Section-III: Improvements of Pipeline

III-1 Present Analysis of Pipeline Network using WaterCAD

III-1.1 Method of Hydraulic Model Building

The method of hydraulic model building is setting the pipeline network model for simulation using pipe location, pipe diameter, etc. The hydraulic model building flow is referred to Figure C.III-01.

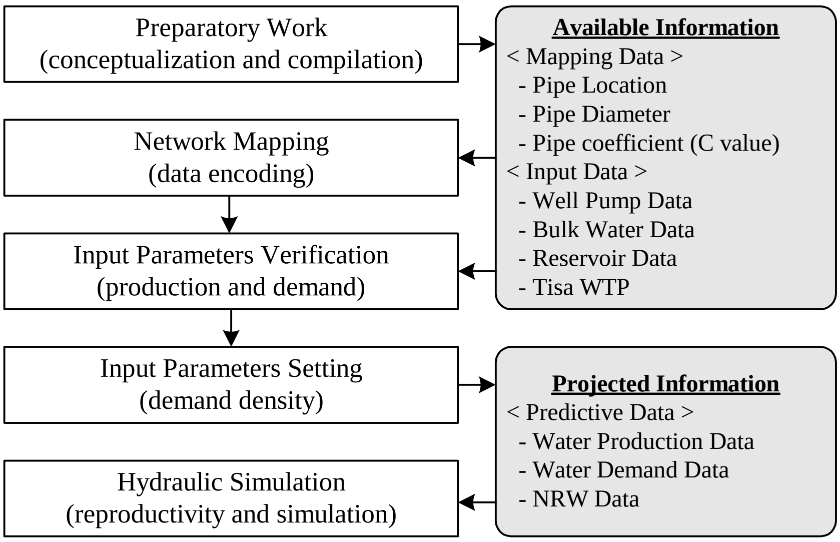

Figure C.III-01 Hydraulic Model Building Flow

In hydraulic model building, these items as follows are not input the model because of unknown.

- ✓ Unknown Pipe
- ✓ Unknown Loss (valve half closed)

III-1.2 Software for Hydraulic Model Building

The hydraulic design and analysis of the transmission system is carried out with a specialized computer program known as WaterCAD. This software is one of the many computerized modeling applications in the field of Hydraulics Engineering.

Besides being user-friendly, the following features are the highlights of WaterCAD:

- Perform steady state, extended period
- Analyze multiple time variable demands at any junction node
- Model pumps using constant power or a multiple point characteristic curve
- Model flow control valves, for example pressure reducing valves, throttle control valves, etc.
- Model cylindrical and non-cylindrical tanks, and constant hydraulic grade source nodes
- Include a powerful extended scenarios management and alternatives features for modeling
- Include both built-in graphical interface and integration with AutoCAD software for tracing the network for use in the data input and review of the analysis output

III-1.3 Hydraulic Model Conceptualization

(1) Simulation code

Hazen-Williams formula would be used for calculating head losses as simulation code.

$$\boxed{H=10.666 \times C^{-1.85} \times D^{-4.87} \times Q^{-1.85} \cdot L}$$

H: Friction Losses (m)
C: Velocity coefficient (110: for DI and PVC pipes, including fitting losses)
D: Pipe diameter (m)
Q: Flow (Lps)
L: Pipe length (m)

(2) Simulation Parameter

As simulation parameter, the value of Hazen-Williams friction coefficient (C) depends on the condition of internal surface of the pipe. It generally adopted C=110. This value takes into account all other head losses which including fitting losses/ bending losses that may have been overlooked in the analysis, plus some allowance.

III-1.4 Input Conditions

(1) Water Demand and NRW

Table C.III-01 Water Demand and NRW for Pipeline Network Analysis in Current Situation

Indicators	Water Demand and NRW in 2008		
	m^3/day	m^3/hr	Lps
DAF	165,963	6,915	1,921
DMF	199,144	8,298	2,305
HMF	365,119	15,212	4,226

Note: Daily Average Flow (DAF) : Daily Maximum Flow (DMF) : Hourly Maximum Flow (HMF) =1.0 : 1.2 : 2.2

(2) Water Source

<u>Ground Water</u>

Table C.III-02 Production Well Pumps

No	Area	Well number	Rated Pump Discharge		Rated Pump Head
			(m^3/hr)	(L/sec)	(m)
1	Talamban	K - 2.2	22	6.11	72.49
2		W - 4.2	169	46.94	70.50
3		W - 4.7	180	50.00	90.52
4		W - 4.8	170	47.22	80.75
5		W - 4.10	140	38.89	74.78
6		W - 4.11	200	55.56	88.00
7		W - 4.12	80	22.22	73.00
8		W - 4.14	95	26.39	78.00
9		W - 4.9	35	9.72	62.68
10	Consolacion	W - 5.1	100	27.78	82.68
11		W - 5.2	75	20.83	71.50
12		W - 5.3	45	12.50	76.00
13		W - 5.4	18	5.00	81.06

14		W - 5.5		90	25.00	84.78
15		W - 5.6		92	25.56	79.43
16		W - 5.7		50	13.89	93.00
17		K - 2.1		55	15.28	69.91
18	Tisa-Pardo	W - 5	(MC-5)	80	22.22	82.50
19		W - 6	(MC-6)	30	8.33	85.90
20		T - 2		70	19.44	85.80
21		T - 5		95	26.39	72.00
22		P - 2		25	6.94	81.78
23		P - 4		80	22.22	39.79
24		P - 6		50	13.89	80.58
25		K - 3.1		40	11.11	62.08
26	Mananga	W - 1.1		60	16.67	73.00
27		W - 1.2		115	31.94	79.43
28		W - 1.3		100	27.78	79.00
29		W - 1.4		80	22.22	72.70
30	Lilo-an	SV - 1		90	25.00	85.21
31		SV - 2		80	22.22	77.08
32		SV - 3		95	26.39	95.75
33		SV - 4		85	23.61	94.14
34		SV - 5		80	22.22	84.22
35		SV - 6		70	19.44	79.44
36		SV - 8		38	10.56	80.73
37		SV - 9		50	13.89	78.17
38		SV - 10		55	15.28	71.00
39		SV - 11		37	10.28	83.27
40		SV - 12		38	10.56	85.30
41		SV - 13		42	11.67	75.78
42		SV - 14		85	23.61	77.46
43		SV - 15		35	9.72	73.90
44		SV - 16		36	10.00	10.00
45		SV - 17		70	19.44	86.59
46	Compostela	W - 3.2		20	5.56	54.88
47		W - 3.3		25	6.94	63.41
48	Mactan	MAC - 1*[1]		20	5.56	46.38
49		MAC - 3*[1]		20	5.56	20.30
50		MAC - 4*[1]		25	6.94	18.80
51		MAC - 5*[1]		20	5.56	22.60
52		K - 2.4*[1]		20	5.56	31.63
53	Lahug	W - 25*[1]	(MC - 25)	15	4.17	77.46
54		W - 27*[1]	(MC - 27)	25	6.94	101.59
55		W - 28*[1]	(MC - 28)	15	4.17	0.00
56		L - 1*[1]		30	8.33	95.25
57		L - 2*[1]		25	6.94	104.00
58		L - 3*[1]		20	5.56	82.86
59		CPH *[1]	(CPW)	20	5.56	132.00
60	Guadalupe	W - 11*[1]	(MC -11)	50	13.89	70.48
61		W - 12*[1]	(MC -12)	30	8.33	79.31
62		W - 13*[1]	(MC -13)	30	8.33	71.94
63		W - 13B*[1]	(MC -13B)	30	8.33	73.58
64		G - 1*[1]		25	6.94	44.76
65		G - 2*[1]		50	13.89	71.95
66		G - 3*[1]		45	12.50	63.77
67		G - 4*[1]		25	6.94	77.40
68		G - 5B*[1]		80	22.22	63.51
69		G - 7*[1]		20	5.56	69.75
70		G - 9*[1]		30	8.33	56.81
71	Banilad-Talamban	W - 29*[1]	(MC - 29)	75	20.83	54.42

72		W - 30*[1] (MC - 30)	55	15.28	77.46
73		W - 31*[1] (MC - 31)	45	12.50	67.38
74		W - 32*[1] (MC - 32)	60	16.67	75.61
75		L - 4*[1]	90	25.00	49.68
76		L - 5*[1]	90	25.00	130.42
77		L - 6*[1]	30	8.33	120.00
78		L - 7*[1]	90	25.00	81.69
79		L - 8*[1]	80	22.22	69.30
80	Pardo	W - 2*[1] (MC - 2)	85	23.61	94.32
81		W - 4B*[1] (MC - 4B)	45	12.50	80.29
82	Central Cebu	W - 9*[1] (MC - 9)	15	4.17	48.78
83		W - 15*[1] (MC - 15)	45	12.50	75.49
84		W - 17*[1] (MC - 17)	55	15.28	54.09
85		W - 18B*[1] (MC - 18B)	60	16.67	74.13
86		K - 3.2*[1]	30	8.33	55.00
87	Mandaue	CAN - 1*[1]	100	27.78	58.00
88		CAN - 2*[1]	95	26.39	81.50
89		CAN - 3*[1]	30	8.33	66.01
90		CAN - 5*[1]	120	33.33	55.94
91		CAN - 6*[1]	70	19.44	67.97
92		CAN - 7*[1]	100	27.78	70.97
93		CAD - 1*[1] (KAD-1)	80	22.22	77.17
94	Jaclupan	MG - 1	300	83.33	74.64
95		MG - 2	232	64.44	75.40
96		MG - 5	102	28.33	75.39
97		MG - 6	102	28.33	75.22
98		MG - 7	172	47.78	77.42
99		MG - 8	108	30.00	75.52
100		MG - 9	106	29.44	75.22
101		MG - 10	105	29.17	74.91
102		MG - 11	97	26.94	74.69
103		MG - 12	100	27.78	73.06
104		MG - 14	102	28.33	74.69
105		MG - 16	103	28.61	74.42
106		MG - 18	101	28.06	74.91
107		MG - 19	105	29.17	74.53
108		MG - 20	192	53.33	74.77
109	Ayala	AYALA-1 (AW -1)	1,466	407.20	88.64

Note*[1]: Direct supply to the pipeline network (46 wells)

Data sources were obtained from Production and Distribution Department, MCWD.

Bulk Water

Table C.III-03 Outline of Bulk Water

No	Name	Q m^3/day
1	Mactan Rock	5,000
2	Foremost	5,500
3	Abejo South	5,500
	Total	16,000

Tisa WTP

Table C.III-04 Outline of Tisa WTP

No	Name	Q m^3/day
1	Tisa WTP	4,700

(3) Reservoir

Table C.III-05 Outline of Reservoirs

No	Code Name	V (m^3)	GL (m)	HWL (m)	LWL (m)	e-depth (m)
1	Casili A Tank	5,000	+60.00	+65.60	+59.60	6.00
2	Casili B Tank	5,000	+60.00	+65.30	+59.60	5.70
3	Liloan High Level Tank	2,000	+72.00	+75.10	+71.00	4.10
4	Talamban Tank	5,000	+65.00	+70.60	+64.60	6.00
5	Mactan MEPZ Tank	3,200	+11.30	+20.90	+11.30	9.60
6	Mactan Saucer Shaped Tank	2,000	+26.00	+46.50	+39.20	7.30
7	Lagtang (Mananga) Tank	5,000	+65.00	+70.80	+65.00	6.00
8	Tisa Tank	5,000	+65.30	+70.30	+64.60	5.70
9	Cordova Water Tower	200	+6.00	+22.33	+17.88	4.45
10	Compostela Ground Reservoir	270	+65.00	+69.50	+65.00	4.00

Note: Data sources were obtained from Engineering Department, MCWD.

(4) Booster Pump

Table C.III-06 Existing Booster Pumps

No	Area	Booster Pump Name	Steady/ Stand-by	Rated Pump Discharge (m^3/hr)	Rated Pump Discharge (L/sec)	Rated Pump Head (m)
1	Guadalupe	BPG-1	Steady	720	8.33	52
2	Mandaue	BPMandaue-1	Steady	74	20.56	78
		BPMandaue-2	Steady	105	29.17	110
		BPMandaue-3	Steady	121	33.61	95
		BPMandaue-4	Steady	271	75.28	71
		BPMandaue-5	Steady	112	31.11	69
3	MEPZ	BPMEPZ-1	Stand-by	69	19.17	84
		BPMEPZ-2	Steady	69	19.17	84
		BPMEPZ-3	Steady	88	24.44	87
4	Banilad/ TESDA	BPNMYC-1	Steady	55	15.28	105
		BPNMYC-2	Stand-by	55	15.28	105
5	Capitol	BPOprra-1	Steady	30	8.33	160
		BPOprra-2	Steady	30	8.33	160
		BPOprra-3	Stand-by	30	8.33	160
6	Nivel Hills	BPPBN-1	Steady	30	8.33	56
		BPPBN-2	Stand-by	30	8.33	56
7	Lahug	BPWilson-1	Steady	30	8.33	100
		BPWilson-2	Stand-by	30	8.33	100

Data sources were obtained from Production and Distribution Department, MCWD.

(5) Pressure Reducing Valve

Table C.III-07 Existing Pressure Reducing Valve

No	Area	PRV number	Setting at discharge side (psi)
1	Punta Princesa	PRV-1	15

Note: Data sources were obtained from Engineering Department, MCWD.

(6) Hydraulic Map of Existing Pipeline Network

The result for existing pipeline network is referred to Figure C.III-02.

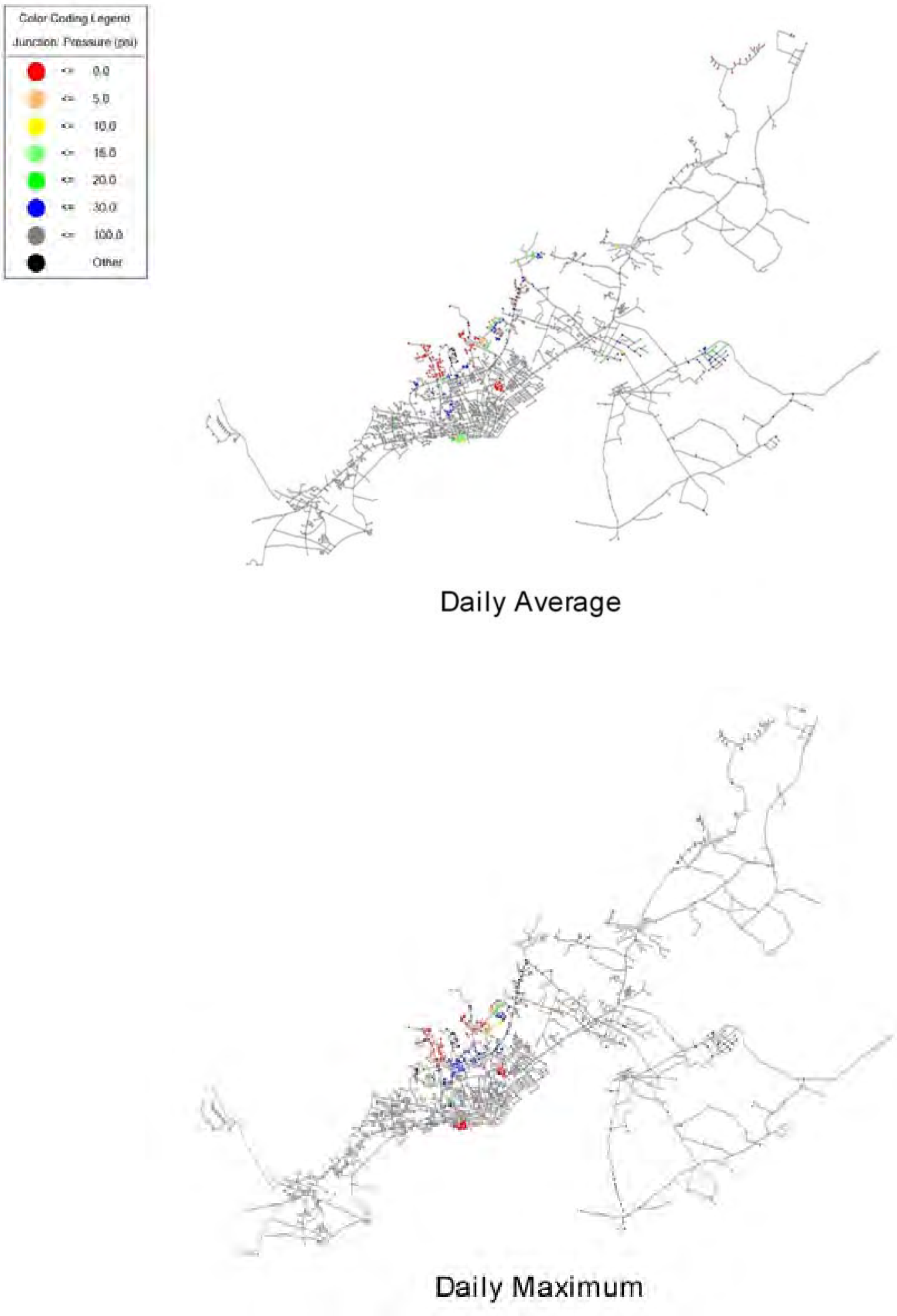

Figure C.III-02 Result of Pipeline Network Analysis in Current Situation (1/2)

Figure C.III-02 Result of Pipeline Network Analysis in Current Situation (2/2)

III-2 Improvement Plan of Pipeline Network

III-2.1 Design Consideration

(1) Design Concept

Target Minimum Water Pressure is 0.07 MPa (=10 psi).

