Table 3.2.1 THE SPECIFICATION OF CORE DRILLING

A. West Floodway / Garang River

No.	Hole	Depth (m)	SPT	UDS	Commenced	Completed
1	RB – 1	15	14	1	30 – Aug - 97	31 - Aug - 97
2	RB – 2	15	14	1	13 – Sep - 97	14 - Sep - 97
3	RB – 3	15	14	1	23 - Sep - 97	24 - Sep - 97
4	RB – 4	15	14	1	26 - Sep - 97	26 - Sep - 97
5	RB – 5	25	23	2	21 - Sep - 97	22 - Sep - 97
6	RB – 6	30	28	2	10 - Sep - 97	12 - Sep - 97
7	RB – 7	15	14	1	22 - Sep - 97	23 - Sep - 97
8	RB – 8	15	14	1	24 - Sep - 97	24 - Sep - 97
9	RB – 9	25	23	2	18 - Sep - 97	19 - Sep - 97
10	RB – 10	15	14	1	21 - Sep - 97	22 - Sep - 97
11	RB – 11	25	23	2	18 - Sep - 97	20 - Sep - 97
12	RB – 12	15	14	1	19 - Sep - 97	20 - Sep - 97
13	RB – 13	15	14	1	16 - Sep - 97	17 - Sep - 97
14	RB – 14	15	14	1	24 - Sep - 97	25 - Sep - 97
15	RB – 15	15	14	1	16 - Sep - 97	16 - Sep - 97
16	RB – 16	15	14	1	17 - Sep - 97	17 - Sep - 97
17	RB – 17	35	33	2	30 - Aug - 97	03 - Sep - 97
18	RB – 18	40	38	2	30 - Aug - 97	04 - Sep - 97
19	RB – 19	15	15	1	01 - Sep - 97	03 - Sep - 97
20	RB – 20	15	14	1	02 - Sep - 97	04 - Sep - 97
21	RB – 21	20	19	1	30 - Aug - 97	31 - Aug - 97
22	RB – 22	20	19	1	30 - Aug - 97	01 - Sep - 97
23	RB – 23	15	14	-	01 - Sep - 97	03 - Sep - 97
24	RB – 24	15	14	1	11 - Sep - 97	12 - Sep - 97
25	RB – 25	15	14	1	02 - Sep - 97	04 - Sep - 97
26	RB – 26	15	15	-	08 - Sep - 97	09 - Sep - 97
27	RB – 27	15	15	-	30 - Aug - 97	31 - Aug - 97
28	RB – 28	15	13	2	15 - Sep - 97	15 - Sep - 97
29	RB – 29	15	14	1	13 - Sep - 97	13 - Sep - 97
30	RB – 30	15	14	1	13 - Sep - 97	14 - Sep - 97
31	RB – 31	15	15	-	10 - Sep - 97	11 - Sep - 97
32	RB – 32	15	15	-	10 - Sep - 97	11 - Sep - 97
33	RB – 33	15	15	-	07 - Sep - 97	09 - Sep - 97
34	RB – 34	15	15	-	08 - Sep - 97	09 - Sep - 97
35	RB – 35	10	10	-	31 - Aug - 97	31 - Aug - 97
36	RB – 36	10	10	-	12 - Sep - 97	12 - Sep - 97
37	RB – 37	10	10	-	03 - Sep - 97	04 - Sep - 97
38	RB – 38	10	10	-	09 - Sep - 97	10 - Sep - 97
39	RB – 39	10	10	-	05 - Sep - 97	05 - Sep - 97
40	RB – 40	10	10	-	07 - Sep - 97	08 - Sep - 97
41	RB – 41	10	10	-	05 - Sep - 97	06 - Sep - 97
42	RB – 42	10	10	-	05 - Sep - 97	06 - Sep - 97
43	RB – 43	10	9	-	02 - Sep - 97	03 - Sep - 97
44	RB – 44	10	10	-	05 - Sep - 97	06 - Sep - 97
45	RB – 45	10	9	-	31 - Aug - 97	01 - Sep - 97
46	RB – 46	10	10	-	02 - Sep - 97	03 - Sep - 97
47	RB – 47	10	9	-	30 - Aug - 97	31 - Aug - 97
84	RB – 48	10	10	-	30 - Aug - 97	31 - Aug - 97
49	RB – 49	10	10	-	01 - Sep - 97	02 - Sep - 97
50	RB – 50	10	8	-	30 - Aug - 97	31 - Aug - 97
51	RB – 51	50	48	2	30 - Sep - 97	07 - Oct - 97
52	RB – 52	50	45	3	15 - Oct - 97	18 - Oct - 97
	TOTAL	870	824	39		

B. Simongan Weir

No.	Hole	Depth (m)	SPT	UDS	Commenced	Completed
1	SB – 1	20	18	3	01 – Sep - 97	03 - Sep - 97
2	SB – 2	20	14	3	30 – Aug - 97	31 - Aug - 97
3	SB – 3	20	20	3	01 – Sep - 97	03 - Sep - 97
4	SB – 4	20	20	-	09 – Sep - 97	12 - Sep - 97
5	SB – 5	20	9	1	26 – Sep - 97	28 - Sep - 97
6	SB – 6	20	7	-	16 - Sep - 97	21 - Sep - 97
		120	88	10		

Table 3.2.2(1/5) SUMMARY OF LABORATORY TEST

LOCATION	BORE HOLE No.	SAMPLING DEPTH (m)	PHYSICAL PROPERTIES												USCS	MECHANICAL PROPERTIES								GEOLOGICAL STRATA	S.P.T
								GRAIN SIZE (%)				CONSISTENCY				SHEARING STRENGTH						CONSOLIDATION PROPERTIES			
																UU		CU							
			Gs	Wn	γn	Sr	e	GRAVEL >4.75mm	SAND 4.75-0.075mm	SILT 0.075-0.002mm	CLAY <0.002mm	LL	PL	PI	SOIL CLASSIFICATION	C	φ	C	φ	C'	φ'	Pc	Cc	SYMBOL	N VALUE
			–	(%)	(g/cm3)	(%)	–					(%)	(%)	(%)		(kgf/cm2)	(°)	(kgf/cm2)	(°)	(kgf/cm2)	(°)	(kgf/cm2)	–		
	RB - 1	10.00 - 10.70	2.66	74.56	1.56	100.00	1.97	–	1.70	54.90	43.40	93.54	35.80	57.74	CH	–	–	0.19	2.00	0.19	3.47	–	–	Ac	3
	RB - 2	9.00 - 9.70	2.63	70.31	1.57	99.73	1.86	–	6.40	66.53	27.07	104.33	30.38	73.95	CH	–	–	–	–	–	–	0.35	0.62	Ac	0
	RB - 3	10.00 - 10.50	2.76	61.65	1.50	85.70	1.99	–	11.70	62.25	26.05	114.53	36.08	78.45	CH	0.02	1.21	–	–	–	–	–	–	Ac	3
	RB - 4	10.00 - 10.70	2.78	80.01	1.53	98.11	2.26	–	2.00	58.98	39.02	110.18	26.80	83.37	CH	0.05	1.61	–	–	–	–	–	–	Ac	3
	RB - 5	7.00 - 7.50	2.71	77.15	1.55	99.29	2.10	–	4.50	59.49	36.01	112.84	34.38	78.47	CH	–	–	–	–	–	–	0.42	0.71	Ac	1
		13.00 - 13.50	2.73	71.57	1.58	99.69	1.96	–	5.30	62.82	31.88	94.23	28.10	66.12	CH	0.03	1.28	–	–	–	–	–	–	Ac	0
	RB - 6	7.00 - 7.70	2.60	71.08	1.54	97.16	1.90	–	7.30	62.07	30.63	101.65	36.36	65.29	CH	–	–	–	–	–	–	0.32	0.66	Ac	3
		13.00 - 13.70	2.65	69.00	1.58	99.57	1.84	–	6.20	65.44	28.36	105.88	36.24	69.64	CH	–	–	0.23	9.99	0.24	12.39	–	–	Ac	6
	RB - 7	10.00 - 10.70	2.68	88.83	1.47	97.36	2.45	–	0.60	61.22	39.18	120.94	38.80	82.13	CH	0.05	4.71	–	–	–	–	–	–	Ac	2
	RB - 8	10.00 - 10.70	2.72	72.66	1.54	96.67	2.05	–	3.60	60.51	35.89	111.12	35.93	75.19	CH	0.02	1.67	–	–	–	–	–	–	Ac	3
	RB - 9	7.00 - 7.45	2.64	81.57	1.67	100.00	1.86	–	5.70	69.33	24.97	80.37	27.22	53.15	CH	–	–	–	–	–	–	0.42	0.57	Ac	3
		13.00 - 13.50	2.72	73.00	1.56	98.51	2.02	–	3.20	68.14	27.96	96.83	32.74	64.09	CH	0.05	1.88	–	–	–	–	–	–	Ac	0
	RB - 10	10.00 - 10.70	2.76	78.05	1.53	97.42	2.21	–	9.40	60.88	29.72	119.84	36.00	83.84	CH	0.02	1.17	–	–	–	–	–	–	Ac	3
	RB - 11	7.00 - 7.70	2.55	88.69	1.51	100.00	2.18	–	2.70	68.14	29.16	106.91	36.26	70.65	CH	–	–	–	–	–	–	0.30	0.69	Ac	1
		13.00 - 13.70	2.75	57.82	1.62	94.41	1.68	–	13.70	66.52	19.78	95.70	31.43	64.27	CH	0.04	2.47	–	–	–	–	–	–	Ac	1
	RB - 12	10.00 - 10.70	2.66	97.12	1.47	100.00	2.56	–	2.10	60.51	37.39	105.49	32.35	73.14	CH	0.01	1.43	–	–	–	–	–	–	Ac	3
WEST	RB - 13	10.00 - 10.45	2.67	77.74	1.56	100.00	2.04	–	3.60	59.05	37.35	114.79	33.83	80.96	CH	0.12	5.84	–	–	–	–	–	–	Ac	4
	RB - 14	10.00 - 10.70	2.56	65.10	1.57	98.69	1.69	–	4.30	64.74	30.96	102.66	32.47	70.20	CH	–	–	–	–	–	–	0.84	0.71	Ac	1
FLOODWAY	RB - 15	10.00 - 10.70	2.64	69.20	1.59	100.00	1.82	–	3.20	66.40	30.40	107.78	27.34	80.44	CH	0.10	6.82	–	–	–	–	–	–	Ac	2
	RB - 16	10.00 - 10.70	2.74	78.54	1.58	100.00	2.11	–	3.80	65.13	31.07	102.48	28.21	74.28	CH	0.04	2.19	–	–	–	–	–	–	Ac	3
	RB - 17	7.60 - 8.00	2.70	52.64	1.70	99.69	1.43	–	13.70	64.87	21.43	67.99	26.77	41.22	CH	–	–	–	–	–	–	0.76	0.43	Ac	2
		10.60 - 10.10	2.72	80.25	1.58	100.00	2.10	–	4.70	61.12	34.18	96.21	34.00	62.21	CH	–	–	0.20	7.21	0.20	8.24	–	–	Ac	4
	RB - 18	7.00 - 7.60	2.60	63.68	1.61	100.00	1.66	–	7.50	62.95	29.55	85.77	32.57	53.19	CH	–	–	0.05	13.51	0.06	25.08	–	–	Ac	3
		10.00 - 10.60	2.54	67.43	1.58	100.00	1.70	–	5.30	57.89	36.81	96.90	35.75	61.15	CH	–	–	0.28	12.65	0.22	22.92	–	–	Ac	3
	RB - 19	10.00 - 10.55	2.67	58.48	1.64	98.52	1.58	–	14.60	59.82	25.58	95.49	36.42	59.07	CH	–	–	0.06	12.42	0.08	17.30	–	–	Ac	7
	RB - 20	10.00 - 10.60	2.74	60.54	1.61	95.91	1.73	–	7.40	63.48	29.21	84.88	34.81	50.07	CH	–	–	0.13	6.02	0.13	9.02	–	–	Ac	3
	RB - 21	9.00 - 9.50	2.73	66.85	1.61	99.38	1.84	–	14.20	55.62	30.18	75.17	31.94	43.23	CH	–	–	0.06	7.85	0.11	10.27	–	–	Ac	3
	RB - 22	9.00 - 9.60	2.77	53.85	1.68	97.07	1.54	–	27.70	56.03	16.27	84.87	36.42	48.45	CH	–	–	0.19	12.53	0.27	17.62	–	–	Ac	3
	RB - 24	6.00 - 6.70	2.63	39.59	1.74	93.24	1.12	–	54.50	37.35	8.15	49.64	25.93	23.71	SC	–	–	0.45	6.33	0.43	9.83	–	–	As	4
	RB - 25	9.00 - 9.50	2.76	36.38	1.81	93.23	1.08	–	18.50	46.59	34.91	68.18	28.65	39.53	CH	–	–	0.17	21.54	0.15	30.78	–	–	Dc	16
	RB - 28	5.00 - 5.60	2.64	42.22	1.77	99.49	1.13	–	29.60	58.32	23.08	48.43	26.64	21.76	CL	0.08	7.43	–	–	–	–	–	–	Da	50
		8.00 - 8.60	2.67	47.98	1.81	99.33	1.03	–	29.70	60.21	7.59	40.68	23.21	17.47	CL	0.18	12.89	–	–	–	–	1.20	0.17	Da	42

Table 3.2.2(1/5) SUMMARY OF LABORATORY TEST

LOCATION	BORE HOLE No.	SAMPLING DEPTH (m)	PHYSICAL PROPERTIES												USCS	MECHANICAL PROPERTIES								GEOLOGICAL STRATA	S.P.T
								GRAIN SIZE (%)				CONSISTENCY				SHEARING STRENGTH						CONSOLIDATION PROPERTIES			
																UU		CU							
			Gs	Wn	γn	Sr	e	GRAVEL >4.75mm	SAND 4.75~0.075mm	SILT 0.075~0.002mm	CLAY <0.002mm	LL	PL	PI	SOIL CLASSIFICATION	C	φ	C	φ	C'	φ'	Pc	Cc	SYMBOL	N VALUE
			-	(%)	(g/cm3)	(%)	-					(%)	(%)	(%)		(kgf/cm2)	(°)	(kgf/cm2)	(°)	(kgf/cm2)	(°)	kgf/cm2	-		
	RB - 1	10.00 ~ 10.70	2.66	74.56	1.56	100.00	1.97	-	1.70	54.90	43.40	93.54	35.80	57.74	CH	-	-	0.19	2.00	0.19	3.47	-	-	Ac	3
	RB - 2	9.00 ~ 9.70	2.63	70.31	1.57	99.73	1.86	-	6.40	66.53	27.07	104.33	30.38	73.95	CH	-	-	-	-	-	-	0.35	0.62	Ac	0
	RB - 3	10.00 ~ 10.50	2.76	61.65	1.50	85.70	1.99	-	11.70	62.25	26.05	114.53	36.08	78.45	CH	0.02	1.21	-	-	-	-	-	-	Ac	3
	RB - 4	10.00 ~ 10.70	2.78	80.01	1.53	98.11	2.26	-	2.00	58.98	39.02	110.18	26.80	83.37	CH	0.05	1.61	-	-	-	-	-	-	Ac	3
	RB - 5	7.00 ~ 7.50	2.71	77.15	1.55	99.29	2.10	-	4.50	59.49	36.01	112.84	34.38	78.47	CH	-	-	-	-	-	-	0.42	0.71	Ac	1
		13.00 ~ 13.50	2.73	71.57	1.58	99.69	1.96	-	5.30	62.82	31.88	94.23	28.10	66.12	CH	0.03	1.28	-	-	-	-	-	-	Ac	0
	RB - 6	7.00 ~ 7.70	2.60	71.08	1.54	97.16	1.90	-	7.30	62.07	30.63	101.65	36.36	65.29	CH	-	-	-	-	-	-	0.32	0.66	Ac	3
		13.00 ~ 13.70	2.65	69.00	1.58	99.57	1.84	-	6.20	65.44	28.36	105.88	36.24	69.64	CH	-	-	0.23	9.99	0.24	12.39	-	-	Ac	6
	RB - 7	10.00 ~ 10.70	2.68	88.83	1.47	97.36	2.45	-	0.60	61.22	39.18	120.94	38.80	82.13	CH	0.05	4.71	-	-	-	-	-	-	Ac	2
	RB - 8	10.00 ~ 10.70	2.72	72.66	1.54	96.67	2.05	-	3.60	60.51	35.89	111.12	35.93	75.19	CH	0.02	1.67	-	-	-	-	-	-	Ac	3
	RB - 9	7.00 ~ 7.45	2.64	81.57	1.67	100.00	1.86	-	5.70	69.33	24.97	80.37	27.22	53.15	CH	-	-	-	-	-	-	0.42	0.57	Ac	3
		13.00 ~ 13.50	2.72	73.00	1.56	98.51	2.02	-	3.20	68.14	27.96	96.83	32.74	64.09	CH	0.05	1.88	-	-	-	-	-	-	Ac	0
	RB - 10	10.00 ~ 10.70	2.76	78.05	1.53	97.42	2.21	-	9.40	60.88	29.72	119.84	36.00	83.84	CH	0.02	1.17	-	-	-	-	-	-	Ac	3
	RB - 11	7.00 ~ 7.70	2.55	88.69	1.51	100.00	2.18	-	2.70	68.14	29.16	106.91	36.26	70.65	CH	-	-	-	-	-	-	0.30	0.69	Ac	1
		13.00 ~ 13.70	2.75	57.82	1.62	94.41	1.68	-	13.70	66.52	19.78	95.70	31.43	64.27	CH	0.04	2.47	-	-	-	-	-	-	Ac	1
	RB - 12	10.00 ~ 10.70	2.66	97.12	1.47	100.00	2.56	-	2.10	60.51	37.39	105.49	32.35	73.14	CH	0.01	1.43	-	-	-	-	-	-	Ac	3
WEST	RB - 13	10.00 ~ 10.45	2.67	77.74	1.56	100.00	2.04	-	3.60	59.05	37.35	114.79	33.83	80.96	CH	0.12	5.84	-	-	-	-	-	-	Ac	4
	RB - 14	10.00 ~ 10.70	2.56	65.10	1.57	98.69	1.69	-	4.30	64.74	30.96	102.66	32.47	70.20	CH	-	-	-	-	-	-	0.84	0.71	Ac	1
FLOODWAY	RB - 15	10.00 ~ 10.70	2.64	69.20	1.59	100.00	1.82	-	3.20	66.40	30.40	107.78	27.34	80.44	CH	0.10	6.82	-	-	-	-	-	-	Ac	2
	RB - 16	10.00 ~ 10.70	2.74	78.54	1.58	100.00	2.11	-	3.80	65.13	31.07	102.48	28.21	74.28	CH	0.04	2.19	-	-	-	-	-	-	Ac	3
	RB - 17	7.60 ~ 8.00	2.70	52.64	1.70	99.69	1.43	-	13.70	64.87	21.43	67.99	26.77	41.22	CH	-	-	-	-	-	-	0.76	0.43	Ac	2
		10.60 ~ 10.10	2.72	80.25	1.58	100.00	2.10	-	4.70	61.12	34.18	96.21	34.00	62.21	CH	-	-	0.20	7.21	0.20	8.24	-	-	Ac	4
	RB - 18	7.00 ~ 7.60	2.60	63.68	1.61	100.00	1.66	-	7.50	62.95	29.55	85.77	32.57	53.19	CH	-	-	0.05	13.51	0.06	25.08	-	-	Ac	3
		10.00 ~ 10.60	2.54	67.43	1.58	100.00	1.70	-	5.30	57.89	36.81	96.90	35.75	61.15	CH	-	-	0.28	12.65	0.22	22.92	-	-	Ac	3
	RB - 19	10.00 ~ 10.55	2.67	58.48	1.64	98.52	1.58	-	14.60	59.82	25.58	95.49	36.42	59.07	CH	-	-	0.06	12.42	0.08	17.30	-	-	Ac	2
	RB - 20	10.00 ~ 10.60	2.74	60.54	1.61	95.91	1.73	-	7.40	63.48	29.21	84.88	34.81	50.07	CH	-	-	0.13	6.02	0.13	9.02	-	-	Ac	3
	RB - 21	9.00 ~ 9.50	2.73	66.85	1.61	99.38	1.84	-	14.20	55.62	30.18	75.17	31.94	43.23	CH	-	-	0.06	7.85	0.11	10.27	-	-	Ac	3
	RB - 22	9.00 ~ 9.60	2.77	53.85	1.68	97.07	1.54	-	27.70	56.03	16.27	84.87	36.42	48.45	CH	-	-	0.19	12.53	0.27	17.62	-	-	Ac	3
	RB - 24	6.00 ~ 6.70	2.63	39.59	1.74	93.24	1.12	-	54.50	37.35	8.15	49.64	25.93	23.71	SC	-	-	0.45	6.33	0.43	9.83	-	-	As	4
	RB - 25	9.00 ~ 9.50	2.76	36.38	1.81	93.23	1.08	-	18.50	46.59	34.91	68.18	28.65	39.53	CH	-	-	0.17	21.54	0.15	30.78	-	-	Dc	16
	RB - 28	5.00 ~ 5.60	2.64	42.72	1.77	99.49	1.13	-	20.60	56.32	23.08	48.43	26.64	21.76	CL	0.08	7.43	-	-	-	-	-	-	Da	50
		8.00 ~ 8.60	2.67	37.93	1.81	98.33	1.03	-	29.70	60.21	7.59	40.68	23.21	17.47	CL	0.18	12.89	-	-	-	-	1.29	0.17	Da	42

