No.

JAPAN INTERNATIONAL COOPERATION AGENCY

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
THE REPUBLIC OF THE PHILIPPINES

THE STUDY
ON
COMPREHENSIVE DISASTER PREVENTION
AROUND MAYON VOLCANO
IN
THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

VOLUME V : DATA BOOK

October 2000

NIPPON KOEI CO., LTD.

KRI INTERNATIONAL CORPORATION

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Table DT I 1 Probable Flood Peak Runoff (2 Year)

Name of River	(1) Drainage Area (km2)	(2) Flood Concentration Time(min)	(3) Return Period (year)	(4) Runoff Coefficient	(5) Representative Station		(6) 24-Hour Rainfall (mm)	(7) Rainfall Intensity (mm/hr)	(8) Probable Basin 1-Day Rainfall(mm)	(9) Average Rainfall Intensity(mm/hr)	(10) Probable Flood Peak Runoff(m3/s)
					Name of Station	Probable 1-Day Rainfall(mm)					
Yawa	74.4	96	2	0.7	Legazpi	176	163	41	195	49	716
Pawa-Burabod	7.6	55	2	0.7	Legazpi	176	163	56	229	78	116
Budiao	7.5	56	2	0.7	Legazpi	176	163	55	229	77	113
Anoling	9.4	49	2	0.7	Legazpi	176	163	60	227	83	152
Quirangay	9.3	46	2	0.7	Guinobatan	162	163	62	209	79	143
Tumpa	5.7	37	2	0.7	Guinobatan	162	163	71	213	93	103
Maninila	4.9	51	2	0.7	Guinobatan	162	163	59	215	77	73
Masarawag	10.5	58	2	0.7	Guinobatan	162	163	54	207	68	140
Ogsong	38.1	128	2	0.7	Guinobatan	162	163	36	191	42	308
Nasisi	84.2	117	2	0.7	Guinobatan	162	163	37	177	41	663
Buang	4.5	39	2	0.7	Buang	194	163	69	172	73	64
Quinali (B)	157.8	178	2	0.7	San Ramon	110	163	29	112	20	619
San Vicente	9.9	63	2	0.7	San Ramon	110	163	51	141	44	86
Arimbay	2.6	25	2	0.7	Sto Domingo	174	163	87	236	126	63
Padang	7.6	44	2	0.7	Sto Domingo	174	163	64	226	88	131
Basud	14.0	52	2	0.7	Sto Domingo	174	163	58	219	78	212
Bulawan	15.4	55	2	0.7	Sto Domingo	174	163	56	218	75	223

Table DT I 2 Probable Flood Peak Runoff (5 Year)

Name of River	(1) Drainage Area (km2)	(2) Flood Concentration Time(min)	(3) Return Period (year)	(4) Runoff Coefficient	(5) Representative Station		(6) 24-Hour Rainfall (mm)	(7) Rainfall Intensity (mm/hr)	(8) Probable Basin 1-Day Rainfall(mm)	(9) Average Rainfall Intensity(mm/hr)	(10) Probable Flood Peak Runoff(m3/s)
					Name of Station	Probable 1-Day Rainfall(mm)					
Yawa	74.4	96	5	0.7	Legazpi	251	255	62	278	68	978
Pawa-Burabod	7.6	55	5	0.7	Legazpi	251	255	81	326	104	154
Budiao	7.5	56	5	0.7	Legazpi	251	255	80	327	103	150
Anoling	9.4	49	5	0.7	Legazpi	251	255	87	323	110	201
Quirangay	9.3	46	5	0.7	Guinobatan	230	255	90	296	104	189
Tumpa	5.7	37	5	0.7	Guinobatan	230	255	103	303	122	135
Maninila	4.9	51	5	0.7	Guinobatan	230	255	85	305	102	97
Masarawag	10.5	58	5	0.7	Guinobatan	230	255	79	294	91	185
Ogsong	38.1	128	5	0.7	Guinobatan	230	255	54	271	57	421
Nasisi	84.2	117	5	0.7	Guinobatan	230	255	56	252	55	906
Buang	4.5	39	5	0.7	Buang	335	255	100	297	116	102
Quinali (B)	157.8	178	5	0.7	San Ramon	166	255	45	169	30	908
San Vicente	9.9	63	5	0.7	San Ramon	166	255	75	213	63	121
Arimbay	2.6	25	5	0.7	Sto Domingo	227	255	125	308	151	76
Padang	7.6	44	5	0.7	Sto Domingo	227	255	92	295	107	158
Basud	14.0	52	5	0.7	Sto Domingo	227	255	84	286	94	257
Bulawan	15.4	55	5	0.7	Sto Domingo	227	255	81	284	91	272

