JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

ROYAL IRRIGATION DEPARTMENT (RID), MOAC
THE KINGDOM OF THAILAND

THE MASTER PLAN STUDY
ON
THE INTEGRATED AGRICULTURE AND WATER RESOURCES DEVELOPMENT
PROJECT
OF HUAI MONG, NAM SUAI AND HUAI LUANG RIVER BASINS
IN THE KINGDOM OF THAILAND

FINAL REPORT
VOLUME II
APPENDIX

AUGUST, 1996

SANYU CONSULTANTS INC.

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FOR
THE MASTER PLAN STUDY
ON
THE INTEGRATED AGRICULTURE AND WATER RESOURCES DEVELOPMENT
PROJECT
OF HUAI MONG, NAM SUAI AND HUAI LUANG RIVER BASIN
IN
THE KINGDOM OF THAILAND

AGREED UPON BETWEEN

ROYAL IRRIGATION DEPARTMENT

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

BANGKOK

DECEMBER 20, 1994

S. Wattanayagorn

MR. SAWAD WATTANAYAGORN
DIRECTOR GENERAL
ROYAL IRRIGATION DEPARTMENT
MINISTRY OF AGRICULTURE
AND COOPERATIVES

MR. SEIICHI TSUJI
LEADER
PREPARATORY STUDY TEAM
JAPAN INTERNATIONAL
COOPERATION AGENCY

I. INTRODUCTION

In response to the request of the Government of the Kingdom of Thailand , the Government of Japan has decided to conduct a Master Plan Study on the Integrated Agriculture and Water Resources Development Project of Huai Mong, Nam Suai and Huai Luang River Basin (hereinafter referred to as "the Study"), within the general framework of technical cooperation between Japan and Thailand, which is set forth in the Agreement on Technical Cooperation between the Government of Japan and the Government of the Kingdom of Thailand signed on November 5, 1981.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of the Government of the Kingdom of Thailand.

The present document sets forth the Scope of Work with regard to the Study.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are:

1. To conduct a Master Plan Study on the Integrated Agriculture and Water Resources Development Project of Huai Mong, Nam Suai and Huai Luang River Basin, and

2. To carry out technology transfer to the Thai counterpart personnel in the course of the Study.

III. STUDY AREA

The Study Area covers approximately 8,660km2 along the Huai Mong, Nam Suai and Huai Luang River Basin, in Northeastern Region.

IV. SCOPE OF THE STUDY

In order to achieve above objectives, the Study will cover the following items;

1. To collect and review relevant existing data and information

   1) Natural condition

   2) Social and Economic condition

   3) Water resource development

   4) Irrigation and drainage

   5) Inundation

   6) Agriculture

   7) Agroeconomy

   8) Environment

   9) Others

2. To review the existing projects and plans by RID in the study area

3. To review the related projects and plans by other organization in the study area

4. To carry out the initial field survey for understanding the present condition

   1) Agricultural water resource development in upper basin of three rivers

   2) Inundation in lower basin of three rivers

   3) Others

5. To analyze collected initial data

6. To identify potentials, problems and constraints against development of the study area

7. To make basic concept for development

   1) Overall agricultural development plan

   2) Selection of priority area(s) and project(s)

8.To carry out the detail field survey on the priority area

9.To analyze collected detail data

10. To prepare master plan

   1) Agricultural water resource development

   2) Improvement of inundation

   3) Irrigation and drainage

   4) Water management

   5) Land use planning

   6) Farming system and cropping pattern

   7) Rural infrastructure development

   8) Agricultural organization and supporting services

   9) Outline design of main facilities

   10) Operation and maintenance plan for major structure

   11) Environment impact

   12) Project implementation schedule

   13) Estimation of project costs and benefits

11.Recommendation

V. STUDY SCHEDULE

The study will be carried out in accordance with the attached tentative work schedule.

VI. REPORTS

JICA shall prepare and submit the following reports in English to the Government of the Kingdom of Thailand.

1. Inception Report
   Twenty (20) copies at the commencement of the Study.

2. Progress Report

   Twenty (20) copies during the field work in the Kingdom of Thailand.

3. Interim Report

   Twenty (20) copies at the end of field work in the Kingdom of Thailand

4. Draft Final Report

Twenty (20) copies work in Japan. The Government of the Kingdom of Thailand will provide JICA with its comments on the Draft Final Report within one (1) month after receipt of the Draft Final Report.

5. Final Report

Fifty (50) copies within two (2) months after the receipt of the comments of the Government of the Kingdom of Thailand on the Draft Final Report.

VII. UNDERTAKING OF THE GOVERNMENT OF THE KINGDOM OF THAILAND

1. To facilitate smooth conduct of the study, the Government of the Kingdom of Thailand shall take necessary measures ;

   1-1.to secure the safety of the Japanese study team,

   1-2. to permit the members of the Japanese study team to enter, leave and stay in the Kingdom of Thailand for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees,

   1-3. to exempt the members of the Japanese study team from taxes, duties, fees and any other charges on equipment, machinery and other materials brought into the Kingdom of Thailand for the conduct of the study,

   1-4. to exempt the members of the Japanese study team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Japanese study team for their services in connection with the implementation of the Study,

   1-5. to provide necessary facilities to the Japanese study team for the remittance as well

as utilization of the funds introduced into the Kingdom of Thailand from Japan in connection with the implementation of the Study,

1-6. to secure permission for entry into private properties or restricted areas for the implementation of the Study,

1-7. to secure permission for the Japanese study team to take all data and documents (including maps and photographs) related to the Study out of the Kingdom of Thailand to Japan,

1-8. to provide medical services as needed. Its expense will be chargeable on the members of the Japanese study team.

2. The Government of the Kingdom of Thailand shall bear claims, if any arises, against the members of the Japanese study team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Japanese study team.

3. Royal Irrigation Department, Ministry of Agriculture and Cooperatives (hereinafter referred to as "RID") shall act as counterpart agency to the Japanese study team and also as coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4. RID shall, at its own expense, provide the Japanese study team with the following, in cooperation with other organizations concerned :

4-1. available data and information related to the Study,

4-2. counterpart personnel,

4-3. suitable office space with necessary equipment in Bangkok and project site(s),

4-4. credentials or identification cards, and

4-5. necessary number of vehicles with drivers for field trip.

VIII.UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take the following measures ;

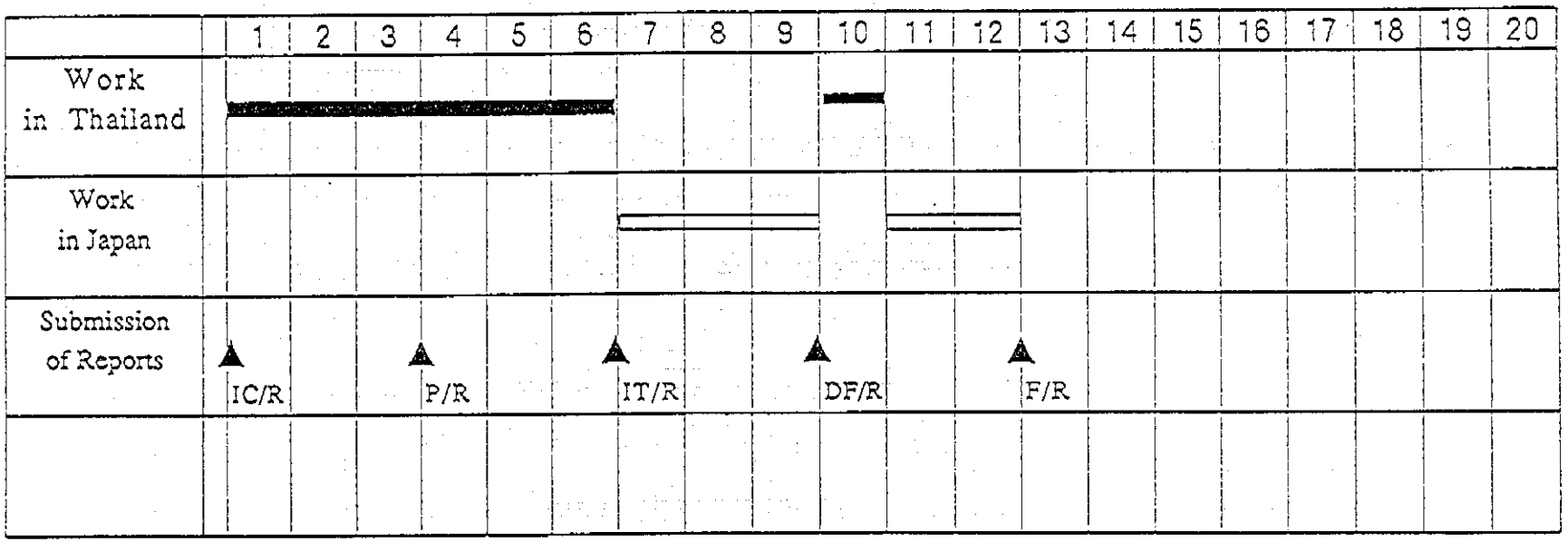
1. To dispatch, at its own expense, study teams to the Kingdom of Thailand, and

2. To pursue technology transfer to the Thai counterpart personnel in the course of the Study.

IX. OTHERS

JICA and RID shall consult with each other in respect of any matter that may arise from or in connection with the Study.

TENTATIVE WORK SCHEDULE



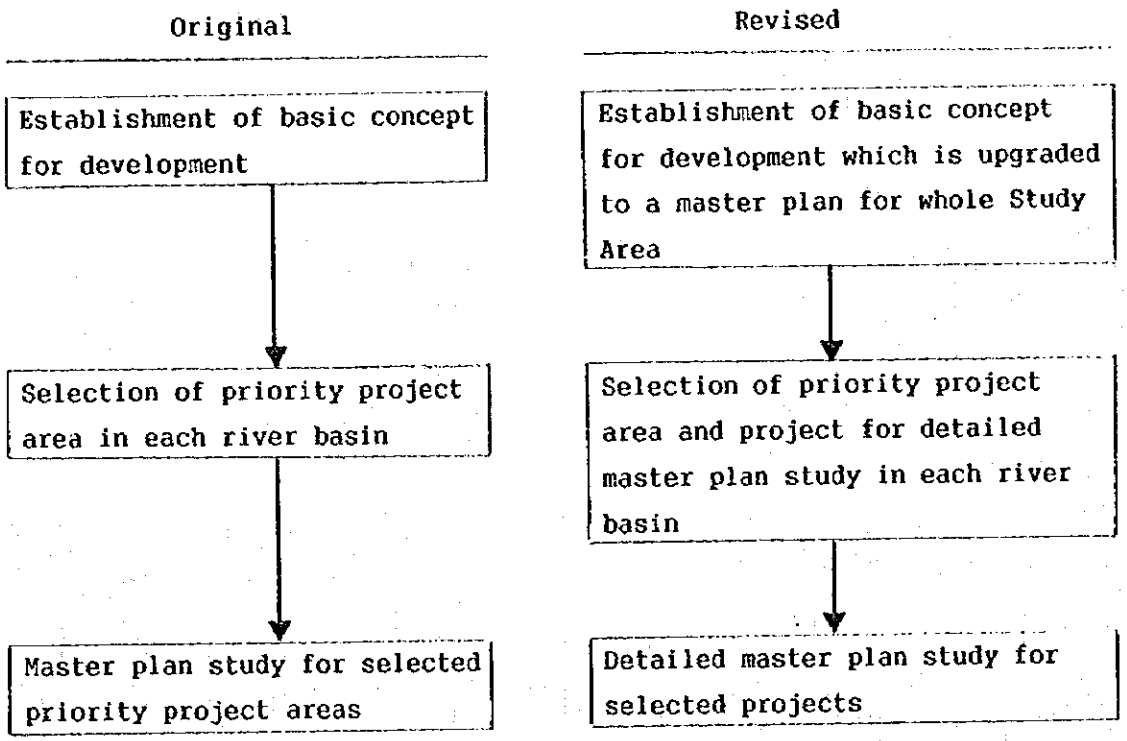
(Note)

IC/R	:	Inception Report
P/R	:	Progress Report
IT/R	:	Interim Report
DF/R	:	Draft Final Report
F/R	:	Final Report

PART-2 Revise of Content of the Study

The RID requested to rivise the content of the Study by letter dated on Dec. 7, 1995. JICA agreed on RID's request and the content of the Study was revised as shown below;

CONTENT OF THE STUDY



PART-3 Comment dated on May 7, 1996

After submission of Interim Report by JICA Study Team, RID submitted the comment(Attachment-1) dated on May 7, 1996 to JICA Thailand Office and the clarification of the comment was made in form of letter (Attachment-2) dated on May 17, 1996.

JICA Study Team provided the draft final report in consideration with the comment and explained a reply to the comment by showing the attached letter(Attachment-3).

Attachment-1

URGENT
No. 0818/๗๐

Royal Irrigation Department
Samsen Road, Bangkok 10300

7 May B.E. 2539 (1996)

Subject : Interim Report of the Master Plan Study on the Integrated Agriculture and Water Resources Development Project of Huai Mong, Nam Suai and Huai Luang River Basin.

Dear Sir,

We would like to take this opportunity to express our sincere thanks and appreciation for your technical assistance under the above mentioned Project. The Interim Report was submitted to RID on 7 March 1996. Then, the meeting between the Study Team and RID Working Group was held on 15 March 1996 for the presentation of the results of study and consideration and comment. It was agreed that any other comments will be informed to the Study Team via JICA Office. Enclosed herewith are the comments of Mr. Koichi YAMAZAKI, JICA Expert; all of which were concurred by RID as follows:

- Generally, the results of study were not substantial enough to meet the objectives of the preparation of Master Plan and Overall Basin Development. ✓

- The guidlines and strategies of water resources development were not clear enough for further use for the long term development of RID. ✓

- Having realized that these 3 river basins have no suitable location for large reservoir construction and the potential area for medium scale project was also limited, the RID then instructed the Study Team to focus on the possibility of enhancing the development of small scale projects and the use of water in the Mekong river. However, the substantial development plan was not described in the Interim Report and this matter was not taken into account seriously.

Mr. EIRYO SUMIDA
Resident Representative Thailand Office,
Japan International Cooperation Agency,
1674/1 New Petchburi Road,
Bangkok 10330, Thailand

This is for your kind consideration and further action. Hoping that our comments will be of some use for the preparation of Final Reoport in order to attain the prescribed objectives, we remain.

Yours sincerely,

(Mr. Charaan Kamaleshan)
Deputy Director General for Engineering
Director General
for

บันทึกข้อความ

ส่วนราชการ Project Planning Section 1

ที่ วันที่ 17 May 1996

เรื่อง

Dear Mr. YAMAZAKI

Concerning Huai Mong, Nam Suai, Huai Luang Project, I would like to make clarification on our comments to JICA for your information as follow:

1. Lack of Basin-planning Target
2. Lack of Basin-planning Development Approach
3. MOAC on Pipe Irrigation for enhancing irrigation in Northeast not shown in the Study.

In case of Mr Chatchai and my absence, please do some necessary clarification if any request arrive.

Regards,
Sunit Th[illegible]
Acting, Chief

CONSULTANTS & ENGINEERS **SANYU CONSULTANTS INC.**

HEAD OFFICE
KYOGIN BLDG., 15-22, 2-CHOME, NISHIKI, NAKA-KU, NAGOYA 460, JAPAN
CABLE ADDRESS : "SANCOINTER" NAGOYA
TELEX : J59901 SANYU TEL : 052-231-6255

BANGKOK LIAISON OFFICE
C/O CAPITAL MANSION, ROOM NO. G-1, 1371 PHAHOLYOTHIN ROAD
SAPHAN KHWAI, BANGKOK 10400, THAILAND
TELEX : 87600 SANYU TH
TEL : 279 4937, 279-7078 or 279-7070-4 ext. G-1
FAX : 279-7078

June 25, 1996

Dear Mr. Suwit,

The content of RID's comment dated on May 7, 1996 are clarified in the letter dated on May 17, 1996 from Mr. Suwit to Mr. Yamazaki as follows;

1. Lack of Basin-planning Target
2. Lack of Basin-planning Development Approach
3. MOAC on Pipe Irrigation for enhancing irrigation in Northeast not shown in the Study

JICA Study Team gave a reply to the comment in the Draft Final Report as shown below:

1. Basin-planning Target		
- 3.10.1	Necessity of the Development	p. 3 - 69
- 3.10.2	Size of the Development	p. 3 - 70
2. Development Approach		
- 3.6.1	Basic Concept to Water Resources Development	p. 3 - 30
- 3.6.2	Water Resources Development Strategy	3 - 31
- 3.6.3	Proposed Water Resources Development Project	3 - 33
- 3.6.8	Utilization of Mekong River Water	3 - 44
- 3.10.3	Agricultural Development Strategy	3 - 71
- 3.10.4	Agricultural Water Resources Development	3 - 71
3. Introduction of Pipe System		
- 3.6.2	Water Resources Development Strategy	p.3 - 32 (line 21)

Sincerely yours,

H. Moriyama

Hiroshi Moriyama
JICA Study Team

PART-4 Topographic Survey

The master plan study on the integrated agriculture and water resources development project of Huai Mong, Nam Suai and Huai Luang river basins was carried out during the period from September 1995 to March 1996 in the Thailand. For the Study, the following topographic surveys were executed by the local survey company hired by the JICA Study Team.

