4.1-7 Thickness of Sand Layer of Filters in Mohara WTP

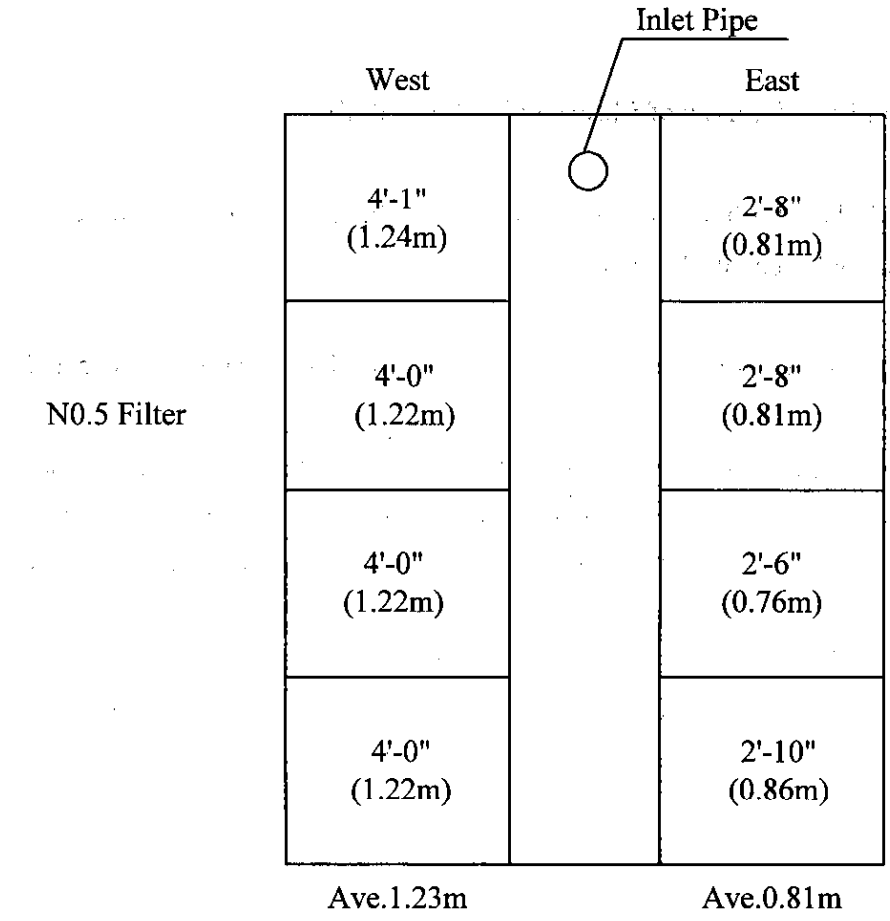
Existing Mohara WTP does not have any reserve of filter media, and washing, verification of grain size distribution, and supplement of filter media.

Figure 4.1-7-1 presents the results of measurements of sand layer thickness at filters No. 5 and 8.

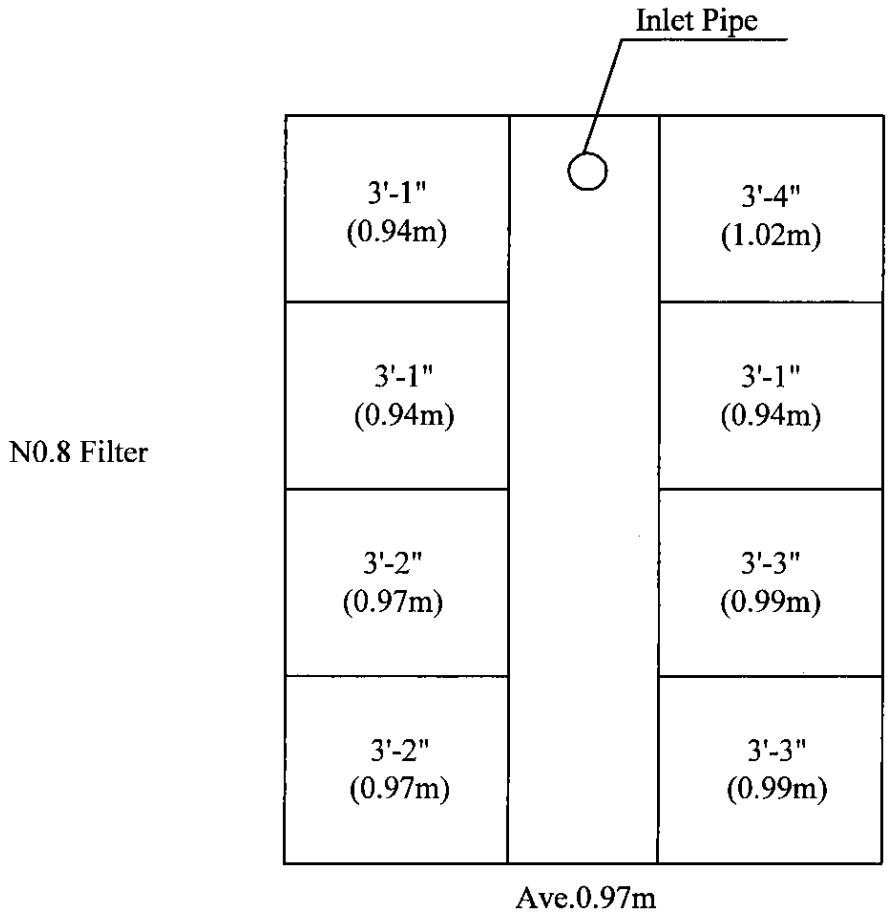
At the filter No.5, since backwashing is supposed to be biased to eastern side filter, thickness of western side filter is almost equal to design thickness at 4 feet or 1.22 m, while eastern side filter shows a range from 2' 6" to 2' 10", 2' 8" or 0.81 m in average, which is equivalent to 41 cm decrease of filter layer thickness.

At filter No. 8, there is no difference between two filter units, and their thickness is 3' 1" to 3' 4", 3' 2" in average, and 25 cm decrease of thickness.

This decrease is enough to make surface washing ineffective. In the proposed project, purchase of reserve filter media and sand washing machine are planned for regular maintenance work of filter media.



N0.5 Filter



N0.8 Filter

Figure 4.1-7-1 Filter Media Depth of Existing Rapid Sand Filter

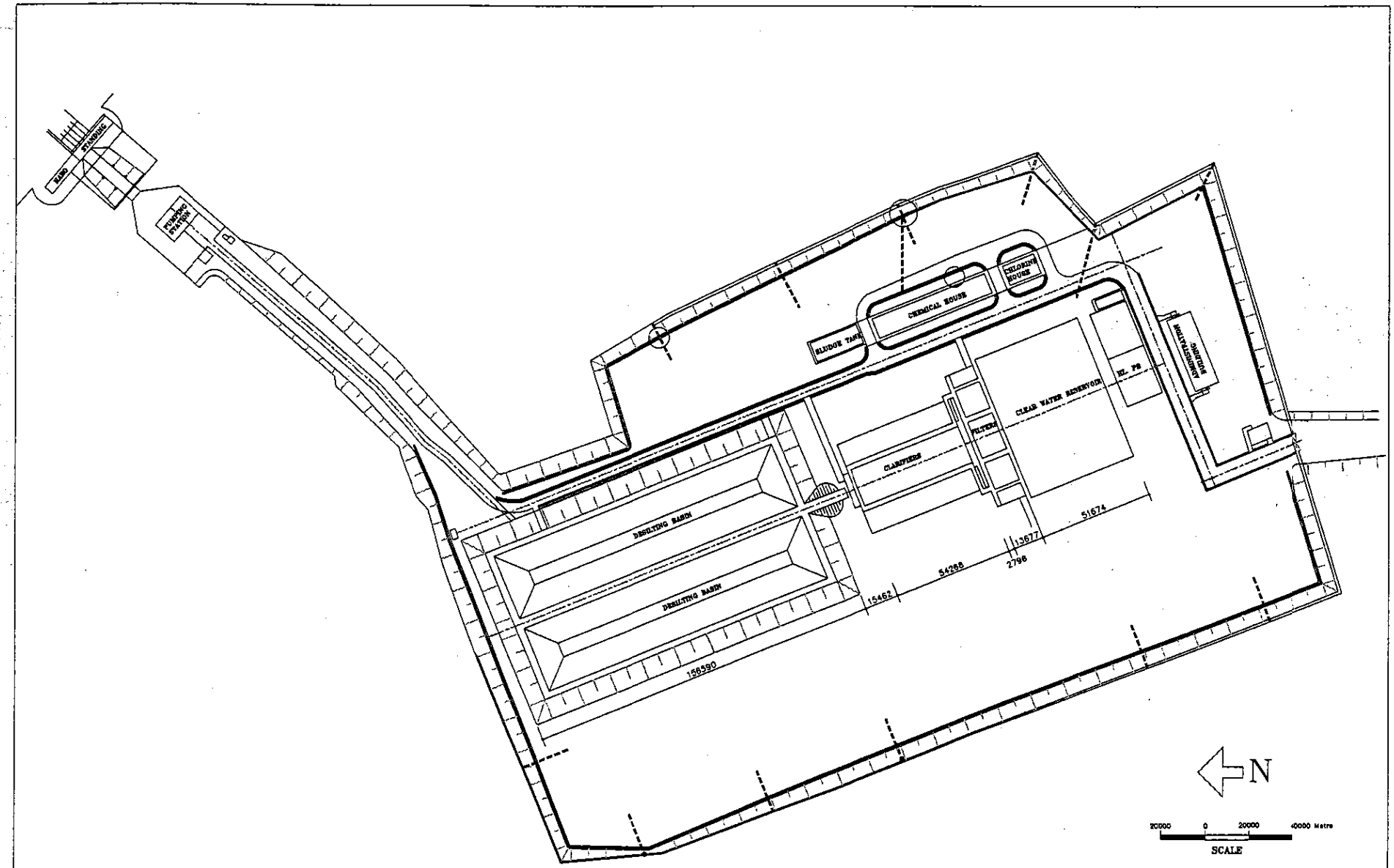
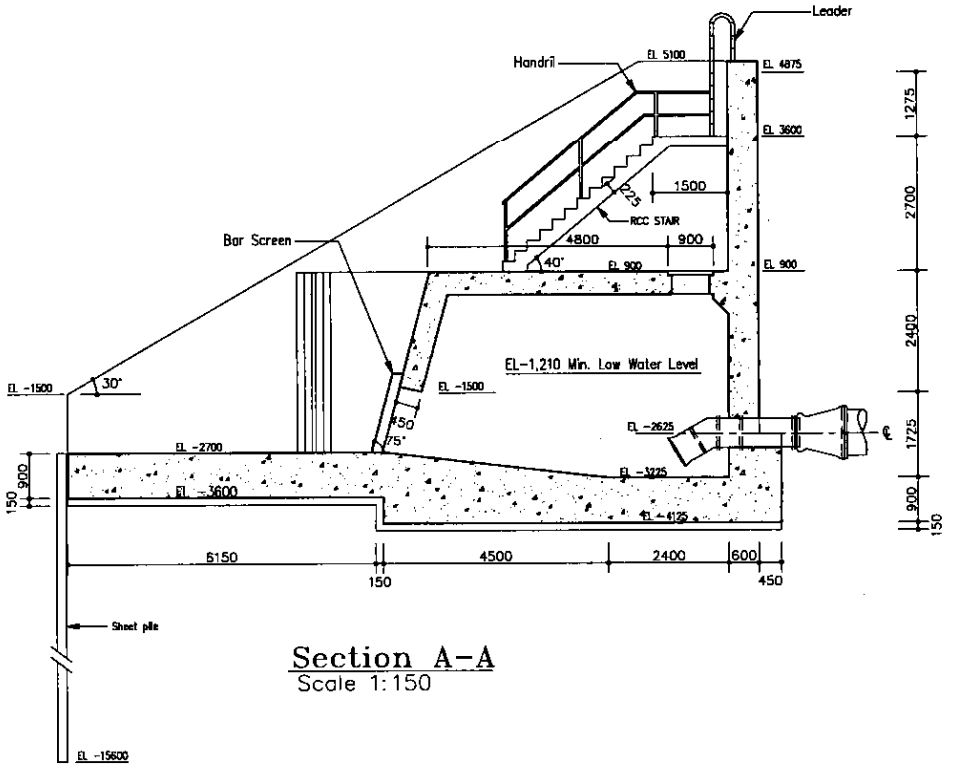
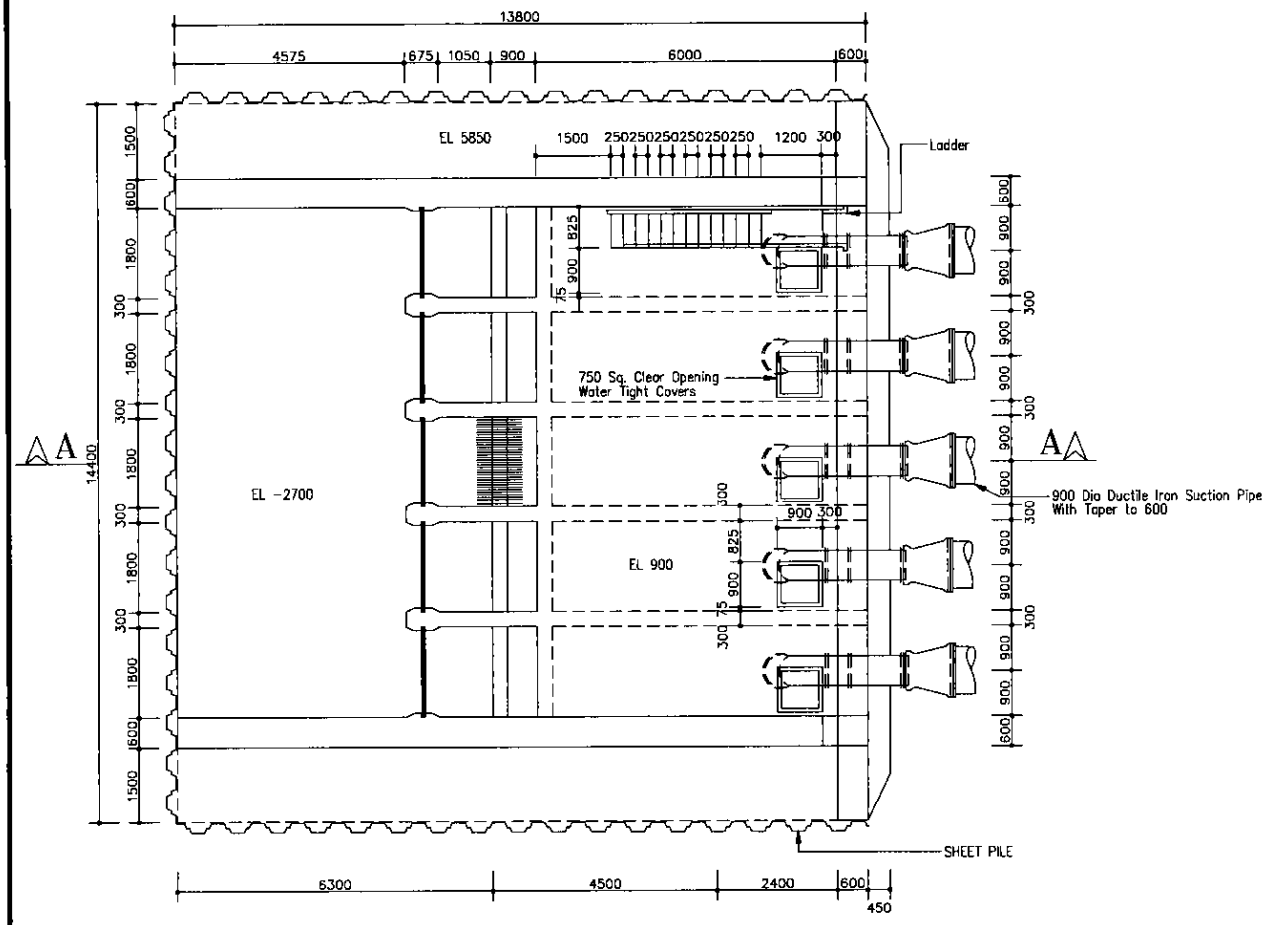


