APPENDIX-B

METEO-HYDROLOGY AND WATER UTILIZATION

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METEO-HYDROLOGY AND WATER UTILIZATION

CHAPTER B-1 CLIMATE AND RAINFALL

B-1.1 Availability of Data

Meteorological data except rainfall data are not available in or near the Study Area. Climate data are available at Pochentong Meteorological Station, directly managed by Department of Meteorology, MOWRAM. Rainfall data are available in and near the Slakou River basin as shown in Fig. B-1.

Major rainfall stations observing rainfall for a long period are Takeo, Kampong Spueu, and Phnom Srouch. These stations are all located in the lowland area. Rainfall data from Takeo can be regarded as long-term records in the Slakou River basin. Besides, data at Kirirom station, Stung Chral station and Sangker Satub station are available on a monthly basis for four years from 1966 to 69, for two years 1968 and 1969, and for only 1966, respectively. The Kirirom was reopened in 2000. This station is very important to understand the rainfall in the mountainous area, because it lies in the highland at an altitude of 680 m above sea level. The Stung Chral, which lies in the western slope of the Elephant Mountains, indicates rainfall in the west slope. In addition, rainfall stations were established at every district capital in Takeo Province in the year 2000. Table B-1 shows the monthly rainfall data of major stations and Table B-2 shows daily rainfall for seven years from 1994 to 2000 collected at MOWRAM Takeo Office. Table B-3 to B-6 show climate factors such as temperature, humidity, wind speed, sunshine hours on a monthly basis.

B-1.2 Climate

The alternating monsoon system controls the climate of Cambodia. The rainy season is brought by the southwest monsoon in the period from May to November when about 90 % of the rainfall occurs. The remaining month from December to April, due to the northeast monsoon, is dry and less humid. March and April are the hottest months and have high potential evapotranspiration.

The Slakou River basin completely lies in the rain shadow area extending to the east of the Elephant Mountains. Rainfall is about 1,200 mm in the low land on an annual average and about 90 % of it occurs during the rainy season.

The following table shows typical climate of the low land region including the Study Area.

Summary of Meteorological Data

Item		Jan	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug	Sep.	Oct.	Nov.	Dec.	Total or average
Rainfall	mm/mon	5.8	3.8	16.6	78.8	109.2	112.1	132.9	155.8	187.9	208.5	123.6	35.4	1,170.5
Temperature	C degree													
mean		26.3	27.6	29.3	30.1	29.9	28.9	28.2	28.2	27.9	27.2	26.5	25.9	28.0
maximum		31.1	32.7	34.5	34.9	34.3	33.0	31.9	31.9	31.7	30.8	30.6	30.4	32.3
minimum		21.4	22.5	24.1	25.3	25.4	24.8	24.6	24.6	24.0	23.7	22.4	21.4	23.7
Humidity	%	72.9	70.5	70.6	71.4	76.4	78.8	82.3	82.9	85.5	86.0	79.6	75.2	77.7
Wind	m/sec	3.1	3.9	4.1	3.8	4.1	4.6	3.9	5.0	4.3	2.7	3.6	3.7	3.9
ET_0	mm/mon	162	174	216	206	191	167	153	159	140	133	146	156	2,000
Sunshine	hr/dat	8.7	8.6	8.6	8.3	7.3	6.1	5.8	5.9	5.6	5.8	7.4	8.4	7.1

Note: Average of monthly data from Department of Meteorology, Pochentong (1991-2000) except potential evapotranspiration (ET_0), which was calculated by the modified Penman method and rainfall data of Takeo, which were obtained from Takeo Station (1982-2000)

Monthly mean maximum temperature is 34.9 ^{o}C in April, while the minimum temperature is 21.4 ^{o}C in December and January. The annual difference of mean temperature is as small as 4.2 ^{o}C. Humidity is minimum, 70.5 % in February and maximum, 86 % in October. Sunshine hours are about 8.5 hours in the dry season and about 6 hours in the rainy season.

B-1.3 Rainfall

B-1.3.1 Rainfall Amount and Rainy Days

Annual rainfall ranges from 898 mm to 1,594 mm and the average annual rainfall is about 1,200 mm in accordance with the data of Takeo Station (see Table B-1).

Monthly Rainfall at Takeo

Year	Jan	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug	Sep.	Oct.	Nov.	Dec.	Annual
1994	0.0	2.0	49.3	52.0	177.5	149.2	200.2	190.0	172.1	144.2	0.0	21.0	1157.5
1995	26.2	0.0	39.5	48.5	116.0	137.2	42.2	133.5	230.5	285.3	49.5	94.5	1202.9
1996	29.2	0.0	0.0	116.8	148.9	65.4	195.7	66.1	213.3	289.0	175.0	26.5	1326.6
1997	0.0	22.5	9.6	92.1	75.7	0.0	186.4	118.4	140.3	233.7	62.9	4.4	946.0
1998	0.0	0.0	0.0	73.0	96.2	78.4	138.4	177.4	210.3	192.4	211.3	44.0	1221.3
1999	31.0	0.0	33.9	170.1	163.2	63.9	52.0	188.2	106.0	526.1	194.9	10.7	1540.0
2000	21.0	0.0	40.0	87.0	74.2	145.7	81.8	170.9	199.5	457.5	138.6	177.9	1594.1
Average	15.4	3.5	24.6	91.4	121.7	91.4	128.1	149.2	181.7	304.0	118.9	54.1	1284.1

Source: Takeo Office of MOWRAM, Period from 1994 to 2000, daily rainfall data are available.

According to the daily rainfall data for seven years from 1994 to 2000, annual rainy days are 80 days and the rainy season from May to November accounts for 69 rainy days. Especially in a period from July to October, rainfall comes at a rate of one time two days to three days. An average amount of a daily rainfall is 16mm.

Rainy Days and Average Daily Rainfall at Takeo

Year	Jan	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug	Sep.	Oct.	Nov.	Dec.	Annual
1994	0	1	5	2	9	7	8	11	13	11	0	1	68
1995	1	0	2	1	6	14	5	9	12	12	4	3	69
1996	2	0	0	6	10	5	15	7	16	16	10	2	89
1997	0	2	1	3	7	0	14	9	8	14	5	1	64
1998	0	0	0	3	6	5	10	9	13	13	12	2	73
1999	3	0	3	8	15	7	8	11	9	16	8	1	89
2000	1	0	2	11	9	13	14	10	12	18	7	10	107
Average	1	0	2	5	9	7	11	9	12	14	7	3	80
Average daily rain (mm)	15.4	8.2	13.3	18.8	13.7	12.5	12.1	15.8	15.3	21.3	18.1	19.0	16.1

B-1.3.2 Regional Variation of Rainfall

It is well known that rainfall remarkably varies between the west and east areas of the Elephant and the Cardamom Mountains and that the east area is a rain shadow area. The Slakou river basin totally lies in this rain shadow zone. Rainfall is high on the western and southern slopes of the mountains where annual totals of 2,000 mm to 4,000 mm are recorded, while in the eastern slopes, the rainfall remarkably reduces towards the east as shown in the isohyetal map of Fig. B-2.

Average annual rainfall is about 1,200 mm in the lowland of the eastern side of the mountains. The seasonal rainfall distribution in the lowland in the range of three hundred kilometers from Battambang to Takeo is quite similar as shown in Fig. B-3.

It is sure that the lowland of the Slakou River basin has also the same seasonal distribution pattern and the same amount of rainfall as those at Takeo, Kampong Spueu or Phnom Srouch.

The mountainous area of the Slakou river basin is 200 m to 800 m above sea level. There are no rainfall records. Rainfall data in the mountainous area near the Slakou River basin is available in only Kirirom as previously stated in Section B-1.1. Fig. B-4 shows that the seasonal pattern is nearly the same on both the upper basin and the lowland, and the rainfall in the upper basin is about 1.4 times higher than that in the lowland.

Thus it can be judged that the seasonal pattern of rainfall is almost the same in the entire area including the mountainous area. But, amount of precipitation in the mountainous area of the Slakou River basin is supposed to be smaller than that at Kirirom where the annual rainfall is about 1,900 mm, because the mountainous area of the Slakou River basin is located more inside the rain shadow area than Kirirom.

B-1.3.3 Spatial Variability of Seasonal Rainfall

Department of Water Resources and Meteorology (DWRAM), Takeo just started the measurement of daily rainfall at every district capital in 2000. These rainfall stations are located in flat lowland apart from 20 km to 30 km among them. Fig. B-5 shows that the rainfall correlation among stations is visually poor on monthly basis. This indicates that rainfalls are very erratic and of limited spatial extent and that there is little pattern in their occurrence. As previously explained in Fig. B-3, the seasonal rainfall pattern on the long-term average is quite similar throughout the lowland, but contradictory to this similarity, spatial correlation in a short term is very poor. Considering that the Study Area is 650 km^2 and that the distance from the water diversion points to the downstream end is about 45 km, they suggest that some parts of the Study Area might have substantial rainfall, while other parts are very little. It means that water allocation based on actual rainfall amount is not practically possible. Also, concerning the water balance study between irrigation water demands and the estimate of available river runoff, it suggests that the Slakou River runoff and the irrigation water demands should be estimated by use of rainfall data at different rainfall stations. It is considered reasonable that the irrigation water demands are estimated by use of rainfall data of Takeo and that those of Kampong Spueu and Phnom Srouch are used for the runoff estimate.

B-1.3.4 Maximum Daily Rainfall and Three-Day Rainfall

Probable daily rainfalls at various return periods and three consecutive day's maximum rainfalls were calculated as follows:

Maximum Rainfall (mm) by Gumbel

Return Period (years)	Daily Rainfall at Takeo	Daily Rainfall at Kampong Spueu	Three Day Rainfall at Takeo
100	158	147	-
50	145	135	-
30	135	126	-
20	127	118	198
10	114	106	173
5	100	92	147

CHAPTER B-2 RUNOFF OF THE SLAKOU RIVER

B-2.1 The Slakou River System

Fig. B-6 shows the Slakou River system. The Slakou River originates from mountains of which peaks are in the range from 600 m to 800 m above sea level. The river flows down the flat plain meandering with a longitudinal gradient of 1:200 – 1:500 in and around the Tumnup Lok Reservoir areas and 1:1,000 – 1:2,000 in the Study Area. The river width is 20 m to 30 m in the upstream of the Study Area and 30 m to 50 m in the downstream part. The riverbanks are composed of fragile sandy soil. In the downstream below the Study Area, the Slakou river flow enters into Thnot Te Reservoir that is situated at the beginning of the habitual inundation area. The catchment area at the Thnot Te Reservoir is about 1,200 km^2. After Thnot Te Reservoir, the river flows down in the habitual inundation area, where paddy cultivation is practiced in the dry season utilizing the inundation water as well as water stored in the reservoir. Then, the Slakou River flows into the Bassac River.

The major tributaries of the Slakou River are Don Phe Stream, Krouch Stream and Tras Stream. The Tras Stream is a main stream of the Slakou River. Reservoirs named as Kpob Trobek, O Saray, and Tumnup Lok were constructed in these tributaries in 1970s. These reservoir dikes and flood sluices have been ruined and not utilized at present. Catchment areas at these ruined reservoirs are 332 km^2, 51 km^2, and 137 km^2, respectively. In addition, three tributaries: Kat Phluk Stream, Boeng Tadeng Thmei – Boeng Ta Ngoun Stream, and Ou Por Amriel Stream come into the Slakou River from northern basin, which is outside of the Study Area. Catchment areas of these three tributaries are 390 km^2 in total.

The watershed of which altitude is more than 60 m above sea level is much covered with miscellaneous small trees and partially denuded. Useful big trees seem to scarcely exist due to disorderly excessive cutting for fuel and housing. Areas of which altitude ranges from El. 5 m to El. 60 m including the Study Area are mostly utilized for rain-fed paddy cultivation. While, areas less than about 5 m above sea level is usually affected by backwater effect of the Bassac River and utilized for paddy cultivation effectively utilizing the inundation water at the recession time of water level in the dry season.

B-2.2 Present Water Utilization

The water resources of the Slakou River were utilized for paddy cultivation in the Study Area through a reservoir irrigation system constructed in the 1970s. Nowadays, however, the Slakou River water resources are used only in an area of about 3,000 ha in the lowland below the Study Area and in a limited area of about 100 ha in the Don Phe Stream basin above the Study Area. Besides, water resources of small streams coming from the Noreay Mountain Range, which is the border of Takeo and Kampot Provinces are utilized for irrigation in some limited areas mainly along the Koh Kaek Main Canal in the Study Area.

The lowland areas below the Study Area are mostly inundated in the rainy season with flooding water caused by backwater effect of the Bassac River. In these habitual inundation areas, the paddy cultivation is practiced in the dry season from land preparation in December to harvesting in March. Direct sowing is carried out in the most of the areas. When inundation water depth gradually decreases as the Bassac River water level lowers, and reaches 10 cm to 20 cm that occurs in December, farmers prepare the paddy fields by puddling draining the excess water and directly sow paddy seeds. These puddling and sowing works need little irrigation water, since residual water is abundant in the fields. The fields need irrigation water for two months from early January to early March. Total requirements of irrigation water are approximately estimated at 600 mm on the conditions of the evapotranspiration of 5 mm/day, percolation loss of 1 mm/day and irrigation efficiency of 60 %. Total irrigation water requirements are estimated at 18 MCM.

Such irrigation water is ensured by reservoirs such as the Thnot Te Reservoir and the Krachab – Chrouy Samraong Reservoir created by low dikes in the downstream of the Slakou River. The Slakou River enters into the Thnot Te Reservoir or the reservoir has been provided so as to directly receive and store the river water, but the Krachab – Chrouy Samraong Reservoir is not directly connected to the Slakou River. Only small canals coming from the Study Area carry excess water into this reservoir. It is noted that these reservoirs are located along the edge of the habitual inundation area. According to the farmers, it often occurs that backed-up inundation water enters into the Thnot Te Reservoir via the spillway in the mid-rainy season. This water is also stored for dry season irrigation. In case of the Krachab – Chrouy Samraong Reservoir, a water gate is often opened to allow backed-up inundation water to enter the reservoir in mid rainy season when the inundation water level is higher than the reservoir water level. In the dry season the stored water is released for irrigation.

The following table shows maximum inundation water level at Angker Borei that is located at about 20 km east of Takeo and Borei Chulsar that is at about 30 km south-east from Takeo. Both sites lie in the downstream of the Slakou River. Comparing these with the crest elevation of the spillway of Thnot Te Reservoir, which is 5.2 m or the dry season paddy field elevation, which is around El. 2.5 m to

El. 3.5 m, maximum inundation water level exceeded the spillway crest elevation in 1996 and 2000, and is higher by at least 0.6 m than the paddy fields in all the recorded years.

Maxim Water Level in Habitual Inundation Area

Year	Month	Angker Borei	Borei Chulsar
1996	September	5.32	-
1997	October	4.20	-
1998	September	-	4.17
1999	October	-	4.47
2000	September	5.41	5.40

This proves that the inundation water can be utilized every year for land preparation works and for irrigation by tentatively stored in such reservoirs. Effective storage capacity is estimated at 18.4 MCM consisting of 13.4 MCM in Thnot Te Reservoir (refer to Thnot Te Feasibility Report, March 1994) and about 5 MCM in the Krachab – Chrouy Samraong Reservoir on the assumption that the water surface area is 5 km^2 and that the effective depth is 1 m.

Besides, there are other two reservoirs below the Study Area. Kanlaeng Chak Reservoir is utilized as a water source for domestic water supply for Takeo town and O'Tom reservoir is utilized for pump irrigation of 250 ha. Also the reservoir has a plan of irrigation development of 285 ha around the reservoir (refer to Fig. 1 of Bidding Documents Vol.1 of O'Tom Lake Flood Protection Rehabilitation, December 1995). The spillway crest of O'Tom reservoir is El.3.9 m, lower than the maximum inundation water level. Thus it is easily assumed that the reservoir is filled with inundation water every year.

B-2.3 Discharge Measurement

In the dry season during the period from the beginning of February to the middle of March and in the rainy season from middle of August to October, 2001, the Slakou river flow was measured at four points such as the Tumnup Lok Reservoir site (hereinafter called as the Slakou upstream), the Slakou river crossing with the National Road No.3 (hereinafter called as the Slakou downstream), one of the two flood sluices of Kpob Trobek Reservoir and a flood sluice of O Saray Reservoir. Besides, flow of the Prek Thnot River was measured once at Peam Kley where water level was being observed daily by MOWRAM.

At the Slakou upstream, the water level figures recorded by an automatic water level gauge indicate those adding 0.66 m to the staff gauge reading. At the Slakou downstream, the sensor of the water level gauge was installed at the zero point level of the staff gauge so as to indicate the same water level as the reading on the staff gauge. These zero points was set at the river bed level under the bridge where the river bed was fixed with concrete slab.

These discharge measurement results are listed in Table B-8. In the dry season, water was flowing with very small discharge at all the points.

Fig. B-7 shows rating curves for both the Slakou upstream and the Slakou downstream.

B-2.4 Estimate of Slakou River Runoff

There are no available runoff data in the Slakou River system. Only the Prek Thnot River, a neighbor basin of the Slakou River basin, has discharge measurement records for a few years.

Both basins are totally located in the eastern slope of the Elephant Mountains and rainfall patterns are almost the same for both basins. The topographic condition and the land use are also similar. Thus the Slakou river runoff was estimated by analyzing the relationship between the runoff of the Prek Thnot River and the basin rainfall taking into account differences in rainfall caused by differences in area occupied by mountain and flow characteristics of the Slakou river, especially in the dry season.

B-2.4.1 Available Data

The Prek Thnot River has a water gauge at Peam Kley. The river water level has been observed daily since September 1996. Also, flow was measured about 20 times for recent four years. Also daily discharge data are available for four years from 1966 to 1969 at Anlong Touk, which is about 500 m downstream of Peam Kley. The catchment areas of two stations are almost the same between two stations and estimated at 3,650 km^2 at Anlong Touk according to Lower Mekong Hydrological Year Book. Table B-9 shows daily discharge at Anlong Touk. Regretfully the water level observation records and the rating curves could not be found. Table B-10 shows the water level at Peam Kley.

B-2.4.2 Prek Thnot River Runoff

(1) Rating curves and daily discharge at Peam Kley

Fig. B-8 shows the records of discharge measurement carried out by staffs of Hydrology Department of MOWRAM at Peam Kley and rating curves between the water level and discharge developed from these discharge records. One rating curve does not cover all the ranges of the records especially for low flow discharge, of which estimate is very important for estimation of available river water and irrigation planning. Thus, two rating curves are developed for high flow and low flow. Table B-11 shows the daily discharge at Peam Kley.

(2) Monthly runoff and annual runoff

Monthly runoff and annual runoff are shown in Table B-12. Basin rainfall in the Prek Thnot River basin was estimated on the assumptions that (i) rainfall in the lowland and low hill of which altitude is less than 400 m above sea level is an average of Kampong Spueu and Phnom Srouch, and that (ii) rainfall in the mountainous area more than 400 m above sea level, which is 520 km^2 is represented by Kirirom rainfall in consideration that rainfall remarkably reduces from 2,000 mm to 1,200 mm to the east in the eastern slope of the Elephant Mountains.

Fig. B-9 shows seasonal runoff pattern and rainfall pattern, which are obtained from the monthly averages for the period from 1966 to 1969. Runoff increases slowly from May to October comparing with the rainfall-increasing rate and then rapidly decreases to December as rainfall does. Runoff for five months from July to November accounts for about 90 % of annual runoff. The large gap between the rainfall and runoff in the beginning stage and even in the middle stage may indicate that much amount of rainfall is consumed by i) infiltration for filling the void of earth, ii) standing in the rain-fed paddy fields furnished with bunds, and iii) large evapotranspiration from earth or water surface and plants.

In the normal year, the basin rainfall is around 1,300 mm in the Prek Thnot River basin and the annual runoff is about 300 mm. The annual runoff rate is about 25 %.

Annual Rainfall and Runoff in Prek Thnot River Basin

Year	Rainfall (mm)	Runoff (mm)	Runoff rate (%)
1966	1,573.7	320.1	20.3
1967	1,295.6	372.4	28.7
1968	1,266.4	213.5	16.9
1969	1,367.4	358.0	26.2
1999	1,646.9	954.4	58.0
2000	1,734.2	586.0	33.8
Average	1,480.7	467.4	30.1

B-2.4.3 Estimate of Slakou River Runoff

Runoff of the Slakou River at the three reservoir sites was estimated for 20 years in total made up of two periods from 1966 to 1969 and 1985 to 2000 when monthly rainfall data are available.

(1) Correlation between basin rainfall and runoff in Prek Thnot River

The analysis to clarify the correlation between rainfall and runoff was made on a monthly basis in consideration of the lack of rainfall stations and daily rainfall data for vast area of the Prek Thnot River Basin. Periods when both rainfall and runoff data are available are only 8.5 years in total composed of 4 years from 1966 to 1969 and 4.5 years from 1996 to 2000. Annual rainfall at Kirirom is higher by 41 % than rainfall in the lowland. Basin rainfall was calculated from rainfall data of Kampong Spueu, Phnom Srouch, and Kirirom on the assumption that rainfall in the 86 % of the total area, which is lower than 400 m above sea level, is an average of rainfall of both Kampong Spueu and Phnom Srouch and remaining 14 % of total basin is the same as that at Kirirom. In the months when rainfall data at Kirirom are not available, basin rainfall was estimated on assumption that basin rainfall in mountains more than 400 m above sea level is higher by 41 % than the average rainfall of Kampong Spueu and Phnom Srouch. Basin rainfall used for this analysis is shown in Table B-13.

1) Method to find the correlation

Tank model method is usually used for estimate of daily runoff from daily basin rainfall data. However, reliable daily rainfall data are not available and rainfall observation points, which measure rainfall for a long period is only two stations. Instead of the tank model method, monthly rainfall distribution method was employed to find the relationship between rainfall and discharge.

Monthly rainfall is partly consumed by evapotranspiration. If rainfall amount is very small, almost all the rainfall water evaporates and no or little rainwater contributes to runoff and groundwater. If rainfall amount is not small but not much, much amount of the rainfall evaporates and a little amount of rainfall contributes to runoff and groundwater. If rainfall is much, large amount of rainfall contributes to runoff. Even if rainfall increases more, evaporation little increases and becomes almost constant, while runoff continuously increases as rainfall does. Considering such a phenomena, following equations in relation between monthly rainfall and monthly effective rainfall, which contributes to runoff were arranged in this analysis:

$ER = R - L$

$L = C1 \times ETo \times (1 - \exp.^{-C2 \times R})$

$L > R$ in the above equation, $L = R$

Where,
- ER: effective rainfall, which contributes to runoff,
- R: monthly rainfall,
- L: loss,
- C1: coefficient,
- ETo: potential evapotranspiration,
- C2: coefficient

Large percentage of effective rainfall contributes to runoff within the same month when the rainfall occurs. Some of the effective rainfall flows out in the next month. Further the small percentage flows out two months, three months, and several months later. Conversely speaking, monthly runoff (Q) is composed of runoff elements caused by rainfall in the same month, last month, two month ago, three months ago, and several months ago as presented by the following equation.

$$Q = A \times ER_0 + B \times ER_1 + C \times ER_2 + D \times ER_3 + E \times ER_4 + F \times ER_5$$

Where, Q: monthly runoff

ER: effective rainfall

Attached figures 0, 1, 2, 3, 4 and 5 indicate this month, last month, two months ago, three months and four months ago, respectively.

A, B, C, D, E and F: contribution rates of effective rainfall to runoff for the same month when runoff (Q) is estimated, last month, two months ago, three months ago, four months ago and five months ago from the month that runoff(Q) is estimated, respectively.

These coefficients of A, B, C, D, E and F, and C1 and C2 were estimated so that the simulated runoff meets to actual runoff as much as possible. In this estimate, minimum base flow was assumed to be 0.3 m^3/sec as a given condition.

2) Simulation Result of Prek Thnot River runoff

Fig. B-10 shows the simulated runoff. This simulation obtained the following coefficient values with correlation coefficient (r^2) of 0.79.

C1 = 1.23 and C2 = 0.006

A = 0.68, B =0.23, C = 0.08, D = 0.015, E = 0.01, F = 0.005

The regression coefficient is judged to be good under the poor condition that rainfall data of only two or three rainfall stations are available for the 3,650 km^2 of the drainage area of the Prek Thnot River.

(2) Application to the Slakou River Basin

1) General considerations

Seasonal rainfall pattern throughout the area located along the eastern side of the Elephant Mountains and rainfall amount in the lowland are quite similar. Both the Prek Thnot river basin and the Slakou River basin are located in the rain shadow area.

Rainfall data of Kampong Spueu, Phnom Srouch, and Kirirom, which are located in the Prek Thnot River basin, were used, since there are no rainfall data in the Slakou River basin. Basin rainfall was assumed that rainfall in the lowland of which elevation is less than 400 m above sea level is an average of Kampong Spueu and Phnom Srouch and that basin rainfall in mountainous area more than 400 m above sea level is higher by 20 % than the average rainfall of the lowland instead of 40 % for the mountainous area for Prek Thnot River Basin. Basin rainfall for the drainage basins of Kpob Trobek Reservoir, O Saray Reservoir and Tumnup Lok is shown in Table B-13.

Both the Prek Thnot River basin above Peam Kley and the Slakou River basin in the upstream of the three existing reservoirs are almost the same in topography, but different in the land use. The Slakou river basin is occupied more by rain-fed paddy fields. It is, therefore, supposed that seasonal runoff pattern of the Slakou River is almost the same as that of the Prek Thnot River, but that the specific runoff in the dry season is smaller than that of the Prek Thnot River.

2) Runoff of Don Phe Stream at Kpob Trobek Reservoir Site

There is an existing reservoir, hereinafter called as the Don Phe Reservoir, at 10 km upstream of the Kpob Trobek Reservoir on the Don Phe Stream. The Don Phe Reservoir has been damaged and not utilized at present. The rehabilitation of the reservoir is planned with development of irrigation facilities in the downstream of the reservoir by GOC under the assistance of IFAD. By the rehabilitation, available runoff at Kpob Trobek Reservoir will be changed. Thus, runoff of the Don Phe Stream was estimated separately for upper and lower basins of the Don Phe Reservoir.

The upper basin is 70 km^2, covered with forest, and the Don Phe Stream is perennial at the Don Phe Reservoir site. Considering these, coefficients of the water loss and effective rainfall distribution coefficients for the runoff from the Don Phe Reservoir upper basin were determined almost similar to those of the Prek Thnot River as follows:

C1 = 1.23 and C2 = 0.006
A = 0.68, B =0.23, C = 0.06, D = 0.015, E = 0.01, F = 0.005

While, the lower basin of the Don Phe Reservoir is 67 km^2, mostly developed by rain-fed paddy fields. Percolation of the paddy fields seems to be very small. A rain-fed paddy plot catches rainfall and stores rainfall water. Ridges of paddy plot hampers water flowing-out. With very low percolation and paddy ridges, rainfall tentatively stays in rain-fed paddy plot and mostly evaporates in the early rainy season usually from May to August. While, once paddy plots are full of water, rainwater rapidly flows down usually in September and October.

No water flows for two to four months in the dry season in accordance with person living near the Kpob Trobek Reservoir, because water from the upper basin is totally diverted for irrigation use in the upstream and no water comes out from the lower basin.

Taking these considerations into account, coefficients of the rainfall loss and effective rainfall distribution coefficents for the lower basin were determined as follows:

C1 = 1.3 and C2 = 0.006
A = 0.70, B =0.23, C = 0.06, D = 0.01, E = 0, F = 0

Table B-14 shows runoff of the Don Phe Stream at both Don Phe Reservoir site and Kpob Trobek Reservoir site.

3) Runoff of Krouch Stream at O Saray Reservoir Site

The Krouch Stream, on which O Saray Reservoir exists, dries up for two to five months every year in the dry season. The catchment area of the reservoir is 51 km^2, of which rain-fed paddy field occupies 26 km^2 and shrub land is 20 km^2. It resembles the lower basin of the Don Phe Reservoir in land use. Considering these into account, the coefficients of the equations were determined the same as those for the lower basin of the Don Phe Reservoir.

4) Runoff of Tras Stream at Tumnup Lok Reservoir Site

The Tras Stream, on which Tumnup Lok Reservoir is located, is perennial, but the flow becomes very small in the dry season. The catchment area of the Tumnup Lok Reservoir is 332 km^2, of which about 75 % is shrub and forestland. Grassland including rain-fed paddy field occupies 25 % comparing with 11 % in the Prek Thnot River basin. Taking these differences into account, the coefficients of the equations were adjusted so that specific runoff in the dry season is smaller than that in the Prek Thnot River.

C1 = 1.23 and C2 = 0.006
A = 0.69, B =0.23, C = 0.06, D = 0.01, E = 0.005, F = 0.005

Table B-14 shows the simulated runoff.

B-2.5 Flood

B-2.5.1 Field Inspection and Hearing at Three Reservoirs

Field inspection and interview to inhabitants who are living near the ruined reservoirs were made in order to collect data and information especially on high flow condition in the rainy season.

(1) Kpob Trobek Reservoir

There are two flood sluices: main flood sluice and sub-flood sluice in this Reservoir. Villagers living near the flood sluices said water level in the reservoir became maximum in both 1996 and 1997, and the flood sluices and the dike were damaged.

In 1996, water level in the reservoir reached about 50 cm below the top of the operation deck of the sub-flood sluice or about 20 cm below the top of the operation deck of the main flood sluice. At that time, the main flood sluice was fully closed. The sub-flood sluice was closed about two-third of the total height. Earthen dike was completely damaged in the range of about 130-m length. Villagers' explanation strongly suggested that piping phenomena in the dike caused it.