(1) For Huai Mong Project

- Dam Axis	0.98 km
- Canal Profile (No. 1)	3.00 km
- Canal Profile (No. 2)	1.94 km
Sub-total	5.92 km

(2) For Flood Protection Project

- Canal Profile	2.96 km
- Canal Sections	1.14 km
Sub-total	4.10 km

(3) For Huai Luang Development Project

- River Profile	7.65 km
- River Sections	4.94 km
Sub-total	12.59 km
Total	22.61 km

APPENDIX B. METEOROLOGY AND HYDROLOGY

Appendix B Meteorology and Hydrology

Rainfall

Discharge

Table-B-1 Monthly and Annual Rainfall (Muang, NBL)

Station: Amphoe Muang, Nong Bua Lamphu (75012) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1943	-	-	-	11.1	31.0	18.9	18.8	47.9	13.6	0.0	0.0	0.0	-
1949	-	-	-	126.9	97.3	44.0	215.2	131.3	426.4	37.1	-	-	-
1950	132.4	338.5	-	73.0	136.7	-	-	-	256.2	-	-	12.0	-
1952	-	-	-	26.0	85.2	139.7	154.9	201.4	161.1	41.5	0.0	0.0	-
1953	24.7	78.0	24.0	131.3	217.8	341.8	145.2	141.0	163.2	32.4	2.7	0.0	1,302.1
1954	12.5	25.4	0.0	48.1	345.3	162.7	148.4	228.5	297.9	150.8	0.0	0.9	1,420.5
1955	0.0	0.0	28.0	96.5	136.7	303.2	212.3	129.5	208.6	0.0	0.0	0.0	1,114.8
1956	0.0	23.0	18.5	126.3	244.7	144.2	301.9	269.2	145.5	33.8	0.0	0.0	1,307.1
1957	0.0	6.8	60.1	24.3	142.2	103.6	161.6	222.2	215.6	73.3	0.0	0.0	1,009.7
1958	15.4	0.0	13.8	0.0	73.7	135.3	112.0	152.8	104.2	7.9	0.0	0.0	615.1
1959	0.0	15.3	19.8	19.3	88.4	64.6	27.0	138.0	39.0	-	0.0	0.0	-
1960	9.4	0.0	7.3	12.0	74.8	3.2	52.8	91.0	65.8	141.5	0.0	0.0	457.8
1961	0.0	2.1	3.4	22.8	58.8	63.1	0.0	80.3	245.5	-	0.0	0.0	-
1962	0.0	0.0	10.4	18.2	29.1	22.9	152.7	181.4	277.8	116.9	20.5	0.0	829.9
1963	0.0	0.0	23.9	42.3	269.5	206.0	197.1	105.4	243.0	116.6	53.2	0.0	1,257.0
1964	0.0	0.0	30.7	135.4	123.3	133.2	116.8	86.2	158.3	180.8	0.0	0.0	964.7
1965	0.0	22.6	25.9	143.3	139.9	109.6	90.0	264.3	148.0	51.1	13.1	0.0	1,007.8
1966	0.0	19.2	54.4	96.4	286.9	234.5	118.6	212.2	111.5	63.8	0.0	36.4	1,233.9
1967	-	-	-	27.1	-	-	-	153.0	-	0.0	0.0	0.0	-
1968	0.0	0.0	22.0	64.4	151.6	59.0	159.2	168.4	197.7	47.0	0.0	0.0	869.3
1969	106.7	0.0	0.0	0.0	167.6	160.8	140.7	90.2	256.3	50.4	0.0	0.0	972.7
1970	0.0	0.0	0.0	167.8	134.1	410.7	103.7	275.4	204.2	36.9	0.0	0.0	1,332.8
1971	0.0	0.0	0.0	22.9	135.2	163.8	196.4	162.3	139.8	0.0	0.0	0.0	820.4
1972	0.0	0.0	35.4	65.8	-	222.7	-	110.3	193.6	144.5	0.0	0.0	-
1973	0.0	0.0	24.2	20.5	294.7	79.4	111.7	215.8	333.3	0.0	0.0	0.0	1,079.6
1974	0.0	0.0	0.0	85.3	140.6	77.6	153.0	354.1	87.2	18.7	0.0	0.0	916.5
1975	0.0	45.9	36.0	45.0	239.0	216.1	171.7	93.9	177.5	0.0	0.0	0.0	1,025.1
1976	0.0	0.0	0.0	61.9	83.2	85.9	40.6	298.3	137.9	0.0	0.0	0.0	707.8
1977	0.0	0.0	0.0	54.3	136.0	154.7	196.9	162.8	139.8	0.0	0.0	0.0	844.5
1978	0.0	0.0	0.0	45.2	172.0	126.7	268.1	255.5	112.2	-	-	-	-
1979	0.0	0.0	0.0	0.0	185.0	387.6	95.1	180.4	215.7	0.0	0.0	0.0	1,063.8
1980	0.0	0.0	0.0	0.0	411.4	436.6	215.8	94.0	416.6	49.5	0.0	0.0	1,623.9
1981	0.0	9.8	4.4	0.0	160.6	155.7	282.9	114.8	54.3	130.0	32.3	0.0	944.8
1982	0.0	6.5	21.3	68.4	107.4	76.8	170.9	108.3	41.9	28.7	26.7	0.0	656.9
1983	0.0	0.0	19.2	20.6	182.2	322.9	104.3	307.4	161.5	0.0	0.0	0.0	1,118.1
1984	20.0	3.9	1.3	85.4	30.9	19.3	286.5	139.4	134.7	39.4	0.0	0.0	760.8
1985	0.0	31.8	0.0	53.8	152.5	208.4	120.0	-	-	-	0.0	0.0	-
1986	0.0	0.0	0.0	109.5	206.4	92.5	114.0	282.0	200.1	170.7	0.0	60.0	1,235.2
1987	0.0	6.5	55.7	92.9	51.8	126.1	46.3	236.5	252.3	9.4	0.0	0.0	877.5
1988	0.0	0.0	0.0	0.0	179.0	205.4	309.7	140.9	188.8	-	-	-	-
1989	0.0	0.0	32.4	117.1	105.2	247.7	106.8	165.0	116.2	74.1	0.0	0.0	964.5
1990	19.5	0.0	0.0	0.0	59.1	108.4	186.0	199.1	443.1	22.6	0.0	0.0	1,037.8
1991	0.0	0.0	22.4	74.9	67.0	40.7	96.3	73.8	98.2	5.8	0.0	0.0	479.1
1992	0.0	0.0	0.0	0.0	106.5	239.6	247.9	-	-	-	-	-	-
1993	0.0	14.7	-	94.2	142.1	76.4	129.6	85.7	199.5	4.8	0.0	0.0	-
Average	8.3	15.9	15.2	56.2	148.4	156.6	149.5	170.2	185.3	49.5	3.7	2.7	961.5

Table-B-2 Monthly and Annual Rainfall (Suwanna Khuha, NBL)

Station: Amphoe Suanna Khuha, Nong Bua Lamphu Unit: mm

Month Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1989	5.5	5.3	206.6	111.1	324.3	226.9	115.3	237.2	271.6	132.3	0.0	0.0	1,636.1
1990	2.1	103.5	37.9	12.4	349.6	300.6	189.4	395.5	232.1	95.4	9.2	0.0	1,727.7
1991	0.0	0.0	69.7	46.0	117.7	98.7	159.0	221.2	166.8	39.2	0.0	0.0	918.3
1992	24.3	28.8	0.0	75.3	107.0	166.6	139.4	323.6	274.8	37.9	0.0	15.5	1,193.2
1993	0.0	1.0	20.3	42.7	195.8	225.4	207.4	204.3	186.2	21.7	2.5	0.0	1,107.3
1994	0.0	23.9	209.9	44.6	111.0	329.0	153.8	239.4	45.7	48.5	0.0	0.0	1,205.8
AVERAGE	5.3	27.1	90.7	55.4	200.9	224.5	160.7	270.2	196.2	62.5	2.0	2.6	1,298.1

Table-B-3 Monthly and Annual Rainfall (Muang, U.T)

Station: Amphoe Muang, Udon Thani (68013) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1952	-	-	-	100.2	109.1	330.8	230.9	460.8	311.8	113.2	0.3	0.0	-
1953	0.0	0.0	1.1	128.4	246.1	325.4	165.2	248.2	293.2	92.3	37.1	0.0	1,537.0
1954	9.2	22.5	0.0	9.5	237.8	129.3	144.3	213.2	273.0	151.3	0.0	0.0	1,190.1
1955	0.0	0.0	5.5	79.5	77.7	380.1	156.1	224.9	201.3	11.5	0.0	0.0	1,136.6
1956	0.0	57.3	24.7	164.7	270.4	233.3	172.6	209.9	219.0	6.6	0.0	0.4	1,358.9
1957	0.0	9.8	95.7	51.3	138.0	256.1	212.4	227.1	276.6	55.4	0.0	0.0	1,322.4
1958	0.0	27.0	41.5	19.8	104.0	295.3	127.4	477.7	210.1	69.3	0.0	0.0	1,372.1
1959	0.0	27.9	17.5	58.3	261.2	78.2	316.4	254.0	181.6	27.9	0.0	0.0	1,523.0
1960	7.3	20.6	60.7	17.1	179.6	127.0	241.0	529.3	275.3	147.0	3.7	0.0	1,608.6
1961	0.0	27.9	32.4	36.5	214.6	274.4	205.2	237.8	487.6	30.2	0.0	0.0	1,546.6
1962	0.0	2.0	3.5	133.8	142.7	224.9	300.5	352.0	306.1	76.1	5.5	0.0	1,547.1
1963	0.0	6.3	56.4	70.5	108.2	277.6	299.3	197.8	287.6	126.8	80.1	0.0	1,510.6
1964	0.0	143.0	25.0	97.9	275.5	181.7	169.7	184.1	129.4	195.3	4.2	0.0	1,405.8
1965	0.1	22.6	36.7	30.5	337.9	224.4	277.7	351.2	199.2	85.9	0.6	0.0	1,566.8
1966	0.0	8.6	72.1	119.1	274.1	247.4	168.1	491.7	176.2	39.1	0.0	0.0	1,596.4
1967	0.0	2.1	11.2	90.9	199.9	281.8	213.7	93.5	540.0	6.6	18.1	0.0	1,457.8
1968	2.4	11.3	42.5	123.6	283.4	184.8	284.5	242.0	308.8	25.6	0.1	0.0	1,509.0
1969	71.0	1.8	41.8	31.5	180.0	230.2	286.3	131.4	327.6	113.9	24.1	0.0	1,439.6
1970	0.0	0.8	28.0	91.0	357.7	652.7	168.0	421.3	642.1	52.3	0.5	0.9	2,415.3
1971	0.0	13.2	11.5	57.7	193.2	186.5	282.3	360.6	228.4	116.8	2.6	41.4	1,494.2
1972	0.0	4.4	120.4	76.4	69.1	202.6	129.2	203.2	110.0	131.4	4.5	1.6	1,052.8
1973	0.0	0.0	4.0	66.4	219.3	173.3	244.8	400.3	272.6	14.1	0.0	0.0	1,394.8
1974	12.4	3.5	78.9	225.0	104.1	96.3	290.3	455.1	210.5	36.9	18.1	0.0	1,531.1
1975	16.6	51.8	16.2	14.6	333.5	285.8	229.5	302.4	289.4	208.0	5.2	0.0	1,753.0
1976	0.0	55.6	17.3	115.8	124.8	214.1	285.1	209.3	313.9	107.7	9.6	0.0	1,453.2
1977	8.9	0.0	21.9	196.5	63.6	157.8	121.2	177.9	229.1	36.7	4.3	26.6	1,044.5
1978	5.0	19.2	67.2	49.0	278.6	152.9	449.3	499.2	213.4	60.2	1.3	0.0	1,795.3
1979	6.0	23.7	3.0	68.8	214.6	166.8	149.6	225.6	105.9	0.3	0.0	0.0	964.3
1980	0.0	5.0	26.2	78.2	387.9	235.4	245.0	260.4	306.7	56.0	0.0	0.0	1,600.8
1981	0.0	3.9	54.0	67.8	279.9	206.6	233.1	217.5	117.9	140.7	19.2	0.0	1,340.6
1982	0.0	31.9	37.9	21.8	197.2	189.0	127.3	199.4	243.2	81.5	6.9	1.2	1,137.3
1983	36.0	0.0	47.3	55.4	85.6	276.7	116.5	182.3	143.6	61.6	0.0	8.5	1,013.5
1984	0.1	5.6	32.4	100.3	123.5	142.3	254.5	216.9	167.3	83.2	13.0	0.0	1,139.1
1985	5.8	33.2	7.3	123.9	133.7	220.0	105.0	139.6	138.1	86.0	3.0	0.0	995.6
1986	0.0	23.2	0.0	52.7	327.8	213.0	308.7	234.8	157.2	56.8	22.5	17.0	1,413.7
1987	0.0	28.5	76.4	53.3	237.5	253.5	104.4	336.4	202.1	128.7	5.2	0.0	1,426.0
1988	0.0	12.6	9.7	79.0	119.5	186.8	198.5	252.5	199.3	158.2	0.0	0.0	1,516.1
1989	2.4	0.0	18.1	68.1	198.2	190.1	109.3	351.4	339.2	101.7	0.0	0.0	1,378.5
1990	0.0	42.3	65.4	62.2	190.3	368.2	288.7	345.4	218.4	75.3	12.4	0.0	1,668.6
1991	0.3	0.0	97.8	9.3	87.9	119.9	209.6	409.8	244.0	80.1	0.0	21.8	1,280.5
1992	58.6	7.0	0.0	10.6	117.0	245.1	248.9	268.2	209.3	23.1	0.0	20.5	1,208.3
1993	0.7	9.4	2.6	48.6	183.6	115.2	195.7	234.5	190.1	1.7	0.0	0.5	982.6
Average	5.9	18.7	34.4	75.1	204.0	227.0	215.9	286.4	257.1	77.9	7.2	3.3	1413.0

Table-B-4 Monthly and Annual Rainfall (Old Dam, U.T)

Station: Huai Luang Old Barrage, Udon Thani (68110) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1954	-	-	-	-	92.7	42.3	124.6	273.4	337.6	181.5	0.0	0.0	-
1955	0.0	0.0	0.0	47.0	274.0	526.5	153.6	452.7	283.4	21.0	5.0	0.0	1,763.2
1956	0.0	0.0	31.6	199.6	620.0	300.6	356.9	328.7	178.2	20.5	0.0	0.0	2,336.1
1957	0.0	5.5	63.9	37.4	335.0	237.8	195.3	375.0	454.0	87.7	0.0	0.0	1,791.6
1958	40.8	8.1	10.9	53.1	208.2	328.6	185.9	609.7	288.2	120.1	0.0	0.0	1,853.6
1959	0.0	0.0	35.6	22.9	254.6	179.7	364.8	279.4	349.3	4.1	0.0	0.0	1,490.4
1960	0.0	14.4	35.9	27.5	265.5	191.0	361.7	445.1	552.8	212.9	8.0	0.0	2,114.8
1961	0.0	28.7	39.8	57.3	318.2	356.0	194.1	422.4	654.3	101.8	0.0	0.0	2,172.6
1962	0.0	0.0	4.7	130.0	209.2	234.9	261.1	334.6	463.1	176.1	12.1	2.3	1,828.1
1963	0.0	3.0	88.5	139.7	129.0	423.0	301.6	262.3	343.3	167.8	58.0	0.0	1,916.2
1964	0.5	100.4	16.2	134.0	424.0	96.3	221.9	263.6	276.0	213.2	0.0	0.0	1,746.1
1965	0.0	26.2	31.4	170.9	199.8	273.8	192.8	428.9	149.2	54.7	0.0	0.0	1,527.7
1966	0.0	4.2	82.2	73.1	592.7	306.3	221.2	441.9	227.9	72.0	0.0	0.0	2,021.5
1967	0.0	17.4	8.9	153.8	129.1	235.5	180.5	150.9	472.8	9.7	25.9	0.0	1,384.5
1968	0.8	14.2	0.0	107.6	261.5	283.0	285.8	366.3	306.8	8.9	0.0	0.0	1,634.9
1969	148.1	0.0	65.3	67.4	246.9	201.7	330.3	184.2	407.4	46.5	72.0	0.0	1,769.8
1970	0.0	0.0	39.0	98.5	241.8	456.2	116.8	375.1	244.9	54.2	0.0	3.8	1,630.3
1971	0.0	47.4	0.0	38.3	298.0	181.5	194.9	303.1	186.5	82.0	0.0	21.6	1,353.3
1972	0.0	8.2	66.6	47.1	96.7	231.9	102.6	177.3	98.3	198.3	1.0	0.9	1,028.9
1973	0.0	0.0	5.2	89.3	224.6	172.6	218.8	170.0	257.4	15.3	0.0	0.0	1,153.2
1974	0.0	5.0	31.4	76.2	62.8	79.3	307.2	527.0	174.1	32.6	28.1	0.0	1,323.7
1975	1.2	25.9	33.3	52.0	406.6	275.9	216.5	138.6	249.7	195.7	22.5	0.0	1,617.9
1976	0.0	19.1	10.5	148.5	84.1	94.1	210.8	200.2	280.5	78.4	0.0	0.0	1,126.2
1977	10.6	0.0	40.1	73.5	70.3	107.2	141.4	192.8	181.7	27.4	8.0	2.8	855.8
1978	0.0	7.5	68.3	39.6	309.5	102.9	358.3	429.6	204.2	17.4	0.0	0.0	1,537.3
1979	0.0	33.2	6.2	67.1	236.9	320.4	185.1	175.1	105.9	3.5	0.0	0.0	1,133.4
1980	0.0	24.4	9.5	32.8	237.3	392.9	441.1	104.0	407.1	60.1	0.0	0.0	1,709.2
1981	0.0	0.0	36.0	35.0	185.6	167.4	298.3	231.2	127.9	-	-	0.0	-
1984	0.0	0.0	0.0	88.9	94.5	62.9	317.7	258.2	180.0	128.0	5.7	0.0	1,135.9
1985	7.4	57.5	10.9	112.2	198.1	255.7	280.2	186.1	88.5	99.0	2.1	0.0	1,297.7
1986	0.0	18.0	0.0	55.8	127.5	202.2	183.7	164.5	99.5	104.5	34.5	11.2	1,001.4
1987	0.0	27.2	65.6	25.7	66.1	435.2	65.8	303.8	311.1	234.7	8.9	0.0	1,544.1
1988	0.0	13.0	6.0	38.9	283.2	167.0	152.2	99.1	138.0	77.5	0.0	0.0	974.9
1989	7.9	0.0	53.0	0.0	0.0	0.0	0.0	0.0	294.1	0.0	0.0	0.0	355.0
Average	6.6	15.4	30.2	77.0	233.1	238.8	230.3	284.3	282.9	85.2	9.1	1.3	1494.1

