Manning's roughness coefficient was assumed at 0.025 taking into account of smooth river bed condition of uniform sandy materials.

3.3 SEDIMENT TRANSPORT CAPACITY AT SELECTED LOCATIONS

Sediment load was calculated by applying the above formulas at Maskup near outlet of Sacobia valley and outlet of the sand pocket in Sacobia river, at Malonzo, San Francisco bridge and Confluence of Rio Chico in Bamban/Parua river and at Friendship bridge and San Jose Malino in the Abacan river. In the study, the Bamban river system includes Marimla and Sapang Cauayang rivers but Sacobia river is separated from the Bamban river.

Table G.1 shows the sediment load and concentration for selected flow rates between 10 m^3/s and 1000 m^3/s and they are summarized that the sediment concentration was estimated at 0.7 - 7% at Maskup in the Sacobia river, 0.05 - 0.5% at San Francisco bridge in the Bamban river, and 0.2 - 1.7% at Friendship bridge in the Abacan river, respectively.

3.4 ANNUAL SEDIMENT LOAD AT SELECTED LOCATIONS

Annual sediment load was calculated at the same locations as those selected above. Since no runoff record was available in the study area, runoff discharge was generated from daily rainfall record in the following manner.

(1) Runoff

A long term daily rainfall record is not available in the study area. A short term daily rainfall record is available at Clerk Air Base for three years, although annual rainfall data is available for more than 30 years. A long term daily rainfall data is available at Dagupan located 100 km northwest of the study area. Since the average annual rainfall depth of Dagupan (2086 mm) is almost same, only 5 % higher than that of Clerk Air Base (1987 mm) and the monthly rainfall pattern is similar each other as shown in Fig G.1 and in Appendix D "Meteo-Hydrology", the daily rainfall data of Dagupan was used for generating runoff.

The average year of rainfall depth was selected as 1989 which was the 5th wettest year within the recent 10 years record. The maximum annual rainfall was recorded in 1972 during the observation period. Tables G.2 and G.3 shows daily rainfall record at Dagupan in 1989 and 1972, respectively.

Then, hourly runoff hydrograph was generated on the basis of 1989 rainfall record at Dagupan assuming runoff coefficient of 0.8 for daily rainfall depth larger than 20 mm. The effective rainfall was calculated at 1,567 mm and they were converted to runoff having triangular distribution for 5 hours a day.

On the other hand, rainfall pattern at Clerk Air Base might be more reliable for the study area. The 1993 rainfall record gives approximately same annual effective rainfall of 1560 mm as Dagupan assuming 0.85 of runoff coefficient for daily rainfall larger than 20 mm. Annual sediment was also estimated for the Clerk Air Base rainfall in 1993.

(2) Annual Sediment Transport Capacity

Table G.4 shows the annual sediment transport capacity at the selected locations for the average rainfall year. Sediment deposit volume was estimated assuming 40 % of porosity. The results show that the annual sediment deposits delivered from Maskup is 3.3 million m^3 which is well coincide with the 3-4 million m^3 sediment delivery from the Sacobia valley in normal flow condition in 1994 which was estimated by the study team based on the field survey (refer to Appendix F "Sediment Balance and Monitoring").

G.4 Long Term Forecast of river bed movement

4.1 INTRODUCTION

A long term sediment movement in river channels was calculated in this section for evaluating changes in river bed elevation as time passes which would affect flood flowing capacity of the river channels. The annual changes were evaluated for 10 years based on topographic data obtained in Mar. 1994 as initial conditions.
The study was applied to three river reaches, Bamban/Parua river channels from Bamban to the confluence of Rio Chico, Sacobia valley from Mactan gate to Maskup gorge and the Abacan river channels from Friendship bridge to the confluence of San Fernando river at Mexico.

4.2 METHODOLOGY

(1) Models

One-dimensional river bed movement model was applied in this study. Sediment load rate was given by Brown's equation while flow conditions such as depth and velocity were calculated by the momentum equation of nonuniform flow as shown below,

$$\partial z/\partial x+\partial h/\partial x+1/2g \cdot \partial (v)^2/\partial x=I_f$$

where x : vertical distance
z : river bed elevation
h : flow depth
I_f : friction loss given by Manning's equation $=n^2v^2/h^{2/3}$

The procedure of calculation is given as follows for each cross section of the river channel.

1) Set initial cross section of channel
2) Set runoff and boundary condition
3) Calculation of water level given by nonuniform flow equation
4) Calculation of sediment load rate given by Brown's equation
5) River bed changes due to sediment balance
6) Next time step and back to 2)

(2) River cross section

Cross sectional data of the channel were prepared on the basis of the results of the cross sectional survey of 600 m interval carried out by the Survey Team in Mar. 1994 for Bamban/Parua river and Abacan river while they were produced for every 400 m from DTM (Digital Topographic Map of 1:10,000 scale) for Sacobia valley. Typical cross sections are shown in Figures G.2, G3 and G4.

(3) Runoff and Parameters

The same runoff data and parameters as the sediment transport capacity study in the previous chapter were applied in this study. Porosity of sediment deposits was assumed to be 40 %.

4.3 *LONG TERM RIVER BED CHANGES IN SACOBIA RIVER CHANNEL*

(1) Model and Boundary Conditions

In the Sacobia model, the upstream end of the Sacobia river was set at Mactan gate located northwest of the Clerk Air Base. Although the drainage basin of Mactan gate site is 18 km^2 and the remaining basin of the Sacobia valley between Mactan and Maskup is 20 km^2, runoff from the drainage area of 38 km^2 was input into the entrance of the river channel at Mactan for simplicity of calculation.

Erosible depth of each section was set at the original river bed elevation of pre-eruption and sediment supply from the upstream entrance was given by sediment transport capacity at the section.

Since the model does not consider any lateral erosion rate, downcutting of the river channel would be overestimated than the actual condition if channel width is given as 100-150 m of normal channel condition. The cross section of the Sacobia valley forms double channels of a narrow low channel of 100-150 m wide and an inner terrace of some 400-600 m wide and 5-10 m deep. Then the cross section was assumed to be rectangular with the width of the terrace.

The downstream end was fixed at the present elevation of Maskup Gorge assuming consolidation works will be provided at the site.

(2) River Bed Movement for 10 years

Tables G.5 and G.6 show the changes in river bed elevation and sediment movement of the Sacobia river for 10 years under the 1989 rainfall condition which is considered to be average climatic condition in the study area. Fig G.5 shows the river bed profiles of 4 cases, 1994, one year, 5 year and 10 year afterward. This calculation does not consider the lahars from the basins upstream of Mactan. The simulation shows that river bed erosion will first occur in the highest section and propagate downstream. Then the sections in the upper half reaches will be eroded to the original river bed in 10 years. The annual sediment volume to be delivered from Maskup, the lowest outlet of the valley, is almost constant for 10 years since the slope of the 1994 condition is almost uniform along the valley and the lower portion will not be affected by the changes of the upstream sections in 10 years.

Since the model did not consider tributary flows and lateral erosions, it seems to be too simple to represent the actual conditions, then the results can be considered only as reference. In the study of sediment transport capacity, it was estimated that the annual rate was about 2.1 million m^3 at Maskup site, the actual sediment transport rate at the site would be between 1.2 and 2.1 million m^3. A two-dimensional study in the valley was also carried out in this study and the results are described in Section 5.9.

4.4 *LONG TERM RIVER BED CHANGES IN BAMBAN RIVER CHANNEL*

(1) Model and Boundary Conditions

The Bamban/Parua river collects water from two river systems of the Marimla river (drainage area of 65 km^2) and the Sapang Cauayang river (21 km^2). In the model, the upstream end of the Bamban/Parua river was set at 3 km upstream of the previous Bamban bridge site and it would receive runoff from the drainage area of 86 km^2 while flow from the remaining basin of 12 km^2 along the river channel was not considered in the model.

For calculation of river bed movement, the initial elevation of each cross section was set at the Mar. 1994 condition and the river bed was allowed to be eroded or aggradated by river flow. Since the upstream end of the calculation was set at No.40, about 3 km upstream of the Bamban bridge site where the river bed was El.85.0 m and not affected by the eruption, any erosion was not allowed at the upstream end. In consideration of normal vegetation coverage of the Marimla and Sapang Cauayang river basins, 1 mm/year of an average erosion rate or 86,000 m^3/year in volume was considered as an allowable sediment production rate from the upstream basins. The water level at the downstream end was set at El.11.0 m which was average water table of the Rio Chico river in the rainy season.

(2) River Bed Movement for 10 years

Tables G.7 and G.8 show the changes in river bed elevation and sediment movement of the Bamban/Parua river for 10 years under the 1989 rainfall condition. In the table, Section No.181 is the downstream end, No.40 is the upstream end and the San Francisco bridge is located approximately at No. 100.

Fig G.6 shows the longitudinal profile of the river bed in 1994, in one year, 5 years and 10 years afterward. The down cutting of the river bed is obvious by 5 to 10 meters in upstream 5-6 km stretches and is lowered to the original river bed in pre-eruption condition within 8-10 years. On the contrary, river bed would be elevated by some 2.5 meters in 10 years from 1994 near the San Francisco bridge. The speed of aggradation would be high in a few years and gradually slowing down afterward. The downstream reaches would be little affected by sediment transport and the effect would appear in longer time.

According to this simulation, it might be said that the river bed movement of the Bamban/Parua river would be serious within the next 10 years and then gradually stabilized to the original river bed elevation in pre-eruption condition. The maximum aggradation in long term period would be some 3 meters in middle reaches and 1 meter in the lower reaches.

Under the most critical condition of climate, however, 1 meter of aggradation within 1 year would be possible in middle and lower reaches according to the simulation based on 1972 rainfall condition which was the largest rainfall of 4670 mm during 30 years of record period at Dagupan. Table G.9 shows the river bed profile under 1972 condition. According to the observation in 1995, the riverbed movement at the Bamban bridge site was estimated at about 1 meter during 1994-1995 period, while the freeboard of the San Francisco bridge was 0.67 m on an average at the middle of October 1995 although the river channel was excavated about 500 m long, 100 m wide and 2 m deep before onset of the 1995 rainy season and it was obvious that the reaches near the San Francisco bridge was in a stage of river bed aggradation. The results of the simulation give generally good estimates.

4.5 EFFECT OF SACOBIA RIVER DIVERSION

(1) Model and Boundary Conditions

The Sacobia river is now flowing down on the flood plain developing in the right bank of the Bamban river below Maskup. In the master plan, the Sacobia river is planned to be diverted to the Bamban river by constructing a diversion channel from Maskup to Malonzo about 5 km upstream of the San Francisco bridge. The riverbed fluctuation of the diversion channel and the effect of the diversion to the Bamban river were evaluated in this section. It was assumed that the diversion works were completed in 1999 following to the construction schedule given in the feasibility study.

A consolidation dam is planned to be placed at the entrance of the diversion channel to stabilize the riverbed elevation at Maskup where is the outlet of the Sacobia valley and the river forms a narrow gorge. The crest elevation of the consolidation dam would be set at El.111.0 m. A diversion channel would be excavated from Maskup to Malonzo. The diversion channel would be a 5.5 km long artificial straight channel with a 1/180 of constant slope having a 150 m wide and 2.5 to 6 m deep single trapezoid section. The river bed of the channel is protected by a series of groundsill with a 500 m interval in the upper half reaches.

In the Sediment Balance Study, the sediment supply from the Sacobia valley was assumed to be 1.8 million m^3 per year in 1999 and afterwards (0.4 million m^3 from upper Sacobia and 1.4 million m^3 from the spindle valley between Mactan and Maskup). It is very difficult to estimate how long the erosion from the spindle valley would last. In this study two alternative cases were examined ; 1) the sediment supply of 1.8 million m^3 is constant for 10 years, and 2) the sediment supply is gradually decreased from 1.8 million m^3 to 0.4 million m^3 for 10 years from 1999.

On the other hand, two alternative conditions of river training works were also examined for the Bamban river channel ; a) with no dredging work in the Bamban river, and b) with dredging works of 0.5 m deep in a 6 km long stretch downstream of the San Francisco bridge every year. In both cases, it is assumed that the river training works of the Bamban river channel is completed in 1999 and the riverbed profile is the same as that in 1994.

(2) River Bed Movement for 10 years

(Case 1-a) Constant sediment supply and no dredging

In the case that no dredging works is carried out in the Bamban river after the Sacobia river is diverted to the Bamban river , the river bed of the Bamban river would be locally aggradated by another 1 meter at maximum in the lower reaches compared with the case of no diversion work but the effect is not generally significant. Fig G.7 shows the river bed profile of the Bamban river with the Sacobia diversion and without dredging in the Bamban river channel. Fig G.8 shows the river bed profile of the diversion channel for the same case. Some 2 m high sediment deposit would be expected in the upper half reaches of the diversion channel if sediment supply would be as high as 180 million m^3 throughout the 10 year period. Tables G.10 and G.11 show riverbed profile and sediment transport of the Bamban river channel while Tables G.12 and G.13 show those of the diversion channel.

(Case 1-b) Constant sediment supply and with dredging

In the case that dredging works would be carried out in the Bamban river channel, the aggradation of the river bed in the Bamban river would be maintained to be some 1.5 meters on an average in the middle and lower reaches of the Bamban river as shown in Fig.G.9. Since the river bed at the confluence of the diversion channel and the Bamban river is affected little by the dredging works, the river bed profile of the diversion channel is almost the same as that of (Case 1-a) as shown in Fig.G.10. Tables G.14 and G.15 show riverbed profile and sediment transport of the Bamban river channel while Tables G.16 and G.17 show those of the diversion channel.

(Case 2-a) Declining sediment supply and no dredging

If the sediment supply is declining year by year from 1.8 to 0.4 million m3 from 1999, the river bed aggradation is 2 meters less than Case 1-a in the middle reaches and 1 meter in the lower reaches as shown in Fig. G.11 and Tables G.18 and G.19. Consequently, the lower river bed condition at the confluence of the diversion channel and the Bamban river would affect the river bed profile of the diversion channel. Downcutting of the diversion channel is expected in its lower stretch as shown in Fig.G.12 and Table G.20 and G.21. Groundsill should be extended to the lower stretch in 10 years.

(Case 2-b) Declining sediment supply and with dredging

Fig. G.13 and Tables G.22 and G.23 show the riverbed profile of the Bamban river in the case that dredging works would be carried out in the Bamban river channel under the condition of declining sediment supply rate. The aggradation of the river bed in the Bamban river would be almost the same as that in (Case 1-b). Downcutting of the diversion channel would be a little deeper than that of (Case 2-a) as shown in Fig.G.14 and Table G.24 and G.25. Extension of groundsill would be needed in the lower stretch.

4.6 LONG TERM RIVER BED CHANGES IN ABACAN RIVER CHANNEL

(1) Model and Boundary Conditions

In the Abacan model, the upstream end of the model was set at the section just below Friendship bridge and the downstream end was set at the confluence of the San Fernando river. The total length of the river channel was 25 km. The drainage area upstream of Friendship bridge was 33 km^2 and the following three tributaries join along the main channel in the model.

Location		Distance	Drainage area
Friendship bridge	(Upstream end)	25 km	33 km^2
Capaya bridge	(Tributary-1)	19 km	49 km^2
Culubasa	(Tributary-2)	15 km	62 km^2
San Jose Malino	(Tributary-3)	10 km	77 km^2
Confluence		0 km	77 km^2

The downstream end was located in lowlying area where was usually inundated during rainy season and the constant water table of EL.5 m was assumed.
Runoff pattern in the basin is different from the Sacobia-Bamban river because major sub basins are located lower slopes of the alluvial fans and therefore flood runoff duration was assumed 15 hours.

Sediment field in the upstream reaches was estimated at 40,000 m3 per annum (see Appendix F "Sediment Balance" and 1 meter deep of sediment deposit in the channel was assumed as allowable erosion depth.

(2) River Bed Movement for 10 years

Tables G.26 and G.27 show the changes in river bed elevation and sediment movement of the Abacan river for 10 years under the 1989 rainfall condition. Fig G.15 shows the river bed profiles of 4 cases, 1994, one year, 5 year and 10 year afterward.
Because of a concave sharp of river bed profile of the Abacan river, sediment transport capacity of the channel gradually decreases from upstream to downstream and sediment deposit is expected in the lower 5 km reaches. Desilting in the lower reaches would be needed.

G.5 *Two-dimensional Flood Inundation Analysis*

5.1 *INTRODUCTION*

The purpose of two-dimensional analysis was to assess the inundation area, flow depth and duration, and sediment deposits depth in flood prone areas due to the overflow of streams due to large scale flood runoff for flood damage analysis as well as to assess the flood flowing capacity and topographic changes of sand pocket with the condition of control structures

The overflow of stream under the 1991 and 1994 topographic conditions in the Bamban river basin were firstly simulated to evaluate applicability of the model. Then flood flow and sediment movement in the sand pocket area were simulated under 1994 topographic condition and the effect of the structures proposed in the sand pocket was assessed. The potential hazard areas were also calculated based on probable flood hydrographs for Bamban/Parua river and Abacan river.

For the numerical simulation, the study applied the computer program of two-dimensional flood and mudflow analysis developed by Public Works Research Institute and Sabo and Landslide Technical Center of Japan.

5.2 *METHODOLOGY*

(1) Models

Basic equations of an unsteady and two-dimensional flow model are expressed as follows:

1) Momentum Equations of Water Flow

x direction:

$$\partial M/\partial t+\beta x\cdot\partial(M\cdot u)/\partial x+\beta y\cdot\partial(M\cdot v)/\partial y=-g\cdot h\cdot\partial H/\partial x-\tau x/\rho$$

y direction:

$$\partial N/\partial t+\beta x\cdot\partial(N\cdot u)/\partial x+\beta y\cdot\partial(N\cdot v)/\partial y=-g\cdot h\cdot\partial H/\partial y-\tau y/\rho$$

where:
- M,N : flow flux of x, y direction
- u,v : velocity of x, y direction
- $\beta x,\beta y$: coefficient of x, y direction
- h : flow depth
- H : elevation of water table
- $\tau x,\tau y$: friction force, $\tau x/\rho= g\cdot n^2\cdot u\cdot(u^2+v^2)^{1/2}/h^{1/3}$
  $\tau y/\rho= g\cdot n^2\cdot v\cdot(u^2+v^2)^{1/2}/h^{1/3}$

2) Water Flow Continuity

$$\partial h/\partial t+\beta x\cdot\partial M/\partial x+N/\partial y=-0$$

3) Sediment Flow Continuity

$$\partial z/\partial t+1/(1-\lambda)\cdot\partial(C_M\cdot M)/\partial x+1/(1-\lambda)\cdot\partial(C_N\cdot N)/\partial y=0$$

where: C_M, C_N : sediment concentration of x, y direction

4) Sediment load rate is given by Brown's equation

The objective study area is divided into meshes of appropriate size depending on the purpose of the study and allowable number of meshes determined by computation capacity. For each time step, flow rate, flow depth, sediment load, changes in elevation are calculated by the above equations for every meshes of the model and the process is repeated in the next time step.