(2) Methodology

Basic concept of improvement plan is to install main (=large) distribution pipeline from each reservoir and additional blanch is install in the model. New pipelines is not setting large diameter compare to around pipelines. Diameter of New pipelines is consider to the balance of pipeline network.

III-2.2 Input Conditions

(1) Water Demand and NRW

Table C.III-08 Water Demand and NRW for Pipeline Network Analysis in Target Year

Distribution Block	Indicators	Water Demand and NRW in 2015		
		m^3/day	m^3/hr	Lps
CLC	Daily Average	19,261	803 m^3/hr	223 Lps
	Daily Maximum	23,113	964 m^3/hr	268 Lps
	Hourly Maximum	42,374	1,767 m^3/hr	491 Lps
Casili	Daily Average	40,323	1,680 m^3/hr	467 Lps
	Daily Maximum	48,388	2,016 m^3/hr	560 Lps
	Hourly Maximum	88,711	3,696 m^3/hr	1,027 Lps
Talamban	Daily Average	58,173	2,424 m^3/hr	673 Lps
	Daily Maximum	69,808	2,909 m^3/hr	808 Lps
	Hourly Maximum	127,981	5,333 m^3/hr	1,481 Lps
Tisa	Daily Average	60,956	2,540 m^3/hr	706 Lps
	Daily Maximum	73,147	3,048 m^3/hr	847 Lps
	Hourly Maximum	134,103	5,588 m^3/hr	1,553 Lps
Lagtan	Daily Average	18,301	763 m^3/hr	212 Lps
	Daily Maximum	21,961	916 m^3/hr	254 Lps
	Hourly Maximum	40,262	1,679 m^3/hr	466 Lps
Mactan	Daily Average	38,136	1,589 m^3/hr	441 Lps
	Daily Maximum	45,763	1,907 m^3/hr	529 Lps
	Hourly Maximum	40,262	3,496 m^3/hr	970 Lps

Note: Daily Average Flow (DAF) : Daily Maximum Flow (DMF) : Hourly Maximum Flow (HMF)
=1.0 : 1.2 : 2.2

(2) Water Source

Table C.III-09 Production Well Pumps

No	Area	Well number	Rated Pump Discharge (m^3/hr)	Rated Pump Discharge (L/sec)	Rated Pump Head (m)
1	Talamban	W - 4.2	169	46.94	70.50
2		W - 4.7	180	50.00	90.52
3		W - 4.8	170	47.22	80.75
4		W - 4.10	140	38.89	74.78
5		W - 4.11	200	55.56	88.00
6		W - 4.12	80	22.22	73.00
7		W - 4.14*1	95	26.39	78.00
8		W - 4.9*1	35	9.72	62.68
9	Consolacion	W - 5.1	100	27.78	82.68
10		W - 5.2	75	20.83	71.50
11		W - 5.3	45	12.50	76.00
12		W - 5.4	18	5.00	81.06
13		W - 5.5	90	25.00	84.78
14		W - 5.6	92	25.56	79.43
15		W - 5.7	50	13.89	93.00
16	Tisa-Pardo	W - 5 (MC-5)	80	22.22	82.50
17		W - 6 (MC-6)	30	8.33	85.90
18		T - 1	550	6.37	80.29
19		T - 2	70	19.44	85.80
20		T - 5	95	26.39	72.00
21		P - 2	25	6.94	81.78
22		P - 4*1	80	22.22	39.79
23		P - 6	50	13.89	80.58
24		K - 3.1*1	40	11.11	62.08
25	Mananga	W - 1.1	60	16.67	73.00
26		W - 1.2	115	31.94	79.43
27		W - 1.3	100	27.78	79.00
28		W - 1.4	80	22.22	72.70
29		W - 2.2*1	27.5	7.64	79.00
30		W - 2.3*1	27.5	7.64	79.00
31		W - 1.5	80	22.22	72.70
32	Lilo-an	SV - 1	90	25.00	85.21
33		SV - 2	80	22.22	77.08
34		SV - 3	95	26.39	95.75
35		SV - 4	85	23.61	94.14
36		SV - 5	80	22.22	84.22
37		SV - 6	70	19.44	79.44
38		SV - 8	38	10.56	80.73
39		SV - 9	50	13.89	78.17
40		SV - 10*1	55	15.28	71.00
41		SV - 11	37	10.28	83.27
42		SV - 12	38	10.56	85.30
43		SV - 13	42	11.67	75.78
44		SV - 14	85	23.61	77.46
45		SV - 15	35	9.72	73.90
46		SV - 16	36	10.00	10.00
47		SV - 17	70	19.44	86.59
48	Compostela	W - 3.2	20	5.56	54.88
49		W - 3.3	25	6.94	63.41
50	Mactan	MAC - 1*1	20	5.56	46.38
51		MAC - 3*1	20	5.56	20.30

No	Area	Well number		Rated Pump Discharge (m^3/hr)	(L/sec)	Rated Pump Head (m)
52		MAC - 4*1		25	6.94	18.80
53		MAC - 5*1		20	5.56	22.60
54		MAC - 6*1		7.5	2.08	46.38
55		MAC - 7*1		7.5	2.08	46.38
56		MAC - 8*1		7.5	2.08	46.38
57		MAC - 9*1		7.5	2.08	46.38
58		MAC - 10*1		7.5	2.08	46.38
59		MAC - 11*1		7.5	2.08	46.38
60		K - 2.4*1		20	5.56	31.63
61	Lahug	W - 25*1	(MC-25)	15	4.17	77.46
62		W - 27*1	(MC-27)	25	6.94	101.59
63		W - 28*1	(MC-28)	15	4.17	0.00
64		L - 1*1		30	8.33	95.25
65		L - 2*1		25	6.94	104.00
66		L - 3*1		20	5.56	82.86
67		CPH *1	(CPW)	20	5.56	132.00
68		CAM - 1*1		1,100	12.73	77.46
69	Guadalupe	W - 11*1	(MC-11)	50	13.89	70.48
70		W - 12*1	(MC-12)	30	8.33	79.31
71		W - 13*1	(MC-13)	30	8.33	71.94
72		W - 13B*1	(MC-13B)	30	8.33	73.58
73		G - 1*1		25	6.94	44.76
74		G - 2*1		50	13.89	71.95
75		G - 3*1		45	12.50	63.77
76		G - 4*1		25	6.94	77.40
77		G - 5B*1		80	22.22	63.51
78		G - 10*1		23	6.37	77.40
79	Banilad-Talamban	W - 29*1	(MC-29)	75	20.83	54.42
80		W - 30*1	(MC-30)	55	15.28	77.46
81		W - 31*1	(MC-31)	45	12.50	67.38
82		W - 32*1	(MC-32)	60	16.67	75.61
83		W - 34R*1	(MC-34R)	1,100	12.73	77.17
84		L – 4*1		90	25.00	49.68
85		L - 5*1		90	25.00	130.42
86		L - 6*1		30	8.33	120.00
87		L - 7*1		90	25.00	81.69
88		L - 8*1		80	22.22	69.30
89		W - 23*1	(MC-23)	36.67	10.19	75.61
90		MAN - 1*1		64.17	17.83	75.61
91		NAZ - 1*1		13.75	3.82	75.61
92	Pardo	W - 2*1	(MC-2)	85	23.61	94.32
93		W - 2B*1	(MC-2B)	1,980	22.92	94.32
94		W - 4B*1	(MC-4B)	45	12.50	80.29
95	Central Cebu	W - 9*1	(MC-9)	15	4.17	48.78
96		W - 15*1	(MC-15)	45	12.50	75.49
97		W - 17*1	(MC-17)	55	15.28	54.09
98		W - 18B*1	(MC-18)	60	16.67	74.13
99		K - 3.2*1		30	8.33	55.00
100	Mandaue	CAN - 1*1		100	27.78	58.00
101		CAN - 2*1		95	26.39	81.50
102		CAN - 3*1		30	8.33	66.01
103		CAN - 5*1		120	33.33	55.94
104		CAN - 6*1		70	19.44	67.97
105		CAN - 7*1		100	27.78	70.97
106		CAN - 8*1		45.83	12.73	70.97

No	Area	Well number	Rated Pump Discharge (m^3/hr)	(L/sec)	Rated Pump Head (m)
107		CUB - 1*1	45.83	12.73	70.97
108		CAD - 1*1 (KAD-1)	80	22.22	77.17
109	Jaclupan	MG - 1	300	83.33	74.64
110		MG - 2	232	64.44	75.40
111		MG - 5	102	28.33	75.39
112		MG - 6	102	28.33	75.22
113		MG - 7	172	47.78	77.42
114		MG - 8	108	30.00	75.52
115		MG - 9	106	29.44	75.22
116		MG - 10	105	29.17	74.91
117		MG - 11	97	26.94	74.69
118		MG - 12	100	27.78	73.06
119		MG - 14	102	28.33	74.69
120		MG - 16	103	28.61	74.42
121		MG - 18	101	28.06	74.91
122		MG - 19	105	29.17	74.53
123		MG - 20	192	53.33	74.77
124	Ayala	AYALA-1*1 (AW-1)	1,466	407.20	88.64

Note*1: Direct supply to the pipeline network (67 wells)

Table C.III-10 Production New Well Pumps in Improvement Plan

No	Area	Well number	Rated Pump Discharge (m^3/hr)	(L/sec)	Rated Pump Head (m)
		Casanga-South-1	300	3.47	60.00
		Casanga-South-2	300	3.47	60.00
		Casanga-South-3	300	3.47	60.00
		Casanga-South-4	300	3.47	60.00
		Casanga-South-5	300	3.47	60.00
		Casanga-South-6	300	3.47	60.00
		Casanga-South-7	300	3.47	60.00
		Casanga-South-8	300	3.47	60.00
		Casanga-South-9	300	3.47	60.00
		Butuanon-North-1	1000	11.57	60.00
		Butuanon-North-2	1000	11.57	60.00
		Butuanon-North-3	1000	11.57	60.00
		Butuanon-North-4	1000	11.57	60.00
		Butuanon-North-5	1000	11.57	60.00
		Butuanon-North-6	1000	11.57	60.00
		Butuanon-North-7	1000	11.57	60.00
		Butuanon-North-8	1000	11.57	60.00
		Butuanon-North-9	1000	11.57	60.00
		Butuanon-North-10	1000	11.57	60.00
		Butuanon-North-11	1000	11.57	60.00
		Butuanon-North-12	1000	11.57	60.00
		Butuanon-North-13	1000	11.57	60.00
		Butuanon-North-14	1000	11.57	60.00
		Butuanon-North-15	1000	11.57	60.00
		Butuanon-North-16	1000	11.57	60.00
		Cebu-North-1	600	6.94	65.00
		Cebu-North-2	600	6.94	65.00
		Cebu-North-3	600	6.94	65.00
		Cebu-North-4	600	6.94	65.00
		Cebu-North-5	600	6.94	65.00
		Cebu-North-6	600	6.94	65.00

No	Area	Well number	Rated Pump Discharge (m^3/hr)	(L/sec)	Rated Pump Head (m)
		Cebu-North-7	600	6.94	65.00
		Cebu-North-8	600	6.94	65.00
		Cebu-River-1	600	6.94	65.00
		Cebu-River-2	600	6.94	65.00
		Cebu-River-3	600	6.94	65.00
		Cebu-River-4	600	6.94	65.00
		Cebu-River-5	600	6.94	65.00
		Cebu-River-6	600	6.94	65.00
		Cebu-River-7	600	6.94	65.00
		Cebu-River-8	600	6.94	65.00
		Cebu-River-9	600	6.94	65.00
		Cebu-River-10	600	6.94	65.00
		Cebu-River-11	600	6.94	65.00
		Cebu-River-12	600	6.94	65.00
		Cebu-River-13	600	6.94	65.00
		Cebu-River-14	600	6.94	65.00
		Cebu-River-15	600	6.94	65.00
		Cebu-River-16	600	6.94	65.00
		Cebu-River-17	600	6.94	65.00
		Cebu-River-18	600	6.94	65.00
		Cebu-River-19	600	6.94	65.00
		Cebu-River-20	600	6.94	65.00
		Cebu-South-1	600	6.94	65.00
		Cebu-South-2	600	6.94	65.00
		Cebu-South-3	600	6.94	65.00
		Cebu-South-4	600	6.94	65.00
		Cebu-South-5	600	6.94	65.00
		Cebu-South-6	600	6.94	65.00
		Cebu-South-7	600	6.94	65.00
		Cebu-South-8	600	6.94	65.00
		Cebu-South-9	600	6.94	65.00
		Cebu-South-10	600	6.94	65.00

Bulk Water

Table C.III-11 Outline of Bulk Water

No	Name	Q m^3/day
1	Mactan Rock	5,000
2	Foremost	5,500
3	Abejo South	5,500
4	Abejo North	7,000
	Total	23,000

Tisa WTP

Table C.III-12 Outline of Tisa WTP

No	Name	Q m^3/day
1	Tisa WTP	4,700

Mactan Desalination Plant

Table C.III-13 Outline of Mactan Desalination Plant

No	Name	Q m^3/day
1	Mactan Desalination Plant	9,600

(3) Reservoir

Table C.III-14 Outline of Reservoirs in Improvement Plan

No	Code Name	Complete	V m^3	GL	LWL	HWL	e-depth	Notes
1	Casili OldTank	1978	5,000	+60.00	+59.60	+65.60	6.00	Existing
2	Casili New Tank	1997	5,000	+60.00	+59.60	+65.30	5.70	Existing
3	Casili-2015 New Tank	New	5,000	+60.00	+59.60	+65.30	5.70	New
4	Liloan High Level Tank	1997	2,000	+72.00	+71.00	+75.10	4.10	Existing
5	Talamban Tank	1980	5,000	+65.00	+64.60	+70.60	6.00	Existing
6	Talamban New Tank	New	10,000	+65.00	+64.60	+70.60	6.00	New
7	Mactan MEPZ Tank	1983	3,200	+11.30	+11.30	+17.30	6.00	Existing
8	Mactan Pusok Tower	1997	2,000	+26.00	+39.20	+46.50	7.30	Existing
9	Mactan New Pusok Tower	New	4,000	+26.00	+39.20	+46.50	7.30	New
10	Lagtang (Mananga) Tank	1980	5,000	+65.00	+65.00	+70.80	5.80	Existing
11	Tisa Tank	1995	5,000	+65.30	+64.60	+70.30	5.70	Existing
12	Tisa New Tank	New	10,000	+65.30	+64.60	+70.30	5.70	New
13	Cordova Water Tower	1993	(200)	+ 6.00	+17.88	+22.33	4.45	Not in Used
14	Compostela Ground Reservoir	1934	270	+65.00	+65.00	+69.50	4.50	Existing
		Total	61,470					