Table-B-5 Monthly and Annual Rainfall (Kh-29, U.T)

Station: Huai Luang(Kh-29), Udon Thani(68291) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1972	0.0	0.0	0.0	0.0	148.4	273.9	128.7	195.6	73.4	188.7	4.7	0.0	1013.4
1973	0.0	0.0	0.0	104.5	229.5	199.3	209.0	204.5	206.6	18.4	0.0	0.0	1171.8
1974	3.1	0.8	56.5	91.3	105.7	63.1	291.6	516.3	195.9	44.5	21.7	0.0	1390.5
1975	17.2	26.2	25.3	25.2	431.1	263.1	258.5	191.0	242.8	149.5	12.9	0.0	1642.8
1976	0.0	26.3	10.0	115.8	116.3	132.8	221.9	198.2	273.6	114.4	0.0	0.0	1209.3
1977	8.6	0.0	20.3	72.8	125.4	92.6	120.8	214.4	240.2	24.7	1.0	15.9	936.7
1978	2.3	5.4	84.8	24.7	273.1	151.7	415.7	368.7	253.4	24.1	0.4	0.0	1604.3
1979	9.3	15.2	0.0	67.2	197.0	351.3	200.3	168.8	107.2	0.0	0.0	0.0	1116.3
1980	0.0	14.5	16.3	25.5	254.2	392.9	404.9	203.0	329.1	55.9	0.0	0.0	1,696.3
1981	0.0	13.6	30.8	35.9	174.8	191.1	277.7	290.0	50.4	147.4	41.6	0.0	1,253.3
1982	0.0	8.5	25.6	81.7	196.0	92.8	172.6	297.4	261.3	85.7	13.3	0.0	1,234.9
1983	35.5	0.2	42.9	52.6	102.4	218.8	64.4	268.0	107.2	92.8	7.1	7.7	999.6
1984	0.0	15.2	15.6	67.7	134.9	92.2	347.4	306.8	184.9	98.0	6.3	0.0	1,269.0
1985	0.0	85.9	1.8	68.5	127.4	255.4	176.1	206.1	123.6	104.5	0.6	0.0	1,149.9
1986	0.0	4.9	0.0	73.6	168.2	167.9	194.4	183.8	142.6	115.0	18.7	11.6	1,080.7
1987	0.0	34.6	82.7	32.3	62.8	293.5	103.7	321.9	259.2	186.9	1.2	0.0	1,378.8
1988	0.0	19.0	6.5	45.1	312.9	215.8	217.1	117.9	168.1	105.7	0.0	0.0	1,208.1
1989	3.6	0.0	41.6	100.3	141.4	136.9	152.1	216.8	292.9	73.8	0.0	0.0	1,159.4
1990	0.0	30.8	55.9	10.2	244.5	339.7	190.5	270.0	211.2	71.4	16.8	0.0	1,441.0
1991	0.0	0.0	68.5	34.0	223.0	82.0	155.1	259.5	213.4	62.6	0.0	22.6	1,120.7
1992	25.7	13.2	0.0	5.6	119.8	293.1	229.7	212.2	236.4	31.2	0.0	22.7	1,189.6
1993	0.0	5.4	37.4	17.2	241.3	125.7	302.2	103.4	184.7	4.0	0.0	0.0	1,021.3
Average	4.8	14.5	28.3	52.4	187.7	201.2	219.7	241.6	198.1	81.8	6.7	3.7	1240.4

Table-B-6 Monthly and Annual Rainfall (Self Settlement, U.T)

Station: Huai Luang Self Settlement, Udon Thani(682304) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1977	-	-	-	-	-	-	-	427.9	178.0	17.5	0.0	0.0	-
1978	30.2	23.1	56.2	74.1	314.5	170.0	355.1	422.0	240.7	17.6	0.0	33.1	1,736.6
1979	9.9	20.9	0.0	100.9	287.9	405.0	195.5	268.6	75.5	11.5	0.0	0.0	1,375.7
1980	0.0	5.5	7.6	36.6	287.0	429.6	379.1	130.0	386.3	43.9	0.0	0.0	1,705.6
1981	0.0	0.0	28.4	59.5	219.9	269.8	158.2	211.3	81.9	92.2	29.8	0.0	1,151.0
1982	0.0	0.0	15.2	7.6	180.8	106.2	211.2	187.9	212.6	55.7	7.1	2.0	986.3
1983	66.1	0.0	9.6	53.0	77.5	380.9	165.3	235.3	99.2	16.2	0.0	0.0	1,103.1
1984	0.0	0.0	2.5	147.8	198.8	97.3	172.3	256.9	224.7	171.7	0.0	0.0	1,272.0
1985	0.0	72.7	0.0	0.0	50.6	142.6	175.3	201.3	108.7	91.8	0.0	0.0	843.0
1986	0.0	2.5	0.0	105.5	161.3	220.5	167.1	155.7	189.8	57.7	0.0	38.3	1,098.4
1987	0.0	36.2	86.4	38.1	89.0	374.6	88.0	241.7	162.9	123.9	21.3	0.0	1,262.1
1988	0.0	7.5	0.0	61.3	313.0	181.2	137.3	110.0	159.1	98.4	0.0	0.0	1,067.8
1989	17.7	2.9	65.0	66.0	294.4	337.2	181.7	296.2	335.5	61.9	0.0	0.0	1,658.5
1990	0.0	25.5	51.6	11.6	316.8	288.8	177.1	376.0	288.0	58.0	0.0	0.0	1,593.4
1991	0.0	0.0	90.0	66.6	130.8	74.0	275.0	255.0	214.6	73.8	0.0	15.7	1,195.5
1992	29.7	20.6	0.0	0.0	141.6	271.2	290.8	276.8	227.0	29.6	0.0	14.4	1,301.7
1993	0.0	0.0	0.0	12.4	133.5	275.9	133.5	155.9	145.8	0.0	0.0	0.0	857.0
Average	9.6	13.6	25.8	52.6	199.8	251.6	203.9	236.3	197.0	62.7	3.6	6.5	1263.0

Table-B-7 Monthly and Annual Rainfall (Sang Khom, U.T)

Station: A. Sang Khom, Udon Thani(68372) Unit: mm

Month Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1980	-	-	-	-	-	-	375.2	269.7	305.9	-	-	-	-
1981	-	-	-	116.6	157.4	477.9	465.4	164.9	132.3	158.2	0.0	0.0	-
1982	0.0	0.0	45.5	71.7	156.0	165.5	172.9	367.6	313.1	33.5	0.0	0.0	1,325.8
1983	0.0	0.0	6.7	87.4	96.6	233.5	241.8	496.0	249.8	101.4	0.0	0.0	1,513.2
1985	0.0	0.0	0.0	105.2	126.1	311.6	201.1	419.6	93.6	25.8	0.0	0.0	1,283.0
1986	0.0	14.7	0.0	37.4	291.0	331.1	194.4	437.3	171.4	128.2	0.5	3.2	1,609.2
1987	0.0	50.6	34.6	122.7	84.4	189.3	92.3	301.9	176.6	18.7	8.4	0.0	1,079.5
1988	0.0	16.4	57.4	27.1	246.7	273.3	203.2	189.4	61.0	167.5	0.0	1.5	1,243.5
1989	7.5	0.0	30.1	128.6	264.5	188.1	157.9	340.4	297.3	149.2	0.0	0.0	1,563.6
1990	0.0	19.5	28.8	43.1	259.5	622.4	203.0	369.7	307.8	85.6	51.4	0.0	1,990.8
1991	0.0	0.0	36.9	45.7	148.7	76.5	252.3	342.6	195.8	110.4	0.0	17.3	1,226.2
1992	21.0	10.2	0.0	0.0	164.2	214.6	335.2	418.0	130.6	20.1	0.0	18.1	1,332.0
1993	0.0	1.7	1.8	56.3	319.5	325.0	196.8	255.5	210.1	0.0	0.0	0.0	1,366.7
Average	2.6	10.3	22.0	70.2	192.9	284.1	237.8	336.4	203.5	83.2	5.0	3.3	1451.2

Table-B-8 Monthly and Annual Rainfall (KH-53, U.T)

Station: Huai Luang(Kh-53), Udon Thani(68430) Unit: mm

Month Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1988	-	-	-	-	-	-	-	-	-	81.5	-	-	-
1989	-	-	-	0.0	87.3	118.3	101.5	195.8	0.0	0.0	0.0	0.0	-
1990	0.0	0.0	0.0	10.9	221.0	213.5	228.0	392.9	308.2	52.8	3.4	0.0	1,430.7
1991	-	-	-	32.8	161.3	61.6	177.7	250.6	149.5	52.6	0.0	25.6	-
1992	54.6	9.2	0.0	0.0	111.7	228.8	259.8	200.8	244.7	27.4	0.0	1.9	1,138.9
1993	0.0	4.7	5.4	33.9	188.8	69.2	99.5	76.0	285.0	0.0	0.0	0.0	762.5
Average	18.2	4.6	1.8	15.5	154.0	138.3	173.3	223.2	197.5	35.7	0.7	5.5	968.4

Table-B-9 Monthly and Annual Rainfall (Phen, U.T)

Station: Amphoe Phen, Udon Thani (68022) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1952	-	-	-	32.2	140.4	197.0	247.5	743.5	483.8	42.0	2.6	0.0	-
1953	0.0	73.2	0.0	157.7	193.2	430.6	173.6	204.7	310.8	29.3	33.8	0.0	1,606.9
1954	0.0	0.0	0.0	82.4	314.6	142.5	181.9	427.3	404.7	140.2	0.0	0.0	1,693.6
1955	0.0	0.0	21.1	61.8	124.9	394.1	144.7	485.4	306.9	40.5	0.0	0.0	1,579.4
1956	0.0	57.4	81.6	0.0	402.1	237.6	217.1	344.6	308.5	4.2	0.0	0.0	1,653.1
1957	0.0	0.0	66.3	54.7	181.7	207.9	181.7	233.0	222.4	38.1	0.0	0.0	1,185.8
1958	0.0	0.0	9.7	5.6	130.0	220.1	146.2	396.7	232.5	139.6	0.0	0.0	1,280.4
1959	0.0	0.0	17.5	35.0	147.5	166.0	495.0	259.6	512.5	0.0	0.0	0.0	1,633.1
1960	0.0	0.0	41.2	17.0	172.6	59.9	293.7	407.0	271.2	113.7	0.0	0.0	1,376.3
1961	0.0	0.0	44.6	100.5	237.0	265.5	55.5	280.0	389.3	84.0	0.0	0.0	1,456.4
1962	0.0	0.0	0.0	114.3	231.1	188.9	226.6	101.7	184.9	143.4	0.0	0.0	1,190.9
1963	0.0	0.0	10.3	74.2	100.0	198.2	197.0	123.7	230.0	73.6	19.1	0.0	1,026.1
1964	2.7	10.0	10.8	53.8	250.7	248.3	185.5	136.8	149.2	96.4	0.0	0.0	1,144.2
1965	0.0	0.0	0.0	83.5	142.9	247.5	190.7	202.6	207.5	5.5	0.0	0.0	1,080.2
1966	0.0	25.0	30.6	136.0	246.9	177.2	190.1	509.3	149.1	-	-	0.0	-
1967	0.0	0.0	30.2	70.2	12.2	287.7	342.4	172.8	303.5	0.0	36.5	0.0	1,255.5
1968	2.0	0.0	0.0	192.4	148.7	238.9	147.8	-	-	25.9	0.0	0.0	-
1969	77.6	0.0	64.9	90.8	178.2	349.3	339.8	104.6	227.3	59.0	15.2	0.0	1,506.7
1970	0.0	0.0	2.5	73.0	299.9	494.4	57.2	276.2	353.2	36.9	0.0	0.9	1,594.2
1971	0.0	6.5	7.5	55.0	163.4	309.9	264.6	266.9	241.4	0.0	0.0	53.0	1,368.2
1972	0.0	0.0	119.8	54.1	140.6	235.3	127.5	227.4	154.7	140.3	0.0	0.0	1,199.7
1973	0.0	0.0	21.8	68.6	161.0	168.8	279.0	359.1	365.0	0.0	0.0	0.0	1,423.3
1974	0.0	0.0	21.5	131.2	228.1	114.4	191.5	535.2	89.5	50.4	58.5	0.0	1,420.3
1975	0.0	18.2	0.0	7.5	282.6	158.1	357.0	149.5	446.4	170.5	0.0	0.0	1,589.8
1976	0.0	0.0	33.1	86.5	122.5	222.5	286.4	171.7	377.5	77.0	0.0	0.0	1,377.2
1977	8.9	0.0	29.5	28.8	69.5	207.2	145.3	242.5	183.5	74.0	0.0	0.0	1,289.2
1978	0.0	0.0	55.7	139.9	238.3	156.0	348.3	426.1	185.3	0.0	0.0	0.0	1,549.6
1979	6.0	16.4	0.0	50.3	235.1	298.5	135.9	355.5	102.2	0.0	0.0	0.0	1,199.9
1980	0.0	16.5	20.2	71.6	278.8	318.7	499.8	148.2	199.8	47.5	0.0	0.0	1,601.1
1981	0.0	0.0	20.5	33.5	338.4	205.6	533.8	183.4	193.3	199.9	0.0	0.0	1,708.4
1982	0.0	13.7	27.0	101.3	127.2	156.2	226.7	364.4	370.2	130.3	0.0	0.0	1,517.0
1983	72.0	9.6	5.8	111.2	99.6	354.7	151.7	339.7	141.8	74.1	3.5	0.0	1,363.7
1984	5.3	4.0	5.7	139.0	120.6	246.5	489.1	460.5	275.5	126.3	11.8	0.0	1,884.3
1985	17.5	55.6	5.2	92.5	236.2	275.4	304.9	483.8	264.8	108.1	9.0	0.0	1,853.0
1986	0.0	2.5	0.0	109.9	416.2	260.3	161.8	453.0	236.8	136.6	0.0	41.8	1,818.9
1987	0.0	19.0	77.0	120.7	147.0	357.2	116.3	439.4	168.1	194.0	48.2	0.0	1,686.9
1988	0.0	21.3	19.3	177.2	502.4	181.4	249.7	266.5	86.9	210.8	0.0	0.0	1,715.5
1989	4.2	0.0	31.7	148.1	385.7	251.5	296.2	397.2	472.8	63.8	0.0	0.0	2,051.2
1990	0.0	25.9	80.3	25.7	372.4	147.0	269.1	363.8	271.3	100.4	19.4	0.0	1,975.3
Average	5.2	9.9	26.7	81.7	213.3	248.1	250.0	316.9	265.1	78.3	6.8	2.5	1504.4

Table-B-10 Monthly and Annual Rainfall (Tank-81, U.T)