(2) Topographic data

Topographic data were produced from DTM (Digital Topographic Map of 1:10,000 scale) in 1991 pre-eruption and 1994 prepared by the Survey Team for Sacobia valley, Bamban river basin and Abacan river basin.

(3) Parameters

The same parameters as the sediment transport capacity study in the previous chapter were applied in this study.

5.3 FLOOD UNDER 1991 TOPOGRAPHIC CONDITION IN BAMBAN RIVER

The flood flow and sediment transport in 1991 was simulated under the following condition.

Topographic data	:	DTM in 1991		
	:	Area of analysis		14.5 km x 6 km
	:	Mesh size		50 m x 50 m
Hydrograph	:	Peak discharge	=	1,000 m^3/s (including sediment)
	:	Duration	=	5 hours
	:	Sediment concentration	=	50 % by volume

The peak discharge of 1,000 m^3/s with 50% of sediment concentration was considered as a typical lahar occurred in 1994, which was derived from effective rainfall of 100 mm at Mactan.

Fig. G.16 shows the distribution of the maximum water depth on the topographic map and Fig. G.17 shows the maximum water depth and sediment deposits of every meshes over the simulation area. The results well represented the situation that the original river channel was filled by sediment but water did not overtop the channel near the Bamban bridge while major flow overtopped at the section downstream of San Francisco Bridge toward left bank area.

5.4 FLOOD UNDER 1994 TOPOGRAPHIC CONDITION IN BAMBAN RIVER

The flow and sediment transport in 1994 was simulated under the following condition.

Topographic data	:	DTM in 1994		
	:	Area of analysis		14.5 km x 6 km
	:	Mesh size		50 m x 50 m
Hydrograph	:	Peak discharge	=	500 m^3/s (including sediment)
	:	Duration	=	5 hours
	:	Sediment concentration	=	10 % by volume

Fig. G.18 shows the distribution of the maximum water depth on the topographic map and Fig. G.19 shows the maximum water depth and sediment deposits of every meshes over the simulation area in 1994. The results can be compared with the chronological changes of Sacobia-Bamban river course in 1994 shown in Fig. G.20 which was reproduced from Appendix G. The stream lines shown in the simulation results well represent the actual water course observed in 1994 although quantitative analysis has not been well carried out.

5.5 POTENTIAL INUNDATION STUDY IN BAMBAN RIVER BASIN

Potential flood inundation over flood prone areas in the Bamban/Parua river basin was simulated under the following condition for 6 cases of probable flood hydroghaphs in different return periods. The flood runoff was input at two locations, Maskup point in the Sacobia river and a confluence of the Marimla and Sapang Cauayang rivers upstream of Bamban bridge in the Bamban river assuming flood events of the same return period occur simultaneously in these basins.

Topographic data :	DTM in 1994	
:	Area of analysis	20 km x 8 km
:	Mesh size	100 m x 100 m

Hydrographs at Maskup and Marimla+Sapang Cauayang (see Fig. G21)

	Peak discharge (m^3/s)	
	Maskup	Marimla+Cauayang
2-year flood	125	270
5-year flood	170	360
10-year flood	230	490
20-year flood	270	580
50-year flood	330	690
100-year flood	370	800

Sediment concentration is given by Brown's equation for the initial discharge

The distribution of maximum water depth of every meshes is illustrated on topographic maps produced by GIS as shown in Figure G. 23 for 100 year floods. Figures G.24 to G.27 show the distribution of maximum water depth and sediment deposits of every meshes for 5, 20, 50 and 100-year floods.

The potential inundation areas estimated in this study are summarized as follows:

Inundation Area in Bamban river basin (unit: ha)

Water depth	2-year	5-year	10-year	20-year	50-year	100-year
0 < h < 0.2	8,360	8,150	7,860	7,500	7,580	7,590
0.2 < h <1.0	1,390	1,930	2,530	3,000	3,130	3,160
1.0 < h	70	80	110	150	170	200
Total	9,20	10,160	10,500	10,650	10,80	10,950

Total area of analysis : 16,000 ha

5.6 POTENTIAL INUNDATION STUDY IN ABACAN RIVER BASIN

Potential flood inundation over flood prone areas in the Abacan river basin was simulated under the following condition. The flood runoff was input at Abacan bridge point.

Topographic data	:	DTM in 1994	
	:	Area of analysis	20 km x 11 km
	:	Mesh size	100 m x 100 m

Hydrographs at Capaya Bridge (see Fig. G22)

Return period	Peak discharge (m^3/s)
2-year flood	180
5-year flood	240
10-year flood	310
20-year flood	370
50-year flood	430
100-year flood	490

Sediment concentration is given by Brown's equation for the initial discharge

The distribution of maximum water depth of every meshes is illustrated on topographic maps produced by GIS as shown in Figure G. 28 for 100 year floods. Figures G.29 to G.32 show the distribution of maximum water depth and sediment deposits of every meshes for 5, 20, 50 and 100-year floods.

The potential inundation areas estimated in this study are summarized as follows:

Inundation Area in Bamban river basin (unit: ha)

Water depth	2-year	5-year	10-year	20-year	50-year	100-year
0 < h < 0.2	6,080	6,170	6,120	6,010	6,00	6,940
0.2 < h <1.0	810	1,170	1,680	2,060	2,350	2,600
1.0 < h	20	20	30	40	50	60
Total	6,910	7,360	7,830	8,110	8,800	9,600

Total area of analysis : 22,000 ha

5.7 *EFFECT OF CONTROL STRUCTURES IN SAND POCKET*

The effects of proposed control structures in sand pocket were examined under 1994 topographic conditions for the 20-year flood. As the control structures, separation dikes between Sacobia and Bamban river, lateral dikes in lower end of sand pocket, sump and 329 highway elevated by 5 meters and collect canals are considered.

Topographic data	:	DTM in 1994	
	:	Area of analysis	14.5 km x 6 km
	:	Mesh size	50 m x 50 m
Hydrograph	:	Peak discharge	= 270 m^3/s (Sacobia)
		(20-year flood)	= 580 m^3/s (Bamban)
	:	Duration	= 24 hours
	:	Sediment concentration	= 10 % by volume

Fig.G.33 shows the distribution of maximum flow depth on topographic map and Fig.G 34 shows the maximum flow depth and sediment deposits of every meshes. In the simulation, the flood flows in sand pocket were well drained into the Sapang Balem river and sediment materials were trapped at the lower lateral dike and sump. Most of sediment deposits were deposited in upper part of the sand pocket. It means that sediment materials will not be transported downstream by a single flood event although it might be gradually transported by normal flows.

A more detailed examination was carried out to evaluate the effect of the lateral dike system in the lower part of the sand pocket which was proposed by the feasibility study. Fig. G.35 shows the water depth and deposit distribution on a 20 meter mesh map due to the 5 year flood hydrograph. The figure shows that sediment materials are trapped by the lateral dike system.

5.8 LONG TERM TOPOGRAPHIC CHANGES IN SAND POCKET

For the purpose of examining the long term changes of topography of the sand pocket, constant runoff of 500 m^3/s was input at Maskup contiguously for 120 hours which is equivalent to 5 years runoff volume from the Sacobia river at Maskup.

Topographic data	:	DTM in 1994		
	:	Area of analysis		14.5 km x 6 km
	:	Mesh size		50 m x 50 m
Hydrograph	:	Peak discharge	=	500 m^3/s
	:	Duration	=	120 hours

Figures G.36 and G.37 show the maximum flow depth and sediment deposits in 1 year, 3 years and 5 years. Because of the siltation of collect canals and sump located lower end of sand pocket, overflow of the canal and river channel occurred in the Sapang Balem river. In actual situation, desilting in the canal and channels should be carried out. The sediment deposit is obvious in the upper half of the sand pocket as well as north east corner of the sand pocket. According to this long term changes and flow conditions due to the probable floods, major flood flow in the sand pocket would run along the separation dike between the sand pocket and the Bamban river. Reinforcement of the dikes along the possible water way should be considered.

Figs. G.38 and 39 shows the longitudinal profile of the sand pocket along the stream lines from Maskup to outlet structures of the sand pocket in 1, 3 and 5 years. The sediment materials would deposit so as to fill the depressions along the slopes and create smoother slopes. The depth of deposit would be some 1-3 meters in maximum in upper reaches and less than 1 m in the lower reaches.

The sand pocket would effectively work to retain sediment in the sand pocket area with in 5 years.

5.9 TOPOGRAPHIC CHANGES IN SACOBIA VALLEY

The topographic changes of the Sacobia valley between Mactan and Maskup would be caused by lateral as well as vertical erosions of the water courses. For the purpose the purpose of evaluating the effects of lateral erosions, a simulation study was carried out by applying a two dimensional model in the valley.

Topographic data	:	DTM in 1994		
	:	Area of analysis		10 km x 2.8 km
	:	Mesh size		50 m x 50 m
Hydrograph	:	Peak discharge	=	1000 m^3/s
	:	Duration	=	5 hours
	:	Sediment concentration	=	10 % by volume

In the simulation, a flood hydrograph having 1,000 m^3/s of peak discharge was input at Mactan gate site. Fig. G.40 shows the maximum water depth on the topographic map and Fig.G.41 shows the maximum flow depth, deposit and erosion of every meshes. The flow water overtopped from the low water channel of 100-200 m wide and create a wider water courses and sub channels outside of the lower channels. Then erosion and deposit occurred in the wider water courses. In this single event of flood, large amount of sediment would first deposit in upper reaches of the channels and then eroded and transported downstream.

G.6 Pasig river Inundation Analysis

6.1 INTRODUCTION

Active lahar events caused drastic topographic changes in the Pasig river basin even in the 1995 rainy season. This study simulated the process of lahar events and the resulting topographic changes by applying the two-dimensional simulation model . Although the study only shows general process of the topographic changes and not reproduce exactly the actual situation in the field, it could be useful to evaluate the possible flood/mudflow inundation areas in coming years.

The study area of the simulation study covers 27 km x 10 km area from the outlet of the Timbu river to the alluvial plain near Delta 5 watching point to 4 km downstream of GSO (Gapan San Fernando Olongapo) highway The original river channel of the Pasig river is placed almost in the center of the simulation area .

Topographic data were produced from DTM (Digital Topographic Map of 1:10,000 scale) based on the aerophotographs taken in Mar.1994.

The study reproduced the topograpy in the end of 1994 assuming sediment supply by lahar events during the 1994 rainy season. Then the topograpy in the end of 1995 was again reproduced assuming sediment supply by lahar events during the 1995 rainy season on the basis of the reproduced topography at the end of 1994.

The potential flood inundation area was estimated for 20 and 100 year probable flood events on the basis of the reproduced topography at the end of 1995.

6.2 LAHARS UNDER 1994 TOPOGRAPHIC CONDITION IN PASIG RIVER

The flow and sediment transport in 1994 was simulated under the following condition.

Topographic data	:	DTM in Mar.1994	
	:	Area of analysis	27 km x 10 km
	:	Mesh size	100 m x 100 m
Hydrograph	:	Combination of three hydrographs	
		Peak discharges	1000 m^3/s, 500 m^3/s and 100
m^3/s			
	:	Triangular shape of 5 hours duration for each hydrograph	
	:	One year simulation equivalent to 5 cycles	
	:	Sediment concentration	= 50 % for 1000 m^3/s,
			30 % for 500 m^3/s and
			10 % for 100 m^3/s
	:	Grain size	0.7 mm uniform

The total flow amount in this study was equivalent to 14.4 million m^3 including 70 million m^3 of sediment and 74 million m^3 of water in volume. Fig. G.42 shows the distribution of the maximum water depth and sediment deposits of every meshes over the simulation area in the end of 1994. The results can be compared with the chronological changes of Pasig in 1994 shown in Fig. G.43 which was reproduced from Appendix G.

6.3 LAHARS UNDER 1995 TOPOGRAPHIC CONDITION IN PASIG RIVER

The flow and sediment transport in 1995 was simulated based on the topographic condition simulated in the previous section under the following condition.

Topographic data	:	DTM produced in the 1994 simulation study	
	:	Area of analysis	27 km x 10 km
	:	Mesh size	100 m x 100 m
Hydrograph	:	Combination of three hydrographs	
		Peak discharges	1000 m^3/s, 500 m^3/s and 100 m^3/s
	:	Triangular shape of 5 hours duration for each hydrograph	
	:	One year simulation equivalent to 5 cycles	
	:	Sediment concentration	= 30 % for 1000 m^3/s, 10 % for 500 m^3/s and 5 % for 100 m^3/s

On the basis of the field observation in 1995, it was assumed that the sediment concentrations of lahars were lower in 1995 than those in 1994. The total flow amount in this study was equivalent to 14.4 million m^3 including 32 million m^3 of sediment and 112 million m^3 of water in volume. Fig. G.44 shows the distribution of the maximum water depth on the topographic map and Fig. G.45 shows the maximum water depth and sediment deposits of every meshes over the simulation area in 1995. The results can also be compared with the chronological changes of Pasig in 1995. The lahar flows were shifting towards the left hand direction downstream of the Angeles Porac road in 1995 and the situation was well expressed in the simulation study. The break of GSO highway ,however, was not be represented in the simulation and inundation in the lowest reaches was not well simulated in the study.

6.4 POTENTIAL INUNDATION STUDY IN PASIG RIVER BASIN

Potential flood inundation over flood prone areas in the Pasig river basin was simulated under the following condition for 2 cases of probable flood hydroghaphs in different return periods which were given by the study of USACE (Ref.G.4). The flood runoff was input at the outlet of the Timbu river.

Topographic data	:	DTM produced by the 1995 simulation study	
	:	Area of analysis	27 km x 10 km
	:	Mesh size	100 m x 100 m

Hydrographs at Delta 5

Return period	Peak discharge (m^3/s)
20-year flood	430
100-year flood	490

Sediment concentration is given by Brown's equation for the initial discharge

The distribution of maximum water depth of every meshes is illustrated on topographic maps produced by GIS as shown in Figure G.46 for 20 year flood and Figures G.47 for 100 year flood. Figures G.48 and G.49 show the distribution of maximum water depth and sediment deposits of every meshes for 20 and 100-year floods.

The potential inundation areas estimated in this study are summarized as follows:

Inundation Area in Pasig river basin (unit: ha)

Water Depth	20-Year Flood	100-Year Flood
0 < h < 0.2	3,596	2,434
0.2 < h < 1.0	2,246	3,922
1.0 < h	224	487
Total	6,066	6,843

Total area of analysis : 27000 ha

REFERENCE

Ref. No.	Title
G.1	Swiss Disaster Relief, "Lahars in the O'Donnell river system, Mt. Pinatubo, Philippines, Final Report", January 1994
G.2	PHIVOLCS-USGS, Progress Report of Joint PHIVOLCS-USGS collaboration, 1992 through mid-1994, Serious but Rapidly Diminishing Hazards at Mount Pinatubo, August, 1994
G.3	T.C. Pierson, R.J. Janda, J.V. Umbal and A.S. Daag, PHIVOLCS-USGS, Immediate and long-term hazards from lahars and excess sedimentation in rivers draining Mt. Pinatubo, Philippines, 1992
G.4	US Army Corps of Engineers, Mount Pinatubo Recovery Action Plan Long Term Report, Eight River Basins Republic of the Philippines, March 1994

TABLES

Table G.1 Sediment Transportation Capacity

Location	Catch-ment area (km2)	Hydraulic gradient	Width (m)	Discharge (m3/s)	Depth (m)	Sediment transport (m3/s)	Concentration
(1) Sacobia							
1) Maskup	38	0.0100	100	10	0.11	0.07	0.69%
				50	0.29	0.77	1.54%
				100	0.44	2.18	2.18%
				500	1.14	24.41	4.88%
				1000	1.73	69.05	6.91%
2) Sand Pocket	61	0.0048	100	10	0.14	0.02	0.19%
				50	0.36	0.21	0.42%
				100	0.54	0.60	0.60%
				500	1.43	6.66	1.33%
				1000	2.16	18.85	1.88%
(2) Bamban							
1) Malonzo	93	0.0038	200	10	0.10	0.01	0.09%
				50	0.25	0.10	0.21%
				100	0.38	0.29	0.29%
				500	1.00	3.24	0.65%
				1000	1.52	9.17	0.92%
2)San Francisco Bridge	94	0.0027	200	10	0.11	0.00	0.05%
				50	0.28	0.06	0.11%
				100	0.43	0.16	0.16%
				500	1.12	1.75	0.35%
				1000	1.69	4.95	0.49%
3)Confluence	98	0.0015	200	10	0.13	0.00	0.02%
				50	0.33	0.02	0.04%
				100	0.50	0.06	0.06%
				500	1.32	0.65	0.13%
				1000	2.00	1.85	0.18%
(3)Abacan							
1)Friendship Bridge	33	0.0067	200	10	0.08	0.02	0.17%
				50	0.21	0.19	0.38%
				100	0.32	0.53	0.53%
				500	0.85	5.94	1.19%
				1000	1.29	16.81	1.68%
2)San Jose Malino	77	0.0040	150	10	0.11	0.01	0.08%
				50	0.30	0.09	0.18%
				100	0.45	0.25	0.25%
				500	1.18	2.81	0.56%
				1000	1.79	7.94	0.79%

* Depth : Uniform Flow (Manning's Formula)
: n=0.025

* Sediment : Brown's Formula

* Diamenter of sediment : 0.7 mm in Sacobia-Bamban river
: 1.0 mm in Abacan river
Density=2.60