FIGURE 4.1-8-1 LAYOUT PLAN OF EXISTING FACILITIES

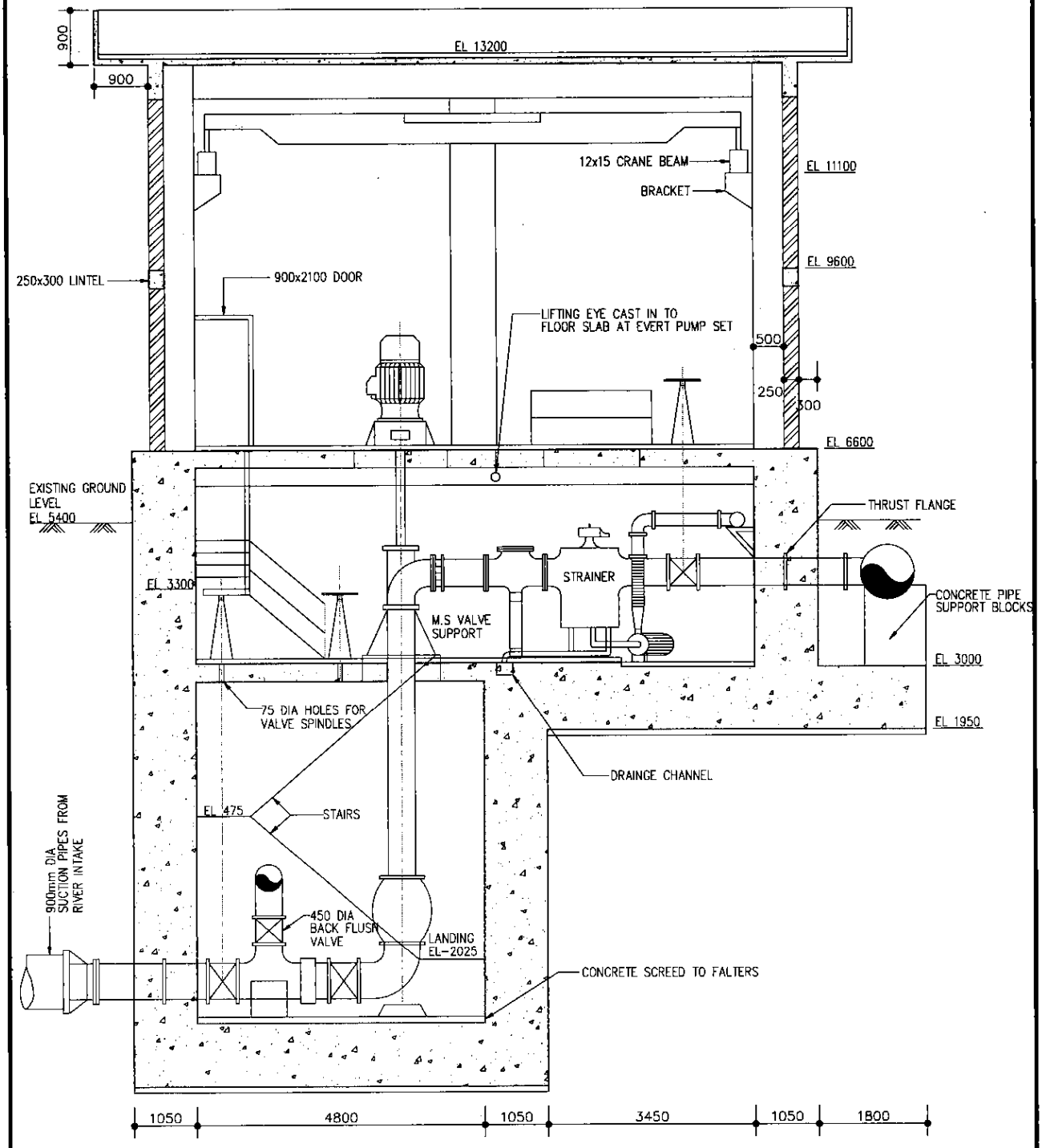


Section A-A
Scale 1:150



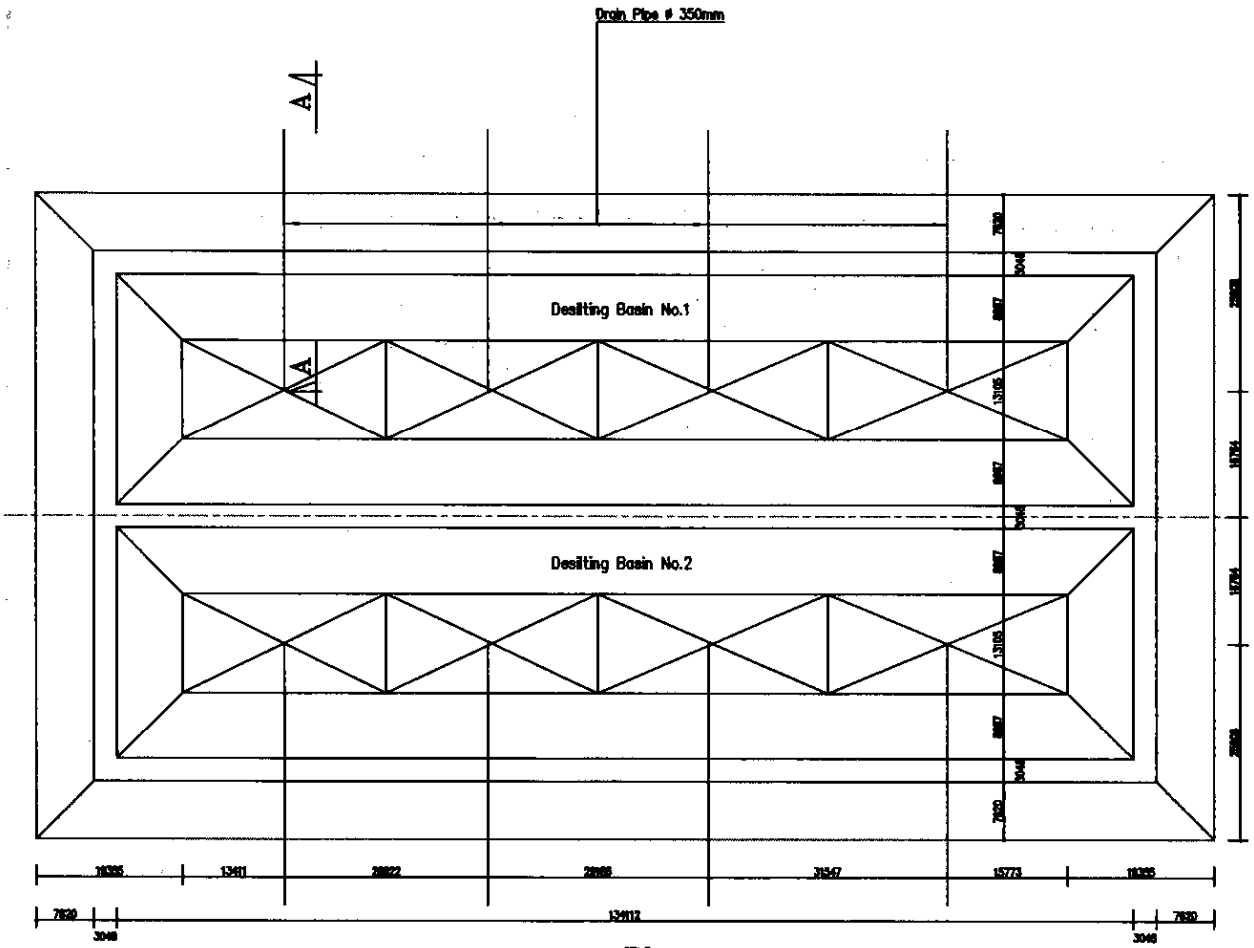
Plan
Scale 1:150

FIGURE 4.1-8-2 EXISTING INTAKE STRUCTURE

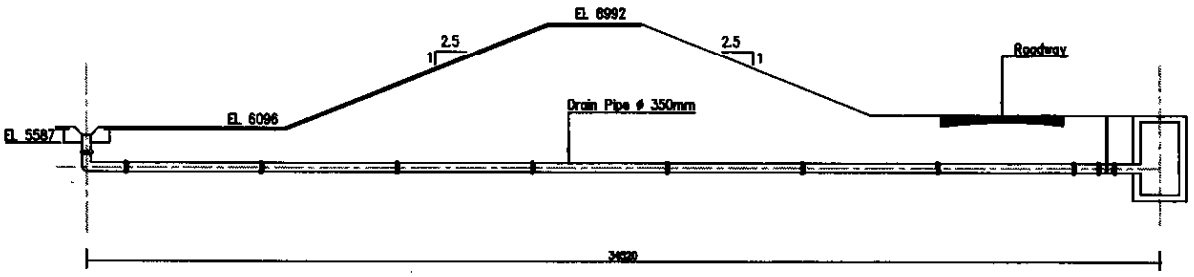


INTAKE PUMP
SCALE 1 : 100

Figure 4.1-8-3 EXISTING INTAKE PUMP

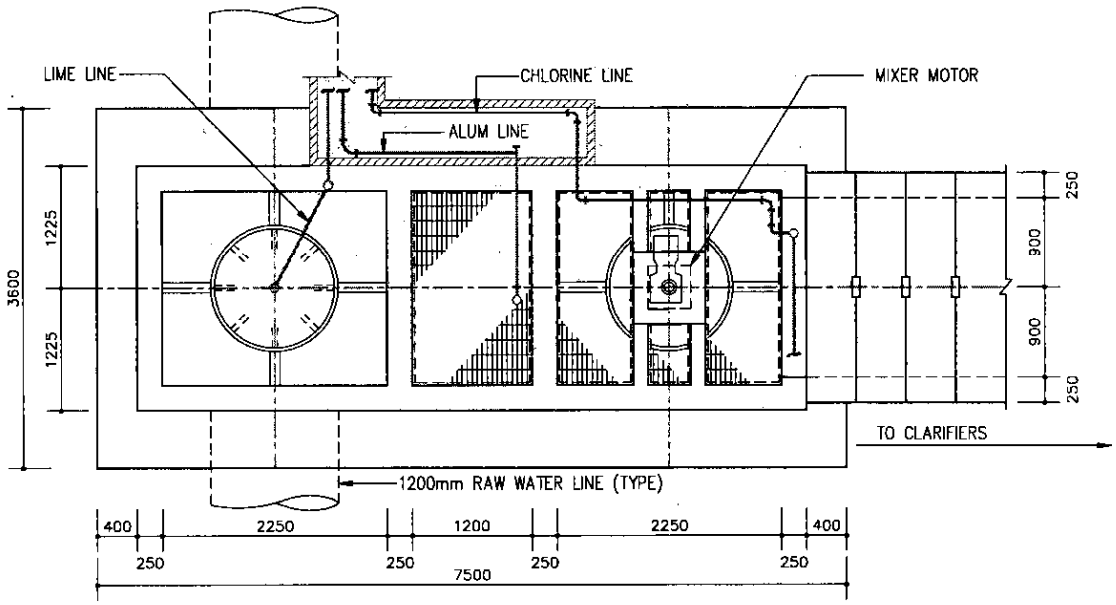


Plan
Scale 1 : 1000

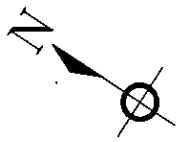


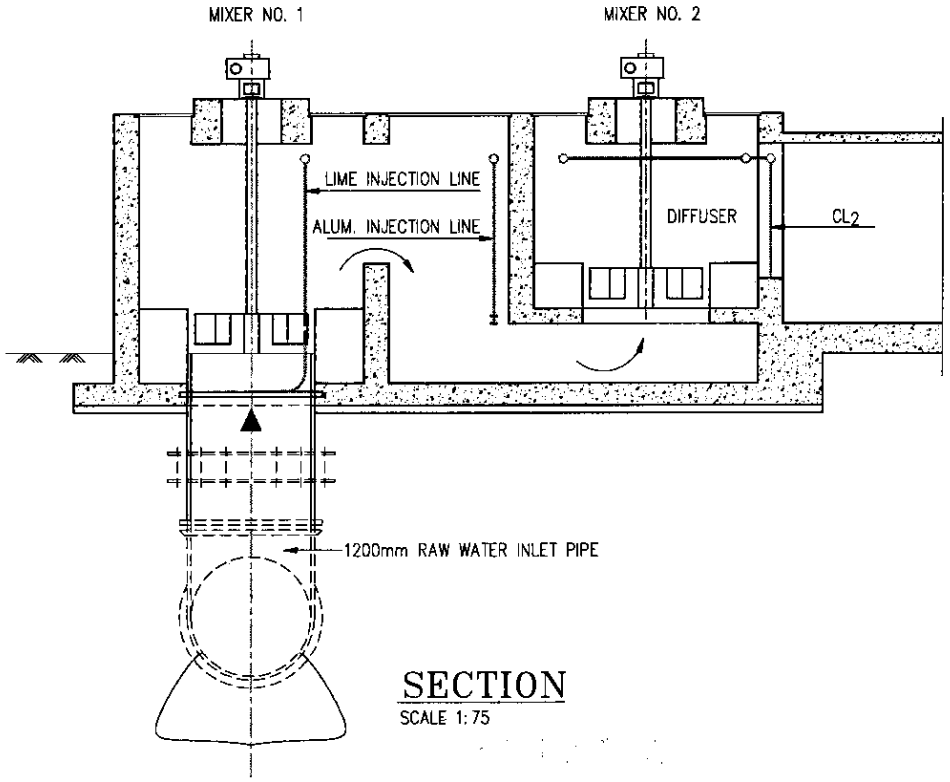
Section
Scale 1 : 250

FIGURE 4.1-8-4 EXISTING DESILTING BASIN



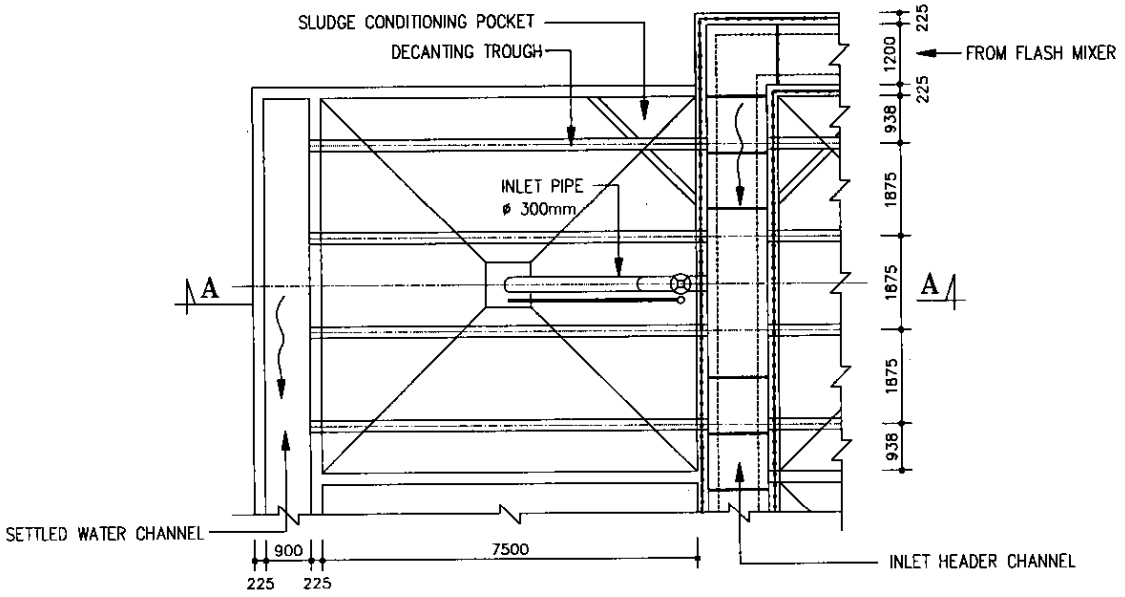
PLAN
SCALE 1:75



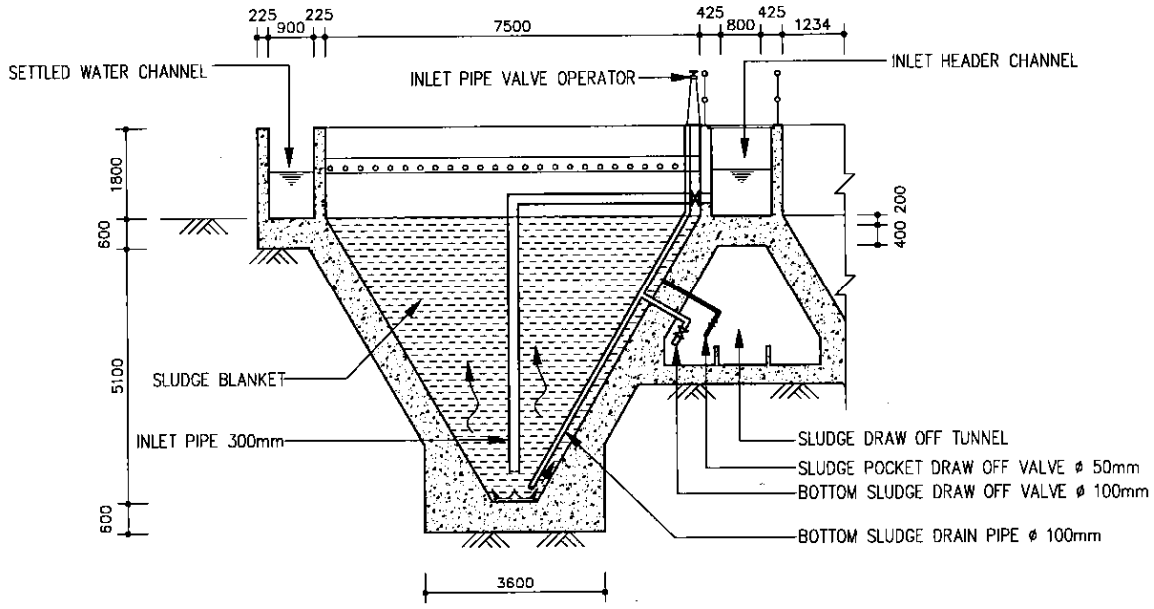


SECTION
SCALE 1:75

FIGURE 4.1-8-5 RAPID MIXING CHAMBER

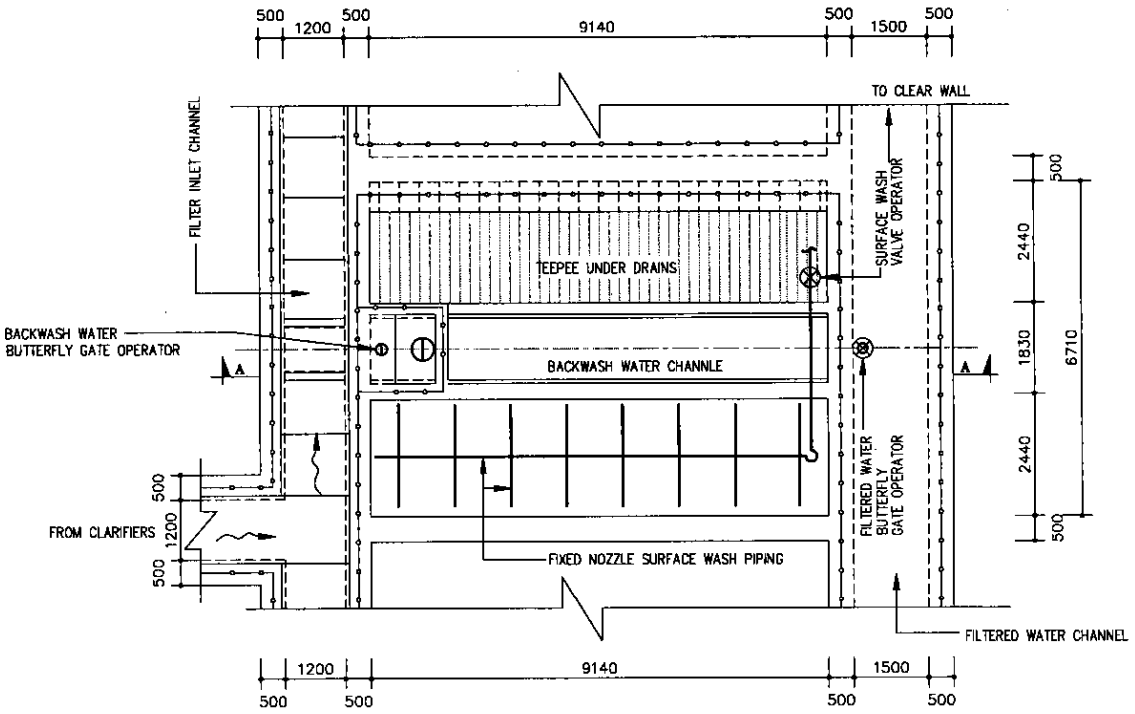


PLAN
SCALE 1:150

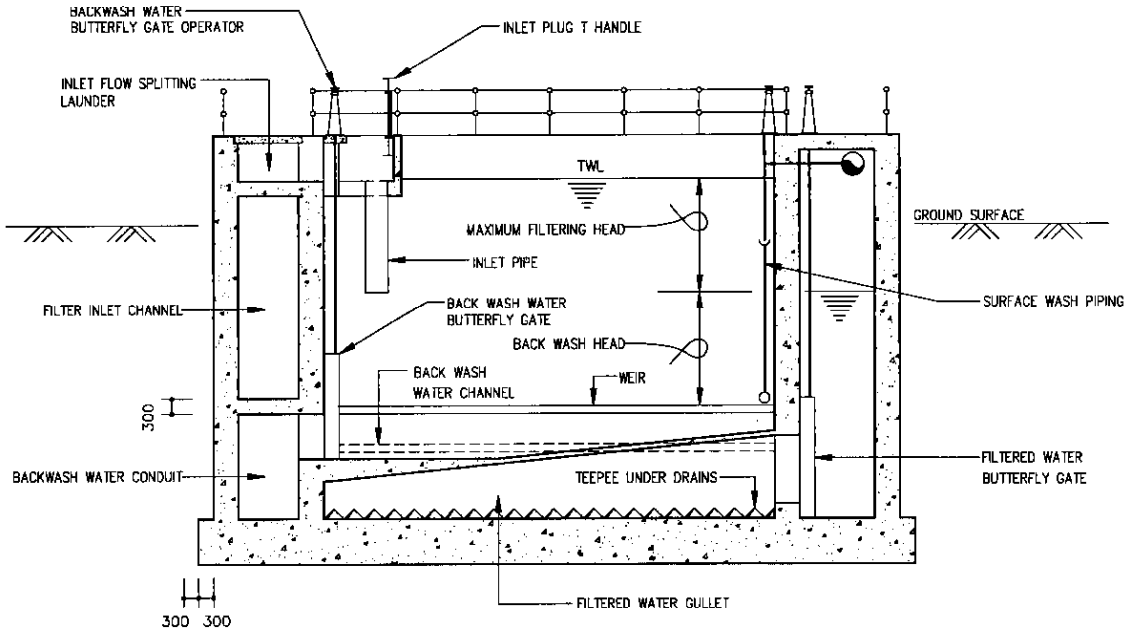


SECTION A–A
SCALE 1 : 150

FIGURE 4.1–8–6 EXISTING CLARIFIER

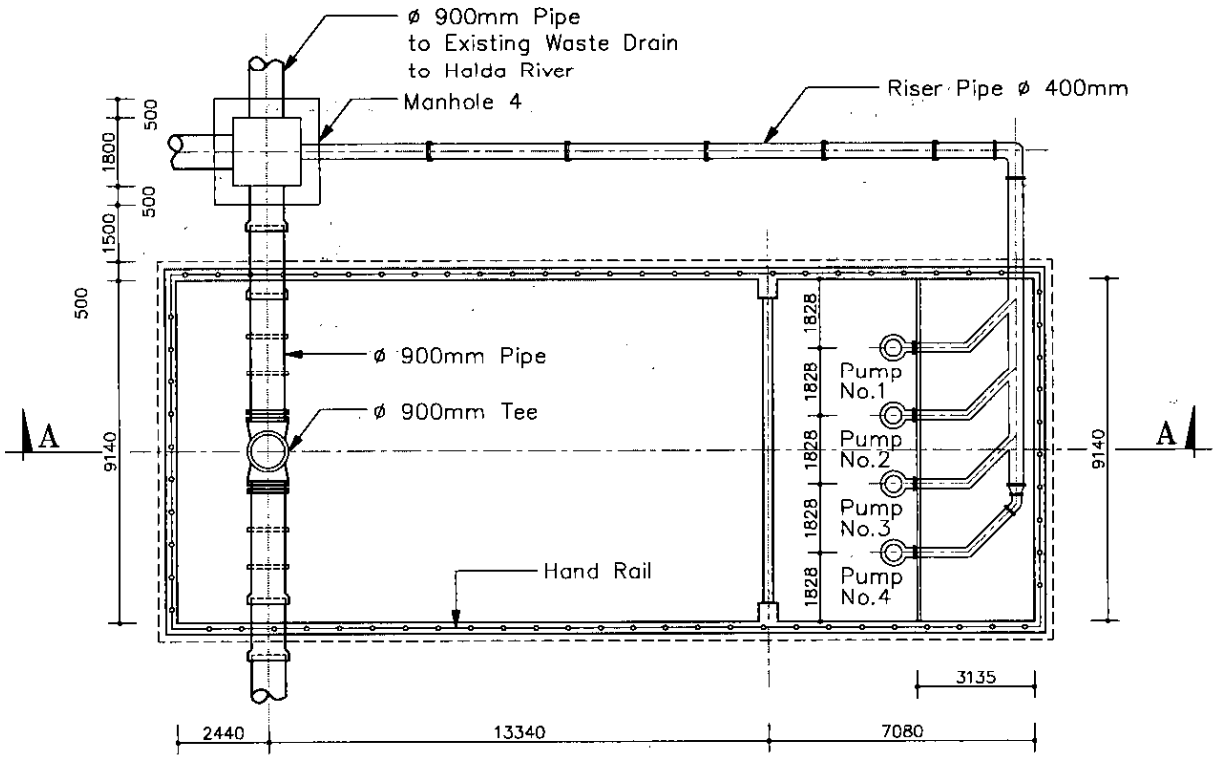


PLAN
SCALE 1:150

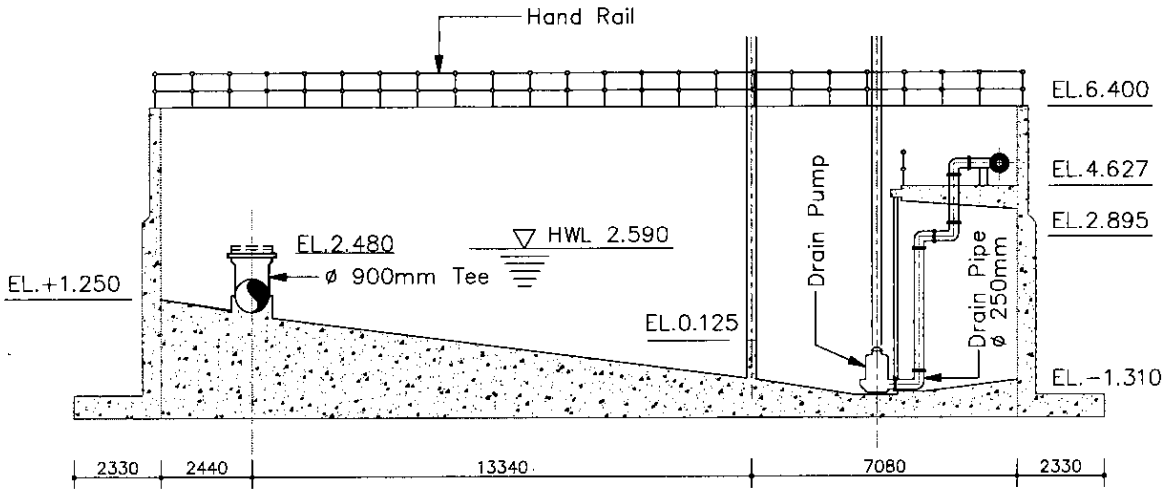


SECTION A-A
SCALE 1:150

FIGURE 4.1-8-7 EXISTING FILTER



Plan
Scale 1 : 200



Section A–A
Scale 1 : 200

FIGURE 4.1–8–8 EXISTING SLUDGE TANK

Table 4.1-9-1 Results of Jar Tests

	Raw Water		Jar Test Results -1				Jar Test Results -2				Jar Test Results -3				Jar Test Results -4				Jar Test Results -5				Jar Test Results -6				Applied (ppm)	
	pH	Turb.	Alum	Lime	pH	Turb.	Alum	Lime	pH	Turb.	Alum	Lime	pH	Turb.	Alum	Lime	pH	Turb.	Alum	Lime	pH	Turb.	Alum	Lime	pH	Turb.	Alum	Lime
1998/10/1	7.194	120	15	0	6.874	4.80	20	0	6.688	3.80	25	0	6.419	2.20	15	5	7.029	4.00	20	5	6.902	3.20	25	5	6.816	1.00	20	5
1998/10/4	7.166	120	15	0	6.811	5.00	20	0	6.580	3.80	25	0	6.402	1.60	15	5	6.978	4.20	20	5	6.889	3.00	25	5	6.828	0.98	20	5
1998/10/6	7.180	130	15	0	6.879	5.60	20	0	6.602	4.00	25	0	6.398	2.00	15	5	7.070	4.80	20	5	6.938	3.20	25	5	6.721	0.98	20	5
1998/10/16	7.029	100	15	0	6.912	5.00	20	0	6.842	4.20	25	0	6.701	3.40	15	5	7.012	4.20	20	5	6.901	3.40	25	5	6.882	2.00	20	5
1998/10/21	7.048	130	20	0	6.872	4.60	25	0	6.678	2.80	30	0	6.502	1.20	20	5	7.112	3.80	25	5	6.998	2.20	30	5	6.902	0.98	20	5
1998/10/22	7.214	120	20	0	7.046	4.40	25	0	6.902	3.20	30	0	6.698	2.00	20	5	7.228	3.60	25	5	7.016	3.00	30	5	6.922	1.80	20	5
1999/1/19	7.104	100	15	0	6.831	5.80	20	0	6.629	3.80	25	0	6.502	1.40	15	5	7.077	3.20	20	5	6.905	3.00	25	5	6.748	0.98	20	5
1999/1/21	7.190	80	15	0	6.938	5.60	20	0	6.780	3.40	25	0	6.572	1.00	15	5	7.098	3.00	20	5	6.982	2.80	25	5	6.749	0.90	20	5
1999/1/22	7.210	100	15	0	6.911	5.60	20	0	6.802	3.80	25	0	6.592	1.20	15	5	7.148	4.20	20	5	7.009	3.00	25	5	6.872	0.98	20	5
1999/1/24	7.239	110	15	0	6.982	5.80	20	0	6.770	4.00	25	0	6.580	1.40	15	5	7.118	4.20	20	5	7.018	3.20	25	5	6.832	1.00	20	5
1999/1/25	7.204	120	20	0	6.829	5.60	25	0	6.652	3.80	30	0	6.428	1.20	20	5	7.098	4.00	25	5	6.942	2.80	30	5	6.708	0.90	25	5
1999/1/26	7.280	130	20	0	6.905	6.00	25	0	6.818	4.20	30	0	6.662	1.60	20	5	7.108	4.40	25	5	7.019	3.00	30	5	6.839	0.98	25	5
1999/1/27	7.192	150	20	0	6.928	6.20	25	0	6.712	4.40	30	0	6.548	2.00	20	5	7.142	4.80	25	5	7.002	3.20	30	5	6.815	1.20	25	5
1999/2/24	7.273	80	15	0	7.002	5.00	20	0	6.873	3.60	25	0	6.608	1.20	15	5	7.140	4.20	20	5	7.017	3.00	25	5	6.910	0.98	20	5
1999/2/25	7.126	70	10	0	6.642	4.80	15	0	6.472	4.00	20	0	6.280	1.20	10	5	7.077	4.00	15	5	6.992	3.20	20	5	6.748	0.88	15	5
1999/2/26	7.302	50	10	0	7.029	4.40	15	0	6.902	3.60	20	0	6.773	1.00	10	5	7.166	3.80	15	5	7.092	2.80	20	5	7.002	0.80	15	5
1999/3/11	7.315	40	15	0	7.185	2.00	20	0	7.096	1.40	25	0	6.982	1.00	15	5	7.580	2.20	20	5	7.482	1.80	25	5	7.390	1.20	10	5
1999/3/18	7.204	80	15	0	6.902	5.60	20	0	6.742	4.00	25	0	6.501	2.00	15	5	7.148	4.20	20	5	7.079	2.80	25	5	6.920	1.40	20	5
1999/3/19	7.288	50	10	0	6.939	5.20	15	0	6.682	3.80	20	0	6.429	3.20	10	5	7.192	4.00	15	5	7.112	3.20	20	5	7.002	2.80	15	5
1999/3/27	7.394	50	10	0	7.078	5.40	15	0	6.912	3.60	20	0	6.886	1.80	10	5	7.428	4.40	15	5	7.216	3.00	20	5	7.002	1.20	15	5
1999/3/31	7.280	50	10	0	6.929	5.20	15	0	6.772	3.80	20	0	6.520	1.20	10	5	7.198	4.00	15	5	7.120	3.00	20	5	6.982	0.98	15	5
1999/5/24	7.188	350	35	0	6.742	5.80	40	0	6.477	4.60	45	0	6.328	2.40	35	10	7.180	4.60	40	10	7.102	2.80	45	10	6.821	1.00	40	10
1999/6/23	7.024	660	40	0	6.587	6.80	45	0	6.218	4.20	50	0	5.886	2.40	40	10	7.287	5.20	45	10	7.004	3.80	50	10	6.896	2.00	45	10
1999/6/24	7.180	640	40	0	6.724	-	45	0	6.560	-	50	0	6.228	-	40	5	7.024	-	45	5	6.896	-	50	5	6.602	-	45	5
1999/7/12	6.948	780	50	0	6.581	10.40	55	0	6.324	5.20	60	0	6.018	3.80	50	10	7.129	7.00	55	10	7.002	4.40	60	10	6.924	3.20	60	10
1999/7/13	6.987	830	55	0	6.524	16.20	60	0	6.218	6.40	65	0	5.892	4.00	55	10	7.180	10.40	60	10	7.087	5.80	65	10	6.924	3.40	65	10
1999/7/14	7.024	750	50	0	6.619	9.80	55	0	6.427	5.00	60	0	6.027	3.60	50	10	7.214	6.80	55	10	7.016	4.00	60	10	6.892	3.00	55	10
1999/8/8	7.204	160	15	0	6.982	6.20	20	0	6.742	5.00	25	0	6.680	3.20	15	10	7.199	4.80	20	10	7.149	3.20	25	10	7.021	2.60	20	10
1999/8/9	7.110	250	20	0	6.916	5.80	25	0	6.802	4.40	30	0	6.615	3.40	20	10	7.148	4.60	25	10	7.098	3.00	30	10	7.021	2.80	25	10
1999/8/10	7.098	370	30	0	6.877	6.40	35	0	6.692	4.80	40	0	6.429	3.20	30	10	7.120	4.80	35	10	7.002	3.00	40	10	6.911	2.80	35	10
1999/8/11	6.901	540	30	0	6.744	6.60	35	0	6.529	5.20	40	0	6.388	3.80	30	10	7.098	4.80	35	10	6.998	3.20	40	10	6.792	2.80	35	10
1999/8/12	7.116	780	45	0	6.904	6.80	50	0	6.742	5.00	55	0	6.528	4.20	45	10	7.129	5.00	50	10	7.090	3.20	55	10	6.982	2.80	50	10
1999/8/13	6.928	830	55	0	6.649	6.60	60	0	6.528	5.20	65	0	6.471	4.60	55	10	7.028	5.00	60	10	6.940	3.20	65	10	6.742	2.80	60	10
1999/8/14	6.992	750	50	0	6.782	6.20	55	0	6.577	4.80	60	0	6.329	3.80	50	10	6.986	4.40	55	10	6.892	3.20	60	10	6.642	2.60	55	10
1999/8/16	6.824	600	35	0	6.572	7.00	40	0	6.281	4.60	50	0	6.004	2.40	35	5	6.781	5.40	40	5	6.502	3.80	50	5	6.321	2.00	40	10
1999/9/16	7.228	140	20	0	7.002	5.80	25	0	6.817	4.00	30	0	6.577	1.20	20	5	7.143	5.00	25	5	7.077	2.80	30	5	6.902	0.98	25	5
1999/9/17	7.180	150	20	0	6.992	5.20	25	0	6.742	4.20	30	0	6.580	3.00	20	5	7.129	4.80	25	5	7.015	3.00	30	5	6.877	2.00	25	5
1999/9/20	7.177	280	30	0	6.920	6.60	35	0	6.742	4.40	40	0	6.529	2.80	30	5	7.119	5.20	35	5	7.071	3.00	40	5	6.870	2.00	35	5
1999/9/21	6.912	250	30	0	6.740	5.80	35	0	6.556	4.20	40	0	6.402	2.20	30	5	7.099	5.00	35	5	7.001	3.00	40	5	6.872	1.80	35	5
1999/9/23	7.012	200	20	0	6.748	5.80	25	0	6.580	4.40	30	0	6.426	3.80	20	5	7.109	5.20	25	5	6.998	4.00	30	5	6.804	3.40	30	5
1999/9/24	7.099	200	25	0	6.811	5.80	30	0	6.572	4.20	35	0	6.402	2.20	25	5	7.092	5.00	30	5	7.007	2.80	35	5	6.874	1.20	30	5
1999/9/25	7.116	140	20	0	6.921	6.00	25	0	6.742	4.00	30	0	6.502	2.60	20	5	7.098	5.20	25	5	7.021	3.20	30	5	6.877	1.40	25	5
1999/9/27	7.109	100	15	0	6.824	5.60	20	0	6.587	3.80	25	0	6.329	1.40	15	5	7.202	4.60	20	5	6.981	3.40	25	5	6.754	1.00	20	5
1999/9/29	7.210	90	20	0	6.996	4.40	25	0	6.724	3.00	30	0	6.518	1.80	20	5	7.110	3.20	25	5	6.995	2.40	30	5	6.580	1.00	20	5
1999/10/1	7.119	100	15	0	6.817	5.20	20	0	6.577	3.80	25	0	6.288	1.40	15	5	7.102	4.60	20	5	7.002	3.00	25	5	6.749	1.00	20	5
1999/10/3	7.142	160	15	0	6.882	5.40	20	0	6.629	3.80	25	0	6.420	1.80	15	5	7.112	4.80	20	5	7.012	3.20	25	5	6.811	1.40	20	5
1999/10/3	7.199	80	20	0	6.924	3.80	25	0	6.584	2.80	30	0	6.402	1.20	20	5	7.109	2.80	25	5	6.987	2.00	30	5	6.826	0.80	20	5
1999/10/4	7.098	150	20	0	6.821	6.00	25	0	6.584	3.80	30	0	6.412	2.00	20	5	6.984	4.60	25	5	6.802	3.40	30	5	6.715	1.20	25	5
1999/10/12	7.188	120	20	0	6.929	5.40	25	0	6.681	3.60	30	0	6.472	1.20	20	5	7.112	3.80	25	5	7.001	2.80	30	5	6.772	0.82	25	5
1999/10/18	7.028	100	15	0	6.642	4.80	20	0	6.528	3.60	25	0	6.339	1.20	15	5	7.098	4.00	20	5	7.002	3.00	25	5	6.728	0.92	20	5
1999/10/27	7.206	120	20	0	7.082	4.60	25	0	6.872	3.60	30	0	6.570	1.00	20	5	7.112	3.80	25	5	7.082	3.00	30	5	6.792	0.98	20	5
1999/10/31	7.286	90	15	0	7.088	5.00	20	0	6.749	3.60	25	0	6.577	1.00	15	5	7.190	4.20	20	5	7.142	3.00	25	5	6.981	0.90	20	5
1999/11/1	7.108	110	20	0	6.986	4.80	25	0	6.674	3.60	30	0	6.429	1.40	20	5	7.112	4.00	25	5	7.002	2.80	30	5	6.811	0.88	25	5
1999/11/2	7.188	90	15	0	6.982	4.60	20	0	6.648	3.80	25	0	6.459	1.40	15	5	7.112	3.80	20	5	7.088	3.20	25	5	6.779	1.00	20	5
1999/11/5	7.220	100	15	0	7.102	5.00	20	0	6.811	4.00	25	0	6.587	1.60	15	5	7.192	4.40	20	5	7.112	3.20	25	5	6.877	1.00	20	5
1999/11/6	7.177	60	15	0	6.992	4.80	20	0	6.649	3.80	25	0	6.428	1.60	15	5	7.149	4.20	20	5	7.098	3.00	25	5	6.811	0.98	20	5
1999/11/16	7.401	60	15	0	7.102	4.60	20	0	6.877	3.60	25	0	6.749	1.40	15	5	7.226	3.80	20	5	7.148	3.00	25	5	6.992	1.00	20	5
1999/11/17	7.275	70	15	0	7.072	4.40	20	0	6.782	3.80	25	0	6.529	2.00	15	5	7.188	3.80	20	5	7.112	3.20	25	5	7.002	1.40	20	5

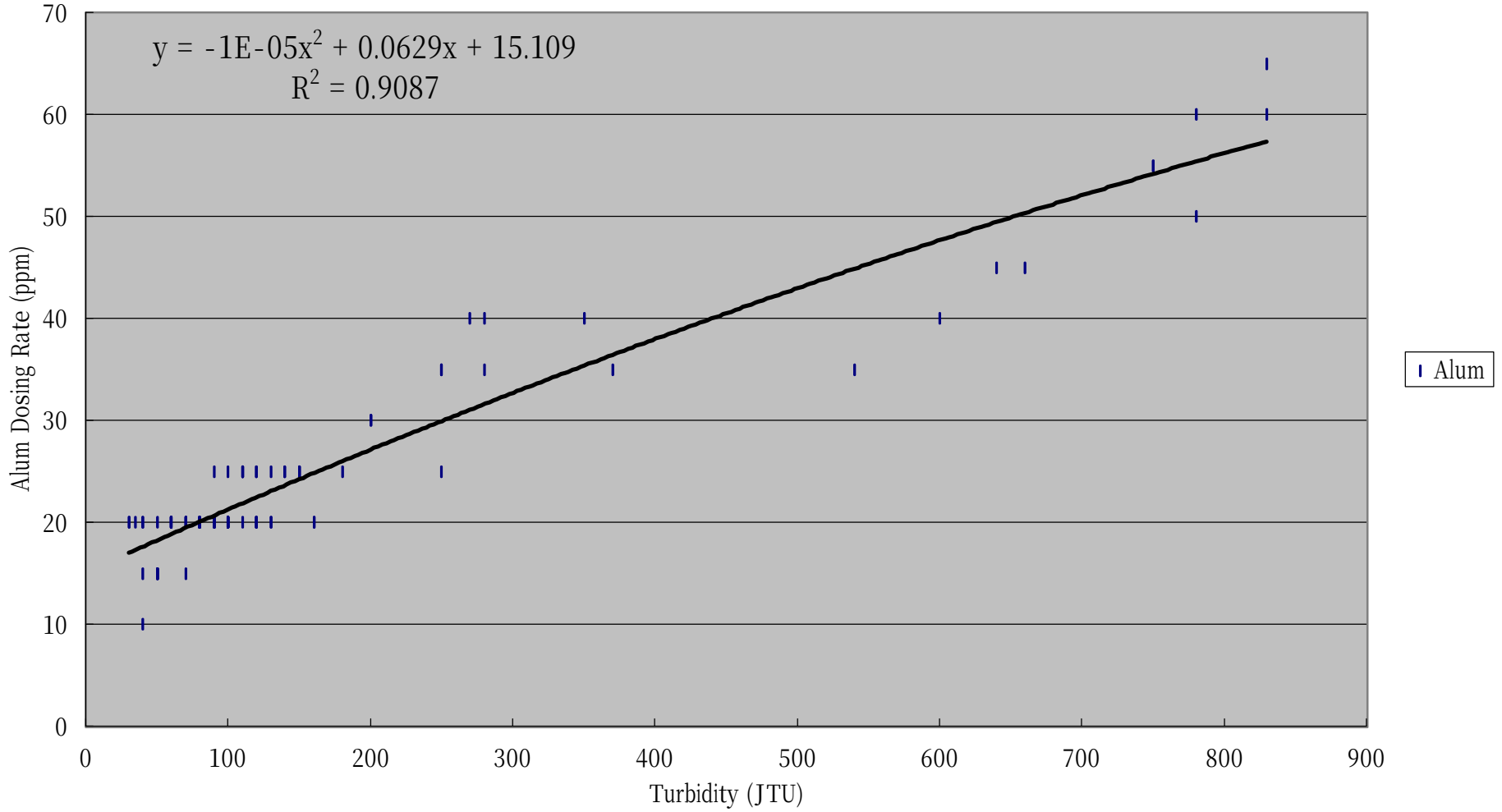
Table 4.1-9-1 Results of Jar Tests

	Raw Water		Jar Test Results -1				Jar Test Results -2				Jar Test Results -3				Jar Test Results -4				Jar Test Results -5				Jar Test Results -6				Applied (ppm)	
	pH	Turb.	Alum	Lime	pH	Turb.	Alum	Lime	pH	Turb.	Alum	Lime	pH	Turb.	Alum	Lime	pH	Turb.	Alum	Lime	pH	Turb.	Alum	Lime	pH	Turb.	Alum	Lime
1999/11/18	7.346	60	15	0	7.102	4.20	20	0	6.929	3.60	25	0	6.742	1.80	15	5	7.194	3.20	20	5	7.112	2.80	25	5	6.988	1.00	20	5
1999/11/19	7.316	50	10	0	7.015	4.80	15	0	6.872	3.60	20	0	6.539	1.40	10	5	7.179	4.00	15	5	7.102	3.00	20	5	7.008	0.98	15	5
1999/11/24	7.314	60	15	0	7.112	4.00	20	0	7.004	3.40	25	0	6.872	1.20	15	5	7.328	3.80	20	5	7.168	3.00	25	5	7.002	0.80	20	5
1999/11/26	7.291	70	15	0	7.102	5.40	20	0	6.985	4.00	25	0	6.724	1.40	15	5	7.286	4.20	20	5	7.110	3.40	25	5	6.985	1.00	20	5
1999/11/27	7.318	100	15	0	7.126	5.40	20	0	6.994	4.00	25	0	6.724	1.80	15	5	7.386	4.40	20	5	7.210	3.60	25	5	7.002	1.40	20	5
1999/11/29	7.294	100	20	0	6.987	5.00	25	0	6.784	3.80	30	0	6.569	1.40	20	5	7.248	4.20	25	5	7.102	3.00	30	5	6.994	1.00	25	5
1999/11/30	7.336	110	20	0	7.118	5.60	25	0	6.996	4.00	30	0	6.804	1.80	20	5	7.412	4.80	25	5	7.248	3.40	30	5	7.007	1.20	25	5
1999/12/1	7.314	80	15	0	7.124	4.60	20	0	7.002	3.80	25	0	6.918	1.20	15	5	7.298	3.80	20	5	7.116	3.00	25	5	7.001	0.80	20	5
1999/12/3	7.296	80	15	0	7.086	4.80	20	0	6.824	3.80	25	0	6.635	1.20	15	5	7.268	4.20	20	5	7.024	3.20	25	5	6.896	0.80	20	5
1999/12/5	7.314	90	15	0	7.126	5.40	20	0	6.927	4.00	25	0	6.715	1.40	15	5	7.328	4.80	20	5	7.204	2.40	25	5	7.086	1.00	20	5
1999/12/6	7.294	100	15	0	7.018	6.00	20	0	6.813	4.20	25	0	6.597	2.00	15	5	7.286	5.60	20	5	7.048	3.80	25	5	6.904	1.40	20	5
1999/12/7	7.288	110	15	0	7.046	7.20	20	0	6.872	4.80	25	0	6.605	2.80	15	5	7.278	6.20	20	5	7.124	4.00	25	5	6.987	2.00	25	5
2000/1/1	7.296	110	20	0	7.002	5.00	25	0	6.815	3.60	30	0	6.570	2.20	20	5	7.179	4.20	25	5	7.139	3.00	30	5	6.982	1.80	25	5
2000/1/5	7.270	100	15	0	7.128	5.40	20	0	6.877	3.60	25	0	6.592	2.20	15	5	7.192	4.60	20	5	7.118	3.20	25	5	6.872	1.80	20	5
2000/1/10	7.328	80	15	0	7.010	5.00	20	0	6.865	3.40	25	0	6.670	1.80	15	5	7.192	4.00	20	5	7.149	3.00	25	5	6.992	1.40	20	5
2000/1/12	7.316	60	15	0	7.102	4.80	20	0	6.874	3.60	25	0	6.668	1.40	15	5	7.177	4.00	20	5	7.112	2.80	25	5	6.910	0.98	20	5
2000/1/14	7.269	70	15	0	7.021	5.20	20	0	6.896	4.00	25	0	6.648	1.80	15	5	7.310	4.60	20	5	7.124	3.40	25	5	7.002	1.20	20	5
2000/1/19	7.269	60	15	0	7.002	4.60	20	0	6.812	3.40	25	0	6.579	1.60	15	5	7.139	3.80	20	5	7.102	2.80	25	5	6.829	1.00	20	5
2000/1/24	7.402	90	15	0	7.102	5.00	20	0	6.829	4.20	25	0	6.677	1.80	15	5	7.174	3.50	20	5	7.133	3.00	25	5	6.838	1.00	20	5
2000/1/26	7.314	80	20	0	7.102	5.40	25	0	6.981	3.40	30	0	6.786	1.40	20	5	7.324	4.20	25	5	7.218	3.00	30	5	7.106	1.00	20	5
2000/1/28	7.262	90	15	0	7.082	5.20	20	0	6.742	3.80	25	0	6.580	1.40	15	5	7.158	4.60	20	5	7.102	3.20	25	5	6.839	1.00	25	5
2000/1/30	7.216	70	15	0	7.062	5.00	20	0	6.810	4.00	25	0	6.572	1.20	15	5	7.169	4.60	20	5	7.116	3.00	25	5	6.811	1.00	20	5
2000/2/3	7.421	40	15	0	7.029	4.60	20	0	6.872	3.80	25	0	6.654	1.40	15	5	7.196	3.80	20	5	7.142	3.00	25	5	6.982	0.98	20	5
2000/2/4	7.324	30	15	0	7.102	4.60	20	0	6.792	3.40	25	0	6.588	1.20	15	5	7.189	4.20	20	5	7.112	2.80	25	5	6.877	0.92	20	5
2000/2/7	7.328	30	15	0	7.072	4.80	20	0	6.815	3.60	25	0	6.602	1.00	15	5	7.176	4.40	20	5	7.116	2.80	25	5	6.928	0.96	20	5
2000/3/7	7.529	35	15	0	7.120	3.40	20	0	6.906	1.80	25	0	6.724	1.00	15	5	7.840	3.80	20	5	7.329	2.00	25	5	7.167	1.20	20	5
2000/3/10	7.486	40	15	0	7.114	4.20	20	0	6.921	3.00	25	0	6.204	1.40	15	5	7.548	4.40	20	5	7.269	3.40	25	5	7.072	1.80	15	5
2000/3/14	7.412	50	15	0	7.144	4.60	20	0	6.980	3.40	25	0	6.695	1.00	15	5	7.648	5.20	20	5	7.269	3.80	25	5	7.088	1.60	20	5
2000/3/15	7.482	40	15	0	7.136	4.00	20	0	6.948	2.80	25	0	6.655	1.00	15	5	7.658	4.40	20	5	7.280	3.20	25	5	7.110	1.80	20	5
2000/3/16	7.462	100	15	0	7.148	5.20	20	0	6.792	4.20	25	0	6.570	1.40	15	5	7.199	4.80	20	5	7.162	3.20	25	5	6.517	0.96	20	5
2000/3/17	7.512	180	20	0	7.149	5.40	25	0	6.922	4.00	30	0	6.574	1.80	20	5	7.226	4.60	25	5	7.182	3.20	30	5	6.811	1.00	25	5
2000/3/18	7.499	270	35	0	7.088	5.80	40	0	6.678	4.20	45	0	6.482	2.60	35	5	7.206	5.20	40	5	7.174	3.00	45	5	6.877	1.00	40	5
2000/3/19	7.281	280	35	0	6.698	6.00	40	0	6.324	4.00	45	0	6.128	2.20	35	5	6.988	4.80	40	5	6.786	3.40	45	5	6.540	1.60	40	10
2000/3/20	7.429	250	35	0	6.988	5.20	40	0	6.675	2.80	45	0	6.328	1.00	35	5	7.226	3.40	40	5	7.084	2.00	45	5	6.898	0.80	35	5
1999/10/11*	7.004	92	15	0	6.886	5.40	20	0	6.710	4.20	25	0	6.624	2.00	15	5	7.102	4.20	20	5	6.996	3.80	25	5	6.910	1.80	20	5
1999/10/14*	7.198	76	15	0	7.084	5.60	20	0	6.886	4.20	25	0	6.702	3.00	15	5	7.188	4.40	20	5	7.096	3.80	25	5	6.994	2.60	20	5
1999/10/15*	7.196	88	15	0	7.124	5.40	20	0	6.902	4.00	25	0	6.798	2.80	15	5	7.264	4.20	20	5	7.112	3.80	25	5	7.086	2.40	20	5
1999/10/16*	7.206	86	15	0	7.180	5.20	20	0	6.964	4.00	25	0	6.815	3.20	15	5	7.368	4.40	20	5	7.164	3.80	25	5	7.092	2.80	20	5
1999/10/16*	7.218	86	15	0	7.180	5.00	20	0	6.964	3.80	25	0	6.815	3.00	15	5	7.268	4.40	20	5	7.164	3.60	25	5	7.092	2.80	20	5
1999/10/17*	7.280	64	15	0	7.124	5.20	20	0	7.002	4.00	25	0	6.896	1.40	15	5	7.264	4.60	20	5	7.118	3.80	25	5	6.996	1.00	20	5
1999/10/18*	7.028	76	15	0	6.894	5.20	20	0	6.678	4.00	25	0	6.510	1.80	15	5	7.118	4.40	20	5	6.996	3.60	25	5	6.804	1.20	20	5
1999/10/18*	7.238	56	15	0	7.109	4.80	20	0	6.924	3.80	25	0	6.785	1.20	15	5	7.228	4.00	20	5	7.134	3.20	25	5	6.986	0.80	20	5
1999/10/19*	7.284	60	15	0	7.018	5.00	20	0	6.896	3.80	25	0	6.628	1.40	15	5	7.296	4.00	20	5	7.124	3.40	25	5	7.006	1.00	20	5
1999/10/7*	7.124	90	15	0	6.974	6.20	20	0	6.712	4.00	25	0	6.568	3.40	15	5	7.169	5.60	20	5	7.004	4.80	25	5	6.990	3.20	25	5
1999/10/9*	7.218	94	15	0	7.124	5.40	20	0	7.002	4.00	25	0	6.929	2.80	15	5	7.206	4.00	20	5	7.102	3.80	25	5	6.998	2.20	20	5
1999/2/23*	7.264	44	10	0	7.102	5.80	15	0	6.998	4.00	20	0	6.877	1.80	10	5	7.250	4.80	15	5	7.118	3.80	20	5	7.002	1.60	15	5
1999/2/27*	7.296	36	10	0	7.109	5.00	15	0	7.084	3.80	20	0	6.998	1.40	10	5	7.312	4.00	15	5	7.248	3.40	20	5	7.106	1.20	15	5
1999/2/28*	7.246	40	10	0	7.204	5.60	15	0	7.176	4.20	20	0	7.008	1.40	10	5	7.324	4.40	15	5	7.234	3.20	20	5	7.180	1.00	15	5
1999/4/20*	7.394	168	20	0	7.012	7.40	25	0	6.814	4.00	30	0	6.675	2.20	20	5	7.284	5.00	25	5	7.170	3.60	30	5	6.998	2.00	25	5
1999/8/21*	7.024	94	15	0	6.496	5.40	20	0	6.214	3.80	25	0	6.008	1.20	15	10	7.406	5.00	20	10	7.218	3.40	25	10	7.002	1.20	20	10
1999/9/19*	7.168	160	20	0	6.986	5.20	25	0	6.784	4.80	30	0	6.578	3.20	20	5	7.224	5.60	25	5	7.102	4.40	30	5	6.990	3.40	30	5