Table DT I 3 Probable Flood Peak Runoff (10 Year)

Name of River	(1) Drainage Area (km2)	(2) Flood Concentration Time(min)	(3) Return Period (year)	(4) Runoff Coefficient	(5) Representative Station		(6) 24-Hour Rainfall (mm)	(7) Rainfall Intensity (mm/hr)	(8) Probable Basin 1-Day Rainfall(mm)	(9) Average Rainfall Intensity(mm/hr)	(10) Probable Flood Peak Runoff(m3/s)
					Name of Station	Probable 1-Day Rainfall(mm)					
Yawa	74.4	96	10	0.7	Legazpi	303	316	76	336	80	1163
Pawa-Burabod	7.6	55	10	0.7	Legazpi	303	316	98	394	123	181
Budiao	7.5	56	10	0.7	Legazpi	303	316	97	394	121	177
Anoling	9.4	49	10	0.7	Legazpi	303	316	105	390	130	237
Quirangay	9.3	46	10	0.7	Guinobatan	274	316	108	353	121	219
Tumpa	5.7	37	10	0.7	Guinobatan	274	316	124	361	141	157
Maninila	4.9	51	10	0.7	Guinobatan	274	316	103	363	118	113
Masarawag	10.5	58	10	0.7	Guinobatan	274	316	95	351	105	215
Ogsong	38.1	128	10	0.7	Guinobatan	274	316	66	322	67	495
Nasisi	84.2	117	10	0.7	Guinobatan	274	316	69	300	65	1066
Buang	4.5	39	10	0.7	Buang	451	316	120	400	152	133
Quinali (B)	157.8	178	10	0.7	San Ramon	208	316	55	212	37	1127
San Vicente	9.9	63	10	0.7	San Ramon	208	316	91	267	77	148
Arimbay	2.6	25	10	0.7	Sto Domingo	262	316	150	356	169	86
Padang	7.6	44	10	0.7	Sto Domingo	262	316	111	341	120	177
Basud	14.0	52	10	0.7	Sto Domingo	262	316	102	330	106	289
Bulawan	15.4	55	10	0.7	Sto Domingo	262	316	98	328	102	306

Table DT I 4 Probable Flood Peak Runoff (20 Year)

Name of River	(1) Drainage Area (km2)	(2) Flood Concentration Time(min)	(3) Return Period (year)	(4) Runoff Coefficient	(5) Representative Station		(6) 24-Hour Rainfall (mm)	(7) Rainfall Intensity (mm/hr)	(8) Probable Basin 1-Day Rainfall(mm)	(9) Average Rainfall Intensity(mm/hr)	(10) Probable Flood Peak Runoff(m3/s)
					Name of Station	Probable 1-Day Rainfall(mm)					
Yawa	74.4	96	20	0.7	Legazpi	356	374	89	394	94	1353
Pawa-Burabod	7.6	55	20	0.7	Legazpi	356	374	115	463	142	210
Budiao	7.5	56	20	0.7	Legazpi	356	374	113	463	140	205
Anoling	9.4	49	20	0.7	Legazpi	356	374	122	458	150	274
Quirangay	9.3	46	20	0.7	Guinobatan	316	374	126	407	137	248
Tumpa	5.7	37	20	0.7	Guinobatan	316	374	144	416	160	177
Maninila	4.9	51	20	0.7	Guinobatan	316	374	120	419	134	128
Masarawag	10.5	58	20	0.7	Guinobatan	316	374	111	404	120	244
Ogsong	38.1	128	20	0.7	Guinobatan	316	374	77	372	76	565
Nasisi	84.2	117	20	0.7	Guinobatan	316	374	80	346	74	1217
Buang	4.5	39	20	0.7	Buang	581	374	140	515	193	168
Quinali (B)	157.8	178	20	0.7	San Ramon	252	374	65	256	44	1359
San Vicente	9.9	63	20	0.7	San Ramon	252	374	106	324	92	177
Arimbay	2.6	25	20	0.7	Sto Domingo	297	374	175	403	188	95
Padang	7.6	44	20	0.7	Sto Domingo	297	374	130	386	134	198
Basud	14.0	52	20	0.7	Sto Domingo	297	374	118	374	118	322
Bulawan	15.4	55	20	0.7	Sto Domingo	297	374	115	372	114	341