Table G.2 Daily Rainfall at Dagupan in1989

Station: DAGUPAN
Year: 1989
Agency: PAGASA

(Unit : mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0	0	2	0	0	1	0	2	15	0	0	0
2	0	0	0	3	1	0	0	39	1	9	0	0
3	0	0	0	12	1	0	0	69	3	5	0	0
4	0	0	0	0	25	23	0	19	44	0	0	0
5	0	0	0	0	0	0	0	19	4	0	0	0
6	0	0	0	0	0	2	1	42	1	5	0	0
7	0	0	0	0	0	4	0	39	0	5	0	0
8	0	0	0	1	0	0	56	9	28	2	0	0
9	0	0	0	0	0	0	2	1	208	0	0	0
10	0	0	0	1	2	8	0	2	62	3	0	0
11	0	0	0	0	0	1	3	0	34	5	0	0
12	0	0	0	0	0	1	0	16	14	0	0	0
13	0	0	0	0	0	0	1	29	17	0	0	0
14	0	0	2	0	53	2	0	2	8	0	0	0
15	0	0	45	0	1	0	81	36	2	0	0	0
16	0	0	0	0	0	0	137	1	19	0	0	1
17	0	0	0	0	28	0	14	4	21	0	0	0
18	0	0	0	0	12	0	3	30	0	0	0	0
19	0	0	0	0	0	0	1	49	0	199	0	0
20	14	0	7	0	9	70	6	10	0	6	0	0
21	0	0	35	0	0	13	8	3	0	0	2	0
22	0	0	0	0	0	42	0	11	1	3	52	0
23	0	0	4	0	0	14	0	17	2	0	0	0
24	0	0	0	0	8	30	0	0	0	0	0	0
25	0	0	0	0	0	0	4	0	0	0	0	0
26	0	0	0	0	9	0	59	0	2	0	0	0
27	0	0	0	0	4	0	3	0	0	0	0	0
28	0	8	0	0	0	0	2	0	35	0	0	0
29	0		0	1	0	31	116	0	19	0	0	0
30	0		0	0	2	4	89	0	1	0	0	0
31	0		1		0		34	0		0		0
Total	14	8	97	18	156	247	619	449	541	241	54	1
										Annual Total =		2446
Daily Max	14	8	45	12	53	70	137	69	208	199	52	1
Rainy Day	1	1	7	5	13	15	19	22	22	10	2	1

Table G.3 Daily Rainfall at Dagupan in1972

Station: DAGUPAN
Year: 1972
Agency: PAGASA

(Unit : mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0	0	17	0	6	2	5	108	0	10	0	0
2	0	0	3	0	1	0	3	107	30	1	0	0
3	0	0	0	0	0	24	69	155	15	0	0	0
4	0	0	0	0	0	0	1	131	2	2	0	0
5	0	0	0	0	1	0	23	36	0	0	3	2
6	0	0	0	0	0	40	70	19	0	1	0	0
7	0	0	0	0	5	64	224	6	0	0	0	1
8	0	0	0	0	0	28	77	0	0	0	0	0
9	5	0	0	0	4	31	110	0	0	0	0	0
10	0	0	0	0	3	23	86	2	21	22	0	0
11	0	0	0	0	0	22	58	0	0	0	0	0
12	2	0	0	0	0	0	42	4	60	0	0	14
13	2	0	0	0	0	0	21	37	0	0	0	0
14	0	0	0	1	0	0	64	18	0	0	0	0
15	0	0	0	0	0	0	15	202	5	0	0	0
16	0	0	0	0	0	0	31	203	0	10	0	0
17	0	0	0	0	0	0	148	87	22	0	0	0
18	0	0	0	0	1	3	171	5	2	0	0	0
19	0	0	10	0	14	0	157	0	0	0	0	0
20	0	0	0	0	6	4	183	1	0	0	0	0
21	0	0	0	0	0	8	65	4	30	0	0	0
22	0	0	0	0	9	26	1	19	3	2	0	0
23	0	0	0	0	0	0	18	34	4	0	0	0
24	0	0	0	25	0	0	26	50	0	0	0	0
25	0	0	0	0	2	7	81	22	0	8	0	0
26	0	0	0	0	1	3	77	6	2	0	0	0
27	0	0	0	0	16	4	150	9	4	0	0	0
28	0	1	0	0	1	2	313	3	2	0	0	0
29	0	1	0	0	11	0	136	5	0	0	0	0
30	5		0	0	0	7	104	1	0	0	0	0
31	0		0		0		132	3		1		0
Total	14	2	30	26	80	296	2659	1275	201	56	3	16
										Annual Total =		4657
Daily Max	5	1	17	25	16	64	313	203	60	22	3	14
Rainy Day	4	2	3	2	15	17	31	27	14	9	1	3

Table G.4 Annual Sediment Transportation Amount

Location	Catch-ment area (km2)	Hydraulic gradient	Rainfall	Annual runoff (million m3)	Annual Trans Cap (million m3)	Concen-tration	Annual deposit (million m3)
(1) Sacobia							
1) Maskup	38	0.0111	Dagupan	59.9	2.0	3.4%	3.4
		(1/90)	Clerk AB	59.6	2.1	3.5%	3.5
2) Sand Pocket	61	0.0048	Dagupan	96.1	0.9	1.0%	1.6
		(1/210)	Clerk AB	95.7	1.0	1.0%	1.6
(2) Bamban							
1) Malonzo	93	0.0038	Dagupan	146.6	0.9	0.6%	1.4
		(1/260)	Clerk AB	146.0	0.9	0.6%	1.6
2) Sanfrancisco Bridge	94	0.0027	Dagupan	148.1	0.5	0.3%	0.8
		(1/370)	Clerk AB	147.5	0.5	0.4%	0.9
3) Confluence	98	0.0015	Dagupan	154.4	0.2	0.1%	0.3
		(1/650)	Clerk AB	153.7	0.2	0.2%	0.4
(3)Abacan							
1) Friendship Bridge	33	0.0067	Dagupan	51.2	0.3	0.6%	0.6
		(1/150)	Clerk AB	48.0	0.3	0.6%	0.5
2) San Jose Malino	77	0.0040	Dagupan	119.6	0.6	0.5%	0.9
		(1/250)	Clerk AB	112.2	0.5	0.5%	0.9

* Depth : Uniform Flow (Manning's Formula)
: n=0.025
* Sediment : Brown's Formula
* Diamenter of sediment : 0.7 mm in Sacobia-Bamban river
: 1.0 mm in Abacan river
Density=2.60
*Discharge Average Year =1989

Table G.5 River Bed Profile of Sacobia River under 1989 Rainfall Condition

(1989 rainfall conditon) (El.m)

Section	distance	El in 94	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10 year
No52	0	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00
No50	400	103.00	102.64	102.58	102.56	102.55	102.54	102.53	102.52	102.51	102.51	102.50
No48	800	107.00	107.18	107.07	107.01	106.96	106.93	106.90	106.87	106.85	106.83	106.81
No46	1200	111.00	111.07	110.98	110.89	110.83	110.78	110.73	110.69	110.66	110.63	110.60
No44	1600	115.00	114.88	114.82	114.74	114.67	114.60	114.55	114.50	114.45	114.41	114.38
No42	2000	119.00	118.90	118.83	118.76	118.69	118.62	118.56	118.50	118.45	118.40	118.36
No40	2400	123.00	122.91	122.82	122.76	122.69	122.62	122.56	122.50	122.45	122.40	122.36
No38	2800	127.00	126.94	126.87	126.80	126.74	126.68	126.63	126.57	126.52	126.48	126.43
No36	3200	131.00	130.97	130.93	130.87	130.82	130.77	130.72	130.68	130.64	130.60	130.55
No34	3600	135.00	134.99	134.95	134.91	134.87	134.83	134.79	134.76	134.73	134.70	134.66
No32	4000	139.00	138.97	138.93	138.90	138.87	138.85	138.83	138.81	138.79	138.76	138.71
No30	4400	143.00	142.94	142.91	142.89	142.87	142.87	142.87	142.86	142.85	142.81	142.74
No28	4800	147.00	146.93	146.90	146.89	146.90	146.92	146.94	146.95	146.93	146.87	146.75
No26	5200	151.00	150.98	150.98	151.01	151.06	151.11	151.14	151.15	151.10	150.95	150.73
No24	5600	155.00	155.03	155.12	155.21	155.31	155.39	155.44	155.39	155.22	154.91	154.51
No22	6000	159.00	159.21	159.41	159.59	159.73	159.83	159.84	159.61	159.17	158.57	157.96
No20	6400	163.00	163.46	163.77	164.02	164.24	164.30	164.01	163.38	162.47	161.60	160.80
No18	6800	168.00	168.26	168.58	168.86	169.04	168.77	167.81	166.72	165.23	164.02	163.00
No16	7200	174.00	174.00	174.06	174.19	173.91	172.60	170.63	169.15	169.00	169.00	169.00
No14	7600	180.00	180.08	180.10	179.75	178.04	175.46	175.00	175.00	175.00	175.00	175.00
No12	8000	186.00	186.11	186.00	183.98	181.00	181.00	181.00	181.00	181.00	181.00	181.00
No10	8400	192.00	192.01	190.38	187.00	187.00	187.00	187.00	187.00	187.00	187.00	187.00
No8	8800	198.00	197.22	193.34	193.00	193.00	193.00	193.00	193.00	193.00	193.00	193.00
No6	9200	204.00	200.27	199.00	199.00	199.00	199.00	199.00	199.00	199.00	199.00	199.00
No4	9600	210.00	205.00	205.00	205.00	205.00	205.00	205.00	205.00	205.00	205.00	205.00
No2	10000	215.99	211.00	211.00	211.00	211.00	211.00	211.00	211.00	211.00	211.00	211.00
No1	10200	216.00	216.00	216.00	216.00	216.00	216.00	216.00	216.00	216.00	216.00	216.00

Table G.6 Sediment Transport of Sacobia River under 1989 Rainfall Condition

(1989 rainfall conditon) (El.m)

Section	distance	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10 year
No52	0										
No50	400	1,206	1,171	1,155	1,146	1,140	1,134	1,129	1,125	1,121	1,118
No48	800	1,101	1,155	1,149	1,142	1,136	1,131	1,127	1,123	1,120	1,116
No46	1200	1,143	1,129	1,134	1,132	1,128	1,124	1,121	1,118	1,115	1,113
No44	1600	1,154	1,115	1,121	1,122	1,120	1,117	1,115	1,113	1,110	1,108
No42	2000	1,129	1,104	1,105	1,107	1,107	1,106	1,105	1,104	1,102	1,101
No40	2400	1,106	1,090	1,089	1,091	1,092	1,092	1,092	1,093	1,092	1,092
No38	2800	1,087	1,070	1,074	1,075	1,077	1,078	1,079	1,081	1,081	1,082
No36	3200	1,072	1,050	1,057	1,060	1,061	1,064	1,066	1,068	1,070	1,070
No34	3600	1,065	1,040	1,043	1,046	1,048	1,051	1,054	1,057	1,059	1,059
No32	4000	1,061	1,029	1,031	1,035	1,037	1,041	1,044	1,048	1,049	1,048
No30	4400	1,052	1,020	1,023	1,027	1,031	1,036	1,039	1,042	1,041	1,035
No28	4800	1,037	1,011	1,017	1,024	1,030	1,036	1,039	1,039	1,032	1,017
No26	5200	1,018	1,002	1,015	1,027	1,035	1,041	1,041	1,034	1,013	983
No24	5600	1,010	1,004	1,025	1,041	1,050	1,053	1,043	1,016	968	911
No22	6000	1,021	1,031	1,055	1,071	1,077	1,068	1,029	962	867	784
No20	6400	1,092	1,102	1,116	1,120	1,112	1,070	953	809	659	575
No18	6800	1,221	1,188	1,187	1,181	1,128	988	779	554	414	351
No16	7200	1,310	1,300	1,282	1,243	1,038	657	402	41	0	0
No14	7600	1,311	1,319	1,317	1,166	682	120	0	0	0	0
No12	8000	1,333	1,324	1,226	714	0	0	0	0	0	0
No10	8400	1,359	1,297	741	0	0	0	0	0	0	0
No8	8800	1,363	970	66	0	0	0	0	0	0	0
No6	9200	1,211	208	0	0	0	0	0	0	0	0
No4	9600	600	0	0	0	0	0	0	0	0	0
No2	10000	200	0	0	0	0	0	0	0	0	0
No1	10200	0	0	0	0	0	0	0	0	0	0

Table G.7 River Bed Profile of Bamban/ River under 1989 Rainfall Condition

(1989 rainfall condition) (EL.m)

Section	distance	EL in94	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
No181	0	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01
No178	600	10.41	9.65	9.52	9.49	9.53	9.59	9.64	9.68	9.70	9.71	9.73
No175	1200	11.39	10.53	10.33	10.30	10.37	10.47	10.55	10.60	10.63	10.66	10.68
No172	1800	11.53	11.28	10.97	10.96	11.11	11.28	11.42	11.51	11.58	11.62	11.67
No169	2400	12.18	12.11	11.75	11.83	12.05	12.27	12.44	12.55	12.63	12.69	12.75
No166	3000	13.22	13.00	13.00	13.00	13.00	13.02	13.08	13.13	13.22	13.29	13.36
No163	3600	13.95	14.00	14.19	14.28	14.22	14.19	14.22	14.27	14.36	14.45	14.53
No160	4200	15.04	15.00	15.00	15.00	15.01	15.03	15.07	15.17	15.29	15.41	15.54
No157	4800	16.19	16.01	16.08	16.15	16.24	16.30	16.36	16.47	16.59	16.72	16.86
No154	5400	16.82	16.70	16.89	17.08	17.24	17.36	17.46	17.58	17.71	17.84	17.98
No151	6000	16.32	17.10	17.47	17.82	18.07	18.23	18.36	18.50	18.64	18.78	18.93
No148	6600	17.69	18.05	18.56	19.02	19.29	19.48	19.64	19.80	19.95	20.11	20.27
No145	7200	18.57	18.91	19.71	20.19	20.50	20.72	20.92	21.10	21.27	21.44	21.61
No142	7800	19.55	19.90	20.84	21.31	21.64	21.89	22.12	22.31	22.50	22.68	22.86
No139	8400	20.50	20.57	22.08	22.47	22.80	23.06	23.31	23.52	23.73	23.92	24.12
No136	9000	23.09	23.00	23.42	23.73	24.04	24.33	24.59	24.84	25.06	25.27	25.47
No133	9600	24.08	24.92	24.80	25.08	25.36	25.66	25.94	26.20	26.44	26.66	26.86
No130	10200	24.70	26.33	26.29	26.56	26.80	27.11	27.39	27.66	27.90	28.12	28.32
No127	10800	27.30	27.67	27.74	27.97	28.20	28.50	28.78	29.05	29.29	29.52	29.72
No124	11400	28.20	28.99	29.25	29.43	29.67	30.00	30.28	30.55	30.80	31.02	31.23
No121	12000	29.70	29.95	30.47	30.93	31.40	31.67	31.94	32.21	32.46	32.68	32.89
No118	12600	31.00	31.76	32.29	32.67	32.94	33.16	33.43	33.67	33.90	34.12	34.32
No115	13200	33.00	33.40	33.84	34.15	34.50	34.75	35.01	35.24	35.46	35.67	35.86
No112	13800	34.80	35.07	35.47	35.78	36.16	36.45	36.70	36.92	37.14	37.35	37.55
No109	14400	36.40	36.70	37.06	37.32	37.68	38.01	38.28	38.49	38.70	38.89	39.08
No106	15000	37.60	38.34	38.71	38.90	39.36	39.68	39.94	40.14	40.32	40.51	40.68
No103	15600	39.50	39.42	40.03	40.73	41.14	41.41	41.63	41.82	42.00	42.17	42.32
No100	16200	39.70	41.51	42.20	42.74	42.88	43.13	43.33	43.52	43.68	43.85	44.00
No97	16800	43.00	43.93	44.17	44.54	44.76	44.98	45.16	45.33	45.48	45.63	45.76
No94	17400	45.20	46.12	46.05	46.37	46.62	46.81	46.96	47.10	47.23	47.37	47.49
No91	18000	48.30	48.06	48.16	48.44	48.72	48.86	48.97	49.08	49.19	49.31	49.42
No88	18600	50.00	50.02	50.14	50.42	50.71	50.85	50.97	51.08	51.15	51.22	51.30
No85	19200	52.50	52.38	52.45	52.67	52.90	53.03	53.14	53.21	53.26	53.29	53.37
No82	19800	55.00	55.53	55.53	55.72	55.82	55.94	56.01	56.02	56.09	56.10	56.16
No79	20400	57.00	57.55	57.33	57.76	57.41	57.48	57.50	58.32	58.41	58.40	57.73
No76	21000	60.00	60.07	60.36	59.84	60.19	60.26	60.49	60.66	60.76	60.71	59.41
No73	21600	63.00	63.91	64.11	63.97	63.98	63.96	64.12	64.03	63.73	62.99	62.26
No70	22200	66.50	67.31	67.98	68.17	67.98	67.84	67.96	66.70	66.05	64.81	63.46
No67	22800	70.80	70.62	70.94	70.95	71.01	70.82	70.54	69.17	67.98	66.46	64.61
No64	23400	74.30	73.09	72.77	73.08	72.67	72.21	71.82	70.62	68.54	66.01	66.00
No61	24000	77.80	75.54	74.85	74.71	74.25	73.58	72.70	71.13	69.00	69.00	69.00
No58	24600	80.30	78.94	77.91	77.33	76.79	75.88	73.98	72.11	71.00	71.00	71.00
No55	25200	82.70	81.52	80.45	79.61	78.32	76.57	73.02	73.00	73.00	73.00	73.00
No52	25800	84.20	83.32	82.27	81.02	78.18	75.00	75.00	75.00	75.00	75.00	75.00
No49	26400	85.20	84.62	83.57	79.02	77.00	77.00	77.00	77.00	77.00	77.00	77.00
No46	27000	85.70	85.32	80.93	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00
No43	27600	86.10	81.00	81.00	81.01	81.00	81.00	81.00	81.00	81.00	81.00	81.00
No40	28200	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00

Tabel G.8 Sediment Transport of Bamban/River under 1989 Rainfall Condition

(1989 rainfall condition) (1000 m3)

