6. Topography, Meteorology/Hydrology and Geology in the Se Kong Basin

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6. Topography, Meteorology/Hydrology and Geology in the Se Kong Basin

6.1 Outline

Based on the collected data described in Chapter 5, topographic maps, meteorological/hydrological data and geological data were reviewed, and applied on the hydropower potential study as basic data. Especially, there are very little meteorological and hydrological observation stations in the basin, and the data have been observed very short period. Therefore, the collected data were rearranged and the monthly discharge, flood, sedimentation and etc. at the each development sites were preliminary analysed. Topography, geology and engineering geology in the basin were also preliminary studied.

6.2 Topographic Maps

At present, the most large scale of the existing topographic map is 1/50,000. This map covers all area in the Se Kong basin excluding a part of basin in Vietname and Cambodia. On the hydropower potential study, therefore, calculation of the catchment area and reservoir capacity at the each site were done mainly using this map. The maps of 1/100,000 and 1/200,000 scales were also referred in the study.

6.3 Preliminary Analysis of Meteorology and Hydrology

6.3.1 Climate and Discharge in the Se Kong Basin

The southern Laos belongs to the monsoon climatic zone and the monsoons characterize the climate in the basin depending on the direction of the monsoons.

The south-west monsoon is a sea wind from the Indian Ocean which brings a lot of rain from May to October. While the north-east monsoon which blows from November to April is a land wind from the continent. It causes rainfall at the east of the Annam Mountains.

Trend of hydrology in the basin is summarized as follows.

(1) **Rainfall (see Fig. 6.3-1 & Table 6.3-2)**

According to the isohyetal map (**reference No.6.3-2**) and the Year Book published by the Mekong Committee, affluent rainfall of more than 3000 mm per year is seen at the Bolaven Plateau and rainfall becomes smaller and smaller with the distance from the Plateau.

The isohyetal lines are not drawn over eastern area of the Annam Mountains because no rainfall data are provided from Vietnam. There may be some area in the Annam Mountains where more rainfall affected by the north-east monsoon occurs. But at this present, no verification could not be made by the collected data.

The mean annual rainfall from 1979 to 1992 is 3,562 mm at the KM42 observation station on the Bolaven Plateau. The station recorded 4,763 mm per year, 2,043 mm per month in August, and 283 mm per day in 1984.

The mean annual rainfall at Pleiku in Vietnam, Pakse, Attapu, and Saravane in Laos is from 2,200 to 1,900 mm per year. These rainfall may be touched off by the common topographic characteristic. Namely, these towns are located at the place where the south-west monsoon blows directly without affection of mountains and there are mountains at the back or surrounding these towns.

According to the rainfall record at Dakchung situated on the west slope and near the ridge of the Annam Mountains and at the height of some 1,100 m, it is deemed that total amount of rainfall of about 1300 mm per year is rather small though only two year period records are available at present. This tendency can be seen in the isohyetal map as the rainfall becomes smaller and smaller with the distance from the Bolaven Plateau. It is also found that the small rainfalls in December and January in dry season are found whereas other stations record little rainfalls in these months except Pleiku in Vietnam.

(2) **Evaporation (see Fig. 6.3-2 & Table 6.3-2)**

Monthly evaporation in Vientiane and in the stations of the southern Lao are shown in **Fig. 6.3-2.**

The mean annual evaporation of 570 mm at Nikhom 34 is rather small than that of 1,700 mm at Pakse. This is probably caused by low temperature, Nikhom 34 is located on the Bolaven Plateau, and the observation by just a pitcher.

The maximum monthly evaporation is appeared at the end of dry season and becomes small during wet season. Although some difference in the monthly evaporation between wet season and dry season are seen, the tendency is clear in Pakse and Savanakhet.

(3) Temperature (see Fig. 6.3-3 & Table 6.3-3)

The mean annual temperature data in Vientiane and two towns in the southern Laos, Pakse and Attapu, show 26 and 27 Centigrade, respectively. Temperature in the southern Laos except high land tends to be higher than that in Vientiane as seen in **Fig. 6.3-3** which shows mean, maximum, and minimum monthly temperature in the same sheet.

Because Nikhom 34 is located in the Bolaven Plateau, the mean annual temperature of 19 Centigrade is lower than that of the plain area in the southern Laos. The station recorded 0 Centigrade in January 1986 and almost constant maximum temperature from 28 to 29 Centigrade through a year.

The average curve in **Fig. 6.3-3** has a gentle peak in March or April. The mean monthly temperature seems to be similar value in May or June during wet season. In dry season, the mean monthly temperature becomes low and the difference between maximum and minimum value becomes large.

(4) Humidity (see Fig. 6.3-4 & Table 6.3-4)

The mean monthly humidity in each station forms the same pattern, high humidity in wet season and low humidity in dry season, as shown in **Fig. 6.3-4.** The maximum humidity, almost 100 %, is recorded through ayear.

The amount of vapor contained in the air which is brought by the monsoon may cause low humidity in dry season and high humidity in wet season.

(5) River Discharge (see Fig. 6.3-5 & Table 6.3-5)

The river discharge in the southern Laos is the maximum level in August or September and minimum in March or April as shown in **Fig. 6.3-5.** The difference between them is rather big and this may mold a common character of the rivers in the southern Laos.

For example, in Attapu, the mean monthly discharge of 116 m^3/s in April is one tenth(1/10) of 1150 m^3/s in August. About sixty (60) percent of total amount of discharge is flown out in three (3) months in August through October in wet season.

(6) **Water Quality (see Table 6.3-7)**

For the sake of reference for the study, four(4) bottles of sample water were taken by hand from the boat near the four project dam sites during the site reconnaissance. River water sample of about one litter per one site was sent to Vientiane by plastic bottle and analyzed by the Laboratory of Water Quality Analysis of the Department of Irrigation & Micro Hydropower under the Ministry of Agriculture and Forestry. Test results are shown in **Table 6.3-7.**

6.3.2 Calculation of Monthly Discharge

The monthly discharge at the each project dam site was calculated on the basis of the daily discharge converted from the observed daily water level at Attapu. The daily water level, as well as discharge, has been measured since July 1988 and the data up to June 1993 were used for the study.

The monthly discharge from 1961 to 1969 at B. Khmuon along the Se Kong River, which is located near the river mouth was not used because the catchment area of 29,600 km^2 at this station is bigger than the area of 10,500 km^2 covered by Attapu observation station. Using the data at Attapu, smaller error was expected when the monthly discharge at the projects were calculated in proportion to the catchment area.

The monthly discharges were calculated in the following sequence.

(1) Conversion of the daily water level to the daily discharge and calculating the monthly discharge at Attapu as shown in the Appendix 1 .

(2) Seeking the mean annual rainfall of each project from the iso- hyetal map shown in the report published by the Mekong Committee (**Reference No. 6.3-2**).
The mean annual rainfall was calculated by the following equation.

$$R = \frac{\sum_{i=1}^{j}(A_i \cdot R_i)}{A_o}$$

Where,

R	:	Mean annual rainfall	[mm]
R_i	:	Intensity of isohyetal line	[mm]
Ao	:	Catchment area	[km^2]
A_i	:	Area between R_i and R_{i+1}	

(3) Calculation of the catchment area ratio : a1=(Catchment area at the project dam site)/(Catchment area at Attapu ; 10,500 km^2)

(4) Calculation of the annual rainfall ratio : a2=(Mean annual rainfall of the project)/(Mean annual rainfall at Attapu)

(5) Calculation of the monthly discharge at the project dam site

Monthly discharge of the Project
= Monthly discharge at Attapu x a1 x a2

The monthly discharge at Attapu is shown in **Table 6.3-8** and the estimated monthly discharge of the projects is shown in **Table 6.3-9**.

6.3.3 Estimation of Flood

The design flood of the projects to be used at the Hydropower Potential Stage is estimated from the Creager Curve which envelops the actual maximum floods and planned design floods of the hydropower projects in Laos and the adjacent countries.

The actual maximum floods in Laos, Thailand, Vietnam, and Cambodia quoted from the report by the Mekong Committee (**reference No. 6.3-2**) and by ECAFE (**reference No.6.3-3**) are plotted with white square in **Fig. 6.3-6**. The design floods analyzed in feasibility stage for the hydropower projects in Laos are marked with hatched square for the design floods of 100 year return period and black square for the design floods of PMF in **Fig. 6.3-6**. The design floods of PMF in Thailand are also figured with black circle.

In addition to the above data, three lines are drown in the figure. One is Creager Curve which envelops above data and shows the design floods for the projects at the Hydropower Potential Stage. The another curve and the straight line below Creager Curve are the proposed ones by ECAFE. ECAFE suggested that the straight line should be used in case of bigger catchment area than 2,700 km^2 and the another curve should be used for remaining

cases. These ECAFE's lines include the actual maximum floods and the design floods of 100 year return period. However, the PMF are not enveloped by these lines.

According to **Fig. 6.3-6,** the design floods in Laos by PMF theory seem bigger than those in Thailand though just three data of PMF in Laos are obtained.

The design floods of the projects are tabulated in **Table 6.3-10** by using Creager Curve which was decided to cross the point of the maximum PMF of Xe Done 2 Hydropower project.

Creager Curve was formulated as below.

$$q = 61A^{(A^{-0.05}-1)}$$

Where,

q	:	Specific discharge	[$m^3/s/km^2$]
A	:	Catchment area	[km^2]

6.3.4 Estimation of Reservoir Sedimentation

(1) Estimation of Suspended Load

A straight line was obtained to envelop the observed data in Laos and Thailand, and estimated data in the hydropower projects in Laos.

In order to estimate the annual suspended load to be considered in the projects, this straight line is used as shown in **Fig.** 6.3-7 because no data related to the suspended load in the Se Kong Basin are available except for the observed data in 1961 at Stung Treng which is located nearly the river mouth of the Se Kong River.

The calculated annual suspended load at Stung Treng based on the regression equation reported by Ake Sundborg (**reference No. 6.3-5**) is come to near the straight line as shown in **Fig. 6.3-5.** The regression analysis was made on the basis of twenty six (26) observed suspended load records in 1961. The equation is shown as below.

$$S = 0.0189\ Q^{1.72}$$

Where,

S	:	Daily suspended load	[tons/day]
Q	:	River discharge	[m^3/s]

The discharge data in 1961 at B. Khmuon were also used to estimate annual suspended load at Stung Treng.

The suspended load is affected by topography, geology, and social and economic activities in the basin.

The relatively clean flow water, not muddy flow, in the Xe Namnoy River was observed during the site reconnaissance though it was wet season. It is supposed that the Bolaben Plateau from which the Xe Namnoy flows out is covered with thin topsoil on the widely spreaded basalt in the Plateau, therefore less soil material may be provided to the river though the plain is relatively cultivated along the national road.

While, though the upstream basin of the Se Kong River and Xe Kaman River was covered with dense forest without large scale sliding area, in which only small villages and foot paths were glanced from the helicopter, the muddy flows were observed at the midstream and downstream. This may be caused by regional geological condition.

However, the differences in the suspended load, like above example, could not be considered because no data was available along the tributaries in the Se Kong basin.

An erosion rate obtained from the total sediment volume based on the envelope line is 0.2 - 0.3 mm per year under condition of unit weight of the sand : 1.6 tons/m^3. The above erosion rate would be adequate considering the future development in the basin though it seems somewhat large at present condition.

(2) Estimation of Bed Load

It is not easy to measure the bed load directly at the river.

Therefore, instead of direct method, the bed load is generally estimated from the calculation by the various kind of formulae through the grain size measurement of the riverbed material or from the results of the sieve analysis at the nearby existing reservoir.

No such measurement record, however, was found in the Se Kong basin. Therefore, the report regarding to the reservoir sedimentation at the Num Ngum Dam (**Reference No. 6.3-4**) was referred. According to the report, fifteen (15) percent of the suspended load is estimated based on the observation of grain size distribution at the river mouth and riverbed.

Consequently twenty (20) percent of the suspended load is assumed in this study with five (5) percent surplus.

(3) Sediment Density

Sediment density varies with the kind of sediment material, period, reservoir fluctuation and so on. It is generally said that the larger grain size sediment material, the longer duration and exposed period of the sediment, the thicker density.

Hence, sediment density from 0.6 to 1.5 tons/m^3 has been used. In this study, 1.0 tons/m^3 was introduced as the above mean value.

(4) Reservoir Sediment Volume

The calculation results are tabulated in **Table 6.3-11.**

No sand flash from the dam and one hundred (100) percent trap efficiency were considered in the calculation.

6.3.5 Estimation of Reservoir Evaporation

The amount of evaporation from an open water surface is governed by temperature of the air and the water, humidity, and wind blowing on the water surface. Since it is difficult to measure it directly at the site, an evaporation pan on the ground is widely used. Therefore, the amount of evaporation at the reservoir is estimated by the measurement or, in case of no available data, by the calculation using the formulae.

The observed data from 1981 to 1992 at Pakse is available in this study and the ratio to the amount of evaporation at Pakse can be calculated from the daily evaporation at each project and Pakse by the following formula.

$$E_r = \psi(e_w - e_a)$$

$$\psi = 0.372\,(1 + 0.6\,V_w)(1 - 0.000374\,P_a)$$

$$\log_{10}e = 10.79574\,(1-T_1/T) - 5.028\,\log_{10}(T/T_1) + 1.50475 \times 10^{-4}\,[1-10^{8.2969(T/T1-1)}] + 0.42873 \times 10^{-3}\,[10^{4.76955(1-T1/T)} - 1] + 0.78614$$

Where,

Er	:	Daily evaporation from the water surface	[mm/day]
ew	:	Vapor pressure above the water	[mb]
ea	:	Vapor pressure in the air	[mb]
Vw	:	Mean wind velocity	[m/s]
Pa	:	Atmospheric pressure	[mb]
Tl	:	Absolute temperature	[°K]
T	:	Temperature	[°K]

Temperature at each project site was calculated based on the mean annual temperature of 27 Centigrade and elevation of 101 meter at Pakse under assumption of gradient of temperature : 0.6 Centigrade per elevation 100 m.

Conversion factor from evaporation measured by the evaporation class A pan to that from the water surface is assumed 0.7.

Consequently, annual evaporation is to be calculated by the below equation.

$$\text{Annual Evaporation at the Projects} = \frac{E_r}{E_o} \times 1{,}715 \times 0.7$$

Monthly evaporation can be obtained from annual evaporation in proportion to the distribution ratio of mean monthly evaporation at Pakse.

The results are tabulated in **Table 6.3-12.**

REFERENCES

No.	Title
6.3-1	United Nation Development Program, Integrated Rural Development Project, Sekong Province Coffee Production Investment Study - Phase 2., Lao/86/015, May 1989
6.3-2	Lower Mekong Basin, Suspended Sediment Transport and Sedimentation Problems, October 1992
6.3-3	Assessment of the Magnitude and Frequency of Flood Flows, Water Resources Series No. 30, ECAFE and WMO, 1967
6.3-4	Sedimentation in the Nam Ngum Reservoir Lao PDR, A Report Submitted to the Mekong Secretariat by Valter Axelsson, October 1992
6.3-5	Evaluation of Sediment Data in the Lower Mekong Basin by Ake Sundborg, 1988
6.3-6	Feasibility Study Report on Xe Katam Small-Scale Hydroelectric Power Development Project, March 1992
6.3-7	Feasibility Study Xe Done 2 Hydroelectric Project Volume 2, April 1991
6.3-8	Nam Theun 2 Hydroelectric Project Feasibility Study, Hydrological Report Volume 5, November 1990
6.3-9	Xe Set Hydropower Project Hydrology Design Memorandum, February 1985
6.3-10	Nam Theun 1/2 Hydropower Project Feasibility Study, Volume 1 Main Report, May 1993

Table 6.3-1 Monthly Rainfall (1/6)

[mm]

Saravane

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1987	0.0	0.0	0.0	0.0	28.8	333.4	580.4	502.3	235.5	68.6	31.9	0.0	1,781
1988	0.0	12.1	10.1	64.9	155.9	442.9	249.9	356.8	73.6	282.6	6.6	0.0	1,655
1989	6.5	0.0	49.3	188.1	354.8	204.3	356.6	478.8	197.7	60.3	0.9	0.0	1,897
1990	0.0	9.4	133.1	61.9	191.7	312.3	298.0	302.2	352.9	101.6	39.7	0.0	1,803
1991	0.0	0.0	7.5	24.7	152.8	278.7	436.0	650.7	506.2	201.3	5.6	2.2	2,266
1992	28.7	3.3	5.2	22.2	106.9	544.4	299.8	889.9	224.3	107.0	0.0	0.0	2,232
Average	5.9	4.1	34.2	60.3	165.2	352.7	370.1	530.1	265.0	136.9	14.1	0.4	1,939
Max.	28.7	12.1	133.1	188.1	354.8	544.4	580.4	889.9	506.2	282.6	39.7	2.2	2,266
Min.	0.0	0.0	0.0	0.0	28.8	204.3	249.9	302.2	73.6	60.3	0.0	0.0	1,655

Data Source : YEAR BOOK by Mekong Committee

Attapu

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1988	0.0	0.0	10.9	72.4	290.8	295.0	230.1	174.5	156.3	284.1	0.1	0.0	1,514
1989	36.9	0.0	111.8	27.0	253.3	145.5	422.0	437.9	281.8	101.5	1.7	0.0	1,819
1990	0.0	0.0	43.5	70.2	247.1	400.7	298.2	456.3	380.1	220.8	78.7	0.0	2,196
1991	0.0	0.0	43.8	21.0	48.5	404.1	558.7	748.5	677.7	227.9	7.6	0.0	2,738
1992	12.8	0.3	11.2	15.2	251.2	382.1	341.2	401.4	205.9	177.2	0.0	0.2	1,799
1993	0.8	1.2	174.8	89.8	163.4	187.4	307.8	0.0	0.0	0.0	0.0	0.0	–
Average	8.4	0.3	66.0	49.3	209.1	302.5	359.7	369.8	283.6	168.6	14.7	0.0	2,013
Max.	36.9	1.2	174.8	89.8	290.8	404.1	558.7	748.5	677.7	284.1	78.7	0.2	2,738
Min.	0.0	0.0	10.9	15.2	48.5	145.5	230.1	0.0	0.0	0.0	0.0	0.0	1,514

Data Source : YEAR BOOK by Mekong Committee

Table 6.3-1 Monthly Rainfall (2/6)

[mm]