Table DT I 5 Probable Flood Peak Runoff (50 Year)

Name of River	(1) Drainage Area (km2)	(2) Flood Concentration Time(min)	(3) Return Period (year)	(4) Runoff Coefficient	(5) Representative Station		(6) 24-Hour Rainfall (mm)	(7) Rainfall Intensity (mm/hr)	(8) Probable Basin 1-Day Rainfall(mm)	(9) Average Rainfall Intensity(mm/hr)	(10) Probable Flood Peak Runoff(m3/s)
					Name of Station	Probable 1-Day Rainfall(mm)					
Yawa	74.4	96	50	0.7	Legazpi	426	450	106	472	111	1604
Pawa-Burabod	7.6	55	50	0.7	Legazpi	426	450	136	554	167	247
Budiao	7.5	56	50	0.7	Legazpi	426	450	134	554	165	241
Anoling	9.4	49	50	0.7	Legazpi	426	450	145	548	176	322
Quirangay	9.3	46	50	0.7	Guinobatan	368	450	149	474	157	284
Tumpa	5.7	37	50	0.7	Guinobatan	368	450	170	485	183	203
Maninila	4.9	51	50	0.7	Guinobatan	368	450	142	488	154	146
Masarawag	10.5	58	50	0.7	Guinobatan	368	450	131	471	137	280
Ogsong	38.1	128	50	0.7	Guinobatan	368	450	92	433	88	654
Nasisi	84.2	117	50	0.7	Guinobatan	368	450	96	403	86	1406
Buang	4.5	39	50	0.7	Buang	785	450	165	696	256	224
Quinali (B)	157.8	178	50	0.7	San Ramon	316	450	77	322	55	1694
San Vicente	9.9	63	50	0.7	San Ramon	316	450	126	406	114	219
Arimbay	2.6	25	50	0.7	Sto Domingo	344	450	206	467	214	108
Padang	7.6	44	50	0.7	Sto Domingo	344	450	153	447	152	225
Basud	14.0	52	50	0.7	Sto Domingo	344	450	140	433	135	368
Bulawan	15.4	55	50	0.7	Sto Domingo	344	450	136	431	130	389

Table DT I 6 Probable Flood Peak Runoff (100 Year)

Name of River	(1) Drainage Area (km2)	(2) Flood Concentration Time(min)	(3) Return Period (year)	(4) Runoff Coefficient	(5) Representative Station		(6) 24-Hour Rainfall (mm)	(7) Rainfall Intensity (mm/hr)	(8) Probable Basin 1-Day Rainfall(mm)	(9) Average Rainfall Intensity(mm/hr)	(10) Probable Flood Peak Runoff(m3/s)
					Name of Station	Probable 1-Day Rainfall(mm)					
Yawa	74.4	96	100	0.7	Legazpi	481	506	118	533	125	1802
Pawa-Burabod	7.6	55	100	0.7	Legazpi	481	506	151	626	187	276
Budiao	7.5	56	100	0.7	Legazpi	481	506	150	626	185	270
Anoling	9.4	49	100	0.7	Legazpi	481	506	161	619	197	361
Quirangay	9.3	46	100	0.7	Guinobatan	407	506	166	524	172	311
Tumpa	5.7	37	100	0.7	Guinobatan	407	506	189	536	201	222
Maninila	4.9	51	100	0.7	Guinobatan	407	506	158	540	168	161
Masarawag	10.5	58	100	0.7	Guinobatan	407	506	146	521	151	307
Ogsong	38.1	128	100	0.7	Guinobatan	407	506	103	479	97	720
Nasisi	84.2	117	100	0.7	Guinobatan	407	506	108	445	95	1549
Buang	4.5	39	100	0.7	Buang	975	506	184	865	315	275
Quinali (B)	157.8	178	100	0.7	San Ramon	369	506	87	375	64	1971
San Vicente	9.9	63	100	0.7	San Ramon	369	506	141	474	132	254
Arimbay	2.6	25	100	0.7	Sto Domingo	379	506	230	514	233	118
Padang	7.6	44	100	0.7	Sto Domingo	379	506	171	493	166	246
Basud	14.0	52	100	0.7	Sto Domingo	379	506	156	477	147	401
Bulawan	15.4	55	100	0.7	Sto Domingo	379	506	151	475	142	425