Sampling Point: Halda River (*:Desilting Basin)

	Raw Water	pH	Turb.	Desilt. Basin	pH	Turb.	Applied	Raw Water	Alum	Lime	Desilt. Basin	Alum	Lime
pH and Turbidity (JTU)	High	7.529	830	High	7.394	168	Chemical	High	65	10	High	30	10
	Low	6.824	30	Low	7.004	36	Dosing	Low	10	5	Low	15	5
	Med.	7.218	100	Med.	7.218	86	Rate	Med.	20	5	Med.	20	5
	Avg.	7.222	178	Avg.	7.199	83	(ppm)	Avg.	25	6	Avg.	20	5

Figure 4.1-9 Raw Water Turbidity vs. Alum Dosing Rate



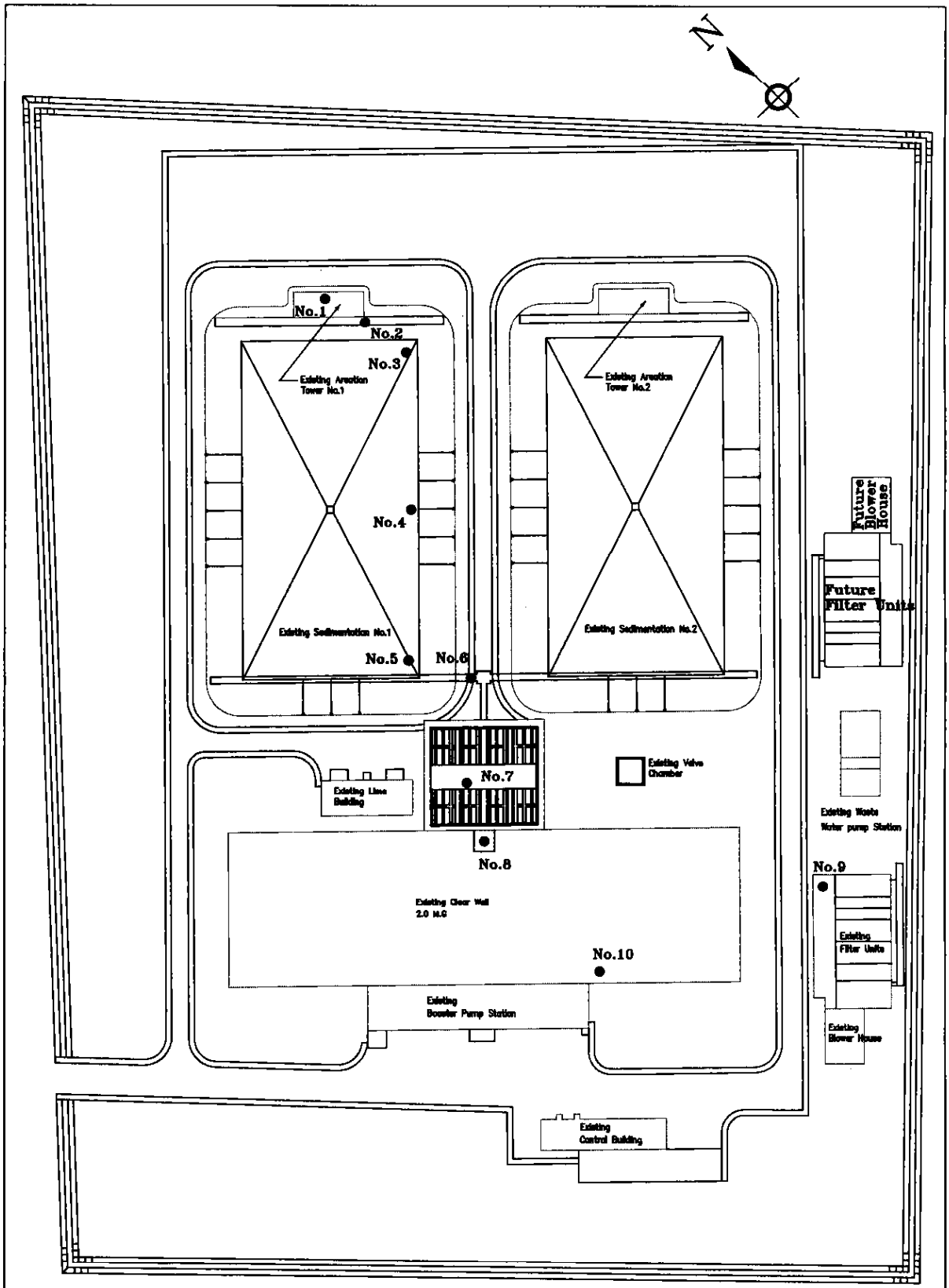


FIGURE 4.1-10-1 SAMPLING POINT FOR WATER QUALITY ANALYSIS IN KALURGHAT IRP&BPS (Sampling Date 3.19.2000)

4.1-11 Monthly Water Production of Existing Facilities (1999)

(unit: m3/day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Daily Avg.
MOD I													
Khulshi TW	618	610	508	479	511	525	550	606	626	505	346	368	521
Almas TW	2,353	2,147	2,137	1,986	1,886	3,190	4,030	4,175	4,062	4,304	3,961	3,907	3,185
Love Lane TW	1,378	1,341	1,278	1,232	1,247	1,196	1,120	1,248	1,269	1,247	1,311	5,161	1,591
Jubilee Road TW	3,978	4,136	3,740	3,476	3,751	3,722	3,828	3,752	3,701	3,771	3,704	3,684	3,769
Ice Factory Road TW	2,308	2,135	2,345	1,990	2,275	2,260	2,209	2,269	2,231	2,216	2,243	2,295	2,233
Collegiate School TW	2,311	2,775	2,048	2,428	2,029	2,309	2,697	2,171	2,652	3,188	3,381	3,307	2,606
Sader Ghat TW	3,028	2,254	2,664	710	2,591	2,760	2,717	503	2,976	2,037	1,829	1,848	2,160
Police Line TW	742	596	439	978	705	591	531	2,705	621	584	506	582	801
Agrabad No.3 TW	661	1,128	500	541	585	582	655	598	594	573	633	801	651
Nalapara TW	2,848	587	3,099	719	2,972	2,614	2,301	2,134	2,383	2,310	2,545	3,004	2,310
Halishahar II. TW	1,148	1,393	1,186	604	1,100	1,070	1,091	1,015	1,207	1,151	1,179	1,105	1,103
Firojshah -I TW	673	622	559	719	591	592	644	624	657	612	767	531	632
Firiojshah II TW	956	705	739	4,697	740	759	780	776	761	388	761	758	1,064
Goalpara TW	5,183	4,983	4,782	2,836	4,946	4,960	4,822	4,899	4,935	6,245	2,582	2,296	4,458
Agrabad No.1 TW	725	2,926	1,077	2,227	1,075	1,070	1,101	1,122	1,108	1,082	1,122	1,152	1,302
Mehedibag TW	4,570	4,401	4,224	3,982	4,000	3,603	3,833	3,810	3,843	3,773	3,355	2,963	3,860
MOD I Total (A)	**33,479**	**32,738**	**31,327**	**29,606**	**31,003**	**31,803**	**32,910**	**32,408**	**33,626**	**33,987**	**30,225**	**33,764**	**32,246**
MOD II													
No. 1 TW	2,168	2,104	1,472	1,125	1,235	1,681	1,065	1,153	1,031	1,173	1,055	1,186	1,366
No. 2 TW	1,516	2,201	2,864	3,458	3,201	2,799	2,236	2,027	1,546	1,419	1,366	1,359	2,164
No. 3 TW	2,907	2,727	2,200	1,228	821	855	849	698	781	851	788	861	1,290
No. 4 TW	2,817	2,455	2,081	1,209	1,108	914	798	671	683	687	807	706	1,239
No. 5 TW	1,404	1,314	1,333	1,022	901	1,409	3,596	3,712	3,806	3,532	3,349	2,829	2,359
No. 6 TW	3,212	3,191	3,045	1,505	1,376	1,271	733	720	840	740	688	534	1,478
No. 7 TW	3,670	3,700	3,588	3,602	3,670	3,708	3,393	3,562	2,750	2,711	2,861	2,593	3,315
No. 8 TW	2,636	2,495	2,939	2,408	1,718	1,657	1,498	1,745	1,575	1,474	1,702	1,503	1,943
No. 9 TW	1,924	1,865	782	714	696	1,447	2,863	2,635	2,574	1,903	1,555	1,183	1,678
No. 10 TW	2,672	2,527	2,221	2,223	1,822	2,250	1,756	2,383	1,853	2,240	2,379	2,405	2,226
No. 11 TW	3,229	3,619	2,426	2,716	3,098	3,396	3,110	3,075	3,480	4,898	3,668	4,030	3,395
No. 12 TW	3,993	3,535	2,969	3,034	2,365	3,154	3,989	4,107	3,936	3,481	2,731	2,138	3,285
No. 13 TW	2,987	4,549	4,115	3,848	5,425	5,268	4,778	4,879	4,118	4,534	4,699	4,633	4,486
No. 14 TW	530	494	461	480	631	1,052	1,070	1,100	207	903	1,377	1,962	859
No. 15 TW	2,378	2,372	2,268	1,654	1,573	1,458	1,566	1,172	1,253	1,173	1,056	965	1,570
No. 16 TW	3,995	3,806	3,778	3,252	3,611	3,421	2,401	1,808	1,631	1,472	1,314	1,009	2,618
No. 17 TW	1,189	1,166	1,114	1,117	1,116	1,150	893	3,256	3,858	3,686	3,471	4,959	2,255
No. 18 TW	-	-	2,210	3,831	2,681	1,751	1,490	1,108	1,157	837	947	1,690	1,482
No. 19 TW	4,324	4,196	4,077	4,493	5,646	5,751	5,638	5,488	5,325	5,047	3,988	4,959	4,917
No. 20 TW	2,914	2,837	2,554	3,405	3,342	3,308	3,053	3,562	3,392	3,296	3,633	3,398	3,226
No. 21 TW	2,490	2,399	2,376	2,323	2,504	2,339	2,390	2,206	2,245	1,945	1,929	1,690	2,235
No. 22 TW	3,369	2,374	3,189	3,011	3,339	3,311	2,914	4,137	3,734	3,842	3,790	4,119	3,436
No. 23 TW	1,692	1,580	1,474	1,339	1,335	992	1,211	3,913	4,169	4,078	4,026	4,165	2,504
No. 24 TW	2,644	2,369	2,091	2,546	2,665	2,533	2,882	3,031	3,215	2,460	2,561	2,673	2,641
MOD II Total (B)	**60,659**	**59,874**	**57,627**	**55,543**	**55,882**	**56,875**	**56,172**	**62,149**	**59,161**	**58,381**	**55,741**	**57,550**	**57,965**
(A) +(B)	**94,139**	**92,612**	**88,954**	**85,149**	**86,885**	**88,678**	**89,083**	**94,557**	**92,787**	**92,367**	**85,967**	**91,314**	**90,210**
Kalurghat B.P.S. (C)	**46,638**	**45,850**	**43,201**	**44,488**	**44,993**	**45,189**	**47,218**	**48,826**	**47,590**	**46,905**	**44,932**	**44,601**	**45,873**
Mohara W.T.P. (D)	**90,417**	**90,680**	**90,002**	**90,813**	**90,745**	**90,503**	**89,785**	**89,966**	**90,018**	**89,780**	**89,831**	**90,465**	**90,246**
PRODUCTION TOTAL													
(A) + (B) + (D)	**184,555**	**183,292**	**178,955**	**175,962**	**177,630**	**179,181**	**178,867**	**184,523**	**182,805**	**182,147**	**175,798**	**181,779**	**180,457**
DISTRIBUTION TOTAL													
(A) + (C) + (D)	**170,534**	**169,268**	**164,529**	**164,907**	**166,741**	**167,495**	**169,913**	**171,200**	**171,234**	**170,672**	**164,988**	**168,830**	**168,365**
Distribution / Product.	92%	92%	92%	94%	94%	93%	95%	93%	94%	94%	94%	93%	93%
Groundwater / Product.	51%	51%	50%	48%	49%	49%	50%	51%	51%	51%	49%	50%	50%
Groundwater / Distribut.	47%	46%	45%	45%	46%	46%	47%	47%	47%	47%	46%	46%	46%
MOD II / G.W. Product.	64%	65%	65%	65%	64%	64%	63%	66%	64%	63%	65%	63%	64%
Kalurghat / MOD II	77%	77%	75%	80%	81%	79%	84%	79%	80%	80%	81%	78%	79%

Source: CWASA

CHAPTER 6

SYUDY ON MANAGERIAL ASPECTS OF WATER WORKS

6.2 Study on Chittagong Water Supply and Sewerage Authority

6.2-1 Organization/Institution of CWASA

Table 6.2-1-1 Summary of Manpower

No	Name of Post (Class 1)	Sanctioned	Existing	Revised	Sanctioned (Revised)	Present
	(Class – 1)	Before 21.12.83		21.12.83	After 21.12.83	2.4.2000
1	Chairman	1	1	1	1	1
2	Member	-	-	-	3	1
3	Chief Engineer	1	1	1	1	-
4	Commercial Manager	1	-	1	1	1
5	Secretary	1	1	1	1	1
6	Superintending Engineer	2	2	2	2	2
7	Chief Accountant	1	1	1	1	1
8	Chief Revenue Officer	1	1	1	1	1
9	Executive Engineer	8	6	6	6	6
10	Senior Superintendent (Re-designated as Executive Engineer in the same scale)	1	-	1	1	1
11	Deputy Chief Accountant	2	2	2	2	1
12	Deputy Chief (Dev.)	1	-	1	1	1
13	Magistrate	-	-	-	1	1
14	Deputy Secretary	1	1	1	1	1
15	Senior Audit Officer	-	-	1	1	1
16	Computer Programmer	-	-	-	1	1
17	Assistant Secretary	2	2	2	2	2
18	Medical Officer	-	-	-	1	1
19	Asstt. Chief (Dev.)	1	1	1	1	1
20	Reserch Officer	1	1	1	1	1
21	Asstt. Engineer	12	12	12	12	12
22	Junior Superintendent (Re-designated as Asstt. Engineer in the same scale)	1	1	1	1	1
23	Superintendent Water Works	1	1	1	1	1
24	Internal Audit Officer	1	1	-	-	-
25	Public Relation Officer	1	-	1	1	-
26	Revenue Officer	3	2	3	3	3
27	Accounts Officer	3	3	2	2	2
28	Budget Officer	1	-	1	1	1
29	Purchase Officer	1	1	1	1	-
30	Estate Officer	1	1	1	1	1
31	Chemist & Quality Central Officer	-	-	-	-	1
	Total Class – 1	50	42	47	53	48
	Total Class – 2	36	30	32	21	21
	Total Class – 3	559	475	539	538	521
	Total Class – 4	123	104	100	125	160
	Grand Total	768	651	718	737	750

6.5-1 Questionnaire Form

4/02/2000

The Feasibility Study on Extension and Expansion of Mohara Water Treatment Plant in Chittagong City

Questionnaire Form
"Citizen's Awareness on Water Supply Service and Environmental Sanitation"

To the People of Chittagong

This questionnaire survey is intended to obtain information on awareness, willingness and affordability, as well as actual conditions of Chittagong people for improvement of existing water supply and sanitation conditions in the City of Chittagong being undertaken by the joint effort of the Japan International Cooperation Agency (JICA) and Chittagong Water Supply and Sewerage Authority (CWASA).

Any answer to this questionnaire survey will not used other than the above-mentioned purpose.

Thank you,

JICA Study Team and CWASA

1. Location for Residence

Name of Street, Ward and Thana:

Street,_____Ward No. _____, Thana No. _____

2. Housing

2.1 Type of Housing

☐ Pucca
☐ Semi-Pucca
☐ Kutcha

2.2 Year of Construction:

☐ Built before 1980
☐ Built between 1981and 1990
☐ Built between 1991 and 1995
☐ Built after 1996

3. Family / Income

(1) Number of inhabitant: _____ persons

(2) Number of family: _____ family

(3) Number of income earners: _____ person

(4) Sum of annual income:

How much is average annual income of your family?

_____ TK (= monthly income _____ TK/month)

(5) Main income source:

☐ Government

☐ Private company

☐ Independent business

☐ Other: Specify_____

3.2 Expenditure (monthly average)

(1) Total Expenditure: _____ TK/month(100%)

1) Expense of housing: _____ (_____ %)

2) Expenses of food: _____ (_____ %)

3) Expenses of fuel and lighting: _____ (_____ %)

4) Education: _____ (_____ %)

5) Transportation/communication: _____ (_____ %)

6) Water bill expense: _____ (_____ %)

7) Sewerage bill expense: _____ (_____ %)

8) Others: _____ (_____ %)

4. Water Supply Condition

4.1 Source of Drinking Water

(1) Do you obtain the water from CWASA?:

☐ Yes, ☐ a) By house connection;

How many people use the house connection?

_____ persons

☐ b) By hydrant;

Could you guest how many people use the hydrant?

_____ persons

☐ No,

1) If no, what is your water source for drinking?

☐ Private shallow well

☐ Other: Please specify _____

2) If no, what is your water source for cloth washing?

- ☐ Private shallow well
- ☐ Stream water/pond water
- ☐ Other: Please specify _____

4.2 Metering

(1) Do you have a water meter at your resident? ☐ Yes, or ☐ No

If yes, is it functioning? ☐ Good, or ☐ Not correct

(2) When did it install?

- ☐ Before 1980
- ☐ 1981~ 1990
- ☐ 1991~ 1995
- ☐ 1996 ~

4.3 Awareness / Willingness / Affordability

(1) Do you encounter water supply interruption? ☐ Yes, or ☐ No

If yes, how many hours a day could you get tap water?

_____ hours a day at; ☐ day-time, or ☐ evening/night time

(2) What is/are the most important improvement of water supply conditions for you, if you may request CWASA? (more than one answer is available)

- ☐ Continuous supply(no interruption when you want)
- ☐ Enough water pressure for your floor
- ☐ Safe for drinking
- ☐ Good quality water supply (What did you expected iron content or offensive smell/taste?)
- ☐ Cheap water charge
- ☐ Other : specify_____

(3) Upon improvement of water supply conditions, do you have willing to pay water charge which may be required for CWASA's investment program, as you consume based on the water meter reading?

- ☐ No, present water charge is maximum to pay. How much is it now? _____ TK
- ☐ Up to 1.5 times of present (up to _____ TK/month)
- ☐ Up to 2.0 times (up to _____TK/month)
- ☐ Up to 2.5 times (up to _____TK/month)
- ☐ Up to 3.0 times (up to _____ TK/month)
- ☐ More than 3.0times (more than _____ TK/month)

5. Sanitary Condition

5.1 Toilet Facility

(1) Type of toilet

☐ Flushing by tap water
☐ Pour flush
☐ Pit latrine
☐ No toilet

5.2 Disposal

(1) Disposal of wastewater from toilet

☐ Discharge to sewer line
☐ Discharge to septic tank
☐ Discharge to drainage line
☐ Discharge to road/pond

(2) Disposal of wastewater from kitchen and bath room

☐ Discharge to sewer line
☐ Discharge to septic tank
☐ Discharge to drainage line
☐ Discharge to road/pond

(3) Do you have experience of overflowing or flooding from sewer pipeline or drainage facility nearby your house ?

☐ Yes, or ☐ No

If yes, how often and how long does it happen?

_____ time/s a year, and _____days for every flooding

6. Water Related Hygiene Conditions

(1) Does your family member have experience of sickness(e.g. diarrhea, dysentery, skin disease) by the usage of tap water?

☐ Yes, or ☐ No

(2) Do you know occurrence of health hazard being caused by unsanitary water source (e.g. shallow well nearby septic tank) or by polluted city water?

☐ Yes, or ☐ No

Thank you.

CHAPTER 7

BASIC PLAN FOR DEVELOPMENT OF WATER SUPPLY SYSTEM

7.4-1 COMPARISON STUDY FOR LOCATION OF DISTRIBUTION RESERVOIR

The study was carried out on the following 7 alternatives taking account of location of land to construct the reservoir and distribution method[1] (refer to attached figures).

Case I-a: Construction of a new reservoir at Khulshi Hill.
Case I-b: Construction of a new reservoir at Nasirabad Hill (back of the Tea Board Factory).
Case I-c: Construction of a new reservoir at the CWASA Nasirabad storage yard.

Case II-a: Construction of a new reservoir beside of existing Battali Hill reservoir.
Case II-b: Demolition of existing Battali Hill reservoir and reconstruction of a new reservoir with appropriate big capacity.

Case III-a: Construction of new reservoir at new Mohara plant.
Case III-b: Construction of new reservoir at new Mohara plant with a new reservoir and a booster pump station at CWASA Nasirabad storage site.

Case I-b above was further divided into the following 3 alternatives.

Case I-b-1: Construction of a new ground reservoir at Nasirabad Hill with a head tank, and transmission to new Battali Hill reservoir through a branched pipeline.
Case I-b-2: Construction of a new elevated reservoir at Nasirabad Hill. Other is the same to Case I-b-1
Case I-b-3: Construction of new ground reservoir with a head tank at Nasirabad Hill

Case I-c above was also further divided into the following 2 alternatives.

Case I-c-1: Construction of new ground reservoir at CWASA Nasirabad storage yard with a head tank, and branched water is boosted to new Battali Hill head tank.
Case I-c-2: Construction of a new elevated reservoir at CWASA Nasirabad storage yard, and transmission to new Battali Hill reservoir through a branched pipeline.

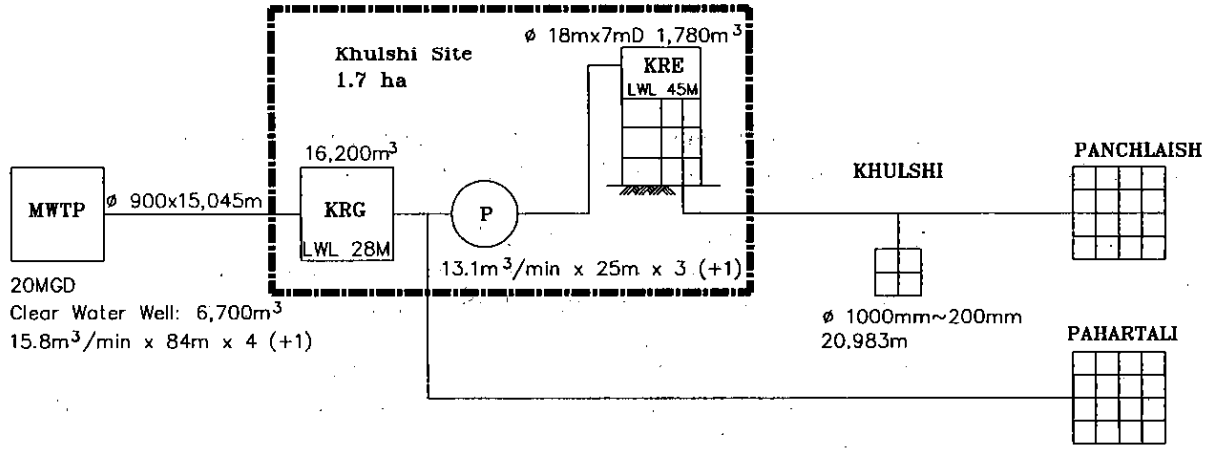
Case III-a above was also further divided into the following 3 alternatives.

Case III-a-1: Direct distribution from a new reservoir at the Mohara plant without any head tank and reservoir outside of the plant.
Case III-a-2: Direct distribution from a new reservoir at the Mohara plant and through new Battali Hill head tank.
Case III-a-3: Direct distribution from a new reservoir at the Mohara plant through new Battali Hill head tank.
Note: Construction of a new reservoir at the Mohara WTP is possible in the premises of the plant without further land acquisition, though slight land acquisition for treatment facilities is needed.

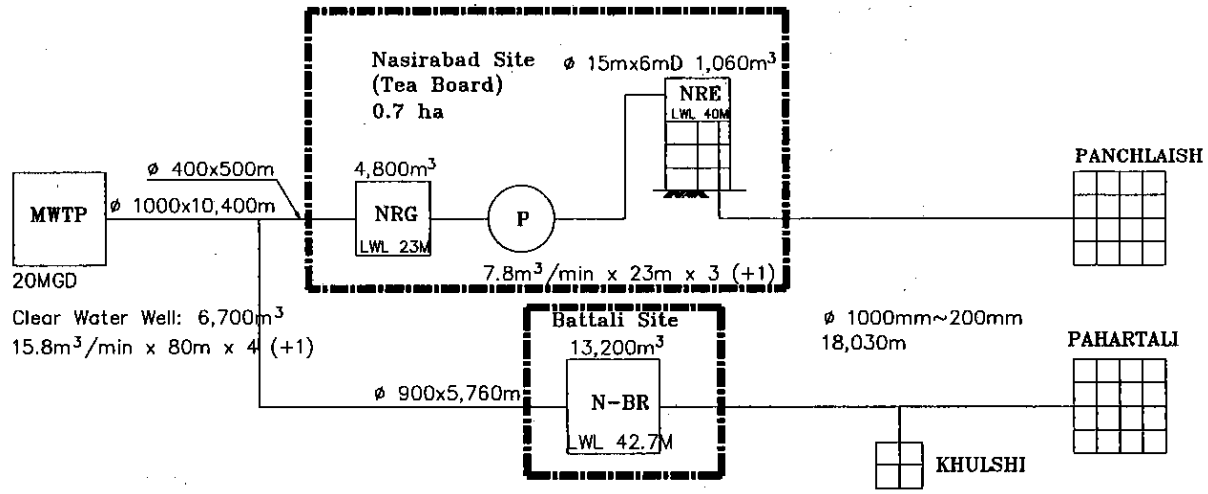
[1] Capacity of facilities, i.e. pumps, pipes and reservoirs were decided as minimum requirements for examined system. Actual facilities shall be designed including surplus capacity for ease of operation.

