198	130	131	88.00	37.00	130.00	6.00	0.10	0.30	0.00
199	62	520	569.00	100.00	120.00	97.00	0.10	0.40	0.20
200	41	42	237.00	100.00	120.00	58.00	0.10	0.10	0.00
201	30	113	250.00	150.00	120.00	-643.00	-0.40	-1.80	-0.40
203	5	36	105.00	150.00	120.00	401.00	0.30	0.70	0.10
179	187	300	500.00	150.00	120.00	-17.00	0.00	0.00	0.00
250	136	301	215.00	65.00	130.00	-66.00	-0.20	-1.30	-0.30
209	160	300	152.00	150.00	120.00	-108.00	-0.10	-0.10	0.00
213	62	524	334.00	97.00	130.00	-737.00	-1.20	-16.50	-5.50
214	30	503	334.00	100.00	120.00	361.00	0.50	4.40	1.50
215	112	511	132.00	75.00	120.00	-665.00	-1.70	-55.20	-7.30
216	500	501	100.00	140.00	130.00	62.00	0.10	0.00	0.00
217	154	501	104.00	65.00	130.00	58.00	0.20	1.10	0.10
218	186	501	221.00	140.00	130.00	-440.00	-0.30	-1.10	-0.20
110	118	503	167.00	75.00	120.00	-243.00	-0.60	-8.60	-1.40
300	215	301	554.00	100.00	120.00	183.00	0.30	1.30	0.70
208	215	300	250.00	100.00	120.00	199.00	0.30	1.50	0.40
17	205	527	250.00	100.00	120.00	99.00	0.10	0.40	0.10
172	15	153	577.00	150.00	120.00	1,601.00	1.10	9.60	5.50
302	10	70	480.00	150.00	120.00	-38.00	0.00	0.00	0.00
304	24	25	55.00	100.00	120.00	27.00	0.00	0.00	0.00

Pipe No.	Net Work Analysis			Distribution Main				I	Pressure Gradient (o/oo)	Loss (m)
	Node A	Node B	Length (m)	Diameter (mm)	C	Flow (cum/d)	Velocity (m/s)			
305	55	172	50.00	100.00	120.00	70.00	0.10		0.20	0.00
306	20	172	50.00	100.00	120.00	-113.00	-0.20		-0.50	0.00
307	23	25	75.00	100.00	120.00	25.00	0.00		0.00	0.00
308	40	178	150.00	150.00	120.00	85.00	0.10		0.00	0.00
77	39	40	180.00	100.00	120.00	192.00	0.30		1.40	0.30
78	40	189	60.00	100.00	120.00	44.00	0.10		0.10	0.00
79	100	101	450.00	44.00	130.00	-17.00	-0.10		-0.80	-0.30
309	41	42	150.00	150.00	120.00	217.00	0.10		0.20	0.00
310	119	521	350.00	65.00	130.00	158.00	0.60		6.70	2.30
311	521	522	350.00	65.00	130.00	79.00	0.30		1.90	0.70
313	33	35	150.00	100.00	120.00	94.00	0.10		0.40	0.10
301	11	523	120.00	150.00	120.00	-439.00	-0.30		-0.90	-0.10
314	59	523	180.00	100.00	120.00	518.00	0.80		8.60	1.50
315	502	524	150.00	75.00	120.00	-124.00	-0.30		-2.50	-0.40
317	524	600	450.00	97.00	130.00	-940.00	-1.50		-25.90	-11.70
319	525	526	210.00	75.00	120.00	-79.00	-0.20		-1.10	-0.20
321	527	528	480.00	65.00	130.00	236.00	0.80		14.00	6.70
322	134	528	200.00	65.00	130.00	-189.00	-0.70		-9.30	-1.90
11	165	601	75.00	65.00	130.00	-156.00	-0.60		-6.60	-0.50
324	188	527	50.00	65.00	130.00	-382.00	-1.30		-34.30	-1.70
325	122	123	160.00	140.00	130.00	100.00	0.10		0.10	0.00
327	56	59	352.00	140.00	130.00	512.00	0.40		1.40	0.50
328	1	49	264.00	158.00	130.00	797.00	0.50		1.80	0.50
329	206	527	215.00	150.00	120.00	565.00	0.40		1.40	0.30
330	156	541	931.00	100.00	120.00	863.00	1.30		22.10	20.50
331	112	540	434.00	97.00	130.00	644.00	1.00		12.90	5.60
601	91	139	162.00	150.00	120.00	443.00	0.30		0.90	0.10
602	91	161	225.00	65.00	130.00	17.00	0.10		0.10	0.00
603	70	93	662.00	150.00	120.00	-313.00	-0.20		-0.50	-0.30
605	93	132	616.00	150.00	120.00	-415.00	-0.30		-0.80	-0.50
606	93	185	300.00	150.00	120.00	102.00	0.10		0.10	0.00
607	56	602	1,000.00	200.00	120.00	-1,455.00	-0.50		-2.00	-2.00
212	22	54	275.00	150.00	120.00	728.00	0.50		2.20	0.60
610	122	160	931.00	225.00	120.00	-79.00	0.00		0.00	0.00
611	91	92	228.00	150.00	120.00	-460.00	-0.30		-1.00	-0.20
612	92	135	690.00	100.00	120.00	-460.00	-0.70		-6.90	-4.80
613	604	610	200.00	97.00	130.00	55.00	0.10		0.10	0.00
614	105	612	250.00	44.00	130.00	-55.00	-0.40		-6.50	-1.60
616	174	542	569.00	97.00	130.00	-161.00	-0.30		-1.00	-0.60
701	15	606	500.00	250.00	120.00	-2,917.00	-0.70		-2.40	-1.20
702	169	603	50.00	55.00	130.00	-34.00	-0.20		-0.90	0.00
705	16	125	850.00	65.00	130.00	130.00	0.50		4.70	4.00
713	102	103	350.00	198.00	130.00	1,374.00	0.50		1.60	0.60
714	103	106	400.00	198.00	130.00	1,320.00	0.50		1.50	0.60
715	28	106	250.00	198.00	130.00	-1,274.00	-0.50		-1.40	-0.30
716	28	107	40.00	198.00	130.00	747.00	0.30		0.50	0.00
717	107	108	200.00	198.00	130.00	686.00	0.30		0.50	0.10
718	108	109	120.00	198.00	130.00	630.00	0.20		0.40	0.10
719	109	511	400.00	198.00	130.00	603.00	0.20		0.30	0.10
731	113	114	265.00	140.00	130.00	221.00	0.20		0.30	0.10
732	114	117	500.00	140.00	130.00	143.00	0.10		0.10	0.10
741	179	208	104.00	140.00	130.00	-342.00	-0.30		-0.70	-0.10
751	610	611	630.00	97.00	130.00	55.00	0.10		0.10	0.10
752	611	612	610.00	65.00	130.00	55.00	0.20		1.00	0.60
761	50	542	1,044.00	97.00	130.00	-424.00	-0.70		-5.90	-6.20
762	68	542	165.00	97.00	130.00	585.00	0.90		10.80	1.80
771	101	102	120.00	140.00	130.00	-414.00	-0.30		-0.90	-0.10
772	100	101	450.00	140.00	130.00	-364.00	-0.30		-0.80	-0.30
773	41	100	120.00	140.00	130.00	-328.00	-0.30		-0.60	-0.10
781	5	6	221.00	250.00	120.00	2,102.00	0.50		1.30	0.30
782	6	27	150.00	250.00	120.00	2,008.00	0.50		1.20	0.20
783	27	181	1,106.00	250.00	120.00	2,062.00	0.50		1.30	1.40
784	102	181	92.00	250.00	120.00	-1,964.00	-0.50		-1.20	-0.10
795	154	501	104.00	140.00	130.00	437.00	0.30		1.10	0.10
796	153	154	165.00	140.00	130.00	531.00	0.40		1.50	0.30



Schematic Diagram of Transmission Mains(M/P)

## Net Work Analysis

## Transmission

File Name NTM01 J  
 Season Wet  
 Network Type Proposed

Demand Year 2015  
 Day Max

Reserver Water Level Fix All  
 Discharge Fix None

Magnification of Demand 1.000

## Reservoir Data

Node	HWL (MSL)	LWL (MSL)	Reservoir
201	1 1,989.00	1,989.00	Bamberekele Intake
203	1 1,948.00	1,948.00	Pedro Intake

## Node Data

Node	Ground Elev (MSL)	Demand (cum/d)		
1	1 1,985.0	0.0	0	0
2	1 1,987.0	0.0	0	0
3	1 1,978.0	0.0	0	0
4	1 1,924.0	0.0	0	0
5	1 1,917.0	0.0	0	0
6	1 1,946.0	0.0	0	0
7	1 1,895.0	0.0	0	0
8	1 1,896.0	0.0	0	0
9	1 1,881.0	0.0	0	0
10	1 1,877.0	0.0	0	0
11	1 1,882.0	0.0	0	0
12	1 1,885.0	0.0	0	0
13	1 1,887.0	0.0	0	0
14	1 1,891.0	0.0	0	0
31	1 1,945.0	0.0	0	0
32	1 1,906.0	0.0	0	0
33	1 1,900.0	0.0	0	0
34	1 1,881.0	0.0	0	0
35	1 1,880.0	0.0	0	0
36	1 1,877.0	0.0	0	0
37	1 1,882.0	0.0	0	0
38	1 1,885.0	0.0	0	0
39	1 1,887.0	0.0	0	0
40	1 1,891.0	0.0	0	0
51	1 1,880.7	0.0	0	0
52	1 1,876.5	0.0	0	0
53	1 1,882.0	0.0	0	0
54	1 1,899.4	0.0	0	0
55	1 1,902.8	0.0	0	0
56	1 1,920.0	0.0	0	0
57	1 1,890.2	0.0	0	0
58	1 1,887.0	0.0	0	0
61	1 1,935.0	0.0	0	0
71	1 1,881.8	0.0	0	0
72	1 1,881.3	0.0	0	0
73	1 1,883.7	0.0	0	0
74	1 1,882.3	0.0	0	0
75	1 1,891.4	0.0	0	0
76	1 1,893.9	0.0	0	0
77	1 1,914.9	0.0	0	0
78	1 1,917.5	0.0	0	0
101	1 1,930.0	6,447.0	0	0
102	1 1,930.0	250.0	0	0
103	1 1,920.0	1,879.0	0	0
104	1 1,946.0	606.0	0	0

## Booster Pump Data

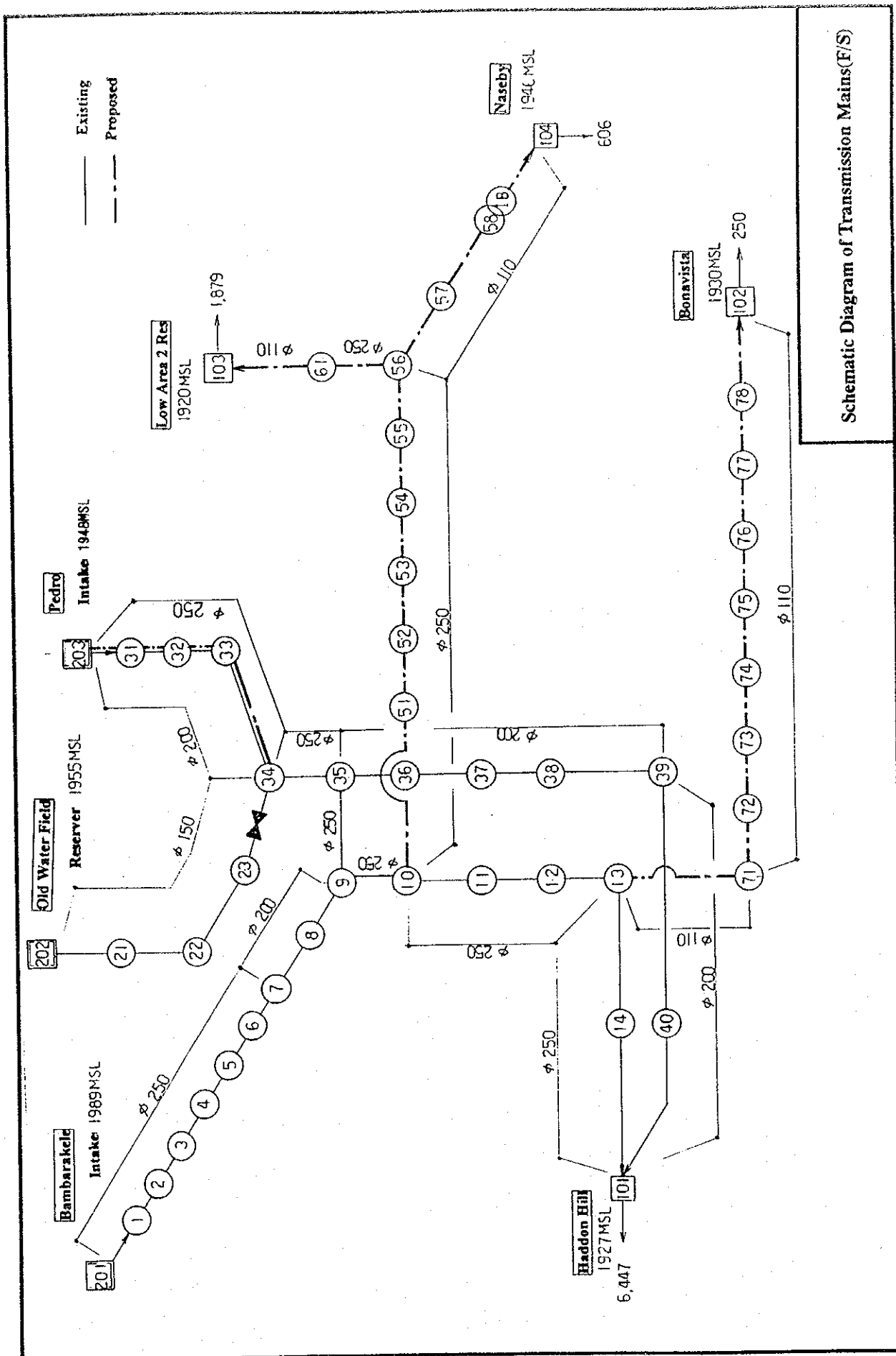
No.	Type	Node A	Node B	Pipe No.	Pressure (m)
1	B	58	104	333	25.0



Pipe Data					
Pipe No.	Node A	Node B	Diameter (mm)	Length (m)	C Value
2	1	2	250.0	56.0	120.0
3	2	3	250.0	201.0	120.0
4	3	4	250.0	123.0	120.0
5	4	5	250.0	207.0	120.0
6	5	6	250.0	621.0	120.0
7	6	7	250.0	884.0	120.0
8	7	8	200.0	641.0	120.0
9	8	9	200.0	1036.0	120.0
10	9	10	250.0	488.0	120.0
11	10	11	250.0	366.0	120.0
12	11	12	250.0	31.0	120.0
13	12	13	250.0	183.0	120.0
14	13	14	250.0	61.0	120.0
15	14	101	250.0	518.0	120.0
32	31	32	200.0	284.0	120.0
33	32	33	200.0	229.0	120.0
34	33	34	200.0	215.0	120.0
35	34	35	250.0	242.0	120.0
36	35	36	200.0	488.0	120.0
37	36	37	200.0	366.0	120.0
38	37	38	200.0	31.0	120.0
39	38	39	200.0	183.0	120.0
40	39	40	200.0	61.0	120.0
41	40	101	200.0	518.0	120.0
51	9	35	250.0	31.0	120.0
201	1	201	250.0	52.0	120.0
203	31	203	200.0	234.0	120.0
301	9	10	250.0	488.0	120.0
311	13	71	97.0	442.0	130.0
312	71	72	97.0	65.0	130.0
313	72	73	97.0	221.0	130.0
314	73	74	97.0	150.0	130.0
315	74	75	97.0	216.0	130.0
316	75	76	97.0	30.0	130.0
317	76	77	97.0	300.0	130.0
318	77	78	97.0	125.0	130.0
319	78	102	97.0	104.0	130.0
321	10	51	250.0	268.0	120.0
322	51	52	250.0	268.0	120.0
323	52	53	250.0	167.0	120.0
324	53	54	250.0	300.0	120.0
325	54	55	250.0	300.0	120.0
326	55	56	250.0	800.0	120.0
327	56	61	250.0	480.0	120.0
328	61	103	97.0	80.0	130.0
331	56	57	97.0	350.0	130.0
332	57	58	97.0	334.0	130.0
333	58	104	97.0	450.0	130.0