Section	distance	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
No181	0	16	16	16	16	16	16	16	16	16	16
No178	600	618	388	329	338	379	421	452	473	490	503
No175	1200	469	363	323	347	390	431	458	478	493	507
No172	1800	313	329	316	360	408	445	467	484	498	511
No169	2400	275	279	315	383	434	467	482	494	505	518
No166	3000	262	220	327	420	471	495	502	507	516	527
No163	3600	235	220	327	421	479	510	514	517	525	536
No160	4200	236	249	341	412	474	514	522	530	538	548
No157	4800	233	249	346	417	479	521	534	545	554	564
No154	5400	202	261	358	432	489	531	552	566	577	587
No151	6000	180	296	391	462	512	548	574	590	601	612
No148	6600	290	348	440	498	537	568	595	613	625	635
No145	7200	354	438	521	548	574	599	626	644	656	667
No142	7800	408	567	617	610	621	640	662	680	693	703
No139	8400	463	722	710	675	672	686	702	719	731	741
No136	9000	471	890	782	735	723	733	745	759	770	779
No133	9600	456	969	841	793	778	783	792	803	812	819
No130	10200	615	946	895	846	835	836	843	849	856	861
No127	10800	869	938	946	892	899	894	899	900	903	905
No124	11400	935	950	988	932	956	949	952	948	947	946
No121	12000	1,082	997	1,021	975	1,017	1,003	1,007	998	993	989
No118	12600	1,109	1,052	1,071	1,026	1,072	1,060	1,066	1,052	1,043	1,036
No115	13200	1,242	1,144	1,138	1,073	1,111	1,110	1,111	1,096	1,084	1,075
No112	13800	1,312	1,219	1,191	1,134	1,155	1,156	1,154	1,138	1,124	1,113
No109	14400	1,362	1,293	1,247	1,203	1,208	1,203	1,195	1,180	1,164	1,151
No106	15000	1,412	1,353	1,289	1,262	1,262	1,247	1,230	1,215	1,197	1,182
No103	15600	1,529	1,410	1,319	1,334	1,315	1,291	1,265	1,248	1,229	1,212
No100	16200	1,523	1,461	1,378	1,381	1,360	1,330	1,297	1,278	1,259	1,239
No97	16800	1,711	1,563	1,463	1,404	1,399	1,364	1,328	1,306	1,286	1,265
No94	17400	1,779	1,598	1,527	1,442	1,438	1,397	1,358	1,333	1,314	1,291
No91	18000	1,930	1,587	1,582	1,486	1,471	1,423	1,383	1,356	1,338	1,313
No88	18600	1,883	1,606	1,639	1,540	1,500	1,448	1,407	1,380	1,364	1,337
No85	19200	1,885	1,628	1,689	1,592	1,524	1,471	1,427	1,394	1,378	1,355
No82	19800	1,856	1,645	1,742	1,647	1,556	1,496	1,445	1,406	1,385	1,375
No79	20400	1,961	1,645	1,844	1,706	1,620	1,538	1,453	1,444	1,389	1,414
No76	21000	2,043	1,613	1,909	1,653	1,630	1,541	1,576	1,461	1,387	1,310
No73	21600	2,054	1,656	1,831	1,705	1,641	1,576	1,647	1,508	1,366	1,052
No70	22200	2,369	1,747	1,761	1,710	1,634	1,651	1,602	1,396	1,111	796
No67	22800	2,525	1,876	1,868	1,602	1,607	1,675	1,359	1,271	872	538
No64	23400	2,477	1,960	1,871	1,619	1,557	1,600	998	957	470	49
No61	24000	2,274	1,906	1,924	1,549	1,480	1,535	796	608	75	50
No58	24600	2,002	1,824	1,908	1,494	1,399	1,429	608	393	75	50
No55	25200	1,594	1,513	1,734	1,335	1,124	862	44	78	79	76
No52	25800	1,310	1,257	1,532	1,026	702	35	79	79	79	76
No49	26400	1,121	1,029	1,263	413	28	77	79	79	79	76
No46	27000	1,007	825	376	27	77	79	79	79	79	76
No43	27600	936	16	25	57	77	79	79	79	79	76
No40	28200	19	19	56	79	77	79	79	79	79	76

Table G.9 River Bed Profile of Bamban/ River under 1972 Rainfall Condition

(1972 rainfall condition) (EL.m)

Section	distance	EL in94	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
No181	0	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01
No178	600	10.41	9.56	9.65	9.81	9.88	9.91	9.94	9.98	10.01	10.03	10.05
No175	1200	11.39	10.20	10.33	10.53	10.62	10.68	10.73	10.79	10.85	10.89	10.92
No172	1800	11.53	10.82	11.12	11.40	11.53	11.62	11.69	11.78	11.86	11.93	11.97
No169	2400	12.18	11.59	12.10	12.40	12.56	12.68	12.78	12.91	13.03	13.13	13.18
No166	3000	13.22	13.00	13.02	13.20	13.38	13.53	13.67	13.84	14.00	14.11	14.18
No163	3600	13.95	14.38	14.20	14.26	14.45	14.64	14.79	14.99	15.18	15.31	15.39
No160	4200	15.04	15.04	15.14	15.21	15.44	15.71	15.98	16.25	16.46	16.61	16.68
No157	4800	16.19	16.04	16.29	16.43	16.70	17.01	17.33	17.57	17.77	17.92	17.99
No154	5400	16.82	16.95	17.37	17.60	17.91	18.24	18.56	18.81	19.02	19.17	19.23
No151	6000	16.32	17.70	18.30	18.62	18.96	19.30	19.63	19.91	20.13	20.27	20.32
No148	6600	17.69	18.75	19.46	19.85	20.22	20.59	20.94	21.24	21.47	21.60	21.62
No145	7200	18.57	19.91	20.66	21.12	21.53	21.93	22.30	22.62	22.85	22.97	22.96
No142	7800	19.55	21.07	21.86	22.38	22.83	23.24	23.63	23.96	24.20	24.28	24.23
No139	8400	20.50	22.26	23.04	23.61	24.10	24.54	24.94	25.28	25.49	25.54	25.43
No136	9000	23.09	23.55	24.28	24.91	25.44	25.89	26.30	26.64	26.82	26.81	26.64
No133	9600	24.08	24.92	25.60	26.28	26.83	27.30	27.72	28.04	28.19	28.10	27.85
No130	10200	24.70	26.38	27.04	27.73	28.29	28.76	29.17	29.47	29.55	29.38	29.04
No127	10800	27.30	27.84	28.47	29.16	29.72	30.20	30.60	30.86	30.87	30.58	30.13
No124	11400	28.20	29.36	29.97	30.66	31.23	31.69	32.09	32.30	32.20	31.78	31.21
No121	12000	29.70	30.62	31.59	32.27	32.84	33.31	33.68	33.83	33.60	33.01	32.30
No118	12600	31.00	32.33	33.16	33.79	34.34	34.81	35.14	35.19	34.79	33.99	33.13
No115	13200	33.00	33.98	34.75	35.37	35.90	36.34	36.63	36.57	35.95	34.90	33.86
No112	13800	34.80	35.61	36.40	37.00	37.53	37.95	38.18	37.98	37.07	35.71	34.57
No109	14400	36.40	37.24	38.00	38.59	39.09	39.48	39.63	39.25	37.96	36.25	35.02
No106	15000	37.60	38.90	39.69	40.26	40.72	41.07	41.12	40.50	38.67	36.63	35.31
No103	15600	39.50	40.35	41.41	41.94	42.36	42.66	42.59	41.66	38.24	37.00	37.00
No100	16200	39.70	42.33	43.14	43.64	44.03	44.29	44.04	42.71	40.00	40.00	40.00
No97	16800	43.00	44.34	45.00	45.46	45.81	46.00	45.53	43.44	42.00	42.00	42.00
No94	17400	45.20	46.29	46.87	47.29	47.58	47.70	46.91	44.43	44.00	44.00	44.00
No91	18000	48.30	48.39	48.91	49.29	49.51	49.53	48.27	46.00	46.00	46.00	46.00
No88	18600	50.00	50.46	51.05	51.35	51.48	51.35	49.38	48.00	48.00	48.00	48.00
No85	19200	52.50	52.81	53.31	53.56	53.61	53.19	50.44	50.00	50.00	50.00	50.00
No82	19800	55.00	55.83	56.17	56.41	56.34	55.48	52.00	52.00	52.00	52.00	52.00
No79	20400	57.00	58.69	58.88	59.10	58.63	55.69	54.00	54.00	54.00	54.00	54.00
No76	21000	60.00	61.73	61.70	61.83	60.70	56.31	56.00	56.00	56.00	56.00	56.00
No73	21600	63.00	65.03	64.93	64.65	62.38	60.00	60.00	60.00	60.00	60.00	60.00
No70	22200	66.50	68.19	67.30	65.90	63.23	62.00	62.00	62.00	62.00	62.00	62.00
No67	22800	70.80	70.54	69.44	66.91	64.21	64.00	64.00	64.00	64.00	64.00	64.00
No64	23400	74.30	72.23	70.90	67.40	66.00	66.00	66.00	66.00	66.00	66.00	66.00
No61	24000	77.80	73.83	71.94	69.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00
No58	24600	80.30	76.01	73.78	71.00	71.01	71.00	71.00	71.00	71.00	71.00	71.00
No55	25200	82.70	77.88	75.18	73.00	73.00	73.00	73.00	73.00	73.00	73.00	73.00
No52	25800	84.20	79.70	76.50	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
No49	26400	85.20	81.23	77.30	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00
No46	27000	85.70	80.16	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00
No43	27600	86.10	81.10	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00
No40	28200	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00

Table G.10 River Bed Profile of Bamban River under 1989 Rainfall Condition
Case 1-a ; constant sediment supply and no dredging

(1989 rainfall condition) (EL.m)

Section	distance	EL in99	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
No181	0	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01
No178	600	10.41	9.71	9.66	9.64	9.64	9.65	9.66	9.68	9.69	9.71	9.72
No175	1200	11.39	10.64	10.57	10.54	10.54	10.55	10.58	10.60	10.62	10.65	10.67
No172	1800	11.53	11.56	11.44	11.40	11.41	11.43	11.47	11.51	11.56	11.60	11.64
No169	2400	12.18	12.55	12.43	12.39	12.40	12.44	12.49	12.55	12.60	12.66	12.72
No166	3000	13.22	12.98	12.88	12.87	12.90	12.95	13.02	13.10	13.18	13.25	13.33
No163	3600	13.95	14.01	13.93	13.93	13.98	14.05	14.14	14.22	14.31	14.40	14.49
No160	4200	15.04	14.61	14.58	14.63	14.72	14.83	14.96	15.08	15.21	15.35	15.48
No157	4800	16.19	15.74	15.77	15.86	15.97	16.10	16.24	16.37	16.51	16.65	16.79
No154	5400	16.82	16.63	16.74	16.88	17.02	17.18	17.33	17.48	17.63	17.77	17.92
No151	6000	16.32	17.20	17.43	17.67	17.88	18.07	18.23	18.39	18.55	18.71	18.87
No148	6600	17.69	18.29	18.61	18.92	19.16	19.35	19.52	19.69	19.86	20.03	20.20
No145	7200	18.57	19.38	19.81	20.15	20.40	20.60	20.80	20.99	21.18	21.36	21.54
No142	7800	19.55	20.49	20.93	21.29	21.56	21.79	22.01	22.21	22.41	22.60	22.79
No139	8400	20.50	21.55	22.13	22.45	22.74	22.98	23.21	23.43	23.65	23.85	24.05
No136	9000	23.09	22.98	23.40	23.71	23.99	24.25	24.50	24.75	24.98	25.20	25.42
No133	9600	24.08	24.31	24.74	25.04	25.32	25.59	25.86	26.12	26.37	26.60	26.82
No130	10200	24.70	25.74	26.17	26.51	26.76	27.04	27.32	27.59	27.84	28.07	28.29
No127	10800	27.30	27.17	27.57	27.90	28.12	28.43	28.71	28.99	29.24	29.48	29.70
No124	11400	28.20	28.69	29.06	29.37	29.53	29.93	30.23	30.51	30.76	31.00	31.22
No121	12000	29.70	29.74	30.16	30.71	31.34	31.61	31.90	32.18	32.44	32.67	32.89
No118	12600	31.00	31.61	32.04	32.50	32.94	33.12	33.40	33.66	33.90	34.13	34.35
No115	13200	33.00	33.35	33.69	34.03	34.39	34.71	35.00	35.24	35.47	35.70	35.90
No112	13800	34.80	35.05	35.36	35.67	36.06	36.42	36.71	36.94	37.18	37.40	37.60
No109	14400	36.40	36.68	37.00	37.25	37.62	38.00	38.29	38.53	38.76	38.97	39.15
No106	15000	37.60	38.35	38.69	38.86	39.32	39.69	39.97	40.20	40.41	40.60	40.77
No103	15600	39.50	39.46	40.06	40.72	41.14	41.43	41.69	41.91	42.11	42.28	42.44
No100	16200	39.70	41.59	42.26	42.78	42.92	43.17	43.42	43.65	43.84	44.00	44.14
No97	16800	43.00	44.01	44.26	44.61	44.83	45.04	45.27	45.49	45.66	45.80	45.92
No94	17400	45.20	46.11	46.15	46.47	46.73	46.90	47.11	47.30	47.45	47.56	47.68
No91	18000	48.30	48.14	48.30	48.59	48.84	48.97	49.16	49.33	49.44	49.52	49.65
No88	18600	50.00	50.13	50.34	50.65	50.92	51.08	51.21	51.32	51.39	51.43	51.58
No85	19200	52.50	52.44	52.69	52.95	53.20	53.37	53.49	53.62	53.76	53.90	54.00
No82	19800	55.00	55.58	55.84	56.04	56.22	56.36	56.46	56.56	56.66	56.77	56.80
No79	20400	57.00	58.45	58.67	58.71	58.82	58.97	59.05	59.11	59.18	59.26	59.37
No76	21000	60.00	61.37	61.79	61.89	61.94	62.02	62.07	62.10	62.12	62.15	62.19
No73	21600	63.00	64.29	64.78	64.92	64.86	64.75	64.64	64.53	64.43	64.35	64.28
No70	22200	66.50	66.45	66.37	66.07	65.80	65.46	65.16	64.90	64.68	64.47	64.28
No67	22800	70.82	69.06	68.54	67.95	67.38	66.85	66.42	66.05	65.76	65.45	65.22
No64	23400	72.21	71.04	69.99	69.01	68.02	67.31	66.76	66.29	66.01	66.00	66.00
No61	24000	73.58	72.43	70.76	69.54	69.00	69.00	69.00	69.00	69.00	69.00	69.00
No58	24600	75.88	74.49	71.87	71.07	71.00	71.00	71.01	71.00	71.00	71.00	71.00
No55	25200	76.57	73.01	73.00	73.00	73.00	73.00	73.00	73.00	73.00	73.00	73.00
No52	25800	75.00	75.01	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
No49	26400	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00
No46	27000	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00
No43	27600	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00
No40	28200	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00

Tabel G.11 Sediment Transport of Bamban River under 1989 Rainfall Condition
Case 1-a ; constant sediment supply and no dredging

(1989 rainfall condition) (1000 m3)

Section	distance	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
No181	0	16	16	16	16	16	16	16	16	16	16
No178	600	637	469	444	436	439	447	458	470	484	497
No175	1200	500	460	440	436	440	449	461	474	487	500
No172	1800	366	447	435	435	442	453	465	478	491	504
No169	2400	369	429	429	436	446	459	472	485	498	511
No166	3000	431	409	423	437	452	467	481	495	508	521
No163	3600	402	396	421	441	459	476	491	505	518	530
No160	4200	410	385	421	448	470	489	504	518	531	543
No157	4800	357	381	426	459	484	505	520	534	548	559
No154	5400	280	387	441	478	507	528	543	558	572	583
No151	6000	245	406	467	504	536	556	569	586	598	609
No148	6600	369	438	500	534	564	581	595	611	624	634
No145	7200	474	495	554	578	598	615	629	645	657	667
No142	7800	603	569	622	630	639	656	669	684	696	705
No139	8400	753	648	691	685	685	699	711	725	736	745
No136	9000	861	724	751	739	730	744	755	767	777	786
No133	9600	840	804	808	792	779	792	802	812	821	828
No130	10200	883	885	866	844	830	844	853	860	866	872
No127	10800	1,081	967	930	893	888	901	910	912	916	918
No124	11400	1,059	1,037	990	933	946	956	965	962	962	962
No121	12000	1,149	1,105	1,047	962	1,020	1,011	1,021	1,015	1,011	1,007
No118	12600	1,152	1,151	1,106	1,030	1,070	1,071	1,081	1,071	1,064	1,056
No115	13200	1,259	1,226	1,186	1,106	1,103	1,121	1,130	1,117	1,107	1,097
No112	13800	1,320	1,284	1,245	1,170	1,158	1,171	1,175	1,163	1,150	1,136
No109	14400	1,365	1,341	1,303	1,241	1,225	1,223	1,219	1,209	1,193	1,176
No106	15000	1,412	1,394	1,343	1,302	1,288	1,270	1,259	1,247	1,228	1,208
No103	15600	1,530	1,447	1,370	1,374	1,348	1,318	1,299	1,284	1,262	1,237
No100	16200	1,527	1,498	1,425	1,421	1,398	1,362	1,338	1,319	1,292	1,263
No97	16800	1,727	1,598	1,507	1,443	1,439	1,402	1,376	1,351	1,320	1,287
No94	17400	1,812	1,641	1,569	1,481	1,477	1,443	1,415	1,382	1,345	1,310
No91	18000	1,962	1,648	1,623	1,528	1,507	1,480	1,451	1,408	1,366	1,331
No88	18600	1,931	1,680	1,681	1,577	1,534	1,521	1,487	1,434	1,384	1,358
No85	19200	1,955	1,717	1,737	1,626	1,562	1,548	1,511	1,450	1,392	1,391
No82	19800	1,942	1,777	1,799	1,685	1,602	1,578	1,541	1,484	1,425	1,415
No79	20400	2,073	1,921	1,913	1,791	1,684	1,638	1,599	1,546	1,494	1,434
No76	21000	2,299	1,987	1,926	1,828	1,738	1,671	1,625	1,575	1,530	1,489
No73	21600	1,585	1,026	729	578	496	407	342	288	245	201
No70	22200	2,096	1,378	845	531	402	323	262	219	187	156
No67	22800	2,086	1,364	786	479	337	265	212	178	146	120
No64	23400	1,622	1,227	630	329	196	154	114	101	63	61
No61	24000	1,426	1,050	465	162	78	61	36	54	63	61
No58	24600	1,288	849	319	101	78	61	36	54	63	61
No55	25200	872	63	79	79	78	76	76	77	78	78
No52	25800	43	78	79	79	78	76	76	77	78	78
No49	26400	76	77	79	79	78	76	76	77	78	78
No46	27000	79	77	79	79	78	76	76	77	78	78
No43	27600	79	77	79	79	78	76	76	77	78	78
No40	28200	79	77	79	79	78	76	76	77	78	78

Table G.12 River Bed Profile of Diversion Channel under 1989 Rainfall Condition
Case 1-a ; constant sediment supply and no dredging

(1989 rainfall condition) (EL.m)

