ANNEX C : METEOROLOGY AND HYDROLOGY

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ANNEX C : METEOROLOGY AND HYDROLOGY

C.1 INTRODUCTION

C.1.1 The Objectives of The Study

The objectives of the study is to learn the meteorological and hydrological conditions prevailing in the study area of the Ariari River Basin Integrated Agricultural Development Project for the formulation of the development plan, and to carry out the analysis forthe design of basic dimensions of facilities.

C.1.2 Summary of Meteorology

The meteorological conditions in the study area can be summarized as follows:

Climate : Tropical Humidity
Annual Rainfall : 2,500 - 3,500 mm
(The variation depends on altitude)
- Rainy season from April to November
(85% of annual rainfall)
- Dry season from December to March
(15% of annual rainfall)
Temperature : Mean Temperature of 26℃ is almost constant throughout the year
Mean Annual Maximum Temperature - 36℃
Mean Annual Minimum Temperature - 17℃
Relative Humidity : Mean-82%, Rainy Season-85%, Dry Season-75%
Duration of Bright Sunshine : Annual mean - 5 hours/day
Mean Wind Velocity : 1.5 m/s

C.1.3 Summary of Hydrology

(1) Rainfall Analysis

- The correlation between annual rainfall and altitude in the Ariari basin was found out.

Correlation coefficient : R=84%
Correlation formula : (Annual Rainfall)=1428+4.688x(Altitude)

- Correlations of monthly rainfall between each rainfall station were studied and the lacking data were supplemented by correlations which have the correlation coefficient of over 75 %. Correlations of 10 days rainfall between the rainfall stations were also studied and no correlation was found out.

- The probability analysis of the rainfall data was made for 15 stations where the observation period was made for a periodof over 9 years and the annual rainfall patterns of droughty year for 2,5,10 and 20 year return periods were analyzed. And, using the result of stations at Lejanias and Caño Blanco, the annual rainfall patterns and effective rainfall at Aguas Claras and La Cooperativa were estimated.

- The probability analysis of annual maximum 24 hours rainfall were made for 13 stations and the annual maximum 24 hours rainfall of 2,5,10 and 20 year return periods were estimated.The results of the study area are summarized below:

Annual Maximum 24 Hours Rainfall (mm)

Station	Altitude (m)	Return Period 1/2	1/5	1/10	1/20
Lejanias	800	111.3	143.6	164.1	183.1
Aguas Claras	520	100.6	134.0	155.8	176.3
La Cooperativa	280	91.5	125.8	148.6	170.4
Puerto Limon	255	90.5	124.9	147.9	169.8

- The continuous drought days at the 15 stations mentioned above were analyzed by probability analysis. The results ofthe stations neighboring to the study area are summarized below:

Continuous Drought Days

Station	Altitude (m)	Return Period 1/2	1/5	1/10	1/20
Lejanias	800	21	35	45	55
Fuente de Oro	300	36	50	60	68
Puerto Limon	255	24	38	50	61
Caño Blanco	240	35	52	64	76

(2) Runoff Analysis

- The droughty discharge at the Angostura bridge of the Guape River were estimated as shown below:

Droughty Discharge at Angostura

Return Period	1/2	1/5	1/10	1/20
River Discharge (m³/s)	18.0	12.2	9.9	8.4
Specific Discharge (l/s/km²)	23.2	15.7	11.5	10.8

The annual river discharge pattern at the Angostura bridge and atthe main small stream in the study area are estimated by probability analysis.

- Considering the condition of the river basin and rainfall, the Storage Function Method was used to analyze the flood discharge of the Guape River and the Ariari River. The coefficients for the Storage Function Method were determinedbased on the actual discharge data at Puerto Rico and Angostura.The flood discharge at each point of the Guape and Ariari Rivers is shown below.

Flood Discharge of the Guape and Ariari Rivers (㎥/s)

Place	Area of Basin (km²)	Return Period 1/2	1/5	1/10	1/20
Lejanias	775.5	296	363	404	441
Puerto Caldas	1,697.3	457	521	557	588
Puerto Lleras	3,790.8	880	995	1,061	1,120
Platanal	4,657.2	846	951	1,010	1,061
Puerto Rico	6,250.4	1,025	1,154	1,225	1,287

The flood discharge at the main small stream in the study area and the relationship between flood discharge and catchment area are estimated.

C.2 AVAILABLE DATA

There are fifteen (15) rainfall stations, seven (7) meteorological stations and five (5) hydrological stations in the Ariari River Basin (See Table C-2-1 and Fig.C-2-1). However, among these stations only two (2) rainfall stations, two (2) meteorological stations and one (1) hydrological station are directly concerned with the study area, and the observation period of these stations are short. For example, the stations at Aguas Claras and La Cooperativa, both of which are existing in the study area, were established just in 1986 and the data is an available only for more or less one year period. Therefore, it is necessary to make use of the data compiled in neighboring stations of the study area.

The river discharge of the Guape River has been observed at Angostura bridge since 1984 and about four (4) years of data is available. Therefore to compensate the shortage of observation period at Angostura station, reference will be made to the data of the Puerto Rico station of the Ariari River which have the data since 1979.

In the pre-feasibility study conducted by HIMAT, hydrological analysis was made based on the data collected up to 1984, while in the present feasibility study, the same task is to be carried out with data collected up to 1987.

C.3 METEOROLOGY

C.3.1 Climate

The climate prevailing over the study area is classified as tropical humid. The annual rainfall pattern in dry season (from December to March) and rainy season (from April to November) are shown in Fig.C-3-1. Comparatively the relative humidity is high throughout the year and an annual rainfall of 2,500 to 3,500 mm can be expected.

C.3.2 Rainfall

Depending on the altitude, the mean annual rainfall varies from 2,500 to 3,500 mm in the study area. Rainy and dry seasons can be seen in the annual rainfall pattern and 85% of the annual rainfall is concentrated in the rainy season (from April to November). The rainfall data in the study area are summarized below:

Annual Rainfall Pattern in the Study Area (mm)

Station	Caño Blanco	La Cooperativa	Aguas Claras	Lejanias
Altitude	240m	280m	520m	800m
Observation period	9 years	2 years	2 years	9 years
Jan.	13	46	25	50
Feb.	108	142	225	150
Mar.	110	116	149	172
Apr.	269	156	304	388
May	285	269	239	448
Jun.	353	226	342	468
Jul.	266	410	381	431
Aug.	288	188	346	356
Sep.	194	238	271	346
Oct.	320	221	343	398
Nov.	192	202	178	184
Dec.	61	99	80	116
Annual	2,460	2,314	2,883	3,508

C.3.3 Other Factors

The data available is insufficient for the study area and other factors are estimated considering the data of stations in the neighboring area. Those meteorological data are summarized in Table C-3-1 and Fig.C-3-2.

(1) Temperature

The mean annual temperature is estimated as 26℃ and it is almost constant throughout the year. Based on the data of stations in the neighboring area, the mean annual maximum and mean annual minimum temperatures are estimated as 36℃ and 17℃ respectively. Generally, the highest temperature can be observed in March and the lowest temperature is expected between June to August.

(2) Relative Humidity

Mean relative humidity is estimated as 82% and is assumed to be almost constant throughout the year. Even in the rainy season, of relative humidity is expected as 85% and in the dry season the relative humidity is assumed as 75%.

(3) Duration of Bright Sunshine

The duration of bright sunshine is estimated as 4.6 hours/day. The bright sunshine duration in the dry season is estimated to be almost two times than that of the rainy season; however, more data is necessary to make it sure.

(4) Wind Velocity

Mean wind velocity is estimated as 1.5 m/s. A relationship is expected between wind velocity and altitude but the data is insufficient to correlate between these two factors. There is a tendency of that the wind velocity of the dry season is higher than that of the rainy season.

(5) Evaporation

Evaporation estimated in the study area is approximately 1,300 mm/year. However, the evaporation value will vary depending on the altitude.

C.4 HYDROLOGY

C.4.1 Rainfall Analysis

(1) Correlation Between Annual Rainfall and Altitude

The correlation between annual rainfall and altitude for the 21 rainfall stations was analyzed and the following results were obtained (See Fig.C-4-1).

Correlation coefficient : R=84%
Correlation Formula : (Annual Rainfall)=1428+4.688x(Altitude)

(2) Correlation of Monthly and 10 Days Rainfall between Each Rainfall Station and Supplement to Lacking Data

Correlation of monthly rainfall between each rainfall station was studied and the results are shown in Table C-4-1. The monthly lacking data were supplemented by correlation with the correlation coefficient of over 75%. Correlation of 10 days rainfall between each rainfall station was also studied and no correlation is found out.

(3) Annual Rainfall Pattern and Effective Rainfall of Drought Year

Probability analysis of the rainfall data of 15 stations where the observation were made for a period of over 9 years were carried out and the annual rainfall pattern of drought year for 2, 5, 10 and 20 year return periods were analyzed. Based on these results, the drought design effective rainfall was estimated by the method of U.S.Bureau of Reclamation as shown in Table C-4-2. The results were shown in Table C-4-3 and Fig.C-4-2.

Using the result of the stations at Lejanias and Caño Blanco, the annual rainfall pattern and effective rainfall at Aguas Claras and La Cooperativa were estimated (See Table C-4-4).

(4) Annual Maximum 24 hours Rainfall

Probability analysis of the annual maximum 24 hours rainfall of 15 stations mentioned above were carried out and the annual maximum

24 hours rainfall of 2,5,10 and 20 year return periods were estimated. The results are shown in Table C-4-5 and Fig.C-4-3 and for each station related with the study area are summarized below:

Annual Maximum 24 Hours Rainfall (mm)

Station	Altitude (m)	Return Period 1/2	1/5	1/10	1/20
Lejanias	800	111.3	143.6	164.1	183.1
Aguas Claras	520	100.6	134.0	155.8	176.3
La Cooperativa	280	91.5	125.8	148.6	170.4
Puerto Limon	255	90.5	124.9	147.9	169.8

(5) Continuous Drought Days

Probability analysis of the continuous drought days were carried out at 15 stations stated in (4). The results of the analysis are shown in Table C-4-6 and Fig.C-4-4 and the results of stations in the study area and it's vicinity are summarized below:

Continuous Drought Days

Station	Altitude (m)	Return Period 1/2	1/5	1/10	1/20
Lejanias	800	21	35	45	55
Fuente de Oro	300	36	50	60	68
Puerto Limon	255	24	38	50	61
Caño Blanco	240	35	52	64	76

C.4.2 Runoff Analysis

(1) The Basin of the Ariari

1) The Ariari River Basin

The study area is situated in the Ariari River system. The Ariari River system originates in the Eastern Range being located at

the departmental boundary between Meta and Huila and flows into the Guaviare, Meta and Orinoco Rivers successively. This river system has its own outfall to the Carribian Sea in Venezuela. The Ariari River system flow straight through the deep valley of mountain area because of their steep slope of river bed. On the other hand rivers show large scale meandering through jungles and plains.

2) The Study Area

The Ariari and Guape Rivers located at the northern boundary of the study area show unstable wandering and meandering in many parts of their courses because of frequent flood and river bed fluctuation. It is noted that many divided traces are shown in large flood plain area. Their river width is approximately 2 km in the section of each 10 km upper and lower reaches from the confluence between the Guape and Ariari Rivers.

Many small streams (caños) flow from west to east and have confluence at the Ariari River. The major caños are: Guanayas, Urichare, Mucuya, Sardinata etc. Many meandering and oxbow lakes as scars of meander could be found in the gentle slope near the river-mouth.

Specific Features of the Main River

River Cano	River Length	Altitude (m)	River Gradient	Remark
Guape-Ariari	83.5 km	250-780	1/70-1/800	Angostura bridge -Puerto Avichure
Guanayas	64.5 km	245-600	1/90-1/440	
Urichare	62.5 km	260-1000	1/8 -1/210	
Mucuya	32.3 km	290-540	1/70-1/180	
Sardinata	64.5 km	245-520	1/85-1/150	

(2) Droughty Discharge Analysis

1) The Droughty Discharge (355 day droughty discharge for 366 days)

Probability analysis of the droughty discharge at the Angostura

bridge of the Guape River and at Puerto Rico of the Ariari River were studied. The result is shown Table C-4-7 and Fig.C-4-5 and summarized below:

Droughty Discharge at Puerto Rico of the Ariari River
(Catchment Area 6250 km²)

Return Period	1/2	1/5	1/10	1/20
River Discharge (m³/s)	89.4	55.2	42.9	34.9
Specific Discharge (l/s/km²)	14.3	8.8	6.8	5.6

Droughty Discharge at Angostura of the Guape River
(Catchment Area 775 km²)

Return Period	1/2	1/5	1/10	1/20
River Discharge (m³/s)	18.0	12.2	9.9	8.4
Specific Discharge (l/s/km²)	23.2	15.7	11.5	10.8

2) The Annual River Discharge Pattern

Probability analysis of the annual river discharge pattern at the Angostura bridge of droughty year was studied and the result is shown in Table C-4-8 and Fig.C-4-6. The annual river discharge pattern is shown in Fig.C-4-7.

Probability analysis of the annual discharge pattern was studied for the droughty year of main caño in the study area. There is no data available for the analysis and the result of the analysis of the pre-feasible study conducted by HIMAT is used in this study. The results are shown in Table C-4-9 and Fig.C-4-8.

(3) Flood Analysis

1) Flood analysis for the Guape River and Ariari River

Considering the condition of the river basin and rainfall, the Storage Function Method was used to analyze the flood discharge of

the Guape River and the Ariari River. The analysis was conducted by following manner:

- Dividing the catchment area and the river
- Selection of the typical flood in the observation history
- Selection of the rainfall station
- Determining the coefficient of the Method (using the actual rainfall and river discharge data)
- Calculation of flood for 2,5,10 and 20 year return period

a) Dividing The Catchment Area and The River

Considering the condition of the rivers distributed in the basin, the Ariari River basin was divided into 8 catchment areas and the river was divided into 4 sections to make a model of the Storage Function Method (See Fig.C-4-9 and C-4-10).

b) Selection of The Typical Flood in The Observation History

Considering the data of river discharge at Angostura of the Guape River and at Puerto Rico of the Ariari River, the following typical flood data is selected for determining the coefficients of the Model.

- from 14/May to 13/June in 1982
- from 26/May to 30/June in 1985
- from 1/July to 31/July in 1987

c) Selection of Rainfall Station

Considering the location and accuracy of the rainfall data, 8 rainfall stations were selected as shown below:

- Lejanias Angostura station for catchment area No.1
- Calime station for catchment area No.2
- San Luis de Cubarral station for catchment area No.3
- Fuente de Oro station for catchment area No.4 and No.5
- Tierra Grata station for catchment area No.6
- Campo Alegre station for catchment area No.7
- Puerto Rico station for catchment area No.8
- La Holanda station for catchment area No.2, No.4 and No.5 of

the flood from 14/May to 13/June in 1982

d) Determining The Coefficient of The Method

The coefficients for the Storage Function Method were determined using the actual daily rainfall data and the actual river discharge data. The coefficients are shown in Table C-4-10 and comparison of actual data and the result of simulation is shown in Fig.C-4-11.

e) Calculation of flood for 2,5,10 and 20 year return periods

Probability analysis of the rainfall data at the station selected is carried out and the design rainfall for flood was obtained for 2,5,10 and 20 year return periods. Using the design rainfall, the flood discharge was calculated for each return period. The results are shown in Table C-4-11, Fig.C-4-12 and is summarized below:

Flood Discharge of the Guape and Ariari Rivers (m³/s)

Place	Catchment Area (km2)	Return Period 1/2	1/5	1/10	1/20
Lejanias	775.5	296	363	404	441
Puerto Cardas	1,697.3	457	521	557	588
Puerto Lleras	3,790.8	880	995	1,061	1,120
Platanal	4,657.2	846	951	1,010	1,061
Puerto Rico	6,250.4	1,025	1,154	1,225	1,287

2) Flood Analysis in The Study Area

The flood discharge of main caños in the study area was analyzed using The Rational Formula and the results of rainfall analysis. The result is shown in Table C-4-12 and relationship between flood discharge and catchment area is shown in Fig.C-4-13.

TABLES

Table C-2-1 SUMMARY OF METEOROLOGICAL AND HYDROLOGICAL STATIONS

Station		Coordinates	Elevation	Observation Period 1960 70 80 90
1. San Luis de Cubarral	(PM)	0347,7351	600	
2. Mesa de Yamanes	(PM)	0333,7352	600	
3. Vistahermosa	(CO)	0302,7344	325	
4. Calime	(PM)	0340,7352	800	
5. Las Dantas	(PM)	0354,7411	3996	
6. Piñalito	(PM)	0259,7338	245	
7. Puerto Lleras	(PM)	0317,7323	245	
8. Tierra Grata	(PM)	0312,7319	191	
9. Los Naranjos	(CO)	0328,7343	220	
10. Puerto Limon	(CO)	0322,7330	255	
11. La Holanda	(CO)	0331,7343	360	
12. Puerto Rico	(LM)	0301,7310	187	
13. Puerto Rico	(PM)	0256,7314	230	
14. Lejanias	(PM)	0331,7406	800	
15. Guape-Lejanias	(LM)	0332,7405	840	
16. Campo Alegre	(PM)	0312,7345	260	
17. Caño Blanco	(PM)	0315,7331	240	
18. Las Micos	(PM)	0313,7351	500	
19. Fuente de Oro	(PM)	0328,7338	300	
20. Penas Blancas	(PM)	0319,7355	440	
21. San Juan de Arama	(PM)	0321,7353	410	
22. Mesetas	(CO)	0321,7402	620	
23. Guejar Piñalito	(LM)	0257,7340	200	
24. Guejar Piñas Blancas	(LG)	0319,7355	440	
25. Guejar el Limon	(LM)	0319,7400	570	
26. Aguas Claras	(CO)	0328,7351	520	
27. La Cooperativa	(CO)	0322,7342	280	

Note : (PM) Rainfall Station
(LM),(LG) Hydrological Station
(CO) Meteorological Station

Table C-3-1 (1) Summary of Meteorogical Data (1)

STATION PTO LIMON (Altitude 255m)

ITEM		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Temprature	MEAN	26.5	26.6	26.7	26.0	25.6	24.8	24.6	24.9	25.2	25.5	25.6	25.8	25.7
(℃)	MAX	27.2	27.7	29.3	28.3	27.7	26.1	26.0	26.2	25.8	26.3	26.2	26.4	29.3
	MIN	24.8	25.2	25.0	25.0	24.7	24.1	24.0	24.2	24.6	24.8	24.6	24.7	24.0
Wind Velosity	MEAN	3,738	3,294	2,997	1,929	1,880	1,460	1,450	1,559	1,851	2,441	2,816	3,829	29,244
(kms)	MAX	6,337	5,509	4,909	3,106	2,311	1,965	1,750	1,855	2,197	3,028	3,439	5,318	6,337
	MIN	1,281	1,413	1,632	42	1,420	1,093	932	1,129	1,580	1,966	2,077	2,049	42
Evaporation	MEAN	144.0	136.8	133.0	113.9	112.2	99.1	102.8	101.4	108.8	113.1	114.0	124.7	1,403.0
(mm)	MAX	167.5	170.5	156.7	144.7	145.3	188.3	145.0	125.3	155.0	158.1	158.2	156.3	183.3
	MIN	107.3	89.1	86.4	85.6	79.0	61.3	72.7	67.7	71.9	74.5	84.6	75.5	61.3
Duration of Bright														
Sunshine	MEAN	193.3	157.5	128.5	111.8	123.6	101.9	117.4	118.8	147.5	154.3	166.3	185.5	1,706.4
(HOURAS)	MAX	239.6	203.3	179.3	138.9	161.4	134.6	163.0	160.1	188.8	183.3	196.6	234.6	239.6
	MIN	155.6	120.1	71.7	54.1	83.4	74.1	68.6	62.7	127.3	127.3	130.6	125.0	54.1

Table C-3-1 (2) Summary of Meteorogical Data (2)

STATION HOLANDA LA (Altitude 360m)

ITEM		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Temprature	MEAN		26.2	26.5	26.3	25.4	24.7	24.5	24.6	25.4	25.0	25.1	25.3	25.4
(℃)	MAX		26.8	27.0	28.2	25.9	24.9	25.6	24.8	25.8	25.0	25.1	25.4	28.2
	MIN		25.8	25.9	25.3	25.0	24.5	23.8	24.2	24.9	24.9	25.1	25.2	23.8
Wind Velosity	MEAN	2,613	2,692	2,607	1,950	1,480	1,298	1,341	1,828	1,795	2,459	2,410	2,730	25,203
(kms)	MAX	3,654	4,147	3,419	2,796	1,800	1,706	1,805	2,364	2,180	2,917	3,145	4,055	4,147
	MIN	1,151	1,481	1,351	941	1,013	843	968	1,560	1,015	1,972	1,683	1,611	843
Evaporation	MEAN	142.5	126.8	103.2	85.1	90.9	87.1	84.0	95.3	91.2	92.2	100.6	108.7	1,207.6
(mm)	MAX	154.2	139.0	132.4	92.4	111.1	120.7	96.3	129.1	114.5	122.7	104.4	138.5	154.2
	MIN	130.7	114.5	78.1	79.8	73.1	69.5	67.4	69.1	50.2	32.9	94.6	77.8	32.9
Relative Humidity														
(%)	MEAN		77.0	75.0	76.0	85.0	85.0	85.0	85.0	84.0	85.0	83.0	81.0	82.0
	MAX		82.0	78.0	86.0	86.0	87.0	89.0	87.0	85.0	87.0	83.0	82.0	89.0
	MIN		73.0	68.0	61.0	83.0	83.0	80.0	82.0	83.0	83.0	83.0	80.0	61.0

Table C-3-1 (3) Summary of Meteorogical Data (3)

STATION MESETAS (Altitude 620m)

ITEM		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Temprature	MEAN	24.3	24.9	24.9	24.1	23.6	23.4	23.2	23.0	23.7	23.9	24.1	24.8	24.0
(℃)	MAX	24.9	25.8	25.7	24.9	24.1	24.5	24.5	23.0	24.3	24.6	24.9	25.6	25.8
	MIN	23.7	23.9	24.1	23.3	23.1	22.3	22.5	22.9	23.0	23.2	23.5	24.0	22.3
Evaporation	MEAN	135.3	100.2	114.3	88.6	89.9	68.3	85.3	95.3	90.5	93.6	100.6	125.2	1,187.1
(mm)	MAX	149.1	116.0	117.2	100.2	90.3	78.9	95.7	100.3	102.0	100.5	107.2	128.5	149.1
	MIN	116.5	84.3	109.7	80.4	89.5	57.7	66.0	91.4	83.3	89.6	94.7	121.7	57.7
Relative Humidity														
(%)	MEAN	85.0	83.0	84.0	86.0	89.0	92.0	90.0	87.0	88.0	88.0	88.0	80.0	87.0
	MAX	85.0	83.0	84.0	88.0	89.0	92.0	90.0	87.0	89.0	91.0	93.0	80.0	93.0
	MIN	85.0	83.0	84.0	84.0	88.0	92.0	89.0	87.0	86.0	86.0	85.0	80.0	80.0
Duration of Bright														
Sunshine	MEAN	177.1	135.3	144.6	103.9	113.2	100.5	123.7	127.8	130.7	127.2	121.3	174.0	1,579.3
(HOURAS)	MAX	193.3	167.6	144.6	128.7	129.7	125.0	137.7	156.5	133.1	127.2	128.5	183.9	193.3
	MIN	160.8	103.0	144.6	79.0	89.7	85.8	116.1	97.4	124.6	127.2	114.1	167.4	79.0

Table C-3-1 (4) Summary of Meteorogical Data (4)

STATION VISTAHERMOSA (Altitude 325m)

ITEM		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Temprature	MEAN	27.3	27.4	26.8	25.4	25.3	24.4	24.4	24.7	25.3	25.7	26.0	26.4	25.7
(℃)	MAX	28.8	30.6	27.7	26.4	25.9	25.9	24.9	25.2	26.3	27.0	26.4	27.5	30.6
	MIN	25.9	25.9	25.8	24.9	24.7	22.9	23.7	23.6	23.5	25.0	25.6	25.6	22.9
Wind Velosity	MEAN	4,947	3,800	3,271	2,337	2,242	1,971	1,882	1,830	1,960	2,557	3,183	4,156	34,136
(kms)	MAX	5,610	5,466	3,779	3,248	2,776	2,268	2,166	2,638	2,414	3,370	4,069	6,452	6,452
	MIN	4,007	2,783	2,231	1,933	1,593	1,547	1,256	421	710	994	955	2,527	421
Evaporation	MEAN	86.0	91.9	264.9	128.1	83.9	105.6	156.2	156.2	119.2	130.2	103.1	143.9	1,517.3
(mm)	MAX	86.0	91.9	264.9	129.4	88.5	118.2	183.7	183.7	147.8	137.4	103.1	143.9	264.9
	MIN	86.0	91.9	264.9	126.7	79.2	85.8	85.8	134.5	88.9	122.1	103.1	143.9	79.2
Duration of Bright Sunshine	MEAN	173.6	140.5	114.5	108.3	118.7	97.3	107.1	130.4	140.3	153.2	161.5	168.4	1,613.8
(HOURAS)	MAX	240.5	206.1	149.1	142.6	151.2	123.9	164.7	164.7	161.6	175.4	198.8	228.8	240.5
	MIN	75.3	97.4	76.1	83.0	67.8	32.9	75.9	106.6	105.7	136.6	134.4	108.7	32.9
Relative Humidity														
(%)	MEAN	69.0	70.0	76.0	84.0	84.0	86.0	85.0	83.0	82.0	82.0	80.0	76.0	80.0
	MAX	76.0	77.0	82.0	94.0	88.0	90.0	89.0	88.0	88.0	85.0	84.0	82.0	94.0
	MIN	58.0	58.0	70.0	76.0	81.0	81.0	80.0	79.0	78.0	77.0	74.0	67.0	58.0

Table. C-4-1 (1) Correlation of Monthly Rainfall (1/28)