Station: Huai Nam Thiang(Tank-81), Udon Thani(68190) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1971	-	-	-	55.0	172.4	260.6	167.3	266.9	147.2	40.3	0.0	53.0	-
1972	0.0	0.0	119.8	54.1	49.1	235.3	94.1	189.8	91.7	99.4	0.0	0.0	933.3
1973	0.0	0.0	31.3	50.7	167.2	149.3	262.0	369.0	350.0	26.3	0.0	0.0	1,405.8
1974	0.0	0.0	36.4	141.2	140.5	115.8	195.8	270.9	109.0	71.5	47.0	0.0	1,128.1
1975	5.5	16.8	17.7	9.2	249.1	162.3	305.1	254.4	321.4	160.2	5.0	0.0	1,506.7
1976	0.0	21.3	21.5	40.6	77.9	165.1	208.6	185.7	218.7	79.4	0.0	0.0	1,018.8
1977	28.9	0.0	26.1	26.0	89.6	163.4	175.9	263.4	204.3	66.8	12.3	20.3	1,077.0
1978	0.0	8.1	53.9	87.6	428.3	142.6	232.6	386.9	208.4	14.0	0.0	0.0	1,562.4
1979	0.0	0.0	0.0	58.7	219.9	141.6	28.5	397.2	38.5	0.0	0.0	0.0	884.4
1980	0.0	0.0	0.0	49.4	253.1	285.7	311.9	113.2	271.3	67.7	0.0	0.0	1,352.3
1981	0.0	0.0	20.2	28.8	300.3	172.7	448.4	120.4	187.2	169.9	1.8	0.0	1,449.7
1982	0.0	16.0	3.0	69.2	130.1	105.5	216.0	279.8	231.1	108.2	6.1	0.0	1,165.0
1983	66.0	5.5	3.5	170.0	97.7	335.9	98.9	224.0	130.5	56.9	0.0	0.0	1,188.9
1984	0.0	9.4	0.0	86.5	147.5	172.4	318.9	389.5	206.1	147.8	5.3	0.0	1,483.4
1985	23.0	23.0	0.0	66.7	164.2	169.6	239.7	268.1	228.5	106.1	0.0	0.0	1,288.9
1986	0.0	0.0	0.0	0.0	413.4	179.5	127.0	332.1	158.8	100.9	0.0	25.9	1,337.6
1987	0.0	13.5	57.8	79.1	117.7	260.0	91.8	302.7	130.7	122.1	13.0	0.0	1,188.4
1988	0.0	0.0	0.0	75.5	321.6	141.1	180.0	156.9	81.1	161.3	0.0	0.0	1,117.5
1989	2.5	0.0	24.6	96.2	244.7	190.3	214.8	317.4	296.8	45.6	0.0	0.0	1,432.9
1990	0.0	21.8	64.4	18.5	233.1	357.4	232.0	278.5	186.4	72.4	23.0	0.0	1,487.5
1991	0.0	0.0	51.5	15.0	85.0	50.5	189.9	209.7	191.1	49.5	0.0	15.0	857.2
1992	21.9	14.6	0.0	0.0	142.8	238.0	300.2	233.8	189.2	34.6	0.0	19.1	1,194.2
1993	0.0	8.8	4.0	40.5	203.1	256.6	262.2	209.8	-	0.0	0.0	0.0	-
Average	6.7	7.2	24.4	57.3	193.4	193.5	213.1	261.7	189.9	78.3	4.9	5.8	1236.3

Table-B-11 Monthly and Annual Rainfall (Tank-80, U.T)

Station: Tank-80, Udon Thani (68180) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1961	-	-	-	-	-	-	143.0	276.4	526.5	181.0	0.0	0.0	-
1962	0.0	0.0	0.0	182.6	58.5	233.6	281.2	212.7	197.5	48.2	0.0	0.0	1,214.3
1963	0.0	0.0	32.0	20.0	77.8	302.8	333.9	31.8	10.1	7.6	8.3	0.0	824.3
1964	0.0	0.0	0.0	43.3	60.6	117.9	46.3	75.9	218.5	225.1	0.0	0.0	787.6
1965	0.0	0.0	0.0	85.3	169.6	700.9	327.3	108.7	182.5	15.0	0.0	0.0	1,589.3
1966	0.0	0.0	0.0	0.0	0.0	243.8	358.7	415.0	84.7	124.3	0.0	0.0	1,226.5
1967	0.0	0.0	0.0	34.3	35.3	234.1	7.5	15.2	457.8	0.0	15.3	0.0	799.5
1968	0.0	0.0	0.0	15.3	175.2	276.4	166.7	206.5	159.8	0.0	0.0	0.0	999.9
1969	0.0	0.0	0.0	54.1	122.0	171.6	257.0	172.5	198.5	-	52.8	0.0	-
1970	0.0	0.0	0.0	77.6	324.3	551.1	151.8	427.7	367.5	35.0	0.0	0.0	1,935.0
1971	0.0	4.3	0.0	0.0	110.1	372.5	312.2	260.3	209.5	15.5	0.0	39.3	1,323.7
1972	0.0	0.0	59.0	68.5	165.7	225.1	119.8	374.7	114.3	157.2	12.0	0.0	1,296.3
1973	0.0	0.0	16.3	77.8	146.1	222.5	290.6	315.6	218.2	22.7	0.0	0.0	1,309.8
1974	5.4	10.3	34.4	138.6	129.5	85.6	360.6	402.8	156.5	45.9	70.0	0.0	1,439.6
1975	4.2	5.0	14.7	38.3	171.3	439.2	462.5	193.9	209.4	222.8	0.0	0.0	1,761.3
1976	0.0	28.2	26.6	67.1	280.0	281.4	243.8	204.5	350.6	59.6	0.0	0.0	1,541.8
1977	7.0	0.0	4.0	85.7	128.7	61.6	149.4	251.9	125.1	12.5	0.0	5.0	830.9
1978	0.0	0.0	48.8	56.0	296.2	239.8	206.8	427.1	230.6	10.0	6.0	0.0	1,521.3
1979	0.0	6.0	0.0	97.2	303.2	159.0	140.1	332.4	80.7	0.0	0.0	0.0	1,118.6
1980	0.0	0.0	0.0	33.7	169.2	122.4	179.7	58.2	361.3	47.8	0.0	0.0	972.3
1981	0.0	0.0	0.0	0.0	306.9	559.5	498.7	175.0	79.6	130.9	10.5	0.0	1,861.1
1982	0.0	10.7	70.1	94.7	180.5	136.2	106.5	155.6	245.4	45.5	0.0	0.0	1,045.2
1983	39.1	0.0	12.0	54.4	90.8	145.1	78.0	193.3	193.0	39.8	0.0	0.0	845.5
1984	0.0	0.0	0.0	0.0	0.0	219.1	353.6	338.4	182.7	150.2	25.5	0.0	1,269.5
1985	17.0	0.0	10.4	55.7	268.3	235.0	200.1	118.5	94.8	141.3	0.0	0.0	1,141.1
1986	0.0	0.0	0.0	59.1	179.4	424.5	199.8	231.9	133.6	37.6	0.0	0.0	1,565.9
1987	0.0	0.0	26.5	85.5	96.0	217.1	127.2	367.9	214.1	26.0	0.0	0.0	1,160.3
1988	0.0	0.0	0.0	3.0	237.2	292.1	82.2	284.4	39.0	144.2	0.0	0.0	1,082.1
1989	0.0	0.0	28.6	179.1	158.2	198.6	203.5	306.3	349.5	100.1	0.0	0.0	1,523.9
1990	0.0	64.5	38.5	29.2	216.3	494.7	302.8	603.6	139.6	108.0	17.0	0.0	2,014.2
1991	0.0	0.0	30.4	21.4	129.6	122.2	186.4	160.8	113.7	78.6	0.0	21.3	864.4
1992	0.9	0.0	0.0	0.0	55.8	147.9	242.7	360.8	102.6	16.6	0.0	0.0	927.3
1993	0.0	0.0	0.0	32.0	365.6	240.3	147.6	163.8	-	0.0	0.0	0.0	-
Average	2.3	4.0	14.1	55.9	172.1	267.9	220.2	249.2	198.4	70.3	6.6	2.0	1263.1

Table-B-12 Monthly and Annual Rainfall (Ban Phu, U.T)

Station: A. Ban Phu, Udon Thani (68062) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1954	-	-	-	-	-	-	-	263.5	414.2	126.8	0.0	0.0	-
1955	0.0	5.0	61.5	89.2	235.4	362.9	214.5	317.5	177.4	29.6	8.5	0.0	1,501.5
1956	0.0	49.0	42.9	88.2	227.0	78.5	295.4	240.4	352.1	25.0	0.0	0.0	1,398.5
1957	0.0	0.0	40.0	11.0	153.4	120.5	213.1	317.8	361.3	46.4	0.0	0.0	1,263.5
1958	23.8	0.0	20.7	19.2	112.4	196.6	133.3	425.1	344.6	75.7	0.0	0.0	1,351.4
1959	0.0	11.9	20.3	52.3	252.0	246.9	339.3	201.5	488.7	10.4	3.6	0.0	1,626.9
1960	0.0	5.7	4.3	25.5	267.0	131.4	261.2	418.0	379.8	141.3	0.0	0.0	1,634.2
1961	0.0	6.0	38.0	63.9	302.6	252.3	56.3	415.4	583.6	118.0	0.0	0.0	1,836.1
1962	0.0	0.0	9.3	114.0	257.7	239.8	204.9	361.7	226.5	143.9	0.0	1.9	1,559.7
1963	0.0	0.0	2.0	0.0	15.5	95.0	112.2	255.5	231.0	81.5	21.2	0.0	813.9
1964	0.0	20.1	15.5	44.1	92.1	69.6	111.7	183.1	172.5	105.9	23.6	8.3	846.5
1965	0.0	48.6	19.4	132.0	269.4	240.3	203.7	243.0	161.4	118.9	0.0	0.0	1,436.7
1966	0.0	3.7	46.4	86.9	298.6	173.2	252.1	543.2	252.8	84.4	2.0	0.0	1,743.3
1967	24.0	1.5	6.5	36.2	87.6	260.3	195.4	121.6	373.7	0.0	98.0	0.0	1,204.8
1968	0.0	0.0	28.9	142.5	302.8	281.5	392.4	288.6	320.4	47.6	0.0	0.0	1,804.7
1969	67.2	0.0	41.9	10.5	198.1	293.6	163.0	86.9	144.6	31.0	31.3	0.0	1,068.1
1970	0.0	0.0	0.0	68.3	125.5	431.0	161.2	122.1	170.6	65.0	0.0	0.0	1,143.7
1971	0.0	0.0	0.0	0.0	283.4	275.0	386.2	169.2	147.8	41.5	0.0	0.0	1,303.1
1972	0.0	50.8	76.3	81.7	129.2	96.7	132.6	223.7	131.4	110.9	-	3.8	-
1973	0.0	0.0	46.5	126.8	171.8	166.0	269.7	210.0	426.7	28.0	0.0	0.0	1,445.5
1974	0.0	3.6	44.5	74.5	205.9	121.8	170.6	259.4	264.5	60.4	18.4	0.0	1,223.6
1975	10.5	43.8	0.0	18.0	340.7	357.7	231.4	216.7	217.7	107.9	52.0	0.0	1,596.4
1976	0.0	29.0	25.3	152.0	116.5	129.0	239.2	182.1	323.1	133.0	0.0	0.0	1,329.2
1977	9.4	0.0	4.2	61.8	65.3	80.8	145.9	193.2	154.9	17.2	5.2	0.0	737.9
1978	18.3	0.0	0.0	19.2	132.5	140.6	196.7	246.9	200.6	33.3	0.0	0.0	988.1
1979	0.0	0.0	0.0	39.2	229.8	-	-	215.1	-	-	0.0	0.0	-
1980	0.0	-	-	80.8	315.3	335.2	244.2	258.1	-	-	-	-	-
1981	0.0	0.0	12.3	40.5	229.0	134.9	252.3	140.5	181.1	149.1	10.8	0.0	1,150.5
1982	0.0	0.0	0.0	-	325.8	268.7	398.0	335.6	183.6	12.9	1.5	5.2	-
1983	15.6	0.0	0.0	0.0	83.6	298.0	211.8	256.8	180.1	53.2	0.0	2.2	1,101.3
1984	0.0	13.3	40.7	88.6	260.7	206.0	404.2	290.9	168.5	64.6	3.2	0.0	1,540.7
1985	44.0	26.5	0.0	25.8	118.6	132.9	112.1	157.9	165.8	95.5	0.0	0.0	879.1
1986	0.0	3.1	0.0	90.5	222.1	192.0	232.7	183.5	281.3	106.2	0.0	19.1	1,330.5
1987	0.0	19.8	55.2	111.3	143.3	308.8	82.0	275.9	264.4	87.1	3.5	0.0	1,351.3
1988	0.0	16.5	25.5	83.9	337.2	229.0	243.8	125.1	150.3	227.7	0.0	0.0	1,439.0
1989	12.8	2.1	62.8	39.9	150.8	153.4	80.7	370.5	214.3	130.2	0.0	0.2	1,217.7
1990	0.0	39.4	48.1	10.2	226.6	306.2	244.8	249.9	257.2	90.8	6.4	0.0	1,479.6
1991	0.0	0.0	137.0	93.6	189.4	100.6	215.9	212.2	223.7	14.3	0.0	14.2	1,200.9
1992	27.1	26.5	0.0	11.7	101.6	214.3	391.5	301.3	159.5	32.5	0.0	15.3	1,281.3
1993	0.0	0.0	58.6	56.6	274.6	208.1	246.1	202.3	203.3	18.3	0.0	0.0	1,267.9
Average	6.5	11.2	27.2	60.3	201.3	208.7	222.2	252.0	254.1	75.4	7.6	1.8	1328.3

Table-B-13 Monthly and Annual Rainfall (KH-18, U.T)

Station: H. Mong (Kh-18), Udon Thani (68201) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1956	-	-	-	-	-	-	-	-	-	-	0.0	0.0	-
1957	0.0	4.1	179.6	236.3	151.3	228.7	232.9	218.1	257.2	44.3	0.0	0.0	1,552.5
1958	2.4	12.9	19.9	12.2	132.7	126.5	166.1	373.4	168.9	46.3	0.0	0.0	1,061.3
1959	7.5	6.2	77.1	101.5	262.5	194.4	137.9	43.5	286.6	0.0	-	-	-
1960	-	-	-	-	-	255.7	218.8	62.3	299.9	229.5	4.1	0.9	-
1961	9.4	8.6	31.1	35.8	328.2	-	-	-	-	-	-	-	-
1964	-	-	-	-	-	110.9	171.8	185.8	325.8	176.1	4.2	0.0	-
1965	0.0	40.3	10.7	82.9	252.3	221.0	114.0	311.5	187.1	59.4	0.0	0.0	1,279.2
1966	0.0	54.3	41.6	116.2	252.5	222.4	135.1	293.2	94.7	115.1	4.8	4.9	1,334.8
1967	0.6	41.8	12.0	98.9	97.0	170.0	141.7	143.0	356.2	4.5	43.3	0.0	1,109.0
1968	0.0	0.0	57.0	87.2	195.2	278.2	174.7	339.4	357.0	11.8	10.6	0.0	1,511.1
1969	81.9	0.0	8.3	145.5	217.8	195.0	-	251.9	260.0	45.9	62.7	-	-
1970	-	-	-	-	-	-	-	-	393.7	81.4	0.0	-	-
1971	0.0	40.7	0.0	21.0	218.5	168.7	291.6	213.9	175.5	119.8	0.0	31.2	1,280.9
1972	0.0	57.6	85.8	94.1	161.9	335.3	179.3	161.5	182.1	178.1	31.3	0.0	1,467.0
1973	0.0	0.0	41.8	108.8	213.1	226.5	230.2	156.4	275.8	13.4	0.0	0.0	1,266.0
1974	0.0	4.5	27.5	51.4	157.0	82.7	130.4	314.4	228.2	102.6	25.0	0.0	1,123.7
1975	17.8	54.5	64.7	67.2	204.9	316.0	232.8	111.4	206.1	162.3	19.1	0.0	1,456.8
1976	0.0	39.5	4.5	88.8	121.3	151.1	178.0	209.9	404.3	126.0	1.5	0.0	1,324.9
1977	16.7	0.0	43.0	114.3	69.7	99.6	165.4	247.4	185.4	8.0	11.3	20.1	980.9
1978	0.0	11.3	69.2	91.0	251.7	190.3	295.6	295.0	241.3	42.0	0.8	0.0	1,488.2
1979	2.5	33.9	0.0	54.9	218.7	396.4	212.4	143.0	210.9	40.4	0.0	0.0	1,313.1
1980	0.0	16.0	13.5	87.8	439.3	377.9	286.6	264.1	567.5	62.4	0.0	0.0	2,115.1
1981	0.0	11.0	72.4	15.0	208.0	169.2	220.7	167.2	130.6	162.4	28.5	0.0	1,185.0
1982	0.0	0.0	83.3	100.4	113.6	81.6	-	-	-	-	-	-	-
Average	6.6	20.8	44.9	86.2	203.2	209.0	195.8	214.6	263.4	83.3	11.2	2.9	1341.9