In 1997, water level in the reservoir reached at the same level as the 1996. At that time, the villagers said the sub-flood sluice was fully opened, but the main flood sluice was fully closed. Water overtopped the dike in the portion damaged in 1996.

In October 1999 and 2000, water level reached about 1.6 m below the top of the operation deck of the main flood sluice or nearly the crest of the repaired portion of the earthen dike, which is lower by about 1.6 m than that in the other part. In these times, both flood sluices were fully opened. The flood discharge is estimated at about 100 m^3/sec.

(2) O Saray Reservoir

O Saray Reservoir is small. The Reservoir is also the same type as Tumnup Lok Reservoir. It is composed of one concrete-made flood sluice and a long earthen dike. The flood sluice and the dike were damaged in 1979. Then in 1985 they were repaired and the flood sluice was reinforced with concrete-made wing walls in the upstream and the downstream. However, the flood sluice and the adjacent dikes were damaged again by flood in 1999. At this time, the flood sluice was closed by 0.5 to 1.0 m and water level in the reservoir reached about 30 cm below the crest of the earthen dike. Water flowed over small lateral dike, which is lower than the main dike, in the range of about 150-m length, to the southwest in parallel to the main road dike.

The main dike was completely damaged in the right side of the flood sluice in a range of about 20-m length and severely damaged at downstream of the right side of the flood sluice. It seems to be caused by piping and swirling stream in the downstream. Discharge through the flood sluice at the 1999 flood is estimated at about 50 m^3/sec.

(3) Tumnup Lok Reservoir

Tumnup Lok Reservoir built on the Tras Stream (the main of the Slakou River), consists of (i) one main flood sluice built on the main stream, (ii) two flood sluices and (iii) an earth-made dike having a height of about 6 m. According to the villagers who live near the main flood sluice in Trabokkpos Village of Kampong Spueu

Province, the dike was damaged two times; one is before 1986 (not clear) and the other is in 1989. At the first damage, the earth-made dike was damaged in the left side of the main flood sluice. The dike was completely washed away by flood flowing over the dike. In 1986, the earth-made dike was repaired, but flood hit the dike again in 1989 and the same portion of the dike was washed away. According to the villagers, the 1989 flood is bigger than the 1986 and the flood flowing over the dike also hit houses and huts, which were located higher position in the left bank. Floodwater reached about 1m above the ground surface at the settlement position. When the flood hit the dike in both 1986 and 1989, the flood sluices were closed with stoplogs. After the 1989 flood, the dike has not been repaired yet, and the flood sluices were abandoned.

B-2.5.2 Flood Discharge at Three Reservoirs

There are no actual flood data for the Slakou River, so floods were estimated by (1) a method (hereinafter called as the IRS method) recommended in Irrigation Rehabilitation Study in Cambodia, 1994 (Mekong Secretariat), based on growth factors for flood frequencies in the Thai catchments with areas less than 15,000 km^2 and elevations below 100 m and (2) Unit Hydrograph Method. In addition, past maximum flood was estimated by non-uniform calculation method for the Tras Stream at the Tumnup Lok Reservoir site.

(1) The IRS method

The method is represented by the following equations.

$MAF = AREA^{0.9}$
$Q_{10} = 1.53\ MAF$
$Q_{100} = 2.20\ MAF$

Where, MAF: mean annual flood (m^3/sec)
Q_{10}: flood expected to occur not more than once every 10 years on an average,
Q_{100}: flood expected to occur not more than once every 100 years on an average.

The catchment area used and flood estimated by the Thai method for each of the reservoir sites are as follows:

Flood (Q_{10} & Q_{100})

Name of Stream	Name of Reservoir	Catchment Area (km^2)	Flood, Q_{10} (m^3/sec)	Flood, Q_{100} (m^3/sec)
Don Phe	Kpob Trobek	137	128	184
Krouch	O Saray	51	53	76
Tras	Tumnup Lok	332	284	409

(2) Flood Estimate by Unit Hydrograph Method

Unit hydrograph method based on ARD Manual 1, which is used and accepted at Office of Accelerated Rural Development (ARD), Ministry of Interior, Thailand was employed for flood estimate of the three rivers at the three reservoir sites. Detail calculation method is explained in "Planning Guideline for Rehabilitation and Reconstruction of Irrigation System".

The features of the catchment areas of the three reservoirs are as follows.

Features of Catchment Area of Three Reservoirs

	Kpob Trobek	O Saray	Tumnup Lok
a) Probable rainfall, 100 years*1	151	147	148
Probable rainfall, 50 years	138	135	136
Probable rainfall, 20 years	121	118	119
b) A = Catchment area, km^2	137	51	332
c) L = Length of stream measured from dam site to the watershed divide, km	32	13	25
d) Lc = length along stream from the central	15	6.5	12

e) s = average slope of stream in the watershed

	point 1	point 2	point 3	point 4	point 5	point 6
El. (m)	35	345	35	100	36	140
Length (m)		33,000		12,000		24,000
Slope		0.00939		0.00542		0.00433

	Kpob Trobek	O Saray	Tumnup Lok
f) t_{lag} = lag time, hrs = $1.90*(LLc/\sqrt{s})^{0.162}$	7.54	5.95	7.44
Tp = flood arrival time = 1.11 t lag	8.37	6.60	8.26
say	8.5	6.5	8.5
Tp/5 = plotting interval or the duration of the individual storm	1.7	1.3	1.7

Note: *1: Probable rainfall is adjusted on the condition that rainfall in the mountainous area more than El. 400 m is increased by 20 % from the probable rainfall of Kampong Spueu station

Rainfall distribution was estimated by the following equation.

$$R_t = R_{24}\left(\frac{t}{24}\right)^k$$

Where, R_t: maximum rainfall during t hours

k: constant value, 1/2～1/3, 1/2 was taken.

The Results of the 100-year probable flood are as follows.

Flood Discharge estimated by Unit Hydrograph Method

Site	Flood Discharge (m^3/sec)		
	100 years	50 years	20 years
Kpob Trobek Reservoir site	190	166	135
O Saray Reservoir site	87	77	64
Tumnup Lok Reservoir site	408	359	289

Fig. B-11 shows the hydrographs for the three streams.

(3) Flood estimate by non-uniform calculation method

Past maximum flood was estimated by non-uniform calculation method for the Tras Stream at Tumnup Lok Reservoir site, based on the cross section survey data of the Tras Stream and the information of past maximum flood water level collected from inhabitants and then confirmed by survey equipment.

Six cross sections were measured. Total distance between cross-sections is 897 m. Cross sections and the distances between cross sections applied for non-uniform calculation are shown in Table B-15. The past maximum flood water level is 38.6 m to 38.7 m in the downstream section and EL. 39.5 m to El. 39.7 m in the upstream section in accordance with field survey.

Non-uniform calculation was made by trial calculation so that the right side of the following equation equals to its left side.

$$Z_1 + H_1 + \frac{\alpha Q^2}{2gA_1^2} + \frac{n^2 Q^2 L}{2R_1^{4/3} A_1^2} = Z_2 + H_2 + \frac{\alpha Q^2}{2gA_2^2} - \frac{n^2 Q^2 L}{2R_2^{4/3} A_2^2}$$

Where,
- Z: riverbed elevation
- H: water depth
- α : energy adjustment coefficient
- Q: discharge
- g: gravity acceleration
- A: flow area
- L: distance between cross sections
- n: roughness coefficient
- R: hydraulic radius

The stream in the reaches calculated is slightly meandering and there are water pools in some concave sides and weed in the both sides. Both banks are paddy fields or upland crop fields. Paddy is growing up in September and October when big flood comes. Considering these conditions, roughness coefficient of 0.045 was adopted.

According to the calculation, the past maximum flood discharge was estimated to be in a range from 300 m/^{3}sec to 350 m^3/sec. Considering the age of persons interviewed, it is regarded as the maximum flood for past 30 years.

Calculation Results – Flood Discharge and Flood Water Level

(1) Discharge = 350 m^3/sec.

Sec. No.	Distance (m)	EL. min. (m)	n	Flow area (m^2)	W.L. (m)	Velocity (m/sec.)	Depth (m)	C.W.D. (m)
1	0.00	36.08	0.045	481.26	38.60	0.73	2.52	1.61
2	171.94	34.90	0.045	365.58	38.79	0.96	3.89	3.16
3	408.34	36.00	0.045	444.55	39.13	0.79	3.13	2.34
4	578.77	35.67	0.045	389.64	39.30	0.90	3.63	2.96
5	729.32	36.20	0.045	374.35	39.50	0.94	3.30	2.67
6	879.42	36.51	0.045	320.50	39.73	1.09	3.22	2.42

(1) Discharge = 300 m^3/sec.

Sec. No.	Distance (m)	EL. min. (m)	n	Flow area (m^2)	W.L. (m)	Velocity (m/sec.)	Depth (m)	C.W.D. (m)
1	0.00	36.08	0.045	481.26	38.60	0.62	2.52	1.56
2	171.94	34.90	0.045	352.29	38.75	0.85	3.85	3.05
3	408.34	36.00	0.045	413.07	39.04	0.73	3.04	2.30
4	578.77	35.67	0.045	354.64	39.20	0.85	3.53	2.90
5	729.32	36.20	0.045	330.73	39.38	0.91	3.18	2.62
6	879.42	36.51	0.045	291.10	39.61	1.03	3.10	2.35

(4) Conclusion

From the above calculation results and considering design flood of 700 m^3/sec for the Thnot Te Reservoir where the catchment area is 1,230 km^2, the following flood discharge are proposed as the design flow for the rehabilitation and reconstruction of three reservoirs.

Kpob Trobek Reservoir: 195 m^3/sec
O Saray Reservoir: 90 m^3/sec
Tumnup Lok Reservoir: 420 m^3/sec

Flood water level just below Tumnup Lok Reservoir site at the time when the design flood of 420 m^3/sec flows down was estimated at El. 39.9 m as shown below.

Design Flood Water Level Just Downstream of Spillway for Tumnup Lok Reservoir

Sec. No.	Distance (m)	El. min. (m)	n	Flow area (m^2)	W.L. (m)	Velocity (m/sec.)	Depth (m)
1	0.00	36.08	0.045	587.48	38.90	0.72	2.82
2	171.94	34.90	0.045	449.58	39.03	0.93	4.13
3	408.34	36.00	0.045	508.41	39.30	0.83	3.30
4	578.77	35.67	0.045	447.04	39.47	0.94	3.80
5	729.32	36.20	0.045	440.58	39.67	0.95	3.47
6	897.42	36.51	0.045	361.67	39.90	1.16	3.39

CHAPTER B-3 WATER QUALITY

The water quality analysis in dry season and rainy season was conducted at ten (10) sites, namely, three (3) on the Slakou River and its tributaries, four (4) open wells, and three (3) ponds. The sampling points were shown in Fig. A-1 and A-2. The analytical results are shown in Table B-16.

For irrigation use, the analytical values in both seasons indicate no serious problems.

From the viewpoint of drinking water, the total coliforms are detected from all samples with high values in both dry and rainy season, except one sample from the pond in Samraong commune. The escherichia coli and fecal coliforms are also observed in most of samples. These indicate that the water quality, even groundwater, in the Study Area is highly polluted with fecal contamination for drinking water resources. In addition, these fecal contamination values in the rainy season are higher than those in the dry season. The hydrological data, observed in August and September 2001, indicate that the sampling date for the rainy season (Sep. 8) is within the initial stage when rainfall and river runoff gradually increase. This suggests that the concentration of pollutant load by the effect of flushing out caused the higher values of contamination.

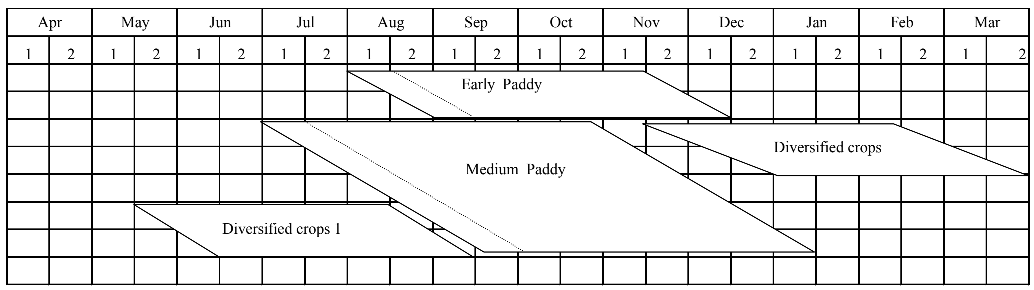
In comparison with water quality standard for bio-diversity conservation of Cambodia, the TSS and total coliform values of most of the surveyed sites exceed the acceptable ranges.

CHAPTER B-4 IRRIGATION WATER REQUIREMENT

B-4.1 Calculation Method and Conditions

The irrigation water requirements were estimated in accordance with the proposed cropping pattern shown below, based on the FAO Irrigation and Drainage Paper No. 24 and 33.

Proposed Cropping Pattern



Proposed crops consist of medium paddy, early paddy, and diversified crops 1 and 2.

B-4.1.1 Net Irrigation Water Requirements

Net irrigation water requirements were estimated on the condition that water saving irrigation method would be introduced for paddy cultivation. Concretely speaking, the paddy field after puddling and transplanting is supplied with water to keep soil water content in the root depth at not less than 75 % of full saturation throughout the total growing period. Moderate submergence is only practiced during a period of 30 days starting at head initiation till the end of flowering. In this irrigation practice, percolation losses can be remarkably reduced. In the estimate of irrigation water requirements, percolation losses were counted only during the period of 30 days starting at head initiation till the end of flowering. This water saving irrigation can make water saving of 20 % to 25 % of total net irrigation water requirements.

(1) Paddy

1) Net Irrigation water requirement in nursery bed

NIWRn = LP + CU + P

Where, NIWRn: net irrigation water requirement in nursery (mm)

LP: water requirement for land preparation (mm), which is assumed to be 120 mm under ha conditions:
Topsoil layer of 40 cm
Void ratio before water filling: 40 %
Water content before land preparation: 50 % of the void

Water depth immediate after the land preparation: 40 mm

CU: consumptive use of water (mm), CU = kc ETo

Where, kc: crop coefficient, supposed to be 1.0.

ETo: potential evepotranspiration (mm) estimated by the modified Penman method, see Section 2.1.

P: percolation (mm), supposed to be 2 mm/day.

Effective rainfall is neglected.

2) Net Irrigation water requirement in main fields

NIWRm = LP + (CU + P + S – ER)

Where, NIWR: net irrigation water requirement in main fields (mm)

LP: water requirement for land preparation (mm) supposed to be 120 mm.
Topsoil layer of 40 cm
Void ratio: 40 %
Pre-water content: 50 % of the void
Water depth immediate after the land preparation: 40 mm

CU: consumptive use of water (mm), CU = kc ETo

Where, kc: crop coefficient, supposed to be as follows in accordance with the FAO Irrigation and Drainage Paper 24.

kc for medium paddy every half a month

1st	2nd	3rd	4th	5th	6th	7th
1.10	1.10	1.10	1.05	1.05	1.05	0.95

kc for early paddy for every half a month

1st	2nd	3rd	4th	5th
1.10	1.10	1.05	1.05	0.95

ETo: potential evepotranspiration (mm) estimated by the modified Penman method, see Section 2.1

P: percolation (mm), supposed to be 2 mm/day only 30 days starting at head initiation till the end of flowering.

S: supplemental irrigation (mm) for moderate submergence at head initiation, supposed to be 30 mm.

ER: effective rainfall (mm)

For the years of 1994 to 2000 when daily rainfall was available, effective rainfall was calculated on the following conditions:
When daily rainfall is less than 5 mm, effective rainfall = 0.0.
When daily rainfall ranges from 5 mm to 80 mm, effective rainfall is 80 % of the daily rainfall.
When daily rainfall is more than 80 mm, effective rainfall is 64 mm.
The results based on the above conditions indicate that monthly effective rainfall is about 75 % of monthly rainfall.
Monthly effective rainfall is assumed to be 75 % of the monthly rainfall, if daily rainfall is not available.

3) Total net irrigation water requirement

NIWR(paddy) = NIWRn x Af + NIWRm

Where, NIWR(paddy): net irrigation water requirements of paddy
Af: area factor for nursery bed, 0.05

(2) Diversified crops (Upland crops)

NIWR crop = CU – ER

Where, NIWRupland crops: net irrigation water requirement for upland crops (mm)

CU: consumptive use of water (mm), CU = kc ETo

Where, kc: crop coefficient, supposed to be as follows.
Many kinds of upland crops are considered. The growing period and the crop coefficient are different in the kind of crops and growing season. Here in this stage, the following crop coefficient is adopted as an average of upland crops.

kc for every half a month

1st	2nd	3rd	4th	5th	6th
0.50	0.55	0.70	0.80	090	0.60

ETo: potential evepotranspiration (mm) estimated by the modified Penman method, see Section 2.1

ER: effective rainfall (mm)

Effective rainfall for upland crops can be estimated by various methods. One is the evapotranspiration/precipitation ratio method, table 34 in FAO Irrigation and Drainage Paper 24. In this calcuration, monthly effective rainfall was simply assumed to be 75 % of the monthly rainfall.

B-4.1.2 Irrigation Water Requirements

Irrigation water requirements were calculated by the following equation.

IWR = (NIWR medium paddy x A medium paddy / Ef paddy+ NIWR early paddy x A early paddy / Ef paddy + NIWR crop1 x A crop1 / Ef crop + NIWR crop2 x A crop2 / Ef crop) / 100,000

Where, IWR: irrigation water requirement (MCM)

NIWR: net irrigation water requirement (mm)

A: planting area (ha)

Ef: irrigation efficiency, irrigation efficiency taken for paddy is 0.6 and that for upland crops is 0.55.

B-4.2 Calculation Results of Irrigation Water Requirements

Table B-17 shows the calculation results of irrigation water requirement for each of crops planned in the proposed cropping pattern.

Peak irrigation water requirement was calculated as weighted average of cropping areas of medium and early paddy. It is 1.1 liters/s/ha.

CHAPTER B-5 WATER BALANCE CALCULATION FOR UPPER SLAKOU RIVER IRRIGATION RECONSTRUCTION PLAN

In order to estimate irrigable area, which can be irrigated by the water resources of the Slakou River through the rehabilitation and reconstruction of Kpob Trobek Reservoir, O Saray Reservoir and Tumnup Lok Reservoir, water balance calculation was made based on the proposed cropping pattern.

B-5.1 Development Alternatives

Considering the combination of the three reservoirs, the following 12 alternatives are taken for water balance calculation.

Alt. 1: Development of Kpob Trobek Reservoir only
- Alt. 1-1: Dike top elevation is 39 m.
- Alt. 1-2: Dike top elevation is 40 m.

Alt. 2: Development of Kpob Trobek Reservoir and O Saray Reservoir with a diversion canal from the O Saray to the Kpob Trobek.
- Alt. 2-1: Dike top elevation of the Kpob Trobek is 39 m.
- Alt. 2-2: Dike top elevation of the Kpob Trobek is 40 m.

Alt. 3: Development of Kpob Trobek Reservoir and Tumnup Lok Reservoir with a diversion canal from the Tumnup Lok to the Kpob Trobek.

Dike Top Elevations

	Kpob Trobek	Tumnup Lok
Alt. 3-1:	39 m	43 m
Alt. 3-2:	39 m	44 m
Alt. 3-3:	40 m	43 m
Alt. 3-4:	40 m	44 m

Alt. 4: Development of Kpob Trobek Reservoir, O Saray Reservoir and Tumnup Lok Reservoir with a diversion canal from the Tumnup Lok via O Saray to the Kpob Trobek.

Dike Top Elevations

	Kpob Trobek	Tumnup Lok
Alt. 4-1:	39 m	43 m
Alt. 4-2:	39 m	44 m
Alt. 4-3:	40 m	43 m
Alt. 4-4:	40 m	44 m

With reference to the Kpob Trobek Reservoir, the JICA Study Team was informed that RGC had a development plan to rehabilitate a reservoir (hereinafter called as the Don Phe Reservoir) located on the Don Phe Stream about 13 km upstream of the Kpob Trobek Reservoir in Kampot Province. Thus the water balance calculation was carried out in case of with-development of the Don Phe Reservoir.

B-5.2 Features of Reservoirs' Alternatives

Development alternatives of reservoirs are shown in the following table.

Features of Reservoir Alternative

Reservoir	Elevation of Dike Top	H.W.L.	Gross Capacity	20 years life			50 years life		
				Dead Storage	L.W.L.	Effect. Storage	Dead Storage	L.W.L.	Effect. Storage
Tumnup Lok	43.0 m	41.3 m	1.66 MCM	0.66 MCM	40.4 m	1.00 MCM	1.66 MCM	41.3 m	0.00 MCM
	44.0 m	42.3 m	3.30 MCM	0.66 MCM	40.4 m	2.64 MCM	1.66 MCM	41.3 m	1.64 MCM
O Saray	40.5 m	38.9 m	0.33 MCM	0.10 MCM	38.3 m	0.23 MCM	0.26 MCM	38.8 m	0.07 MCM
Kpob Trobek	39.0 m	37.3 m	2.77 MCM	0.13 MCM	34.2 m	2.63 MCM	0.34 MCM	34.8 m	2.43 MCM
	40.0 m	38.3 m	5.13 MCM	0.13 MCM	34.2 m	5.00 MCM	0.34 MCM	34.8 m	4.80 MCM

Storage volume and area curves of the Kpob Trobek, the O Saray, and the Tumnup Lok are shown in Fig. B-12.

Full supply level (FSL) is set at 1.7 m below the dike top surface in both the Kpob Trobek and the Tumnup Lok and 1.6 m below the dike top surface in consideration of the flood water depth above the spillway crest and the freeboard.

Dead storage volume is allocated for sedimentation. Its volume was estimated in consultation with the experience of sedimentation in existing shallow reservoirs and sedimentation volume adopted by projects located near the Study Area such as "Rehabilitation of Thnot Te Reservoir Project (ADB)" and "The Integrated Agricultural and Rural Development Project in the Suburbs of Phnom Penh (JICA)". Thnot Te Reservoir, which is located on the Slakou River below the Study Area adopts the specific sedimentation volume of 80 m^3/km^2/year or 0.08 mm/km^2/year. The latter project area is located in the Prek Thnot River Basin, which is a neighbor basin of the Slakou River basin. In this project, specific sedimentation volume of 100 m^3/km^2/year or 0.1 mm/km^2/year is adopted.

On the tributaries of the Slakou flowing from the northern basin, there exist several shallow reservoirs, of which size is nearly the same as Kpob Trobek or O Saray. These reservoirs have been functioning well without suffering from the sedimentation since the completion of their construction in the Pol Pot Regime around 25 years ago.

Sediment transportation is very small during a normal time. Once heavy rainfall comes, sediment transport considerably increases as river flow remarkably increases.

It is supposed that when flood comes, water in the reservoir becomes cloud with storm water containing suspended load and turbid with deposit stirred up from the reservoir bottom, since small reservoirs have small scale against flood with only water depth of 1 m to 3 m and a few million cubic storage capacity.

If water is not flowing out from the reservoir, most of the sediment transported to reservoir gradually deposits in the bottom of the reservoir. While, when flood comes at the full storage time, excess water spills out from the reservoir and much amount of suspended load contained in the excess water and deposits stirred up from the bottom will be drained.

Considering the above, specific sedimentation volume was decided at 0.1 mm/km^2/year and dead storage volumes were simply calculated as products of the specific sedimentation volume and the drainage area.

Catchment Area and Sedimentation Volume

Reservoir	Catchment Area (km^2)	Sedimentation Volume (m^3/year)
Kpob Trobek, with project of Don Phe rehabilitation	67	6,700
O Saray	51	5,100
Tumnup Lok	332	33,200

Note: Catchment area taken into account for Kpob Trobek Reservoir is only lower basin of the Don Phe Reservoir supposing that the Don Phe Reservoir catches bed load and suspended load coming into the reservoir from the upper basin.

B-5.3 Calculation Method and Conditions

Water balance calculation methods are shown in Fig. B-13.

Conditions and assumptions are summarized as follows:

(1) Calculation period: 20 years from 1966 to 1969 and from 1985 to 2000.

(2) Calculation cycle: half a monthly basis.

(3) Estimated monthly runoff was simply divided into half a monthly runoff.

(4) Judgement of calculation results: irrigable area which can be guaranteed irrigation water supply at 80 % dependability on water-saving irrigation method was estimated. Number of times of irrigation water deficit was counted. In principle, four times of water deficit out of 20 years for each crop was regarded as that irrigation water could guarantee to cover the irrigation area at 80 % dependability.

(5) In case of full development alternatives (Alt. 4 series), the Kpob Trobek and the O Saray were regarded as one reservoir and the water balance calculation was made as if two reservoirs: the Kpob Trobek including O Saray and the Tumnup Lok were connected.

(6) In case of with-development of the Don Phe Reservoir, runoff flowing into Kpob Trobek Reservoir consists of (i) spilling-out discharge from the Don Phe Reservoir and (ii) runoff flowing from the basin between the Don Phe Reservoir and Kpob Trobek Reservoir. The spilling-out discharge from the Don Phe Reservoir was estimated by water balance calculation at the Don Phe Reservoir

level on the assumptions that the cropping pattern the Study Team has proposed is adopted in the Don Phe Reservoir's benefited area and that the Don Phe Reservoirs' effective storage is 2.5 MCM. Table B-18 shows the runoff flowing into the Kpob Trobek with project condition of the Don Phe Reservoir rehabilitation.

(7) Evaporation (Ev) and percolation (P) from Don Phe Reservoir:

Storage volume > 1.0 MCM, then Ev = 0.1 MCM/half a month

1.0 MCM ≧ Storage volume > 0, then Ev = 0.05 MCM/half a month

Storage volume ≦ 0, then Ev = 0

P = 0.01 MCM/half a month constantly.

(9) Evaporation loss (Ev) (MCM) from the three reservoirs:

If reservoir water level ≧ LWL, then Ev = 0.9 x ETo/1000 x WSA

If reservoir water level < LWL, then Ev = 0

Where,	ETo:	potential evapotranspiration (mm/half a month), It was estimated by the modified Penman method.
	WSA:	water surface area (million m^2) (see Fig. B-12)

(10) Percolation loss from the three reservoirs:

P = p /1000 x D x WSA

Where,	p:	percolation rate supposed to be 0.5 mm/day
	D:	days of half a month
	WSA:	water surface area (million m^2) (see Fig. B-12)

In order to calculate WSA from reservoir storage volume (S), following regression equations are employed.

Kpob Trobek Reservoir:	$WSA = 0.0024 \times S^3 - 0.0735 \times S^2 + 0.8736 \times S$
O Saray Reservoir:	$WSA = 0.3884 \times S^3 - 1.2424 \times S^2 + 1.8773 \times S$
Tumnup Lok Reservoir:	$WSA = 0.0371 \times S^3 - 0.3497 \times S^2 + 1.3147 \times S$

Where,	WSA:	water surface area (million m^2)
	S:	storage (MCM)

B-5.4 Water Balance Calculation Results

B-5.4.1 Irrigable Area

Table B-19 shows the irrigable area in each of reservoir development alternatives. Table B-20 shows irrigation water requirements in case of Alt. 3-1.

B-5.4.2 Conveyance Capacity of Diversion Canal

According to the results of the water balance calculation for 20 years, maximum amount of water conveyed by the diversion canal from Tumnup Lok Reservoir to Kpob Trobek Reservoir is shown in the following table.

Discharge at recurrence period of 5 years is estimated at 3.1 m^3/sec. This discharge is, however, only an average for half a month. Thus some surplus should be taken into account for the design of the diversion canal.

Maximum Discharge on Half-Monthly Basis on Diversion Canal (Alternative 3-1 Case)

Year	Max. Amount (MCM)	Max. Discharge (m^3/sec)	Order from largest	Year	Max. Amount (MCM)	Max. Discharge (m^3/sec)	Order from largest
1966	3.97	3.06	4	1991	4.29	3.31	1
1967	3.58	2.76		1992	2.02	1.56	
1968	3.74	2.89	5	1993	2.98	2.30	
1969	2.04	1.48		1994	2.29	1.77	
1985	2.38	1.84		1995	2.66	2.05	
1986	2.71	2.09		1996	2.40	1.74	
1987	3.12	2.41		1997	4.23	3.26	2
1988	3.39	2.62		1998	1.88	1.36	
1989	1.95	1.50		1999	4.01	3.09	3
1990	3.66	2.82		2000	0.84	0.65	

B-5.5 Additional Water Balance Calculation

Instead of reconstruction of the storage dam at the Tumnup Lok Reservoir site, construction of a small diversion weir that has no storage capacity, is conceivable as one of the alternatives for Alt. 3-1.

Thus, in order to estimate irrigable area for the alternative of small diversion dam, water balance calculation between available river runoff and irrigation demands was conducted. The conditions and assumptions in the water balance calculation are the same as those mentioned in the previous section. Only condition of diversion discharge through the intake from the Tras Stream was changed, because water at the storm time exceeding the diversion capacity of the intake structure can not be diverted and flows down without storage. Monthly amount diverted by an intake was assumed by the following conditions.

If $Qr > Qc/0.7$, $Qin = Qc$
If $Qr < Qc/0.7$, $Qin = 0.7\ Qr$
Where, Qin: monthly diverted amount
Qr: monthly river discharge
Qc: intake capacity

The results of the water balance calculation are shown below.

Water Balance Calculation Results – Irrigable Area in Alt. 3-1-1

Time	Total Irri. Area	Medium Paddy	Short Paddy	Upland C 1	Upland C 2
20 years	3,350	1,800	800	350	450
50 years	3,250	1,700	800	350	450

CHAPTER B-6 THE SMALL RESERVOIR REHABILITATION PLAN (SRP) (ANG 160 RESERVOIR AND KIM SEI RESERVOIR)

B-6.1 Runoff

(1) Ang 160 Reservoir

Assumed runoff is shown in Table B-21.