III-2.3 Improved Pipeline Network

(1) Hydraulic Map of Improved Pipeline Network

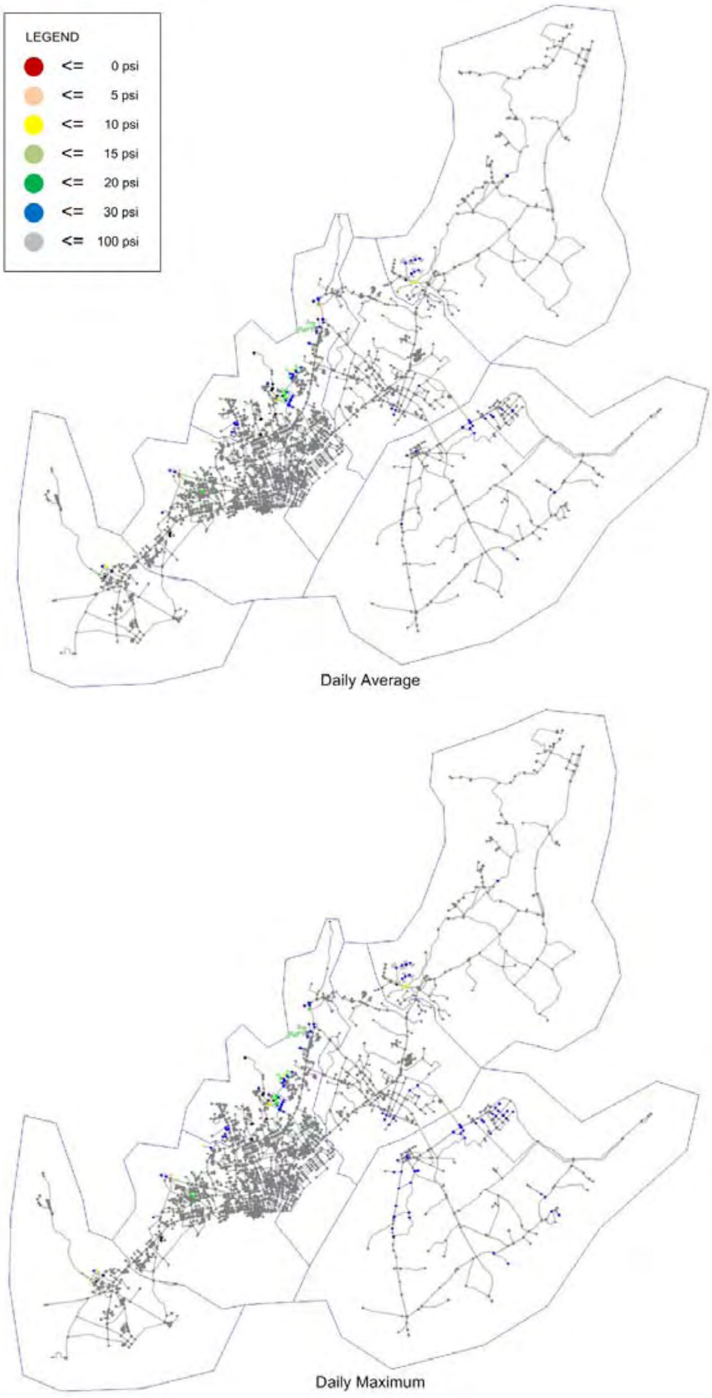

Figure C.III-03 Result of plan on Improvement for Pipeline Network Analysis (1/2)

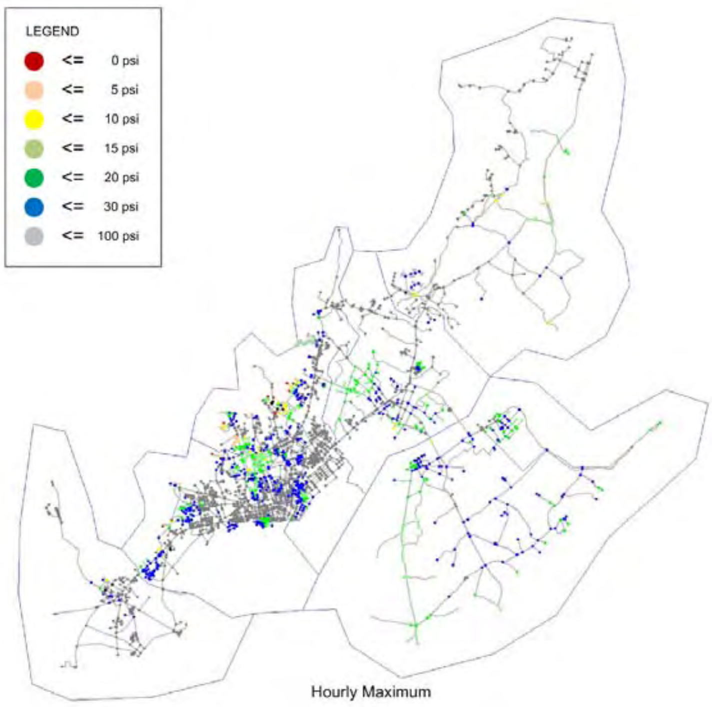

Figure C.III-03 Result of plan on Improvement for Pipeline Network Analysis (2/2)

(2) Transmission Pump in Improvement Plan

Table C.III-15 Outline of Transmission Pumps in Improvement Plan

	Area	Transmission Pump Name	Steady/ Stand-by	Rated Pump Discharge		Rated Pump Head	Note
				(m^3/hr)	(L/sec)	(m)	
1	Tisa Reservoir to Talamban Reservoir	-	Steady	396	110.00	30	New
			Steady	396	110.00	30	New
			Steady	396	110.00	30	New
			Stand-by	396	110.00	30	New
			Stand-by	396	110.00	30	New
2	Talamban Reservoir to Casili Reservoir	-	Steady	381	105.83	20	New
			Steady	381	105.83	20	New
			Steady	381	105.83	20	New
			Steady	381	105.83	20	New
			Stand-by	381	105.83	20	New
			Stand-by	381	105.83	20	New

(3) Booster Pump in Improvement Plan

Table C.III-16 Outline of Booster Pumps in Improvement Plan

	Area	Booster Pump Name	Steady/ Stand-by	Rated Pump Discharge		Rated Pump Head	Note
				(m^3/hr)	(L/sec)	(m)	
1	Guadalupe	BPG	Steady	720	8.33	52	Existing
2	Guadalupe	BPG New-1	Steady	116	32.23	40	New
		BPG New-3	Steady	2,785	32.23	40	New
		BPG New-2	Stand-by	2,785	32.23	40	New
3	Mandaue	BPMandaue-1	Steady	74	20.56	78	Existing
		BPMandaue-2	Steady	105	29.17	110	Existing
		BPMandaue-3	Steady	121	33.61	95	Existing
		BPMandaue-4	Steady	271	75.28	71	Existing

		BPMandaue-5	Steady	112	31.11	69	Existing
4	MEPZ	BPMEPZ-1	Stand-by	69	19.17	84	Existing
		BPMEPZ-2	Steady	69	19.17	84	Existing
		BPMEPZ-3	Steady	88	24.44	87	Existing
5	Banilad/ TESDA	BPNMYC-1	Steady	55	15.28	105	Existing
		BPNMYC-2	Stand-by	55	15.28	105	Existing
6	Capitol	BPOprra-1	Steady	30	8.33	160	Existing
		BPOprra-2	Steady	30	8.33	160	Existing
		BPOprra-3	Stand-by	30	8.33	160	Existing
7	Nivel Hills	BPPBN-1	Steady	30	8.33	56	Existing
		BPPBN-2	Stand-by	30	8.33	56	Existing
8	Lahug	BPWilson-1	Steady	30	8.33	100	Existing
		BPWilson-2	Stand-by	30	8.33	100	Existing
9	Lahug	BPWilson New-1	Steady	65	18.00	60	New
		BPWilsonNew -2	Stand-by	65	18.00	60	New

(4) Pressure Reducing Valve

Table C.III-17 Outline of Pressure Reducing Valve

No	Area	PRV number	Setting at discharge side (psi)	Note
1	Punta Princesa	PRV-1	15	Existing

(5) BOQ

Table C.III-18 BOQ of Pipelines

Diameter	Distribution Block/ Length (m)						Total
	CLC	Casili	Talamban	Tisa	Lagtang	Mactan	
75 MM	0	0	0	0	0	0	0
100 MM	0	4,500	0	0	0	0	4,500
150 MM	0	8,000	19,000	0	0	0	27,000
200 MM	0	0	0	0	0	0	0
300 MM	0	0	0	0	0	0	0
400 MM	0	0	0	0	0	0	0
500 MM	0	0	0	0	0	0	0
600 MM	0	0	0	0	0	0	0
700 MM	0	0	0	0	0	0	0
800 MM	0	0	0	0	0	0	0
Total	0	12,500	19,000	0	0	0	31,500

Table C.III-19 Outline of New Transmision Water Pipelines

Diameter	Distribution Block/ Length (m)						Total
	CLC	Casili	Talamban	Tisa	Lagtang	Mactan	
75 MM	0	0	0	0	0	0	0
100 MM	0	0	0	0	0	0	0
150 MM	0	0	0	0	0	0	0
200 MM	0	0	0	0	0	0	0
300 MM	0	0	0	0	0	0	0
400 MM	0	0	2,700	0	0	8,100	10,800
500 MM	0	0	2,700	0	0	0	2,700
600 MM	0	3,550	2,700	0	0	788	7,038
700 MM	0	0	2,700	0	0	0	2,700
800 MM	0	3,550	0	0	0	0	3,550
Total	0	7,100	10,800	0	0	8,888	26,788

Table C.III-20 Outline of New Distribution Water Pipelines

Diameter	Distribution Block/ Length (m)						Total
	CLC	Casili	Talamban	Tisa	Lagtang	Mactan	
75 MM	249	691	85	359	374	137	1,895
100 MM	495	575	408	1,238	386	634	3,736
150 MM	5,119	2,786	1,707	713	1,298	3,100	14,723
200 MM	7,096	4,119	3,491	1,667	0	287	16,660
300 MM	5,657	2,098	1,346	257	0	6,589	15,947
400 MM	1,367	773	102	0	0	2,771	5,013
500 MM	0	190	4,901	0	0	0	5,091
600 MM	0	0	1,021	0	0	0	1,021
700 MM	0	0	980	3,951	0	203	5,134
800 MM	0	0	0	0	0	0	0
Total	19,983	11,232	14,041	8,185	2,058	13,721	69,220

Table C.III-21 Outline of New Pipelines in Total

Diameter	Distribution Block/ Length (m)						Total
	CLC	Casili	Talamban	Tisa	Lagtang	Mactan	
75 MM	249	691	85	359	374	137	1,895
100 MM	495	5,075	408	1,238	386	634	8,236
150 MM	5,119	10,786	20,707	713	1,298	3,100	41,723
200 MM	7,096	4,119	3,491	1,667	0	287	16,660
300 MM	5,657	2,098	1,346	257	0	6,589	15,947
400 MM	1,367	773	2,802	0	0	10,871	15,813
500 MM	0	190	7,601	0	0	0	7,791
600 MM	0	3,550	3,721	0	0	788	8,059
700 MM	0	0	3,680	3,951	0	203	7,834
800 MM	0	3,550	0	0	0	0	3,550
Total	19,983	30,832	43,841	8,185	2,058	22,609	127,508

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Section-IV: Cost Estimation

I-1 Methodology of CAPEX Estimation

I-1.1 Cost Estimation for Water Source

(1) Well Intake Facilities Construction

Water Intake Facilities construction costs includes mobilization and demobilization charges, drilling, supply and installation of casing, gravel packing and sealing, surface sealing with concrete, developing the well, test pump test, and well disinfection.

The unit prices are computed based on normal conditions. Unit prices should be adjusted for places where accessibility and availability of materials locally are major problems.

(2) Well Intake Facilities Rehabilitation

Water Intake Facilities rehabilitation costs more or less are the same as constructing new well. Items of work should be itemized, then deduct the items cost that are not needed in the rehabilitation from new well construction.

(3) Jaclupan Weir Rehabilitation

Rehabilitation cost of Jaclupan weir will consist of sheet pile of size about 60m in wide and 30m in deep, heavy equipment rental, welding and cutting fit out and other miscellaneous item.

(4) Tisa WTP Rehabilitation

The Tisa Water Treatment Plant rehabilitation costs includes earthworks, structural works, building works, piping works, electrical and mechanical works and landscaping work.

(5) Mactan Desalination Plant Construction

Desalination Plant construction cost at Mactan comprises of surface water intake structure, process equipment, auxiliary equipment, concentrates disposal and building structure. Production well cost were included at Water Intake Facilities item of work.

I-1.3 Cost Estimation for Reservoirs

(1) Tisa Water Reservoir Construction

Tisa Reservoir total capacity of water is 10,000m³. Item of works includes earthworks, structural works, building works, piping works, electrical and mechanical works and landscaping works.

(2) Casili Water Reservoir Construction

Casili Reservoir total capacity of water is 5,000m³. Item of works includes earthworks, structural works, building works, piping works, electrical and mechanical works and landscaping works.

(3) Talamban Water Reservoir Construction

Talamban Reservoir total capacity of water is 10,000m³. Item of works includes earthworks, structural works, building works, piping works, electrical and mechanical works and landscaping works.

(4) Mactan Water Tower Construction

Capable volume of Mactan Water Tower is designed at 2,000 m^3/site times two giving as a total volume of 4,000 m^3. Compare to other reservoir, construction cost is much expensive due to the massive concrete and steel works. Item of works is the same as with other reservoirs.

I-1.4 Cost Estimation for Pipelines

(1) Raw Water Pipeline Installation

Pipe sizes for raw water pipeline are diameters of 4" (100mm) and 6" (150mm) pipes. HDPE pipe were considered to use for this item. Installation cost for raw water pipes includes earth-work, road breaking and restoration, pipes, valves and fittings.

(2) Transmission Pipeline Installation

Pipe sizes for transmission pipeline ranges from 16" (400mm) from 32" (800mm) Ø pipes. CL/CC steel pipe were use for this item. Installation cost for transmission pipes includes earth-work, earth retaining work, road breaking and restoration, pipes, valves and fittings.

(3) Pump Station Construction (From Tisa Reservoir to Talamban Reservoir)

Pumping Station is with pump size of 8" (200mm) Ø x 5 Nos (including 2 Nos Stand-by)and delivery rate of 396 m^3/hr. Cost for each pump station includes cost for piping, valves, fittings, control panels, related materials and equipment, installation, earthworks and building structure.

(4) Pump Station Construction (From Talamban Reservoir to Casili Reservoir)

Pumping Station is with pump size of 8" (200mm) Ø x 4 Nos (including 2 Nos Stand-by)and delivery rate of 381 m^3/hr. Cost for each pump station includes cost for piping, valves, fittings, control panels, related materials and equipment, installation, earthworks and building structure.

(5) Main Distribution Pipeline Installation

Pipe sizes for main distribution pipeline ranges from 12" (300mm) from 28" (700mm) Ø pipes. CL/CC steel pipe were use for this item. Installation cost for main distribution pipes includes earthwork, earth retaining work, road breaking and restoration, pipes, valves and fittings.

(6) Pump Station Construction (Talamban D.B -1)

Pumping Station is with pump size of 6" (150mm) Ø x 3 Nos (including 1 No Stand-by)and delivery rate of 116 m^3/hr. Cost for each pump station includes cost for piping, valves, fittings, control panels, related materials and equipment, installation, earthworks and building structure.

(7) Pump Station Construction (Talamban D.B -2)

Pumping Station is with pump size of 6" (150mm) Ø x 3 Nos (including 1 No Stand-by)and delivery rate of 64.8 m^3/hr. Cost for each pump station includes cost for piping, valves, fittings, control panels, related materials and equipment, installation, earthworks and building structure.

(8) Secondary Distribution Pipeline Installation

Pipe sizes for secondary distribution pipeline ranges from 3" (75mm) from 8" (200mm) Ø pipes. HDPE pipe were use for this item. Installation cost for secondary distribution pipes includes earthwork, road breaking and restoration, pipes, valves and fittings.

I-1.5 Cost Estimation for NRW Reduction

Costs of NRW reduction include pipe repairing work efficiency. The first priority is given to NRW reduction to implement necessary measures.

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I-2 Methodology of OPEX Estimation

I-2.1 Cost Estimate of OPEX Component

(1) Human Cost

OPEX for human consist of labor cost (salaries and wages plus benefits), and the retirement payment for the employees. Labor costs are not always followed inflation rate. Therefore the labor cost is estimated to increase 1% inflation rate annually.