Table 3.2.2(2/5) SUMMARY OF LABORATORY TEST

LOCATION	BORE HOLE No.	SAMPLING DEPTH	PHYSICAL PROPERTIES												USCS	MECHANICAL PROPERTIES								GEOLOGICAL STRATA	S.P.T
								GRAIN SIZE (%)				CONSISTENCY				SHEARING STRENGTH						CONSOLIDATION PROPERTIES			
																UU		CU							
			Gs	Wn	γn	Sr	e	GRAVEL >4.75mm	SAND 4.75-0.075mm	SILT 0.075-0.002mm	CLAY <0.002mm	LL	PL	PI	SOIL CLASSIFICATION	C	φ	C	φ	C'	φ'	Pc	Cc	SYMBOL	N VALUE
		(m)	-	(%)	(g/cm3)	(%)	-					(%)	(%)	(%)		(kgf/cm2)	(°)	(kgf/cm2)	(°)	(kgf/cm2)	(°)	(kgf/cm2)	-		
WEST FLOODWAY	RB - 51	4.00 - 4.70	2.58	64.39	1.57	97.43	1.70	-	15.40	67.42	17.18	90.26	26.34	63.92	CH	0.01	1.16	-	-	-	-	-	-	Ac	1
		7.10 - 7.65	2.53	88.87	1.58	100.00	2.03	-	4.58	63.38	32.04	99.16	29.89	69.27	CH	-	-	-	-	-	-	0.61	0.59	Ac	0
	RB - 52	3.00 - 3.60	2.66	56.24	1.74	100.00	1.38	-	17.20	60.15	20.65	67.22	26.44	40.78	CH	0.06	2.84	-	-	-	-	-	-	B	5
		7.00 - 7.60	2.66	89.26	1.49	99.83	2.38	-	17.90	63.52	18.58	85.44	38.27	47.17	CH	0.01	1.52	-	-	-	-	-	-	Ac	3
		11.00 - 11.60	2.75	64.54	1.61	97.50	1.82	-	7.40	60.97	31.63	92.72	28.81	63.91	CH	0.01	2.7	-	-	-	-	-	-	Ac	2
SIMONGAN WEIR	SB - 1	14.55 - 15.15	2.74	36.04	1.86	98.60	1.00	-	57.80	29.02	13.18	49.78	22.17	27.61	SC	-	-	0.21	17.01	0.20	28.86	-	-	As	11
		16.15 - 16.75	2.56	49.64	1.72	100.00	1.22	-	23.60	59.29	17.11	61.65	15.36	36.30	CH	-	-	-	-	-	-	0.58	0.38	Ac	11
		17.70 - 18.30	2.66	45.32	1.77	100.00	1.18	-	38.20	47.66	14.14	58.44	16.29	32.15	CH	-	-	0.31	17.83	0.24	31.14	-	-	Ac	14
	SB - 2	8.55 - 9.15	2.68	42.88	1.83	100.00	1.10	-	45.40	37.13	15.27	54.96	25.14	29.82	CH	-	-	0.14	17.37	0.14	26.87	-	-	Ac	6
		11.40 - 12.00	2.60	48.24	1.76	100.00	1.20	-	13.30	56.20	30.50	62.95	26.29	36.66	CH	-	-	-	-	-	-	1.23	0.44	Ac	12
		13.60 - 14.20	2.53	49.00	1.72	100.00	1.17	-	2.40	63.00	34.60	82.86	40.83	42.04	MH	-	-	0.29	20.99	0.21	30.34	-	-	Dc	20
	SB - 3	11.00 - 11.55	2.71	46.60	1.78	100.00	1.24	-	15.10	48.85	36.05	68.70	29.07	39.62	CH	-	-	-	-	-	-	1.40	0.31	As	17
		13.00 - 13.55	2.78	42.76	1.85	100.00	1.15	-	43.10	41.81	15.09	58.48	28.09	30.37	CH	-	-	0.30	15.74	0.26	21.45	-	-	As	26
		17.00 - 17.55	2.73	37.69	1.77	91.40	1.13	-	3.20	65.80	31.00	76.91	30.36	46.55	CH	-	-	-	-	-	-	0.93	0.26	Ac	19
	SB - 5	4.50 - 5.10	2.59	69.43	1.65	91.40	1.59	-	4.60	64.12	31.28	63.60	27.67	35.92	CH	0.45	4.46	-	-	-	-	1.17	0.40	Ds	20
GARANG RIVER	RB - 29	4.00 - 4.50	2.26	36.86	1.81	98.33	0.98	-	3.90	60.50	35.60	88.45	25.00	63.45	OH	0.44	15.73	-	-	-	-	-	-	Ac	14
	RB - 30	4.50 - 4.90	2.76	45.75	1.82	100.00	1.21	-	6.70	60.52	32.78	83.97	26.09	57.88	CH	0.15	23.13	-	-	-	-	-	-	Ac	8

Table 3.2.2(2/5) SUMMARY OF LABORATORY TEST

LOCATION	BORE HOLE No.	SAMPLING DEPTH (m)	PHYSICAL PROPERTIES												USCS	MECHANICAL PROPERTIES								GEOLOGICAL STRATA	S.P.T
								GRAIN SIZE (%)				CONSISTENCY				SHEARING STRENGTH						CONSOLIDATION PROPERTIES			
																UU		CU							
			Gs	Wn	γn	Sr	e	GRAVEL >4.75mm	SAND 4.75-0.075mm	SILT 0.075-0.002mm	CLAY <0.002mm	LL	PL	PI	SOIL CLASSIFICATION	C	φ	C	φ	C'	φ'	Pc	Cc	SYMBOL	N VALUE
			-	(%)	(g/cm3)	(%)	-					(%)	(%)	(%)		(kgf/cm2)	(°)	(kgf/cm2)	(°)	(kgf/cm2)	(°)	kgf/cm2	-		
WEST FLOODWAY	RB - 51	4.00 - 4.70	2.58	64.39	1.57	97.43	1.70	-	15.40	67.42	17.18	90.26	26.34	63.92	CH	0.01	1.16	-	-	-	-	-	-	Ac	1
		7.10 - 7.65	2.53	88.87	1.58	100.00	2.03	-	4.58	63.38	32.04	99.16	29.89	69.27	CH	-	-	-	-	-	-	0.61	0.59	Ac	0
	RB - 52	3.00 - 3.60	2.66	56.24	1.74	100.00	1.38	-	17.20	60.15	20.65	67.22	26.44	40.78	CH	0.06	2.84	-	-	-	-	-	-	B	5
		7.00 - 7.60	2.66	89.26	1.49	99.83	2.38	-	17.90	63.52	18.58	85.44	38.27	47.17	CH	0.01	1.52	-	-	-	-	-	-	Ac	3
		11.00 - 11.60	2.75	64.54	1.61	97.50	1.82	-	7.40	60.97	31.63	92.72	28.81	63.91	CH	0.01	2.7	-	-	-	-	-	-	Ac	2
SIMONGAN WEIR	SB - 1	14.55 - 15.15	2.74	36.04	1.86	98.60	1.00	-	57.80	29.02	13.18	49.78	22.17	27.61	SC	-	-	0.21	17.01	0.20	28.86	-	-	As	11
		16.15 - 16.75	2.56	49.64	1.72	100.00	1.22	-	23.60	59.29	17.11	61.65	15.36	36.30	CH	-	-	-	-	-	-	0.58	0.38	Ac	11
		17.70 - 18.30	2.66	45.32	1.77	100.00	1.18	-	38.20	47.66	14.14	58.44	16.29	32.15	CH	-	-	0.31	17.83	0.24	31.14	-	-	Ac	14
	SB - 2	8.55 - 9.15	2.68	42.88	1.83	100.00	1.10	-	45.40	37.13	15.27	54.96	25.14	29.82	CH	-	-	0.14	17.37	0.14	26.87	-	-	Ac	6
		11.40 - 12.00	2.60	48.24	1.76	100.00	1.20	-	13.30	56.20	30.50	62.95	26.29	36.66	CH	-	-	-	-	-	-	1.23	0.44	Ac	12
		13.60 - 14.20	2.53	49.00	1.72	100.00	1.17	-	2.40	63.00	34.60	82.86	40.83	42.04	MH	-	-	0.29	20.99	0.21	30.34	-	-	Dc	29
	SB - 3	11.00 - 11.55	2.71	46.60	1.78	100.00	1.24	-	15.10	48.85	36.05	68.70	29.07	39.62	CH	-	-	-	-	-	-	1.40	0.31	As	17
		13.00 - 13.55	2.78	42.76	1.85	100.00	1.15	-	43.10	41.81	15.09	58.48	28.09	30.37	CH	-	-	0.30	15.74	0.26	21.45	-	-	As	26
		17.00 - 17.55	2.73	37.69	1.77	91.40	1.13	-	3.20	65.80	31.00	76.91	30.36	46.55	CH	-	-	-	-	-	-	0.93	0.26	Ac	19
	SB - 5	4.50 - 5.10	2.53	69.43	1.65	91.40	1.59	-	4.60	64.12	31.28	63.60	27.67	35.92	CH	0.45	4.45	-	-	-	-	1.17	0.40	Ds	28
GARANG RIVER	RB - 29	4.00 - 4.50	2.26	36.86	1.81	98.33	0.98	-	3.90	60.50	35.60	88.45	25.00	63.45	OH	0.44	15.73	-	-	-	-	-	-	Ac	14
	RB - 30	4.50 - 4.90	2.76	45.75	1.82	100.00	1.21	-	6.70	60.52	32.78	83.97	26.09	57.88	CH	0.15	23.13	-	-	-	-	-	-	Ac	8

Table 3.2.2(3/5) SUMMARY OF LABORATORY TEST (GRAIN SIZE ANALYSIS) 1/3

LOCATION	BORE-HOLE No.	TEST DEPTH	PHYSICAL PROPERTIES											USCS	MECHANICAL PROPERTIES								GEOLOGICAL STATE	S.P.T
								GRAIN SIZE (%)				CONSISTENCY			SHEARING STRENGTH						CONSOLIDATION PROPERTIES			
															UU		CU							
			Gs	Wn	γn	Sr	e	GRAVEL >4.75mm	SAND 4.75-0.075mm	SILT 0.075-0.002mm	CLAY <0.002mm	LL	PL	PI	C	ϕ	C	ϕ	C'	ϕ'	Pc	Cc	SYMBOL	N VALUE
		(m)	-	(%)	(g/cm3)	(%)	-					(%)	(%)	(%)										
															(kg/cm2)	(°)	(kg/cm2)	(°)	(kg/cm2)	(°)	(kg/cm2)	-		
WEST FLOODWAY	RB - 1	7.50 - 8.00	2.70	40.36				-	36.00	53.39	10.61	51.02	26.24	24.78	CH									Ac	3
		12.50 - 13.00	2.64	59.39				3.60	9.70	65.88	20.82	124.92	39.44	85.48	CH									Ac	6
	RB - 2	3.50 - 4.00	2.79	37.52				-	78.00	21.58	0.42	-	-	-	SM									As	3
		12.50 - 13.00	2.77	95.42				-	2.20	62.11	35.69	124.04	37.04	87.00	CH									Ac	0
	RB - 3	4.50 - 5.00	2.78	75.81				-	1.40	61.81	36.79	101.60	34.94	66.66	CH									Ac	0
		14.50 - 15.00	2.71	83.32				-	1.90	61.73	35.87	109.37	31.96	77.41	CH									Ac	6
	RB - 4	3.50 - 4.00	2.68	48.13				-	33.70	56.80	9.50	66.44	30.46	35.98	CH									Ac	0
		6.50 - 7.00	2.68	60.08				-	6.80	63.39	29.81	85.52	29.03	56.49	CH									Ac	3
	RB - 5	4.50 - 5.00	2.55	49.11				-	13.10	67.33	19.57	70.31	26.21	44.10	CH									Ac	0
		18.50 - 19.00	2.75	88.00				-	6.60	59.43	33.97	113.16	32.02	81.14	CH									Ac	7
		22.50 - 23.00	2.55	38.88				-	1.90	64.91	33.19	90.99	27.59	63.40	CH									Dc	29
	RB - 6	3.50 - 4.00	2.66	47.82				5.00	25.20	52.96	16.84	57.58	23.56	34.02	CH									Ac	8
		9.50 - 10.00	2.62	90.47				-	0.80	63.72	35.48	130.28	35.15	95.13	CH									Ac	3
		16.50 - 17.00	2.66	43.59				-	3.40	64.68	31.92	117.97	27.38	90.59	CH									Ac	6
	RB - 7	3.50 - 4.00	2.66	67.24				-	17.80	64.43	17.77	82.35	25.52	56.83	CH									Ac	3
		14.50 - 15.00	2.64	69.35				-	2.10	62.48	35.42	104.33	24.75	79.58	CH									Ac	4
	RB - 8	2.50 - 3.00	2.75	56.52				-	6.50	58.62	34.88	68.01	22.39	45.62	CH									Ac	4
		5.50 - 6.00	2.70	59.29				-	18.30	61.06	20.64	70.74	21.13	49.61	CH									Ac	3
	RB - 9	4.50 - 5.00	2.78	71.58				-	5.20	61.99	32.81	102.93	21.53	81.40	CH									Ac	1
		19.50 - 20.00	2.66	46.48				-	1.60	60.03	38.37	89.74	21.15	68.59	CH									Dc	13
		23.50 - 24.00	2.76	42.28				-	11.40	59.84	28.76	80.91	21.05	59.86	CH									Dc	23
	RB - 10	3.50 - 4.00	2.78	52.65				-	3.20	53.78	43.02	96.91	19.89	77.01	CH									Ac	26
	RB - 11	4.50 - 5.00	2.67	82.45				-	4.30	62.52	33.18	96.82	29.63	67.19	CH									Ac	1
		17.50 - 18.00	2.65	54.98				-	12.10	60.85	27.05	75.53	22.99	50.54	CH									Ac	16
		20.50 - 21.00	2.65	36.89				1.90	11.40	60.67	26.03	86.49	25.53	60.96	CH									Dc	51
	RB - 12	5.50 - 6.00	2.79	67.77				-	14.50	58.77	26.73	74.00	25.86	48.14	CH									Ac	3
		14.50 - 15.00	2.66	74.65				-	6.60	64.31	29.09	101.11	28.66	72.46	CH									Ac	3
	RB - 13	4.50 - 5.00	2.66	75.97				-	7.60	63.30	29.10	120.71	28.98	91.73	CH									Ac	3
		6.50 - 7.00	2.67	74.93				-	3.00	66.90	30.10	116.15	32.70	83.44	CH									Ac	3
	RB - 14	2.50 - 3.00	2.62	51.80				-	3.90	57.54	38.56	122.91	25.45	97.46	CH									Ac	7
		14.50 - 15.00	2.75	63.57				-	3.30	61.57	35.13	104.25	25.00	79.25	CH									Ac	6
	RB - 15	3.50 - 4.00	2.67	49.66				-	33.50	61.07	5.43	116.91	33.52	83.39	CH									As	3
		14.50 - 15.00	2.70	49.46				-	12.60	62.75	24.65	82.13	25.00	57.13	CH									Dc	24
	RB - 16	4.50 - 5.00	2.75	82.83				-	7.10	59.20	33.70	96.23	32.93	63.30	CH									Ac	3
		14.50 - 15.00	2.64	59.85				-	7.40	59.28	33.32	81.97	25.50	56.47	CH									Ac	18
	RB - 17	3.50 - 4.00	2.54	79.60				-	13.40	59.55	26.15	100.85	38.69	62.16	CH									Ac	3
		5.50 - 6.00	2.66	52.77				-	23.20	61.22	15.58	69.71	28.49	41.22	CH									Ac	4