Node No.	Net Work Analysis		Transmission			J		Leakage (cum/d)
	Elevation of Pipe (MSL)	Demand (cum/d)	Dynamic Pressure (MSL)	Dynamic Pressure (m)	Static Pressure (m)			
1	1,985.0	0.0	1,988.7	3.7	4.0	0.0	0.0	0.0
2	1,987.0	0.0	1,988.3	1.3	2.0	0.0	0.0	0.0
3	1,978.0	0.0	1,987.0	9.0	11.0	0.0	0.0	0.0
4	1,924.0	0.0	1,986.2	62.2	65.0	0.0	0.0	0.0
5	1,917.0	0.0	1,984.9	67.9	72.0	0.0	0.0	0.0
6	1,946.0	0.0	1,980.9	34.9	43.0	0.0	0.0	0.0
7	1,895.0	0.0	1,975.2	80.2	94.0	0.0	0.0	0.0
8	1,896.0	0.0	1,962.9	66.9	93.0	0.0	0.0	0.0
9	1,881.0	0.0	1,943.0	62.0	108.0	0.0	0.0	0.0
10	1,877.0	0.0	1,941.4	64.4	112.0	0.0	0.0	0.0
11	1,882.0	0.0	1,939.5	57.5	107.0	0.0	0.0	0.0
12	1,885.0	0.0	1,939.3	54.3	104.0	0.0	0.0	0.0
13	1,887.0	0.0	1,938.4	51.4	102.0	0.0	0.0	0.0
14	1,891.0	0.0	1,938.1	47.1	98.0	0.0	0.0	0.0
31	1,945.0	0.0	1,954.7	9.7	44.0	0.0	0.0	0.0
32	1,906.0	0.0	1,950.6	44.6	83.0	0.0	0.0	0.0
33	1,900.0	0.0	1,947.3	47.3	89.0	0.0	0.0	0.0
34	1,881.0	0.0	1,944.2	63.2	108.0	0.0	0.0	0.0
35	1,880.0	0.0	1,943.1	63.1	109.0	0.0	0.0	0.0
36	1,877.0	0.0	1,940.9	63.9	112.0	0.0	0.0	0.0
37	1,882.0	0.0	1,939.2	57.2	107.0	0.0	0.0	0.0
38	1,885.0	0.0	1,939.1	54.1	104.0	0.0	0.0	0.0
39	1,887.0	0.0	1,938.2	51.2	102.0	0.0	0.0	0.0
40	1,891.0	0.0	1,938.0	47.0	98.0	0.0	0.0	0.0
51	1,880.7	0.0	1,940.9	60.2	108.3	0.0	0.0	0.0
52	1,876.5	0.0	1,940.4	63.9	112.5	0.0	0.0	0.0
53	1,882.0	0.0	1,940.1	58.1	107.0	0.0	0.0	0.0
54	1,899.4	0.0	1,939.6	40.2	89.6	0.0	0.0	0.0
55	1,902.8	0.0	1,939.1	36.3	86.2	0.0	0.0	0.0
56	1,920.0	0.0	1,937.6	17.6	69.0	0.0	0.0	0.0
57	1,890.2	0.0	1,933.6	43.4	98.8	0.0	0.0	0.0
58	1,887.0	0.0	1,929.8	42.8	102.0	0.0	0.0	0.0
61	1,935.0	0.0	1,937.1	2.1	54.0	0.0	0.0	0.0
71	1,881.8	0.0	1,937.4	55.6	107.2	0.0	0.0	0.0
72	1,881.3	0.0	1,937.2	55.9	107.7	0.0	0.0	0.0
73	1,883.7	0.0	1,936.7	53.0	105.3	0.0	0.0	0.0
74	1,882.3	0.0	1,936.4	54.1	106.7	0.0	0.0	0.0
75	1,891.4	0.0	1,935.9	44.5	97.6	0.0	0.0	0.0
76	1,893.9	0.0	1,935.9	42.0	95.1	0.0	0.0	0.0
77	1,914.9	0.0	1,935.2	20.3	74.1	0.0	0.0	0.0
78	1,917.5	0.0	1,934.9	17.4	71.5	0.0	0.0	0.0
101	1,930.0	6,447.0	1,935.6	5.6	59.0	6,286.8	6,286.8	0.0
102	1,930.0	250.0	1,934.7	4.7	59.0	219.2	219.2	0.0
103	1,920.0	1,879.0	1,929.6	9.6	69.0	1,879.0	1,879.0	0.0
104	1,946.0	606.0	1,949.6	3.6	43.0	0.0	0.0	0.0

Net Work Analysis				Transmission					
Pipe No.	Node A	Node B	Length	Diameter	C	Flow	Velocity	Pressure Gradient	Loss
			(m)	(mm)		(cum/d)	(m/s)	(o/oo)	(m)
2	1	2	56.00	250.00	120.00	4,951.00	1.20	6.50	0.40
3	2	3	201.00	250.00	120.00	4,951.00	1.20	6.50	1.30
4	3	4	123.00	250.00	120.00	4,951.00	1.20	6.50	0.80
5	4	5	207.00	250.00	120.00	4,951.00	1.20	6.50	1.30
6	5	6	621.00	250.00	120.00	4,951.00	1.20	6.50	4.00
7	6	7	884.00	250.00	120.00	4,951.00	1.20	6.50	5.70
8	7	8	641.00	200.00	120.00	4,951.00	1.80	19.20	12.30
9	8	9	1,036.00	200.00	120.00	4,951.00	1.80	19.20	19.90
10	9	10	488.00	250.00	120.00	3,456.00	0.80	3.30	1.60
11	10	11	366.00	250.00	120.00	4,428.00	1.00	5.30	1.90
12	11	12	31.00	250.00	120.00	4,428.00	1.00	5.30	0.20
13	12	13	183.00	250.00	120.00	4,428.00	1.00	5.30	1.00
14	13	14	61.00	250.00	120.00	4,178.00	1.00	4.70	0.30
15	14	101	518.00	250.00	120.00	4,178.00	1.00	4.70	2.40
32	31	32	284.00	200.00	120.00	4,230.00	1.60	14.30	4.10
33	32	33	229.00	200.00	120.00	4,230.00	1.60	14.30	3.30
34	33	34	215.00	200.00	120.00	4,230.00	1.60	14.30	3.10
35	34	35	242.00	250.00	120.00	4,230.00	1.00	4.80	1.20
36	35	36	488.00	200.00	120.00	2,268.00	0.80	4.50	2.20
37	36	37	366.00	200.00	120.00	2,268.00	0.80	4.50	1.60
38	37	38	31.00	200.00	120.00	2,268.00	0.80	4.50	0.10
39	38	39	183.00	200.00	120.00	2,268.00	0.80	4.50	0.80
40	39	40	61.00	200.00	120.00	2,268.00	0.80	4.50	0.30
41	40	101	518.00	200.00	120.00	2,268.00	0.80	4.50	2.30
51	9	35	31.00	250.00	120.00	-1,962.00	-0.50	-1.20	0.00
201	1	201	52.00	250.00	120.00	-4,951.00	-1.20	-6.50	-0.30
203	31	203	234.00	200.00	120.00	-4,230.00	-1.60	-14.30	-3.40
301	9	10	488.00	250.00	120.00	3,456.00	0.80	3.30	1.60
311	13	71	442.00	97.00	130.00	250.00	0.40	2.20	1.00
312	71	72	65.00	97.00	130.00	250.00	0.40	2.20	0.10
313	72	73	221.00	97.00	130.00	250.00	0.40	2.20	0.50
314	73	74	150.00	97.00	130.00	250.00	0.40	2.20	0.30
315	74	75	216.00	97.00	130.00	250.00	0.40	2.20	0.50
316	75	76	30.00	97.00	130.00	250.00	0.40	2.20	0.10
317	76	77	300.00	97.00	130.00	250.00	0.40	2.20	0.70
318	77	78	125.00	97.00	130.00	250.00	0.40	2.20	0.30
319	78	102	104.00	97.00	130.00	250.00	0.40	2.20	0.20
321	10	51	268.00	250.00	120.00	2,485.00	0.60	1.80	0.50
322	51	52	268.00	250.00	120.00	2,485.00	0.60	1.80	0.50
323	52	53	167.00	250.00	120.00	2,485.00	0.60	1.80	0.30
324	53	54	300.00	250.00	120.00	2,485.00	0.60	1.80	0.50
325	54	55	300.00	250.00	120.00	2,485.00	0.60	1.80	0.50
326	55	56	800.00	250.00	120.00	2,485.00	0.60	1.80	1.40
327	56	61	480.00	250.00	120.00	1,879.00	0.40	1.10	0.50
328	61	103	80.00	97.00	130.00	1,879.00	2.90	93.20	7.50
331	56	57	350.00	97.00	130.00	606.00	0.90	11.50	4.00
332	57	58	334.00	97.00	130.00	606.00	0.90	11.50	3.80
333	58	104	450.00	97.00	130.00	606.00	0.90	11.50	5.20



Schematic Diagram of Transmission Mains(F/S)

## Net Work Analysis

## Transmission

File Name NTM02 K  
 Season Wet  
 Network Type Proposed

Demand Year 2005  
 Day Max

Reserver Water Level Fix All  
 Discharge Fix None

Magnification of Demand 1.000

## Reservoir Data

Node	HWL (MSL)	LWL (MSL)	Reservoir
201	1,989.00	1,989.00	Bamberekele Intake
203	1,948.00	1,948.00	Pedro Intake

## Node Data

Node	Ground Elev (MSL)	Demand (cum/d)		
1	1,985.0	0.0	0	0
2	1,987.0	0.0	0	0
3	1,978.0	0.0	0	0
4	1,924.0	0.0	0	0
5	1,917.0	0.0	0	0
6	1,946.0	0.0	0	0
7	1,895.0	0.0	0	0
8	1,896.0	0.0	0	0
9	1,881.0	0.0	0	0
10	1,877.0	0.0	0	0
11	1,882.0	0.0	0	0
12	1,885.0	0.0	0	0
13	1,887.0	0.0	0	0
14	1,891.0	0.0	0	0
31	1,945.0	0.0	0	0
32	1,906.0	0.0	0	0
33	1,900.0	0.0	0	0
34	1,881.0	0.0	0	0
35	1,880.0	0.0	0	0
36	1,877.0	0.0	0	0
37	1,882.0	0.0	0	0
38	1,885.0	0.0	0	0
39	1,887.0	0.0	0	0
40	1,891.0	0.0	0	0
51	1,880.7	0.0	0	0
52	1,876.5	0.0	0	0
53	1,882.0	0.0	0	0
54	1,899.4	0.0	0	0
55	1,902.8	0.0	0	0
56	1,920.0	0.0	0	0
57	1,890.2	0.0	0	0
58	1,887.0	0.0	0	0
61	1,935.0	0.0	0	0
71	1,881.8	0.0	0	0
72	1,881.3	0.0	0	0
73	1,883.7	0.0	0	0
74	1,882.3	0.0	0	0
75	1,891.4	0.0	0	0
76	1,893.9	0.0	0	0
77	1,914.9	0.0	0	0
78	1,917.5	0.0	0	0
101	1,930.0	5,978.0	0	0
102	1,930.0	232.0	0	0
103	1,920.0	1,742.0	0	0
104	1,946.0	562.0	0	0

## Booster Pump Data

No.	Type	Node A	Node B	Pipe No.	Pressure (m)
1	B	58	104	333	25.0

Pipe Data

Pipe No.	Node A	Node B	Diameter (mm)	Length (m)	C Value
2	1	2	250.0	56.0	120.0
3	2	3	250.0	201.0	120.0
4	3	4	250.0	123.0	120.0
5	4	5	250.0	207.0	120.0
6	5	6	250.0	621.0	120.0
7	6	7	250.0	884.0	120.0
8	7	8	200.0	641.0	120.0
9	8	9	200.0	1036.0	120.0
10	9	10	250.0	488.0	120.0
11	10	11	250.0	366.0	120.0
12	11	12	250.0	31.0	120.0
13	12	13	250.0	183.0	120.0
14	13	14	250.0	61.0	120.0
15	14	101	250.0	518.0	120.0
32	31	32	200.0	284.0	120.0
33	32	33	200.0	229.0	120.0
34	33	34	200.0	215.0	120.0
35	34	35	250.0	242.0	120.0
36	35	36	200.0	488.0	120.0
37	36	37	200.0	366.0	120.0
38	37	38	200.0	31.0	120.0
39	38	39	200.0	183.0	120.0
40	39	40	200.0	61.0	120.0
41	40	101	200.0	518.0	120.0
51	9	35	250.0	31.0	120.0
201	1	201	250.0	52.0	120.0
203	31	203	200.0	234.0	120.0
311	13	71	97.0	442.0	130.0
312	71	72	97.0	65.0	130.0
313	72	73	97.0	221.0	130.0
314	73	74	97.0	150.0	130.0
315	74	75	97.0	216.0	130.0
316	75	76	97.0	30.0	130.0
317	76	77	97.0	300.0	130.0
318	77	78	97.0	125.0	130.0
319	78	102	97.0	104.0	130.0
321	10	51	250.0	268.0	120.0
322	51	52	250.0	268.0	120.0
323	52	53	250.0	167.0	120.0
324	53	54	250.0	300.0	120.0
325	54	55	250.0	300.0	120.0
326	55	56	250.0	800.0	120.0
327	56	61	250.0	480.0	120.0
328	61	103	97.0	80.0	130.0
331	56	57	97.0	350.0	130.0
332	57	58	97.0	334.0	130.0
333	58	104	97.0	450.0	130.0