Pakse

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1950	–	–	10.0	47.1	–	–	–	–	–	–	32.0	–	–
1951	12.9	60.1	49.3	56.6	–	–	–	–	–	–	20.3	2.2	–
1952	8.0	–	5.0	31.0	89.1	389.2	491.6	592.7	302.5	132.5	14.0	2.0	–
1953	–	–	23.2	28.4	267.8	351.7	168.0	398.7	169.6	143.6	31.0	–	–
1954	–	5.9	10.0	39.5	–	135.5	139.7	583.8	671.0	15.8	–	3.0	–
1955	0.0	–	4.8	26.2	45.4	226.3	115.7	434.2	117.8	56.4	24.8	–	–
1956	–	9.3	0.0	46.7	548.3	179.4	367.1	291.8	220.0	18.0	5.0	–	–
1958	–	–	–	0.0	40.8	184.7	304.6	87.7	331.9	–	0.0	8.5	–
1959	–	–	–	26.4	64.4	173.3	253.7	349.7	410.8	38.1	10.0	4.0	–
1960	–	–	–	–	–	287.4	272.7	733.4	298.2	162.1	15.6	0.0	–
1961	0.0	0.3	4.5	56.9	307.8	542.8	396.7	543.3	492.7	208.7	2.6	10.1	2,566
1962	0.0	11.9	1.9	93.8	253.5	413.4	442.0	676.4	496.7	33.2	1.9	0.0	2,425
1963	0.0	0.0	55.3	65.7	116.9	185.7	534.3	383.3	266.9	111.7	55.6	0.0	1,775
1964	0.5	0.0	0.0	53.7	371.4	229.4	296.1	618.6	487.3	110.7	29.4	1.6	2,199
1965	0.0	8.0	1.8	73.8	136.0	536.4	590.3	379.2	173.3	10.5	19.4	0.0	1,929
1966	0.0	1.4	7.9	17.5	336.0	284.8	511.8	382.7	368.7	67.2	2.9	13.4	1,994
1967	0.0	0.0	0.0	97.0	134.9	243.4	403.6	615.1	257.4	61.5	24.1	0.0	1,837
1968	0.0	0.5	1.9	36.1	189.9	338.9	373.7	488.1	580.9	82.0	7.7	0.0	2,100
1969	5.6	0.0	3.3	87.9	267.4	382.6	602.6	240.4	233.9	101.4	0.0	0.0	1,925
1970	0.0	0.0	24.7	10.2	189.0	286.8	265.8	600.7	294.5	30.7	13.8	8.2	1,724
1971	0.0	64.1	17.3	9.4	196.7	803.4	633.3	338.8	128.8	30.6	0.4	18.6	2,241
1972	0.0	68.3	22.6	133.9	35.5	742.1	477.6	400.3	260.6	86.6	28.2	14.4	2,270
1973	0.0	0.0	32.2	22.3	161.9	299.3	281.0	552.2	142.1	30.7	7.8	9.0	1,539
1974	4.0	0.0	36.8	94.9	335.8	478.2	192.2	729.9	160.1	151.7	76.7	1.6	2,262
1975	9.0	8.8	52.8	42.5	314.0	386.2	337.9	678.6	283.6	35.1	9.0	3.0	2,141
1976	0.0	0.0	1.5	145.8	195.9	262.1	455.3	359.8	281.3	65.7	25.9	0.0	1,793
1977	0.0	0.0	82.7	18.3	119.3	186.1	371.1	619.1	470.1	59.9	5.3	0.0	1,932
1978	22.4	0.0	54.3	118.8	256.2	409.7	425.3	922.9	350.3	79.7	15.3	0.0	2,655
1979	10.2	0.0	0.0	244.3	299.1	905.0	302.5	786.7	387.0	2.0	0.0	0.0	2,937
1980	0.0	0.0	50.4	107.6	220.3	291.4	204.7	259.3	293.4	60.8	34.9	0.0	1,523
1981	0.0	5.4	1.4	76.0	307.9	470.0	359.8	523.2	111.7	302.1	13.7	0.0	2,171
1982	0.0	0.0	0.0	65.6	113.0	514.2	322.6	309.6	418.4	67.1	9.7	2.4	1,823
1983	0.0	0.0	2.4	17.1	205.8	819.0	168.9	404.6	197.9	270.5	6.0	0.0	2,092
1984	0.0	1.4	47.4	81.4	198.0	346.8	340.8	977.3	372.0	142.8	53.0	0.0	2,561
1985	4.6	13.0	7.0	173.8	224.1	548.4	310.6	505.0	240.7	51.8	53.1	0.0	2,132
1986	0.0	0.3	0.6	42.9	333.7	268.1	501.9	813.1	237.2	210.1	25.7	6.7	2,440
1987	0.0	0.0	14.0	58.9	139.2	429.8	662.7	552.3	166.6	60.1	28.1	0.0	2,112
1988	0.0	43.0	3.4	50.0	274.6	411.9	201.8	334.7	75.4	278.8	2.6	0.0	1,676
1989	2.5	0.0	20.7	125.2	379.9	231.6	359.5	415.4	314.7	40.6	5.2	0.0	1,895
1991	0.0	0.0	0.7	14.9	61.1	295.8	340.2	558.7	335.7	148.6	8.7	0.5	1,765
1992	16.6	10.1	0.0	21.0	66.5	189.8	257.4	644.8	294.2	64.8	1.0	3.1	1,569
Average	2.4	7.6	17.7	72.8	217.5	410.7	384.6	535.9	295.3	98.6	18.3	3.0	2,065
Max.	22.4	68.3	82.7	244.3	379.9	905.0	662.7	977.3	580.9	302.1	76.7	18.6	2,937
Min.	0.0	0.0	0.0	9.4	35.5	185.7	168.9	240.4	75.4	2.0	0.0	0.0	1,523

Data Source : YEAR BOOK by Mekong Committee
Department of Hydrology & Meteorology

Table 6.3-1 Monthly Rainfall (3/6)

[mm]

KM 42

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1979	0.0	17.0	32.0	255.4	258.4	338.7	369.6	1,060.3	655.0	26.4	48.0	20.0	3,081
1980	0.0	0.4	232.8	90.0	123.4	262.8	286.8	655.8	431.1	209.8	52.4	1.9	2,347
1981	0.0	5.0	45.2	166.0	414.0	1,132.4	516.8	1,128.8	220.4	281.4	50.5	0.0	3,961
1983	5.0	0.0	0.6	187.8	233.3	880.6	274.5	584.1	492.7	441.2	107.3	25.1	3,232
1984	5.9	12.5	18.4	136.6	239.2	593.0	658.4	2,042.5	641.2	300.9	98.1	16.3	4,763
1985	12.9	36.9	166.6	378.1	437.9	1,045.8	640.8	796.3	287.8	309.8	288.1	17.0	4,418
1986	0.0	19.1	39.5	135.4	630.7	376.0	777.4	909.2	259.6	292.2	34.6	34.1	3,508
1987	0.0	0.0	61.7	418.5	159.0	512.1	808.5	1,079.0	397.2	271.1	101.4	0.7	3,809
1988	4.0	32.9	11.7	357.5	573.7	437.4	375.1	497.6	269.3	406.6	20.2	0.0	2,986
1989	12.7	0.0	140.4	269.6	506.9	353.4	756.6	588.6	579.6	168.6	82.1	0.0	3,459
1990	13.8	0.0	110.7	297.8	502.1	487.3	370.3	1,009.9	502.2	300.1	136.1	0.0	3,730
1991	11.4	11.7	63.0	140.7	321.5	537.8	781.3	1,226.7	615.3	228.8	20.0	6.7	3,965
1992	74.4	9.0	35.4	6.9	203.8	691.3	417.3	988.9	396.5	191.0	11.3	18.5	3,044
1993	0.0	13.5	44.8	77.4	241.5	194.0	--	--	--	--	--	--	--
Average	10.0	11.3	71.6	208.4	346.1	560.2	541.0	966.7	442.1	263.7	80.8	10.8	3,562
Max.	74.4	36.9	232.8	418.5	630.7	1,132.4	808.5	2,042.5	655.0	441.2	288.1	34.1	4,763
Min.	0.0	0.0	0.6	6.9	123.4	194.0	274.5	497.6	220.4	26.4	11.3	0.0	2,347

Data Source : Department of Hydrology & Meteorology

Table 6.3-1 Monthly Rainfall (4/6)

[mm]

Sekong town

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	25.0	10.5	98.6	142.1	266.9	379.2	133.1	342.7	226.1	126.5	8.8	0.4	1,760
1990	0.4	81.7	140.7	42.6	55.8	240.0	248.5	363.9	279.7	155.5	57.0	0.4	1,666
1991	0.0	1.2	0.0	23.2	107.3	184.8	220.4	392.4	307.8	109.7	1.0	0.0	1,348
1992	3.4	1.2	22.8	44.4	84.1	230.8	435.9	489.0	219.9	107.7	19.3	0.0	1,658
Average	7.2	23.7	65.5	63.1	128.5	258.7	259.5	397.0	258.4	124.8	21.5	0.2	1,608
Max.	25.0	81.7	140.7	142.1	266.9	379.2	435.9	489.0	307.8	155.5	57.0	0.4	1,760
Min.	0.0	1.2	0.0	23.2	55.8	184.8	133.1	342.7	219.9	107.7	1.0	0.0	1,348

Data Source : Department of Hydrology & Meteorology in Attapu

Dakchung

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1987	--	--	--	70.0	82.0	130.0	117.0	440.0	401.0	29.0	94.0	16.0	--
1988	34.0	40.0	21.0	69.0	116.0	134.0	121.0	105.0	165.0	261.0	112.0	116.0	1,294
1989	34.0	11.0	28.0	375.0	--	--	--	--	--	--	--	--	--
Average	34.0	25.5	24.5	171.3	99.0	132.0	119.0	272.5	283.0	145.0	103.0	66.0	1,294
Max.	34.0	40.0	28.0	375.0	116.0	134.0	121.0	440.0	401.0	261.0	112.0	116.0	1,294
Min.	34.0	11.0	21.0	69.0	82.0	130.0	117.0	105.0	165.0	29.0	94.0	16.0	1,294

Data Source : " UNDP INTEGRATED RURAL DEVELOPMENT PROJECT SEKONG PROVINCE
Coffee production Investment Study - Phase 2, May 1989 "

Table 6.3-1 Monthly Rainfall (5/6)

[mm]

Kontum in Vietnam

No.	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	1927	0.0	213.4	182.9	243.8	420.6	396.2	277.4	426.7	137.2	0.0	45.7	0.0	2,344
2	1930	0.0	0.0	48.8	100.6	0.0	237.7	295.7	512.1	256.0	61.0	121.9	0.0	1,634
3	1931	0.0	0.0	67.1	118.9	0.0	231.6	265.2	310.9	0.0	131.1	54.9	0.0	1,180
4	1932	0.0	152.4	36.6	265.2	118.9	359.7	329.2	137.2	408.4	0.0	0.0	0.0	1,807
5	1933	0.0	0.0	30.5	82.3	91.4	381.0	317.0	295.7	265.2	374.9	54.9	0.0	1,893
6	1934	0.0	182.9	182.9	45.7	213.4	222.5	280.4	301.8	213.4	213.4	118.9	274.3	2,249
7	1935	0.0	0.0	0.0	61.0	0.0	0.0	298.7	0.0	0.0	0.0	0.0	0.0	360
8	1936	0.0	0.0	0.0	182.9	140.2	0.0	0.0	161.5	463.3	204.2	61.0	152.4	1,366
9	1937	0.0	0.0	91.4	42.7	158.5	222.5	472.4	237.7	249.9	106.7	45.7	0.0	1,628
10	1938	0.0	42.7	30.5	64.0	128.0	170.7	274.3	274.3	448.1	76.2	39.6	0.0	1,548
11	1939	0.0	0.0	88.4	0.0	408.4	140.2	387.1	0.0	405.4	76.2	91.4	61.0	1,658
12	1956	0.0	30.5	243.8	152.4	195.1	262.1	249.9	256.0	475.5	118.9	91.4	0.0	2,076
13	1957	0.0	0.0	91.4	54.9	256.0	249.9	268.2	0.0	0.0	64.0	67.1	0.0	1,052
14	1958	0.0	121.9	109.7	137.2	234.7	246.9	323.1	253.0	445.0	317.0	33.5	57.9	2,280
15	1959	0.0	0.0	108.7	210.3	231.6	313.9	192.0	362.7	426.7	61.0	125.0	0.0	2,033
16	1961	30.5	182.9	82.3	79.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	375
17	1964	0.0	45.7	30.5	73.2	125.0	381.0	198.1	323.1	399.3	45.7	152.4	0.0	1,774
18	1965	0.0	0.0	61.0	97.5	457.2	350.5	307.8	317.0	192.0	259.1	0.0	0.0	2,042
19	1966	0.0	0.0	30.5	161.5	298.7	222.5	262.1	259.1	344.4	115.8	0.0	0.0	1,695
20	1967	0.0	0.0	67.1	51.8	91.4	176.8	195.1	295.7	347.5	76.2	91.4	0.0	1,393
21	1968	0.0	0.0	61.0	106.7	298.7	152.4	374.9	408.4	320.0	128.0	164.6	91.4	2,106
22	1969	0.0	61.0	274.3	79.2	201.2	335.3	332.2	222.5	143.3	103.6	61.0	91.4	1,905
23	1970	0.0	61.0	57.9	112.8	445.0	61.0	149.4	280.4	170.7	115.8	79.2	182.9	1,716
24	1971	0.0	0.0	152.4	125.0	222.5	201.2	274.3	231.6	317.0	76.2	152.4	0.0	1,753
25	1972	0.0	0.0	0.0	274.3	201.2	0.0	100.6	204.2	262.1	0.0	0.0	0.0	1,042
26	1973	0.0	30.5	115.8	57.9	158.5	207.3	310.9	112.8	225.6	67.1	243.8	0.0	1,530
27	1974	0.0	213.4	30.5	0.0	0.0	0.0	536.4	304.8	597.4	91.4	274.3	0.0	2,048
28	1977	0.0	0.0	0.0	33.5	0.0	0.0	109.7	289.6	0.0	182.9	176.8	0.0	792
29	1978	0.0	0.0	73.2	125.0	219.5	317.0	118.9	551.7	213.4	259.1	158.5	30.5	2,067
30	1979	0.0	0.0	0.0	137.2	76.2	45.7	207.3	152.4	499.9	48.8	51.8	0.0	1,219
31	1980	61.0	61.0	42.7	91.4	149.4	204.2	341.4	411.5	438.9	76.2	91.4	0.0	1,969
32	1981	0.0	0.0	243.8	57.9	201.2	539.5	268.2	429.8	280.4	97.5	213.4	0.0	2,332
33	1982	0.0	0.0	61.0	88.4	414.5	347.5	213.4	341.4	371.9	173.7	57.9	0.0	2,070
34	1983	0.0	0.0	0.0	76.2	189.0	423.7	405.4	365.8	170.7	246.9	67.1	0.0	1,945
35	1984	0.0	0.0	0.0	39.6	103.6	506.0	265.2	125.0	326.1	76.2	70.1	0.0	1,512
36	1985	0.0	0.0	30.5	48.8	155.4	320.0	231.6	353.6	295.7	384.0	42.7	0.0	1,862
37	1986	0.0	0.0	91.4	228.6	198.1	411.5	103.6	533.4	164.6	225.6	128.0	0.0	2,085
38	1987	0.0	0.0	274.3	103.6	128.0	332.2	263.5	274.3	268.2	79.2	70.1	0.0	1,814
39	1988	0.0	0.0	0.0	76.2	502.9	213.4	317.0	591.3	216.4	185.9	42.7	94.5	2,240
40	1989	0.0	0.0	36.6	0.0	204.2	219.5	225.6	320.0	265.2	33.5	140.2	0.0	1,445
Max.		61.0	213.4	274.3	274.3	502.9	539.5	536.4	591.3	597.4	384.0	274.3	274.3	2,344
Min.		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	360
Average		2.3	35.0	78.3	102.2	191.0	235.1	259.1	280.7	275.6	123.8	87.0	25.9	1,696

Data Source : Mekong Committee

Table 6.3-1 Monthly Rainfall (6/6)

[mm]

Pleiku in Vietnam

No.	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	1927	0.0	0.0	0.0	0.0	0.0	182.9	536.4	448.1	0.0	103.6	79.2	0.0	1,350
2	1930	0.0	0.0	42.7	39.6	374.9	396.2	518.2	266.5	121.9	121.9	158.5	33.5	2,094
3	1931	0.0	0.0	0.0	0.0	0.0	0.0	295.7	0.0	262.1	515.1	182.9	213.4	1,469
4	1932	0.0	0.0	0.0	118.9	91.4	152.4	137.2	548.6	438.9	249.9	152.4	121.9	2,012
5	1933	0.0	0.0	274.3	115.8	45.7	282.6	374.9	356.6	509.0	115.8	112.8	0.0	2,198
6	1934	0.0	38.6	42.7	51.8	164.6	277.4	402.3	448.1	350.5	140.2	51.8	0.0	1,969
7	1935	0.0	0.0	0.0	0.0	170.7	222.5	542.5	0.0	423.7	118.9	182.9	64.0	1,725
8	1936	0.0	0.0	0.0	109.7	228.6	704.1	417.6	426.7	615.7	0.0	0.0	0.0	2,502
9	1937	243.8	121.9	0.0	51.8	185.9	353.6	551.7	725.4	310.9	115.8	82.3	0.0	2,743
10	1938	0.0	0.0	97.5	137.2	85.3	469.4	329.2	249.9	606.6	664.5	42.7	64.0	2,746
11	1939	0.0	0.0	36.6	125.0	240.8	310.9	545.6	801.6	277.4	67.1	67.1	0.0	2,472
12	1956	182.9	121.9	42.7	91.4	179.8	271.3	359.7	304.8	566.9	88.4	73.2	274.3	2,557
13	1957	0.0	0.0	0.0	51.8	0.0	161.5	542.5	588.3	268.2	152.4	48.8	0.0	1,814
14	1958	0.0	0.0	61.0	42.7	143.3	234.7	414.5	332.2	332.2	201.2	0.0	0.0	1,762
15	1959	0.0	45.7	125.0	121.9	170.7	213.4	414.5	484.6	350.5	167.6	30.5	91.4	2,216
16	1961	0.0	0.0	213.4	82.3	304.8	634.0	475.5	670.6	201.2	310.9	61.0	0.0	2,954
17	1964	0.0	0.0	91.4	79.2	289.6	201.2	326.1	359.7	469.4	131.1	152.4	30.5	2,131
18	1965	0.0	30.5	0.0	121.9	152.4	432.8	478.5	259.1	271.3	64.0	121.9	30.5	1,963
19	1966	0.0	76.2	42.7	100.6	606.6	103.6	435.9	329.2	265.2	73.2	91.4	33.5	2,158
20	1967	91.4	0.0	243.8	140.2	329.2	329.2	371.9	499.9	167.6	146.3	67.1	0.0	2,387
21	1968	0.0	0.0	0.0	106.7	189.0	243.8	274.3	469.4	411.5	57.9	0.0	0.0	1,753
22	1969	30.5	0.0	0.0	67.1	201.2	231.6	582.2	539.5	515.1	152.4	0.0	30.5	2,350
23	1970	0.0	0.0	0.0	76.2	237.7	253.0	399.3	329.2	249.9	155.4	182.9	0.0	1,884
24	1971	0.0	0.0	0.0	182.9	243.8	353.6	445.0	222.5	225.6	109.7	243.8	0.0	2,027
25	1972	0.0	0.0	42.7	164.6	143.3	414.5	576.1	292.6	490.7	213.4	36.6	45.7	2,420
26	1973	0.0	0.0	30.5	100.6	131.1	137.2	381.0	734.6	332.2	198.1	146.3	0.0	2,192
27	1974	0.0	0.0	0.0	216.4	292.6	438.9	274.3	713.2	167.6	195.1	134.1	182.9	2,615
28	1977	0.0	0.0	0.0	33.5	167.6	155.4	262.1	301.8	557.8	39.6	39.6	0.0	1,558
29	1978	274.3	0.0	33.5	94.5	231.6	359.7	356.6	941.8	341.4	76.2	39.6	0.0	2,749
30	1979	182.9	0.0	30.5	70.1	378.0	667.5	426.7	704.1	390.1	97.5	33.5	0.0	2,981
31	1980	182.9	0.0	61.0	30.5	454.2	396.2	356.6	335.3	536.4	225.6	79.2	0.0	2,658
32	1981	0.0	0.0	0.0	82.3	225.6	719.3	237.7	512.1	310.9	347.5	128.0	0.0	2,563
33	1982	0.0	30.5	61.0	131.1	201.2	841.2	457.2	365.8	341.4	64.0	30.5	0.0	2,524
34	1983	0.0	0.0	0.0	182.9	91.4	378.0	167.6	371.9	301.8	588.3	121.9	0.0	2,204
35	1984	0.0	0.0	67.1	341.4	125.0	487.7	289.6	1,200.9	301.8	185.9	161.5	0.0	3,161
36	1985	0.0	0.0	30.5	152.4	70.1	676.7	298.7	512.1	283.5	82.3	67.1	0.0	2,173
37	1986	0.0	91.4	42.7	82.3	563.9	158.5	280.4	560.8	502.9	158.5	42.7	128.0	2,612
38	1987	0.0	274.3	42.7	30.5	121.9	253.0	350.5	466.3	231.6	76.2	152.4	0.0	1,999
39	1988	0.0	30.5	0.0	54.9	201.2	378.0	185.9	234.7	201.2	509.0	182.9	0.0	1,978
40	1989	0.0	0.0	45.7	85.3	356.6	225.6	307.8	320.0	280.4	149.4	30.5	0.0	1,801
Max.		274.3	274.3	274.3	341.4	606.6	841.2	582.2	1,200.9	615.7	664.5	243.8	274.3	3,161
Min.		0.0	0.0	0.0	0.0	0.0	0.0	137.2	0.0	0.0	0.0	0.0	0.0	1,350
Average		29.7	21.6	45.0	96.7	209.8	342.8	384.5	456.2	344.6	180.7	90.3	33.6	2,236