	St.Code	1	2	3	4
		SANLUIS DE CUBARRAL	MESA DE YAMANES	VISTAHERMOSA	CALIME
1	SANLUIS DE CUBARRAL		R=0.665 N=139 A=193.000 B=1.002	R=0.528 N=175 A=252.495 B=0.894	R=0.741 N=78 A=128.096 B=0.629
2	MESA DE YAMANES	R=0.665 N=139 A=73.079 B=0.442		R=0.562 N=153 A=127.504 B=0.646	R=0.690 N=46 A=45.670 B=0.481
3	VISTAHERMOSA	R=0.528 N=175 A=80.635 B=0.312	R=0.562 N=153 A=89.414 B=0.489		R=0.638 N=71 A=40.417 B=0.386
4	CALIME	R=0.741 N=78 A=86.251 B=0.871	R=0.690 N=46 A=198.219 B=0.991	R=0.638 N=71 A=215.736 B=1.056	
5	LAS DANTAS	R=0.242 N=12 A=118.323 B=0.049	R=0.411 N=12 A=94.558 B=0.148	R=0.470 N=9 A=104.013 B=0.261	----------
6	PIÑALITO	R=0.468 N=68 A=68.059 B=0.315	R=0.678 N=38 A=69.021 B=0.549	R=0.506 N=69 A=99.466 B=0.458	R=0.396 N=55 A=79.986 B=0.229

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (2) Correlation of Monthly Rainfall (2/28)

	St.Code	1	2	3	4
		SANLUIS DE CUBARRAL	MESA DE YAMANES	VISTAHERMOSA	CALIME
7	PUERTO LLERAS	R=0.352 N=72 A=74.293 B=0.520	R=0.290 N=42 A=170.493 B=0.647	R=0.264 N=67 A=165.043 B=0.585	R=0.221 N=60 A=148.993 B=0.305
8	TIERRA GRATA	R=0.638 N=44 A=1.762 B=0.597	R=0.471 N=25 A=93.838 B=0.551	R=0.729 N=38 A=45.142 B=0.838	R=0.631 N=46 A=38.512 B=0.432
9	LOS NARANJOS	R=0.539 N=60 A=99.915 B=0.359	R=0.697 N=68 A=55.076 B=0.661	R=0.545 N=62 A=128.791 B=0.643	---------- ---------- ---------- ----------
10	PUERTO LIMON	R=0.583 N=139 A=84.206 B=0.298	R=0.738 N=132 A=51.175 B=0.533	R=0.696 N=154 A=65.606 B=0.637	R=0.755 N=35 A=-26.969 B=0.508
11	LA HOLANDA	R=0.712 N=72 A=31.083 B=0.438	R 0.595 N=33 A=76.456 B=0.533	R=0.733 N=70 A=50.496 B=0.720	R=0.709 N=57 A=48.447 B=0.371
13	PUERTO RICO	R=0.699 N=78 A=32.659 B=0.523	R=0.506 N=36 A=123.794 B=0.499	R=0.501 N=73 A=119.940 B=0.557	R=0.506 N=62 A=95.690 B=0.298

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (3) Correlation of Monthly Rainfall (3/28)

	St.Code	1	2	3	4
		SANLUIS DE CUBARRAL	MESA DE YAMANES	VISTAHERMOSA	CALIME
14	LEJANIAS	R=0.797 N=67 A=23.148 B=0.689	R=0.627 N=36 A=111.658 B=0.804	R=0.745 N=63 A=102.588 B=0.895	R=0.713 N=62 A=72.265 B=0.522
15	GUAPE-LEJANIAS	R=0.758 N=31 A=97.537 B=1.093	R=0.697 N=8 A=348.544 B=1.295	R=0.700 N=25 A=229.204 B=1.350	R=0.669 N=31 A=226.508 B=0.662
16	CAMPO ALEGRE	R=0.720 N=67 A=0.058 N=0.579	R=0.692 N=36 A=51.802 B=0.758	R=0.722 N=63 A=44.923 B=0.834	R=0.669 N=56 A=25.384 B=0.458
17	CANO BLANCO	R=0.656 N=62 A=30.679 B=0.460	R=0.661 N=45 A=71.162 B=0.601	R=0.687 N=63 A=57.637 B=0.667	R=0.661 N=58 A=48.387 B=0.381
18	LOS MICOS	R=0.738 N=73 A=10.465 B=0.702	R=0.724 N=41 A=99.028 B=0.811	R=0.608 N=69 A=110.580 B=0.812	R=0.682 N=69 A=54.897 B=0.547
19	FUENTE DE ORO	R=0.804 N=61 A=-15.124 B=0.579	R=0.589 N=37 A=96.288 B=0.520	R=0.596 N=58 A=86.120 B=0.599	R=0.687 N=56 A=28.332 B=0.430

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (4) Correlation of Monthly Rainfall (4/28)

	St.Code	1	2	3	4
		SANLUIS DE CUBARRAL	MESA DE YAMANES	VISTAHERMOSA	CALIME
20	PENAS BLANCAS	R=0.504 N=37 A=-10.851 B=0.977	R=0.611 N=22 A=-27.124 B=2.086	R=0.437 N=36 A=134.782 B=1.071	R=0.363 N=39 A=157.496 B=0.496
21	SAN JUAN DE ARAMA	R=0.749 N=34 A=21.440 B=0.563	R=0.745 N=22 A=53.389 B=0.836	R=0.559 N=35 A=125.988 B=0.465	R=0.600 N=36 A=114.475 B=0.297
22	MESETAS	R=0.885 N=22 A=-4.671 B=0.624	R=0.822 N=7 A=68.634 B=1.255	R=0.779 N=17 A=68.876 B=0.757	R=0.778 N=22 A=86.979 B=0.355
26	AGUAS CLARAS	R=0.846 N=17 A=3.253 B=0.642	R=0.832 N=3 A=-426.100 B=3.909	R=0.922 N=14 A=56.250 B=0.597	R=0.625 N=17 A=101.661 B=0.298
27	LA COOPERATIVA	R=0.775 N=13 A=9.903 B=0.550	---------- ---------- ---------- ----------	R=0.739 N=12 A=63.242 B=0.552	R=0.550 N=13 A=84.673 B=0.218

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (5) Correlation of Monthly Rainfall (5/28)

	St.Code	5	6	7	8
		LAS DANTAS	PIÑALITO	PUERTO LLERAS	TIERRA GRATA
1	SANLUIS DE CUBARRAL	R=0.242 N=12 A=277.147 B=1.197	R=0.468 N=68 A=284.151 B=0.696	R=0.352 N=72 A=344.279 B=0.239	R=0.638 N=44 A=229.767 B=0.683
2	MESA DE YAMANES	R=0.411 N=12 A=147.436 B=1.142	R=0.678 N=38 A=92.610 B=0.838	R=0.290 N=42 A=217.254 B=0.130	R=0.471 N=25 A=154.802 B=0.402
3	VISTAHERMOSA	R=0.470 N=9 A=69.038 B=0.849	R=0.506 N=69 A=113.369 B=0.558	R=0.264 N=67 A=188.209 B=0.119	R=0.729 N=38 A=71.949 B=0.634
4	CALIME	----------	R=0.396 N=55 A=361.550 B=0.687	R=0.221 N=60 A=395.467 B=0.161	R=0.631 N=46 A=231.148 B=0.923
5	LAS DANTAS		----------	----------	----------
6	PIÑALITO	----------		R=0.162 N=58 A=186.876 B=0.072	R=0.616 N=33 A=73.963 B=0.420

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (6) Correlation of Monthly Rainfall (6/28)

	St.Code	5	6	7	8
		LAS DANTAS	PIÑALITO	PUERTO LLERAS	TIERRA GRATA
7	PUERTO LLERAS	----------	R=0.162 N=58 A=221.580 B=0.387		R=0.244 N=44 A=130.662 B=0.462
8	TIERRA GRATA	----------	R=0.616 N=33 A=96.744 B=0.902	R=0.244 N=44 A=194.083 B=0.129	
9	LOS NARANJOS	R=0.348 N=40 A=137.837 B=0.557	----------	----------	----------
10	PUERTO LIMON	R=0.491 N=19 A=68.323 B=0.946	R=0.673 N=38 A=49.347 B=0.899	R=0.624 N=36 A=42.603 B=0.809	R=0.776 N=9 A=53.870 B=0.797
11	LA HOLANDA	----------	R=0.289 N=56 A=156.680 B=0.289	R=0.123 N=60 A=203.286 B=0.050	R=0.559 N=42 A=130.177 B=0.387
13	PUERTO RICO	----------	R=0.664 N=63 A=102.291 B=0.718	R=0.372 N=69 A=192.957 B=0.227	R=0.523 N=41 A=109.075 B=0.417

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (7) Correlation of Monthly Rainfall (7/28)

	St.Code	5	6	7	8
		LAS DANTAS	PIÑALITO	PUERTO LLERAS	TIERRA GRATA
14	LEJANIAS	———	R=0.289 N=54 A=229.214 B=0.421	R=0.298 N=64 A=236.445 B=0.158	R=0.701 N=49 A=131.445 B=0.703
15	GUAPE-LEJANIAS	———	R=0.324 N=22 A=456.438 B=0.633	R=0.525 N=28 A=290.563 B=1.603	R=0.686 N=32 A=287.468 B=0.969
16	CAMPO ALEGRE	———	R=0.425 N=55 A=161.130 B=0.507	R=0.331 N=63 A=193.482 B=0.175	R=0.552 N=40 A=100.820 B=0.474
17	CANO BLANCO	———	R=0.421 N=52 A=124.079 B=0.449	R=0.554 N=58 A=145.381 B=0.223	R=0.645 N=45 A=100.386 B=0.478
18	LOS MICOS	———	R=0.493 N=57 A=160.069 B=0.707	R=0.266 N=63 A=244.404 B=0.163	R=0.730 N=47 A=123.068 B=0.752
19	FUENTE DE ORO	———	R=0.428 N=49 A=120.024 B=0.452	R=0.331 N=58 A=174.485 B=0.144	R=0.623 A=41 A=112.701 B=0.462

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (8) Correlation of Monthly Rainfall (8/28)

	St.Code	5	6	7	8
		LAS DANTAS	PIÑALITO	PUERTO LLERAS	TIERRA GRATA
20	PENAS BLANCAS	———	R=0.306 N=30 A=239.135 B=0.858	R=0.506 N=40 A=126.261 B=1.502	R=0.402 N=42 A=189.235 B=0.749
21	SAN JUAN DE ARAMA	———	R=0.254 N=30 A=195.235 B=0.261	R=0.455 N=37 A=162.017 B=0.505	R=0.614 N=39 A=144.047 B=0.416
22	MESETAS	———	R=0.005 N=16 A=274.642 B=0.004	R=0.431 N=20 A=159.934 B=0.642	R=0.581 N=23 A=142.935 B=0.387
26	AGUAS CLARAS	———	R=0.160 N=17 A=236.761 B=0.143	R=0.595 N=15 A=148.480 B=0.811	R=0.700 N=18 A=147.508 B=0.382
27	LA COOPERATIVA	———	R=0.475 N=14 A=135.966 B=0.320	R=0.672 N=11 A=111.122 B=0.692	R=0.713 N=14 A=110.458 B=0.329

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (9) Correlation of Monthly Rainfall (9/28)

	St.Code	9	10	11	13
		LOS NARANJOS	PUERTO LIMON	LA HOLANDA	PUERTO RICO
1	SANLUIS DE CUBARRAL	R=0.539 N=60 A=281.390 B=0.809	R=0.583 N=139 A=235.351 B=1.143	R=0.712 N=72 A=165.546 B=1.158	R=0.699 N=78 A=178.259 B=0.935
2	MESA DE YAMANES	R=0.697 N=68 A=121.168 B=0.735	R=0.738 N=132 A=76.892 B=1.022	R=0.595 N=33 A=111.905 B=0.864	R=0.506 N=36 A=118.726 B=0.513
3	VISTAHERMOSA	R=0.545 N=62 A=101.568 B=0.461	R=0.696 N=154 A=60.108 B=0.760	R=0.733 N=70 A=63.258 B=0.747	R=0.501 N=73 A=113.459 B=0.451
4	CALIME	———	R=0.755 N=35 A=213.598 B=1.122	R=0.709 N=57 A=150.920 B=1.358	R=0.506 N=62 A=246.552 B=0.858
5	LAS DANTAS	R=0.348 N=40 A=129.278 B=0.217	R=0.491 N=19 A=105.085 B=0.255	———	———
6	PIÑALITO	———	R=0.673 N=38 A=86.569 B=0.648	R=0.289 N=56 A=132.268 B=0.288	R=0.664 N=63 A=46.755 B=0.814

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (10) Correlation of Monthly Rainfall (10/28)

	St.Code	9	10	11	13
		LOS NARANJOS	PUERTO LIMON	LA HOLANDA	PUERTO RICO
7	PUERTO LLERAS	———	R=0.624 N=36 A=139.353 B=0.639	R=0.123 N=60 A=210.012 B=0.301	R=0.372 N=69 A=108.395 B=0.612
8	TIERRA GRATA	———	R=0.776 N=9 A=48.076 B=0.756	R=0.559 N=42 A=64.631 B=0.808	R=0.523 N=41 A=99.539 B=0.657
9	LOS NARANJOS		R=0.637 N=75 A=82.215 B=0.811	———	———
10	PUERTO LIMON	R=0.637 N=75 A=96.077 B=0.500		R=0.781 N=32 A=42.916 B=0.883	———
11	LA HOLANDA	———	R=0.781 N=32 A=49.640 B=0.691		———
13	PUERTO RICO	———	R=0.589 N=35 A=137.283 B=0.586	R=0.548 N=68 A=104.413 B=0.694	

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (11) Correlation of Monthly Rainfall (11/28)

	St.Code	9	10	11	13
		LOS NARANJOS	PUERTO LIMON	LA HORANDA	PUERTO RICO
14	LEJANIAS	----------	R=0.833 N=29 A=74.349 B=0.984	R=0.787 N=61 A=81.228 B=1.007	----------
15	GUAPE-LEJANIAS	----------	----------	R=0.790 N=34 A=116.364 B=1.728	----------
16	CAMPO ALEGRE	----------	R=0.808 N=31 A=38.622 B=0.964	R=0.730 N=59 A=47.142 B=0.879	----------
17	CANO BLANCO	----------	R=0.881 N=29 A=16.391 B=0.809	R=0.720 N=51 A=50.428 B=0.746	----------
18	LOS MICOS	----------	R=0.858 N=33 A=49.534 B=1.196	R=0.765 N=59 A=56.801 B=1.146	----------
19	FUENTE DE ORO	----------	R=0.831 N=29 A=41.435 B=0.802	R=0.820 N=51 A=33.191 B=0.905	----------

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (12) Correlation of Monthly Rainfall (12/28)

	St.Code	9	10	11	13
		LAS DANTAS	PUERTO LIMON	LA HORANDA	PUERTO RICO
20	PENAS BLANCAS	----------	R=0.569 N=11 A=-55.197 B=2.760	R=0.364 N=39 A=139.854 B=1.003	----------
21	SAN JUAN DE ARAMA	----------	R=0.684 N=11 A=89.109 B=0.787	R=0.684 N=36 A=76.925 B=0.741	----------
22	MESETAS	----------	----------	R=0.847 N=24 A=24.822 B=0.911	----------
26	AGUAS CLARAS	----------	----------	R=0.723 N=19 A=61.735 B=0.759	----------
27	LA COOPERATIVA	----------	----------	R=0.654 N=16 A=72.097 B=0.535	----------

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (13) Correlation of Monthly Rainfall (13/28)

	St.Code	14	15	16	17
		LEJANIAS	GUAPE-LEJANIAS	CAMPO ALEGRE	CANO BLANCO
1	SANLUIS DE CUBARRAL	R=0.787 N=67 A=140.203 B=0.974	R=0.758 N=31 A=113.601 B=0.526	R=0.720 N=67 A=206.146 B=0.895	R=0.856 N=62 A=209.318 B=0.935
2	MESA DE YAMANES	R=0.627 N=36 A=81.299 B=0.489	R=0.697 N=8 A=-28.614 B=0.375	R=0.692 N=36 A=112.607 B=0.633	R=0.661 N=45 A=91.320 B=0.727
3	VISTAHERMOSA	R=0.745 N=63 A=27.415 B=0.621	R=0.700 N=25 A=24.545 B=0.363	R=0.722 N=63 A=84.213 B=0.625	R=0.687 N=63 A=75.360 B=0.707
4	CALIME	R=0.713 N=62 A=140.203 B=0.974	R=0.669 N=31 A=92.543 B=0.677	R=0.669 N=56 A=241.175 B=0.977	R=0.661 N=58 A=209.314 B=1.147
5	LAS DANTAS	----------	----------	----------	----------
6	PIÑALITO	R=0.289 N=54 A=115.527 B=0.199	R=0.324 N=22 A=90.653 B=0.166	R=0.425 N=55 A=108.902 B=0.356	R=0.421 N=52 A=117.101 B=0.394

Note. R : Correlation. %. N : Number of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (14) Correlation of Monthly Rainfall (14/28)

	St.Code	14	15	16	17
		LEJANIAS	GUAPE-LEJANIAS	CAMPO ALEGRE	CANO BLANCO
7	PUERTO LLERAS	R=0.298 N=64 A=116.988 B=0.562	R=0.525 N=28 A=50.654 B=0.172	R=0.331 N=63 A=156.435 B=0.825	R=0.554 N=58 A=-2.215 B=1.377
8	TIERRA GRATA	R=0.701 N=49 A=29.327 B=0.700	R=0.686 N=32 A=-6.388 B=0.485	R=0.552 N=40 A=113.243 B=0.643	R=0.845 N=45 A=55.940 B=0.871
9	LOS NARANJOS	----------	----------	R=0.808 N=31 A=42.444 B=0.678	----------
10	PUERTO LIMON	R=0.833 N=29 A=-2.975 B=0.705	----------	----------	R=0.881 N=29 A=30.966 B=0.959
11	LA HOLANDA	R=0.787 N=61 A=33.001 B=0.816	R=0.780 N=34 A=45.227 B=0.362	R=0.730 N=59 A=76.401 B=0.607	R=0.720 N=51 A=72.020 B=0.696
13	PUERTO RICO	R=0.557 N=63 A=89.573 N=0.473	R=0.563 N=32 A=69.308 B=0.309	R=0.620 N=62 A=107.219 B=0.597	R=0.514 N=55 A=115.857 B=0.543

Note. R : Correlation. %. N : Number of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (15) Correlation of Monthly Rainfall (15/28)

	St.Code	14	15	16	17
		LEJANIAS	GUAPE-LEJANIAS	CAMPO ALEGRE	CANO BLANCO
14	LEJANIAS		R=0.848 N=34 A=24.980 B=0.565	R=0.731 N=61 A=124.665 B=0.831	R=0.642 N=62 A=133.269 B=0.818
15	GUAPE-LEJANIAS	R=0.848 N=34 A=113.708 B=1.274		R=0.642 N=25 A=308.448 B=1.041	R=0.701 N=33 A=218.733 B=1.586
16	CAMPO ALEGRE	R=0.731 N=61 A=22.766 B=0.643	R=0.642 N=25 A=13.236 B=0.396		R=0.730 N=53 A=33.013 B=0.921
17	CANO BLANCO	R=0.642 N=62 A=50.925 B=0.503	R=0.701 N=30 A=38.916 B=0.309	R=0.730 N=53 A=89.821 B=0.578	
18	LOS MICOS	R=0.774 N=71 A=41.298 B=0.804	R=0.701 N=34 A=60.563 B=0.490	R=0.765 N=62 A=93.047 B=0.908	R=0.675 N=67 A=103.772 B=0.954
19	FUENTE DE ORO	R=0.786 N=59 A=11.519 B=0.695	R=0.747 N=27 A=48.335 B=0.371	R=0.775 N=53 A=77.364 B=0.845	R=0.731 N=54 A=73.297 B=0.737

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (16) Correlation of Monthly Rainfall (16/28)

	St.Code	14	15	16	17
		LEJANIAS	GUAPE-LEJANIAS	CAMPO ALEGRE	CANO BLANCO
20	PENAS BLANCAS	----------	R=0.569 N=11 A=-55.197 B=2.760	R=0.364 N=39 A=139.854 B=1.003	----------
21	SAN JUAN DE ARAMA	----------	R=0.684 N=11 A=89.109 B=0.787	R=0.684 N=36 A=76.925 B=0.741	----------
22	MESETAS	----------	----------	R=0.847 N=24 A=24.622 B=0.911	----------
26	AGUAS CLARAS	----------	----------	R=0.723 N=19 A=61.735 B=0.759	----------
27	LA COOPERATIVA	----------	----------	R=0.654 N=16 A=72.097 B=0.535	----------

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (17) Correlation of Monthly Rainfall (17/28)

	St.Code	14	15	16	17
		LEJANIAS	GUAPE-LEJANIAS	CAMPO ALEGRE	CANO BLANCO
1	SANLUIS DE CUBARRAL	R=0.797 N=67 A=140.203 B=0.974	R=0.758 N=31 A=113.601 B=0.526	R=0.720 N=67 A=206.146 B=0.895	R=0.656 N=62 A=209.318 B=0.935
2	MESA DE YAMANES	R=0.627 N=36 A=81.299 B=0.489	R=0.697 N=8 A=-28.814 B=0.375	R=0.692 N=36 A=112.607 B=0.633	R=0.661 N=45 A=91.320 B=0.727
3	VISTAHERMOSA	R=0.745 N=63 A=27.415 B=0.621	R=0.700 N=25 A=24.545 B=0.363	R=0.722 N=63 A=84.213 B=0.625	R=0.687 N=63 A=75.360 B=0.707
4	CALIME	R=0.713 N=62 A=140.203 B=0.974	R=0.669 N=31 A=92.543 B=0.677	R=0.669 N=56 A=241.175 B=0.977	R=0.661 N=58 A=209.314 B=1.147
5	LAS DANTAS	----------	----------	----------	----------
6	PIÑALITO	R=0.289 N=54 A=115.527 B=0.199	R=0.324 N=22 A=90.653 B=0.166	R=0.425 N=55 A=108.902 B=0.356	R=0.421 N=52 A=117.101 B=0.394

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (18) Correlation of Monthly Rainfall (18/28)

	St.Code	14	15	16	17
		LEJANIAS	GUAPE-LEJANIAS	CAMPO ALEGRE	CANO BLANCO
7	PUERTO LLERAS	R=0.298 N=64 A=116.988 B=0.562	R=0.525 N=28 A=50.654 B=0.172	R=0.331 N=63 A=156.435 B=0.625	R=0.554 N=58 A=-2.215 B=1.377
8	TIERRA GRATA	R=0.701 N=49 A=29.327 B=0.700	R=0.686 N=32 A=-6.388 B=0.485	R=0.552 N=40 A=113.243 B=0.643	R=0.645 N=45 A=55.940 B=0.871
9	LOS NARANJOS	----------	----------	R=0.808 N=31 A=42.444 B=0.678	----------
10	PUERTO LIMON	R=0.833 N=29 A=-2.975 B=0.705	----------	----------	R=0.881 N=29 A=30.966 B=0.959
11	LA HOLANDA	R=0.787 N=61 A=33.001 B=0.616	R=0.790 N=34 A=45.227 B=0.362	R=0.730 N=59 A=76.401 B=0.607	R=0.720 N=51 A=72.020 B=0.696
13	PUERTO RICO	R=0.557 N=63 A=89.573 B=0.473	R=0.563 N=32 A=69.308 B=0.309	R=0.620 N=62 A=107.219 B=0.597	R=0.514 N=55 A=115.857 B=0.543

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (19) Correlation of Monthly Rainfall (19/28)

	St.Code	14	15	16	17
		LEJANIAS	GUAPE-LEJANIAS	CAMPO ALEGRE	CAÑO BLANCO
14	LEJANIAS		R=0.848 N=34 A=24.980 B=0.565	R=0.731 N=61 A=124.665 B=0.831	R=0.642 N=62 A=133.269 B=0.818
15	GUAPE-LEJANIAS	R=0.848 N=34 A=113.708 B=1.274		R=0.642 N=25 A=308.448 B=1.041	R=0.701 N=33 A=218.733 B=1.586
16	CAMPO ALEGRE	R=0.731 N=61 A=22.766 B=0.643	R=0.642 N=25 A=13.236 B=0.396		R=0.730 N=53 A=33.013 B=0.921
17	CAÑO BLANCO	R=0.642 N=62 A=50.925 B=0.503	R=0.701 N=30 A=38.916 B=0.309	R=0.730 N=53 A=89.821 B=0.578	
18	LOS MICOS	R=0.774 N=71 A=41.298 B=0.804	R=0.701 N=34 A=60.563 B=0.490	R=0.765 N=62 A=93.047 B=0.908	R=0.675 N=67 A=103.772 B=0.954
19	FUENTE DE ORO	R=0.786 N=59 A=11.519 N=0.695	R=0.747 N=27 A=48.335 B=0.371	R=0.775 N=53 A=77.364 B=0.645	R=0.731 N=54 A=73.297 B=0.737

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (20) Correlation of Monthly Rainfall (20/28)

	St.Code	14	15	16	17
		LEJANIAS	GUAPE-LEJANIAS	CAMPO ALEGRE	CAÑO BLANCO
20	PEÑAS BLANCAS	R=0.521 N=46 A=66.069 B=0.986	R=0.568 N=32 A=131.771 B=0.350	R=0.519 N=35 A=144.758 B=1.127	R=0.475 N=43 A=112.115 B=1.336
21	SAN JUAN DE ARAMA	R=0.813 N=43 A=51.401 B=0.599	R=0.638 N=29 A=86.522 B=0.287	R=0.665 N=34 A=150.961 B=0.490	R=0.699 N=43 A=92.440 B=0.743
22	MESETAS	R=0.871 N=24 A=31.084 B=0.648	R=0.816 N=23 A=15.851 B=0.427	R=0.805 N=19 A=137.818 B=0.591	R=0.697 N=21 A=88.681 B=0.750
26	AGUAS CLARAS	R=0.820 N=19 A=38.239 B=0.587	R=0.808 N=19 A=46.365 B=0.366	R=0.716 N=18 A=138.254 B=0.533	R=0.767 N=19 A=60.580 B=0.820
27	LA COOPERATIVA	R=0.769 N=16 A=60.574 B=0.419	R=0.736 N=16 A=72.152 B=0.229	R=0.407 N=14 A=142.311 B=0.278	R=0.622 N=16 A=74.167 B=0.574

Table. C-4-1 (21) Correlation of Monthly Rainfall (21/28)