Table-B-14 Monthly and Annual Rainfall (Ban Dung, U.T)

Station: A. Ban Dung , Udon Thani(68212) Unit: mm

Month Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1974	-	-	-	11.4	41.0	106.2	234.1	239.1	94.5	11.1	7.3	0.5	-
1975	21.2	2.8	15.1	6.4	13.4	163.4	328.2	351.1	186.4	167.7	3.6	0.0	1,259.3
1976	0.0	19.0	0.0	89.9	119.3	117.8	216.5	202.7	279.7	35.6	0.0	0.0	1,080.5
1977	0.0	0.0	0.0	81.4	141.4	110.8	198.8	377.0	206.1	8.0	0.0	0.0	1,123.5
1978	0.0	22.8	68.6	108.5	319.1	222.9	327.6	449.8	207.5	40.1	0.0	0.0	1,766.9
1979	0.0	0.0	0.0	83.4	413.0	481.0	196.9	263.5	0.0	0.0	0.0	0.0	1,437.8
1980	0.0	19.0	86.0	138.1	350.8	318.2	248.3	273.4	216.2	0.0	0.0	0.0	1,650.0
1981	0.0	0.0	20.3	42.1	483.8	396.4	421.6	234.4	131.3	13.6	0.0	0.0	1,743.5
1982	0.0	13.5	60.9	237.1	147.1	127.4	366.2	465.4	132.8	10.0	0.0	0.0	1,550.4
1983	0.0	0.0	0.0	87.6	63.7	162.1	155.1	470.9	106.9	131.9	0.0	0.0	1,178.2
1984	0.0	0.0	0.0	36.9	174.2	97.8	431.4	290.5	225.1	99.6	0.0	0.0	1,355.5
1985	27.7	68.6	51.6	90.4	60.1	128.8	169.2	502.9	115.9	0.0	0.0	0.0	1,215.2
1986	0.0	17.9	0.0	57.4	269.1	266.4	194.7	276.2	235.2	77.6	0.0	50.0	1,444.5
1987	0.0	27.8	61.5	60.4	73.1	215.6	110.9	328.1	176.5	70.4	21.6	0.0	1,145.9
1988	0.0	0.0	0.0	34.8	174.2	168.2	205.3	121.0	56.0	157.3	0.0	0.0	916.8
1989	0.0	0.0	48.5	67.5	266.3	202.1	212.4	345.1	61.8	26.0	0.0	0.0	1,229.7
1990	0.0	34.0	63.6	27.8	224.2	408.7	351.7	468.2	195.8	78.3	15.4	0.0	1,867.7
1991	0.0	0.0	78.3	61.1	178.3	67.4	253.5	352.0	251.3	41.4	0.0	22.5	1,305.8
1992	34.5	0.0	1.4	5.6	114.0	282.8	367.2	457.9	191.3	35.8	0.0	15.3	1,505.8
1993	0.0	31.5	1.0	57.9	385.1	331.2	271.3	242.6	186.2	0.0	0.0	0.0	1,506.8
Average	4.4	13.5	29.3	72.3	209.0	224.7	264.0	340.7	166.4	52.3	2.1	4.6	1383.4

Table-B-15 Monthly and Annual Rainfall (Nam Som, U.T)

Station: A. Nam Som, Udon Thani (68272) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1975	-	-	-	0.0	107.8	290.2	189.8	214.2	102.2	57.2	44.5	0.0	-
1976	0.0	28.1	7.4	112.4	216.8	146.1	194.3	210.4	245.6	113.0	8.6	0.0	1,282.7
1977	10.4	0.0	48.2	86.3	96.8	42.3	116.3	273.6	197.7	42.4	5.3	0.0	919.3
1978	0.0	8.0	37.3	71.1	163.1	137.4	202.1	200.5	208.0	35.2	0.0	0.0	1,062.7
1979	0.0	9.9	0.0	188.1	182.8	353.7	146.9	147.6	230.1	22.4	0.0	0.0	1,281.5
1980	0.0	0.0	4.8	69.5	471.6	373.3	162.4	182.9	565.9	18.1	0.0	0.0	1,848.5
1981	0.0	23.4	65.9	64.5	244.5	208.9	406.3	188.2	141.1	30.9	26.6	0.0	1,400.3
1982	0.0	0.0	0.0	0.0	116.2	67.5	188.3	172.5	427.3	114.3	53.2	0.0	1,139.3
1983	48.7	0.0	5.5	44.9	188.9	224.1	167.5	267.8	312.7	89.6	0.0	0.0	1,349.7
1984	0.0	3.0	5.5	77.3	190.2	130.6	289.3	157.1	125.2	249.8	32.0	0.0	1,260.0
1985	39.2	26.6	5.0	120.6	142.4	135.5	173.2	218.6	286.3	72.6	0.0	0.0	1,220.0
1986	0.0	0.0	0.0	248.0	290.0	243.2	190.0	149.0	168.8	194.9	0.0	23.1	1,507.0
1987	0.0	54.8	65.3	167.4	169.8	187.5	109.0	432.7	303.1	23.5	12.3	0.0	1,525.4
1988	0.0	7.8	13.2	90.3	331.4	253.8	116.3	248.4	172.0	306.8	0.0	0.0	1,540.0
1989	9.6	3.9	64.0	124.7	135.2	125.4	112.6	271.2	355.1	103.9	0.0	0.0	1,305.6
1990	0.0	11.9	71.8	29.2	333.5	318.0	98.6	386.0	26.5	168.4	15.1	0.0	1,459.0
1991	0.0	0.0	11.7	89.5	120.8	73.6	335.8	516.0	183.9	54.0	0.0	31.3	1,416.6
1992	0.0	23.7	0.0	0.0	75.5	304.9	332.1	708.0	207.9	63.5	0.0	5.0	1,720.6
1993	0.0	15.6	0.0	15.0	281.7	301.6	164.3	171.9	139.2	0.0	0.0	0.0	1,089.3
Average	6.0	12.0	22.5	84.1	203.1	206.2	194.5	259.3	231.5	92.7	10.4	3.1	1335.5

Table-B-16 Monthly and Annual Rainfall (Muang, NK)

Station: Amphoe Muang, Nong Khai (30012) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1943	-	-	-	0.0	0.0	185.0	255.2	155.5	205.0	0.0	0.0	0.0	-
1944	181.5	0.0	0.0	0.0	107.2	-	334.5	338.3	170.4	219.1	12.0	0.0	-
1945	0.0	68.8	0.0	0.0	164.7	419.0	313.4	64.5	45.1	0.0	0.0	25.0	1,100.5
1946	0.0	10.2	47.4	102.0	199.9	236.5	201.5	319.3	150.0	0.0	0.0	0.0	1,266.8
1947	50.5	0.0	70.0	96.1	195.5	336.0	94.0	204.0	92.0	5.0	0.0	0.0	1,143.1
1948	0.0	0.0	0.0	178.0	68.4	178.0	218.7	614.8	450.3	42.7	0.0	0.0	1,750.9
1949	0.0	21.0	8.3	12.3	-	90.0	421.5	598.4	479.4	100.2	57.5	0.0	-
1950	0.0	0.0	0.0	0.0	322.0	412.2	391.5	-	-	3.2	58.2	223.7	-
1951	148.6	0.0	12.5	22.8	-	-	122.0	63.5	225.0	22.8	0.0	0.0	-
1952	0.0	0.0	134.2	0.0	132.7	253.3	350.5	369.9	323.0	16.0	0.0	0.0	1,579.6
1953	70.3	84.4	0.0	39.1	250.0	227.2	148.7	273.4	360.8	0.0	66.3	0.0	1,520.2
1954	0.0	88.6	14.0	108.4	329.8	205.7	82.8	264.0	224.3	92.0	0.0	0.0	1,409.6
1955	0.0	0.0	30.0	40.3	163.4	289.3	117.2	380.3	240.6	36.0	0.0	0.0	1,297.1
1956	0.0	66.2	22.8	92.3	315.4	277.4	264.5	272.5	416.0	3.1	0.0	0.0	1,730.2
1957	0.0	0.0	30.5	91.3	166.2	285.8	279.4	336.4	196.4	107.7	0.0	0.0	1,493.7
1958	26.0	5.3	13.2	81.2	191.0	227.4	182.4	229.7	188.1	29.9	0.0	0.0	1,174.2
1959	0.0	19.7	35.0	9.4	266.7	93.9	404.4	229.9	727.1	0.0	2.2	0.0	1,788.3
1960	0.0	5.5	18.8	83.4	156.3	141.7	282.2	516.5	562.0	56.3	11.5	0.0	1,834.2
1961	0.0	16.3	16.0	29.4	278.6	238.9	156.2	377.3	379.3	110.4	0.0	0.0	1,602.4
1962	0.0	0.0	7.2	90.9	277.4	244.9	245.1	483.7	350.5	175.6	6.7	0.9	1,882.9
1963	0.0	0.0	46.8	117.1	203.2	300.4	334.4	247.1	238.0	66.3	47.9	4.8	1,606.0
1964	4.1	31.3	30.8	149.5	372.2	264.1	203.8	243.5	251.7	139.0	0.2	0.0	1,690.2
1965	0.0	6.3	5.0	149.5	160.5	296.1	201.2	243.8	397.1	48.8	0.0	0.0	1,508.3
1966	0.8	7.7	63.7	162.9	297.9	231.3	185.4	539.4	118.5	55.3	0.1	0.0	1,663.0
1967	3.2	1.1	8.9	117.7	126.0	215.2	210.9	264.7	620.5	1.5	12.5	0.0	1,582.2
1968	0.6	0.4	16.7	146.8	291.9	246.9	202.4	252.4	335.5	36.6	0.0	0.0	1,530.2
1969	37.9	0.0	118.2	133.2	182.7	326.4	404.7	167.2	287.7	38.3	19.2	0.0	1,715.5
1970	0.0	0.0	26.6	75.4	311.3	529.1	187.4	547.2	390.9	19.6	0.2	6.9	2,094.6
1971	0.8	8.7	14.2	87.6	464.9	379.4	425.0	231.5	171.0	53.2	2.1	10.2	1,848.6
1972	0.0	0.3	33.5	53.1	127.2	313.3	130.9	390.6	104.2	138.4	34.4	9.3	1,335.2
1973	0.0	0.0	9.0	124.4	180.0	166.7	275.0	287.7	291.4	35.3	0.8	0.0	1,370.3
1974	0.0	0.1	35.0	19.7	144.6	161.3	267.1	462.9	71.1	58.5	23.8	0.0	1,244.1
1975	20.7	28.6	17.6	73.7	352.9	380.9	247.4	519.2	367.8	120.6	9.2	0.0	2,138.6
1976	0.0	24.2	28.6	54.2	209.1	257.4	163.7	253.0	330.8	102.4	0.0	0.0	1,423.4
1977	18.4	0.0	30.7	115.4	171.3	106.5	177.4	307.2	219.4	20.1	11.0	29.6	1,207.0
1978	7.7	23.5	13.4	57.4	276.2	229.9	393.6	432.8	293.9	18.9	7.6	0.0	1,754.9
1979	0.9	26.0	10.9	116.8	278.5	273.2	103.1	205.8	192.4	2.1	0.0	0.0	1,209.7
1980	0.0	2.2	11.5	83.6	331.0	530.6	283.0	276.4	378.6	61.8	0.0	0.0	1,958.7
1981	0.0	8.9	4.4	94.0	287.7	274.5	427.2	183.7	206.5	159.3	59.7	0.0	1,705.9
1982	0.0	12.6	90.0	107.3	183.0	0.0	315.5	346.4	361.0	109.0	26.7	4.7	1,556.2
1983	0.0	19.8	1.3	64.1	128.7	200.7	205.7	428.0	191.9	136.6	0.0	10.4	1,387.2
1984	0.3	4.3	53.3	72.7	206.6	189.6	329.2	458.9	254.0	182.0	14.3	0.0	1,765.2
1985	15.1	20.8	11.6	87.1	174.1	280.8	242.2	243.0	181.6	111.2	0.0	0.0	1,367.5
1986	0.0	1.6	0.0	31.0	450.6	384.0	216.4	582.3	223.5	153.0	0.0	13.8	2,056.2
1987	0.5	14.7	41.2	39.2	36.6	404.6	81.4	334.8	193.8	72.3	30.5	0.0	1,249.6
1988	0.0	30.3	20.2	140.9	371.2	116.5	259.4	147.8	150.4	128.5	0.0	0.0	1,365.2
1989	4.8	4.0	60.2	115.2	210.7	161.8	75.4	341.8	331.1	47.4	0.0	0.0	1,352.4
1990	0.3	20.1	60.5	83.3	242.5	318.8	249.4	246.1	317.2	61.3	62.2	0.0	1,661.7
1991	0.0	0.0	100.6	27.5	141	99.5	108.3	227.9	211.7	10.7	0.0	11.8	939.0
1992	61.7	22.3	2.2	20.3	225.2	218.6	437.1	201.2	162.7	39.8	0.1	17.1	1,408.3
1993	0.0	9.5	2.6	17.6	289.7	243.2	161.6	183.0	213.2	2.5	0.0	0.0	1,122.9
Average	13.1	14.3	28.6	76.3	229.5	255.4	242.3	321.1	278.4	65.0	11.5	7.4	1,542.8

Table-B-17 Monthly and Annual Rainfall (Tha Bo, NK)

Station: Amphoe Tha Bo, Nong Khai (30032) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1950	-	-	-	108.1	207.5	362.5	927.6	400.5	768.4	159.6	180.8	21.0	-
1951	0.0	0.0	31.0	79.6	211.9	744.2	271.0	180.7	346.2	211.0	17.9	0.0	2,093.5
1952	0.0	0.0	72.6	50.6	46.2	70.1	141.8	50.5	81.6	105.7	10.0	0.0	629.1
1953	5.0	7.5	47.6	61.0	121.4	345.1	152.4	151.2	262.7	60.5	0.0	0.0	1,214.4
1954	0.0	0.0	0.0	64.6	196.8	227.1	71.4	286.9	285.9	122.0	0.0	0.0	1,254.7
1955	0.0	27.6	75.2	215.5	187.3	326.8	259.0	238.0	265.1	0.0	0.0	0.0	1,594.5
1956	0.0	67.3	63.6	114.9	-	-	-	-	-	-	-	-	-
1957	-	-	-	57.8	284.0	244.5	593.7	306.7	346.6	56.9	0.0	0.0	1,890.2
1958	32.5	9.1	0.0	55.8	197.7	305.4	94.8	246.6	189.4	49.4	0.0	0.0	1,180.7
1959	0.0	22.1	54.3	33.6	259.3	183.8	348.2	178.7	487.8	0.0	3.2	0.0	1,571.0
1960	0.0	4.2	8.4	59.3	140.4	78.3	427.7	449.1	527.4	65.2	3.5	0.0	1,763.5
1961	0.0	11.7	27.3	84.9	148.9	295.3	137.1	285.4	473.9	148.9	0.0	0.0	1,913.4
1962	0.0	0.0	11.1	80.5	334.5	232.0	239.7	392.0	303.9	161.8	20.0	0.0	1,775.5
1963	0.0	0.0	41.3	93.6	185.4	194.4	218.4	196.4	143.4	91.9	89.5	0.0	1,254.3
1964	9.9	21.8	7.2	75.2	318.1	236.1	230.0	98.6	248.1	125.3	0.0	4.4	1,374.7
1965	0.0	8.8	7.0	196.2	165.1	246.2	209.5	248.9	369.9	62.3	0.0	0.0	1,513.9
1966	0.9	6.9	78.0	105.6	254.2	307.2	228.2	493.7	129.4	60.0	1.2	0.0	1,665.3
1967	2.3	1.7	25.9	80.3	137.7	187.8	167.3	157.0	290.0	0.0	17.9	0.0	1,067.9
1968	0.7	0.0	28.6	118.1	191.3	190.6	233.2	306.6	247.3	18.5	0.1	0.0	1,335.0
1969	44.7	0.0	61.1	64.6	148.3	361.5	182.5	115.3	359.8	51.8	12.7	0.0	1,402.3
1970	0.0	0.0	33.8	84.2	292.1	451.2	187.7	346.4	259.4	24.6	0.0	2.3	1,681.7
1971	2.4	22.6	11.7	28.2	404.2	312.7	864.0	260.9	199.7	81.0	0.7	21.3	1,709.4
1972	0.0	0.0	52.8	101.1	182.2	374.7	193.5	271.6	201.6	200.2	39.8	9.8	1,627.3
1973	0.0	0.0	13.6	44.4	157.8	137.4	280.7	400.4	508.0	31.1	0.0	0.0	1,573.4
1974	0.0	13.0	61.3	124.6	183.7	208.7	151.9	445.4	94.1	95.0	35.9	0.0	1,413.6
1975	18.9	56.2	27.4	22.3	320.5	370.7	153.2	268.0	341.5	115.7	8.9	0.0	1,703.3
1976	0.0	29.3	63.4	129.4	139.5	182.7	190.7	147.1	342.4	64.0	0.0	0.0	1,288.5
1977	16.3	0.0	54.1	84.7	145.7	129.4	-	-	-	-	-	-	-
1978	0.0	16.6	23.7	81.9	230.0	249.3	334.6	238.7	291.7	86.0	2.5	0.0	1,555.0
1979	4.2	40.6	0.0	64.0	278.2	231.6	90.5	108.0	220.0	0.0	0.0	0.0	1,037.1
1980	0.0	0.0	0.0	60.6	298.7	546.9	255.8	370.0	302.2	77.4	0.0	0.0	1,911.6
1981	0.0	0.0	27.8	108.8	264.2	290.2	484.1	198.1	208.9	132.6	5.3	0.0	1,720.0
1982	0.0	0.0	87.1	26.6	233.3	72.9	218.4	434.4	339.8	0.9	0.0	0.0	1,413.4
1983	43.9	4.0	0.0	48.8	64.8	311.7	217.7	246.3	238.4	86.5	0.0	6.5	1,268.6
1984	0.0	11.0	0.0	82.1	90.1	125.2	351.6	254.3	180.2	120.1	14.2	0.0	1,228.8
1985	43.0	77.5	6.3	22.4	73.6	227.3	278.5	159.0	198.6	81.1	0.0	0.0	1,167.3
1986	0.0	0.0	0.0	15.1	203.7	324.0	198.6	298.7	289.2	118.2	0.0	16.5	1,524.0
1987	0.0	5.8	55.8	93.6	130.2	370.8	55.5	231.6	173.2	76.7	0.0	0.0	1,193.2
1988	0.0	0.2	8.2	88.0	141.2	185.1	165.8	139.3	215.9	127.5	0.0	0.0	1,371.2
1989	7.6	2.5	56.2	80.3	192.4	286.0	100.1	325.0	248.8	40.3	0.0	0.0	1,339.2
1990	0.0	24.0	27.9	20.2	293.1	226.8	350.1	204.0	234.7	74.0	15.4	0.0	1,470.2
1991	0.0	0.0	86.1	82.9	267.8	133.0	161.5	263.7	298.1	37.7	0.0	11.5	1,342.3
1992	42.2	24.0	0.0	13.7	164.5	317.8	354.6	217.9	202.3	27.4	0.0	22.2	1,386.6
1993	0.2	7.2	0.1	36.7	246.3	248.9	184.5	272.7	136.3	0.1	0.0	0.0	1,133.0
Average	6.5	12.5	31.8	76.0	218.5	266.4	249.0	259.2	282.2	77.4	11.4	2.8	1,493.5