Data Source : Mekong Committee

Table 6.3-2 Monthly Evaporation (1/2)

[mm]

Vientiane

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1981	129	119	152	150	137	107	104	125	106	123	118	116	1,486
1982	114	105	111	115	130	115	11	77	86	113	120	95	1,191
1987	125	121	143	157	198	152	158	144	137	132	140	129	1,734
1988	136	127	156	171	175	158	157	132	155	127	136	132	1,762
1989	128	128	146	177	172	146	152	129	122	137	136	123	1,696
Average	126	120	142	154	162	136	116	121	121	126	130	119	1,574
Max.	136	128	156	177	198	158	158	144	155	137	140	132	1,762
Min.	114	105	111	115	130	107	11	77	86	113	118	95	1,191

Nikhom 34

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1984	37	70	67	42	40	37	40	26	31	39	47	53	528
1985	65	62	67	28	32	47	27	28	31	42	41	54	524
1986	62	57	43	56	42	43	42	33	37	34	45	55	547
1987	--	--	--	48	37	42	47	24	34	34	47	60	--
1988	77	69	81	47	45	32	26	--	--	45	--	61	--
1989	55	114	46	47	65	54	23	44	25	48	64	68	652
1990	72	66	62	58	36	14	53	49	25	53	73	50	611
Average	61	73	61	47	42	38	37	34	31	42	53	57	572
Max.	77	114	81	58	65	54	53	49	37	53	73	68	652
Min.	37	57	43	28	32	14	23	24	25	34	41	50	524

Data Source : YEAR BOOK by Mekong Committee
and Data from Department of Hydrology & Meteorology

Table 6.3-2 Monthly Evaporation (2/2)

[mm]

Savanakhet

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1981	187	161	142	90	87	40	39	40	73	77	123	130	1,188
1982	131	103	156	113	81	64	84	61	44	80	92	104	1,112
1984	112	126	162	135	84	70	64	46	59	76	102	105	1,141
1985	100	99	150	137	98	56	78	59	63	84	97	109	1,131
1986	120	116	177	125	94	70	70	46	82	91	106	157	1,254
1987	162	141	194	197	175	149	124	163	155	180	148	159	1,946
1988	169	180	169	201	178	–	–	189	170	139	163	161	–
1989	111	96	145	109	76	48	51	31	52	72	136	102	1,029
1990	100	85	96	153	93	58	40	41	47	60	56	60	888
1991	61	98	145	134	112	53	38	25	38	66	90	78	938
1992	43	41	122	159	98	31	58	59	43	68	149	64	935
1993	128	68	88	97	51	–	–	–	–	–	–	–	–
Average	119	110	145	137	102	64	65	69	75	90	115	112	1,156
Max.	187	180	194	201	178	149	124	189	170	180	163	161	1,946
Min.	43	41	88	90	51	31	38	25	38	60	56	60	888

Pakse

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1981	203	195	302	239	154	89	85	82	101	105	135	192	1,881
1982	199	221	304	204	154	103	96	78	65	103	134	193	1,855
1984	204	255	276	217	131	106	83	53	86	116	125	171	1,821
1985	205	210	259	191	119	91	96	77	80	120	126	179	1,750
1986	213	227	288	263	135	98	90	66	100	109	137	–	–
1987	171	182	233	192	149	81	69	73	61	86	86	164	1,546
1988	166	178	236	130	72	38	46	63	76	83	151	187	1,425
1989	178	186	194	167	97	64	60	56	54	100	136	146	1,441
1990	181	188	175	198	125	75	80	80	69	96	109	142	1,516
1991	182	192	248	252	251	108	116	83	118	128	151	169	1,997
1992	165	170	232	233	168	87	97	76	115	190	199	181	1,913
Average	188	200	250	208	141	85	83	71	84	112	135	172	1,715
Max.	213	255	304	263	251	108	116	83	118	190	199	193	1,997
Min.	165	170	175	130	72	38	46	53	54	83	86	142	1,425

Data Source : YEAR BOOK by Mekong Committee
and Data from Department of Hydrology & Meteorology

Table 6.3-3 Monthly Temperature (1/4)

Vientiane

[°C]

1) Average Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.	Max	Min.
1981	21.6	25.4	27.8	28.3	27.8	27.6	27.2	27.8	27.8	26.5	25.1	20.6	26.1	28.3	20.6
1982	21.9	24.7	28.1	27.4	29.1	28.5	27.8	27.0	26.7	26.8	25.8	20.2	26.2	29.1	20.2
1987	22.5	24.5	26.3	28.5	29.4	28.3	28.4	27.6	27.6	27.2	26.6	19.9	26.4	29.4	19.9
1988	23.6	25.6	27.6	29.2	28.4	28.1	27.9	27.4	27.9	26.3	23.0	21.6	26.4	29.2	21.6
1989	22.7	23.9	25.4	29.5	28.4	27.7	28.1	27.3	27.5	26.4	24.7	21.6	26.1	29.5	21.6
Average	22.5	24.8	27.0	28.6	28.6	28.0	27.9	27.4	27.5	26.6	25.0	20.8	26.2	29.1	20.8
Max.	23.6	25.6	28.1	29.5	29.4	28.5	28.4	27.8	27.9	27.2	26.6	21.6	26.4	29.5	21.6
Min.	21.6	23.9	25.4	27.4	27.8	27.6	27.2	27.0	26.7	26.3	23.0	19.9	26.1	28.3	19.9

2) Extreme Maximum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1981	31.9	37.0	37.4	37.8	36.2	33.8	33.9	35.0	34.6	34.1	33.1	30.3	38.0
1982	31.5	35.8	37.7	37.6	38.0	35.2	34.1	34.4	33.4	33.0	32.1	31.0	37.7
1987	32.0	33.5	36.3	37.1	37.5	35.9	35.2	34.7	33.5	33.8	32.9	30.2	38.2
1988	34.2	34.9	38.6	39.0	37.0	37.0	34.5	34.0	34.5	32.8	31.1	30.7	37.8
1989	33.1	34.7	35.5	38.8	36.9	35.0	35.5	35.0	35.0	32.5	32.6	30.7	38.5
Average	32.5	35.2	37.1	38.1	37.1	35.4	34.6	34.6	34.2	33.2	32.4	30.6	38.0
Max.	34.2	37.0	38.6	39.0	38.0	37.0	35.5	35.0	35.0	34.1	33.1	31.0	38.5
Min.	31.5	33.5	35.5	37.1	36.2	33.8	33.9	34.0	33.4	32.5	31.1	30.2	37.7

3) Extreme Minimum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1981	10.9	16.6	18.7	20.5	22.1	23.1	22.0	23.0	22.4	21.0	15.4	11.8	12.8
1982	14.4	14.8	20.5	18.8	23.0	23.7	23.3	22.7	22.5	21.8	18.8	9.1	11.2
1984	14.5	14.8	19.0	21.0	23.0	23.4	23.7	22.3	21.5	19.0	19.3	10.0	13.0
1985	15.0	15.0	17.0	21.3	23.2	23.6	22.6	23.0	22.6	20.5	14.5	12.0	13.0
1986	14.5	15.2	14.5	21.3	23.0	23.0	23.3	22.5	21.5	26.4	15.5	12.0	11.8
Average	13.9	15.3	17.9	20.6	22.9	23.4	23.0	22.7	22.1	21.7	16.7	11.0	12.4
Max.	15.0	16.6	20.5	21.3	23.2	23.7	23.7	23.0	22.6	26.4	19.3	12.0	13.0
Min.	10.9	14.8	14.5	18.8	22.1	23.0	22.0	22.3	21.5	19.0	14.5	9.1	11.2

Data Source : YEAR BOOK by Mekong Committee

Table 6.3-3 Monthly Temperature (2/4)

Nikhom 34

[°C]

1) Average Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.	Max	Min.
1984	16.3	17.8	19.1	20.8	20.4	20.8	21.7	20.6	19.8	19.1	17.2	15.6	19.1	21.7	15.6
1985	16.2	19.9	20.2	20.3	20.7	20.6	20.5	20.4	19.7	18.8	18.1	15.0	19.2	20.7	15.0
1986	13.5	15.1	17.6	19.5	20.3	20.6	20.1	20.2	19.6	19.3	17.4	16.3	18.3	20.6	13.5
1989	19.5	18.1	20.5	22.5	22.6	22.5	22.4	22.1	22.0	21.0	18.5	17.6	20.8	22.6	17.6
1990	13.6	18.8	17.0	19.0	22.2	21.7	22.0	21.7	21.7	21.3	19.6	17.2	19.7	22.2	13.6
Average	15.8	17.9	18.9	20.4	21.2	21.2	21.3	21.0	20.6	19.9	18.2	16.3	19.4	21.6	15.1
Max.	19.5	19.9	20.5	22.5	22.6	22.5	22.4	22.1	22.0	21.3	19.6	17.6	20.8	22.6	17.6
Min.	13.5	15.1	17.0	19.0	20.3	20.6	20.1	20.2	19.6	18.8	17.2	15.0	18.3	20.6	13.5

2) Extreme Maximum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1984	26.5	29.0	24.3	29.7	28.0	27.0	27.0	26.0	27.5	27.1	27.0	26.8	29.7
1985	26.0	28.6	28.2	28.2	27.5	27.0	27.6	25.5	29.7	27.8	26.8	26.8	29.7
1986	27.0	27.5	28.7	29.0	28.5	28.2	28.3	28.0	28.0	27.5	27.5	26.7	29.0
1989	28.0	29.0	29.5	28.6	28.4	29.0	27.0	27.0	27.5	26.0	27.0	26.6	29.5
1990	26.8	27.0	28.0	28.0	28.2	26.5	26.7	26.3	28.2	27.4	28.3	27.6	28.3
Average	26.9	28.2	27.7	28.7	28.1	27.5	27.3	26.6	28.2	27.2	27.3	26.9	29.2
Max.	28.0	29.0	29.5	29.7	28.5	29.0	28.3	28.0	29.7	27.8	28.3	27.6	29.7
Min.	26.0	27.0	24.3	28.0	27.5	26.5	26.7	25.5	27.5	26.0	26.8	26.6	28.3

3) Extreme Minimum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1984	1.6	1.9	17.9	11.9	12.5	15.3	13.0	16.0	11.8	8.2	2.0	3.3	1.6
1985	4.5	7.2	10.0	10.4	11.5	14.3	13.7	14.4	10.6	8.0	7.5	1.0	1.0
1986	0.0	0.2	10.5	7.3	12.2	12.6	12.5	12.7	9.9	9.7	6.5	1.9	0.0
1989	9.1	5.5	9.5	16.5	8.9	18.2	16.5	17.6	17.5	12.5	6.4	7.1	5.5
1990	0.1	6.5	6.0	6.7	18.2	18.5	18.2	18.1	16.5	14.0	8.0	6.0	0.1
Average	3.1	4.3	10.8	10.6	12.7	15.8	14.8	15.8	13.3	10.5	6.1	3.9	1.6
Max.	9.1	7.2	17.9	16.5	18.2	18.5	18.2	18.1	17.5	14.0	8.0	7.1	5.5
Min.	0.0	0.2	6.0	6.7	8.9	12.6	12.5	12.7	9.9	8.0	2.0	1.0	0.0

Data Source : Department of Hydrology & Meteorology and
" XE KATAM SMALL-SCALE HYDROELECTRIC POWER DEVEROPMENT PROJECT
, March 1992 " F/S Report

Table 6.3-3 Monthly Temperature (3/4)

Pakse

[°C]

1) Average Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.	Max	Min.
1981	23.4	27.0	29.7	29.3	28.1	26.7	26.7	26.5	27.3	26.3	25.5	22.4	26.6	29.7	22.4
1982	23.1	27.2	29.6	28.6	28.9	27.3	27.0	26.4	26.0	26.6	26.4	22.3	26.6	29.6	22.3
1984	23.2	26.5	28.7	29.9	27.9	27.1	26.9	25.5	26.2	25.6	24.9	23.7	26.3	29.9	23.2
1985	24.2	27.7	28.3	28.8	28.0	27.2	27.0	26.4	26.6	26.4	26.5	23.9	26.8	28.8	23.9
1986	22.9	26.2	28.4	30.3	27.9	27.6	26.9	26.4	27.0	26.6	24.4	23.7	26.5	30.3	22.9
1987	34.3	26.4	29.7	30.0	29.4	27.7	26.5	27.5	27.2	27.5	26.5	22.4	27.9	34.3	22.4
1988	25.7	27.8	29.9	29.4	28.6	27.5	27.7	26.7	27.2	25.3	23.9	22.8	26.9	29.9	22.8
1989	25.6	25.6	27.2	29.6	28.4	27.7	26.9	26.7	26.6	26.3	25.2	23.7	26.6	29.6	23.7
1991	25.6	26.4	29.7	30.7	30.2	27.5	27.0	27.0	27.9	27.2	26.8	26.5	27.7	30.7	25.6
Average	25.3	26.8	29.0	29.6	28.6	27.4	27.0	26.6	26.9	26.4	25.6	23.5	26.9	30.3	23.2
Max.	34.3	27.8	29.9	30.7	30.2	27.7	27.7	27.5	27.9	27.5	26.8	26.5	27.9	34.3	25.6
Min.	22.9	25.6	27.2	28.6	27.9	26.7	26.5	25.5	26.0	25.3	23.9	22.3	26.3	28.8	22.3

2) Extreme Maximum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1981	34.9	36.2	38.0	38.0	35.4	32.5	32.2	33.2	33.3	33.5	33.0	32.5	38.0
1982	32.1	36.8	37.7	37.5	36.0	34.0	32.9	32.2	32.4	34.2	33.7	33.7	37.7
1984	33.0	35.7	38.2	38.2	34.3	33.5	33.5	31.8	32.9	32.7	33.0	33.0	38.2
1985	33.7	35.9	37.4	37.8	35.0	33.5	32.8	32.0	33.5	33.9	33.5	33.5	37.8
1986	34.2	34.4	38.5	38.0	37.8	33.9	34.0	33.8	34.0	33.5	32.5	33.6	38.5
1987	33.5	35.5	37.9	38.0	37.5	35.5	34.0	33.8	34.0	35.0	34.0	33.7	38.0
1988	35.8	37.0	39.5	38.6	36.0	34.5	34.2	32.2	37.0	32.0	32.8	32.2	39.5
1989	36.6	36.8	37.0	38.0	36.0	34.0	33.0	32.3	33.5	33.8	33.8	34.0	38.0
1991	35.2	36.5	38.1	39.4	39.8	35.6	33.5	32.5	32.8	32.8	33.5	33.4	39.8
Average	34.3	36.1	38.0	38.2	36.4	34.1	33.3	32.6	33.7	33.5	33.3	33.3	38.4
Max.	36.6	37.0	39.5	39.4	39.8	35.6	34.2	33.8	37.0	35.0	34.0	34.0	39.8
Min.	32.1	34.4	37.0	37.5	34.3	32.5	32.2	31.8	32.4	32.0	32.5	32.2	37.7

3) Extreme Minimum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1981	12.8	17.3	22.4	22.4	21.8	23.1	22.7	23.3	23.0	20.7	17.5	14.1	12.8
1982	14.2	17.4	23.4	20.8	20.5	22.0	22.6	22.4	22.0	20.2	18.6	11.2	11.2
1984	13.0	15.0	15.0	24.0	22.2	23.0	22.0	22.0	22.3	18.3	17.3	14.0	13.0
1986	12.8	14.5	11.8	23.2	22.5	21.5	21.4	21.5	22.0	20.7	16.0	15.0	11.8
1987	14.9	15.5	21.3	21.5	23.1	22.8	22.3	22.2	22.0	19.2	18.1	13.3	13.3
1988	15.8	17.2	18.0	21.4	23.3	22.3	23.0	21.5	22.3	19.0	16.2	14.0	14.0
1989	15.2	14.5	16.5	22.3	22.0	22.2	22.4	21.8	22.8	17.6	16.5	14.6	14.5
1991	16.3	16.7	22.2	19.5	22.3	23.0	23.0	23.0	22.4	17.0	16.3	15.1	15.1
Average	14.4	16.0	18.8	21.9	22.2	22.5	22.4	22.2	22.4	19.1	17.1	13.9	13.2
Max.	16.3	17.4	23.4	24.0	23.3	23.1	23.0	23.3	23.0	20.7	18.6	15.1	15.1
Min.	12.8	14.5	11.8	19.5	20.5	21.5	21.4	21.5	22.0	17.0	16.0	11.2	11.2

Data Source : YEAR BOOK by Mekong Committee

Table 6.3-3 Monthly Temperature (4/4)

Attapu

[°C]

1) Average Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.	Max	Min.
1987	24.6	25.4	29.6	30.1	29.2	27.6	25.6	27.4	27.8	27.7	27.3	22.4	27.0	30.1	22.4
1988	24.0	27.0	29.5	31.1	28.9	27.9	28.0	27.6	27.4	25.6	25.2	21.7	27.0	31.1	21.7
1989	26.0	24.3	27.0	28.8	29.0	27.6	26.9	26.0	27.2	26.7	25.4	23.4	26.5	29.0	23.4
1990	26.2	27.7	29.4	30.7	29.3	27.5	28.5	27.4	27.1	27.5	25.4	24.5	27.6	30.7	24.5
1991	25.2	26.3	29.6	30.4	30.4	27.4	26.8	27.4	26.9	26.3	27.2	23.1	27.2	30.4	23.1
1992	21.5	26.9	29.0	31.0	29.3	27.6	26.9	26.9	26.8	25.8	25.8	26.3	27.0	31.0	21.5
1993	24.4	25.0	28.1	29.1	–	–	–	–	–	–	–	–	–	–	–
Average	24.6	26.1	28.9	30.1	29.3	27.6	27.1	27.1	27.2	26.6	26.0	23.5	27.0	30.4	22.7
Max.	26.2	27.7	29.6	31.1	30.4	27.9	28.5	27.6	27.8	27.7	27.3	26.3	27.6	31.1	24.5
Min.	21.5	24.3	27.0	28.8	28.9	27.4	25.6	26.0	26.8	25.6	25.2	21.7	26.5	29.0	21.5

2) Extreme Maximum

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1989	36.0	32.3	37.5	34.0	33.7	31.9	31.0	34.0	34.0	34.5	–	34.5	–
1990	36.5	37.0	38.0	40.0	39.0	33.7	33.5	35.0	33.0	35.8	34.7	34.8	40.0
1991	35.6	38.0	39.0	40.8	40.6	37.4	35.2	32.5	35.0	34.8	34.5	34.9	40.8
1992	35.3	36.2	38.5	40.1	39.8	35.0	34.5	34.6	34.0	34.6	32.2	35.5	40.1
1993	34.5	35.7	39.0	38.5	–	–	–	–	–	–	–	–	–
Average	35.6	35.8	38.4	38.7	38.3	34.5	33.6	34.0	34.0	34.9	33.8	34.9	40.3
Max.	36.5	38.0	39.0	40.8	40.6	37.4	35.2	35.0	35.0	35.8	34.7	35.5	40.8
Min.	34.5	32.3	37.5	34.0	33.7	31.9	31.0	32.5	33.0	34.5	32.2	34.5	40.0

3) Extreme Minimum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1989	15.0	16.3	17.0	23.6	24.2	23.3	22.7	20.5	21.0	17.5	–	11.4	–
1990	14.8	15.5	20.5	22.0	22.1	22.8	21.0	16.0	23.0	19.6	16.6	14.1	14.1
1991	13.4	16.0	18.5	19.8	21.5	20.5	20.5	23.6	20.0	16.2	14.4	14.2	13.4
1992	12.4	16.4	18.2	19.0	18.2	22.5	21.2	22.0	21.0	18.2	16.0	15.2	12.4
1993	14.5	14.0	19.0	21.7	–	–	–	–	–	–	–	–	–
Average	14.0	15.8	18.6	21.2	21.5	22.3	21.4	20.5	21.3	17.9	15.7	13.7	13.3
Max.	15.0	16.4	20.5	23.6	24.2	23.3	22.7	23.6	23.0	19.6	16.6	15.2	14.1
Min.	12.4	14.0	17.0	19.0	18.2	20.5	20.5	16.0	20.0	16.2	14.4	11.4	12.4