DT I 7 Dimention of Basic Plan of River Improvement for Macabalo and Tibu River

Macabalo River

Section	Distance	Top Width	Botom Width	Depth R	Depth L	New Dike	Raising Dike Height	Widening River Channel	rip-rap R	rip-rap L
	(m)	(m)	(m)	(m)	(m)					
7	196.7	30.00	26.00	2.81	2.81	O	--	--	O	O
6	155.4	30.00	26.00	3.00	3.00	O	--	--	O	O
5	504.0	30.00	26.00	3.00	3.00	O	--	--	O	O
4	300.0	36.00	32.00	3.50	3.50	O	--	--	O	O
3	100.0	12.20	11.20	1.90	1.90	O	O 1.1m	O +20.3m	O	O
2	323.0	12.20	11.20	1.90	1.90	O	O 1.1m	O +20.3m	O	O
1	122.5	12.20	11.20	1.90	1.90	O	O 1.1m	O +20.3m	O	O
27	70.0	6.00	4.00	2.00	2.00	O	O 1.0m	O +27.5m	O	O
									O	O
26	70.0	7.00	5.00	3.50	3.50	O	--	O +9.5m	O	O
									O	O
25	30.0	5.50	4.00	2.00	2.00	O	O 1.0m	O +6.0m	O	O
24	65.0	4.50	3.50	1.00	1.00	O	O 2.0m	O +6.5m	O	O
									O	O
28	50.0	7.50	6.00	2.00	2.00	O	O 1.0m	O +4.5m	O	O
									O	O
66	100.0	13.00	10.00	2.50	2.50	O	O 0.5m	O +1.5m	O	O

Tibu River

Section	Distance	Top Width	Botom Width	Depth R	Depth L	New Dike	Raising Dike Height	Widening River Channel	rip-rap R	rip-rap L
	(m)	(m)	(m)	(m)	(m)					
24	124.7	40.00	39.00	5.00	5.00	O	--	--	O	O
23	78.4	40.00	39.00	2.10	2.10	O	--	--	O	O
22	236.6	14.00	4.80	3.50	3.50	O	--	--	O	O
21	70.0	14.00	4.80	4.50	3.50	O	--	--	O	O
20	186.2	11.40	10.40	2.20	2.20	O	O 0.6m	--	O	O
19	90.3	11.40	10.40	2.20	2.20	O	O 0.6m	--	O	O
18	48.1	10.30	9.30	3.80	3.80	O	--	--	O	O

DT I 8 Existing Flow Capacity of River Channel (Macabalo River)