Table 3.2.2(3/5) SUMMARY OF LABORATORY TEST (GRAIN SIZE ANALYSIS) 1/3

LOCATION	BORE-HOLE No.	TEST DEPTH	PHYSICAL PROPERTIES												MECHANICAL PROPERTIES									
								GRAIN SIZE (%)				CONSISTENCY			USCS	SHEARING STRENGTH						CONSOLIDATION PROPERTIES		GEOLOGICAL STATE	S.P.T
																UU		CU							
			Gs	Wn	γ n	Sr	e	GRAVEL >4.75mm	SAND 4.75-0.075mm	SILT 0.075-0.002mm	CLAY <0.002mm	LL	PL	PI	SOIL CLASSIFICATION	C	ϕ	C	ϕ	C'	ϕ'	Pc	Cc	SYMBOL	N VALUE
		(m)	-	(%)	(g/cm3)	(%)	-					(%)	(%)	(%)		(kg/cm2)	(°)	(kg/cm2)	(°)	(kg/cm2)	(°)	(kg/cm2)	-		
WEST FLOODWAY	RB - 1	7.50 - 8.00	2.70	40.36				-	36.00	53.39	10.61	51.02	26.24	24.78	CH									Ac	3
		12.50 - 13.00	2.64	59.39				3.60	9.70	65.88	20.82	124.92	39.44	85.48	CH									Ac	6
	RB - 2	3.50 - 4.00	2.79	37.52				-	78.00	21.58	0.42	-	-	-	SM									As	3
		12.50 - 13.00	2.77	95.42				-	2.20	62.11	35.69	124.04	37.04	87.00	CH									Ac	0
	RB - 3	4.50 - 5.00	2.78	75.81				-	1.40	61.81	36.79	101.60	34.94	66.66	CH									Ac	0
		14.50 - 15.00	2.71	83.32				-	1.90	61.73	35.87	109.37	31.95	77.41	CH									Ac	5
	RB - 4	3.50 - 4.00	2.68	48.13				-	33.70	56.80	9.50	66.44	30.46	35.98	CH									Ac	0
		6.50 - 7.00	2.68	60.08				-	6.80	63.39	29.81	85.52	29.03	56.49	CH									Ac	3
	RB - 5	4.50 - 5.00	2.55	49.11				-	13.10	67.33	19.57	70.31	26.21	44.10	CH									Ac	0
		18.50 - 19.00	2.75	88.00				-	6.60	59.43	33.97	113.16	32.02	81.14	CH									Ac	7
		22.50 - 23.00	2.55	38.88				-	1.90	64.91	33.19	90.99	27.59	63.40	CH									Dc	29
	RB - 6	3.50 - 4.00	2.66	47.82				5.00	25.20	52.96	16.84	57.58	23.56	34.02	CH									Ac	3
		9.50 - 10.00	2.62	90.47				-	0.80	63.72	35.48	130.28	35.15	95.13	CH									Ac	3
		16.50 - 17.00	2.66	43.59				-	3.40	64.68	31.92	117.97	27.38	90.59	CH									Ac	6
	RB - 7	3.50 - 4.00	2.66	67.24				-	17.80	64.43	17.77	82.35	25.52	56.83	CH									Ac	3
		14.50 - 15.00	2.64	69.35				-	2.10	62.48	35.42	104.33	24.75	79.58	CH									Ac	4
	RB - 8	2.50 - 3.00	2.75	56.52				-	6.50	58.62	34.88	68.01	22.39	45.62	CH									Ac	4
		5.50 - 6.00	2.70	59.29				-	18.30	61.06	20.64	70.74	21.13	49.61	CH									Ac	3
	RB - 9	4.50 - 5.00	2.78	71.58				-	5.20	61.99	32.81	102.93	21.53	81.40	CH									Ac	1
		19.50 - 20.00	2.66	46.48				-	1.60	60.03	38.37	89.74	21.15	68.59	CH									Dc	13
		23.50 - 24.00	2.76	42.28				-	11.40	59.84	28.76	80.91	21.05	59.86	CH									Dc	23
	RB - 10	3.50 - 4.00	2.78	52.65				-	3.20	53.78	43.02	96.91	19.89	77.01	CH									Ac	25
	RB - 11	4.50 - 5.00	2.67	82.45				-	4.30	62.52	33.18	96.82	29.63	67.19	CH									Ac	1
		17.50 - 18.00	2.65	54.98				-	12.10	60.85	27.05	75.53	22.99	50.54	CH									Ac	16
		20.50 - 21.00	2.65	36.89				1.90	11.40	60.67	26.03	86.49	25.53	60.96	CH									Dc	51
	RB - 12	5.50 - 6.00	2.79	67.77				-	14.50	58.77	26.73	74.00	25.86	48.14	CH									Ac	3
		14.50 - 15.00	2.66	74.65				-	6.60	64.31	29.09	101.11	28.66	72.46	CH									Ac	3
	RB - 13	4.50 - 5.00	2.66	75.97				-	7.60	63.30	29.10	120.71	28.98	91.73	CH									Ac	3
		6.50 - 7.00	2.67	74.93				-	3.00	66.90	30.10	116.15	32.70	83.44	CH									Ac	3
	RB - 14	2.50 - 3.00	2.62	51.80				-	3.90	57.54	38.56	122.91	25.45	97.46	CH									Ac	7
		14.50 - 15.00	2.75	63.57				-	3.30	61.57	35.13	104.25	25.00	79.25	CH									Ac	6
	RB - 15	3.50 - 4.00	2.67	49.66				-	33.50	61.07	5.43	116.91	33.52	83.39	CH									As	3
		14.50 - 15.00	2.70	49.46				-	12.60	62.75	24.65	82.13	25.00	57.13	CH									Dc	34
	RB - 16	4.50 - 5.00	2.75	82.83				-	7.10	59.20	33.70	96.23	32.93	63.30	CH									Ac	3
		14.50 - 15.00	2.64	59.85				-	7.40	59.28	33.32	81.97	25.50	56.47	CH									Ac	18
	RB - 17	3.50 - 4.00	2.54	79.60				-	13.40	59.55	26.15	100.85	38.69	62.16	CH									Ac	3
		5.50 - 6.00	2.66	52.77				-	23.20	61.22	15.58	69.71	28.49	41.22	CH									Ac	4

Table 3.2.2(4/5) SUMMARY OF LABORATORY TEST (GRAIN SIZE ANALYSIS) 2/3

LOCATION	BORE-HOLE No.	TEST DEPTH	PHYSICAL PROPERTIES											USCS	MECHANICAL PROPERTIES								GEOLOGICAL STATE	S.P.T
								GRAIN SIZE (%)				CONSISTENCY			SHEARING STRENGTH						CONSOLIDATION PROPERTIES			
															UU		CU							
			Gs	Wn	γn	Sr	e	GRAVEL >4.75mm	SAND 4.75-0.075mm	SILT 0.075-0.002mm	CLAY <0.002mm	LL	PL	PI	C	ϕ	C	ϕ	C'	ϕ'	Pc	Cc	SYMBOL	N VALUE
		(m)	-	(%)	(g/cm3)	(%)	-					(%)	(%)	(%)	(kg/cm2)	(°)	(kg/cm2)	(°)	(kg/cm2)	(°)	(kg/cm2)	-		
WEST FLOODWAY		16.50 - 17.00	2.55	35.56				-	33.50	55.88	10.62	54.98	28.07	26.91	CH									Ds	52
		27.50 - 28.00	2.55	42.46				-	6.90	64.71	28.39	74.80	31.33	43.48	CH									Dc	40
	RB - 18	3.50 - 4.00	2.56	50.96				-	34.00	54.58	11.42	74.49	23.43	51.06	CH									As	3
		5.50 - 6.00	2.60	60.92				-	8.50	67.41	24.09	57.19	23.98	33.21	CH									Ac	3
		17.50 - 18.00	2.62	40.67				-	6.10	57.57	36.33	123.62	40.85	82.76	CH									Dc	52
	RB - 19	4.50 - 5.00	2.73	46.65				-	12.90	55.33	31.77	83.42	27.47	55.94	CH									Ac	7
		8.50 - 9.00	2.71	46.64				-	46.40	49.68	3.92	54.39	42.03	12.36	OH									As	13
		14.50 - 15.00	2.62	58.26				-	9.30	63.81	26.89	80.54	42.58	37.96	OH									Ac	19
	RB - 20	2.50 - 3.00	2.63	48.24				-	17.00	59.15	23.85	76.07	22.99	53.08	CH									Ac	6
		6.50 - 7.00	2.68	46.77				-	18.50	63.05	8.45	37.02	23.04	13.99	CL									Ac	3
		12.50 - 13.00	2.60	57.41				-	12.10	60.98	26.92	73.79	30.52	43.27	CH									Ac	3
	RB - 21	4.50 - 5.00	2.64	41.28				-	53.20	43.09	3.71	45.19	21.13	24.07	SC									As	3
		6.50 - 7.00	2.58	52.70				-	21.50	58.72	19.78	71.42	31.40	40.02	CH									Ac	6
		13.50 - 14.00	2.71	60.30				-	20.70	60.10	19.20	83.69	34.36	49.33	CH									As	11
		18.50 - 19.00	2.62	40.59				-	6.70	66.14	26.89	76.53	30.12	46.41	CH									Dc	30
	RB - 22	2.50 - 3.00	2.58	52.44				-	12.90	67.95	15.15	71.89	27.85	44.05	CH									Ao	3
		6.50 - 7.00	2.74	59.20				-	11.19	58.13	30.77	86.36	27.68	58.69	CH									Ac	3
		12.50 - 13.00	2.56	51.23				-	9.10	62.25	28.65	79.59	32.34	47.25	CH									Ac	3
		16.50 - 17.00	2.65	43.70				-	2.90	65.55	31.55	98.94	30.67	68.27	CH									Dc	29
	RB - 23	6.50 - 7.00	2.68	41.81				-	49.30	50.03	0.67	46.78	22.80	23.98	CL									As	11
		9.50 - 10.00	2.61	43.89				-	47.60	47.10	5.30	50.51	22.86	27.65	CH									As	
		11.50 - 12.00	2.64	35.70				-	12.90	69.00	18.10	67.50	28.05	39.45	CH									Dc	67
	RB - 24	2.50 - 3.00	2.64	44.61					9.50	57.19	33.31	73.53	25.00	48.53	CH									Ac	11
		12.50 - 13.00	2.75	35.61				-	72.80	25.40	1.80	-	-	-	SM									Ds	34
	RB - 25	2.50 - 3.00	2.57	44.06				-	7.70	61.13	31.17	102.05	25.71	76.34	CH									Ac	10
		12.50 - 13.00	2.57	44.46				-	4.40	60.66	34.94	76.89	26.76	50.13	CH									Dc	16
	RB - 26	4.50 - 5.00	2.65	68.17				-	1.80	59.95	38.25	112.64	27.50	85.14	CH									Ac	13
		14.50 - 15.00	2.50	55.58				-	2.50	63.23	34.27	81.57	29.41	52.16	CH									Dc	44
	RB - 27	7.50 - 8.00	2.78	36.72				11.10	73.20	15.70	0.00	-	-	-	SM									Da	50<
		11.50 - 12.00	2.74	46.47					74.20	25.80	0.00	-	-	-	SM									Da	50<
	RB - 28	4.50 - 5.00	2.64	26.81				4.10	33.30	53.92	8.68	50.87	22.36	28.51	CH									Da	50<
	RB - 51	13.50 - 14.00	2.66	41.55				-	10.20	62.01	27.79	80.85	25.39	55.46	CH									Dc	45
		16.50 - 17.00	2.64	51.23				-	6.50	61.50	32.00	99.15	27.60	71.55	CH									Dc	26
		24.50 - 25.00	2.68	29.05				1.70	12.60	61.04	24.66	101.15	19.17	81.96	CL									Dc	43
	RB - 52	28.50 - 29.00	2.70	47.68				-	8.60	69.82	21.58	74.43	31.52	42.91	CH									Dc	40

Table 3.2.2(5/5) SUMMARY OF LABORATORY TEST (GRAIN SIZE ANALYSIS) 3/3

LOCATION	BORE-HOLE No.	TEST DEPTH	PHYSICAL PROPERTIES											USCS	MECHANICAL PROPERTIES								GEOLOGICAL STATE	S.P.T
								GRAIN SIZE (%)				CONSISTENCY			SHEARING STRENGTH						CONSOLIDATION PROPERTIES			
															UU		CU							
			Gs	Wn	γn	Sr	e	GRAVEL >4.75mm	SAND 4.75-0.075mm	SILT 0.075-0.002mm	CLAY <0.002mm	LL	PL	PI	C	φ	C	φ	C'	φ'	Pc	Cc	SYMBOL	N VALUE
		(m)	-	(%)	(g/cm3)	(%)	-					(%)	(%)	(%)	SOIL CLASSIFICATION	(kg/cm2)	(°)	(kg/cm2)	(°)	(kg/cm2)	(°)	(kg/cm2)	-		
GARANG RIVER	RB - 29	2.50 - 3.00	2.54	42.21				-	20.90	58.48	20.62	64.83	23.74	41.08	CH									Ac	5
		9.50 - 10.00	2.55	52.97				-	9.70	60.98	29.32	80.66	22.94	57.72	CH									Ac	7
	RB - 30	3.50 - 4.00	2.62	36.91				-	11.30	59.51	29.19	84.49	24.73	59.77	CH									Ac	23
		9.50 - 10.00	2.52	55.11				-	8.80	63.37	27.83	82.04	26.52	55.52	CH									Ac	8
	RB - 31	2.50 - 3.00	2.53	36.56				-	23.00	61.34	15.66	78.91	26.63	52.28	CH									Ac	10
		8.50 - 9.00	2.89	13.18				16.97	71.12	10.83	1.06	-	-	-	S-P									Da	46
		11.50 - 12.00	2.85	26.57				17.23	59.45	21.45	1.87	-	-	-	SM									Da	50
	RB - 32	10.50 - 11.00	2.78	26.57				-	82.20	17.66	0.14	-	-	-	SM									Da	24
		12.50 - 13.00	2.73	38.17				-	42.10	53.29	4.61	62.66	21.18	41.48	CH									Da	60
	RB - 33	3.50 - 4.00	2.63	51.58				-	14.90	58.02	27.08	72.83	25.79	47.04	CH									Ac	3
		6.50 - 7.00	2.86	14.12				4.70	77.60	17.38	0.32	-	-	-	SM									As	20
		12.50 - 13.00	2.77	43.21				-	9.40	59.71	30.89	61.01	26.49	34.52	CH									Dc	13
	RB - 34	3.50 - 4.00	2.79	34.49				5.70	59.50	31.03	3.77	37.65	21.70	15.95	SC									As	7
		7.50 - 8.00	2.69	39.28				-	8.80	61.41	19.79	88.06	25.75	62.31	CH									Dc	15
	RB - 35	3.50 - 4.00	2.74	42.96				2.10	20.50	57.79	19.61	74.74	30.43	44.31	CH									Da	8
		8.50 - 9.00	2.75	17.22				25.84	68.65	5.50	0.00	-	-	-	S-P									Da	50<
	RB - 36	3.50 - 4.00	2.83	19.46				-	75.60	22.57	1.83	-	-	-	SM									As	5
		8.50 - 9.00	2.86	9.06				41.95	43.35	12.86	1.84	-	-	-	SM									Da	48
	RB - 37	3.50 - 4.00	2.75	40.33				-	12.10	59.18	28.72	80.59	26.58	54.01	CH									Ac	10
		9.50 - 10.00	2.53	29.49				3.30	64.50	30.82	1.38	38.33	19.41	18.92	SC									Da	24
	RB - 38	4.50 - 5.00	2.65	62.91				-	2.80	63.14	34.06	99.98	29.69	70.29	CH									Ac	6
		8.50 - 9.00	2.78	49.51				-	22.80	62.57	14.63	41.14	21.99	19.15	CL									Ac	5
	RB - 39	9.50 - 10.00	2.68	30.21				-	50.30	47.92	1.78	33.86	22.39	11.47	SC									Da	43
	RB - 40	2.50 - 3.00	2.79	20.61				-	42.00	48.12	9.88	63.46	21.21	42.25	CH									Ac	11
		9.50 - 10.00	2.87	5.03				48.17	39.11	10.91	1.81	-	-	-	GM									Da	52
	RB - 41	4.50 - 5.00	2.75	36.54				-	20.10	60.45	19.45	64.66	30.00	34.56	CH									Da	66
		5.50 - 6.00	2.56	28.90				1.80	24.10	62.54	11.56	58.40	28.57	29.82	CH									Da	63
	RB - 42	3.50 - 4.00	2.55	28.42				1.60	17.60	59.06	21.74	61.94	23.67	38.27	CH									Ac	21
	RB - 43	2.50 - 3.00	2.75	29.48				-	19.20	58.17	22.63	64.33	20.81	43.52	CH									Ac	13
		4.50 - 5.00	2.78	34.18				-	13.80	57.52	28.68	61.38	31.15	30.24	CH									Da	66
		5.50 - 6.00	2.64	34.85				3.60	49.60	45.99	0.81	44.19	28.37	15.82	SM									Da	73
	RB - 44	4.50 - 5.00	2.58	32.87				2.20	41.50	48.87	7.43	55.77	25.26	30.51	CH									Da	65
		7.50 - 8.00	2.54	28.50				6.40	26.90	60.76	5.94	77.93	28.64	50.29	CH									Da	24
	RB - 45	2.50 - 3.00	2.61	42.50				-	28.20	47.70	24.10	52.23	15.34	36.89	CH									Ac	13
		4.50 - 5.00	2.75	15.50				47.74	39.53	12.74	0.00	-	-	-	GM									Da	65
		5.50 - 6.00	2.71	13.81				67.58	31.75	0.68	0.00	-	-	-	GP									Da	50<
	RB - 46	1.50 - 2.00	2.56	40.60				-	11.60	66.97	21.43	66.35	21.43	44.92	CH									B	8
		2.50 - 3.00	2.66	40.29				-	16.50	66.32	17.18	60.23	21.95	38.28	CH									B	15
	RB - 47	1.50 - 2.00	2.66	37.14				4.30	37.40	44.03	14.27	56.87	24.54	32.33	CH									B	24
		2.50 - 3.00	2.57	39.67				-	30.30	54.55	15.15	61.30	30.18	31.12	CH									B	15
	RB - 48	2.50 - 3.00	2.67	24.36				43.67	52.13	4.20	0.00	-	-	-	SP									B	50<
		8.50 - 9.00	2.75	33.35				3.80	41.40	53.29	1.51	48.75	22.34	26.41	CL									Da	29
	RB - 49	3.50 - 4.00	2.72	14.06				63.09	31.78	5.13	0.00	-	-	-	GP									Da	50<
		5.50 - 6.00	2.63	27.84				6.20	45.90	47.25	0.65	37.46	21.88	15.61	SC									Da	39
	RB - 50	1.50 - 2.00	2.67	43.80				-	41.70	48.94	9.36	58.73	22.58	36.15	CH									Ac	3
		2.50 - 2.85	2.66	37.14				55.74	34.70	9.56	0.00	-	-	-	G-P									Da	50<