(2) Kim Sei Reservoir

Based on the interview survey, it is judged that water resources are poor in the Kim Sei reservoir. Without water in paddy fields that form a catchment area of the Kim Sei Reservoir, runoff from the catchment area is not expected. In a drought year, farmers try to keep limited water in their paddy fields and dam off the flow of Canal 8. Thus runoff-starting time is further late. While, once the paddy fields are full of water, water flows continuously and when heavy rainfall comes, big flow occurs.

Runoff was approximately estimated on the following assumptions and conditions.

i) Average annual runoff is about 20 %.
ii) The peak runoff comes in September and October.
iii) In seven months from late December to early July, there is usually no runoff.
iv) Runoff usually starts in late July, but it is one month late in drought year.
v) Runoff amount increases up to October.

Assumed runoff is shown in Table B-22.

Thus in order to manage the areas to benefit from the Kim Sei reservoir, it is recommended that:

(i) Nursery of paddy should be oparated in August with residual water in the Kim Sei Reservoir, (ii) paddy should be transplanted in late August to early September and harvested in late November to early December. Water stored in the Kim Sei Reservoir should be intensively utilized for nursery, land preparation, and late growing season in November as well as a period of 30 days from head initiation to flowering that is most sensitive period to water deficit.

B-6.2 Flood

The Rational Formula was employed for estimating flood discharge for both Ang 160 and Kim Sei reservoirs.

Flood was calculated from probable daily rainfall estimated at return period of 20 years and 100 years from annual maximum daily rainfall of Kampong Spueu station (see Section B-1.3.4). Flood peak is calculated by the following equation:

$Q_{max} = 1/3.6 \cdot f \, rt \, A$

Where: Q_{max}: flood peak (m^3/sec)
f: runoff coefficient (see the following table)
rt: rainfall intensity (mm/hr)
A: catchment area (km^2)

Peak Runoff Coefficient

Steep slope topography	0.75 - 0.9
Hilly area and forest	0.5 - 0.75
Plain agricultural land	0.45 - 0.6
Paddy field under irrigation	0.7 - 0.8
Small river in plains	0.45 - 0.75
Mountain river	0.75 - 0.85

The catchment area of Ang 160 is 2 km^2 consisting of hilly forest, grass plain and rain-fed paddy field. Kim Sei Reservoir's catchment area is mostly rain-fed paddy fields of about 5 km^2. Considering these land use and topography, runoff coefficents of 0.7 and 0.6 were adopted for estimate of flood for Ang 160 Reservoir and Kim Sei Reservoir, respectively.

Flood arrival time has to be known to estimate rainfall intensity during the flood arrival time.

Rainfall intensity was estimated by the following equation, because of no hourly rainfall data.

$rt = R_{24}/24 \times (24/T)^n$

Where, rt: T-hour maximum rainfall intensity (mm/hr)
R_{24}: daily rainfall (mm)
n: 0.5～ 0.667. 0.5 was taken.

The flood arrival time was estimated by Fukushima-Kadoya equation shown below.

$tp = C \times A^{0.22} re^{-0.35}$

Where, C: coefficient in accordance with land use as follows:
Natural hilly area = 250 ～ 350 = 290
Grazing area 190 ～ 210 = 200
Here, C=290 was taken.
A: catchment area (km^2)
re: average effective rainfall during flood arrival time (mm/hr)

Results of peak flood estimate are shown in the following table.

Estimated Peak Flood Discharge of Ang 160 and Kim Sei Reservoir

Name of Reservoir	Catchment Area (km^2)	Probable Food (m^3/sec.)	
		20 year	100 year
Ang 160 Reservoir	2.0	6.0	7.8
Kim Sei Reservoir	5.2	11.4	14.8

B-6.3 Water Balance Study – Estimate of Irrigable Area

In order to estimate irrigable area, water balance calculation between irrigation water requirements and assumed available water resources was made. In the calculation, the assumptions and conditions are almost the same as those in USP.

(1) Ang 160 Reservoir

Relation between the reservoir elevation and area or storage volume is shown in the following table.

Relation between Elevation and Area and between Elevation and Volume of Ang 160 Reservoir

Elevation (m)	Area (m^2)	Depth (m)	Volume (m^3)	Accumulated Volume (m^3)	Effective Storage (m^3)	Remarks
45.3	43,006	0.3	8,505	36,250	29,305	
45.0	34,500	0.5	13,125	27,745	20,800	High WL.
44.5	18,000	0.5	7,675	14,620	7,675	
44.0	12,700	0.5	4,690	6,945	0	Low WL.
43.5	6,060	0.5	2,255	2,255	0	
43.0	2,960	0	0	0	0	

The design dike top elevation was determined at 46.5 m, the same as the present one. The design low water level was decided at 44.0 m so that the most of paddy fields located in the downstream of the reservoir can be served by gravity.

An area to benefit with this development was estimated at 25 ha at 80 % dependability.

Medium paddy:	17.0 ha
Short Paddy:	8.0 ha
Diversified crop 1:	2.0 ha
Diversified crop 2:	3.0 ha

Irrigation water requirements for the irrigation of above crops are shown in Table B-23.

(2) Kim Sei Reservoir

Relation between reservoir elevation and the area or storage volume is shown in the following table.

Relation between Elevation and Area and between Elevation and Volume in Kim Sei Reservoir

Elevation (m)	Area (m^2)	Depth (m)	Volume (m^3)	Accumulated Volume (m^3)	Effective Storage (m^3)	Remarks
12.6	87,621	0.1	8,016	27,491	19,729	High WL.
12.5	72,700	0.5	19,475	19,475	13,205	
12.0	5,200	0	0	0	0	Low WL.

The design top elevation of the dike was determined at 13.8 m, almost the same as the present one. The high water level for the reservoir was determined at 12.6 m in order to prevent paddy field existing in the reservoir from deep submergence so that paddy cultivation can be practiced even after the rehabilitation of the reservoir. The design low water level was decided at 12.0 m so that the most of paddy fields located in the downstream of the reservoir can be served by gravity irrigation. The effective storage volume at the water level of 12.6 m is expected to be 19,700 m^3 taking into account dead loss of 100 mm in the paddy fields existing in the reservoir. The design flood water level will be 13.2 m taking a freeboard of 0.6 m.

An area to benefit with the reservoir rehabilitation was estimated at 27 ha at 80 % dependability.

Medium paddy:	18.0 ha
Short Paddy:	9.0 ha

Instead of paddy, vegetables are also recommendable in a period from October to January.

Irrigation water requirements for cultivation of paddy in the above area are shown in Table B-24.

CHAPTER B-7 RECOMMENDATIONS FOR RIVER WATER RESOURCES DEVELOPMENT

1. Most of river water flows down at storm times and base flow is very small even in the main Slakou River. Thus, river water at storm times should be tentatively stored for effectively using it. For this, existing reservoirs and ponds should be reconstructed and rehabilitated.
2. The water resources available for the area to be irrigated by Kpob Trobek Reservoir are largely influenced by the rehabilitation of Don Phe Reservoir located on the Don Phe Stream above Kpob Trobek Reservoir. At present, the features of the rehabilitation plan of Don Phe Reservoir such as effective storage capacity, volume and area curves of the reservoir, irrigable area, irrigation water distribution plan have not been determined yet. When the rehabilitation plan of Don Phe Reservoir is formulated, the area to be irrigated by Kpob Trobek Reservoir has to be fully respected.
3. If the Don Phe Reservoir irrigation system uses water more than the design, the Kpob Trobek Reservoir irrigation system is obliged to reduce the irrigation area or suffers from water shortage. Therefore, water diversion operation at Don Phe Reservoir is very important for the Kpob Trobek Reservoir irrigation area as well as for the Don Phe Reservoir irrigation area. Persons in charge of water management should closely contact and keep communication between Don Phe and Kpob Trobek Reservoirs. Water distribution plan at the Don Phe Reservoir level should be prepared considering both Don Phe and Kpob Trobek irrigation systems.
4. It is supposed that the Tras Stream, which is a main stream of the Slakou River, is the most stable among the three tributaries. In order to secure water resources for USP, it is desirable to convey water from the Tras Stream to Kpob Trobek Reservoir.
5. Even if water is obtained from the Tras Stream, water resources are quite limited in comparison with the scale of arable land in the Study Area. Thus, whenever water overflows out through spillway at Kpob Trobek Reservoir, excess water should be diverted as much as possible and conveyed through the main canal beyond a project-authorized benefited area especially for transplanting period of paddy.
6. There is little flow data in small rivers located in the rain shadow area, eastern part of the Elephant Mountains. In this Study, two water level gauges were installed at Tumnup Lok Reservoir site and National Road No.3 point on the

Slakou River. In order to analyze river runoff or to know the relation between rainfall and river flow, rain gauges should be installed in the Slakou River basin. It is very useful to understand available runoff and flood in small river systems including the Slakou River system.

7. Pond is also important water source for domestic use and minor irrigation, especially for vegetables, valuable crops and paddy nursery. Even in the area covered by the reservoir irrigation system as well as in area where irrigation water cannot be obtained, pond is very useful. The pond should be located at the place where surface runoff can be easily caught, and/or canal water can be easily diverted to the pond or groundwater lies near the ground surface.

Tables

Table B-1 Monthly Rainfall (1/2)

Takeo El.about 10 m Unit:mm

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1982	0.0	0.0	30.0	54.0	99.1	204.4	214.0	151.3	226.0	27.0	0.0	0.0	1005.8
1983	0.0	0.0	0.0	152.6	0.0	132.4	183.5	169.0	106.7	101.6	0.0	55.2	901.0
1984	0.0	0.0	0.0	105.5	102.3	173.4	102.3	122.1	304.0	339.6	37.6	0.0	1286.8
1985	0.0	9.8	0.0	164.7	177.1	32.0	60.4	35.0	190.3	254.0	170.2	0.0	1093.5
1986	0.0	0.0	0.0	11.5	195.4	6.7	166.8	90.0	113.4	163.4	100.0	51.2	898.4
1987	0.0	0.0	0.0	31.9	105.0	116.0	41.6	181.6	110.7	227.5	175.7	0.0	990.0
1988	0.0	2.0	52.9	67.6	254.0	46.2	141.1	116.8	310.0	205.3	42.0	10.0	1247.9
1989	0.0	11.0	0.0	0.0	8.0	128.0	93.8	215.0	108.8	99.2	414.1	144.5	1222.4
1990	0.0	0.0	13.4	73.0	115.0	119.0	78.0	139.0	176.0	215.0	215.0	24.0	1167.4
1991	0.0	25.0	0.0	65.0	95.0	53.0	237.9	341.1	167.3	83.6	0.0	0.0	1067.9
1992	0.0	0.0	0.0	29.3	30.0	182.3	94.7	189.1	281.7	0.0	270.5	8.0	1085.6
1993	2.0	0.0	47.7	103.3	41.5	297.5	215.0	165.0	203.0	117.5	91.5	0.0	1284.0
1994	0.0	2.0	49.3	52.0	177.5	149.2	200.2	190.0	172.1	144.2	0.0	21.0	1157.5
1995	26.2	0.0	39.5	48.5	116.0	137.2	42.2	133.5	230.5	285.3	49.5	94.5	1202.9
1996	29.9	0.0	0.0	116.8	148.9	65.4	195.7	66.1	213.3	289.0	175.0	26.5	1326.6
1997	0.0	22.5	9.6	92.1	75.7	0.0	186.4	118.4	140.3	233.7	62.9	4.4	946.0
1998	0.0	0.0	0.0	73.0	96.2	78.4	138.4	177.4	210.3	192.4	211.3	44.0	1221.3
1999	31.0	0.0	33.9	170.1	163.2	63.9	52.0	188.2	106.0	526.1	194.9	10.7	1540.0
2000	21.0	0.0	40.0	87.0	74.2	145.7	81.8	170.9	199.5	457.5	138.6	177.9	1594.1
Average	5.8	3.8	16.6	78.8	109.2	112.1	132.9	155.8	187.9	208.5	123.6	35.4	1170.5

Source: Takeo Office of MOWRAM, Period from 1994 to 2000, daily rainfall data are available.

Kampong Spueu Lat.11.26 Lon.104.31 El.about 25 m Unit:mm

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1966	0.0	25.0	31.2	49.9	147.8	152.7	202.5	104.4	90.6	366.4	94.6	84.2	1349.3
1967	24.0	0.0	0.0	110.0	105.5	166.5	131.0	87.0	195.5	200.0	18.3	1.6	1039.4
1968	0.0	0.0	0.0	80.7	63.5	287.9	162.2	31.7	202.4	158.2	24.0	0.0	1010.6
1969	58.0	9.0	no data	39.5	127.2	99.3	46.1	214.4	251.3	281.9	105.2	3.2	1235.1
1985	0.0	62.4	0.0	304.2	315.4	139.4	0.0	50.5	320.8	113.5	87.3	0.0	1393.5
1986	8.4	4.6	0.0	96.3	92.4	105.4	88.5	69.6	235.8	202.3	188.2	60.9	1152.5
1987	0.0	0.0	0.5	5.4	120.7	99.9	48.7	136.8	226.3	88.8	281.5	0.0	1008.6
1988	0.0	0.0	17.0	85.7	125.6	193.8	103.0	110.0	183.4	238.4	53.5	0.0	1110.4
1989	4.5	0.0	0.0	0.0	156.9	56.6	111.7	134.5	230.9	281.9	0.0	0.0	977.0
1990	0.0	0.0	5.5	44.9	134.9	80.5	103.7	121.1	130.4	70.1	105.9	5.2	802.2
1991	0.0	7.8	0.0	85.7	56.4	178.5	208.3	171.1	176.8	166.0	0.0	13.2	1063.5
1992	0.0	0.0	0.0	26.1	51.0	112.9	194.0	106.0	161.3	184.8	32.3	4.6	873.0
1993	54.0	0.0	48.0	21.5	33.0	102.0	44.1	63.9	206.1	319.2	0.0	0.0	891.8
1994	0.0	0.0	116.1	13.5	79.3	96.9	191.9	164.7	286.5	60.5	0.0	0.0	1009.4
1995	0.0	0.0	5.0	0.0	159.9	62.5	99.6	161.8	307.0	236.5	51.8	10.0	1094.1
1996	7.5	0.0	0.0	134.8	124.5	321.3	106.8	103.2	256.4	274.2	124.2	12.4	1465.3
1997	0.0	0.0	35.5	114.7	159.0	25.1	171.7	156.0	130.5	185.9	35.0	6.6	1020.0
1998	0.0	6.7	no data	135.5	54.4	64.5	95.3	224.3	401.4	95.4	192.3	11.7	1281.5
1999	11.8	17.0	42.5	191.0	291.7	61.0	116.3	335.6	133.9	317.0	151.0	0.0	1668.8
2000	29.1	9.0	97.5	120.7	117.0	186.3	131.6	168.4	271.0	437.9	177.7	131.2	1877.4
Average	9.9	7.1	22.2	83.0	125.8	129.7	117.9	135.8	219.9	213.9	86.1	17.2	1166.2

Source: Department of Meteorology, MOWRAM for the period from 1985 to 2000, and Lower Mekong Hydrological Yearbook for 1966 to 1969.

Table B-1 Monthly Rainfall (2/2)

Phnom Srouch Lat.11.22 Lon.104.22 El.about 50m Unit: mm

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1966	4.2	31.2	21.4	92.2	212.4	215.0	188.2	227.6	146.2	261.2	166.4	115.0	1681.0
1967	30.2	0.0	0.0	179.6	170.0	188.0	251.0	141.4	123.2	278.0	42.8	15.0	1419.2
1968	0.0	5.6	0.0	129.7	140.9	264.7	155.0	147.1	219.6	197.8	23.3	7.9	1291.6
1969	35.2	25.8	7.1	10.1	183.2	89.2	121.1	210.4	283.7	281.6	66.5	2.6	1316.5
1983	0.0	0.0	0.0	82.0	43.7	100.0	70.7	273.5	187.7	117.3	20.5	11.6	907.0
1984	0.0	0.0	0.0	0.0	99.7	163.9	82.3	142.7	158.9	155.4	40.4	0.0	843.3
1985	0.6	0.0	0.0	171.2	166.7	67.2	96.3	55.9	194.0	299.7	120.1	0.0	1171.7
1986	27.0	37.6	10.7	36.5	40.2	129.7	88.6	131.4	162.3	78.8	205.3	0.0	948.1
1987	0.0	0.0	0.0	15.5	74.0	165.7	17.1	88.7	124.3	129.5	319.2	0.0	934.0
1988	0.0	5.0	23.0	118.5	83.5	49.8	56.0	52.0	171.5	138.0	0.0	0.0	697.3
1989	0.0	0.0	29.5	105.5	259.5	5.5	46.0	82.0	394.0	183.0	0.0	0.0	1105.0
1990	0.0	0.0	0.0	101.5	52.0	46.0	35.0	90.0	97.5	112.5	174.7	0.0	709.2
1991	0.0	12.0	25.9	50.1	25.0	234.2	160.5	387.3	165.8	208.5	0.0	0.0	1269.3
1992	16.0	0.0	0.0	58.8	15.0	53.5	105.5	75.5	200.5	349.0	0.0	0.0	873.8
1993	15.0	0.0	76.0	12.0	102.5	61.0	96.0	78.0	219.5	291.0	41.0	0.0	992.0
1994	0.0	0.0	106.0	15.5	100.0	64.0	318.2	219.0	106.5	67.0	0.0	4.5	1000.7
1995	0.0	0.0	41.0	0.0	55.0	36.0	107.5	169.7	295.0	198.5	51.0	18.0	971.7
1996	6.0	0.0	0.0	94.0	84.0	159.0	221.5	98.5	172.7	175.0	171.2	21.5	1203.4
1997	0.0	0.0	71.0	6.0	62.0	0.0	160.0	191.0	80.0	72.0	12.0	0.0	654.0
1998	0.0	3.0	0.0	57.5	24.0	46.0	116.5	238.5	120.0	293.0	159.7	12.0	1070.2
1999	6.0	6.0	79.0	223.5	315.0	93.0	149.8	147.2	98.0	297.5	no data	no data	1415.0
2000	36.0	35.0	133.0	68.0	89.5	186.5	no data	no data	no data	no data	no data	no data	-
Average	8.0	7.3	28.3	74.0	109.0	109.9	125.8	154.6	177.2	199.3	80.7	10.4	1070.2

Source: Department of Meteorology, MOWRAM for the period from 1983 to 2000, and Lower Mekong Hydrological Yearbook for 1966 to 1969.

Stung Chral Lat.11.11 Lon.104.04 El. about 30m, west slope Unit: mm

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1967	17.2	2.2	45.5	81.0	389.8	478.2	no data	no data	no data	no data	no data	no data	-
1968	0.0	22.9	1.1	137.8	92.2	238.1	491.7	732.6	404.6	197.8	1.0	9.9	2329.7
1969	71.2	68.1	34.1	98.7	180.9	362.6	558.6	374.4	813.7	221.4	81.7	10.6	2876
Average	29.5	31.1	26.9	105.8	221.0	359.6	525.2	553.5	609.2	209.6	41.4	10.3	2602.9

Kirirom Lat.11.19 Lon.104.02 El.680 m Unit: mm

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1966	0.2	40.3	63.1	213.9	226.5	190.5	248.6	105.4	181.9	367.5	168.2	120.1	1926.2
1967	32.1	0.0	6.4	99.6	223.2	186.6	335.2	355.7	93.7	318.2	34.3	10.0	1695.0
1968	1.4	17.8	0.0	232.5	203.4	177.5	355.3	347.0	227.0	382.9	11.9	3.7	1960.4
1969	69.3	21.8	20.5	44.7	235.7	142.3	205.8	432.8	441.1	235.7	66.8	2.0	1918.5
2000	no data	no data	no data	no data	no data	no data	no data	300.2	201.4	493.5	141.6	71.2	-
Average	25.8	20.0	22.5	147.7	222.2	174.2	286.2	308.2	229.0	359.6	84.6	41.4	1875.0

Sangker Satub Lat.11.18 Lon.104.08 El.about 70 m Unit: mm

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1966	7.2	0.0	49.5	104.6	190.6	75.2	296.6	116.2	201.2	269.2	124.6	66.6	1501.5
1967	0.2	0.0	29.0	360.4	98.0	161.6	no data	no data	no data	236.8	25.6	no data	-
1968	0.0	21.0	1.8	133.0	223.6	346.9	119.4	124.0	182.0	239.8	no data	no data	-
Average	2.5	7.0	26.8	199.3	170.7	194.6	208.0	120.1	191.6	248.6	75.1	66.6	1501.5

Source: Lower Mekong Hydrological Year Book

Table B-2 Daily Rainfall at Takeo Station (1/4)

Year: 1994 Unit: mm

Date	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1												
2		2.0					34.4	7.2		8.2		21.0
3												
4						6.4		17.8		2.0		
5							26.5					
6									18.0	12.0		
7						26.5	6.2					
8					2.0					18.5		
9						9.0	11.2		18.5	1.5		
10					6.5	64.0			11.0			
11						18.3	11.0		7.0	11.0		
12					37.0	16.0						
13							12.0	10.0	2.0	12.0		
14				17.0						20.0		
15					27.0							
16			2.5				5.4	2.7	10.0			
17					1.0				6.0	16.0		
18								61.0	2.0			
19					29.0			32.0	9.5	24.0		
20				35.0	6.0					19.0		
21												
22			3.0		31.5			12.0	78.5			
23						9.0		2.0				
24			17.5		37.5							
25								24.2	2.1			
26			7.0						3.5			
27								10.1				
28			19.3									
29								11.0	4.0			
30												
31							93.5					
Total	0.0	2.0	49.3	52.0	177.5	149.2	200.2	190.0	172.1	144.2	0.0	21.0
Rain days	0	1	5	2	9	7	8	11	13	11	0	1

Year: 1995

Date	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1												
2								34.0	13.2			
3										7.8		
4						16.3			1.0			
5										3.7		
6							7.0					
7						6.1				71.0		
8							6.2			26.0		
9					46.0	2.2					23.8	
10					4.8	11.4				76.5	12.0	
11						21.0			23.4	32.3		
12					3.0	4.5			2.9		8.7	
13					9.5				3.0			
14					3.0							
15												
16						16.3			50.7	29.5		
17						2.5		7.2	26.4	17.8		
18								13.2		7.1	5.0	5.3
19						2.3						82.0
20						4.2						7.2
21			26.5				7.8					
22	26.2							18.8	6.6			
23						23.4		20.0	10.4			
24							5.0	11.9	40.1	1.4		
25						2.0			15.5			
26								0.1				
27			13.0									
28						23.0	16.2	11.6		6.5		
29								16.7				
30						2.0			37.3			
31				48.5	49.7					5.7		
Total	26.2	0.0	39.5	48.5	116.0	137.2	42.2	133.5	230.5	285.3	49.5	94.5
Rain days	1	0	2	1	6	14	5	9	12	12	4	3

Table B-2 Daily Rainfall at Takeo Station (2/4)

Year: 1996

Date	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1									16.3	11.1		
2											39.0	20.8
3				14.2					7.6		10.0	
4								1.9	12.5			
5									17.0	47.7		
6				67.4		22.0			1.5		4.4	5.7
7				18.5					3.5	3.2		
8								5.4			11.8	
9					46.0		6.7			26.7		
10					4.8		7.5		15.2	6.0		
11							6.0		8.5	12.0		
12					3.0					39.3		
13					9.5				6.4	2.0	5.2	
14				3.0			25.6		16.0	14.5		
15					32.0			30.8				
16				4.7			21.7					
17					6.0						17.3	
18							16.2	5.4		30.5	11.8	
19					25.0				3.1			
20					10.0		16.0					
21						26.6	24.0					
22	26.2				2.6					21.5	22.7	
23				9.0			24.0			10.0	32.0	
24	3.7					9.4			10.5	7.5		
25							9.0					
26							9.5	12.0		23.0		
27								5.6	37.0			
28					10.0		3.3		37.7			
29						1.0	9.5	5.0	12.3	4.0		
30							8.5		8.2	30.0	20.8	
31						6.4	8.2					
Total	29.9	0.0	0.0	116.8	148.9	65.4	195.7	66.1	213.3	289.0	175.0	26.5
Rain days	2	0	0	6	10	5	15	7	16	16	10	2

Year: 1997

Date	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1							55.5	10.7		13.0		
2					2.5			22.0		8.7		
3					1.4			15.0		13.5	14.5	
4							8.0	9.2		42.7	0.5	4.4
5							6.0			19.0		
6							34.0			16.0		
7					23.8		4.1			5.2		
8												
9				9.1						18.7		
10		12.0										
11		10.5										
12									13.0			
13							10.1				23.5	
14							9.7					
15							15.0			7.5		
16							4.1	13.7				
17							3.9			5.5		
18							4.4			18.0		
19									22.5			
20			9.6									
21							15.1					
22					23.4				36.0			
23				39.0			10.4	15.4	6.7		0.7	
24					4.0			8.0	11.0		23.7	
25								20.0				
26									16.0			
27								4.4		7.9		
28							6.1			56.7		
29									31.5	1.3		
30				44.0	11.0				3.6			
31					9.6							
Total	0.0	22.5	9.6	92.1	75.7	0.0	186.4	118.4	140.3	233.7	62.9	4.4
Rain days	0	2	1	3	7	0	14	9	8	14	5	1

Table B-2 Daily Rainfall at Takeo Station (3/4)

Year: 1998

Date	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1								11.3			12.0	
2							2.3				8.5	
3							22.5	82.2			6.8	
4							4.8		23.0	15.4	2.0	
5							6.3		9.5		17.1	
6											17.0	
7									1.2	12.0	48.2	
8								7.0		23.5		
9										12.5	6.5	
10							5.0	11.5		10.5		
11										3.4		27.3
12				1.0			19.5		2.5	1.0		
13				62.0		6.3						
14												16.7
15											47.0	
16						2.7		9.0			1.7	
17									5.1			
18					13.0			31.0	63.2			
19						23.3		5.3				
20					27.8					3.4		
21				10.0					8.3	15.8		
22												
23							31.0	9.1			28.0	
24									18.2			
25					3.5		31.0		5.5	1.6		
26								11.0				
27									44.5			
28							7.2		9.0			
29					15.8				4.7	30.2		
30					2.7	16.1			15.6	31.1	16.5	
31					33.4	30.0	8.8			32.0		
Total	0.0	0.0	0.0	73.0	96.2	78.4	138.4	177.4	210.3	192.4	211.3	44.0
Rain days	0	0	0	3	6	5	10	9	13	13	12	2

Year: 1999

Date	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1			0.5	28.0		4.0		8.2		121.0	3.8	
2				28.5	7.5			18.5		22.0	45.0	
3				2.2	7.0	17.5		38.0			45.0	
4					5.8	8.0		4.0			22.0	
5						8.0	4.5			4.0	25.0	10.7
6			10.0	32.1			9.0			11.0		
7									6.5	10.0		
8					8.0					80.4		
9					23.0		6.5		40.0			
10					6.8				1.5			
11										62.0	10.0	
12	12.5				11.5			7.0		6.0		
13								24.5		13.0		
14					38.0				7.0	1.9		
15					7.0	12.0		5.0	6.3		38.5	
16					1.0							
17							3.0		4.5	2.5	5.6	
18	5.5									2.8		
19						4.9			17.2			
20					7.0							
21				34.0								
22					19.5				19.0			
23					1.1		7.0	32.0				
24				2.6			7.3					
25	13.0				8.0					4.5		
26										67.0		
27								6.0				
28				35.7						92.0		
29				7.0	12.0		7.7					
30						9.5	7.0	35.0	4.0	26.0		
31			23.4					10.0				
Total	31.0	0.0	33.9	170.1	163.2	63.9	52.0	188.2	106.0	526.1	194.9	10.7
Rain days	3	0	3	8	15	7	8	11	9	16	8	1

Table B-2 Daily Rainfall at Takeo Station (4/4)

Year: 2000

Date	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1										10.0	23.5	
2				8.5	15.0	12.5	12.7	27.2				
3					12.0		2.3					
4							1.8					
5			11.0				1.9	7.6				
6												
7						4.5		12.5				1.0
8					14.3	20.2						15.5
9				1.6		1.2				33.0		
10					2.4	8.2	8.2		4.2	9.3		
11			29.0	30.0	10.3		3.7		8.6	89.5		
12					5.1				1.0			36.0
13				1.0					8.5	66.2		2.4
14				3.5	4.4		5.5		30.4	10.5		35.5
15							0.5			17.0		
16				1.3			2.1		6.5	47.0	58.0	
17				2.2		10.7	7.2				25.5	
18						50.1				7.3		
19					3.2	1.8	9.2	58.0	1.0	5.3	1.2	35.0
20								8.6	37.0	58.4		30.0
21					7.5				0.8			
22				0.5			25.2	6.5	69.0	12.5		
23				12.0				27.7		18.0	14.2	
24	21.0						1.0	18.5				
25				5.4			0.5					
26				21.0		26.0		2.1			13.5	
27						1.0				5.5		
28						2.3		2.2	28.0	31.5		1.0
29						2.0				4.3	2.7	
30						5.2			4.5	27.7		20.5
31										4.5		1.0
Total	21.0	0.0	40.0	87.0	74.2	145.7	81.8	170.9	199.5	457.5	138.6	177.9
Rain days	1	0	2	11	9	13	14	10	12	18	7	10

Source: MOWRAM Takeo

Table B-3 Temperature

Mean Unit: C degree

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1991	27.1	27.7	29.3	30.7	30.5	28.8	28.0	27.7	28.1	26.9	26.2	26.3	28.1
1992	25.7	28.1	29.8	n	31.5	29.2	28.5	27.8	27.3	26.2	25.3	25.8	27.8
1993	25.9	26.7	28.5	29.9	29.5	28.0	27.9	27.4	27.5	26.9	26.2	25.6	27.5
1994	26.4	28.7	28.7	30.0	29.8	29.0	28.3	28.7	27.4	27.5	26.2	27.0	28.1
1995	25.4	25.9	28.8	30.2	29.2	28.8	28.4	28.7	27.0	27.4	26.6	25.9	27.7
1996	25.7	26.9	28.4	30.0	29.1	28.7	27.7	27.8	28.0	27.7	27.7	25.4	27.7
1997	25.8	28.0	29.0	30.1	30.3	30.2	28.5	28.8	28.3	28.1	27.7	27.6	28.5
1998	27.1	28.6	30.6	30.4	30.2	29.1	28.7	28.8	28.4	27.1	25.7	24.8	28.3
1999	26.7	27.6	30.5	29.8	29.1	28.6	28.4	28.5	28.6	27.6	27.0	23.9	28.0
2000	27.3	27.7	29.3	29.7	29.7	28.8	28.3	28.5	28.3	27.1	26.8	26.8	28.2
Average	26.3	27.6	29.3	30.1	29.9	28.9	28.2	28.2	27.9	27.2	26.5	25.9	28.0

The mean temperature is the average of max. and min. monthly averages shown below.