Table-B-18 Monthly and Annual Rainfall (Bang Phuan, NK)

Station: H. Bang Phuan (Tank-24), Nong Khai (30180) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1956	-	-	-	-	4.4	19.6	6.3	29.7	196.5	0.0	0.0	0.0	-
1957	0.0	0.0	41.8	73.4	228.8	265.8	211.5	262.2	375.5	130.9	0.0	0.0	1,589.9
1958	0.0	2.0	0.0	55.6	130.2	291.9	255.7	333.9	104.4	72.4	0.0	0.0	1,246.1
1959	0.0	9.9	74.2	73.1	231.9	206.0	365.7	314.1	484.9	6.8	0.0	0.0	1,766.6
1960	0.0	6.9	21.5	8.2	145.4	110.5	353.3	487.5	260.9	108.1	0.0	0.0	1,502.3
1961	0.0	4.3	11.1	60.6	266.4	175.0	88.8	373.4	-	-	-	-	-
1962	-	-	-	0.0	213.5	163.7	173.3	428.1	242.0	176.8	0.0	0.0	-
1963	0.0	0.0	0.0	68.0	148.7	240.6	161.4	199.9	253.1	63.4	56.5	0.0	1,191.6
1964	0.0	0.0	29.4	46.6	344.6	156.3	106.1	185.2	312.0	131.7	0.0	0.0	1,311.9
1965	0.0	0.0	0.0	190.8	203.6	293.7	163.3	226.0	316.7	27.6	6.8	0.0	1,428.5
1966	0.0	2.0	31.9	116.6	257.2	251.1	210.2	381.4	125.6	0.0	3.6	0.0	1,379.6
1967	0.0	0.0	2.4	30.2	96.7	210.6	142.5	87.7	297.8	0.0	20.0	0.0	887.9
1968	0.0	0.0	16.7	112.6	163.0	226.3	141.6	178.6	291.5	0.0	0.0	0.0	1,130.3
1969	63.7	0.0	63.1	87.7	201.0	188.8	241.0	158.8	268.7	42.7	55.5	0.0	1,371.0
1970	0.0	0.0	41.1	67.9	182.2	555.3	112.5	353.0	187.5	37.3	0.0	0.0	1,536.8
1971	0.0	0.0	0.0	0.0	272.2	232.0	210.8	157.0	122.1	35.0	0.0	0.0	1,029.1
1972	0.0	0.0	34.6	35.2	36.0	357.1	73.7	258.8	124.5	141.1	8.8	2.9	1,072.7
1973	0.0	0.0	0.0	82.4	195.7	249.4	286.8	185.1	244.7	25.7	0.4	0.0	1,270.2
1974	1.0	0.8	20.3	55.0	84.7	89.8	161.3	389.2	150.8	43.6	20.4	0.0	1,016.9
1975	21.8	27.6	68.4	10.8	296.6	287.7	340.7	212.3	380.8	131.0	24.6	0.0	1,802.3
1976	0.0	14.4	138.0	88.8	104.5	146.6	75.5	178.0	481.0	83.4	4.2	0.0	1,314.4
1977	0.0	0.0	19.5	133.2	30.4	74.8	257.9	204.4	215.6	14.4	0.0	3.2	953.4
1978	7.6	5.2	64.0	53.0	281.8	140.5	251.0	265.9	132.3	15.1	0.0	0.0	1,216.4
1979	0.0	31.0	5.2	46.1	283.3	172.1	203.7	167.6	52.4	20.3	0.0	0.0	981.7
1980	0.0	0.0	0.0	53.9	230.3	335.2	291.2	246.7	135.9	31.8	0.0	0.0	1,325.0
1981	0.0	5.3	4.3	3.7	184.8	129.4	163.4	155.2	293.1	111.6	0.0	0.0	1,050.8
1982	0.0	0.0	17.6	11.2	62.5	142.8	268.0	241.9	355.5	49.6	3.4	0.0	1,152.5
1983	22.7	3.2	0.0	47.5	82.3	246.3	124.0	282.9	122.4	25.5	0.0	0.0	956.8
1984	0.0	0.0	30.7	32.9	151.9	180.7	212.7	244.9	105.9	124.7	5.5	0.0	1,089.9
1985	6.5	10.7	0.0	5.3	139.6	148.1	164.6	108.2	155.8	83.5	5.5	0.0	827.8
1986	0.0	0.0	0.0	12.6	281.4	237.3	264.0	243.3	238.4	85.5	0.0	0.0	1,362.5
1987	0.0	0.0	99.3	56.9	76.5	285.0	11.0	262.9	224.0	91.2	0.0	0.0	1,106.8
1988	0.0	0.0	1.4	141.3	406.1	146.6	225.5	142.9	169.5	135.2	0.0	0.0	1,368.5
1989	0.0	0.0	34.8	40.7	198.8	205.1	117.2	363.5	330.4	50.6	0.0	0.0	1,341.1
1990	0.0	33.5	65.7	42.0	286.4	0.0	204.3	171.5	174.2	52.8	21.5	0.0	1,051.9
1991	0.0	0.0	142.1	56.9	157.7	135.1	269.9	199.2	156.5	49.8	0.0	0.0	1,167.2
1992	44.9	37.7	0.0	3.2	0.0	253.8	266.6	286.7	185.7	31.2	0.0	16.5	1,126.3
1993	0.0	1.8	7.0	32.6	295.4	265.0	87.7	181.5	161.3	5.5	0.0	0.0	1,037.8
Average	4.7	5.5	30.2	55.0	183.1	205.7	191.2	240.8	227.8	60.4	6.4	0.6	1,211.3

Table-B-19 Monthly and Annual Rainfall (Phon Phisai, NK)

Station: Amphoe Phon Phisai, Nong Khai (30022) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1952	-	-	-	64.6	307.4	382.4	264.5	486.2	680.5	27.0	0.0	0.0	-
1953	15.2	85.5	13.0	87.6	360.1	344.7	284.2	509.0	322.3	13.8	10.0	0.0	2,045.4
1954	13.0	11.8	0.0	32.7	443.7	199.1	96.3	327.6	377.6	144.9	0.0	0.0	1,646.7
1955	0.0	0.0	37.5	63.9	235.7	265.9	223.9	352.2	207.6	57.7	0.0	0.0	1,444.4
1956	0.0	75.7	24.4	66.2	304.7	313.6	293.3	388.2	378.0	0.0	0.0	0.0	1,844.1
1957	0.0	0.0	25.4	58.1	280.0	426.3	326.5	344.8	399.2	26.1	0.0	0.0	1,886.4
1958	30.5	0.0	32.1	64.4	155.0	463.8	352.4	421.0	173.0	60.5	0.0	0.0	1,752.7
1959	0.0	0.0	46.3	52.6	229.5	158.3	513.8	429.6	482.1	25.5	0.0	0.0	1,937.7
1960	0.0	3.5	64.2	52.3	231.5	244.5	156.9	871.7	459.0	50.8	0.0	0.0	2,434.4
1961	0.0	27.0	15.5	59.0	127.8	304.3	216.9	399.3	428.0	72.0	0.0	0.0	1,649.8
1962	0.0	0.0	9.5	98.5	218.5	379.9	388.2	482.3	391.0	138.5	0.0	0.0	2,106.4
1963	0.0	0.0	24.5	29.2	152.3	321.4	384.7	334.3	319.5	71.7	0.0	0.0	1,637.6
1964	6.5	17.0	28.0	113.5	304.8	292.3	204.8	185.3	197.0	117.5	0.0	0.0	1,466.7
1965	0.0	15.8	4.5	116.9	237.7	580.0	241.0	330.5	161.1	71.5	0.0	0.0	1,759.0
1966	0.0	10.0	67.6	152.2	321.4	314.8	338.3	812.7	230.0	102.0	0.0	0.0	2,349.0
1967	7.0	0.0	0.0	103.8	140.0	190.3	318.4	98.0	401.5	0.0	7.0	0.0	1,266.0
1968	0.0	2.0	6.2	88.0	187.5	262.5	262.5	307.5	472.2	36.5	0.0	0.0	1,624.9
1969	24.0	0.0	38.0	13.5	301.5	410.9	356.0	209.1	192.5	39.7	0.0	0.0	1,585.2
1970	0.0	0.0	72.5	121.7	431.8	649.3	247.4	566.1	405.0	13.5	0.0	0.0	2,507.3
1971	0.0	0.0	0.0	74.0	381.4	420.6	364.4	348.8	130.3	97.3	3.0	18.5	1,838.3
1972	0.0	5.5	34.0	95.9	123.5	299.3	276.3	454.0	168.4	117.2	6.5	5.5	1,586.1
1973	0.0	0.0	10.5	33.9	315.5	219.6	197.8	400.1	311.9	33.3	0.0	0.0	1,522.6
1974	0.0	8.5	44.6	151.2	196.1	164.7	399.2	583.8	174.5	42.0	53.1	0.0	1,817.7
1975	10.8	8.5	43.2	82.2	324.0	480.2	379.8	808.5	267.3	133.3	48.0	0.0	2,585.8
1976	0.0	22.7	22.8	82.7	161.9	310.8	399.1	241.4	553.1	29.1	0.0	0.0	1,623.6
1977	16.3	0.0	0.0	187.5	238.6	90.3	479.3	289.1	269.8	0.0	26.4	0.0	1,597.3
1978	10.5	17.9	127.4	172.1	318.2	437.4	440.0	343.7	216.0	80.8	15.4	0.0	2,179.4
1979	0.0	114.5	75.0	135.4	434.8	462.9	305.0	261.9	124.7	26.0	0.0	0.0	1,940.2
1980	0.0	35.7	16.6	159.5	330.2	381.9	708.5	360.8	273.0	105.1	0.0	0.0	2,371.3
1981	0.0	0.0	13.5	219.9	268.0	379.7	715.8	425.3	262.0	212.9	0.0	0.0	2,497.1
1982	0.0	3.8	94.7	68.8	245.3	240.0	245.9	648.1	336.6	117.6	0.0	0.0	2,000.8
1983	69.8	12.3	4.3	56.3	129.0	263.6	178.5	523.9	349.6	162.2	-	0.0	-
1984	-	-	4.2	103.5	345.2	241.6	533.3	551.7	273.2	184.8	7.8	0.0	-
1985	36.5	88.6	19.8	130.0	334.8	417.1	164.2	417.6	126.4	68.7	0.0	0.0	1,803.7
1986	0.0	0.0	0.0	60.0	506.9	535.0	397.6	472.8	238.8	111.6	0.0	13.5	2,336.2
1987	0.0	20.3	39.0	89.7	96.0	634.3	141.7	368.0	634.2	128.2	0.0	0.0	2,051.4
1988	0.0	41.6	14.6	39.8	354.8	226.4	107.4	389.2	140.7	142.5	0.0	0.0	1,457.0
1989	15.6	0.0	20.2	112.2	205.0	184.2	188.5	396.5	372.9	108.5	0.0	0.0	1,603.6
1990	0.0	40.5	79.1	69.6	279.0	561.0	289.7	306.4	225.7	127.5	149.9	0.0	2,128.4
Average	6.9	18.1	30.9	91.4	270.7	345.0	320.1	421.7	308.4	79.4	8.6	1.0	1,902.1

Table-B-20 Monthly and Annual Rainfall (Tank-4, NK)

Station: Huai Pleo Nguak (Tank-4), Nong Khai (30170) Unit: mm

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1954	-	-	-	-	-	36.2	101.0	461.5	397.6	0.0	0.0	0.0	-
1955	0.0	0.0	50.0	0.0	71.0	519.2	447.7	418.4	160.6	0.0	0.0	0.0	1,666.9
1956	0.0	0.0	2.8	74.2	265.0	411.2	313.0	438.0	193.0	0.0	0.0	0.0	1,697.2
1957	0.0	0.0	100.0	76.0	266.0	473.0	435.0	373.0	367.0	54.9	0.0	0.0	2,144.9
1958	40.0	0.0	31.5	160.3	158.8	551.7	332.0	365.5	372.5	148.4	0.0	0.0	2,160.7
1959	0.0	18.9	42.2	105.3	312.9	141.0	519.5	345.7	535.0	11.7	0.0	0.0	2,032.2
1960	0.0	8.6	17.5	0.0	293.4	387.9	420.2	923.9	476.0	41.5	0.0	0.0	2,569.0
1961	0.0	0.0	20.5	70.4	169.5	239.0	212.9	510.5	621.7	33.1	0.0	0.0	1,877.6
1962	0.0	0.0	30.5	139.8	159.8	430.2	262.2	497.0	378.5	139.2	0.0	0.0	2,037.2
1963	0.0	0.0	14.5	38.6	177.0	374.6	411.4	482.5	309.6	82.7	18.2	0.0	1,909.1
1964	0.0	0.0	0.0	181.6	178.7	414.9	99.7	354.8	317.3	299.0	0.0	0.0	1,846.0
1965	0.0	32.1	0.0	158.9	314.2	692.5	407.8	524.0	383.2	168.9	0.0	0.0	2,681.6
1966	0.0	0.0	118.0	187.6	483.1	465.5	345.1	1192.5	221.9	118.8	0.0	0.0	3,132.5
1967	0.0	32.6	0.0	119.2	101.1	260.4	236.7	-	617.4	0.0	3.5	0.0	-
1968	0.0	8.6	39.3	80.2	226.6	422.2	323.2	526.1	799.7	0.0	0.0	0.0	2,425.9
1969	55.6	0.0	79.3	74.9	154.2	498.8	641.0	254.3	245.0	25.1	6.2	0.0	2,034.4
1970	0.0	0.0	35.5	138.6	333.4	668.4	363.1	433.1	301.9	0	0.0	0.0	2,274.0
1971	0.0	0.0	0.0	138.6	306.5	470.7	405.7	188.1	183.9	76.8	0.0	0.0	1,770.3
1972	0.0	0.0	53.6	82.0	151.2	295.9	460.5	348.2	75.9	136.4	52.2	0.0	1,655.9
1973	0.0	0.0	0.0	50.8	372.8	316.4	143.1	552.1	294.5	15.3	0.0	0.0	1,745.0
1974	0.0	3.6	35.8	90.3	111.0	247.4	443.0	633.0	175.5	15.0	47.0	0.0	1,801.6
1975	0.0	0.5	36.0	41.0	226.0	496.6	647.4	721.3	431.4	158.4	19.0	0.0	2,477.6
1976	0.0	24.0	18.4	67.2	197.5	257.7	237.7	422.6	284.1	98.5	0.0	0.0	1,607.7
1977	0.0	0.0	0.0	62.3	344.4	185.4	471.7	373.2	338.1	10.6	0.0	42.5	1,828.2
1978	0.0	14.5	31.0	202.1	331.0	457.2	479.0	410.6	131.8	85.2	50.2	0.0	2,192.6
1979	0.0	50.0	21.4	65.3	359.0	589.3	283.5	307.2	225.5	29.6	0.0	0.0	1,930.8
1980	0.0	26.2	0.0	211.1	333.0	444.1	464.4	318.1	335.9	112.0	0.0	0.0	2,238.8
1981	0.0	0.2	0.7	218.7	365.7	367.1	564.6	413.7	317.3	228.2	47.9	0.0	2,524.1
1982	0.0	0.0	30.7	0.0	119.1	282.5	201.0	575.0	364.5	192.3	0.0	10.0	1,775.1
1983	36.0	0.0	10.0	58.5	161.6	305.1	264.1	770.8	300.0	187.2	0.0	0.0	2,093.3
1984	0.0	0.0	10.1	90.5	412.0	218.5	690.1	384.7	215.5	193.8	6.3	0.0	2,221.5
1985	0.0	8.4	0.0	140.5	222.8	375.7	213.4	433.7	175.6	113.2	0.0	0.0	1,683.3
1986	0.0	0.0	0.0	81.5	328.4	364.4	330.1	403.3	181.8	134.5	0.0	0.0	1,824.0
1987	0.0	17.7	60.4	51.4	15.1	434.5	165.9	433.9	492.5	106.4	0.0	0.0	1,777.8
1988	0.0	0.0	0.0	17.1	246.5	402.6	176.9	322.0	159.3	148.5	0.0	0.0	1,472.9
1989	0.0	0.0	24.2	110.0	150.0	173.6	164.7	510.4	292.2	91.5	0.0	0.0	1,516.6
1990	0.0	59.6	56.8	78.6	288.5	0.0	260.2	266.7	311.4	155.8	144.9	0.0	1,622.5
1991	0.0	0.0	76.8	91.9	57.1	181.4	363.1	528.2	287.2	34.8	0.0	19.4	1,639.9
1992	60.4	13.5	0.0	1.6	0.0	288.5	581.1	350.6	224.4	5.4	0.0	22.5	1,548.0
1993	0.0	14.6	0.0	75.3	291.9	596.2	541.3	203.7	396.5	0.0	3.2	0.0	2,122.7
Average	4.9	8.4	26.9	93.1	232.2	368.4	353.1	460.8	322.3	86.3	10.0	2.4	1,968.8