Table 3.3.1 HYDROLOGICAL STATIONS AND DATA COLLECTION

No.	Station	Organi-zation	Start Year	Year of Record: 67 * * 70 * * * * 75 * * * * 80 * * * * 85 * * * * 90	91 * * * * 96
				by Feasibility Study in1993	Additional Data
(1) Daily Rainfall Data					
25	Kebonadem	PU,BMG	1951	A A A A A A A A B B A A A A A A A A A A A A B A A	
33	Karangtengah	PU,BMG	1948	A A A A A A A A A A A A A A A A A A A A A A A A A	
34	Ngareanak	PU,BMG	1951	A A A A A A B A A A A A A A A A A A A A A A A B B	
37	Boja	PU,BMG	1969	B A A A A A B B A B A A B B A A B A A B B B	
39	Limbangan	PU,BMG	1951	A A A A B A B B A A B B B A A A A A A A A B A A	
41d	Bringinmangkang	BMG	1958	B A A B A A A A A A A A A A A A A A A A A B A A	
41e	BMG Semarang	BMG	1968	A A A A A A A A A A A A A A A A A A A A A A A A	A A A A A A
44	Mijen	PU,BMG	1958	A A A A A A B A A B A A A A A A A A A A A A A A	A A A A A A
59	Candi	BMG	1958	A A A A A A A A B B A A A A A B A B B A A A A B	
65c	Sumurjurang	PU,BMG	1952	B B A A B A B A B A A A A A B A A A B B A A A A	B A A A B A
68b	Klepu	BMG	1951	B A B B B B B B B B A A A A B A B B B B B	
97	Plamongan	PU,BMG	1958	B B A A A A A A A A A A A A A A A A A A A A A A	
99	Banyumeneng	PU,BMG	1956	B A B A A B A A A A A A A A A A A A A A A A A A	
(2) Hourly Rainfall Data					
41e	BMG Semarang	BMG	1959	(1959-1966=A) A B A A A A A A A A A A A A A A A A	A A A A A A
5	Kaligading	IHE	1980	B A A A A B A A B B A	B B A B A A
(3) Daily Discharge Data					
	Panjangan	IHE	1983	(Garang River A=192.6km2) A A A A	A A A A A A
	Patemon	IHE	1992	(Garang River A= 75.0km2)	B A A A A
	Kalipancur	IHE	1992	(Kreo River A= 66.1km2)	B A A A A
(4) Hourly Water Level Data					
	Simongan Weir	PU	1987	(Garang River A=204.0km2) B B B B	B B B B B B
			1961	(Annual Maximum Water Level =1961-1996) C C C C	C C C C C C

Note : Symbol=A means complete data, Symbol=B means incomplete data, Symbol=C means intermittent data

Table 3.3.2 ANNUAL MAXIMUM RAINFALL FOR EACH DURATION AT BMG-SEMARANG STATION

Unit : mm

No.	year	5-min.	10-min.	15-min.	30-min.	45-min.	60-min.	120-min.	3-hours	6-hours	12-hours	1-day
1	1959	20	25	30	50	53	53	55	55	55	55	75
2	1960	18	22	32	46	46	47	51	57	67	71	87
3	1961	21	26	28	40	43	44	50	66	87	116	124
4	1962	11	20	25	30	35	38	45	52	73	76	100
5	1963	22	24	25	38	40	40	44	62	70	118	120
6	1964	21	31	42	62	78	80	89	91	98	100	100
7	1965	11	15	18	28	38	40	41	44	91	125	166
8	1966	27	30	34	43	50	54	72	80	90	91	91
9	1976	17	20	32	43	59	75	107	107	135	183	206
10	1978	17	25	36	60	72	85	98	102	115	115	115
11	1979	15	24	29	37	50	56	99	114	126	126	126
12	1980	14	28	62	82	82	91	175	185	192	192	192
13	1981	20	40	50	65	70	80	113	120	204	228	253
14	1982	10	10	16	47	58	69	80	103	131	131	157
15	1983	18	36	54	73	83	93	93	96	96	96	96
16	1984	16	27	35	47	61	67	79	83	85	81	91
17	1985	15	25	35	55	71	96	149	149	149	247	253
18	1986	31	46	62	72	86	100	105	123	129	130	130
19	1987	27	32	37	60	85	88	93	93	96	138	138
20	1988	15	26	36	51	71	81	102	102	117	174	174
21	1989	16	26	30	44	55	80	100	100	108	142	142
22	1990	10	20	30	50	57	58	66	70	82	100	115
23	1991	10	20	30	40	48	49	70	71	125	132	132
24	1992	16	21	30	55	75	80	88	94	98	99	99
25	1993	22	30	40	75	84	92	108	110	130	182	238
26	1994	20	30	36	55	56	68	79	79	86	90	90
27	1995	15	22	35	60	67	79	100	100	100	100	124
28	1996	25	37	41	66	85	110	114	116	117	117	117

Table 3.3.3 PROBABLE RAINFALL FOR EACH DURATION AT BMG-SEMARANG STATION

(1) Updated Data N=28 (1959-1966, 1976-1996)

Return Period T (year)	Gumbel Variable Y	5-min. (mm)	10-min. (mm)	15-min. (mm)	30-min. (mm)	45-min. (mm)	60-min. (mm)	120-min. (mm)	3-hours (mm)	6-hours (mm)	12-hours (mm)	1-day (mm)
2	0.36651	17.1	25.2	33.7	50.6	60.4	68.2	83.4	89.2	103.9	120.1	130.0
3	0.90273	19.6	28.8	38.9	57.1	68.0	77.8	98.1	103.7	120.2	142.1	154.0
5	1.49994	22.5	32.8	44.8	64.4	76.4	88.6	114.5	119.9	138.3	166.6	180.7
8	2.01342	25.0	36.2	49.8	70.6	83.7	97.9	128.5	133.8	153.8	187.7	203.7
10	2.25037	26.2	37.8	52.1	73.5	87.0	102.2	135.0	140.2	161.0	197.5	214.3
20	2.97020	29.6	42.6	59.1	82.2	97.2	115.2	154.7	159.7	182.8	227.0	246.5
25	3.19853	30.7	44.1	61.3	85.0	100.4	119.3	160.9	165.8	189.8	236.4	256.7
30	3.38429	31.6	45.3	63.1	87.2	103.1	122.6	166.0	170.9	195.4	244.1	265.0
40	3.67625	33.0	47.3	65.9	90.8	107.2	127.9	174.0	178.8	204.2	256.1	278.1
50	3.90194	34.1	48.8	68.1	93.5	110.4	132.0	180.2	184.9	211.1	265.3	288.2
60	4.08596	35.0	50.0	69.9	95.7	113.0	135.3	185.2	189.9	216.6	272.9	296.4
80	4.37574	36.4	52.0	72.7	99.3	117.1	140.5	193.2	197.7	225.4	284.8	309.4
100	4.60015	37.5	53.4	74.9	102.0	120.3	144.6	199.3	203.8	232.2	294.0	319.4
150	5.00730	39.5	56.2	78.9	106.9	126.0	151.9	210.4	214.8	244.6	310.7	337.6
200	5.29581	40.9	58.1	81.7	110.4	130.1	157.1	218.3	222.6	253.3	322.6	350.5
1000	6.90723	48.6	68.8	97.4	130.0	152.9	186.2	262.4	266.2	302.2	388.8	422.6
	Xo	15.28	22.80	30.16	46.16	55.23	61.53	73.42	79.25	92.81	105.01	113.64
	1/a	4.83	6.66	9.73	12.14	14.13	18.05	27.36	27.07	30.31	41.08	44.73

Note : X = Xo + Y*(1/a)

(2) by Feasibility Study in 1993 Data N=22 (1959-1966, 1976-1990)

Return Period T (year)	Gumbel Variable Y	5-min. (mm)	10-min. (mm)	15-min. (mm)	30-min. (mm)	45-min. (mm)	60-min. (mm)	120-min. (mm)	3-hours (mm)	6-hours (mm)	12-hours (mm)	1-day (mm)
2	0.36651	16.7	24.7	33.3	48.4	54.5	64.7	80.0	87.6	103.8	121.2	132.0
5	1.49994	21.6	31.8	43.8	60.5	66.8	82.4	109.6	116.7	136.2	164.4	177.6
100	4.60015	34.9	51.3	72.5	93.6	100.5	130.6	190.2	196.2	226.2	280.8	297.6

Table 3.3.4 RAINFALL INTENSITY FORMULA FOR SHORT DURATION

(T < 2 hours)

Return Period T (year)	Time (min.)	Probable Data (mm/hr)	by Formula (mm/hr)	Difference (%)	Rainfall Intensity Formula (R=mm/hr, T=min.)
2	5	204.6	195.0	-4.7	R = 1567.1/(T+11.79)^0.739
	10	151.4	160.9	6.3	
	15	134.9	138.1	2.4	
	30	101.2	99.4	-1.8	
	45	80.5	79.3	-1.5	
	60	68.2	66.7	-2.2	
	120	41.7	42.6	2.2	
5	5	270.2	261.2	-3.3	R = 1271.9/(T+ 6.95)^0.638
	10	196.7	209.0	6.3	
	15	179.0	177.2	-1.0	
	30	128.7	127.1	-1.2	
	45	101.9	102.3	0.4	
	60	88.6	87.0	-1.8	
	120	57.2	57.8	1.0	
10	5	313.8	305.6	-2.6	R = 1230.2/(T+ 5.20)^0.600
	10	226.7	240.6	6.1	
	15	208.2	202.9	-2.5	
	30	146.9	145.4	-1.0	
	45	116.1	117.6	1.3	
	60	102.2	100.5	-1.7	
	120	67.5	68.0	0.7	
20	5	355.4	348.2	-2.0	R = 1241.4/(T+ 4.12)^0.575
	10	255.5	270.8	6.0	
	15	236.2	227.5	-3.7	
	30	164.4	163.0	-0.9	
	45	129.6	132.2	2.0	
	60	115.2	113.4	-1.6	
	120	77.3	77.6	0.4	
25	5	368.8	361.9	-1.9	R = 1245.5/(T+ 3.81)^0.568
	10	264.7	280.4	5.9	
	15	245.2	235.3	-4.0	
	30	170.0	168.7	-0.8	
	45	133.9	136.9	2.2	
	60	119.3	117.6	-1.4	
	120	80.5	80.7	0.2	
50	5	409.6	403.9	-1.4	R = 1273.4/(T+ 3.06)^0.550
	10	292.7	309.7	5.8	
	15	272.5	259.1	-4.9	
	30	187.0	185.8	-0.6	
	45	147.2	151.2	2.7	
	60	132.0	130.2	-1.4	
	120	90.1	90.2	0.1	
100	5	450.0	445.5	-1.0	R = 1318.3/(T+ 2.53)^0.537
	10	320.6	338.8	5.7	
	15	299.7	282.9	-5.6	
	30	204.0	202.9	-0.5	
	45	160.3	165.5	3.2	
	60	144.6	142.8	-1.2	
	120	99.6	99.5	-0.1	

Table 3.3.5 RAINFALL INTENSITY FORMULA FOR LONG DURATION

(T > 1 hour)

Return Period T (year)	Time (min.)	Probable Data (mm/hr)	by Formula (mm/hr)	Difference (%)	Rainfall Intensity Formula (R=mm/hr, T=min.)
	60	68.2	68.8	0.9	
	120	41.7	41.2	-1.2	
2	180	29.7	30.0	1.0	R = 2417.0/(T+10.80)^0.836
	360	17.3	17.2	-0.6	
	720	10.0	9.8	-2.0	
	1440	5.4	5.5	1.9	
	60	88.6	90.0	1.6	
	120	57.2	55.1	-3.7	
5	180	40.0	40.6	1.5	R = 3245.6/(T+14.75)^0.831
	360	23.0	23.6	2.6	
	720	13.9	13.5	-2.9	
	1440	7.5	7.6	1.3	
	60	102.2	104.2	2.0	
	120	67.5	64.3	-4.7	
10	180	46.7	47.5	1.7	R = 3721.3/(T+15.67)^0.826
	360	26.8	27.7	3.4	
	720	16.5	15.9	-3.6	
	1440	8.9	9.1	2.2	
	60	115.2	117.8	2.3	
	120	77.3	73.1	-5.4	
20	180	53.2	54.2	1.9	R = 4202.2/(T+16.63)^0.824
	360	30.5	31.7	3.9	
	720	18.9	18.3	-3.2	
	1440	10.3	10.4	1.0	
	60	119.3	122.0	2.3	
	120	80.5	76.0	-5.6	
25	180	55.3	56.3	1.8	R = 4430.3/(T+17.47)^0.826
	360	31.6	33.0	4.4	
	720	19.7	19.0	-3.6	
	1440	10.7	10.8	0.9	
	60	132.0	135.3	2.5	
	120	90.1	84.6	-6.1	
50	180	61.6	62.8	1.9	R = 4923.2/(T+18.23)^0.824
	360	35.2	36.9	4.8	
	720	22.1	21.3	-3.6	
	1440	12.0	12.1	0.8	
	60	144.6	148.3	2.6	
	120	99.6	93.1	-6.5	
100	180	67.9	69.3	2.1	R = 5426.1/(T+19.02)^0.824
	360	38.7	40.8	5.4	
	720	24.5	23.5	-4.1	
	1440	13.3	13.4	0.8	
	60	186.2	191.6	2.9	
	120	131.2	121.4	-7.5	
1000	180	88.7	90.7	2.3	R = 7100.8/(T+20.89)^0.822
	360	50.4	53.6	6.3	
	720	32.4	31.0	-4.3	
	1440	17.6	17.7	0.6	

Table 3.3.6 HOURLY RAINFALL DATA IN ANNUAL MAXIMUM DAILY RAINFALL AT BMG-SEMARANG STATION

Unit : mm

Year	Date	Total	8:00	9:00	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	1:00	2:00	3:00	4:00	5:00	6:00	7:00
1987	Jan.27	138.0	0	0	0	0	0	4.2	45.8	29	9	7.4	2.2	3.3	2	8	9.5	4.5	9.5	3	0.6	0	0	0	0	0
1988	Dec.17	174.6	0	0	0	0	0	0	0	0	0	0	0	0	0	2.6	44.2	10.4	4.2	2.3	4.2	44	13.7	17	29.9	2.1
1989	Feb. 6	141.5	6.5	0	3	5.5	0.3	0.7	0	0.3	0.7	0	4.9	1.6	6.5	8	41	5	2.5	9.7	4	1	28	9	1.5	1.8
1990	Jan.22	115.0	0	0	0	0	0	0	0	0	0.2	4.2	9.6	4	17	14	3.5	15.5	10.5	8.5	8.5	4	0.5	10	3	2
1991	Dec.26	132.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	3.9	0.1	35.5	23	27	16.5	11.5	12	1.3	0.7
1992	Mar.11	98.8	0	0	0	0	0	0	0	0	0	0	0	40	47	7.3	3.2	0.3	1	0	0	0	0	0	0	0
1993	Jan.28	237.5	1.5	11	4	10.5	33	15	0.2	0	0.3	0	0	24.5	22	16	18	34	10	16	10.5	1	0.5	8	1.5	0
1994	Mar. 8	90.0	0	0	0	0	0	0	6	0	56	7	10.5	6	4.5	0	0	0	0	0	0	0	0	0	0	0
1995	Dec.12	124.0	1.2	1.3	7.5	1.5	0	4	0	0	0	0	0	2	12.5	51	10	2.5	0.5	0	0	0.5	5	3.5	4	17
1996	Apr. 23	116.9	0	0	0	0	0	0	0	0	0	0.6	0	0	0.1	114.4	1.8	0	0	0	0	0	0	0	0	0