Section	Distance	Top Width	Botom Width	Depth	River Width	Bed Slope	Sidewall Slope	Rough-ness	Water Depth	Sectional Area	Wetted Perimeter	Hydraulic Radius	Velocity	Calculated Discharge	Design Discharge
	(m)	(m)	(m)	(m)	(m)	1/n	1:m	*n*	h_1(m)	A(m2)	P(m)	R(m)	V_1(m/s)		
									1.00						
7	196.7	30.00	26.00	2.81	26.0	1/1,000	1:0.71	0.030	1.81	49.392	30.443	1.622	1.455	71.9	105.0
6	155.4	30.00	26.00	3.00	26.0	1/1,000	1:0.67	0.030	2.00	54.667	30.807	1.774	1.545	84.5	105.0
5	504.0	30.00	26.00	3.00	26.0	1/1,000	1:0.67	0.030	2.00	54.667	30.807	1.774	1.545	84.5	105.0
4	300.0	36.00	32.00	3.50	32.0	1/1,000	1:0.57	0.030	2.50	83.571	37.759	2.213	1.790	149.6	105.0
3	100.0	12.20	11.20	1.90	11.2	1/1,000	1:0.26	0.030	0.90	10.293	13.061	0.788	0.899	9.3	105.0
2	323.0	12.20	11.20	1.90	11.2	1/1,000	1:0.26	0.030	0.90	10.293	13.061	0.788	0.899	9.3	105.0
1	122.5	12.20	11.20	1.90	11.2	1/1,000	1:0.26	0.030	0.90	10.293	13.061	0.788	0.899	9.3	105.0
27	70.0	6.00	4.00	2.00	4.0	1/1,000	1:0.50	0.030	1.00	4.500	6.236	0.722	0.848	3.8	105.0
26	70.0	7.00	5.00	3.50	5.0	1/1,000	1:0.29	0.030	2.50	14.286	10.200	1.401	1.320	18.9	70.0
25	30.0	5.50	4.00	2.00	4.0	1/1,000	1:0.38	0.030	1.00	4.375	6.136	0.713	0.841	3.7	34.0
24	65.0	4.50	3.50	1.00	3.5	1/1,000	1:0.50	0.030	0.00	-	3.500	-	-	-	34.0
28	50.0	7.50	6.00	2.00	6.0	1/1,000	1:0.38	0.030	1.00	6.375	8.136	0.784	0.896	5.7	35.0
66	100.0	13.00	10.00	2.50	10.0	1/1,000	1:0.60	0.030	1.50	16.350	13.499	1.211	1.198	19.6	39.0

DT I 9 Design Capacity of Planned River Channel (Macabalo River)

Section	Distance	Top Width	Botom Width	Depth	River Width	Bed Slope	Sidewall Slope	Rough-ness	Water Depth	Sectional Area	Wetted Perimeter	Hydraulic Radius	Velocity	Calculated Discharge	Design Discharge
	(m)	(m)	(m)	(m)	(m)	1/n	1:m	*n*	h_1(m)	A(m2)	P(m)	R(m)	V_1(m/s)		
7	196.7	30.70	26.00	3.30	26.0	1/1,000	1:0.71	0.030	2.30	63.565	31.646	2.009	1.678	106.7	105.0
6	155.4	30.41	26.00	3.30	26.0	1/1,000	1:0.67	0.030	2.30	63.327	31.529	2.009	1.678	106.3	105.0
5	504.0	30.41	26.00	3.30	26.0	1/1,000	1:0.67	0.030	2.30	63.327	31.529	2.009	1.678	106.3	105.0
4	300.0	36.00	32.00	3.50	32.0	1/1,000	1:0.57	0.030	2.50	83.571	37.759	2.213	1.790	149.6	105.0
3	100.0	**38.70**	**31.50**	3.00	31.5	1/1,000	**1:1.20**	0.030	2.00	67.800	37.748	1.796	1.558	105.6	105.0
2	323.0	**38.70**	**31.50**	3.00	31.5	1/1,000	**1:1.20**	0.030	2.00	67.800	37.748	1.796	1.558	105.6	105.0
1	122.5	**38.70**	**31.50**	3.00	31.5	1/1,000	**1:1.20**	0.030	2.00	67.800	37.748	1.796	1.558	105.6	105.0
27	70.0	**38.70**	**31.50**	3.00	31.5	1/1,000	**1:1.20**	0.030	2.00	67.800	37.748	1.796	1.558	105.6	105.0
26	70.0	**22.90**	**14.50**	3.50	14.5	1/1,000	**1:1.20**	0.030	2.50	43.750	22.310	1.961	1.651	72.3	70.0
25	30.0	**17.20**	**10.00**	3.00	10.0	1/1,000	**1:1.20**	0.030	2.00	24.800	16.248	1.526	1.397	34.7	34.0
24	65.0	**17.20**	**10.00**	3.00	10.0	1/1,000	**1:1.20**	0.030	2.00	24.800	16.248	1.526	1.397	34.7	34.0
28	50.0	**17.70**	**10.50**	3.00	10.5	1/1,000	**1:1.20**	0.030	2.00	25.800	16.748	1.540	1.406	36.3	35.0
66	100.0	**18.70**	**11.50**	3.00	11.5	1/1,000	**1:1.20**	0.030	2.00	27.800	17.748	1.566	1.422	39.5	39.0