Table-B-21 Monthly and Annual Discharge (KH-53, Huai Luang)

Station: Ban Tha Tum, Code: H220102, C.A.: 1,210 sq.km Unit:MCM

Month Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1976	0.00	0.00	0.00	0.00	0.00	2.53	3.21	4.47	36.89	43.35	17.63	0.00	108.08
1977	0.00	0.00	0.00	0.00	0.00	5.32	0.48	4.74	83.65	20.39	1.02	0.00	115.60
1978	0.00	0.00	0.00	0.00	0.00	6.82	84.86	204.64	108.86	87.85	3.05	0.00	496.08
1979	0.00	0.00	0.00	0.00	0.00	71.32	68.31	72.54	23.14	5.33	0.00	0.00	240.64
1980	0.00	0.00	0.00	0.00	0.00	84.95	55.16	86.20	123.50	30.72	1.01	0.00	381.54
1981	0.00	0.00	0.00	0.00	0.00	37.99	57.65	74.93	35.98	37.10	4.31	0.41	248.37
1982	0.41	0.42	0.59	0.41	2.72	9.37	12.42	20.59	53.91	60.90	16.51	0.65	178.90
1983	0.81	0.47	0.57	0.57	0.53	15.40	21.87	52.22	74.58	10.26	4.73	1.95	183.96
1984	1.13	0.59	0.03	0.00	1.19	1.80	28.52	39.34	41.97	52.43	3.27	1.30	171.57
1985	1.12	0.44	0.78	0.72	4.76	14.35	46.19	53.78	30.28	18.48	3.24	0.29	174.43
1986	0.00	0.00	0.00	0.00	0.85	9.41	29.90	33.15	27.08	12.71	13.26	0.67	127.03
AVERAGE	0.32	0.17	0.18	0.15	0.91	23.57	37.14	58.78	58.17	34.50	6.18	0.48	220.56

Assuming rainfall as 1,300mm, Runoff percent= 14, Specific yield= 5.9 l/s/sq.km
Dry season Runoff= 7.48MCM(3.4%)

Table-B-22 Monthly and Annual Discharge (H220102, Huai Lunag)

Station: Nong Wua So, Code: H220102(Kh-53), C.A.: 436 sq.km Unit:MCM

Month Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1972	0.00	0.00	0.00	0.04	0.00	0.06	6.60	0.07	0.28	7.21	0.60	0.00	14.86
1973	0.00	0.00	0.63	0.05	0.47	7.41	3.04	14.35	33.69	13.55	0.00	0.00	73.19
1974	6.35	5.84	7.28	6.55	6.98	7.91	6.50	38.08	25.26	12.50	7.67	6.77	137.69
1975	2.78	2.18	1.95	6.15	6.17	11.10	32.43	7.07	50.74	29.47	1.99	0.87	152.90
1976	0.00	0.00	0.01	2.21	2.22	1.97	1.36	2.39	18.18	15.83	6.95	0.23	51.35
1977	1.33	0.17	0.38	1.35	1.62	0.63	3.43	13.94	47.89	2.20	2.95	2.23	78.12
1978	0.21	0.17	0.17	1.03	4.07	1.19	25.64	87.38	76.61	28.44	2.12	0.57	227.60
1979	0.00	0.00	0.00	2.77	4.31	41.05	9.97	22.54	3.00	0.72	1.14	1.28	86.78
1980	1.23	0.93	1.19	0.97	3.50	30.84	20.26	13.15	81.34	11.09	2.41	0.52	167.43
1981	0.23	0.23	0.69	0.40	1.40	5.22	16.78	15.84	5.97	6.99	3.34	0.37	57.46
1982	0.09	0.06	0.06	0.68	1.70	1.59	2.01	7.95	36.99	26.20	3.86	0.65	81.84
1983	0.65	0.75	0.80	0.38	0.33	10.82	6.85	33.05	42.33	9.63	2.90	0.71	109.20
1984	0.53	0.42	0.48	0.03	1.11	1.19	13.11	13.64	27.32	19.84	1.99	0.16	79.82
1985	0.10	0.10	0.11	0.16	1.93	8.82	10.91	22.04	5.86	11.01	2.67	0.12	63.83
1986	0.21	0.00	0.00	0.00	2.01	2.30	2.75	14.12	27.63	4.06	3.58	0.80	57.46
1989	0.43	0.20	0.67	1.77	1.48	1.69	1.39	5.21	37.87	16.48	3.20	1.03	71.42
1990	3.29	2.34	1.33	0.10	1.76	15.13	17.53	12.93	66.98	48.12	4.25	1.82	175.58
1991	0.42	0.23	0.10	0.92	2.32	1.46	2.14	18.92	32.31	12.87	1.48	0.05	73.22
AVERAGE	0.99	0.76	0.88	1.42	2.41	8.35	10.15	19.04	34.46	15.35	2.95	1.01	97.76

Assuming rainfall as 1,300mm, Runoff percent= 17, Specific yield= 7.11 l/s/sq.km
Dry season Runoff= 8.01MCM(8.2%)

Table-B-23 Monthly and Annual Discharge (H190104, Huai Mong)

Station: Ban Krual, Code: H190104, C.A.: 2,370 sq.km Unit:MCM

Month Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1980	0.00	0.00	0.00	0.00	17.36	248.78	133.47	170.70	321.77	97.93	15.98	3.05	1039.04
1981	1.65	0.66	0.72	0.92	21.75	59.57	197.94	116.81	118.60	97.00	26.98	3.86	646.46
1982	1.68	1.12	1.37	1.55	4.92	7.78	24.47	130.25	249.84	149.58	43.19	6.34	622.09
1983	5.28	1.85	0.60	0.72	1.61	35.00	70.49	193.48	270.06	53.82	26.14	4.55	663.60
1984	0.94	0.01	0.00	0.07	2.90	27.91	128.05	108.34	107.91	136.57	21.47	5.00	539.17
1985	1.82	2.11	0.58	0.05	0.54	12.49	75.17	82.14	0.00	0.00	0.00	0.00	174.90
AVERAGE	1.90	0.96	0.55	0.55	13.18	65.26	104.93	133.62	178.03	89.15	22.29	3.80	614.21

Assuming rainfall as 1,400mm, Runoff percent= 19, Specific yield= 8.22 l/s/sq.km
Dry season Runoff= 30.05MCM(4.9%)

Table-B-24 Monthly and Annual Discharge (H190201, Huai Mong)

Station: Ban Po Tak, Code: H190201, C.A.: 255 sq.km Unit:MCM

Month Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1980	0.00	0.00	0.00	0.00	3.18	45.27	35.53	37.12	72.33	16.77	2.99	1.02	214.21
1981	0.68	0.24	0.27	0.15	3.53	11.14	39.74	36.02	24.18	14.17	4.07	1.37	135.56
1982	0.67	0.27	0.37	0.38	1.47	5.11	4.03	25.42	50.09	27.19	4.11	1.67	120.78
1983	1.41	0.47	0.19	0.32	0.59	4.16	4.71	23.53	48.80	7.36	1.77	0.72	94.03
1984	0.42	0.21	0.05	0.19	2.46	4.51	39.51	20.94	16.04	20.69	3.60	1.15	109.77
1985	0.49	0.3	0.07	0.05	0.57	3.67	13.93	15.37	21.19	6.25	2.32	0.65	64.86
1986	0.26	0.09	0.04	0.48	15.78	18.14	17.98	19.37	36.3	7.04	3.44	1.37	120.29
1987	0.54	0.37	2.94	2.47	2.26	23.6	9.07	37.98	33.26	17.74	2.83	1.45	134.51
1988	0.68	0.43	0.32	0.17	20.47	28.02	27.76	22.86	15.82	22.56	3.88	1.38	144.35
AVERAGE	0.57	0.26	0.47	0.47	5.59	15.96	21.36	26.51	35.33	15.53	3.22	1.20	126.48

Assuming rainfall as 1,300mm, Runoff percent= 16, Specific yield= 6.8 l/s/sq.km
Dry season Runoff= 9.8MCM(3.5%)

Table-B-25 Monthly and Annual Discharge (M190101(KH-18), Huai Mong)

Monthly Discharge of Huai Mong River

Station: Ban Na Ang, Code: M190101(Kh-18), C.A.: 1,307 sq.km Unit:MCM

Month Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
1957	0.03	0.01	0.00	0.28	0.18	4.04	10.05	13.56	43.58	11.25	3.13	0.14	86.25
1958	0.68	0.45	0.37	0.87	0.65	0.96	1.12	86.66	101.19	4.80	0.51	0.83	199.09
1959	0.04	0.02	0.02	0.02	14.77	3.34	12.06	25.08	145.86	4.93	0.32	0.06	206.52
1960	0.14	0.09	0.08	0.05	7.87	6.54	34.01	73.54	106.00	97.52	2.14	0.44	328.42
1961	0.64	0.38	0.38	0.07	4.17	41.85	6.03	36.86	243.71	38.92	3.27	1.11	377.39
1962	0.56	0.44	0.37	0.41	1.50	7.16	20.22	80.66	74.10	89.66	2.51	0.89	278.48
1963	0.36	0.21	0.18	0.36	0.46	1.71	12.14	48.48	51.93	15.53	28.53	0.73	160.62
1964	0.32	0.18	0.11	0.20	20.92	15.24	28.23	9.72	59.56	91.29	5.23	1.29	232.29
1965	0.19	0.13	0.11	0.15	0.52	37.99	13.95	82.82	87.55	4.20	0.92	0.27	228.80
1966	0.25	0.22	0.21	0.17	8.44	59.22	30.97	60.84	73.57	3.26	3.25	0.86	241.26
1967	0.21	0.01	5.55	0.24	1.39	3.99	22.52	2.06	139.46	29.99	3.23	0.49	209.14
1968	0.34	0.23	0.15	0.03	4.21	19.10	41.64	41.52	71.08	8.84	2.60	0.37	190.11
1969	0.00	0.00	0.00	0.23	0.29	1.42	40.70	18.74	37.07	17.52	8.07	0.92	124.96
1970	0.91	0.65	0.58	0.63	2.16	92.45	37.02	152.49	168.38	37.85	6.40	2.51	502.03
1971	1.28	1.07	1.01	0.88	7.82	9.78	32.53	62.48	80.22	28.99	3.28	1.96	231.30
1972	1.78	0.00	1.34	1.13	1.07	5.57	3.47	4.01	26.46	66.48	5.43	2.17	118.91
1973	1.62	1.45	1.15	0.95	2.45	25.50	54.65	31.81	133.47	31.67	3.45	1.26	289.43
1974	1.13	0.89	0.91	0.65	0.21	0.86	0.31	82.91	143.11	12.39	11.24	0.88	255.49
1975	0.32	0.04	0.04	0.02	0.66	66.51	61.86	33.32	75.62	61.58	3.59	0.69	304.25
1976	1.19	0.51	0.14	0.11	2.68	1.28	2.33	15.11	117.84	98.47	18.14	0.40	258.20
1977	0.89	0.12	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.22
1979	0.00	0.00	0.00	0.25	2.83	213.55	90.90	53.56	16.24	3.31	2.56	2.44	385.64
1980	0.89	0.98	0.09	1.10	48.63	212.79	124.97	82.89	396.02	24.80	6.74	2.62	902.52
1981	2.62	1.61	1.42	0.25	3.63	9.42	84.15	30.84	31.37	28.45	13.35	0.96	208.07
1982	0.02	0.00	0.00	0.01	0.03	0.58	7.48	35.66	142.87	143.46	21.68	1.90	353.69
1983	1.29	0.63	0.02	0.18	0.24	21.69	116.13	41.42	65.17	136.35	4.84	1.54	389.50
1984	0.64	0.44	0.01	0.00	0.07	21.77	116.44	41.62	74.26	136.38	5.54	1.55	398.72
1985	0.00	0.00	0.02	0.00	0.50	2.39	57.85	26.73	64.35	17.66	5.57	0.84	175.91
1986	1.43	1.12	0.54	0.41	32.84	44.28	68.34	18.94	44.04	35.42	23.22	3.78	274.36
1987	0.00	0.00	0.00	0.01	1.04	3.39	41.24	54.50	125.48	73.61	4.33	0.53	304.13
1988	0.03	0.00	0.00	0.03	27.30	88.24	113.69	76.71	81.98	69.97	9.05	1.23	468.23
Average	0.64	0.38	0.48	0.31	6.44	32.99	41.52	45.99	97.47	45.95	6.84	1.15	280.16

Assuming rainfall as 1,300mm, Runoff percent= 16, Specific yield= 6.8 l/s/sq.km
Dry season Runoff= 9.8MCM(3.5%)

APPENDIX C. WATER RESOURCES POTENTIAL

Appendix C Water Resources Potential

APPENDIX-C Water Resources Potential

A) Runoff Analysis

In order to know the water resources potential in the Study Area, runoff analysis using Tank model was performed. Rainfall for the analysis was selected by using Thiessen Polygon Method, in which five stations namely, Muang districts of Nong Khai and Udonthani, Kh-29, Kh-18 and Banphu stations were used. Figure- C-1 shows the Thiessen polygons and Table-C-1 represents the share of each stations for each sub-basin and rainfall.

B) Calibration of Tank Model

As it is mentioned earlier that the daily discharge data are not sufficient, therefore, a station called Kh-18 in the upstream of Huai Mong river having a catchment area of 1,307 sq.km was selected for calibration. After a considerable number trials, best suited year was found as 1976 with a coefficient of correlation of 0.89. Trials also done for the station Kh-53 in the upstream of Huai Luang river. But no satisfactory results were found. Tank coefficients, actual and calculated discharge is presented in Figure-C-2.

c) Results of the Calculation

Using the above mentioned model, runoff of each sub-basin in the three basins were calculated for twenty years(1974-93). Table-C-2 shows the result of the calculation. The total annual average runoff from the whole basin may be found as 2656.14 MCM. For the water balance analysis, the year of 1989 which has a value of 2611.30 MCM has been selected as an average year due to its closeness to the twenty years average and 4th lowest annual value(1913.23 MCM) i.e. 1/5 year probality was found in the 1976, and has been selected for drought year reference.

D) Water Balance

Afeter performing the runoff analysis, an attempted has been made for a water balance study for two conditions i.e. one for existing condition and other for the after development condition. In the study, the following assumptions have been made.

i)	capacity of a small scale project(reservoir)	: 0.50 MCM
ii)	average crop area	: 0.80 ha
iii)	crop intensity for small reservoirs	: 105%
iv)	" large and medium reservoirs	: 115%
v)	irrigation efficiency	: 50%
vi)	effective rainfall	: 75% of actual
vii)	length of reservoir operation	: 20 years
viii)	basis of operation	: 10 day basis

(for after development condition, crop intensity for medium scale reservoirs was folllowed as their capacities, which falls between 100 and 140%)

The out come of the results are summerized and presented in the Tables- C-3 and C-4.