Node No.	Net Work Analysis			Transmission		K	Leakage	
	Elevation of Pipe (MSL)	Demand (cum/d)	Dynamic Pressure (MSL)	Dynamic Pressure (m)	Static Pressure (m)			
1	1,985.0	0.0	1,988.7	3.7	4.0	0.0	0.0	0.0
2	1,987.0	0.0	1,988.3	1.4	2.0	0.0	0.0	0.0
3	1,978.0	0.0	1,987.1	9.1	11.0	0.0	0.0	0.0
4	1,924.0	0.0	1,986.4	62.4	65.0	0.0	0.0	0.0
5	1,917.0	0.0	1,985.1	68.1	72.0	0.0	0.0	0.0
6	1,946.0	0.0	1,981.4	35.4	43.0	0.0	0.0	0.0
7	1,895.0	0.0	1,976.1	81.1	94.0	0.0	0.0	0.0
8	1,896.0	0.0	1,964.6	68.6	93.0	0.0	0.0	0.0
9	1,881.0	0.0	1,946.1	65.1	108.0	0.0	0.0	0.0
10	1,877.0	0.0	1,944.7	67.7	112.0	0.0	0.0	0.0
11	1,882.0	0.0	1,943.0	61.0	107.0	0.0	0.0	0.0
12	1,885.0	0.0	1,942.8	57.8	104.0	0.0	0.0	0.0
13	1,887.0	0.0	1,942.0	55.0	102.0	0.0	0.0	0.0
14	1,891.0	0.0	1,941.8	50.8	98.0	0.0	0.0	0.0
31	1,945.0	0.0	1,955.3	10.3	44.0	0.0	0.0	0.0
32	1,906.0	0.0	1,952.1	46.1	83.0	0.0	0.0	0.0
33	1,900.0	0.0	1,949.5	49.5	89.0	0.0	0.0	0.0
34	1,881.0	0.0	1,947.0	66.0	108.0	0.0	0.0	0.0
35	1,880.0	0.0	1,946.1	66.1	109.0	0.0	0.0	0.0
36	1,877.0	0.0	1,944.2	67.2	112.0	0.0	0.0	0.0
37	1,882.0	0.0	1,942.7	60.7	107.0	0.0	0.0	0.0
38	1,885.0	0.0	1,942.6	57.6	104.0	0.0	0.0	0.0
39	1,887.0	0.0	1,941.9	54.9	102.0	0.0	0.0	0.0
40	1,891.0	0.0	1,941.7	50.7	98.0	0.0	0.0	0.0
51	1,880.7	0.0	1,944.2	63.5	108.3	0.0	0.0	0.0
52	1,876.5	0.0	1,943.8	67.3	112.5	0.0	0.0	0.0
53	1,882.0	0.0	1,943.6	61.6	107.0	0.0	0.0	0.0
54	1,899.4	0.0	1,943.1	43.7	89.6	0.0	0.0	0.0
55	1,902.8	0.0	1,942.6	39.8	86.2	0.0	0.0	0.0
56	1,920.0	0.0	1,941.4	21.4	69.0	0.0	0.0	0.0
57	1,890.2	0.0	1,937.9	47.7	98.8	0.0	0.0	0.0
58	1,887.0	0.0	1,934.6	47.5	102.0	0.0	0.0	0.0
61	1,935.0	0.0	1,940.9	5.9	54.0	0.0	0.0	0.0
71	1,881.8	0.0	1,941.2	59.4	107.2	0.0	0.0	0.0
72	1,881.3	0.0	1,941.0	59.7	107.7	0.0	0.0	0.0
73	1,883.7	0.0	1,940.6	56.9	105.3	0.0	0.0	0.0
74	1,882.3	0.0	1,940.3	58.0	106.7	0.0	0.0	0.0
75	1,891.4	0.0	1,939.9	48.5	97.6	0.0	0.0	0.0
76	1,893.9	0.0	1,939.8	45.9	95.1	0.0	0.0	0.0
77	1,914.9	0.0	1,939.3	24.4	74.1	0.0	0.0	0.0
78	1,917.5	0.0	1,939.0	21.5	71.5	0.0	0.0	0.0
101	1,930.0	5,978.0	1,939.6	9.6	59.0	6,286.8	6,286.8	0.0
102	1,930.0	232.0	1,938.8	8.8	59.0	219.2	219.2	0.0
103	1,920.0	1,742.0	1,934.4	14.4	69.0	1,879.0	1,879.0	0.0
104	1,948.0	562.0	1,955.1	9.1	43.0	0.0	0.0	0.0

Net Work Analysis				Transmission					Pressure Gradient (o/oo)	Loss (m)
Pipe No.	Node A	Node B	Length (m)	Diameter (mm)	C	Flow (cum/d)	Velocity (m/s)			
2	1	2	56.00	250.00	120.00	4,771.00	1.10	6.00	0.30	
3	2	3	201.00	250.00	120.00	4,771.00	1.10	6.00	1.20	
4	3	4	123.00	250.00	120.00	4,771.00	1.10	6.00	0.70	
5	4	5	207.00	250.00	120.00	4,771.00	1.10	6.00	1.30	
6	5	6	621.00	250.00	120.00	4,771.00	1.10	6.00	3.80	
7	6	7	884.00	250.00	120.00	4,771.00	1.10	6.00	5.30	
8	7	8	641.00	200.00	120.00	4,771.00	1.80	17.90	11.50	
9	8	9	1,036.00	200.00	120.00	4,771.00	1.80	17.90	18.50	
10	9	10	488.00	250.00	120.00	3,205.00	0.80	2.90	1.40	
11	10	11	366.00	250.00	120.00	4,106.00	1.00	4.60	1.70	
12	11	12	31.00	250.00	120.00	4,106.00	1.00	4.60	0.10	
13	12	13	183.00	250.00	120.00	4,106.00	1.00	4.60	0.80	
14	13	14	61.00	250.00	120.00	3,874.00	0.90	4.10	0.30	
15	14	101	518.00	250.00	120.00	3,874.00	0.90	4.10	2.10	
32	31	32	284.00	200.00	120.00	3,742.00	1.40	11.40	3.20	
33	32	33	229.00	200.00	120.00	3,742.00	1.40	11.40	2.60	
34	33	34	215.00	200.00	120.00	3,742.00	1.40	11.40	2.50	
35	34	35	242.00	250.00	120.00	3,742.00	0.90	3.90	0.90	
36	35	36	488.00	200.00	120.00	2,103.00	0.80	3.90	1.90	
37	36	37	366.00	200.00	120.00	2,103.00	0.80	3.90	1.40	
38	37	38	31.00	200.00	120.00	2,103.00	0.80	3.90	0.10	
39	38	39	183.00	200.00	120.00	2,103.00	0.80	3.90	0.70	
40	39	40	61.00	200.00	120.00	2,103.00	0.80	3.90	0.20	
41	40	101	518.00	200.00	120.00	2,103.00	0.80	3.90	2.00	
51	9	35	31.00	250.00	120.00	-1,639.00	-0.40	-0.80	0.00	
201	1	201	52.00	250.00	120.00	-4,771.00	-1.10	-6.00	-0.30	
203	31	203	234.00	200.00	120.00	-3,742.00	-1.40	-11.40	-2.70	
311	13	71	442.00	97.00	130.00	232.00	0.40	1.90	0.90	
312	71	72	65.00	97.00	130.00	232.00	0.40	1.90	0.10	
313	72	73	221.00	97.00	130.00	232.00	0.40	1.90	0.40	
314	73	74	150.00	97.00	130.00	232.00	0.40	1.90	0.30	
315	74	75	216.00	97.00	130.00	232.00	0.40	1.90	0.40	
316	75	76	30.00	97.00	130.00	232.00	0.40	1.90	0.10	
317	76	77	300.00	97.00	130.00	232.00	0.40	1.90	0.60	
318	77	78	125.00	97.00	130.00	232.00	0.40	1.90	0.20	
319	78	102	104.00	97.00	130.00	232.00	0.40	1.90	0.20	
321	10	51	268.00	250.00	120.00	2,304.00	0.50	1.60	0.40	
322	51	52	268.00	250.00	120.00	2,304.00	0.50	1.60	0.40	
323	52	53	167.00	250.00	120.00	2,304.00	0.50	1.60	0.30	
324	53	54	300.00	250.00	120.00	2,304.00	0.50	1.60	0.50	
325	54	55	300.00	250.00	120.00	2,304.00	0.50	1.60	0.50	
326	55	56	800.00	250.00	120.00	2,304.00	0.50	1.60	1.30	
327	56	61	480.00	250.00	120.00	1,742.00	0.40	0.90	0.50	
328	61	103	80.00	97.00	130.00	1,742.00	2.70	81.00	6.50	
331	56	57	350.00	97.00	130.00	562.00	0.90	10.00	3.50	
332	57	58	334.00	97.00	130.00	562.00	0.90	10.00	3.30	
333	58	104	450.00	97.00	130.00	562.00	0.90	10.00	4.50	



# Appendix 5.4.2 Node Demand List for Network Analysis (Year 2015)

(Unit: cum/d)

Node No.	Demand Day Max cum/d	Piyatissapura	High Area 1 Pedro, W/P, G/B, Low ers L	Low Area 1 Barabakele Haddon Hill	Low Area 2 New Bore Hole New Reserver	High Area 2 Upper Lake Road Naseby	Bonavista Race Course Bonavista	Unique View Low Area 1 Unique View	Vijithapura Low Area 1 Vijithapura	Remark
1	122			122						
2	70			70						
3										
4	76			76						
5	40			40						
6	76			76						
7										
8										
9	133			133						
10	25					25				
11	86		86							
12	66				66					
13	51				51					
14	66				66					
15	61				61					
16	85				85					
17										
18	107			107						
19	85			85						
20	83			83						
21	97			97						
22	79			79						
23	82			82						
24	117			117						
25	51			51						
26										
27	75			75						
28	26			26						
29	13			13						
30	80			80						
31	93			93						
32										
33	51				51					
34										
35	61				61					
36	51			51						
37	47			47						
38	42			42						
39	50						50			
40	40						40			
41	44			44						
42	38									
43	40			40						
44	54			54						

# Node Demand List for Network Analysis(Year 2015)

(Unit:cum/d)

Node No.	Demand		Piyatissapura	High Area 1 Pedro, W/F, G/B, Low Pedro, W/F, G/B, Low	Low Area 1 Baaharakele Baddon Hill	Low Area 2 New Bore Hole New Reserver	High Area 2 Upper Lake Road Naseby	Bonavista Race Course Bonabista	Unique View Low Area 1 Unique View	Vijithapura Low Area 1 Vijithapura	Remark
	Day Max	cum/d									
45	67				67						
46	127				127						
47	36				36						
48	101				101						
49	160				160						
50	144			144							
51	47				47						
52	97				97						
53	97				97						
54	51				51						
55	89				89						
56	49			49							
57	93				93						
58	119				119						
59	122			122							
60	100				100						
61	50				50						
62	76						76				
63	38				38						
64	44				44						
65											
66	40			40							
67	38			38							
68	42			42							
69	50				50						
70	132						132				
71	87					87					
73	0				0						
100	33				33						
101	25				25						
102	37				37						
103	50				50						
104	19										
105	17										
106	43				43						
107	32				32						
108	30				30						
109	20				20						
110											
111											
112	0				0						
113	29				29						
114	57				57						

Node Demand List for Network Analysis (Year 2015)

(Unit: cum/d)

Node No.	Demand		Piyatissapura	High Area 1 Pedro, W/F, G/B, Low ers L	Low Area 1 Bambarakele Haddon Hill	Low Area 2 New Bore Hole New Reservoir		High Area 2 Upper Lake Road Masoby	Bonavista Base Course Bonabista	Unique View		Vijithapura Low Area 1 Vijithapura	Remark
	Day Max	cum/d								Low Area 1	Unique View		
115													
116													
117	59				59								
118	37				37								
119	64				64								
120	113					113							
121	109					109							
122	89			89									
123	65			65									
124	68					68							
125	108					108							
126	107					107							
127	54					54							
128	38					38							
129	8					8							
130	7					7							
131	4					4							
132	51						51						
133	18						18						
134	54			54									
135	58			58									
136	71			71									
137	118			118									
138													
139	165			165									
140	31				31								
141	99				99								
142	103				103								
143	110				110								
144	39						39						
145	6						6						
146	54					54							
147	98					98							
148	63				63								
149	28				28								
150	118					118							
151	76					76							
152	66					66							
153	71					71							
154	66					66							
155	22					22							
156	40				40								
157	24				24								
158	24				24								
159													

Node Demand List for Network Analysis (Year 2015)

(Unit: cum/d)

Node No.	Demand		Piyatissapura	High Area 1 Pedro, W/F, G/B, Low ers L	Low Area 1 Bambarete Haddon Hill	Low Area 2 New Bore Hole New Reservoir	High Area 2 Upper Lake Road Naseby	Bonavista Race Course Bonavista	Unique View Low Area 1 Unique View	Vijithapura Low Area 1 Vijithapura	Remark
	Day Max	cum/d									
160	19			19							
161	11			11							
162	38				38						
163	7				7						
164	4			4							
165	101		101								
166	18				18						
167											
168											
169	22								22		From Unique View
170	13				13						
171	19				19						
172	51				51						
173	51							51			
174	104			104							
175											
176	23				23						
177	23				23						
178	55							55			
179	25							25			
180								0			
181	80				80						
182	13				13						
183	12				12						
184							66				
185	66					66					
186	66										
187	76			76							
188	8			8							
189	29							29			
203	0										Water Source Haddon Hill
205	0										Water Source New Water Field
206	0										Water Source Old Water Field
208	0										Water Source Bonavista
209	0										Water Source Lovers Leap
215	0										Water Source Gamunu/Brewery
300	47			47							
301	76			76							
302	0										
303	0										
304	70			70							
402	0										

Node Demand List for Network Analysis (Year 2015)

(Unit: cum/d)

Node No.	Demand Day Max cum/d	Piyattissapura Piyattissapura Piyattissapura	High Area 1 Pedro, W/P, G/B, Low ers L Pedro, W/P, G/B, Low ers L	Low Area 1 Bambarakele Haddon Hill	Low Area 2 New Bore Hole New Reserver	High Area 2 Upper Lake Road Naseby	Bonavista Race Course Bonabista	Unique View Low Area 1 Unique View	Vijithapura Low Area 1 Vijithapura	Remark
403	0									
404	0									
405	0									
406	0									
407	0									
408	0									
409	0									
410	0									
411	0									
412	0									
414	0									
415	0									
500	25				25					
501	76				76					
502	80					80				
503	76			76						
510	51		51							
511	20			20						
520	63					63				
521	51			51						
522	51			51						
523	51		51							
524	51					51				
525	51			51						
526	51			51						
527	30		30							
528	30		30							
540	658								658	Vijithapura Local Area
541	905							905	Unique View	Local Area
542										
600	0									Water Source Naseby
601	0									Water Source Piyattissapura
602	0									Water Source Pedro
603	0									Water Source Unique View
604	0									Water Source Vijithapura
606	0									Water Source Low Area 2
Total	11,000	101	1,717	4,825	1,879	806	250	928	694	11,000

# Node Demand List for Network Analysis(Year 2005)

## Appendix 5.4.3

(Unit:cum/d)

Node No.	Demand Day Max cum/d	Piyatissapura	High Area 1 Pedro, W/F, 6/B, Low ers L	Low Area 1 Banbarakele Haddon Hill	Low Area 2 New Bore Hole New Reserver	High Area 2 Upper Lake Road Naseby	Bonavista Race Course Bonavista	Unique View Low Area 1 Unique View	Vijithapura Low Area 1 Vijithapura	Remark
1	113			113						
2	65			65						
3										
4	70			70						
5	37			37						
6	70			70						
7										
8										
9	124			124						
10	23					23				
11	80		80							
12	61				61					
13	47				47					
14	61				61					
15	56				56					
16	79				79					
17										
18	99			99						
19	79			79						
20	77			77						
21	90			90						
22	73			73						
23	76			76						
24	109			109						
25	47			47						
26										
27	69			69						
28	24			24						
29	12			12						
30	74			74						
31	86			86						
32										
33	47				47					
34										
35	56				56					
36	47			47						
37	44			44						
38	39			39						
39	46						46			
40	37						37			
41	41			41						
42	36			36						
43	37			37						
44	50			50						

Node Demand List for Network Analysis (Year 2005)

(Unit: cum/d)

Node No.	Demand	Piyatissapura Piyatissapura Piyatissapura	High Area 1 Pedro, W/F, G/B, Low ers L Pedro, W/F, G/B, Low ers L	Low Area 1 Bambarakele Haddon Hill	Low Area 2 New Bore Hole New Reserver	High Area 2 Upper Lake Road Naseby	Bonavista Race Course Bonabista	Unique View Low Area 1 Unique View	Vijithapura Low Area 1 Vijithapura	Remark
	Day Max cum/d									
45	62			62						
46	118			118						
47	34			34						
48	94			94						
49	148			148						
50	133		133							
51	44			44						
52	90			90						
53	90			90						
54	47			47						
55	82			82						
56	45		45							
57	86			86						
58	111			111						
59	113		113							
60	93			93						
61	46			46		70				
62	70									
63	36			36						
64	41			41						
65										
66	37		37							
67	36		36							
68	39		39							
69	46			46						
70	123				81	123				
71	81									
73	0			0						
100	31			31						
101	23			23						
102	35			35						
103	46			46						
104	18								18	From Vijithapura
105	16								16	From Vijithapura
106	40			40						
107	30			30						
108	28			28						
109	19			19						
110										
111										
112	0			0						
113	27			27						
114	52			52						

Node Demand List for Network Analysis (Year 2005)

(Unit: cum/d)