Maximum Unit: C degree

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1991	32.3	33.2	34.7	35.7	35.1	32.8	31.3	30.8	31.4	30.1	30	30.8	32.4
1992	30.7	33.3	35.5	n	36.7	33.5	32.2	31.4	32.4	29.8	29.7	30.8	32.4
1993	29.9	31.9	33.3	34.9	33.3	31.2	30.8	30.3	30.6	30.6	31.6	30.2	31.6
1994	32.2	34.4	33.8	34.8	34.3	33.2	32.1	32.9	31.1	31.6	31.6	31.7	32.8
1995	29.7	30.2	33.5	34.7	33.6	32.8	32.2	32.7	31.3	31.8	31.7	31.3	32.1
1996	30.3	32.0	33.2	34.7	33.1	32.4	31.0	30.7	31.1	31.2	31.5	29.9	31.8
1997	30.9	32.6	34.4	35.3	35.0	35.1	32.3	32.7	32.0	31.5	31.1	32.1	32.9
1998	32.2	33.6	35.9	35.1	34.7	33.3	32.6	32.4	32.2	30.1	28.9	29.6	32.6
1999	31.5	32.7	36.3	34.6	33.2	32.7	32.1	32.6	32.6	30.9	30.2	27.3	32.2
2000	31.7	32.6	34.2	34.2	34.1	32.9	32.3	32.1	32.0	30.4	30.1	30.2	32.2
Average	31.1	32.7	34.5	34.9	34.3	33.0	31.9	31.9	31.7	30.8	30.6	30.4	32.3

Minimum Unit: C degree

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1991	21.9	22.1	23.9	25.6	25.8	24.7	24.6	24.6	24.7	23.6	22.4	21.8	23.8
1992	20.6	22.9	24.0	25.8	26.3	24.9	24.7	24.1	22.1	22.6	20.9	20.8	23.3
1993	21.9	21.5	23.6	24.8	25.7	24.7	24.9	24.4	24.3	23.1	20.7	20.9	23.4
1994	20.5	22.9	23.6	25.2	25.3	24.8	24.5	24.4	23.7	23.4	20.7	22.2	23.4
1995	21.0	21.5	24.1	25.7	24.7	24.8	24.5	24.6	22.7	23.0	21.4	20.4	23.2
1996	21.0	21.8	23.5	25.3	25.0	24.9	24.4	24.8	24.8	24.2	23.8	20.8	23.7
1997	20.6	23.3	23.6	24.9	25.6	25.3	24.7	24.9	24.5	24.6	24.2	23.0	24.1
1998	22.0	23.6	25.2	25.6	25.6	24.9	24.7	25.1	24.6	24.0	22.5	20.0	24.0
1999	21.9	22.4	24.7	25.0	24.9	24.5	24.7	24.4	24.5	24.2	23.8	20.5	23.8
2000	22.8	22.7	24.3	25.1	25.3	24.7	24.2	24.8	24.5	23.8	23.4	23.4	24.1
Average	21.4	22.5	24.1	25.3	25.4	24.8	24.6	24.6	24.0	23.7	22.4	21.4	23.7

Source: Department of Meteorology, Pochentong

Table B-4 Humidity

Unit: %

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1991	72.0	68.0	66.6	68.0	74.8	80.7	84.9	84.6	86.8	86.6	78.3	74.9	77.2
1992	71.7	68.7	68.3	71.3	75.3	78.1	81.8	84.3	85.0	85.0	76.3	76.5	76.9
1993	72.7	68.4	70.7	67.6	77.5	79.1	83.4	83.1	85.0	82.7	77.1	77.3	77.1
1994	76.4	75.0	77.0	72.2	74.8	77.4	85.9	82.0	88.7	86.7	80.4	83.8	80.0
1995	71.4	69.3	68.7	68.2	75.3	78.9	80.5	83.7	85.4	85.0	79.8	75.1	76.8
1996	72.1	67.1	65.7	75.3	78.7	78.9	89.5	90.0	89.7	88.8	82.5	72.4	79.2
1997	72.6	74.4	73.1	72.9	73.6	73.1	80.6	80.8	83.5	84.5	80.3	n	77.2
1998	75.1	74.8	68.0	70.6	73.6	73.1	80.6	80.8	83.5	84.5	80.3	68.1	76.1
1999	72.9	70.7	74.9	71.7	82.5	80.4	81.8	81.8	85.7	86.3	79.3	72.6	78.4
2000	72.0	68.5	73.0	76.0	78.0	88.0	74.0	78.0	82.0	89.5	82.0	76.0	78.1
Average	72.9	70.5	70.6	71.4	76.4	78.8	82.3	82.9	85.5	86.0	79.6	75.2	77.7

Source: Department of Meteorology, Pochentong, n: no data

Table B-5 Wind Speed

at 12 m above ground surface Unit: m/sec

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1991	2.0	4.0	2.0	2.0	3.0	6.0	2.0	4.0	2.0	3.0	2.0	1.5	2.8
1992	2.0	4.0	3.0	3.0	3.0	5.0	2.0	3.0	n	3.0	4.0	3.0	3.2
1993	2.0	4.0	5.0	3.0	3.0	2.0	3.5	4.5	4.5	3.5	4.5	3.5	3.6
1994	4.0	1.5	3.0	4.0	4.0	4.5	3.5	3.0	2.5	2.5	4.0	2.0	3.2
1995	1.5	3.0	3.0	2.0	6.0	4.0	3.0	2.0	1.0	1.5	4.0	5.0	3.0
1996	2.5	3.4	3.2	3.1	2.7	2.7	3.3	3.4	2.5	1.2	2.4	3.0	2.8
1997	2.5	3.0	5.0	6.5	4.5	4.0	5.0	6.0	5.0	2.5	3.0	4.0	4.3
1998	5.5	4.0	5.0	5.0	4.5	4.0	5.0	6.0	5.0	2.5	3.0	4.0	4.5
1999	5.0	4.0	6.0	7.0	7.0	7.0	6.5	9.0	8.0	5.5	7.0	8.0	6.7
2000	3.5	8.0	6.0	2.0	3.0	7.0	5.0	9.0	8.0	2.0	2.0	2.5	4.8
Average	3.1	3.9	4.1	3.8	4.1	4.6	3.9	5.0	4.3	2.7	3.6	3.7	3.9

Source: Department of Meteorology, Pochentong

Table B-6 Sunshine hours

Unit: hrs/day

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1991	n	n	n	n	8.5	5.5	5.4	5.5	5.2	4.3	n	n	5.7
1992	8.1	8.9	9.2	8.4	7.7	5.1	6.0	3.6	n	6.7	8.5	7.7	7.3
1993	8.3	8.7	7.9	7.8	7.1	5.1	5.8	5.2	4.9	5.7	8.0	7.4	6.8
1994	8.5	8.4	7.1	8.9	7.1	4.7	3.7	5.2	5.0	6.9	9.0	7.4	6.8
1995	8.4	9.7	7.9	9.8	7.6	7.1	6.3	6.6	4.9	6.1	5.8	7.7	7.3
1996	8.8	8.6	9.5	7.2	6.2	7.1	5.0	6.5	4.4	5.2	6.0	n	6.8
1997	9.0	7.0	9.0	6.8	6.2	7.2	4.6	5.1	5.6	6.5	7.9	9.5	7.0
1998	9.9	9.3	10.2	9.1	8.0	6.8	8.0	7.9	7.7	5.3	6.9	9.7	8.2
1999	10.0	9.5	10.2	9.4	8.8	6.1	7.0	7.0	7.5	5.7	7.0	9.4	8.1
2000	7.5	7.6	6.2	7.3	6.3	6.3	6.0	6.5	5.6	5.5	7.4	8.2	6.7
Average	8.7	8.6	8.6	8.3	7.3	6.1	5.8	5.9	5.6	5.8	7.4	8.4	7.1

Source: Department of Meteorology, Pochentong, n: no data,

Table B-7 Water Level in Habitual Inundation Area

	Year	**2000**	**at Angkor Borei**		about 20 km east from Takeo						Unit: cm		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average							416	437	503	480			459
Maximum							435	445	**541**	515			541
Minimum							384	426	446	453			384
	Year	**1998**	**at Angkor Borei**		about 20 km east from Takeo								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average							177	191					184
Maximum							190	195					195
Minimum							150	184					150
	Year	**1997**	**at Angkor Borei**		about 20 km east from Takeo								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average							192	386	409	403	294	142	304
Maximum							305	418	417	**420**	347	230	420
Minimum							140	314	404	353	236	40	40
	Year	**1996**	**at Angkor Borei**		about 20 km east from Takeo								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average				44	82	84	182	316	379	491	413	368	262
Maximum				62	196	137	235	367	389	**532**	446	373	532
Minimum				11.8	31	45	155	222	370	448	377	362	11.8
	Year	**2000**	**at Borei Chulsar**		30 km south-east from Takeo								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	165	110	82	59	89	169	334	439	504	484	386	260	257
Maximum	204	131	112	85	142	239	433	445	**540**	518	457	318	540
Minimum	135	84	64	17	50	122	249	434	448	456	323	217	17
	Year	**1999**	**at Borei Chulsar**		30 km south-east from Takeo								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	106	73	49	48	92	158	200	365	404	427	392	266	215
Maximum	132	92	78	68	119	183	253	398	423	**447**	412	337	447
Minimum	81	55	18	11	42	102	183	263	395	397	345	209	11
	Year	**1998**	**at Borei Chulsar**		30 km south-east from Takeo								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	112	73	55	42	50	67	143	176	250	305	239	180	141
Maximum	138	110	88	78	114.369	182.26	227.723	414.2	**417.27**	393.769	358.46	224	417.27
Minimum	87	43	6	0	20	36	69	109	203.5	263	213.5	138	0
	Year	**1997**	**at Borei Chulsar**		30 km south-east from Takeo								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average		99	74	60	52	64	164		410	407	296	178	180
Maximum		118	109	91	88	93	272		415.5	**422**	366	227	422
Minimum		81	24	32	14	32	54		402	375	231	133	14

Source: MOWRAM Takeo

Table B-8 Discharge Measurement Results of the Slakou River

S1 = Slakou Upstream (Tumnup Lok Reservoir Site)
S2 = Slakou Downstream (National Road 3 Crossing Point Site)
S3 = Ou Saray Reservoir
S41 = Kpok Trobek Reservoir, big sluice
S42 = Kpok Trobek Reservoir, small sluice

Qv = discharge calculated from velocity measured by current meter
Qs = discharge calculated by equation, Qs=1.7*B*H^3/2 (m3/s)
B = width of each water flow gate (m): S3 = 7.83m x 90%, S41 = 10.11m x 90%, and S42 = 3.92 m x 90%

Year 2001

Date	S1		S2		S3			S4						
								S41			S42			total
	H(m)	Qv(m^3/s)	H(m)	Qv(m^3/s)	H(m)	Qv(m^3/s)	Qs(m^3/s)	H(m)	Qv(m^3/s)	Qs(m^3/s)	H(m)	Qv(m^3/s)	Qs(m^3/s)	Q(m^3/s)
14-Feb	0.31	0.15			0.00	0.00								
15-Feb			0.21	0.48										
18-Feb								0.09	0.17	0.38	0.00		0.00	0.17
21-Feb	0.23	0.09	0.12	0.23	0.00	0.00		0.06	0.10	0.20	0.00		0.00	0.10
27-Feb														
23-Aug	0.58	2.27	0.79	8.53										
24-Aug														
25-Aug	0.42	1.18	0.56	4.10	0.06		0.18	0.18	0.77	1.18	0.00		0.00	0.77
26-Aug	0.39	0.70	0.43	2.57	0.05		0.13	0.14	0.59	0.81	0.00		0.00	0.59
27-Aug	0.38	0.78	0.34	2.46	0.05		0.13	0.14	0.73	0.81	0.00		0.00	0.73
28-Aug	0.35	0.60	0.38	1.93	0.05		0.13	0.12	0.69	0.64	0.00		0.00	0.69
29-Aug	0.73	4.29	0.38	2.12	0.05		0.13	0.16	0.82	0.97	0.00		0.00	0.82
30-Aug	0.83	4.31	0.53	5.40	0.06		0.18	0.27	2.22	2.17	0.02		0.02	2.23
31-Aug	0.84	5.25	0.66	6.31	0.06		0.18	0.23	1.86	1.71	0.00		0.00	1.86
1-Sep	0.65	3.10	0.79	8.56	0.07		0.22	0.21	1.39	1.49	0.00		0.00	1.39
3-Sep	0.45	1.48	0.52	4.33	0.06		0.18	0.17	0.98	1.08	0.00		0.00	0.98
4-Sep	0.44	1.34	0.45	4.20	0.05		0.13	0.26	1.96	2.03	0.01		0.00	1.97
5-Sep	0.72	4.01	0.52	4.82	0.08		0.27	0.29	2.32	2.42	0.04		0.05	2.37
6-Sep	0.61	2.60	0.76	8.92	0.12	0.37	0.49	0.35	4.90	3.20	0.10		0.19	5.09
7-Sep	0.72	3.48	0.73	7.82	0.08		0.25	0.39	5.20	3.77	0.14		0.31	5.51
8-Sep	0.93	6.74	0.76	8.89	0.31	1.18	2.07	0.23	1.90	1.71	0.00		0.00	1.90
9-Sep	0.59	2.32	0.83	9.29	0.12	0.39	0.50	0.21	1.42	1.49	0.00		0.00	1.42
10-Sep	0.88	5.74	0.71	6.51	0.16	0.72	0.77	0.22	1.43	1.54	0.00		0.00	1.43
11-Sep	0.56	2.26	0.83	9.52	0.13	0.56	0.56	0.22	1.85	1.60	0.00		0.00	1.85
12-Sep	0.50	1.70	0.74	7.47	0.12	0.45	0.50	0.18	1.12	1.13	0.00		0.00	1.12
13-Sep	0.43	1.27	0.66	7.04	0.12	0.40	0.50	0.16	1.12	0.99	0.00		0.00	1.12
14-Sep	0.68	3.86	0.67	7.83	0.31	1.95	2.07	0.20	1.50	1.38	0.00		0.00	1.50
15-Sep	0.56	2.33	0.90	11.03	0.41	2.48	3.15	0.23	1.85	1.71	0.00		0.00	1.85
16-Sep	0.49	2.05	0.94	11.28	0.27	1.50	1.68	0.19	1.37	1.28	0.00		0.00	1.37
17-Sep	0.61	3.21	0.67	7.77	0.26	1.37	1.59	0.17	1.03	1.08	0.00		0.00	1.03
18-Sep	1.59	33.25	1.06	12.36	0.66	7.07	6.35	0.47	4.95	4.98	0.22		0.62	5.57
19-Sep	1.45	24.41	1.81	45.06	0.52	4.95	4.43	0.82		11.49	0.57		2.58	14.07
20-Sep	1.62	34.14	2.43	61.92	0.44	3.84	3.50	0.86		12.34	0.61		2.86	15.19
21-Sep	0.97	7.30	2.41	64.53	0.28	1.60	1.77	0.79		10.86	0.54		2.38	13.24
22-Sep	1.00	7.66	1.90	45.45	0.23	1.29	1.32	0.52	6.25	5.80	0.27		0.84	7.10
23-Sep	1.49	27.36	1.73	40.97	0.63	5.59	5.99	0.68	9.62	8.67	0.43		1.69	11.31
24-Sep	2.06	41.82	1.87	41.51	0.70	7.53	7.02	1.20		20.33	0.95		5.55	25.89
25-Sep	1.18	9.20	2.39	62.40	0.31	2.33	2.07	0.54		6.14	0.29		0.94	7.07
26-Sep	0.91	5.17	1.80	38.37	0.39	2.24	2.86	0.56		6.40	0.31		1.01	7.41
27-Sep	1.31	20.16	1.57	36.82	0.51	4.03	4.36	0.38		3.62	0.13		0.28	3.90
28-Sep	1.19	17.01	1.86	38.16	0.40	2.57	2.97	0.72		9.45	0.47		1.93	11.38
29-Sep	1.93	37.71	2.13	44.33	0.54		4.75	0.60		7.19	0.35		1.24	8.43
30-Sep	2.19	51.56	2.34	49.79	0.56		5.02	0.57		6.66	0.32		1.09	7.74
1-Oct	2.46	65.57	2.97	49.41	1.05		12.89	0.94		14.10	0.69		3.44	17.53
2-Oct	2.73	88.53	3.62	68.35	1.38		19.42	1.10		17.85	0.85		4.70	22.55
3-Oct	2.29	61.84	4.05	104.04	0.67	6.63	6.57	0.84		11.91	0.59		2.72	14.63
4-Oct	2.04	52.15	3.56	103.01	0.55	5.04	4.89	0.75		10.05	0.50		2.12	12.17
5-Oct	1.87	49.01	3.11	86.39	0.37	2.45	2.70	0.64		7.92	0.39		1.46	9.38
6-Oct	2.33	69.54	2.77	69.01	0.32	1.69	2.17	0.57		6.66	0.32		1.09	7.74
7-Oct	1.96	49.32	2.94	73.04	0.63		5.99	0.79		10.86	0.54		2.38	13.24

Table B-9 Prek Thnot River Discharge at Anlong Touk (1/4)

Year 1963 Unit: m3/sec

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1										77.5	69.8	13.5
2										90.5	34.8	10.7
3										150.0	29.8	8.7
4										168.0	24.8	7.5
5										162.0	37.2	7.5
6										124.0	54.6	6.0
7										135.0	103.0	4.6
8										97.8	135.0	4.5
9										73.0	122.0	4.5
10										57.8	124.0	4.5
11										59.0	73.0	4.5
12										43.8	62.2	4.5
13										35.8	55.0	4.5
14										26.5	46.3	3.8
15										45.6	39.7	3.8
16										54.2	32.4	4.2
17										40.7	27.5	4.2
18										38.2	22.0	4.2
19										35.1	18.5	4.2
20										49.0	16.2	4.2
21										73.5	14.5	4.0
22										44.5	12.5	4.0
23										33.7	11.2	3.6
24										25.2	10.0	3.5
25										20.0	12.8	3.5
26										17.2	17.5	3.4
27										15.0	28.5	3.4
28										12.5	22.3	3.3
29										17.5	18.7	3.3
30										58.6	15.5	2.8
31										71.5		2.8
Mean										63.0	43.0	4.9
Max.										168.0	135.0	13.5
Min.										12.5	10.0	2.8

Year 1964 Unit: m3/sec

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2.7	0.5	0.1	0.1	3.6	78.0	34.2	27.0	74.5	316.0	68.5	17.0
2	2.7	0.5	0.1	0.1	3.6	57.6	22.8	16.4	60.0	344.0	114.0	16.6
3	2.7	0.5	0.1	0.1	2.3	35.7	14.6	15.9	57.2	384.0	141.0	15.4
4	2.7	0.5	0.7	0.1	7.6	31.5	11.9	15.1	45.6	369.0	83.0	14.9
5	2.7	0.5	0.5	0.1	5.6	24.9	27.9	11.9	51.6	156.0	70.5	14.1
6	2.7	0.5	0.2	0.1	4.2	14.9	33.6	11.6	51.2	111.0	68.0	12.8
7	2.7	0.5	0.1	0.1	16.7	10.7	18.3	12.8	44.7	109.0	67.5	11.2
8	2.7	0.5	0.1	0.1	34.8	12.3	19.8	11.4	47.4	96.8	78.0	10.5
9	2.7	0.5	0.1	0.1	20.4	12.3	26.1	63.0	37.5	77.5	80.0	9.6
10	2.7	0.5	0.1	0.1	14.1	12.8	29.7	228.0	43.8	80.5	64.0	9.2
11	2.7	0.5	0.1	0.1	7.6	7.6	27.9	336.0	62.0	76.5	82.5	8.7
12	2.7	0.5	0.1	0.1	6.0	31.2	18.0	373.0	65.0	107.0	45.0	8.3
13	2.2	0.5	0.1	0.1	7.6	19.8	34.8	197.0	68.0	175.0	44.7	8.5
14	1.2	0.5	0.1	0.1	5.1	13.3	76.0	80.5	51.2	158.0	40.8	8.7
15	1.2	0.5	0.1	0.1	46.8	14.1	74.0	54.0	121.0	99.2	43.5	9.6
16	1.2	0.5	0.1	0.1	40.8	12.6	69.0	41.7	102.0	150.0	30.3	8.5
17	1.2	0.5	0.1	2.7	31.8	12.3	58.0	36.9	76.5	92.0	47.4	7.6
18	1.2	0.5	0.1	4.1	74.0	10.3	33.6	29.1	50.8	83.0	94.5	6.8
19	1.2	0.5	0.1	6.0	42.0	10.7	57.0	27.0	46.5	94.0	64.5	6.1
20	1.2	0.5	0.1	11.0	17.5	11.0	67.0	23.1	50.8	83.5	46.8	6.0
21	1.2	0.5	0.1	7.1	14.9	11.2	54.4	21.3	42.3	129.0	48.0	5.5
22	1.2	0.5	0.1	5.9	14.9	17.5	36.3	23.4	37.5	120.0	40.8	5.2
23	1.2	0.5	0.1	14.9	14.9	38.1	33.9	27.3	54.8	112.0	33.6	5.0
24	1.2	0.5	0.1	14.9	110.0	38.1	51.6	27.0	198.0	100.0	30.0	4.9
25	1.2	0.4	0.1	10.1	65.5	24.3	58.8	22.3	322.0	76.0	28.2	4.7
26	1.2	0.4	0.1	14.9	114.0	21.6	36.3	22.8	406.0	108.0	24.0	4.6
27	0.6	0.2	0.1	14.9	80.5	14.6	63.0	54.8	389.0	154.0	21.9	4.5
28	0.6	0.2	0.1	8.5	80.0	28.5	42.6	118.0	270.0	121.0	20.7	4.4
29	0.5	0.1	0.1	4.4	135.0	32.7	30.0	157.0	190.0	162.0	19.2	4.2
30	0.5		0.1	4.2	129.0	24.3	25.5	101.0	264.0	195.0	18.9	4.1
31	0.5		0.1		133.0		22.5	58.8		118.0		4.0
Mean	1.7	0.4	0.2	4.2	41.4	22.8	39.0	72.4	112.7	147.0	55.3	8.4
Max.	2.7	0.5	0.7	14.9	135.0	78.0	76.0	373.0	406.0	384.0	141.0	17.0
Min.	0.5	0.1	0.1	0.1	2.3	7.6	11.9	11.4	37.5	76.0	18.9	4.0

Source: Department of Hydrology and River Works

Table B-9 Prek Thnot River Discharge at Anlong Touk (2/4)

Year 1965 Unit: m3/sec

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3.8	1.6	3.7	1.8	3.3	19.5	21.9	22.2	44.7	99.8	117.0	17.2
2	3.8	1.6	3.7	1.4	2.7	25.2	19.2	15.9	59.2	89.0	107.0	17.5
3	3.7	1.7	2.3	1.4	8.7	33.6	19.2	13.3	84.5	83.0	95.0	15.1
4	3.7	1.7	1.8	1.3	8.5	29.4	13.8	12.3	134.0	125.0	83.0	14.1
5	3.7	1.6	1.3	1.2	6.3	27.6	13.3	11.0	158.0	142.0	85.5	13.3
6	3.7	1.4	1.0	1.3	6.6	16.7	15.4	11.2	66.0	158.0	93.5	13.1
7	3.7	1.3	1.0	1.4	9.6	11.9	12.3	11.7	95.0	164.0	75.0	12.1
8	3.6	1.3	0.6	1.4	16.4	8.5	10.3	14.1	105.0	156.0	61.0	11.4
9	3.6	1.2	0.6	2.8	15.4	7.6	9.8	14.1	79.5	118.0	54.0	11.2
10	3.4	1.1	0.5	2.7	10.7	7.8	9.8	12.1	103.0	99.2	48.0	10.8
11	3.3	1.0	0.5	5.0	10.1	27.9	9.6	10.7	98.6	93.5	46.2	12.1
12	3.3	1.0	0.4	5.8	7.5	70.5	15.1	10.5	68.0	151.0	47.7	15.1
13	3.2	0.8	0.4	4.7	6.1	135.0	18.9	15.7	59.2	204.0	45.9	17.2
14	3.1	0.8	0.4	13.6	18.0	171.0	50.4	13.6	44.4	240.0	41.7	14.9
15	2.9	0.7	0.2	9.6	10.7	204.0	32.7	20.1	52.0	216.0	36.0	12.6
16	2.7	0.7	0.2	13.6	7.3	93.0	22.5	23.1	66.5	232.0	35.1	10.5
17	2.5	0.7	0.2	6.3	5.8	53.2	27.9	17.5	88.5	252.0	47.4	9.4
18	2.4	0.7	1.3	5.5	11.4	38.7	30.6	23.1	157.0	346.0	99.8	8.5
19	2.3	0.7	1.3	5.5	8.3	32.4	47.2	26.4	247.0	439.0	57.2	8.0
20	2.2	0.8	1.3	8.0	6.4	26.7	57.6	25.8	298.0	466.0	43.2	7.5
21	2.0	0.8	1.2	6.3	13.1	24.0	27.9	18.6	372.0	452.0	44.4	7.6
22	1.9	0.7	1.2	4.7	26.1	28.5	21.9	15.7	409.0	350.0	41.1	7.6
23	1.9	0.6	1.1	3.8	21.6	22.5	18.9	14.1	460.0	304.0	34.5	7.6
24	1.8	0.6	1.4	3.4	18.0	29.1	19.8	26.4	412.0	322.0	33.3	8.3
25	1.8	0.6	1.4	3.2	12.1	26.4	33.9	65.5	358.0	344.0	27.9	8.3
26	1.7	0.6	1.2	2.9	12.6	35.1	40.8	46.8	332.0	362.0	26.1	7.8
27	1.7	0.6	1.4	2.3	10.5	34.2	52.4	36.9	366.0	286.0	22.5	3.9
28	1.6	0.6	1.3	2.5	7.3	30.6	32.7	33.6	389.0	151.0	21.6	6.3
29	1.6		2.7	2.2	24.0	25.8	33.0	49.2	276.0	118.0	20.1	6.0
30	1.7		1.7	1.9	42.3	27.0	33.0	52.8	132.0	148.0	18.6	5.5
31	1.6		1.7		25.8		29.7	58.4		139.0		5.3
Mean	2.7	1.0	1.3	4.3	12.7	44.1	25.9	23.9	187.0	221.0	53.6	10.5
Max.	3.8	1.7	3.7	13.6	42.3	204.0	57.6	65.5	460.0	466.0	117.0	17.5
Min.	1.6	0.6	0.2	1.2	2.7	7.6	9.6	10.5	44.4	83.0	18.6	3.9