Table 3.3.7 HOURLY RAINFALL RATIO IN ANNUAL MAXIMUM DAILY RAINFALL AND DESIGN STORM

Year	Date	Total	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	Peak	1	2	3	4	5	6	7	8	9	10	11	12
1987	Dec. 4	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.33	0.21	0.07	0.05	0.02	0.02	0.01	0.06	0.07	0.03	0.07	0.02	0.00
1988	Jan. 7	1.0	0.00	0.00	0.00	0.00	0.00	0.01	0.25	0.06	0.02	0.01	0.02	0.25	0.08	0.10	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	Oct.15	1.0	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.05	0.06	0.29	0.04	0.02	0.07	0.03	0.01	0.20	0.06	0.01	0.01	0.05	0.00	0.02
1990	Jan.25	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.08	0.03	0.15	0.12	0.03	0.13	0.09	0.07	0.07	0.03	0.00	0.09	0.03	0.02	0.00
1991	Feb. 7	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.27	0.17	0.20	0.13	0.09	0.09	0.01	0.01	0.00	0.00	0.00	0.00	0.00
1992	Nov.22	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.48	0.07	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993	Jan.29	1.0	0.14	0.06	0.00	0.00	0.00	0.00	0.00	0.10	0.09	0.07	0.08	0.14	0.04	0.07	0.04	0.00	0.00	0.03	0.01	0.00	0.01	0.05	0.02	0.04
1994	Mar. 5	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.62	0.08	0.12	0.07	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1995	May.10	1.0	0.06	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.10	0.41	0.08	0.02	0.00	0.00	0.00	0.00	0.04	0.03	0.03	0.14	0.01	0.01
1996	Apr. 2	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average(=Ai)		1.0	0.02	0.01	0.00	0.00	0.00	0.00	0.03	0.02	0.02	0.03	0.07	0.39	0.09	0.07	0.07	0.03	0.02	0.03	0.02	0.01	0.02	0.03	0.01	0.01
Return Period		Rd(mm)	Design Storm Rs (mm)																							
5-year		180.7	3.6	1.8	0.0	0.0	0.0	0.0	5.4	3.6	3.6	5.4	12.6	70.5	16.3	12.6	12.6	5.4	3.6	5.4	3.6	1.8	3.6	5.4	1.8	1.8
10-year		214.3	4.3	2.1	0.0	0.0	0.0	0.0	6.4	4.3	4.3	6.4	15.0	83.6	19.3	15.0	15.0	6.4	4.3	6.4	4.3	2.1	4.3	6.4	2.1	2.1
25-year		256.7	5.1	2.6	0.0	0.0	0.0	0.0	7.7	5.1	5.1	7.7	18.0	100.1	23.1	18.0	18.0	7.7	5.1	7.7	5.1	2.6	5.1	7.7	2.6	2.6
50-year		288.2	5.8	2.9	0.0	0.0	0.0	0.0	8.6	5.8	5.8	8.6	20.2	112.4	25.9	20.2	20.2	8.6	5.8	8.6	5.8	2.9	5.8	8.6	2.9	2.9
100-year		319.4	6.4	3.2	0.0	0.0	0.0	0.0	9.6	6.4	6.4	9.6	22.4	124.6	28.7	22.4	22.4	9.6	6.4	9.6	6.4	3.2	6.4	9.6	3.2	3.2

Note : (Hourly Rainfall in Design Storm)Rs = (Average Ratio)Ai * (Probable Rainfall in a day)Rd

Table 3.3.6 HOURLY RAINFALL DATA IN ANNUAL MAXIMUM DAILY RAINFALL AT BMG-SEMARANG STATION

Unit : mm

Year	Date	Total	8:00	9:00	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	1:00	2:00	3:00	4:00	5:00	6:00	7:00
1987	Jan.27	138.0	0	0	0	0	0	4.2	45.8	29	9	7.4	2.2	3.3	2	8	9.5	4.5	9.5	3	0.6	0	0	0	0	0
1988	Dec.17	174.6	0	0	0	0	0	0	0	0	0	0	0	0	0	2.6	44.2	10.4	4.2	2.3	4.2	44	13.7	17	29.9	2.1
1989	Feb. 6	141.5	6.5	0	3	5.5	0.3	0.7	0	0.3	0.7	0	4.9	1.6	6.5	8	41	5	2.5	9.7	4	1	28	9	1.5	1.8
1990	Jan.22	115.0	0	0	0	0	0	0	0	0	0.2	4.2	9.6	4	17	14	3.5	15.5	10.5	8.5	8.5	4	0.5	10	3	2
1991	Dec.26	132.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	3.9	0.1	35.5	23	27	16.5	11.5	12	1.3	0.7
1992	Mar.11	98.8	0	0	0	0	0	0	0	0	0	0	0	40	47	7.3	3.2	0.3	1	0	0	0	0	0	0	0
1993	Jan.28	237.5	1.5	11	4	10.5	33	15	0.2	0	0.3	0	0	24.5	22	16	18	34	10	16	10.5	1	0.5	8	1.5	0
1994	Mar. 8	90.0	0	0	0	0	0	0	6	0	56	7	10.5	6	4.5	0	0	0	0	0	0	0	0	0	0	0
1995	Dec.12	124.0	1.2	1.3	7.5	1.5	0	4	0	0	0	0	0	2	12.5	51	10	2.5	0.5	0	0	0.5	5	3.5	4	17
1996	Apr. 23	116.9	0	0	0	0	0	0	0	0	0	0.6	0	0	0.1	114.4	1.8	0	0	0	0	0	0	0	0	0

Table 3.3.7 HOURLY RAINFALL RATIO IN ANNUAL MAXIMUM DAILY RAINFALL AND DESIGN STORM

Year	Date	Total	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	Peak	1	2	3	4	5	6	7	8	9	10	11	12
1987	Dec. 4	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.33	0.21	0.07	0.05	0.02	0.02	0.01	0.06	0.07	0.03	0.07	0.02	0.00
1988	Jan. 7	1.0	0.00	0.00	0.00	0.00	0.00	0.01	0.25	0.06	0.02	0.01	0.02	0.25	0.08	0.10	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	Oct.15	1.0	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.05	0.06	0.29	0.04	0.02	0.07	0.03	0.01	0.20	0.06	0.01	0.01	0.05	0.00	0.02
1990	Jan.25	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.08	0.03	0.15	0.12	0.03	0.13	0.09	0.07	0.07	0.03	0.00	0.09	0.03	0.02	0.00
1991	Feb. 7	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.27	0.17	0.20	0.13	0.09	0.09	0.01	0.01	0.00	0.00	0.00	0.00	0.00
1992	Nov.22	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.48	0.07	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993	Jan.29	1.0	0.14	0.06	0.00	0.00	0.00	0.00	0.00	0.10	0.09	0.07	0.08	0.14	0.04	0.07	0.04	0.00	0.00	0.03	0.01	0.00	0.01	0.05	0.02	0.04
1994	Mar. 5	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.62	0.08	0.12	0.07	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1995	May.10	1.0	0.06	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.10	0.41	0.08	0.02	0.00	0.00	0.00	0.00	0.04	0.03	0.03	0.14	0.01	0.01
1996	Apr. 2	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVerage(=Ai)		1.0	0.02	0.01	0.00	0.00	0.00	0.00	0.03	0.02	0.02	0.03	0.07	0.39	0.09	0.07	0.07	0.03	0.02	0.03	0.02	0.01	0.02	0.03	0.01	0.01
Return Period		Rd(mm)	Design Storm Rs (mm)																							
5-year		180.7	3.6	1.8	0.0	0.0	0.0	0.0	5.4	3.6	3.6	5.4	12.6	70.5	16.3	12.6	12.6	5.4	3.6	5.4	3.6	1.8	3.6	5.4	1.8	1.8
10-year		214.3	4.3	2.1	0.0	0.0	0.0	0.0	6.4	4.3	4.3	6.4	15.0	83.6	19.3	15.0	15.0	6.4	4.3	6.4	4.3	2.1	4.3	6.4	2.1	2.1
25-year		256.7	5.1	2.6	0.0	0.0	0.0	0.0	7.7	5.1	5.1	7.7	18.0	100.1	23.1	18.0	18.0	7.7	5.1	7.7	5.1	2.6	5.1	7.7	2.6	2.6
50-year		288.2	5.8	2.9	0.0	0.0	0.0	0.0	8.6	5.8	5.8	8.6	20.2	112.4	25.9	20.2	20.2	8.6	5.8	8.6	5.8	2.9	5.8	8.6	2.9	2.9
100-year		319.4	6.4	3.2	0.0	0.0	0.0	0.0	9.6	6.4	6.4	9.6	22.4	124.6	28.7	22.4	22.4	9.6	6.4	9.6	6.4	3.2	6.4	9.6	3.2	3.2

Note : (Hourly Rainfall in Design Storm)Rs = (Average Ratio)Ai * (Probable Rainfall in a day)Rd

Table 3.3.8 ANNUAL MAXIMUM DISCHARGE AT SIMONGAN WEIR

Year	Date	Data max. H (m)	Head h=H-5.6 (m)	Center Portion Q1 (m3/s) =1.57*64.6m*h^1.5	Side Portion Q2 (m3/s) =1.8*10.4m*h^1.5	Discharge Q=Q1+Q2 (m3/s)
1961		7.9	2.3	353.8	65.3	419
1962		7.3	1.7	224.8	41.5	266
1963		9.4	3.8	751.3	138.7	890
1964		6.9	1.3	150.3	27.7	178
1965		7.4	1.8	244.9	45.2	290
1966		x	x	x	x	x
1967		x	x	x	x	x
1968		6.6	1.0	101.4	18.7	120
1969		7.1	1.5	186.3	34.4	221
1970		7.0	1.4	168.0	31.0	199
1971		7.0	1.4	168.0	31.0	199
1972		6.9	1.3	150.3	27.7	178
1973		6.9	1.3	150.3	27.7	178
1974		7.8	2.2	331.0	61.1	392
1975		6.9	1.3	150.3	27.7	178
1976		7.9	2.3	353.8	65.3	419
1977		7.5	1.9	265.6	49.0	315
1978		7.5	1.9	265.6	49.0	315
1979		7.2	1.6	205.3	37.9	243
1980		6.7	1.1	117.0	21.6	139
1981		8.1	2.5	400.9	74.0	475
1982		7.7	2.1	308.6	57.0	366
1983		7.4	1.8	244.9	45.2	290
1984		7.3	1.7	224.8	41.5	266
1985		8.2	2.6	425.2	78.5	504
1986		7.4	1.8	244.9	45.2	290
1987	Dec.21	7.70	2.1	308.6	57.0	366
1988	Mar.25	7.80	2.2	331.0	61.1	392
1989	Feb.05	7.60	2.0	286.9	52.9	340
1990	Jan.26	9.40	3.8	751.3	138.7	890
1991	Jan.09	8.25	2.7	437.5	80.8	518
1992	Jan.09	8.05	2.5	388.9	71.8	461
1993	Jan.30	9.10	3.5	664.1	122.6	787
1994	Mar.11	7.50	1.9	265.6	49.0	315
1995	Nov.29	7.65	2.1	297.7	54.9	353
1996	Dec.02	7.90	2.3	353.8	65.3	419

Note : Max. H means annual maximum water level by watching at site.
Water level data were given by RANTING DINAS (DOLOG PENGGARON)
Gates at side portions are closed even at flood time.

Table 3.3.9 PROBABLE PEAK DISCHARGE AT SIMONGAN

Return Period T (year)	umbel Variable Y	Probable Discharge (m3/s) N=36 (1961-1996) Up-dated	Probable Discharge (m3/s) N=30 (1961-1990) by Feasibilty Study in 1993
2	0.36651	330	350
3	0.90273	416	
5	1.49994	512	520
8	2.01342	595	
10	2.25037	633	630
20	2.97020	748	740
25	3.19853	785	780
30	3.38429	815	800
40	3.67625	862	840
50	3.90194	898	880
60	4.08596	927	
80	4.37574	974	940
100	4.600165	1010	980
150	5.00730	1075	1,040
200	5.29581	1122	1,080

Note : X = Xo + Y*(1/a)

Xo = 271.20 1/a = 160.60

Table 3.3.9 PROBABLE PEAK DISCHARGE AT SIMONGAN

Return Period T (year)	umbel Variable Y	Probable Discharge (m3/s) N=36 (1961-1996) Up-dated	Probable Discharge (m3/s) N=30 (1961-1990) by Feasibilty Study in 1993
2	0.36651	330	350
3	0.90273	416	
5	1.49994	512	520
8	2.01342	595	
10	2.25037	633	630
20	2.97020	748	740
25	3.19853	785	770
30	3.38429	815	800
40	3.67625	862	840
50	3.90194	898	880
60	4.08596	927	
80	4.37574	974	940
100	4.60015	1010	980
150	5.00730	1075	1,040
200	5.29581	1122	1,080

Note : X = Xo + Y*(1/a)

Xo = 271.20 1/a = 160.60

Table 3.3.10 DAILY RAINFALL AT FLOOD TIME

Unit : mm

	BMG	Kaligading	Sumurjurang	Mijen	Thiessen
Ci=	0.13	0.12	0.58	0.17	Rt=Sum(Ri*Ci)
1987 Dec. 21	0.0	77.6	142.0	143.0	116.0
1990 Jan. 25	0.7	149.7	185.0	218.0	162.4
1993 Jan. 29	136.0	232.0	172.0	144.0	169.8
1994 Mar. 11	5.5	64.6	81.0	108.0	73.8
1995 Nov. 29	34.9	61.8	49.0	101.0	57.5

Table 3.3.11(1/2) HOURLY DATA OBSERVED AT FLOOD TIME

Unit : mm

Date	Time	at Simongan Weir		Rainfall (mm)	
		Water Level	Discharge	Kaligading	Basin Rainfall
		H(m)	Q(m3/s)	R(mm)	Rt(mm)
1987 Dec. 21	15:00			0.0	0.0
	16:00			0.4	0.6
	17:00			6.8	10.2
	18:00			45.3	67.7
	19:00	6.20	55.8	17.8	26.6
	20:00	7.55	327.1	6.6	9.9
	21:00	7.70	365.6	0.7	1.0
	22:00	7.40	290.1	0.0	0.0
	23:00	7.20	243.2	0.0	0.0
Dec. 22	0:00	7.00	199.0	0.0	0.0
	1:00	7.00	199.0	0.0	0.0
	2:00	6.40	86.0	0.0	0.0
	3:00			0.0	0.0
	Total			77.6	116.0
1990 Jan. 25	17:00			0.0	0.0
	18:00			2.8	3.0
	19:00			8.3	9.0
	20:00			11.2	12.2
	21:00	7.50	314.6	21.0	22.8
	22:00	8.54	605.6	57.0	61.8
	23:00	8.83	697.2	15.0	16.3
Jan. 26	0:00	8.87	710.0	26.0	28.2
	1:00	8.95	737.0	7.3	7.9
	2:00	9.40	890.0	0.2	0.2
	3:00	9.05	769.9	0.5	0.5
	4:00	8.55	609.9	0.4	0.4
	5:00	7.77	383.8	0.0	0.0
	6:00	6.98	195.7	0.0	0.0
	7:00	6.20	55.8	0.0	0.0
	8:00			0.0	0.0
	Total			149.7	162.4

Note : Q = (1.57*64.6m + 1.8*10.4m) * (H-5.6)^1.5

Table 3.3.11(2/2) HOURLY DATA OBSERVED AT FLOOD TIME

Unit : mm

Date	Time	at Simongan Weir		Rainfall (mm)	
		Water Level H(m)	Discharge Q(m3/s)	Kaligading R(mm)	Basin Rainfall Rt(mm)
1993 Jan. 29	10:00			0.0	0.0
	11:00			1.4	1.0
	12:00			0.4	0.3
	13:00			0.0	0.0
	14:00			0.7	0.5
	15:00			1.2	0.9
	16:00			1.2	0.9
	17:00			15.2	11.1
	18:00	6.60	120.1	9.0	6.6
	19:00	7.50	314.6	20.0	14.6
	20:00	7.20	243.2	41.0	30.0
	21:00	7.80	392.0	10.0	7.3
	22:00	7.70	365.6	20.0	14.6
	23:00	8.50	593.3	40.5	29.6
Jan. 26	0:00	8.50	593.3	15.5	11.3
	1:00	9.00	753.2	30.5	22.3
	2:00	9.10	786.7	4.7	3.4
	3:00	8.70	655.7	4.8	3.5
	4:00	8.20	503.7	7.5	5.5
	5:00	7.60	339.8	7.2	5.3
	6:00	6.80	157.9	1.2	0.9
	7:00			0.0	0.0
	Total			232.0	169.8
1994 Mar. 11	11:00			0.0	0.0
	12:00			29.8	34.0
	13:00			6.2	7.1
	14:00	6.70	138.6	23.5	26.8
	15:00	7.45	302.3	3.3	3.8
	16:00	7.50	314.6	0.0	0.0
	17:00	7.20	243.2	0.4	0.5
	18:00	6.90	178.1	1.4	1.6
	19:00			0.0	0.0
	Total			64.6	73.8
1995 Nov. 29	11:00			0.0	0.0
	12:00			0.8	0.7
	13:00	6.20	55.8	30.0	27.9
	14:00	6.60	120.1	31.0	28.8
	15:00	7.65	352.6	0.0	0.0
	16:00	7.40	290.1	0.0	0.0
	17:00	7.10	220.7	0.0	0.0
	18:00	6.70	138.6	0.0	0.0
	19:00	6.60	120.1	0.0	0.0
	20:00	6.40	86.0	0.0	0.0
	21:00	6.40	86.0	0.0	0.0
	22:00	6.30	70.4	0.0	0.0
	23:00	6.30	70.4	0.0	0.0
Nov. 30	0:00	6.20	55.8	0.0	0.0
	1:00			0.0	0.0
	Total			61.8	57.5

Note : Q = (1.57*64.6m + 1.8*10.4m) * (H-5.6)^1.5

Table 3.3.12 PARAMETERS ESTIMATED BY FLOOD ANALYSIS

Flood	by Storage Function Method			
	K	P	TL(hr)	F
1987 Dec. 21	2.33	1.0	2	0.241
1990 Jan. 25	1.78	1.0	2	0.630
1993 Jan. 29	1.03	1.0	2	0.583
1994 Mar. 11	1.52	1.0	2	0.283
1995 Nov. 29	2.64	1.0	1	0.408
Average	1.9	1.0	2	0.429

Note : Constant P should be equal or less than 1.0

Table 3.3.13 PARAMETERS IN STORAGE FUNCTION METHOD

(for Basin Unit)