	St.Code	18	19	20	21
		LOS MICOS	FUENTE DE ORO	PENAS BLANCAS	SAN JUAN DE ARAMA
1	SANLUIS DE CUBARRAL	R=0.738 N=73 A=174.640 B=0.776	R=0.804 N=61 A=156.406 B=1.116	R=0.504 N=37 A=313.733 B=0.260	R=0.749 N=34 A=161.097 B=0.998
2	MESA DE YAMANES	R=0.724 N=41 A=58.837 B=0.647	R=0.589 N=37 A=107.465 B=0.666	R=0.611 N=22 A=148.861 B=0.179	R=0.745 N=22 A=66.819 B=0.664
3	VISTAHERMOSA	R=0.608 N=69 A=81.461 B=0.455	R=0.596 N=58 A=85.205 B=0.593	R=0.437 N=36 A=157.420 B=0.178	R=0.559 N=35 A=70.628 B=0.672
4	CALIME	R=0.672 N=69 A=201.203 B=0.827	R=0.687 N=56 A=198.075 B=1.099	R=0.363 N=39 A=354.189 B=0.266	R=0.600 N=36 A=155.735 B=1.214
5	LAS DANTAS	----------	R=0.428 N=49 A=125.324 B=0.406	----------	----------
6	PIÑALITO	R=0.493 N=57 A=88.219 B=0.344	R=0.428 N=49 A=125.324 B=0.406	R=0.306 N=30 A=143.531 B=0.109	R=0.254 N=30 A=126.598 B=0.248

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (22) Correlation of Monthly Rainfall (22/28)

	St.Code	18	19	20	21
		LOS MICOS	FUENTE DE ORO	PENAS BLANCAS	SAN JUAN DE ARAMA
7	PUERTO LLERAS	R=0.266 N=63 A=155.678 B=0.434	R=0.331 N=58 A=131.804 B=0.762	R=0.506 N=40 A=105.278 B=0.170	R=0.455 N=37 A=65.417 B=0.411
8	TIERRA GRATA	R=0.730 N=47 A=23.577 B=0.709	R=0.623 N=41 A=50.800 B=0.840	R=0.402 N=42 A=167.151 B=0.215	R=0.614 N=39 A=24.397 B=0.905
9	LOS NARANJOS	----------	----------	----------	----------
10	PUERTO LIMON	R=0.858 N=33 A=16.915 B=0.616	R=0.831 N=29 A=22.325 B=0.861	R=0.569 N=11 A=158.791 B=0.117	R=0.684 N=11 A=66.655 B=0.596
11	LA HOLANDA	R=0.765 N=59 A=59.984 B=0.510	R 0.820 N=51 A=44.226 B=0.743	R=0.364 N=39 A=190.355 B=0.132	R=0.684 N=36 A=79.284 B=0.630
13	PUERTO RICO	R=0.731 N=64 A=75.471 B=0.520	R=0.627 N=56 A=94.995 B=0.700	----------	R=0.538 N=33 A=70.668 B=0.641

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (23) Correlation of Monthly Rainfall (23/28)

	St.Code	18	19	20	21
		LOS MICOS	FUENTE DE ORO	PENAS BLANCAS	SAN JUAN DE ARAMA
14	LEJANIAS	R=0.774 N=71 A=84.084 B=0.745	R=0.786 N=59 A=94.424 B=0.890	R=0.887 N=36 A=48.887 B=0.589	R=0.813 N=43 A=50.364 B=1.103
15	GUAPE-LEJANIAS	R=0.701 N=34 A=203.463 B=1.001	R=0.747 N=27 A=157.422 B=1.502	R=0.568 N=32 A=246.750 B=0.921	R=0.638 N=29 A=210.858 B=1.419
16	CAMPO ALEGRE	R=0.765 N=62 A=37.601 N=0.845	R=0.776 N=53 A=23.517 B=0.930	R=0.519 N=35 A=134.105 B=0.239	R=0.665 N=34 A=-9.632 B=0.904
17	CANO BLANCO	R=0.675 N=67 A=66.826 B=0.477	R=0.731 N=54 A=48.365 B=0.725	R=0.475 N=43 A=135.080 B=0.109	R=0.699 N=43 A=40.794 B=0.658
18	LOS MICOS		R=0.754 N=63 A=60.089 B=1.052	R=0.566 N=43 A=192.017 B=0.316	R=0.755 N=40 A=40.157 B=1.007
19	FUENTE DE ORO	R=0.754 N=63 A=59.613 B=0.541		R=0.473 N=36 A=177.519 B=0.170	R=0.738 N=33 A=49.022 B=0.803

Note. R : Correlation. %. N : Number of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (24) Correlation of Monthly Rainfall (24/28)

	St.Code	18	19	20	21
		LOS MICOS	FUENTE DE ORO	PENAS BLANCAS	SAN JUAN DE ARAMA
20	PENAS BLANCAS	R=0.566 N=43 A=59.693 B=1.013	R=0.473 N=36 A=60.222 B=1.315		R=0.691 N=43 A=61.322 B=1.828
21	SAN JUAN DE ARAMA	R=0.755 N=40 A=84.560 B=0.519	R=0.738 N=33 A=77.454 B=0.878	R=0.691 N=43 A=141.618 B=0.261	
22	MESETAS	R=0.707 N=24 A=73.812 B=0.503	R=0.877 N=19 A=30.111 B=0.819	R=0.792 N=23 A=53.680 B=0.827	R=0.805 N=20 A=25.870 B=0.915
26	AGUAS CLARAS	R=0.805 N=19 A=85.078 B=0.521	R=0.892 N=13 A=-8.193 B=0.929	R=0.726 N=19 A=54.815 B=0.649	R=0.848 N=19 A=12.981 B=0.975
27	LA COOPERATIVA	R=0.719 N=16 A=89.735 B=0.370	R=0.665 N=10 A=43.307 B=0.588	R=0.877 N=16 A=71.640 B=0.458	R=0.848 N=16 A=54.122 B=0.639

Note. R : Correlation. %. N : Number of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (25) Correlation of Monthly Rainfall (25/28)

	St.Code	22	26	27	
		MESETAS	AGUAS CLARAS	LA COOPERATIVA	
1	SANLUIS DE CUBARRAL	R=0.885 N=22 A=95.865 B=1.257	R=0.848 N=17 A=109.897 B=1.116	R=0.775 N=13 A=124.156 B=1.092	
2	MESA DE YAMANES	R=0.822 N=7 A=15.339 B=0.538	R=0.832 N=3 A=132.945 B=0.177	…… …… …… ……	
3	VISTAHERMOSA	R=0.778 N=17 A=34.819 B=0.801	R=0.922 N=14 A=-44.449 B=1.425	R=0.739 N=12 A=18.937 B=0.988	
4	CALIME	R=0.778 N=22 A=38.733 B=1.706	R=0.825 N=17 A=191.318 B=1.308	R=0.550 N=13 A=236.382 B=1.387	
5	LAS DANTAS	…… …… …… ……	…… …… …… ……	…… …… …… ……	
6	PIÑALITO	R=0.005 N=16 A=171.288 B=0.005	R=0.160 N=17 A=125.372 B=0.180	R=0.475 N=14 A=53.485 B=0.705	

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (26). Correlation of Monthly Rainfall (26/28)

	St.Code	22	26	27	
		MESETAS	AGUAS CLARAS	LA COOPERATIVA	
7	PUERTO LLERAS	R=0.431 N=20 A=77.553 B=0.290	R=0.595 N=15 A=26.858 B=0.437	R=0.872 N=11 A=-6.016 B=0.854	
8	TIERRA GRATA	R=0.581 N=23 A=68.665 B=0.873	R=0.700 N=18 A=-37.887 B=1.283	R=0.713 N=14 A=-44.815 B=1.548	
9	LOS NARANJOS	…… …… …… ……	…… …… …… ……	…… …… …… ……	
10	PUERTO LIMON	…… …… …… ……	…… …… …… ……	…… …… …… ……	
11	LA HOLANDA	R=0.847 N=24 A=50.780 B=0.788	R=0.723 N=19 A=77.854 B=0.688	R=0.854 N=16 A=70.854 B=0.800	
13	PUERTO RICO	R=0.560 N=23 A=78.909 B=0.802	R=0.738 N=18 A=20.366 B=0.698	R=0.784 N=14 A=-3.922 B=0.998	

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table. C-4-1 (27) Correlation of Monthly Rainfall (27/28)

	St.Code	22	26	27	
		MESETAS	AGUAS CLARAS	LA COOPERATIVA	
14	LEJANIAS	R=0.871 N=24 A=45.812 B=1.170	R=0.820 N=19 A=76.078 B=1.145	—————— —————— —————— ——————	
15	GUAPE-LEJANIAS	R=0.816 N=23 A=166.046 B=1.561	R=0.808 N=19 A=113.317 B=1.781	R=0.736 N=16 A=69.845 B=2.357	
16	CAMPO ALEGRE	R=0.805 N=19 A=-61.237 B=1.097	R=0.716 N=18 A=-20.608 B=0.962	R=0.407 N=14 A=73.609 B=0.595	
17	CANO BLANCO	R=0.697 N=21 A=58.855 B=0.648	R=0.767 N=19 A=53.201 B=0.718	R=0.622 N=16 A=76.123 B=0.673	
18	LOS MICOS	R=0.707 N=24 A=102.665 B=0.993	R=0.805 N=19 A=7.401 B=1.244	R=0.719 N=16 A=8.619 B=1.394	
19	PUENTE DE ORO	R=0.877 N=18 A=29.924 B=0.938	R=0.892 N=13 A=68.133 B=0.856	R=0.665 N=10 A=112.036 B=0.752	

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

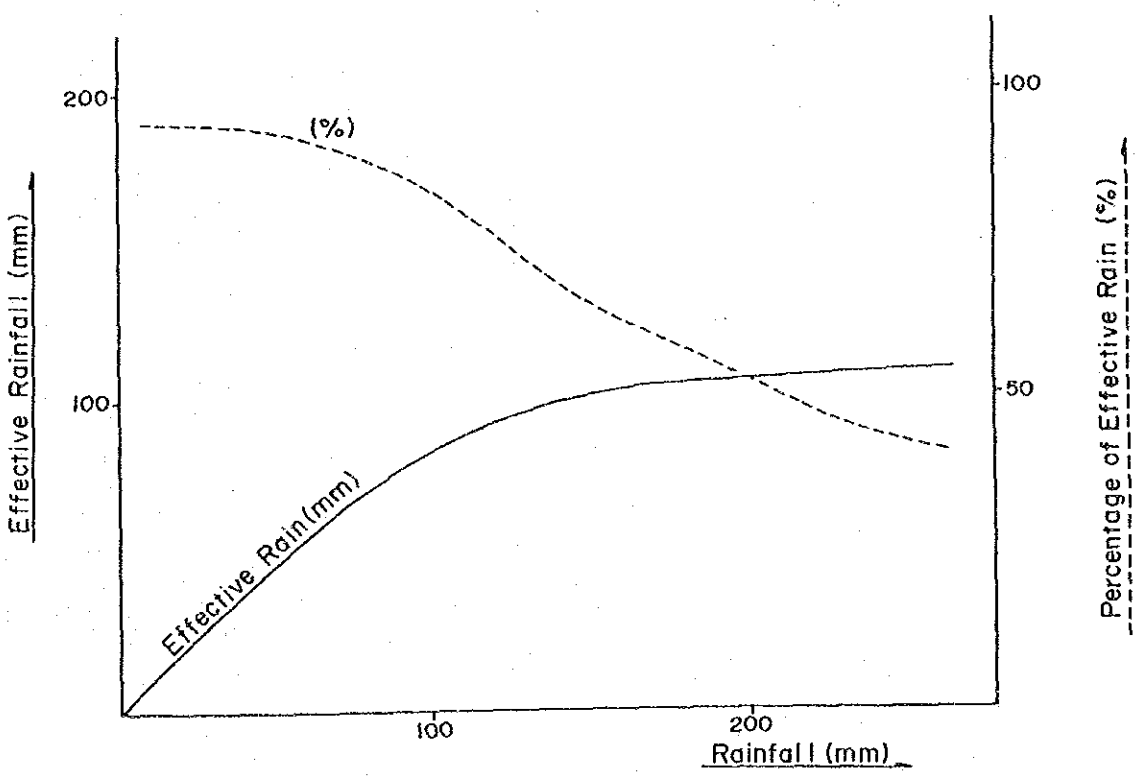
Table. C-4-1 (28) Correlation of Monthly Rainfall (28/28)

	St.Code	22	26	27	
		MESETAS	AGUAS CLARAS	LA COOPERATIVA	
20	PENAS BLANCAS	R=0.792 N=23 A=66.121 B=1.002	R=0.726 N=19 A=98.617 B=0.812	R=0.677 N=16 A=71.052 B=1.001	
21	SAN JUAN DE ARAMA	R=0.805 N=20 A=73.167 B=0.709	R=0.848 N=19 A=59.595 B=0.738	R=0.648 N=16 A=89.554 B=0.658	
22	MESETAS		R=0.765 N=14 A=28.678 B=0.852	R=0.477 N=11 A=117.356 B=0.584	
26	AGUAS CLARAS	R=0.765 N=14 A=104.954 B=0.688		R=0.725 N=15 A=50.856 B=0.936	
27	LA COOPERATIVA	R=0.477 N=11 A=124.292 B=0.389	R=0.725 N=15 A=61.325 B=0.561		

Note. R : Correlation. %. N : Nunber of Data
A,B : Coefficient. (Y=A+B*X)

Table C-4-2 RELATIONSHIP BETWEEN RAINFALL AND EFFECTIVE RAINFALL

Rainfall		Effective Rainfall		
inches	mm	inches	mm	%
1	25.4	0.95	24.13	95
2	50.8	1.85	46.99	93
3	76.2	2.67	67.82	89
4	101.6	3.32	84.33	83
5	127.0	3.79	96.87	74
6	152.4	4.02	102.11	67
7	177.8	4.07	103.38	58
8	203.2	4.12	104.65	52
9	228.6	4.17	105.92	46
10	254.0	4.22	107.19	42



EFFECTIVE RAINFALL

Table C-4-3 (1)

Calculation of Probability for Station at CANO BLANCO

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1979	2970	1	1953(1985)	0.748	5.56
1980	2707	2	2248(1984)	0.861	16.67
1981	2690	3	2485(1986)	0.952	27.78
1982	2881	4	2660(1987)	1.019	38.89
1983	2895	5	2690(1981)	1.031	50.00
1984	2248	6	2707(1980)	1.037	61.11
1985	1953	7	2881(1982)	1.104	72.22
1986	2485	8	2895(1983)	1.109	83.33
1987	2660	9	2970(1979)	1.138	94.44

Total Xs= 23489 mm Average Xo= 2609.8 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.779	2033
10%	10	0.821	2144
20%	5	0.876	2287
25%	4	0.898	2344
33%	3	0.930	2426
50%	2	0.992	2589

Rainfall Patern and Effective Rainfall for Design Year at CANO BLANCO

Month	9 Years Average	Return Period 1/2	1/4	1/5	1/10
1	34	33(32)	30(29)	30(28)	28(26)
2	87	86(75)	78(69)	76(68)	72(64)
3	155	153(102)	139(98)	135(97)	127(94)
4	308	305(108)	276(108)	270(107)	253(107)
5	302	299(108)	271(107)	265(107)	248(106)
6	358	355(108)	321(108)	314(108)	294(108)
7	271	269(107)	244(106)	238(106)	223(106)
8	273	271(107)	246(106)	240(106)	225(105)
9	196	195(105)	176(103)	172(103)	161(103)
10	336	334(108)	302(108)	295(108)	276(108)
11	220	218(106)	197(105)	193(105)	181(104)
12	70	70(63)	63(57)	61(56)	58(53)
Annual	2610	2589(1177)	2344(1105)	2287(1099)	2144(1084)

( ) ; Effective Rainfall [mm]

Table C-4-3 (2)

Calculation of Probability for Station at MESA DE YAMANES

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1969	3690	1	1899(1980)	0.602	2.94
1970	3451	2	2280(1977)	0.723	8.82
1971	3851	3	2677(1983)	0.849	14.71
1972	3429	4	2764(1979)	0.876	20.59
1973	3381	5	2793(1986)	0.885	26.47
1974	3077	6	2987(1978)	0.947	32.35
1975	3609	7	3077(1974)	0.975	38.24
1976	----	8	3109(1985)	0.986	44.12
1977	2280	9	3231(1984)	1.024	50.00
1978	2987	10	3381(1973)	1.072	55.88
1979	2764	11	3429(1972)	1.087	61.76
1980	1899	12	3451(1970)	1.094	67.65
1981	3591	13	3591(1981)	1.138	73.53
1982	----	14	3609(1975)	1.144	79.41
1983	2677	15	3690(1969)	1.170	85.29
1984	3231	16	3807(1987)	1.207	91.18
1985	3109	17	3851(1971)	1.221	97.06
1986	2793				
1987	3807				

Total Xs= 53627 mm Average Xo= 3154.5 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.707	2229
10%	10	0.760	2398
20%	5	0.831	2620
25%	4	0.859	2710
33%	3	0.901	2841
50%	2	0.984	3105

Rainfall Patern and Effective Rainfall for Design Year at MESA DE YAMANES

Month	17 Years Average	Return Period 1/2	1/4	1/5	1/10
1	53	52(49)	46(43)	44(41)	40(38)
2	126	124(93)	108(87)	104(86)	95(81)
3	173	170(103)	148(101)	143(100)	131(96)
4	358	353(108)	308(108)	298(108)	272(108)
5	375	369(108)	322(108)	312(108)	285(108)
6	415	409(108)	357(108)	345(108)	316(108)
7	322	317(108)	276(108)	267(107)	245(106)
8	309	304(108)	266(107)	257(107)	235(106)
9	316	311(108)	271(107)	263(107)	240(106)
10	329	324(108)	283(108)	273(108)	250(107)
11	263	259(107)	226(105)	218(106)	200(106)
12	115	113(89)	99(83)	96(81)	87(75)
Annual	3155	3105(1197)	2710(1172)	2620(1165)	2398(1144)

( ) : Effective Rainfall

[mm]

Table C-4-3 (3)

Calculation of Probability for Station at SAN LUIS CUBARRAI

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1969	5338	1	3610(1987)	0.740	2.94
1970	5141	2	3928(1985)	0.805	8.82
1971	6200	3	4095(1984)	0.839	14.71
1972	5541	4	4228(1973)	0.867	20.59
1973	4228	5	4500(1977)	0.922	26.47
1974	5144	6	4678(1983)	0.959	32.35
1975	5413	7	4805(1976)	0.985	38.24
1976	4805	8	4845(1986)	0.993	44.12
1977	4500	9	4970(1981)	1.018	50.00
1978	----	10	5141(1970)	1.054	55.88
1979	5165	11	5144(1974)	1.054	61.76
1980	----	12	5165(1979)	1.059	67.65
1981	4970	13	5338(1969)	1.094	73.53
1982	5352	14	5352(1982)	1.097	79.41
1983	4678	15	5413(1975)	1.109	85.29
1984	4095	16	5541(1972)	1.136	91.18
1985	3928	17	6200(1971)	1.271	97.06
1986	4845				
1987	3610				

Total Xs= 82954 mm Average Xo= 4879.6 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.785	3831
10%	10	0.826	4032
20%	5	0.880	4292
25%	4	0.901	4395
33%	3	0.931	4543
50%	2	0.991	4837

Rainfall Patern and Effective Rainfall for Design Year at SAN LUIS CUBAR

Month	17 Years Average	Return Period 1/2	1/4	1/5	1/10
1	101	100(84)	91(78)	89(75)	84(73)
2	170	168(103)	153(102)	149(101)	140(99)
3	269	267(107)	242(106)	237(106)	222(106)
4	639	633(108)	575(108)	562(108)	528(108)
5	630	625(108)	568(108)	554(108)	521(108)
6	559	554(108)	503(108)	492(108)	462(108)
7	472	468(108)	425(108)	415(108)	390(108)
8	458	454(108)	413(108)	403(108)	379(108)
9	448	444(108)	404(108)	394(108)	370(108)
10	451	448(108)	407(108)	397(108)	373(108)
11	414	410(108)	373(108)	364(108)	342(108)
12	269	266(107)	242(106)	236(106)	222(106)
Annual	4880	4837(1264)	4395(1256)	4292(1253)	4032(1247)

( ) : Effective Rainfall

[mm]

Table C-4-3 (4)

Calculation of Probability for Station at LEJANIAS

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1979	----	1	2677(1985)	0.756	12.50
1980	----	2	3295(1984)	0.930	37.50
1981	----	3	4091(1987)	1.155	62.50
1982	----	4	4109(1986)	1.160	87.50
1983	----				
1984	3295				
1985	2677				
1986	4109				
1987	4091				
Total	Xs= 14172 mm		Average	Xo= 3543.0 mm	

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.684	2422
10%	10	0.741	2624
20%	5	0.817	2894
25%	4	0.848	3003
33%	3	0.893	3164
50%	2	0.985	3490

Rainfall Patern and Effective Rainfall for Design Year at LEJANIAS

Month	4 Years Average	Return Period 1/2	1/4	1/5	1/10
1	50	50(46)	43(40)	41(39)	37(35)
2	151	149(101)	128(94)	123(93)	112(89)
3	174	171(103)	147(101)	142(99)	129(95)
4	392	386(108)	332(108)	320(108)	290(108)
5	453	446(108)	384(108)	370(108)	335(108)
6	473	466(108)	401(108)	386(108)	350(108)
7	435	428(108)	369(108)	355(108)	322(108)
8	360	354(108)	305(108)	294(108)	266(107)
9	350	344(108)	296(108)	286(108)	259(107)
10	402	396(108)	341(108)	329(108)	298(108)
11	186	183(104)	157(103)	152(102)	138(98)
12	118	116(90)	100(83)	96(81)	87(75)
Annual	3543	3490(1201)	3003(1177)	2894(1170)	2624(1145)

( ) : Effective Rainfall [mm]

Table C-4-3 (5)

Calculation of Probability for Station at LEJANIAS

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1979	2571	1	2074(1980)	0.670	5.56
1980	2074	2	2464(1981)	0.796	16.67
1981	2464	3	2571(1979)	0.830	27.78
1982	2888	4	2677(1985)	0.864	38.89
1983	3705	5	2888(1982)	0.932	50.00
1984	3295	6	3295(1984)	1.064	61.11
1985	2677	7	3705(1983)	1.196	72.22
1986	4109	8	4091(1987)	1.321	83.33
1987	4091	9	4109(1986)	1.327	94.44

Total Xs= 27873 mm Average Xo= 3097.0 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.648	2005
10%	10	0.708	2194
20%	5	0.791	2448
25%	4	0.824	2552
33%	3	0.873	2705
50%	2	0.975	3019

Rainfall Patern and Effective Rainfall for Design Year at LEJANIAS

Month	9 Years Average	Return Period 1/2	1/4	1/5	1/10
1	66	65(59)	55(50)	52(49)	47(44)
2	128	125(93)	106(86)	101(84)	91(78)
3	186	182(104)	153(102)	147(101)	132(96)
4	341	332(108)	281(108)	270(107)	242(106)
5	377	367(108)	311(108)	298(108)	267(107)
6	382	372(108)	314(108)	302(108)	270(107)
7	310	302(108)	255(107)	245(106)	219(106)
8	302	295(108)	249(107)	239(106)	214(106)
9	296	288(108)	244(106)	234(106)	209(106)
10	366	357(108)	302(108)	290(108)	260(107)
11	221	215(106)	182(104)	175(103)	157(103)
12	122	119(91)	100(84)	96(81)	86(75)
Annual	3097	3019(1209)	2552(1178)	2448(1166)	2194(1138)

( ) : Effective Rainfall [mm]

Table C-4-3 (6)

Calculation of Probability for Station at CALIME

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1978	2780	1	1004(1980)	0.245	5.00
1979	2784	2	2780(1978)	0.679	15.00
1980	1004	3	2784(1979)	0.680	25.00
1981	5554	4	3805(1985)	0.930	35.00
1982	4852	5	4091(1984)	1.000	45.00
1983	5478	6	4852(1982)	1.186	55.00
1984	4091	7	5104(1986)	1.247	65.00
1985	3805	8	5469(1987)	1.336	75.00
1986	5104	9	5478(1983)	1.339	85.00
1987	5469	10	5554(1981)	1.357	95.00

Total Xs= 40921 mm Average Xo= 4092.1 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.331	1353
10%	10	0.413	1689
20%	5	0.541	2214
25%	4	0.599	2452
33%	3	0.692	2831
50%	2	0.907	3713

Rainfall Patern and Effective Rainfall for Design Year at CALIME

Month	10 Years Average	Return Period 1/2	1/4	1/5	1/10
1	148	134(97)	89(76)	80(70)	61(56)
2	139	126(94)	83(73)	75(67)	57(53)
3	197	179(103)	118(91)	107(87)	81(71)
4	354	321(108)	212(106)	191(105)	146(100)
5	442	401(108)	265(107)	239(106)	182(104)
6	483	438(108)	288(108)	261(107)	199(105)
7	433	393(108)	260(107)	235(106)	179(103)
8	442	401(108)	265(107)	239(106)	182(104)
9	344	312(108)	206(106)	186(104)	142(99)
10	545	495(108)	327(108)	295(108)	225(105)
11	342	310(108)	205(106)	185(104)	141(99)
12	223	202(106)	134(96)	121(92)	92(78)
Annual	4092	3713(1263)	2452(1190)	2214(1162)	1689(1079)

( ) : Effective Rainfall [mm]

Table C-4-3 (7)

Calculation of Probability for Station at CAMPO ALEGRE

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1979	2606	1	2453(1980)	0.869	5.56
1980	2453	2	2511(1987)	0.889	16.67
1981	3782	3	2606(1979)	0.923	27.78
1982	3196	4	2654(1984)	0.940	38.89
1983	2829	5	2663(1986)	0.944	50.00
1984	2654	6	2709(1985)	0.960	61.11
1985	2709	7	2829(1983)	1.002	72.22
1986	2663	8	3196(1982)	1.132	83.33
1987	2511	9	3782(1981)	1.340	94.44

Total Xs= 25403 mm Average Xo= 2822.6 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.771	2178
10%	10	0.815	2301
20%	5	0.872	2461
25%	4	0.894	2524
33%	3	0.927	2616
50%	2	0.991	2798