DT I 10 Work Volume Calculation (Macabalo River)

Section	Distance	Top Width	Botom Width	Depth Existing	Depth Plan	rip-rap h	Sidewall Slope	Upper +Width	Botom +Width	Depth +h	rip-rap s	**rip-rap S**	**Excavation v1**	**Excavation v2**	**Excavation va**	**Embank-ment v3**	**Embank-ment vh**
	(m)	(m)	(m)	(m)	(m)		1:m	(m)	(m)	(m)	(m2/m)	**(m2)**	(m3/m)	(m3/m)	**(m3)**	(m3/m)	**(m3)**
																1.0	
7	196.7	30.70	26.00	2.81	3.30	4.30	1:0.71	0.00	0.00	**0.49**	10.56	**2,077**	1.86	-	**366**	1.35	**266**
6	155.4	30.41	26.00	3.00	3.30	4.30	1:0.67	0.00	0.00	**0.30**	10.34	**1,607**	1.83	-	**284**	0.74	**115**
5	504.0	30.41	26.00	3.00	3.30	4.30	1:0.67	0.00	0.00	**0.30**	10.34	**5,211**	1.83	-	**922**	0.74	**373**
4	300.0	36.00	32.00	3.50	3.50	4.50	1:0.57	0.00	0.00	0.00	10.37	**3,111**	1.79	-	**537**	-	-
3	100.0	38.70	31.50	1.90	3.00	4.00	1:1.20	**23.86**	**20.30**	**1.10**	12.50	**1,250**	2.10	41.95	**4,405**	4.66	**466**
2	323.0	38.70	31.50	1.90	3.00	4.00	1:1.20	**23.86**	**20.30**	**1.10**	12.50	**4,038**	2.10	41.95	**14,228**	4.66	**1,505**
1	122.5	38.70	31.50	1.90	3.00	4.00	1:1.20	**23.86**	**20.30**	**1.10**	12.50	**1,531**	2.10	41.95	**5,396**	4.66	**571**
27	70.0	38.70	31.50	2.00	3.00	4.00	1:1.20	**30.30**	**27.50**	**1.00**	12.50	**875**	2.10	57.80	**4,193**	4.03	**282**
26	70.0	22.90	14.50	3.50	3.50	4.50	1:1.20	**15.90**	**9.50**	0.00	14.06	**984**	2.10	44.45	**3,259**	-	-
25	30.0	17.20	10.00	2.00	3.00	4.00	1:1.20	**9.30**	**6.00**	**1.00**	12.50	**375**	2.10	15.30	**522**	4.03	**121**
24	65.0	17.20	10.00	1.00	3.00	4.00	1:1.20	**7.90**	**6.50**	**2.00**	12.50	**813**	2.10	7.20	**605**	12.13	**788**
28	50.0	17.70	10.50	2.00	3.00	4.00	1:1.20	**7.80**	**4.50**	**1.00**	12.50	**625**	2.10	12.30	**720**	4.03	**202**
66	100.0	18.70	11.50	2.50	3.00	4.00	1:1.20	**4.50**	**1.50**	**0.50**	12.50	**1,250**	2.10	7.50	**960**	1.51	**151**
												23,747			**36,397**		**4,840**
												23,750			**36,400**		**4,840**

DT I 11 Flow Capacity of Existing River Channel (Tibu River)

Section	Distance	Top Width	Botom Width	Depth	River Width	Bed Slope	Sidewall Slope	Rough-ness	Water Depth	Sectional Area	Wetted Perimeter	Hydraulic Radius	Velocity	Calculated Discharge	Design Discharge
	(m)	(m)	(m)	(m)	(m)	1/n	1:m	*n*	h_1(m)	A(m2)	P(m)	R(m)	V_1(m/s)		
									1.00						
24	124.7	40.00	39.00	5.00	39.0	1/2,000	1:0.10	0.030	4.00	157.600	47.040	3.350	1.669	263.0	17.0
23	78.4	40.00	39.00	2.10	39.0	1/2,000	1:0.24	0.030	1.10	43.188	41.261	1.047	0.768	33.2	17.0
22	236.6	14.00	4.80	3.50	4.8	1/2,000	1:1.31	0.030	2.50	20.214	13.057	1.548	0.997	20.2	17.0
21	70.0	14.00	4.80	3.50	4.8	1/2,000	1:1.31	0.030	2.50	20.214	13.057	1.548	0.997	20.2	17.0
20	186.2	11.40	10.40	2.20	10.4	1/2,000	1:0.23	0.030	1.20	12.807	12.861	0.996	0.743	9.5	17.0
19	90.3	11.40	10.40	2.20	10.4	1/2,000	1:0.23	0.030	1.20	12.807	12.861	0.996	0.743	9.5	17.0
18	48.1	10.30	9.30	3.80	9.3	1/2,000	1:0.13	0.030	2.80	27.072	14.948	1.811	1.107	30.0	17.0