Distribution System by Location of Reservoir

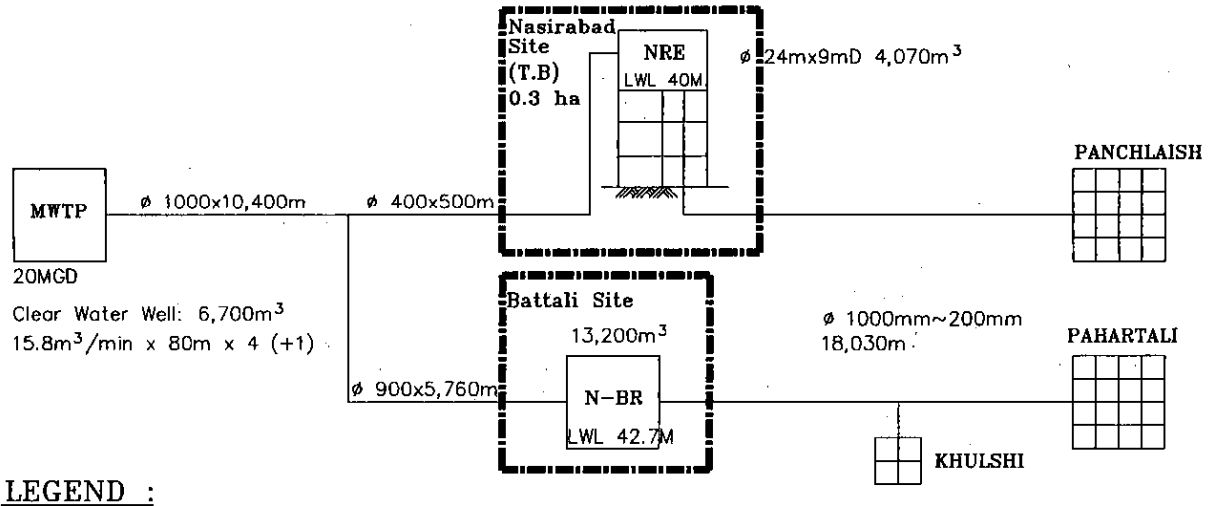
Alternative I-a (Khulshi Reservoir)



Alternative I-b-I (Nasirabad + New Battali Hill Reservoirs)



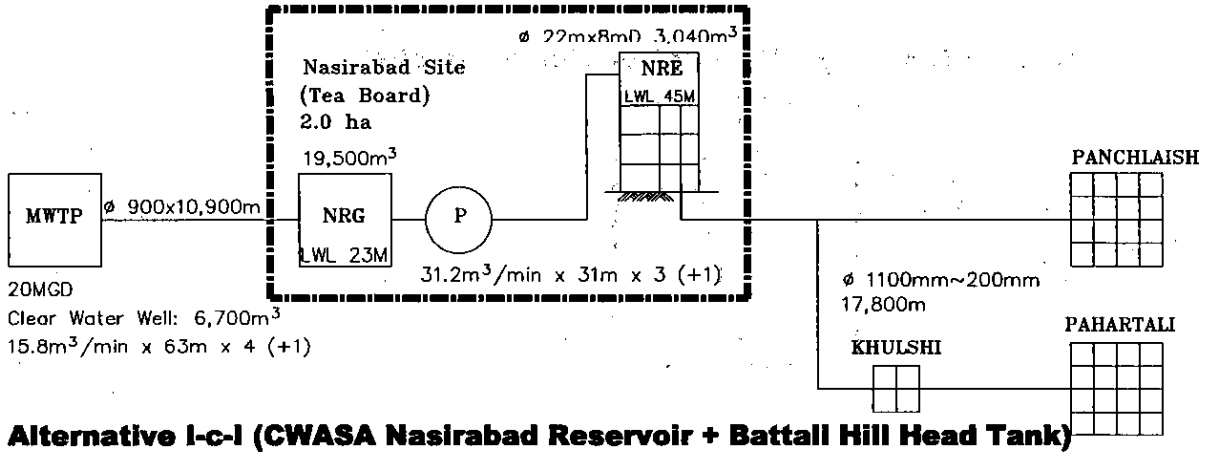
Alternative I-b-2 (Nasirabad Elevated + New Battli Hill Reservoirs)



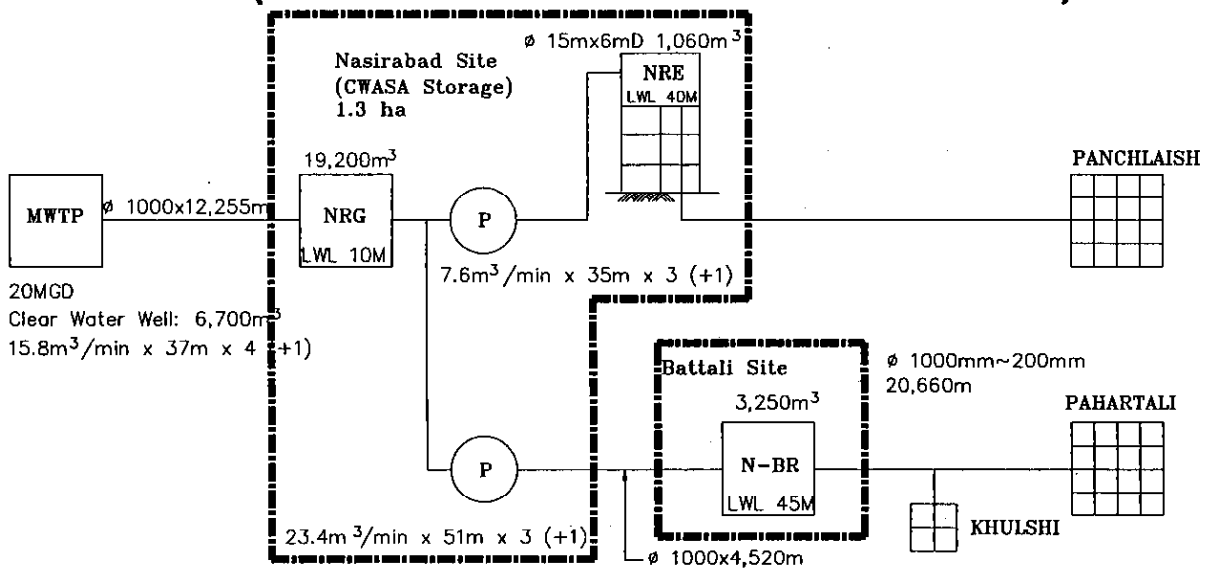
LEGEND :

MWTP : Mohara Water Treatment Plant (Expansion)
KRG / KRE : Khulshi Reservoir (Ground / Elevated Tank)
NRG / NRE : Nasirabad Reservoir (Ground / Elevated Tank)
E-BR / N-BR : Existing / New Battali Hill Reservoir
P : Lift Pump

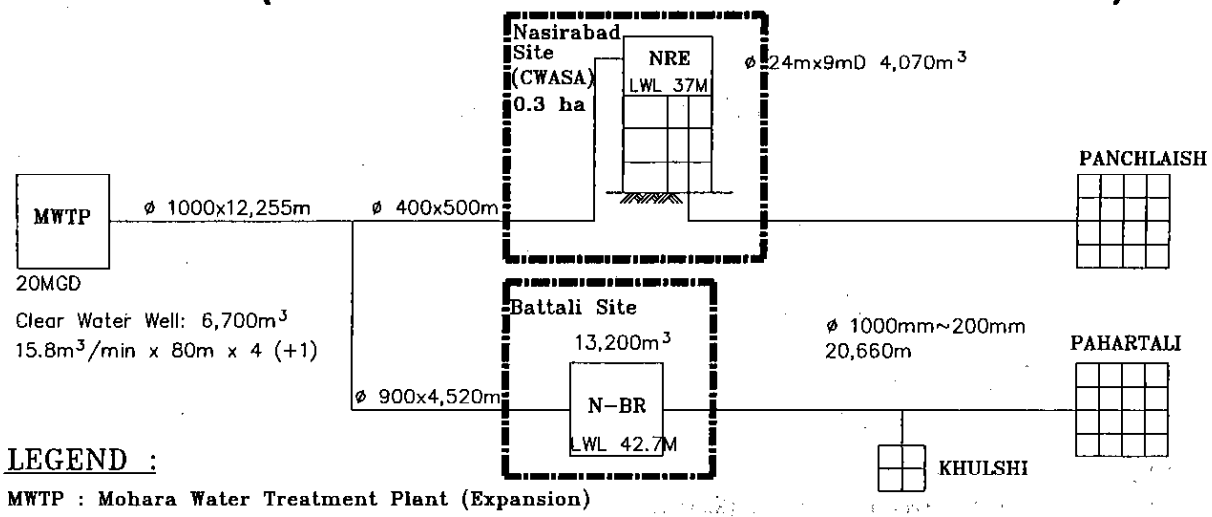
Alternative I-b-3 (Nasirabad Reservoir)



Alternative I-c-I (CWASA Nasirabad Reservoir + Battali Hill Head Tank)



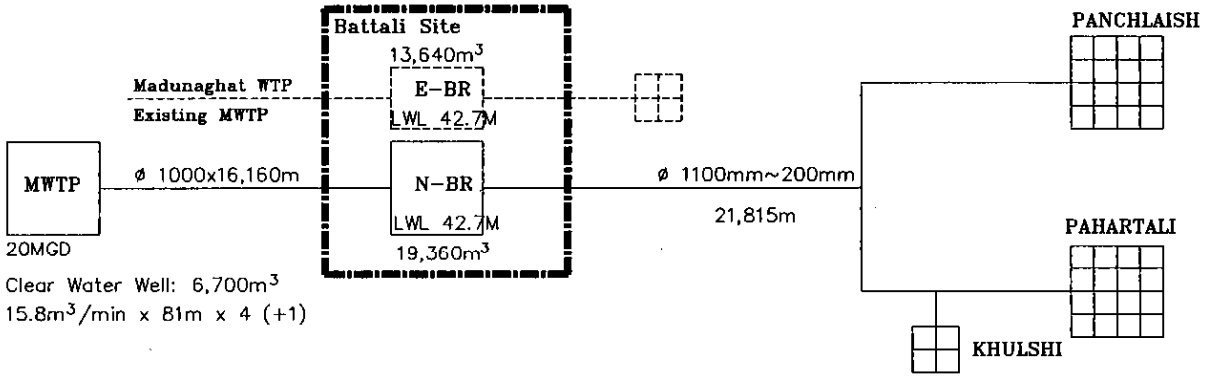
Alternative I-c-2 (CWASA Nasirabad Elevated + New Battli Hill Reservoirs)



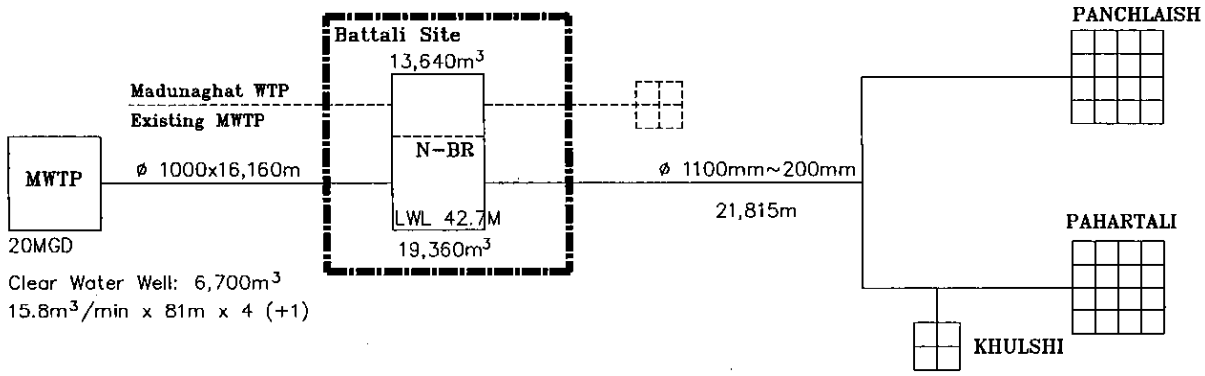
LEGEND :

MWTP : Mohara Water Treatment Plant (Expansion)
KRG / KRE : Khulshi Reservoir (Ground / Elevated Tank)
NRG / NRE : Nasirabad Reservoir (Ground / Elevated Tank)
E-BR / N-BR : Existing / New Battali Hill Reservoir
P : Lift Pump

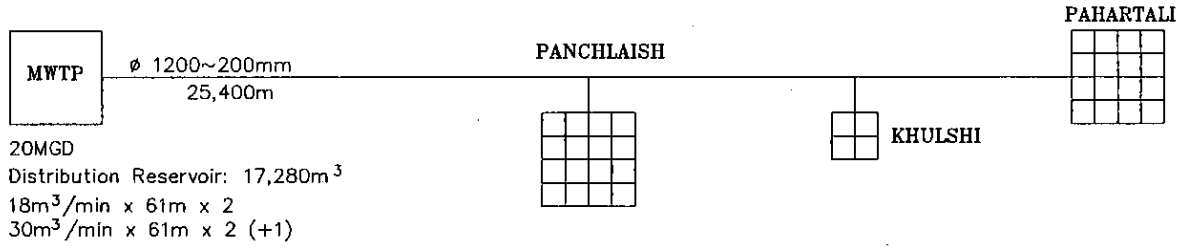
Alternative II-a (Existing + New Battali Hill Reservoirs)



Alternative II-b (New Battali Hill Reservoir)



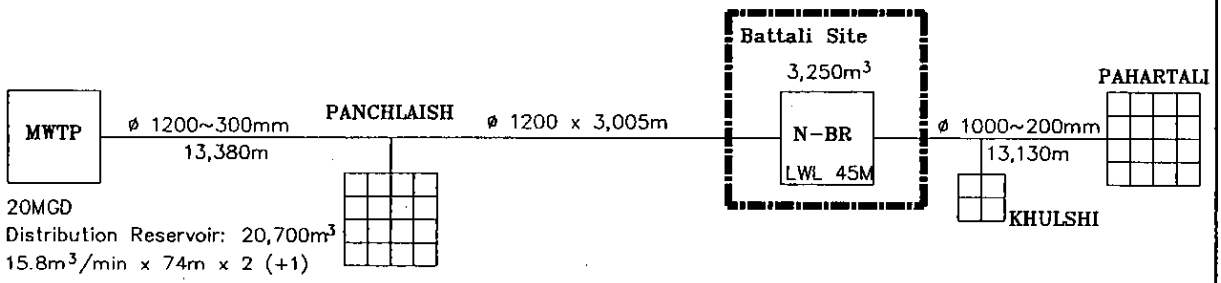
Alternative III-a-1 (Mohara WTP Direct Distribution)



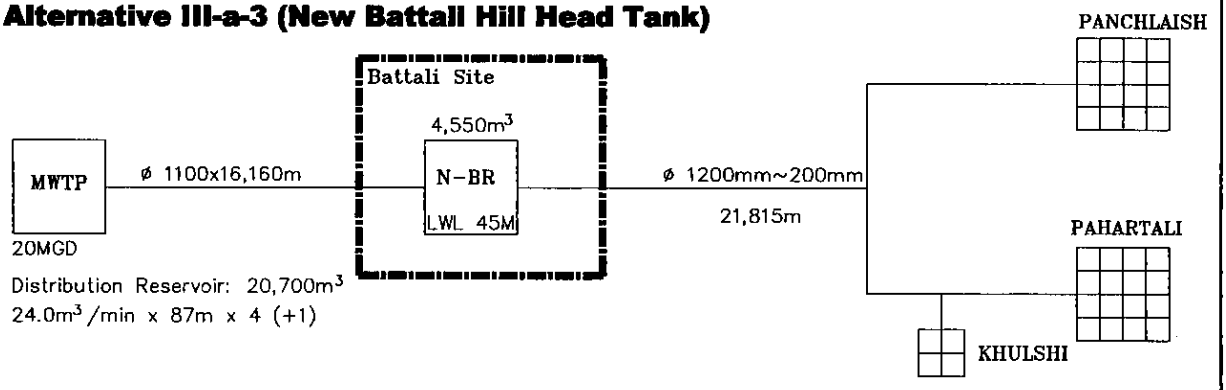
LEGEND :

MWTP : Mohara Water Treatment Plant (Expansion)
KRG / KRE : Khulshi Reservoir (Ground / Elevated Tank)
NRG / NRE : Nasirabad Reservoir (Ground / Elevated Tank)
E-BR / N-BR : Existing / New Battali Hill Reservoir
P : Lift Pump

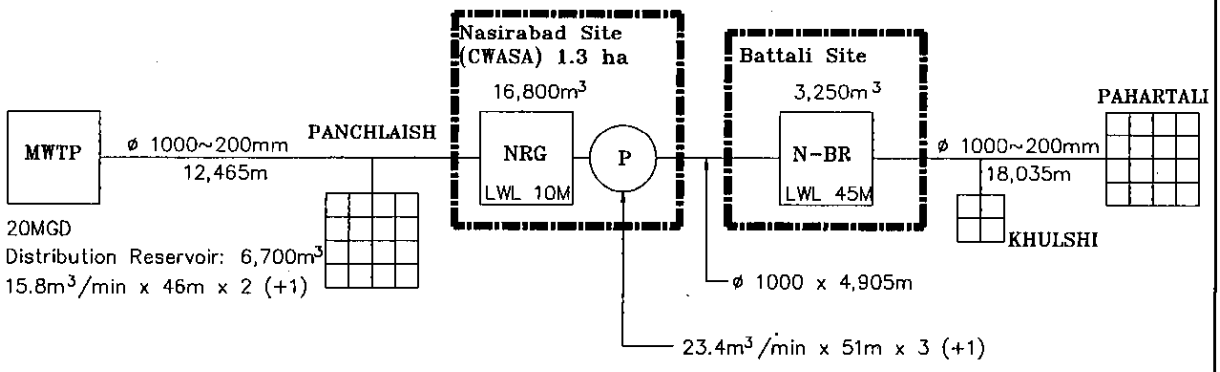
Alternative III-a-2 (Mohara WTP Direct Distribution + Battali Hill Head Tank)



Alternative III-a-3 (New Battali Hill Head Tank)



Alternative III-b (Mohara WTP Direct Distribution + Nasirabad BPS + Battali Hill Head Tank)



LEGEND :

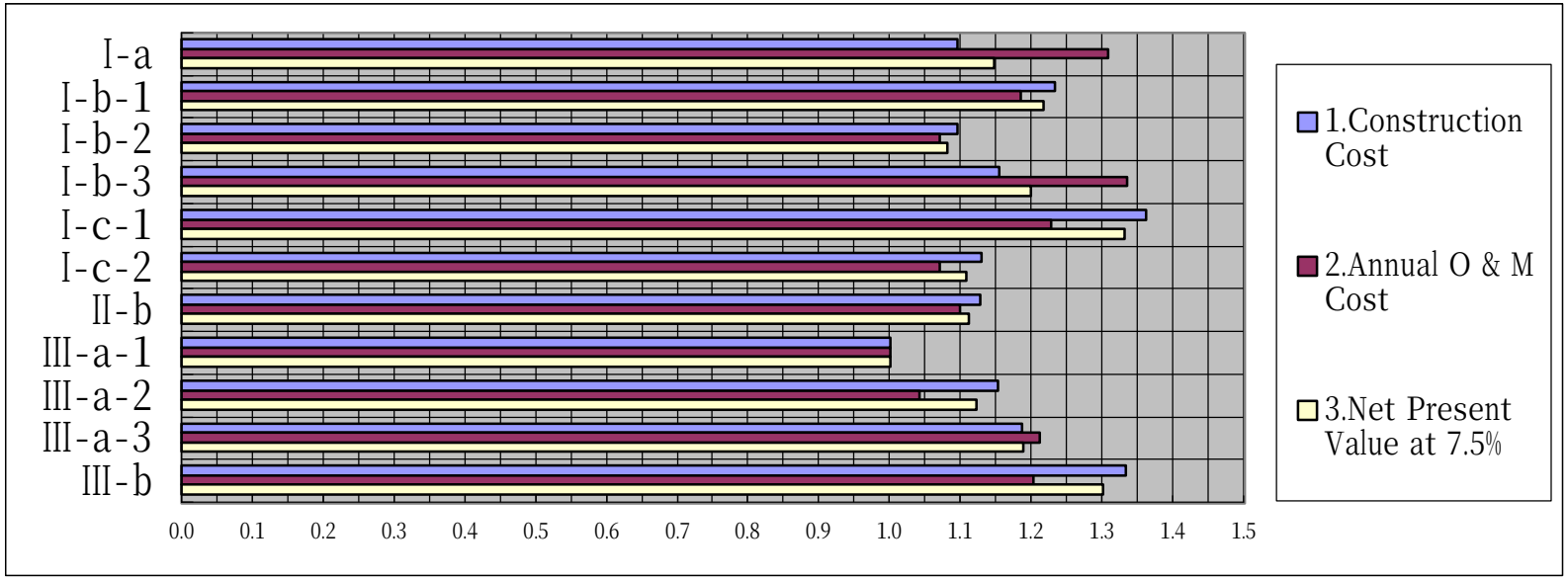
MWTP : Mohara Water Treatment Plant (Expansion)
KRG / KRE : Khulshi Reservoir (Ground / Elevated Tank)
NRG / NRE : Nasirabad Reservoir (Ground / Elevated Tank)
E-BR / N-BR : Existing / New Battali Hill Reservoir
P : Lift Pump

Evaluation Results on Alternatives

	1. Stability	2. Ease of System Control	3. Ease of Maintenance	4. Construction cost	5. O & M Cost	6. Total Cost NPV	7. Availability of land	8. Workability and Compensation	9. Necessity of Existing Battali Hill Rsvr Demolition	Total
Weight	7	5	3	1	1	7	5	3	7	
Evaluation Result:										
I-a	B	A	C	B	D	B	C	A	A	3A3B2C1D
I-b-1	B	A	C	C	C	C	C	C	D	1A1B6C1D
I-b-2	A	A	B	B	B	B	C	C	D	2A4B2C1D
I-b-3	B	A	C	B	D	C	C	A	A	3A2B3C1D
I-c-1	C	A	C	D	C	D	A	C	B	2A1B4C2D
I-c-2	A	A	B	B	B	B	A	C	D	3A4B1C1D
II-b	A	A	B	B	B	B	A	C	D	3A4B1C1D
III-a-1	D	D	A	A	A	A	A	A	A	7A0B0C2D
III-a-2	D	C	A	B	A	B	A	C	B	3A3B2C1D
III-a-3	C	B	A	C	C	C	A	C	B	2A2B5C0D
III-b	D	C	C	D	C	D	A	C	B	1A1B4C3D
Weighted Point (Total)										
I-a	21.0	25.0	3.0	3.0	-1.0	21.0	5.0	15.0	35.0	**127.0**
III-a-1	-7.0	-5.0	15.0	5.0	5.0	35.0	25.0	15.0	35.0	**123.0**
I-c-2	35.0	25.0	9.0	3.0	3.0	21.0	25.0	3.0	-7.0	**117.0**
II-b	35.0	25.0	9.0	3.0	3.0	21.0	25.0	3.0	-7.0	**117.0**
I-b-3	21.0	25.0	3.0	3.0	-1.0	7.0	5.0	15.0	35.0	**113.0**
I-b-2	35.0	25.0	9.0	3.0	3.0	21.0	5.0	3.0	-7.0	**97.0**
III-a-3	7.0	15.0	15.0	1.0	1.0	7.0	25.0	3.0	21.0	**95.0**
III-a-2	-7.0	5.0	15.0	3.0	5.0	21.0	25.0	3.0	21.0	**91.0**
I-c-1	7.0	25.0	3.0	-1.0	1.0	-7.0	25.0	3.0	21.0	**77.0**
I-b-1	21.0	25.0	3.0	1.0	1.0	7.0	5.0	3.0	-7.0	**59.0**
III-b	-7.0	5.0	3.0	-1.0	1.0	-7.0	25.0	3.0	21.0	**43.0**
Weighted Point (Technical)										
I-b-2	35.0	25.0	9.0					3.0		**72.0**
I-c-2	35.0	25.0	9.0					3.0		**72.0**
II-b	35.0	25.0	9.0					3.0		**72.0**
I-a	21.0	25.0	3.0					15.0		**64.0**
I-b-3	21.0	25.0	3.0					15.0		**64.0**
I-b-1	21.0	25.0	3.0					3.0		**52.0**
III-a-3	7.0	15.0	15.0					3.0		**40.0**
I-c-1	7.0	25.0	3.0					3.0		**38.0**
III-a-1	-7.0	-5.0	15.0					15.0		**18.0**
III-a-2	-7.0	5.0	15.0					3.0		**16.0**
III-b	-7.0	5.0	3.0					3.0		**4.0**
Weighted Point (Economical)										
III-a-1				5.0	5.0	35.0				**45.0**
III-a-2				3.0	5.0	21.0				**29.0**
I-b-2				3.0	3.0	21.0				**27.0**
I-c-2				3.0	3.0	21.0				**27.0**
II-b				3.0	3.0	21.0				**27.0**
I-a				3.0	-1.0	21.0				**23.0**
I-b-1				1.0	1.0	7.0				**9.0**
I-b-3				3.0	-1.0	7.0				**9.0**
III-a-3				1.0	1.0	7.0				**9.0**
I-c-1				-1.0	1.0	-7.0				**-7.0**
III-b				-1.0	1.0	-7.0				**-7.0**
Weighted Point (Practical)										
III-a-1							25.0	15.0	35.0	**75.0**
I-a							5.0	15.0	35.0	**55.0**
I-b-3							5.0	15.0	35.0	**55.0**
I-c-1							25.0	3.0	21.0	**49.0**
III-a-2							25.0	3.0	21.0	**49.0**
III-a-3							25.0	3.0	21.0	**49.0**
III-b							25.0	3.0	21.0	**49.0**
I-c-2							25.0	3.0	-7.0	**21.0**
II-b							25.0	3.0	-7.0	**21.0**
I-b-1							5.0	3.0	-7.0	**1.0**
I-b-2							5.0	3.0	-7.0	**1.0**

Ebaluation point	
A:	5
B:	3
C:	1
D:	-1

	1	2	3	4	5	6	7	8	9	10	11
	I-a	I-b-1	I-b-2	I-b-3	I-c-1	I-c-2	II-b	III-a-1	III-a-2	III-a-3	III-b
1.Construction Cost	1,424	1,603	1,423	1,501	1,770	1,469	1,465	1,302	1,498	1,543	1,733
Ratio to Case I-a (=1.00)	**1.00**	**1.13**	**1.00**	**1.05**	**1.24**	**1.03**	**1.03**	**0.91**	**1.05**	**1.08**	**1.22**
Ratio to Least Case (=1.00)	1.09	1.23	1.09	1.15	1.36	1.13	1.13	1.00	1.15	1.18	1.33
	B	C	B	B	D	B	B	A	B	C	D
2.Annual O & M Cost	46.1	41.8	37.7	47.1	43.3	37.7	38.8	35.3	36.8	42.8	42.4
Ratio to Case I-a (=1.00)	**1.00**	**0.91**	**0.82**	**1.02**	**0.94**	**0.82**	**0.84**	**0.77**	**0.80**	**0.93**	**0.92**
Ratio to Least Case (=1.00)	1.31	1.18	1.07	1.33	1.23	1.07	1.10	1.00	1.04	1.21	1.20
	D	C	B	D	C	B	B	A	A	C	C
3.Net Present Value at 7.5%	1,692	1,796	1,596	1,771	1,965	1,635	1,640	1,477	1,656	1,754	1,920
Ratio to Case I-a (=1.00)	**1.00**	**1.06**	**0.94**	**1.05**	**1.16**	**0.97**	**0.97**	**0.87**	**0.98**	**1.04**	**1.13**
Ratio to Least Case (=1.00)	1.15	1.22	1.08	1.20	1.33	1.11	1.11	1.00	1.12	1.19	1.30
7.5%	B	C	B	C	D	B	B	A	B	C	D
Order	6	9	2	8	11	3	4	1	5	7	10



NPV of Costs for Alternative I-a

Direct Cost				
1. Mohara WTP				
Civil Works-1	65,437,000	Plant	Civil Total	
Civil Works-2	284,713,837	Trans. Pipe.	350,150,837	
M&E Works	207,171,000			
2. Khulshi Hill Reservoir		Land Aq. Area	Unit Land Price	
Civil Works	169,592,000	17,000	8,500	
M&E Works	92,742,000	m2	Tk/m2	
3. Distribution Pipes				
Civil Works	203,862,290			
M&E Works	0			
TOTAL	1,423,897,659	(including 25% OH & Profit)		
Civil Works	904,506,409	Land Cost	144,500,000	
M&E Works	374,891,250			

(unit: TAKA)

Year	CURRENT COST					NET PRESENT VALUE
	Initial Costs			O & M Costs	Total	
	Land	Civil Works	M&E Works			
1	144,500,000	301,502,136			446,002,136	1,692,365,388
2		301,502,136	74,978,250		376,480,386	7.5%
3		301,502,136	299,913,000		601,415,136	
4				46,129,793	46,129,793	
5				46,129,793	46,129,793	
6				46,129,793	46,129,793	
7				46,129,793	46,129,793	
8				46,129,793	46,129,793	
9				46,129,793	46,129,793	
10				46,129,793	46,129,793	
11				46,129,793	46,129,793	
12				46,129,793	46,129,793	
13				46,129,793	46,129,793	
14				46,129,793	46,129,793	
15				46,129,793	46,129,793	
16				46,129,793	46,129,793	
17				46,129,793	46,129,793	
18			149,956,500	46,129,793	196,086,293	
19				46,129,793	46,129,793	
20				46,129,793	46,129,793	
21				46,129,793	46,129,793	
22				46,129,793	46,129,793	
23				46,129,793	46,129,793	
24				46,129,793	46,129,793	
25				46,129,793	46,129,793	
26				46,129,793	46,129,793	
27				46,129,793	46,129,793	
28				46,129,793	46,129,793	
29				46,129,793	46,129,793	
30				46,129,793	46,129,793	
31				46,129,793	46,129,793	
32				46,129,793	46,129,793	
33		-90,450,641	-37,489,125	46,129,793	-81,809,973	

NPV of Costs for Alternative I-b-1

Direct Cost				
1. Mohara WTP				
Civil Works-1	65,437,000	Plant	Civil Total	
Civil Works-2	378,488,975	Trans. Pipe.	443,925,975	
M&E Works	205,974,000			
2. Nasirabad Reservoir		Land Aq. Area	Unit Land Price	
Civil Works	95,336,000	7,000	5,600	
M&E Works	78,161,000	m2	Tk/m2	
3. New Battali Hill Reservoir				
Civil Works	122,529,000			
M&E Works	0			
4. Old Battali Hill Reservoir Rebuilt				
Civil Works	114,434,000			
M&E Works	0			
5. Distribution Pipes				
Civil Works	190,445,479			
M&E Works	0			
TOTAL	1,602,706,818	(including 25% OH & Profit)		
Civil Works	1,208,338,068	Land Cost	39,200,000	
M&E Works	355,168,750			

(unit: TAKA)

Year	CURRENT COST					NET PRESENT VALUE
	Initial Costs			O & M Costs	Total	
	Land	Civil Works	M&E Works			
1	39,200,000	402,779,356			441,979,356	1,795,730,203
2		402,779,356	71,033,750		473,813,106	7.5%
3		402,779,356	284,135,000		686,914,356	
4				41,797,848	41,797,848	
5				41,797,848	41,797,848	
6				41,797,848	41,797,848	
7				41,797,848	41,797,848	
8				41,797,848	41,797,848	
9				41,797,848	41,797,848	
10				41,797,848	41,797,848	
11				41,797,848	41,797,848	
12				41,797,848	41,797,848	
13				41,797,848	41,797,848	
14				41,797,848	41,797,848	
15				41,797,848	41,797,848	
16				41,797,848	41,797,848	
17				41,797,848	41,797,848	
18			142,067,500	41,797,848	183,865,348	
19				41,797,848	41,797,848	
20				41,797,848	41,797,848	
21				41,797,848	41,797,848	
22				41,797,848	41,797,848	
23				41,797,848	41,797,848	
24				41,797,848	41,797,848	
25				41,797,848	41,797,848	
26				41,797,848	41,797,848	
27				41,797,848	41,797,848	
28				41,797,848	41,797,848	
29				41,797,848	41,797,848	
30				41,797,848	41,797,848	
31				41,797,848	41,797,848	
32				41,797,848	41,797,848	
33		-120,833,807	-35,516,875	41,797,848	-114,552,834	

NPV of Costs for Alternative I-b-2

Direct Cost				
1. Mohara WTP				
Civil Works-1	65,437,000	Plant	Civil Total	
Civil Works-2	377,828,630	Trans. Pipe.	443,265,630	
M&E Works	205,974,000			
2. Nasirabad Reservoir		Land Aq. Area	Unit Land Price	
Civil Works	48,707,000	3,000	5,600	
M&E Works	0	m2	Tk/m2	
3. New Battali Hill Reservoir				
Civil Works	122,529,000			
M&E Works	0			
4. Old Battali Hill Reservoir Rebuilt				
Civil Works	114,434,000			
M&E Works	0			
5. Distribution Pipes				
Civil Works	190,445,479			
M&E Works	0			
TOTAL	1,423,493,886	(including 25% OH & Profit)		
Civil Works	1,149,226,386	Land Cost	16,800,000	
M&E Works	257,467,500			

(unit: TAKA)

Year	CURRENT COST					NET PRESENT VALUE
	Initial Costs			O & M Costs	Total	
	Land	Civil Works	M&E Works			
1	16,800,000	383,075,462			399,875,462	1,595,867,518
2		383,075,462	51,493,500		434,568,962	7.5%
3		383,075,462	205,974,000		589,049,462	
4				37,719,795	37,719,795	
5				37,719,795	37,719,795	
6				37,719,795	37,719,795	
7				37,719,795	37,719,795	
8				37,719,795	37,719,795	
9				37,719,795	37,719,795	
10				37,719,795	37,719,795	
11				37,719,795	37,719,795	
12				37,719,795	37,719,795	
13				37,719,795	37,719,795	
14				37,719,795	37,719,795	
15				37,719,795	37,719,795	
16				37,719,795	37,719,795	
17				37,719,795	37,719,795	
18			102,987,000	37,719,795	140,706,795	
19				37,719,795	37,719,795	
20				37,719,795	37,719,795	
21				37,719,795	37,719,795	
22				37,719,795	37,719,795	
23				37,719,795	37,719,795	
24				37,719,795	37,719,795	
25				37,719,795	37,719,795	
26				37,719,795	37,719,795	
27				37,719,795	37,719,795	
28				37,719,795	37,719,795	
29				37,719,795	37,719,795	
30				37,719,795	37,719,795	
31				37,719,795	37,719,795	
32				37,719,795	37,719,795	
33		-114,922,639	-25,746,750	37,719,795	-102,949,594	

NPV of Costs for Alternative I-b-3

Direct Cost				
1. Mohara WTP				
Civil Works-1	65,437,000	Plant	Civil Total	
Civil Works-2	206,273,235	Trans. Pipe.	271,710,235	
M&E Works	183,837,000			
2. Nasirabad Reservoir		Land Aq. Area	Unit Land Price	
Civil Works	205,105,000	20,000	5,600	
M&E Works	192,969,000	m2	Tk/m2	
3. Distribution Pipes				
Civil Works	257,525,436			
M&E Works	0			
TOTAL	1,500,933,339	(including 25% OH & Profit)		
Civil Works	917,925,839	Land Cost	112,000,000	
M&E Works	471,007,500			

(unit: TAKA)

Year	CURRENT COST					NET PRESENT VALUE
	Initial Costs			O & M Costs	Total	
	Land	Civil Works	M&E Works			
1	112,000,000	305,975,280			417,975,280	1,770,885,595
2		305,975,280	94,201,500		400,176,780	7.5%
3		305,975,280	376,806,000		682,781,280	
4				47,090,955	47,090,955	
5				47,090,955	47,090,955	
6				47,090,955	47,090,955	
7				47,090,955	47,090,955	
8				47,090,955	47,090,955	
9				47,090,955	47,090,955	
10				47,090,955	47,090,955	
11				47,090,955	47,090,955	
12				47,090,955	47,090,955	
13				47,090,955	47,090,955	
14				47,090,955	47,090,955	
15				47,090,955	47,090,955	
16				47,090,955	47,090,955	
17				47,090,955	47,090,955	
18			188,403,000	47,090,955	235,493,955	
19				47,090,955	47,090,955	
20				47,090,955	47,090,955	
21				47,090,955	47,090,955	
22				47,090,955	47,090,955	
23				47,090,955	47,090,955	
24				47,090,955	47,090,955	
25				47,090,955	47,090,955	
26				47,090,955	47,090,955	
27				47,090,955	47,090,955	
28				47,090,955	47,090,955	
29				47,090,955	47,090,955	
30				47,090,955	47,090,955	
31				47,090,955	47,090,955	
32				47,090,955	47,090,955	
33		-91,792,584	-47,100,750	47,090,955	-91,802,379	

NPV of Costs for Alternative I-c-1

Direct Cost				
1. Mohara WTP				
Civil Works-1	65,437,000	Plant	Civil Total	
Civil Works-2	410,024,801	Trans. Pipe.	475,461,801	
M&E Works	155,910,000			
2. Nasirabad Reservoir		Land Aq. Area	Unit Land Price	
Civil Works	202,176,000	13,000	5,600	
M&E Works	246,977,000	m2	Tk/m2	
3. New Battali Hill Reservoir				
Civil Works	77,661,000			
M&E Works	0			
4. Distribution Pipes				
Civil Works	199,664,932			
M&E Works	0			
TOTAL	1,770,113,416	(including 25% OH & Profit)		
Civil Works	1,193,704,666	Land Cost	72,800,000	
M&E Works	503,608,750			

(unit: TAKA)

Year	CURRENT COST					NET PRESENT VALUE
	Initial Costs			O & M Costs	Total	
	Land	Civil Works	M&E Works			
1	72,800,000	397,901,555			470,701,555	1,964,616,815
2		397,901,555	100,721,750		498,623,305	7.5%
3		397,901,555	402,887,000		800,788,555	
4				43,282,248	43,282,248	
5				43,282,248	43,282,248	
6				43,282,248	43,282,248	
7				43,282,248	43,282,248	
8				43,282,248	43,282,248	
9				43,282,248	43,282,248	
10				43,282,248	43,282,248	
11				43,282,248	43,282,248	
12				43,282,248	43,282,248	
13				43,282,248	43,282,248	
14				43,282,248	43,282,248	
15				43,282,248	43,282,248	
16				43,282,248	43,282,248	
17				43,282,248	43,282,248	
18			201,443,500	43,282,248	244,725,748	
19				43,282,248	43,282,248	
20				43,282,248	43,282,248	
21				43,282,248	43,282,248	
22				43,282,248	43,282,248	
23				43,282,248	43,282,248	
24				43,282,248	43,282,248	
25				43,282,248	43,282,248	
26				43,282,248	43,282,248	
27				43,282,248	43,282,248	
28				43,282,248	43,282,248	
29				43,282,248	43,282,248	
30				43,282,248	43,282,248	
31				43,282,248	43,282,248	
32				43,282,248	43,282,248	
33		-119,370,467	-50,360,875	43,282,248	-126,449,094	