Rainfall Patern and Effective Rainfall for Design Year at CAMPO ALEGRE

Month	9 Years Average	Return Period 1/2	1/4	1/5	1/10
1	62	62(56)	56(51)	54(50)	51(47)
2	87	86(75)	78(69)	76(68)	71(64)
3	145	144(100)	130(95)	127(94)	119(91)
4	323	320(108)	289(108)	282(108)	263(107)
5	369	366(108)	330(108)	322(108)	301(108)
6	429	426(108)	384(108)	374(108)	350(108)
7	259	266(107)	240(106)	234(106)	219(106)
8	203	201(106)	181(104)	177(103)	165(103)
9	213	212(106)	191(105)	186(104)	174(103)
10	289	286(108)	258(107)	252(107)	236(106)
11	278	275(108)	248(107)	242(106)	226(105)
12	155	154(102)	139(98)	135(97)	126(94)
Annual	2823	2798(1191)	2524(1165)	2461(1159)	2301(1142)

( ) : Effective Rainfall [mm]

Table C-4-3 (8)

Calculation of Probability for Station at LOS MICOS

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1979	2564	1	2023(1980)	0.640	5.56
1980	2023	2	2336(1982)	0.738	16.67
1981	4261	3	2564(1979)	0.810	27.78
1982	2336	4	3062(1984)	0.968	38.89
1983	3504	5	3417(1985)	1.080	50.00
1984	3062	6	3504(1983)	1.108	61.11
1985	3417	7	3610(1986)	1.141	72.22
1986	3610	8	3694(1987)	1.168	83.33
1987	3694	9	4261(1981)	1.347	94.44

Total Xs= 28470 mm Average Xo= 3163.4 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.641	2026
10%	10	0.702	2222
20%	5	0.786	2487
25%	4	0.820	2595
33%	3	0.871	2755
50%	2	0.975	3084

Rainfall Patern and Effective Rainfall for Design Year at LOS MICOS

Month	9 Years Average	Return Period 1/2	1/4	1/5	1/10
1	60	59(54)	49(46)	47(44)	42(40)
2	105	103(85)	86(75)	83(72)	74(66)
3	133	130(95)	109(88)	105(86)	93(79)
4	363	354(108)	298(108)	286(108)	255(107)
5	379	370(108)	311(108)	298(108)	266(107)
6	464	452(108)	381(108)	365(108)	326(108)
7	368	359(108)	302(108)	290(108)	259(107)
8	303	296(108)	249(107)	238(106)	213(106)
9	239	233(106)	196(105)	188(105)	168(103)
10	334	325(108)	274(108)	263(107)	235(106)
11	288	281(108)	237(106)	227(105)	203(106)
12	125	122(92)	103(85)	98(82)	88(76)
Annual	3163	3084(1188)	2595(1151)	2487(1139)	2222(1109)

( ) : Effective Rainfall [mm]

Table C-4-3 (9)

Calculation of Probability for Station at PINALITO

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1978	3219	1	1498(1986)	0.543	5.00
1979	2840	2	2244(1982)	0.814	15.00
1980	2495	3	2337(1983)	0.847	25.00
1981	3505	4	2495(1980)	0.904	35.00
1982	2244	5	2840(1979)	1.029	45.00
1983	2337	6	2924(1984)	1.060	55.00
1984	2924	7	2929(1987)	1.062	65.00
1985	3594	8	3219(1978)	1.167	75.00
1986	1498	9	3505(1981)	1.271	85.00
1987	2929	10	3594(1985)	1.303	95.00

Total Xs= 27585 mm Average Xo= 2758.5 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.617	1703
10%	10	0.682	1882
20%	5	0.771	2126
25%	4	0.807	2225
33%	3	0.861	2375
50%	2	0.973	2683

Rainfall Patern and Effective Rainfall for Design Year at PINALITO

Month	10 Years Average	Return Period 1/2	1/4	1/5	1/10
1	72	70(63)	58(53)	55(51)	49(46)
2	139	135(97)	112(89)	107(87)	95(80)
3	204	198(105)	164(103)	157(103)	139(98)
4	244	237(106)	197(105)	188(105)	166(103)
5	343	334(108)	277(108)	265(107)	234(106)
6	299	291(108)	241(106)	231(105)	204(106)
7	350	340(108)	282(108)	269(107)	238(106)
8	291	283(108)	235(106)	224(105)	198(105)
9	173	169(103)	140(99)	134(96)	118(91)
10	256	249(107)	206(106)	197(105)	174(103)
11	239	232(106)	193(105)	184(104)	163(103)
12	150	146(100)	121(92)	115(90)	102(85)
Annual	2758	2683(1219)	2226(1180)	2126(1165)	1882(1132)

( ) ; Effective Rainfall [mm]

Table C-4-3 (10)

Calculation of Probability for Station at PUERTO LLERAS

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1979	----	1	1383(1986)	0.610	12.50
1980	2598	2	2262(1987)	0.998	37.50
1981	----	3	2598(1980)	1.146	62.50
1982	----	4	2825(1984)	1.246	87.50
1983	----				
1984	2825				
1985	----				
1986	1383				
1987	2262				

Total Xs= 9068 mm Average Xo= 2267.0 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.541	1228
10%	10	0.615	1394
20%	5	0.718	1628
25%	4	0.761	1725
33%	3	0.827	1874
50%	2	0.966	2189

Rainfall Patern and Effective Rainfall for Design Year at PUERTO LLERAS

Month	4 Years Average	Return Period 1/2	1/4	1/5	1/10
1	52	50(47)	40(37)	37(35)	32(30)
2	75	73(65)	57(53)	54(50)	46(43)
3	114	110(88)	87(75)	82(72)	70(63)
4	277	268(107)	211(106)	199(105)	170(103)
5	270	260(107)	205(106)	194(105)	166(103)
6	283	274(108)	216(106)	204(106)	174(103)
7	193	187(104)	147(101)	139(98)	119(91)
8	266	257(107)	202(106)	191(105)	163(103)
9	266	257(107)	203(106)	191(105)	164(103)
10	226	218(106)	172(103)	162(103)	139(98)
11	162	156(103)	123(93)	116(90)	99(83)
12	82	79(70)	63(57)	59(54)	51(47)
Annual	2267	2189(1118)	1725(1048)	1628(1029)	1394(972)

( ) : Effective Rainfall [mm]

Table C-4-3 (11)

Calculation of Probability for Station at FUENTE DE ORO

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1979	2660	1	2173(1985)	0.695	5.56
1980	2462	2	2462(1980)	0.787	16.67
1981	3756	3	2517(1983)	0.805	27.78
1982	5726	4	2660(1979)	0.851	38.89
1983	2517	5	2876(1986)	0.920	50.00
1984	2879	6	2879(1984)	0.921	61.11
1985	2173	7	3097(1987)	0.990	72.22
1986	2876	8	3756(1981)	1.201	83.33
1987	3097	9	5726(1982)	1.831	94.44

Total Xs= 28148 mm Average Xo= 3127.5 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.571	1787
10%	10	0.640	2003
20%	5	0.736	2302
25%	4	0.775	2425
33%	3	0.835	2611
50%	2	0.960	3001

Rainfall Patern and Effective Rainfall for Design Year at FUENTE DE ORO

Month	9 Years Average	Return Period 1/2	1/4	1/5	1/10
1	78	75(67)	61(56)	58(53)	50(47)
2	141	135(97)	109(88)	104(85)	90(77)
3	126	121(92)	97(82)	92(79)	80(71)
4	404	368(108)	313(108)	298(108)	259(107)
5	392	376(108)	304(108)	288(108)	251(107)
6	332	319(108)	258(107)	244(106)	213(106)
7	264	253(107)	205(106)	194(105)	169(103)
8	241	231(105)	187(104)	177(103)	154(102)
9	236	226(105)	183(104)	174(103)	151(102)
10	425	408(108)	330(108)	313(108)	272(108)
11	375	360(108)	291(108)	276(108)	240(106)
12	113	109(88)	88(76)	83(73)	73(65)
Annual	3128	3001(1201)	2425(1154)	2302(1140)	2003(1101)

( ) : Effective Rainfall [mm]

Table C-4-3 (12)

Calculation of Probability for Station at LOS NARANJOS

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1966	-----	1	2303(1968)	0.757	5.56
1967	2772	2	2639(1973)	0.868	16.67
1968	2303	3	2769(1972)	0.911	27.78
1969	3450	4	2772(1967)	0.912	38.89
1970	3471	5	3265(1974)	1.074	50.00
1971	3393	6	3303(1975)	1.086	61.11
1972	2769	7	3393(1971)	1.116	72.22
1973	2639	8	3450(1969)	1.135	83.33
1974	3265	9	3471(1970)	1.142	94.44
1975	3303				

Total Xo= 27364 mm Average Xo= 3040.5 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.764	2322
10%	10	0.809	2459
20%	5	0.867	2637
25%	4	0.890	2707
33%	3	0.924	2809
50%	2	0.991	3013

Rainfall Patern and Effective Rainfall for Design Year at LOS NARANJOS

Month	9 Years Average	Return Period 1/2	1/4	1/5	1/10
1	86	86(74)	77(68)	75(67)	70(63)
2	105	104(86)	94(80)	91(78)	85(74)
3	142	141(99)	127(94)	123(93)	115(90)
4	407	403(108)	362(108)	353(108)	329(108)
5	333	330(108)	297(108)	289(108)	269(107)
6	413	409(108)	368(108)	358(108)	334(108)
7	322	319(108)	286(108)	279(108)	260(107)
8	281	279(108)	251(107)	244(106)	228(105)
9	259	256(107)	230(105)	224(105)	209(106)
10	350	347(108)	312(108)	304(108)	283(108)
11	202	201(106)	180(103)	176(103)	164(103)
12	139	138(98)	124(93)	121(92)	113(89)
Annual	3040	3013(1217)	2707(1190)	2637(1185)	2459(1167)

( ) : Effective Rainfall [mm]

Table C-4-3 (13)

Calculation of Probability for Station at PUERTO LIMON

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1968	----	1	1892(1977)	0.711	2.63
1969	2288	2	1893(1978)	0.712	7.89
1970	2489	3	2288(1969)	0.860	13.16
1971	2961	4	2289(1975)	0.860	18.42
1972	2741	5	2348(1973)	0.882	23.68
1973	2348	6	2362(1985)	0.888	28.95
1974	2566	7	2467(1976)	0.927	34.21
1975	2289	8	2489(1970)	0.936	39.47
1976	2467	9	2503(1980)	0.941	44.74
1977	1892	10	2545(1984)	0.956	50.00
1978	1893	11	2566(1974)	0.964	55.26
1979	3132	12	2741(1972)	1.030	60.53
1980	2503	13	2905(1983)	1.092	65.79
1981	3230	14	2913(1982)	1.095	71.05
1982	2913	15	2961(1971)	1.113	76.32
1983	2905	16	3132(1979)	1.177	81.58
1984	2545	17	3230(1981)	1.214	86.84
1985	2362	18	3506(1987)	1.318	92.11
1986	3521	19	3521(1986)	1.323	97.37
1987	3506				

Total Xs= 50552 mm Average Xo= 2660.7 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.732	1947
10%	10	0.781	2078
20%	5	0.846	2251
25%	4	0.872	2320
33%	3	0.910	2420
50%	2	0.985	2621

Rainfall Patern and Effective Rainfall for Design Year at PUERTO LIMON

Month	19 Years Average	Return Period 1/2	1/4	1/5	1/10
1	52	52(48)	46(43)	44(41)	41(38)
2	92	91(78)	80(71)	78(69)	72(64)
3	147	145(100)	128(95)	125(93)	115(90)
4	287	283(108)	251(107)	243(106)	225(105)
5	316	312(108)	276(108)	268(107)	247(106)
6	374	369(108)	326(108)	317(108)	292(108)
7	287	283(108)	250(107)	243(106)	224(105)
8	278	273(108)	242(106)	235(106)	217(106)
9	226	222(106)	197(105)	191(105)	176(103)
10	293	288(108)	255(107)	248(106)	229(105)
11	217	214(106)	189(105)	184(104)	169(103)
12	92	90(77)	80(70)	78(69)	72(64)
Annual	2661	2621(1162)	2320(1130)	2251(1120)	2078(1100)

( ) : Effective Rainfall [mm]

Table C-4-3 (14)

Calculation of Probability for Station at VISTAHERMOSA

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1969	2174	1	2035(1977)	0.788	2.63
1970	2685	2	2045(1985)	0.792	7.89
1971	2784	3	2174(1969)	0.842	13.16
1972	2230	4	2179(1979)	0.844	18.42
1973	2269	5	2230(1972)	0.864	23.68
1974	2621	6	2269(1973)	0.879	28.95
1975	2808	7	2420(1983)	0.937	34.21
1976	3062	8	2523(1987)	0.977	39.47
1977	2035	9	2572(1978)	0.996	44.74
1978	2572	10	2621(1974)	1.015	50.00
1979	2179	11	2685(1970)	1.040	55.26
1980	2831	12	2746(1982)	1.064	60.53
1981	2814	13	2784(1971)	1.079	65.79
1982	2746	14	2808(1975)	1.088	71.05
1983	2420	15	2814(1981)	1.090	76.32
1984	3122	16	2831(1980)	1.097	81.58
1985	2045	17	3062(1976)	1.186	86.84
1986	3127	18	3122(1984)	1.209	92.11
1987	2523	19	3127(1986)	1.211	97.37

Total Xs= 49046 mm Average Xo= 2581.4 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.784	2024
10%	10	0.825	2130
20%	5	0.879	2269
25%	4	0.900	2323
33%	3	0.931	2402
50%	2	0.991	2558

Rainfall Patern and Effective Rainfall for Design Year at VISTAHERMOSA

Month	19 Years Average	Return Period 1/2	1/4	1/5	1/10
1	40	39(37)	36(34)	35(33)	33(31)
2	103	102(85)	93(79)	91(78)	85(74)
3	156	155(102)	141(99)	137(98)	129(95)
4	291	288(108)	262(107)	255(107)	240(106)
5	383	380(108)	345(108)	337(108)	316(108)
6	359	356(108)	323(108)	315(108)	296(108)
7	283	280(108)	254(107)	249(107)	233(106)
8	220	218(106)	198(105)	193(105)	181(104)
9	216	214(106)	195(105)	190(105)	178(103)
10	273	271(107)	246(106)	240(105)	225(105)
11	176	175(103)	159(103)	155(102)	145(100)
12	82	81(71)	74(66)	72(64)	68(61)
Annual	2581	2558(1149)	2323(1126)	2269(1120)	2130(1101)

[mm]

( ) : Effective Rainfall

Table C-4-3 (15)

Calculation of Probability for Station at LA HOLANDA

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1978	2146	1	2100(1979)	0.806	5.00
1979	2100	2	2146(1978)	0.824	15.00
1980	2487	3	2315(1985)	0.889	25.00
1981	3672	4	2385(1983)	0.916	35.00
1982	2600	5	2487(1980)	0.955	45.00
1983	2385	6	2600(1982)	0.998	55.00
1984	2739	7	2739(1984)	1.051	65.00
1985	2315	8	2787(1986)	1.070	75.00
1986	2787	9	2820(1987)	1.082	85.00
1987	2820	10	3672(1981)	1.410	95.00

Total Xs= 26050 mm Average Xo= 2605.0 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.745	1942
10%	10	0.793	2066
20%	5	0.855	2228
25%	4	0.880	2292
33%	3	0.916	2386
50%	2	0.988	2573

Rainfall Patern and Effective Rainfall for Design Year at LA HOLANDA

Month	10 Years Average	Return Period 1/2	1/4	1/5	1/10
1	39	39(37)	35(33)	34(32)	31(29)
2	81	80(71)	72(64)	70(63)	64(59)
3	160	158(103)	141(99)	137(98)	127(94)
4	294	291(108)	259(107)	252(107)	233(106)
5	325	321(108)	286(108)	278(108)	258(107)
6	310	306(108)	273(108)	265(107)	246(106)
7	236	233(106)	208(106)	202(106)	187(104)
8	242	239(106)	213(106)	207(106)	192(105)
9	209	207(105)	184(104)	179(103)	166(103)
10	352	348(108)	310(108)	301(108)	279(108)
11	255	252(107)	225(105)	218(106)	203(106)
12	100	99(83)	88(76)	85(74)	79(70)
Annual	2605	2573(1149)	2292(1123)	2228(1116)	2066(1097)

( ) : Effective Rainfall [mm]

Table C-4-3 (16)

Calculation of Probability for Station at PUERTO RICO

Year	Annual Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1979	3433	1	2063(1986)	0.662	5.56
1980	2833	2	2610(1987)	0.837	16.67
1981	3876	3	2752(1983)	0.882	27.78
1982	3800	4	2833(1980)	0.909	38.89
1983	2752	5	3262(1985)	1.046	50.00
1984	3440	6	3433(1979)	1.101	61.11
1985	3262	7	3440(1984)	1.103	72.22
1986	2063	8	3800(1982)	1.218	83.33
1987	2610	9	3876(1981)	1.243	94.44

Total Xs= 28069 mm Average Xo= 3118.7 mm

Probability [mm]	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	0.692	2158
10%	10	0.747	2330
20%	5	0.821	2560
25%	4	0.851	2653
33%	3	0.894	2789
50%	2	0.983	3064

Rainfall Patern and Effective Rainfall for Design Year at PUERTO RICO

Month	9 Years Average	Return Period 1/2	1/4	1/5	1/10
1	58	57(52)	49(46)	47(44)	43(40)
2	91	89(77)	77(69)	75(67)	68(61)
3	143	140(99)	121(92)	117(91)	107(87)
4	331	325(108)	282(108)	272(107)	248(105)
5	382	375(108)	325(108)	314(108)	285(108)
6	370	364(108)	315(108)	304(108)	277(108)
7	393	386(108)	334(108)	323(108)	294(108)
8	362	355(108)	308(108)	297(108)	270(107)
9	260	256(107)	221(106)	214(106)	194(105)
10	312	306(108)	265(107)	256(107)	233(106)
11	278	273(108)	236(106)	228(105)	208(106)
12	139	137(98)	119(91)	114(90)	104(85)
Annual	3119	3064(1188)	2653(1156)	2560(1148)	2330(1127)

( ) : Effective Rainfall [mm]

Table C-4-4 (1) Rainfall Pattern and Effective Rainfall for Design Year
Station Caño Blanco

Month	Return Period 1／2	1／5	1／10	1／20
JAN	34 (32)	30 (28)	28 (26)	26 (25)
FEB	86 (75)	76 (68)	71 (64)	68 (61)
MAR	154 (102)	136 (97)	127 (94)	121 (92)
APR	306 (108)	270 (108)	253 (107)	240 (106)
MAY	300 (108)	265 (108)	248 (107)	235 (106)
JUN	355 (108)	314 (108)	294 (108)	279 (108)
JUL	269 (108)	237 (106)	223 (106)	211 (106)
AUG	271 (108)	239 (106)	224 (105)	213 (106)
SEP	194 (105)	172 (103)	161 (103)	153 (102)
OCT	333 (108)	294 (108)	276 (108)	262 (108)
NOV	218 (106)	193 (105)	181 (104)	171 (103)
DEC	69 (63)	61 (56)	58 (53)	55 (50)
Annual	2589 (1130)	2287 (1102)	2144 (1084)	2033 (1074)

Table C-4-4 (2) Rainfall Pattern and Effective Rainfall for Design Year
Station La Cooperativa

Month	Return Period 1／2	1／5	1／10	1／20
JAN	52 (48)	46 (43)	43 (40)	40 (38)
FEB	161 (103)	141 (99)	132 (96)	125 (93)
MAR	131 (96)	115 (90)	108 (87)	102 (84)
APR	177 (103)	155 (102)	145 (100)	137 (98)
MAY	305 (108)	267 (108)	250 (107)	236 (106)
JUN	256 (108)	224 (105)	210 (106)	198 (105)
JUL	465 (108)	408 (108)	381 (108)	361 (108)
AUG	213 (106)	187 (104)	174 (103)	165 (103)
SEP	269 (108)	236 (106)	221 (106)	209 (106)
OCT	250 (107)	220 (106)	205 (106)	194 (105)
NOV	229 (105)	201 (106)	187 (104)	177 (103)
DEC	112 (89)	98 (82)	92 (78)	87 (75)
Annual	2620 (1189)	2298 (1159)	2148 (1141)	2031 (1125)

Table C-4-4 (3) Rainfall Pattern and Effective Rainfall for Design Year
Station Aguas Claras

Month	Return Period 1／2	1／5	1／10	1／20
JAN	25 (24)	21 (20)	19 (18)	18 (17)
FEB	223 (106)	189 (105)	173 (103)	161 (103)
MAR	148 (101)	125 (93)	114 (90)	106 (87)
APR	302 (108)	255 (108)	233 (106)	217 (106)
MAY	237 (106)	200 (106)	184 (104)	171 (103)
JUN	339 (108)	287 (108)	263 (108)	244 (106)
JUL	378 (108)	319 (108)	293 (108)	272 (108)
AUG	343 (108)	290 (108)	266 (108)	247 (106)
SEP	269 (108)	227 (105)	208 (106)	194 (105)
OCT	340 (108)	287 (108)	263 (108)	245 (106)
NOV	177 (103)	149 (101)	137 (97)	127 (94)
DEC	79 (70)	67 (61)	51 (56)	57 (53)
Annual	2804 (1157)	2368 (1131)	2169 (1112)	2019 (1095)

Table C-4-4 (4) Rainfall Pattern and Effective Rainfall for Design Year
Station Lejanias

Month	Return Period 1/2	1/5	1/10	1/20
JAN	64 (58)	52 (48)	47 (44)	43 (40)
FEB	125 (93)	101 (84)	91 (78)	83 (72)
MAR	181 (104)	147 (101)	132 (96)	120 (92)
APR	332 (108)	270 (108)	242 (106)	221 (106)
MAY	368 (108)	298 (108)	267 (108)	244 (106)
JUN	372 (108)	302 (108)	271 (108)	247 (106)
JUL	302 (108)	245 (106)	220 (106)	201 (106)
AUG	294 (108)	239 (106)	214 (106)	196 (105)
SEP	289 (108)	234 (106)	210 (106)	192 (105)
OCT	357 (108)	289 (108)	259 (108)	237 (106)
NOV	215 (106)	175 (103)	157 (103)	143 (100)
DEC	119 (91)	96 (81)	86 (75)	79 (70)
Annual	3019 (1209)	2448 (1168)	2194 (1142)	2005 (1114)

Table C-4-5 (1) Calculation of Probability for Station at LEJANIAS

Year	24 Max. Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1979	88.0	1	168.0(1987)	1.455	5.56
1980	65.0	2	148.0(1986)	1.282	16.67
1981	102.0	3	136.0(1983)	1.178	27.78
1982	102.0	4	130.0(1985)	1.126	38.89
1983	136.0	5	102.0(1981)	0.884	50.00
1984	100.0	6	102.0(1982)	0.884	61.11
1985	130.0	7	100.0(1984)	0.866	72.22
1986	148.0	8	88.0(1979)	0.762	83.33
1987	168.0	9	65.0(1980)	0.563	94.44

Total Xs= 1039.0 mm Average Xo= 115.4 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.586	183.1
10%	10	1.422	164.1
20%	5	1.244	143.6
25%	4	1.183	136.6
33%	3	1.102	127.2
50%	2	0.964	111.3

Table C-4-5 (2) Calculation of Probability for Station at PUERTO LIMON

Year	24 Max. Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1968	144.0	1	151.2(1979)	1.579	2.78
1969	67.2	2	144.0(1968)	1.503	8.33
1970	92.2	3	134.0(1981)	1.399	13.89
1971	116.7	4	118.8(1974)	1.240	19.44
1972	104.0	5	116.7(1971)	1.218	25.00
1973	80.0	6	111.5(1980)	1.164	30.56
1974	118.8	7	104.0(1972)	1.086	36.11
1975	98.1	8	98.1(1975)	1.024	41.67
1976	96.0	9	96.0(1976)	1.002	47.22
1977	60.0	10	92.2(1970)	0.963	52.78
1978	87.5	11	89.5(1984)	0.934	58.33
1979	151.2	12	87.5(1978)	0.914	63.89
1980	111.5	13	80.0(1973)	0.835	69.44
1981	134.0	14	80.0(1985)	0.835	75.00
1982	33.4	15	67.2(1969)	0.702	80.56
1983	60.0	16	60.0(1977)	0.626	86.11
1984	89.5	17	60.0(1983)	0.626	91.67
1985	80.0	18	33.4(1982)	0.349	97.22
1986	----				
1987	----				

Total Xs= 1724.1 mm Average Xo= 95.8 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.773	169.8
10%	10	1.544	147.9
20%	5	1.304	124.9
25%	4	1.224	117.2
33%	3	1.119	107.1
50%	2	0.945	90.5

Table C-4-5 (3) Calculation of Probability for Station at MESA DE YAMANES

Year	24 Max. Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1969	149.0	1	175.0(1975)	1.433	3.33
1970	140.0	2	160.0(1984)	1.310	10.00
1971	120.0	3	150.0(1981)	1.228	16.67
1972	103.0	4	149.0(1969)	1.220	23.33
1973	129.0	5	145.0(1978)	1.187	30.00
1974	138.0	6	140.0(1970)	1.146	36.67
1975	175.0	7	138.0(1974)	1.130	43.33
1976	75.0	8	129.0(1973)	1.056	50.00
1977	75.0	9	120.0(1971)	0.983	56.67
1978	145.0	10	103.0(1972)	0.843	63.33
1979	95.0	11	100.0(1983)	0.819	70.00
1980	----	12	95.0(1979)	0.778	76.67
1981	150.0	13	78.0(1982)	0.639	83.33
1982	78.0	14	75.0(1976)	0.614	90.00
1983	100.0	15	75.0(1977)	0.614	96.67
1984	160.0				
1985	----				
1986	----				

Total Xs= 1832.0 mm Average Xo= 122.1 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.576	192.4
10%	10	1.415	172.8
20%	5	1.240	151.5
25%	4	1.180	144.1
33%	3	1.100	134.4
50%	2	0.964	117.8