Data Source : Department of Hydrology & Meteorology

Table 6.3-4 Monthly Relative Humidity (1/4)

Vientiane

[%]

1) Average

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.	Max	Min.
1981	66	65	63	70	78	82	83	81	79	78	71	67	74	83	63
1982	70	70	66	70	72	75	80	84	83	80	74	70	75	84	66
1985	72	73	65	66	77	82	84	86	85	83	76	72	77	86	65
1986	70	67	60	69	82	82	81	82	81	77	72	72	75	82	60
1987	69	69	72	70	74	81	78	84	84	80	76	64	75	84	64
Average	69	69	65	69	77	80	81	83	82	80	74	69	75	84	64
Max.	72	73	72	70	82	82	84	86	85	83	76	72	77	86	66
Min.	66	65	60	66	72	75	78	81	79	77	71	64	74	82	60

2) Extreme Maximum

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1981	99	96	96	97	99	98	99	98	98	98	97	99	99
1982	99	99	97	96	96	97	97	99	98	97	97	99	99
1985	98	95	93	93	97	98	99	99	99	100	97	98	100
1986	100	95	95	96	100	99	100	98	99	99	96	97	100
1987	97	96	99	97	98	99	98	98	100	98	98	99	100
Average	99	96	96	96	98	98	99	98	99	98	97	98	100
Max.	100	99	99	97	100	99	100	99	100	100	98	99	100
Min.	97	95	93	93	96	97	97	98	98	97	96	97	99

3) Extreme Minimum

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1981	30	28	25	34	39	43	44	47	40	39	38	34	25
1982	35	25	28	36	36	43	44	45	46	44	42	28	25
1985	38	19	13	22	37	47	55	59	52	49	44	29	13
1986	29	23	22	26	48	47	47	49	31	39	42	32	22
1987	37	21	21	25	35	46	46	50	47	43	37	18	18
Average	34	23	22	29	39	45	47	50	43	43	41	28	21
Max.	38	28	28	36	48	47	55	59	52	49	44	34	25
Min.	29	19	13	22	35	43	44	45	31	39	37	18	13

Data Source : YEAR BOOK by Mekong Committee

Table 6.3-4 Monthly Relative Humidity (2/4)

[%]

Average Humidi **Nikhom 34**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.	Max	Min.
1984	69	65	71	81	82	84	83	88	84	78	76	71	78	88	65
1985	70	74	72	81	82	87	84	84	83	78	78	74	79	87	70
1986	70	70	75	76	82	85	81	84	80	81	76	72	78	85	70
1987	--	--	--	75	83	82	84	84	83	78	82	72	--	--	--
1988	72	73	77	--	--	83	85	--	--	--	--	73	--	--	--
1989	73	67	75	81	82	83	84	83	82	81	74	69	78	84	67
1990	69	69	76	77	85	87	84	84	82	82	79	70	79	87	69
1991	65	66	75	77	79	83	84	85	85	80	68	67	76	85	65
1992	67	68	76	77	80	85	86	87	84	77	70	73	78	87	67
1993	67	65	72	78	83	82	--	--	--	--	--	--	--	--	--
Average	69	69	74	78	82	84	84	85	83	79	75	71	78	86	68
Max.	73	74	77	81	85	87	85	88	84	82	82	74	79	88	70
Min.	65	65	71	75	79	82	81	83	80	77	68	67	76	84	65

Data Source : " XE KATAM SMALL-SCALE HYDROELECTRIC POWER DEVEROPMENT PROJECT FESIBILITY STUDY , March 1992 "
and Data from the Department of Hydrology & Meteorology

Table 6.3-4 Monthly Relative Humidity (3/4)

Pakse

[%]

1) Average

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.	Max.	Min.
1981	61	60	57	66	76	84	85	85	81	82	75	66	73	85	57
1982	61	60	58	68	75	80	82	85	86	79	75	68	73	86	58
1984	61	58	57	63	74	79	81	87	82	77	74	67	72	87	57
1985	64	65	61	71	78	83	82	86	83	79	75	67	75	86	61
1986	63	63	61	62	79	82	84	87	81	78	73	70	74	87	61
1987	63	59	59	64	70	82	86	83	84	78	77	64	72	86	59
1988	64	63	57	68	76	79	77	84	77	83	70	65	72	84	57
1989	63	60	63	67	77	81	84	84	84	77	69	60	72	84	60
1990	60	58	62	61	73	83	82	83	85	82	77	69	73	85	58
1991	64	61	59	65	72	83	85	84	80	76	72	62	72	85	59
1992	60	54	52	54	66	78	80	82	79	76	60	57	66	82	52
Average	62	60	59	64	74	81	83	85	82	79	72	65	72	85	58
Max.	64	65	63	71	79	83	86	87	85	83	77	70	75	87	61
Min.	60	54	52	54	66	78	77	82	77	73	60	57	66	82	52

2) Extreme Maximum

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1981	97	94	88	98	97	98	99	99	97	97	97	95	99
1982	92	92	90	93	100	99	99	99	99	99	99	99	100
1984	100	99	97	96	98	97	98	98	99	98	96	98	100
1985	98	95	95	99	99	100	98	100	100	100	98	100	100
1986	97	98	91	90	100	98	99	98	99	97	96	98	100
1987	98	90	90	94	97	99	99	99	99	100	100	86	100
Average	97	95	92	95	99	99	99	99	99	99	98	96	100
Max.	100	99	97	99	100	100	99	100	100	100	100	100	100
Min.	92	90	88	90	97	97	98	98	97	97	96	86	99

3) Extreme Minimum

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1981	12	17	30	31	42	53	52	54	47	48	41	28	12
1982	24	27	27	37	47	47	52	56	54	41	36	27	24
1984	14	16	27	29	38	54	51	55	53	41	42	32	14
1985	26	33	21	36	52	54	50	56	51	31	36	38	21
1986	25	27	23	27	32	52	55	52	45	48	38	32	23
1987	28	28	32	31	38	50	58	50	55	34	37	38	28
1988	27	28	23	39	34	42	52	61	43	55	37	28	23
1989	28	26	29	34	46	52	55	54	48	42	36	25	25
Average	23	25	27	33	41	51	53	55	50	43	38	31	21
Max.	28	33	32	39	52	54	58	61	55	55	42	38	28
Min.	12	16	21	27	32	42	50	50	43	31	36	25	12

Data Source : YEAR BOOK by Mekong Committee

Table 6.3-4 Monthly Relative Humidity (4/4)

Attapu

1) Average [%]

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.	Max	Min.
1989	72	62	58	66	75	82	81	84	84	78	71	67	73	84	58
1990	65	61	66	73	78	84	85	86	84	81	79	72	76	86	61
1991	69	75	62	63	70	84	86	82	85	80	70	71	75	86	62
1992	69	70	66	63	74	84	84	86	79	79	73	71	75	86	63
1993	69	65	66	71	–	–	–	–	–	–	–	–	–	–	–
Average	69	66	63	67	74	83	84	84	83	79	73	70	75	85	61
Max.	72	75	66	73	78	84	86	86	85	81	79	72	76	86	63
Min.	65	61	58	63	70	82	81	82	79	78	70	67	73	84	58

2) Extreme Maximum

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1989	92	94	98	92	95	98	97	98	96	100	97	90	100
1990	95	92	98	97	99	98	99	100	100	100	100	100	100
1991	99	99	98	92	97	98	99	100	99	100	99	100	100
1992	98	98	98	97	97	100	99	98	98	98	96	97	100
1993	97	98	97	97	–	–	–	–	–	–	–	–	–
Average	96	96	98	95	97	99	99	99	98	100	98	97	100
Max.	99	99	98	97	99	100	99	100	100	100	100	100	100
Min.	92	92	97	92	95	98	97	98	96	98	96	90	100

3) Extreme Minimum

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1989	40	24	24	24	43	55	57	66	61	48	44	40	24
1990	23	33	33	38	41	63	60	60	63	54	53	44	23
1991	34	34	28	32	40	51	63	63	63	56	45	44	28
1992	33	31	37	35	41	58	64	65	51	47	32	42	31
1993	41	24	27	39	–	–	–	–	–	–	–	–	–
Average	34	29	30	34	41	57	61	64	60	51	44	43	27
Max.	41	34	37	39	43	63	64	66	63	56	53	44	31
Min.	23	24	24	24	40	51	57	60	51	47	32	40	23

Data Source : Data from the Department of Hydrology & Meteorology in Attapu

Table 6.3-5 Wind Velocity and Direction (1/2)

Nikhom 34

1) Mean Wind Velocity (m/s) and Direction

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1983								0.7	0.7	0.9	1.8		
								W	SW	N	NE		
1984	0.6	0.9	2.8	1.5	0.6	1.5	1.2	1.2	0.6	1.0	1.0	0.8	1.1
	SE	E	NW	SW	SW	NW	SW	W	E	W	NE	NE	
1985	0.8	0.8	0.8	1.6	0.8	1.8	1.0	1.2	0.8	1.2	1.5	1.2	1.1
	E	SW	SW	NE	SW	W	W	W	E	NS	N	E	
1986	0.8	0.6	0.6	0.6	0.6	1.2	1.2	1.0	0.8	1.0	1.0	0.8	0.9
	E	E	N	W	W	SW	W	W	E	NW	NE	NE	
1987				1.6	0.8	1.2	1.2	1.2	1.0	1.0	0.8	0.8	
				N	SW	W	W	NW	SE	N	NE	E	
1988	0.8	0.8	1.5			1.0	2.0					1.2	
	NW	SW	NW			NW	N					NE	
1989	0.8	1.0	1.2	0.8	1.2	1.0	1.2	0.8	1.0	1.0	1.0	1.0	1.0
	NE	N	NE	NE	NW	NW	NW	NW	W	NW	N	NE	
1990	0.8	0.8	1.0	0.6	0.8								
	NE	S	NW	NE	SW								
Ave.	0.8	0.8	1.4	1.2	0.8	1.3	1.3	1.0	0.8	1.0	1.2	1.0	1.0
Max.	0.8	1.0	2.8	1.6	1.2	1.8	2.0	1.2	1.0	1.2	1.8	1.2	1.1
Min.	0.6	0.6	0.8	0.6	0.6	1.0	1.0	0.7	0.6	0.9	0.8	0.8	0.9

2) Mean of Daily Maximum Wind Velocity (m/s) and direction

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1983								1.7	1.5	1.9	3.5		
								W	SW	E	N		
1984	1.2	2.6	1.6	1.7	1.8	3.3	2.7	2.1	1.6	2.1	3.2	2.8	2.2
	E	NE	SW	SW	SW	W	NW	W	W	SE	NE	NE	
1985	2.7	2.3	2.6	1.9	2.3	2.8	2.8	3.5	2.7	3.2	3.1	2.3	2.7
	NE	SW	S	SW	SW	W	SW	W	NW	E	E	NE	
1986	2.7	2.4	2.6	1.8	4.5	4.3	4.8	4.5	4.6	5.2	5.7	6.4	4.1
	NW	SW	S	SW	SW	SW	W	W	NW	S	NE	NE	
1987				0.2	0.5	0.6	0.6	0.5	5.1	0.5	5	5.1	
				NW	SW	W	W	NW	SE	NE	NE	E	
1988	5.2	5.7	5			5.9	0.4					4.1	
	S	NW	SW			W	W					N	
1989	4.7	4.3	4.5	4	4.2	4.5	4.8	4.8	3.9	3.9	3.8	3.4	4.2
	NE	NE	NE	NW	NW	NW	NW	NW	NW	NE	NE	NE	
1990	3	3.6	2.9	3.2	3.4								
	NW	NW	NW	NW	NW								
Ave.	3.3	3.5	3.2	2.1	2.8	3.6	2.7	2.9	3.2	2.8	4.1	4.0	3.3
Max.	5.2	5.7	5.0	4.0	4.5	5.9	4.8	4.8	5.1	5.2	5.7	6.4	4.2
Min.	1.2	2.3	1.8	0.2	0.5	0.6	0.4	0.5	1.5	0.5	3.1	2.3	2.2

Data Source : " XE KATAM SMALL-SCALE HYDROELECTRIC POWER DEVEROPMENT PROJECT, March 1992 "

Table 6.3-5 Wind Velocity and Direction (2/2)

Pakse

Year	Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1980	Direction	NE	SE	SE	SE	SE	SE	SE	SE	SE	NE,SE	NE	NE	
	Mean speed	2	3	5	4	4	3	3	3	3	3	3	4	3
	Max.	12	36	16	41	58	23	29	16	29	16	12	16	58
1981	Direction	NE	SE	SE	SE	SE	SE	SE	SE	SE	E	N	N	--
	Mean speed	4	4	5	7	6	4	5	5	4	6	6	6	5
	Max.	27	18	18	49	39	39	24	16	39	27	23	29	49
1982	Direction	NE	SE	SE	SE	SE	SE	SEW	SE	SE	SE	N	N	
	Mean speed	4	5	6	6	6	6	6	6	4	4	4	6	5
	Max.	14	19	19	16	27	19	27	31	19	17	14	31	31
1985	Direction	N	SE	SE	SE	SE	S	SE	S	SE	N	N	N	--
	Mean speed	3	3	3	3	4	3	3	3	3	3	3	3	3
	Max.	7	8	7	20	20	10	8	20	6	8	10	14	20
1986	Direction	N	S	S	S	W	S	SE	SE	S	N	N	N	--
	Mean speed	3	3	3	3	3	3	2	2	2	2	3	3	3
	Max.	7	7	10	18	10	10	8	16	18	8	10	8	18
1987	Direction	N	SE	SE	SE	E,SE	SE	S,SE	SE	W	W	W	N	--
	Mean speed	2	3	5	3	3	3	3	3	2	2	0	4	3
	Max.	8	7	25	16	10	11	10	7	10	10	10	12	25
1988	Direction	N	S	SE	SE	SE	SE	SE	SE	N	N	N	N	--
	Mean speed	5	5	7	6	6	4	4	4	4	5	6	5	5
	Max.	14	16	19	19	19	16	10	14	10	14	19	19	19
1989	Direction	N	SE	N,SE	ESE	ESE	SE	SE	SE	W	N	N	N	--
	Mean speed	2	3	3	3	3	2	2	2	2	2	3	2	2
	Max.	7	8	10	10	12	8	12	5	6	7	9	9	12
Mean	Wind Speed	3	4	5	4	4	4	4	4	3	3	3	4	4
	Max.	27	36	25	49	58	39	24	31	39	27	23	31	58

Data Source : YEAR BOOK by Mekong Committee

Table 6.3-6 Monthly Discharge (1/3)

[m^3/s]

Se Kong River at Khmuon (Catchment Area : 29,600 km2)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average	Max.	Min.
1961	302	199	160	155	675	1,653	4,401	6,426	4,977	3,248	926	469	1,966	6,426	155
1962	429	368	289	289	453	1,590	3,020	4,254	4,077	1,974	732	523	1,491	4,254	289
1963	392	314	267	241	279	825	1,929	4,292	3,836	1,933	676	470	1,288	4,292	241
1964	365	295	243	225	490	532	1,328	2,966	3,934	2,708	1,360	568	1,251	3,934	225
1965	400	298	223	252	353	2,053	2,717	2,416	3,200	1,182	592	485	1,181	3,200	223
1966	349	282	211	211	823	734	2,621	3,483	4,657	797	668	539	1,271	4,657	211
1967	433	287	212	204	327	837	1,968	3,468	3,867	2,054	623	499	1,231	3,867	204
1968	348	249	194	184	290	449	886	4,042	5,417	1,267	501	406	1,186	5,417	184
1969	322	242	176	161	253	529	3,063	4,353	4,380	1,458	733	539	1,351	4,380	161
1970	419	287	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	376	280	219	214	439	1,022	2,424	3,967	4,260	1,836	757	500	1,357	4,492	210
Max.	433	368	289	289	823	2,053	4,401	6,426	5,417	3,248	1,360	568	1,966	6,426	289
Min	302	199	160	155	253	449	886	2,416	3,200	797	501	406	1,181	3,200	155

Data Source : Makong Committee

Se Kong River at Attapu (Catchment Area : 10,500 km2)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average	Max.	Min.
1988	-	-	-	-	-	-	316	582	283	888	321	208	-	-	-
1989	123	70	52	55	299	473	727	1,023	891	444	229	168	380	1,023	52
1990	103	78	74	77	126	276	331	740	1,380	1,173	657	269	440	1,380	74
1991	161	129	115	104	127	310	612	1,886	1,428	1,079	386	246	549	1,886	104
1992	257	215	189	178	210	526	597	1,520	1,136	875	496	316	543	1,520	178
1993	267	217	177	166	169	204	-	-	-	-	-	-	-	-	-
Average	182	142	121	116	188	358	516	1,150	1,024	892	418	241	478	1,452	102
Max	267	217	189	178	299	526	727	1,886	1,428	1,173	657	316	549	1,886	178
Min	103	70	52	55	126	204	316	582	283	444	229	168	380	1,023	52

Data Source : Department of Hydrology & Meteorology at Attapu

Xe Set River at Xe Set P/S (Catchment Area : 325 km2)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average	Max.	Min.
1985	5.4	3.8	3.3	4.1	9.1	31.6	26.6	28.7	27.8	17.9	9.9	6.2	31.6	3.3	14.5
1986	4.2	3.2	2.5	3.5	9.4	11.3	13.4	34.0	31.1	21.7	16.4	7.3	34.0	2.5	13.2
1989	3.9	2.7	2.1	3.4	11.7	22.6	28.6	39.8	46.0	21.9	8.7	5.4	46.0	2.1	16.4
1990	3.5	1.8	2.7	2.7	6.4	7.6	14.8	20.0	28.2	38.3	20.4	13.5	38.3	1.9	13.3
1991	3.7	2.3	2.4	3.1	6.2	7.9	34.7	48.3	41.1	32.9	12.0	6.6	48.3	2.3	16.7
1992	4.2	2.4	1.9	1.8	3.8	14.9	26.0	41.8	27.9	17.0	7.8	5.1	41.8	1.8	12.9
1993	3.1	2.3	2.0	2.2	5.2	4.6	-	-	-	-	-	-	-	-	-
Ave	4.0	2.7	2.4	3.0	7.2	14.4	24.0	35.4	33.7	24.8	12.5	7.4	40.0	2.3	14.5
Max	5.4	3.8	3.3	4.1	11.7	31.6	34.7	48.3	46.0	38.3	20.4	13.5	48.3	3.3	16.7
Min	3.1	1.8	1.9	1.8	3.6	4.6	13.4	20.0	27.8	17.0	7.8	5.1	31.6	1.8	12.9

Data Source : Se Xet P/S

Table 6.3-6 Monthly Discharge (2/3)

Dak Bla River in Vietnam at Kontum Catchment Area : 3,060 km2 [m^3/s]