Year 1966 Unit: m3/sec

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	4.3	1.9	1.5	2.2	1.9	19.7	16.4	91.0	15.7	42.2	117.0	37.2
2	4.0	1.9	1.3	1.6	1.7	11.5	12.7	184.0	33.0	34.0	92.0	77.0
3	3.9	1.8	1.1	1.2	1.8	32.0	40.0	175.0	54.2	35.1	75.0	62.2
4	3.8	1.8	1.1	1.2	3.1	21.7	35.1	122.0	87.0	59.4	60.2	28.4
5	3.8	1.8	1.0	0.7	3.9	34.0	44.2	138.0	96.2	63.0	41.8	15.7
6	3.8	1.7	1.5	1.2	1.8	18.5	31.6	150.0	124.0	131.0	35.1	13.7
7	3.8	1.6	1.9	1.8	1.5	22.0	29.1	115.0	59.0	174.0	30.3	12.7
8	3.6	1.8	1.8	1.4	2.6	15.1	57.0	123.0	38.9	193.0	27.2	11.5
9	3.4	2.2	1.4	1.2	9.2	9.2	49.4	107.0	30.0	242.0	24.7	12.7
10	3.3	2.2	1.1	1.0	17.2	7.1	34.7	78.0	35.1	295.0	22.9	18.5
11	3.1	1.9	1.0	0.7	19.4	8.5	43.0	73.0	40.8	218.0	22.0	21.4
12	3.0	1.7	0.9	0.5	14.9	7.1	38.9	53.8	35.8	139.0	21.2	16.9
13	3.0	1.6	0.8	0.3	12.9	5.2	68.0	47.0	33.3	79.5	20.3	12.9
14	2.9	1.5	0.7	0.5	8.8	6.1	87.0	45.0	59.4	68.5	91.5	10.1
15	2.8	1.4	0.7	0.4	11.0	5.2	92.5	38.2	126.0	57.8	63.4	14.9
16	2.8	1.4	0.6	0.5	9.7	5.6	76.0	30.9	121.0	51.8	79.5	43.8
17	2.7	1.3	0.6	0.5	9.2	12.2	45.8	28.4	149.0	50.6	79.0	41.0
18	2.6	1.3	0.6	1.5	7.1	64.6	55.4	21.7	172.0	44.6	60.2	25.9
19	2.6	1.2	0.6	2.5	5.3	133.0	56.2	20.3	197.0	44.6	73.5	16.5
20	2.5	1.1	0.6	3.0	7.0	115.0	71.0	18.0	201.0	54.6	57.4	13.2
21	2.5	1.1	0.6	9.7	6.5	103.0	74.0	15.1	163.0	43.4	51.0	10.6
22	2.3	1.1	0.5	25.0	4.7	56.2	60.2	16.2	175.0	42.2	55.4	9.0
23	2.3	1.1	0.5	18.0	4.1	43.4	43.0	22.6	141.0	51.8	68.4	8.1
24	2.2	1.1	0.4	10.3	6.1	27.8	37.2	44.6	72.0	120.0	24.4	7.6
25	2.2	2.1	0.5	6.5	17.7	37.9	50.2	23.8	56.2	191.0	20.9	10.1
26	2.2	1.2	0.6	5.1	19.4	63.8	91.5	20.9	53.0	233.0	18.8	12.4
27	2.1	1.1	0.5	3.1	13.7	44.2	95.6	24.4	47.0	289.0	16.7	10.6
28	2.1	1.6	1.3	2.5	32.0	29.7	72.5	33.3	62.2	145.0	17.2	8.5
29	2.0		1.3	2.1	62.2	22.6	61.0	23.2	53.0	115.0	35.8	8.0
30	2.0		3.8	1.8	71.0	18.2	82.5	15.9	57.4	139.0	32.3	7.3
31	2.0		3.0		26.0		80.0	16.9		114.0		6.7
Mean	2.9	1.5	1.1	3.6	13.3	33.3	55.9	61.8	86.3	115.0	47.8	19.5
Max.	4.3	2.2	3.8	25.0	71.0	133.0	95.6	184.0	201.0	295.0	117.0	77.0
Min.	2.0	1.1	0.4	0.3	1.5	5.2	12.7	15.1	15.7	34.0	16.7	6.7

Source: Department of Hydrology and River Works

Table B-9 Prek Thnot River Discharge at Anlong Touk (3/4)

Year 1967 Unit: m3/sec

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	6.2	3.0	1.4	0.8	3.8	22.3	30.0	153.0	121.0	82.0	34.0	4.7
2	5.9	3.0	1.4	0.8	3.5	14.6	29.7	145.0	251.0	143.0	32.3	4.8
3	5.8	2.9	1.4	0.8	3.3	11.0	54.6	138.0	303.0	147.0	26.3	4.7
4	5.6	2.8	1.3	0.8	3.5	9.9	29.1	155.0	169.0	228.0	20.1	4.7
5	5.6	2.7	1.8	0.7	4.7	12.4	27.2	238.0	164.0	298.0	21.0	4.5
6	5.3	2.6	2.3	7.8	7.6	13.4	19.4	195.0	152.0	305.0	21.2	4.4
7	5.1	2.6	1.4	7.3	9.7	24.4	17.2	155.0	117.0	338.0	17.9	4.3
8	4.9	2.5	1.4	4.4	15.9	64.2	13.6	92.5	106.0	448.0	15.6	3.1
9	4.9	2.3	1.3	3.0	15.4	58.2	15.9	70.0	82.5	500.0	15.2	3.6
10	4.7	2.3	1.3	2.3	7.8	49.0	18.5	64.2	103.0	476.0	13.4	3.5
11	4.7	2.2	1.2	1.9	15.9	34.3	20.1	111.0	77.5	366.0	13.6	3.5
12	4.5	2.2	1.1	1.8	15.6	47.0	30.9	77.5	61.8	300.0	13.4	3.4
13	4.4	2.1	1.1	1.8	27.8	21.7	35.7	92.5	66.5	181.0	13.6	3.3
14	4.3	2.1	1.1	1.7	25.9	21.2	35.4	88.0	55.4	151.0	13.4	3.3
15	4.1	2.0	1.1	1.6	15.6	14.6	36.4	67.5	47.0	176.0	11.5	3.1
16	4.0	1.9	1.1	1.4	13.7	21.7	29.1	61.0	43.0	133.0	10.3	3.1
17	4.0	1.9	1.1	6.7	14.4	54.6	57.0	57.0	42.2	164.0	9.7	3.1
18	3.9	1.9	1.0	5.5	14.7	39.2	55.0	148.0	45.0	119.0	9.2	3.0
19	3.6	1.8	1.0	19.1	11.5	30.6	129.0	62.6	53.0	98.6	8.3	3.0
20	3.5	1.8	1.0	22.6	29.0	27.8	130.0	59.0	49.0	70.0	9.9	3.0
21	3.4	1.7	1.1	10.3	17.2	18.0	93.0	54.6	39.9	59.4	8.8	2.9
22	3.4	1.5	1.2	7.1	18.5	17.7	68.0	117.0	31.3	53.0	7.1	2.9
23	3.4	1.5	1.4	5.9	31.6	12.2	53.0	158.0	27.5	49.0	6.7	2.9
24	3.5	1.4	1.3	7.0	14.7	15.2	35.7	154.0	26.6	45.0	6.4	2.8
25	3.6	1.3	1.3	7.6	9.9	22.9	29.1	101.0	30.0	68.0	6.1	2.8
26	3.6	1.3	1.0	7.1	8.0	79.0	29.0	162.0	90.0	64.2	5.6	2.8
27	3.8	1.3	1.0	12.9	6.8	91.5	31.6	106.0	85.0	52.2	5.3	2.8
28	3.6	1.4	1.0	7.1	6.2	73.0	25.9	213.0	70.0	51.4	4.9	2.7
29	3.4		0.9	4.3	7.6	62.6	35.7	326.0	91.0	41.0	4.8	2.7
30	3.5		0.9	4.5	39.9	45.4	30.9	360.0	70.0	36.8	4.3	2.6
31	3.3		0.9		47.8		47.0	125.0		34.0		2.5
Mean	4.3	2.1	1.2	5.5	15.1	34.3	41.7	132.0	89.0	170.0	13.0	3.4
Max.	6.2	3.0	2.3	22.6	47.8	91.5	130.0	360.0	303.0	500.0	34.0	4.8
Min.	3.3	1.3	0.9	0.7	3.3	9.9	13.6	54.6	26.6	34.0	4.3	2.5

Year 1968 Unit: m3/sec

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2.3	1.2	1.0	0.1	11.2	2.2	13.9	60.6	15.9	54.2	22.0	3.1
2	2.3	1.2	1.0	0.1	23.5	3.8	8.8	37.2	16.9	40.6	18.2	3.0
3	2.3	1.1	1.1	0.1	11.0	2.8	7.4	35.4	16.7	37.2	17.7	3.3
4	2.2	1.1	0.9	0.1	23.5	5.5	6.8	39.6	15.9	40.3	15.9	3.6
5	2.2	1.1	0.8	0.3	19.4	5.3	5.8	66.0	19.4	43.8	14.2	3.5
6	2.2	1.1	0.5	0.1	11.0	4.8	4.8	130.0	21.4	51.8	12.9	3.4
7	2.1	1.0	0.5	0.1	7.1	3.5	6.4	84.5	26.3	92.0	11.2	3.3
8	2.1	1.0	0.4	0.9	6.1	4.5	4.4	78.0	27.8	44.2	10.6	3.1
9	2.1	1.0	0.4	2.7	3.6	8.0	7.0	29.4	25.0	28.1	8.8	3.0
10	2.1	0.9	0.4	2.1	2.2	5.5	12.0	25.3	19.1	47.0	7.8	3.0
11	1.9	0.9	0.4	1.9	5.2	5.1	57.4	25.6	16.9	50.2	7.1	2.9
12	1.9	0.9	0.3	1.9	3.6	4.5	61.4	38.6	22.3	57.4	7.4	2.9
13	1.8	0.9	0.3	2.0	4.9	3.5	30.3	55.4	66.0	42.6	7.4	2.8
14	1.7	0.9	0.3	3.3	4.8	3.4	16.4	62.2	72.5	49.4	7.0	2.8
15	1.7	0.9	0.3	2.3	5.9	7.1	14.2	75.0	44.6	60.2	6.4	2.8
16	1.7	0.9	0.3	1.7	6.7	11.5	15.4	101.0	28.7	94.5	6.1	2.7
17	1.5	0.8	0.3	1.2	8.0	8.5	15.4	89.5	26.9	83.0	5.5	2.6
18	1.4	0.8	0.2	1.0	4.9	79.0	21.1	83.5	36.4	139.0	4.9	2.5
19	1.4	0.8	0.2	0.5	5.8	30.6	18.0	93.0	45.0	111.0	4.7	2.5
20	1.4	0.7	0.1	0.4	5.6	11.7	15.2	164.0	61.8	214.0	4.7	2.5
21	1.4	0.7	0.1	0.3	3.5	12.7	21.4	177.0	38.9	259.0	4.4	2.3
22	1.4	0.6	0.1	1.1	3.5	11.7	41.8	163.0	49.0	302.0	4.3	2.2
23	1.3	0.6	0.1	0.6	2.9	29.7	33.0	161.0	59.0	392.0	4.1	2.2
24	1.3	0.6	0.1	2.2	3.8	36.1	40.3	125.0	80.0	385.0	3.6	2.3
25	1.3	0.5	0.1	3.0	3.3	26.6	88.0	82.0	82.0	148.0	3.4	2.3
26	1.3	0.5	0.1	2.7	5.2	26.6	106.0	49.0	101.0	111.0	4.0	2.2
27	1.3	0.5	0.1	3.8	3.8	23.5	115.0	33.0	92.0	63.8	4.5	2.1
28	1.2	0.5	0.1	3.0	3.5	80.0	93.0	27.2	132.0	42.2	3.9	2.1
29	1.2	0.5	0.1	2.5	2.7	54.6	58.2	24.4	71.5	35.8	3.5	2.1
30	1.2		0.1	4.7	2.7	20.8	16.4	20.5	71.5	31.6	3.3	2.0
31	1.2		0.1		2.5		33.3	16.9		25.3		2.0
Mean	1.7	0.8	0.3	1.5	6.8	17.8	31.9	72.7	46.7	102.0	8.0	2.7
Max.	2.3	1.2	1.1	4.7	23.5	80.0	115.0	177.0	132.0	392.0	22.0	3.6
Min.	1.17	0.47	0.09	0.09	2.23	2.23	4.38	16.9	15.9	25.3	3.25	2.01

Source: Department of Hydrology and River Works

Table B-9 Prek Thnot River Discharge at Anlong Touk (4/4)

Year 1969 Unit: m3/sec

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2.0	1.1	0.8	0.7	0.3	1.1	8.1	25.3	32.0	95.0	200.0	8.6
2	1.9	1.1	0.7	0.7	0.5	1.4	8.8	57.8	41.4	133.0	270.0	7.8
3	1.9	1.1	0.7	1.1	0.4	1.2	12.7	58.2	52.6	160.0	266.0	7.4
4	1.8	0.9	0.7	2.1	0.5	1.0	11.7	27.8	116.0	224.0	289.0	7.0
5	1.7	0.9	0.6	1.3	1.2	1.1	8.5	41.0	436.0	338.0	286.0	6.5
6	1.6	1.6	0.6	1.1	1.3	1.1	6.8	63.8	495.0	325.0	281.0	6.5
7	1.5	1.4	0.6	1.0	3.0	1.0	5.8	61.8	433.0	342.0	235.0	6.5
8	2.3	1.5	0.5	0.9	2.8	0.9	7.8	124.0	358.0	414.0	130.0	5.9
9	2.3	1.6	0.5	1.4	2.6	1.0	8.3	71.0	426.0	448.0	112.0	5.6
10	2.0	1.9	0.5	1.2	2.3	1.0	5.9	34.0	343.0	441.0	65.5	5.6
11	1.9	1.9	0.5	0.5	1.6	0.9	4.5	27.5	222.0	320.0	44.6	5.3
12	1.8	1.3	0.5	0.5	1.4	0.9	3.8	18.2	176.0	235.0	38.6	5.2
13	1.7	1.2	0.4	0.4	1.3	1.1	3.6	16.7	128.0	118.0	35.4	5.1
14	1.6	1.1	0.3	0.3	8.5	1.1	4.4	15.9	84.0	105.0	28.7	5.1
15	1.5	1.0	0.4	0.4	22.9	1.0	8.1	12.9	103.0	117.0	30.9	4.9
16	1.3	1.0	0.5	0.4	66.5	1.3	6.4	9.5	138.0	106.0	28.1	4.9
17	1.3	0.9	0.6	0.5	76.5	1.8	5.6	8.1	125.0	69.5	26.3	4.8
18	1.3	0.9	0.6	0.7	3.3	2.0	4.5	19.1	84.5	68.0	20.2	4.7
19	1.4	0.8	1.6	0.9	4.4	1.9	8.1	49.4	81.5	65.5	22.3	4.7
20	1.4	0.7	1.5	1.8	3.6	1.4	5.5	43.4	109.0	65.5	21.4	4.7
21	2.1	0.7	1.4	0.7	4.9	1.0	6.5	35.0	106.0	69.5	20.2	4.5
22	1.9	0.9	1.3	0.4	3.6	0.9	7.6	34.4	129.0	67.0	16.9	4.4
23	1.9	0.9	1.3	0.3	3.1	1.1	7.8	45.0	190.0	65.0	16.2	4.4
24	1.8	0.9	0.9	0.3	3.1	1.6	50.2	33.7	64.2	63.8	14.4	4.3
25	1.6	0.8	0.8	0.2	2.8	2.7	67.0	29.4	54.2	64.6	13.4	4.0
26	1.6	0.9	0.7	0.2	2.3	3.8	38.2	25.0	68.5	137.0	12.4	3.9
27	1.6	0.9	0.7	0.2	2.1	3.6	21.7	22.6	98.0	86.5	12.0	3.9
28	1.5	0.8	0.6	0.2	1.9	4.3	19.7	58.6	105.0	120.0	10.8	3.8
29	1.4		0.5	0.3	1.5	11.0	35.0	74.5	64.2	107.0	9.9	3.8
30	1.3		0.5	0.3	1.4	9.0	47.0	84.0	57.0	147.0	9.2	3.5
31	1.2		0.6		1.3		28.1	80.5		166.0		3.4
Mean	1.7	1.1	0.7	0.7	7.5	2.1	15.1	42.2	164.0	170.0	85.5	5.2
Max.	2.3	1.9	1.6	2.1	76.5	11.0	67.0	124.0	495.0	448.0	289.0	8.6
Min.	1.2	0.7	0.3	0.2	0.3	0.9	3.6	8.1	32.0	63.8	9.2	3.4

Year 1970 Unit: m3/sec

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3.1	2.8	0.8									
2	3.1	9.5										
3	3.6	5.9										
4	3.6	5.2										
5	3.5	5.1										
6	3.5	5.1										
7	3.5	4.8										
8	3.4	4.7										
9	3.4	4.7										
10	3.3	4.3										
11	3.3	4.0										
12	3.0	3.9										
13	2.9	2.5										
14	2.8	2.2										
15	2.8	1.9										
16	2.7	1.4										
17	2.5	1.4										
18	2.5	1.3										
19	2.2	1.3										
20	1.9	1.2										
21	1.9	1.2										
22	1.8	1.0										
23	1.8	1.0										
24	1.8	0.9										
25	1.7	0.9										
26	1.7	0.9										
27	1.6	0.9										
28	1.6	0.8										
29	1.5											
30	1.5											
31	3.0											
Mean	1.7	1.1										
Max.	2.3	1.9										
Min.	1.2	0.7										

Source: Department of Hydrology and River Works

Table B-10 Gauge Height at Peam Kley on the Prek Thnot River (1/3)

Year 1996 Unit: m

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1									2.26	5.00	4.49	2.50
2									2.90	4.70	4.49	2.35
3									2.65	3.95	5.20	2.25
4									2.97	4.33	6.15	2.55
5									3.05	4.75	6.15	2.70
6									3.14	4.90	6.40	2.45
7									3.29	4.85	6.15	2.15
8									4.38	3.93	5.29	1.95
9									3.47	2.78	4.80	1.65
10									3.61		4.35	1.45
11									3.20		4.30	
12									3.57		4.10	
13									3.87		3.75	
14									3.70		3.38	
15									4.01		4.25	
16									4.58		3.80	
17									4.70	3.52	3.40	
18									3.45	3.40	3.10	
19									3.70	3.68	2.95	
20									4.05	5.23	3.28	
21									4.35	6.29	3.75	
22									3.90	6.48	3.50	
23									3.40	5.96	3.25	
24									3.05	4.54	3.10	
25									2.75	4.15	3.60	
26									2.55	4.40	3.30	
27									3.13	5.20	3.15	1.64
28									3.90	6.27	2.95	1.62
29									4.55	7.35	2.75	1.60
30									5.25	6.60	2.60	1.58
31										4.90		1.56
Mean									3.58	4.88	4.06	2.00
Max.									5.25	7.35	6.40	2.70
Min.									2.26	2.78	2.60	1.45

Year 1997 Unit: m

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.54	1.05	1.13	1.04			1.05	2.86	2.66	4.20	2.93	1.25
2	1.53	1.04	1.14	1.04			1.10	2.92	2.55	3.60	2.76	1.24
3	1.52	1.28	1.14	1.07			1.10	5.65	2.35	3.41	2.35	1.24
4	1.51	1.30	1.14	1.10			1.20	7.45	2.25	4.69	1.85	1.23
5	1.50	1.31	1.15	1.07			1.20	7.15	2.35	4.39	2.22	1.22
6	1.49	1.30	1.15	1.06			1.10	6.75	2.49	3.70	2.47	1.22
7	1.48	1.28	1.15	1.08			1.12	5.85	2.44	3.53	2.19	1.21
8	1.47	1.26	1.19	1.10			1.55	4.30	2.40	3.25	1.93	1.20
9	1.46	1.24	1.21	1.09			1.25	3.35	2.40	3.02	1.90	1.20
10	1.45	1.24	1.13	1.09			1.25	3.25	2.31	2.81	1.87	1.21
11	1.44	1.27	1.11	1.07			1.38	3.00	2.28	2.71	1.84	1.21
12	1.43	1.36	1.09	1.07			1.53	2.90	2.23	2.66	1.77	1.20
13	1.42	1.39	1.08	1.19			1.55	2.40	2.59	2.63	1.69	1.20
14	1.41	1.42	1.10	1.13			1.60	2.30	2.79	2.59	1.63	1.20
15	1.40	1.56	1.17	1.10			1.50	2.20	2.65	2.42	1.59	1.20
16	1.39	1.54	1.23	1.08			1.76	2.10	2.34	3.15	1.55	1.18
17	1.38	1.42	1.42	1.07			1.90	2.00	3.40	3.31	1.49	1.16
18	1.37	1.35	1.60	1.07			2.00	2.00	3.30	3.35	1.45	1.17
19	1.36	1.32	1.26	1.06			1.70	2.00	3.20	3.12	1.41	1.17
20	1.35	1.25	1.18	1.05			1.40	1.94	3.20	2.85	1.37	1.18
21	1.34	1.23	1.19	1.04			1.31	1.98	3.30	2.45	1.35	1.18
22	1.33	1.20	1.18	1.07			2.10	2.10	3.32	2.41	1.33	1.17
23	1.32	1.21	1.16	1.14		1.03	2.36	2.20	3.35	2.40	1.32	1.16
24	1.31	1.22	1.13	1.12		1.04	2.65	2.50	4.10	2.73	1.30	1.15
25	1.30	1.23	1.11	1.10		1.02	3.20	3.40	4.65	2.62	1.32	1.14
26	1.29	1.20	1.11	1.55		1.00	3.00	4.05	4.80	2.59	1.30	1.15
27	1.28	1.15	1.09	1.20		1.00	3.10	4.10	4.90	2.55	1.29	1.16
28	1.27	1.14	1.06	1.07		0.99	3.00	4.04	5.37	2.51	1.28	1.15
29	1.26		1.06	1.05		1.02	2.90	4.15	5.84	2.47	1.26	1.14
30	1.20		1.06			1.05	2.70	3.85	5.10	2.43	1.25	1.13
31	1.06		1.05				2.68	2.80		2.20		1.12
Mean	1.38	1.28	1.16	1.10		1.02	1.85	3.47	3.23	2.99	1.71	1.19
Max.	1.54	1.56	1.60	1.55		1.05	3.20	7.45	5.84	4.69	2.93	1.25
Min.	1.06	1.04	1.05	1.04		0.99	1.05	1.94	2.23	2.20	1.25	1.12

Source: Department of Hydrology and River Works

Table B-10 Gauge Height at Peam Kley on the Prek Thnot River (2/3)

Year 1998 Unit: m

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.11	1.00	1.26	0.96		0.94	1.01	2.07	2.29	5.40	2.73	2.32
2	1.10	1.02	1.13	0.96		1.04	1.00	1.89	2.21	5.68	2.76	2.32
3	1.10	1.03	1.14	0.97		1.09	1.05	1.80	2.10	5.80	2.79	2.32
4	1.09	1.02	1.11	0.98		1.11	1.08	1.71	2.68	5.33	3.22	2.29
5	1.09	1.00	1.09	0.98		1.17	1.16	1.71	2.80	6.08	3.10	2.25
6	1.11	1.00	1.08	0.95		1.11	1.39	2.19	2.93	5.70	3.10	2.21
7	1.11	0.99	1.12	0.93		1.09	1.45	2.02	3.00	4.54	3.38	2.05
8	1.10	0.98	1.11	0.92		1.07	1.25	1.70	2.89	4.40	3.41	1.99
9	1.10	1.00	1.12	0.90		1.06	1.17	1.57	2.73	4.41	3.47	1.95
10	1.10	0.98	1.09	0.90		1.03	1.12	1.50	2.85	4.55	3.27	1.91
11	1.08	0.96	1.07	1.00		0.99	1.07	1.43	2.86	4.51	2.97	1.85
12	1.06	0.95	1.04	1.05		0.96	1.08	1.47	2.54	4.38	2.79	1.81
13	1.10	0.96	1.01	1.02		0.95	1.24	1.61	2.90	4.43	2.57	1.79
14	1.08	0.95	1.00	1.00		0.99	1.24	1.60	2.66	4.05	2.35	1.54
15	1.08	0.94	1.05	1.00		1.01	1.18	1.73	2.67	4.04	2.29	1.55
16	1.06	0.92	1.04	0.98		1.16	1.18	1.35	3.48	3.75	2.59	1.52
17	1.08	0.92	1.00	0.96		1.12	1.26	2.07	3.10	3.55	3.21	1.50
18	1.10	0.92	1.02	0.95		1.12	1.23	1.84	3.15	3.30	3.47	1.47
19	1.11	0.94	1.03	0.93		1.10	2.00	2.21	3.63	3.13	3.57	1.46
20	1.10	0.96	0.99	0.98		1.09	1.96	2.28	3.61	2.95	3.26	1.44
21	1.08	1.10	0.99	1.32		1.07	1.25	2.08	3.25	2.79	2.95	1.43
22	1.09	1.08	0.96	1.31		1.06	1.23	2.15	2.84	2.68	2.64	1.42
23	1.10	1.22	0.94	1.14		1.09	1.19	2.20	2.85	2.54	2.49	1.41
24	1.10	1.14	0.92	1.12		1.07	1.18	1.97	2.93	2.40	2.40	1.40
25	1.08	1.15	0.91	1.10		1.13	1.25	2.21	2.85	2.49	2.25	1.38
26	1.08	1.14	0.92	1.10		1.12	1.31	2.71	3.60	2.74	2.19	1.37
27	1.06	1.59	0.94	1.10		1.08	1.28	2.65	4.60	3.10	2.13	1.36
28	1.04	1.36	0.95	1.08		1.05	1.45	2.26	4.91	3.00	2.12	1.34
29	1.03		0.95	1.07		1.03	1.36		5.05	2.71	2.01	1.33
30	1.02		0.95	1.04		1.02	1.83		5.05	2.70	2.10	1.32
31	0.98		0.95				2.10			2.72		1.32
Mean	1.08	1.04	1.03	1.02		1.06	1.31	1.93	3.17	3.87	2.79	1.70
Max.	1.11	1.59	1.26	1.32		1.17	2.10	2.71	5.05	6.08	3.57	2.32
Min.	0.98	0.92	0.91	0.90		0.94	1.00	1.35	2.10	2.40	2.01	1.32

Year 1999 Unit: m

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.32	1.11	1.12	0.96	2.13	2.65	3.25	3.60	3.47	2.30	7.34	
2	1.30	1.10	1.12	1.04	2.25	2.57	3.53	3.20	4.36	2.54	7.31	
3	1.31	1.11	1.11	1.15	2.50	2.83	4.61	2.96	4.51	2.60	7.23	
4	1.35	1.14	1.12	1.21	3.12	3.03	4.53	3.98	5.01	2.71	6.94	
5	1.80	1.12	1.14	1.47	3.10	2.32	4.59	4.44	5.44	3.11	7.18	
6	2.31	1.10	1.12	1.78	2.97	3.46	4.49	5.79	5.53	3.35	7.28	
7	2.30	1.23	1.14	1.76	2.51	4.28	4.39	5.76	5.29	3.52	6.69	
8	1.40	1.24	1.20	1.58	2.43	4.23	2.30	5.36	4.73	3.56	5.70	
9	1.41	1.22	1.15	1.61	2.09	4.10	2.05	4.99	4.52	4.38	5.85	
10	1.44	1.21	1.20	1.70	2.10	3.25	2.08	4.95	4.65	4.72	5.83	
11	1.32	1.22	1.21	1.70	2.03	3.07	2.26	3.85	3.67	4.51	5.01	
12	1.31	1.20	1.22	2.19	2.10	2.97	2.20	3.47	3.43	4.74	4.98	
13	1.30	1.20	1.15	2.19	2.12	2.90	2.22	3.23	3.07	4.95	4.93	
14	1.39	1.16	1.11	2.27	2.13	2.85	2.21	2.21	3.02	5.34	4.96	
15	1.35	1.14	1.11	1.91	2.15	2.68	2.16	2.16	2.98	5.54	3.97	
16	1.31	1.14	1.10	1.76	2.50	2.61	2.20	2.36	2.96	5.72	3.91	
17	1.30	1.13	1.10	1.62	3.18	2.31	2.24	2.51	2.94	5.78	3.45	
18	1.35	1.12	1.08	1.55	4.71	2.32	2.02	2.83	2.91	5.84	3.35	
19	1.35	1.12	1.07	1.49	3.65	2.78	2.00	3.09	3.06	5.96	3.25	
20	1.27	1.13	1.06	1.45	3.66	3.08	2.00	3.05	3.30	5.98	3.50	
21	1.25	1.12	1.05	1.49	3.50	3.19	1.90	3.16	3.52	6.08	3.89	
22	1.22	1.15	1.04	1.67	3.53	3.19	1.87	3.20	3.56	6.15	2.75	
23	1.21	1.10	1.04	1.85	5.00	3.09	1.80	3.09	3.66	6.14	2.72	
24	1.20	1.11	1.04	1.99	5.76	3.06	1.73	3.07	3.56	6.08	2.65	
25	1.20	1.11	1.10	2.15	5.71	3.35	1.69	3.03	3.07	6.06	2.62	
26	1.18	1.10	1.08	2.48	2.91	3.15	2.71	3.11	2.74	6.23	2.54	
27	1.16	1.12	1.07	2.48	2.96	3.09	2.93	3.12	2.61	6.31	2.45	
28	1.14	1.10	1.02	2.47	2.20	3.07	3.63	3.21	2.54	6.34	2.37	
29	1.12	1.11	0.98	2.50	2.55	3.03	3.70	3.31	2.44	6.16	2.33	
30	1.11		0.96	2.46	2.57	3.18	3.71	3.35	2.31	6.63	2.31	
31	1.12		0.96		2.53	3.33	3.73	3.31		7.12		
Mean	1.36	1.14	1.10	1.80	2.99	3.07	2.80	3.51	3.63	5.05	4.51	
Max.	2.31	1.24	1.22	2.50	5.76	4.28	4.61	5.79	5.53	7.12	7.34	
Min.	1.11	1.10	0.96	0.96	2.03	2.31	1.69	2.16	2.31	2.30	2.31	

Source: Department of Hydrology and River Works

Table B-10 Gauge Height at Peam Kley on the Prek Thnot River (3/3)