Section	distance	EL in99	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
N49	0	63.20	62.72	63.27	63.48	63.55	63.59	63.61	63.62	63.63	63.64	63.64
N50	280	64.75	64.30	64.90	65.17	65.26	65.32	65.34	65.36	65.38	65.39	65.39
N51	560	66.30	66.11	66.72	67.01	67.12	67.19	67.21	67.22	67.24	67.25	67.26
N52	840	67.85	67.86	68.45	68.77	68.85	68.91	68.96	68.98	69.00	69.02	69.03
N53	1120	69.40	69.67	70.27	70.59	70.66	70.71	70.78	70.79	70.80	70.82	70.84
N54	1400	70.95	71.48	72.05	72.35	72.47	72.50	72.55	72.57	72.61	72.64	72.66
N55	1680	72.50	73.22	73.79	74.07	74.24	74.25	74.28	74.36	74.43	74.50	74.53
N56	1960	74.05	75.01	75.57	75.86	76.12	76.16	76.17	76.32	76.43	76.52	76.61
N57	2240	75.60	76.82	77.47	77.64	78.18	78.64	78.80	78.93	79.01	79.09	79.16
N58	2520	77.15	78.68	79.72	80.46	80.80	81.00	81.23	81.33	81.42	81.52	81.62
N59	2800	78.70	81.50	82.41	82.97	83.33	83.45	83.72	83.82	83.92	84.04	84.14
N60	2850	80.90	82.05	82.82	83.15	83.48	84.00	84.18	84.26	84.36	84.48	84.54
N61	3075	82.15	83.86	84.41	85.31	85.69	86.02	86.25	86.27	86.41	86.54	86.64
N62	3300	83.40	85.95	86.84	87.26	87.77	87.86	88.26	88.30	88.46	88.62	88.77
N63	3350	85.70	86.43	87.27	87.53	87.99	88.17	88.59	88.92	88.99	89.07	89.19
N64	3575	86.95	88.31	89.01	89.07	89.74	90.33	90.60	90.95	91.05	91.14	91.25
N65	3800	88.20	90.15	90.84	91.37	91.96	92.43	92.57	92.82	93.10	93.20	93.32
N66	3850	90.50	90.68	91.13	91.68	92.15	92.51	92.84	93.12	93.55	93.74	93.82
N67	4075	91.75	92.71	92.87	93.41	93.75	94.10	94.76	95.21	95.58	95.79	95.89
N68	4300	93.00	94.85	93.98	95.00	95.29	95.86	96.82	97.23	97.45	97.85	97.95
N69	4350	95.30	95.31	95.30	95.36	95.67	96.26	97.01	97.43	97.76	98.36	98.56
N70	4575	96.55	97.25	97.00	96.93	97.20	97.91	98.53	98.97	99.98	100.40	100.61
N71	4800	97.80	99.43	98.29	97.80	97.86	98.70	100.16	101.02	102.09	102.28	102.65
N72	4850	100.10	100.36	100.10	100.10	100.10	100.10	100.34	101.36	102.20	102.60	103.30
N73	5075	101.35	102.38	101.88	101.89	101.88	101.88	101.98	103.05	103.85	104.81	105.38
N74	5300	102.60	104.31	106.52	106.66	106.62	106.64	106.53	106.54	106.58	106.91	107.47
N75	5350	104.90	104.90	106.90	107.00	106.96	106.98	106.99	107.01	107.00	107.19	108.56
N76	5475	105.60	106.79	107.91	108.06	108.01	108.02	107.99	108.00	108.05	109.19	109.90
N77	5600	106.30	108.80	112.03	112.84	113.08	113.09	113.11	113.06	113.05	113.09	113.13
N78	5650	111.00	111.00	112.39	113.76	113.52	113.44	113.49	113.44	113.74	113.45	113.49
N79	5900	113.50	113.58	114.21	115.90	116.46	116.47	116.50	116.41	116.32	116.37	116.40
N80	6150	116.00	116.02	116.32	117.79	118.79	118.94	118.92	119.07	118.83	119.08	119.07
N81	6400	118.50	118.50	118.53	119.79	121.28	121.39	121.46	121.30	121.25	121.09	121.62
N82	6650	121.00	121.00	121.00	121.75	123.28	124.06	123.64	123.52	123.87	124.24	123.91
N83	6900	123.50	123.50	123.50	123.87	125.01	126.47	125.62	125.57	126.35	126.52	126.22
N84	7150	126.00	126.00	126.00	126.11	126.95	128.46	129.32	128.28	128.70	128.40	128.15
N85	7650	131.00	131.00	131.00	131.00	131.23	132.17	133.94	134.30	132.37	131.73	131.49
N86	8150	136.00	136.00	136.01	136.01	136.01	136.33	137.66	139.38	139.27	139.15	139.12
N87	8650	141.00	141.00	141.00	141.00	141.02	141.00	141.58	143.22	144.20	144.13	144.09
N88	9150	146.00	146.00	146.03	146.04	146.00	146.05	146.07	146.87	147.77	147.73	147.69
N89	9650	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00

Tabel G.13 Sediment Transport of Diversion Channel under 1989 Rainfall Condition
Case 1-a ; constant sediment supply and no dredging

(1989 rainfall condition) (1000 m3)

Section	distance	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
N49	0	1,185	1,195	1,256	1,284	1,298	1,299	1,300	1,303	1,305	1,309
N50	280	1,166	1,217	1,265	1,287	1,300	1,299	1,301	1,303	1,305	1,309
N51	560	1,148	1,241	1,275	1,290	1,302	1,300	1,302	1,304	1,305	1,309
N52	840	1,140	1,265	1,286	1,295	1,305	1,301	1,302	1,305	1,306	1,310
N53	1120	1,141	1,288	1,299	1,298	1,307	1,303	1,303	1,305	1,307	1,311
N54	1400	1,151	1,312	1,312	1,301	1,309	1,305	1,304	1,306	1,308	1,311
N55	1680	1,172	1,335	1,324	1,305	1,310	1,307	1,305	1,307	1,309	1,312
N56	1960	1,200	1,357	1,335	1,312	1,310	1,309	1,308	1,310	1,312	1,313
N57	2240	1,239	1,379	1,347	1,322	1,312	1,309	1,314	1,315	1,315	1,317
N58	2520	1,287	1,405	1,353	1,344	1,331	1,316	1,319	1,318	1,319	1,321
N59	2800	1,347	1,446	1,384	1,361	1,343	1,330	1,327	1,325	1,326	1,328
N60	2850	1,367	1,453	1,391	1,365	1,345	1,335	1,328	1,326	1,328	1,330
N61	3075	1,403	1,478	1,401	1,376	1,362	1,341	1,331	1,330	1,333	1,333
N62	3300	1,458	1,495	1,431	1,390	1,377	1,353	1,332	1,338	1,341	1,340
N63	3350	1,476	1,502	1,435	1,397	1,378	1,359	1,333	1,340	1,344	1,342
N64	3575	1,500	1,529	1,443	1,411	1,384	1,373	1,344	1,343	1,347	1,347
N65	3800	1,543	1,551	1,445	1,433	1,404	1,384	1,361	1,348	1,352	1,354
N66	3850	1,557	1,556	1,449	1,438	1,409	1,386	1,364	1,352	1,353	1,356
N67	4075	1,563	1,570	1,466	1,453	1,421	1,396	1,373	1,367	1,360	1,359
N68	4300	1,594	1,575	1,483	1,464	1,432	1,418	1,389	1,383	1,370	1,364
N69	4350	1,607	1,571	1,492	1,466	1,436	1,426	1,394	1,386	1,376	1,365
N70	4575	1,608	1,576	1,498	1,480	1,455	1,449	1,407	1,397	1,396	1,372
N71	4800	1,630	1,568	1,496	1,488	1,477	1,469	1,421	1,431	1,415	1,383
N72	4850	1,642	1,571	1,497	1,498	1,486	1,480	1,427	1,442	1,417	1,388
N73	5075	1,651	1,575	1,498	1,498	1,493	1,492	1,460	1,468	1,430	1,411
N74	5300	1,684	1,559	1,498	1,498	1,493	1,496	1,493	1,494	1,463	1,438
N75	5350	1,696	1,576	1,499	1,497	1,494	1,494	1,493	1,494	1,467	1,446
N76	5475	1,698	1,611	1,501	1,496	1,494	1,495	1,494	1,494	1,470	1,473
N77	5600	1,719	1,631	1,504	1,495	1,494	1,494	1,494	1,495	1,492	1,493
N78	5650	1,737	1,672	1,522	1,501	1,494	1,494	1,493	1,495	1,493	1,494
N79	5900	1,737	1,721	1,571	1,493	1,491	1,496	1,491	1,506	1,482	1,495
N80	6150	1,740	1,743	1,630	1,513	1,492	1,497	1,488	1,502	1,484	1,496
N81	6400	1,744	1,754	1,682	1,549	1,497	1,496	1,493	1,494	1,494	1,496
N82	6650	1,744	1,755	1,727	1,602	1,501	1,499	1,488	1,492	1,488	1,515
N83	6900	1,744	1,755	1,753	1,656	1,530	1,483	1,484	1,505	1,501	1,503
N84	7150	1,745	1,755	1,767	1,696	1,582	1,452	1,482	1,533	1,508	1,492
N85	7650	1,745	1,755	1,775	1,755	1,689	1,516	1,405	1,562	1,486	1,474
N86	8150	1,745	1,755	1,777	1,772	1,754	1,642	1,432	1,424	1,441	1,457
N87	8650	1,745	1,757	1,777	1,772	1,777	1,736	1,557	1,415	1,433	1,454
N88	9150	1,746	1,759	1,779	1,775	1,777	1,776	1,673	1,486	1,427	1,451
N89	9650	1,748	1,763	1,780	1,772	1,781	1,778	1,729	1,550	1,424	1,448

Table G.14 River Bed Profile of Bamban River under 1989 Rainfall Condition
Case 1-b ; constant sediment supply and dredging works

(1989 rainfall condition) (EL.m)

Section	distance	EL in99	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
No181	0	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01
No178	600	10.41	9.71	9.66	9.64	9.64	9.65	9.66	9.67	9.68	9.69	9.70
No175	1200	11.39	10.64	10.57	10.54	10.54	10.55	10.57	10.59	10.61	10.63	10.64
No172	1800	11.53	11.56	11.44	11.40	11.40	11.43	11.46	11.49	11.53	11.56	11.59
No169	2400	12.18	12.55	12.43	12.39	12.40	12.43	12.47	12.52	12.57	12.61	12.65
No166	3000	13.22	12.98	12.88	12.87	12.89	12.94	13.00	13.06	13.12	13.18	13.23
No163	3600	13.95	14.01	13.93	13.93	13.97	14.03	14.11	14.18	14.24	14.31	14.36
No160	4200	15.04	14.61	14.58	14.63	14.71	14.80	14.91	15.01	15.10	15.19	15.27
No157	4800	16.19	15.74	15.77	15.85	15.95	16.06	16.18	16.28	16.38	16.47	16.56
No154	5400	16.82	16.63	16.74	16.87	17.00	17.13	17.25	17.36	17.46	17.55	17.64
No151	6000	16.32	17.20	17.43	17.65	17.84	18.00	18.13	18.24	18.35	18.45	18.54
No148	6600	17.69	18.29	18.61	18.89	19.11	19.27	19.39	19.51	19.61	19.71	19.81
No145	7200	18.57	19.38	19.80	20.11	20.33	20.49	20.63	20.75	20.87	20.97	21.06
No142	7800	19.55	20.49	20.91	21.23	21.46	21.64	21.78	21.90	22.02	22.12	22.21
No139	8400	20.50	21.55	22.10	22.37	22.59	22.77	22.91	23.03	23.15	23.25	23.34
No136	9000	23.09	22.98	23.37	23.60	23.80	23.96	24.11	24.24	24.35	24.45	24.54
No133	9600	24.08	24.31	24.68	24.90	25.07	25.22	25.36	25.49	25.59	25.69	25.78
No130	10200	24.70	25.74	26.09	26.30	26.47	26.61	26.73	26.84	26.93	27.02	27.10
No127	10800	27.30	27.17	27.46	27.65	27.80	27.92	28.03	28.12	28.21	28.29	28.34
No124	11400	28.20	28.69	28.92	29.09	29.21	29.31	29.41	29.49	29.55	29.60	29.61
No121	12000	29.70	29.74	29.95	30.12	30.27	30.41	30.59	30.76	30.94	31.12	31.29
No118	12600	31.00	31.61	31.80	31.95	32.07	32.19	32.32	32.44	32.56	32.68	32.79
No115	13200	33.00	33.35	33.47	33.56	33.65	33.73	33.82	33.91	33.99	34.07	34.15
No112	13800	34.80	35.05	35.14	35.22	35.30	35.38	35.46	35.54	35.62	35.69	35.76
No109	14400	36.40	36.68	36.78	36.86	36.94	37.00	37.07	37.13	37.18	37.23	37.28
No106	15000	37.60	38.35	38.47	38.55	38.64	38.69	38.74	38.79	38.83	38.85	38.87
No103	15600	39.50	39.46	39.67	39.82	39.98	40.08	40.20	40.32	40.44	40.56	40.67
No100	16200	39.70	41.59	41.92	42.08	42.22	42.31	42.40	42.49	42.57	42.66	42.74
No97	16800	43.00	44.01	44.07	44.18	44.27	44.33	44.39	44.44	44.49	44.54	44.59
No94	17400	45.20	46.11	46.07	46.15	46.21	46.26	46.31	46.35	46.39	46.43	46.47
No91	18000	48.30	48.14	48.28	48.38	48.42	48.46	48.49	48.53	48.56	48.59	48.62
No88	18600	50.00	50.13	50.30	50.49	50.54	50.58	50.62	50.65	50.68	50.70	50.72
No85	19200	52.50	52.44	52.64	52.88	52.93	52.96	52.98	52.99	53.00	53.01	53.02
No82	19800	55.00	55.58	55.79	55.99	56.05	56.09	56.09	56.09	56.09	56.09	56.07
No79	20400	57.00	58.45	58.65	58.68	58.75	58.78	58.77	58.73	58.69	58.65	58.60
No76	21000	60.00	61.37	61.78	61.88	61.90	61.90	61.87	61.81	61.74	61.66	61.59
No73	21600	63.00	64.29	64.78	64.92	64.85	64.71	64.55	64.38	64.21	64.01	63.74
No70	22200	66.50	66.45	66.36	66.07	65.74	65.40	65.09	64.82	64.57	64.31	64.07
No67	22800	70.82	69.06	68.51	67.93	67.29	66.78	66.37	66.00	65.66	65.31	65.04
No64	23400	72.21	71.04	69.94	68.92	67.89	67.22	66.70	66.24	66.00	66.00	66.00
No61	24000	73.58	72.43	70.67	69.28	69.00	69.00	69.00	69.00	69.00	69.00	69.00
No58	24600	75.88	74.49	71.85	71.00	71.00	71.01	71.01	71.00	71.00	71.00	71.00
No55	25200	76.57	73.01	73.00	73.00	73.00	73.00	73.00	73.00	73.00	73.00	73.00
No52	25800	75.00	75.01	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
No49	26400	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00
No46	27000	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00
No43	27600	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00
No40	28200	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00

Tabel G.15 Sediment Transport of Bamban River under 1989 Rainfall Condition
Case 1-b ; constant sediment supply and dredging works

(1989 rainfall condition) (1000 m3)

Section	distance	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
No181	0	16	16	16	16	16	16	16	16	16	16
No178	600	637	469	444	436	438	445	454	465	475	484
No175	1200	500	460	440	435	439	447	457	467	477	486
No172	1800	366	447	435	435	441	450	460	471	480	489
No169	2400	369	429	429	435	444	455	466	476	486	494
No166	3000	431	409	423	437	450	462	474	484	493	501
No163	3600	402	396	420	440	456	470	482	491	500	507
No160	4200	410	385	420	446	465	481	492	501	509	516
No157	4800	357	381	426	456	477	494	505	513	520	526
No154	5400	280	386	440	473	496	514	523	529	535	541
No151	6000	245	406	464	497	520	537	542	547	552	558
No148	6600	369	437	495	523	543	557	560	564	567	572
No145	7200	474	493	545	562	572	581	583	585	587	590
No142	7800	603	565	608	606	605	608	608	609	608	609
No139	8400	753	640	670	652	640	636	634	632	629	627
No136	9000	861	712	719	693	673	662	658	655	649	644
No133	9600	840	786	762	731	704	689	683	677	668	661
No130	10200	883	857	803	765	732	716	706	697	686	679
No127	10800	1,081	923	844	797	759	739	728	716	703	697
No124	11400	1,059	951	907	885	869	848	835	821	806	795
No121	12000	1,149	1,083	1,031	999	980	958	941	925	906	889
No118	12600	1,152	1,110	1,076	1,060	1,049	1,031	1,014	999	980	961
No115	13200	1,259	1,229	1,190	1,169	1,156	1,141	1,123	1,106	1,088	1,068
No112	13800	1,320	1,310	1,287	1,271	1,256	1,244	1,225	1,207	1,188	1,168
No109	14400	1,365	1,372	1,363	1,364	1,361	1,351	1,332	1,313	1,293	1,273
No106	15000	1,412	1,434	1,438	1,453	1,453	1,444	1,425	1,404	1,384	1,362
No103	15600	1,530	1,531	1,530	1,545	1,540	1,532	1,511	1,489	1,467	1,444
No100	16200	1,527	1,546	1,557	1,585	1,589	1,583	1,563	1,541	1,519	1,496
No97	16800	1,727	1,665	1,654	1,681	1,678	1,674	1,653	1,632	1,609	1,586
No94	17400	1,812	1,749	1,716	1,751	1,751	1,753	1,737	1,721	1,703	1,681
No91	18000	1,962	1,742	1,729	1,763	1,760	1,761	1,744	1,729	1,710	1,688
No88	18600	1,931	1,769	1,748	1,771	1,768	1,768	1,751	1,735	1,716	1,693
No85	19200	1,955	1,799	1,783	1,779	1,775	1,774	1,756	1,741	1,720	1,696
No82	19800	1,942	1,847	1,840	1,790	1,783	1,778	1,760	1,744	1,723	1,698
No79	20400	2,073	1,962	1,951	1,830	1,801	1,783	1,760	1,743	1,719	1,691
No76	21000	2,299	2,020	1,963	1,854	1,810	1,778	1,749	1,730	1,705	1,676
No73	21600	1,585	1,046	766	575	501	438	383	343	307	275
No70	22200	2,096	1,399	877	519	389	320	266	233	201	178
No67	22800	2,086	1,382	821	456	323	261	213	186	152	131
No64	23400	1,622	1,235	670	287	188	152	115	96	62	58
No61	24000	1,426	1,050	499	112	75	66	37	57	63	58
No58	24600	1,288	838	332	79	75	66	37	57	63	58
No55	25200	872	44	79	79	78	76	76	77	78	77
No52	25800	43	76	79	79	78	76	76	77	78	77
No49	26400	76	77	79	79	78	76	76	77	78	77
No46	27000	79	77	79	79	78	76	76	77	78	77
No43	27600	79	77	79	79	78	76	76	77	78	77
No40	28200	79	77	79	79	78	76	76	77	78	77