NPV of Costs for Alternative I-c-2

Direct Cost				
1. Mohara WTP				
Civil Works-1	65,437,000	Plant	Civil Total	
Civil Works-2	393,282,393	Trans. Pipe.	458,719,393	
M&E Works	205,974,000			
2. Nasirabad Reservoir		Land Aq. Area	Unit Land Price	
Civil Works	53,738,000	3,000	5,600	
M&E Works	0	m2	Tk/m2	
3. New Battali Hill Reservoir				
Civil Works	122,529,000			
M&E Works	0			
4. Old Battali Hill Reservoir Rebuilt				
Civil Works	122,816,000			
M&E Works	0			
5. Distribution Pipes				
Civil Works	198,208,092			
M&E Works	0			
TOTAL	1,469,280,606	(including 25% OH & Profit)		
Civil Works	1,195,013,106	Land Cost	16,800,000	
M&E Works	257,467,500			

(unit: TAKA)

Year	CURRENT COST					NET PRESENT VALUE
	Initial Costs			O & M Costs	Total	
	Land	Civil Works	M&E Works			
1	16,800,000	398,337,702			415,137,702	1,635,136,387
2		398,337,702	51,493,500		449,831,202	7.5%
3		398,337,702	205,974,000		604,311,702	
4				37,719,795	37,719,795	
5				37,719,795	37,719,795	
6				37,719,795	37,719,795	
7				37,719,795	37,719,795	
8				37,719,795	37,719,795	
9				37,719,795	37,719,795	
10				37,719,795	37,719,795	
11				37,719,795	37,719,795	
12				37,719,795	37,719,795	
13				37,719,795	37,719,795	
14				37,719,795	37,719,795	
15				37,719,795	37,719,795	
16				37,719,795	37,719,795	
17				37,719,795	37,719,795	
18			102,987,000	37,719,795	140,706,795	
19				37,719,795	37,719,795	
20				37,719,795	37,719,795	
21				37,719,795	37,719,795	
22				37,719,795	37,719,795	
23				37,719,795	37,719,795	
24				37,719,795	37,719,795	
25				37,719,795	37,719,795	
26				37,719,795	37,719,795	
27				37,719,795	37,719,795	
28				37,719,795	37,719,795	
29				37,719,795	37,719,795	
30				37,719,795	37,719,795	
31				37,719,795	37,719,795	
32				37,719,795	37,719,795	
33		-119,501,311	-25,746,750	37,719,795	-107,528,266	

NPV of Costs for Alternative II-b

Direct Cost				
1. Mohara WTP				
Civil Works-1	65,437,000	Plant	Civil Total	
Civil Works-2	396,245,787	Trans. Pipe.	461,682,787	
M&E Works	206,278,000			
2. New Battali Hill Reservoir				
Civil Works	160,368,000			
M&E Works	0			
3. Old Battali Hill Reservoir Rebuilt				
Civil Works	122,816,000			
M&E Works	0			
4. Distribution Pipes				
Civil Works	221,162,179			
M&E Works	0			
TOTAL	1,465,383,708	(including 25% OH & Profit)		
Civil Works	1,207,536,208	Land Cost	0	
M&E Works	257,847,500			

(unit: TAKA)

Year	CURRENT COST					NET PRESENT VALUE
	Initial Costs			O & M Costs	Total	
	Land	Civil Works	M&E Works			
1	0	402,512,069			402,512,069	1,640,460,432
2		402,512,069	51,569,500		454,081,569	7.5%
3		402,512,069	206,278,000		608,790,069	
4				38,757,275	38,757,275	
5				38,757,275	38,757,275	
6				38,757,275	38,757,275	
7				38,757,275	38,757,275	
8				38,757,275	38,757,275	
9				38,757,275	38,757,275	
10				38,757,275	38,757,275	
11				38,757,275	38,757,275	
12				38,757,275	38,757,275	
13				38,757,275	38,757,275	
14				38,757,275	38,757,275	
15				38,757,275	38,757,275	
16				38,757,275	38,757,275	
17				38,757,275	38,757,275	
18			103,139,000	38,757,275	141,896,275	
19				38,757,275	38,757,275	
20				38,757,275	38,757,275	
21				38,757,275	38,757,275	
22				38,757,275	38,757,275	
23				38,757,275	38,757,275	
24				38,757,275	38,757,275	
25				38,757,275	38,757,275	
26				38,757,275	38,757,275	
27				38,757,275	38,757,275	
28				38,757,275	38,757,275	
29				38,757,275	38,757,275	
30				38,757,275	38,757,275	
31				38,757,275	38,757,275	
32				38,757,275	38,757,275	
33		-120,753,621	-25,784,750	38,757,275	-107,781,096	

NPV of Costs for Alternative III-a-1

Direct Cost				
1. Mohara WTP				
Civil Works-1	112,018,000	Plant	Civil Total	
Civil Works-2	0	Trans. Pipe.	112,018,000	
M&E Works	342,981,667			
2. Distribution Pipes				
Civil Works	586,503,289			
M&E Works	0			
TOTAL	1,301,878,695	(including 25% OH & Profit)		
Civil Works	873,151,611	Land Cost	0	
M&E Works	428,727,084			

(unit: TAKA)

Year	CURRENT COST					NET PRESENT VALUE
	Initial Costs			O & M Costs	Total	
	Land	Civil Works	M&E Works			
1	0	291,050,537			291,050,537	1,477,424,744
2		291,050,537	85,745,417		376,795,954	7.5%
3		291,050,537	342,981,667		634,032,204	
4				35,297,671	35,297,671	
5				35,297,671	35,297,671	
6				35,297,671	35,297,671	
7				35,297,671	35,297,671	
8				35,297,671	35,297,671	
9				35,297,671	35,297,671	
10				35,297,671	35,297,671	
11				35,297,671	35,297,671	
12				35,297,671	35,297,671	
13				35,297,671	35,297,671	
14				35,297,671	35,297,671	
15				35,297,671	35,297,671	
16				35,297,671	35,297,671	
17				35,297,671	35,297,671	
18			171,490,834	35,297,671	206,788,505	
19				35,297,671	35,297,671	
20				35,297,671	35,297,671	
21				35,297,671	35,297,671	
22				35,297,671	35,297,671	
23				35,297,671	35,297,671	
24				35,297,671	35,297,671	
25				35,297,671	35,297,671	
26				35,297,671	35,297,671	
27				35,297,671	35,297,671	
28				35,297,671	35,297,671	
29				35,297,671	35,297,671	
30				35,297,671	35,297,671	
31				35,297,671	35,297,671	
32				35,297,671	35,297,671	
33		-87,315,161	-42,872,708	35,297,671	-94,890,199	

NPV of Costs for Alternative III-a-2

Direct Cost				
1. Mohara WTP				
Civil Works-1	120,109,000	Plant	Civil Total	
Civil Works-2	27,685,182	Trans. Pipe.	147,794,182	
M&E Works	294,444,000			
3. New Battali Hill Reservoir				
Civil Works	82,879,000			
M&E Works	0			
4. Distribution Pipes				
Civil Works	673,558,967			
M&E Works	0			
TOTAL	1,498,345,186	(including 25% OH & Profit)		
Civil Works	1,130,290,186	Land Cost	0	
M&E Works	368,055,000			

(unit: TAKA)

Year	CURRENT COST					NET PRESENT VALUE
	Initial Costs			O & M Costs	Total	
	Land	Civil Works	M&E Works			
1	0	376,763,395			376,763,395	1,656,229,465
2		376,763,395	73,611,000		450,374,395	7.5%
3		376,763,395	294,444,000		671,207,395	
4				36,758,310	36,758,310	
5				36,758,310	36,758,310	
6				36,758,310	36,758,310	
7				36,758,310	36,758,310	
8				36,758,310	36,758,310	
9				36,758,310	36,758,310	
10				36,758,310	36,758,310	
11				36,758,310	36,758,310	
12				36,758,310	36,758,310	
13				36,758,310	36,758,310	
14				36,758,310	36,758,310	
15				36,758,310	36,758,310	
16				36,758,310	36,758,310	
17				36,758,310	36,758,310	
18			147,222,000	36,758,310	183,980,310	
19				36,758,310	36,758,310	
20				36,758,310	36,758,310	
21				36,758,310	36,758,310	
22				36,758,310	36,758,310	
23				36,758,310	36,758,310	
24				36,758,310	36,758,310	
25				36,758,310	36,758,310	
26				36,758,310	36,758,310	
27				36,758,310	36,758,310	
28				36,758,310	36,758,310	
29				36,758,310	36,758,310	
30				36,758,310	36,758,310	
31				36,758,310	36,758,310	
32				36,758,310	36,758,310	
33		-113,029,019	-36,805,500	36,758,310	-113,076,209	

NPV of Costs for Alternative III-a-3

Direct Cost				
1. Mohara WTP				
Civil Works-1	119,760,000	Plant	Civil Total	
Civil Works-2	444,453,335	Trans. Pipe.	564,213,335	
M&E Works	333,110,000			
2. New Battali Hill Reservoir				
Civil Works	104,316,000			
M&E Works	0			
3. Distribution Pipes				
Civil Works	232,403,525			
M&E Works	0			
TOTAL	1,542,553,575	(including 25% OH & Profit)		
Civil Works	1,126,166,075	Land Cost	0	
M&E Works	416,387,500			

(unit: TAKA)

Year	CURRENT COST					NET PRESENT VALUE
	Initial Costs			O & M Costs	Total	
	Land	Civil Works	M&E Works			
1	0	375,388,692			375,388,692	1,754,002,972
2		375,388,692	83,277,500		458,666,192	7.5%
3		375,388,692	333,110,000		708,498,692	
4				42,754,595	42,754,595	
5				42,754,595	42,754,595	
6				42,754,595	42,754,595	
7				42,754,595	42,754,595	
8				42,754,595	42,754,595	
9				42,754,595	42,754,595	
10				42,754,595	42,754,595	
11				42,754,595	42,754,595	
12				42,754,595	42,754,595	
13				42,754,595	42,754,595	
14				42,754,595	42,754,595	
15				42,754,595	42,754,595	
16				42,754,595	42,754,595	
17				42,754,595	42,754,595	
18			166,555,000	42,754,595	209,309,595	
19				42,754,595	42,754,595	
20				42,754,595	42,754,595	
21				42,754,595	42,754,595	
22				42,754,595	42,754,595	
23				42,754,595	42,754,595	
24				42,754,595	42,754,595	
25				42,754,595	42,754,595	
26				42,754,595	42,754,595	
27				42,754,595	42,754,595	
28				42,754,595	42,754,595	
29				42,754,595	42,754,595	
30				42,754,595	42,754,595	
31				42,754,595	42,754,595	
32				42,754,595	42,754,595	
33		-112,616,608	-41,638,750	42,754,595	-111,500,763	

NPV of Costs for Alternative III-b

Direct Cost				
1. Mohara WTP				
Civil Works-1	65,437,000	Plant	Civil Total	
Civil Works-2	144,078,638	Trans. Pipe.	209,515,638	
M&E Works	160,408,000			
2. Nasirabad Reservoir		Land Aq. Area	Unit Land Price	
Civil Works	156,514,000	13,000	5,600	
M&E Works	175,020,000	m2	Tk/m2	
3. New Battali Hill Reservoir				
Civil Works	82,879,000			
M&E Works	0			
4. Distribution Pipes				
Civil Works	543,816,814			
M&E Works	0			
TOTAL	1,732,991,815	(including 25% OH & Profit)		
Civil Works	1,240,906,815	Land Cost	72,800,000	
M&E Works	419,285,000			

(unit: TAKA)

Year	CURRENT COST					NET PRESENT VALUE
	Initial Costs			O & M Costs	Total	
	Land	Civil Works	M&E Works			
1	72,800,000	413,635,605			486,435,605	1,919,786,809
2		413,635,605	83,857,000		497,492,605	7.5%
3		413,635,605	335,428,000		749,063,605	
4				42,439,010	42,439,010	
5				42,439,010	42,439,010	
6				42,439,010	42,439,010	
7				42,439,010	42,439,010	
8				42,439,010	42,439,010	
9				42,439,010	42,439,010	
10				42,439,010	42,439,010	
11				42,439,010	42,439,010	
12				42,439,010	42,439,010	
13				42,439,010	42,439,010	
14				42,439,010	42,439,010	
15				42,439,010	42,439,010	
16				42,439,010	42,439,010	
17				42,439,010	42,439,010	
18			167,714,000	42,439,010	210,153,010	
19				42,439,010	42,439,010	
20				42,439,010	42,439,010	
21				42,439,010	42,439,010	
22				42,439,010	42,439,010	
23				42,439,010	42,439,010	
24				42,439,010	42,439,010	
25				42,439,010	42,439,010	
26				42,439,010	42,439,010	
27				42,439,010	42,439,010	
28				42,439,010	42,439,010	
29				42,439,010	42,439,010	
30				42,439,010	42,439,010	
31				42,439,010	42,439,010	
32				42,439,010	42,439,010	
33		-124,090,682	-41,928,500	42,439,010	-123,580,172	

Case I －a　Khulushi Reservoir　　Unit : Taka

No.		Name of Facility	Item	Dimension	Unit	Unit Cost	Quantity	Price	Note	E&M	Civil
1	Mohara WTP										
	1-1	Clear Well	Civil Work	6.716 m3	L.S.		1	53,290,000			53,290,000
			Mechanical & Electrical Cost		L.S.		1	9,561,000		9,561,000	
	1-2	Transmission Pump House	Civil Work		L.S.		1	12,147,000			12,147,000
	1-3	Transmission Pump	Mechanical & Electrical Cos	15.8m3/min ×84.m ×4 (+1)	L.S.		1	98,706,000		98,706,000	
	1-4	Power Receiving Facility		3,000 KVA	L.S.		1	19,296,000		19,296,000	
	1-5	Generator		1,500 KVA ×2	L.S.		1	79,608,000		79,608,000	
	1-6	Transmission Pipe		DIP900mmT	m	18,924	15,045	284,713,837			284,713,837
		Sub Total						557,321,837	¥1,476,902,867	207,171,000	350,150,837
2	Khulushi Reservoir										
	2-1	Distribution Reservoir	Ground Reservoir	16,200 m3	L.S.		1	83,268,000			83,268,000
			Elevated Tank	dia18m ×7mD ×16mH	L.S.		1	22,052,000			22,052,000
			Lift Pump	13.1m3/min ×25m ×3 (+1)	L.S.		1	65,794,000		65,794,000	
			Pump House		L.S.		1	4,240,000			4,240,000
			Power Receiving Facility	500 KVA	L.S.		1	4,393,000		4,393,000	
			Generator	250 KVA ×2	L.S.		1	22,555,000		22,555,000	
			Administration Building		L.S.		1	1,779,000			1,779,000
			Inplant Piping		L.S.		1	30,836,000			30,836,000
			Earth Work		L.S.		1	18,230,000			18,230,000
			Road Work		L.S.		1	8,123,000			8,123,000
			Lighting		L.S.		1	1,064,000			1,064,000
		Sub Total						262,334,000	¥695,185,100	92,742,000	169,592,000
3	Distribution Pipe										
	3-1	Distribution Pipes		DIP1000mmD	m	23,472	1,140	26,757,852			26,757,852
				DIP900mmD	m	19,825	910	18,041,023			18,041,023
				DIP800mmD	m	16,587	2,875	47,687,338			47,687,338
				DIP700mmD	m	13,651	200	2,730,200			2,730,200
				DIP600mmD	m	11,570	985	11,396,253			11,396,253
				DIP500mmD	m	9,085	3,513	31,915,254			31,915,254
				DIP450mmD	m	7,931	810	6,424,110			6,424,110
				DIP400mmD	m	6,918	0	0			0
				DIP350mmD	m	6,076	420	2,552,088			2,552,088
				DIP300mmD	m	5,235	3,225	16,882,553			16,882,553
				PVC250mmD	m	6,477	4,065	26,328,192			26,328,192
				PVC200mmD	m	4,629	2,840	13,147,428			13,147,428
		Sub Total					20,983	203,862,290	¥540,235,069	0	203,862,290
		Total (Direct Construction Cost)						1,023,518,127	¥2,712,323,036	299,913,000	723,605,127
4	Overhead & Profit etc.		25% of Direct Construction Cost		L.S.		1	255,879,532		74,978,250	180,901,282
	Grand Total							1,279,397,659	¥2,712,323,036	374,891,250	904,506,409

Case I −b−1 New Battali and Nasirabad Reservoir

Unit : Taka

No.		Name of Facility	Item	Dimension	Unit	Unit Cost	Quantity	Price	Note	E&M	Civil
1	Mohara WTP										
	1-1	Clear Well	Civil Work	6,716 m3	L.S.		1	53,290,000			53,290,000
			Mechanical & Electrical Cost		L.S.		1	9,561,000		9,561,000	
	1-2	Transmission Pump House	Civil Work		L.S.		1	12,147,000			12,147,000
	1-3	Transmission Pump	Mechanical & Electrical Cos	15.8m3/min ×80.m ×4 (+1)	L.S.		1	97,509,000		97,509,000	
	1-4	Power Receiving Facility	Mechanical & Electrical Cos	3,900 KVA	L.S.		1	19,296,000		19,296,000	
	1-5	Generator	Mechanical & Electrical Cos	1,500 KVA ×2	L.S.		1	79,608,000		79,608,000	
	1-4	Transmission Pipe		DIP1000mmT	m	22,405	10,400	233,010,960			233,010,960
				DIP900mmT	m	18,924	5,180	98,027,097			98,027,097
				DIP900mmT	m	28,386	580	16,464,011	near Battali Hill Reservoir		16,464,011
				DIP400mmT	m	6,603	500	3,301,725			3,301,725
			Reinstallation	DIP900mmR	m	26,401	580	15,312,696	near Battali Hill Reservoir		15,312,696
			Reinstallation ACP to DIP	DIP600mmT	m	22,088	370	8,172,486	near Battali Hill Reservoir		8,172,486
			Transmission Route Rehabilitation		L.S.		1	4,200,000	Stair & Retaining Wall		4,200,000
		Sub Total						649,899,975	¥1,722,234,932	205,974,000	443,925,975
2	Nasirabad Reservoir										
	2-1	Distribution Reservoir	Ground Reservoir	4,800 m3	L.S.		1	38,087,000			38,087,000
			Elevated Tank	dia15m ×6mD ×18mH	L.S.		1	19,767,000			19,767,000
			Lift Pump	7.8m3/min ×23m ×3 (+1)	L.S.		1	56,603,000		56,603,000	
			Pump House		L.S.		1	3,994,000			3,994,000
			Power Receiving Facility	400 KVA	L.S.		1	3,514,000		3,514,000	
			Generator	200 KVA ×2	L.S.		1	18,044,000		18,044,000	
			Administration Building		L.S.		1	1,779,000			1,779,000
			Inplant Piping		L.S.		1	16,785,000			16,785,000
			Earth Work		L.S.		1	9,923,000			9,923,000
			Road Work		L.S.		1	4,422,000			4,422,000
			Lighting		L.S.		1	579,000			579,000
		Sub Total						173,497,000	¥459,767,050	78,161,000	95,336,000
3	New Battali Reservoir										
	3-1	Distribution Reservoir	Ground Reservoir 4 Basin	13,200 m3	L.S.		1	67,848,000			67,848,000
			Inplant Piping		L.S.		1	22,979,000			22,979,000
			Earth Work		L.S.		1	16,456,000			16,456,000
			Road Work		L.S.		1	3,666,000			3,666,000
			Lighting		L.S.		1	480,000			480,000
			Retaining Wall		L.S.		1	11,100,000			11,100,000
		Sub Total						122,529,000	¥324,701,850	0	122,529,000
4	Old Battali Reservoir Rebuilt										
	4-1	Distribution Reservoir	Ground Reservoir	13,700 m3	L.S.		1	70,418,000	Rebuilt		70,418,000
			Inplant Piping		L.S.		1	23,410,000			23,410,000
			Earth Work		L.S.		1	8,382,000			8,382,000
			Road Work		L.S.		1	3,735,000			3,735,000
			Lighting		L.S.		1	489,000			489,000
			Demolition Cost		L.S.		1	8,000,000			8,000,000
		Sub Total						114,434,000	¥303,250,100	0	114,434,000
5	Distribution Pipe										
	5-1	Distribution Pipes		DIP1000mmD	m	35,208	370	13,026,849	near Battali Hill Reservoir		13,026,849
				DIP1000mmD	m	23,472	80	1,877,744			1,877,744
				DIP900mmD	m	19,825	0	0			0
				DIP800mmD	m	16,587	3,410	56,561,329			56,561,329
				DIP700mmD	m	13,651	1,000	13,651,000			13,651,000
				DIP600mmD	m	11,570	2,475	28,635,255			28,635,255
				DIP500mmD	m	9,085	3,670	33,341,583			33,341,583
				DIP450mmD	m	7,931	1,545	12,253,395			12,253,395
				DIP400mmD	m	6,918	600	4,150,740			4,150,740
				DIP350mmD	m	6,076	420	2,552,088			2,552,088
				DIP300mmD	m	5,235	2,270	11,883,223			11,883,223
				PVC250mmD	m	6,477	1,285	8,322,688			8,322,688
				PVC200mmD	m	4,629	905	4,189,585			4,189,585
		Sub Total					18,030	190,445,479	¥504,680,521	0	190,445,479
		Total (Direct Construction Cost)						1,250,805,454	¥3,314,634,453	284,135,000	966,670,454
6	Overhead & Profit etc.		25% of Direct Construction Cost		L.S.		1	312,701,363		71,033,750	241,667,613
										0	0
	Grand Total							1,563,506,817	¥3,314,634,453	355,168,750	1,208,338,067

Case I －b－2 New Battali and Nasirabad Reservoir

Unit : Taka

No.		Name of Facility	Item	Dimension	Unit	Unit Cost	Quantity	Price	Note	E&M	Civil
1	Mohara WTP										
	1-1	Clear Well	Civil Work	6,716 m3	L.S.		1	53,290,000			53,290,000
			Mechanical & Electrical Cost		L.S.		1	9,561,000		9,561,000	
	1-2	Transmission Pump House	Civil Work		L.S.		1	12,147,000			12,147,000
	1-3	Transmission Pump	Mechanical & Electrical Cos	15.8m3/min ×80.m ×4 (+1)	L.S.		1	97,509,000		97,509,000	
	1-4	Power Receiving Facility		3,000 KVA	L.S.		1	19,296,000		19,296,000	
	1-5	Generator		1,500 KVA ×2	L.S.		1	79,608,000		79,608,000	
	1-4	Transmission Pipe		DIP1000mmT	m	22,405	10,400	233,010,960			233,010,960
				DIP900mmT	m	18,924	5,180	98,027,097			98,027,097
				DIP900mmT	m	28,386	580	16,464,011	near Battali Hill Reservoir		16,464,011
				DIP400mmT	m	6,603	400	2,641,380			2,641,380
			Reinstallation	DIP900mmT	m	26,401	580	15,312,696	near Battali Hill Reservoir		15,312,696
			Reinstallation ACP to DIP	DIP600mmT	m	22,088	370	8,172,486	near Battali Hill Reservoir		8,172,486
			Transmission Route Rehabilitation		L.S.		1	4,200,000	Stair & Retaining Wall		4,200,000
		Sub Total						649,239,630	¥1.720,485,018	205,974,000	443,265,630
2	Nasirabad Reservoir										
	2-1	Distribution Reservoir	Elevated Tank	dia24m ×9mD ×18mH	L.S.		1	30,624,000			30,624,000
			Inplant Piping		L.S.		1	8,134,000			8,134,000
			Earth Work		L.S.		1	6,615,000			6,615,000
			Road Work		L.S.		1	2,948,000			2,948,000
			Lighting		L.S.		1	386,000			386,000
		Sub Total						48,707,000	¥129,073,550	0	48,707,000
3	New Battali Reservoir										
	3-1	Distribution Reservoir	Ground Reservoir 4 Basin	13,200 m3	L.S.		1	67,848,000			67,848,000
			Inplant Piping		L.S.		1	22,979,000			22,979,000
			Earth Work		L.S.		1	16,456,000			16,456,000
			Road Work		L.S.		1	3,666,000			3,666,000
			Lighting		L.S.		1	480,000			480,000
			Retaining Wall		L.S.		1	11,100,000			11,100,000
		Sub Total						122,529,000	¥324,701,850	0	122,529,000
4	Old Battali Reservoir Rebuilt										
	4-1	Distribution Reservoir	Ground Reservoir	13,700 m3	L.S.		1	70,418,000	Rebuilt		70,418,000
			Inplant Piping		L.S.		1	23,410,000			23,410,000
			Earth Work		L.S.		1	8,382,000			8,382,000
			Road Work		L.S.		1	3,735,000			3,735,000
			Lighting		L.S.		1	489,000			489,000
			Demolition Cost		L.S.		1	8,000,000			8,000,000
		Sub Total						114,434,000	¥303,250,100	0	114,434,000
5	Distribution Pipe										
	5-1	Distribution Pipes		DIP1000mmD	m	35,208	370	13,026,849	near Battali Hill Reservoir		13,026,849
				DIP1000mmD	m	23,472	80	1,877,744			1,877,744
				DIP900mmD	m	19,825	0	0			0
				DIP800mmD	m	16,587	3,410	56,561,329			56,561,329
				DIP700mmD	m	13,651	1,000	13,651,000			13,651,000
				DIP600mmD	m	11,570	2,475	28,635,255			28,635,255
				DIP500mmD	m	9,085	3,670	33,341,583			33,341,583
				DIP450mmD	m	7,931	1,545	12,253,395			12,253,395
				DIP400mmD	m	6,918	600	4,150,740			4,150,740
				DIP350mmD	m	6,076	420	2,552,088			2,552,088
				DIP300mmD	m	5,235	2,270	11,883,223			11,883,223
				PVC250mmD	m	6,477	1,285	8,322,688			8,322,688
				PVC200mmD	m	4,629	905	4,189,585			4,189,585
		Sub Total					18,030	190,445,479	¥504,680,521	0	190,445,479
		Total (Direct Construction Cost)						1,125,355,109	¥2,982,191,039	205,974,000	919,381,109
6	Overhead & Profit etc.		25% of Direct Construction Cost		L.S.		1	281,338,777		51,493,500	229,845,277
	Grand Total							1,406,693,886	¥2,982,191,039	257,467,500	1,149,226,386

Case I -b-3 Nasirabad Reservoir

Unit : Taka

No		Name of Facility	Item	Dimension	Unit	Unit Cost	Quantity	Price	Note	E&M	Civil
1	Mohara WTP										
	1-1	Clear Well	Civil Work	6,716 m3	L.S.		1	53,290,000			53,290,000
			Mechanical & Electrical Cost		L.S.		1	9,561,000		9,561,000	
	1-2	Transmission Pump House	Civil Work		L.S.		1	12,147,000			12,147,000
	1-3	Transmission Pump	Mechanical & Electrical Cost	15.8m3/min ×63.m ×4 (+1)	L.S.		1	91,856,000		91,856,000	
	1-4	Power Receiving Facility	Mechanical & Electrical Cos	2,500 KVA	L.S.		1	16,080,000		16,080,000	
	1-5	Generator	Mechanical & Electrical Cos	1,250 KVA ×2	L.S.		1	66,340,000		66,340,000	
	1-4	Transmission Pipe		DIP900mmT	m	18,924	10,900	206,273,235			206,273,235
		Sub Total						455,547,235	¥1,207,200,173	183,837,000	271,710,235
2	Nasirabad Reservoir										
	2-1	Distribution Reservoir	Ground Reservoir	19,500 m3	L.S.		1	100,230,000			100,230,000
			Elevated Tank	dia22m ×8mD ×23mH	L.S.		1	31,247,000			31,247,000
			Lift Pump	31.2m3/min ×31m ×3 (+1)	L.S.		1	112,126,000		112,126,000	
			Pump House		L.S.		1	9,275,000			9,275,000
			Power Receiving Facility	1,500 KVA	L.S.		1	13,178,000		13,178,000	
			Generator	750 KVA ×2	L.S.		1	67,665,000		67,665,000	
			Administration Building		L.S.		1	1,779,000			1,779,000
			Inplant Piping		L.S.		1	32,494,000			32,494,000
			Earth Work		L.S.		1	20,001,000			20,001,000
			Road Work		L.S.		1	8,912,000			8,912,000
			Lighting		L.S.		1	1,167,000			1,167,000
		Sub Total						398,074,000	¥1,054,896,100	192,969,000	205,105,000
3	Distribution Pipe										
	3-1	Distribution Pipes		DIP1100mmD	m	26,542	4,050	107,494,695			107,494,695
				DIP1000mmD	m	23,472	0	0			0
				DIP900mmD	m	19,825	1,980	39,254,094			39,254,094
				DIP800mmD	m	16,587	1,820	30,188,158			30,188,158
				DIP700mmD	m	13,651	1,700	23,206,700			23,206,700
				DIP600mmD	m	11,570	0	0			0
				DIP500mmD	m	9,085	2,010	18,260,649			18,260,649
				DIP450mmD	m	7,931	1,900	15,068,900			15,068,900
				DIP400mmD	m	6,918	600	4,150,740			4,150,740
				DIP350mmD	m	6,076	440	2,673,616			2,673,616
				DIP300mmD	m	5,235	1,910	9,998,659			9,998,659
				PVC250mmD	m	6,477	430	2,785,024			2,785,024
				PVC200mmD	m	4,629	960	4,444,201			4,444,201
		Sub Total					17,800	257,525,436	¥682,442,406	0	257,525,436
		Total (Direct Construction Cost)						1,111,146,671	¥2,944,538,679	376,806,000	734,340,671
5	Overhead & Profit etc.		25% of Direct Construction Cost		L.S.		1	277,786,668		94,201,500	183,585,168
	Grand Total							1,388,933,339	¥2,944,538,679	471,007,500	917,925,839

Case Ⅰ－c－1　Nasirabad Reservoir and New Battali Reservoir

Unit : Taka

No.		Name of Facility	Item	Dimension	Unit	Unit Cost	Quantity	Price	Note	E&M	Civil
1	Mohara WTP										
	1-1	Clear Well	Civil Work	6,716 m3	L.S.		1	53,290,000			53,290,000
			Mechanical & Electrical Cost		L.S.		1	9,561,000		9,561,000	
	1-2	Transmission Pump House	Civil Work		L.S.		1	12,147,000			12,147,000
	1-3	Transmission Pump	Mechanical & Electrical Cost	15.8m3/min ×37.m ×4 (+1)	L.S.		1	80,413,000		80,413,000	
	1-4	Power Receiving Facility	Mechanical & Electrical Cost	2,000 KVA	L.S.		1	12,864,000		12,864,000	
	1-5	Generator	Mechanical & Electrical Cost	1,000 KVA ×2	L.S.		1	53,072,000		53,072,000	
	1-6	Transmission Pipe		DIP1000mmT	m	22,405	12,255	274,572,050	Mohara WTP to Nasirabad Re.		274,572,050
				DIP1000mmT	m	22,405	3,940	88,275,306	Nasirabad Re. to Battali Hill Re.		88,275,306
				DIP1000mmT	m	33,607	580	19,492,263	near Battali Hill Reservoir		19,492,263
			Reinstallation	DIP900mmT	m	26,401	580	15,312,696	near Battali Hill Reservoir		15,312,696
			Reinstallation ACP to DIP	DIP600mmT	m	22,088	370	8,172,486	near Battali Hill Reservoir		8,172,486
			Transmission Route Rehabilitation		L.S.		1	4,200,000	Stair & Retaining Wall		4,200,000
		Sub Total						631,371,801	¥1,673,135,271	155,910,000	475,461,801
2	Nasirabad Reservoir										
	2-1	Distribution Reservoir	Ground Reservoir	19,200 m3	L.S.		1	98,688,000			98,688,000
			Elevated Tank	dia15m ×6mD ×27.4mH	L.S.		1	24,389,000			24,389,000
			Lift Pump	7.8m3/min ×35m ×3 (+1)	L.S.		1	62,867,000	to Elevated Tank	62,867,000	
			Lift Pump	23.4m3/min ×51m ×3 (+1)	L.S.		1	118,174,000	to Battali Hill New Reservoir	118,174,000	
			Pump House		L.S.		1	15,230,000			15,230,000
			Power Receiving Facility	2,000 KVA	L.S.		1	12,864,000		12,864,000	
			Generator	1,000 KVA ×2	L.S.		1	53,072,000		53,072,000	
			Administration Building		L.S.		1	1,779,000			1,779,000
			Inplant Piping		L.S.		1	32,243,000			32,243,000
			Earth Work		L.S.		1	19,846,000			19,846,000
			Road Work		L.S.		1	8,843,000			8,843,000
			Lighting		L.S.		1	1,158,000			1,158,000
		Sub Total						449,153,000	¥1,190,255,450	246,977,000	202,176,000
3	New Ballali Reservoir										
	3-1	Distribution Reservoir	Ground Reservoir	3,250 m3	L.S.		1	25,788,000			25,788,000
			Inplant Piping		L.S.		1	20,327,000			20,327,000
			Earth Work		L.S.		1	16,331,000			16,331,000
			Road Work		L.S.		1	3,638,000			3,638,000
			Lighting		L.S.		1	477,000			477,000
			Retaining Wall		L.S.		1	11,100,000			11,100,000
		Sub Total						77,661,000	¥205,801,650	0	77,661,000
4	Distribution Pipe										
	4-1	Distribution Pipes		DIP1000mmD	m	35,208	370	13,026,849	near Battali Hill Reservoir		13,026,849
				DIP1000mmD	m	23,472	80	1,877,744			1,877,744
				DIP900mmD	m	19,825	0	0			0
				DIP800mmD	m	16,587	3,410	56,561,329			56,561,329
				DIP700mmD	m	13,651	1,700	23,206,700			23,206,700
				DIP600mmD	m	11,570	1,875	21,693,375			21,693,375
				DIP500mmD	m	9,085	1,990	18,078,951			18,078,951
				DIP450mmD	m	7,931	700	5,551,700			5,551,700
				DIP400mmD	m	6,918	600	4,150,740			4,150,740
				DIP350mmD	m	6,076	4,565	27,738,766			27,738,766
				DIP300mmD	m	5,235	2,685	14,055,707			14,055,707
				PVC250mmD	m	6,477	700	4,533,760			4,533,760
				PVC200mmD	m	4,629	1,985	9,189,312			9,189,312
		Sub Total					20,660	199,664,932	¥529,112,070	0	199,664,932
		Total (Direct Construction Cost)						1,357,850,733	¥3,598,304,442	402,887,000	954,963,733
5	Overhead & Profit etc.		25% of Direct Construction Cost		L.S.		1	339,462,683		100,721,750	238,740,933
	Grand Total							1,697,313,416	¥3,598,304,442	503,608,750	1,193,704,666