Node No.	Demand Day Max cum/d	Pivatissapura Pivatissapura Pivatissapura	High Area 1 Pedro, W/P, G/B, Low ers L Pedro, W/P, G/B, Low ers L	Low Area 1 Babarakele Haddon Hill	Low Area 2 New Bore Hole New Reserver	High Area 2 Upper Lake Road Maseby	Bonavista Race Course Bonabista	Unique View Low Area 1 Unique View	Vijithapura Low Area 1 Vijithapura	Remark
115										
116										
117	54			54						
118	35			35						
119	59			59						
120	105				105					
121	101				101					
122	82		82							
123	60		60							
124	63				63					
125	100				100					
126	99				99					
127	50				50					
128	36				36					
129	7				7					
130	7				7					
131	4				4					
132	47					47				
133	17					17				
134	50		50							
135	53		53							
136	66		66							
137	110		110							
138										
139	153		153							
140	29			29						
141	92			92						
142	96			96						
143	102			102						
144	37					37				
145	6					6				
146	50				50					
147	91				91					
148	58			58						
149	26			26						
150	110				110					
151	70				70					
152	61				61					
153	66				66					
154	61				61					
155	21				21					
156	37			37						
157	22			22						
158	22			22						
159										



Node Demand List for Network Analysis (Year 2005)

(Unit: cum/d)

Node No.	Demand		Piyatissapura	High Area 1 Pedro, W/P, G/H, Low ers L	Low Area 1 Babarakele Haddon Hill	Low Area 2 New Bore Hole New Reserver	High Area 2		Bonavista Race Course Bonabista	Unique View Low Area 1 Unique View	Vijithapura Low Area 1 Vijithapura	Remark
	Day Max	cum/d					Upper Lake Road	Naseby				
160	18	18		18								
161	10	10		10								
162	36	36			36							
163	7	7			7							
164	4	4		4								
165	94	94	94									
166	17	17			17							
167												
168												
169	21	21								21		From Unique View
170	12	12			12							
171	18	18			18							
172	47	47			47				47			
173	47	47										
174	97	97		97								
175												
176	22	22			22							
177	22	22			22							
178	51	51							51			
179	23	23							23			
180									0			
181	74	74			74							
182	12	12			12							
183	11	11			11							
184												
185	61	61						61				
186	61	61				61						
187	70	70		70								
188	7	7		7								
189	27	27							27			
203	0	0										Water Source Haddon Hill
205	0	0										Water Source New Water Field
206	0	0										Water Source Old Water Field
208	0	0										Water Source Bonavista
209	0	0										Water Source Lovers Leap
215	0	0										Water Source Tamunu/Brewery
300	44	44		44								
301	70	70		70								
302	0	0										
303	0	0										
304	65	65		65								
402	0	0										

# Node Demand List for Network Analysis (Year 2005)

(Unit: cum/d)

Node No.	Demand Day Max	Piyatissapura	High Area 1 Pedro, W/F, G/B, Low ers L	Low Area 1 Barbarakele	Low Area 2 New Bore Hole	High Area 2 Upper Lake Road	Bonavista Race Course	Unique View Low Area 1	Vijithapura Low Area 1	Remark
	cum/d	Piyatissapura	Pedro, W/F, G/B, Low ers L	Haddon Hill	New Reservoir	Naseby	Bonabista	Unique View	Vijithapura	
403	0									
404	0									
405	0									
406	0									
407	0									
408	0									
409	0									
410	0									
411	0									
412	0									
414	0									
415	0									
500	23				23					
501	70				70					
502	74					74				
503	70			70						
510	47		47							
511	19			19						
520	58					58				
521	47			47						
522	47			47						
523	47		47							
524	47					47				
525	47			47						
526	47			47						
527	28		28							
528	28		28							
540	610								610	Vijithapura Local Area
541	840							840	Unique View	Local Area
542										
600	0									Water Source Naseby
601	0									Water Source Piyatissapura
602	0									Water Source Pedro
603	0									Water Source Unique View
604	0									Water Source Vijithapura
606	0									Water Source Low Area 2
Total	10,200	94	1,592	4,475	1,742	562	231	860	644	10,200

#### Appendix 5.4.4 Magnification of Node Demand for Network Analysis

Year		1,995	2,005	2,015	Remark
Day Mean	Demand	8,133	8,506	8,919	Including NRW
	Magnification	0.739	0.773	0.811	=8,919/11,000
	Load Factor	1.2	1.2	1.2	
Day Max	Demand	9,760	10,200	11,000	=8,919*1.2
	Magnification	0.887	0.928	1.000	=11,000/11,000
	Peak Factor	2.0	2.0	2.0	
Hourly Max	Demand	16,266	17,012	17,838	=8,919*2.0
	Magnification	1.479	1.547	1.622	=17,838/11,000

Withdrawal flow in nodes are based on daily maximum flow(2,015) and modified by node No.

# Appendix 5.4.5 Calculation of Node Demand for Vijithapura and Unique View Hill Reservoir

Dry and Wet Season

Network Type	CASE		Magnification		Vijithapura (Node No.540)		Unique View Hill (Node No.541)		Remark
	Year	Demand	Demand	Magnification	Demand	Remark	Demand	Remark	
Existing					658		905		=Basic node flow to node Demand List(2,15)
	1,995	Day Mean	Day Mean	0.739	Actual Demand	=658*0.739	669	=905*0.739	
			Day Mean	0.739	Input Demand	=486/0.739	905	=669/0.739	
	1,995	Hourly Max	Day Max	0.887	Actual Demand	=658*0.887	803	=905*0.887	
			Hourly Max	1.479	Input Demand	=584/1.479	543	=803/1.479	
	2,015	Day Mean	Day Mean	0.811	Actual Demand	=658*0.811	734	=905*0.811	
			Day Mean	0.811	Input Demand	=534/0.811	905	=734/0.811	
	2,015	Hourly Max	Day Max	1.000	Actual Demand	=658*1.000	905	=905*1.000	
			Hourly Max	1.622	Input Demand	=406/1.622	558	=905/1.622	

Dry and Wet Season

Network Type	CASE		Magnification		Vijithapura (Node No.540)		Unique View Hill (Node No.541)		Remark
	Year	Demand	種別	Magnification	Demand	Remark	Demand	Remark	
Proposed					694		928		=Basic node flow to node Demand List(2,15)
	1,995	Day Mean	Day Mean	0.739	Actual Demand	=694*0.739	686	=928*0.739	
			Day Mean	0.739	Input Demand	=513/0.739	928	=686/0.739	
	1,995	Hourly Max	Day Max	0.887	Actual Demand	=694*0.887	823	=928*0.887	
			Hourly Max	1.479	Input Demand	=616/1.479	557	=823/1.479	
	2,005	Day Mean	Day Mean	0.773	Actual Demand	=694*0.773	717	=928*0.773	
			Day Mean	0.773	Input Demand	=536/0.773	928	=717/0.773	
	2,005	Hourly Max	Day Max	0.928	Actual Demand	=694*0.928	861	=928*0.928	
			Hourly Max	1.547	Input Demand	=416/1.547	557	=861/1.547	
	2,015	Day Mean	Day Mean	0.811	Actual Demand	=694*0.811	753	=928*0.811	
			Day Mean	0.811	Input Demand	=563/0.811	928	=753/0.811	
	2,015	Hourly Max	Day Max	1.000	Actual Demand	=694*1.000	928	=928*1.000	
			Hourly Max	1.622	Input Demand	=428/1.622	572	=928/1.622	

Withdrawal flow in nodes at Vijithapura, Unique View Hill Reservoir in Low Area 1 is based on Daily maximum Flow

Appendix 5.4.6 Calculation of Node Demand for High Area 1 Reservoir  
Dry Season

Reservoir	Node No.	2,015 Supply (cum/d)	Ratio (%)	1,995 Supply (cum/d)	2,005 Supply (cum/d)	Remark
New Water Field	205	68	3.96%	50	63	
Old Water Field	206	393	22.89%	290	364	
Gamunu/Brewery	215	266	15.49%	197	247	
Lovers Leap	209	111	6.46%	82	103	
(Pedro)		879	51.19%	650	815	Treated as Reservoir
Total		1,717	100.00%	1,269	1,592	

1,995 Demand      High Area 1/All Area=1,717/11,000=0.156  
0.156\*8,133=1,269cum/d

Upon demand calculation, above mentioned values shall be adopted.  
Reservoirs excluding Pedro Reservoir are assumed as withdrawal nodes.

Appendix 5.5 Summary of Project Cost

	Facilities	Description	Unit	Unit Price	2005		2015		Total Cost
					Quantity	Cost	Quantity	Cost	
1	Intake Facilities								
	Well and Pump	Well	150 m/piece	pcs	7,944,000.0	7	55,608,000	0	55,608,000
		Pump Equipment	0.7cum/min*50m*15kw	set	2,778,000.0	8	22,224,000	0	22,224,000
		Electrical Facilities	15 kw	set	1,068,000.0	7	7,476,000	0	7,476,000
		Power Supply Cost	15 kw	set	75,000.0	7	525,000	0	525,000
		Pump House	10 m2/set	set	200,000.0	7	1,400,000	0	1,400,000
		Transmission Pipe	PVC Φ160	m	3,502.0	1,240	4,342,480	0	4,342,480
	Transmission Facilities	To Madbon Hill Res							
		(Pump Pit)	21cum						
		Concrete		m3	9,530.0	24	228,720	0	228,720
		Form Work		m2	1,060.0	169	168,540	0	168,540
		Reinforcement	0.12	ton	72,970.0	3	218,910	0	218,910
		Miscellaneous	100%	set	0.0	1	616,170	0	616,170
		Pump House	25 m2	m2	20,000.0	25	500,000	0	500,000
		Pump Equipment	3.47cum/m*68m*75kw	set	3,168,000.0	2	6,336,000	0	6,336,000
		Electrical Facilities	75 kw	set	3,998,000.0	1	3,998,000	0	3,998,000
		Power Supply Cost	75 kw	set	1,404,000.0	1	1,404,000	0	1,404,000
		To Low Area 2 Res							
		(Pump Pit)	21cum						
		Concrete		m3	9,530.0	24	228,720	0	228,720
		Form Work		m2	1,060.0	169	168,540	0	168,540
		Reinforcement	0.12	ton	72,970.0	3	218,910	0	218,910
		Miscellaneous	100%	set	0.0	1	616,170	0	616,170
		Pump House	25 m2	m2	20,000.0	25	500,000	0	500,000
		Pump Equipment	1.30cum/m*63m*30kw	set	1,945,000.0	2	3,890,000	0	3,890,000
		Electrical Facilities	30 kw	set	1,756,000.0	1	1,756,000	0	1,756,000
		Power Supply Cost	30 kw	set	75,000.0	1	75,000	0	75,000
	Sub Total					112,499,160		0	112,499,160
2	Transmission Pipe Line								
	Transmission Main of Underground Water								
		DI	Φ300	m	10,190.0	4,320	44,020,800	0	44,020,800
		PVC	Φ225	m	4,501.0	700	3,150,700	0	3,150,700
	Transmission Main of Surface Water								
		DI	Φ250	m	8,550.0	3,545	30,309,750	498	4,172,400
		PVC	Φ110	m	2,884.0	2,867	8,268,428	0	8,268,428
	To Nassy Res								
		Pump Equipment	0.42cum/m*25m*3.7kw	set	1,303,000.0	1	1,303,000	0	1,303,000
		Pump House	4.0 m2	m2	20,000.0	4	80,000	0	80,000
		Electrical Facilities	3.7 kw	set	578,000.0	1	578,000	0	578,000
		Power Supply Cost	3.7 kw	set	75,000.0	1	75,000	0	75,000
	To Vijiapuram								
		Pump Equipment	0.48cum/m*25m*3.7kw	set	1,317,000.0	1	1,317,000	0	1,317,000
		Pump House	4.0 m2	m2	20,000.0	4	80,000	0	80,000
		Electrical Facilities	3.7 kw	set	605,000.0	1	605,000	0	605,000
		Power Supply Cost	3.7 kw	set	75,000.0	1	75,000	0	75,000
	To Unique View Hill								
		Pump Equipment	0.64cum/m*85m*18kw	set	1,700,000.0	1	1,700,000	0	1,700,000
		Pump House	4.0 m2	m2	20,000.0	4	80,000	0	80,000
		Electrical Facilities	18 kw	set	1,306,000.0	1	1,306,000	0	1,306,000
		Power Supply Cost	18 kw	set	75,000.0	1	75,000	0	75,000
	Sub Total					93,023,678		4,172,400	97,196,078
3	Treatment Facilities								
		Chlorinator		set	600,000.0	3	1,800,000	0	1,800,000
		Chlorination House	10 m2	set	450,000.0	3	1,350,000	0	1,350,000
	Sub Total					3,150,000		0	3,150,000
4	Distribution Facilities								
	Old Water Field Reservoir								
		Concrete		m3	9,530.0	160	1,524,800	0	1,524,800
		Form Work		m2	1,060.0	400	424,000	0	424,000
		Reinforcement	0.12	ton	72,970.0	19	1,386,430	0	1,386,430
		Miscellaneous	100%	set	0.0	1	3,335,230	0	3,335,230
		Sub Total				6,670,460		0	6,670,460
	Pedro Reservoir								
		Concrete		m3	9,530.0	520	4,955,600	0	4,955,600
		Form Work		m2	1,060.0	1,280	1,356,800	0	1,356,800
		Reinforcement	0.12	ton	72,970.0	62	4,524,140	0	4,524,140
		Miscellaneous	100%	set	0.0	1	10,836,540	0	10,836,540
		Sub Total				21,673,080		0	21,673,080
	Unique View Reservoir								
		Concrete		m3	9,530.0	240	2,287,200	0	2,287,200
		Form Work		m2	1,060.0	610	646,600	0	646,600
		Reinforcement	0.12	ton	72,970.0	29	2,116,130	0	2,116,130
		Miscellaneous	100%	set	0.0	1	5,049,930	0	5,049,930
		Sub Total				10,099,860		0	10,099,860
	Vijiapuram Reservoir								
		Concrete		m3	9,530.0	190	1,810,700	0	1,810,700
		Form Work		m2	1,060.0	480	508,800	0	508,800
		Reinforcement	0.12	ton	72,970.0	23	1,678,310	0	1,678,310
		Miscellaneous	100%	set	0.0	1	3,997,810	0	3,997,810
		Sub Total				7,995,620		0	7,995,620
	Low Area 2 Reservoir								
		Concrete		m3	9,530.0	430	4,097,900	0	4,097,900
		Form Work		m2	1,060.0	1,080	1,144,800	0	1,144,800
		Reinforcement	0.12	ton	72,970.0	52	3,794,440	0	3,794,440
		Miscellaneous	100%	set	0.0	1	9,037,140	0	9,037,140
		Sub Total				18,074,280		0	18,074,280
	Distribution Pipe								
		PVC Φ63		m	2,464.0	50	123,200	0	123,200
		PVC Φ75		m	2,554.5	1,460	3,729,570	0	3,729,570
		PVC Φ110		m	2,924.5	1,939	5,378,156	0	5,378,156
		PVC Φ160		m	3,586.0	1,828	6,555,208	1,773	6,357,978
		PVC Φ225		m	4,663.0	1,760	8,206,880	132	615,516
		DIP Φ250		m	9,178.5	2,069	18,990,317	0	18,990,317
		Sub Total				42,983,330		6,973,494	49,956,824
	Sub Total					107,496,630		6,973,494	114,470,124
	Grand Total					316,169,468		11,146,894	327,316,362
		Civil Work				261,890,458		11,146,894	273,037,352
		M & E				54,289,000		0	54,289,000