Table G.16 River Bed Profile of Diversion Channel under 1989 Rainfall Condition
Case 1-b ; constant sediment supply and dredging works

(1989 rainfall condition) (EL.m)

Section	distance	EL in99	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
N49	0	63.20	62.72	63.27	63.49	63.51	63.51	63.49	63.43	63.37	63.30	63.24
N50	280	64.75	64.30	64.89	65.18	65.24	65.26	65.24	65.20	65.16	65.11	65.06
N51	560	66.30	66.11	66.72	67.02	67.11	67.14	67.14	67.10	67.07	67.03	66.99
N52	840	67.85	67.86	68.45	68.74	68.85	68.88	68.88	68.85	68.85	68.82	68.79
N53	1120	69.40	69.67	70.25	70.56	70.67	70.70	70.71	70.69	70.69	70.67	70.65
N54	1400	70.95	71.48	72.04	72.36	72.48	72.50	72.52	72.51	72.47	72.46	72.44
N55	1680	72.50	73.22	73.77	74.07	74.25	74.26	74.27	74.28	74.27	74.26	74.23
N56	1960	74.05	75.01	75.57	75.85	76.12	76.13	76.13	76.16	76.19	76.19	76.16
N57	2240	75.60	76.82	77.46	77.66	78.19	78.60	78.75	78.85	78.90	78.94	78.97
N58	2520	77.15	78.68	79.67	80.45	80.77	80.98	81.17	81.30	81.36	81.43	81.46
N59	2800	78.70	81.50	82.32	82.98	83.30	83.45	83.65	83.82	83.89	84.00	84.04
N60	2850	80.90	82.05	82.72	83.15	83.52	83.99	84.17	84.25	84.33	84.40	84.45
N61	3075	82.15	83.86	84.37	85.30	85.69	86.00	86.24	86.27	86.37	86.45	86.51
N62	3300	83.40	85.95	86.76	87.39	87.74	87.84	88.22	88.30	88.42	88.52	88.59
N63	3350	85.70	86.43	87.22	87.46	87.96	88.15	88.55	88.91	88.99	89.02	89.08
N64	3575	86.95	88.31	88.97	89.11	89.54	90.26	90.57	90.94	91.06	91.08	91.15
N65	3800	88.20	90.15	90.84	91.22	91.78	92.24	92.67	92.80	93.11	93.13	93.22
N66	3850	90.50	90.68	91.22	91.63	92.18	92.51	92.86	93.11	93.46	93.73	93.77
N67	4075	91.75	92.71	92.86	93.27	93.75	93.97	94.62	95.22	95.45	95.80	95.83
N68	4300	93.00	94.85	94.06	94.23	95.27	95.74	96.64	97.26	97.44	97.77	97.88
N69	4350	95.30	95.31	95.30	95.30	95.68	96.18	96.93	97.35	97.64	98.11	98.50
N70	4575	96.55	97.25	97.01	96.99	96.97	97.89	98.63	99.02	99.76	100.16	100.58
N71	4800	97.80	99.43	98.31	98.26	97.81	98.88	99.94	100.46	101.70	102.21	102.62
N72	4850	100.10	100.36	100.10	100.10	100.10	100.10	100.25	100.89	101.98	102.37	102.98
N73	5075	101.35	102.38	101.88	101.89	101.88	101.88	101.74	102.67	103.56	104.67	105.10
N74	5300	102.60	104.31	106.62	106.65	106.56	106.55	106.50	106.53	106.56	106.81	107.27
N75	5350	104.90	104.90	106.96	107.11	107.02	107.03	106.97	106.99	106.90	107.18	107.43
N76	5475	105.60	106.79	108.01	108.10	108.00	107.94	107.97	107.99	107.95	108.11	109.62
N77	5600	106.30	108.80	112.07	112.88	113.09	113.11	113.00	113.10	112.99	113.09	113.12
N78	5650	111.00	111.00	112.42	113.74	113.52	113.47	113.76	113.48	113.78	113.44	113.51
N79	5900	113.50	113.58	114.25	115.90	116.47	116.43	116.39	116.47	116.37	116.46	116.36
N80	6150	116.00	116.02	116.34	117.80	118.76	118.98	118.73	119.06	118.69	119.10	119.04
N81	6400	118.50	118.50	118.54	119.80	121.27	121.47	121.38	121.30	121.40	121.41	121.63
N82	6650	121.00	121.00	121.00	121.76	123.31	124.02	123.67	123.42	123.87	123.91	123.88
N83	6900	123.50	123.50	123.50	123.90	125.04	126.47	125.69	125.52	126.48	126.44	126.21
N84	7150	126.00	126.00	126.00	126.14	126.99	128.48	129.29	128.25	128.67	128.34	128.14
N85	7650	131.00	131.00	131.00	131.01	131.26	132.23	134.00	134.29	132.20	131.72	131.47
N86	8150	136.00	136.00	136.01	136.03	136.02	136.36	137.73	139.39	139.25	139.15	139.11
N87	8650	141.00	141.00	141.00	141.00	141.03	141.01	141.62	143.28	144.19	144.13	144.08
N88	9150	146.00	146.00	146.03	146.04	146.00	146.04	146.08	146.94	147.76	147.73	147.69
N89	9650	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00

Tabel G.17 Sediment Transport of Diversion Channel under 1989 Rainfall Condition
Case 1-b ; constant sediment supply and dredging works

(1989 rainfall condition) (1000 m3)

Section	distance	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
N49	0	1,185	1,201	1,258	1,292	1,311	1,320	1,330	1,341	1,352	1,361
N50	280	1,166	1,223	1,267	1,293	1,311	1,319	1,327	1,339	1,349	1,359
N51	560	1,148	1,247	1,278	1,295	1,311	1,318	1,326	1,337	1,347	1,357
N52	840	1,140	1,271	1,290	1,298	1,313	1,318	1,324	1,336	1,346	1,355
N53	1120	1,141	1,294	1,302	1,302	1,314	1,318	1,323	1,335	1,344	1,354
N54	1400	1,151	1,317	1,314	1,307	1,315	1,318	1,323	1,336	1,343	1,354
N55	1680	1,172	1,339	1,326	1,311	1,316	1,319	1,322	1,334	1,343	1,353
N56	1960	1,200	1,361	1,338	1,318	1,317	1,319	1,323	1,333	1,342	1,352
N57	2240	1,239	1,383	1,349	1,329	1,317	1,319	1,324	1,334	1,342	1,351
N58	2520	1,287	1,408	1,357	1,350	1,334	1,325	1,329	1,336	1,345	1,352
N59	2800	1,347	1,448	1,390	1,366	1,347	1,337	1,337	1,340	1,349	1,354
N60	2850	1,367	1,454	1,397	1,370	1,349	1,340	1,340	1,342	1,351	1,355
N61	3075	1,403	1,475	1,411	1,382	1,364	1,346	1,343	1,345	1,354	1,357
N62	3300	1,458	1,492	1,441	1,397	1,378	1,359	1,345	1,350	1,359	1,361
N63	3350	1,476	1,498	1,447	1,401	1,380	1,364	1,346	1,352	1,361	1,362
N64	3575	1,500	1,523	1,455	1,417	1,385	1,377	1,358	1,355	1,362	1,364
N65	3800	1,543	1,544	1,459	1,431	1,410	1,390	1,376	1,361	1,363	1,368
N66	3850	1,557	1,549	1,462	1,435	1,414	1,396	1,378	1,366	1,364	1,370
N67	4075	1,563	1,566	1,475	1,453	1,425	1,407	1,386	1,377	1,372	1,371
N68	4300	1,594	1,570	1,488	1,468	1,432	1,428	1,406	1,387	1,390	1,372
N69	4350	1,607	1,566	1,490	1,476	1,435	1,435	1,413	1,390	1,395	1,374
N70	4575	1,608	1,567	1,493	1,497	1,451	1,459	1,427	1,399	1,410	1,387
N71	4800	1,630	1,560	1,492	1,496	1,481	1,482	1,440	1,423	1,425	1,407
N72	4850	1,642	1,563	1,492	1,500	1,494	1,489	1,443	1,433	1,432	1,413
N73	5075	1,651	1,568	1,499	1,500	1,494	1,500	1,464	1,468	1,444	1,433
N74	5300	1,684	1,552	1,499	1,500	1,494	1,496	1,493	1,496	1,480	1,451
N75	5350	1,696	1,571	1,500	1,499	1,493	1,495	1,493	1,497	1,483	1,457
N76	5475	1,698	1,607	1,502	1,498	1,494	1,494	1,494	1,495	1,488	1,461
N77	5600	1,719	1,629	1,504	1,496	1,492	1,495	1,494	1,494	1,491	1,494
N78	5650	1,737	1,670	1,522	1,501	1,493	1,492	1,497	1,492	1,494	1,495
N79	5900	1,737	1,720	1,569	1,493	1,491	1,503	1,487	1,502	1,481	1,497
N80	6150	1,740	1,743	1,627	1,514	1,489	1,501	1,489	1,499	1,485	1,493
N81	6400	1,744	1,755	1,679	1,548	1,497	1,492	1,501	1,485	1,500	1,491
N82	6650	1,744	1,757	1,723	1,601	1,505	1,489	1,498	1,489	1,500	1,499
N83	6900	1,744	1,757	1,750	1,655	1,530	1,476	1,489	1,506	1,501	1,498
N84	7150	1,745	1,757	1,765	1,695	1,581	1,448	1,484	1,540	1,500	1,490
N85	7650	1,745	1,757	1,775	1,756	1,686	1,508	1,407	1,571	1,476	1,476
N86	8150	1,745	1,758	1,777	1,773	1,754	1,634	1,429	1,421	1,442	1,458
N87	8650	1,745	1,759	1,779	1,772	1,778	1,731	1,549	1,410	1,434	1,455
N88	9150	1,746	1,760	1,779	1,775	1,777	1,774	1,666	1,477	1,429	1,451
N89	9650	1,748	1,764	1,780	1,773	1,780	1,777	1,727	1,535	1,427	1,449

Table G.18 River Bed Profile of Bamban River under 1989 Rainfall Condition
Case 2-a ; declining sediment supply and no dredging

(1989 rainfall condition) (EL.m)

Section	distance	EL in99	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
No181	0	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01
No178	600	10.41	9.71	9.66	9.64	9.64	9.65	9.66	9.68	9.69	9.71	9.72
No175	1200	11.39	10.64	10.57	10.54	10.54	10.56	10.58	10.60	10.62	10.65	10.67
No172	1800	11.53	11.56	11.44	11.40	11.41	11.43	11.47	11.51	11.56	11.60	11.64
No169	2400	12.18	12.55	12.43	12.39	12.40	12.44	12.49	12.55	12.60	12.66	12.72
No166	3000	13.22	12.98	12.88	12.87	12.90	12.95	13.02	13.10	13.18	13.25	13.33
No163	3600	13.95	14.01	13.93	13.93	13.98	14.05	14.14	14.22	14.31	14.40	14.49
No160	4200	15.04	14.61	14.58	14.63	14.72	14.83	14.96	15.08	15.21	15.35	15.48
No157	4800	16.19	15.74	15.77	15.86	15.97	16.10	16.24	16.37	16.51	16.65	16.79
No154	5400	16.82	16.63	16.74	16.88	17.02	17.18	17.33	17.48	17.63	17.77	17.92
No151	6000	16.32	17.20	17.43	17.67	17.88	18.07	18.23	18.39	18.55	18.71	18.87
No148	6600	17.69	18.29	18.61	18.92	19.16	19.35	19.52	19.69	19.86	20.03	20.20
No145	7200	18.57	19.38	19.81	20.15	20.40	20.60	20.80	20.99	21.18	21.36	21.54
No142	7800	19.55	20.49	20.93	21.29	21.56	21.79	22.01	22.22	22.41	22.60	22.79
No139	8400	20.50	21.55	22.13	22.45	22.74	22.98	23.21	23.43	23.65	23.85	24.05
No136	9000	23.09	22.98	23.40	23.71	23.99	24.25	24.50	24.75	24.98	25.20	25.42
No133	9600	24.08	24.31	24.74	25.04	25.32	25.59	25.86	26.12	26.37	26.60	26.82
No130	10200	24.70	25.74	26.17	26.51	26.76	27.04	27.32	27.59	27.84	28.07	28.29
No127	10800	27.30	27.17	27.57	27.90	28.12	28.43	28.71	28.99	29.24	29.48	29.70
No124	11400	28.20	28.69	29.06	29.37	29.53	29.93	30.23	30.51	30.76	31.00	31.22
No121	12000	29.70	29.74	30.16	30.71	31.34	31.61	31.90	32.18	32.44	32.67	32.89
No118	12600	31.00	31.61	32.04	32.50	32.94	33.12	33.40	33.66	33.90	34.13	34.35
No115	13200	33.00	33.35	33.69	34.03	34.39	34.71	35.00	35.24	35.47	35.70	35.90
No112	13800	34.80	35.05	35.36	35.67	36.06	36.42	36.71	36.94	37.18	37.40	37.60
No109	14400	36.40	36.68	37.00	37.25	37.62	38.00	38.29	38.53	38.76	38.97	39.15
No106	15000	37.60	38.35	38.69	38.86	39.32	39.69	39.97	40.20	40.41	40.60	40.77
No103	15600	39.50	39.46	40.06	40.72	41.14	41.43	41.69	41.91	42.11	42.28	42.44
No100	16200	39.70	41.59	42.26	42.78	42.92	43.17	43.42	43.65	43.83	44.00	44.13
No97	16800	43.00	44.01	44.26	44.61	44.83	45.05	45.27	45.49	45.66	45.80	45.91
No94	17400	45.20	46.11	46.15	46.47	46.73	46.90	47.11	47.30	47.45	47.56	47.66
No91	18000	48.30	48.14	48.30	48.59	48.84	48.97	49.16	49.33	49.44	49.52	49.59
No88	18600	50.00	50.13	50.34	50.65	50.93	51.08	51.21	51.32	51.39	51.43	51.47
No85	19200	52.50	52.44	52.69	52.95	53.20	53.37	53.49	53.61	53.72	53.79	53.83
No82	19800	55.00	55.58	55.84	56.04	56.22	56.36	56.46	56.54	56.60	56.63	56.62
No79	20400	57.00	58.45	58.67	58.72	58.82	58.97	59.05	59.07	59.04	58.97	58.87
No76	21000	60.00	61.37	61.79	61.89	61.94	62.02	62.07	62.03	61.91	61.74	61.55
No73	21600	63.00	64.29	64.78	64.92	64.87	64.75	64.64	64.49	64.29	64.01	63.51
No70	22200	66.50	66.45	66.37	66.07	65.80	65.46	65.16	64.90	64.67	64.41	64.07
No67	22800	70.82	69.06	68.54	67.96	67.38	66.84	66.42	66.06	65.76	65.42	65.11
No64	23400	72.21	71.04	69.99	69.02	68.01	67.31	66.75	66.29	66.01	66.00	66.00
No61	24000	73.58	72.43	70.76	69.53	69.00	69.00	69.00	69.00	69.00	69.00	69.00
No58	24600	75.88	74.49	71.87	71.04	71.00	71.00	71.01	71.00	71.00	71.00	71.00
No55	25200	76.57	73.01	73.00	73.00	73.00	73.00	73.00	73.00	73.00	73.00	73.00
No52	25800	75.00	75.01	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
No49	26400	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00
No46	27000	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00
No43	27600	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00
No40	28200	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00

Tabel G.19 Sediment Transport of Bamban River under 1989 Rainfall Condition
Case 2-a ; declining sediment supply and no dredging

(1989 rainfall condition) (1000 m3)

Section	distance	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
No181	0	16	16	16	16	16	16	16	16	16	16
No178	600	637	469	444	436	439	447	458	471	484	497
No175	1200	500	460	440	436	440	449	461	474	487	500
No172	1800	366	447	435	435	442	453	465	478	491	504
No169	2400	369	429	429	436	446	459	472	485	498	511
No166	3000	431	409	423	437	452	467	481	495	508	521
No163	3600	402	396	421	441	459	476	491	505	518	530
No160	4200	410	385	421	448	470	489	504	518	531	543
No157	4800	357	381	426	459	484	505	520	534	548	559
No154	5400	280	387	441	478	507	528	543	558	572	583
No151	6000	245	406	467	504	536	556	569	586	598	609
No148	6600	369	438	500	534	564	581	595	611	624	635
No145	7200	474	495	554	578	598	615	629	645	657	667
No142	7800	603	569	622	630	639	656	669	684	696	706
No139	8400	753	648	691	685	685	699	711	725	736	745
No136	9000	861	724	751	739	730	744	755	767	777	786
No133	9600	840	804	808	792	779	792	802	812	821	828
No130	10200	883	885	866	844	830	844	853	860	867	872
No127	10800	1,081	967	930	893	888	901	910	912	916	918
No124	11400	1,059	1,037	990	933	946	956	965	962	962	962
No121	12000	1,149	1,105	1,047	962	1,020	1,011	1,021	1,015	1,011	1,007
No118	12600	1,152	1,151	1,106	1,030	1,070	1,071	1,081	1,071	1,064	1,056
No115	13200	1,259	1,226	1,186	1,106	1,103	1,121	1,130	1,117	1,107	1,097
No112	13800	1,320	1,284	1,245	1,170	1,158	1,172	1,175	1,163	1,150	1,136
No109	14400	1,365	1,341	1,303	1,241	1,225	1,223	1,219	1,209	1,193	1,176
No106	15000	1,412	1,394	1,343	1,302	1,288	1,270	1,259	1,247	1,228	1,208
No103	15600	1,530	1,447	1,370	1,374	1,348	1,318	1,299	1,284	1,262	1,238
No100	16200	1,527	1,498	1,425	1,421	1,398	1,362	1,338	1,318	1,292	1,264
No97	16800	1,727	1,598	1,507	1,443	1,439	1,402	1,376	1,350	1,319	1,288
No94	17400	1,812	1,641	1,569	1,481	1,477	1,444	1,415	1,381	1,345	1,310
No91	18000	1,962	1,648	1,623	1,528	1,507	1,480	1,450	1,407	1,366	1,327
No88	18600	1,931	1,680	1,681	1,577	1,534	1,522	1,487	1,433	1,384	1,341
No85	19200	1,955	1,717	1,737	1,626	1,562	1,548	1,510	1,448	1,394	1,349
No82	19800	1,942	1,777	1,799	1,686	1,602	1,578	1,538	1,474	1,412	1,357
No79	20400	2,073	1,921	1,913	1,791	1,684	1,637	1,589	1,510	1,427	1,355
No76	21000	2,299	1,987	1,928	1,828	1,737	1,668	1,600	1,497	1,399	1,318
No73	21600	1,585	1,026	734	576	495	409	366	358	358	384
No70	22200	2,096	1,378	850	531	401	322	259	222	202	209
No67	22800	2,086	1,364	792	478	336	264	210	178	152	143
No64	23400	1,622	1,226	638	325	195	153	113	100	63	60
No61	24000	1,426	1,050	474	155	78	60	36	54	63	60
No58	24600	1,288	849	328	92	78	60	36	54	63	60
No55	25200	872	63	79	79	78	76	76	77	78	78
No52	25800	43	78	79	79	78	76	76	77	78	78
No49	26400	76	77	79	79	78	76	76	77	78	78
No46	27000	79	77	79	79	78	76	76	77	78	78
No43	27600	79	77	79	79	78	76	76	77	78	78
No40	28200	79	77	79	79	78	76	76	77	78	78