(2) Power Cost

Electric power cost for pumping of water from wells, water treatment facilities and the operation cost of desalination plant beginning on year 2011 are considered. Inflation rate of 0% is assumed for the power cost projection.

(3) Chemical Cost

OPEX for chemical treatment of water from all water sources (ground water, surface water) except bulk water are computed and inflated annually by 6%.

The kind of chemical are shown in Table D.IV-01 as follows:

Table D.IV-01 Chemical for Tisa WTP

Name	Objective	Target
Chlorine	Disinfection	All water sources except Bulk Water
Aluminum Sulfate	Flocculating Agent	Water source from Buhisan Dam
Copper Sulfate	Flocculating Agent	Water source from Buhisan Dam
PAC	Flocculating Agent	Water source from Buhisan Dam

(4) Operation and Maintenance Cost

Operation and maintenance cost consist of fuel cost and maintenance of materials. OPEX increased yearly by 7% for fuel expenses and 6% for the others.

(5) Other Cost

Other cost is broken down into training cost, office supplies and other OPEX. Inflation rate of 6% is used for yearly increased.

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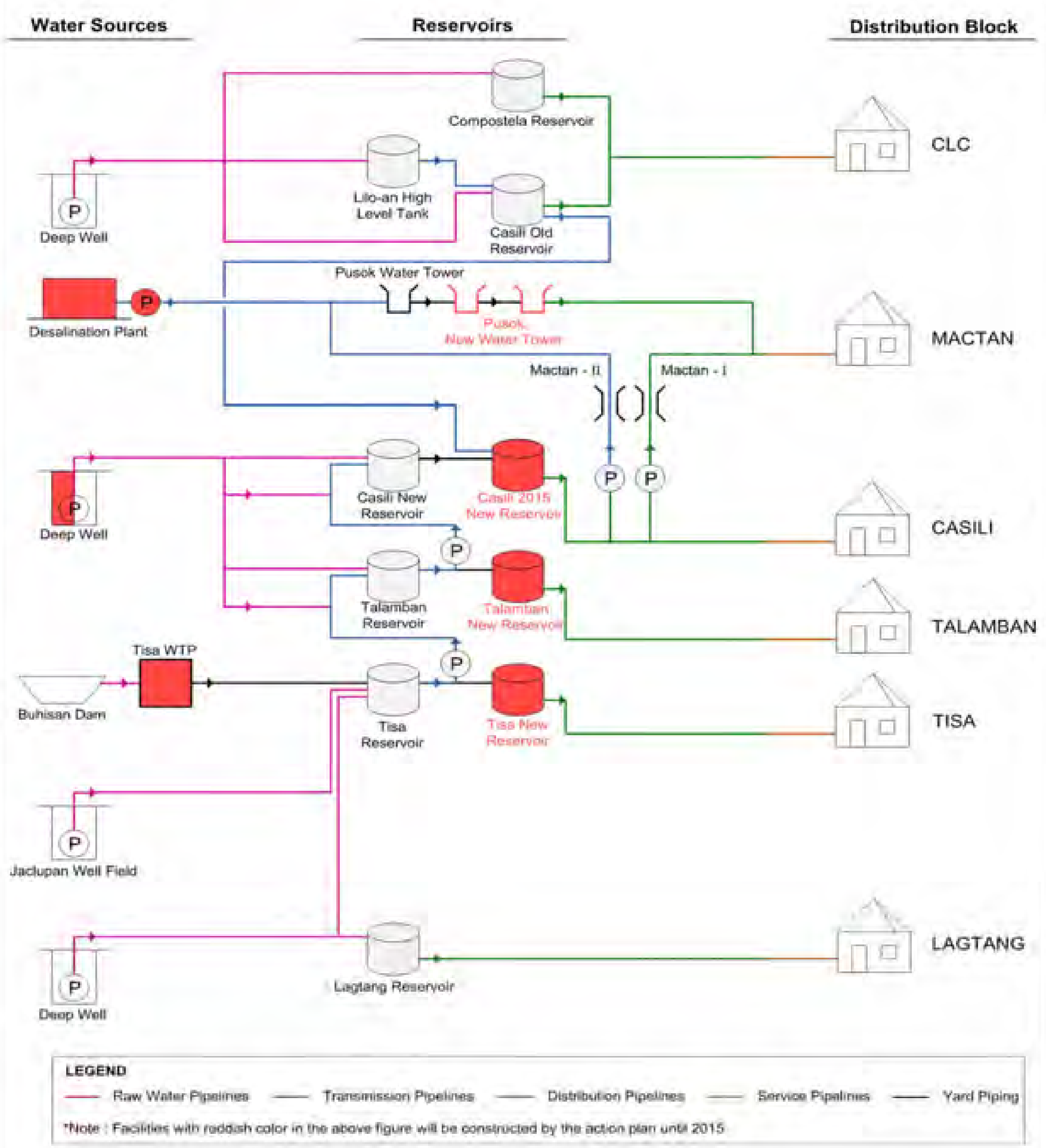
Chapter-II: Drawing (Water Supply Improvements)



Metropolitan Cebu Water District JICA Study Team NJS Consultants Co., Ltd. Nippon Koei Co., Ltd.	**Figure A.11** Identification of Water Supply Facilities and Definition of Pipelines

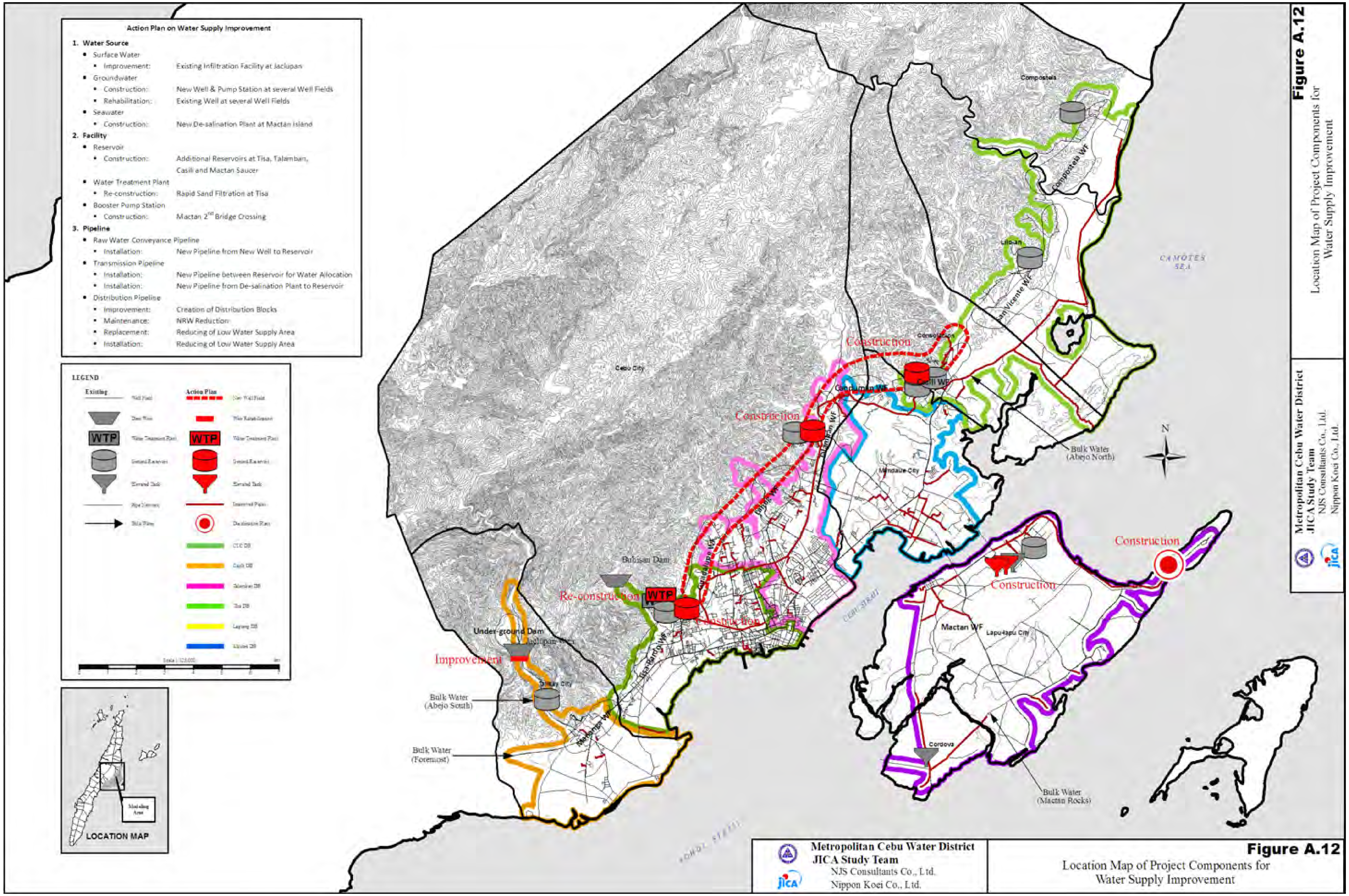

Action Plan on Water Supply Improvement
1. Water Source
Surface Water
Improvement: Existing Infiltration Facility at Jaclupan
Groundwater
Construction: New Well & Pump Station at several Well Fields
Rehabilitation: Existing Well at several Well Fields
Seawater
Construction: New De-salination Plant at Mactan Island
2. Facility
Reservoir
Construction: Additional Reservoirs at Tisa, Talamban, Casili and Mactan Saucer
Water Treatment Plant
Re-construction: Rapid Sand Filtration at Tisa
Booster Pump Station
Construction: Mactan 2nd Bridge Crossing
3. Pipeline
Raw Water Conveyance Pipeline
Installation: New Pipeline from New Well to Reservoir
Transmission Pipeline
Installation: New Pipeline between Reservoir for Water Allocation
Installation: New Pipeline from De-salination Plant to Reservoir
Distribution Pipeline
Improvement: Creation of Distribution Blocks
Maintenance: NRW Reduction
Replacement: Reducing of Low Water Supply Area
Installation: Reducing of Low Water Supply Area
LEGEND
Existing
Action Plan
WTP
WTP
LOCATION MAP
Compostela
Compostela WF
Liloan
San Vicente WF
CAMOTES SEA
Consolacion
Construction
Casili WF
Construction
Cebu City
Mandaue City
Bulk Water (Abejo North)
N
Construction
Construction
Mactan WF
Lapu-lapu City
Busay Dam
Re-construction
WTP
Construction
Under-ground Dam
Jaclupan WF
Improvement
Talisay City
Bulk Water (Abejo South)
Bulk Water (Foremost)
Cordova
Bulk Water (Mactan Rocks)
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Figure A.12
Location Map of Project Components for Water Supply Improvement

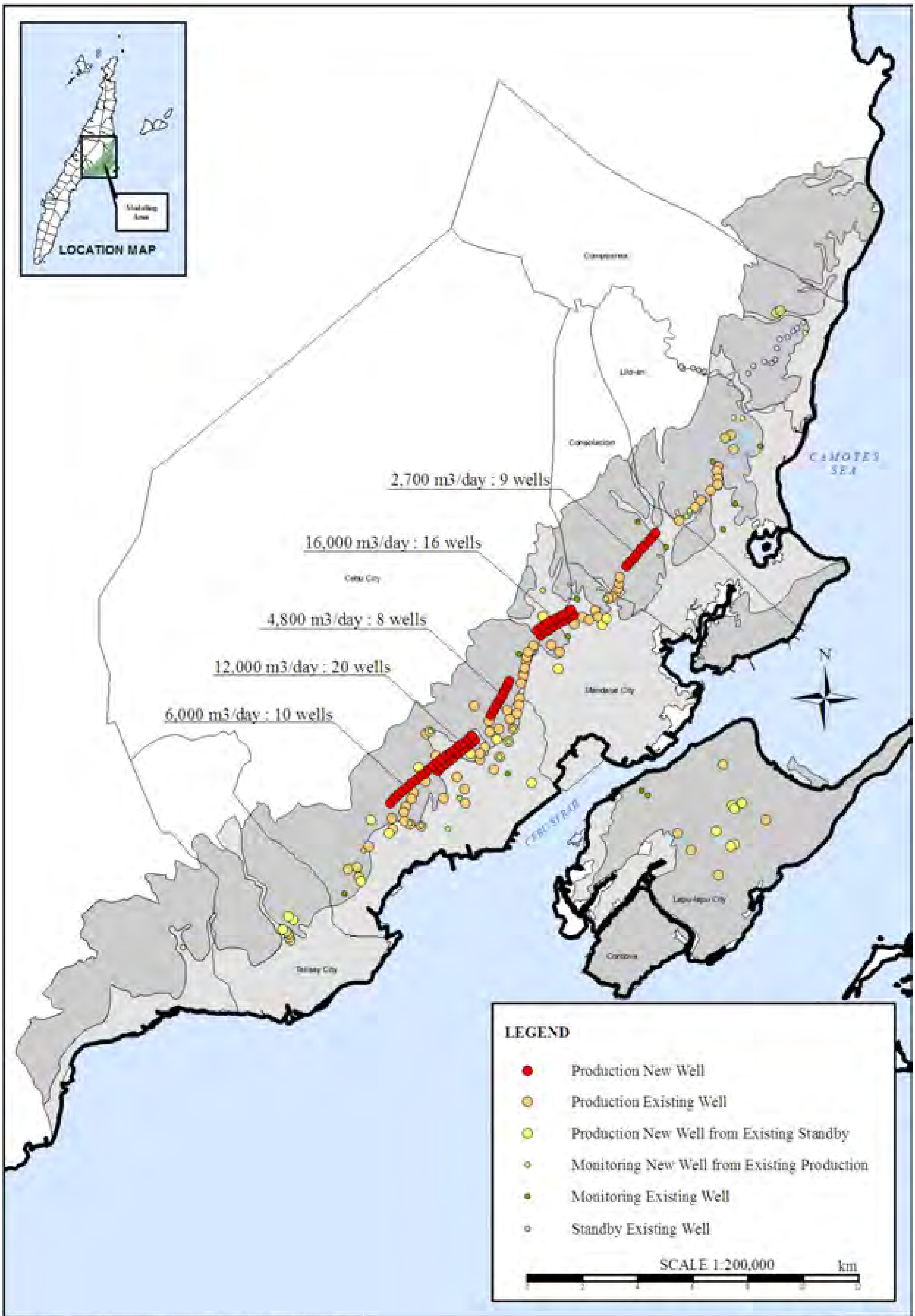

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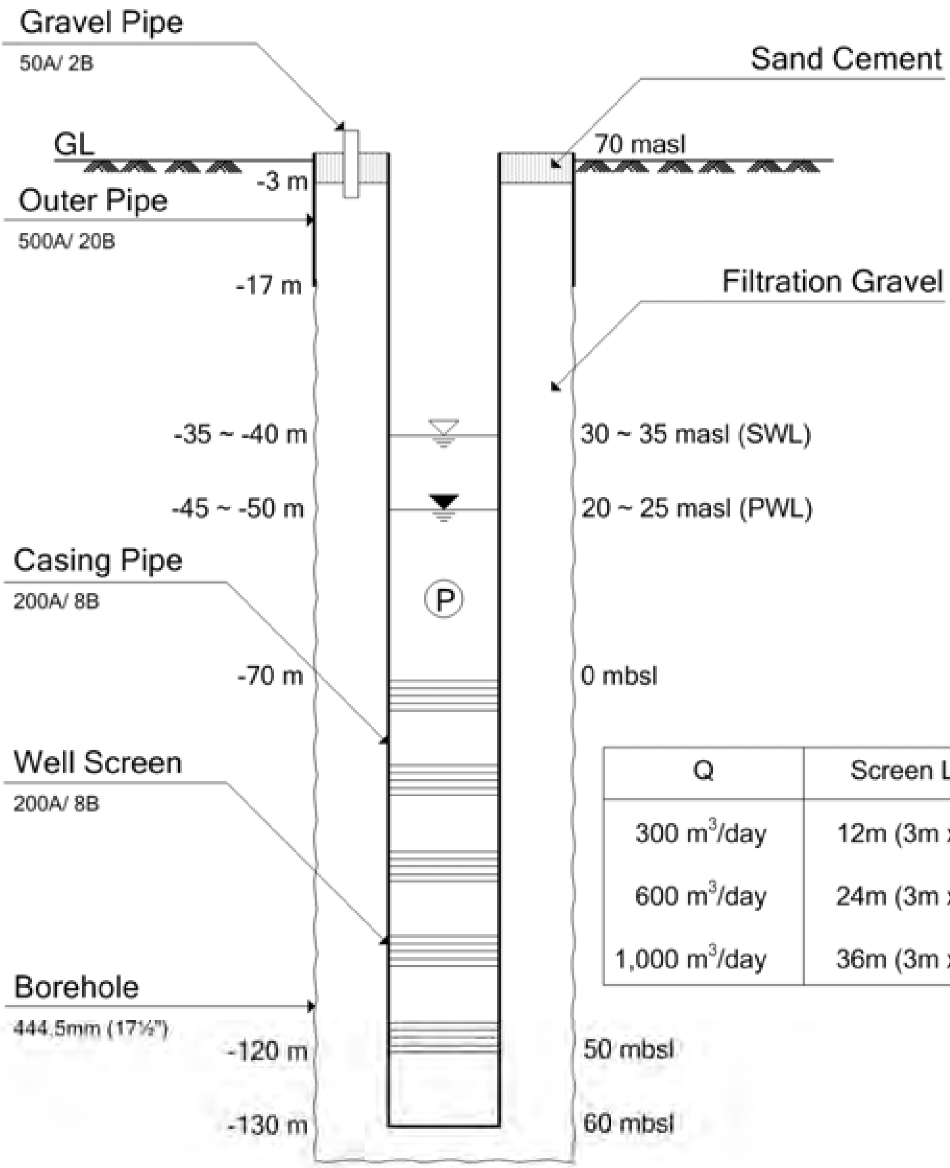
Figure A.21.1
Location Map of New Well Fields



Q	Screen Length
300 m^3/day	12m (3m x 4 pcs.)
600 m^3/day	24m (3m x 8 pcs.)
1,000 m^3/day	36m (3m x 12 pcs.)