No.	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Averag	Max.	Min.
1	1951	82.2	61.9	35.2	18.0	49.2	92.0	66.5	99.8	116.8	144.2	128.9	83.3	106.6	144.2	66.5
2	1952	83.6	43.6	49.9	31.7	36.4	63.0	89.7	108.2	177.9	163.9	150.7	144.2	95.4	177.9	31.7
3	1953	80.3	56.3	61.8	21.0	60.7	56.2	117.0	111.8	101.5	158.9	127.1	124.1	89.7	158.9	21.0
4	1954	87.9	90.2	55.9	51.6	73.3	102.0	118.5	156.3	166.6	160.9	117.6	99.2	107.5	166.6	51.6
5	1955	62.9	38.8	43.8	52.1	60.4	79.4	105.7	150.2	141.7	182.1	142.0	136.0	99.8	182.1	38.8
6	1956	110.7	95.7	94.0	46.4	75.2	82.6	127.8	87.0	149.5	104.8	56.7	66.5	91.4	149.5	46.4
7	1957	65.3	66.9	53.0	23.5	39.5	68.3	127.0	181.2	152.5	179.3	136.8	101.4	99.6	181.2	23.5
8	1958	74.7	20.7	27.7	25.4	39.9	72.3	101.3	131.0	125.3	172.0	127.0	130.6	87.3	172.0	20.7
9	1959	71.5	45.9	57.3	37.2	46.6	92.8	86.8	126.4	133.8	143.5	111.7	108.9	88.5	143.5	37.2
10	1960	84.7	61.6	84.1	67.6	52.0	63.6	83.3	111.5	130.9	133.4	123.5	86.8	90.3	133.4	52.0
11	1961	46.5	46.1	21.8	14.4	40.2	86.4	134.8	84.7	159.6	132.3	108.5	83.1	80.7	159.6	14.4
12	1962	92.2	58.4	49.7	51.6	36.3	60.7	126.7	112.3	125.7	141.5	116.1	69.3	86.9	141.5	36.3
13	1963	41.7	31.7	6.8	35.6	25.4	65.7	119.7	113.7	141.9	176.5	165.6	121.2	87.1	176.5	6.8
14	1964	85.2	86.9	65.1	30.1	60.3	76.9	121.9	109.2	111.6	123.1	94.5	79.3	87.0	123.1	30.1
15	1965	114.6	73.9	55.6	50.3	44.8	100.4	156.4	150.8	132.5	127.9	105.6	110.5	101.9	156.4	44.8
16	1966	109.1	120.2	96.5	48.6	94.6	96.6	164.9	97.0	89.1	118.1	98.0	84.8	101.5	164.9	48.6
17	1967	79.7	64.0	37.0	26.4	44.9	112.0	82.4	200.5	214.5	204.3	111.5	92.9	105.8	214.5	26.4
18	1968	67.1	40.5	23.4	14.2	36.3	49.9	55.9	165.4	147.0	159.6	100.8	77.0	78.1	165.4	14.2
19	1969	48.3	29.3	13.4	11.0	21.4	59.5	124.0	127.8	131.5	112.6	71.6	62.3	67.7	131.5	11.0
20	1970	42.0	27.3	16.7	17.2	56.9	100.5	144.5	129.4	151.4	180.1	191.6	93.5	95.9	191.6	16.7
21	1971	57.0	40.4	28.7	21.4	28.7	73.1	130.9	137.2	146.7	100.4	61.5	54.3	73.4	146.7	21.4
22	1972	110.3	103.4	74.3	26.3	52.7	68.3	107.0	101.3	119.7	112.7	110.4	83.6	89.2	119.7	26.3
23	1973	82.2	42.8	22.8	18.5	43.5	55.6	83.3	105.1	111.1	217.9	252.5	108.7	95.3	252.5	18.5
24	1974	78.4	60.3	46.2	51.0	58.3	100.7	82.6	112.7	149.9	152.4	81.2	92.6	88.9	152.4	46.2
25	1975	44.3	34.5	35.5	37.5	50.6	105.4	113.1	176.4	176.7	174.5	172.9	106.0	102.3	176.7	34.5
26	1976	78.9	58.2	45.1	46.7	48.8	101.3	94.6	159.4	167.6	148.3	109.5	91.4	95.8	167.6	45.1
27	1977	60.8	43.5	31.8	30.3	104.9	59.8	83.2	212.3	204.6	230.0	130.9	179.9	114.3	230.0	30.3
28	1978	76.1	54.2	40.7	28.9	28.5	47.2	68.1	118.3	147.0	83.0	132.6	73.5	74.8	147.0	28.5
29	1979	44.3	35.5	29.7	27.9	45.4	73.7	60.3	70.8	69.8	249.9	118.9	63.0	74.1	249.9	27.9
30	1980	59.1	41.8	33.5	35.8	77.0	70.3	129.9	160.8	179.4	125.2	86.0	64.4	88.6	179.4	33.5
31	1981	78.1	68.4	71.5	22.9	43.5	93.7	115.2	158.6	157.6	188.5	142.4	150.7	107.4	188.5	22.9
32	1982	139.7	106.7	96.4	67.2	69.8	89.2	116.5	167.4	140.1	145.4	118.0	46.0	108.5	167.4	67.2
33	1983	56.5	42.0	46.2	30.1	42.2	70.9	83.0	140.8	125.8	160.0	126.6	98.0	85.2	160.0	30.1
34	1984	61.7	66.5	62.1	16.8	55.7	64.5	112.5	102.3	124.5	131.0	72.2	97.4	80.6	131.0	16.8
35	1985	37.7	53.6	39.8	31.1	51.0	53.7	107.1	77.7	113.3	169.8	143.9	141.9	85.1	169.8	31.1
36	1986	103.2	83.5	42.3	33.8	78.7	94.1	135.4	131.2	149.3	148.5	101.3	117.3	101.6	149.3	33.8
37	1987	49.0	32.1	34.0	24.0	23.6	63.6	83.8	147.1	140.5	137.2	119.6	85.6	76.7	147.1	23.6
38	1988	69.8	28.5	18.7	22.8	43.2	64.7	68.1	119.1	154.6	148.5	129.3	105.1	81.0	154.6	18.7
39	1989	90.9	90.1	49.9	22.5	54.9	88.0	124.8	159.1	174.3	130.1	104.2	105.8	99.6	174.3	22.5
Average		74.8	57.6	46.1	32.5	51.2	77.4	106.6	131.1	142.4	153.1	120.5	97.7	91.6	166.6	31.2
Max.		139.7	120.2	96.5	67.6	104.9	112.0	164.9	212.3	214.5	249.9	252.5	179.9	114.3	252.5	67.2
Min		37.7	20.7	6.8	11.0	21.4	47.2	55.9	70.8	69.8	83.0	56.7	46.0	67.7	119.7	6.8

Data source : Mekong Committee

Table 6.3-6 Monthly Discharge (3/3)

Se San River at Pleikrong Dam Site (at Trung Nghia) (Catchment Area : 3,224 km2) [m^3/s]

No.	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Averag	Max.	Min.
1	1961	–	–	–	–	–	–	173.5	383.2	323.4	397.9	235.5	141.9	–	–	–
2	1962	91.4	63.8	53.9	50.5	96.9	268.0	269.5	334.4	277.2	302.9	163.7	84.8	171.4	334.4	50.5
3	1963	66.8	49.0	36.6	35.5	42.8	88.8	118.0	186.0	181.6	159.6	87.0	54.5	92.2	186.0	35.5
4	1964	57.5	42.8	34.8	27.9	30.4	75.9	76.4	204.4	343.8	187.2	88.4	58.9	102.4	343.8	27.9
5	1965	49.6	42.6	29.5	27.3	59.0	45.0	150.7	235.1	456.4	259.2	337.2	137.7	152.4	456.4	27.3
6	1966	57.1	36.8	31.1	28.2	48.3	82.1	124.0	219.0	266.0	259.2	337.2	137.7	135.6	337.2	28.2
7	1967	53.5	47.2	39.3	36.8	43.0	44.9	161.1	210.3	269.1	143.0	86.1	58.7	99.4	269.1	36.8
8	1968	66.6	42.2	28.2	25.6	43.8	188.2	16.1	364.8	412.4	145.1	82.3	81.3	124.7	412.4	16.1
9	1969	59.9	35.1	21.5	17.4	14.4	17.3	49.5	278.5	270.0	243.9	128.8	90.9	102.3	278.5	14.4
10	1970	41.8	33.2	27.8	28.3	38.7	59.7	115.7	199.7	164.5	189.7	122.6	72.3	91.2	199.7	27.8
11	1971	28.6	25.2	24.1	23.8	54.1	156.0	211.0	268.2	228.4	125.5	76.2	48.5	105.8	268.2	23.8
12	1972	83.0	51.7	45.1	42.3	72.6	254.2	171.6	463.0	313.8	238.9	262.8	101.7	175.1	463.0	42.3
13	1973	76.4	47.9	41.7	39.2	66.3	230.8	163.3	441.2	297.7	251.6	151.4	114.3	160.2	441.2	39.2
14	1974	93.5	58.0	50.5	47.2	83.4	294.1	191.0	513.8	351.5	243.6	145.9	109.4	181.8	513.8	47.2
15	1975	56.2	44.4	37.4	44.3	40.8	127.3	98.0	307.3	227.5	271.8	163.8	125.6	128.7	307.3	37.4
16	1976	50.3	32.6	27.5	25.1	42.4	71.7	127.3	225.0	271.2	178.6	192.0	101.0	112.1	271.2	25.1
17	1977	43.7	28.2	23.7	21.6	37.0	62.8	113.0	205.0	247.0	148.9	88.8	55.7	89.6	247.0	21.6
18	1978	52.9	43.6	37.5	37.5	37.5	46.8	61.8	104.4	175.0	130.0	76.1	47.0	70.8	175.0	37.5
19	1979	39.3	27.9	29.8	32.2	42.0	82.9	83.8	345.0	351.0	100.0	86.2	40.2	105.0	351.0	27.9
20	1980	38.4	20.5	22.5	22.2	39.8	119.0	262.6	456.1	251.0	229.0	104.0	62.8	135.7	456.1	20.5
21	1981	58.5	42.6	34.3	35.7	71.4	116.0	174.6	150.5	282.7	215.5	131.3	85.2	116.5	282.7	34.3
22	1982	68.7	52.0	52.2	52.6	62.7	286.0	191.9	338.9	175.5	230.3	224.2	102.4	153.1	338.9	52.0
23	1983	78.9	57.3	45.0	45.4	44.0	146.0	260.1	236.3	364.0	268.1	234.9	129.4	159.1	364.0	44.0
24	1984	48.4	35.6	26.9	23.6	34.9	71.2	91.7	205.9	166.8	164.6	102.9	66.6	86.6	205.9	23.6
25	1985	64.4	45.6	34.5	48.0	54.5	222.0	112.0	374.0	336.0	297.9	204.2	97.1	157.5	374.0	34.5
26	1986	77.1	57.8	42.7	46.9	54.9	202.7	182.6	350.3	261.6	217.0	184.0	107.0	148.7	350.3	42.7
27	1987	58.7	42.7	35.0	32.6	115.8	90.6	165.6	241.9	280.7	204.0	134.4	90.2	124.4	280.7	32.6
28	1988	68.4	49.8	35.9	33.1	37.8	67.2	146.3	224.5	235.1	224.0	143.5	133.2	116.6	235.1	33.1
29	1989	45.1	35.3	26.2	23.6	54.1	110.3	92.1	156.8	101.2	115.1	115.5	63.1	78.2	156.8	23.6
30	1990	55.0	37.3	33.4	36.9	102.7	108.4	164.4	315.2	273.4	268.0	128.7	73.5	133.1	315.2	33.4
31	1991	51.0	37.9	31.9	31.9	59.2	110.7	109.8	162.5	208.3	261.2	190.4	107.1	113.5	261.2	31.9
32	1992	65.3	47.4	41.7	31.9	34.4	90.0	–	–	–	–	–	–	–	–	–
Average		59.5	42.4	34.9	34.0	53.5	127.0	142.9	280.7	269.8	215.2	155.2	89.7	124.1	315.9	32.4
Max.		93.5	63.8	53.9	52.6	115.8	294.1	269.5	513.8	456.4	397.9	337.2	141.9	181.8	513.8	52.0
Min.		28.6	20.5	21.5	17.4	14.4	17.3	16.1	104.4	101.2	100.0	76.1	40.2	70.8	156.8	14.4

Data Source : Mekong Committee

Table 6.3-7 Results of Water Quality Analysis

Lao People's Democratic Republic
Peace Independence Democracy Unity Prosperity.

Ministry of Agriculture - Forestry
Dept. of Irrigation & Micro Hydropower
Laboratory of W.Q.A.

Vientiane, 16/08/93
No. 086/WQA

RESULT OF WATER QUALITY ANALYSIS

Parameter		1	2	3	4
Date		20/7/93	30/7/93	31/7/93	1/8/93
pH		7.06	6.50	7.03	7.19
TSS	mg/l	33	12	50	126
Turbidity	ppm	4	3	7	12
Color	ppm	0	0	1	2
Conductivity	mS/m	4.57	0.50	3.60	4.30
Ca	meq/l	0.189	0.00?	0.169	0.202
Mg	"	0.173	0.049	0.128	0.169
Na	"	0.075	0.010	0.061	0.072
K	"	0.026	0.006	0.028	0.028
Alkalinity	"	0.209	0.019	0.108	0.354
Cl	"	0.041	0.013	0.042	0.043
SO_4	"	0.254	0.022	0.220	0.128
Tot. Hardness	"	0.371	0.049	0.297	0.371
Tot. Fe	mg/l	0.062	0.146	0.102	0.129
NH_4-N	"	0.027	0.015	0.017	0.018
PO_4-P	"	0.010	0.006	0.012	0.009
Tot. P	"	0.020	0.014	0.016	0.016
Si	"	5.3	1.8	4.4	5.5
COD_{Mn}	"	2.620	1.684	2.100	4.050
$KMnO_4$	"	10.352	6.653	8.297	16.002

Laboratory of W.Q.A.

Laboratory of Water Quality Analysis
Vientiane, Lao PDR

Remark:
1. Xekong No.4
2. Xe Namnoy at Ban Latsasim
3. Xekong No.3
4. Xe Kaman No.1

Table 6.3-8 Monthly Discharge at Attapu

Catchment Area : 10,500 km2
Annual Rainfall : 2,161 mm

Monthly Average Discharge [m3/s]

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	316	582	283	888	321	208	888	208	325
1989	123	70	52	55	299	473	727	1,023	891	444	229	168	1,023	52	380
1990	103	78	74	77	126	276	331	740	1,380	1,173	657	269	1,380	74	440
1991	161	129	115	104	127	310	612	1,886	1,428	1,079	386	246	1,886	104	549
1992	257	215	189	178	210	526	597	1,520	1,136	875	496	316	1,520	178	543
1993	267	217	177	166	169	204	-	-	-	-	-	-	267	166	171
Max	267	217	189	178	299	526	727	1,886	1,428	1,173	657	316	1,886		
Min	103	70	52	55	126	204	316	582	283	444	229	168		52	
Ave	182	142	121	116	155	298	430	1,150	1,024	892	418	241			446

Monthly Runoff Volume [x10^6 m3]

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Max	Min	Ave
1988	-	-	-	-	-	-	846	1,560	733	2,378	833	557	6,907	2,378	557	987
1989	329	169	140	144	802	1,227	1,947	2,739	2,310	1,190	594	450	12,041	2,739	140	1,003
1990	277	189	197	200	338	715	886	1,983	3,578	3,142	1,702	720	13,928	3,578	189	1,161
1991	432	313	307	270	341	805	1,639	5,052	3,701	2,890	1,001	659	17,410	5,052	270	1,451
1992	689	538	507	461	561	1,364	1,598	4,072	2,943	2,342	1,286	845	17,208	4,072	461	1,434
1993	715	526	475	430	452	529	-	-	-	-	-	-	3,127	715	430	521
Max	715	538	507	461	802	1,364	1,947	5,052	3,701	3,142	1,702	845	70,621	5,052	-	-
Min	277	169	140	144	338	529	846	1,560	733	1,190	594	450	-	-	140	-
Ave	489	347	325	301	416	773	1,153	3,081	2,653	2,389	1,083	646	-	-	-	1,177

Average	448	[m3/s]
	4.26	[m3/s/100km2]
Annual Runoff	14,124	[x10^6 m3/year]
	1,345	[mm/year]

Table 6.3-9 Monthly Discharge of the Projects (1/7)

Se Kong No.3 Catchment Area 9710 km2 (a1 = 0.925 : Catchment Area Ratio to Attapu)
Annual Rainfall 2174 mm (a2 = 1.006 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	294	542	263	826	299	193	826	193	302
1989	114	65	49	52	279	440	676	951	829	413	213	156	951	49	353
1990	96	73	68	72	117	257	308	689	1,284	1,091	611	250	1,284	68	410
1991	150	120	107	97	119	289	569	1,755	1,328	1,004	359	228	1,755	97	510
1992	239	200	176	166	195	490	555	1,414	1,056	814	461	294	1,414	166	505
1993	248	202	165	154	157	190	-	-	-	-	-	-	248	154	160
Max	248	202	176	166	279	490	676	1,755	1,328	1,091	611	294	1,755	-	-
Min	96	65	49	52	117	190	294	542	263	413	213	156	-	49	-
Ave	170	132	113	108	144	278	400	1,070	952	830	389	225	-	-	415

Average 416 [m3/s]
4.29 [m3/s/100km2]
Runoff 13,140 [x10^6 m3/year]
1,353 [mm/y]

Se Kong No.4 Catchment Area 5400 km2 (a1 = 0.5143 : Catchment Area Ratio to Attapu)
Annual Rainfall 1917 mm (a2 = 0.8871 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	144	266	129	405	147	95	405	95	148
1989	56	32	24	25	137	216	332	467	407	203	105	77	467	24	173
1990	47	36	34	35	58	126	151	338	630	535	300	123	630	34	201
1991	74	59	52	47	58	142	279	861	651	492	176	112	861	47	250
1992	117	98	86	81	96	240	272	694	518	399	226	144	694	81	248
1993	122	99	81	76	77	93	-	-	-	-	-	-	122	76	78
Max	122	99	86	81	137	240	332	861	651	535	300	144	861	-	-
Min	47	32	24	25	58	93	144	266	129	203	105	77	-	24	-
Ave	83	65	55	53	71	136	196	525	467	407	191	110	-	-	203

Average 204 [m3/s]
3.78 [m3/s/100km2]
Runoff 6,444 [x10^6 m3/year]
1,193 [mm/y]

Se Kong No.5 Catchment Area 2,600 km2 (a1 = 0.248 : Catchment Area Ratio to Attapu)
Annual Rainfall 1,736 mm (a2 = 0.803 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	63	116	56	177	64	41	177	41	65
1989	24	14	10	11	60	94	145	203	177	88	46	33	203	10	76
1990	21	16	15	15	25	55	66	147	275	233	131	54	275	15	88
1991	32	26	23	21	25	62	122	375	284	215	77	49	375	21	109
1992	51	43	38	35	42	105	119	302	226	174	99	63	302	35	108
1993	53	43	35	33	34	41	-	-	-	-	-	-	53	33	34
Max	53	43	38	35	60	105	145	375	284	233	131	63	375		
Min	21	14	10	11	25	41	63	116	56	88	46	33		10	
Ave	36	28	24	23	31	59	86	229	204	177	83	48			89

Average 89 [m3/s]
3.42 [m3/s/100km2]
Runoff 2,810 [x10^6 m3/year]
1,081 [mm/y]

Xe Kaman No.1 Catchment Area 3,800 km2 (a1 = 0.362 : Catchment Area Ratio to Attapu)
Annual Rainfall 1,766 mm (a2 = 0.817 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	93	172	84	263	95	62	263	62	96
1989	36	21	15	16	89	140	215	302	264	131	68	50	302	15	112
1990	31	23	22	23	37	82	98	219	408	347	194	80	408	22	130
1991	48	38	34	31	38	92	181	558	422	319	114	73	558	31	162
1992	76	64	56	53	62	156	176	450	336	259	147	93	450	53	181
1993	79	64	52	49	50	60	-	-	-	-	-	-	79	49	51
Max	79	64	56	53	89	156	215	558	422	347	194	93	558		
Min	31	21	15	16	37	60	93	172	84	131	68	50		15	
Ave	54	42	36	34	46	88	127	340	303	264	124	71			132

Average 132 [m3/s]
3.48 [m3/s/100km2]
Runoff 4,177 [x10^6 m3/year]
1,099 [mm/year]

Table 6.3-9 Monthly Discharge of the Projects (2/7)

Xe Kaman No.2 Catchment Area 1,770 km2 (a1 = 0.169 : Catchment Area Ratio to Attapu)
Annual Rainfall 1,748 mm (a2 = 0.809 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	43	79	39	121	44	28	121	28	44
1989	17	10	7	8	41	65	99	139	122	61	31	23	139	7	52
1990	14	11	10	11	17	38	45	101	188	160	90	37	188	10	60
1991	22	18	16	14	17	42	83	257	195	147	53	34	257	14	75
1992	35	29	26	24	29	72	81	207	155	119	68	43	207	24	74
1993	36	30	24	23	23	28	-	-	-	-	-	-	36	23	23
Max	36	30	26	24	41	72	99	257	195	160	90	43	257		
Min	14	10	7	8	17	28	43	79	39	61	31	23		7	
Ave	25	19	17	16	21	41	69	157	140	122	57	33			61