Sub Basin	A (km2)	K	P	TL (hr)	F1	Qb (m3/s)	Rsa (mm)
B－1	73.5	1.9	1.0	2.0	0.43	3.7	300
B－2	15.1	1.9	1.0	2.0	0.43	0.8	300
B－3	36.6	1.9	1.0	2.0	0.43	1.8	300
B－4	45.7	1.9	1.0	2.0	0.43	2.3	300
B－5	7.3	1.9	1.0	2.0	0.43	0.4	300
B－6	14.4	1.9	1.0	2.0	0.43	0.7	300
B－7	11.4	1.9	1.0	2.0	0.43	0.6	300
Total	204.0						

Note : Qb = 0.05m3/s/km2

(for Channel Unit)

River Channel	K	P	TL (hr)	Length L(km)	Bed Slope I
C－1	－	－	0.055	9.0	0.01429
C－2	－	－	0.019	4.0	0.02500
C－3	－	－	0.036	5.5	0.01250
C－4	－	－	0.078	4.0	0.00143

Note: TL = 0.000736*L*I^-0.5

Table 3.3.12 PARAMETERS ESTIMATED BY FLOOD ANALYSIS

Flood	by Storage Function Method			
	K	P	TL(hr)	F
1987 Dec. 21	2.33	1.0	2	0.241
1990 Jan. 25	1.78	1.0	2	0.630
1993 Jan. 29	1.03	1.0	2	0.583
1994 Mar. 11	1.52	1.0	2	0.283
1995 Nov. 29	2.64	1.0	1	0.408
Average	1.9	1.0	2	0.43

Note : Constant P should be equal or less than 1.0

Table 3.3.13 PARAMETERS IN STORAGE FUNCTION METHOD

(for Basin Unit)

Sub Basin	A (km2)	K	P	TL (hr)	F1	Qb (m3/s)	Rsa (mm)
B - 1	73.5	1.9	1.0	2.0	0.43	3.7	300
B - 2	15.1	1.9	1.0	2.0	0.43	0.8	300
B - 3	36.6	1.9	1.0	2.0	0.43	1.8	300
B - 4	45.7	1.9	1.0	2.0	0.43	2.3	300
B - 5	7.3	1.9	1.0	2.0	0.43	0.4	300
B - 6	14.4	1.9	1.0	2.0	0.43	0.7	300
B - 7	11.4	1.9	1.0	2.0	0.43	0.6	300
Total	204.0						

Note : Qb = 0.05m3/s/km2

(for Channel Unit)

River Channel	K	P	TL (hr)	Length L(km)	Bed Slope I
C - 1	-	-	0.055	9.0	0.01429
C - 2	-	-	0.019	4.0	0.02500
C - 3	-	-	0.036	5.5	0.01250
C - 4	-	-	0.078	4.0	0.00143

Note: TL = 0.000736*L*I^-0.5

Table 3.3.14 100-YEAR PROBABLE FLOOD AND FLOOD CONTROL BY JATIBARANG DAM

Time	Design Storm	Dam Site		Simongan Weir	
	100-year	Inflow	Outflow	Probable Flood	Design Flood
(hour)	(mm)	(m3/s)	(m3/s)	(m3/s)	(m3/s)
1	6.4	3	0	10	8
2	3.2	3	0	10	8
3	0.0	15	1	54	41
4	0.0	16	2	62	48
5	0.0	11	3	44	35
6	0.0	7	3	30	25
7	9.6	5	3	22	19
8	6.4	4	4	17	16
9	6.4	22	4	79	63
10	9.6	27	6	102	81
11	22.4	29	7	112	90
12	124.6	37	11	140	114
13	28.7	67	17	246	198
14	22.4	283	40	1,010	788
15	22.4	226	76	890	730
16	9.6	178	99	702	615
17	6.4	149	110	585	541
18	9.6	108	114	429	430
19	6.4	77	110	306	336
20	3.2	65	103	254	291
21	6.4	52	95	204	246
22	9.6	38	86	150	198
23	3.2	36	77	138	180
24	2.9	41	70	155	186
1	0.0	32	64	124	157
2	0.0	25	57	99	132
Total	319.4				
Peak	124.6	283	114	1,010	788
Flood Control Volume (Vnet)			2,505,000	m3	
Flood Control Capacity (V = Vnet * 1.2)			3,006,000	m3 (Jatibarang Dam)	

Note : Area Reduction Factor(0.75) is multiplied by Design Storm
Storage Function Method was used for Flood Run-off Calculation

Table 3.3.15 OUTLET CONDITION OF DAM FOR FLOOD CONTROL

Water Level H (EL.m)	Water Depth h=H-148.6 (m)	Outflow Q=C*B*h^1.5 (m3/s)	Storage Volume V (m3)	Volume > NWL dV=V-1730000 (m3)	Remarks
148.6	0.0	0.0	17,300,000	0	Normal W.L.
149.0	0.4	7.6			
150.0	1.4	49.7	18,641,000	1,341,000	
151.0	2.4	111.5			
152.0	3.4	188.1			
153.0	4.4	276.9			
154.0	5.4	376.5			
155.0	6.4	485.7	24,270,000	6,970,000	

Note : Overflow Width B=15m, Discharge Coefficient C=2.0

Table 3.3.16 PROBABLE PEAK DISCHARGE AND DESIGN DISCHARGE

(by Storage Function Method)

Return Period	Design Storm		Area	Peak Discharge at Simongan	
	Peak	Total	Reduction	Probable Discharge	After Dam Control
year	mm/hr	mm/day	Factor	m3/s	m3/s
5	70.5	180.7	0.667	512	399
10	83.6	214.3	0.697	633	493
25	100.1	256.7	0.723	785	612
50	112.4	288.2	0.738	898	700
100	124.6	319.4	0.750	1,010	788

Table 3.3.17 MONTHLY RAINFALL FOR 30 YEARS AT SUMURJURANG STATION (No.65c)

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1967	394.0	566.4	383.0	487.0	91.0	0.0	0.0	0.0	0.0	17.0	116.0	450.0	2504.4
1968	664.0	369.7	369.0	404.0	262.0	297.0	211.0	144.0	99.0	52.0	259.0	361.4	3492.1
1969	456.0	719.0	754.0	766.0	28.0	90.0	57.0	0.0	16.0	172.0	224.0	443.0	3725.0
1970	454.0	308.0	444.0	367.0	248.0	186.0	160.0	0.0	124.0	119.0	379.0	778.0	3567.0
1971	786.0	518.0	462.0	439.0	226.0	309.0	28.0	0.0	56.0	272.0	326.0	300.3	3722.3
1972	668.0	336.0	545.0	74.0	154.0	18.0	0.0	0.0	0.0	0.0	180.0	242.0	2217.0
1973	524.0	222.0	326.5	226.0	204.0	108.7	144.0	22.0	144.0	319.8	387.2	323.0	2951.2
1974	549.0	259.0	671.0	318.0	154.0	16.0	44.0	72.0	96.0	373.0	214.0	439.0	3205.0
1975	373.0	259.0	569.0	362.0	223.0	51.3	0.0	25.0	270.0	255.0	439.0	278.7	3105.0
1976	952.0	442.0	668.0	67.0	18.0	33.0	3.0	16.0	0.0	57.0	269.0	228.0	2753.0
1977	433.0	323.0	633.0	210.0	161.0	117.0	0.0	0.0	0.0	0.0	150.0	470.0	2497.0
1978	764.0	462.0	443.0	88.0	102.0	129.0	83.0	37.0	212.0	139.0	143.0	254.0	2856.0
1979	608.0	633.0	440.0	477.0	266.0	131.0	41.0	20.0	105.0	110.0	216.0	159.0	3206.0
1980	734.0	315.0	331.0	399.0	254.0	0.0	71.0	126.0	36.0	176.0	379.0	566.0	3387.0
1981	402.0	378.0	98.0	0.0	201.5	112.4	203.4	0.0	0.0	0.0	64.0	412.0	1871.3
1982	364.0	263.0	626.0	525.0	0.0	0.0	0.0	0.0	0.0	0.0	124.0	250.0	2152.0
1983	436.0	217.0	191.0	301.0	355.0	19.0	0.0	0.0	0.0	363.0	296.0	87.0	2265.0
1984	228.0	516.0	243.0	111.0	56.0	70.0	87.0	51.0	426.0	84.0	232.0	391.0	2495.0
1985	63.0	245.0	152.0	218.0	35.0	0.0	94.8	79.0	114.6	215.2	260.8	306.4	1783.8
1986	592.6	245.0	568.0	209.0	72.0	223.0	44.0	101.0	119.0	94.0	147.0	199.0	2613.6
1987	765.0	660.0	291.0	55.0	116.0	45.0	73.0	0.0	0.0	6.0	301.0	745.0	3057.0
1988	566.0	589.0	442.0	345.0	190.0	31.0	33.0	20.0	26.0	220.0	192.0	884.0	3538.0
1989	374.0	730.0	513.0	347.0	244.0	218.0	118.0	12.0	48.0	150.0	329.0	358.0	3441.0
1990	760.0	237.0	287.0	157.0	93.0	168.0	56.0	74.0	46.0	49.0	182.0	604.0	2713.0
1991	840.0	415.0	176.0	353.0	150.3	5.0	13.1	0.0	0.0	12.1	273.9	335.9	2574.3
1992	382.0	281.0	405.0	367.0	250.0	141.0	7.0	253.0	180.0	254.0	120.0	410.0	3050.0
1993	755.0	384.0	252.0	307.0	61.0	165.0	52.0	32.0	64.0	23.0	145.0	228.0	2468.0
1994	640.0	300.0	575.0	211.0	53.0	3.0	2.0	14.0	0.0	103.0	306.0	435.0	2642.0
1995	397.0	356.0	457.0	75.0	171.0	215.0	0.0	0.0	65.4	76.0	380.0	531.0	2723.4
1996	319.0	726.0	350.0	72.0	95.0	28.0	30.0	87.0	83.0	213.0	259.0	527.0	2789.0
Average	541.4	409.1	422.2	277.9	151.1	97.6	55.2	39.5	77.7	130.8	243.1	399.9	2845.5

Note : After supplementation of missing data

Table 3.3.18 MONTHLY DISCHARGE OBSERVED IN GARANG RIVER SYSTEM

Panjangan Station in Garang River (A=192.6km2) Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1987	23.11	29.72	24.66	12.05	6.38	5.05	3.49	2.46	1.88	2.08	3.82	8.91	10.19
1988	16.21	20.73	22.69	10.68	6.66	2.95	2.53	1.70	1.75	3.51	4.17	11.42	8.73
1989	9.86	49.14	16.50	10.65	9.44	10.19	3.92	3.03	1.88	4.06	7.39	15.20	11.51
1990	40.18	14.76	12.71	7.77	7.07	5.22	3.55	3.05	2.15	1.67	2.63	13.52	9.54
1991	18.50	22.22	17.18	18.73	6.32	3.30	2.73	1.44	1.36	1.29	5.75	9.57	8.94
1992	9.97	11.79	12.07	14.13	9.62	7.18	5.34	6.27	6.50	6.65	5.11	14.77	9.11
1993	27.47	38.99	22.74	21.12	5.26	6.07	2.76	3.29	3.07	2.71	2.27	4.17	11.47
1994	15.14	12.38	27.17	16.31	7.23	3.88	2.98	2.26	1.64	3.03	3.51	4.49	8.32
1995	13.68	13.69	15.68	8.30	8.04	6.92	2.91	2.89	1.33	1.66	12.62	15.11	8.54
1996	14.95	28.09	21.55	10.93	7.18	5.22	2.79	3.07	3.01	5.58	10.67	16.37	10.73
Average	18.91	24.15	19.30	13.07	7.32	5.60	3.30	2.95	2.46	3.22	5.79	11.35	9.71

Patemon Station in Garang River Upstream (A=75.0km2) Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1992	X	X	2.60	4.13	2.83	1.87	1.11	1.87	1.70	1.64	2.18	3.19	2.30
1993	11.00	8.28	5.70	5.18	2.04	2.53	1.18	0.94	0.91	0.88	1.31	2.11	3.48
1994	9.51	4.54	10.10	7.03	2.05	1.04	0.81	0.60	0.34	0.25	0.39	1.62	3.19
1995	4.40	7.19	8.28	8.97	6.03	8.39	3.43	0.82	0.79	1.09	3.92	4.79	4.81
1996	4.09	8.06	12.30	6.20	3.53	2.24	1.59	1.64	1.28	1.66	3.36	8.74	4.55
Average	7.25	7.02	7.80	6.30	3.30	3.21	1.62	1.17	1.00	1.10	2.23	4.09	3.67

Kalipancur Station in Kreo River (A=66.1km2) Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1992	X	X	6.74	6.79	4.40	2.71	1.14	2.13	1.91	1.88	2.09	7.65	3.66
1993	16.71	13.74	9.19	10.54	5.38	8.26	7.17	7.59	6.79	5.97	4.91	4.50	8.36
1994	14.25	8.39	15.50	9.63	3.03	0.81	0.74	0.56	0.55	0.60	0.98	2.20	4.76
1995	2.75	2.94	4.92	3.38	2.88	4.27	2.60	2.04	0.97	0.92	2.92	9.41	3.34
1996	6.59	10.51	10.52	6.37	4.83	3.16	0.71	0.92	0.79	1.33	2.25	3.22	4.24
Average	10.08	8.90	9.37	7.34	4.10	3.84	2.47	2.65	2.20	2.14	2.63	5.40	4.87

Table 3.3.19 FLOW REGIME AND BALANCE IN OBSERVED DAILY DISCHARGE RECORDS

Panjangan Station in Garang River (A=192.6km2)

Year	Days	Flow Regime								Annual Run-off (1) mm	No.65c Rainfall (2) mm	Annual Rainfall(mm) (2)*0.99	Annual Loss (3)-(1) mm	Run-off Ratio (%)
		Max (m3/s)	25% (m3/s)	50% (m3/s)	75% (m3/s)	95% (m3/s)	99% (m3/s)	Min (m3/s)	Mean (m3/s)					
1987	365	99.20	11.10	5.35	2.62	1.77	1.64	1.50	10.19	1,668	3,057	3,026	1,358	55
1988	366	123.00	11.00	4.80	2.11	1.48	1.36	0.64	8.73	1,433	2,538	2,513	1,080	57
1989	365	187.00	12.50	8.31	3.41	1.82	1.57	1.28	11.51	1,885	3,441	3,407	1,522	55
1990	365	201.00	9.72	6.02	2.50	1.40	1.30	1.30	9.54	1,562	2,713	2,686	1,124	58
1991	365	63.60	14.00	4.62	1.80	1.14	1.02	1.02	8.94	1,464	2,574	2,548	1,084	57
1992	366	32.50	11.20	7.40	5.30	4.00	3.50	3.50	9.11	1,496	3,050	3,020	1,524	50
1993	365	309.00	12.30	3.72	2.77	2.13	1.45	1.45	11.47	1,878	2,468	2,443	565	77
1994	365	115.00	10.80	4.25	2.75	1.62	1.40	1.18	8.32	1,362	2,642	2,616	1,254	52
1995	365	45.40	10.80	6.80	2.75	1.18	0.52	0.52	8.54	1,398	2,723	2,696	1,298	52
1996	366	53.80	15.00	7.40	3.25	2.50	2.28	2.06	10.73	1,762	2,789	2,761	999	64
Average		122.95	11.84	5.87	2.93	1.90	1.60	1.45	9.71	1,591	2,800	2,772	1,181	58
Q/100km2		63.84	6.15	3.05	1.52	0.99	0.83	0.75	5.04					

(1)=Mean*Days*86.4/A

Patemon Station in Garang River Upstream (A=75.0km2)

(2)*1.03

1992	366	22.50	2.37	1.50	1.22	1.10	0.95	0.74	2.30	970	3,050	3,142	2,172	31
1993	365	106.00	4.27	1.44	0.98	0.75	0.71	0.63	3.48	1,463	2,468	2,542	1,079	58
1994	365	50.50	4.40	1.01	0.53	0.23	0.21	0.21	3.19	1,341	2,642	2,721	1,380	49
1995	365	21.50	7.12	4.62	1.07	0.74	0.71	0.65	4.81	2,023	2,723	2,805	782	72
1996	366	28.80	6.30	3.10	1.46	1.22	1.14	1.10	4.55	1,918	2,789	2,873	955	67
Average		45.86	4.89	2.33	1.05	0.81	0.74	0.67	3.67	1,543	2,734	2,816	1,273	55
Q/100km2		61.15	6.52	3.11	1.40	1.08	0.99	0.89	4.89					

Kalipancur Station in Kreo River (A=66.1km2)

(2)*1.00

1992	366	16.70	5.00	2.82	1.17	0.95	0.95	0.87	3.66	1,751	3,050	3,050	1,299	57
1993	365	134.00	8.40	6.80	5.00	3.82	3.40	3.00	8.36	3,989	2,468	2,468	-1,521	162
1994	365	40.00	8.00	1.25	0.65	0.50	0.42	0.30	4.76	2,271	2,642	2,642	371	86
1995	365	21.90	4.20	2.30	1.17	0.87	0.72	0.40	3.34	1,593	2,723	2,723	1,130	59
1996	366	17.30	6.50	3.20	0.95	0.65	0.50	0.47	4.24	2,028	2,789	2,789	761	73
Average		45.98	6.42	3.27	1.79	1.36	1.20	1.01	4.87	2,326	2,734	2,734	408	87
Q/100km2		69.56	9.71	4.95	2.70	2.05	1.81	1.52	7.37					

Table 3.3.20 THIESSEN COEFFICIENT AND BASIN RAINFALL

Station	Average Rainfall in 1971 - 1990 (mm/year)	Thiessen Coefficient		
		Catchment Area		
		Panjangan	Patemon	Kalipancur
No.59	2,365	0.16	0.12	0.00
No.44	2,563	0.16	0.45	0.00
No.39	3,380	0.14	0.26	0.12
No.65c	2,791	0.54	0.17	0.88
Total		1.00	1.00	1.00
Basin Rainfall		2,769	2,790	2,862
Basin Rainfall / No.65c		0.99	1.00	1.03