Case I －c－2 New Battali and Nasirabad Reservoir

Unit : Taka

No.		Name of Facility	Item	Dimension	Unit	Unit Cost	Quantity	Price	Note	E&M	Civil
1	Mohara WTP										
	1-1	Clear Well	Civil Work	6,716 m3	L.S.		1	53,290,000			53,290,000
			Mechanical & Electrical Cost		L.S.		1	9,561,000		9,561,000	
	1-2	Transmission Pump House	Civil Work		L.S.		1	12,147,000			12,147,000
	1-3	Transmission Pump	Mechanical & Electrical Cos	15.8m3/min ×80.m ×4 (+1)	L.S.		1	97,509,000		97,509,000	
	1-4	Power Receiving Facility		3,000 KVA	L.S.		1	19,296,000		19,296,000	
	1-5	Generator		1,500 KVA ×2	L.S.		1	79,608,000		79,608,000	
	1-4	Transmission Pipe		DIP1000mmT	m	22,405	12,255	274,572,050			274,572,050
				DIP900mmT	m	18,924	3,940	74,561,151			74,561,151
				DIP900mmT	m	28,386	580	16,464,011	near Battali Hill Reservoir		16,464,011
			Reinstallation	DIP900mmT	m	26,401	580	15,312,696	near Battali Hill Reservoir		15,312,696
			Reinstallation ACP to DIP	DIP600mmT	m	22,088	370	8,172,486	near Battali Hill Reservoir		8,172,486
			Transmission Route Rehabilitation		L.S.		1	4,200,000	Stair & Retaining Wall		4,200,000
		Sub Total						664,693,393	¥1,761,437,491	205,974,000	458,719,393
2	Nasirabad Reservoir										
	2-1	Distribution Reservoir	Elevated Tank	dia24m ×9mD ×24.4mH	L.S.		1	35,655,000			35,655,000
			Inplant Piping		L.S.		1	8,134,000			8,134,000
			Earth Work		L.S.		1	6,615,000			6,615,000
			Road Work		L.S.		1	2,948,000			2,948,000
			Lighting		L.S.		1	386,000			386,000
		Sub Total						53,738,000	¥142,405,700	0	53,738,000
3	New Battali Reservoir										
	3-1	Distribution Reservoir	Ground Reservoir 4 Basin	13,200 m3	L.S.		1	67,848,000			67,848,000
			Inplant Piping		L.S.		1	22,979,000			22,979,000
			Earth Work		L.S.		1	16,456,000			16,456,000
			Road Work		L.S.		1	3,666,000			3,666,000
			Lighting		L.S.		1	480,000			480,000
			Retaining Wall		L.S.		1	11,100,000			11,100,000
		Sub Total						122,529,000	¥324,701,850	0	122,529,000
4	Old Battali Reservoir Rebuilt										
	4-1	Distribution Reservoir	Ground Reservoir	13,700 m3	L.S.		1	70,418,000	Rebuilt		70,418,000
			Inplant Piping		L.S.		1	23,410,000			23,410,000
			Earth Work		L.S.		1	16,764,000			16,764,000
			Road Work		L.S.		1	3,735,000			3,735,000
			Lighting		L.S.		1	489,000			489,000
			Demolition Cost		L.S.		1	8,000,000			8,000,000
		Sub Total						122,816,000	¥325,462,400	0	122,816,000
5	Distribution Pipe										
	5-1	Distribution Pipes		DIP1000mmD	m	35,208	370	13,026,849	near Battali Hill Reservoir		13,026,849
				DIP1000mmD	m	23,472	80	1,877,744			1,877,744
				DIP900mmD	m	19,825	0	0			0
				DIP800mmD	m	16,587	3,410	56,561,329			56,561,329
				DIP700mmD	m	13,651	1,000	13,651,000			13,651,000
				DIP600mmD	m	11,570	2,575	29,792,235			29,792,235
				DIP500mmD	m	9,085	1,990	18,078,951			18,078,951
				DIP450mmD	m	7,931	700	5,551,700			5,551,700
				DIP400mmD	m	6,918	600	4,150,740			4,150,740
				DIP350mmD	m	6,076	4,565	27,738,766			27,738,766
				DIP300mmD	m	5,235	2,685	14,055,707			14,055,707
				PVC250mmD	m	6,477	700	4,533,760			4,533,760
				PVC200mmD	m	4,629	1,985	9,189,312			9,189,312
		Sub Total					20,660	198,208,092	¥525,251,444	0	198,208,092
		Total (Direct Construction Cost)						1,161,984,485	¥3,079,258,886	205,974,000	956,010,485
6	Overhead & Profit etc.		25% of Direct Construction Cost		L.S.		1	290,496,121		51,493,500	239,002,621
	Grand Total							1,452,480,607	¥3,079,258,886	257,467,500	1,195,013,107

Case II －b　New Battali Reservoir　　Unit : Taka

No.		Name of Facility	Item	Dimension	Unit	Unit Cost	Quantity	Price	Note	E&M	Civil
1	Mohara WTP										
	1-1	Clear Well	Civil Work	6,716 m3	L.S.		1	53,290,000			53,290,000
			Mechanical & Electrical Cost		L.S.		1	9,561,000		9,561,000	
	1-2	Transmission Pump House	Civil Work		L.S.		1	12,147,000			12,147,000
	1-3	Transmission Pump	Mechanical & Electrical Cos	15.8m3/min ×81.m ×4 (+1)	L.S.		1	97,813,000		97,813,000	
	1-4	Power Receiving Facility	Mechanical & Electrical Cos	3,000 KVA	L.S.		1	19,296,000		19,296,000	
	1-5	Generator	Mechanical & Electrical Cos	1,500 KVA ×2	L.S.		1	79,608,000		79,608,000	
	1-4	Transmission Pipe		DIP1000mmT	m	22,405	15,580	349,068,342			349,068,342
	1-4	Transmission Pipe		DIP1000mmT	m	33,607	580	19,492,263	near Battali Hill Reservoir		19,492,263
			Reinstallation	DIP900mmT	m	26,401	580	15,312,696	near Battali Hill Reservoir		15,312,696
			Reinstallation ACP to DIP	DIP600mmT	m	22,088	370	8,172,486	near Battali Hill Reservoir		8,172,486
			Transmission Route Rehabilitation		L.S.		1	4,200,000	Stair & Retaining Wall		4,200,000
		Sub Total						667,960,787	¥1,770,096,086	206,278,000	461,682,787
2	New Battali Reservoir										
	2-1	Distribution Reservoir	Ground Reservoir	19,360 m3	L.S.		1	99,511,000			99,511,000
			Inplant Piping		L.S.		1	24,806,000			24,806,000
			Earth Work		L.S.		1	19,929,000			19,929,000
			Road Work		L.S.		1	4,440,000			4,440,000
			Lighting		L.S.		1	582,000			582,000
			Retaining Wall		L.S.		1	11,100,000			11,100,000
		Sub Total						160,368,000	¥424,975,200	0	160,368,000
3	Old Battali Reservoir Rebuilt										
	3-1	Distribution Reservoir	Ground Reservoir	13,700 m3	L.S.		1	70,418,000	Rebuilt		70,418,000
			Inplant Piping		L.S.		1	23,410,000			23,410,000
			Earth Work		L.S.		1	16,764,000			16,764,000
			Road Work		L.S.		1	3,735,000			3,735,000
			Lighting		L.S.		1	489,000			489,000
			Demolition Cost		L.S.		1	8,000,000			8,000,000
		Sub Total						122,816,000	¥325,462,400	0	122,816,000
4	Distribution Pipe										
	4-1	Distribution Pipes		DIP1100mmD	m	39,813	370	14,730,755	near Battali Hill Reservoir		14,730,755
				DIP1100mmD	m	26,542	80	2,123,352			2,123,352
				DIP1000mmD	m	23,472	0	0			0
				DIP900mmD	m	19,825	0	0			0
				DIP800mmD	m	16,587	4,785	79,368,317			79,368,317
				DIP700mmD	m	13,651	2,595	35,424,345			35,424,345
				DIP600mmD	m	11,570	0	0			0
				DIP500mmD	m	9,085	2,005	18,215,225			18,215,225
				DIP450mmD	m	7,931	1,810	14,355,110			14,355,110
				DIP400mmD	m	6,918	600	4,150,740			4,150,740
				DIP350mmD	m	6,076	4,065	24,700,566			24,700,566
				DIP300mmD	m	5,235	3,485	18,243,627			18,243,627
				PVC250mmD	m	6,477	270	1,748,736			1,748,736
				PVC200mmD	m	4,629	1,750	8,101,408			8,101,408
		Sub Total					21,815	221,162,179	¥586,079,775	0	221,162,179
		Total (Direct Construction Cost)						1,172,306,966	¥3,106,613,461	206,278,000	966,028,966
5	Overhead & Profit etc.		25% of Direct Construction Cost		L.S.		1	293,076,742		51,569,500	241,507,242
	Grand Total							1,465,383,708	¥3,106,613,461	257,847,500	1,207,536,208

Case Ⅲ-a-1 Nasirabad Reservoir and New Battali Reservoir Unit : Taka

No.		Name of Facility	Item	Dimension	Unit	Unit Cost	Quantity	Price	Note	E&M	Civil
1	Mohara WTP										
	1-1	Clear Water Reservoir	Civil Work	17,280 m3	L.S.		1	88,820,000			88,820,000
			Mechanical & Electrical Cost		L.S.		1	9,361,000		9,361,000	
	1-2	Distribution Pump House	Civil Work		L.S.		1	18,036,000			18,036,000
	1-3	Inplant Piping		DIP1200mmTP	m	25,810	200	5,162,000	Connection Pipe of Clearwell to LPS		5,162,000
	1-4	Distribution Pump	Mechanical & Electrical Cost	18.m3/min ×61.m ×2	L.S.		1	75,310,000	1 Pump Flow Control	75,310,000	
	1-5	Distribution Pump	Mechanical & Electrical Cost	30.m3/min ×61.m ×2 (+1)	L.S.		1	111,238,667	1 Pump Flow Control	111,238,667	
	1-5	Pump Control Facilities	Mechanical & Electrical Cost		L.S.		1	15,000,000		15,000,000	
	1-6	Power Receiving Facility	Mechanical & Electrical Cost	4,000 KVA	L.S.		1	25,728,000		25,728,000	
	1-7	Generator	Mechanical & Electrical Cost	2,000 KVA ×2	L.S.		1	106,144,000		106,144,000	
		Sub Total						454,999,667	¥1,205,749,117	342,981,667	112,018,000
2	Distribution Pipe										
	2-1	Distribution Pipes		DIP1400mmD	m	40,800	0	0			0
				DIP1200mmD	m	31,495	12,140	382,351,728			382,351,728
				DIP1100mmD	m	26,542	1,910	50,695,029			50,695,029
				DIP1000mmD	m	23,472	1,980	46,474,164			46,474,164
				DIP900mmD	m	19,825	1,820	36,082,046			36,082,046
				DIP800mmD	m	16,587	1,700	28,197,730			28,197,730
				DIP700mmD	m	13,651	0	0			0
				DIP600mmD	m	11,570	0	0			0
				DIP500mmD	m	9,085	2,480	22,530,552			22,530,552
				DIP450mmD	m	7,931	825	6,543,075			6,543,075
				DIP400mmD	m	6,918	0	0			0
				DIP350mmD	m	6,076	420	2,552,088			2,552,088
				DIP300mmD	m	5,235	735	3,847,652			3,847,652
				PVC250mmD	m	6,477	430	2,785,024			2,785,024
				PVC200mmD	m	4,629	960	4,444,201			4,444,201
		Sub Total					25,400	586,503,289	¥1,554,233,715	0	586,503,289
		Total (Direct Construction Cost)						1,041,502,955	¥2,759,982,832	342,981,667	698,521,289
5	Overhead & Profit etc.		25% of Direct Construction Cost		L.S.		1	260,375,739		85,745,417	174,630,322
	Grand Total							1,301,878,694	¥2,759,982,832	428,727,083	873,151,611

Case Ⅲ－a－2　New Battali Reservoir　　Unit : Taka

No.		Name of Facility	Item	Dimension	Unit	Unit Cost	Quantity	Price	Note	E&M	Civil
1	Mohara WTP										
	1-1	Clear Well	Civil Work	20,000 m3	L.S.		1	102,800,000			102,800,000
			Mechanical & Electrical Cost		L.S.		1	9,561,000		9,561,000	
	1-2	Distribution Pump House	Civil Work		L.S.		1	12,147,000			12,147,000
	1-3	Inplant Piping		DIP1200mmTP	m	25,810	200	5,162,000	Connection Pipe of Clearwell to LPS		5,162,000
	1-4	Distribution Pump	Mechanical & Electrical Cos	24.m3/min ×74.m ×4 (+1)	L.S.		1	138,011,000		138,011,000	
	1-5	Pump Control Facilities	Mechanical & Electrical Cost		L.S.		1	15,000,000		15,000,000	
	1-6	Power Receiving Facility	Mechanical & Electrical Cos	4,000 KVA	L.S.		1	25,728,000		25,728,000	
	1-7	Generator	Mechanical & Electrical Cos	2,000 KVA ×2	L.S.		1	106,144,000		106,144,000	
	1-8	Transmission Pipe	Reinstallation	DIP900mmT	m	26,401	580	15,312,696			15,312,696
			Reinstallation ACP to DIP	DIP600mmT	m	22,088	370	8,172,486			8,172,486
			Transmission Route Rehabilitation		L.S.		1	4,200,000	Stair & Retaining Wall		4,200,000
		Sub Total						442,238,182	¥1,171,931,182	294,444,000	147,794,182
2	New Battali Reservoir										
	2-1	Distribution Reservoir	Ground Reservoir	3,250 m3	L.S.		1	31,006,000			31,006,000
			Inplant Piping		L.S.		1	20,327,000			20,327,000
			Earth Work		L.S.		1	16,331,000			16,331,000
			Road Work		L.S.		1	3,638,000			3,638,000
			Lighting		L.S.		1	477,000			477,000
			Retaining Wall		L.S.		1	11,100,000			11,100,000
		Sub Total						82,879,000	¥219,629,350	0	82,879,000
3	Distribution Pipe										
	3-1	Distribution Pipes		DIP1200mmD	m	31,495	15,580	490,695,216			490,695,216
				DIP1200mmD	m	47,243	580	27,400,824	near Battali Hill Reservoir		27,400,824
				DIP1100mmD	m	26,542	0	0			0
				DIP1000mmD	m	35,208	370	13,026,849	near Battali Hill Reservoir		13,026,849
				DIP1000mmD	m	23,472	80	1,877,744			1,877,744
				DIP900mmD	m	19,825	0	0			0
				DIP800mmD	m	16,587	3,410	56,561,329			56,561,329
				DIP700mmD	m	13,651	1,700	23,206,700			23,206,700
				DIP600mmD	m	11,570	1,375	15,908,475			15,908,475
				DIP500mmD	m	9,085	1,990	18,078,951			18,078,951
				DIP450mmD	m	7,931	715	5,670,665			5,670,665
				DIP400mmD	m	6,918	600	4,150,740			4,150,740
				DIP350mmD	m	6,076	420	2,552,088			2,552,088
				DIP300mmD	m	5,235	1,090	5,706,041			5,706,041
				PVC250mmD	m	6,477	700	4,533,760			4,533,760
				PVC200mmD	m	4,629	905	4,189,585			4,189,585
		Sub Total					29,515	673,558,967	¥1,784,931,264	0	673,558,967
		Total (Direct Construction Cost)						1,198,676,149	¥3,176,491,796	294,444,000	904,232,149
5	Overhead & Profit etc.		25% of Direct Construction Cost		L.S.		1	299,669,037		73,611,000	226,058,037
	Grand Total							1,498,345,187	¥3,176,491,796	368,055,000	1,130,290,187

Case Ⅲ－a－3　New Battali Reservoir　　Unit : Taka

No.		Name of Facility	Item	Dimension	Unit	Unit Cost	Quantity	Price	Note	E&M	Civil
1	Mohara WTP										
	1-1	Clear Well	Civil Work	20,000 m3	L.S.		1	102,800,000			102,800,000
			Mechanical & Electrical Cost		L.S.		1	9,561,000		9,561,000	
	1-2	Transmission Pump House	Civil Work		L.S.		1	12,147,000			12,147,000
	1-3	Inplant Piping		DIP1200mmTP	m	25,810	100	2,581,000	Connection Pipe of Clearwell to LPS		2,581,000
				DIP1100mmTP	m	22,320	100	2,232,000	Connection Pipe of LPS to Distri. Pipe		2,232,000
	1-4	Transmission Pump	Mechanical & Electrical Cost	24.m3/min ×87.m ×4 (+1)	L.S.		1	143,709,000		143,709,000	
	1-5	Pump Control Facilities	Mechanical & Electrical Cost		L.S.		1	15,000,000		15,000,000	
	1-6	Power Receiving Facility	Mechanical & Electrical Cost	5,000 KVA	L.S.		1	32,160,000		32,160,000	
	1-7	Generator	Mechanical & Electrical Cost	2,500 KVA ×2	L.S.		1	132,680,000		132,680,000	
	1-8	Transmission Pipe		DIP1100mmT	m	25,335	15,580	394,726,311			394,726,311
				DIP1100mmT	m	38,003	580	22,041,842	near Battali Hill Reservoir		22,041,842
			Reinstallation	DIP900mmT	m	26,401	580	15,312,696			15,312,696
			Reinstallation ACP to DIP	DIP600mmT	m	22,088	370	8,172,486			8,172,486
			Transmission Route Rehabilitation		L.S.		1	4,200,000	Stair & Retaining Wall		4,200,000
		Sub Total						897,323,335	¥2,377,906,836	333,110,000	564,213,335
2	New Battali Reservoir										
	2-1	Distribution Reservoir	Ground Reservoir	4,550 m3	L.S.		1	44,973,000			44,973,000
			Inplant Piping		L.S.		1	24,051,000			24,051,000
			Earth Work		L.S.		1	19,323,000			19,323,000
			Road Work		L.S.		1	4,305,000			4,305,000
			Lighting		L.S.		1	564,000			564,000
			Retaining Wall		L.S.		1	11,100,000			11,100,000
		Sub Total						104,316,000	¥276,437,400	0	104,316,000
3	Distribution Pipe										
	3-1	Distribution Pipes		DIP1200mmD	m	47,243	370	17,479,836	near Battali Hill Reservoir		17,479,836
	3-1	Distribution Pipes		DIP1200mmD	m	31,495	80	2,519,616			2,519,616
				DIP1000mmD	m	23,472	0	0			0
				DIP900mmD	m	19,825	2,500	49,563,250			49,563,250
				DIP800mmD	m	16,587	2,285	37,901,067			37,901,067
				DIP700mmD	m	13,651	2,595	35,424,345			35,424,345
				DIP600mmD	m	11,570	0	0			0
				DIP500mmD	m	9,085	2,005	18,215,225			18,215,225
				DIP450mmD	m	7,931	1,810	14,355,110			14,355,110
				DIP400mmD	m	6,918	600	4,150,740			4,150,740
				DIP350mmD	m	6,076	4,065	24,700,566			24,700,566
				DIP300mmD	m	5,235	3,485	18,243,627			18,243,627
				PVC250mmD	m	6,477	270	1,748,736			1,748,736
				PVC200mmD	m	4,629	1,750	8,101,408			8,101,408
		Sub Total					21,815	232,403,525	¥615,869,341	0	232,403,525
		Total (Direct Construction Cost)						1,234,042,859	¥3,270,213,577	333,110,000	900,932,859
5	Overhead & Profit etc.		25% of Direct Construction Cost		L.S.		1	308,510,715		83,277,500	225,233,215
	Grand Total							1,542,553,574	¥3,270,213,577	416,387,500	1,126,166,074

Case Ⅲ-b Nasirabad Reservoir and New Battali Reservoir

Unit : Taka

No.		Name of Facility	Item	Dimension	Unit	Unit Cost	Quantity	Price	Note	E&M	Civil
1	Mohara WTP										
	1-1	Clear Well	Civil Work	6,716 m3	L.S.		1	53,290,000			53,290,000
			Mechanical & Electrical Cost		L.S.		1	9,561,000		9,561,000	
	1-2	Transmission Pump House	Civil Work		L.S.		1	12,147,000			12,147,000
	1-3	Distribution Pump	Mechanical & Electrical Cos	15.8m3/min ×46 m ×4 (+1)	L.S.		1	84,911,000		84,911,000	
	1-4	Power Receiving Facility	Mechanical & Electrical Cos	2,000 KVA	L.S.		1	12,864,000		12,864,000	
	1-5	Generator	Mechanical & Electrical Cos	1000 KVA ×2	L.S.		1	53,072,000		53,072,000	
	1-6	Transmission Pipe		DIP1000mmT	m	22,405	4,325	96,901,193	Nasirabad Re. to Battali Hill Re.		96,901,193
				DIP1000mmT	m	33,607	580	19,492,263	near Battali Hill Reservoir		19,492,263
			Reinstallation	DIP900mmT	m	26,401	580	15,312,696	near Battali Hill Reservoir		15,312,696
			Reinstallation ACP to DIP	DIP600mmT	m	22,088	370	8,172,486	near Battali Hill Reservoir		8,172,486
			Transmission Route Rehabilitation		L.S.		1	4,200,000	Stair & Retaining Wall		4,200,000
		Sub Total						369,923,638	¥980,297,639	160,408,000	209,515,638
2	Nasirabad Reservoir										
	2-1	Distribution Reservoir	Ground Reservoir	16,800 m3	L.S.		1	86,352,000			86,352,000
			Lift Pump	23.4m3/min ×51m ×3 (+1)	L.S.		1	109,084,000	to Battali Hill New Reservoir	109,084,000	
			Pump House		L.S.		1	10,302,000			10,302,000
			Power Receiving Facility	2,000 KVA	L.S.		1	12,864,000		12,864,000	
			Generator	1000 KVA ×2	L.S.		1	53,072,000		53,072,000	
			Administration Building		L.S.		1	1,779,000			1,779,000
			Inplant Piping		L.S.		1	30,160,000			30,160,000
			Earth Work		L.S.		1	18,565,000			18,565,000
			Road Work		L.S.		1	8,272,000			8,272,000
			Lighting		L.S.		1	1,084,000			1,084,000
		Sub Total						331,534,000	¥878,565,100	175,020,000	156,514,000
3	New Battali Reservoir										
	3-1	Distribution Reservoir	Ground Reservoir	3,250 m3	L.S.		1	31,006,000			31,006,000
			Inplant Piping		L.S.		1	20,327,000			20,327,000
			Earth Work		L.S.		1	16,331,000			16,331,000
			Road Work		L.S.		1	3,638,000			3,638,000
			Lighting		L.S.		1	477,000			477,000
			Retaining Wall		L.S.		1	11,100,000			11,100,000
		Sub Total						82,879,000	¥219,629,350	0	82,879,000
4	Distribution Pipe										
	4-1	Distribution Pipes		DIP1000mmD	m	35,208	370	13,026,849	near Battali Hill Reservoir		13,026,849
				DIP1000mmD	m	23,472	13,705	321,681,019			321,681,019
				DIP900mmD	m	19,825	3,535	70,082,436			70,082,436
				DIP800mmD	m	16,587	3,410	56,561,329			56,561,329
				DIP700mmD	m	13,651	1,000	13,651,000			13,651,000
				DIP600mmD	m	11,570	2,075	24,007,335			24,007,335
				DIP500mmD	m	9,085	1,990	18,078,951			18,078,951
				DIP450mmD	m	7,931	715	5,670,665			5,670,665
				DIP400mmD	m	6,918	600	4,150,740			4,150,740
				DIP350mmD	m	6,076	435	2,643,234			2,643,234
				DIP300mmD	m	5,235	1,045	5,470,471			5,470,471
				PVC250mmD	m	6,477	700	4,533,760			4,533,760
				PVC200mmD	m	4,629	920	4,259,026			4,259,026
		Sub Total					30,500	543,816,814	¥1,441,114,557	0	543,816,814
		Total (Direct Construction Cost)						1,328,153,452	¥3,519,606,647	335,428,000	992,725,452
5	Overhead & Profit etc.		25% of Direct Construction Cost		L.S.		1	332,038,363		83,857,000	248,181,363
	Grand Total							1,660,191,814	¥3,519,606,647	419,285,000	1,240,906,814

Electrical Cost of Alternatives

Alternative No.		Item		Pump Capacity						Electrical charge					Maintenance Cost (1%)		Total
				Q	H	Power	Pieces	Stand-by	Total Power	Operation Hours	kWh/day	Cost			M&E Cost (Taka)	Taka/year	Taka/year
				(m3/min)	(m)	(kw)			(kw)	(hours)		Taka/kwh	Total (Taka/day)	Total (Taka/year)			
1	Case I -a	Transmission Pump	Mohara	15.8	84.0	360	4	1	1,440	24	34,560						
		Lift Pump	Khulushi	13.1	25.0	100	3	1	300	16	4,800						
		Total							1,740		39,360	2.95	116,112	42,380,880	374,891,250	3,748,913	46,129,793
2	Case I -b-1	Transmission Pump	Mohara	15.8	80.0	340	4	1	1,360	24	32,640						
		Lift Pump	Nasirabad	7.8	23.0	60	3	1	180	16	2,880						
		Total							1,540		35,520	2.95	104,784	38,246,160	355,168,750	3,551,688	41,797,848
3	Case I -b-2	Transmission Pump	Mohara	15.8	80.0	340	4	1	1,360	24	32,640						
		Lift Pump	Nasirabad	-	-	-	-	-	0	16	0						
		Total							1,360		32,640	2.95	96,288	35,145,120	257,467,500	2,574,675	37,719,795
5	Case I -b-3	Transmission Pump	Mohara	15.8	63.0	270	4	1	1,080	24	25,920						
		Lift Pump	Nasirabad	31.2	31.0	280	3	1	840	16	13,440						
		Total							1,920		39,360	2.95	116,112	42,380,880	471,007,500	4,710,075	47,090,955
6	Case I -c-1	Transmission Pump	Mohara	15.8	37.0	160	4	1	640	24	15,360						
		Lift Pump	Nasirabad	7.8	35.0	80	3	1	240	16	3,840						
		Lift Pump	Nasirabad	23.4	51.0	340	3	1	1,020	16	16,320						
		Total							1,900		35,520	2.95	104,784	38,246,160	503,608,750	5,036,088	43,282,248
1	Case I -c-2	Transmission Pump	Mohara	15.8	80.0	340	4	1	1,360	24	32,640						
		Lift Pump	New Battali	-	-	-	-	-	0	16	0						
		Total							1,360		32,640	2.95	96,288	35,145,120	257,467,500	2,574,675	37,719,795
7	Case II -b	Transmission Pump	Mohara	15.8	81.0	350	4	1	1,400	24	33,600						
		Lift Pump	New Battali	-	-	-	-	-	0	16	0						
		Total							1,400		33,600	2.95	99,120	36,178,800	257,847,500	2,578,475	38,757,275
8	Case III -a-1	Distribution Pump	Mohara	18.0	61.0	300	2	0	600	18	10,800						
		Distribution Pump	Mohara	30.0	61.0	500	2	1	1,000	18	18,000						
		Total							1,600		28,800	2.95	84,960	31,010,400	428,727,083	4,287,271	35,297,671
9	Case III -a-2	Distribution Pump	Mohara	24.0	74.0	480	4	1	1,920	16	30,720						
		Total							1,920		30,720	2.95	90,624	33,077,760	368,055,000	3,680,550	36,758,310
10	Case III -a-3	Distribution Pump	Mohara	24.0	87.0	560	4	1	2,240	16	35,840						
		Total							2,240		35,840	2.95	105,728	38,590,720	416,387,500	4,163,875	42,754,595
11	Case III -b	Transmission Pump	Mohara	15.8	46.0	200	4	1	800	24	19,200						
		Lift Pump	Nasirabad	23.4	51.0	340	3	1	1,020	16	16,320						
		Total							1,820		35,520	2.95	104,784	38,246,160	419,285,000	4,192,850	42,439,010

Pump Efficiency	70 %		
Operation Hours	24 Hours	for Transmission Pump	
	16 Hours	for Lift Pump	(=24/1.5)
Power Supply Cost	2.95 Taka/kwh		

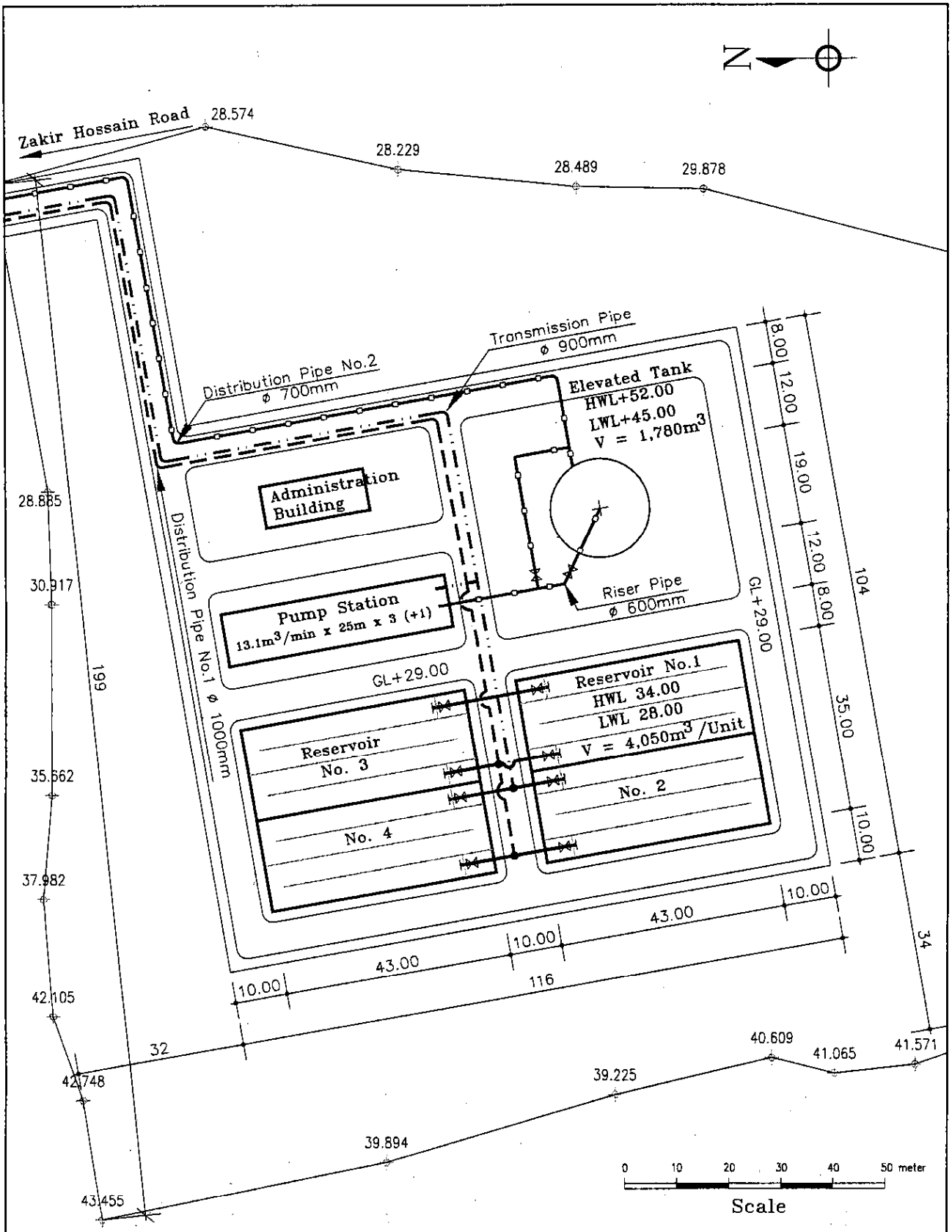


FIGURE 7.4-1-1 LAYOUT PLAN OF PROPOSED KHULSHI RESERVOIR (Alternative Case I-a)