Average 61 [m3/s]
3.45 [m3/s/100km2]
Runoff 1,926 [x10^6 m3/year]
1,088 [mm/y]

Xe Kaman No.3 Catchment Area 655 km2 (a1 = 0.062 : Catchment Area Ratio to Attapu)
Annual Rainfall 1,860 mm (a2 = 0.861 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	17	31	15	48	17	11	48	11	17
1989	7	4	3	3	16	25	39	55	48	24	12	9	55	3	20
1990	6	4	4	4	7	15	18	40	74	63	35	14	74	4	24
1991	9	7	6	6	7	17	33	101	77	58	21	13	101	6	29
1992	14	12	10	10	11	26	32	82	61	47	27	17	82	10	29
1993	14	12	10	9	9	11	-	-	-	-	-	-	14	9	9
Max	14	12	10	10	16	26	39	101	77	63	35	17	101		
Min	6	4	3	3	7	11	17	31	15	24	12	9		3	
Ave	10	8	7	6	8	16	23	62	55	48	22	13			24

Average 24 [m3/s]
3.67 [m3/s/100km2]
Runoff 758 [x10^6 m3/year]
1,158 [mm/y]

Xe Kaman No.4 Site A Catchment Area 135 km2 (a1 = 0.013 : Catchment Area Ratio to Attapu)
Annual Rainfall 1600 mm (a2 = 0.740 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	3.0	5.5	2.7	8.5	3.1	2.0	8.5	2.0	3.1
1989	1.2	0.7	0.5	0.5	2.9	4.5	6.9	9.7	8.5	4.2	2.2	1.6	9.7	0.5	3.6
1990	1.0	0.7	0.7	0.7	1.2	2.6	3.2	7.0	13.1	11.2	6.3	2.6	13.1	0.7	4.2
1991	1.5	1.2	1.1	1.0	1.2	3.0	5.8	18.0	13.6	10.3	3.7	2.3	18.0	1.0	5.2
1992	2.4	2.0	1.8	1.7	2.0	5.0	5.7	14.5	10.8	8.3	4.7	3.0	14.5	1.7	5.2
1993	2.5	2.1	1.7	1.6	1.6	1.9	-	-	-	-	-	-	2.5	1.6	1.6
Max	2.5	2.1	1.8	1.7	2.9	5.0	6.9	18.0	13.6	11.2	6.3	3.0	18.0		
Min	1.0	0.7	0.5	0.5	1.2	1.9	3.0	5.5	2.7	4.2	2.2	1.6		0.5	
Ave	1.7	1.4	1.2	1.1	1.5	2.9	4.1	11.0	9.7	8.5	4.0	2.3			4.2

Average 4 [m3/s]
3.16 [m3/s/100km2]
Runoff 134 [x10^6 m3/year]
996 [mm/y]

Xe Kaman No.4 Sit Catchment Area 95 km2 (a1 = 0.009 : Catchment Area Ratio to Attapu)
Annual Rainfall 1600 mm (a2 = 0.740 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	2.1	3.9	1.9	5.9	2.2	1.4	5.9	1.4	2.2
1989	0.8	0.5	0.4	0.4	2.0	3.2	4.9	6.9	6.0	3.0	1.5	1.1	6.9	0.4	2.5
1990	0.7	0.5	0.5	0.5	0.8	1.8	2.2	5.0	9.2	7.9	4.4	1.8	9.2	0.5	3.0
1991	1.1	0.9	0.8	0.7	0.9	2.1	4.1	12.6	9.6	7.2	2.6	1.6	12.6	0.7	3.7
1992	1.7	1.4	1.3	1.2	1.4	3.5	4.0	10.2	7.6	5.9	3.3	2.1	10.2	1.2	3.6
1993	1.8	1.5	1.2	1.1	1.1	1.4	-	-	-	-	-	-	1.8	1.1	1.1
Max	1.8	1.5	1.3	1.2	2.0	3.5	4.9	12.6	9.6	7.9	4.4	2.1	12.6		
Min	0.7	0.5	0.4	0.4	0.8	1.4	2.1	3.9	1.9	3.0	1.5	1.1		0.4	
Ave	1.2	1.0	0.8	0.8	1.0	2.0	2.9	7.7	6.8	6.0	2.8	1.6			3.0

Average 3 [m3/s]
3.16 [m3/s/100km2]
Runoff 95 [x10^6 m3/year]
996 [mm/y]

Table 6.3-9 Monthly Discharge of the Projects (3/7)

Xe Kaman No.4 Site C Catchment Area 30 km2 (a1 = 0.003 : Catchment Area Ratio to Attapu)
Annual Rainfall 1600 mm (a2 = 0.740 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	0.7	1.2	0.6	1.9	0.7	0.4	1.9	0.4	0.7
1989	0.3	0.1	0.1	0.1	0.6	1.0	1.5	2.2	1.9	0.9	0.5	0.4	2.2	0.1	0.8
1990	0.2	0.2	0.2	0.2	0.3	0.6	0.7	1.6	2.9	2.5	1.4	0.6	2.9	0.2	0.9
1991	0.3	0.3	0.2	0.2	0.3	0.7	1.3	4.0	3.0	2.3	0.8	0.5	4.0	0.2	1.2
1992	0.5	0.5	0.4	0.4	0.4	1.1	1.3	3.2	2.4	1.9	1.0	0.7	3.2	0.4	1.1
1993	0.6	0.5	0.4	0.4	0.4	0.4	-	-	-	-	-	-	0.6	0.4	0.4
Max	0.6	0.5	0.4	0.4	0.6	1.1	1.5	4.0	3.0	2.5	1.4	0.7	4.0		
Min	0.2	0.1	0.1	0.1	0.3	0.4	0.7	1.2	0.6	0.9	0.5	0.4		0.1	
Ave	0.4	0.3	0.3	0.2	0.3	0.6	0.9	2.4	2.2	1.9	0.9	0.5			0.9

Average	1	[m3/s]
	3.16	[m3/s/100km2]
Runoff	30	[x10^6 m3/year]
	996	[mm/y]

Xe Kaman No.4 Site D Catchment Area 40 km2 (a1 = 0.004 : Catchment Area Ratio to Attapu)
Annual Rainfall 1600 mm (a2 = 0.740 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	0.9	1.6	0.8	2.5	0.9	0.6	2.5	0.6	0.9
1989	0.3	0.2	0.1	0.2	0.8	1.3	2.1	2.9	2.5	1.3	0.6	0.5	2.9	0.1	1.1
1990	0.3	0.2	0.2	0.2	0.4	0.8	0.9	2.1	3.9	3.3	1.9	0.8	3.9	0.2	1.2
1991	0.5	0.4	0.3	0.3	0.4	0.9	1.7	5.3	4.0	3.0	1.1	0.7	5.3	0.3	1.5
1992	0.7	0.6	0.5	0.5	0.6	1.5	1.7	4.3	3.2	2.5	1.4	0.9	4.3	0.5	1.5
1993	0.8	0.6	0.5	0.5	0.5	0.6	-	-	-	-	-	-	0.8	0.5	0.5
Max	0.8	0.6	0.5	0.5	0.8	1.5	2.1	5.3	4.0	3.3	1.9	0.9	5.3		
Min	0.3	0.2	0.1	0.2	0.4	0.6	0.9	1.6	0.8	1.3	0.6	0.5		0.1	
Ave	0.5	0.4	0.3	0.3	0.4	0.8	1.2	3.2	2.9	2.5	1.2	0.7			1.3

Average	1	[m3/s]
	3.16	[m3/s/100km2]
Runoff	40	[x10^6 m3/year]
	996	[mm/y]

Xe Kaman No.4 Site E Catchment Area 60 km2 (a1 = 0.006 : Catchment Area Ratio to Attapu)
Annual Rainfall 1600 mm (a2 = 0.740 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	1.3	2.5	1.2	3.8	1.4	0.9	3.8	0.9	1.4
1989	0.5	0.3	0.2	0.2	1.3	2.0	3.1	4.3	3.8	1.9	1.0	0.7	4.3	0.2	1.6
1990	0.4	0.3	0.3	0.3	0.5	1.2	1.4	3.1	5.8	5.0	2.8	1.1	5.8	0.3	1.9
1991	0.7	0.5	0.5	0.4	0.5	1.3	2.6	8.0	6.0	4.6	1.6	1.0	8.0	0.4	2.3
1992	1.1	0.9	0.8	0.8	0.9	2.2	2.5	6.4	4.8	3.7	2.1	1.3	6.4	0.8	2.3
1993	1.1	0.9	0.7	0.7	0.7	0.9	-	-	-	-	-	-	1.1	0.7	0.7
Max	1.1	0.9	0.8	0.8	1.3	2.2	3.1	8.0	6.0	5.0	2.8	1.3	8.0		
Min	0.4	0.3	0.2	0.2	0.5	0.9	1.3	2.5	1.2	1.9	1.0	0.7		0.2	
Ave	0.8	0.6	0.5	0.5	0.7	1.3	1.8	4.9	4.3	3.8	1.8	1.0			1.9

Average	2	[m3/s]
	3.16	[m3/s/100km2]
Runoff	60	[x10^6 m3/year]
	996	[mm/y]

Xe Namnoy Mid. Catchment Area 537 km2 (a1 = 0.051 : Catchment Area Ratio to Attapu)
Annual Rainfall 2560 mm (a2 = 1.185 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	19	35	17	54	19	13	54	13	20
1989	7	4	3	3	18	29	44	62	54	27	14	10	62	3	23
1990	6	5	4	5	8	17	20	45	84	71	40	16	84	4	27
1991	10	8	7	6	8	19	37	114	87	65	23	15	114	6	33
1992	16	13	11	11	13	32	36	92	69	53	30	19	92	11	33
1993	16	13	11	10	10	12	-	-	-	-	-	-	16	10	10
Max	16	13	11	11	18	32	44	114	87	71	40	19	114		
Min	6	4	3	3	8	12	19	35	17	27	14	10		3	
Ave	11	9	7	7	9	18	26	70	62	54	25	15			27

Average	27	[m3/s]
	5.05	[m3/s/100km2]
Runoff	856	[x10^6 m3/year]
	1,594	[mm/y]

Table 6.3-9 Monthly Discharge of the Projects (4/7)

Xe Namnoy Down. Catchment Area 1252 km2 (a1 = 0.119 : Catchment Area Ratio to Attapu)
Annual Rainfall 2827 mm (a2 = 1.308 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	49	91	44	139	50	32	139	32	51
1989	19	11	8	9	47	74	113	160	139	69	36	26	160	8	59
1990	16	12	11	12	20	43	52	115	215	183	102	42	215	11	69
1991	25	20	18	16	20	48	95	294	223	168	60	38	294	16	86
1992	40	34	30	28	33	82	93	237	177	136	77	49	237	28	85
1993	42	34	28	26	26	32	-	-	-	-	-	-	42	26	27
Max	42	34	30	28	47	82	113	294	223	183	102	49	294		
Min	16	11	8	9	20	32	49	91	44	69	36	26		8	
Ave	28	22	19	18	24	47	67	179	160	139	65	38			70

Average 70 [m3/s]
5.58 [m3/s/100km2]
Runoff 2,203 [x10^6 m3/year]
1,760 [mm/y]

Houay Katak Tok Catchment Area 199 km2 (a1 = 0.019 : Catchment Area Ratio to Attapu)
Annual Rainfall 2414 mm (a2 = 1.117 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	7	12	6	19	7	4	19	4	7
1989	3	1	1	1	8	10	15	22	19	9	5	4	22	1	8
1990	2	2	2	2	3	6	7	16	29	25	14	6	29	2	9
1991	3	3	2	2	3	7	13	40	30	23	8	5	40	2	12
1992	5	5	4	4	4	11	13	32	24	19	11	7	32	4	11
1993	6	5	4	4	4	4	-	-	-	-	-	-	6	4	4
Max	6	5	4	4	8	11	15	40	30	25	14	7	40		
Min	2	1	1	1	3	4	7	12	6	9	5	4		1	
Ave	4	3	3	2	3	6	9	24	22	19	9	5			9

Average 9 [m3/s]
4.76 [m3/s/100km2]
Runoff 299 [x10^6 m3/year]
1,503 [mm/y]

Nam Kong No.1 Catchment Area 1250 km2 (a1 = 0.119 : Catchment Area Ratio to Attapu)
Annual Rainfall 1877 mm (a2 = 0.869 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	33	60	29	92	33	22	92	22	34
1989	13	7	5	6	31	49	75	106	92	46	24	17	106	5	39
1990	11	8	8	8	13	29	34	77	143	121	68	28	143	8	46
1991	17	13	12	11	13	32	63	195	148	112	40	25	195	11	57
1992	27	22	20	18	22	54	82	157	117	90	51	33	157	18	56
1993	28	22	18	17	17	21	-	-	-	-	-	-	28	17	18
Max	28	22	20	18	31	54	75	195	148	121	68	33	195		
Min	11	7	5	6	13	21	33	60	29	46	24	17		5	
Ave	19	15	13	12	16	31	45	119	106	92	43	25			46

Average 46 [m3/s]
3.70 [m3/s/100km2]
Runoff 1,460 [x10^6 m3/year]
1,168 [mm/y]

Nam Kong No.2 Catchment Area 850 km2 (a1 = 0.081 : Catchment Area Ratio to Attapu)
Annual Rainfall 1829 mm (a2 = 0.846 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	22	40	19	61	22	14	61	14	22
1989	8	5	4	4	21	32	50	70	61	30	16	12	70	4	26
1990	7	5	5	5	9	19	23	51	95	80	45	18	95	5	30
1991	11	9	8	7	9	21	42	129	98	74	26	17	129	7	38
1992	18	15	13	12	14	36	41	104	78	60	34	22	104	12	37
1993	18	15	12	11	12	14	-	-	-	-	-	-	18	11	12
Max	18	15	13	12	21	36	50	129	98	80	45	22	129		
Min	7	5	4	4	9	14	22	40	19	30	16	12		4	
Ave	12	10	8	8	11	20	29	79	70	61	29	17			31

Average 31 [m3/s]
3.61 [m3/s/100km2]
Runoff 968 [x10^6 m3/year]
1,139 [mm/y]

Table 6.3-9 Monthly Discharge of the Projects (5/7)

Nam Kong No.3

Catchment Area 600 km2 (a1 = 0.057 : Catchment Area Ratio to Attapu)
Annual Rainfall 1812 mm (a2 = 0.839 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	15	28	14	43	15	10	43	10	16
1989	6	3	3	3	14	23	35	49	43	21	11	8	49	3	18
1990	5	4	4	4	6	13	16	35	66	56	31	13	66	4	21
1991	8	6	5	5	6	15	29	90	68	52	19	12	90	5	26
1992	12	10	9	9	10	25	29	73	54	42	24	15	73	9	26
1993	13	10	8	8	8	10	-	-	-	-	-	-	13	8	8
Max	13	10	9	9	14	25	35	90	68	56	31	15	90		
Min	5	3	3	3	6	10	15	28	14	21	11	8		3	
Ave	9	7	6	6	7	14	21	55	49	43	20	12			21

Average 21 [m3/s]
3.57 [m3/s/100km2]
Runoff 677 [x10^6 m3/year]
1,128 [mm/y]

Xe Xou

Catchment Area 1480 km2 (a1 = 0.141 : Catchment Area Ratio to Attapu)
Annual Rainfall 1665 mm (a2 = 0.770 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	34	63	31	96	35	23	96	23	35
1989	13	8	6	6	33	51	79	111	97	49	25	18	111	6	41
1990	11	8	8	8	14	30	36	80	150	127	71	29	150	8	48
1991	18	14	12	11	14	34	66	205	155	117	42	27	205	11	60
1992	28	23	21	19	23	57	65	165	123	95	54	34	165	19	59
1993	29	24	19	18	18	22	-	-	-	-	-	-	29	18	19
Max	29	24	21	19	33	57	79	205	155	127	71	34	205		
Min	11	8	6	6	14	22	34	63	31	49	25	18		6	
Ave	20	15	13	13	17	32	47	125	111	97	45	26			48

Average 49 [m3/s]
3.29 [m3/s/100km2]
Runoff 1,534 [x10^6 m3/year]
1,036 [mm/y]

Dak E Site A

Catchment Area 230 km2 (a1 = 0.022 : Catchment Area Ratio to Attapu)
Annual Rainfall 2000 mm (a2 = 0.925 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	6	12	6	18	7	4	18	4	7
1989	2	1	1	1	6	10	15	21	18	9	5	3	21	1	8
1990	2	2	1	2	3	6	7	15	28	24	13	5	28	1	9
1991	3	3	2	2	3	6	12	38	29	22	8	5	38	2	11
1992	5	4	4	4	4	11	12	31	23	18	10	6	31	4	11
1993	5	4	4	3	3	4	-	-	-	-	-	-	5	3	3
Max	5	4	4	4	6	11	15	38	29	24	13	6	38		
Min	2	1	1	1	3	4	6	12	6	9	5	3		1	
Ave	4	3	2	2	3	6	9	23	21	18	9	5			9

Average 9 [m3/s]
3.95 [m3/s/100km2]
Runoff 286 [x10^6 m3/year]
1,245 [mm/y]

Dak E Site B

Catchment Area 40 km2 (a1 = 0.004 : Catchment Area Ratio to Attapu)
Annual Rainfall 2050 mm (a2 = 0.949 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	1.1	2.1	1.0	3.2	1.2	0.8	3.2	0.8	1.2
1989	0.4	0.3	0.2	0.2	1.1	1.7	2.6	3.7	3.2	1.6	0.8	0.6	3.7	0.2	1.4
1990	0.4	0.3	0.3	0.3	0.5	1.0	1.2	2.7	5.0	4.2	2.4	1.0	5.0	0.3	1.6
1991	0.6	0.5	0.4	0.4	0.5	1.1	2.2	6.8	5.2	3.9	1.4	0.9	6.8	0.4	2.0
1992	0.9	0.8	0.7	0.6	0.8	1.9	2.2	5.5	4.1	3.2	1.9	1.1	5.5	0.6	2.0
1993	1.0	0.8	0.6	0.6	0.6	0.7	-	-	-	-	-	-	1.0	0.6	0.6
Max	1.0	0.8	0.7	0.6	1.1	1.9	2.6	6.8	5.2	4.2	2.4	1.1	6.8		
Min	0.4	0.3	0.2	0.2	0.5	0.7	1.1	2.1	1.0	1.6	0.8	0.6		0.2	
Ave	0.7	0.5	0.4	0.4	0.6	1.1	1.6	4.2	3.7	3.2	1.5	0.9			1.6

Average 2 [m3/s]
4.04 [m3/s/100km2]
Runoff 51 [x10^6 m3/year]
1,276 [mm/y]

Table 6.3-9 Monthly Discharge of the Projects (6/7)

Dak E Site C

Catchment Area 168 km2 (a1 = 0.016 : Catchment Area Ratio to Attapu)
Annual Rainfall 2050 mm (a2 = 0.949 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	5	9	4	13	5	3	13	3	5
1989	2	1	1	1	5	7	11	16	14	7	3	3	16	1	6
1990	2	1	1	1	2	4	5	11	21	18	10	4	21	1	7
1991	2	2	2	2	2	5	9	29	22	16	6	4	29	2	8
1992	4	3	3	3	3	8	9	23	17	13	8	5	23	3	8
1993	4	3	3	3	3	3	-	-	-	-	-	-	4	3	3
Max	4	3	3	3	5	8	11	29	22	18	10	5	29		
Min	2	1	1	1	2	3	5	9	4	7	3	3		1	
Ave	3	2	2	2	2	5	7	17	16	14	8	4			7

Average	7	[m3/s]
	4.04	[m3/s/100km2]
Runoff	214	[x10^6 m3/year]
	1,276	[mm/y]