Table C-4-5 (4) Calculation of Probability for Station at SAN LUIS DE CUBARRA

Year	24 Max. Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1969	150.0	1	212.0(1970)	1.424	2.63
1970	212.0	2	196.0(1978)	1.316	7.89
1971	140.0	3	180.0(1981)	1.209	13.16
1972	154.0	4	166.0(1979)	1.115	18.42
1973	132.0	5	160.0(1977)	1.075	23.68
1974	142.0	6	154.0(1972)	1.034	28.95
1975	144.0	7	150.0(1969)	1.007	34.21
1976	113.0	8	150.0(1984)	1.007	39.47
1977	160.0	9	148.0(1980)	0.994	44.74
1978	196.0	10	144.0(1975)	0.967	50.00
1979	166.0	11	142.0(1974)	0.954	55.26
1980	148.0	12	140.0(1971)	0.940	60.53
1981	180.0	13	140.0(1985)	0.940	65.79
1982	137.0	14	137.0(1982)	0.920	71.05
1983	130.0	15	132.0(1973)	0.887	76.32
1984	150.0	16	130.0(1983)	0.873	81.58
1985	140.0	17	118.0(1987)	0.793	86.84
1986	117.0	18	117.0(1986)	0.786	92.11
1987	118.0	19	113.0(1976)	0.759	97.37

Total Xs= 2829.0 mm Average Xo= 148.9 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.302	193.8
10%	10	1.225	182.4
20%	5	1.137	169.3
25%	4	1.106	164.7
33%	3	1.063	158.3
50%	2	0.987	146.9

Table C-4-5 (5) Calculation of Probability for Station at CALINE

Year	24 Max. Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1978	134.0	1	173.0(1980)	1.330	5.56
1979	120.0	2	148.0(1981)	1.137	16.67
1980	173.0	3	135.0(1983)	1.038	27.78
1981	148.0	4	135.0(1985)	1.038	38.89
1982	125.0	5	134.0(1979)	1.030	50.00
1983	135.0	6	128.0(1986)	0.984	61.11
1984	73.0	7	125.0(1982)	0.961	72.22
1985	135.0	8	120.0(1979)	0.922	83.33
1986	128.0	9	73.0(1984)	0.561	94.44

Total Xs= 1171.0 mm Average Xo= 130.1 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.520	197.8
10%	10	1.380	179.6
20%	5	1.226	159.5
25%	4	1.173	152.6
33%	3	1.101	143.3
50%	2	0.978	127.3

Table C-4-5 (6) Calculation of Probability for Station at PINALITO

Year	24 Max. Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1978	201.0	1	201.0(1978)	1.773	5.00
1979	149.0	2	149.0(1979)	1.315	15.00
1980	94.0	3	140.0(1984)	1.235	25.00
1981	68.0	4	125.0(1986)	1.103	35.00
1982	64.0	5	114.0(1987)	1.006	45.00
1983	100.4	6	100.4(1983)	0.886	55.00
1984	140.0	7	94.0(1980)	0.829	65.00
1985	78.0	8	78.0(1985)	0.688	75.00
1986	125.0	9	68.0(1981)	0.600	85.00
1987	114.0	10	64.0(1982)	0.565	95.00

Total Xs= 1133.4 mm Average Xo= 113.3 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.735	196.7
10%	10	1.517	172.0
20%	5	1.288	145.9
25%	4	1.211	137.2
33%	3	1.110	125.8
50%	2	0.941	106.7

Table C-4-5 (7) Calculation of Probability for Station at PUERTO LLERAS

Year	24 Max. Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1979	85.0	1	183.0(1983)	1.695	5.56
1980	107.0	2	134.0(1982)	1.241	16.67
1981	74.0	3	120.7(1987)	1.118	27.78
1982	134.0	4	107.0(1980)	0.991	38.89
1983	183.0	5	97.0(1984)	0.898	50.00
1984	97.0	6	91.0(1985)	0.843	61.11
1985	91.0	7	85.0(1979)	0.787	72.22
1986	80.0	8	80.0(1986)	0.741	83.33
1987	120.7	9	74.0(1981)	0.685	94.44

Total Xs= 971.7 mm Average Xo= 108.0 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.571	169.6
10%	10	1.411	152.3
20%	5	1.237	133.5
25%	4	1.177	127.1
33%	3	1.097	118.5
50%	2	0.962	103.9

Table C-4-5 (8) Calculation of Probability for Station at LOS NARANJOS

Year	24 Max. Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
166	110.0	1	148.0(168)	1.361	3.85
167	122.0	2	135.0(185)	1.241	11.54
168	148.0	3	134.0(187)	1.232	19.23
169	99.0	4	132.9(174)	1.222	26.92
170	121.3	5	122.0(167)	1.122	34.62
171	88.0	6	121.3(170)	1.115	42.31
172	86.0	7	110.0(166)	1.011	50.00
173	80.6	8	99.0(169)	0.910	57.69
174	132.9	9	88.0(171)	0.809	65.38
175	72.0	10	86.0(172)	0.791	73.08
176	----	11	85.0(186)	0.782	80.77
177	----	12	80.6(173)	0.741	88.46
178	----	13	72.0(175)	0.662	96.15
179	----				
180	----				
181	----				
182	----				
183	----				
184	----				
185	135.0				
186	85.0				
187	134.0				

Total Xs= 1413.8 mm Average Xo= 108.8 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.460	158.8
10%	10	1.336	145.3
20%	5	1.199	130.4
25%	4	1.151	125.2
33%	3	1.087	118.2
50%	2	0.975	106.0

Table C-4-5 (9) Calculation of Probability for Station at LA HOLANDA

Year	24 Max. Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1978	47.0	1	160.0(1982)	1.552	5.00
1979	110.1	2	136.2(1984)	1.321	15.00
1980	92.1	3	127.5(1987)	1.237	25.00
1981	110.0	4	110.1(1979)	1.068	35.00
1982	160.0	5	110.0(1981)	1.067	45.00
1983	64.4	6	92.1(1980)	0.893	55.00
1984	136.2	7	91.9(1985)	0.891	65.00
1985	91.9	8	91.8(1986)	0.890	75.00
1986	91.8	9	64.4(1983)	0.625	85.00
1987	127.5	10	47.0(1978)	0.456	95.00

Total Xs= 1031.0 mm Average Xo= 103.1 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.762	181.7
10%	10	1.538	158.5
20%	5	1.302	134.2
25%	4	1.223	126.1
33%	3	1.119	115.4
50%	2	0.948	97.7

Table C-4-5 (10) Calculation of Probability for Station at PUERTO RICO

Year	24 Max. Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1979	123.0	1	126.0(1982)	1.314	5.56
1980	115.0	2	123.0(1979)	1.282	16.67
1981	80.0	3	115.0(1980)	1.199	27.78
1982	126.0	4	100.0(1983)	1.043	38.89
1983	100.0	5	90.8(1986)	0.947	50.00
1984	50.0	6	90.4(1985)	0.943	61.11
1985	90.4	7	88.0(1987)	0.918	72.22
1986	90.8	8	80.0(1981)	0.834	83.33
1987	88.0	9	50.0(1984)	0.521	94.44

Total Xs= 863.2 mm Average Xo= 95.9 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.599	153.4
10%	10	1.432	137.4
20%	5	1.252	120.1
25%	4	1.190	114.2
33%	3	1.108	106.3
50%	2	0.969	92.9

Table C-4-5 (11) Calculation of Probability for Station at CAMPO ALEGRE

Year	24 Max. Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1979	74.0	1	165.0(1981)	1.339	5.56
1980	134.0	2	150.0(1982)	1.217	16.67
1981	165.0	3	150.0(1983)	1.217	27.78
1982	150.0	4	135.0(1986)	1.096	38.89
1983	150.0	5	134.0(1980)	1.087	50.00
1984	90.0	6	103.0(1985)	0.836	61.11
1985	103.0	7	100.0(1987)	0.812	72.22
1986	135.0	8	90.0(1984)	0.795	83.33
1987	100.0	9	74.0(1979)	0.601	94.44

Total Xs= 1109.0 mm Average Xo= 123.2 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.534	189.0
10%	10	1.388	171.0
20%	5	1.227	151.2
25%	4	1.172	144.4
33%	3	1.098	135.3
50%	2	0.971	119.6

Table C-4-5 (12) Calculation of Probability for Station at LAS MICOS

Year	24 Max. Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1979	126.0	1	140.0(1981)	1.331	5.56
1980	53.0	2	135.0(1985)	1.283	16.67
1981	140.0	3	134.0(1987)	1.273	27.78
1982	70.0	4	126.0(1979)	1.197	38.89
1983	100.0	5	104.0(1984)	0.988	50.00
1984	104.0	6	100.0(1983)	0.950	61.11
1985	135.0	7	85.0(1986)	0.808	72.22
1986	85.0	8	70.0(1982)	0.665	83.33
1987	134.0	9	53.0(1980)	0.504	94.44

Total Xs= 947.0 mm Average Xo= 105.2 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.720	181.0
10%	10	1.512	159.0
20%	5	1.291	135.8
25%	4	1.217	128.0
33%	3	1.119	117.7
50%	2	0.955	100.5

Table C-4-5 (13) Calculation of Probability for Station at VISTAHERMOSA

Year	24 Max. Rainfall [mm]	No.	Data(year) [mm]	Ratio Xi/Xo	Probability [%]
1969	86.0	1	211.8(1976)	1.883	2.63
1970	77.2	2	180.0(1973)	1.601	7.89
1971	111.6	3	152.2(1980)	1.353	13.16
1972	85.5	4	147.4(1981)	1.311	18.42
1973	180.0	5	130.0(1986)	1.156	23.68
1974	74.0	6	127.0(1984)	1.129	28.95
1975	102.8	7	125.9(1978)	1.120	34.21
1976	211.8	8	114.5(1982)	1.018	39.47
1977	84.0	9	111.6(1971)	0.992	44.74
1978	125.9	10	105.1(1983)	0.935	50.00
1979	75.2	11	102.8(1975)	0.914	55.26
1980	152.2	12	94.4(1987)	0.839	60.53
1981	147.4	13	86.0(1969)	0.765	65.79
1982	114.5	14	85.5(1972)	0.760	71.05
1983	105.1	15	84.0(1977)	0.747	76.32
1984	127.0	16	77.2(1970)	0.687	81.58
1985	52.0	17	75.2(1979)	0.669	86.84
1986	130.0	18	74.0(1974)	0.658	92.11
1987	94.4	19	52.0(1985)	0.462	97.37

Total Xs= 2136.6 mm Average Xo= 112.5 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.672	188.0
10%	10	1.475	165.9
20%	5	1.266	142.3
25%	4	1.195	134.4
33%	3	1.102	123.9
50%	2	0.945	106.3

Table C-4-6 (1) Probability of Continuous Drought Days
(Station SAN LUIS DE CUBARRAL)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1969	16.0	1	43.0(1979)	2.224	2.78
1970	16.0	2	36.0(1985)	1.862	8.33
1971	10.0	3	28.0(1983)	1.448	13.89
1972	17.0	4	27.0(1986)	1.397	19.44
1973	----	5	22.0(1982)	1.138	25.00
1974	7.0	6	22.0(1981)	1.138	30.56
1975	16.0	7	19.0(1978)	0.983	36.11
1976	9.0	8	17.0(1977)	0.879	41.67
1977	17.0	9	17.0(1972)	0.879	47.22
1978	19.0	10	16.0(1975)	0.828	52.78
1979	43.0	11	16.0(1970)	0.828	58.33
1980	14.0	12	16.0(1969)	0.828	63.89
1981	22.0	13	15.0(1987)	0.776	69.44
1982	22.0	14	14.0(1984)	0.724	75.00
1983	28.0	15	14.0(1980)	0.724	80.56
1984	14.0	16	10.0(1971)	0.517	86.11
1985	36.0	17	9.0(1976)	0.466	91.67
1986	27.0	18	7.0(1974)	0.362	97.22
1987	15.0				

Total Xs= 348.0 mm Average Xo= 19.3 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.952	37.7
10%	10	1.649	31.9
20%	5	1.342	25.9
25%	4	1.241	24.0
33%	3	1.113	21.5
50%	2	0.905	17.5

Table C-4-6 (2) Probability of Continuous Drought Days
(Station MESA DE YANANES)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1969	17.0	1	70.0(1975)	2.482	3.33
1970	34.0	2	43.0(1974)	1.525	10.00
1971	18.0	3	39.0(1977)	1.383	16.67
1972	17.0	4	39.0(1981)	1.383	23.33
1973	29.0	5	34.0(1970)	1.206	30.00
1974	43.0	6	32.0(1978)	1.135	36.67
1975	70.0	7	31.0(1976)	1.099	43.33
1976	31.0	8	29.0(1973)	1.028	50.00
1977	39.0	9	26.0(1986)	0.922	56.67
1978	32.0	10	18.0(1971)	0.638	63.33
1979	7.0	11	17.0(1969)	0.603	70.00
1980	----	12	17.0(1972)	0.603	76.67
1981	39.0	13	14.0(1984)	0.496	83.33
1982	----	14	7.0(1979)	0.248	90.00
1983	7.0	15	7.0(1983)	0.248	96.67
1984	14.0				
1985	----				
1986	26.0				

Total Xs= 423.0 mm Average Xo= 28.2 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	2.551	71.9
10%	10	1.999	56.4
20%	5	1.484	41.8
25%	4	1.326	37.4
33%	3	1.132	31.9
50%	2	0.840	23.7

Table C-4-6 (3) Probability of Continuous Drought Days
(Station CALIME)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1978	23.0	1	33.0(1985)	1.610	6.25
1979	28.0	2	30.0(1983)	1.463	18.75
1980	----	3	28.0(1979)	1.366	31.25
1981	15.0	4	23.0(1978)	1.122	43.75
1982	11.0	5	15.0(1981)	0.732	56.25
1983	30.0	6	13.0(1986)	0.634	68.75
1984	11.0	7	11.0(1982)	0.537	81.25
1985	33.0	8	11.0(1984)	0.537	93.75
1986	13.0				

Total Xs= 164.0 mm Average Xo= 20.5 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	2.057	42.2
10%	10	1.721	35.3
20%	5	1.384	28.4
25%	4	1.275	26.1
33%	3	1.136	23.3
50%	2	0.913	18.7

Table C-4-6 (4) Probability of Continuous Drought Days
(Station PINALITO)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1978	----	1	59.0(1979)	2.280	6.25
1979	59.0	2	36.0(1982)	1.391	18.75
1980	27.0	3	27.0(1980)	1.043	31.25
1981	19.0	4	25.0(1986)	0.966	43.75
1982	36.0	5	22.0(1987)	0.850	56.25
1983	9.0	6	19.0(1981)	0.734	68.75
1984	10.0	7	10.0(1984)	0.386	81.25
1985	----	8	9.0(1983)	0.348	93.75
1986	25.0				
1987	22.0				

Total Xs= 207.0 mm Average Xo= 25.9 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	2.442	63.2
10%	10	1.936	50.1
20%	5	1.458	37.7
25%	4	1.310	33.9
33%	3	1.127	29.2
50%	2	0.848	22.0

Table C-4-6 (5) Probability of Continuous Drought Days
(Station PUERTO LLERAS)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1979	8.0	1	51.0(1980)	1.675	5.56
1980	51.0	2	45.0(1986)	1.478	16.67
1981	35.0	3	44.0(1985)	1.445	27.78
1982	24.0	4	37.0(1987)	1.215	38.89
1983	10.0	5	35.0(1981)	1.150	50.00
1984	20.0	6	24.0(1982)	0.788	61.11
1985	44.0	7	20.0(1984)	0.657	72.22
1986	45.0	8	10.0(1983)	0.328	83.33
1987	37.0	9	8.0(1979)	0.263	94.44

Total Xs= 274.0 mm Average Xo= 30.4 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	2.789	84.9
10%	10	2.147	65.4
20%	5	1.559	47.5
25%	4	1.382	42.1
33%	3	1.166	35.5
50%	2	0.847	25.8

Table C-4-6 (6) Probability of Continuous Drought Days
(Station LOS NARANJOS)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1967	21.0	1	41.0(1973)	2.247	6.25
1968	16.0	2	21.0(1967)	1.151	18.75
1969	14.0	3	20.0(1972)	1.096	31.25
1970	10.0	4	16.0(1968)	0.877	43.75
1971	16.0	5	16.0(1971)	0.877	56.25
1972	20.0	6	14.0(1969)	0.767	68.75
1973	41.0	7	10.0(1970)	0.548	81.25
1974	8.0	8	8.0(1974)	0.438	93.75

Total Xs= 146.0 mm Average Xo= 18.2 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	2.082	38.0
10%	10	1.729	31.6
20%	5	1.377	25.1
25%	4	1.264	23.1
33%	3	1.120	20.4
50%	2	0.892	16.3

Table C-4-6 (7) Probability of Continuous Drought Days
(Station PUERTO LIMON)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1968	7.0	1	51.0(1976)	1.889	3.33
1969	15.0	2	48.0(1980)	1.778	10.00
1970	16.0	3	43.0(1975)	1.593	16.67
1971	27.0	4	40.0(1974)	1.481	23.33
1972	16.0	5	31.0(1977)	1.148	30.00
1973	29.0	6	29.0(1973)	1.074	36.67
1974	40.0	7	27.0(1971)	1.000	43.33
1975	43.0	8	26.0(1979)	0.963	50.00
1976	51.0	9	26.0(1981)	0.963	56.67
1977	31.0	10	18.0(1978)	0.667	63.33
1978	18.0	11	16.0(1972)	0.593	70.00
1979	26.0	12	16.0(1970)	0.593	76.67
1980	48.0	13	15.0(1969)	0.556	83.33
1981	26.0	14	12.0(1984)	0.444	90.00
1982	----	15	7.0(1968)	0.259	96.67
1983	----				
1984	12.0				
1985	----				
1986	----				
1987	----				

Total Xs= 405.0 mm Average Xo= 27.0 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	2.260	61.0
10%	10	1.835	49.5
20%	5	1.423	38.4
25%	4	1.293	34.9
33%	3	1.129	30.5
50%	2	0.875	23.6

Table C-4-6 (8) Probability of Continuous Drought Days
(Station LA HOLANDA)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1978	----	1	48.0(1979)	1.623	7.14
1979	48.0	2	45.0(1986)	1.522	21.43
1980	44.0	3	44.0(1980)	1.488	35.71
1981	----	4	36.0(1985)	1.217	50.00
1982	19.0	5	19.0(1982)	0.643	64.29
1983	----	6	10.0(1987)	0.338	78.57
1984	5.0	7	5.0(1984)	0.169	92.86
1985	36.0				
1986	45.0				
1987	10.0				

Total Xs= 207.0 mm Average Xo= 29.6 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	3.786	112.0
10%	10	2.671	79.0
20%	5	1.744	51.6
25%	4	1.485	43.9
33%	3	1.184	35.0
50%	2	0.773	22.8

Table C-4-6 (9) Probability of Continuous Drought Days
(Station PUERTO RICO)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1979	24.0	1	54.0(1985)	1.968	5.56
1980	24.0	2	31.0(1986)	1.130	16.67
1981	28.0	3	28.0(1981)	1.020	27.78
1982	27.0	4	27.0(1982)	0.984	38.89
1983	17.0	5	24.0(1979)	0.874	50.00
1984	19.0	6	24.0(1980)	0.874	61.11
1985	54.0	7	23.0(1987)	0.838	72.22
1986	31.0	8	19.0(1984)	0.692	83.33
1987	23.0	9	17.0(1983)	0.619	94.44

Total Xs= 247.0 mm Average Xo= 27.4 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.702	46.7
10%	10	1.497	41.1
20%	5	1.279	35.1
25%	4	1.205	33.1
33%	3	1.109	30.4
50%	2	0.947	26.0

Table C-4-6 (10) Probability of Continuous Drought Days
(Station LEJAÑIAS)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1979	----	1	47.0(1985)	1.945	8.33
1980	----	2	29.0(1983)	1.200	25.00
1981	----	3	24.0(1986)	0.993	41.67
1982	9.0	4	21.0(1987)	0.869	58.33
1983	29.0	5	15.0(1984)	0.621	75.00
1984	15.0	6	9.0(1982)	0.372	91.67
1985	47.0				
1986	24.0				
1987	21.0				

Total Xs= 145.0 mm Average Xo= 24.2 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	2.276	55.0
10%	10	1.848	44.6
20%	5	1.432	34.6
25%	4	1.301	31.4
33%	3	1.136	27.5
50%	2	0.880	21.3

Table C-4-6 (11) Probability of Continuous Drought Days
(Station CAMPO ALEGRE)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1979	----	1	46.0(1985)	1.484	8.33
1980	----	2	34.0(1982)	1.097	25.00
1981	----	3	30.0(1983)	0.968	41.67
1982	34.0	4	30.0(1987)	0.968	58.33
1983	30.0	5	28.0(1986)	0.903	75.00
1984	18.0	6	18.0(1984)	0.581	91.67
1985	46.0				
1986	28.0				
1987	30.0				

Total Xs= 186.0 mm Average Xo= 31.0 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.639	50.8
10%	10	1.458	45.2
20%	5	1.265	39.2
25%	4	1.199	37.2
33%	3	1.111	34.4
50%	2	0.963	29.9

Table C-4-6 (12) Probability of Continuous Drought Days
(Station LAS NICOS)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1979	----	1	52.0(1986)	1.438	8.33
1980	----	2	49.0(1985)	1.355	25.00
1981	44.0	3	44.0(1981)	1.217	41.67
1982	----	4	30.0(1983)	0.829	58.33
1983	30.0	5	23.0(1987)	0.636	75.00
1984	19.0	6	19.0(1984)	0.525	91.67
1985	49.0				
1986	52.0				
1987	23.0				

Total Xs= 217.0 mm Average Xo= 36.2 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.939	70.1
10%	10	1.651	59.7
20%	5	1.357	49.1
25%	4	1.260	45.6
33%	3	1.135	41.0
50%	2	0.932	33.7

Table C-4-6 (13) Probability of Continuous Drought Days
(Station VISTAHERMOSA)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1969	16.0	1	81.0(1979)	3.233	2.78
1970	20.0	2	45.0(1977)	1.796	8.33
1971	14.0	3	43.0(1974)	1.716	13.89
1972	19.0	4	29.0(1980)	1.157	19.44
1973	28.0	5	28.0(1973)	1.118	25.00
1974	43.0	6	27.0(1983)	1.078	30.56
1975	16.0	7	22.0(1982)	0.878	36.11
1976	13.0	8	22.0(1981)	0.878	41.67
1977	45.0	9	21.0(1986)	0.838	47.22
1978	----	10	20.0(1970)	0.798	52.78
1979	81.0	11	19.0(1972)	0.758	58.33
1980	29.0	12	18.0(1987)	0.718	63.89
1981	22.0	13	16.0(1969)	0.639	69.44
1982	22.0	14	16.0(1975)	0.639	75.00
1983	27.0	15	14.0(1971)	0.559	80.56
1984	10.0	16	13.0(1976)	0.519	86.11
1985	7.0	17	10.0(1984)	0.399	91.67
1986	21.0	18	7.0(1985)	0.279	97.22
1987	18.0				

Total Xs= 451.0 mm Average Xo= 25.1 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	2.203	55.2
10%	10	1.786	44.8
20%	5	1.383	34.6
25%	4	1.256	31.5
33%	3	1.096	27.5
50%	2	0.848	21.2

Table C-4-6 (14) Probability of Continuous Drought Days
(Station CANO BLANCO)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1981	38.0	1	78.0(1986)	2.044	8.33
1982	----	2	38.0(1981)	0.996	25.00
1983	27.0	3	33.0(1987)	0.865	41.67
1984	22.0	4	31.0(1985)	0.812	58.33
1985	31.0	5	27.0(1983)	0.707	75.00
1986	78.0	6	22.0(1984)	0.576	91.67
1987	33.0				

Total Xs= 229.0 mm Average Xo= 38.2 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.993	76.1
10%	10	1.679	64.1
20%	5	1.362	52.0
25%	4	1.259	48.1
33%	3	1.127	43.0
50%	2	0.914	34.9

Table C-4-6 (15) Probability of Continuous Drought Days
(Station FUENTE DE ORO)

Year	Maximum [days]	No.	Data(year) [days]	Ratio Xi/Xo	Probability [%]
1981	45.0	1	66.0(1985)	1.730	7.14
1982	35.0	2	45.0(1981)	1.180	21.43
1983	29.0	3	43.0(1986)	1.127	35.71
1984	20.0	4	35.0(1982)	0.918	50.00
1985	66.0	5	29.0(1983)	0.760	64.29
1986	43.0	6	29.0(1987)	0.760	78.57
1987	29.0	7	20.0(1984)	0.524	92.86

Total Xs= 267.0 mm Average Xo= 38.1 mm

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Rainfall [mm]
5%	20	1.794	68.4
10%	10	1.556	59.4
20%	5	1.308	49.9
25%	4	1.225	46.7
33%	3	1.117	42.6
50%	2	0.938	35.8

Table C-4-7 (1)

Calculation of Probability for Station at PUERTO RICO

Year	@ Min. Discharge [m3/sec]	No.	Data(year) [m3/sec]	Ratio Xi/Xo	Probability [%]
1979	137.5	1	28.2(1987)	0.288	5.56
1980	105.0	2	58.0(1986)	0.592	16.67
1981	101.0	3	90.0(1985)	0.918	27.78
1982	112.0	4	101.0(1981)	1.030	38.89
1983	101.4	5	101.4(1983)	1.035	50.00
1984	149.0	6	105.0(1980)	1.071	61.11
1985	90.0	7	112.0(1982)	1.143	72.22
1986	58.0	8	137.5(1979)	1.403	83.33
1987	28.2	9	149.0(1984)	1.520	94.44

Total Xs= 882.1 Average Xo= 98.0 m3/se

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Discharge [m3/sec]
5%	20	0.356	34.9
10%	10	0.438	42.9
20%	5	0.564	55.2
25%	4	0.620	60.7
33%	3	0.708	69.4
50%	2	0.912	89.4

Table C-4-7 (2)

Calculation of Probability for Station at LEJANIAS

Year	@ Min. Discharge [m3/sec]	No.	Data(year) [m3/sec]	Ratio Xi/Xo	Probability [%]
1984	30.6	1	10.3(1985)	0.531	12.50
1985	10.3	2	16.6(1986)	0.856	37.50
1986	16.6	3	20.1(1987)	1.036	62.50
1987	20.1	4	30.6(1984)	1.577	87.50

Total Xs= 77.6 Average Xo= 19.4 m3/se

Hazen Plot

Probability	Return Period [year]	Ratio Xi/Xo	Discharge [m3/sec]
5%	20	0.434	8.4
10%	10	0.513	9.9
20%	5	0.629	12.2
25%	4	0.679	13.2
33%	3	0.757	14.7
50%	2	0.928	18.0

Table C-4-8 Probability of Mean River Discharge (Station ANGOSTURA)

Year	Mean Discharge [m3/S]	No.	Data(year) [m3/s]	Ratio Xi/Xo	Probability [%]
1984	92.0	1	68.2(1987)	0.897	12.50
1985	73.8	2	70.0(1986)	0.921	37.50
1986	70.0	3	73.8(1985)	0.971	62.50
1987	68.2	4	92.0(1984)	1.211	87.50

Total Xs= 304 m3/s Average Xo= 76.0 m3/s

Probability [%]	Return Period [year]	Ratio Xi/Xo	Mean Discharge [m3/s]
5%	20	0.772	58.7
10%	10	0.816	62.0
20%	5	0.873	66.3
25%	4	0.895	68.0
33%	3	0.928	70.5
50%	2	0.993	75.5

Discharge Pattern and Specific Discharge for Design Year at ANGOSTURA

Month	4 Years Average	Return Period 1/2	1/5	1/10	1/20
1	57.7	57.3(73.9)	50.4(64.9)	47.1(60.7)	44.5(57.
2	74.0	73.4(94.7)	64.5(83.2)	60.3(77.8)	57.1(73.
3	47.7	47.4(61.1)	41.7(53.7)	38.9(50.2)	36.8(47.
4	60.3	59.8(77.2)	52.6(67.8)	49.2(63.4)	46.5(60.
5	80.8	80.3(103.5)	70.6(91.0)	65.9(85.0)	62.4(80.
6	134.5	133.6(172.2)	117.4(151.4)	109.7(141.5)	103.8(133.
7	119.3	118.5(152.7)	104.1(134.3)	97.3(125.5)	92.1(118.
8	89.1	88.4(114.0)	77.7(100.2)	72.7(93.7)	68.8(88.
9	77.4	76.9(99.2)	67.6(87.2)	63.2(81.5)	59.8(77.
10	72.4	71.9(92.7)	63.2(81.5)	59.1(76.2)	55.9(72.
11	56.3	55.9(72.0)	49.1(63.3)	45.9(59.2)	43.4(56.
12	42.5	42.2(54.4)	37.1(47.8)	34.7(44.7)	32.8(42.
Annual	76.0	75.5(97.3)	66.3(85.5)	62.0(79.9)	58.7(75.