Table G.20 River Bed Profile of Diversion Channel under 1989 Rainfall Condition
Case 2-a ; declining sediment supply and no dredging

(1989 rainfall condition) (EL.m)

Section	distance	EL in99	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
N49	0	63.20	62.72	63.27	63.48	63.55	63.60	63.59	63.42	63.17	62.90	62.62
N50	280	64.75	64.30	64.91	65.17	65.26	65.32	65.28	64.94	64.53	64.18	63.77
N51	560	66.30	66.11	66.73	67.01	67.13	67.18	67.11	66.60	66.06	65.60	65.08
N52	840	67.85	67.86	68.45	68.75	68.86	68.91	68.83	68.18	67.57	67.00	66.38
N53	1120	69.40	69.67	70.27	70.58	70.67	70.71	70.61	69.79	69.12	68.42	67.68
N54	1400	70.95	71.48	72.05	72.37	72.47	72.51	72.31	71.32	70.56	69.72	68.82
N55	1680	72.50	73.22	73.77	74.06	74.24	74.27	73.94	72.82	71.91	70.96	69.87
N56	1960	74.05	75.01	75.58	75.85	76.12	76.13	75.57	74.34	73.19	72.10	70.81
N57	2240	75.60	76.82	77.47	77.68	78.16	78.08	77.15	75.69	74.29	72.97	71.62
N58	2520	77.15	78.68	79.68	80.46	80.74	80.41	78.78	76.86	75.24	73.57	72.32
N59	2800	78.70	81.50	82.40	82.97	83.27	82.72	80.68	78.70	78.70	78.70	78.70
N60	2850	80.90	82.05	82.80	83.17	83.33	82.91	80.95	80.90	80.90	80.90	80.90
N61	3075	82.15	83.86	84.39	85.39	85.48	84.35	82.05	82.01	81.97	81.88	81.86
N62	3300	83.40	85.95	86.72	87.46	87.40	85.83	83.40	83.40	83.40	83.40	83.40
N63	3350	85.70	86.43	87.20	87.57	87.60	86.04	85.70	85.70	85.70	85.70	85.70
N64	3575	86.95	88.31	88.90	89.18	89.08	87.04	86.92	86.79	86.74	86.67	86.63
N65	3800	88.20	90.15	91.54	91.44	90.80	88.20	88.20	88.20	88.20	88.20	88.20
N66	3850	90.50	90.68	92.03	91.79	90.70	90.50	90.50	90.50	90.50	90.50	90.50
N67	4075	91.75	92.71	93.66	93.50	91.64	91.86	91.74	91.66	91.58	91.50	91.42
N68	4300	93.00	94.85	95.28	94.91	93.00	93.00	93.00	93.00	93.00	93.00	93.00
N69	4350	95.30	95.31	95.64	95.39	95.30	95.30	95.30	95.30	95.30	95.30	95.30
N70	4575	96.55	97.25	97.34	97.04	96.86	96.76	96.67	96.62	96.54	96.43	96.30
N71	4800	97.80	99.43	98.56	98.32	97.95	97.80	97.80	97.80	97.80	97.80	97.80
N72	4850	100.10	100.36	100.10	100.10	100.10	100.10	100.10	100.10	100.10	100.10	100.10
N73	5075	101.35	102.38	101.94	101.83	101.77	101.69	101.59	101.54	101.49	101.41	101.30
N74	5300	102.60	104.31	103.58	103.19	103.03	102.84	102.60	102.60	102.60	102.60	102.60
N75	5350	104.90	104.90	104.90	104.90	104.90	104.90	104.90	104.90	104.90	104.90	104.90
N76	5475	105.60	106.79	106.08	105.95	105.92	105.89	105.80	105.77	105.76	105.73	105.68
N77	5600	106.30	108.80	107.19	106.88	106.80	106.70	106.49	106.42	106.37	106.30	106.30
N78	5650	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00
N79	5900	113.50	113.58	113.50	113.50	113.50	113.50	113.50	113.50	113.50	113.50	113.50
N80	6150	116.00	116.02	116.00	116.00	116.00	116.00	116.00	116.00	116.00	116.00	116.00
N81	6400	118.50	118.50	118.50	118.50	118.50	118.50	118.50	118.50	118.50	118.50	118.50
N82	6650	121.00	121.00	121.00	121.00	121.00	121.00	121.00	121.00	121.00	121.00	121.00
N83	6900	123.50	123.50	123.50	123.50	123.50	123.50	123.50	123.50	123.50	123.50	123.50
N84	7150	126.00	126.00	126.00	126.00	126.00	126.00	126.00	126.00	126.00	126.00	126.00
N85	7650	131.00	131.00	131.00	131.00	131.00	131.00	131.00	131.00	131.00	131.00	131.00
N86	8150	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00
N87	8650	141.00	141.00	141.00	141.00	141.00	141.00	141.00	141.00	141.00	141.00	141.00
N88	9150	146.00	146.00	146.00	146.00	146.00	146.00	146.00	146.00	146.00	146.00	146.00
N89	9650	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00

Tabel G.21 Sediment Transport of Diversion Channel under 1989 Rainfall Condition
Case 2-a ; declining sediment supply and no dredging

(1989 rainfall condition) (1000 m3)

Section	distance	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
N49	0	1,185	1,195	1,257	1,284	1,297	1,289	1,205	1,062	933	826
N50	280	1,166	1,217	1,266	1,287	1,298	1,288	1,198	1,052	923	815
N51	560	1,148	1,241	1,276	1,290	1,301	1,286	1,185	1,036	909	799
N52	840	1,140	1,266	1,287	1,295	1,303	1,284	1,165	1,014	891	778
N53	1120	1,141	1,289	1,299	1,299	1,305	1,281	1,139	990	868	754
N54	1400	1,151	1,313	1,311	1,303	1,307	1,276	1,107	964	840	725
N55	1680	1,172	1,336	1,323	1,307	1,308	1,268	1,068	933	807	690
N56	1960	1,200	1,357	1,335	1,314	1,309	1,256	1,024	897	770	646
N57	2240	1,239	1,380	1,346	1,324	1,310	1,234	975	852	727	595
N58	2520	1,287	1,405	1,354	1,343	1,306	1,197	918	797	675	542
N59	2800	1,347	1,445	1,387	1,357	1,290	1,131	841	733	609	493
N60	2850	1,367	1,453	1,393	1,361	1,283	1,115	841	733	609	493
N61	3075	1,403	1,476	1,405	1,367	1,270	1,054	841	733	609	493
N62	3300	1,458	1,493	1,438	1,370	1,232	981	840	731	606	492
N63	3350	1,476	1,499	1,445	1,369	1,219	976	850	737	613	496
N64	3575	1,500	1,523	1,457	1,370	1,174	973	850	737	613	496
N65	3800	1,543	1,542	1,466	1,367	1,109	969	846	735	611	495
N66	3850	1,557	1,552	1,465	1,362	1,113	978	857	745	624	501
N67	4075	1,563	1,595	1,458	1,328	1,111	978	857	745	624	501
N68	4300	1,594	1,625	1,453	1,269	1,118	974	855	742	621	499
N69	4350	1,607	1,628	1,451	1,271	1,129	989	863	749	630	508
N70	4575	1,608	1,639	1,444	1,272	1,129	989	863	749	630	508
N71	4800	1,630	1,642	1,435	1,266	1,126	986	861	746	627	504
N72	4850	1,642	1,638	1,443	1,282	1,147	1,006	880	760	636	514
N73	5075	1,651	1,630	1,443	1,282	1,147	1,006	880	760	636	514
N74	5300	1,684	1,616	1,439	1,280	1,144	1,003	878	759	634	510
N75	5350	1,696	1,619	1,468	1,325	1,184	1,030	903	772	645	517
N76	5475	1,698	1,632	1,468	1,325	1,184	1,030	903	772	645	517
N77	5600	1,719	1,620	1,466	1,324	1,183	1,029	902	772	645	516
N78	5650	1,737	1,608	1,470	1,335	1,197	1,058	923	789	655	521
N79	5900	1,737	1,608	1,470	1,335	1,197	1,058	923	789	655	521
N80	6150	1,740	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N81	6400	1,744	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N82	6650	1,744	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N83	6900	1,744	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N84	7150	1,745	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N85	7650	1,745	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N86	8150	1,745	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N87	8650	1,745	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N88	9150	1,746	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N89	9650	1,748	1,606	1,470	1,335	1,197	1,058	923	789	655	521

Table G.22 River Bed Profile of Bamban River under 1989 Rainfall Condition
Case 2-b ; declining sediment supply and dredging works

(1989 rainfall condition) (EL.m)

Section	distance	EL in99	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
No181	0	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01
No178	600	10.41	9.71	9.66	9.64	9.64	9.65	9.66	9.67	9.68	9.69	9.70
No175	1200	11.39	10.64	10.57	10.54	10.54	10.55	10.57	10.59	10.61	10.63	10.64
No172	1800	11.53	11.56	11.44	11.40	11.40	11.43	11.46	11.49	11.53	11.56	11.59
No169	2400	12.18	12.55	12.43	12.39	12.40	12.43	12.47	12.52	12.57	12.61	12.65
No166	3000	13.22	12.98	12.88	12.87	12.89	12.94	13.00	13.06	13.12	13.18	13.23
No163	3600	13.95	14.01	13.93	13.93	13.97	14.03	14.11	14.18	14.24	14.31	14.36
No160	4200	15.04	14.61	14.58	14.63	14.71	14.80	14.91	15.01	15.10	15.19	15.27
No157	4800	16.19	15.74	15.77	15.85	15.95	16.06	16.18	16.28	16.38	16.47	16.56
No154	5400	16.82	16.63	16.74	16.87	17.00	17.13	17.25	17.36	17.46	17.55	17.64
No151	6000	16.32	17.20	17.43	17.65	17.84	18.00	18.13	18.24	18.35	18.45	18.54
No148	6600	17.69	18.29	18.61	18.89	19.11	19.27	19.39	19.51	19.61	19.71	19.81
No145	7200	18.57	19.38	19.80	20.11	20.33	20.49	20.63	20.75	20.87	20.97	21.06
No142	7800	19.55	20.49	20.91	21.23	21.46	21.64	21.78	21.90	22.02	22.12	22.21
No139	8400	20.50	21.55	22.10	22.37	22.59	22.77	22.91	23.03	23.15	23.25	23.34
No136	9000	23.09	22.98	23.37	23.60	23.80	23.96	24.11	24.24	24.35	24.45	24.54
No133	9600	24.08	24.31	24.68	24.90	25.08	25.22	25.36	25.49	25.59	25.69	25.78
No130	10200	24.70	25.74	26.09	26.30	26.47	26.61	26.73	26.84	26.93	27.02	27.10
No127	10800	27.30	27.17	27.46	27.65	27.80	27.92	28.03	28.12	28.21	28.29	28.34
No124	11400	28.20	28.69	28.92	29.09	29.21	29.31	29.41	29.49	29.55	29.60	29.61
No121	12000	29.70	29.74	29.95	30.12	30.27	30.41	30.59	30.76	30.94	31.12	31.28
No118	12600	31.00	31.61	31.80	31.95	32.07	32.19	32.32	32.44	32.56	32.68	32.79
No115	13200	33.00	33.35	33.47	33.56	33.65	33.73	33.82	33.91	33.99	34.07	34.15
No112	13800	34.80	35.05	35.14	35.22	35.30	35.38	35.46	35.54	35.62	35.69	35.76
No109	14400	36.40	36.68	36.78	36.85	36.94	37.00	37.07	37.13	37.18	37.23	37.27
No106	15000	37.60	38.35	38.47	38.55	38.64	38.69	38.74	38.79	38.83	38.85	38.87
No103	15600	39.50	39.46	39.67	39.82	39.98	40.08	40.20	40.32	40.43	40.54	40.63
No100	16200	39.70	41.59	41.92	42.07	42.22	42.30	42.40	42.49	42.57	42.64	42.70
No97	16800	43.00	44.01	44.07	44.18	44.27	44.33	44.39	44.44	44.49	44.52	44.56
No94	17400	45.20	46.11	46.07	46.15	46.21	46.26	46.31	46.35	46.39	46.41	46.43
No91	18000	48.30	48.14	48.28	48.38	48.42	48.46	48.49	48.52	48.55	48.55	48.56
No88	18600	50.00	50.13	50.30	50.50	50.54	50.58	50.62	50.64	50.64	50.63	50.61
No85	19200	52.50	52.44	52.64	52.88	52.93	52.96	52.98	52.98	52.95	52.93	52.89
No82	19800	55.00	55.58	55.79	55.99	56.05	56.09	56.09	56.08	56.00	55.99	55.93
No79	20400	57.00	58.45	58.65	58.68	58.75	58.78	58.76	58.69	58.54	58.56	58.50
No76	21000	60.00	61.37	61.78	61.88	61.90	61.90	61.86	61.72	61.51	61.30	61.17
No73	21600	63.00	64.29	64.78	64.92	64.85	64.71	64.55	64.33	64.01	63.60	62.89
No70	22200	66.50	66.45	66.36	66.07	65.74	65.40	65.09	64.82	64.53	64.25	62.33
No67	22800	70.82	69.06	68.51	67.93	67.29	66.78	66.37	66.00	65.65	64.25	64.00
No64	23400	72.21	71.04	69.94	68.92	67.89	67.22	66.70	66.24	66.00	66.00	66.00
No61	24000	73.58	72.43	70.67	69.28	69.00	69.00	69.00	69.00	69.00	69.00	69.00
No58	24600	75.88	74.49	71.85	71.00	71.00	71.01	71.01	71.00	71.00	71.01	71.02
No55	25200	76.57	73.01	73.00	73.00	73.00	73.00	73.00	73.00	73.00	73.00	73.00
No52	25800	75.00	75.01	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
No49	26400	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00
No46	27000	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00	79.00
No43	27600	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00
No40	28200	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00

Tabel G.23 Sediment Transport of Bamban River under 1989 Rainfall Condition
Case 2-b ; declining sediment supply and dredging works

(1989 rainfall condition) (1000 m3)

Section	distance	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
No181	0	16	16	16	16	16	16	16	16	16	16
No178	600	637	469	444	436	438	445	454	465	475	484
No175	1200	500	460	440	435	439	447	457	467	477	486
No172	1800	366	447	435	435	441	450	460	471	480	489
No169	2400	369	429	429	435	444	455	466	476	486	494
No166	3000	431	409	423	437	450	462	474	484	493	501
No163	3600	402	396	420	440	456	470	482	491	500	507
No160	4200	410	385	420	446	465	481	492	501	509	516
No157	4800	357	381	426	456	477	494	505	513	520	526
No154	5400	280	386	440	473	496	514	523	529	535	541
No151	6000	245	406	464	497	520	537	542	547	552	558
No148	6600	369	437	495	523	543	557	560	564	567	572
No145	7200	474	493	545	562	572	581	583	585	587	590
No142	7800	603	565	608	606	605	608	608	609	608	609
No139	8400	753	640	670	652	640	636	634	632	629	627
No136	9000	861	712	719	693	673	662	658	655	649	644
No133	9600	840	786	762	731	704	689	683	676	668	661
No130	10200	883	857	803	765	732	716	706	697	686	678
No127	10800	1,081	923	844	797	759	739	728	716	703	697
No124	11400	1,059	951	907	885	869	848	835	821	806	795
No121	12000	1,149	1,083	1,031	999	980	958	941	925	906	889
No118	12600	1,152	1,110	1,076	1,060	1,049	1,031	1,014	998	980	961
No115	13200	1,259	1,229	1,190	1,169	1,155	1,141	1,123	1,106	1,087	1,067
No112	13800	1,320	1,310	1,287	1,271	1,256	1,244	1,225	1,207	1,188	1,168
No109	14400	1,365	1,372	1,363	1,364	1,360	1,351	1,332	1,313	1,293	1,272
No106	15000	1,412	1,434	1,438	1,453	1,452	1,444	1,425	1,404	1,383	1,361
No103	15600	1,530	1,531	1,530	1,545	1,539	1,532	1,511	1,489	1,466	1,443
No100	16200	1,527	1,545	1,557	1,586	1,588	1,584	1,563	1,541	1,516	1,493
No97	16800	1,727	1,665	1,654	1,682	1,677	1,674	1,653	1,631	1,604	1,581
No94	17400	1,812	1,749	1,716	1,752	1,750	1,753	1,737	1,720	1,696	1,673
No91	18000	1,962	1,742	1,729	1,763	1,758	1,761	1,744	1,726	1,699	1,676
No88	18600	1,931	1,768	1,748	1,772	1,766	1,768	1,750	1,730	1,700	1,677
No85	19200	1,955	1,799	1,783	1,780	1,774	1,774	1,755	1,731	1,697	1,674
No82	19800	1,942	1,847	1,840	1,790	1,782	1,778	1,756	1,724	1,691	1,665
No79	20400	2,073	1,963	1,951	1,830	1,801	1,781	1,749	1,680	1,685	1,632
No76	21000	2,299	2,020	1,963	1,854	1,810	1,774	1,726	1,632	1,690	1,614
No73	21600	1,585	1,046	766	575	501	441	411	425	625	714
No70	22200	2,096	1,399	877	519	389	319	265	241	479	467
No67	22800	2,086	1,382	821	456	323	260	212	187	426	96
No64	23400	1,622	1,235	670	287	188	152	115	95	57	39
No61	24000	1,426	1,050	499	112	75	66	37	57	57	39
No58	24600	1,288	838	332	79	75	66	37	57	57	39
No55	25200	872	44	79	79	78	76	76	77	77	76
No52	25800	43	76	79	79	78	76	76	77	77	76
No49	26400	76	77	79	79	78	76	76	77	77	76
No46	27000	79	77	79	79	78	76	76	77	77	76
No43	27600	79	77	79	79	78	76	76	77	77	76
No40	28200	79	77	79	79	78	76	76	77	77	76