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Figure A.21.2
Standard Design of New Well Construction

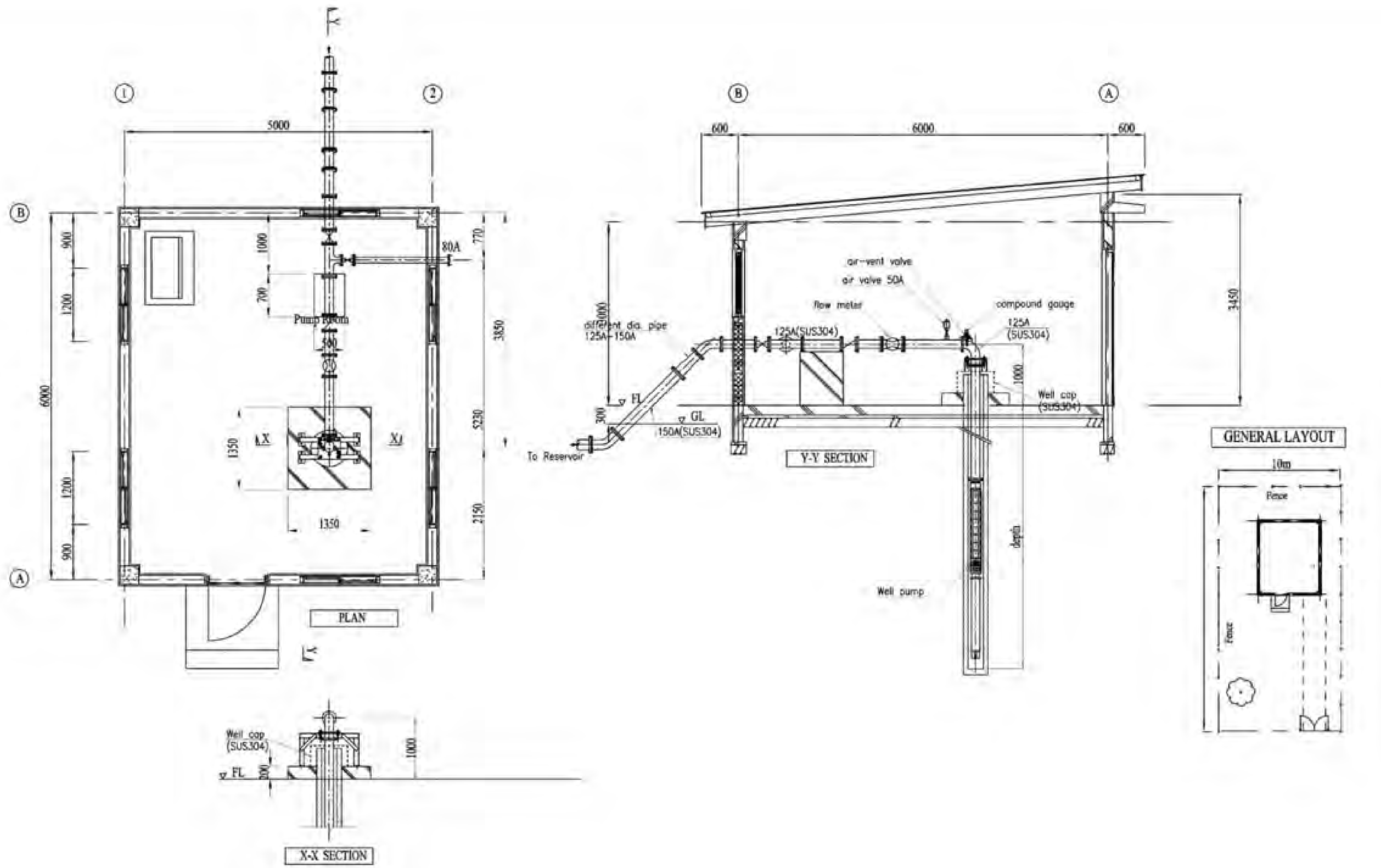

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Figure A.21.3
General Layout Plan of New Well Pump House

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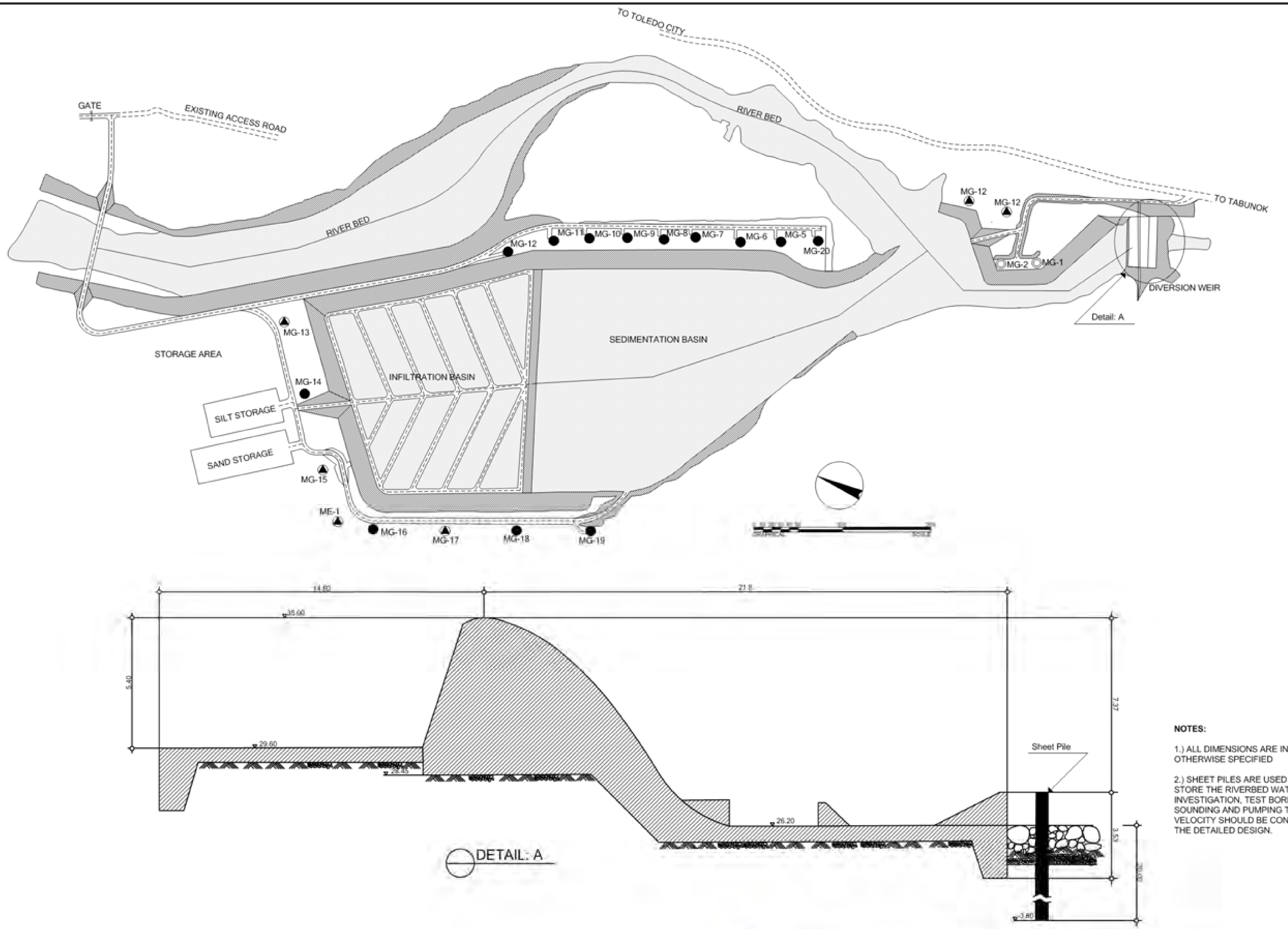
Figure A.21.3
General Layout Plan of New Well Pump House



NOTES:

1.) ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SPECIFIED

2.) SHEET PILES ARE USED FOR BAFFLE FENCE TO STORE THE RIVERBED WATER. AT THE FIRST INVESTIGATION, TEST BORING FOR BEDROCK SOUNDING AND PUMPING TEST FOR FLOOR VELOCITY SHOULD BE CONFIRMED TO PROCEED THE DETAILED DESIGN.

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Figure A.22
Proposed Design of Existing Jaclupan Weir Rehabilitation

Figure A.22
Proposed Design of Existing Jaclupan Weir Rehabilitation
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Nippon Koei Co., Ltd.

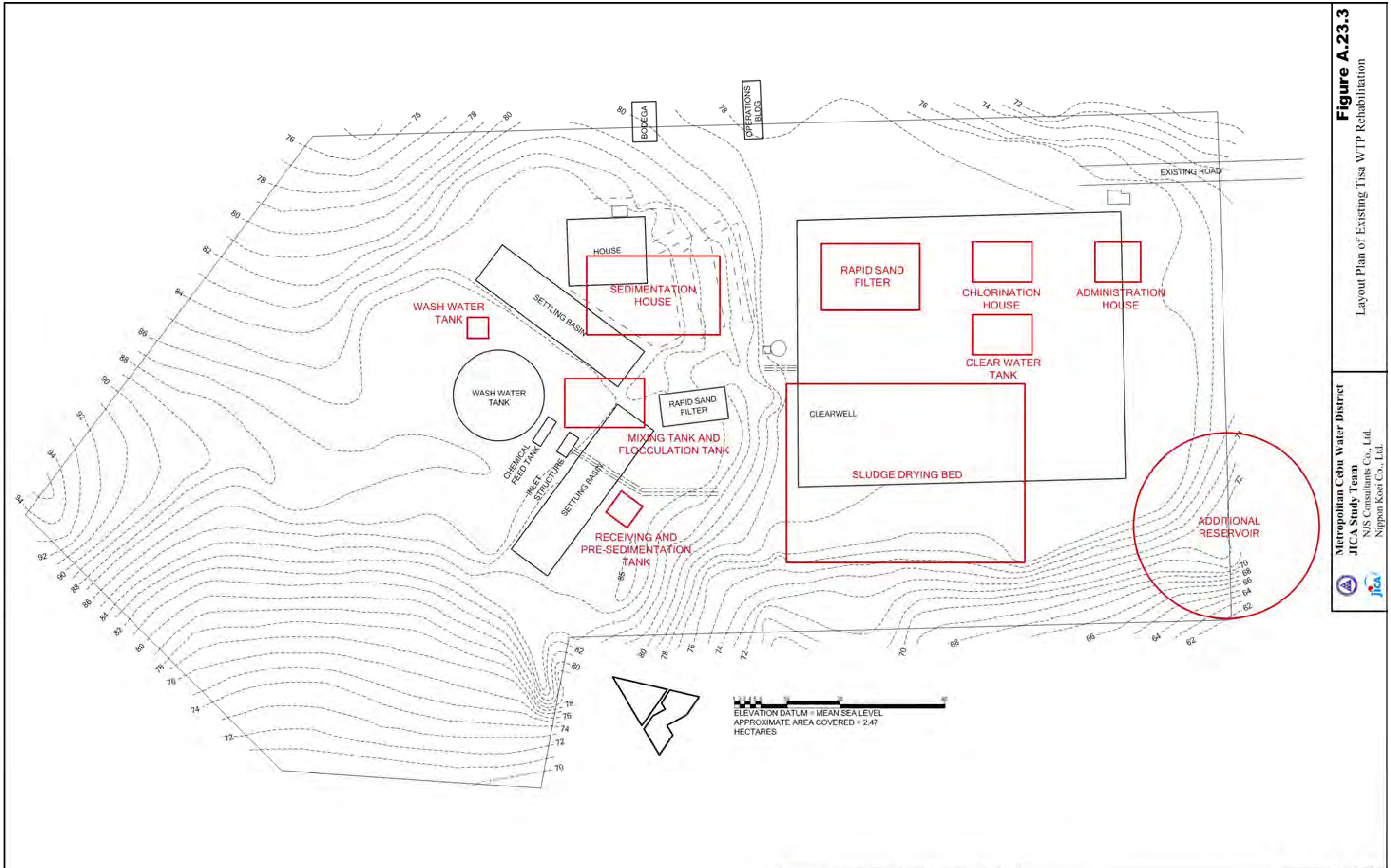

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Figure A.23.1
Layout Plan of Existing Tisa WTP Rehabilitation

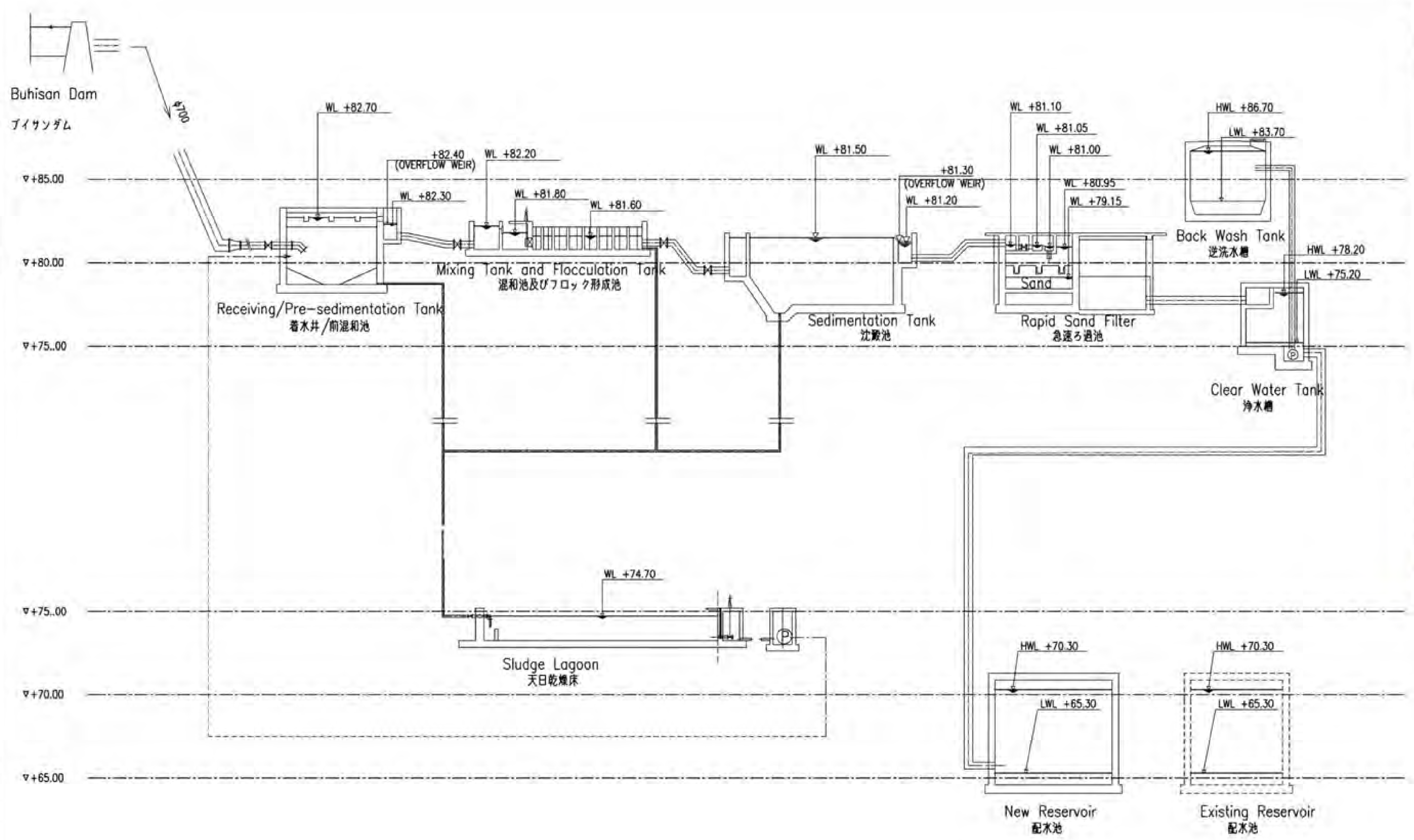

Figure A.23.2
Hydraulic Profile of New Tisa WTP

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Figure A.23.2
Hydraulic Profile of New Tisa WTP