( ) : Specific Discharge [l/s/km2]

Table C-4-9 (1) Probability of Mean River Discharge
(Station GUANAYAS)

Year	Mean Discharge [m3/S]	No.	Data(year) [m3/s]	Ratio Xi/Xo	Probability [%]
1969	1.04	1	.51(1976)	0.595	4.17
1970	.91	2	.52(1977)	0.606	12.50
1971	1.08	3	.67(1979)	0.781	20.83
1972	.80	4	.80(1974)	0.933	29.17
1973	.99	5	.80(1972)	0.933	37.50
1974	.80	6	.86(1984)	1.003	45.83
1975	1.04	7	.91(1970)	1.061	54.17
1976	.51	8	.99(1973)	1.155	62.50
1977	.52	9	1.04(1969)	1.213	70.83
1978	----	10	1.04(1975)	1.213	79.17
1979	.67	11	1.07(1981)	1.248	87.50
1980	----	12	1.08(1971)	1.259	95.83
1981	1.07				
1982	----				
1983	----				
1984	.86				

Total Xs= 10 m3/s Average Xo= .9 m3/s

Probability [%]	Return Period [year]	Ratio Xi/Xo	Mean Discharge [m3/s]
5%	20	0.605	.52
10%	10	0.671	.58
20%	5	0.762	.65
25%	4	0.799	.68
33%	3	0.855	.73
50%	2	0.970	.83

Discharge Pattern and Specific Discharge for Design Year at GUANAYAS (m3/s)

Month	12 Years Average	Return Period 1/2	1/5	1/10	1/20
1	.15	.15(5.18)	.11(4.07)	.10(3.58)	.09(3.23)
2	.40	.39(13.83)	.30(10.85)	.27(9.56)	.24(8.62)
3	.47	.46(16.25)	.36(12.75)	.32(11.23)	.28(10.12)
4	1.49	1.45(51.50)	1.14(40.42)	1.00(35.60)	.90(32.09)
5	1.19	1.16(41.13)	.91(32.28)	.80(28.44)	.72(25.63)
6	1.70	1.65(58.76)	1.30(46.12)	1.14(40.62)	1.03(36.62)
7	.89	.86(30.76)	.68(24.14)	.60(21.27)	.54(19.17)
8	.82	.80(28.34)	.63(22.25)	.55(19.59)	.50(17.66)
9	.96	.93(33.18)	.73(26.04)	.64(22.94)	.58(20.68)
10	1.07	1.04(36.98)	.82(29.03)	.72(25.57)	.65(23.05)
11	.88	.85(30.42)	.67(23.87)	.59(21.03)	.53(18.95)
12	.26	.25(8.99)	.20(7.05)	.17(6.21)	.16(5.60)
Annual	.86	.83(29.61)	.65(23.24)	.58(20.47)	.52(18.45)

( ) : Specific Discharge [l/s/km2]

Table C-4-9 (2) Probability of Mean River Discharge
(Station URICHARE)

Year	Mean Discharge [m3/S]	No.	Data(year) [m3/s]	Ratio Xi/Xo	Probability [%]
1969	3.17	1	1.84(1976)	0.675	4.17
1970	2.86	2	1.89(1977)	0.694	12.50
1971	3.28	3	2.26(1979)	0.830	20.83
1972	2.59	4	2.58(1974)	0.947	29.17
1973	3.05	5	2.59(1972)	0.951	37.50
1974	2.58	6	2.72(1984)	0.998	45.83
1975	3.19	7	2.86(1970)	1.050	54.17
1976	1.84	8	3.05(1973)	1.120	62.50
1977	1.89	9	3.17(1969)	1.164	70.83
1978	----	10	3.19(1975)	1.171	79.17
1979	2.26	11	3.26(1981)	1.197	87.50
1980	----	12	3.28(1971)	1.204	95.83
1981	3.26				
1982	----				
1983	----				
1984	2.72				

Total Xs= 33 m3/s Average Xo= 2.7 m3/s

Probability [%]	Return Period [year]	Ratio Xi/Xo	Mean Discharge [m3/s]
5%	20	0.687	1.87
10%	10	0.743	2.02
20%	5	0.818	2.23
25%	4	0.848	2.31
33%	3	0.892	2.43
50%	2	0.982	2.68

Discharge Pattern and Specific Discharge for Design Year at URICHARE (m3/s

Month	12 Years Average	Return Period 1/2	1/5	1/10	1/20
1	.92	.90(18.94)	.75(15.77)	.68(14.33)	.63(13.25)
2	1.56	1.53(32.12)	1.28(26.74)	1.16(24.30)	1.07(22.46)
3	1.75	1.72(36.04)	1.43(30.00)	1.30(27.26)	1.20(25.20)
4	4.33	4.25(89.16)	3.54(74.23)	3.22(67.44)	2.97(62.34)
5	3.57	3.51(73.51)	2.92(61.20)	2.65(55.60)	2.45(51.40)
6	4.85	4.76(99.87)	3.97(83.15)	3.60(75.54)	3.33(69.83)
7	2.82	2.77(58.07)	2.31(48.35)	2.10(43.92)	1.94(40.60)
8	2.64	2.59(54.36)	2.16(45.26)	1.96(41.12)	1.81(38.01)
9	2.98	2.93(61.37)	2.44(51.09)	2.21(46.41)	2.05(42.91)
10	3.27	3.21(67.34)	2.67(56.06)	2.43(50.93)	2.25(47.08)
11	2.78	2.73(57.25)	2.27(47.66)	2.07(43.30)	1.91(40.03)
12	1.22	1.20(25.12)	1.00(20.92)	.91(19.00)	.84(17.57)
Annual	2.72	2.68(56.10)	2.23(46.70)	2.02(42.43)	1.87(39.22)

( ) : Specific Discharge [l/s/km2]

Table C-4-9 (3) Probability of Mean River Discharge
(Station MUCUYA)

Year	Mean Discharge [m3/S]	No.	Data(year) [m3/s]	Ratio Xi/Xo	Probability [%]
1969	1.00	1	.41(1976)	0.512	4.17
1970	.85	2	.43(1977)	0.537	12.50
1971	1.04	3	.60(1979)	0.750	20.83
1972	.72	4	.72(1972)	0.900	29.17
1973	.95	5	.74(1974)	0.925	37.50
1974	.74	6	.80(1984)	1.000	45.83
1975	1.01	7	.85(1970)	1.063	54.17
1976	.41	8	.95(1973)	1.187	62.50
1977	.43	9	1.00(1969)	1.250	70.83
1978	----	10	1.01(1975)	1.262	79.17
1979	.60	11	1.04(1971)	1.300	87.50
1980	----	12	1.05(1981)	1.312	95.83
1981	1.05				
1982	----				
1983	----				
1984	.80				

Total Xs= 10 m3/s Average Xo= .8 m3/s

Probability [%]	Return Period [year]	Ratio Xi/Xo	Mean Discharge [m3/s]
5%	20	0.533	.43
10%	10	0.606	.48
20%	5	0.709	.57
25%	4	0.752	.60
33%	3	0.817	.65
50%	2	0.956	.76

scharge Pattern and Specific Discharge for Design Year at MUCUYA (m3/s)

Month	12 Years Average	Return Period 1/2	1/5	1/10	1/20
1	.04	.04(1.61)	.03(1.19)	.02(1.02)	.02(.90)
2	.32	.31(12.84)	.23(9.52)	.19(8.14)	.17(7.16)
3	.38	.36(15.25)	.27(11.31)	.23(9.67)	.20(8.51)
4	1.50	1.44(60.20)	1.07(44.64)	.91(38.17)	.80(33.57)
5	1.13	1.08(45.35)	.80(33.63)	.69(28.75)	.60(25.29)
6	1.73	1.65(69.03)	1.22(51.19)	1.05(43.76)	.92(38.50)
7	.81	.78(32.51)	.58(24.10)	.49(20.61)	.43(18.13)
8	.74	.71(29.70)	.53(22.02)	.45(18.83)	.40(16.56)
9	.91	.87(36.52)	.65(27.08)	.55(23.15)	.49(20.37)
10	1.02	.98(40.94)	.73(30.35)	.62(25.95)	.55(22.83)
11	.83	.80(33.31)	.59(24.70)	.50(21.12)	.44(18.58)
12	.17	.16(6.82)	.12(5.06)	.10(4.33)	.09(3.80)
Annual	.80	.76(32.01)	.57(23.73)	.48(20.29)	.43(17.85)

) : Specific Discharge [l/s/km2]

Table C-4-9 (4) Probability of Mean River Discharge
(Station SARDINATA)

Year	Mean Discharge [m3/S]	No.	Data(year) [m3/s]	Ratio Xi/Xo	Probability [%]
1969	.80	1	.33(1976)	0.516	4.17
1970	.68	2	.35(1977)	0.547	12.50
1971	.83	3	.48(1979)	0.750	20.83
1972	.57	4	.57(1972)	0.891	29.17
1973	.76	5	.59(1974)	0.922	37.50
1974	.59	6	.64(1984)	1.000	45.83
1975	.81	7	.68(1970)	1.063	54.17
1976	.33	8	.76(1973)	1.188	62.50
1977	.35	9	.80(1969)	1.250	70.83
1978	----	10	.81(1975)	1.266	79.17
1979	.48	11	.83(1971)	1.297	87.50
1980	----	12	.84(1981)	1.313	95.83
1981	.84				
1982	----				
1983	----				
1984	.64				

Total Xs= 8 m3/s Average Xo= .6 m3/s

Probability [%]	Return Period [year]	Ratio Xi/Xo	Mean Discharge [m3/s]
5%	20	0.538	.34
10%	10	0.611	.39
20%	5	0.713	.46
25%	4	0.755	.48
33%	3	0.820	.52
50%	2	0.957	.61

Discharge Pattern and Specific Discharge for Design Year at SARDINATA (m3

Month	12 Years Average	Return Period 1/2	1/5	1/10	1/20
1	.04	.04(2.06)	.03(1.54)	.02(1.32)	.02(1.16
2	.26	.25(13.41)	.19(9.99)	.16(8.56)	.14(7.54
3	.30	.29(15.48)	.21(11.52)	.18(9.88)	.16(8.70
4	1.19	1.14(61.39)	.85(45.71)	.73(39.17)	.64(34.52
5	.91	.87(46.84)	.65(34.96)	.56(29.95)	.49(26.40
6	1.37	1.31(70.67)	.98(52.63)	.84(45.10)	.74(39.74
7	.65	.62(33.53)	.46(24.97)	.40(21.40)	.35(18.86
8	.59	.57(30.44)	.42(22.66)	.36(19.42)	.32(17.12
9	.73	.70(37.66)	.52(28.04)	.45(24.03)	.39(21.18
10	.82	.79(42.30)	.59(31.50)	.50(26.99)	.44(23.79
11	.66	.63(34.05)	.47(25.35)	.40(21.73)	.36(19.15
12	.14	.13(7.22)	.10(5.38)	.09(4.61)	.08(4.06
Annual	.64	.61(32.93)	.46(24.52)	.39(21.01)	.34(18.52

( ) : Specific Discharge [l/s/km2]

Table C-4-10 Coefficients of The Storage Function Method

(1) Coefficients of Catchment Area

Saturated Accumulate Rainfall Rsa =800 mm
Runoff Ratio F1 =0.5

Catchment Area No.	Area (km^2)	Value of K	Value of P	Delayed Time (hr)	Base flow (m^3/s)
1	775	104.00	0.33	2.92	37.22
2	922	95.20	0.33	2.57	44.25
3	1315	121.20	0.33	4.84	63.12
4	779	185.80	0.33	5.07	37.37
5	391	271.20	0.33	4.29	18.77
6	475	314.60	0.33	2.25	22.82
7	1244	285.60	0.33	4.88	59.69
8	350	249.60	0.33	1.75	16.79

(2) Coefficients of Rivers

River No.	Value of K	Value of P	Delayed Time (hr)
1	469.20	0.60	1.56
2	807.00	0.60	2.68
3	1398.60	0.60	4.64
4	289.20	0.60	0.96

Table C-4-11 (1) Result of Flood Analysis
(for 2 year Return Period)

Saturated Accumulate Rainfall Rsa =800 mm
Runoff Ratio F1 =0.5

Catchment Area No.	Area (km²)	Value of K	Value of P	Delayed Time (hr)	Maximam Discharge (m³/s)	Time of Max.Q (hr)	Base flow (m³/s)
1	775	104.00	0.33	2.92	146.03	174	37.22
2	922	95.20	0.33	2.57	460.00	360	44.25
3	1315	121.20	0.33	4.84	417.70	174	63.12
4	779	185.80	0.33	5.07	303.24	366	37.37
5	391	271.20	0.33	4.29	113.06	366	18.77
6	475	314.60	0.33	2.25	35.03	720	22.82
7	1244	285.60	0.33	4.88	134.88	336	59.69
8	350	240.60	0.33	1.75	71.82	696	16.79

River No.	Value of K	Value of P	Delayed Time (hr)	Maximam Discharge (m³/s)	Time of Max.Q (hr)
1	469.20	0.60	1.56	457.4	372
2	807.00	0.60	2.68	880.0	390
3	1398.60	0.60	4.64	846.1	438
4	289.20	0.60	0.96	1024.8	450

Table C-4-11 (2) Result of Flood Analysis
(for 5 year Return Period)

Saturated Accumulate Rainfall Rsa =800 mm
Runoff Ratio F1 =0.5

Catchment Area No.	Area (km^2)	Value of K	Value of P	Delayed Time (hr)	Maximam Discharge (m^3/s)	Time of Max.Q (hr)	Base flow (m^3/s)
1	775	104.00	0.33	2.92	190.22	168	37.22
2	922	95.20	0.33	2.57	521.31	360	44.25
3	1315	121.20	0.33	4.84	477.48	174	63.12
4	779	185.80	0.33	5.07	347.31	366	37.37
5	391	271.20	0.33	4.29	133.20	366	18.77
6	475	314.60	0.33	2.25	37.09	720	22.82
7	1244	285.60	0.33	4.88	158.02	336	59.69
8	350	240.60	0.33	1.75	85.04	696	16.79

River No.	Value of K	Value of P	Delayed Time (hr)	Maximam Discharge (m^3/s)	Time of Max.Q (hr)
1	469.20	0.60	1.56	520.9	372
2	807.00	0.60	2.68	994.9	390
3	1398.60	0.60	4.64	951.0	432
4	289.20	0.60	0.96	1154.0	444

Table C-4-11 (3) Result of Flood Analysis
(for 10 year Return Period)

Saturated Accumulate Rainfall Rsa =800 mm
Runoff Ratio F1 =0.5

Catchment Area No.	Area (km^2)	Value of K	Value of P	Delayed Time (hr)	Maximam Discharge (m^3/s)	Time of Max.Q (hr)	Base flow (m^3/s)
1	775	104.00	0.33	2.92	218.57	168	37.22
2	922	95.20	0.33	2.57	555.61	360	44.25
3	1315	121.20	0.33	4.84	509.63	174	63.12
4	779	185.80	0.33	5.07	371.79	366	37.37
5	391	271.20	0.33	4.29	144.48	366	18.77
6	475	314.60	0.33	2.25	38.64	438	22.82
7	1244	285.60	0.33	4.88	172.06	318	59.69
8	350	240.60	0.33	1.75	92.96	696	16.79

River No.	Value of K	Value of P	Delayed Time (hr)	Maximam Discharge (m^3/s)	Time of Max.Q (hr)
1	469.20	0.60	1.56	557.0	372
2	807.00	0.60	2.68	1061.3	384
3	1398.60	0.60	4.64	1009.6	432
4	289.20	0.60	0.96	1225.0	444

Table C-4-11 (4) Result of Flood Analysis
(for 20 year Return Period)

Saturated Accumulate Rainfall Rsa =800 mm
Runoff Ratio F1 =0.5

Catchment Area No.	Area (km^2)	Value of K	Value of P	Delayed Time (hr)	Maximam Discharge (m^3/s)	Time of Max.Q (hr)	Base flow (m^3/s)
1	775	104.00	0.33	2.92	244.53	168	37.22
2	922	95.20	0.33	2.57	584.84	360	44.25
3	1315	121.20	0.33	4.84	537.50	174	63.12
4	779	185.80	0.33	5.07	392.59	366	37.37
5	391	271.20	0.33	4.29	154.08	366	18.77
6	475	314.60	0.33	2.25	40.13	438	22.82
7	1244	285.60	0.33	4.88	185.50	318	59.69
8	350	240.60	0.33	1.75	100.24	312	16.79

River No.	Value of K	Value of P	Delayed Time (hr)	Maximam Discharge (m^3/s)	Time of Max.Q (hr)
1	469.20	0.60	1.56	588.3	372
2	807.00	0.60	2.68	1119.5	384
3	1398.60	0.60	4.64	1060.9	426
4	289.20	0.60	0.96	1287.4	438

Table C-4-12 (1) Flood Discharge in the Study Area

Rainfall at LEJANIAS

Name of Cano	Aria of Basin (km2)	Item	Return Period 1/2	1/5	1/10	1/20
GUANAYAS	28.1	RI(mm/hr)	18.6	26.0	30.9	35.6
		T(hr)	2.98	2.66	2.50	2.38
		Q(m3/s)	87.130	121.564	144.676	166.900
		q(m3/s/km2)	3.103	4.326	5.149	5.940
URICHARE	47.7	RI(mm/hr)	16.8	23.5	27.9	32.2
		T(hr)	3.47	3.09	2.91	2.77
		Q(m3/s)	133.756	186.488	221.945	256.038
		q(m3/s/km2)	2.804	3.910	4.653	5.368
MUCUYA	23.9	RI(mm/hr)	19.2	26.8	31.9	36.8
		T(hr)	2.85	2.54	2.39	2.27
		Q(m3/s)	76.491	106.646	126.922	146.419
		q(m3/s/km2)	3.200	4.462	5.311	6.126
SARDINATA	18.6	RI(mm/hr)	20.1	28.1	33.4	38.6
		T(hr)	2.65	2.36	2.22	2.11
		Q(m3/s)	62.453	87.074	103.630	119.549
		q(m3/s/km2)	3.358	4.681	5.571	6.427

Note: RI: Rainfall Intensity T: Concentration Time
Q: Peak Flood Discharge q:Specific Peak Flood Discharge

Table C-4-12 (2) Flood Discharge in the Study Area

Rainfall at AGUAS CLARAS

Name of Cano	Aria of Basin (km2)	Item	Return Period 1/2	1/5	1/10	1/20
GUANAYAS	28.1	RI(mm/hr)	16.3	23.7	28.9	33.9
		T(hr)	3.12	2.74	2.56	2.42
		Q(m3/s)	76.420	111.073	135.206	158.861
		q(m3/s/km2)	2.720	3.953	4.812	5.653
URICHARE	47.7	RI(mm/hr)	14.7	21.4	26.1	30.7
		T(hr)	3.64	3.19	2.98	2.82
		Q(m3/s)	117.235	170.395	207.416	243.706
		q(m3/s/km2)	2.458	3.572	4.348	5.109
MUCUYA	23.9	RI(mm/hr)	16.8	24.5	29.8	35.0
		T(hr)	2.98	2.62	2.44	2.31
		Q(m3/s)	67.042	97.443	118.614	139.367
		q(m3/s/km2)	2.805	4.077	4.963	5.831
SARDINATA	18.6	RI(mm/hr)	17.7	25.7	31.2	36.7
		T(hr)	2.78	2.44	2.27	2.15
		Q(m3/s)	54.739	79.560	96.846	113.791
		q(m3/s/km2)	2.943	4.277	5.207	6.118

Note: RI: Rainfall Intensity T: Concentration Time
Q: Peak Flood Discharge q:Specific Peak Flood Discharge

Table C-4-12 (3) Flood Discharge in the Study Area

Rainfall at LA COOPERATIVA

Name of Cano	Aria of Basin (km2)	Item	Return Period 1/2	1/5	1/10	1/20
GUANAYAS	28.1	RI(mm/hr)	14.4	21.8	27.1	32.4
		T(hr)	3.26	2.82	2.61	2.46
		Q(m3/s)	67.530	102.291	127.114	151.963
		q(m3/s/km2)	2.403	3.640	4.524	5.408
URICHARE	47.7	RI(mm/hr)	13.0	19.7	24.5	29.3
		T(hr)	3.80	3.28	3.04	2.86
		Q(m3/s)	103.597	156.923	195.002	233.123
		q(m3/s/km2)	2.172	3.290	4.088	4.887
MUCUYA	23.9	RI(mm/hr)	14.9	22.5	28.0	33.5
		T(hr)	3.11	2.69	2.50	2.35
		Q(m3/s)	58.244	88.739	111.515	133.315
		q(m3/s/km2)	2.479	3.755	4.666	5.578
SARDINATA	18.6	RI(mm/hr)	15.6	23.6	29.4	35.1
		T(hr)	2.90	2.51	2.32	2.18
		Q(m3/s)	48.371	73.270	91.050	108.849
		q(m3/s/km2)	2.601	3.939	4.895	5.852

Note: RI: Rainfall Intensity T: Concentration Time
Q: Peak Flood Discharge q:Specific Peak Flood Discharge

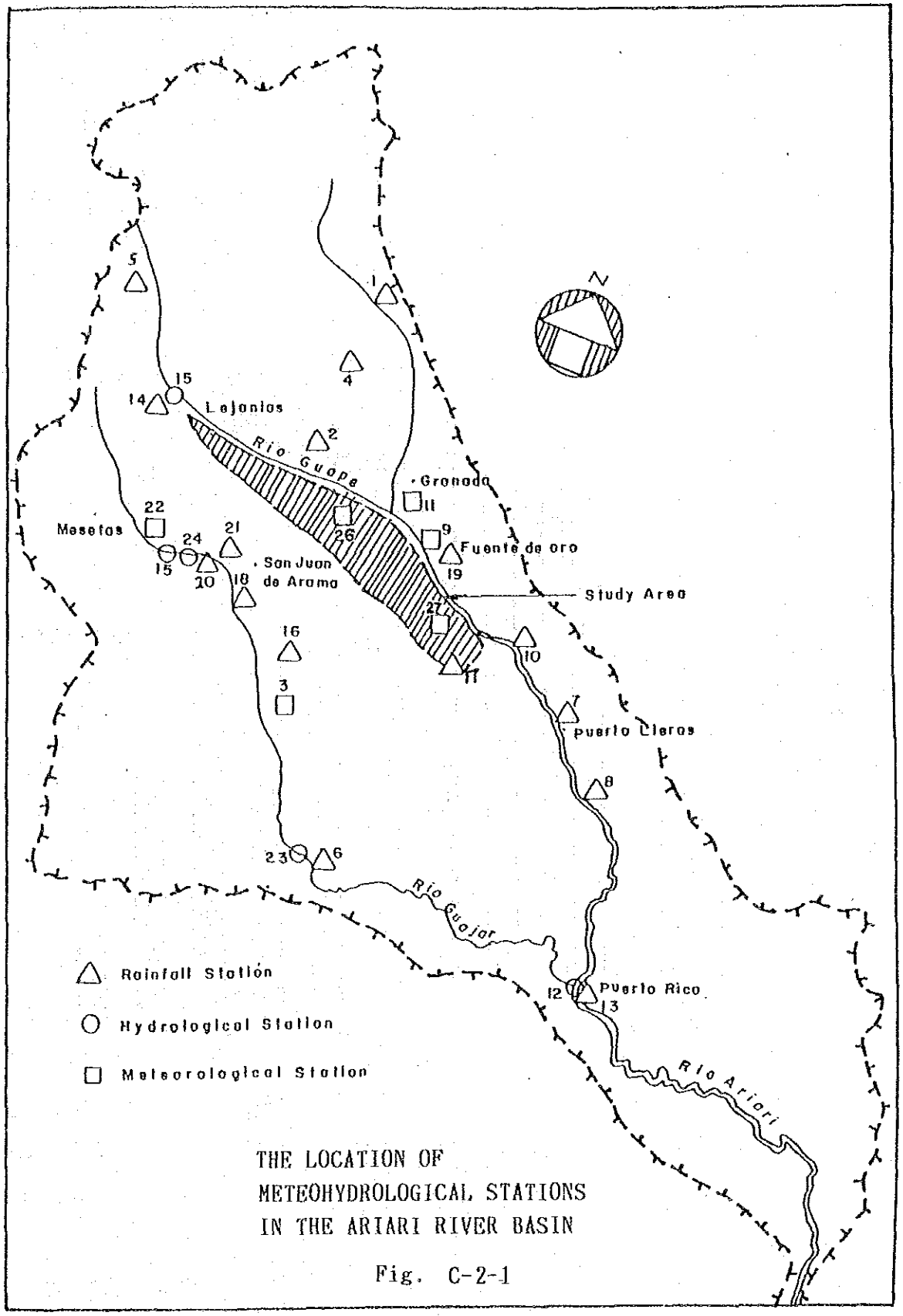
Table C-4-12 (4) Flood Discharge in the Study Area