## **Chapter 6**

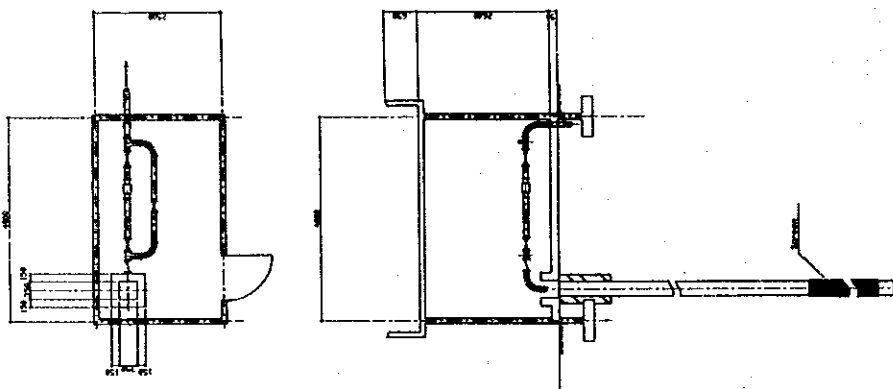
### **Appendix 6.1 Drawings**

## Appendix 6.1 Drawing

**Drawing List**

No.	Drawing Name
W.1- 1	Intake Facilities
W.2- 1	Typical Drawing of Service Reservoir
W.2- 2	Layout of Old Water Field Service Reservoir
W.2- 3	Layout of Pedro Service Reservoir
W.2- 4	Layout of Unique View Hill Service Reservoir
W.2- 5	Layout of Vijitapura Service Reservoir





### Well and Well Pump

A-6.1-2

Reservoir	L1	L2	Depth	No.	V(cum)	Y.L
Old Water Field	4,500	3,700	3,000	2	100	1,955
Pedro	6,000	6,200	3,000	2	220	1,948
Unique View Hill	8,600	8,600	3,000	1	200	1,980
Vijithapura	8,500	5,500	3,000	1	140	1,925
Low area 2	10,000	7,900	3,000	2	470	1,920

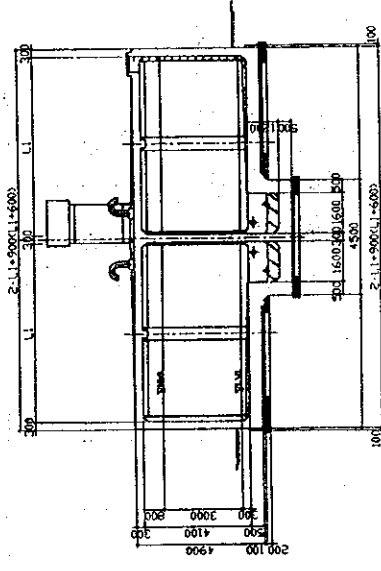
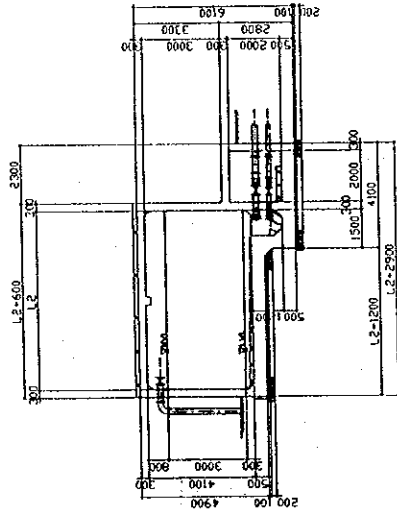
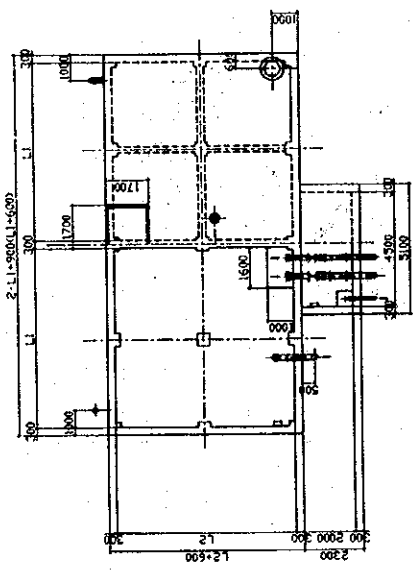


Figure W2-1  
Typical Drawing of Service Reservoir

Figure W.2-2  
Layout of Old Water Field Service  
Reservoir

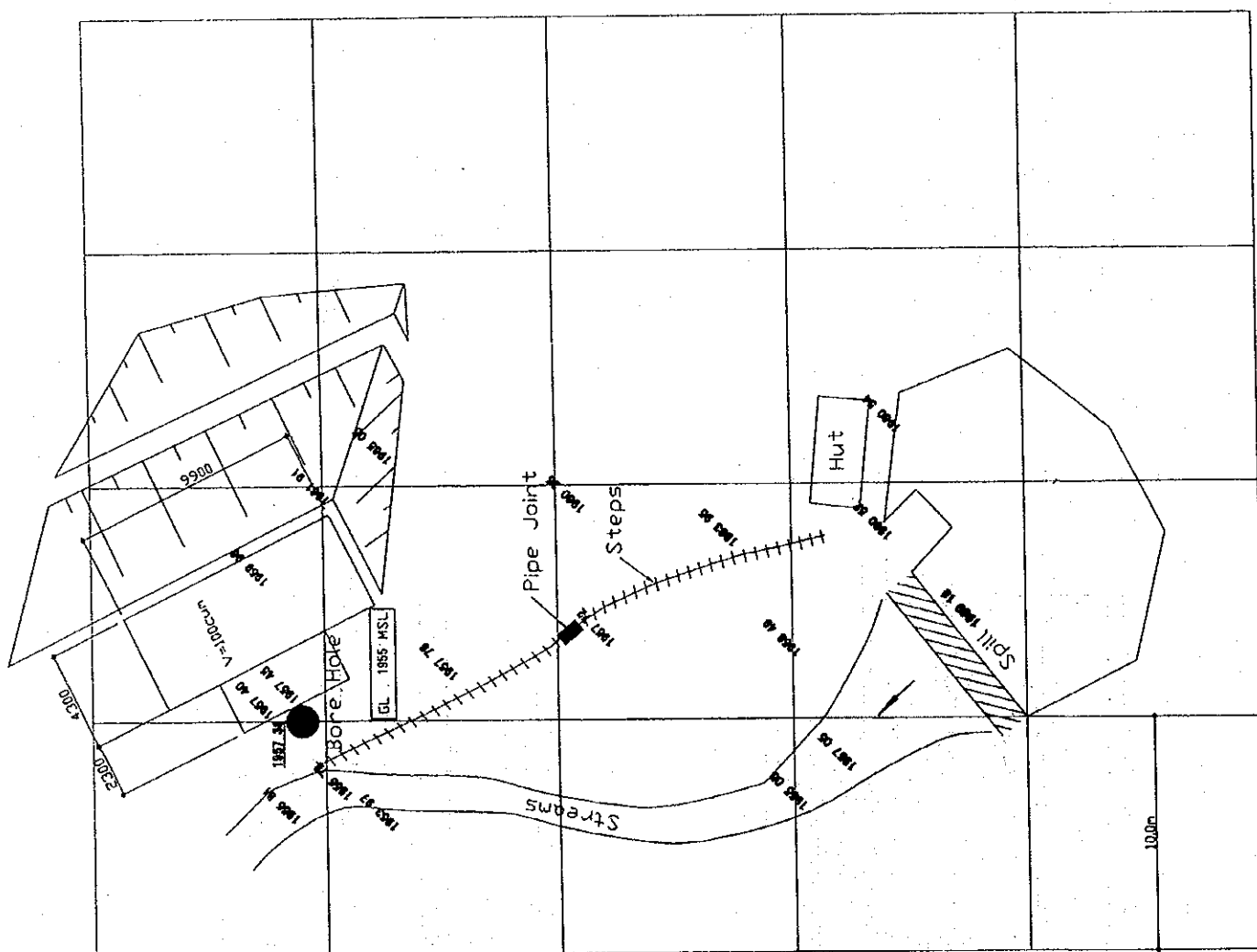


Figure W.2-3  
Layout of Pedro Service Reservoir

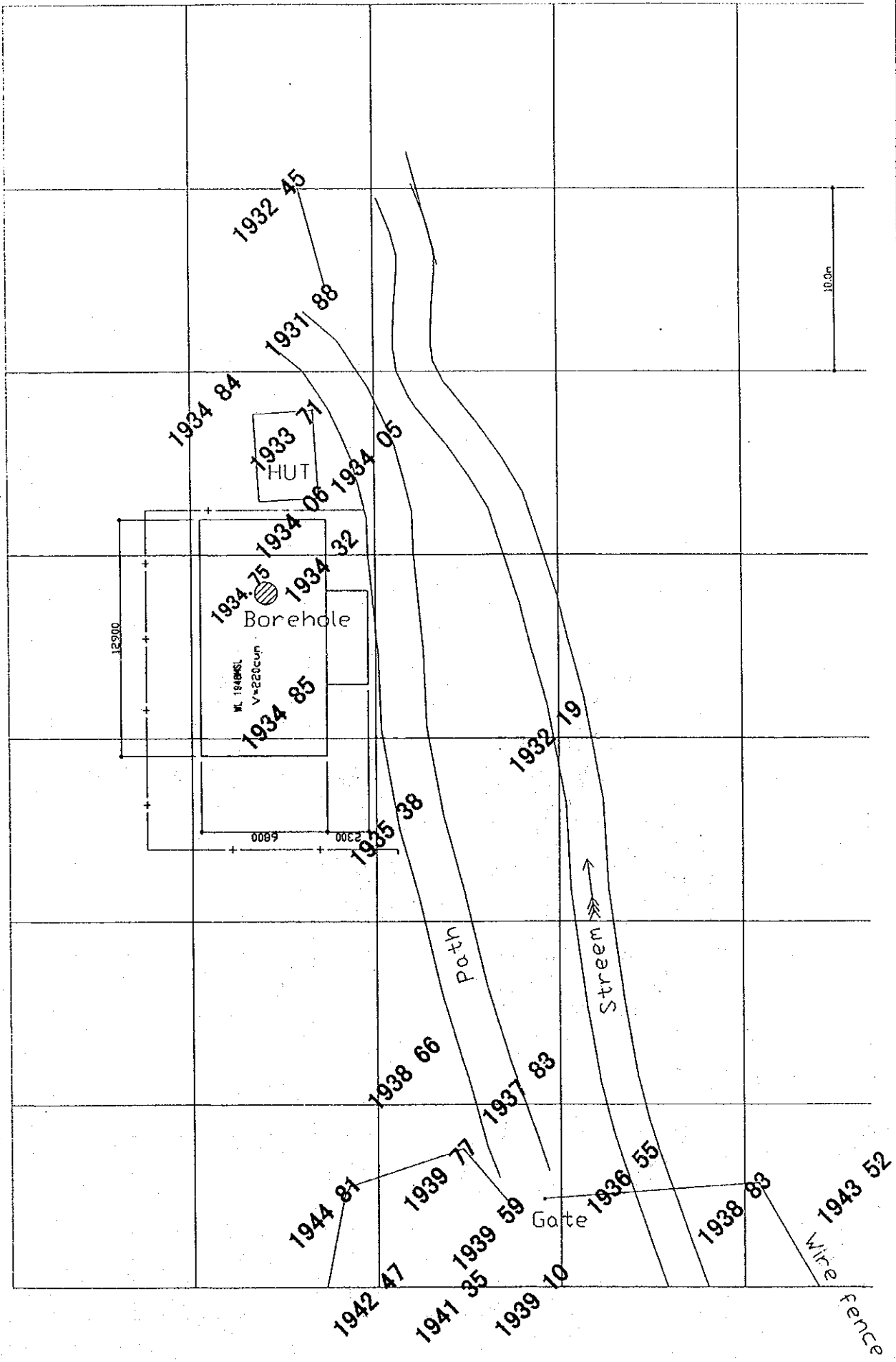


Figure W.2-4  
Layout of Unique View Hill Service  
Reservoir

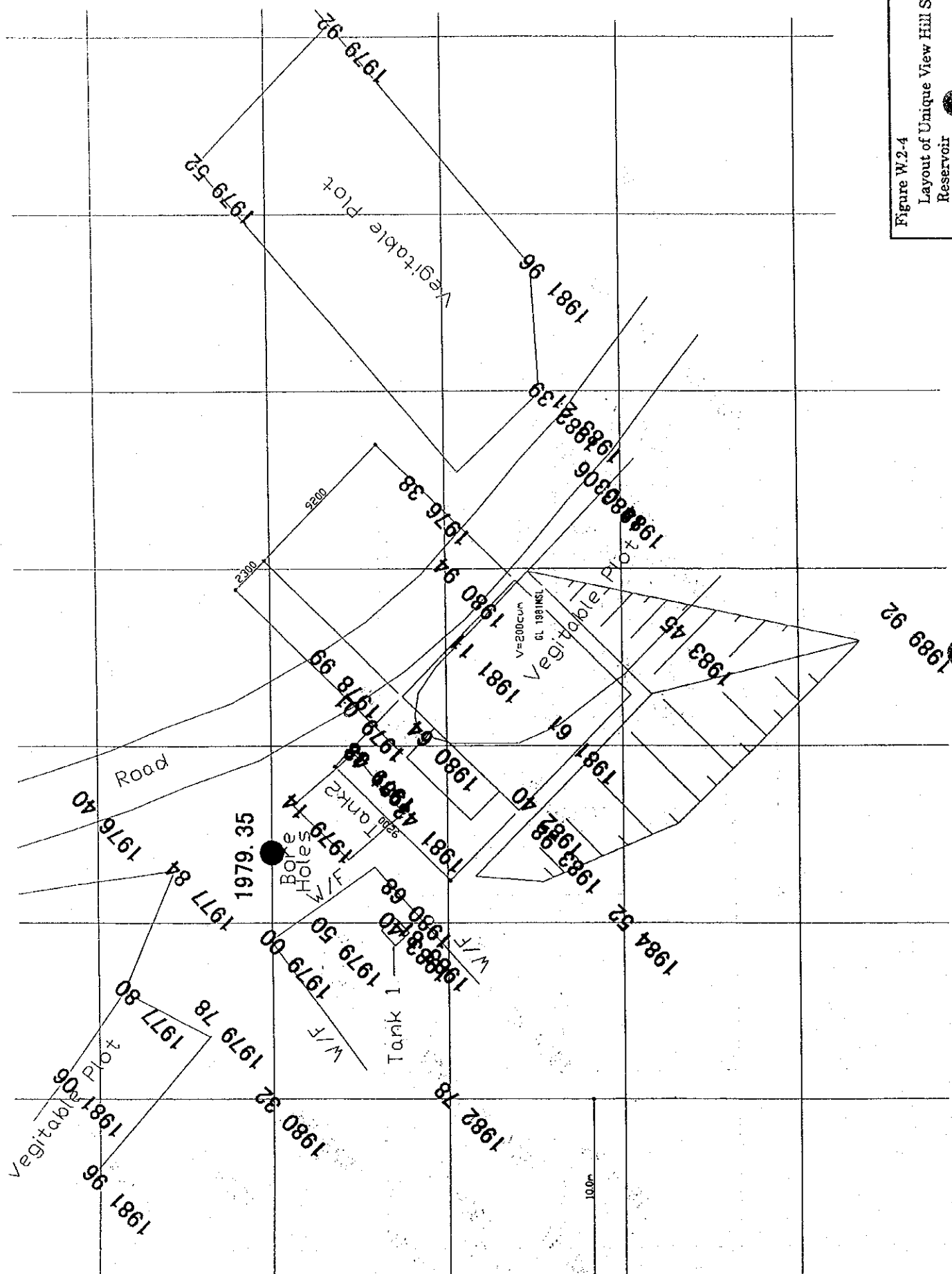
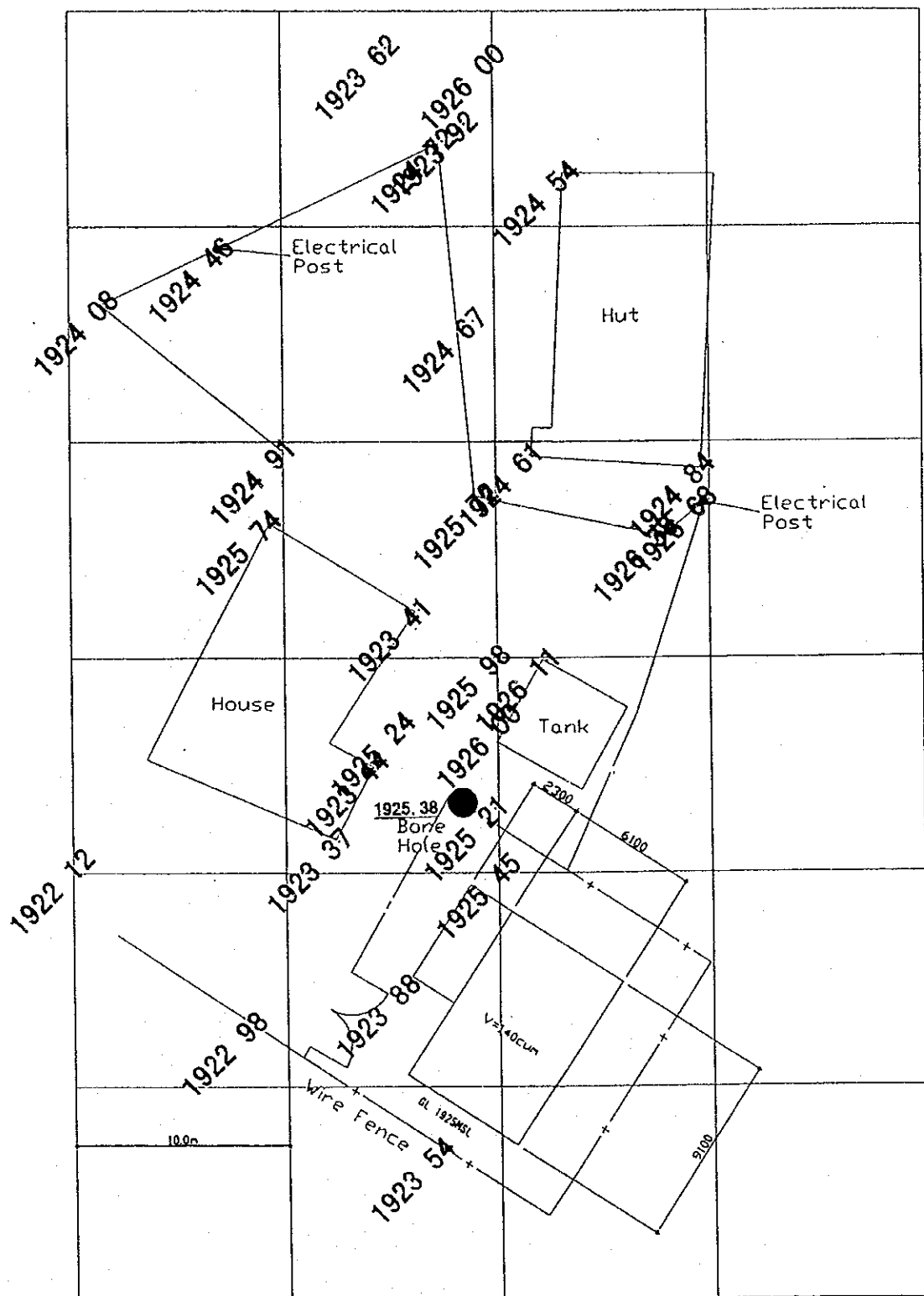