Table 3.3.21 MONTHLY EVAPORATION IN TANK MODEL

Month	Pan Evaporation (1) mm/day	Annual Loss mm/year	Evaporation in Tank Model (1)*0.734 mm/day
Jan.	3.3		2.42
Feb.	3.7		2.72
Mar.	3.8		2.79
Apr.	4.0		2.94
May	4.3		3.16
Jun.	4.5		3.30
Jul.	4.8		3.52
Aug.	5.1		3.74
Sep.	5.7		4.18
Oct.	5.5		4.04
Nov.	4.4		3.23
Dec.	3.8		2.79
Total(mm/yr)	1,610	1,181	1,181

Note : (Annual Loss) / (Annual Pan Evaporation) = 0.734

Table 3.3.22 COMPARISON OF FLOW REGIME BETWEEN TANK-MODEL AND OBSERVATION

Panjangan Station (A=192.6km2)

Kind of Data	Year	Flow Regime								Annual
		Max (m3/s)	25% (m3/s)	50% (m3/s)	75% (m3/s)	95% (m3/s)	99% (m3/s)	Min (m3/s)	Mean (m3/s)	Loss (mm)
by Tank Model	1987	115.41	11.68	4.41	2.02	0.61	0.56	0.54	10.82	1,254
	1988	100.65	14.64	6.69	3.44	1.81	1.51	1.39	12.54	1,444
	1989	86.57	15.10	9.11	5.11	3.19	3.00	2.83	12.56	1,350
	1990	126.40	10.58	5.97	3.43	1.73	1.42	1.33	9.62	1,111
	1991	81.09	11.61	5.37	2.98	1.02	0.95	0.93	9.54	986
	1992	72.02	10.93	6.33	4.19	2.97	2.80	2.68	9.75	1,419
	1993	178.31	8.85	5.15	3.05	1.63	1.42	1.35	8.98	973
	1994	68.13	11.07	4.72	2.38	0.96	0.89	0.88	8.85	1,167
	1995	51.15	10.99	5.47	2.99	1.34	1.10	1.03	8.53	1,299
	1996	67.42	10.93	5.23	3.30	1.95	1.68	1.64	9.05	1,275
	Average	94.72	11.64	5.85	3.29	1.72	1.53	1.46	10.02	1,228
by Observation	1987	99.20	11.10	5.35	2.62	1.77	1.64	1.50	10.19	1,358
	1988	123.00	11.00	4.80	2.11	1.48	1.36	0.64	8.73	1,080
	1989	187.00	12.50	8.31	3.41	1.82	1.57	1.28	11.51	1,522
	1990	201.00	9.72	6.02	2.50	1.40	1.30	1.30	9.54	1,124
	1991	63.60	14.00	4.62	1.80	1.14	1.02	1.02	8.94	1,084
	1992	32.50	11.20	7.40	5.30	4.00	3.50	3.50	9.11	1,524
	1993	309.00	12.30	3.72	2.77	2.13	1.45	1.45	11.47	565
	1994	115.00	10.80	4.25	2.75	1.62	1.40	1.18	8.32	1,254
	1995	45.40	10.80	6.80	2.75	1.18	0.52	0.52	8.54	1,298
	1996	53.80	15.00	7.40	3.25	2.50	2.28	2.06	10.73	999
	Average	122.95	11.84	5.87	2.93	1.90	1.60	1.45	9.71	1,181

Table 3.3.23 FLOW REGIME FOR 30 YEARS AT SIMONGAN WEIR

(Catchment Area at Simongan Weir A=204.0km2)

Year	Days	Flow Regime								Annual Run-off	No.65c Rainfall	Annual Rainfall(mm)	Annual Loss
		Max (m3/s)	25% (m3/s)	50% (m3/s)	75% (m3/s)	95% (m3/s)	99% (m3/s)	Min (m3/s)	Mean (m3/s)	(1) mm	(2) mm	(2)*0.99	(3)-(1) mm
by Tank Model (= Discharge at Panjangan * 204.0km2/192.6km2)										(1)=Mean*Days*86.4/A			
1967	365	198.71	11.81	5.87	2.60	1.03	0.96	0.95	10.04	1,552	2,504	2,479	927
1968	366	115.98	12.94	7.82	5.38	3.89	3.37	3.21	12.43	1,928	3,492	3,457	1,529
1969	365	131.38	17.43	8.06	5.02	3.20	2.88	2.78	15.58	2,409	3,725	3,688	1,279
1970	365	128.67	15.20	9.76	5.75	3.59	3.08	3.00	13.18	2,037	3,567	3,531	1,494
1971	365	83.45	18.58	11.10	6.97	4.80	4.24	4.11	15.98	2,471	3,722	3,685	1,214
1972	366	144.85	10.21	5.75	3.07	1.44	1.37	1.35	9.95	1,542	2,217	2,195	653
1973	365	110.44	10.97	6.41	4.16	2.71	2.43	2.37	9.63	1,488	2,951	2,921	1,433
1974	365	89.68	14.35	7.49	4.89	3.33	2.90	2.80	12.33	1,906	3,205	3,173	1,267
1975	365	82.36	14.45	8.24	5.72	3.80	3.51	3.37	11.49	1,777	3,105	3,074	1,297
1976	366	148.87	12.78	6.21	3.36	1.65	1.45	1.44	12.21	1,893	2,753	2,725	832
1977	365	83.46	10.23	5.07	2.75	1.31	1.23	1.21	9.11	1,408	2,497	2,472	1,064
1978	365	81.98	10.81	5.57	4.12	2.96	2.65	2.60	10.33	1,596	2,856	2,827	1,231
1979	365	99.12	14.98	8.26	4.59	3.06	2.85	2.78	12.48	1,929	3,206	3,174	1,245
1980	366	262.16	14.14	8.04	4.62	2.46	2.01	1.92	12.70	1,969	3,387	3,353	1,384
1981	365	55.94	9.35	4.79	2.76	1.15	1.10	1.08	7.30	1,128	1,871	1,852	724
1982	365	112.35	8.81	3.97	1.60	0.89	0.83	0.80	8.13	1,258	2,152	2,130	872
1983	365	72.34	9.14	4.14	2.11	0.78	0.72	0.70	7.27	1,123	2,265	2,242	1,119
1984	366	53.07	8.57	3.58	2.29	1.45	1.09	0.97	7.03	1,090	2,495	2,470	1,380
1985	365	72.24	5.17	2.86	1.73	0.70	0.61	0.59	4.83	747	1,784	1,766	1,019
1986	365	107.93	10.15	4.83	3.18	1.94	1.72	1.61	8.75	1,352	2,614	2,588	1,236
by Observation (= Discharge at Panjangan * 204.0km2/192.6km2)													
1987	365	105.07	11.76	5.67	2.78	1.87	1.74	1.59	10.79	1,668	3,057	3,026	1,358
1988	366	130.28	11.65	5.08	2.23	1.57	1.44	0.68	9.25	1,433	3,538	3,503	2,070
1989	365	198.07	13.24	8.80	3.61	1.93	1.66	1.36	12.19	1,885	3,441	3,407	1,522
1990	365	212.90	10.30	6.38	2.65	1.48	1.38	1.38	10.10	1,562	2,713	2,686	1,124
1991	365	67.36	14.83	4.89	1.91	1.21	1.08	1.08	9.47	1,464	2,574	2,548	1,084
1992	366	34.42	11.86	7.84	5.61	4.24	3.71	3.71	9.65	1,496	3,050	3,020	1,524
1993	365	327.29	13.03	3.94	2.93	2.26	1.54	1.54	12.15	1,878	2,468	2,443	565
1994	365	121.81	11.44	4.50	2.91	1.72	1.48	1.25	8.81	1,362	2,642	2,616	1,254
1995	365	48.09	11.44	7.20	2.91	1.25	0.55	0.55	9.05	1,398	2,723	2,696	1,298
1996	366	56.98	15.89	7.84	3.44	2.65	2.41	2.18	11.37	1,762	2,789	2,761	999
Average (30 years)		117.91	12.18	6.33	3.59	2.21	1.93	1.83	10.45	1,617	2,845	2,817	1,200

Table 3.3.24(1/3) 5-DAY DISCHARGE AT PANJANGAN IN GARANG RIVER

by Tank Model (A=192.6 km2)

Unit : m3/s

Year	1- 5	5-10	10-15	15-20	20-25	25-31
1967						
Jan	30.217	20.746	8.392	12.758	9.472	9.883
Feb	30.350	84.102	19.676	9.312	6.770	9.807
Mar	6.745	14.682	17.950	11.106	14.289	18.566
Apr	37.578	14.250	16.112	12.420	15.906	26.187
May	9.969	7.144	15.138	6.989	6.313	5.682
Jun	5.454	5.248	5.047	4.850	4.658	4.469
Jul	4.281	4.093	3.909	3.729	3.553	3.364
Aug	3.174	3.003	2.835	2.670	2.509	2.336
Sep	2.158	1.993	1.832	1.673	1.519	1.367
Oct	1.222	1.081	1.005	1.241	0.973	0.946
Nov	0.940	0.933	5.733	1.720	0.988	4.192
Dec	4.033	9.637	25.054	11.790	7.462	17.417
1968						
Jan	13.014	28.203	27.247	21.047	43.111	16.958
Feb	7.852	12.068	6.758	18.061	26.394	14.315
Mar	8.218	5.406	5.587	8.289	17.273	40.455
Apr	49.662	50.193	12.233	7.807	5.701	5.181
May	7.337	5.359	16.473	10.146	6.918	9.626
Jun	9.024	6.173	13.542	9.860	16.667	12.693
Jul	7.222	5.912	11.040	8.724	9.399	8.932
Aug	6.009	7.638	5.311	7.881	6.866	6.529
Sep	4.535	4.293	4.414	5.802	6.159	4.275
Oct	3.905	3.779	3.642	3.439	3.251	3.627
Nov	5.915	13.037	6.813	4.446	7.127	7.503
Dec	8.735	5.148	6.174	9.226	38.200	12.466
1969						
Jan	6.445	11.996	10.636	25.478	32.387	17.748
Feb	27.542	15.574	13.276	54.026	51.037	24.727
Mar	33.866	15.371	13.134	33.854	37.036	50.550
Apr	80.459	21.614	42.584	20.174	53.628	20.367
May	11.654	9.056	9.483	7.847	7.534	7.267
Jun	7.003	18.622	7.956	6.734	6.470	6.245
Jul	6.020	6.722	5.955	6.321	6.111	5.257
Aug	5.026	4.817	4.613	4.413	4.217	4.007
Sep	3.793	3.596	3.403	3.214	3.243	2.950
Oct	5.196	7.143	3.291	2.722	6.772	5.291
Nov	8.009	12.246	10.825	5.086	4.025	3.628
Dec	2.971	15.984	6.072	24.911	21.053	14.484
1970						
Jan	7.722	8.775	21.757	15.698	37.799	14.152
Feb	16.910	11.902	10.937	22.832	9.903	9.413
Mar	8.222	16.741	21.480	20.802	24.527	14.985
Apr	19.788	15.642	11.334	9.421	23.614	11.621
May	7.868	13.365	8.143	12.252	13.907	9.230
Jun	17.735	7.876	6.240	9.712	8.662	6.853
Jul	5.648	5.393	5.185	10.907	12.567	10.077
Aug	5.945	4.879	4.675	4.475	4.280	4.070
Sep	3.855	6.771	9.300	5.432	4.200	3.537
Oct	3.701	3.428	3.118	2.941	14.139	4.032
Nov	9.003	10.039	7.285	11.327	16.707	14.332
Dec	19.982	65.348	17.448	10.345	18.770	41.304
1971						
Jan	19.791	20.875	26.203	48.728	21.626	62.317
Feb	18.267	26.393	37.750	17.895	27.865	32.505
Mar	22.004	25.461	37.930	14.267	12.949	18.543
Apr	24.181	21.450	31.522	26.411	20.009	10.711
May	10.913	30.705	16.234	9.914	8.122	7.857
Jun	10.809	28.052	13.164	8.737	15.680	12.464
Jul	8.324	7.430	7.197	6.817	6.583	6.330
Aug	6.079	5.853	5.632	5.415	5.203	4.976
Sep	4.744	4.643	4.439	6.491	4.557	4.041
Oct	8.146	5.203	8.580	8.443	10.237	8.387
Nov	4.591	6.926	10.858	21.747	19.294	8.602
Dec	15.054	11.578	14.420	9.405	9.548	7.364

Year	1- 5	5-10	10-15	15-20	20-25	25-31
1972						
Jan	21.397	23.726	65.685	46.327	13.007	10.310
Feb	7.569	6.013	7.138	8.358	26.087	32.360
Mar	19.012	29.806	17.643	23.143	27.982	28.253
Apr	12.136	8.570	7.576	6.981	7.045	6.857
May	6.516	15.654	11.131	7.753	6.618	6.014
Jun	5.667	5.465	5.268	5.075	4.886	4.946
Jul	4.742	4.442	4.259	4.080	3.904	3.716
Aug	3.527	3.356	3.189	3.025	2.864	2.692
Sep	2.514	2.350	2.189	2.031	1.877	1.725
Oct	1.580	1.453	1.414	1.388	1.362	1.334
Nov	1.308	1.287	4.988	11.525	5.059	3.613
Dec	6.942	2.945	4.826	3.481	11.871	10.380
1973						
Jan	6.710	49.657	35.171	29.428	8.645	4.998
Feb	9.962	15.916	10.591	5.761	4.467	3.973
Mar	6.379	10.960	9.805	8.981	11.778	9.618
Apr	6.731	6.205	4.979	15.312	6.332	12.222
May	5.683	4.579	5.882	10.438	9.520	7.519
Jun	5.837	6.114	7.123	4.645	4.651	4.063
Jul	3.721	3.549	24.349	7.157	4.274	3.431
Aug	3.244	3.075	2.909	2.746	2.587	2.826
Sep	3.736	2.868	2.820	2.581	5.453	3.756
Oct	2.427	16.235	4.370	3.347	3.047	13.512
Nov	17.673	16.731	27.189	10.407	5.602	8.826
Dec	9.285	15.931	10.964	16.231	7.164	10.125
1974						
Jan	9.631	6.288	42.923	42.462	15.573	11.128
Feb	15.871	9.654	8.633	11.706	18.262	10.824
Mar	15.458	26.761	21.155	40.081	43.457	16.588
Apr	13.483	31.876	20.748	9.421	7.224	10.493
May	10.774	24.309	10.370	7.659	6.332	6.054
Jun	5.822	5.613	5.410	5.239	5.074	4.903
Jul	4.733	4.541	5.411	4.364	4.138	4.037
Aug	3.858	3.677	4.588	3.479	3.437	4.231
Sep	4.430	7.949	5.113	3.263	2.991	2.813
Oct	4.191	11.946	23.456	9.644	17.621	6.028
Nov	5.820	4.149	3.860	3.108	14.790	10.845
Dec	4.941	9.223	12.710	28.855	20.569	15.039
1975						
Jan	13.338	7.380	5.741	11.922	31.755	15.800
Feb	11.632	15.074	11.635	14.843	10.901	7.867
Mar	9.610	32.423	15.858	17.491	16.086	34.963
Apr	17.954	12.525	8.287	18.173	16.469	22.374
May	10.423	18.647	9.008	8.589	8.512	12.048
Jun	7.102	6.171	5.865	5.682	5.447	5.764
Jul	5.495	5.016	4.818	4.624	4.435	4.231
Aug	4.028	3.844	3.663	3.508	3.347	3.549
Sep	5.345	5.647	16.171	5.818	4.961	5.645
Oct	5.338	8.164	9.652	4.601	4.548	10.506
Nov	11.075	7.481	10.943	20.063	16.700	22.252
Dec	21.029	8.797	6.373	7.426	14.468	9.770
1976						
Jan	40.029	30.030	23.932	16.529	96.741	33.956
Feb	15.048	15.604	13.591	18.595	38.903	27.148
Mar	38.088	23.533	55.371	44.809	20.458	11.777
Apr	9.690	8.433	7.620	7.892	7.711	7.918
May	7.021	6.860	6.687	6.450	6.236	6.005
Jun	5.777	5.817	6.735	5.391	5.171	4.979
Jul	4.787	4.596	4.409	4.226	4.047	3.861
Aug	3.680	3.505	3.334	3.166	3.002	2.901
Sep	2.747	2.577	2.410	2.247	2.087	1.931
Oct	1.780	1.733	1.594	2.175	1.627	1.406
Nov	1.566	1.526	1.846	14.166	11.475	8.986
Dec	3.966	7.685	13.560	6.660	4.870	4.173