Year 2000 Unit: m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1			1.61	1.22	1.77	1.75	2.64	2.33	3.34	3.65	5.34	
2			1.60	1.20	1.78	1.80	2.38	2.32	3.42	3.80	4.37	
3			1.60	1.22	2.21	2.29	2.39	2.42	3.39	3.65	3.82	
4			1.68	1.24	2.73	2.97	2.34	2.35	3.09	3.15	3.77	
5			1.74	1.26	2.73	3.27	2.17	2.18	2.85	2.85	3.09	
6			1.76	1.25	2.66	3.41	2.69	2.05	2.66	3.63	2.87	
7			1.79	1.27	2.52	3.23	2.99	2.04	2.46	3.65	2.69	
8			1.78	1.30	2.43	2.99	2.91	2.22	2.46	3.45	2.56	
9			1.75	1.34	1.93	2.89	2.58	2.19	2.48	2.96	2.42	
10			1.72	1.30	1.84	2.93	2.43	2.16	2.68	2.89	2.32	
11			1.78	1.27	1.83	2.60	2.83	2.09	2.58	2.85	2.27	
12			1.76	1.30	1.93	2.32	3.40	2.25	2.54	3.50	2.22	
13			1.82	1.34	2.07	2.16	3.51	2.22	2.82	4.40	2.18	
14			1.84	1.38	2.77	2.04	3.29	2.13	2.87	5.35	2.18	
15			1.45	1.40	2.73	1.92	3.27	2.29	2.74	8.62	2.16	
16			1.83	1.42	2.03	1.83	3.83	2.12	2.81	8.98	2.18	
17			1.78	2.21	1.87	1.92	3.96	2.15	2.53	8.81	2.39	
18			2.01	2.98	1.87	1.93	3.88	2.33	2.69	8.41	3.54	
19			1.76	3.06	1.83	2.48	4.23	2.31	2.69	7.07	3.75	
20			1.54	2.95	1.77	2.91	4.47	2.67	2.76	6.40	3.87	
21			1.44	2.88	1.74	2.67	3.47	3.00	2.76	4.59	3.42	
22			1.35	3.15	1.72	2.39	3.08	3.13	2.91	4.41	2.97	
23			1.26	3.64	1.75	2.35	2.88	3.54	2.99	4.34	2.73	
24			1.26	3.22	1.74	2.28	2.69	3.56	3.37	4.48	2.48	
25			1.26	2.89	1.86	2.23	2.81	3.59	3.34	5.18	2.36	
26			1.28	2.94	1.93	2.23	2.81	4.09	3.14	4.33	2.30	
27			1.26	2.77	2.10	2.33	3.23	4.02	2.95	3.70	2.31	
28			1.25	2.73	1.99	2.33	3.56	3.72	3.09	3.38	2.35	
29			1.23	2.05	1.99	2.73	2.94	3.62	3.72	3.72	2.25	
30			1.20	1.90	2.04	2.65	2.68	3.37	3.86	4.63	2.17	
31			1.22		2.04		2.39	3.29		5.33		
Mean			1.57	2.00	2.07	2.46	3.06	2.70	2.93	4.71	2.84	
Max.			2.01	3.64	2.77	3.41	4.47	4.09	3.86	8.98	5.34	
Min.			1.20	1.20	1.72	1.75	2.17	2.04	2.46	2.85	2.16	

Year 2001 Unit: m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.57	1.45										
2	1.53	1.41										
3	1.49	1.37										
4	1.45	1.37										
5	1.42	1.35										
6	1.49	1.35										
7	1.59	1.34										
8	1.54	1.33										
9	1.50	1.31										
10	1.48	1.27										
11	1.47	1.26										
12	1.46	1.27										
13	1.50	1.24										
14	2.65	1.23										
15	3.19	1.22										
16	3.13	1.21										
17	2.36	1.21										
18	2.09	1.20										
19	1.84	1.19										
20	1.79	1.17										
21	1.74	1.14										
22	1.72	1.10										
23	1.73	1.15										
24	1.68	1.18										
25	1.57	1.17										
26	1.51	1.11										
27	1.46	1.08										
28	1.43	1.08										
29	1.43											
30	1.43											
31	1.48											
Mean	1.73	1.24										
Max.	3.19	1.45										
Min.	1.42	1.08										

Note: All the gauge height data in these tables were added by 0.1 m to the original records, because of reading mistake by 10 cm.
Source: Department of Hydrology and River Works

Table B-11 Prek Thnot River Discharge at Peam Kley (1/3)

Year 1996 Unit: m3/sec

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1									34.9	326.4	248.3	47.7
2									74.7	279.1	248.3	39.2
3									57.0	177.5	360.0	34.5
4									80.1	226.1	542.3	50.7
5									86.6	286.8	542.3	60.3
6									94.1	310.2	596.5	44.7
7									107.5	302.3	542.3	30.4
8									232.9	175.1	375.6	22.9
9									124.8	65.9	294.5	13.7
10									139.2		228.8	8.8
11									99.4		222.0	
12									135.0		196.0	
13									168.1		154.4	
14									148.8		116.0	
15									184.8		215.3	
16									261.3		160.0	
17									279.1	129.8	117.9	
18									122.8	117.9	90.7	
19									148.8	146.7	78.6	
20									189.7	365.1	106.6	
21									228.8	572.3	154.4	
22									171.6	614.4	127.8	
23									117.9	502.8	103.8	
24									86.6	255.5	90.7	
25									63.8	202.3	138.1	
26									50.7	235.7	108.4	
27									93.3	360.0	95.0	13.4
28									171.6	568.0	78.6	12.9
29									256.9	826.5	63.8	12.3
30									368.6	641.8	53.8	11.8
31										310.2		11.3
Mean									146.0	333.3	215.0	27.6
Max.									368.6	826.5	596.5	60.3
Min.									34.9	65.9	53.8	8.8

Year 1997 Unit: m3/sec

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	10.8	2.1	3.1	2.0			2.1	71.7	57.7	208.8	77.0	4.9
2	10.6	2.0	3.2	2.0			2.7	76.2	50.7	138.1	64.5	4.7
3	10.4	5.4	3.2	2.3			2.7	441.6	39.2	118.9	39.2	4.7
4	10.1	5.8	3.2	2.7			4.1	852.9	34.5	277.6	19.6	4.6
5	9.9	6.0	3.4	2.3			4.1	774.9	39.2	234.3	33.2	4.4
6	9.7	5.8	3.4	2.2			2.7	676.9	47.1	148.8	45.9	4.4
7	9.4	5.4	3.4	2.4			3.0	480.6	44.2	130.9	32.0	4.3
8	9.2	5.1	4.0	2.7			11.1	222.0	41.9	103.8	22.2	4.1
9	9.0	4.7	4.3	2.6			4.9	113.1	41.9	84.1	21.2	4.1
10	8.8	4.7	3.1	2.6			4.9	103.8	37.1	68.0	20.2	4.3
11	8.6	5.3	2.8	2.3			7.3	82.5	35.7	61.0	19.3	4.3
12	8.3	6.9	2.6	2.3			10.6	74.7	33.6	57.7	17.1	4.1
13	8.1	7.5	2.4	4.0			11.1	41.9	53.2	55.7	14.8	4.1
14	7.9	8.1	2.7	3.1			12.3	36.6	66.6	53.2	13.1	4.1
15	7.7	11.3	3.7	2.7			9.9	32.4	57.0	43.0	12.1	4.1
16	7.5	10.8	4.6	2.4			16.8	28.4	38.7	95.0	11.1	3.8
17	7.3	8.1	8.1	2.3			21.2	24.7	117.9	109.4	9.7	3.5
18	7.1	6.7	12.3	2.3			24.7	24.7	108.4	113.1	8.8	3.7
19	6.9	6.1	5.1	2.2			15.0	24.7	99.4	92.4	7.9	3.7
20	6.7	4.9	3.8	2.1			7.7	22.6	99.4	71.0	7.1	3.8
21	6.5	4.6	4.0	2.0			6.0	24.0	108.4	44.7	6.7	3.8
22	6.3	4.1	3.8	2.3			28.4	28.4	110.3	42.5	6.3	3.7
23	6.1	4.3	3.5	3.2		1.9	39.8	32.4	113.1	41.9	6.1	3.5
24	6.0	4.4	3.1	3.0		2.0	57.0	47.7	196.0	62.4	5.8	3.4
25	5.8	4.6	2.8	2.7		1.7	99.4	117.9	271.6	55.1	6.1	3.2
26	5.6	4.1	2.8	11.1		1.5	82.5	189.7	294.5	53.2	5.8	3.4
27	5.4	3.4	2.6	4.1		1.5	90.7	196.0	310.2	50.7	5.6	3.5
28	5.3	3.2	2.2	2.3		1.4	82.5	188.5	389.8	48.2	5.4	3.4
29	5.1		2.2	2.1		1.7	74.7	202.3	478.6	45.9	5.1	3.2
30	4.1		2.2			2.1	60.3	165.7	343.0	43.6	4.9	3.1
31	2.2		2.1				59.0	67.3		32.4		3.0
Mean	7.5	5.6	3.7	2.8		1.7	27.7	176.3	125.3	89.9	18.5	3.9
Max.	10.8	11.3	12.3	11.1		2.1	99.4	852.9	478.6	277.6	77.0	4.9
Min.	2.2	2.0	2.1	2.0		1.4	2.1	22.6	33.6	32.4	4.9	3.0

Table B-11 Prek Thnot River Discharge at Peam Kley (2/3)

Year 1998 Unit: m3/sec

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2.8	1.5	5.1	1.1		1.0	1.6	27.3	36.2	395.2	62.4	37.7
2	2.7	1.7	3.1	1.1		2.0	1.5	20.9	32.8	447.4	64.5	37.7
3	2.7	1.9	3.2	1.2		2.6	2.1	18.0	28.4	470.7	66.6	37.7
4	2.6	1.7	2.8	1.3		2.8	2.4	15.3	59.0	382.7	101.2	36.2
5	2.6	1.5	2.6	1.3		3.7	3.5	15.3	67.3	527.6	90.7	34.5
6	2.8	1.5	2.4	1.0		2.8	7.5	32.0	77.0	451.2	90.7	32.8
7	2.8	1.4	3.0	0.9		2.6	8.8	25.4	82.5	255.5	116.0	26.5
8	2.7	1.3	2.8	0.8		2.3	4.9	15.0	73.9	235.7	118.9	24.3
9	2.7	1.5	3.0	0.6		2.2	3.7	11.6	62.4	237.1	124.8	22.9
10	2.7	1.3	2.6	0.6		1.9	3.0	9.9	71.0	256.9	105.7	21.5
11	2.4	1.1	2.3	1.5		1.4	2.3	8.3	71.7	251.2	80.1	19.6
12	2.2	1.0	2.0	2.1		1.1	2.4	9.2	50.1	232.9	66.6	18.3
13	2.7	1.1	1.6	1.7		1.0	4.7	12.6	74.7	239.8	51.9	17.7
14	2.4	1.0	1.5	1.5		1.4	4.7	12.3	57.7	189.7	39.2	10.8
15	2.4	1.0	2.1	1.5		1.6	3.8	15.9	58.3	188.5	36.2	11.1
16	2.2	0.8	2.0	1.3		3.5	3.8	6.7	125.8	154.4	53.2	10.4
17	2.4	0.8	1.5	1.1		3.0	5.1	27.3	90.7	132.9	100.3	9.9
18	2.7	0.8	1.7	1.0		3.0	4.6	19.3	95.0	108.4	124.8	9.2
19	2.8	1.0	1.9	0.9		2.7	24.7	32.8	141.3	93.3	135.0	9.0
20	2.7	1.1	1.4	1.3		2.6	23.3	35.7	139.2	78.6	104.8	8.6
21	2.4	2.7	1.4	6.1		2.3	4.9	27.6	103.8	66.6	78.6	8.3
22	2.6	2.4	1.1	6.0		2.2	4.6	30.4	70.2	59.0	56.4	8.1
23	2.7	4.4	1.0	3.2		2.6	4.0	32.4	71.0	50.1	47.1	7.9
24	2.7	3.2	0.8	3.0		2.3	3.8	23.6	77.0	41.9	41.9	7.7
25	2.4	3.4	0.7	2.7		3.1	4.9	32.8	71.0	47.1	34.5	7.3
26	2.4	3.2	0.8	2.7		3.0	6.0	61.0	138.1	63.1	32.0	7.1
27	2.2	12.1	1.0	2.7		2.4	5.4	57.0	264.2	90.7	29.6	6.9
28	2.0	6.9	1.0	2.4		2.1	8.8	34.9	311.8	82.5	29.2	6.5
29	1.9		1.0	2.3		1.9	6.9		334.6	61.0	25.0	6.3
30	1.7		1.0	2.0		1.7	18.9		334.6	60.3	28.4	6.1
31	1.3		1.0				28.4			61.7		6.1
Mean	2.5	2.3	1.9	1.9		2.3	6.9	23.9	109.0	194.0	71.2	16.6
Max.	2.8	12.1	5.1	6.1		3.7	28.4	61.0	334.6	527.6	135.0	37.7
Min.	1.3	0.8	0.7	0.6		1.0	1.5	6.7	28.4	41.9	25.0	6.1

Year 1999 Unit: m3/sec

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	6.1	2.8	3.0	1.1	29.6	57.0	103.8	138.1	124.8	36.6	823.9	
2	5.8	2.7	3.0	2.0	34.5	51.9	130.9	99.4	230.2	50.1	816.0	
3	6.0	2.8	2.8	3.4	47.7	69.5	265.7	79.3	251.2	53.8	795.3	
4	6.7	3.2	3.0	4.3	92.4	84.9	254.0	181.1	328.0	61.0	722.6	
5	18.0	3.0	3.2	9.2	90.7	37.7	262.8	241.2	402.5	91.6	782.6	
6	37.1	2.7	3.0	17.4	80.1	123.8	248.3	468.7	419.0	113.1	808.2	
7	36.6	4.6	3.2	16.8	48.2	219.3	234.3	462.9	375.6	129.8	662.7	
8	7.7	4.7	4.1	11.8	43.6	212.7	36.6	388.0	283.7	133.9	451.2	
9	7.9	4.4	3.4	12.6	28.0	196.0	26.5	324.7	252.6	232.9	480.6	
10	8.6	4.3	4.1	15.0	28.4	103.8	27.6	318.2	271.6	282.2	476.7	
11	6.1	4.4	4.3	15.0	25.8	88.2	34.9	165.7	145.6	251.2	328.0	
12	6.0	4.1	4.4	32.0	28.4	80.1	32.4	124.8	120.8	285.2	323.1	
13	5.8	4.1	3.4	32.0	29.2	74.7	33.2	102.0	88.2	318.2	315.0	
14	7.5	3.5	2.8	35.3	29.6	71.0	32.8	32.8	84.1	384.5	319.9	
15	6.7	3.2	2.8	21.5	30.4	59.0	30.8	30.8	80.9	420.9	179.9	
16	6.0	3.2	2.7	16.8	47.7	54.4	32.4	39.8	79.3	455.1	172.7	
17	5.8	3.1	2.7	12.9	97.6	37.1	34.0	48.2	77.8	466.8	122.8	
18	6.7	3.0	2.4	11.1	280.7	37.7	25.4	69.5	75.5	478.6	113.1	
19	6.7	3.0	2.3	9.7	143.4	65.9	24.7	89.9	87.4	502.8	103.8	
20	5.3	3.1	2.2	8.8	144.5	89.1	24.7	86.6	108.4	506.9	127.8	
21	4.9	3.0	2.1	9.7	127.8	98.5	21.2	95.9	129.8	527.6	170.4	
22	4.4	3.4	2.0	14.2	130.9	98.5	20.2	99.4	133.9	542.3	63.8	
23	4.3	2.7	2.0	19.6	326.4	89.9	18.0	89.9	144.5	540.2	61.7	
24	4.1	2.8	2.0	24.3	462.9	87.4	15.9	88.2	133.9	527.6	57.0	
25	4.1	2.8	2.7	30.4	453.1	113.1	14.8	84.9	88.2	523.4	55.1	
26	3.8	2.7	2.4	46.5	75.5	95.0	61.0	91.6	63.1	559.4	50.1	
27	3.5	3.0	2.3	46.5	79.3	89.9	77.0	92.4	54.4	576.7	44.7	
28	3.2	2.7	1.7	45.9	32.4	88.2	141.3	100.3	50.1	583.3	40.3	
29	3.0	2.8	1.3	47.7	50.7	84.9	148.8	109.4	44.2	544.4	38.2	
30	2.8		1.1	45.3	51.9	97.6	149.9	113.1	37.1	648.7	37.1	
31	3.0		1.1		49.4	111.2	152.1	109.4		767.3		
Mean	7.9	3.3	2.7	20.6	103.9	92.5	87.6	147.3	158.9	374.1	318.1	
Max.	37.1	4.7	4.4	47.7	462.9	219.3	265.7	468.7	419.0	767.3	823.9	
Min.	2.8	2.7	1.1	1.1	25.8	37.1	14.8	30.8	37.1	36.6	37.1	

Table B-11 Prek Thnot River Discharge at Peam Kley (3/3)

Year 2000 Unit: m3/sec

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1			12.6	4.4	17.1	16.5	56.4	38.2	112.2	143.4	384.5	
2			12.3	4.1	17.4	18.0	40.8	37.7	119.9	160.0	231.5	
3			12.3	4.4	32.8	36.2	41.4	43.0	116.9	143.4	162.3	
4			14.5	4.7	62.4	80.1	38.7	39.2	89.9	95.0	156.6	
5			16.2	5.1	62.4	105.7	31.2	31.6	71.0	71.0	89.9	
6			16.8	4.9	57.7	118.9	59.7	26.5	57.7	141.3	72.4	
7			17.7	5.3	48.8	102.0	81.7	26.1	45.3	143.4	59.7	
8			17.4	5.8	43.6	81.7	75.5	33.2	45.3	122.8	51.3	
9			16.5	6.5	22.2	73.9	52.5	32.0	46.5	79.3	43.0	
10			15.6	5.8	19.3	77.0	43.6	30.8	59.0	73.9	37.7	
11			17.4	5.3	18.9	53.8	69.5	28.0	52.5	71.0	35.3	
12			16.8	5.8	22.2	37.7	117.9	34.5	50.1	127.8	33.2	
13			18.6	6.5	27.3	30.8	128.8	33.2	68.8	235.7	31.6	
14			19.3	7.3	65.2	26.1	107.5	29.6	72.4	386.2	31.6	
15			8.8	7.7	62.4	21.9	105.7	36.2	63.1	1192.8	30.8	
16			18.9	8.1	25.8	18.9	163.4	29.2	68.0	1308.9	31.6	
17			17.4	32.8	20.2	21.9	178.7	30.4	49.4	1253.4	41.4	
18			25.0	80.9	20.2	22.2	169.2	38.2	59.7	1127.6	131.9	
19			16.8	87.4	18.9	46.5	212.7	37.1	59.7	754.8	154.4	
20			10.8	78.6	17.1	75.5	245.5	58.3	64.5	596.5	168.1	
21			8.6	73.2	16.2	58.3	124.8	82.5	64.5	262.8	119.9	
22			6.7	95.0	15.6	41.4	89.1	93.3	75.5	237.1	80.1	
23			5.1	142.4	16.5	39.2	73.2	131.9	81.7	227.4	62.4	
24			5.1	101.2	16.2	35.7	59.7	133.9	115.0	246.9	46.5	
25			5.1	73.9	19.9	33.6	68.0	137.1	112.2	356.5	39.8	
26			5.4	77.8	22.2	33.6	68.0	194.7	94.1	226.1	36.6	
27			5.1	65.2	28.4	38.2	102.0	186.0	78.6	148.8	37.1	
28			4.9	62.4	24.3	38.2	133.9	151.0	89.9	116.0	39.2	
29			4.6	26.5	24.3	62.4	77.8	140.2	151.0	151.0	34.5	
30			4.1	21.2	26.1	57.0	59.0	115.0	166.9	268.7	31.2	
31			4.4		26.1		41.4	107.5		382.7		
Mean			12.3	37.0	29.6	50.1	94.1	69.9	80.0	350.1	83.5	
Max.			25.0	142.4	65.2	118.9	245.5	194.7	166.9	1308.9	384.5	
Min.			4.1	4.1	15.6	16.5	31.2	26.1	45.3	71.0	30.8	

Year 2001 Unit: m3/sec

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	11.6	8.8										
2	10.6	7.9										
3	9.7	7.1										
4	8.8	7.1										
5	8.1	6.7										
6	9.7	6.7										
7	12.1	6.5										
8	10.8	6.3										
9	9.9	6.0										
10	9.4	5.3										
11	9.2	5.1										
12	9.0	5.3										
13	9.9	4.7										
14	57.0	4.6										
15	98.5	4.4										
16	93.3	4.3										
17	39.8	4.3										
18	28.0	4.1										
19	19.3	4.0										
20	17.7	3.7										
21	16.2	3.2										
22	15.6	2.7										
23	15.9	3.4										
24	14.5	3.8										
25	11.6	3.7										
26	10.1	2.8										
27	9.0	2.4										
28	8.3	2.4										
29	8.3											
30	8.3											
31	9.4											
Mean	19.7	4.9										
Max.	98.5	8.8										
Min.	8.1	2.4										

Table B-12 Monthly Rainfall and Runoff on Prek Thnot River

Year		Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1966															
Runoff	at Anlong Touk	MCM	7.7	3.7	2.8	9.3	35.7	86.4	149.6	165.6	223.6	307.7	124.0	52.3	1168.4
	3650 km2	mm	2.1	1.0	0.8	2.5	9.8	23.7	41.0	45.4	61.3	84.3	34.0	14.3	320.1
Rainfall	at K.Speu	mm	0.0	25.0	31.2	49.9	147.8	152.7	202.5	104.4	90.6	366.4	94.6	84.2	1349.3
	at Phnom Srouch	mm	4.2	31.2	21.4	92.2	212.4	215.0	188.2	227.6	146.2	261.2	166.4	115.0	1681.0
	at Kirirom	mm	0.2	40.3	63.1	213.9	226.5	190.5	248.6	105.4	181.9	367.5	168.2	120.1	1926.2
Basin rain		mm	1.8	29.8	31.5	91.4	186.7	184.8	202.9	157.4	127.4	321.5	135.9	102.5	1573.7
1967															
Runoff		MCM	11.5	5.0	3.2	14.4	40.4	89.0	111.7	354.8	230.7	456.0	33.7	9.0	1359.2
		mm	3.2	1.4	0.9	3.9	11.1	24.4	30.6	97.2	63.2	124.9	9.2	2.5	372.4
Rainfall	at K.Speu	mm	24.0	0.0	0.0	110.0	105.5	166.5	131.0	87.0	195.5	200.0	18.3	1.6	1039.4
	at Phnom Srouch	mm	30.2	0.0	0.0	179.6	170.0	188.0	251.0	141.4	123.2	278.0	42.8	15.0	1419.2
	at Kirirom	mm	32.1	0.0	6.4	99.6	223.2	186.6	335.2	355.7	93.7	318.2	34.3	10.0	1695.0
Basin rain		mm	27.8	0.0	0.9	138.4	149.9	178.6	211.5	148.6	150.0	250.3	31.1	8.5	1295.6
1968															
Runoff	at Anlong Touk	MCM	4.5	2.0	0.9	4.0	18.2	46.0	85.4	194.6	121.2	274.4	20.7	7.2	779.2
		mm	1.2	0.5	0.3	1.1	5.0	12.6	23.4	53.3	33.2	75.2	5.7	2.0	213.5
Rainfall	at K.Speu	mm	0.0	0.0	0.0	80.7	63.5	287.9	162.2	31.7	202.4	158.2	24.0	0.0	1010.6
	at Phnom Srouch	mm	0.0	5.6	0.0	129.7	140.9	264.7	155.0	147.1	219.6	197.8	23.3	7.9	1291.6
	at Kirirom	mm	1.4	17.8	0.0	232.5	203.4	177.5	355.3	347.0	227.0	382.9	11.9	3.7	1960.4
Basin rain		mm	0.2	4.9	0.0	123.3	116.6	262.2	186.6	126.1	213.3	207.2	22.0	3.9	1266.4
1969															
Runoff	at Anlong Touk	MCM	4.5	2.6	1.9	1.8	20.1	5.4	40.4	113.0	425.1	456.4	221.7	13.9	1306.7
		mm	1.2	0.7	0.5	0.5	5.5	1.5	11.1	31.0	116.5	125.1	60.8	3.8	358.0
Rainfall	at K.Speu	mm	58.0	9.0	no data	39.5	127.2	99.3	46.1	214.4	251.3	281.9	105.2	3.2	1235.1
	at Phnom Srouch	mm	35.2	25.8	7.1	10.1	183.2	89.2	121.1	210.4	283.7	281.6	66.5	2.6	1316.5
	at Kirirom	mm	69.3	21.8	20.5	44.7	235.7	142.3	205.8	432.8	441.1	235.7	66.8	2.0	1918.5
Basin rain		mm	49.8	18.0	9.0	27.6	166.7	101.1	101.0	243.8	292.2	275.2	83.1	2.8	1367.4
Average															
Runoff	at Anlong Touk	MCM	7.1	3.3	2.2	7.4	28.6	56.7	96.8	207.0	250.1	373.6	100.0	20.6	1153.4
		mm	1.9	0.9	0.6	2.0	7.8	15.5	26.5	56.7	68.5	102.4	27.4	5.6	316.0
Rainfall	at K.Speu	mm	8.0	8.3	10.4	80.2	105.6	202.4	165.2	74.4	162.8	241.5	45.6	28.6	1133.1
	at Phnom Srouch	mm	17.4	15.7	7.1	102.9	176.6	189.2	178.8	181.6	193.2	254.7	74.8	35.1	1427.1
	at Kirirom	mm	25.8	20.0	22.5	147.7	222.2	174.2	286.2	310.2	235.9	326.1	70.3	34.0	1875.0
Basin rain		mm	14.6	13.1	10.7	99.5	152.7	192.7	188.3	154.0	186.3	259.2	61.6	32.2	1364.8
1999															
Runoff	at Peam Kley	MCM	21.1	8.3	7.2	53.4	278.3	247.8	234.7	394.5	411.8	1001.9	824.6	no data	3483.6
		mm	5.8	2.3	2.0	14.6	76.2	67.9	64.3	108.1	112.8	274.5	225.9	no data	954.4
Rainfall	at K.Speu	mm	11.8	17.0	42.5	191.0	291.7	61.0	116.3	335.6	133.9	317.0	151.0	0.0	1668.8
	at Phnom Srouch	mm	6.0	6.0	79.0	223.5	315.0	93.0	149.8	147.2	98.0	297.5	no data	no data	1415.0
	at Kirirom	mm	(12.5)	(16.2)	(85.6)	(292.0)	(427.4)	(108.5)	(187.5)	(340.1)	(163.4)	(432.9)	(212.8)	(.0)	2278.9
Basin rain		mm	9.4	12.2	64.3	219.3	321.0	81.5	140.8	255.5	122.7	325.2	159.8	-	1646.9
2000															
Runoff	at Peam Kley	MCM	no data	no data	32.9	95.9	79.3	129.9	252.0	187.1	207.5	937.6	216.5	no data	2138.7
		mm	no data	no data	9.0	26.3	21.7	35.6	69.1	51.3	56.8	256.9	59.3	no data	586.0
Rainfall	at K.Speu	mm	29.1	9.0	97.5	120.7	117.0	186.3	131.6	168.4	271.0	437.9	177.7	131.2	1877.4
	at Phnom Srouch	mm	36.0	35.0	133.0	68.0	89.5	186.5	no data	no data	no data	no data	no data	no data	-
	at Kirirom	mm	-	-	(162.4)	(132.9)	(145.5)	(262.6)	(185.4)	300.2	201.4	493.5	141.6	71.2	2096.8
Basin rain		mm	-	-	122.0	99.8	109.3	197.3	139.3	187.2	261.1	445.8	172.6	-	1734.2

Figures in parentheses are of assumed by the correlation equation presented in Figure B-4 from Kompong Spueu and Phnom Srouch rainfall.