Figure W.2-5  
Layout of Vijiapura Service Reservoir



## **Chapter 7**

### **Appendix 7.1 Annual Operation and Maintenance Cost**

# Appendix 7.1 Annual Operation and Maintenance Cost

## Nuwara Eliya Master Plan

Item	hrs/d	kW	kWh/d	Rs/month	Chemical kg/d	Man-Power Rs/month	Spare Parts Cost	Rs/month	Total Rs/year
1. Intake									
Intake Pump	5	232.0	1,160	2,420	162,500		42,902,000	429,020	
2. T.P.									
T.P.					Chlorine	817	1,800,000	18,000	
3. Transmission									
Booster Pump	15	3.7	56	220	7,948		1,881,000	18,810	
4. Distribution									
Booster Pump	19	21.7	412	440	56,856		4,928,000	49,280	
5. Labor						5	20,000	100,000	
6. Maintenance						1	30,000	30,000	
7. Manager/Engineer						1	50,000	50,000	
Total				227,744	Chlorine	817	51,511,000	515,110	923,671

Intake Pump 24hr\*3Month/12Month\*0.81=5hrs/d

Transmission Booster Pump 24hr\*9Month/12Month\*0.81=15hrs/d

Distribution Booster Pump 24hr\*0.81=19hrs/d

## Nuwara Eliya Feasibility Study

Item	hrs/d	kW	kWh/d	Rs/month	Chemical kg/d	Man-Power Rs/month	Spare Parts Cost	Rs/month	Total Rs/year
1. Intake									
Intake Pump	5	232.0	1,160	2,420	162,500		42,902,000	429,020	
2. T.P.									
T.P.					Chlorine	776	1,800,000	18,000	
3. Transmission									
Booster Pump	14	0.0	0	220	0		1,881,000	18,810	
3. Distribution									
Booster Pump	18	18.0	324	440	44,712		4,928,000	49,280	
4. Labor						5	20,000	100,000	
5. Maintenance						1	30,000	30,000	
6. Manager/Engineer						1	50,000	50,000	
Total				207,872	Chlorine	776	51,511,000	515,110	903,758

Intake Pump 24hr\*3Month/12Month\*0.77=5hrs/d

Transmission Booster Pump 24hr\*9Month/12Month\*0.77=14hrs/d

Distribution Booster Pump 24hr\*0.77=18hrs/d



## **Chapter 11**

**Appendix 11.1 Population in Sewerage Service Area**

**Appendix 11.2 Peak Factor**  
**(Hourly Maximum / Maximum Daily)**

**Appendix 11.3 Sewage Flow Calculation**

**Appendix 11.1 Population in Sewerage Service Area**

No.	ID GN	Name	All Area			Without Forest/Park			M/P Service Area (1997)			M/P Service Area (2015)			M/P Service Area (2005)			F/S Service Area (2005)		
			Area(ha)	Families	Population	Size	Density (pc/ha)	Percentage	Area (ha)	Density (pc/ha)	Area (ha)	Population	Area (ha)	Density	Population	Area (ha)	Density	Area (ha)	Density	Population
1	No. 535	Nuwara Eliya	250.2	196	1,056	5.44	4	45.3%	136.9	8	38.7	8	310	38.7	11	445	38.7	15.3	10	148
2	No. 535A	Mahagastota	162.9	396	1,895	4.79	12													
3	No. 535B	Kalukele	110.2	258	1,279	4.96	12	28.7%	78.6	16	46.1	16	738	46.1	23	1,060	46.1	2.9	19	56
4	No. 535C	Kellegala	147.3	406	2,049	5.05	14													
5	No. 535D	N'Eliya Central	373.6	655	3,962	6.05	11	61.1%	145.3	27	78.4	27	2,117	78.4	39	3,041	78.4	7	33	229
6	No. 535E	Sadathenna	306.5	430	2,407	5.60	8													
7	No. 535F	Hewa Eliya West	129.6	428	1,721	4.02	13	33.6%	86.1	20	49	20	980	49	29	1,408	49	44.3	24	1,073
8	No. 535G	Hewa Eliya North	177.2	379	2,076	5.48	12													
9	No. 535H	Hewa Eliya East	159.5	417	1,641	3.94	10													
10	No. 535I	Buluele	248.0	538	1,981	3.68	8	60.3%	98.5	20	31.1	20	622	31.1	29	893	31.1	1.9	24	46
11	No. 535J	Toppass	1,317.0	466	2,285	4.90	2													
12	No. 535K	Babarakele	943.7	480	2,108	4.39	2													
13	No. 535L	N'Eliya West	259.2	424	1,946	4.59	8	59.1%	106.0	18	70.9	18	1,276	70.9	26	1,833	70.9	12.6	22	275
14	No. 535M	Santhipura	801.3	310	1,588	5.12	2													
15	No. 535N	Kalapura	1,371.0	572	2,770	4.84	2													
Total			6,757.20	6,355	30,774	4.84	ave				314.2	18	6,043	314.2	28	8,680	314.2	84.0	22	1,827

Annual population Increase Ratio

(1997-2000) 1.0270

(2001-2005) 1.0225

(2006-2010) 1.0185

(2011-2015) 1.0160

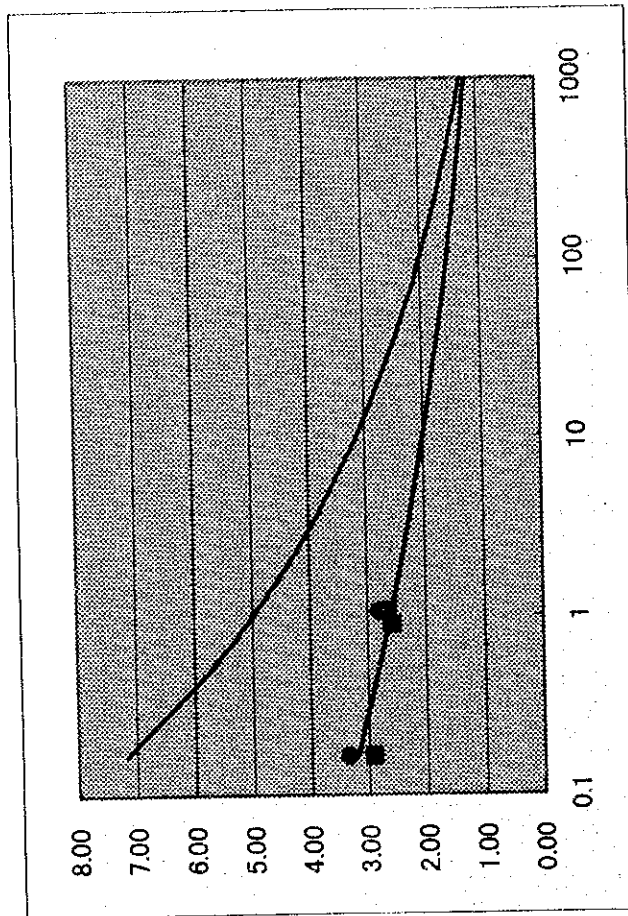
## Appendix 11.2 Peaking Factor (Hourly Maximum/Daily Maximum)

Population (x 10 <sup>3</sup> )	Sewage (m <sup>3</sup> /dav)	I	II	Actual 1	Actual 2	Factor
0.165	46	7.17	3.20	3.34	2.91	2.00
0.5	139	5.74	2.82			
1	277	5.00	2.60			
0.904	250	5.10	2.63	2.59	2.57	
1.069	296	4.93	2.58	2.79	2.65	
2	554	4.35	2.40			1.80
3	831	4.01	2.29			
4	1,108	3.79	2.22			
5	1,385	3.62	2.16			
10	2,770	3.15	2.00			
20	5,540	2.75	1.84			
30	8,310	2.53	1.76			
40	11,080	2.39	1.70			
50	13,850	2.29	1.66			
60	16,620	2.20	1.62			
70	19,390	2.14	1.60			1.50
80	22,160	2.08	1.57			
90	24,930	2.03	1.55			
100	27,700	1.99	1.53			
150	41,550	1.84	1.46			
200	55,400	1.73	1.41			1.35
250	69,250	1.66	1.38			
300	83,100	1.60	1.35			

Caluculation

I:  $M = 5 / P^{0.2}$  (Babbit Factor - M)

II:  $M = 2.6 / P^{0.115}$  (Hantana)



## Appendix 11.3 Sewage Flow Calculation

### Sri Lanka - Nuwara Eliya

#### 1. Population by Year

ID GN	Name	Area (ha)	Population					
			1997	1998	2000	2005	2010	2015
No. 535	Nuwara Eliya	38.7	310	318	336	376	412	446
No. 535B	Kalukele	46.1	738	758	799	893	979	1,060
No. 535D	N'Eliya Central	78.4	2,117	2,174	2,293	2,563	2,809	3,041
No. 535F	Hewa Eliya West	49	980	1,006	1,062	1,187	1,301	1,408
No. 535I	Hewa Eliya East	31.1	622	639	674	753	825	893
No. 535L	N'Eliya East	70.9	1,276	1,310	1,382	1,545	1,693	1,833
Total		314.2	6,043	6,205	6,546	7,317	8,019	8,681

Annual population Increase Ratio		(1997-2000)	1.0270
		(2001-2005)	1.0225
		(2006-2010)	1.0185
		(2011-2015)	1.0160

#### 2. Per Capita Domestic Supply Water (Design Average Daily Flow)

Unit: Lpcd

	1998	2000	2005	2010	2015
Domestic Water Supply	93	93	93	93	93

Gardening water is excluded. ( 107 - 14 = 93 Lpcd )

#### 3. Non-Domestic Water Consumption (Design Average Daily Flow)

Unit: m3/d

Year	1995	2000	2005	2010	2015
Commercial, Institutionals	315	360	402	441	477
Religious, Premices, Schools	145	166	186	204	221
Sub-total of Commercial Use	460	526	588	645	698
Tourist, Hotel, Guest House	595	680	760	833	902
Hospitals	33	38	42	46	50
Sub-total of Hotel/Hospital Use etc.	628	718	802	879	952
Industories	190	217	243	266	288
Total	1,278	1,461	1,633	1,790	1,938

#### 4. Water Supply to Sewage Service Area

(Design Average Daily Flow)

Unit: m3/d

Item	1995	2000	2005	2010	2015
Commercial Water	276	316	353	387	558
Hotel/Hospital Water	377	431	481	527	762
Industrial Water	190	217	243	266	288
Total	843	964	1,077	1,180	1,608

Ratio of Commercial/Hotel Water Use in Sewage Service Area	by 2005	60%
	by 2015	80%
Ratio of Industrial Water Use in Sewage Service Area		100%

### 5. Per Capita Sewage Flow by Year

Unit: Lpcd

Item		1998	2000	2005	2010	2015
Domestic Wastewater	Q1	74	74	74	74	74
	Q2	89	89	89	89	89
	Q3	148	148	148	148	148
Commercial Wastewater	Q1	36	39	39	39	51
	Q2	43	47	47	47	61
	Q3	72	78	78	78	102
Infiltration	Q1	20	20	20	20	23
	Q2					
	Q3					

Discharging Ratio of Domestic and Commercial Water Supply to Sewerage 80%

Infiltration for Domestic and Commercial Water. 15%

Daily Maximum / Daily Average 1.2

Hourly Maximum / Daily Average 2

Q1: Design Average Daily Flow

Q2: Design Maximum Daily Flow

Q3: Design Maximum Hourly Flow

### 6. Amount of Sewage Flow

#### Master Plan

Year		2005 (M/P Area)			2015 (M/P)		
Area(ha)		314.2			314.2		
Population		7,317			8,681		
Item		Q1	Q2	Q3	Q1	Q2	Q3
Domestic Wastewater		541	651	1,083	642	773	1,285
Commercial Wastewater		285	344	571	446	530	885
Infiltration		124	124	124	200	200	200
Sub-total		950	1,119	1,778	1,288	1,503	2,370
Hotel/Hospital		481	577	962	762	914	1,524
Industrial Use etc.		243	243	486	288	288	576
Sewage Flow (m3/day)	Total	1,674	1,939	3,226	2,338	2,705	4,470
	Round	1,700	1,900	3,200	2,300	2,700	4,500

#### Feasibility Study

Year		2005 (F/S)		
Area(ha)		84.0		
Population		1,827		
Item		Q1	Q2	Q3
Domestic Wastewater		135	163	270
Commercial Wastewater		285	344	571
Infiltration		76	76	76
Sub-total		496	583	917
Hotel/Hospital		481	577	962
Industrial Use etc.		243	243	486
Sewage Flow (m3/day)	Total	1,220	1,403	2,365
	Round	1,200	1,400	2,400