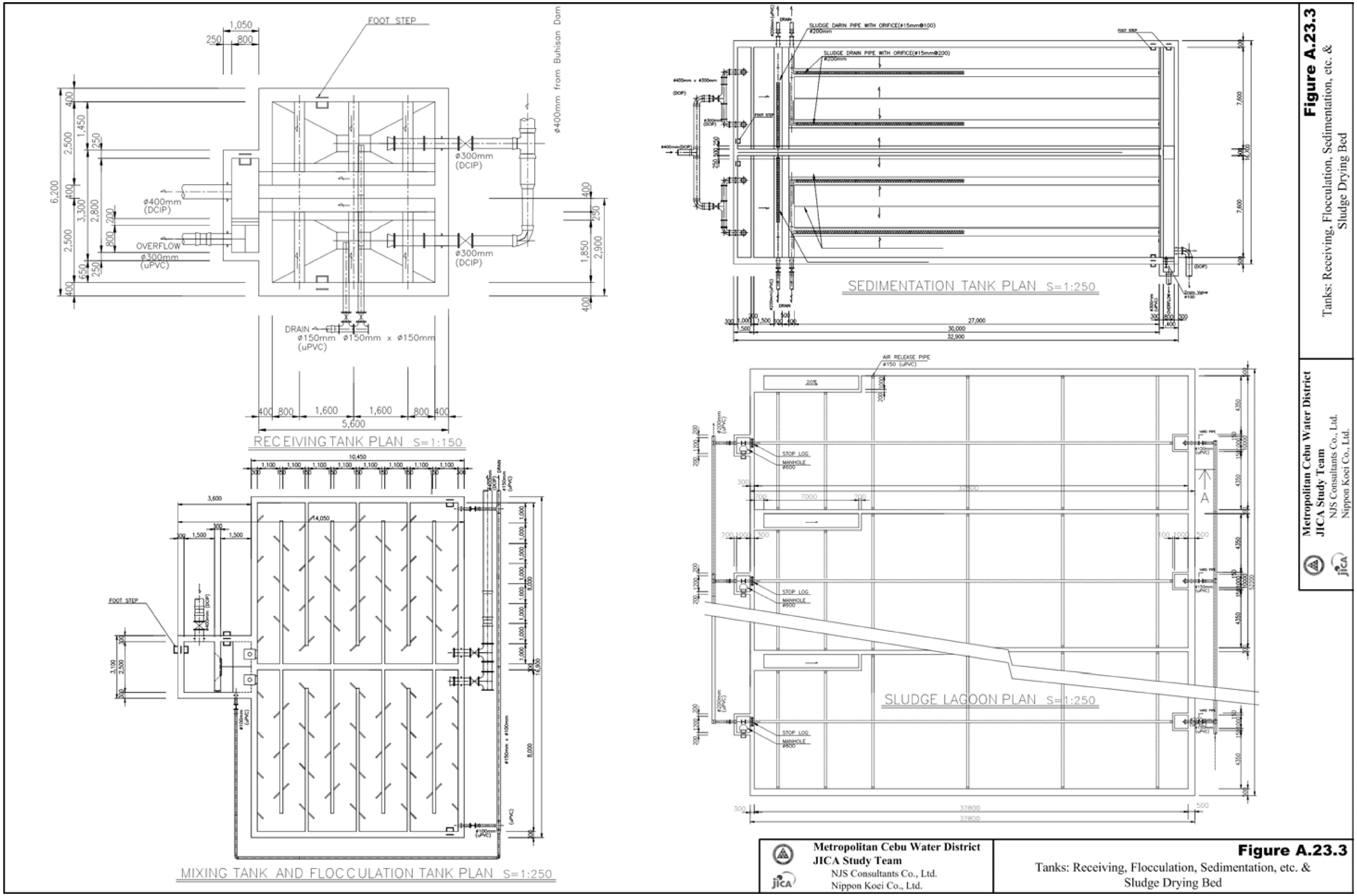

Figure A.23.3
Tanks: Receiving, Flocculation, Sedimentation, etc. & Sludge Drying Bed

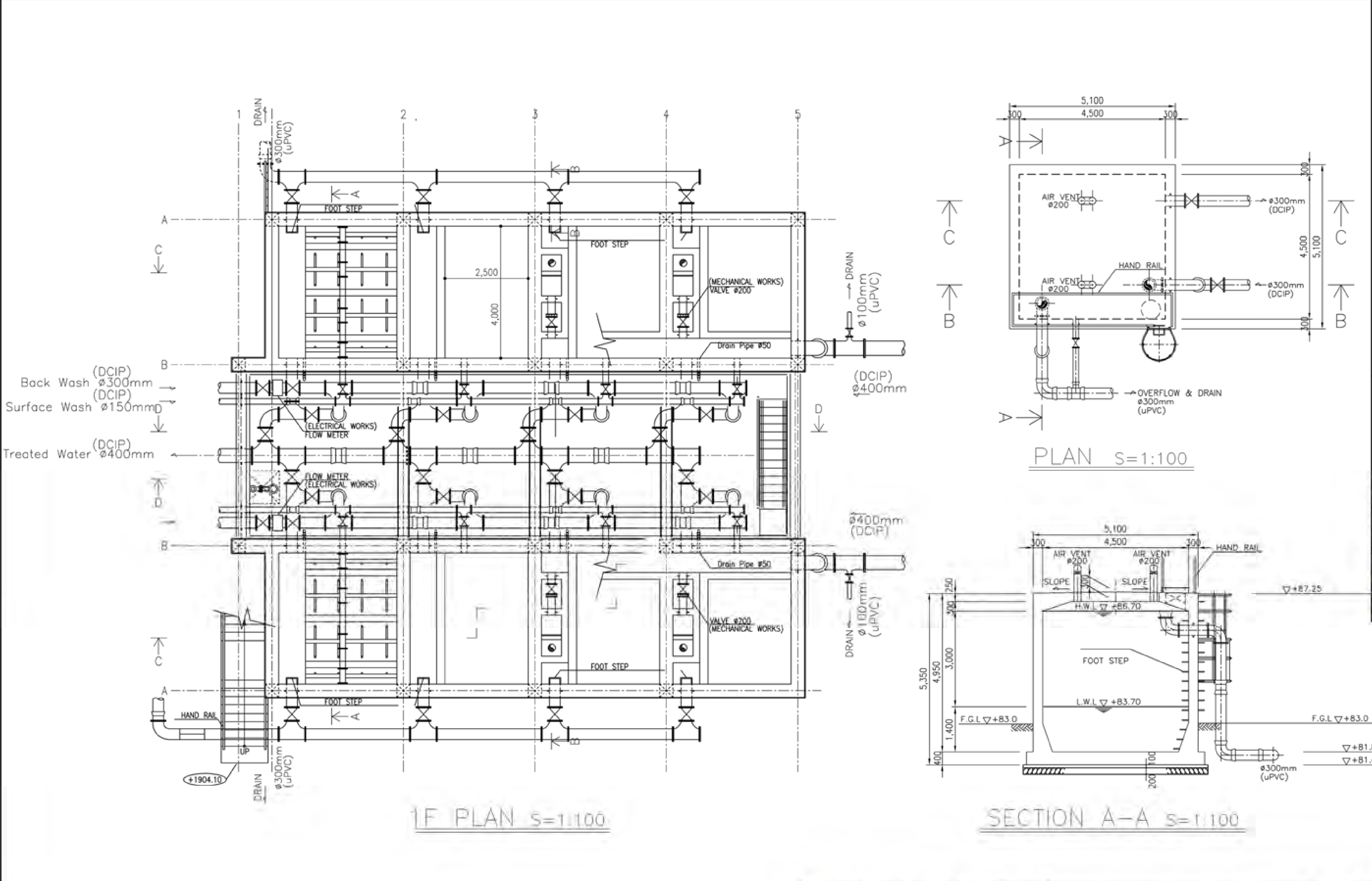

Figure A.23.4
Rapid Sand Filter: Layout, Filter Tank, etc. & Back-wash Tank

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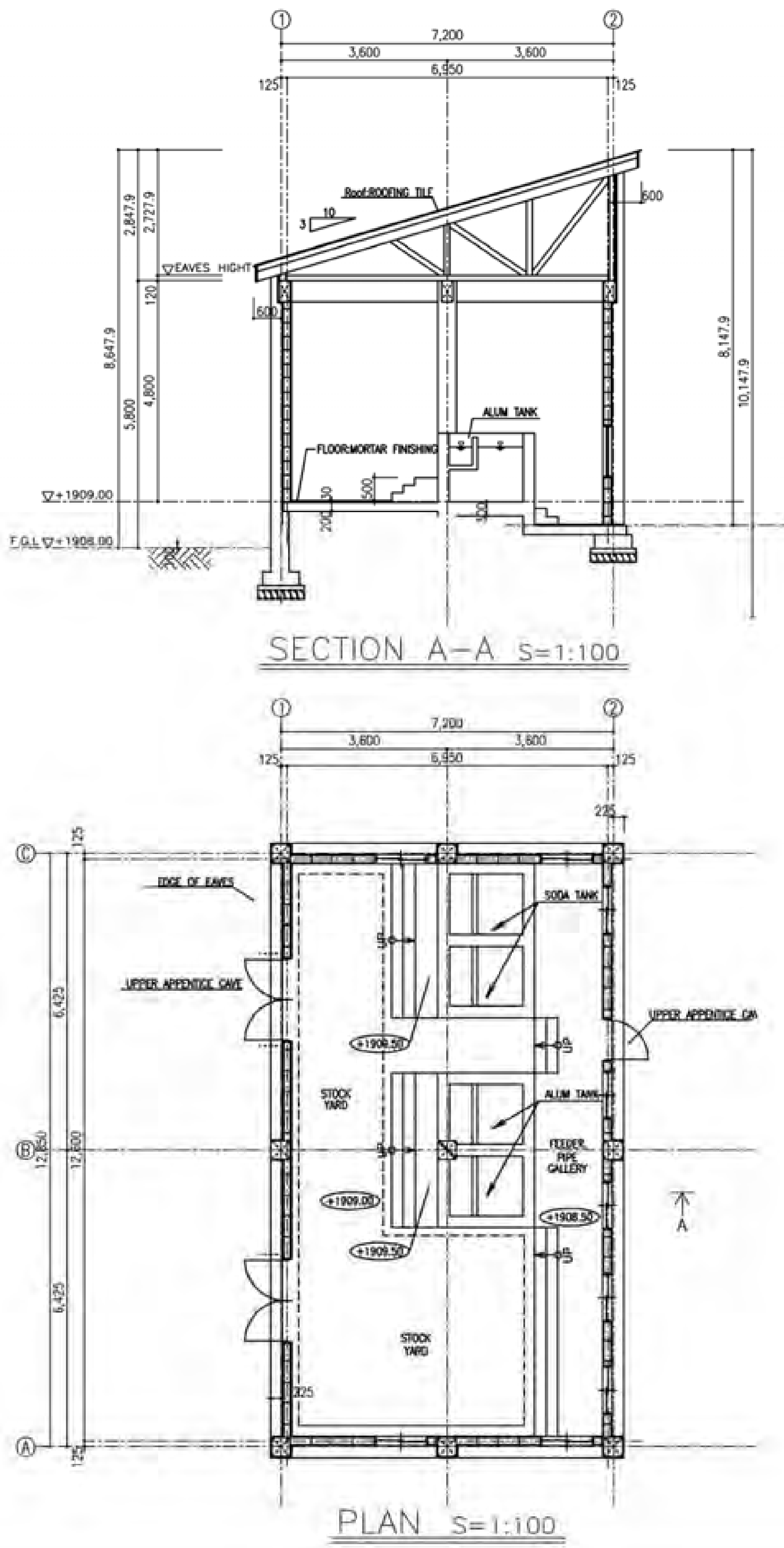
Figure A.23.4
Rapid Sand Filter: Layout, Filter Tank, etc. & Back-wash Tank

Figure A.23.5
Houses: Administration and Chemical
Metropolitan Cebu Water District
JICA Study Team
NJS Consultants Co., Ltd.
Nippon Koei Co., Ltd.