Table G.24 River Bed Profile of Diversion Channel under 1989 Rainfall Condition
Case 2-b ; declining sediment supply and dredging works

(1989 rainfall condition) (EL.m)

Section	distance	EL in99	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
N49	0	63.20	62.72	63.27	63.49	63.51	63.51	63.45	63.19	62.90	62.53	62.31
N50	280	64.75	64.30	64.89	65.18	65.24	65.26	65.17	64.74	64.32	63.82	63.47
N51	560	66.30	66.11	66.72	67.02	67.11	67.14	67.01	66.42	65.87	65.26	64.77
N52	840	67.85	67.86	68.45	68.74	68.85	68.88	68.71	68.00	67.34	66.65	66.06
N53	1120	69.40	69.67	70.25	70.56	70.67	70.71	70.49	69.66	68.88	68.12	67.36
N54	1400	70.95	71.48	72.04	72.35	72.48	72.52	72.21	71.22	70.30	69.44	68.49
N55	1680	72.50	73.22	73.76	74.07	74.22	74.28	73.83	72.67	71.63	70.65	69.52
N56	1960	74.05	75.01	75.57	75.85	76.11	76.12	75.49	74.17	72.94	71.75	70.46
N57	2240	75.60	76.82	77.48	77.67	78.17	78.03	77.04	75.50	74.05	72.64	71.23
N58	2520	77.15	78.68	79.69	80.45	80.73	80.49	78.49	76.70	75.01	73.38	71.83
N59	2800	78.70	81.50	82.42	82.98	83.22	82.83	79.77	78.70	78.70	78.70	78.70
N60	2850	80.90	82.05	82.80	83.17	83.35	83.00	80.90	80.90	80.90	80.90	80.90
N61	3075	82.15	83.86	84.40	85.41	85.48	84.45	82.18	82.02	81.97	81.88	81.86
N62	3300	83.40	85.95	86.77	87.47	87.47	85.50	83.40	83.40	83.40	83.40	83.40
N63	3350	85.70	86.43	87.17	87.59	87.52	85.89	85.70	85.70	85.70	85.70	85.70
N64	3575	86.95	88.31	88.88	89.18	89.00	86.66	86.92	86.79	86.74	86.67	86.63
N65	3800	88.20	90.15	91.46	91.45	90.30	88.20	88.20	88.20	88.20	88.20	88.20
N66	3850	90.50	90.68	91.96	91.83	90.71	90.50	90.50	90.50	90.50	90.50	90.50
N67	4075	91.75	92.71	93.59	93.45	91.94	91.82	91.74	91.66	91.58	91.50	91.42
N68	4300	93.00	94.85	95.34	95.11	93.00	93.00	93.00	93.00	93.00	93.00	93.00
N69	4350	95.30	95.31	95.62	95.31	95.30	95.30	95.30	95.30	95.30	95.30	95.30
N70	4575	96.55	97.25	97.32	96.93	96.81	96.71	96.67	96.62	96.54	96.43	96.30
N71	4800	97.80	99.43	98.69	97.90	97.82	97.80	97.80	97.80	97.80	97.80	97.80
N72	4850	100.10	100.36	100.10	100.10	100.10	100.10	100.10	100.10	100.10	100.10	100.10
N73	5075	101.35	102.38	101.94	101.83	101.74	101.67	101.59	101.54	101.49	101.41	101.30
N74	5300	102.60	104.31	103.56	103.19	102.97	102.78	102.60	102.60	102.60	102.60	102.60
N75	5350	104.90	104.90	104.90	104.90	104.90	104.90	104.90	104.90	104.90	104.90	104.90
N76	5475	105.60	106.79	106.08	105.95	105.92	105.89	105.80	105.77	105.76	105.73	105.68
N77	5600	106.30	108.80	107.22	106.88	106.80	106.69	106.49	106.42	106.37	106.30	106.30
N78	5650	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00
N79	5900	113.50	113.58	113.50	113.50	113.50	113.50	113.50	113.50	113.50	113.50	113.50
N80	6150	116.00	116.02	116.00	116.00	116.00	116.00	116.00	116.00	116.00	116.00	116.00
N81	6400	118.50	118.50	118.50	118.50	118.50	118.50	118.50	118.50	118.50	118.50	118.50
N82	6650	121.00	121.00	121.00	121.00	121.00	121.00	121.00	121.00	121.00	121.00	121.00
N83	6900	123.50	123.50	123.50	123.50	123.50	123.50	123.50	123.50	123.50	123.50	123.50
N84	7150	126.00	126.00	126.00	126.00	126.00	126.00	126.00	126.00	126.00	126.00	126.00
N85	7650	131.00	131.00	131.00	131.00	131.00	131.00	131.00	131.00	131.00	131.00	131.00
N86	8150	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00	136.00
N87	8650	141.00	141.00	141.00	141.00	141.00	141.00	141.00	141.00	141.00	141.00	141.00
N88	9150	146.00	146.00	146.00	146.00	146.00	146.00	146.00	146.00	146.00	146.00	146.00
N89	9650	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00	151.00

Tabel G.25 Sediment Transport of Diversion Channel under 1989 Rainfall Condition
Case 2-b ; declining sediment supply and dredging works

(1989 rainfall condition) (1000 m3)

Section	distance	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10year
N49	0	1,185	1,201	1,257	1,292	1,310	1,307	1,231	1,088	964	838
N50	280	1,166	1,223	1,266	1,293	1,310	1,305	1,221	1,076	950	829
N51	560	1,148	1,247	1,277	1,295	1,311	1,301	1,204	1,060	930	816
N52	840	1,140	1,271	1,289	1,299	1,312	1,296	1,180	1,038	906	796
N53	1120	1,141	1,294	1,301	1,303	1,313	1,290	1,152	1,012	879	773
N54	1400	1,151	1,317	1,313	1,307	1,315	1,281	1,119	982	849	743
N55	1680	1,172	1,339	1,325	1,312	1,316	1,269	1,080	945	815	705
N56	1960	1,200	1,360	1,337	1,318	1,319	1,251	1,034	904	776	660
N57	2240	1,239	1,382	1,348	1,329	1,319	1,226	982	856	729	610
N58	2520	1,287	1,408	1,356	1,349	1,313	1,187	921	799	673	554
N59	2800	1,347	1,449	1,387	1,362	1,301	1,106	851	732	609	493
N60	2850	1,367	1,456	1,394	1,366	1,296	1,082	849	732	609	493
N61	3075	1,403	1,480	1,406	1,371	1,285	1,022	849	732	609	493
N62	3300	1,458	1,497	1,439	1,374	1,251	950	844	731	606	492
N63	3350	1,476	1,503	1,446	1,374	1,234	951	851	736	614	496
N64	3575	1,500	1,527	1,459	1,372	1,195	950	851	736	614	496
N65	3800	1,543	1,545	1,469	1,366	1,120	958	847	734	611	495
N66	3850	1,557	1,554	1,469	1,357	1,128	971	859	744	624	501
N67	4075	1,563	1,595	1,465	1,322	1,122	971	859	744	624	501
N68	4300	1,594	1,622	1,460	1,274	1,118	969	856	742	621	499
N69	4350	1,607	1,626	1,459	1,275	1,127	984	866	748	630	508
N70	4575	1,608	1,638	1,451	1,278	1,127	984	866	748	630	508
N71	4800	1,630	1,640	1,439	1,274	1,123	982	864	745	627	504
N72	4850	1,642	1,636	1,448	1,289	1,146	1,004	882	759	636	514
N73	5075	1,651	1,629	1,448	1,289	1,146	1,004	882	759	636	514
N74	5300	1,684	1,615	1,444	1,287	1,144	1,001	880	758	634	510
N75	5350	1,696	1,617	1,467	1,333	1,178	1,031	903	771	645	517
N76	5475	1,698	1,632	1,467	1,333	1,178	1,031	903	771	645	517
N77	5600	1,719	1,619	1,465	1,333	1,177	1,030	902	771	645	516
N78	5650	1,737	1,608	1,470	1,335	1,197	1,058	923	789	655	521
N79	5900	1,737	1,608	1,470	1,335	1,197	1,058	923	789	655	521
N80	6150	1,740	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N81	6400	1,744	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N82	6650	1,744	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N83	6900	1,744	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N84	7150	1,745	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N85	7650	1,745	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N86	8150	1,745	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N87	8650	1,745	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N88	9150	1,746	1,606	1,470	1,335	1,197	1,058	923	789	655	521
N89	9650	1,748	1,606	1,470	1,335	1,197	1,058	923	789	655	521

Table G.26 River Bed Profile of Abacan River under 1989 Rainfall Condition

(1989 rainfall conditon) (El.m)

Section	distance	El in 94	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10 year
KP0.0	0	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
KP0.6	600	4.10	3.89	3.91	3.95	3.99	4.02	4.05	4.08	4.10	4.13	4.15
KP1.2	1200	4.46	4.68	4.75	4.82	4.89	4.94	5.00	5.04	5.08	5.12	5.16
KP1.8	1800	5.14	5.24	5.34	5.43	5.52	5.60	5.67	5.73	5.79	5.84	5.90
KP2.4	2400	5.97	5.99	6.12	6.23	6.34	6.43	6.52	6.59	6.67	6.75	6.83
KP3.0	3000	6.54	6.74	6.88	7.02	7.15	7.26	7.36	7.47	7.58	7.68	7.78
KP3.6	3600	7.36	7.57	7.73	7.88	8.03	8.16	8.28	8.42	8.56	8.68	8.78
KP4.2	4200	8.20	8.44	8.62	8.79	8.97	9.12	9.29	9.46	9.59	9.71	9.82
KP4.8	4800	9.26	9.32	9.52	9.73	9.96	10.20	10.42	10.58	10.72	10.84	10.93
KP5.4	5400	10.15	10.42	10.61	10.82	11.04	11.26	11.47	11.62	11.75	11.87	11.95
KP6.0	6000	11.35	11.51	11.71	11.94	12.17	12.39	12.61	12.77	12.90	12.99	13.05
KP6.6	6600	12.77	12.58	12.83	13.09	13.36	13.63	13.88	14.06	14.16	14.23	14.25
KP7.2	7200	13.42	13.82	14.11	14.41	14.73	15.03	15.26	15.41	15.48	15.49	15.46
KP7.8	7800	14.67	15.07	15.42	15.75	16.07	16.33	16.52	16.61	16.62	16.56	16.47
KP8.4	8400	15.92	16.45	16.84	17.19	17.51	17.78	17.91	17.93	17.85	17.71	17.53
KP9.0	9000	17.09	17.90	18.32	18.70	19.02	19.24	19.30	19.19	19.00	18.75	18.49
KP9.6	9600	19.00	19.49	19.96	20.36	20.66	20.81	20.73	20.47	20.14	19.75	19.38
KP10.2	10200	21.04	21.49	21.98	22.36	22.62	22.64	22.35	21.86	21.36	20.80	20.37
KP10.8	10800	23.23	23.66	24.10	24.46	24.62	24.40	23.79	22.99	22.36	22.23	22.23
KP11.4	11400	25.57	25.91	26.29	26.62	26.63	26.07	25.04	24.57	24.57	24.57	24.57
KP12.0	12000	28.05	28.37	28.72	29.00	28.73	27.58	27.05	27.05	27.05	27.05	27.05
KP12.6	12600	30.79	30.95	31.24	31.41	30.68	29.79	29.79	29.79	29.79	29.79	29.79
KP13.2	13200	33.13	33.62	33.88	33.82	32.32	32.13	32.13	32.13	32.13	32.13	32.13
KP13.8	13800	35.68	36.28	36.53	35.90	34.68	34.68	34.68	34.68	34.68	34.68	34.68
KP14.4	14400	38.94	39.02	39.18	37.94	37.94	37.94	37.94	37.94	37.94	37.94	37.94
KP15.0	15000	41.86	41.71	41.77	40.86	40.86	40.86	40.86	40.86	40.86	40.86	40.86
KP15.6	15600	44.67	44.90	44.80	43.67	43.67	43.67	43.67	43.67	43.67	43.67	43.67
KP16.2	16200	48.01	48.42	48.08	47.01	47.01	47.01	47.01	47.01	47.01	47.01	47.01
KP16.8	16800	51.93	51.81	51.07	50.93	50.93	50.93	50.93	50.93	50.93	50.93	50.93
KP17.4	17400	56.19	55.45	55.19	55.19	55.19	55.19	55.19	55.19	55.19	55.19	55.19
KP18.0	18000	60.18	59.18	59.18	59.18	59.18	59.18	59.18	59.18	59.18	59.18	59.18
KP18.6	18600	62.74	62.68	61.86	61.74	61.74	61.74	61.74	61.74	61.74	61.74	61.74
KP19.2	19200	67.02	66.56	66.02	66.02	66.02	66.02	66.02	66.02	66.02	66.02	66.02
KP19.8	19800	70.28	70.86	69.29	69.29	69.28	69.28	69.28	69.28	69.28	69.28	69.28
KP20.4	20400	74.33	74.95	73.33	73.33	73.33	73.33	73.33	73.33	73.33	73.33	73.33
KP21.0	21000	79.17	78.34	78.17	78.17	78.17	78.17	78.17	78.17	78.17	78.17	78.17
KP21.6	21600	84.51	83.51	83.51	83.51	83.51	83.51	83.51	83.51	83.51	83.51	83.51
KP22.2	22200	88.54	87.54	87.54	87.54	87.54	87.54	87.54	87.54	87.54	87.54	87.54
KP22.8	22800	94.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33
KP23.4	23400	98.85	97.85	97.85	97.85	97.85	97.85	97.85	97.85	97.85	97.85	97.85
KP24.0	24000	103.87	102.87	102.87	102.87	102.87	102.87	102.87	102.87	102.87	102.87	102.87
KP24.6	24600	109.40	109.40	109.40	109.40	109.40	109.40	109.40	109.40	109.40	109.40	109.40

Table G.27 Sediment Transport of Abacan River under 1989 Rainfall Condition

(1989 rainfall conditon) (1000 m3)

Section	distance	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10 year
KP0.0	0	97	97	97	97	97	97	97	97	97	97
KP0.6	600	372	321	351	387	423	459	492	521	549	575
KP1.2	1200	200	339	381	417	452	485	514	541	567	593
KP1.8	1800	422	411	449	482	511	537	559	581	605	629
KP2.4	2400	507	495	524	552	576	594	609	629	652	674
KP3.0	3000	528	607	628	649	665	672	680	702	725	743
KP3.6	3600	698	728	744	759	765	756	768	797	815	827
KP4.2	4200	871	856	868	878	871	851	885	915	920	922
KP4.8	4800	1,043	984	995	1,002	983	970	1,017	1,032	1,028	1,015
KP5.4	5400	1,078	1,105	1,128	1,144	1,132	1,117	1,147	1,150	1,136	1,106
KP6.0	6000	1,263	1,237	1,274	1,293	1,281	1,262	1,258	1,247	1,217	1,169
KP6.6	6600	1,366	1,373	1,425	1,444	1,426	1,411	1,373	1,339	1,284	1,212
KP7.2	7200	1,254	1,521	1,585	1,603	1,590	1,566	1,491	1,415	1,329	1,229
KP7.8	7800	1,505	1,706	1,776	1,804	1,786	1,734	1,606	1,466	1,339	1,207
KP8.4	8400	1,747	1,918	1,976	1,999	1,952	1,850	1,668	1,471	1,302	1,146
KP9.0	9000	2,081	2,164	2,197	2,204	2,124	1,940	1,681	1,418	1,208	1,031
KP9.6	9600	2,568	2,419	2,425	2,401	2,261	1,971	1,619	1,296	1,059	872
KP10.2	10200	2,866	2,708	2,678	2,603	2,359	1,916	1,447	1,079	818	649
KP10.8	10800	3,141	3,003	2,916	2,770	2,368	1,731	1,144	775	478	389
KP11.4	11400	3,400	3,268	3,132	2,869	2,238	1,364	660	389	402	389
KP12.0	12000	3,603	3,501	3,334	2,874	1,895	742	379	389	402	389
KP12.6	12600	3,816	3,728	3,521	2,695	1,134	395	379	389	402	389
KP13.2	13200	3,930	3,931	3,637	2,185	513	395	379	389	402	389
KP13.8	13800	4,276	4,115	3,599	1,124	375	397	379	389	404	389
KP14.4	14400	4,640	4,268	3,217	382	375	397	379	389	404	389
KP15.0	15000	4,690	4,374	2,412	383	375	397	379	389	404	389
KP15.6	15600	4,608	4,407	1,903	390	376	397	379	389	404	389
KP16.2	16200	4,743	4,352	1,231	390	378	397	379	389	404	389
KP16.8	16800	5,002	4,137	555	396	378	397	379	389	404	389
KP17.4	17400	4,929	3,689	472	396	378	397	379	389	404	389
KP18.0	18000	4,307	3,474	473	400	379	397	379	389	404	389
KP18.6	18600	3,703	3,474	473	400	379	397	379	389	404	389
KP19.2	19200	3,661	2,897	395	404	388	400	385	392	409	392
KP19.8	19800	3,336	2,517	397	405	389	403	385	394	412	394
KP20.4	20400	3,690	1,563	429	425	425	430	427	428	429	430
KP21.0	21000	4,083	540	429	425	425	430	427	428	429	430
KP21.6	21600	3,602	440	429	427	427	430	430	428	429	430
KP22.2	22200	2,952	440	429	427	427	430	430	428	429	430
KP22.8	22800	2,407	455	473	473	473	473	473	473	473	473
KP23.4	23400	1,775	455	473	473	473	473	473	473	473	473
KP24.0	24000	1,138	460	473	473	473	473	473	473	473	473
KP24.6	24600	453	460	473	473	473	473	473	473	473	473