Rainfall at PUERTO LIMON

Name of Cano	Aria of Basin (km2)	Item	Return Period 1/2	1/5	1/10	1/20
GUANAYAS	28.1	RI(mm/hr)	14.2	21.6	27.0	32.3
		T(hr)	3.28	2.83	2.62	2.46
		Q(m3/s)	66.569	101.338	126.333	151.265
		q(m3/s/km2)	2.369	3.606	4.496	5.383
URICHARE	47.7	RI(mm/hr)	12.8	19.6	24.4	29.2
		T(hr)	3.82	3.30	3.05	2.86
		Q(m3/s)	102.123	155.460	193.805	232.053
		q(m3/s/km2)	2.141	3.259	4.063	4.865
MUCUYA	23.9	RI(mm/hr)	14.7	22.3	27.8	33.3
		T(hr)	3.13	2.70	2.50	2.35
		Q(m3/s)	58.400	88.902	110.831	132.703
		q(m3/s/km2)	2.444	3.720	4.637	5.552
SARDINATA	18.6	RI(mm/hr)	15.4	23.4	29.2	35.0
		T(hr)	2.91	2.51	2.33	2.19
		Q(m3/s)	47.683	72.587	90.491	108.349
		q(m3/s/km2)	2.564	3.903	4.865	5.825

Note: RI: Rainfall Intensity T: Concentration Time
Q: Peak Flood Discharge q:Specific Peak Flood Discharge

F I G U I R E S



THE LOCATION OF
METEOHYDROLOGICAL STATIONS
IN THE ARIARI RIVER BASIN

Fig. C-2-1

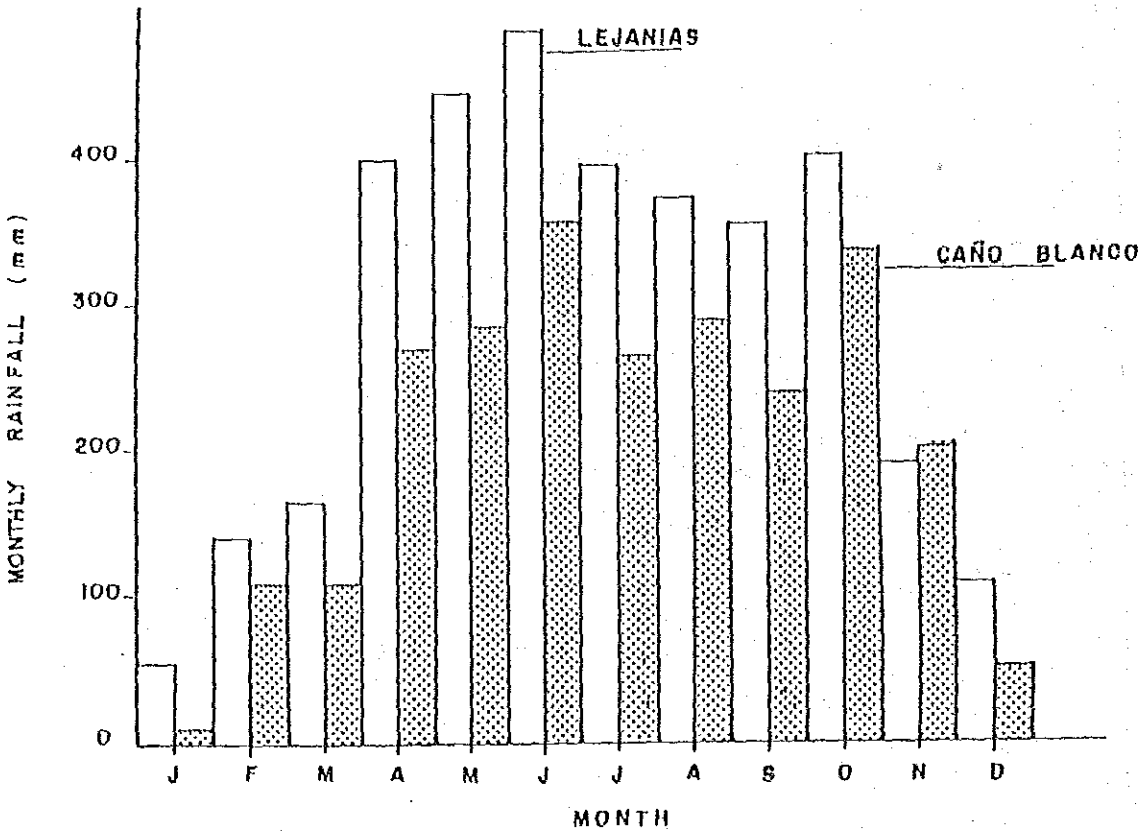


Fig. C-3-1 RAINFALL PATTERN OF THE STUDY AREA

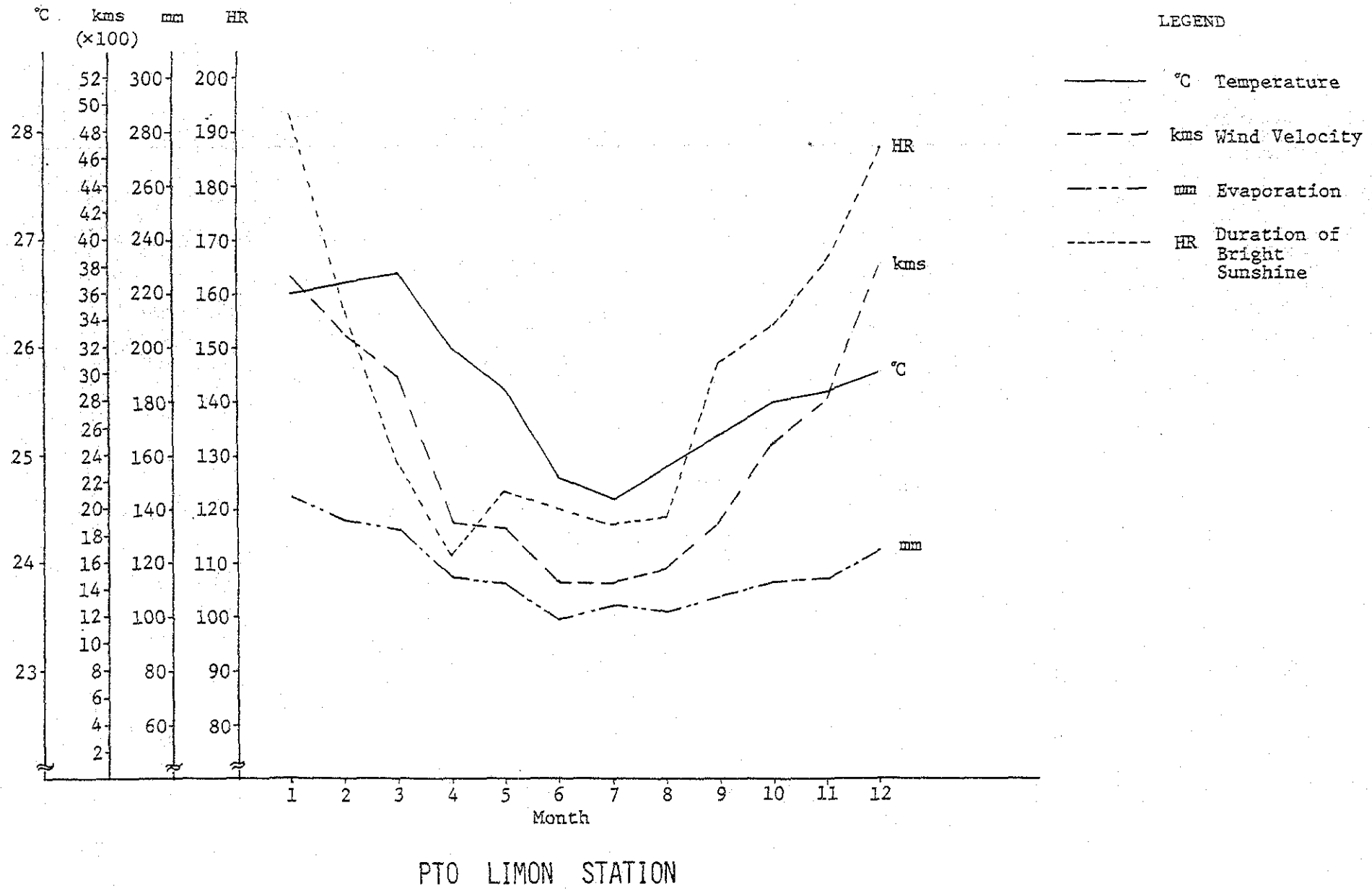


Fig.C-3-2 (1) Meteorological Condition in The Ariari Basin

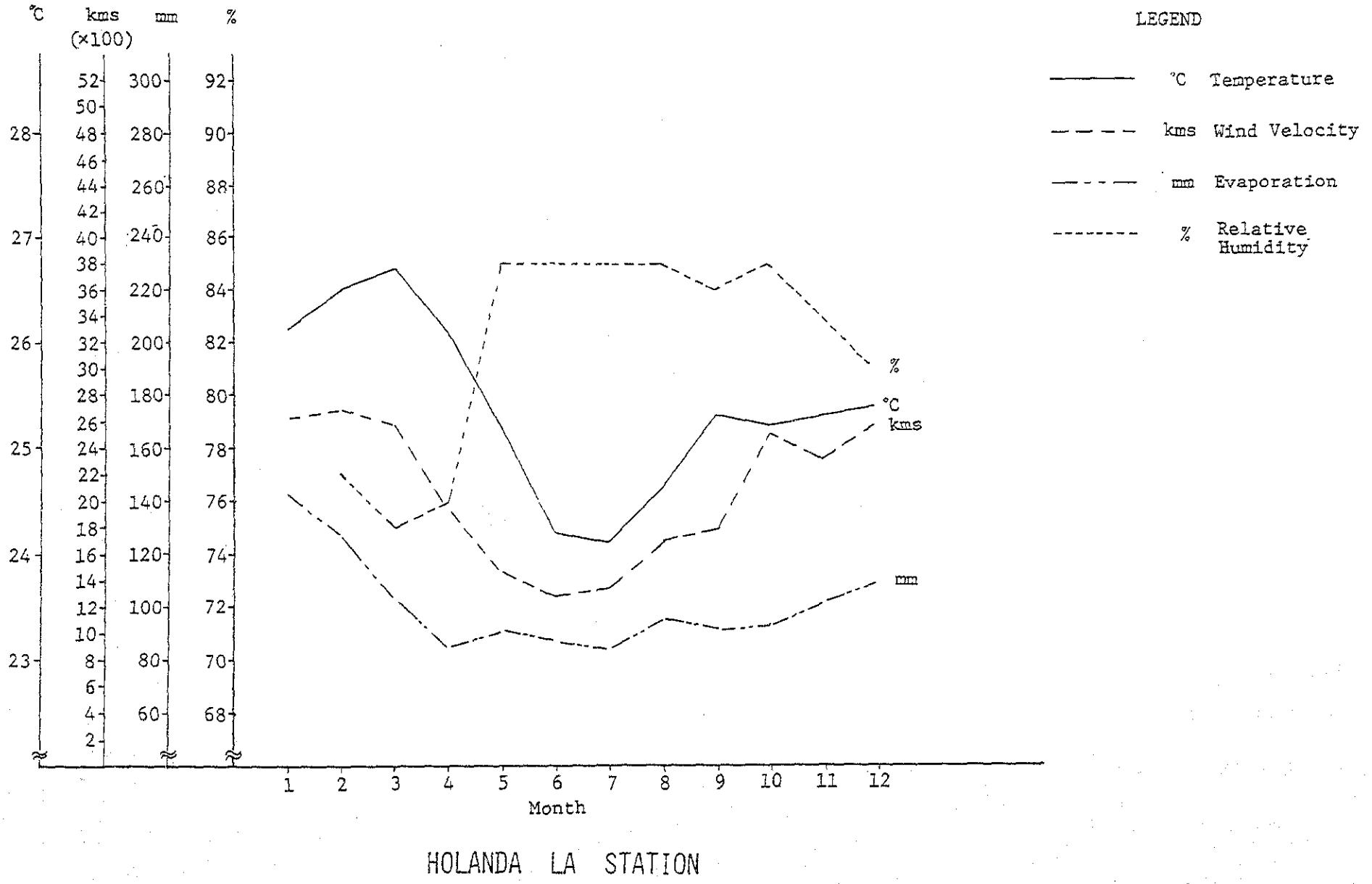


Fig.C-3-2 (2) Meteorological Condition in The Ariari Basin

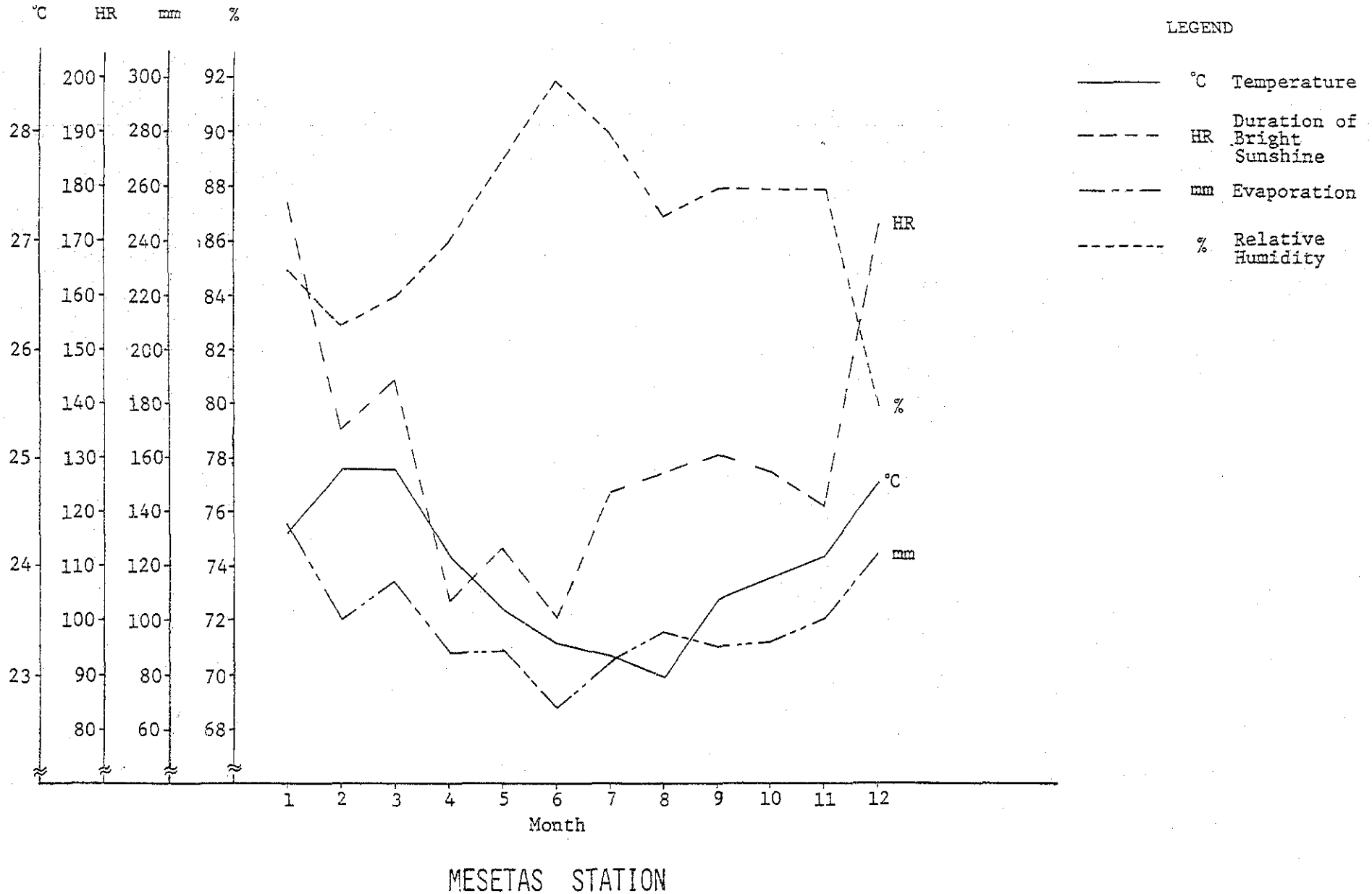


Fig.C-3-2 (3) Meteorological Condition in The Ariari Basin

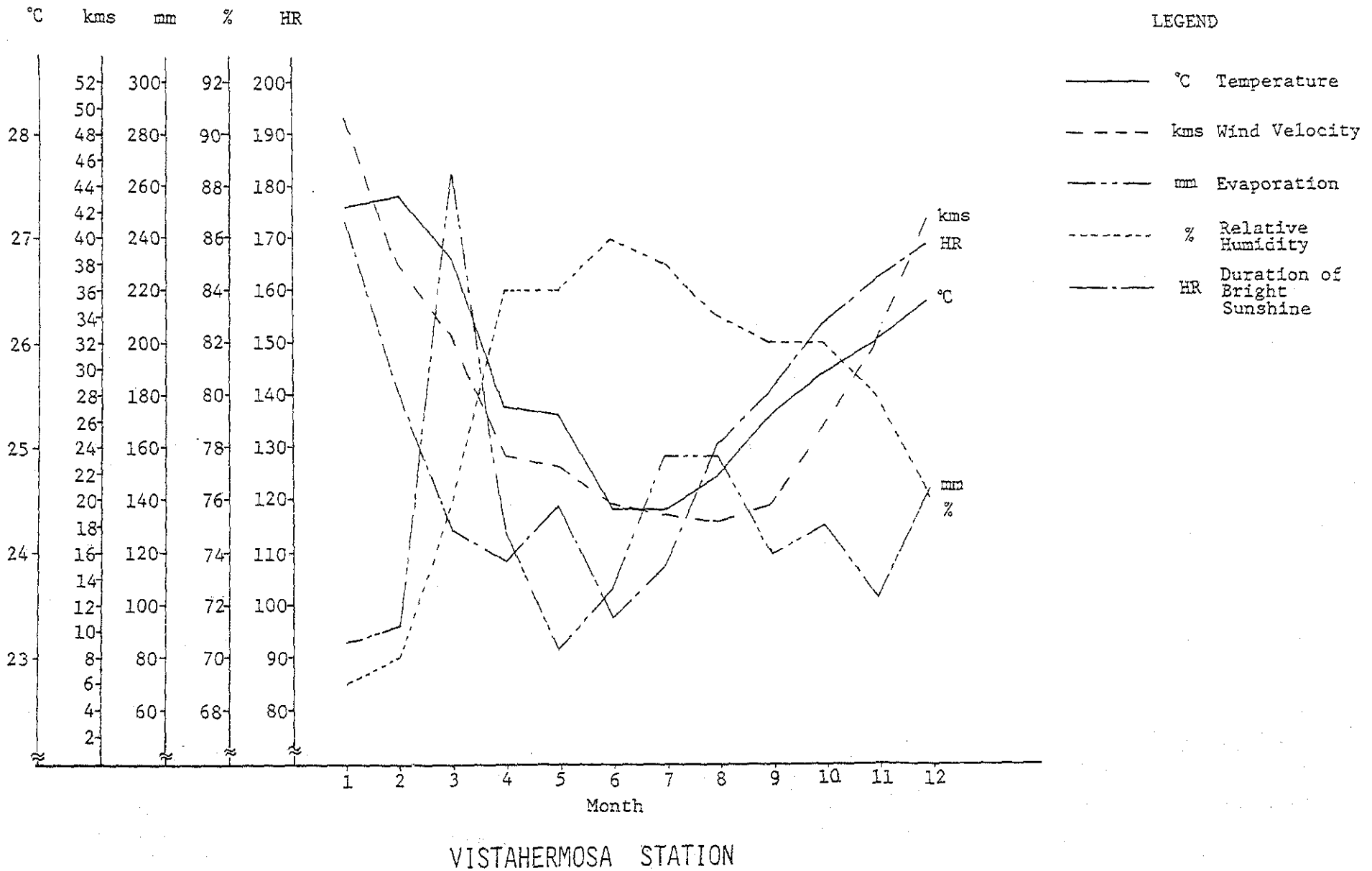


Fig.C-3-2 (4) Meteorological Condition in The Ariari Basin

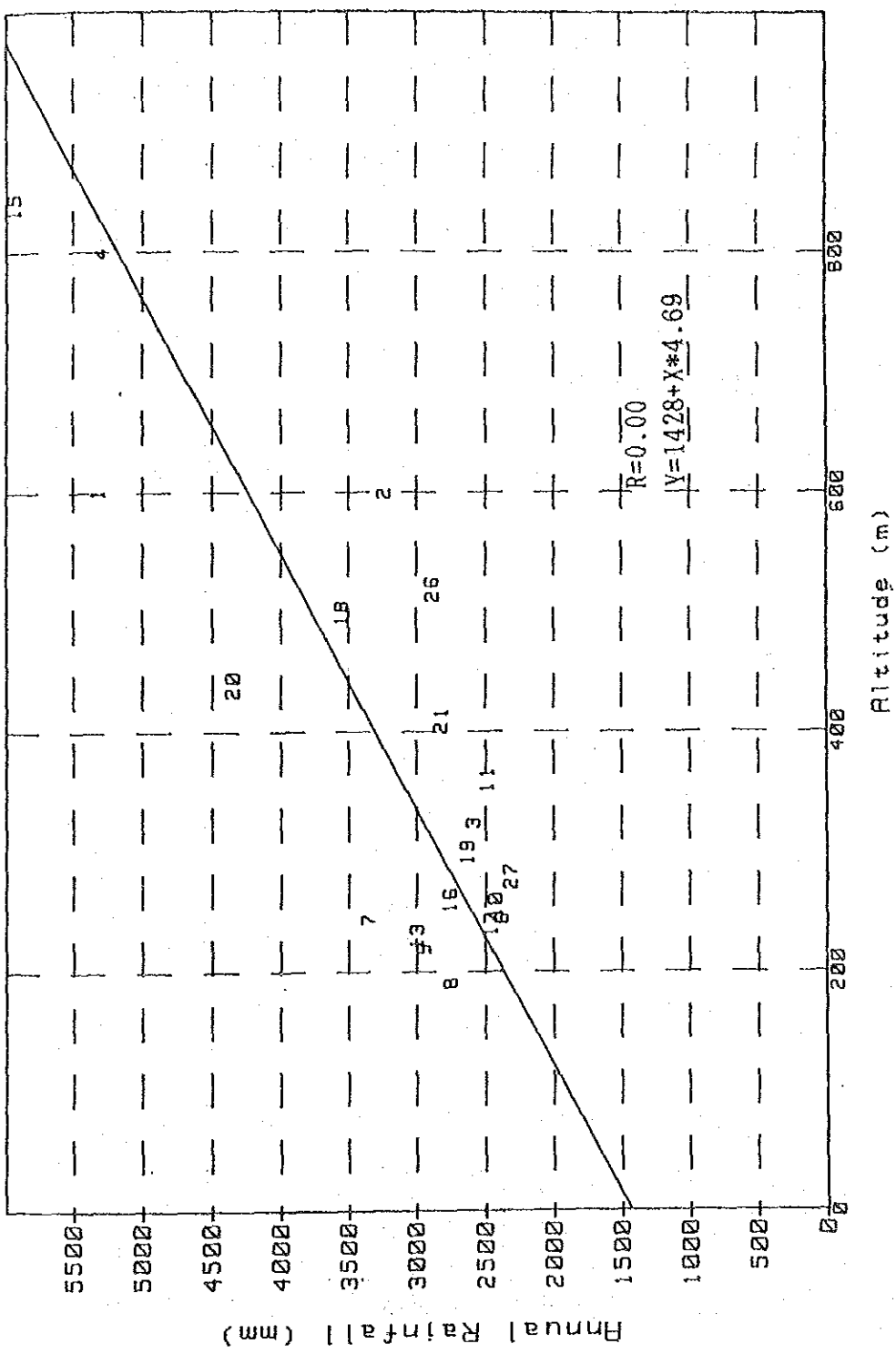


Fig. C-4-1 Relation of Annual Rainfall and Altitude

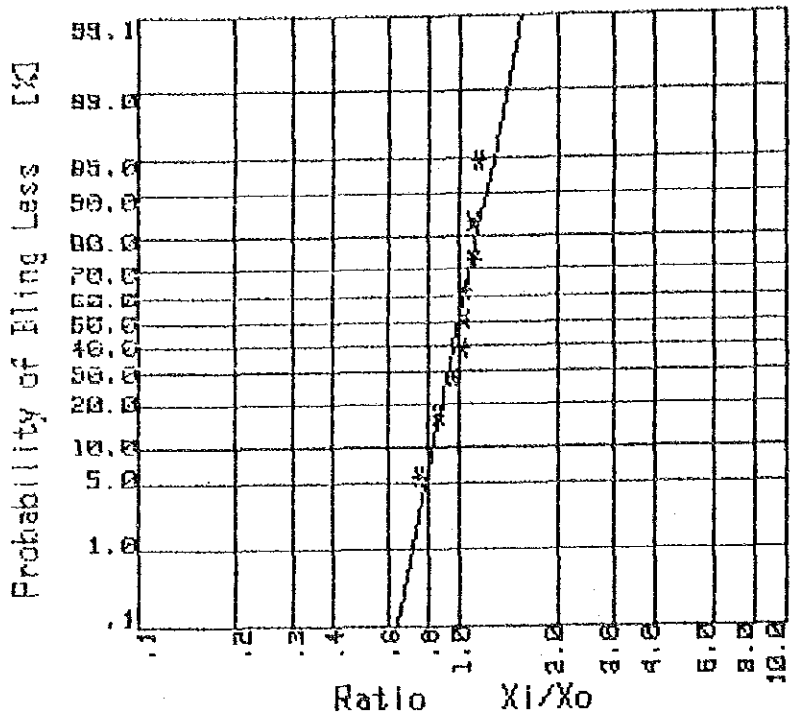


Fig. C-4-2 (1)
Probability of Annual Rainfall at CANO BLANCO

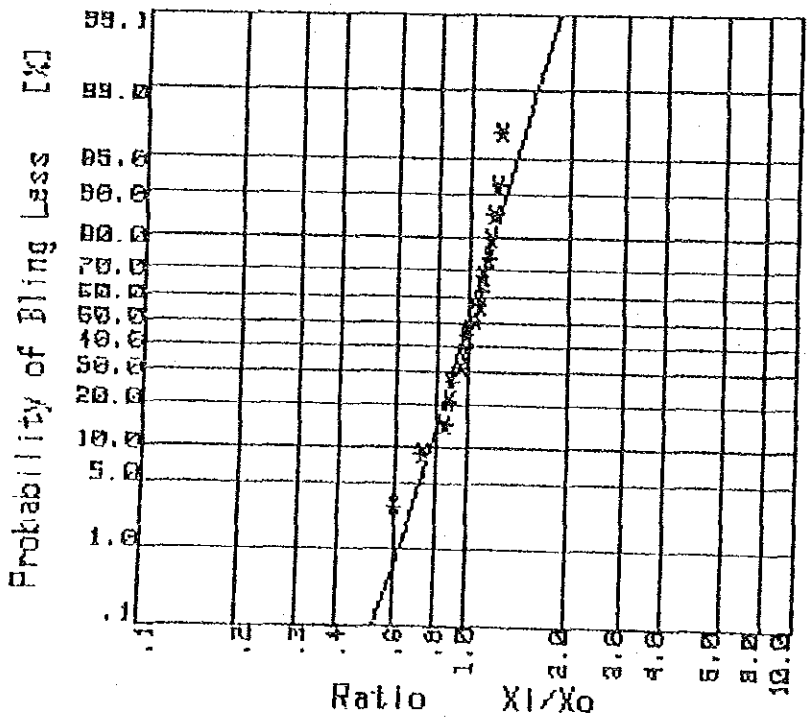


Fig. C-4-2 (2)
Probability of Annual Rainfall at MESA DE YANANES
Calculation of Probability for Station at SAN LUIS CUBARRAL