DT I 12 Design Capacity of Planned River Channel (Tibu River)

Section	Distance	Top Width	Botom Width	Depth	River Width	Bed Slope	Sidewall Slope	Rough-ness	Water Depth	Sectional Area	Wetted Perimeter	Hydraulic Radius	Velocity	Calculated Discharge	Design Discharge
	(m)	(m)	(m)	(m)	(m)	1/n	1:m	*n*	h_1(m)	A(m2)	P(m)	R(m)	V_1(m/s)		
24	124.7	40.00	39.00	5.00	39.0	1/2,000	1:0.10	0.030	4.00	157.600	47.040	3.350	1.669	263.0	17.0
23	78.4	40.00	39.00	2.10	39.0	1/2,000	1:0.24	0.030	1.10	43.188	41.261	1.047	0.768	33.2	17.0
22	236.6	14.00	4.80	3.50	4.8	1/2,000	1:1.31	0.030	2.50	20.214	13.057	1.548	0.997	20.2	17.0
21	70.0	14.00	4.80	3.50	4.8	1/2,000	1:1.31	0.030	2.50	20.214	13.057	1.548	0.997	20.2	17.0
20	186.2	11.68	10.40	**2.80**	10.4	1/2,000	1:0.23	0.030	1.80	19.456	14.092	1.381	0.924	18.0	17.0
19	90.3	11.68	10.40	**2.80**	10.4	1/2,000	1:0.23	0.030	1.80	19.456	14.092	1.381	0.924	18.0	17.0
18	48.1	10.30	9.30	3.80	9.3	1/2,000	1:0.13	0.030	2.80	27.072	14.948	1.811	1.107	30.0	17.0

DT I 13 Work Volume Calculation (Tibu River)

Section	Distance	Top Width	Botom Width	Depth Existing	Depth Plan	rip-rap h	Sidewall Slope	Upper +Width	Botom +Width	Depth +h	rip-rap s	**rip-rap S**	Excavation v1	Excavation v2	Excavation Va	Embank - ment V3	Embank - ment Vb
	(m)	(m)	(m)	(m)	(m)		1:m	(m)	(m)	(m)	(m2/m)	**(m2)**	(m3/m)	(m3/m)	**(m3)**	(m3/m)	**(m3)**
																1.0	
24	124.7	40.00	39.00	5.00	5.00	6.00	1:0.10	0.00	0.00	0.00	12.06	**1,504**	1.55	-	**193**	-	-
23	78.4	40.00	39.00	2.10	2.10	3.10	1:0.24	0.00	0.00	0.00	6.37	**499**	1.62	-	**127**	-	-
22	236.6	14.00	4.80	3.50	3.50	4.50	1:1.31	0.00	0.00	0.00	14.86	**3,516**	2.16	-	**511**	-	-
21	70.0	14.00	4.80	3.50	3.50	4.50	1:1.31	0.00	0.00	0.00	14.86	**1,040**	2.16	-	**151**	-	-
20	186.2	11.68	10.40	2.20	2.80	3.80	1:0.23	0.00	0.00	**0.60**	7.79	**1,450**	1.61	-	**300**	1.58	**294**
19	90.3	11.68	10.40	2.20	2.80	3.80	1:0.23	0.00	0.00	**0.60**	7.79	**703**	1.61	-	**145**	1.58	**143**
18	48.1	10.30	9.30	3.80	3.80	4.80	1:0.13	0.00	0.00	0.00	9.68	**466**	1.57	-	**76**	-	-
												9,178			**1,503**		**437**
												9,180			**1,500**		**437**