Q1: Design Average Daily Flow

Q2: Design Maximum Daily Flow

Q3: Design Maximum Hourly Flow

## **Chapter 12**

- Appendix 12.1 Design Calculation for Sewage Treatment Plant**
- Appendix 12.2 Sewer Network Hydraulic Analysis**
- Appendix 12.3 Pumping Station**
  - Capacity Calculation**
- Appendix 12.4 Sewage Treatment Plant**
  - Capacity Calculation**
- Appendix 12.5 Summary of Construction Cost**
- Appendix 12.6 Cost of Sewer**
- Appendix 12.7 Unit Cost**



# Appendix 12.1 Design Calculation for Sewage Treatment Plant

Treatment Method	Subsidiary Pond	Flow	Aerated Lagoon (Dual Power)	Trickling Filter	Oxidation Ditch
1 Design Criteria		<p><b>Design Flow</b></p> <p>Daily Average 2,300 m<sup>3</sup>/day</p> <p>Daily Maximum 2,800 m<sup>3</sup>/day</p> <p>Hourly Maximum 4,500 m<sup>3</sup>/day</p> <p><b>Load</b></p> <p>Influent - BOD<sub>5</sub> Load 552 kg-BOD<sub>5</sub>/day</p> <p>Influent - SS Load 575 kg-BOD<sub>5</sub>/day</p>	<p><b>Water Quality - Influent</b></p> <p>BOD<sub>5</sub> 240 mg/l</p> <p>SS 250 mg/l</p> <p><b>Removal Rate</b></p> <p>BOD<sub>5</sub> 88 %</p> <p>SS 80 %</p> <p><b>Water Quality - Effluent</b></p> <p>BOD<sub>5</sub> 30 mg/l</p> <p>SS 50 mg/l</p>		
2 Flow Diagram	<p>(Inlet)</p> <p>Screen &amp; Grit Chamber</p> <p>Anaerobic Pond</p> <p>Facultative Pond</p> <p>Maturation Pond</p> <p>(Outlet)</p>	<p>(Inlet)</p> <p>Screen &amp; Grit Chamber</p> <p>Complete Mixing Lagoon</p> <p>Partial Mixing Lagoon</p> <p>Disaeration Tank</p> <p>(Outlet)</p>	<p>(Inlet)</p> <p>Screen &amp; Grit Chamber</p> <p>Oxidation Ditch</p> <p>Primary Sedimentation Tank</p> <p>First Trickling Filter</p> <p>Second Trickling Filter</p> <p>Final Sedimentation Tank</p> <p>Disinfection Tank</p> <p>(Outlet)</p> <p>Sludge Thickening Tank</p> <p>Sludge Drying Bed</p>	<p>(Inlet)</p> <p>Screen &amp; Grit Chamber</p> <p>Oxidation Ditch</p> <p>Sedimentation Tank</p> <p>Disinfection Tank</p> <p>(Outlet)</p> <p>Sludge Thickening Tank</p> <p>Sludge Drying Bed</p>	
3 Outline of Major Facilities	<p>1) Grit Chamber</p> <p>Type Dimension L = 2.2 m W = 0.6 m D = 0.3 m</p> <p>Number (2-standby) 3 units</p> <p>Surface Area 4 m<sup>2</sup></p> <p>Surface Load 1,742 m<sup>3</sup>/m<sup>2</sup>/day</p> <p>2) Anaerobic Pond</p> <p>Type Rectangular</p> <p>BOD-Volumetric Load = 150.00 kg-BOD/m<sup>3</sup>/day (at 23.6 °C)</p> <p>BOD Removal = 50 %</p> <p>BOD - Effluent 120.0 mg/l</p> <p>Dimension L = 25.0 m W = 25.0 m D = 4.0 m</p> <p>Number (1-standby) 4 units</p> <p>Surface Area 2,500 m<sup>2</sup></p> <p>Volume 10,000 m<sup>3</sup></p> <p>Retention Time 2.17 days</p>	<p>1) Grit Chamber</p> <p>Type Dimension L = 2.2 m W = 0.6 m D = 0.3 m</p> <p>Number (2-standby) 3 units</p> <p>Surface Area 4 m<sup>2</sup></p> <p>Surface Load 1,742 m<sup>3</sup>/m<sup>2</sup>/day</p> <p>2) Complete Mixing Aerated Lagoon</p> <p>Type Rectangular</p> <p>Dimension L = 23.0 m W = 9.0 m D = 3.0 m</p> <p>Number 2 units</p> <p>Surface Area 1,380 m<sup>2</sup></p> <p>Capacity 4,140 m<sup>3</sup></p> <p>Retention Time 1.50 days</p> <p>Aerator Power 25.0 kW</p> <p>- Oxygen Supply 21.8 kW</p> <p>- Aeration 24.8 kW</p>	<p>1) Grit Chamber</p> <p>Type Dimension L = 2.2 m W = 0.6 m D = 0.3 m</p> <p>Number (1-standby) 3 units</p> <p>Surface Area 4 m<sup>2</sup></p> <p>Surface Load 1,742 m<sup>3</sup>/m<sup>2</sup>/day</p> <p>2) Primary Sedimentation Tank</p> <p>Type Circular Tank</p> <p>Dimension L = 6.0 m dia. D = 3.0 m</p> <p>Number 2 units</p> <p>Surface Area 72 m<sup>2</sup></p> <p>Surface Load 48.8 m<sup>3</sup>/m<sup>2</sup>/day</p> <p>Volume 85 m<sup>3</sup></p> <p>Retention Time 1.5 hours</p>	<p>1) Grit Chamber</p> <p>Type Dimension L = 2.2 m W = 0.6 m D = 0.3 m</p> <p>Number (1-standby) 3 units</p> <p>Surface Area 4 m<sup>2</sup></p> <p>Surface Load 1,742 m<sup>3</sup>/m<sup>2</sup>/day</p> <p>2) Oxidation Ditch</p> <p>Type Circular Channel</p> <p>Dimension L = 110.0 m W = 4.0 m D = 3.0 m</p> <p>Number 2 units</p> <p>Surface Area 880 m<sup>2</sup></p> <p>Volume 2,640 m<sup>3</sup></p> <p>Retention Time 23.0 hours</p> <p>Oxygen Supply 55 kg-O<sub>2</sub>/hr</p> <p>Aerator Power 30 kW</p> <p>Sludge Age 14.5 day</p>	



Treatment Method	Stabilization Pond	Aerated Lagoon (Dual Power)	Trickling Filter	Final Sedimentation Tank	Oxidation Ditch
3 Outline of Major Facilities	<p>3) Facultative Pond</p> <p>Type: Rectangular</p> <p>Req'd Surface Area: 60.3 m<sup>2</sup>, 0.993 ha</p> <p>where, T = 15 sec</p> <p>Dimension: L = 115.0 m, W = 25.0 m, D = 1.5 m</p> <p>Number: 4 units</p> <p>Surface Area: 11,500 m<sup>2</sup></p> <p>Volume: 17,250 m<sup>3</sup></p> <p>Retention Time: 7.5 days</p>	<p>5) Partial Mixing Aerated Lagoon</p> <p>Type: Rectangular</p> <p>Dimension: L = 13.0 m, W = 30.0 m, D = 4.0 m</p> <p>Number: 2 units</p> <p>Surface Area: 300 m<sup>2</sup></p> <p>Volume: 1,200 m<sup>3</sup></p> <p>Retention Time: 3.00 days</p> <p>Aerator Power: 6.0 kW</p> <p>- Aeration</p>	<p>5) Trickling Filter</p> <p>Type: Circular</p> <p>Primary: L = 13.0 m, D = 1.5 m</p> <p>Number: 2 units</p> <p>Surface Area: 338 m<sup>2</sup></p> <p>Volume: 507 m<sup>3</sup></p> <p>BOD Load: 1.16 kg/m<sup>3</sup>/day</p> <p>Secondary: L = 13 m, D = 1.5 m</p> <p>Number: 2 units</p> <p>Surface Area: 338 m<sup>2</sup></p> <p>Volume: 507 m<sup>3</sup></p> <p>BOD Load: 0.55 kg/m<sup>3</sup>/day</p>	<p>5) Final Sedimentation Tank</p> <p>Type: Circular Tank</p> <p>Dimension: L = 16.0 m dia, D = 16.0 m</p> <p>Number: 3 units</p> <p>Surface Area: 768 m<sup>2</sup></p> <p>Volume: 69 m<sup>3</sup>/m<sup>2</sup>/day</p> <p>Retention Time: 6.9 hours</p>	
	<p>4) Maturation Pond</p> <p>Type: Rectangular</p> <p>Retention Time: 5 days</p> <p>Dimension: L = 26.0 m, W = 25.0 m, D = 1.5 m</p> <p>Number: 3 units</p> <p>Surface Area: 7,800 m<sup>2</sup></p> <p>Volume: 11,700 m<sup>3</sup></p> <p>Retention Time: 5.1 days</p>	<p>5) Disinfection Tank</p> <p>Type: Rectangular</p> <p>Dimension: L = 30.0 m, W = 1.0 m, D = 1.0 m</p> <p>Number: 1 unit</p> <p>Surface Area: 30 m<sup>2</sup></p> <p>Volume: 30 m<sup>3</sup></p> <p>Retention Time: 15.7 min.</p>	<p>5) Final Sedimentation Tank</p> <p>Type: Circular Tank</p> <p>Dimension: L = 10.0 m dia, D = 3.0 m</p> <p>Number: 2 units</p> <p>Surface Area: 200 m<sup>2</sup></p> <p>Volume: 17.6 m<sup>3</sup>/m<sup>2</sup>/day</p> <p>Retention Time: 4.1 hours</p>		
			<p>5) Disinfection Tank</p> <p>Type: Rectangular</p> <p>Dimension: L = 30.0 m, W = 1.0 m, D = 1.0 m</p> <p>Number: 1 unit</p> <p>Surface Area: 30 m<sup>2</sup></p> <p>Volume: 30 m<sup>3</sup></p> <p>Retention Time: 15.7 min.</p>	<p>5) Disinfection Tank</p> <p>Type: Rectangular</p> <p>Dimension: L = 1.0 m, W = 0.3 m, D = 30.0 m</p> <p>Number: 1 unit</p> <p>Surface Area: 0 m<sup>2</sup></p> <p>Volume: 10 m<sup>3</sup></p> <p>Retention Time: 15.7 min.</p>	
3 Outline of Major Facilities			<p>6) Sludge Thickening Tank</p> <p>Type: Circular Tank</p> <p>Dimension: L = 3.0 m dia, D = 4.0 m</p> <p>Number: 1 unit</p> <p>Surface Area: 9 m<sup>2</sup></p> <p>Solid Matter Load: 65.1 kg/m<sup>2</sup>/day</p> <p>Volume: 28 m<sup>3</sup></p>	<p>6) Sludge Thickening Tank</p> <p>Type: Circular Tank</p> <p>Dimension: L = 3.0 m dia, D = 4.0 m</p> <p>Number: 1 unit</p> <p>Surface Area: 9 m<sup>2</sup></p> <p>Solid Matter Load: 65.1 kg/m<sup>2</sup>/day</p> <p>Volume: 28 m<sup>3</sup></p>	
			<p>7) Sludge Drying Bed</p> <p>Type: Drying Bed</p> <p>Thick'd Sludge Dimension: L = 9.2 m, W = 26.0 m, D = 6.0 m</p> <p>Number: 6 units</p> <p>Surface Area: 996 m<sup>2</sup></p> <p>Volume: 281 m<sup>3</sup></p> <p>Retention Time: 30.5 days</p>	<p>7) Sludge Drying Bed</p> <p>Type: Drying Bed</p> <p>Thick'd Sludge Dimension: L = 9.2 m, W = 26.0 m, D = 6.0 m</p> <p>Number: 6 units</p> <p>Surface Area: 996 m<sup>2</sup></p> <p>Volume: 281 m<sup>3</sup></p> <p>Retention Time: 30.5 days</p>	

Treatment Method	Stabilization Pond	Aerated Lagoon (Dual Power)	Trickling Filter	Oxidation Ditch
4 Area Requirement	Grit Chamber Anaerobic Pond Facultative Pond Maturation Pond Total Approx. 4.4 ha	Grit Chamber Complete Mixing Lagoon Partial Mixing Lagoon Disinfection Tank Total Approx. 0.8 ha	Grit Chamber Trickling Filter Sedimentation Tank Disinfection Tank Sludge Thickening Tank Sludge Drying Bed Total Approx. 0.4 ha	Grit Chamber Oxidation Ditch Sedimentation Tank Disinfection Tank Sludge Thickening Tank Sludge Drying Bed Total Approx. 0.4 ha
5 Power Consumption excluding: - office - lighting	Approx. 0 kW	Aerator Complete Mixing Partial Mixing Disinfection Total Approx. 35 kW	Recirculation Pump Trickling Filter Sludge Collector Primary Sedimentation Tank Secondary Sedimentation Tank Sludge Thickener Sludge Pump Surplus Disinfection Total Approx. 39 kW	Aerator Oxidation Ditch Sludge Collector Sedimentation Tank Sludge Thickener Sludge Pump Return Surplus Disinfection Total Approx. 53 kW

## **Appendix 12.2    Sewer Network Hydraulic Analysis    (Master Plan)**

### **Appendix 12.2.1    Alternative 1 (Applied)**

# Sewage Flow Calculation Table (Nuwara Eliya)

P 1

※Unit Sewage Flow : 0.187m<sup>3</sup>/capita-day

Pipe No.	Down stream	Service Area		Length		T	Storm Run-off				Sewage Flow				Other Flow		Design Sewer				Remarks																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		Sec.	Accum.	ha	m		min	Rainfall per ha	C	Service Area		R.O.	Pop/D	Population		Flow	Sec.	Accum.	Accum.	Dia.		Slope %	V	Flow	G.L.	Level	D																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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# Sewage Flow Calculation Table (Nuwara Eliya)

P 2

※Unit Sewage Flow : 0.187m<sup>3</sup>/capita-day

Pipe No.	Down stream	Service Area		Length		T	Storm Run-off					Sewage Flow			Other Flow		Accum.	Design Sewer					Remarks																			
		Sec.	Accum.	ha	ha		C	Rainfall per ha	Pop/D	Service Area		R.O.	Population		Flow	Sec.		Accum.	Dia.	Slope	V	Flow		G.L.	Level	D																
										ha	ha		P	P													m <sup>3</sup> /s	m <sup>3</sup> /s	m <sup>3</sup> /s	%	m/s	m <sup>3</sup> /s	m	m								
																																			Sec.	Accum.	P	P	m <sup>3</sup> /s	m <sup>3</sup> /s	m	m
10		35	35	440	440									000074	000074	00007	150	200	0385	00068	187393	187595	116																			
11		03	77	50	490									000006	000163	00016	150	2010	1222	00216	187876	1877589	200																			
12	29		513	470	1350							148	00003			001668	00170	300	350	0809	00572	187787	1875764	275																		
13	15	67	67	400	400							261	00006				00006	150	4050	1734	00306	187405	1872879	100																		
14		111	111	500	500							433	00009				00009	150	4030	1730	00306	187405	1872879	100																		
15	19	143	321	500	1000							558	00027				00027	150	200	0385	00068	186575	1863379	220																		
16	18	84	84	90	90							328	00007				000093	150	2060	1237	00219	186714	1865969	100																		
17		72	72	150	150							258	00006				000533	150	6500	2197	00388	186714	1865039	193																		
18		25	181	150	300							98	00015				000525	225	500	0799	00318	186575	1864214	129																		
19	21	110	612	375	1375							400	00051				000133	225	500	0799	00318	186575	1863304	220																		

# Sewage Flow Calculation Table (Nuwara Eliya)

P 3

\*Unit Sewage Flow : 0.187m<sup>3</sup>/capita-day

Pipe No.	Down stream	Service Area		Length		T	Storm Run-off					Sewage Flow			Other Flow		Design Sewer					Remarks																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
		Sec.	Accum.	ha	ha		m	min	Rainfall per ha	C	Service Area		R.O.	Pop/D	Population		Flow	Sec.	Accum.	Accum.	Dia.		Slope	V	Flow	G.L.	Level	D																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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※Unit Sewage Flow : 0.187m<sup>3</sup>/capita·day

[illegible]