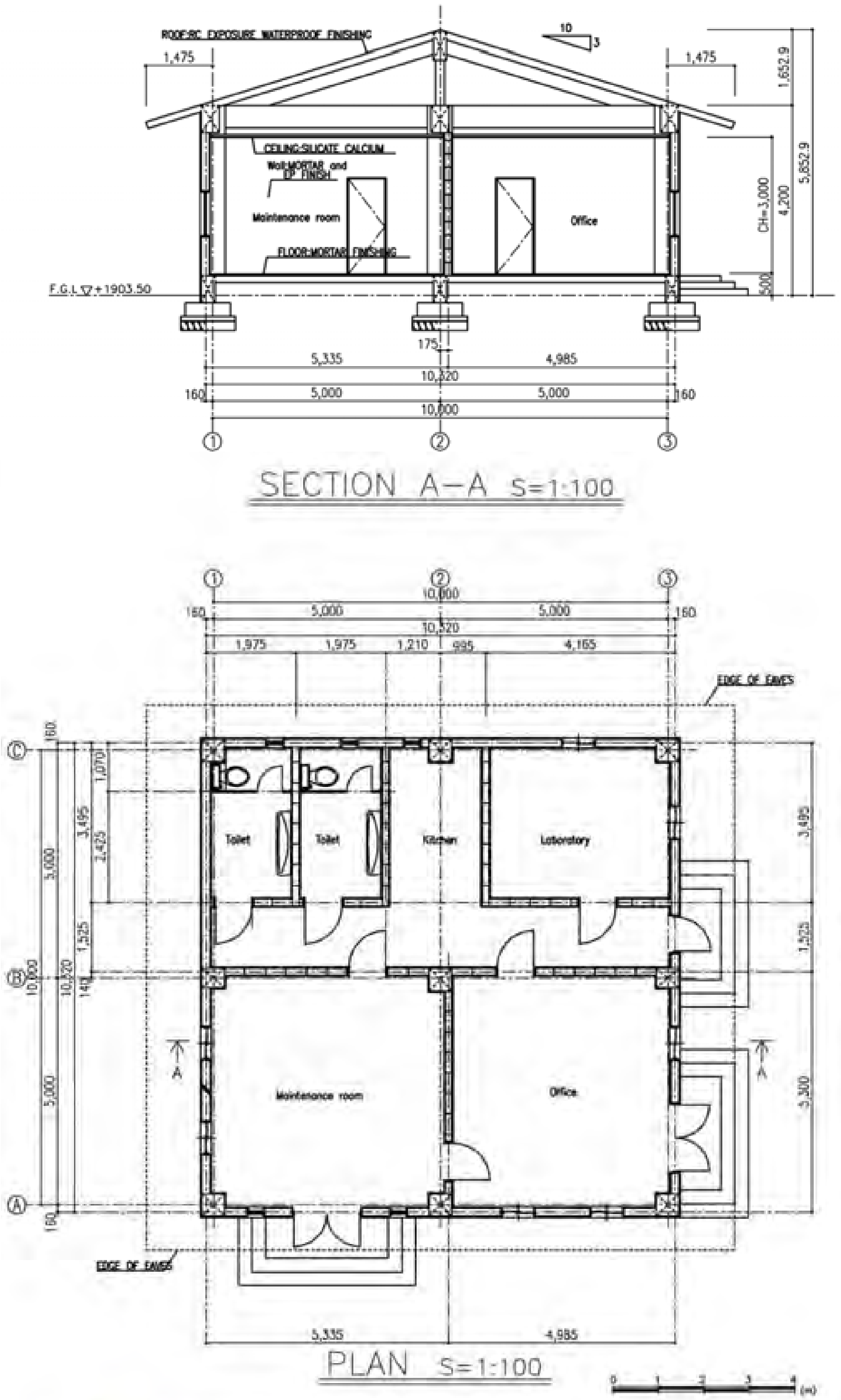


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Figure A.23.5
Houses: Administration and Chemical

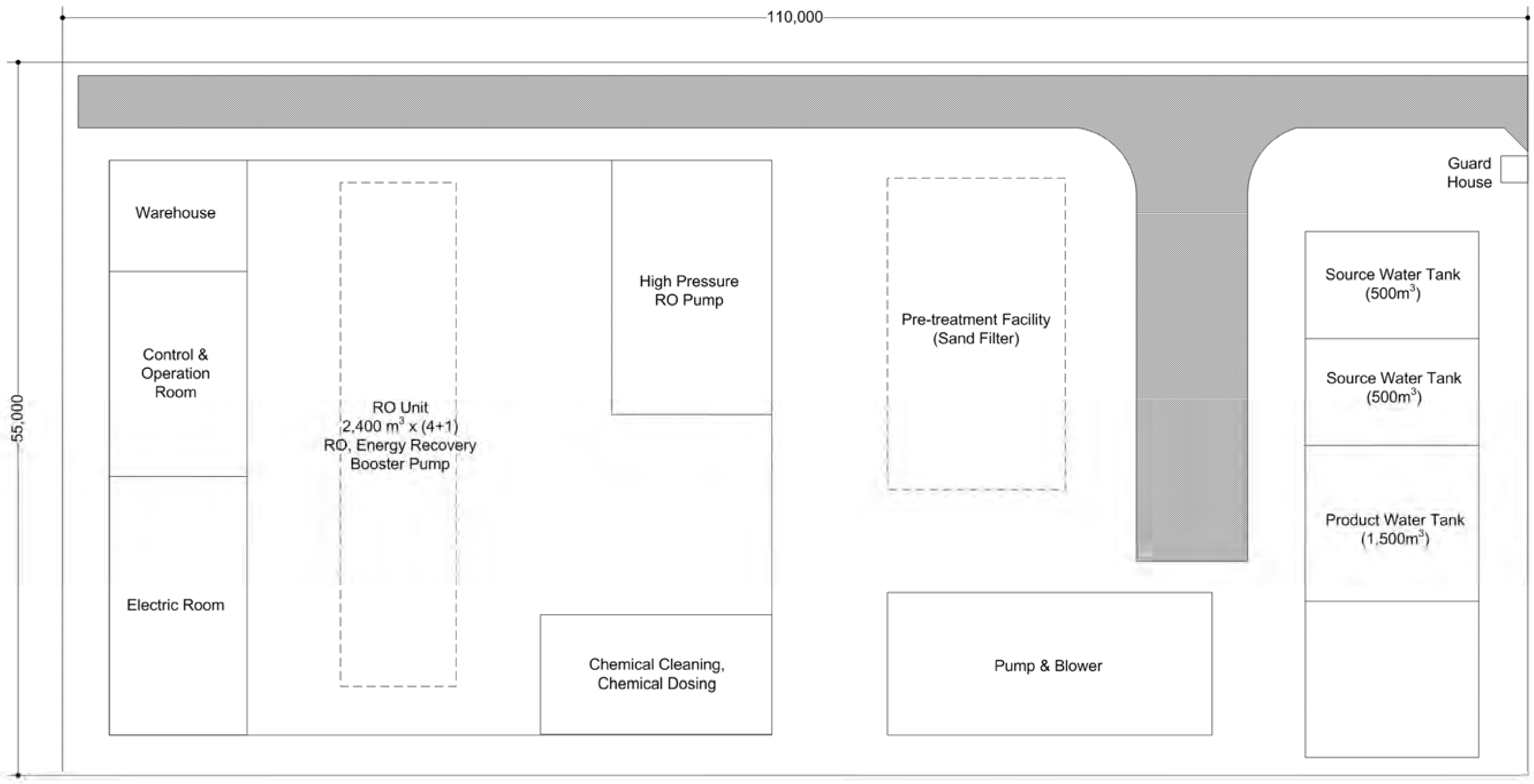

Figure A.24
Layout Plan of New Mactan Desalination Plant Construction
Metropolitan Cebu Water District
JICA Study Team
NJS Consultants Co., Ltd.
Nippon Koei Co., Ltd.

Metropolitan Cebu Water District
JICA Study Team
NJS Consultants Co., Ltd.
Nippon Koei Co., Ltd.

Figure A.24
Layout Plan of New Mactan Desalination Plant Construction

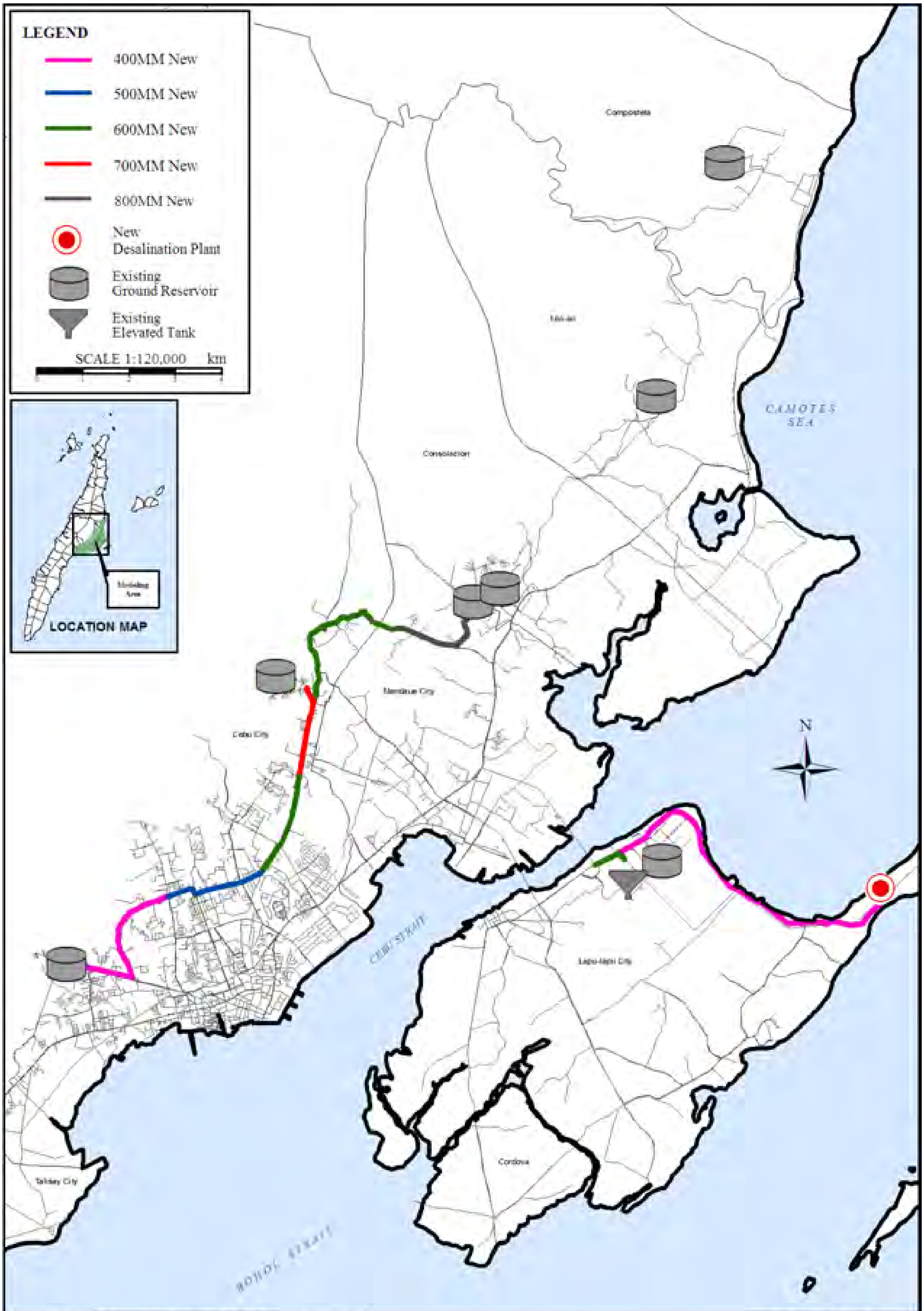

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Figure A.31
General Route Map of Transmission Pipeline Installation

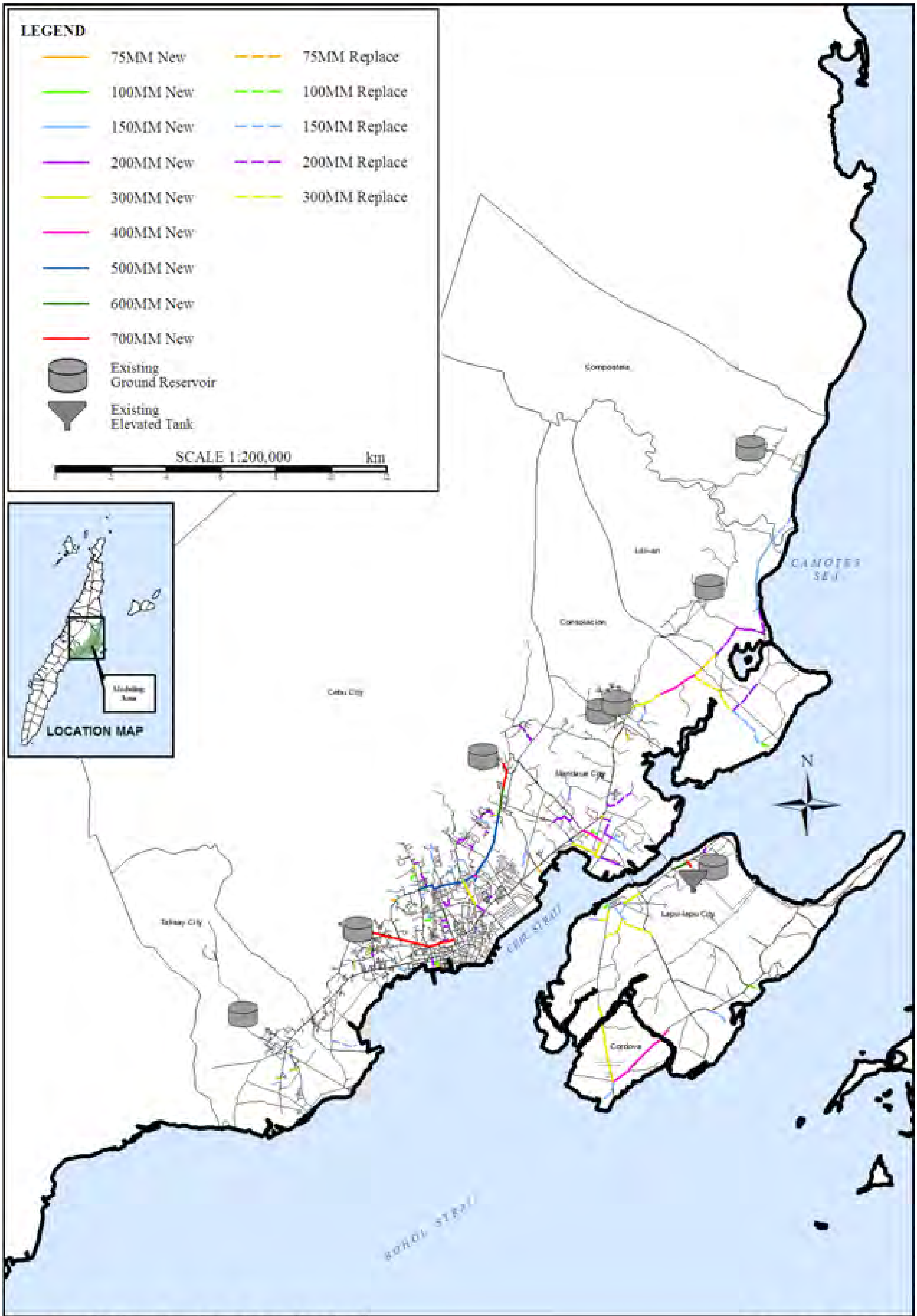

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Figure A.32
Location Map of Main and Secondary Distribution Pipeline Improvement

Chapter-III
Technical Transfer

Part-A Workshop Record

A.I Workshop (1)

1.1 General Information

(1) Summary

The aims of this workshop-1 were;

(1) to integrate the planning information, and
(2) to confirm the work sharing and action to be taken.

MCWD with JICA Study Team distributed the study outputs of the Phase-I (basic study and groundwater modeling) for common understanding of the workshop participants and the initial portion of Phase-II (planning on WATSAN and groundwater conservation) as a draft idea for exchanging of effective opinions in the MCWD action plans.

Based on the information including that owned by the stakeholders, public hearing for WATSAN planning were held among the decision-makers, the funding agencies, implementing agencies and supporting groups for progressive planning which will be considerably supported from stakeholders.

Major agenda of the workshop-1 were:

(i) Overall Objectives:	Expected Outputs from this Workshop-1
(ii) Group Discussions:	(A) WATSAN Sector Planning • Understanding of Current Situations • Exchange Opinions regarding Identified Action Plans (B) Groundwater Development & Conservation • Groundwater Modeling & Simulation • Social Acceptance for Groundwater Potential
(iii) Wrap-up Confirmation:	by fields of following • Socio-economic Conditions • Demand & Supply Balance • Water Supply System & Facilities • Reduction of NRW & Water Saving • Urban Sanitation & Sewerage • Water Sources Management

(2) Schedule

Date: on the 1st & 2nd days of October 2009
Place: at 8th Floor of MCWD (Magallanes Street Corner Lapu-lapu Street, Cebu City 6000)

Pacing Schedule

<u>< On the 1st day of October 2009 ></u>

1. Registration 08:30 – 09:00
2. Opening Program 09:15 – 10:00
3. Plenary Orientation 10:00 – 11:00
4. Group Orientation 11:15 – 12:00
5. Group Discussions 13:15 – 17:00

<u>< On the 2nd day of October 2009 ></u>

6. Review of Past Activities 09:00 – 09:15
7. Group Discussions 09:15 – 12:00
8. Wrap-up Confirmation 15:00 – 16:00

1.2 List of Participants

Following are list of participants. Total number of attendees was 53.