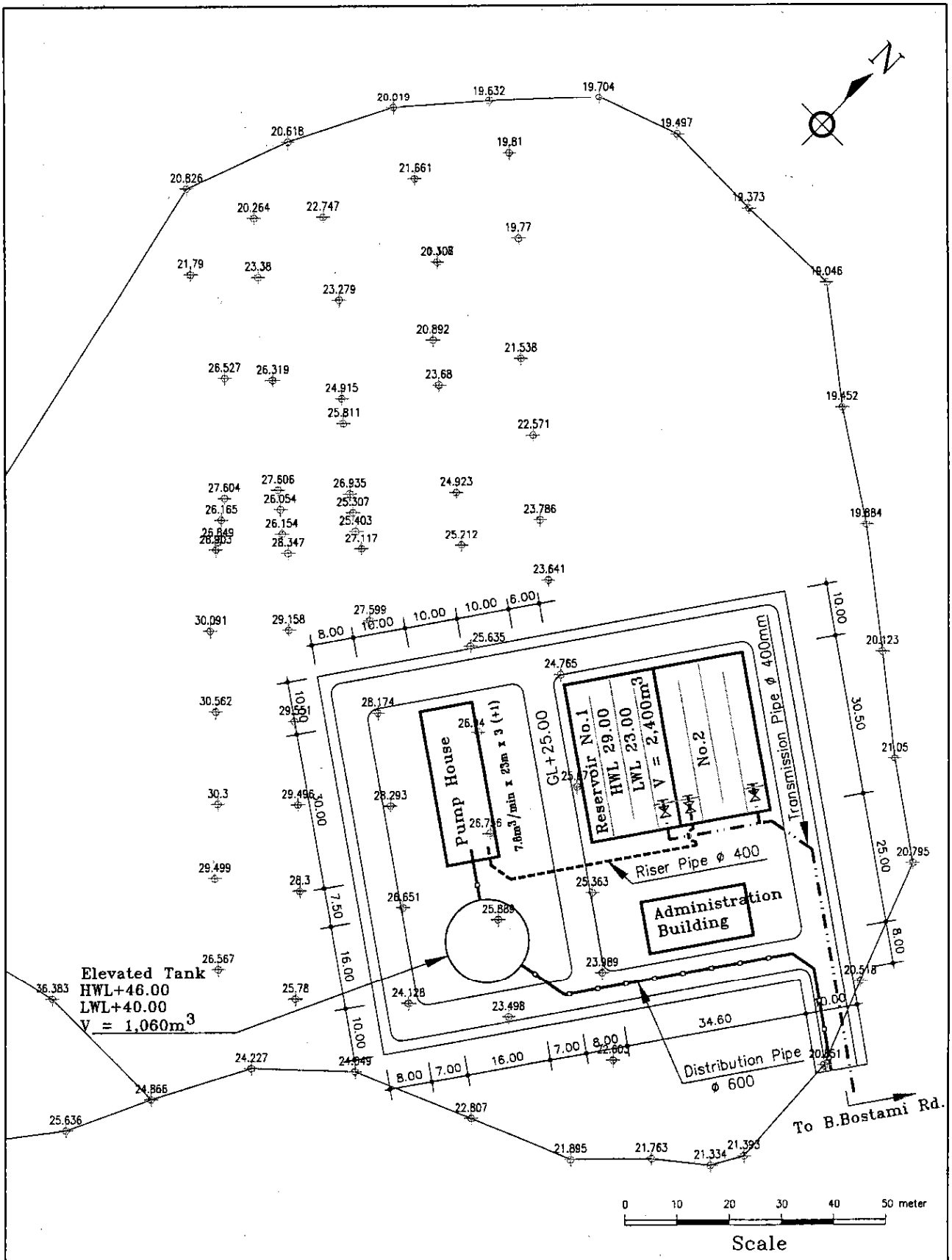


FIGURE 7.4-1-2 LAYOUT PLAN OF PROPOSED NASIRABAD RESERVOIR (Alternative Case I-b-1)

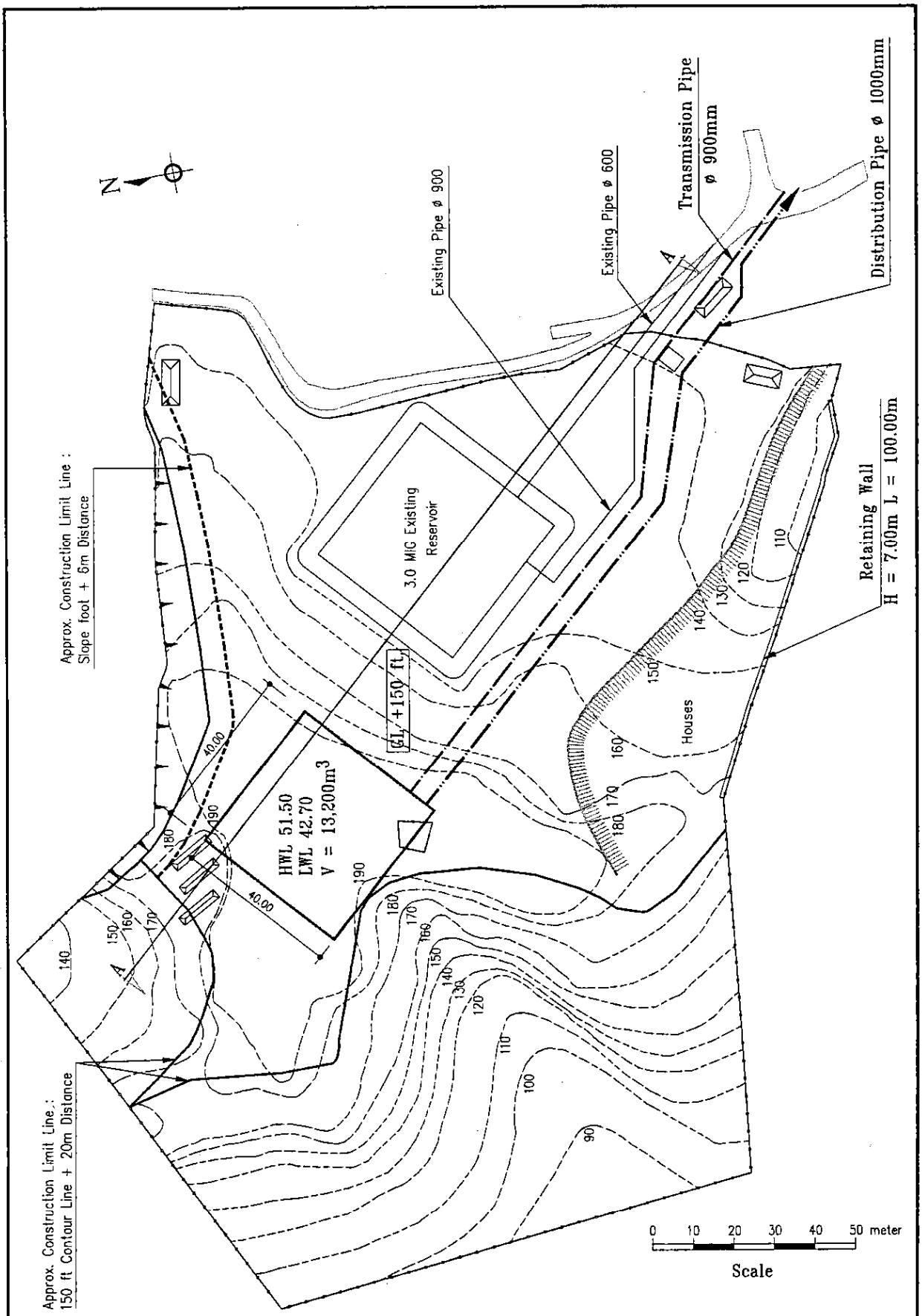


FIGURE 7.4-1-3 FUTURE-1 LAYOUT OF BATTALI HILL RESERVOIR
(Alternative Case I-b-1, I-b-2)

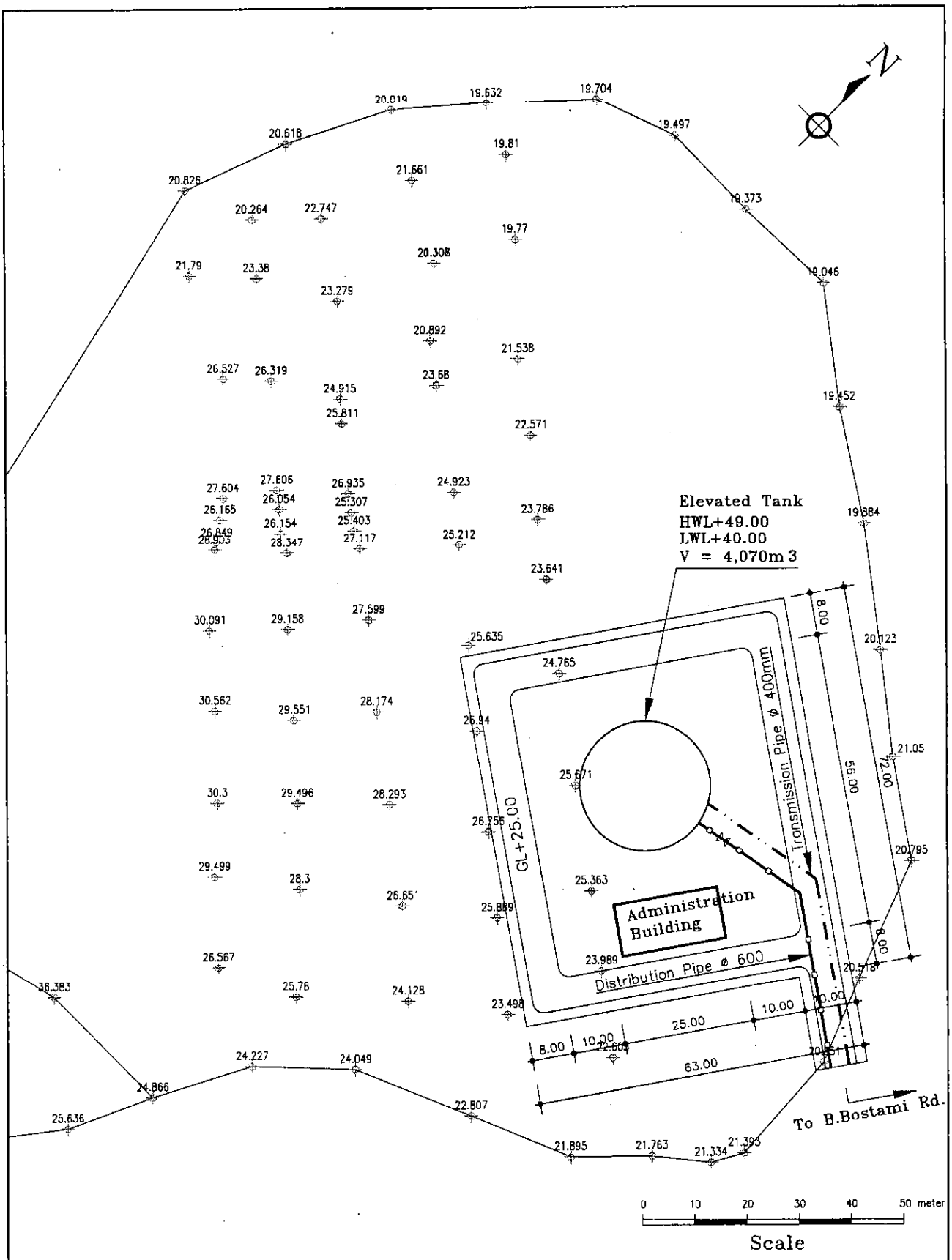


FIGURE 7.4-1-4 LAYOUT PLAN OF PROPOSED NASIRABAD RESERVOIR (Alternative Case I-b-2)

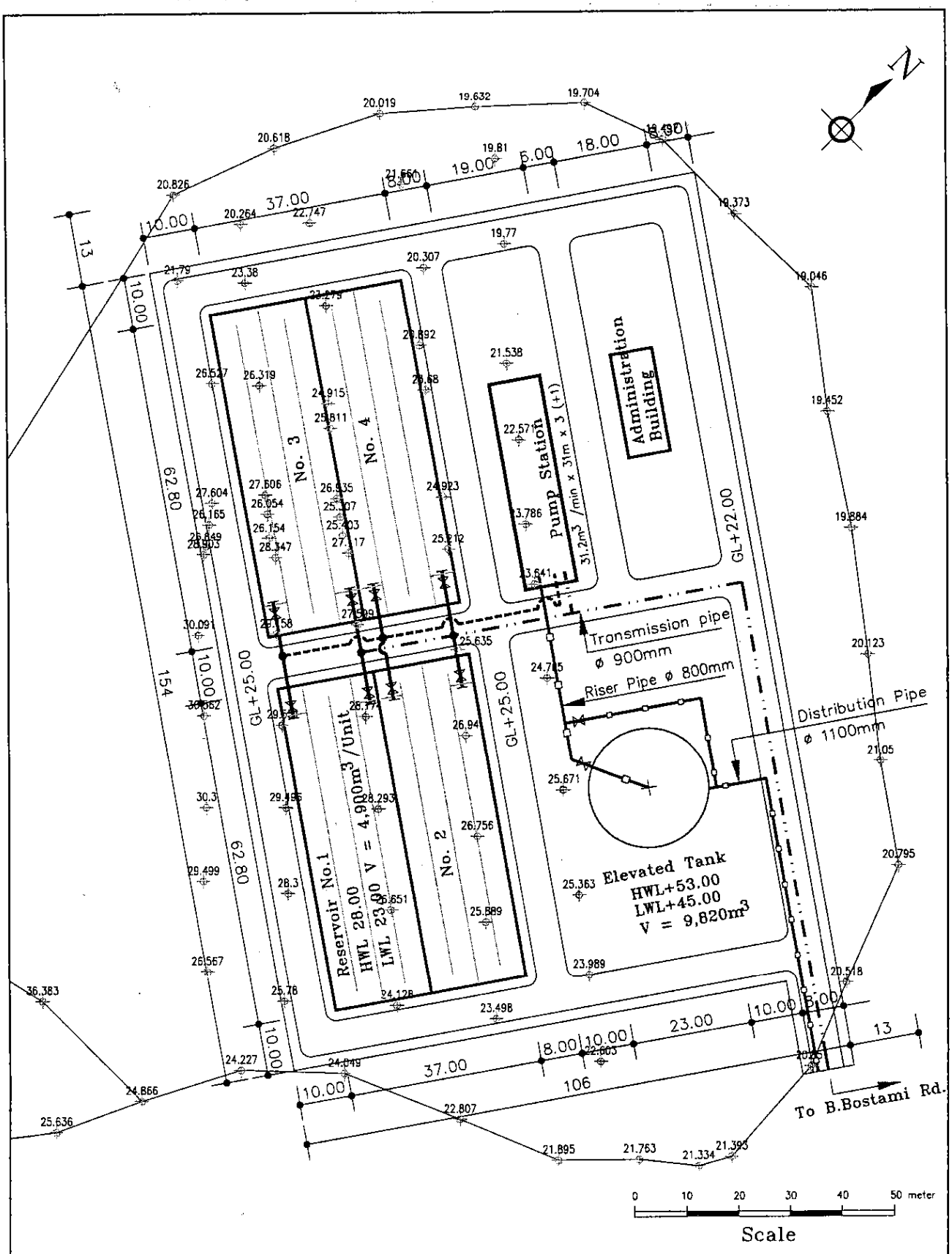


FIGURE 7.4-1-5 LAYOUT PLAN OF PROPOSED NASIRABAD RESERVOIR (Alternative Case I-b-3)

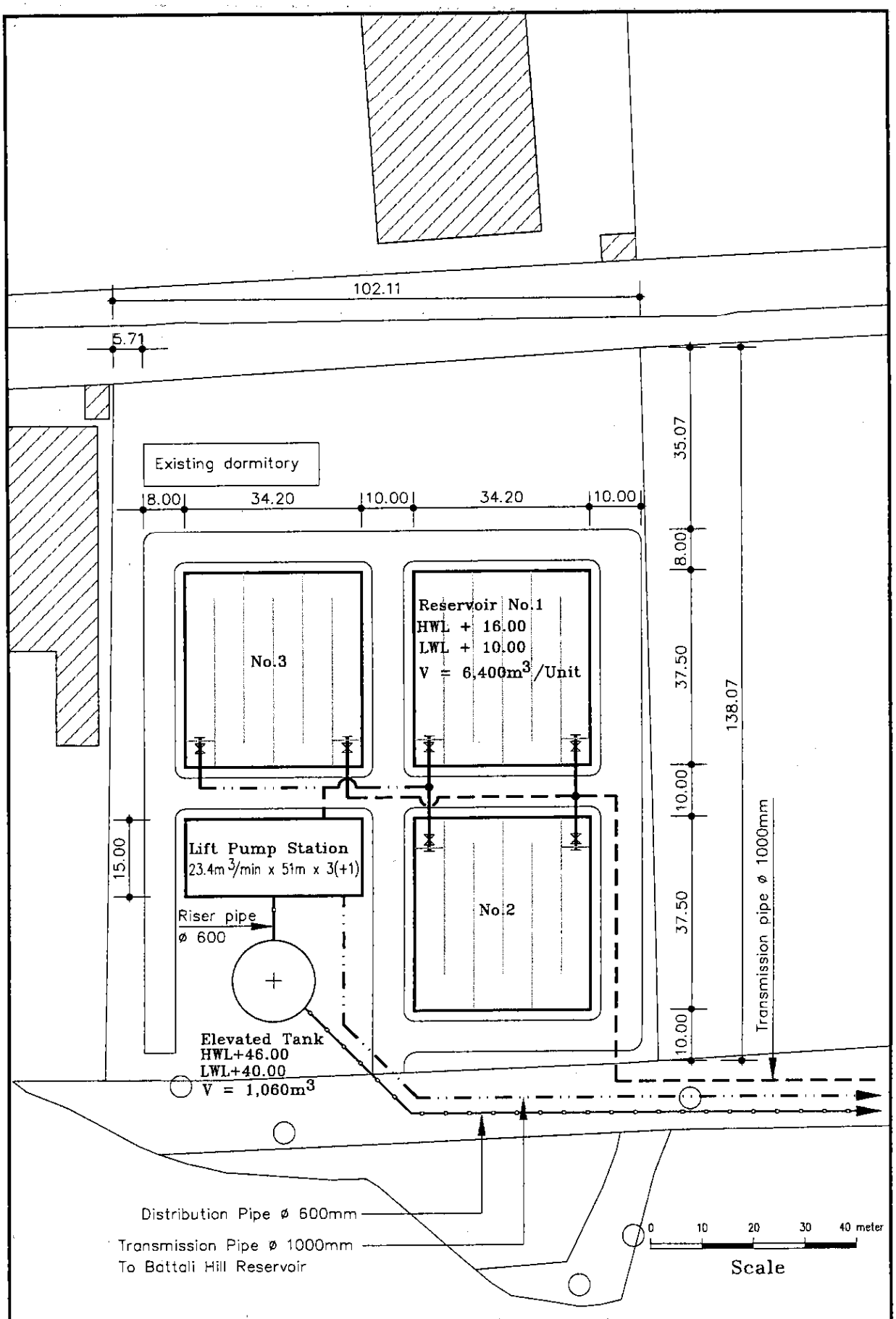


FIGURE 7.4-1-6 LAYOUT PLAN OF PROPOSED NASIRABAD RESERVOIR
(Alternative Case I-c-1)

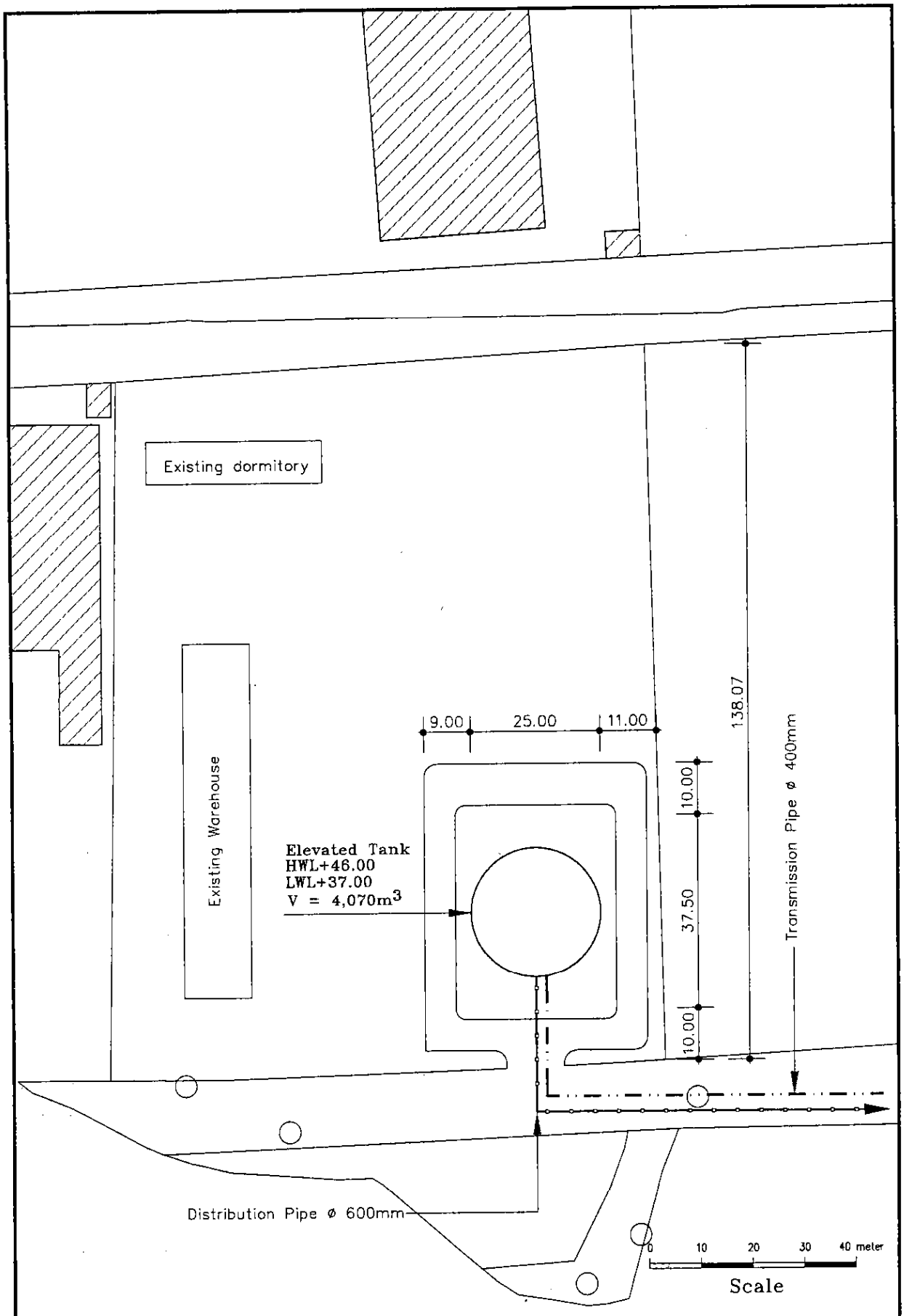


FIGURE 7.4-1-7 LAYOUT PLAN OF PROPOSED NASIRABAD RESERVOIR
(Alternative Case I-c-2)

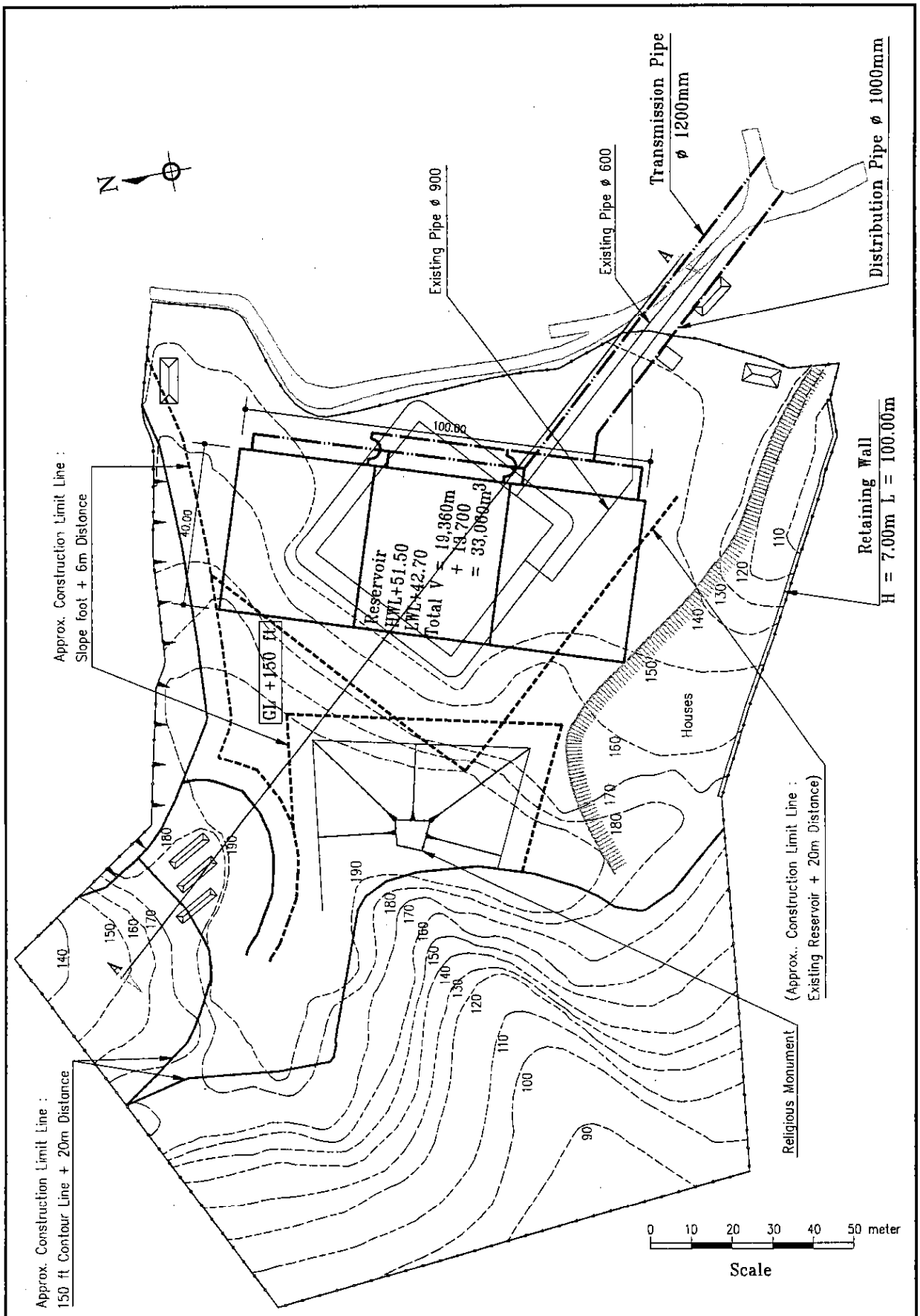


FIGURE 7.4-1-8 FUTURE-2 LAYOUT OF BATTALI HILL RESERVOIR
(Alternative Case II-b)

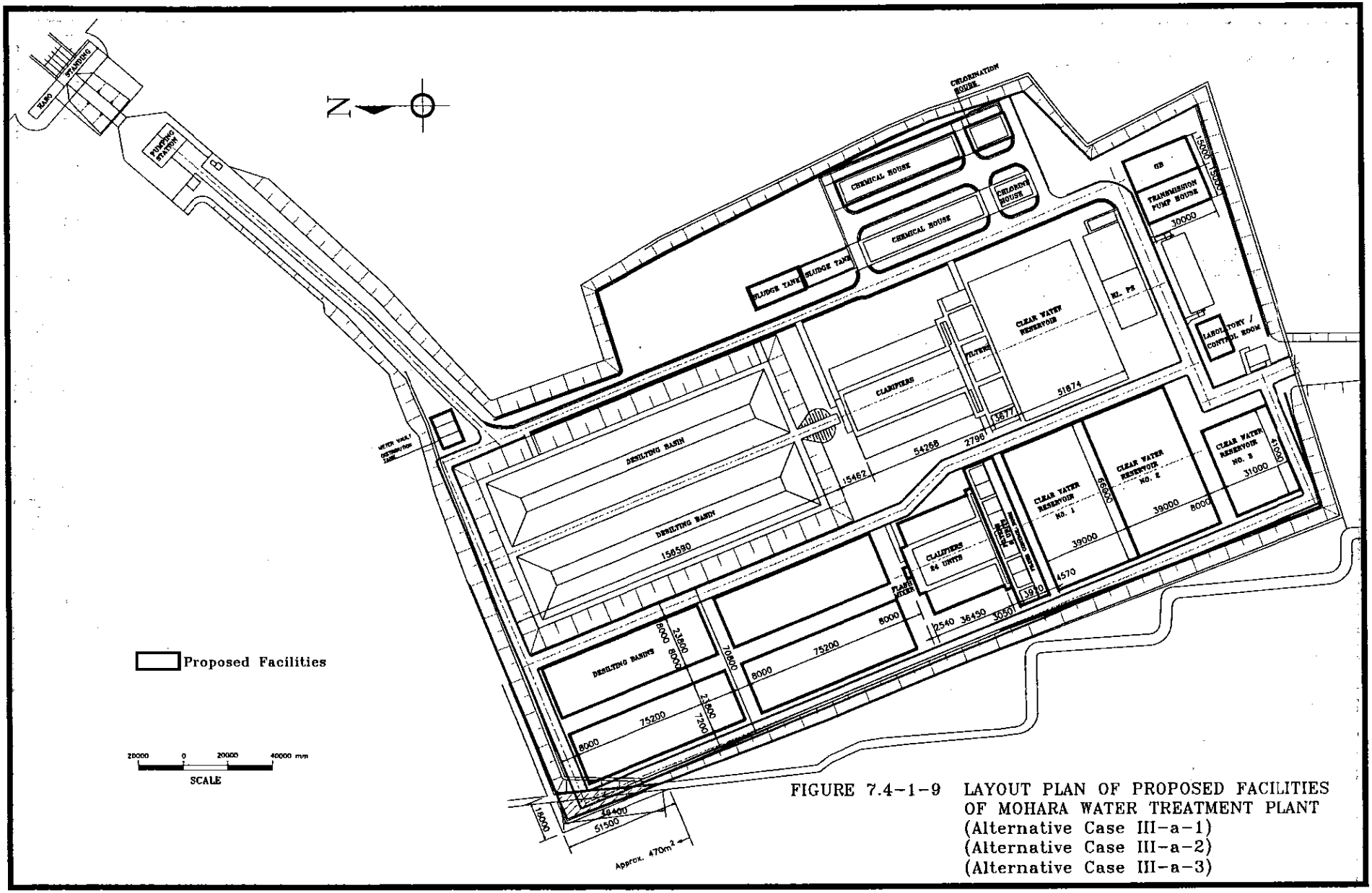


FIGURE 7.4-1-9 LAYOUT PLAN OF PROPOSED FACILITIES OF MOHARA WATER TREATMENT PLANT
(Alternative Case III-a-1)
(Alternative Case III-a-2)
(Alternative Case III-a-3)

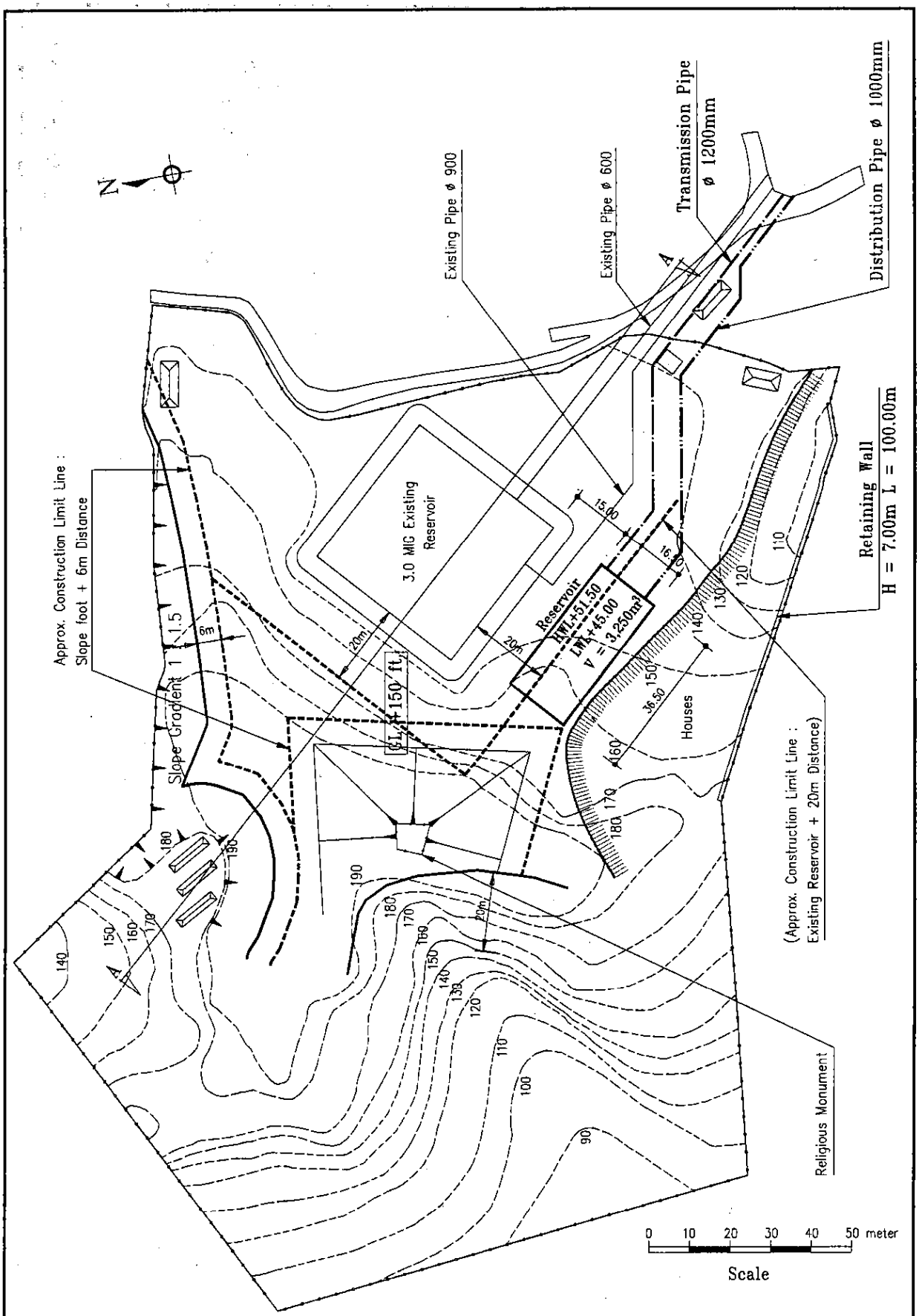


FIGURE 7.4-1-10 FUTURE LAYOUT OF BATTALI HILL RESERVOIR
(Alternative Case III-a-2 & III-b)