Dak E Site D

Catchment Area 22 km2 (a1 = 0.002 : Catchment Area Ratio to Attapu)
Annual Rainfall 2400 mm (a2 = 1.111 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	0.7	1.4	0.7	2.1	0.7	0.5	2.1	0.5	0.8
1989	0.3	0.2	0.1	0.1	0.7	1.1	1.7	2.4	2.1	1.0	0.5	0.4	2.4	0.1	0.9
1990	0.2	0.2	0.2	0.2	0.3	0.6	0.8	1.7	3.2	2.7	1.5	0.6	3.2	0.2	1.0
1991	0.4	0.3	0.3	0.2	0.3	0.7	1.4	4.4	3.3	2.5	0.9	0.6	4.4	0.2	1.3
1992	0.6	0.5	0.4	0.4	0.5	1.2	1.4	3.5	2.6	2.0	1.2	0.7	3.5	0.4	1.3
1993	0.6	0.5	0.4	0.4	0.4	0.5	-	-	-	-	-	-	0.6	0.4	0.4
Max	0.6	0.5	0.4	0.4	0.7	1.2	1.7	4.4	3.3	2.7	1.5	0.7	4.4		
Min	0.2	0.2	0.1	0.1	0.3	0.5	0.7	1.4	0.7	1.0	0.5	0.4		0.1	
Ave	0.4	0.3	0.3	0.3	0.4	0.7	1.0	2.7	2.4	2.1	1.0	0.6			1.0

Average	1.0	[m3/s]
	4.73	[m3/s/100km2]
Runoff	33	[x10^6 m3/year]
	1,494	[mm/y]

Dak E Site E

Catchment Area 50 km2 (a1 = 0.005 : Catchment Area Ratio to Attapu)
Annual Rainfall 2000 mm (a2 = 0.925 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	1.4	2.6	1.2	3.9	1.4	0.9	3.9	0.9	1.4
1989	0.5	0.3	0.2	0.2	1.3	2.1	3.2	4.5	3.9	2.0	1.0	0.7	4.5	0.2	1.7
1990	0.5	0.3	0.3	0.3	0.6	1.2	1.5	3.3	6.1	5.2	2.9	1.2	6.1	0.3	1.9
1991	0.7	0.6	0.5	0.5	0.8	1.4	2.7	8.3	6.3	4.8	1.7	1.1	8.3	0.5	2.4
1992	1.1	0.9	0.8	0.8	0.9	2.3	2.6	8.7	5.0	3.9	2.2	1.4	8.7	0.8	2.4
1993	1.2	1.0	0.8	0.7	0.7	0.9	-	-	-	-	-	-	1.2	0.7	0.8
Max	1.2	1.0	0.8	0.8	1.3	2.3	3.2	8.3	6.3	5.2	2.9	1.4	8.3		
Min	0.5	0.3	0.2	0.2	0.6	0.9	1.4	2.6	1.2	2.0	1.0	0.7		0.2	
Ave	0.8	0.6	0.5	0.5	0.7	1.3	1.9	5.1	4.5	3.9	1.8	1.1			2.0

Average	2	[m3/s]
	3.95	[m3/s/100km2]
Runoff	62	[x10^6 m3/year]
	1,245	[mm/y]

H. Lamphan Gnai

Catchment Area 195 km2 (a1 = 0.019 : Catchment Area Ratio to Attapu)
Annual Rainfall 3001 mm (a2 = 1.389 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	8	15	7	23	8	5	23	5	8
1989	3	2	1	1	8	12	19	26	23	11	6	4	26	1	10
1990	3	2	2	2	3	7	9	19	36	30	17	7	36	2	11
1991	4	3	3	3	3	8	16	49	37	28	10	6	49	3	14
1992	7	6	5	5	5	14	15	39	29	23	13	8	39	5	14
1993	7	6	5	4	4	5	-	-	-	-	-	-	7	4	4
Max	7	6	5	5	8	14	19	49	37	30	17	8	49		
Min	3	2	1	1	3	5	8	15	7	11	6	4		1	
Ave	5	4	3	3	4	8	11	30	26	23	11	6			11

Average	12	[m3/s]
	5.92	[m3/s/100km2]
Runoff	384	[x10^6 m3/year]
	1,868	[mm/y]

Table 6.3-9 Monthly Discharge of the Projects (7/7)

Xe Pian

Catchment Area 220 km2 (a1 = 0.021 : Catchment Area Ratio to Attapu)
Annual Rainfall 3200 mm (a2 = 1.481 : Annual Rainfall Ratio to Attapu)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min	Ave
1988	-	-	-	-	-	-	10	18	9	28	10	6	28	6	10
1989	4	2	2	2	9	15	23	32	28	14	7	5	32	2	12
1990	3	2	2	2	4	9	10	23	43	36	20	8	43	2	14
1991	5	4	4	3	4	10	19	59	44	33	12	8	59	3	17
1992	8	7	6	6	7	16	19	47	35	27	15	10	47	6	17
1993	8	7	5	5	5	6	-	-	-	-	-	-	8	5	5
Max	8	7	6	6	9	16	23	59	44	36	20	10	59		
Min	3	2	2	2	4	6	10	18	9	14	7	5		2	
Ave	6	4	4	4	5	9	13	36	32	28	13	7			14

Average	14	[m3/s]
	8.31	[m3/s/100km2]
Runoff	438	[x10^6 m3/year]
	1,992	[mm/y]

Table 6.3-10 Estimation of Design Flood in Se Kong Basin

Calculated by Creager Curve : Q=61xA^(A^-0.05 -1)

Project		Catchment Area [km2]	Flood [m3/s/km2]	Flood [m3/s]
Se Kong	No.3	9,710	2.08	20,174
Se Kong	No.4	5,400	3.03	16,368
Se Kong	No.5	2,600	4.73	12,307
Xe Kaman	No.1	3,800	3.77	14,321
Xe Kaman	No.2	1,770	5.92	10,471
Xe Kaman	No.3	655	10.13	6,633
Xe Namnoy	Mid.	537	11.20	6,012
Xe Namnoy	Down.	1,252	7.18	8,990
H. Katak Tok		199	17.81	3,545
Nam Kong	No.1	1,250	7.19	8,984
Nam Kong	No.2	850	8.85	7,518
Nam Kong	No.3	600	10.59	6,353
Xe Xou		1,480	6.54	9,686
H. Lamphan Gnai		195	17.97	3,505
Xe Pian		220	17.05	3,750

Table 6.3-11 Calculated Sediment Volume of Projects

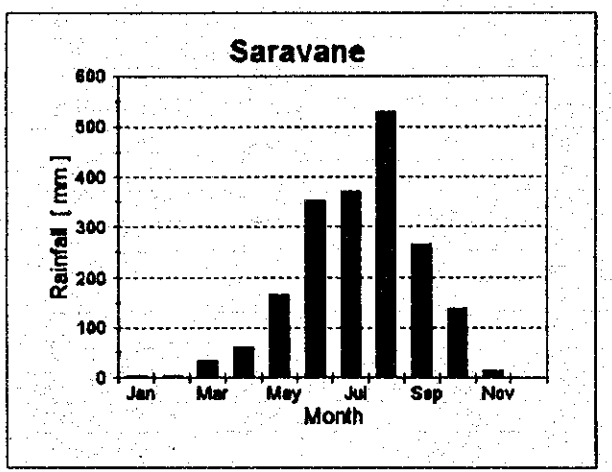
Conditions :1) Suspended load is to be calculated by S = 371A^0.993
S : suspended load [tons/year]
A : catchment area [km2]
2) Bed load is 20 % of suspended load.
3) Unit weight of material is 1.6 t/m3 in erosion rate.
4) Unit weight of material is 1.0 t/m3 in sediment volume.

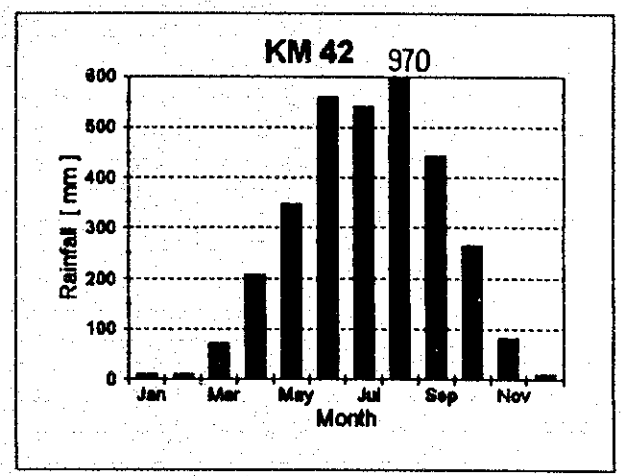
Project		Catchment Area [km2]	Suspended Load [tons/year]	Sediment Yield [tons/km2/y]	Annual Erosion Rate [mm/y]	Sediment Vol. after 100 years [10^6m3]
Se Kong	No.3	9,710	3,378,179	417	0.26	405
Se Kong	No.4	5,400	1,886,431	419	0.26	226
Se Kong	No.5	2,600	912,940	421	0.26	110
Xe Kaman	No.1	3,800	1,330,758	420	0.26	160
Xe Kaman	No.2	1,770	623,177	422	0.26	75
Xe Kaman	No.3	655	232,221	425	0.27	28
Xe Kaman No.4	Site A	135	48,394	430	0.27	6
	Site B	95	34,139	431	0.27	4
	Site C	30	10,868	435	0.27	1
	Site D	40	14,462	434	0.27	2
	Site E	60	21,631	433	0.27	3
Xe Namnoy	Mid.	537	190,651	426	0.27	23
Xe Namnoy	Down.	1,252	441,870	424	0.26	53
H. Katak Tok		199	71,143	429	0.27	9
Nam Kong	No.1	1,250	441,170	424	0.26	53
Nam Kong	No.2	850	300,806	425	0.27	36
Nam Kong	No3	600	212,852	426	0.27	26
Xe Xou		1,480	521,728	423	0.26	63
Dak E Meule	Site A	230	82,143	429	0.27	10
	Site B	40	14,462	434	0.27	2
	Site C	168	60,132	430	0.27	7
	Site D	22	7,987	436	0.27	1
	Site E	50	18,049	433	0.27	2
H. Lamphan Gnai		195	69,723	429	0.27	8
Xe Pian		220	78,596	429	0.27	9

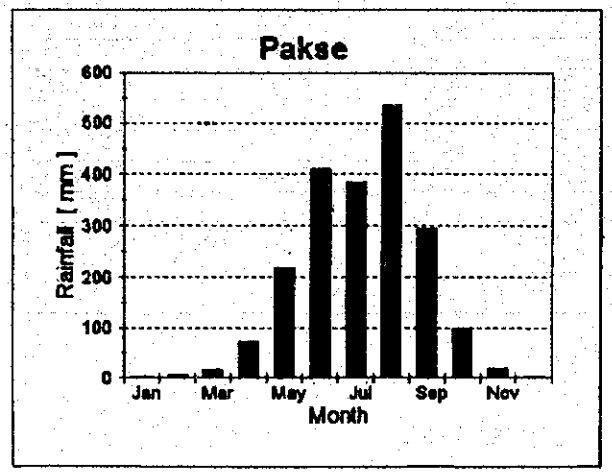
Table 6.3-12 Estimation of Evaporation

Project		Catchment Area [km2]	HWL [EL.m]	Estimated Temperature [degree]	Calculated Evaporation [mm/day]	Ratio to Pakse	Estimated Evaporation [mm/year]	Design Evaporation [mm/year]
Pakse		--	101	27.0	4.384	1.00	1716	--
Se Kong	No.3	9,710	160	26.6	3.82	0.87	1,048	1100
Xe Xou		1,480	220	26.3	3.76	0.86	1,029	
Xe Kaman	No.1	3,800	280	25.9	3.67	0.84	1,005	
Se Kong	No.4	5,400	300	25.8	3.65	0.83	999	1000
Nam Kong	No.1	1,250	340	25.6	3.60	0.82	987	
Xe Kaman	No.2	1,770	400	25.2	3.52	0.80	964	
Nam Kong	No.2	850	460	24.8	3.44	0.78	942	
Se Kong	No.5	2,600	500	24.6	3.40	0.77	930	
Nam Kong	No.3	600	540	24.4	3.36	0.77	919	
Dak E Meule	Site C	168	780	22.9	3.07	0.70	840	900
Dak E Meule	Site D	22	780	22.9	3.07	0.70	840	
Xe Namnoy	Mid.	537	780	22.9	3.07	0.70	840	
H. Lamphan Gnai		195	820	22.7	3.03	0.69	830	
Xe Pian		220	820	22.7	3.03	0.69	830	
H. Katak Tok		199	880	22.3	2.96	0.67	810	
Xe Kaman	No.3	655	900	22.2	2.94	0.67	805	
Dak E Meule	Site A	230	960	21.8	2.87	0.65	786	800
Dak E Meule	Site E	50	990	21.7	2.85	0.65	781	
Dak E Meule	Site B	40	1,000	21.6	2.83	0.65	776	
Xe Kaman No.4	Site C	30	1,100	21.0	2.73	0.62	748	
Xe Kaman No.4	Site D	40	1,110	20.9	2.71	0.62	743	
Xe Kaman No.4	Site E	60	1,120	20.9	2.71	0.62	743	
Xe Kaman No.4	Site B	95	1,140	20.8	2.70	0.62	739	
Xe Kaman No.4	Site A	135	1,160	20.6	2.66	0.61	730	

Fig. 6.3-1 Monthly Rainfall (1/2)







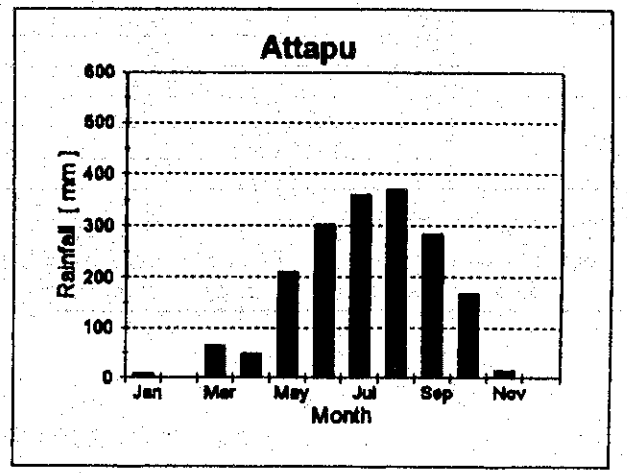
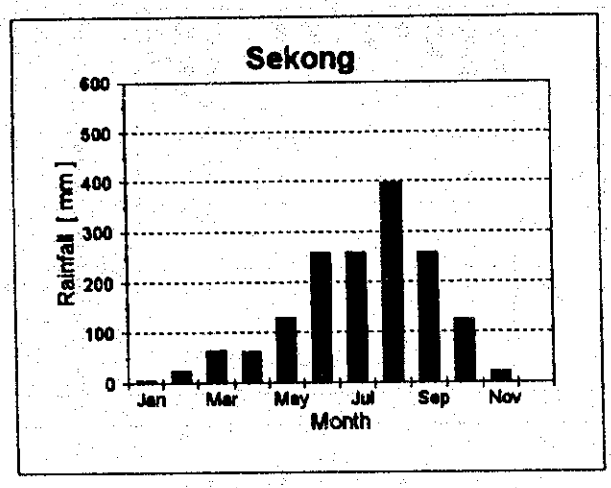
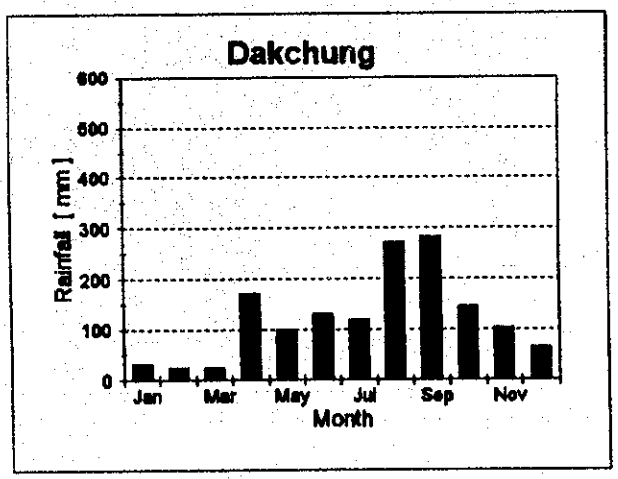
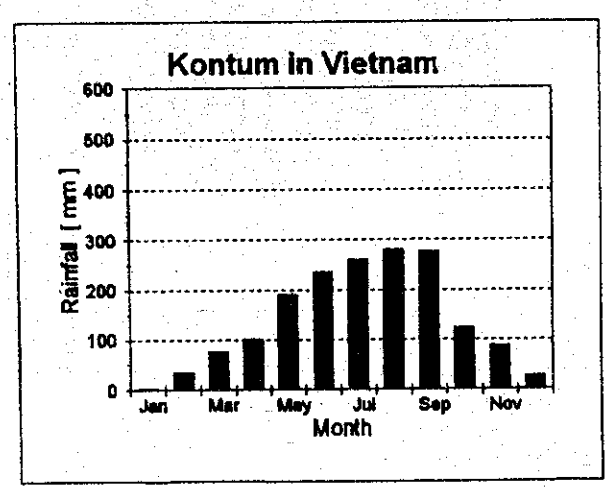


Fig. 6.3-1 Monthly Rainfall (2/2)







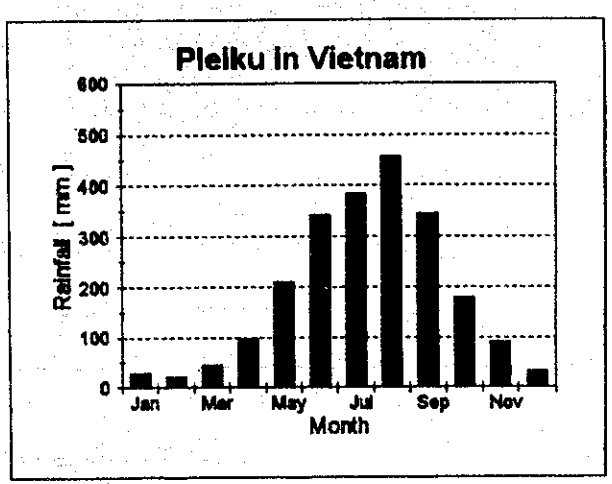
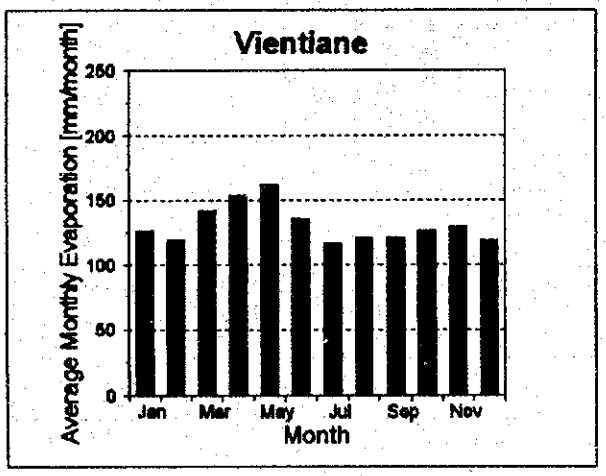
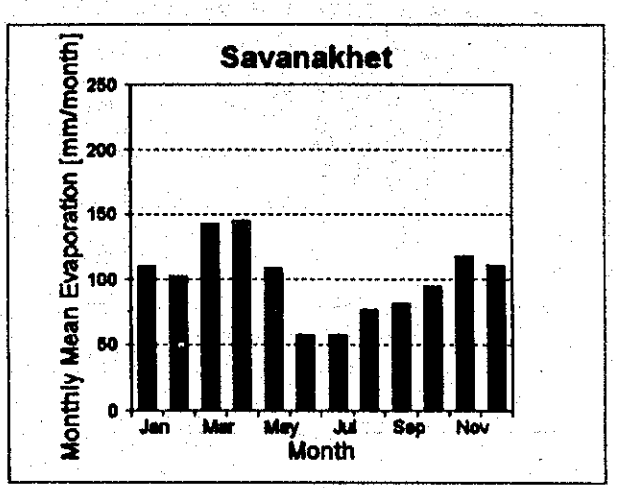
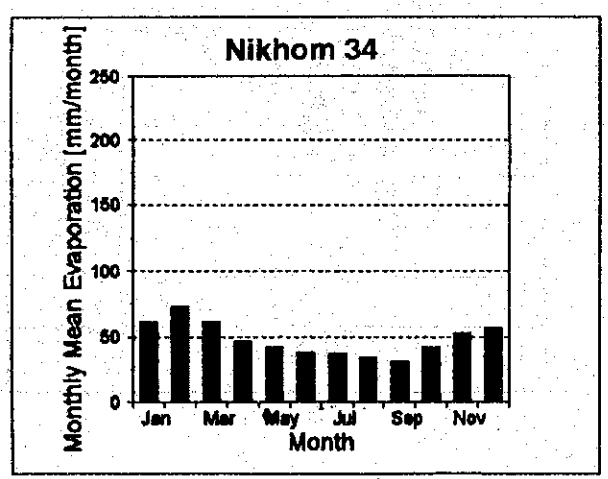