Table 3.3.24(2/3) 5-DAY DISCHARGE AT PANJANGAN IN GARANG RIVER

by Tank Model (A=192.6 km2) Unit : m3/s

Year	1- 5	5-10	10-15	15-20	20-25	25-31	Year	1- 5	5-10	10-15	15-20	20-25	25-31
1977							1982						
Jan	9.586	7.942	7.306	29.846	15.707	19.312	Jan	4.068	8.194	6.012	27.796	8.646	13.677
Feb	12.146	13.239	6.414	5.496	6.565	40.436	Feb	14.241	9.736	14.563	10.275	9.144	5.535
Mar	29.005	47.121	15.455	26.245	23.196	16.121	Mar	22.604	37.975	26.588	24.961	15.142	20.317
Apr	7.829	6.670	10.454	8.086	17.461	8.323	Apr	44.064	29.939	21.869	8.638	8.363	18.988
May	5.810	4.884	4.701	4.522	8.834	15.372	May	8.888	6.040	5.023	4.830	4.643	4.441
Jun	13.023	12.316	8.561	5.520	4.490	4.311	Jun	4.242	4.062	3.886	3.714	3.546	3.381
Jul	4.131	3.952	3.777	3.605	3.437	3.257	Jul	3.215	3.050	2.889	2.730	2.575	2.409
Aug	3.076	2.912	2.751	2.594	2.440	2.274	Aug	2.241	2.090	1.941	1.795	1.652	1.499
Sep	2.103	1.945	1.789	1.638	1.489	1.346	Sep	1.340	1.192	1.053	1.001	0.975	0.949
Oct	1.286	1.260	1.235	1.209	1.183	1.156	Oct	0.924	0.899	0.875	0.850	0.825	0.799
Nov	5.645	5.451	2.219	3.156	1.609	1.328	Nov	10.506	2.354	1.174	1.239	0.869	0.823
Dec	13.924	8.459	4.243	4.606	8.579	29.116	Dec	1.075	5.598	7.451	4.805	1.930	7.285
1978							1983						
Jan	47.722	14.487	19.136	25.221	35.694	33.829	Jan	20.303	17.622	20.027	22.114	8.553	5.334
Feb	22.264	30.208	33.380	13.618	19.541	11.589	Feb	9.514	7.317	4.669	9.216	4.035	8.279
Mar	10.075	7.130	11.837	18.959	38.403	23.474	Mar	8.812	6.458	18.834	5.546	3.888	3.132
Apr	8.767	7.076	8.880	6.412	5.725	5.204	Apr	5.459	5.582	14.018	16.583	12.491	5.318
May	5.084	4.880	6.372	7.308	7.091	4.969	May	12.331	14.735	18.662	9.943	7.198	7.017
Jun	4.569	5.180	4.464	6.134	4.564	4.948	Jun	4.792	3.742	3.539	3.353	3.187	3.024
Jul	4.778	4.461	7.637	4.530	3.867	3.688	Jul	2.861	2.699	2.540	2.383	2.231	2.067
Aug	4.078	3.646	3.334	3.203	3.030	2.848	Aug	1.902	1.752	1.606	1.462	1.322	1.171
Sep	9.279	7.370	6.574	4.658	4.469	2.996	Sep	1.014	0.868	0.759	0.731	0.706	0.681
Oct	5.219	6.698	3.470	3.761	3.587	2.616	Oct	7.310	2.890	0.896	7.252	15.301	14.880
Nov	3.922	3.736	2.921	4.800	3.944	3.165	Nov	4.484	2.092	1.298	1.104	5.727	36.950
Dec	3.873	11.862	9.222	5.768	7.692	6.249	Dec	16.337	4.698	4.795	2.409	1.602	3.480
1979							1984						
Jan	23.404	47.044	33.077	18.147	9.394	13.393	Jan	5.887	8.378	3.630	2.831	8.845	5.662
Feb	31.522	43.138	17.150	21.880	32.775	14.208	Feb	22.870	20.025	28.346	24.439	11.082	6.397
Mar	9.501	17.370	23.338	33.669	15.225	11.723	Mar	18.045	24.483	7.305	5.647	4.399	3.474
Apr	10.589	27.756	44.436	18.063	18.855	11.263	Apr	3.238	3.438	5.905	4.490	3.683	3.404
May	9.243	15.693	12.163	9.530	14.462	8.750	May	3.045	2.874	2.760	2.647	3.372	2.635
Jun	12.924	15.676	8.750	6.770	6.184	5.967	Jun	2.380	2.853	7.442	3.007	2.162	2.020
Jul	5.750	5.535	6.276	5.391	5.068	4.969	Jul	3.618	1.960	1.804	3.028	1.928	1.685
Aug	4.757	5.072	4.449	4.254	4.063	3.859	Aug	1.514	1.502	1.402	1.192	1.056	1.568
Sep	3.649	3.457	4.355	3.474	3.098	6.899	Sep	5.640	20.467	11.767	21.448	12.871	4.219
Oct	10.009	5.410	3.392	2.950	2.853	3.141	Oct	2.858	2.336	1.770	1.616	1.909	1.686
Nov	5.566	6.144	5.302	3.018	3.008	15.938	Nov	2.101	1.911	4.747	3.638	4.191	10.383
Dec	6.530	7.210	4.007	3.168	3.480	6.803	Dec	17.618	10.438	11.748	8.118	8.595	13.752
1980							1985						
Jan	8.791	7.234	19.980	14.141	105.25	23.267	Jan	6.500	4.693	3.737	2.899	2.800	2.516
Feb	9.430	17.905	15.130	14.249	13.978	9.079	Feb	2.356	2.244	6.594	5.115	25.695	9.594
Mar	6.732	8.800	7.773	24.110	15.723	15.202	Mar	7.991	8.062	4.518	4.301	4.998	3.706
Apr	9.479	10.304	10.217	29.126	18.018	16.135	Apr	3.230	3.087	3.558	9.831	14.482	6.712
May	18.699	10.897	7.120	5.653	5.363	22.773	May	3.684	2.885	2.698	2.828	2.446	2.288
Jun	9.046	6.147	5.201	5.005	4.814	4.626	Jun	2.131	1.989	1.850	1.714	1.581	1.451
Jul	4.438	4.251	4.068	3.890	3.714	6.518	Jul	1.608	1.365	1.567	1.149	5.027	1.683
Aug	6.803	7.567	14.109	5.237	3.699	3.390	Aug	2.207	1.379	0.998	0.865	0.784	1.972
Sep	3.192	3.009	4.718	2.974	2.686	2.514	Sep	6.607	5.338	1.661	0.829	0.686	0.640
Oct	2.349	2.188	2.053	1.904	3.290	16.340	Oct	0.613	0.589	1.013	0.822	9.693	9.260
Nov	17.408	6.234	14.110	5.288	8.208	22.050	Nov	8.246	3.954	4.292	4.424	2.359	9.971
Dec	22.048	23.960	11.479	7.462	52.725	17.407	Dec	28.093	8.130	3.786	2.131	4.805	14.546
1981							1986						
Jan	9.558	13.085	23.766	12.916	10.973	16.597	Jan	8.083	10.428	19.642	38.780	20.007	25.456
Feb	27.463	8.907	15.392	15.071	13.861	22.614	Feb	15.278	6.604	4.929	14.522	12.160	9.508
Mar	9.426	8.350	11.222	6.954	5.470	5.021	Mar	14.620	70.306	13.999	19.466	13.280	12.373
Apr	4.825	4.649	4.477	4.308	4.143	3.982	Apr	14.144	11.831	11.961	9.924	6.137	4.805
May	6.859	13.889	6.700	8.002	5.954	4.171	May	4.533	4.345	7.107	4.816	4.198	4.076
Jun	3.792	3.625	3.642	3.391	6.121	9.434	Jun	4.548	3.991	6.735	11.691	10.924	6.245
Jul	4.723	7.059	4.382	19.889	5.046	3.998	Jul	4.778	3.708	3.530	3.422	3.233	3.721
Aug	3.427	3.197	3.029	2.864	2.703	2.530	Aug	3.150	5.362	3.104	2.796	4.645	4.856
Sep	2.351	2.186	2.024	1.866	1.711	1.559	Sep	2.583	2.618	3.846	2.979	3.907	2.580
Oct	1.413	1.273	1.206	1.181	1.155	1.128	Oct	2.201	2.038	3.611	1.958	1.761	4.888
Nov	1.102	1.081	1.061	1.040	1.059	4.039	Nov	5.060	7.249	3.787	2.783	1.839	2.977
Dec	9.031	11.583	8.071	19.455	11.823	13.038	Dec	1.846	1.615	5.770	3.505	3.719	10.964

Table 3.3.24(3/3) 5-DAY DISCHARGE AT PANJANGAN IN GARANG RIVER

by Observation (A=192.6 km2)

Unit : m3/s

Year	1- 5	5-10	10-15	15-20	20-25	25-31	Year	1- 5	5-10	10-15	15-20	20-25	25-31
1987							1992						
Jan	7.528	7.856	23.920	45.620	24.620	28.133	Jan	6.440	12.980	12.720	7.360	10.380	9.967
Feb	10.902	29.680	40.820	31.640	37.860	25.867	Feb	13.840	10.820	9.400	14.480	12.420	9.250
Mar	34.160	21.680	11.480	16.340	29.020	33.533	Mar	9.780	13.580	14.560	17.440	9.440	8.367
Apr	9.954	17.996	19.200	8.650	9.514	6.992	Apr	16.160	12.800	21.240	10.720	12.400	11.440
May	7.300	7.842	6.436	6.458	4.752	5.665	May	7.340	8.440	10.960	7.520	7.380	15.000
Jun	6.578	6.854	4.430	4.020	3.814	4.596	Jun	11.220	10.480	6.500	5.180	5.060	4.620
Jul	4.206	3.356	3.150	3.672	3.218	3.342	Jul	5.420	5.480	6.440	5.310	4.750	4.750
Aug	2.762	2.700	2.490	2.310	2.284	2.245	Aug	5.260	4.450	5.300	3.700	9.680	8.750
Sep	1.798	1.962	1.988	1.798	1.718	2.018	Sep	7.240	9.100	8.240	5.600	4.420	4.400
Oct	2.212	1.910	1.826	2.898	1.962	1.728	Oct	7.900	10.160	5.080	5.910	5.840	5.300
Nov	1.772	3.078	2.230	3.276	5.120	7.436	Nov	4.990	6.620	3.550	3.900	5.910	5.690
Dec	6.550	7.198	7.714	10.756	14.828	6.822	Dec	21.680	17.500	24.820	12.800	8.000	5.658
1988							1993						
Jan	9.120	11.512	11.380	16.000	34.304	15.135	Jan	4.326	5.758	5.366	4.800	25.700	103.64
Feb	21.760	30.200	22.580	20.880	17.616	9.030	Feb	49.780	44.780	39.600	32.580	35.820	26.300
Mar	11.788	13.668	11.702	18.408	25.300	49.833	Mar	24.100	29.260	19.980	17.320	19.220	25.933
Apr	13.030	16.718	12.468	8.858	6.862	6.122	Apr	16.164	32.700	35.060	17.720	17.522	7.556
May	7.968	10.902	5.518	5.866	5.480	4.643	May	9.184	6.068	5.852	3.812	3.434	3.548
Jun	2.376	2.378	3.502	4.362	2.484	2.606	Jun	3.436	9.538	8.486	7.864	3.858	3.250
Jul	3.440	3.142	2.304	2.460	2.066	1.917	Jul	3.672	2.834	2.834	2.418	2.496	2.370
Aug	1.816	1.984	1.872	1.496	1.526	1.530	Aug	3.500	3.350	3.300	3.500	3.400	2.792
Sep	1.408	1.994	2.294	1.880	1.490	1.452	Sep	2.750	3.940	2.600	2.750	3.350	3.050
Oct	1.732	1.564	4.340	3.328	2.184	7.198	Oct	3.250	2.900	3.050	2.368	2.456	2.317
Nov	3.256	2.380	4.316	4.286	3.920	6.856	Nov	1.602	1.450	1.730	3.688	2.880	2.258
Dec	8.876	15.086	16.840	11.482	12.968	4.605	Dec	4.566	4.378	2.802	3.982	5.238	4.057
1989							1994						
Jan	10.336	12.436	7.122	8.154	10.516	10.460	Jan	7.680	12.800	21.680	22.020	13.120	13.800
Feb	52.940	54.660	25.900	38.480	86.740	27.400	Feb	12.000	14.160	14.480	9.320	12.800	10.933
Mar	29.880	17.060	11.084	9.994	17.280	14.183	Mar	11.120	27.560	24.840	11.160	55.840	31.617
Apr	9.076	11.500	6.380	9.904	13.588	13.480	Apr	16.240	14.280	20.500	18.800	17.300	10.720
May	8.822	9.504	8.816	16.320	4.412	8.903	May	10.400	8.800	8.580	5.900	5.600	4.600
Jun	13.420	8.782	9.518	12.160	10.902	6.354	Jun	4.450	4.350	3.650	3.650	3.700	3.500
Jul	3.852	7.534	4.792	2.334	2.744	2.552	Jul	3.450	3.250	3.050	2.900	2.750	2.583
Aug	4.242	3.894	2.976	2.726	2.290	2.195	Aug	2.600	2.650	2.456	2.236	1.972	1.730
Sep	2.134	1.834	1.706	1.484	1.864	2.232	Sep	1.664	1.796	1.620	1.620	1.620	1.512
Oct	4.192	2.816	2.080	4.760	4.098	6.032	Oct	1.356	2.192	2.500	3.650	4.150	4.133
Nov	3.014	2.898	8.076	11.480	6.984	11.906	Nov	5.050	3.350	3.050	2.550	2.750	4.340
Dec	17.420	11.648	13.060	22.718	8.316	17.555	Dec	3.072	8.290	4.452	2.706	5.560	3.150
1990							1995						
Jan	12.966	22.360	13.520	41.320	53.160	88.150	Jan	4.900	8.080	15.440	7.400	17.440	26.317
Feb	34.980	14.080	10.736	9.370	6.816	11.103	Feb	12.820	11.680	21.480	12.600	12.160	9.867
Mar	13.870	11.290	9.344	24.228	8.560	9.613	Mar	13.520	16.720	10.800	20.880	19.040	13.533
Apr	7.056	8.520	7.522	6.734	8.000	8.792	Apr	10.160	9.600	8.960	7.980	6.800	6.320
May	7.426	5.394	6.112	8.486	7.148	7.705	May	6.140	6.920	15.840	7.440	6.040	6.225
Jun	6.340	4.044	3.846	4.648	6.754	5.692	Jun	5.530	6.140	9.900	7.800	6.700	5.420
Jul	5.774	3.998	3.220	2.780	3.214	2.500	Jul	4.700	4.250	3.300	2.154	1.136	2.105
Aug	3.224	2.668	4.956	2.584	2.474	2.500	Aug	3.250	3.500	3.150	2.850	2.550	2.170
Sep	1.836	2.446	2.136	1.720	2.500	2.276	Sep	1.796	1.620	0.916	0.520	0.872	2.280
Oct	1.804	1.560	1.460	1.508	1.320	2.250	Oct	2.456	1.928	1.400	1.356	1.400	1.473
Nov	2.566	1.300	1.708	2.538	3.264	4.404	Nov	1.846	7.080	10.290	11.040	18.240	27.240
Dec	14.268	10.530	13.440	10.712	19.020	13.197	Dec	11.180	10.400	18.140	15.200	21.120	14.700
1991							1996						
Jan	22.860	27.820	8.092	13.590	15.700	22.183	Jan	13.680	16.800	10.080	14.320	17.640	16.817
Feb	18.600	18.740	28.760	21.800	27.920	14.367	Feb	20.800	27.260	32.820	31.040	20.720	37.850
Mar	15.600	19.140	20.500	19.720	13.580	15.000	Mar	29.980	32.700	27.160	14.480	16.720	10.467
Apr	26.260	14.910	14.320	14.440	27.420	15.040	Apr	8.980	9.260	10.800	16.920	11.920	7.680
May	12.350	6.964	6.442	5.530	3.712	3.483	May	8.360	7.220	6.740	7.360	6.710	6.750
Jun	3.128	3.098	3.386	3.648	3.516	3.034	Jun	5.250	6.090	5.400	4.870	4.754	4.970
Jul	3.192	3.004	2.990	2.790	2.370	2.175	Jul	3.100	3.100	2.706	2.476	2.650	2.708
Aug	1.800	1.542	1.356	1.380	1.308	1.260	Aug	2.750	3.562	2.956	3.000	3.056	3.083
Sep	1.806	1.332	1.500	1.212	1.236	1.092	Sep	2.650	3.860	3.050	2.950	3.000	2.568
Oct	1.068	1.236	1.236	1.380	1.434	1.345	Oct	2.236	4.238	3.450	3.750	3.350	14.667
Nov	2.226	3.084	7.598	5.538	8.818	7.244	Nov	9.170	13.480	7.280	7.180	20.800	6.130
Dec	12.144	9.184	9.622	5.534	7.518	12.760	Dec	16.480	21.460	22.660	11.920	11.200	14.833

Table 3.3.25 MAXIMUM AND MINIMUM VALUE OF TIDAL LEVEL IN THE PERIOD FROM APRIL TO AUGUST 1997

Unit : cm

Months / Date	April. 1997		May. 1997		Jun . 1997		July . 1997		August . 1997		
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	
1	176	118	184	100	189	106	162	114	174	118	
2	174	105	182	94	184	109	162	106	178	124	
3	170	99	188	96	174	112	164	112	182	122	
4	176	95	176	100	168	110	156	105	180	120	
5	170	105	166	107	172	116	162	110	176	123	
6	174	96	160	110	177	126	169	117	166	121	
7	164	109	162	121	180	129	178	116	162	-	
8	160	114	152	117	180	121	182	124	158	120	
9	135	115	160	123	181	120	174	113	170	114	
10	143	116	166	128	184	116	176	115	166	117	
11	141	112	171	120	183	118	169	108	178	105	
12	154	110	168	116	177	112	176	123	174	107	
13	166	107	178	103	184	111	167	108	180	99	
14	164	82	179	100	182	113	172	122	170	91	
15	168	77	180	100	182	112	168	118	173	104	
16	167	102	175	100	177	124	164	115	102	102	
17	160	94	169	100	174	120	158	112	164	108	
18	156	91	165	96	178	120	158	108	160	116	
19	160	94	164	105	173	119	155	108	153	112	
20	161	111	153	104	172	117	170	109	149	116	
21	159	122	157	110	174	116	165	102	142	115	
22	159	122	153	111	175	118	168	111	152	114	
23	154	132	160	115	188	117	169	112	159	119	
24	154	125	167	110	187	124	170	112	165	111	
25	152	126	173	120	190	120	170	115	166	122	
26	164	126	174	116	188	119	177	112	164	116	
27	169	129	178	122	192	113	170	120	171	117	
28	179	123	182	108	179	112	185	116	167	112	
29	188	118	187	108	176	119	-	-	169	116	
30	179	102	186	104	-	-	-	-	172	113	
31	-	-	194	104	-	-	-	-	170	119	*Average*
Average	163	109	171	109	180	117	168	113	165	114	-
Max. Value	188	-	194	-	192	-	185	-	182	-	188.2
Min. Value	-	77	-	94	-	106	-	102	-	91	94.0

Mean High Water Level = 188.20 / 100 - 1.641 = +0.241 → EL. + 0.250 (TTG)

Mean Low Water Level = 94.00 / 100 - 1.641 = -0.701 → EL. - 0.700 (TTG)

Mean Sea Level = 144.00 / 100 - 1.641 = -0.201 → EL. - 0.200 (TTG)

Note: The Datum difference between TTG and BPP is 1.641 m.