## **Appendix 12.2.2      Alternative 2**



# Sewage Flow Calculation Table (Nuwara Eliya)

P 1

※Unit Sewage Flow : 0.187m<sup>3</sup>/capita·day

Pipe No	Down stream	Service Area		Length		T	Storm Run-off				Sewage Flow				Other Flow		Design Sewer						Remarks																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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# Sewage Flow Calculation Table (Nuwara Eliya)

P 2

※Unit Sewage Flow : 0.187m<sup>3</sup>/capita-day

Pipe No.	Down stream	Service Area		Length		T	Storm Run-off					Sewage Flow			Other Flow		Design Sewer					Remarks																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
		Sec.	Accum.	ha	m		m	C	Rainfall		R.O.	Pop/D	Population		Flow	Sec.	Accum.	Accum.	Dia.	Slope	V		Flow	G.L.	Level	D																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
									mm/s	per ha			ha	ha													P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

# Sewage Flow Calculation Table (Nuwara Eliya)

P 3

※Unit Sewage Flow : 0.187m<sup>3</sup>/capita·day

Pipe No.	Down stream	Service Area		Length		T	Storm Run-off						Sewage Flow			Other Flow		Design Sewer						Remarks																		
		Sec.	Accum.	ha	m		m	Rainfall per ha	C	Service Area		R.O.	Pop/D	Population		Flow	Sec.	Accum.	Accum.	Dia.	Slope	V	Flow		G.L.	Level	D															
										Sec.	Accum.			P	P													P	P	P	P	m3/s	m3/s	m3/s	m3/s	mm	%	m/s	m3/s	M	M	m
20		186	186	150	150									205	205	00004			00004	150	840	0790	00140	186300	1861824	101																
21	STP2	120	918	120	1495									321	2862	00062			000769	225	500	0799	00318	186173	1860482	100	100mManu Oya															
22		181	181	350	350									476	476	00010			00010	150	4900	1828	00323	186173	1860559	100																
24	26	87	87	400	400									272	272	00006			00006	150	1340	0998	00176	186229	1861119	100	300mG.L															
25		92	52	750	750									289	289	00006			000038	150	200	0385	00068	186229	1861119	100																
26	29	184	363	620	1370									340	901	00020			000038	150	200	0385	00068	187787	1870733	397	600mManu Oya															
27	29	256	256	650	650									666	666	00014			001002	225	500	0799	00318	187787	1876202	142	550mG.L															
28		239	239	620	620									621	621	00013			00013	150	200	0385	00068	187787	1876528	217	500mG.L															
29			1371	620	1990										2336	00051			002706	200	001	0033	00010	187787	1876100	156	Pumping Station															
30	36	207	1578	380	2370									538	2874	00062			002706	400	240	0812	01020	186170	1860055	120																

×Unit Sewage Flow : 0.187m<sup>3</sup>/capita-day

[illegible]

## Appendix 12.3 Pumping Station - Capacity Calculation

### 1. Pumping Facility

Alternative		Alternative 1		Alternative 2	
Area		Nuwara Eliya		Nuwara Eliya	
Pump Station		P/S 1	P/S 2	P/S 1	P/S 2
P/S Flow	m3/sec	0.01480	0.04700	0.01480	0.03210
	m3/min	0.888	2.820	0.888	1.926
P/S Type		Circular	Circular	Circular	Circular
Number (+1)-standby		1 (+ 1)	1 (+ 1)	1 (+ 1)	1 (+ 1)
Capacity	m3/min	0.89	2.82	0.89	1.93
Head	m	39	23	10	19
h1 =	m	29.40	13.50	8.00	13.50
h2 =	m	7.78	7.19	0.28	3.55
D =		150	200	150	200
L =		1,400	620	50	620
V =		0.838	1.496	0.838	1.022
h3 =	m	1.50	1.50	1.50	1.50
Diameter	mm	87	155	87	128
Diameter	mm	100	150	100	125
Motor Output	kW	10.8	20.3	2.8	11.5
Motor Output	kW	11	22	3.7	15

### 2. Pump Pit (Circular)

Alternative		Alternative 1		Alternative 2	
Area		Nuwara Eliya		Nuwara Eliya	
Pump Station		P/S 1	P/S 2	P/S 1	P/S 2
P/S Flow	m3/sec	0.01480	0.04810	0.01480	0.03210
	m3/min	0.888	2.886	0.888	1.926
P/S Type		Circular	Circular	Circular	Circular
Number (+1)-standby		1 (+ 1)	1 (+ 1)	1 (+ 1)	1 (+ 1)
Capacity	m3/min	0.89	2.89	0.89	1.93
Pump Minimum Starting Period	min	8	15	8	15
Pump Pit Capacity	cu.m	1.78	10.84	1.78	7.24
	Therefore cu.m	2.00	11.60	2.00	8.00
Ground Level	m	0.00	0.00	0.00	0.00
Inlet Pipe Level	m	-4.00	-4.00	-4.00	-4.00
Effective Depth	m	1.00	1.00	1.00	1.00
Top	m	0.50	0.50	0.50	0.50
Bottom	m	0.50	0.50	0.50	0.50
Required Area	sq.m	2.00	11.00	2.00	8.00
Diameter	m	1.60	3.74	1.60	3.19
	Therefore m	2.00	3.80	2.00	3.20
Dimension (DIA)	m	2.00	3.80	2.00	3.20
	(D) m	6.00	6.00	6.00	6.00
Retention Time	min	3.54	3.93	3.54	4.18

## **Appendix 12.4**

## **Sewage Treatment Plant – Capacity Calculation**

**Appendix 12.4.1      Alternative 1 – Nuwara Eliya (Aerated Lagoon)**

**Appendix 12.4.2      Alternative 2 – Nuwara Eliya (Aerated Lagoon)**

**Appendix 12.4.3      Alternative 2 – Hospital/Brewery (Aerated Lagoon)**



## Appendix 12.4.1 Sewage Treatment Plant - Capacity Calculation

### CAPACITY CALCULATION OF FACILITIES

#### Alternative 1 - Nuwara Eliya (Aerated Lagoon)

## 1 BASIC CONDITIONS

### 1-1 BASIC ITEMS

- (1) Name : Nuwara Eliya Sewage Treatment Plant
- (2) Land Area : Approximately 2.20 ha
- (3) Elevation : 1855.000 m
- (4) Inlet Pipe Level : 1854.850 m
- (5) Pipe Diameter : 400 m
- (6) Land Use : Tea Plantation
- (7) Collection System : Seperate Type
- (8) Treatment Method : Sewage Treatment : Aerated Lagoon Method  
Sludge Treatment : Pond Accumulation
- (9) Effluent Point : Nanu Oya
- (10) Effluent Point Water Level : 1852.000 m
- (11) Target Year : Year 2000 (Phase 1)
- (12) Lowest Monthly Average Temperature : 15 °C (January)

### 1-2 Design Population

Design Population : 8,680 Persons (Total)

### 1-3 Design Sewage Flow

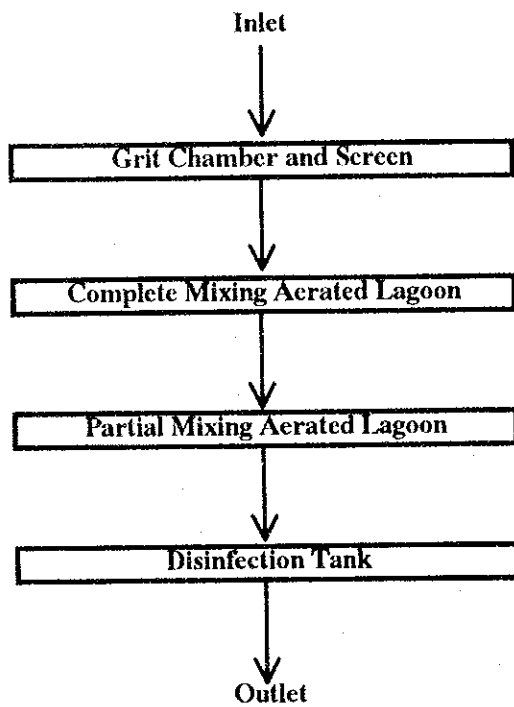
ITEM	m3/day	m3/hr	m3/min	m3/sec
Daily Average	2,340	97.5	1.63	0.027
Daily Maximum	2,700	112.5	1.88	0.031
Hourly Maximum	4,500	187.5	3.13	0.052

### 1-4 Design Sewage Quality

ITEM	INFLUENT (mg/L)	EFFLUENT (mg/L)	REMOVAL RATIO (%)	REMARKS
BOD	240	30	88	
SS	250	50	80	



**1-5 Flow Chart (Dual Power Aerated Lagoon)**



### 1-6 Design Criteria for Dual Power Aerated Lagoon

ITEMS	UNIT	Formula or Value	Application
1-6-1 Grit Chamber			
(1) Water Surface Load	m <sup>3</sup> /m <sup>2</sup> /day	> 1800	1,800
(2) Average Velocity	m/sec	> 0.3	0.3
1-6-2 Complete Mixing Aerated Lagoon			
(1) Retention Time	day	1.5 - 2.5	1.50
(2) Water Depth	m	3.0 - 4.0	3.0
(3) Power Requirement for Mixing	W/m <sup>3</sup>	> 6.0	6.0
1-6-3 Partial Mixing Aerated Lagoon			
(1) Retention Time	day	2.0	2.0
(2) Water Depth	m	2.0 - 4.0	3.0
(3) Power Requirement for Mixing	W/m <sup>3</sup>	> 1.0	1.0
(4) Number of Cell	Cell/Basin	1 - 3	3
1-6-4 Storm Water Settling Tank			
(1) Water Depth	m	1.5 - 3.0	1.5
(2) Retention Time (Hourly Max. - Rain)	hour	> 0.5	0.5
(3) Water Surface Load (Hourly Max. - Rain)	m <sup>3</sup> /m <sup>2</sup> /day	75 - 150	150.0
1-6-5 Disinfection Tank			
(1) Retention Time	min.	> 15	15.0
(2) Dosage	mg/l	2.0 - 4.0	3.0

## 2 CAPACITY CALCULATION

### 2-1 Grit Chamber and Screen (Hourly Maximum)

ITEM	SIGN	UNIT	CALCULATION	RESULT
Type	-	-	Parallel Flow Type	
Design Flow	Q1	m3/day	-	4,500
	Q2	m3/sec	-	0.052
Water Surface Load	WSL	m3/m2/day	-	1,800
Required Surface Area	RSA	m2	Q1/WSL	2.500
Basin Number (Total)	BN	basin	-	3
Basin Number (Stand-By)	BNS	basin	-	1
Average Velocity	V	m/sec	-	0.30
Depth	H	m	-	0.30
Width	W1	m	Q2/(V*H)	0.579
	Therefore W2	m	-	0.50
Length	L1	m	RSA/W2/(BN-BNS)	2.500
	Therefore L2	m	-	2.70
Dimension	(W)	W	W2	0.50
	(L)	L	L2	2.70
	(Basin)	-	basin	BN
	(Stand-By)	-	stand-by	BNS
Screen Type	-	-	Fine Bar Screen	
Screen Set Number	SSN	set	BN	3
Check		UNIT	APPLICATION	RESULT
Water Surface Load		m3/m2/day	> 1800	1,667
Average Velocity		m/sec	> 0.3	0.17

## 2-2 Complete Mixing Aerated Lagoon (Daily Maximum)

ITEM	SIGN	UNIT	CALCULATION	RESULT
Type	-	-	Rectangular Type	
Design Flow	Q1	m3/day	-	2,700
	Q2	m3/hr	-	112.50
Retention Time	T1	day	-	1.50
Inlet BOD Quality	So	mg/L	-	240
Required Volume	V1	m3/basin	$Q1 \cdot T$	4,050
Basin Number	BN	basin	-	4
Required Volume per Basin	VBN	m3/basin	$Q1 \cdot T / BN$	1,013
Water Depth	H	m	-	3.00
Required Surface Area	A	m2	$V/H$	338
Width	W	m	-	14.00
Length	L1	m	$A/W$	24.107
	L2	m	-	25.00
Oxygen Demand Rate	PR1	kg/h	$(4.16 \cdot 10^{-5}) \cdot r \cdot Q1 \cdot So$	40
-max. oxygen uptake	r	W/m3	-	1.5
Aeration Unit Power Rate	PRO	kg/h	$1000 \cdot PR1 / (N \cdot Q1 \cdot T1)$	5.25
Therefore	PRO	W/m3	-	5.3
-aeration performance	N	W/m3	-	1.9
Power Requirement	P1	kW	-	13.0
1) Oxygen Requirement	P1O	kW	$PR1/N$	21.3
2) Mixing Power	P1M	kW	$V1 \cdot P0 \cdot 10^{-3}$	24.3
Dimension	(Width)	W	W	14.00
	(Length)	L	L2	25.00
	(Depth)	H	H	3.00
	(Basin)	-	BN	4
Aerator Type	-	-	Slanting Shaft Screw Aerator	
Check		UNIT	APPLICATION	RESULT
Retention Time		day	1.5 - 2.5	1.56

### 2-3 Partial Mixing Aerated Lagoon (Daily Maximum)

ITEM	SIGN	UNIT	CALCULATION	RESULT
Type	-	-	Rectangular Type	
Design Flow	Q1	m3/day	-	2,700
	Q2	m3/hr	-	112.50
Retention Time	T2	day	-	2.00
Required Volume	V2	m3/basin	$Q2 \cdot T$	5,400
Basin Number	BN	basin	-	4
Cells Number	CN	cell/basin	-	3
Stand-by Cell Number	CNS	basin	-	2
Sludge Accumulation	SA	m3/year	$365 \cdot Q1 \cdot Xi / (x \cdot 10^6)$	1,355
-inert solid concentration	Xi	mg/l	-	55
-weight fraction of solids	x	-	-	0.04
No. of Cells Cleaned per Year	CNC	basin	-	2
Total Sludge Accumulation	TSA	m3	-	2,033
Required Volume	V	m3/cell	$(Q1 \cdot T + TSA) / (BN \cdot CN - CNS)$	743
Water Depth	D	m	-	4.00
Required Surface Area	A	m2/cell	$V/H$	186
Width	W	m	-	12.00
Length	L1	m	$A/W$	15.485
Therefore	L1	m	-	16.00
Power Requirement	P2	kW	-	3.0
1) Mixing Power	P2M	kW	$Q1 \cdot T2 \cdot CN \cdot 10^{-3}$	5.4
Dimension (Width)	W	m	W	12.00
(Length)	L	m	L1	16.00
(Depth)	H	m	H	4.00
(Basin)	-	basin	BN	4
(Cell)	-	cell/basin	CN	3
(Stand-by Cell)	-	cell	-	2
Aerator Type	-	-	Slanting Shaft Screw Aerator	
Check		UNIT	APPLICATION	RESULT
Surface Area		m2	-	2,304
Retention Time		day	2.0	2.09

## 2-6 Disinfection Tank (Daily Maximum)

ITEM	SIGN	UNIT	CALCULATION	RESULT
Chemical Type	-	-	Chlorination Type	
Design Flow	Q1	m3/day	-	2,700
	Q2	m3/min	-	1.88
Retention Time	T	min.	-	15.0
Basin Number	BN	basin	-	1
Required Volume	V	m3	$Q2 \cdot T$	28
Width	W	m	-	1.00
Water Depth	H	m	-	1.00
Length therefore	L1	m	$V/(W \cdot H)$	28.125
	L2	m	-	30.00
Dosage	D	mg/L	-	3.0
Required Chemical Therefore	RC1	kg/day	$Q1 \cdot D \cdot 10^{-3} / C$	8.10
	RC2	kg/hr	$RC1 / 24$	0.34
Dimension (Width) (Length) (Depth) (Depth)	W	m	W	1.00
	L	m	L2	30.00
	H	m	H	1.00
	BN	basin	-	1
Chlorine Feeder	-	unit	including 1 for stand-by	2
Check		UNIT	APPLICATION	RESULT
Retention Time		min.	> 15	16.0