Fig. 6.3-2 Monthly Evaporation







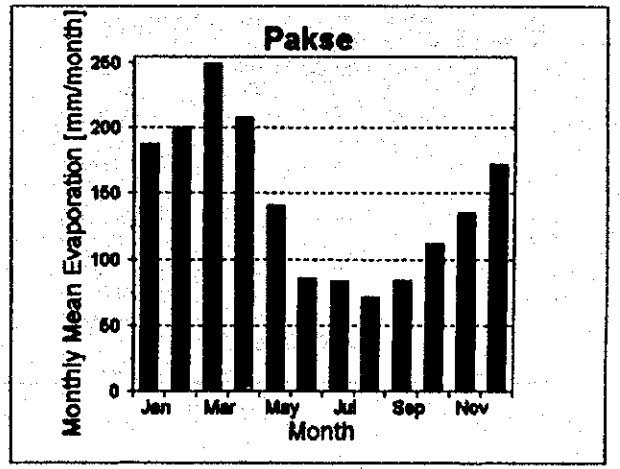
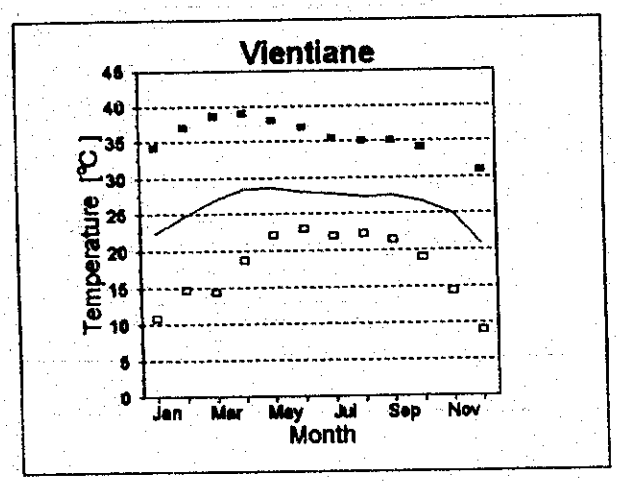
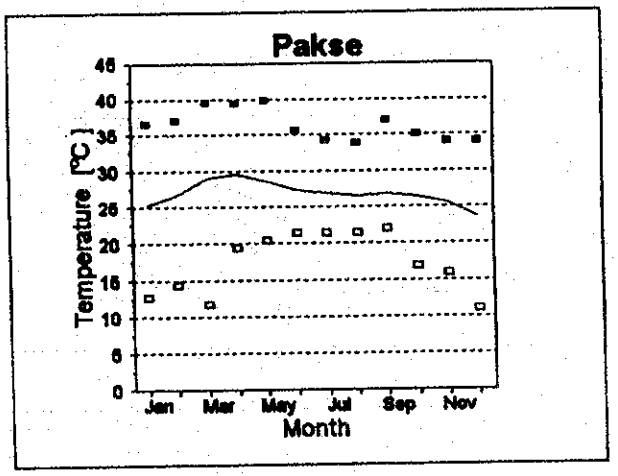
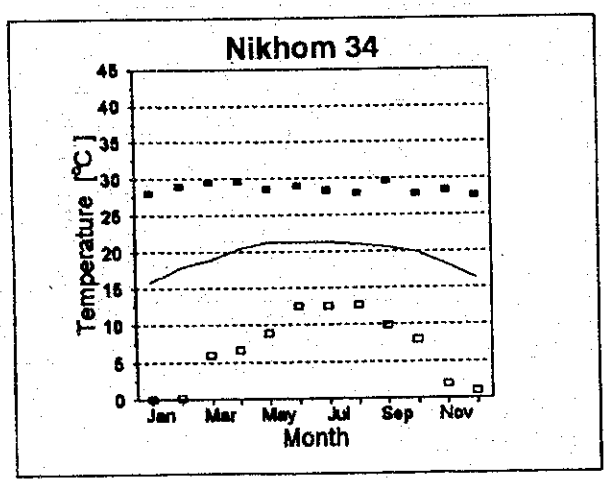
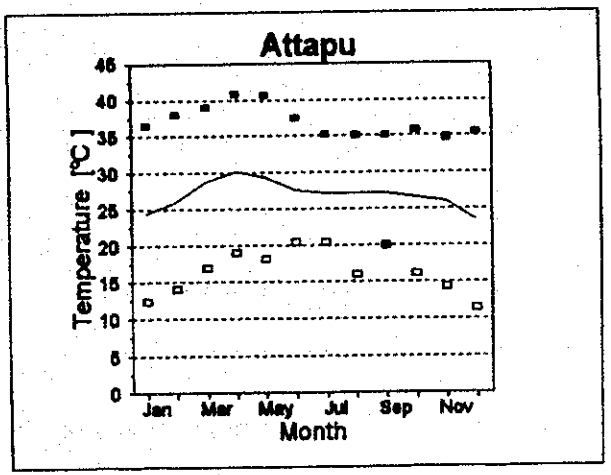


Fig. 6.3-3 Monthly Temperature









——— : Average ▬ : Extreme Maximum □ : Extreme Minimum

Fig. 6.3-4 Monthly Relative Humidity

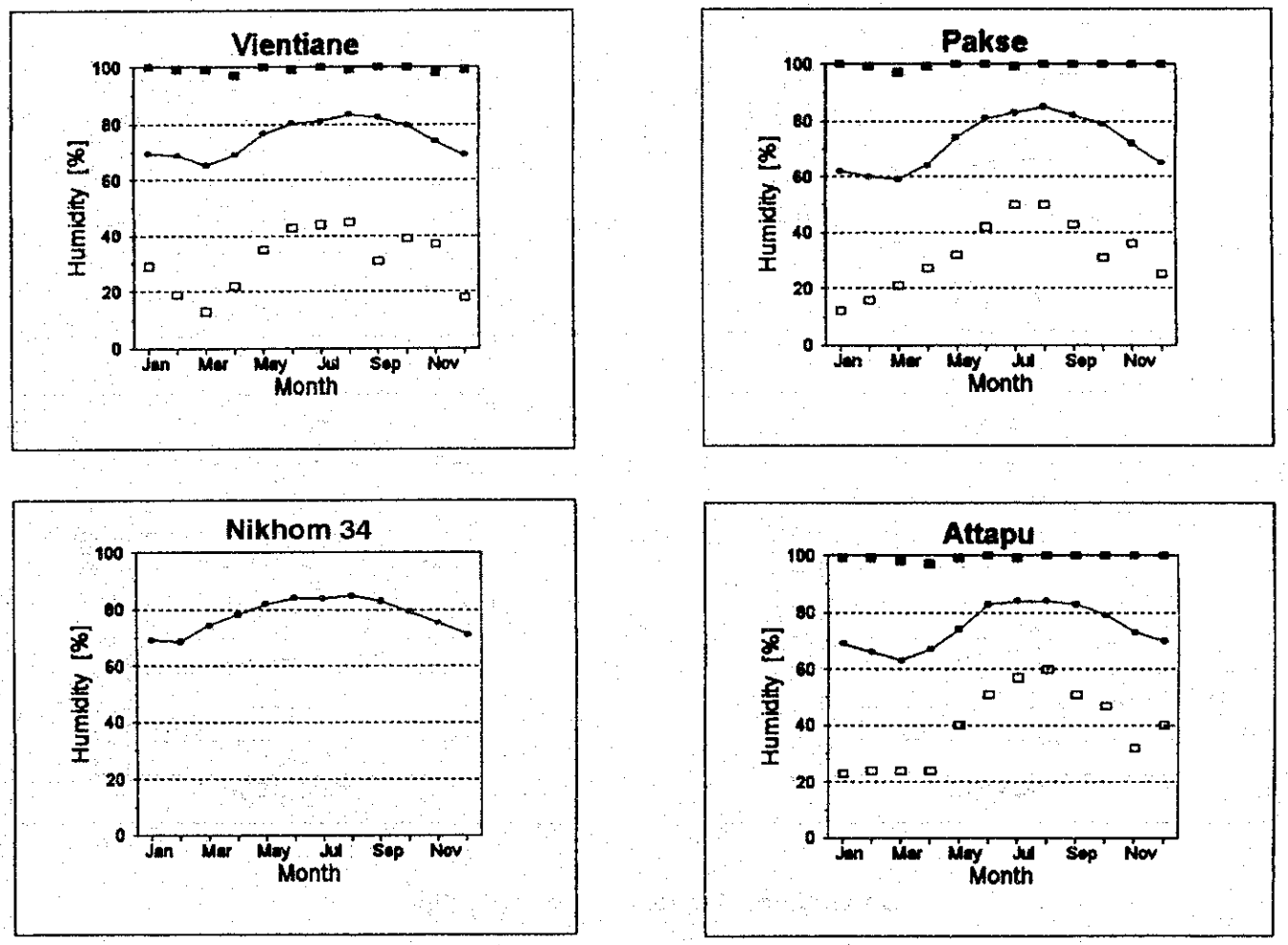
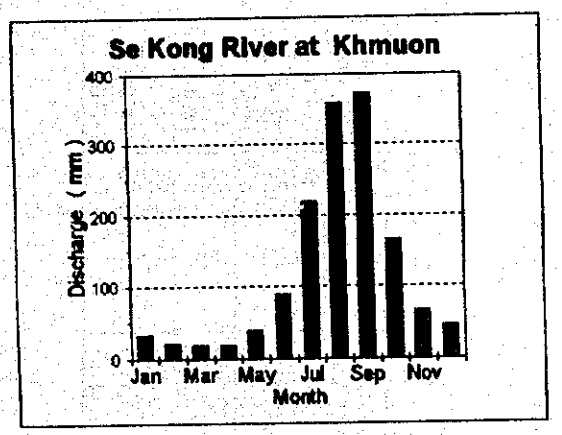
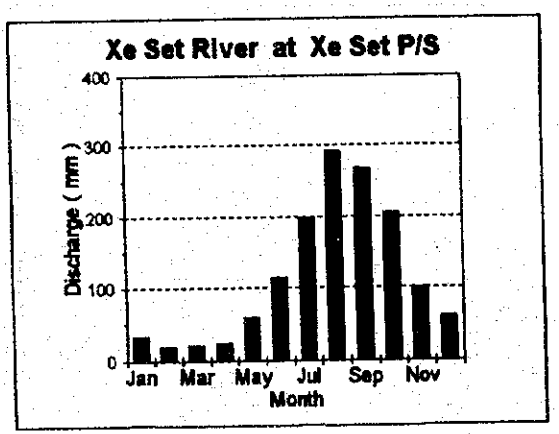
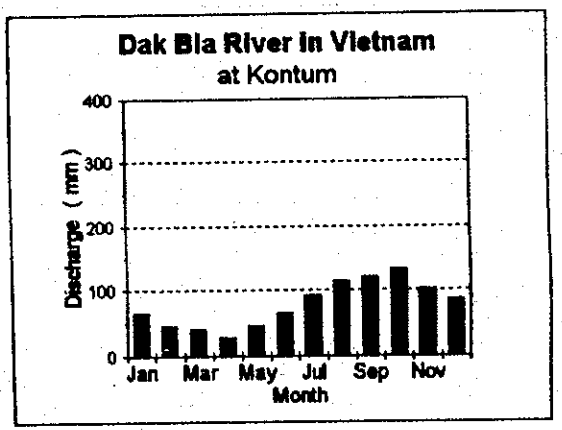
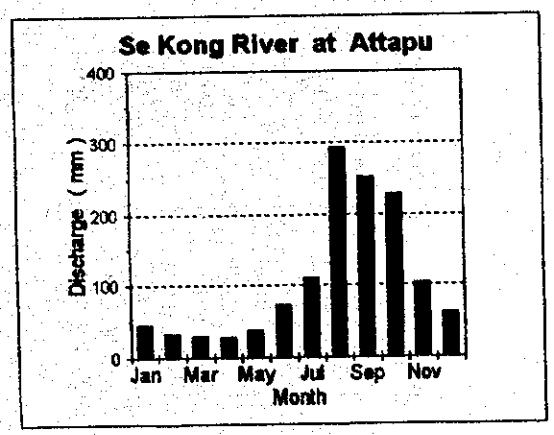


Fig. 6.3-5 Monthly Discharge (mm)









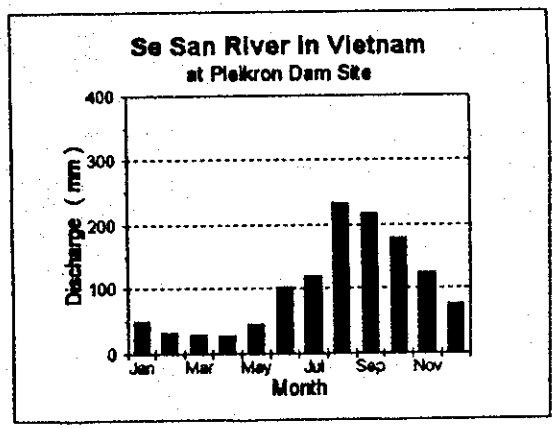
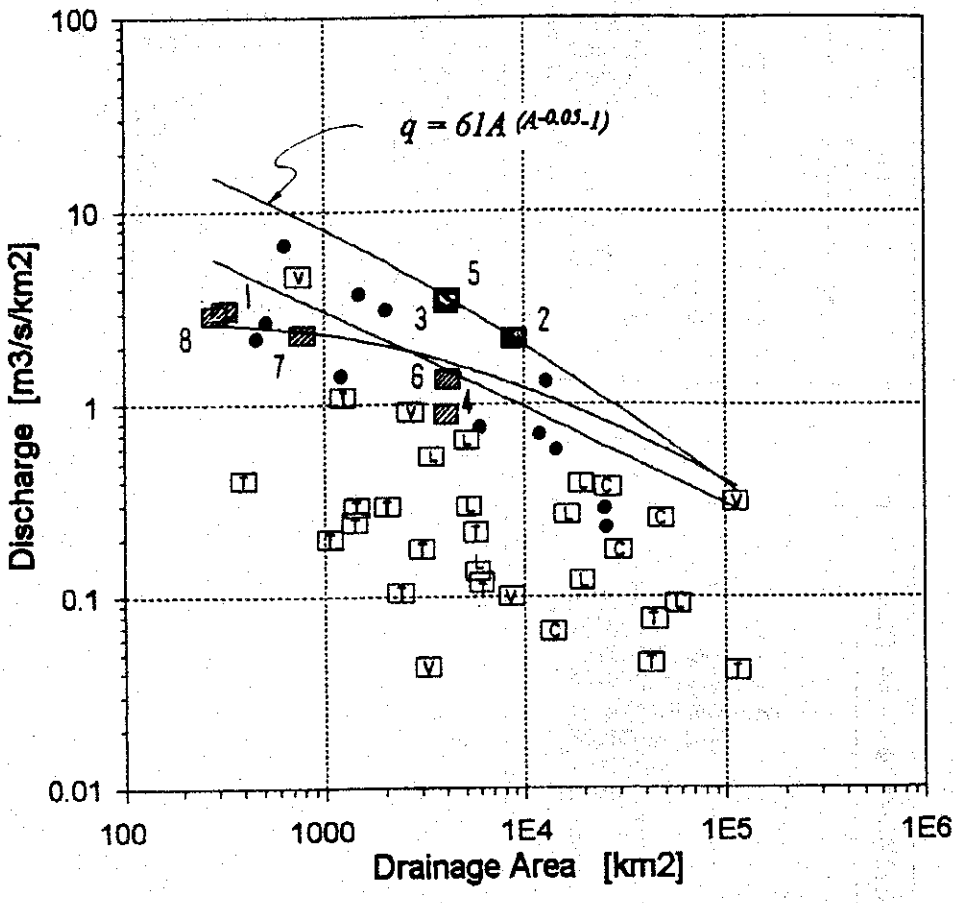


Fig. 6.3-6 Maximum Discharge and Design Flood in Laos and Adjacent Countries



Actual Maximum Discharges

- [L] : Data in Laos
- [T] : Data in Thailand
- [V] : Data in Vietnam
- [C] : Data in Cambodia

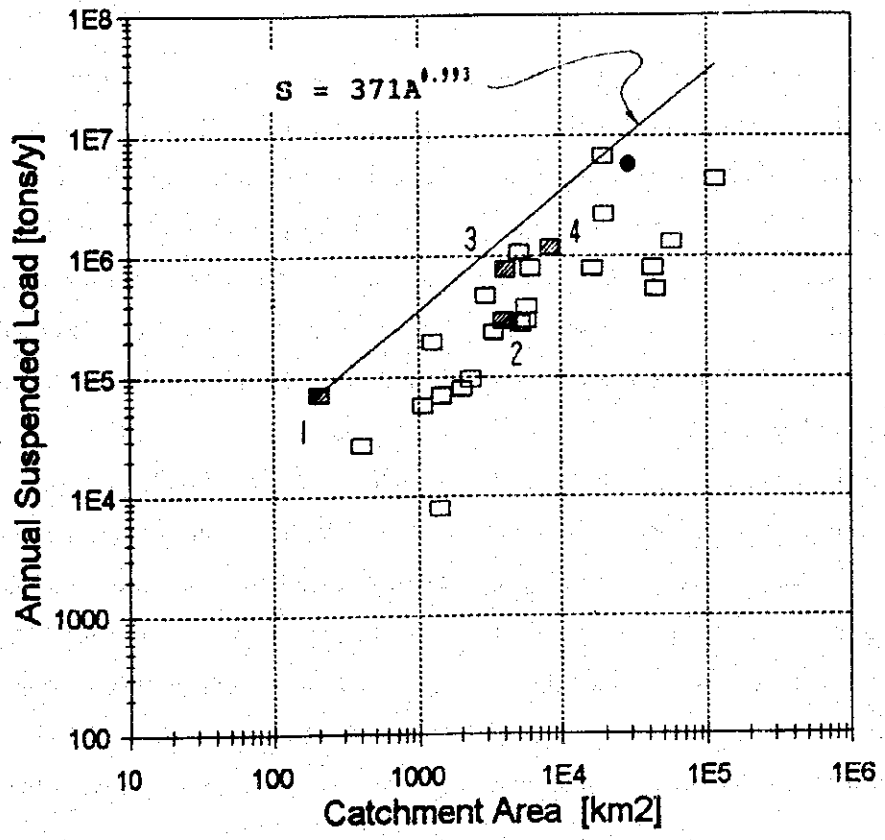
Design Floods

- ■ : Design Flood (PMF) in Laos
- ▨ : Design Flood (1/100) in Laos
- ● : Design Flood (PMF) in Thailand

Design Flood of Hydropower Project in Laos

No.	Project	Catchment Area [km2]	Design Flood [m3/s]	Flood per km2 [m3/s/km2]	Remarks
1	Xeset	325	1,000	3.08	1/100
2	Nam Theun 1/2	8,937	19,700	2.20	PMF
3	Nam Theun 2	4,013	13,515	3.37	PMF
4	Nam Theun 2	4,013	3,550	0.88	1/100
5	Xe Done 2	4,092	14,600	3.57	PMF
6	Xe Done 2	4,092	5,500	1.34	1/100
7	Xe Namnoy	784	1,800	2.30	1/100
8	Xe Katam	290	840	2.90	1/100

Fig. 6.3-7 Annual Suspended Load in Laos and Thailand (tons/year)



□ : Data from Mekong Committe (Reference No.8-2)

● : Se Kong River at Khmuon (C.A.=29,600 km2 load = 5,970,000 t/y)

▨ : Data quoted from F/S report in Laos

No.	Project	Catchment Area [km2]	Annual Suspended Load [t/y]
1	Namsai	203	72,500
2	Nam Thun 2	4013	292,000
3	Xe Done 2	4090	790,000
4	Nam Ngum	8460	1,200,000