Organization		No.	Name	Position	
Chair	MCWD	15	Lazaro Salvacion	EWRKC	Manager
			Ronnel Magalso		Groundwater Division
			Jefferson Benedicto		SCRO
			Maria Dianne Rallon		Sr. Proj. Planning & Devt. Officer
			Lemuel Canastra		Surface Water
			Duchess Carl Anne Salcedo		EWRKC Secretary
			Orlando Tinapay		WR Engineer
			Annie Sevilla		
			Wawa Tenedo	Corporate Planning	Manager
			June Golosino		Planning Specialist
			Ernie Delco	Operations	Assistant General Manager
			Michael Balazo	Technical Services	Assistant General Manager
			Raul Tabasa	Engineering Department	Manager
			Eugenio Singson		Manager
			Richard		
	Consultants	9	Norihisa Taoka	JICA Study Team	Team Leader/ Water Supply Planning
			Nobukatsu Sakiyama		Vice-Leader/ Hydrogeologist
			Satoshi Omoto		Water Supply Facility Planning
			Keiji Ishii		Groundwater Modeling
			Terou Maruyama		Corporate Management/ Financial Analyst
			Isao Sakaoka		NRW Reduction/ Saving Water Specialist
			Georgia Karamitrou		Urban Sanitation Planning
			Takanori Nemoto		Pipeline Analyst
			Tomoyuki Hosono		Environment & Social Consideration

	Organization	No.	Name	Position	
LGUs	Cebu Province	1	Adolfo V. Quiroga	PPDO	PPDC
	Compostela	1	Carmelo L. Tejero	MPDO	Municipal Planning & Dept. Coordinator
	Lilo-an	2	Nena Limpag		Municipal Planning & Dept. Coordinator
			Myrna Magdayo	OBO	
	Consolacion	1	Salome I. Palang	MPDO	Municipal Planning & Dept. Coordinator
	Cordova	2	Leonides A. Ator		Municipal Planning & Dept. Coordinator
			Elgie Tampus		MPDC Staff
	Mandaue	1	Gerson Zambo	LGU Representative	
	Lapu-lapu	2	Perla Amar	CPDO	City Planning & Dept. Coordinator
			Edwin Romero		Planning Officer III
	Cebu	1	Vincent Mangle		Admin Officer
	Talisay	2	Mario Dandi Capistrano	CPDO	CPDC Staff
			Jonas Francisco Abalo		CPDC Staff
National Government	NWRB	2	Susan Abano		
			Renato Rizo		
	LWUA	1	Alden A. Ganhinhin		
	DENR	4	Wilfredo Labajo	Region VII	Sr. FMS
			Wilfredo Lee		POV
			Ambrocio Wenceslao		WMS Chief
			Al Emil Berador		Chief GeoSciences Division MGB-7
	DPWH	1	Joshua Monsanto	Region VII	Engineer III
Donors	EOJ	0			
	JICA	2	Naoto Kuwae	JICA Philippines Office	Representative
			Minnie Dacanay		Planning and Coordination Section
	USAID	0			
	ADB	0			
Academe	USC-WRC	3	Fr. Herman Van Engelen		Director
			Engr. Elsie Bajarias		Water Supply Engineer
			Herminia Demegillo		Hydrology Engineer
	UP	0			
Observer	NGO	3	Socorro Atega	CUSW	Executive Director
			Casiano Q. Catapang		President
			Caridad Corridor		Program Committee Consultant

1.3 Wrap-up Results

Following are summary of discussion items among the stakeholders.

(1) Socio-economic Conditions

- ✓ The result of socio-economic survey focused on the relationship between the hose income and the cost for getting water.
- ✓ The survey result indicated that the lower income groups were paying higher cost for getting water than the higher income level.
- ✓ Rectification of this situation is required to tackle on the poverty stratum measure.

(2) Water Demand & Supply Balance

- ✓ Regarding the demand projection, some of the assumptions need to be further discussed with the Cooperate Planning.
- ✓ However, it was recognized that the water demand in MCWD service area will increase by about 1.5 times in 2015 compared to the present water demand.
- ✓ In order to meet the increasing demand, making best use of available water sources in MCWD area is required.
- ✓ Possibility of maximizing the existing surface water sources and measures for reduction of NRW should be examined in order to fill the future gap between demand and supply.

(3) Water Supply System & Facilities

- ✓ Water Distribution Network is complicated in current situation.
- ✓ 10 psi (7m) is required in water pressure as minimum service level, however it is not satisfied in current situation.

(4) NRW Reduction & Water Saving

- ✓ Managerial Improvement of meter reading with customer's cooperation shall be promoted.
- ✓ PR shall introduce the water-saving products.
- ✓ Participatory approach for water saving shall be promoted among the stakeholders.

(5) Urban Sanitation & Sewerage

- ✓ Key Comments for Sanitation:
  - The role of LGUs in the Improvement Plan
    - ■ Coordination of LGU activities through an Integrated Sanitation Development Agency (including Water Resources?)
    - ■ The role of NGOs and CBS
  - Regulation
    - ■ Clear definition of Environmental Regulatory Responsibilities between DENR and LGUs
- ✓ Key Issues
  - Cooperation of key stakeholders (LGUs, MCWD, DENR, DOH, NGOs, USERS)
  - Public Awareness campaigns & willingness to pay
  - Pilot studies to raise awareness
  - Prioritization based on critical indicators (Environment, Health)
  - NOT "one size fits all". Taylor made solutions for each area.

(6) Water Sources Management

- ✓ Groundwater Modeling/ Predictive Simulation
  - Activation of Effective Coordination Committee
    - ■ NWRB System: Research & Monitoring of Non-MCWD
    - ■ Regulation: Periodical Integration of Stakeholders Opinions
  - Groundwater Potential
    - ■ According to Current Regulation (175,000 m3/day)
    - ■ Responsibility of Water Supply (as Franchised Provider)
  - Improvement of Groundwater Model
    - ■ Cooperation of NWRB, LWUA, MCWD, USC, UP...

✓ Groundwater Development & Conservation
- Comprehensive Development by Island Unit Base
- Additional Development in other Jurisdiction areas
- Improvement on Operation System for GW Regulation

A.II Workshop (2)

2.1 General Information

(1) Summary

The aims of this workshop-2 were;

(1) to present to the stakeholders the integrated WATSAN draft plans with recommendations,
(2) to recognize the expected extent of WATSAN service achievements,
(3) to gather feedbacks on the soundness, applicability and practical implementation of the proposed plans with recommendations, and
(4) to come up with agreements/ consensus on the next steps ahead.

MCWD with JICA Study Team distributed the study outputs of the Phase-I (basic study and groundwater modeling) for common understanding of the workshop participants and the initial portion of Phase-II (planning on WATSAN and groundwater conservation) as a draft idea for exchanging of effective opinions in the MCWD action plans.

Based on the information including that owned by the stakeholders, public hearing for WATSAN planning were held among the decision-makers, the funding agencies, implementing agencies and supporting groups for progressive planning which will be considerably supported from stakeholders.

Major agenda of the workshop-2 were:

(i)	Overall Objectives:	Feedback Information from this Workshop-2
(ii)	Orientation /Discussions:	WATSAN Improvement Plan
(iii)	Wrap-up Confirmation:	by fields of following • Action Plan on Water Supply • Basic Plan on Urban Sanitation • Technical Recommendations • Managerial Recommendations

(2) Schedule

Date: on the 29^{th} & 30^{th} days of March 2010
Place: at 8^{th} Floor of MCWD (Social Hall)

Pacing Schedule

< On the 29^{th} day of March 2010 >

1.	Registration	08:30 – 09:00
2.	Opening Program	09:15 – 09:30
3.	Plenary Orientation	09:30 – 10:00
4.	Review of Workshop-1	10:00 – 10:30
5.	Orientation/ Discussions	11:15 – 17:00

< On the 30^{th} day of March 2010 >

6.	Review of Past Activities	09:00 – 09:15
7.	Orientation/ Discussions	09:15 – 11:30
8.	Wrap-up Confirmation	11:30 – 12:00

2.2 List of Participants

Following are list of participants. Total number of attendees was 45.

	Organization	No.	Name	Position	
Chair	MCWD	24	Armand Paredes	GM	
			Lazaro Salvacion	EWRKC	Manager
			Ronnel Magalso		Groundwater Division
			Jefferson Benedicto		SCRO
			Maria Dianne Rallon		Sr. Proj. Planning & Devt. Officer
			Lemuel Canastra		Surface Water
			Duchess Carl Anne Salcedo		EWRKC Secretary
			Rana Nina Elisino	Corporate Planning	Planning Specialist
			June Golosino		Planning Specialist
			Michael Balazo	Technical Services	Assistant General Manager
			Raul Tabasa	Engineering Department	Manager
			Eugenio Singson		Manager
			Nelson Ruiz		Manager
			Joselina Amores		Manager
			Richard Misal		Principal Engineer C
			Pacencio Quimson		Principal Engineer C
			Roy Basa		Principal Engineer C
			Juantio Borces		Principal Engineer C
			Arvin John Jaluague		Principal Engineer C
			Julius Montejo		Principal Engineer C
			Joselito Perez		Principal Draftman
			Astrophel Logarta	Production and Distribution Department	Manager
			Genaro Mejor		Manager
			Angelo Cabije	Service Connection and Installation Department	Manager
	Consultants	7	Norihisa Taoka	JICA Study Team	Team Leader/ Water Supply Planning
			Nobukatsu Sakiyama		Vice-Leader/ Hydrogeologist
			Satoshi Omoto		Water Supply Facility Planning
			Hideyuki Takagi		Financial Analyst
			Eleanora Tan		Corporate Management
			Georgia Karamitrou		Urban Sanitation Planning
			Takanori Nemoto		Pipeline Analyst

	Organization	No.	Name	Position	
LGUs	Cebu Province	1	Delia Cabajana	PPDO	Planning Officer I
	Compostela	1	Carmelo L. Tejero	MPDO	Municipal Planning & Dept. Coordinator
	Lilo-an	0			
	Consolacion	1	Danio Capang Pangen	MPDO	Planning Officer I
	Cordova	1	Elgie Tampus		Municipal Planning & Dept. Coordinator
	Mandaue	1	Gerson Lando	LGU Representative	Planning Officer
	Lapu-lapu	1	Edwin Romero	CPDO	Planning Officer III
	Cebu	0			
	Talisay	1	Mario Dandi Capistrano	CPDO	Planning Officer
	Balamban	1	Gloria Jane Villaflor		Municipal Planning & Dept. Coordinator
	Asturias	0			
National Gov-ernment	NWRB	0			
	LWUA	1	Cielito Establecida	Area 5	Division Manager
	DENR	0			
	DPWH	0			
Donors	EOJ	0			
	JICA	2	Naoto Kuwae	JICA Philippines Office	Representative
			Minnie Dacanay		Planning and Coordination Section
	USAID	0			
	ADB	0			
Aca-deme	USC-WRC	1	Fe Walag		Deputy Director
	UP	0			
Ob-server	NGO	2	Casiano Catapang		President
			Caridad Corridor	CUSW	Program Committee Consultant

2.3 Wrap-up Results

Following are summary of discussion items among the stakeholders.

(1) Action Plan on Water Supply

- ✓ Supply amount to LGUs in 2015 was recognized.
- ✓ Supply pressure in 2015 was accepted by LGUs.
- ✓ Cooperation to GW clearance was confirmed by NWRB and LGUs.
- ✓ Cooperation to construction clearance was confirmed by LGUs and DPWH.
- ✓ Cooperation to IEA legal formality was confirmed by DENR and LGUs.

(2) Basic Plan on Urban Sanitation

- ✓ the need for a new Institutional Framework for sanitation (MOA) by all stakeholders
- ✓ the need for a sanitation advocate/ officer in each stakeholder's organization
- ✓ the need for a coordinator/ facilitator/ monitor of change (DENR?)
- ✓ stakeholders' follow up sanitation meeting within the next ?? months
- ✓ cooperation of all stakeholders to support existing Septage Management Project and Public Awareness Campaigns (mainly LGUs/ MCWD)

(3) Technical Recommendations

- ✓ Improvement needs of system design concept were recognized by LWUA and MCWD.
- ✓ Technical guideline for groundwater development was understood by LWUA and MCWD.
- ✓ Needs of model improvement were recognized by NWRB, MCWD, LWUA and Academe.
- ✓ Needs of groundwater conservation was recognized by NWRB, DENR, LGUs and MCWD.

(4) Managerial Recommendations

- ✓ Needs of institutional strengthening were confirmed by NWRB, DENR and LGUs.
- ✓ Needs of streamlining on law with its operation were confirmed by NWRB, DENR and LGUs.
- ✓ Needs of MCWD rationalization and re-organization were recognized by MCWD and LGUs.

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Part-B Seminar Record

B.I Groundwater Modeling

1.1 General Information

(1) Summary

The aims of this seminar (groundwater modeling) were;

- to strengthen the capacity of MCWD for sustainable model operation through transfer the basic knowledge and on-the-job training, and
- to guide how improve the model in future including maintaining, up-dating and un-grading.

With these objectives, JICA study team (Keiji Ishii: Groundwater Modeling and Nobukatsu Sakiyama: Hydrogeologist) conducted the groundwater modeling seminar of basic course and advanced course including following series;

< Basic Course >

(1) to introduce the outline of groundwater modeling,
(2) to exercise the typical tutorials by participants (MCWD),

< Advance Course >

(3) to explain how the Cebu Model was built, and
(4) to discuss how the Cebu Model can be improved.

(2) Schedule

This seminar was conducted in the JICA study office (7th floor of MCWD) with following schedule;

< Basic Course >
On the 12th and 13th days of October 2009

< Advance Course >
On the 14th and 15th days of October 2009

Each seminar included following contents;

< Basic Course >

- General Information: reference documents, contact address to supplier, etc.
- Integrated Simulation Code
- Demonstration of Interface on Saltwater Intrusion
- Simulation Code: MODFLOW, MODPATH, MT3D, SEAWAT, etc.
- Methodology of Model Building: standard and application of GW modeling
- Exercise: 3D General Flow, 2D Density General Flow, 3D Density Flow (subjects)

< Advance Course >

- Past Design of Cebu Model Building: how to prepare and enter the input data
- Review of Cebu Model: model limitations, weak points
- Future Improvement of Cebu Model: expected modification tasks (to be reflect to “supporting report”)

2.2 List of Participants

Total numbers of attendees for basic and advanced courses were 10 and 4. Following are list of participants.

< Basic Course >

	Participants	Post	
1	Lasaro P. Salvacion	Department Manager	EWRKC
2	Ronnel Y. Magalso	Division Manager – Groundwater	EWRKC
3	Lemuel A. Canastra	Division Manager – Surface water	EWRKC
4	Orlando D. Tinapay	Water Resources Engineer	EWRKC
5	Glenda T. Ponce	Principal Engineer C	EWRKC
6	Jose Eugenio B. Singson Jr.	Division Manager – Technical	PMD
7	Astrophel S.Logarta	Department Manager	P&DD
8	Edgar D. Ortega	Division Manager – Distribution	P&DD
9	Genaro L. Mejor	Division Manager - Production	P&DD
10	Angelo H. Cabije	Department Manager	SCID

< Advanced Course >

	Participants	Post	
1	Ronnel Y. Magalso	Division Manager – Groundwater	EWRKC
2	Lemuel A. Canastra	Division Manager – Surface water	EWRKC
3	Glenda T. Ponce	Principal Engineer C	EWRKC
4	Angelo H. Cabije	Department Manager	SCID

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B.II Pipeline Networks Hydraulic Modeling

1.1 General Information

(1) Summary

The aim of this seminar (pipeline networks hydraulic modeling) is to strengthen the capacity of MCWD for sustainable model operation through transfer the basic knowledge and on-the-job training.

With this objective, JICA study team (Takanori Nemoto) conducted the modeling seminar of basic course including following contents.

< Basic Course >
(1) to introduce the outline of pipeline hydraulic modeling, and
(2) to exercise the typical tutorials by participants (MCWD).

(2) Schedule

This seminar was conducted at the 8th floor of MCWD with following schedule;

< Basic Course >
On the 22nd day of October 2009

Seminar included following contents;

< Contents >
- Review of Workshop (1); 1-Oct 2009
- Introduction on the Operation of WaterCAD-5000
- Demonstration of Model Building: standard and application of modeling

1.2 List of Participants

Total numbers of attendees for basic course were 9. Following are list of participants.

< Basic Course >

Participants		Post	
1	Raul E. Tabasa	Manager	ED
2	Joel Eugenio B. Singson Jr.	Division Manager	TD, PMD
3	Pacencio T. Quimson	Principal Engineer C	ED
4	Jude Antonio F. Godin	Principal Engineer C	ED
5	Juan M. Conde	Principal Engineer C	ED
6	Juliet F. Pe	Principal Draftsmen	ED
7	Edgar L. Mejor	Division Manager	DD, PDD
8	Maximino A. Sayson Jr.	GIS Operation Admin	MIS
9	Ma. Christina W. Betita	GIS Database Admin	MIS

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