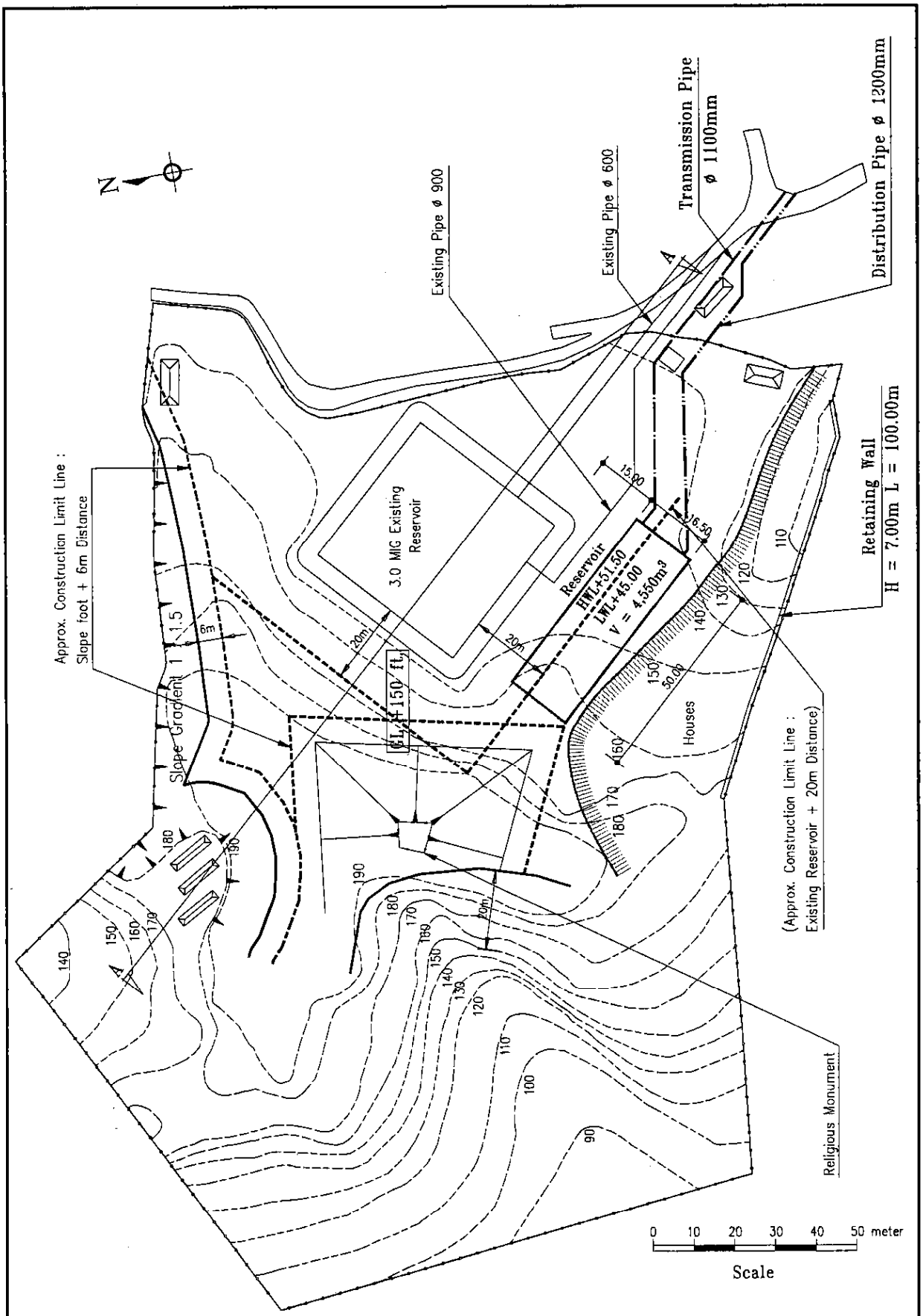


FIGURE 7.4-1-11 FUTURE LAYOUT OF BATTALI HILL RESERVOIR
(Alternative Case III-a-3)

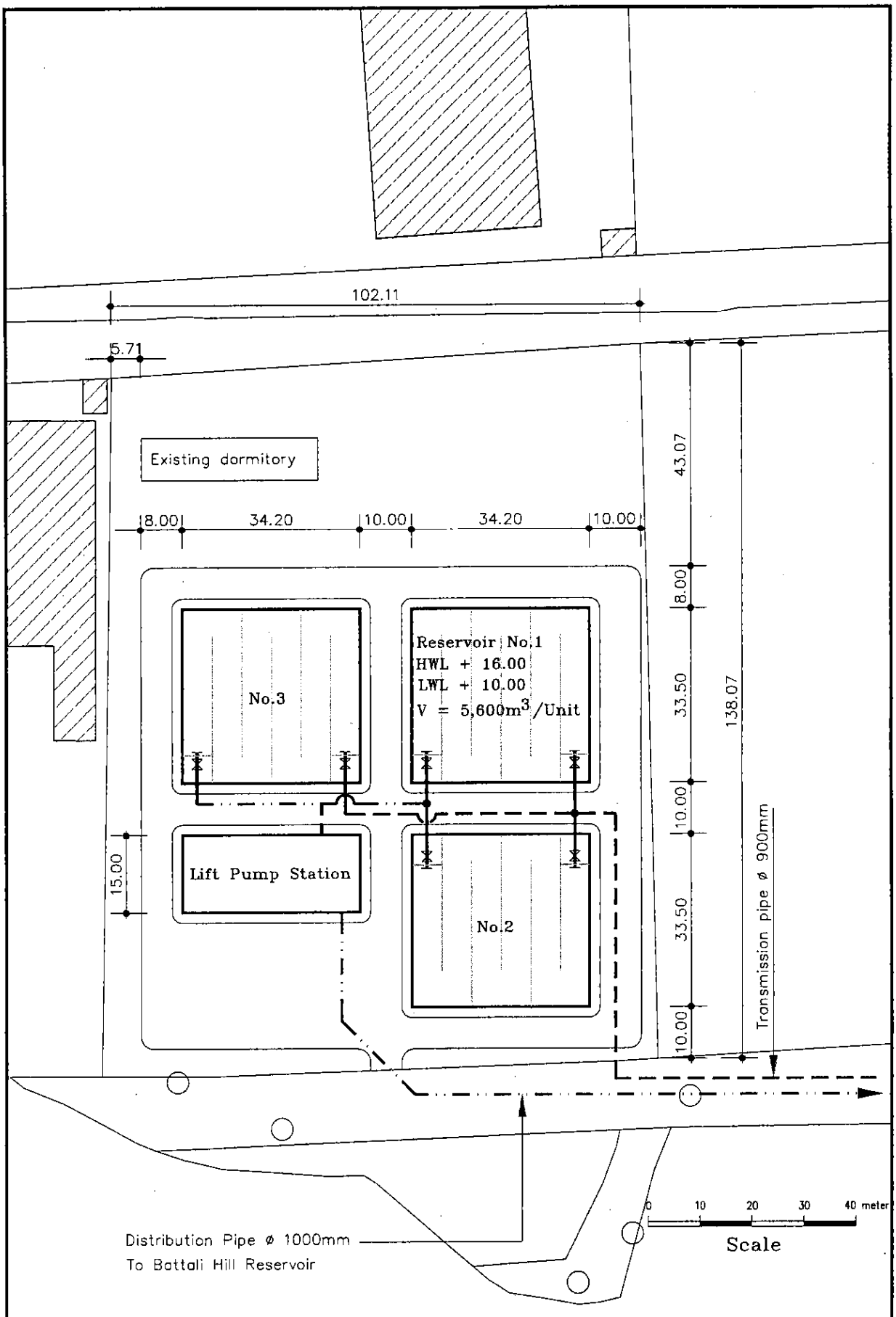


FIGURE 7.4-1-12 LAYOUT PLAN OF PROPOSED NASIRABAD RESERVOIR (Alternative Case III-b)

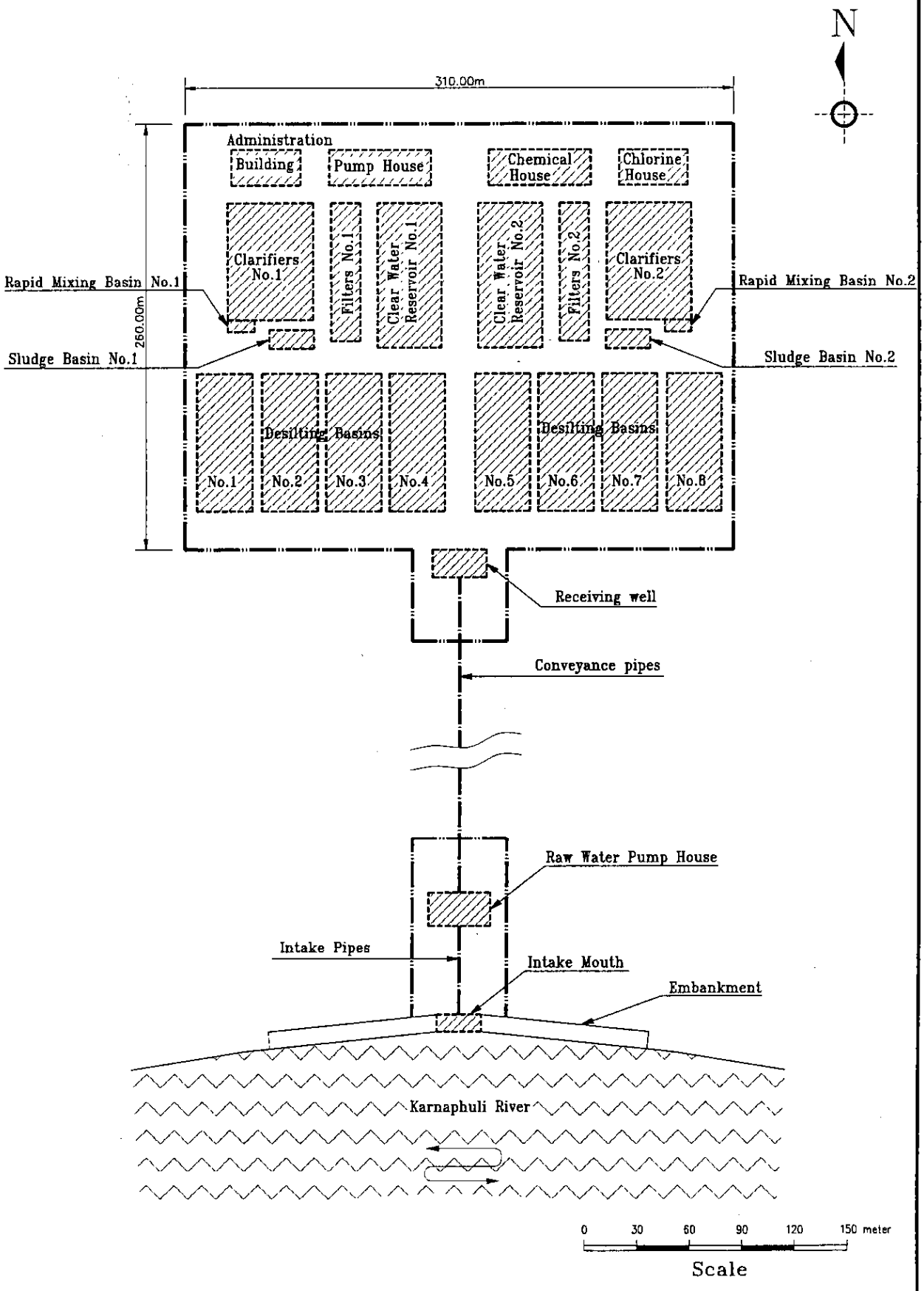


FIGURE 7.4-2-1 PROPOSED FACILITIES OF KARNAPHULI WATER TREATMENT PLANT (2010)

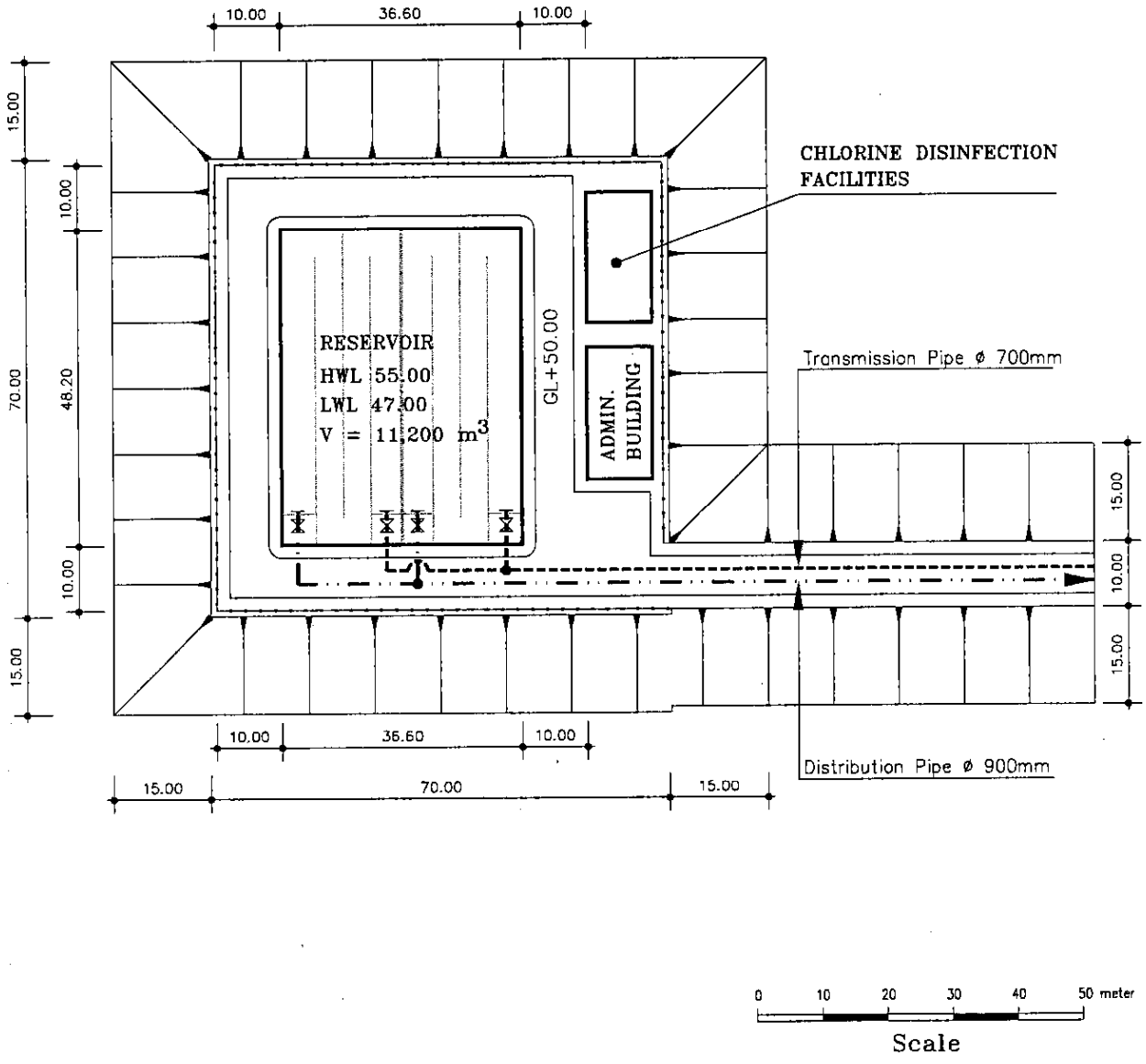


Figure 7.4-2-2 LAYOUT PLAN OF PROPOSED SALIMPUR RESERVOIR (2010)

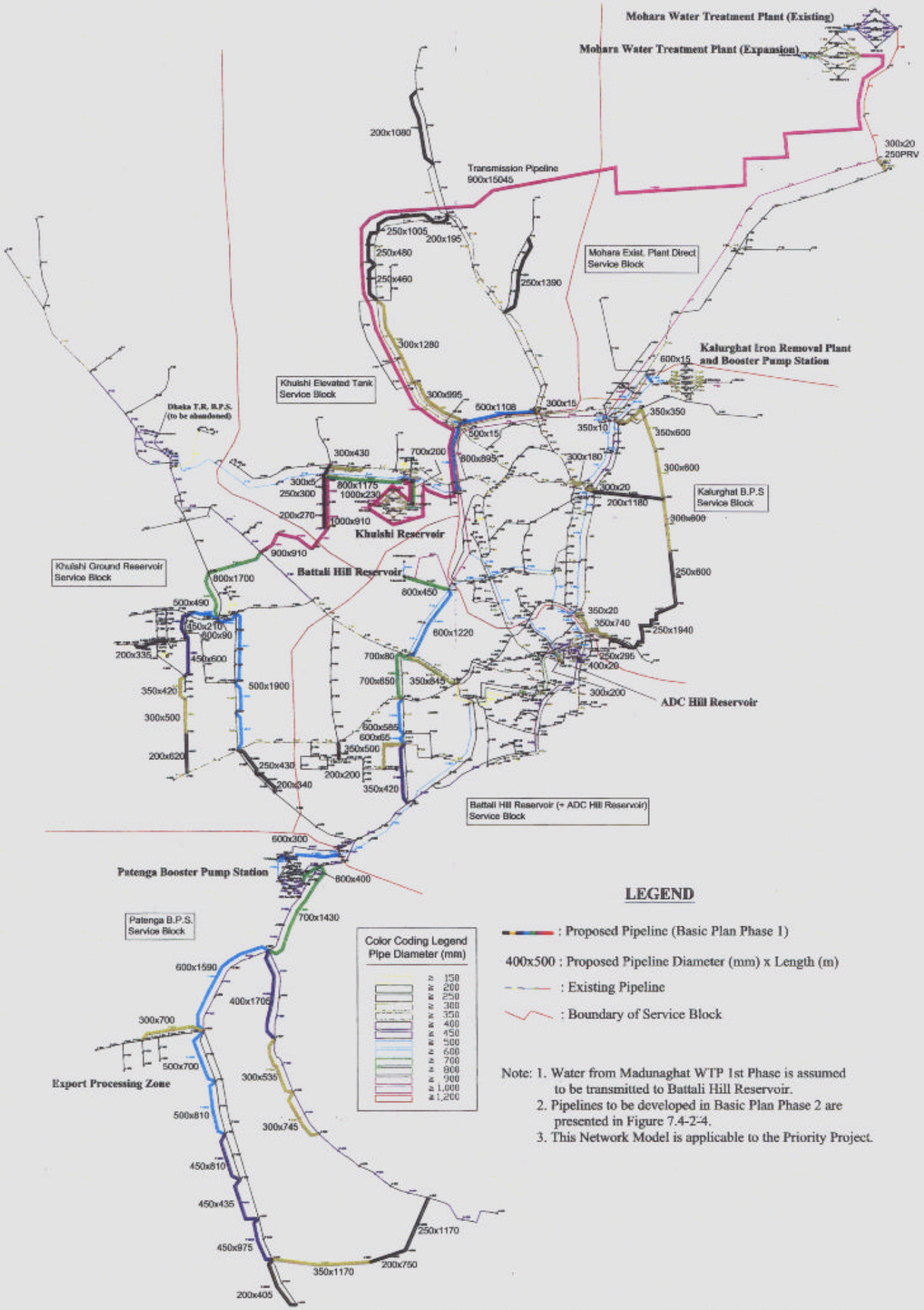


Figure 7.4-2-3 Proposed Transmission / Distribution Network (Basic Plan Phase 1, 2005)

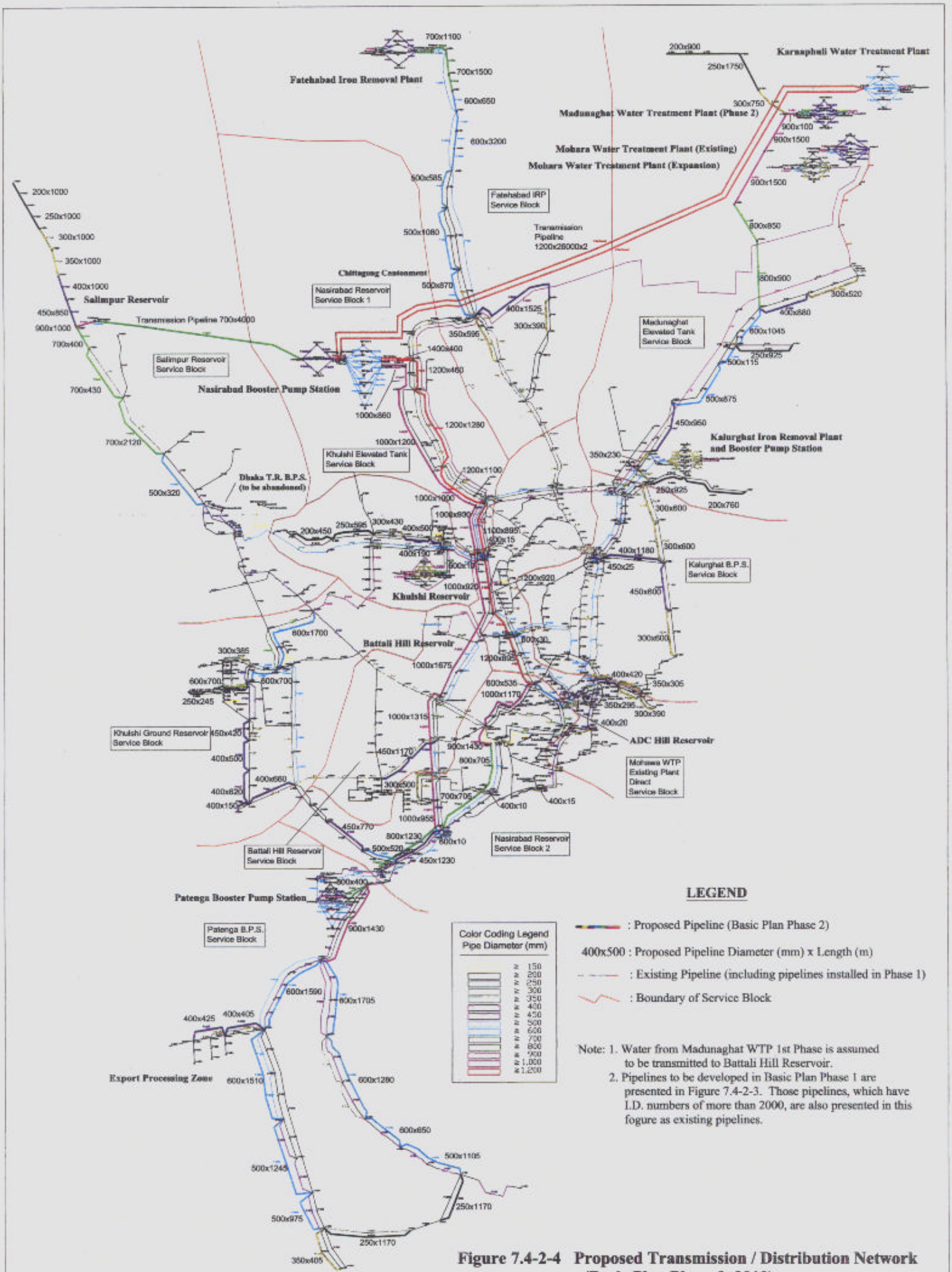


Figure 7.4-2-4 Proposed Transmission / Distribution Network (Basic Plan Phase 2, 2010)

7.4-3 Hydraulic Analysis of Transmission / Distribution Network for Basic Plan

A dynamic hydraulic analysis of transmission / distribution network was conducted for extended period of 72 hours. Software used for the analysis was "Cybernet" version 3.5 by Haestad Methods Inc. USA. The software was developed based on research conducted by the U.S. Environmental protection Agency (EPA).

The analysis was carried out for 72 hours to verify capacities of pumps, reservoirs, and pipelines. Therefore, computation results presented herewith are only for peak time, i.e. 09:00 hours. However, computation results for reservoirs are presented for 72 hours for perusal.

Computation results presented herewith are;

1. Junction Report (for peak time of 09:00hrs)
2. Pipe Report (for peak time of 09:00hrs)
3. Detailed Report for Tank (Reservoir)

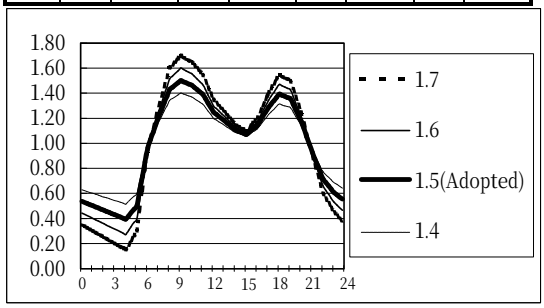
Pipes with number 2000 or more means pipes to be developed in Phase 1 by 2005. And pipes with number 3000 or more means pipes to be developed in Phase 2 by 2010.

Hourly water demand fluctuation to be applied in the analysis was assumed as presented in attached sheet with a peak rate of 1.5.

Relationship between Nodes and Wards are also presented herewith.

7.4-3-1 Hourly Fluctuation of Distribution Flow

Peak	1.7		1.6		1.5 (Adopted)		1.4	
hour	Rate	Excess	Rate	Excess	Rate	Excess	Rate	Excess
0:00	0.35	0.000	0.44	0.000	**0.54**	**0.000**	0.63	0.000
0:15	0.34	0.000	0.43	0.000	**0.53**	**0.000**	0.62	0.000
0:30	0.33	0.000	0.42	0.000	**0.52**	**0.000**	0.61	0.000
0:45	0.31	0.000	0.41	0.000	**0.51**	**0.000**	0.61	0.000
1:00	0.30	0.000	0.40	0.000	**0.50**	**0.000**	0.60	0.000
1:15	0.29	0.000	0.39	0.000	**0.49**	**0.000**	0.59	0.000
1:30	0.28	0.000	0.38	0.000	**0.48**	**0.000**	0.59	0.000
1:45	0.26	0.000	0.37	0.000	**0.47**	**0.000**	0.58	0.000
2:00	0.25	0.000	0.36	0.000	**0.46**	**0.000**	0.57	0.000
2:15	0.24	0.000	0.35	0.000	**0.46**	**0.000**	0.56	0.000
2:30	0.23	0.000	0.34	0.000	**0.45**	**0.000**	0.56	0.000
2:45	0.21	0.000	0.32	0.000	**0.44**	**0.000**	0.55	0.000
3:00	0.20	0.000	0.31	0.000	**0.43**	**0.000**	0.54	0.000
3:15	0.19	0.000	0.30	0.000	**0.42**	**0.000**	0.54	0.000
3:30	0.18	0.000	0.29	0.000	**0.41**	**0.000**	0.53	0.000
3:45	0.16	0.000	0.28	0.000	**0.40**	**0.000**	0.52	0.000
4:00	0.15	0.000	0.27	0.000	**0.39**	**0.000**	0.51	0.000
4:15	0.19	0.000	0.30	0.000	**0.42**	**0.000**	0.54	0.000
4:30	0.23	0.000	0.34	0.000	**0.45**	**0.000**	0.56	0.000
4:45	0.26	0.000	0.37	0.000	**0.47**	**0.000**	0.58	0.000
5:00	0.30	0.000	0.40	0.000	**0.50**	**0.000**	0.60	0.000
5:15	0.46	0.000	0.54	0.000	**0.62**	**0.000**	0.69	0.000
5:30	0.63	0.000	0.68	0.000	**0.73**	**0.000**	0.79	0.000
5:45	0.79	0.000	0.82	0.000	**0.85**	**0.000**	0.88	0.000
6:00	0.95	0.000	0.96	0.000	**0.96**	**0.000**	0.97	0.000
6:15	1.04	0.038	1.03	0.032	**1.03**	**0.027**	1.02	0.021
6:30	1.13	0.125	1.11	0.107	**1.09**	**0.089**	1.07	0.071
6:45	1.21	0.213	1.18	0.182	**1.15**	**0.152**	1.12	0.121
7:00	1.30	0.300	1.26	0.257	**1.21**	**0.214**	1.17	0.171
7:15	1.38	0.375	1.32	0.321	**1.27**	**0.268**	1.21	0.214
7:30	1.45	0.450	1.39	0.386	**1.32**	**0.321**	1.26	0.257
7:45	1.53	0.525	1.45	0.450	**1.38**	**0.375**	1.30	0.300
8:00	1.60	0.600	1.51	0.514	**1.43**	**0.429**	1.34	0.343
8:15	1.63	0.625	1.54	0.536	**1.45**	**0.446**	1.36	0.357
8:30	1.65	0.650	1.56	0.557	**1.46**	**0.464**	1.37	0.371
8:45	1.68	0.675	1.58	0.579	**1.48**	**0.482**	1.39	0.386
9:00	1.70	0.700	1.60	0.600	**1.50**	**0.500**	1.40	0.400
9:15	1.69	0.688	1.59	0.589	**1.49**	**0.491**	1.39	0.393
9:30	1.68	0.675	1.58	0.579	**1.48**	**0.482**	1.39	0.386
9:45	1.66	0.663	1.57	0.568	**1.47**	**0.473**	1.38	0.379
10:00	1.65	0.650	1.56	0.557	**1.46**	**0.464**	1.37	0.371
10:15	1.63	0.625	1.54	0.536	**1.45**	**0.446**	1.36	0.357
10:30	1.60	0.600	1.51	0.514	**1.43**	**0.429**	1.34	0.343
10:45	1.58	0.575	1.49	0.493	**1.41**	**0.411**	1.33	0.329
11:00	1.55	0.550	1.47	0.471	**1.39**	**0.393**	1.31	0.314
11:15	1.50	0.500	1.43	0.429	**1.36**	**0.357**	1.29	0.286
11:30	1.45	0.450	1.39	0.386	**1.32**	**0.321**	1.26	0.257
11:45	1.40	0.400	1.34	0.343	**1.29**	**0.286**	1.23	0.229



Peak	1.7		1.6		1.5 (Adopted)		1.4	
hour	Rate	Excess	Rate	Excess	Rate	Excess	Rate	Excess
12:00	1.35	0.350	1.30	0.300	**1.25**	**0.250**	1.20	0.200
12:15	1.33	0.325	1.28	0.279	**1.23**	**0.232**	1.19	0.186
12:30	1.30	0.300	1.26	0.257	**1.21**	**0.214**	1.17	0.171
12:45	1.28	0.275	1.24	0.236	**1.20**	**0.196**	1.16	0.157
13:00	1.25	0.250	1.21	0.214	**1.18**	**0.179**	1.14	0.143
13:15	1.23	0.225	1.19	0.193	**1.16**	**0.161**	1.13	0.129
13:30	1.20	0.200	1.17	0.171	**1.14**	**0.143**	1.11	0.114
13:45	1.18	0.175	1.15	0.150	**1.13**	**0.125**	1.10	0.100
14:00	1.15	0.150	1.13	0.129	**1.11**	**0.107**	1.09	0.086
14:15	1.14	0.138	1.12	0.118	**1.10**	**0.098**	1.08	0.079
14:30	1.13	0.125	1.11	0.107	**1.09**	**0.089**	1.07	0.071
14:45	1.11	0.113	1.10	0.096	**1.08**	**0.080**	1.06	0.064
15:00	1.10	0.100	1.09	0.086	**1.07**	**0.071**	1.06	0.057
15:15	1.13	0.125	1.11	0.107	**1.09**	**0.089**	1.07	0.071
15:30	1.15	0.150	1.13	0.129	**1.11**	**0.107**	1.09	0.086
15:45	1.18	0.175	1.15	0.150	**1.13**	**0.125**	1.10	0.100
16:00	1.20	0.200	1.17	0.171	**1.14**	**0.143**	1.11	0.114
16:15	1.25	0.250	1.21	0.214	**1.18**	**0.179**	1.14	0.143
16:30	1.30	0.300	1.26	0.257	**1.21**	**0.214**	1.17	0.171
16:45	1.35	0.350	1.30	0.300	**1.25**	**0.250**	1.20	0.200
17:00	1.40	0.400	1.34	0.343	**1.29**	**0.286**	1.23	0.229
17:15	1.44	0.438	1.38	0.375	**1.31**	**0.313**	1.25	0.250
17:30	1.48	0.475	1.41	0.407	**1.34**	**0.339**	1.27	0.271
17:45	1.51	0.513	1.44	0.439	**1.37**	**0.366**	1.29	0.293
18:00	1.55	0.550	1.47	0.471	**1.39**	**0.393**	1.31	0.314
18:15	1.54	0.538	1.46	0.461	**1.38**	**0.384**	1.31	0.307
18:30	1.53	0.525	1.45	0.450	**1.38**	**0.375**	1.30	0.300
18:45	1.51	0.513	1.44	0.439	**1.37**	**0.366**	1.29	0.293
19:00	1.50	0.500	1.43	0.429	**1.36**	**0.357**	1.29	0.286
19:15	1.44	0.438	1.38	0.375	**1.31**	**0.313**	1.25	0.250
19:30	1.38	0.375	1.32	0.321	**1.27**	**0.268**	1.21	0.214
19:45	1.31	0.313	1.27	0.268	**1.22**	**0.223**	1.18	0.179
20:00	1.25	0.250	1.21	0.214	**1.18**	**0.179**	1.14	0.143
20:15	1.16	0.163	1.14	0.139	**1.12**	**0.116**	1.09	0.093
20:30	1.08	0.075	1.06	0.064	**1.05**	**0.054**	1.04	0.043
20:45	0.99	0.000	0.99	0.000	**0.99**	**0.000**	0.99	0.000
21:00	0.90	0.000	0.91	0.000	**0.93**	**0.000**	0.94	0.000
21:15	0.83	0.000	0.85	0.000	**0.87**	**0.000**	0.90	0.000
21:30	0.75	0.000	0.79	0.000	**0.82**	**0.000**	0.86	0.000
21:45	0.68	0.000	0.72	0.000	**0.77**	**0.000**	0.81	0.000
22:00	0.60	0.000	0.66	0.000	**0.71**	**0.000**	0.77	0.000
22:15	0.56	0.000	0.62	0.000	**0.69**	**0.000**	0.75	0.000
22:30	0.53	0.000	0.59	0.000	**0.66**	**0.000**	0.73	0.000
22:45	0.49	0.000	0.56	0.000	**0.63**	**0.000**	0.71	0.000
23:00	0.45	0.000	0.53	0.000	**0.61**	**0.000**	0.69	0.000
23:15	0.43	0.000	0.51	0.000	**0.59**	**0.000**	0.67	0.000
23:30	0.40	0.000	0.49	0.000	**0.57**	**0.000**	0.66	0.000
23:45	0.38	0.000	0.46	0.000	**0.55**	**0.000**	0.64	0.000
Total	96.00	21.99	96.00	18.85	**96.00**	**15.71**	96.00	12.56
Peak	1.70		1.60		**1.50**		1.40	
Min. Required Capacity		5.50 hours		4.71 hours		**3.93 hours**		3.14 hours