Total catchment area	3650.0	km2	in total
Hill area (altitude more than 400 m)	520.0	km2	The high land is supposed to get rain at the level of Kirirom.
Low land and low hill less than El.400m	3130.0	km2	The low land is supposed to get the average rainfall of K.Speu and Phnom Srouch.
Mountaneous area	14.25	%	
Referrence: mountaneous area (altitude more than 200 m)	1100.0	km2	

Table B-13 Basin Rainfall in Prek Thnot River Basin at Peam Kley and in Slakou River Basin at Three Reservoirs (1/2)

Prek Thnot River Basin

Prek Thnot	y=1.409*x		y: rain in mountainous area, x: rain in low land
Mountaneous area	14.25	%	
Hill area (altitude more than 400 m)	520.0	km^2	The high land is assumed to get rain at the level of Kirirom.
Total catchment area	3650.0	km^2	
Low land and low hill under El.400m	3130.0	km^2	The low land is assumed to get the average rainfall of K.Speu and Phnom Srouch.
Referrence: mountaneous area (altitude more than 200 m)			1100.0 km2

Unit:mm

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1966	2	30	32	91	187	185	203	157	127	321	136	103	1,574
1967	28	0	1	138	150	179	212	149	150	250	31	9	1,296
1968	0	5	0	123	117	262	187	126	213	207	22	4	1,266
1969	50	18	9	28	167	101	101	244	292	275	83	3	1,370
1985	0	33	0	252	255	109	51	56	272	219	110	0	1,357
1986	19	22	6	70	70	124	94	106	211	149	208	32	1,111
1987	0	0	0	11	103	141	35	119	186	116	318	0	1,028
1988	0	3	21	108	111	129	84	86	188	199	28	0	957
1989	2	0	16	56	220	33	83	115	331	246	0	0	1,102
1990	0	0	3	77	99	67	73	112	121	97	148	3	800
1991	0	10	14	72	43	218	195	295	181	198	0	7	1,235
1992	8	0	0	45	35	88	158	96	191	282	17	2	924
1993	37	0	66	18	72	86	74	75	225	323	22	0	997
1994	0	0	118	15	95	85	270	203	208	67	0	2	1,064
1995	0	0	24	0	114	52	110	175	319	230	54	15	1,093
1996	7	0	0	121	110	254	174	107	227	238	156	18	1,412
1997	0	0	56	64	117	13	176	184	111	136	25	3	886
1998	0	5	0	102	41	58	112	245	276	206	186	13	1,244
1999	9	12	64	219	321	81	141	255	123	325	160	0	1,712
2000	34	23	122	100	109	197	139	187	261	446	173	123	1,915
Average	10	8	28	86	127	123	134	155	211	227	94	17	1,217

Kpob Trobek Reservoir

Slakou	y=1.20*x	
Mountaneous area	12.41	%
Hill area (altitude more than400 m)	17.0	km^2
Total catchment area	137.0	km^2
Low land and low hill less than El.300m	120.0	km^2

Unit:mm

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1966	2	29	29	80	183	184	199	162	122	317	133	101	1541
1967	27	0	0	142	143	178	200	129	155	244	31	8	1258
1968	0	4	0	113	108	270	171	105	212	191	23	4	1201
1969	48	18	8	26	160	97	91	226	278	279	85	3	1319
1985	0	32	0	244	247	106	49	55	264	212	106	0	1314
1986	18	22	5	68	68	120	91	103	204	144	202	31	1076
1987	0	0	0	11	100	136	34	116	180	112	308	0	995
1988	0	3	20	105	107	125	81	83	182	193	27	0	926
1989	2	0	15	54	213	32	81	111	320	238	0	0	1067
1990	0	0	3	75	96	65	71	108	117	94	144	3	774
1991	0	10	13	70	42	211	189	286	176	192	0	7	1196
1992	8	0	0	44	34	85	153	93	185	274	17	2	895
1993	35	0	64	17	69	84	72	73	218	313	21	0	965
1994	0	0	114	15	92	82	261	197	201	65	0	2	1030
1995	0	0	24	0	110	50	106	170	308	223	53	14	1059
1996	7	0	0	117	107	246	168	103	220	230	151	17	1367
1997	0	0	55	62	113	13	170	178	108	132	24	3	858
1998	0	5	0	99	40	57	109	237	267	199	180	12	1205
1999	9	12	62	212	311	79	136	247	119	315	155	0	1658
2000	33	23	118	97	106	191	135	177	267	441	175	127	1890
Average	10	8	27	82	122	121	128	148	205	220	92	17	1180

Table B-13 Basin Rainfall in Prek Thnot River Basin at Peam Kley and in Slakou River Basin at Three Reservoirs (2/2)

O Saray Reservoir

Slakou	y=1.20x	
Mountaneous area	0.00	%
Hill area (altitude more than 400 m)	0.0	km^2
Total catchment area	51.0	km^2
Low land and low hill less than El.300m	51.0	km^2

Unit:mm

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1966	2	28	26	71	180	184	195	166	118	314	131	100	1515
1967	27	0	0	145	138	177	191	114	159	239	31	8	1229
1968	0	3	0	105	102	276	159	89	211	178	24	4	1151
1969	47	17	7	25	155	94	84	212	268	282	86	3	1279
1985	0	31	0	238	241	103	48	53	257	207	104	0	1283
1986	18	21	5	66	66	118	89	101	199	141	197	30	1050
1987	0	0	0	10	97	133	33	113	175	109	300	0	971
1988	0	3	20	102	105	122	80	81	177	188	27	0	904
1989	2	0	15	53	208	31	79	108	312	232	0	0	1041
1990	0	0	3	73	93	63	69	106	114	91	140	3	756
1991	0	10	13	68	41	206	184	279	171	187	0	7	1167
1992	8	0	0	42	33	83	150	91	181	267	16	2	873
1993	35	0	62	17	68	82	70	71	213	305	21	0	942
1994	0	0	111	15	90	80	255	192	197	64	0	2	1005
1995	0	0	23	0	107	49	104	166	301	218	51	14	1033
1996	7	0	0	114	104	240	164	101	215	225	148	17	1334
1997	0	0	53	60	111	13	166	174	105	129	24	3	837
1998	0	5	0	97	39	55	106	231	261	194	176	12	1176
1999	9	12	61	207	303	77	133	241	116	307	151	0	1617
2000	33	22	115	94	103	186	132	168	271	438	178	131	1872
Average	9	8	26	80	119	119	124	143	201	216	90	17	1152

Tumnup Lok Reservoir

Slakou	y=1.20*x	
Mountaneous area	2.41	%
Hill area (altitude more than 400 m)	8.0	km^2
Total catchment area	332.0	km^2
Low land and low hill less than El.300m	324.0	km^2

Unit:mm

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1966	2	28	27	73	181	184	196	165	119	314	131	100	1520
1967	27	0	0	144	139	177	193	117	159	240	31	8	1235
1968	0	3	0	107	103	275	161	93	211	180	24	4	1161
1969	47	17	7	25	156	95	85	215	270	281	86	3	1287
1985	0	31	0	239	242	104	48	53	259	208	104	0	1289
1986	18	21	5	67	67	118	89	101	200	141	198	31	1055
1987	0	0	0	11	98	133	33	113	176	110	302	0	976
1988	0	3	20	103	105	122	80	81	178	189	27	0	908
1989	2	0	15	53	209	31	79	109	314	234	0	0	1046
1990	0	0	3	74	94	64	70	106	114	92	141	3	759
1991	0	10	13	68	41	207	185	281	172	188	0	7	1172
1992	8	0	0	43	33	84	150	91	182	268	16	2	878
1993	35	0	62	17	68	82	70	71	214	307	21	0	946
1994	0	0	112	15	90	81	256	193	197	64	0	2	1010
1995	0	0	23	0	108	49	104	167	302	219	52	14	1038
1996	7	0	0	115	105	241	165	101	216	226	148	17	1341
1997	0	0	54	61	111	13	167	174	106	130	24	3	841
1998	0	5	0	97	39	56	106	233	262	195	177	12	1182
1999	9	12	61	208	305	77	134	243	117	309	152	0	1625
2000	33	22	116	95	104	187	132	170	270	439	177	130	1875
Average	9	8	26	81	120	119	125	144	202	217	90	17	1157

Table B-14 Estimated Discharge for Three Reservoirs and Don Phe Reservoir Sites (1/2)

Discharge in Don Phe Stream at Don Phe Reservoir (m^3/s)												
Year	Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1966	0.05	0.03	0.02	0.07	0.48	1.04	1.54	1.22	1.01	3.48	1.85	0.77
1967	0.23	0.10	0.05	0.02	0.15	0.86	1.51	0.92	1.23	2.50	0.87	0.23
1968	0.07	0.05	0.03	0.01	0.01	1.95	1.54	0.72	1.85	2.02	0.68	0.18
1969	0.07	0.05	0.02	0.01	0.28	0.23	0.29	1.54	3.09	3.58	1.43	0.40
1985	0.14	0.08	0.03	0.91	1.47	0.67	0.21	0.07	2.38	2.46	1.21	0.34
1986	0.11	0.07	0.03	0.01	0.01	0.29	0.31	0.33	1.64	1.42	1.86	0.58
1987	0.17	0.07	0.04	0.02	0.01	0.41	0.14	0.36	1.35	1.01	3.21	1.04
1988	0.29	0.09	0.06	0.03	0.01	0.32	0.27	0.20	1.32	1.87	0.64	0.17
1989	0.06	0.04	0.02	0.01	0.79	0.28	0.23	0.36	3.33	3.12	1.01	0.26
1990	0.10	0.07	0.02	0.01	0.01	0.01	0.12	0.31	0.67	0.63	0.95	0.31
1991	0.09	0.04	0.02	0.02	0.01	1.19	1.49	2.72	2.09	2.06	0.69	0.20
1992	0.07	0.04	0.02	0.01	0.01	0.07	0.75	0.43	1.42	2.99	1.02	0.27
1993	0.09	0.06	0.03	0.01	0.01	0.06	0.14	0.11	1.75	3.68	1.25	0.32
1994	0.10	0.07	0.03	0.01	0.01	0.06	2.03	1.78	2.06	0.86	0.27	0.09
1995	0.04	0.03	0.01	0.01	0.01	0.01	0.33	0.91	3.33	2.89	1.01	0.27
1996	0.11	0.06	0.02	0.01	0.01	1.63	1.41	0.67	1.93	2.56	1.68	0.49
1997	0.15	0.07	0.04	0.02	0.01	0.01	0.90	1.19	0.88	1.02	0.35	0.11
1998	0.04	0.03	0.02	0.01	0.01	0.01	0.34	1.70	2.98	2.45	1.93	0.59
1999	0.19	0.08	0.04	0.57	2.19	0.79	0.77	1.96	1.27	3.51	2.06	0.61
2000	0.17	0.08	0.05	0.02	0.01	0.95	0.87	1.14	2.77	6.04	3.14	1.33
Discharge at Kpob Trobek Reservoir from the lower basin of Don Phe Reservoir (m^3/s)												
Year	Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1966	0.00	0.00	0.00	0.00	0.29	0.81	1.27	1.02	0.79	3.15	1.55	0.56
1967	0.13	0.02	0.00	0.00	0.00	0.64	1.18	0.58	1.03	2.19	0.72	0.17
1968	0.03	0.00	0.00	0.00	0.00	1.83	1.23	0.43	1.57	1.61	0.51	0.12
1969	0.02	0.00	0.00	0.00	0.09	0.04	0.11	1.14	2.60	3.27	1.22	0.30
1985	0.05	0.00	0.00	0.62	1.10	0.42	0.10	0.02	2.08	2.13	0.97	0.25
1986	0.05	0.00	0.00	0.00	0.00	0.15	0.17	0.17	1.37	1.17	1.55	0.46
1987	0.11	0.02	0.00	0.00	0.00	0.25	0.08	0.22	1.11	0.81	2.82	0.87
1988	0.22	0.04	0.00	0.00	0.00	0.17	0.13	0.06	1.08	1.59	0.52	0.12
1989	0.02	0.00	0.00	0.00	0.55	0.19	0.12	0.20	2.94	2.73	0.86	0.19
1990	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.16	0.49	0.48	0.74	0.22
1991	0.05	0.01	0.00	0.00	0.00	0.95	1.21	2.32	1.75	1.74	0.53	0.12
1992	0.02	0.00	0.00	0.00	0.00	0.00	0.56	0.25	1.17	2.63	0.86	0.21
1993	0.03	0.00	0.00	0.00	0.00	0.00	0.04	0.01	1.49	3.28	1.08	0.26
1994	0.04	0.00	0.00	0.00	0.00	0.00	1.75	1.46	1.74	0.67	0.18	0.03
1995	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.69	2.93	2.52	0.81	0.18
1996	0.02	0.00	0.00	0.00	0.00	1.36	1.13	0.46	1.63	2.20	1.37	0.38
1997	0.08	0.01	0.00	0.00	0.00	0.00	0.72	0.93	0.67	0.82	0.26	0.06
1998	0.01	0.00	0.00	0.00	0.00	0.00	0.22	1.41	2.60	2.11	1.60	0.45
1999	0.10	0.01	0.00	0.30	1.77	0.59	0.57	1.62	0.99	3.11	1.72	0.47
2000	0.10	0.01	0.00	0.00	0.00	0.74	0.64	0.84	2.53	5.65	2.83	1.12
Discharge at Kpob Trobek Reservoir (m^3/s)												
Year	Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1966	0.05	0.03	0.02	0.07	0.77	1.85	2.82	2.25	1.79	6.64	3.40	1.33
1967	0.36	0.13	0.05	0.02	0.15	1.50	2.69	1.49	2.26	4.69	1.59	0.41
1968	0.10	0.05	0.03	0.01	0.01	3.78	2.77	1.15	3.41	3.64	1.19	0.30
1969	0.08	0.05	0.02	0.01	0.37	0.27	0.40	2.68	5.70	6.85	2.65	0.70
1985	0.19	0.08	0.03	1.53	2.57	1.09	0.32	0.09	4.46	4.60	2.17	0.59
1986	0.16	0.07	0.03	0.01	0.01	0.43	0.48	0.51	3.00	2.59	3.41	1.04
1987	0.28	0.09	0.04	0.02	0.01	0.66	0.22	0.57	2.46	1.82	6.04	1.91
1988	0.51	0.13	0.06	0.03	0.01	0.49	0.40	0.27	2.40	3.47	1.15	0.29
1989	0.08	0.04	0.02	0.01	1.34	0.47	0.35	0.56	6.26	5.84	1.87	0.46
1990	0.13	0.07	0.02	0.01	0.01	0.01	0.15	0.47	1.16	1.11	1.69	0.53
1991	0.15	0.05	0.02	0.02	0.01	2.14	2.70	5.04	3.84	3.79	1.22	0.32
1992	0.09	0.04	0.02	0.01	0.01	0.07	1.31	0.68	2.60	5.61	1.88	0.48
1993	0.12	0.06	0.03	0.01	0.01	0.06	0.17	0.13	3.24	6.96	2.33	0.58
1994	0.14	0.07	0.03	0.01	0.01	0.06	3.78	3.24	3.80	1.52	0.45	0.12
1995	0.05	0.03	0.01	0.01	0.01	0.01	0.53	1.60	6.26	5.42	1.82	0.46
1996	0.13	0.06	0.02	0.01	0.01	2.98	2.54	1.14	3.56	4.75	3.05	0.87
1997	0.23	0.08	0.04	0.02	0.01	0.01	1.61	2.12	1.55	1.84	0.61	0.17
1998	0.05	0.03	0.02	0.01	0.01	0.01	0.56	3.11	5.58	4.57	3.53	1.04
1999	0.28	0.10	0.04	0.87	3.96	1.38	1.34	3.58	2.25	6.62	3.77	1.08
2000	0.27	0.09	0.05	0.02	0.01	1.69	1.51	1.98	5.30	11.69	5.96	2.44

Note: Sum of the discharge from the upper basin and lower basin of the Don Phe Reservoir.

Table B-14 Estimated Discharge for Three Reservoirs and Don Phe Reservoir Sites (2/2)

Discharge at O Saray Reservoir (m^3/s)												
Year	Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1966	0.00	0.00	0.00	0.00	0.22	0.61	0.97	0.78	0.60	2.40	1.18	0.43
1967	0.10	0.02	0.00	0.00	0.00	0.49	0.90	0.44	0.78	1.67	0.55	0.13
1968	0.02	0.00	0.00	0.00	0.00	1.39	0.93	0.32	1.19	1.23	0.39	0.09
1969	0.01	0.00	0.00	0.00	0.07	0.03	0.08	0.87	1.98	2.49	0.93	0.23
1985	0.04	0.00	0.00	0.47	0.84	0.32	0.08	0.01	1.58	1.62	0.74	0.19
1986	0.03	0.00	0.00	0.00	0.00	0.11	0.13	0.13	1.04	0.89	1.18	0.35
1987	0.08	0.01	0.00	0.00	0.00	0.19	0.06	0.16	0.84	0.61	2.15	0.66
1988	0.17	0.03	0.00	0.00	0.00	0.13	0.10	0.05	0.82	1.21	0.39	0.09
1989	0.01	0.00	0.00	0.00	0.42	0.14	0.09	0.15	2.24	2.08	0.65	0.15
1990	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.12	0.37	0.36	0.56	0.17
1991	0.04	0.01	0.00	0.00	0.00	0.73	0.92	1.77	1.33	1.32	0.41	0.09
1992	0.01	0.00	0.00	0.00	0.00	0.00	0.43	0.19	0.89	2.00	0.66	0.16
1993	0.02	0.00	0.00	0.00	0.00	0.00	0.03	0.01	1.13	2.50	0.82	0.20
1994	0.03	0.00	0.00	0.00	0.00	0.00	1.33	1.11	1.32	0.51	0.13	0.02
1995	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.52	2.23	1.92	0.62	0.14
1996	0.02	0.00	0.00	0.00	0.00	1.03	0.86	0.35	1.24	1.67	1.04	0.29
1997	0.06	0.01	0.00	0.00	0.00	0.00	0.54	0.71	0.51	0.62	0.19	0.05
1998	0.01	0.00	0.00	0.00	0.00	0.00	0.17	1.07	1.98	1.61	1.22	0.34
1999	0.07	0.01	0.00	0.23	1.35	0.45	0.43	1.23	0.75	2.37	1.31	0.36
2000	0.07	0.01	0.00	0.00	0.00	0.56	0.49	0.64	1.93	4.30	2.15	0.85

Discharge at Tumnup Lok Reservoir (m^3/s)												
Year	Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1966	0.23	0.13	0.09	0.29	1.98	4.65	6.95	5.65	4.43	16.15	8.31	3.33
1967	0.85	0.30	0.16	0.04	0.37	3.76	6.52	3.53	5.60	11.41	3.85	0.97
1968	0.20	0.12	0.09	0.02	0.01	9.47	6.73	2.70	8.31	8.70	2.87	0.68
1969	0.16	0.12	0.06	0.01	0.98	0.75	0.99	6.39	13.66	16.75	6.52	1.67
1985	0.41	0.22	0.11	3.80	6.33	2.75	0.75	0.18	10.80	11.17	5.32	1.39
1986	0.35	0.19	0.08	0.03	0.01	1.12	1.23	1.31	7.33	6.32	8.32	2.50
1987	0.66	0.20	0.09	0.06	0.01	1.67	0.55	1.46	6.00	4.46	14.63	4.59
1988	1.21	0.27	0.13	0.11	0.01	1.26	1.04	0.72	5.86	8.43	2.78	0.67
1989	0.15	0.11	0.06	0.01	3.33	1.16	0.91	1.42	15.17	14.17	4.51	1.04
1990	0.26	0.20	0.08	0.01	0.01	0.01	0.40	1.21	2.88	2.75	4.17	1.28
1991	0.34	0.10	0.05	0.04	0.01	5.25	6.61	12.24	9.32	9.21	2.94	0.76
1992	0.22	0.10	0.06	0.01	0.01	0.15	3.23	1.72	6.35	13.59	4.55	1.13
1993	0.23	0.15	0.10	0.01	0.01	0.11	0.45	0.34	7.87	16.83	5.62	1.37
1994	0.28	0.19	0.12	0.01	0.01	0.09	9.16	7.89	9.25	3.70	1.07	0.29
1995	0.11	0.08	0.02	0.01	0.01	0.01	1.34	3.96	15.17	13.13	4.43	1.06
1996	0.28	0.19	0.08	0.02	0.01	7.27	6.22	2.83	8.65	11.52	7.46	2.10
1997	0.51	0.20	0.10	0.04	0.01	0.01	3.96	5.21	3.81	4.51	1.46	0.40
1998	0.11	0.06	0.04	0.01	0.01	0.01	1.42	7.58	13.53	11.09	8.58	2.48
1999	0.67	0.23	0.10	2.21	9.67	3.30	3.27	8.68	5.52	16.05	9.15	2.61
2000	0.62	0.20	0.15	0.04	0.01	4.15	3.73	4.82	13.06	28.46	14.65	6.09

Total Discharge for Three Reservoirs (m^3/s)												
Year	Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1966	0.29	0.15	0.11	0.36	2.97	7.12	10.74	8.67	6.82	25.19	12.89	5.09
1967	1.31	0.44	0.21	0.06	0.53	5.75	10.11	5.46	8.64	17.77	5.98	1.51
1968	0.32	0.17	0.11	0.03	0.02	14.64	10.44	4.18	12.91	13.56	4.45	1.07
1969	0.26	0.17	0.08	0.02	1.41	1.05	1.46	9.94	21.34	26.10	10.10	2.59
1985	0.64	0.30	0.15	5.79	9.74	4.16	1.15	0.28	16.84	17.38	8.24	2.17
1986	0.54	0.26	0.11	0.04	0.02	1.66	1.84	1.94	11.38	9.80	12.92	3.90
1987	1.02	0.30	0.12	0.08	0.02	2.53	0.83	2.20	9.30	6.89	22.81	7.16
1988	1.89	0.44	0.18	0.14	0.02	1.89	1.54	1.03	9.08	13.11	4.33	1.05
1989	0.24	0.15	0.08	0.03	5.10	1.77	1.35	2.13	23.67	22.09	7.03	1.64
1990	0.41	0.27	0.11	0.02	0.02	0.02	0.58	1.80	4.41	4.22	6.42	1.98
1991	0.53	0.15	0.07	0.05	0.02	8.12	10.23	19.05	14.48	14.32	4.57	1.18
1992	0.33	0.15	0.08	0.02	0.02	0.22	4.98	2.59	9.84	21.20	7.09	1.77
1993	0.37	0.21	0.13	0.02	0.02	0.17	0.65	0.47	12.24	26.28	8.77	2.15
1994	0.45	0.26	0.15	0.02	0.02	0.15	14.26	12.24	14.38	5.73	1.66	0.44
1995	0.16	0.10	0.03	0.02	0.02	0.02	2.03	6.09	23.66	20.47	6.87	1.65
1996	0.43	0.25	0.10	0.03	0.02	11.29	9.62	4.33	13.46	17.95	11.55	3.25
1997	0.80	0.30	0.14	0.06	0.02	0.02	6.12	8.04	5.87	6.97	2.27	0.61
1998	0.16	0.08	0.06	0.03	0.02	0.02	2.15	11.76	21.08	17.26	13.33	3.86
1999	1.03	0.34	0.14	3.31	14.98	5.13	5.04	13.50	8.52	25.05	14.23	4.04
2000	0.96	0.30	0.19	0.06	0.02	6.40	5.73	7.45	20.29	44.45	22.76	9.38

Table B-15

for Non-Uniform Calculation for Tras Stream

(Sections from downstream to upstream)

Cross Section No.	Distance between C.sections	Distance	Elevation	Cross Section No.	Distance between C.sections	Distance	Elevation	Cross Section No.	Distance between C.sections	Distance	Elevation
	(m)	(m)	(m)		(m)	(m)	(m)		(m)	(m)	(m)
1	171.9	0.00	37.38	2	236.4	0.00	37.30	3	170.43	0.00	38.00
(Downstream)		36.53	37.26			22.20	37.80			38.70	38.10
		69.32	37.08			43.10	36.50			109.30	37.90
		105.24	36.88			50.80	36.30			201.90	38.00
		130.77	36.78			68.60	37.40			213.60	38.00
		149.76	37.31			112.70	37.80			283.50	38.00
		174.77	37.58			159.10	37.90			289.60	37.30
		273.78	37.37			179.90	38.50			295.20	36.80
		302.20	37.12			284.50	38.10			295.70	36.20
		305.41	36.49			287.70	37.90			300.00	36.00
		314.85	37.92			303.20	38.40			305.70	36.50
		329.25	38.25			305.60	36.30			321.30	37.10
		331.90	37.85			309.10	34.90			322.30	37.70
		335.55	36.18			311.80	35.30			348.30	38.40
		343.85	36.08			318.60	36.40			370.00	39.40
		350.99	36.48			328.80	37.40			374.40	40.70
		352.79	36.38			336.80	37.70				
		354.08	38.72			343.60	38.30				
Cross Section No.	Distance between C.sections	Distance	Elevation	Cross Section No.	Distance between C.sections	Distance	Elevation	Cross Section No.	Distance between C.sections	Distance	Elevation
	(m)	(m)	(m)		(m)	(m)	(m)		(m)	(m)	(m)
4	150.6	0.00	38.30	5	168.6	0.00	38.70	6	0	0.00	41.80
		60.65	38.11			10.00	36.80			12.53	40.14
		64.42	37.27			25.10	38.50			19.04	39.35
		75.88	37.23			80.50	38.60			34.86	38.35
		79.74	38.25			203.30	38.60			67.30	38.08
		104.15	38.21			219.00	38.70			91.28	38.68
		168.80	38.53			284.40	38.50			124.12	38.61
		202.30	38.25			288.70	38.40			139.37	38.85
		272.91	38.29			293.40	37.90			164.28	38.75
		303.21	38.40			297.50	36.30			173.72	38.24
		304.63	36.44			300.60	36.20			180.13	37.54
		307.85	35.77			315.20	36.60			185.19	36.71
		310.95	35.96			320.70	39.00			193.40	36.51
		316.52	35.67			346.60	39.40			201.40	36.70
		321.45	37.76			364.10	39.50			208.30	37.10
		330.09	38.42			405.70	39.80			211.92	37.45
		339.54	39.46			442.70	40.50			218.55	38.62
		347.83	40.98			444.70	40.90			228.97	38.67
										274.84	40.83
										300.83	41.20

Table B-16 Results of Water Quality Analysis (1/2)

Dry Season

Parameter	Unit	River			Deep well				Pond			WHO	Standard Value*2	
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Guideline*1	River	Lake/Reservoir
Air Temperature	•	27.0	27.0	27.0	27.0	27.5	29.0	28.0	26.0	28.0	29.0	-	-	-
Conductivity	ms/cm	110	98	100	505	267	887	551	100	79	107	-	-	-
pH Value	Unit	7.50	7.52	7.73	7.40	5.97	7.22	7.08	6.45	6.42	6.64	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5
Total Dissolved Solids (TDS)	mg/L	100	87	67	300	147	555	400	50	70	60	1000	-	-
Suspended Solids (TSS)	mg/L	57.3	119.3	86.7	2.7	4.0	1.0	1.3	60.0	18.0	21.0	-	25 - 100	1 - 15
Aikalinity (as $CaCO_3$)	mg/L	66	40	58	266	36	482	314	44	20	32	-	-	-
Calcium (Ca)	mg/L	7.4	3.8	7.1	13.4	6.0	2.0	24.4	2.9	2.2	3.5	-	-	-
Magnesium (Mg)	mg/L	3.3	1.0	2.2	7.4	2.1	18.4	26.7	0.9	1.1	1.5	-	-	-
Total Hardness (Ca+Mg)	mg/L	31.9	13.5	26.7	63.8	23.4	80.6	170.7	10.9	9.9	14.7	500	-	-
Chloride (Cl)	mg/L	0.9	1.4	0.8	2.0	5.5	0.6	1.2	0.5	1.9	1.4	250	-	-
Fluoride (F)	mg/L	0.20	2.30	0.10	0.60	0.40	0.07	0.07	0.40	0.40	0.80	1.5	-	-
Copper (Cu)	mg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	-	-
Iron (Fe)	mg/L	1.63	2.23	1.59	0.15	0.36	0.13	0.19	1.97	1.58	0.70	0.3	-	-
Manganese (Mn)	mg/L	0.30	0.10	0.10	0.80	0.40	0.10	0.60	0.10	0.30	0.10	0.5	-	-
Nitrate (NO_3-N)	mg/L	0.2	0.0	0.0	0.9	0.7	0.9	1.1	0.1	0.3	0.3	50	-	-
N-Amonia (NH_4-N)	mg/L	0.23	0.66	0.55	0.00	0.21	0.52	0.20	0.08	0.28	0.58	3	-	-
Potassium (K)	mg/L	1.50	1.90	1.80	0.80	1.20	0.70	1.75	1.80	0.90	1.40	-	-	-
E-Coli	cfu/1000ml	330	620	570	20	0	0	60	520	30	30	0	-	-
Total Coliforms	cfu/1000ml	2000	8400	2000	400	560	700	600	14400	2000	3600	0	<5000	<1000
Fecal Coliforms	cfu/1000ml	70	0	150	130	40	180	440	10	70	100	0	-	-
COD_{Mn}	mg/L	2.3	7.4	3.0	1.7	0.7	0.3	2.8	5.8	10.3	6.0	-	-	1 - 8
BOD	mg/L	33.0	16.0	22.0	37.0	53.0	81.0	78.0	69.0	73.0	60.0	-	1 - 10	-

*1: WHO guideline for drinking water quality

*2: Water quality standard in public water areas for bio-diversity conservation (Sub-decree on Water Pollution Control, 1999, RGC)

Sampling date: Feburuary 13, 2001

Table B-16 Results of Water Quality Analysis (2/2)

Rainy Season

Parameter	Unit	River			Deep well				Pond			WHO	Standard Value*2	
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Guideline*1	River	Lake/Reservoir
Air Temperature	•	29.0	29.5	29.0	28.0	29.0	28.5	28.0	29.0	28.5	28.0	-	-	-
Conductivity	ms/cm	735	660	670	5490	1830	3950	8180	760	1140	1280	-	-	-
pH Value	Unit	7.29	7.15	7.42	7.60	6.44	6.83	7.51	6.97	6.64	7.44	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5
Total Dissolved Solids (TDS)	mg/L	90	130	103	455	175	315	640	115	145	128	1000	-	-
Suspended Solids (TSS)	mg/L	140.0	274.0	205.0	8.5	11.5	8.0	8.5	115.0	39.5	24.8	-	25 - 100	1 - 15
Aikalinity (as $CaCO_3$)	mg/L	27	24	23	246	30	29	190	150	26	23	-	-	-
Calcium (Ca)	mg/L	2.2	1.3	2.0	23.8	4.4	1.6	17.7	12.0	2.2	1.3	-	-	-
Magnesium (Mg)	mg/L	2.9	1.5	2.2	10.9	2.9	1.7	30.8	8.1	0.4	1.0	-	-	-
Total Hardness (Ca+Mg)	mg/L	17.3	9.4	14.5	103.0	22.7	10.9	170.9	63.1	7.2	7.5	500	-	-
Chloride (Cl)	mg/L	2.0	3.7	3.4	0.2	32.6	0.3	0.2	3.8	8.2	22.1	250	-	-
Fluoride (F)	mg/L	0.00	0.00	0.00	0.50	0.30	0.35	0.55	0.35	0.10	0.30	1.5	-	-
Copper (Cu)	mg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	-	-
Iron (Fe)	mg/L	2.10	2.80	2.10	0.60	0.15	0.90	10.20	0.50	2.70	0.70	0.3	-	-
Manganese (Mn)	mg/L	0.00	0.00	0.00	0.80	0.40	0.10	0.20	0.10	0.30	0.10	0.5	-	-
Nitrate (NO_3-N)	mg/L	0.2	0.2	0.2	0.7	0.7	0.2	1.9	0.2	0.2	1.4	50	-	-
N-Amonia (NH_4-N)	mg/L	0.03	0.03	0.05	0.19	0.21	0.07	0.09	0.06	0.05	0.06	3	-	-
Potassium (K)	mg/L	1.68	0.02	0.05	1.07	1.60	1.72	1.29	1.31	1.90	3.71	-	-	-
E-Coli	cfu/1000ml	400	1800	400	0	3600	300	0	800	0	4000	0	-	-
Total Coliforms	cfu/1000ml	20000	11200	18400	1400	5600	3200	22320	15200	0	58800	0	<5000	<1000
Fecal Coliforms	cfu/1000ml	2200	5200	2000	0	3100	200	0	2600	600	4000	0	-	-
COD_{Mn}	mg/L	4.5	11.6	6.4	1.6	1.7	14.7	3.1	6.4	9.4	12.0	-	-	1 - 8
BOD	mg/L	2.2	3.1	2.0	2.1	2.0	1.7	2.1	1.1	1.0	1.1	-	1 - 10	-