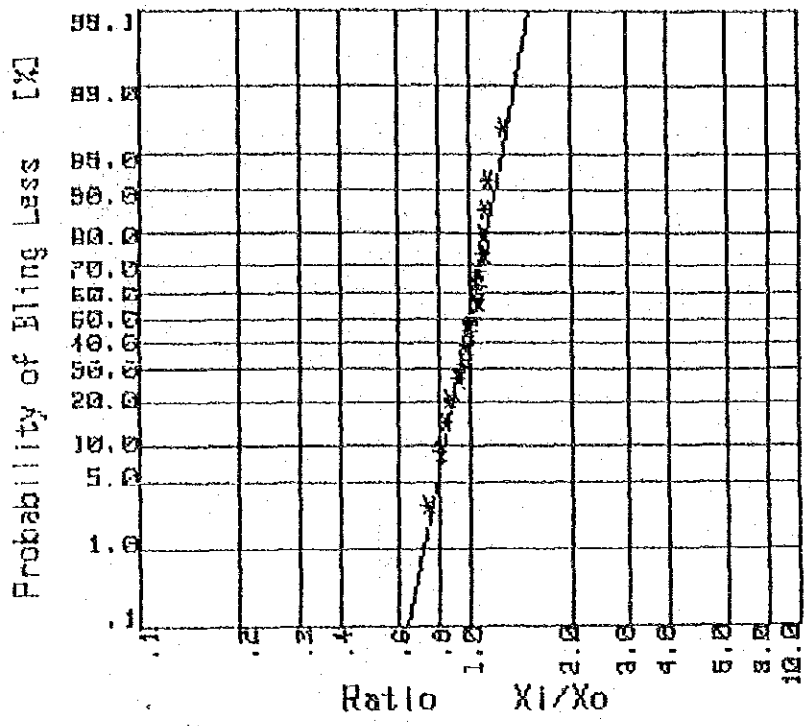


Fig. C-4-2 (3)
Probability of Annual Rainfall at SAN LUIS CUBARRAL

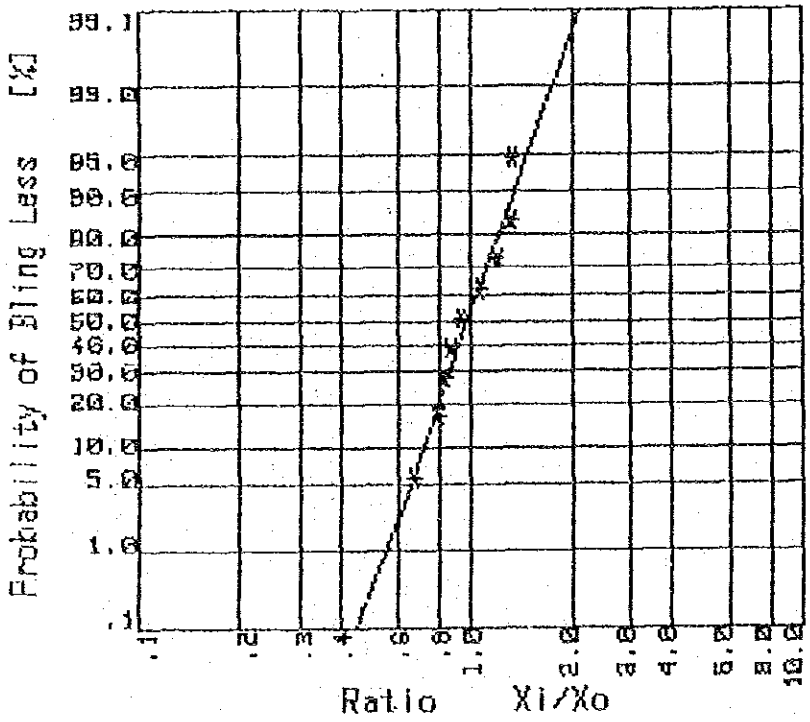


Fig. C-4-2 (4)
Probability of Annual Rainfall at LEJANIAS

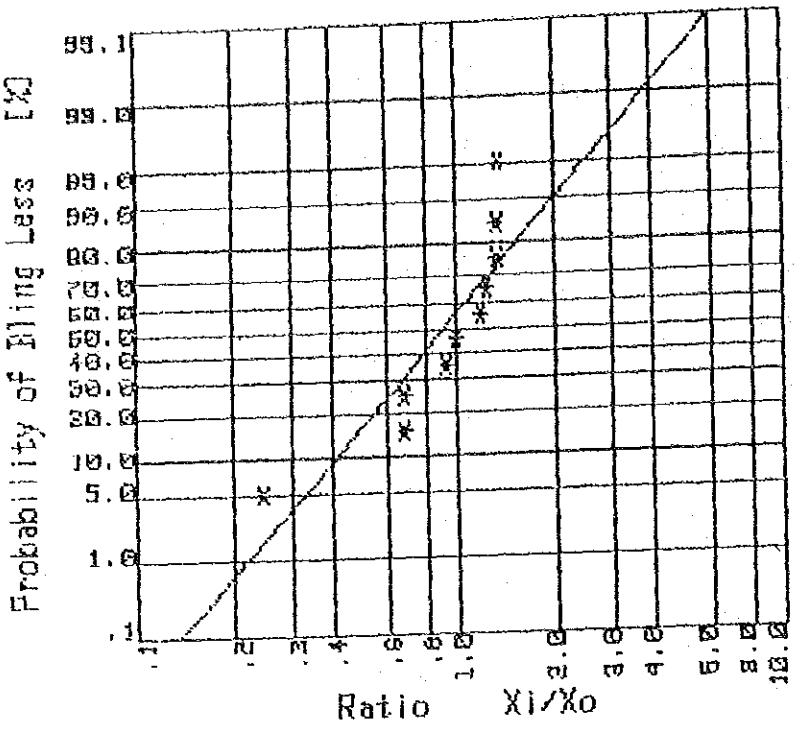


Fig. C-4-2 (5)

Probability of Annual Rainfall at CALIME

Calculation of Probability for Station at CAMPO ALEGRE

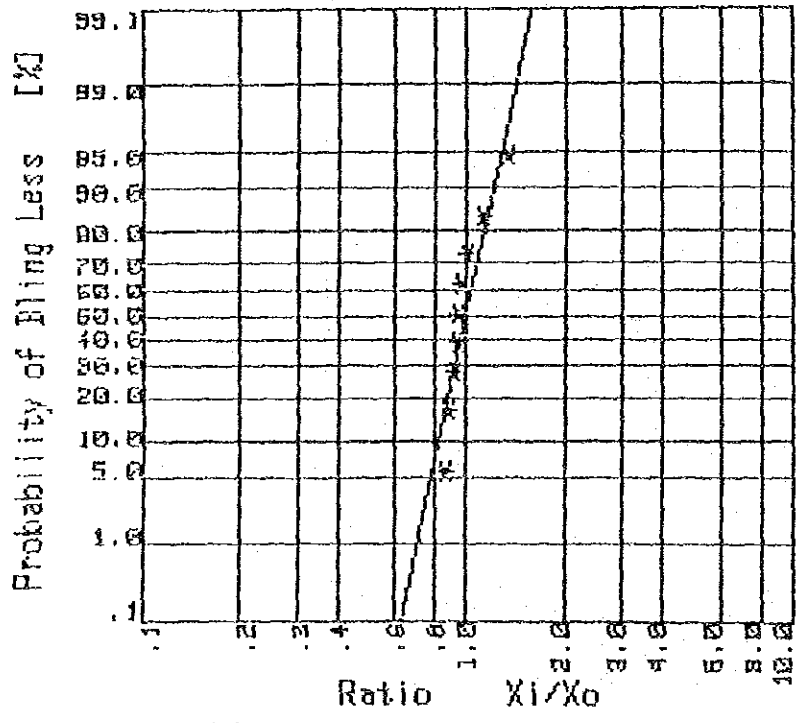


Fig. C-4-2 (6)

Probability of Annual Rainfall at CAMPO ALEGRE

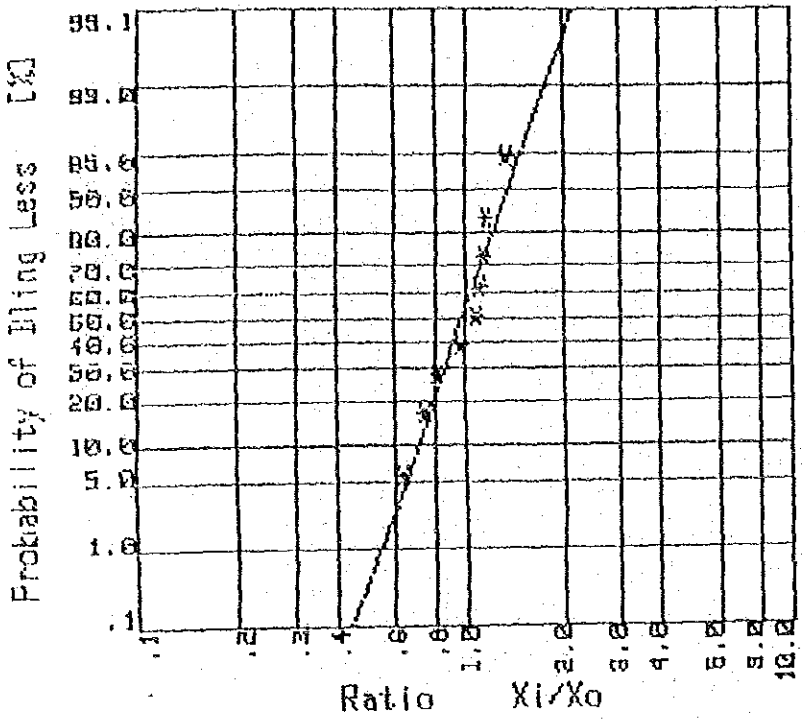


Fig. C-4-2 (7)
Probability of Annual Rainfall at LOS MICOS

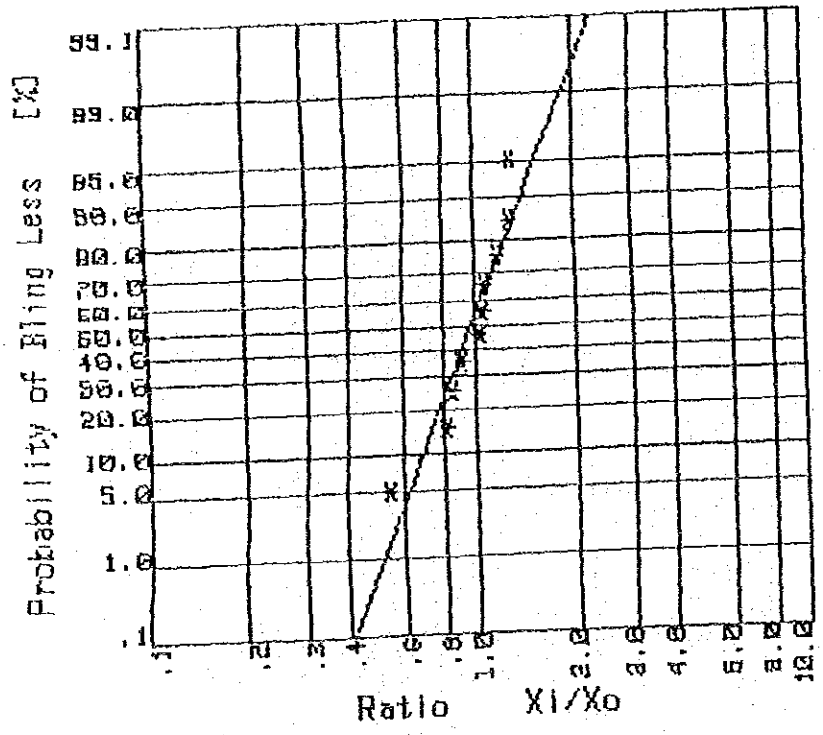


Fig. C-4-2 (8)
Probability of Annual Rainfall at PINALITO

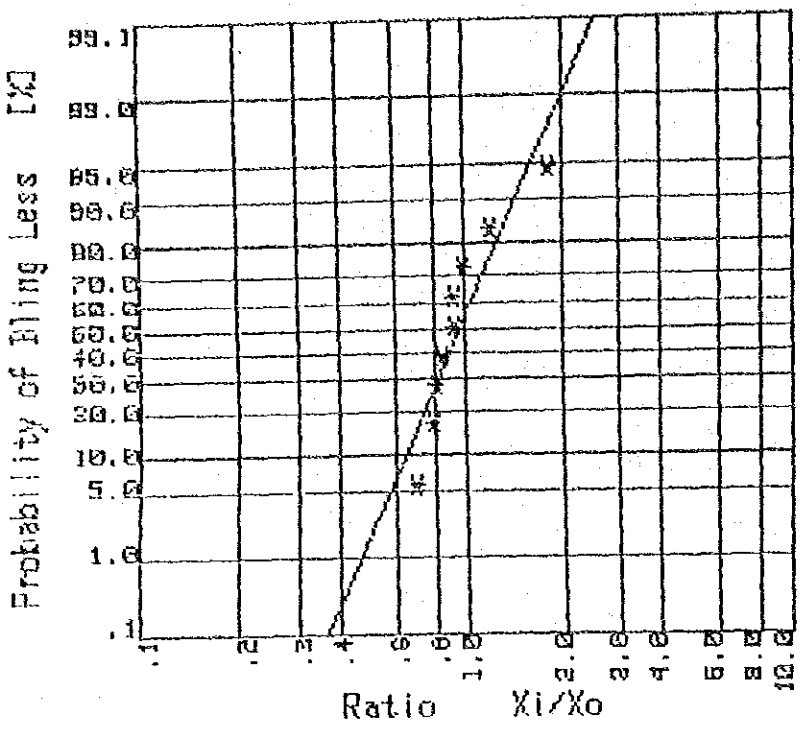


Fig. C-4-2 (9)
Probability of Annual Rainfall at FUENTE DE ORO

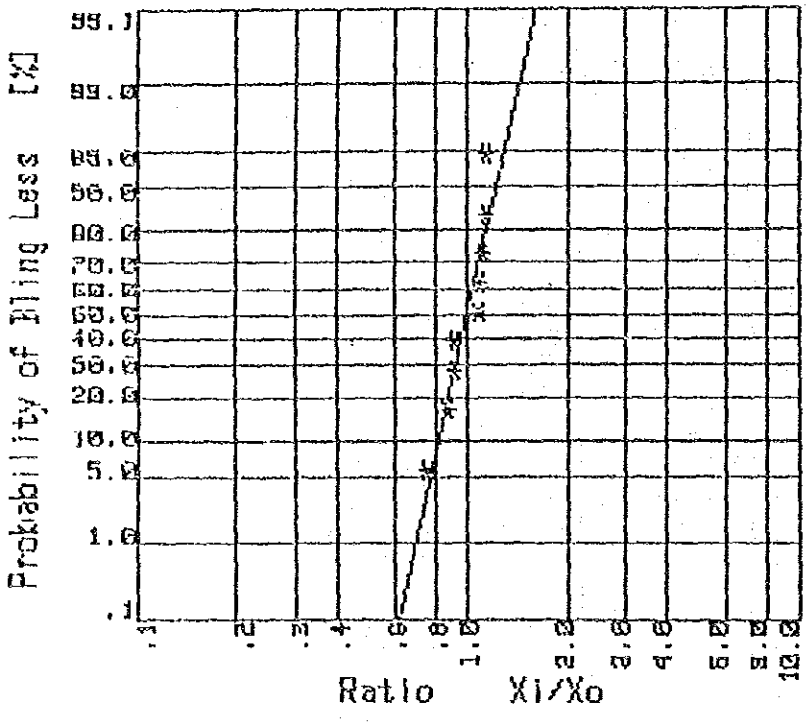


Fig. C-4-2 (10)
Probability of Annual Rainfall at LOS NARANJOS

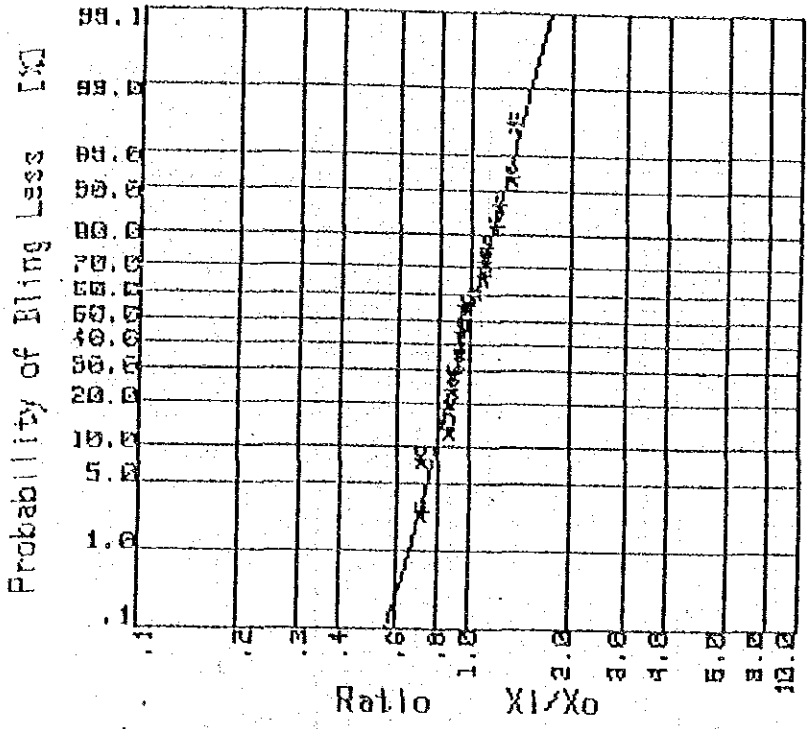


Fig. C-4-2 (11)
Probability of Annual Rainfall at PUERTO LIMON

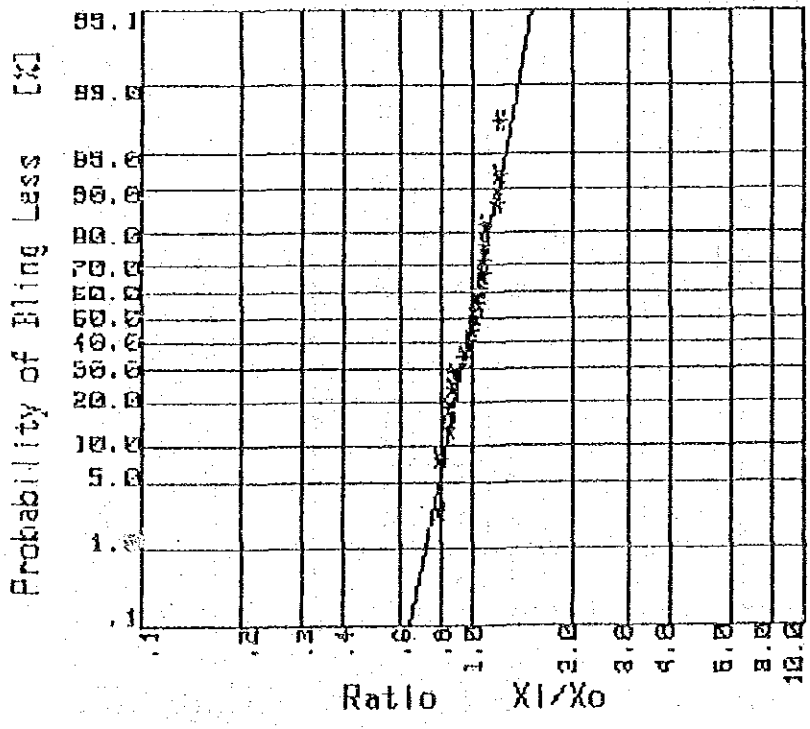


Fig. C-4-2 (12)
Probability of Annual Rainfall at VISTAHERMOSA

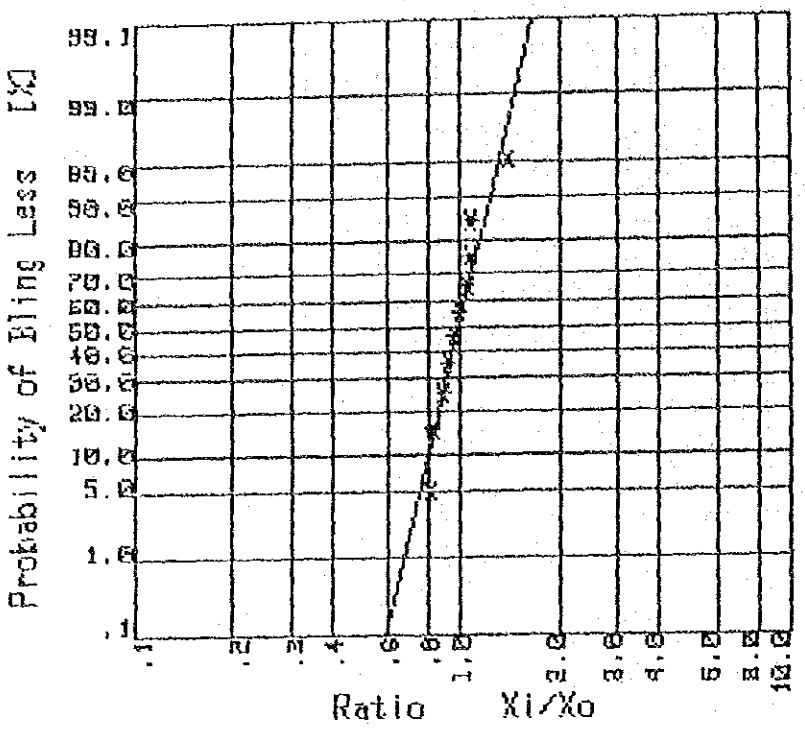


Fig. C-4-2 (13)
Probability of Annual Rainfall at LA HOLANDA

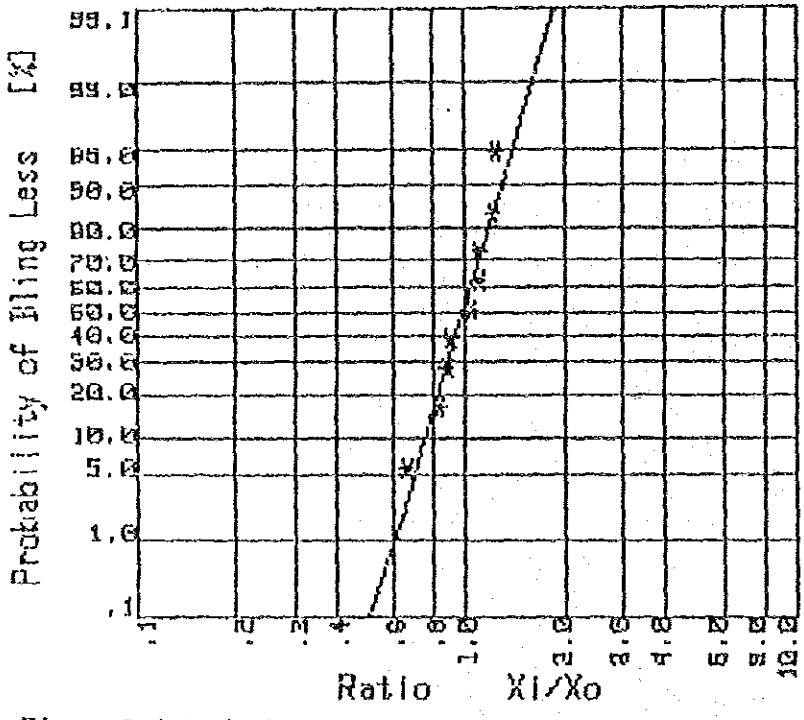


Fig. C-4-2 (14)
Probability of Annual Rainfall at PUERTO RICO