*1: WHO guideline for drinking water quality

*2: Water quality standard in public water areas for bio-diversity conservation (Sub-decree on Water Pollution Control, 1999, RGC)

Table B-17 Irrigation Water Requirements (1/2)

Unit : m^3/sec/1,000 ha

Crop	January		February		March		April		May		June		July		August		September		October		November		December	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Medium Paddy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.41	0.51	0.56	0.56	0.50	0.26	0.30	0.54	0.49	0.43	0.15
1966	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.34	0.57	0.68	0.76	0.90	0.00	0.00	0.63	0.53	0.34	0.11
1967	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.40	0.60	0.73	0.36	0.42	0.19	0.20	0.93	0.75	0.50	0.18
1968	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.38	0.71	0.88	0.34	0.40	0.35	0.36	0.91	0.73	0.50	0.18
1969	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.48	0.36	0.39	0.33	0.35	0.03	0.05	0.59	0.50	0.50	0.18
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.47	0.70	0.87	0.38	0.45	0.09	0.10	0.34	0.31	0.50	0.18
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.37	0.60	0.72	0.68	0.79	0.33	0.34	0.61	0.51	0.41	0.14
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.48	0.42	0.47	0.69	0.81	0.14	0.15	0.32	0.29	0.50	0.18
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.39	0.54	0.65	0.33	0.29	0.18	0.19	0.84	0.68	0.49	0.18
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.44	0.35	0.38	0.69	0.81	0.64	0.63	0.00	0.00	0.23	0.05
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.45	0.50	0.59	0.43	0.51	0.16	0.17	0.21	0.21	0.46	0.16
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.31	0.33	0.31	0.47	0.55	0.71	0.70	1.00	0.80	0.50	0.18
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.44	0.40	0.45	0.33	0.32	1.11	1.08	0.10	0.10	0.49	0.18
1993	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.33	0.45	0.52	0.34	0.40	0.55	0.54	0.65	0.54	0.50	0.18
1994	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.36	0.63	0.31	0.67	0.37	0.27	0.51	1.00	0.80	0.42	0.18
1995	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.47	0.63	0.39	0.81	0.29	0.00	0.43	0.63	0.77	0.50	0.01
1996	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.31	0.62	0.81	0.33	0.37	0.00	0.09	0.46	0.19	0.40	0.18
1997	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.46	0.54	0.64	1.01	0.34	0.00	0.24	0.69	0.66	0.50	0.18
1998	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.37	0.33	0.59	0.85	0.29	0.35	0.14	0.00	0.53	0.32	0.18
1999	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.47	0.35	0.49	0.62	0.96	0.00	0.00	0.00	0.77	0.46	0.18
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.44	0.57	0.31	0.72	0.30	0.00	0.00	0.81	0.17	0.15	0.02
Early Paddy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.99	0.92	0.29	0.53	0.65	0.21	0.00	0.00
1966	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.12	1.32	0.00	0.00	0.77	0.22	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.86	0.82	0.24	0.51	1.14	0.40	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.85	0.78	0.41	0.69	1.11	0.39	0.00	0.00
1969	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.84	0.77	0.04	0.13	0.72	0.19	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.88	0.84	0.11	0.26	0.40	0.03	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.06	1.21	0.39	0.67	0.74	0.20	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.07	1.22	0.17	0.38	0.38	0.02	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.84	0.77	0.23	0.48	1.02	0.34	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.07	1.23	0.70	0.96	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.91	0.91	0.20	0.44	0.26	0.00	0.00	0.00
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.93	0.95	0.77	1.03	1.22	0.44	0.00	0.00
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.84	0.77	1.18	1.41	0.13	0.00	0.00	0.00
1993	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.85	0.78	0.61	0.88	0.78	0.22	0.00	0.00
1994	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.06	0.77	0.34	0.84	1.22	0.44	0.00	0.00
1995	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.15	0.77	0.00	0.77	0.77	0.42	0.00	0.00
1996	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.84	0.77	0.00	0.23	0.55	0.00	0.00	0.00
1997	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.27	0.77	0.00	0.56	0.83	0.32	0.00	0.00
1998	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.17	0.77	0.42	0.36	0.00	0.22	0.00	0.00
1999	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.03	1.39	0.00	0.00	0.00	0.42	0.00	0.00
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.09	0.77	0.00	0.00	0.98	0.00	0.00	0.00

Table B-17 Irrigation Water Requirements (2/2)

Unit : m^3/sec/1,000 ha

Crop	January		February		March		April		May		June		July		August		September		October		November		December	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Diversified Crop 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.18	0.25	0.24	0.30	0.21	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1966	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.09	0.23	0.35	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.08	0.64	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1969	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.09	0.21	0.53	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.56	0.46	0.58	0.63	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.69	0.00	0.06	0.34	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.12	0.56	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.49	0.03	0.18	0.20	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.06	0.28	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.10	0.37	0.50	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.33	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.28	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1994	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1995	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.03	0.63	0.57	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1996	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.37	0.25	0.26	0.00	0.40	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1997	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.61	0.73	0.00	0.55	0.17	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1998	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.00	0.18	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1999	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.10	0.62	0.60	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.15	0.00	0.48	0.44	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diversified Crop 2	0.67	0.74	0.94	0.73	0.52	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.20	0.36
1966	0.70	0.81	0.85	0.64	0.47	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.15
1967	0.57	0.69	0.98	0.75	0.55	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.27	0.46
1968	0.70	0.81	0.98	0.75	0.55	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.28	0.46
1969	0.39	0.52	0.93	0.71	0.53	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.45
1985	0.70	0.81	0.93	0.71	0.55	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.46
1986	0.70	0.81	0.98	0.75	0.55	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.27
1987	0.70	0.81	0.98	0.75	0.55	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.46
1988	0.70	0.81	0.97	0.74	0.41	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.25	0.43
1989	0.70	0.81	0.92	0.70	0.55	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.70	0.81	0.98	0.75	0.52	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.38
1991	0.70	0.81	0.85	0.64	0.55	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.28	0.46
1992	0.70	0.81	0.98	0.75	0.55	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.43
1993	0.69	0.80	0.98	0.75	0.43	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.28	0.46
1994	0.70	0.81	0.98	0.75	0.55	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.16	0.46
1995	0.70	0.53	0.98	0.75	0.55	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.28	0.00
1996	0.70	0.53	0.98	0.75	0.55	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.46
1997	0.70	0.81	0.73	0.75	0.55	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.28	0.46
1998	0.70	0.81	0.98	0.75	0.55	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.46
1999	0.56	0.61	0.98	0.75	0.49	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.22	0.46
2000	0.70	0.59	0.98	0.75	0.33	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table B-18 Runoff to Kpob Trobek Reservoir with Project Condition of Don Phe Reservoir Rehabilitation

Unit : MCM

Year	January		February		March		April		May		June		July		August		September		October		November		December	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
1966	0.06	0.06	0.03	0.03	0.02	0.02	0.07	0.07	0.37	0.40	1.98	2.29	3.52	3.41	2.11	2.18	1.02	1.02	7.99	9.06	3.28	3.64	1.25	1.57
1967	0.21	0.20	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	1.14	1.84	3.31	3.06	1.07	1.07	2.05	1.98	5.66	5.91	0.93	0.93	0.22	0.24
1968	0.03	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.51	4.79	3.46	3.27	0.55	0.59	3.20	3.52	4.05	4.18	0.66	0.66	0.15	0.16
1969	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.12	0.06	0.06	0.14	0.15	1.48	2.83	6.54	6.54	8.72	9.24	2.38	2.72	0.39	0.41
1985	0.06	0.07	0.00	0.00	0.00	0.00	0.80	1.84	3.22	3.45	1.13	1.09	0.14	0.15	0.02	0.02	2.69	4.52	5.71	6.00	2.17	2.37	0.32	0.34
1986	0.06	0.06	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.19	0.21	0.23	0.22	0.24	1.77	1.77	1.96	2.77	3.34	3.69	0.78	1.10
1987	0.14	0.15	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.10	0.11	0.28	0.30	1.43	1.43	1.05	2.05	7.21	7.40	1.77	2.20
1988	0.37	0.37	0.05	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.22	0.17	0.18	0.08	0.09	1.40	1.41	4.09	4.24	0.67	0.67	0.16	0.17
1989	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.76	0.24	0.24	0.15	0.16	0.26	0.27	6.24	6.55	6.49	6.81	2.31	2.31	0.25	0.46
1990	0.03	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.05	0.21	0.22	0.64	0.64	0.62	0.66	0.96	1.08	0.29	0.31
1991	0.07	0.07	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.23	2.14	3.37	3.28	6.07	6.47	3.95	3.82	3.72	3.87	0.69	0.69	0.16	0.17
1992	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.78	0.33	0.35	1.52	2.23	5.47	5.78	2.17	2.23	0.27	0.29
1993	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.01	0.02	1.93	2.26	8.06	8.48	1.88	2.25	0.34	0.36
1994	0.05	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.90	4.72	3.27	3.98	3.65	4.05	1.43	1.03	0.23	0.23	0.04	0.04
1995	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.29	0.89	0.95	5.07	7.33	6.91	6.53	1.25	1.23	0.24	0.25
1996	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.05	3.66	3.05	3.06	0.60	0.64	3.57	3.75	6.05	6.25	3.12	3.64	0.57	0.76
1997	0.10	0.11	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93	0.99	1.47	2.08	0.87	0.87	1.99	1.90	0.33	0.33	0.08	0.08
1998	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.31	1.82	3.01	5.71	6.45	5.25	5.87	4.47	3.82	0.89	0.99
1999	0.13	0.14	0.02	0.02	0.00	0.00	0.39	0.86	5.02	5.33	1.64	1.44	1.36	0.98	4.17	4.27	1.70	1.28	8.32	9.05	4.78	3.77	0.75	1.05
2000	0.13	0.14	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.95	1.87	1.63	1.30	1.76	2.25	5.51	6.07	15.04	16.05	6.34	7.45	2.90	3.24

Table B-19 Water Balance Calculation Results - Irrigable Area in Each of Reservoir System Alternatives

Alternative	Kpob Trobek		O Saray	Tunump Lok		20 Years after completion of reconstruction (ha)				
		Dike Top El.			Dike Top El.	Total Irri. Area	M. Paddy	S. Paddy	Upland C 1	Upland C 2
Alt. 1-1	□ ›	39m	-	-	-	1,100	550	250	100	200
Alt. 1-2	□ ›	40m	-	-	-	1,500	650	300	150	400
Alt. 2-1	□ ›	39m	□ ›	-	-	1,550	750	350	150	300
Alt. 2-2	□ ›	40m	□ ›	-	-	1,800	950	400	150	300
Alt. 3-1	□ ›	39m	-	□ ›	43m	4,550	2,400	1,100	500	550
Alt. 3-2	□ ›	39m	-	□ ›	44m	5,400	2,700	1,300	700	700
Alt. 3-3	□ ›	40m	-	□ ›	43m	5,500	2,700	1,300	700	800
Alt. 3-4	□ ›	40m	-	□ ›	44m	6,100	3,000	1,500	700	900
Alt. 4-1	□ ›	39m	□ ›	□ ›	43m	4,800	2,500	1,200	500	600
Alt. 4-2	□ ›	39m	□ ›	□ ›	44m	5,600	2,800	1,300	700	800
Alt. 4-3	□ ›	40m	□ ›	□ ›	43m	5,800	2,800	1,300	800	900
Alt. 4-4	□ ›	40m	□ ›	□ ›	44m	6,300	3,100	1,500	900	800

Alternative	Kpob Trobek		O Saray	Tunump Lok		50 Years after completion of reconstruction (ha)				
		Dike Top El.			Dike Top El.	Total Irri. Area	M. Paddy	S. Paddy	Upland C 1	Upland C 2
Alt. 1-1	□ ›	39m	-	-	-	1,000	550	250	100	100
Alt. 1-2	□ ›	40m	-	-	-	1,400	650	300	150	300
Alt. 2-1	□ ›	39m	□ ›	-	-	1,350	650	300	150	250
Alt. 2-2	□ ›	40m	□ ›	-	-	1,650	850	400	150	250
Alt. 3-1	□ ›	39m	-	□ ›	43m	3,750	2,100	1,000	300	350
Alt. 3-2	□ ›	39m	-	□ ›	44m	4,650	2,400	1,200	500	550
Alt. 3-3	□ ›	40m	-	□ ›	43m	4,900	2,600	1,200	500	600
Alt. 3-4	□ ›	40m	-	□ ›	44m	5,750	2,900	1,400	700	750
Alt. 4-1	□ ›	39m	□ ›	□ ›	43m	4,150	2,300	1,100	350	400
Alt. 4-2	□ ›	39m	□ ›	□ ›	44m	5,050	2,600	1,200	600	650
Alt. 4-3	□ ›	40m	□ ›	□ ›	43m	5,100	2,600	1,300	550	650
Alt. 4-4	□ ›	40m	□ ›	□ ›	44m	5,900	3,000	1,400	700	800

Table B-20 Irrigation Water Requirements for Alternative 3-1

(1) Irrigation water requirement in year

Unit : m³/sec

Year	January		February		March		April		May		June		July		August		September		October		November		December	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
1966	0.38	0.44	0.47	0.35	0.26	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.81	1.49	1.75	3.06	3.60	0.00	0.00	2.37	1.51	0.85	0.34
1967	0.31	0.38	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.03	0.00	0.00	0.10	1.09	1.62	1.89	1.81	1.91	0.73	1.04	3.48	2.30	1.35	0.69
1968	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.08	0.00	0.00	0.06	0.94	2.02	2.31	1.75	1.81	1.30	1.63	3.39	2.24	1.36	0.70
1969	0.22	0.29	0.51	0.39	0.29	0.12	0.00	0.00	0.00	0.00	0.05	0.10	0.33	1.48	0.85	1.00	1.73	1.68	0.13	0.28	2.21	1.40	1.34	0.69
1985	0.38	0.44	0.51	0.39	0.30	0.12	0.00	0.00	0.00	0.00	0.22	0.28	0.29	1.41	2.00	2.29	1.88	1.99	0.33	0.54	1.27	0.78	1.36	0.70
1986	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.00	0.29	0.35	0.06	0.92	1.60	1.86	2.79	3.24	1.21	1.55	2.29	1.45	1.05	0.48
1987	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.03	0.00	0.06	0.34	1.50	1.01	1.22	2.82	3.28	0.53	0.78	1.19	0.73	1.36	0.70
1988	0.38	0.44	0.53	0.41	0.23	0.09	0.00	0.00	0.00	0.00	0.19	0.24	0.08	1.04	1.40	1.66	1.73	1.55	0.69	0.99	3.13	2.05	1.30	0.66
1989	0.38	0.44	0.51	0.39	0.30	0.12	0.00	0.00	0.00	0.15	0.00	0.03	0.20	1.26	0.85	1.00	2.85	3.31	2.30	2.56	0.00	0.00	0.54	0.13
1990	0.38	0.44	0.54	0.41	0.28	0.11	0.00	0.00	0.00	0.02	0.00	0.05	0.24	1.33	1.24	1.49	2.05	2.23	0.62	0.90	0.79	0.50	1.22	0.60
1991	0.38	0.44	0.47	0.35	0.30	0.12	0.00	0.00	0.00	0.04	0.17	0.23	0.06	0.75	0.80	0.83	2.15	2.37	2.56	2.81	3.74	2.48	1.36	0.70
1992	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.12	0.00	0.00	0.20	1.25	0.97	1.17	1.73	1.62	3.97	4.13	0.39	0.25	1.32	0.66
1993	0.38	0.44	0.54	0.41	0.23	0.09	0.00	0.00	0.00	0.11	0.00	0.00	0.06	0.79	1.08	1.32	1.74	1.81	1.99	2.27	2.41	1.54	1.36	0.70
1994	0.38	0.44	0.54	0.41	0.30	0.06	0.00	0.00	0.00	0.00	0.00	0.31	0.06	0.86	1.71	0.83	2.76	1.75	1.03	2.14	3.74	2.48	1.09	0.70
1995	0.38	0.29	0.54	0.41	0.30	0.06	0.00	0.00	0.00	0.03	0.00	0.01	0.37	1.41	1.73	1.02	3.21	1.54	0.00	1.88	2.36	2.37	1.36	0.02
1996	0.38	0.29	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.03	0.18	0.13	0.19	0.75	1.69	2.10	1.73	1.74	0.00	0.47	1.69	0.47	1.02	0.70
1997	0.38	0.44	0.40	0.41	0.30	0.11	0.00	0.00	0.00	0.05	0.31	0.36	0.06	1.38	1.37	1.62	3.81	1.65	0.00	1.19	2.56	1.96	1.36	0.70
1998	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.00	0.27	0.00	0.15	0.92	0.80	1.49	3.32	1.54	1.31	0.74	0.00	1.50	0.79	0.70
1999	0.31	0.34	0.54	0.41	0.27	0.09	0.00	0.00	0.00	0.04	0.05	0.31	0.36	1.41	0.85	1.25	2.62	3.82	0.00	0.00	0.00	2.36	1.23	0.70
2000	0.38	0.32	0.54	0.41	0.18	0.12	0.00	0.00	0.00	0.14	0.08	0.00	0.30	1.28	1.52	0.83	2.93	1.58	0.00	0.00	3.01	0.40	0.35	0.05

(2) Irrigation water requirement in order

Unit : m³/sec

Order	January		February		March		April		May		June		July		August		September		October		November		December	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
1	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.15	0.31	0.36	0.37	1.50	2.02	2.31	3.81	3.82	3.97	4.13	3.74	2.48	1.36	0.70
2	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.14	0.29	0.35	0.36	1.48	2.00	2.29	3.32	3.60	2.56	2.81	3.74	2.48	1.36	0.70
3	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.12	0.27	0.31	0.34	1.41	1.73	2.10	3.21	3.31	2.30	2.56	3.48	2.37	1.36	0.70
4	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.11	0.22	0.31	0.33	1.41	1.71	1.89	3.06	3.28	1.99	2.27	3.39	2.36	1.36	0.70
5	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.08	0.19	0.28	0.30	1.41	1.69	1.86	2.93	3.24	1.31	2.14	3.13	2.30	1.36	0.70
6	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.05	0.18	0.24	0.29	1.38	1.62	1.75	2.85	2.37	1.30	1.88	3.01	2.24	1.36	0.70
7	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.04	0.17	0.23	0.24	1.33	1.60	1.66	2.82	2.23	1.21	1.63	2.56	2.05	1.36	0.70
8	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.04	0.08	0.13	0.20	1.28	1.52	1.62	2.79	1.99	1.03	1.55	2.41	1.96	1.35	0.70
9	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.03	0.05	0.10	0.20	1.26	1.49	1.49	2.76	1.91	0.73	1.19	2.37	1.54	1.34	0.70
10	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.03	0.05	0.06	0.19	1.25	1.40	1.49	2.62	1.81	0.69	1.04	2.36	1.51	1.32	0.70
11	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.03	0.00	0.05	0.15	1.09	1.37	1.32	2.15	1.81	0.62	0.99	2.29	1.50	1.30	0.69
12	0.38	0.44	0.54	0.41	0.30	0.12	0.00	0.00	0.00	0.03	0.00	0.03	0.10	1.04	1.24	1.25	2.05	1.75	0.53	0.90	2.21	1.45	1.23	0.69
13	0.38	0.44	0.54	0.41	0.30	0.11	0.00	0.00	0.00	0.02	0.00	0.01	0.08	0.94	1.08	1.22	1.88	1.74	0.33	0.78	1.69	1.40	1.22	0.66
14	0.38	0.44	0.53	0.41	0.29	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.92	1.01	1.17	1.81	1.68	0.13	0.74	1.27	0.78	1.09	0.66
15	0.38	0.38	0.51	0.41	0.28	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.92	0.97	1.02	1.75	1.65	0.00	0.54	1.19	0.73	1.05	0.60
16	0.38	0.34	0.51	0.39	0.27	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.86	0.85	1.00	1.74	1.62	0.00	0.47	0.79	0.50	1.02	0.48
17	0.38	0.32	0.51	0.39	0.26	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.81	0.85	1.00	1.73	1.58	0.00	0.28	0.39	0.47	0.85	0.34
18	0.31	0.29	0.47	0.39	0.23	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.79	0.85	0.83	1.73	1.55	0.00	0.00	0.00	0.40	0.79	0.13
19	0.31	0.29	0.47	0.35	0.23	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.75	0.80	0.83	1.73	1.54	0.00	0.00	0.00	0.25	0.54	0.05
20	0.22	0.29	0.40	0.35	0.18	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.75	0.80	0.83	1.73	1.54	0.00	0.00	0.00	0.00	0.35	0.02

Table B-21 Assumed Runoff to Ang 160 Reservoir

Unit: l/sec

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1966	1	1	1	2	12	27	42	34	27	97	50	20
1967	5	2	1	0	2	22	39	21	34	69	23	6
1968	1	1	1	0	0	55	41	16	50	52	17	4
1969	1	1	0	0	6	4	6	38	82	101	39	10
1985	2	1	1	22	38	16	5	1	65	67	32	8
1986	2	1	0	0	0	7	7	8	44	38	50	15
1987	4	1	1	0	0	10	3	9	36	27	88	28
1988	7	1	1	1	0	7	6	4	35	51	17	4
1989	1	1	0	0	20	7	5	9	91	85	27	6
1990	2	1	0	0	0	0	2	7	17	17	25	8
1991	2	1	0	0	0	31	40	74	56	55	18	5
1992	1	1	0	0	0	1	19	10	38	82	27	7
1993	1	1	1	0	0	1	3	2	47	101	34	8
1994	2	1	1	0	0	1	55	48	56	22	6	2
1995	1	0	0	0	0	0	8	24	91	79	27	6
1996	2	1	0	0	0	42	37	17	52	69	45	13
1997	3	1	1	0	0	0	24	31	23	27	9	2
1998	1	0	0	0	0	0	9	46	81	67	52	15
1999	4	1	1	13	58	19	20	52	33	97	55	16
2000	4	1	1	0	0	24	22	29	79	171	88	37

Table B-22 Assumed Runoff to Kim Sei Reservoir

Unit: l/sec

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1966	0	0	0	0	0	0	51	79	61	245	120	21
1967	0	0	0	0	0	0	47	45	80	170	56	7
1968	0	0	0	0	0	0	49	33	122	125	40	4
1969	0	0	0	0	0	0	4	89	202	254	95	11
1985	0	0	0	0	0	0	4	1	161	165	75	9
1986	0	0	0	0	0	0	7	13	106	91	121	17
1987	0	0	0	0	0	0	3	17	86	63	219	50
1988	0	0	0	0	0	0	5	5	84	124	40	5
1989	0	0	0	0	0	0	5	15	228	212	67	7
1990	0	0	0	0	0	0	1	12	38	37	58	8
1991	0	0	0	0	0	0	48	180	136	135	42	5
1992	0	0	0	0	0	0	23	20	91	204	67	8
1993	0	0	0	0	0	0	1	1	115	254	84	10
1994	0	0	0	0	0	0	70	113	135	52	14	1
1995	0	0	0	0	0	0	8	53	228	196	63	7
1996	0	0	0	0	0	0	45	36	126	171	106	14
1997	0	0	0	0	0	0	29	72	52	63	20	2
1998	0	0	0	0	0	0	9	109	201	164	124	17
1999	0	0	0	0	0	0	23	126	76	242	133	18
2000	0	0	0	0	0	0	26	65	197	438	219	42

Table B-23 Irrigation Water Requirements for Area benefited by Ang 160 Reservoir

Unit : l/sec

Order	January		February		March		April		May		June		July		August		September		October		November		December	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
1	1.9	2.2	2.7	2.1	1.5	0.6	0.0	0.0	0.0	0.6	1.1	1.3	1.5	8.3	11.5	13.8	23.4	23.4	24.3	25.3	23.0	15.1	8.1	4.0
2	1.6	2.2	2.7	2.1	1.5	0.6	0.0	0.0	0.0	0.5	1.1	1.3	1.5	8.2	11.4	13.6	20.3	22.1	15.7	17.2	23.0	15.1	8.1	4.0
3	1.9	2.2	2.7	2.1	1.5	0.6	0.0	0.0	0.0	0.5	1.0	1.2	1.4	7.9	10.0	12.5	19.7	20.3	14.1	15.7	21.3	14.4	8.1	4.0
4	1.1	2.2	2.7	2.1	1.5	0.6	0.0	0.0	0.0	0.4	0.8	1.1	1.3	7.9	9.9	11.3	18.8	20.1	12.2	14.0	20.8	14.3	8.1	4.0
5	1.9	2.2	2.7	2.1	1.5	0.6	0.0	0.0	0.0	0.3	0.7	1.0	1.2	7.9	9.8	11.2	18.0	19.9	8.0	13.1	19.2	13.9	8.1	4.0
6	1.9	2.2	2.7	2.1	1.5	0.6	0.0	0.0	0.0	0.2	0.7	0.9	1.2	7.7	9.4	10.6	17.5	14.5	8.0	11.6	18.5	13.6	8.1	4.0
7	1.9	2.2	2.7	2.1	1.5	0.6	0.0	0.0	0.0	0.2	0.6	0.8	1.0	7.5	9.3	10.0	17.3	13.7	7.4	10.0	15.7	12.5	8.1	4.0
8	1.9	2.2	2.7	2.1	1.5	0.6	0.0	0.0	0.0	0.1	0.3	0.5	0.9	7.3	8.9	9.8	17.1	12.3	6.3	9.5	14.8	11.9	8.1	4.0
9	1.9	2.2	2.7	2.1	1.5	0.6	0.0	0.0	0.0	0.1	0.2	0.4	0.9	7.1	8.8	9.1	16.9	11.7	4.5	7.3	14.5	9.4	8.0	4.0
10	1.9	2.2	2.7	2.1	1.5	0.6	0.0	0.0	0.0	0.1	0.2	0.2	0.8	7.1	8.3	9.1	16.1	11.2	4.2	6.4	14.5	9.2	7.8	4.0
11	1.9	2.2	2.7	2.1	1.5	0.6	0.0	0.0	0.0	0.1	0.0	0.2	0.7	6.3	8.1	8.0	13.2	11.1	3.8	6.1	14.0	9.2	7.8	3.9
12	1.9	2.2	2.7	2.1	1.5	0.6	0.0	0.0	0.0	0.1	0.0	0.1	0.5	6.1	7.5	7.6	12.6	10.7	3.2	5.5	13.6	8.9	7.3	3.9
13	1.9	2.2	2.7	2.1	1.5	0.6	0.0	0.0	0.0	0.1	0.0	0.0	0.4	5.6	6.6	7.4	11.5	10.7	2.0	4.8	10.4	8.6	7.3	3.8
14	1.9	2.2	2.7	2.1	1.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.4	5.5	6.1	7.1	11.2	10.4	0.8	4.5	7.8	4.7	6.5	3.7
15	1.9	1.9	2.6	2.0	1.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.4	5.5	5.9	6.2	10.8	10.2	0.0	3.3	7.3	4.4	6.3	3.4
16	1.9	1.7	2.5	2.0	1.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.4	5.2	5.2	6.1	10.7	9.9	0.0	2.9	4.9	3.1	6.1	2.8
17	1.9	1.6	2.5	1.9	1.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.4	4.9	5.2	6.1	10.6	9.7	0.0	1.7	2.4	2.8	5.1	2.0
18	1.9	1.5	2.3	1.9	1.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.4	4.8	5.1	5.1	10.6	9.6	0.0	0.0	0.0	2.4	4.8	0.8
19	1.5	1.5	2.3	1.8	1.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.4	4.6	4.9	5.1	10.6	9.5	0.0	0.0	0.0	1.5	3.3	0.3
20	1.9	1.4	2.0	1.8	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.4	4.6	4.9	5.1	10.6	9.5	0.0	0.0	0.0	0.0	2.1	0.1

Table B-24 Irrigation Water Requirements for Area benefited by Kim Sei Reservoir

Unit : l/sec

Order	January		February		March		April		May		June		July		August		September		October		November		December	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	16.2	30.9	20.2	22.8	28.4	33.5	22.3	7.1	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	16.1	27.0	18.7	13.4	19.7	33.5	22.3	7.1	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	15.2	26.2	16.6	11.7	18.1	31.5	21.3	7.1	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	14.3	25.0	16.4	9.0	15.3	30.9	21.2	7.1	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	14.2	24.0	16.1	5.2	15.2	28.8	20.6	7.1	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	13.7	23.3	10.1	5.1	13.6	27.9	20.1	7.1	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	13.2	23.2	9.1	4.5	11.9	24.5	18.4	7.1	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	13.1	22.9	7.5	3.3	11.3	23.0	17.6	7.1	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	12.5	22.6	7.0	1.9	8.8	22.9	13.6	7.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	12.5	21.6	6.2	1.8	7.8	22.5	13.5	6.8	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	11.5	17.9	6.0	1.6	7.4	22.4	13.5	6.8	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	11.1	17.1	6.0	1.3	6.7	21.8	13.0	6.3	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	11.0	15.8	6.0	0.9	5.9	17.8	12.5	6.2	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	10.7	15.3	6.0	0.3	5.5	14.5	6.5	5.5	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	9.9	14.6	6.0	0.0	4.0	13.9	6.0	5.2	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	9.8	14.4	6.0	0.0	3.5	10.1	4.0	5.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	9.8	14.4	6.0	0.0	2.1	4.9	3.7	4.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	8.9	14.4	6.0	0.0	0.0	0.0	3.2	3.6	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	8.9	14.4	6.0	0.0	0.0	0.0	2.0	1.7	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	8.9	13.7	5.3	0.0	0.0	0.0	0.0	0.2	0.0