Figure-C-1 Thiessen Polygons

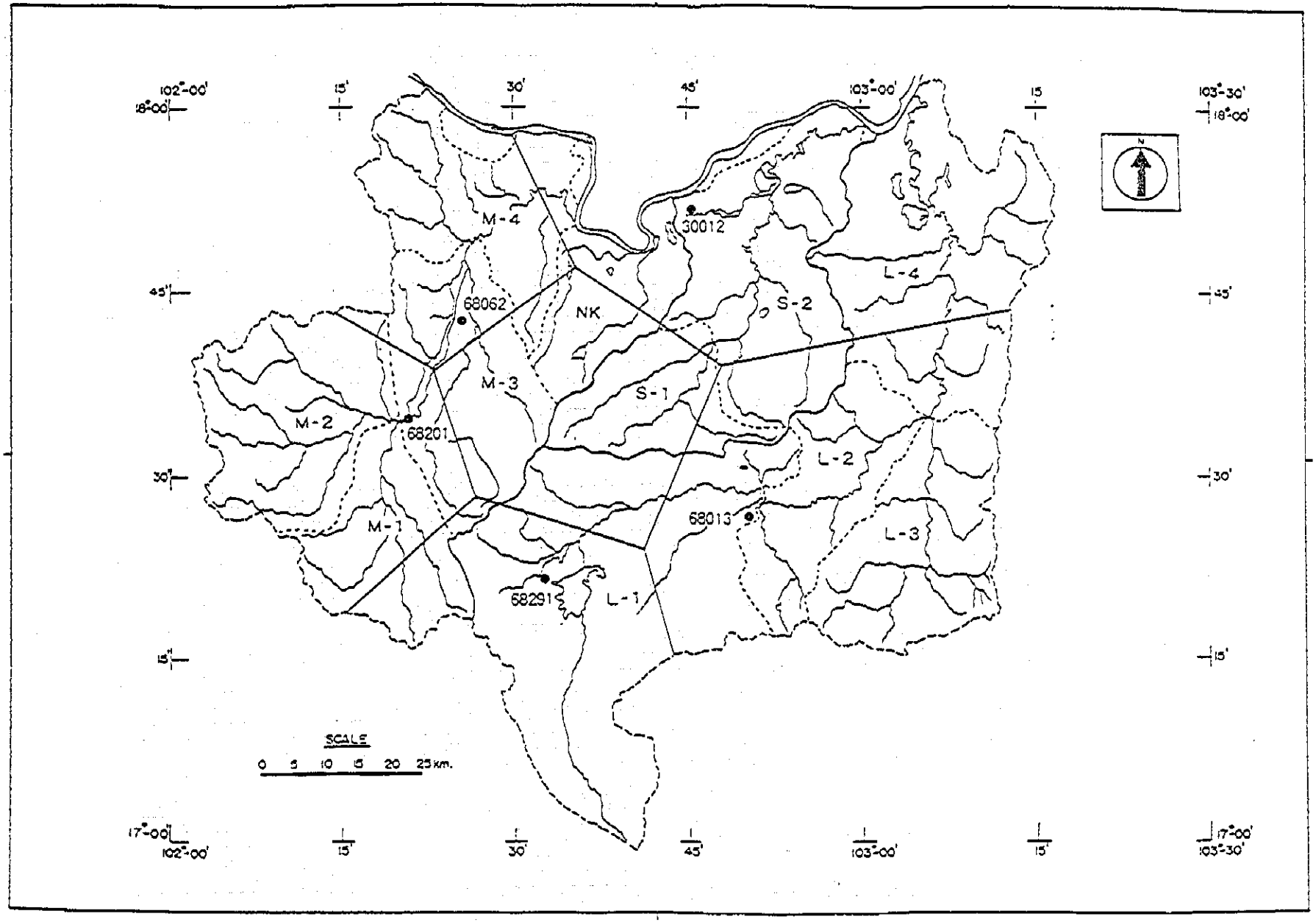
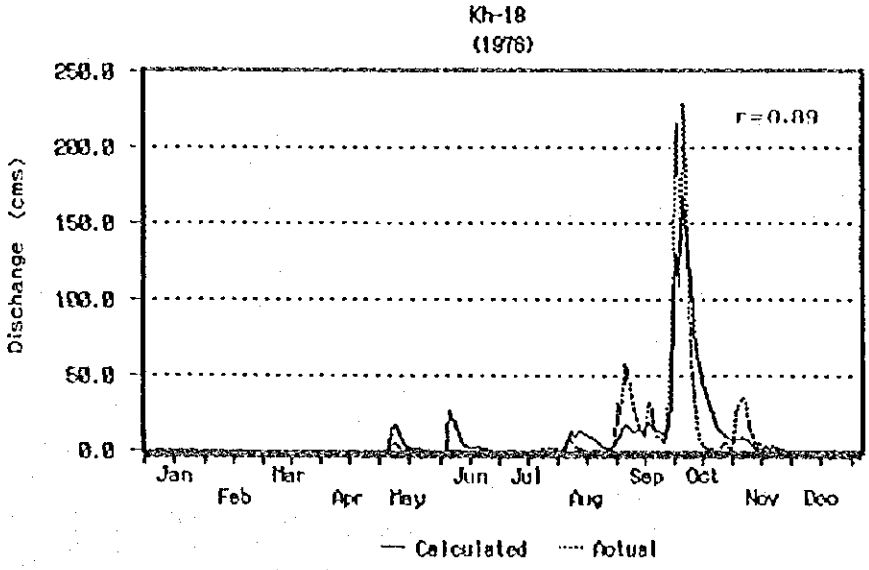


Figure-C-2 Calibration of Tank Model



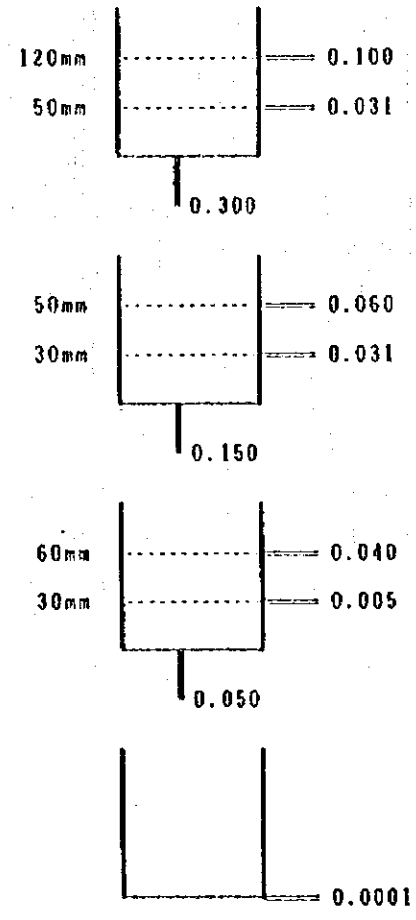


Table-C-1 Percentage of Area Covered by Thiessen Polygon

Basin	Sub Basin	Area (sq. km))	Station Name	Code	Thiessen (%)	Rainfall (mm)
	M1	522	KH-18	68201	79	1333
			Muang, U. T.	68013	21	
Huai Mong	M2	785	KH-18	68201	100	1332
	M3	747	KH-18	68201	46	1317
			Banphu	68062	42	
			Muang, U. T.	68013	12	
	M4	657	Banphu	68062	87	1322
			Muang, N. K.	30012	13	
	S1	403	Muang, U. T.	68013	45	1351
			Muang, N. K.	30012	20	
Nam Suai			Banphu	68062	18	
			KH-53	68431	17	
	S2	911	Muang, N. K.	30012	80	1462
			Muang, U. T.	68013	20	
	L1	1730	KH-53	68431	70	1297
			Muang, U. T.	68013	30	
	L2	541	Muang, U. T.	68013	100	1337
Huai Luang	L3	814	Muang, U. T.	68013	100	1337
	L4	1015	Muang, N. K.	30012	80	1462
			Muang, U. T.	68013	20	
Other	NK	384	Banphu	68062	52	1391
			Muang, N. K.	30012	48	
Other	OT	98	Banphu	68062	51	1393
			Muang, N. K.	30012	49	
	Total	8,607 sq. km				

Table-C-2 Calculated Yearly(1974-93) Basin Runoff

Unit: MCM

Year	Huai Mong Basin (2.711sq. km)					Nam Suai Basin (1.314sq. km)			Huai Luang Basin (4.100sq. km)					Others (482sq. km)		Grand Total (8.607sq. km)	
	M1	M2	M3	M4	Total	S1	S2	Total	L1	L2	L3	L4	Total	NK	OT		
1974	101.53	133.19	124.09	104.40	463.21	110.11	253.14	363.25	581.21	181.78	272.73	282.04	1317.75	73.36	18.87	2236.44	
1975	135.83	181.97	216.65	254.74	789.19	180.21	551.14	731.35	739.56	230.34	346.58	614.06	1930.54	187.86	48.20	3687.14	
1976	111.78	171.42	144.28	116.70	544.18	84.89	218.42	303.31	410.66	128.34	193.11	243.35	975.47	71.85	18.42	1913.23	4th Lowest (1/5 year)
1977	56.87	86.42	71.05	62.20	276.54	51.09	177.91	229.00	214.99	69.74	104.93	198.22	587.88	54.39	14.01	1161.82	Lowest (1/20 year)
1978	171.29	230.62	165.71	97.37	664.99	159.68	458.26	617.94	736.26	275.18	414.04	510.58	1936.05	105.83	27.41	3352.22	
1979	122.33	212.30	204.69	209.78	749.10	78.53	193.91	272.44	329.37	74.46	112.03	216.05	731.90	107.55	27.36	1888.35	3rd Lowest (1/7 year)
1980	344.37	568.47	473.70	397.14	1783.68	205.14	542.19	747.33	839.70	239.62	360.54	604.14	2044.01	235.80	60.23	4871.05	
1981	86.08	116.34	120.83	132.44	455.69	104.33	365.12	469.45	386.84	137.53	206.93	406.80	1138.10	111.71	28.75	2203.70	
1982	216.53	395.90	333.39	299.42	1245.24	92.86	300.22	393.08	335.29	83.63	125.83	334.49	879.24	150.98	38.40	2706.94	
1983	126.10	206.01	182.38	169.94	684.43	85.28	293.39	378.67	288.62	91.68	137.95	326.88	845.14	115.03	29.47	2052.74	
1984	187.29	325.83	281.47	267.71	1062.30	116.17	413.51	529.68	433.27	102.15	153.70	460.72	1149.84	171.60	43.93	2957.35	
1985	55.58	86.60	76.40	72.45	291.03	53.02	225.96	278.98	245.37	59.09	88.91	251.76	645.12	64.42	16.63	1296.18	2nd Lowest (1/10 year)
1986	146.00	206.92	199.42	201.87	754.21	149.20	618.73	767.93	346.42	197.02	296.44	689.36	1529.24	186.14	47.99	3285.51	
1987	157.03	228.27	217.39	189.86	792.55	134.19	346.73	480.92	555.88	188.06	282.96	386.32	1413.21	126.27	32.32	2845.27	
1988	182.29	259.60	250.85	205.56	898.30	140.72	304.59	445.31	503.34	245.06	368.72	339.36	1456.47	119.52	30.48	2950.08	
1989	146.39	206.23	199.96	171.32	723.90	125.49	325.54	451.03	425.91	201.62	303.60	362.70	1293.83	113.48	29.06	2611.30	Average
1990	206.78	303.11	288.36	252.05	1050.30	170.21	422.87	593.08	648.12	248.31	373.61	471.15	1741.18	160.17	40.95	3585.68	
1991	119.11	160.93	158.93	126.72	565.69	105.18	216.24	321.42	437.93	191.09	287.51	240.93	1157.45	77.80	19.83	2142.24	
1992	188.46	293.94	270.63	241.74	994.82	135.09	360.54	495.63	513.65	168.72	253.86	401.70	1337.93	149.06	38.06	3015.50	
1993	157.21	258.06	230.18	206.73	852.18	100.32	268.57	368.89	378.32	123.93	186.47	299.23	987.95	120.40	30.72	2360.14	
Average	150.94	231.61	210.52	189.01	782.08	119.09	342.85	461.93	467.53	161.87	243.52	381.99	1254.91	125.16	32.06	2656.14	

Table-C-3 Water Balance for Existing Condition

Unit:MCM

Year	Season	Huai Xong Basin (2,711sq.km)				Total	Xam Sual Basin (1,314sq.km)		Total	Huai Luang Basin (1,100sq.km)				Total	Others (182sq.km)		Grand Total (Whole Basin) (8,607sq.km)
		X1	X2	X3	X4		S1	S2		L1	L2	L3	L4		RR	OT	
1974	Dry	2.58	3.41	9.86	13.25	13.25	2.16	6.96	6.96	11.51	10.28	12.11	32.67	32.67	1.71	0.52	55.10
	Wet	98.51	128.61	316.73	446.41	446.41	101.02	350.89	350.89	445.91	325.93	556.99	1157.02	1157.02	61.66	18.35	2034.34
	Total	101.09	132.08	326.59	459.66	459.66	103.18	357.85	357.85	457.48	336.21	569.11	1189.69	1189.69	63.37	18.87	2089.44
1975	Dry	4.96	6.41	18.24	25.38	25.38	4.68	14.83	14.83	13.24	11.51	19.31	42.00	42.00	3.67	1.05	86.92
	Wet	129.88	183.01	510.66	755.73	755.73	166.44	705.16	705.16	536.93	403.37	687.35	1687.54	1687.54	171.96	47.15	3367.56
	Total	134.82	189.41	529.10	781.11	781.11	171.12	719.99	719.99	550.17	414.88	706.66	1729.54	1729.54	175.62	48.20	3454.46
1976	Dry	9.10	12.57	36.01	50.54	50.54	7.94	26.70	26.70	21.12	18.49	31.00	70.19	70.19	6.95	2.06	156.44
	Wet	102.06	157.29	388.36	488.68	488.68	71.35	269.46	269.46	231.32	191.13	326.85	739.90	739.90	54.84	16.37	1569.25
	Total	111.16	169.86	424.37	539.23	539.23	79.30	296.16	296.16	252.43	212.62	357.85	810.09	810.09	61.79	18.42	1725.69
1977	Dry	9.21	11.99	31.65	46.69	46.69	8.74	30.43	30.43	22.98	26.13	42.80	92.80	92.80	7.04	2.11	179.06
	Wet	47.16	73.19	177.21	225.88	225.88	37.87	192.80	192.80	93.22	81.87	137.33	390.58	390.58	39.69	11.91	860.85
	Total	56.37	85.18	211.86	272.57	272.57	46.61	223.23	223.23	116.20	108.01	180.13	483.37	483.37	46.73	14.01	1039.91
1978	Dry	10.39	13.41	37.11	48.31	48.31	9.39	34.09	34.09	25.13	22.85	38.18	88.24	88.24	7.17	2.15	179.96
	Wet	159.91	214.75	525.28	608.82	608.82	141.44	572.71	572.71	498.77	428.00	718.68	1624.15	1624.15	83.74	25.16	2914.68
	Total	170.31	228.16	562.70	657.13	657.13	150.83	606.80	606.80	523.90	450.85	756.86	1712.39	1712.39	90.91	27.41	3094.65
1979	Dry	12.80	16.92	45.67	57.41	57.41	10.88	40.23	40.23	29.08	26.46	44.22	103.01	103.01	8.21	2.47	211.32
	Wet	108.92	193.87	490.61	686.89	686.89	62.26	225.31	225.31	153.59	108.61	186.58	475.30	475.30	87.97	24.89	1500.36
	Total	121.73	210.80	536.31	744.29	744.29	73.13	265.54	265.54	182.67	135.07	230.80	578.31	578.31	96.18	27.36	1711.68
1980	Dry	15.07	20.92	55.20	69.76	69.76	12.02	44.08	44.08	31.11	27.70	46.37	109.50	109.50	9.86	2.85	235.06
	Wet	328.10	544.54	1325.31	1704.31	1704.31	182.31	689.60	689.60	600.69	423.73	727.55	1752.80	1752.80	208.27	57.38	4372.36
	Total	343.17	565.17	1380.51	1774.08	1774.08	194.33	733.68	733.68	631.80	451.43	773.93	1822.30	1822.30	218.13	60.23	4608.41
1981	Dry	18.55	26.55	68.96	87.28	87.28	13.98	52.68	52.68	34.81	31.28	52.33	126.38	126.38	11.80	3.52	281.65
	Wet	67.10	88.71	252.15	361.97	361.97	86.46	411.68	411.68	206.64	187.26	312.67	861.37	861.37	89.47	25.23	1752.72
	Total	85.65	115.26	321.10	452.24	452.24	100.44	464.36	464.36	241.46	218.54	364.99	987.75	987.75	101.27	28.75	2034.38
1982	Dry	19.80	28.10	73.31	93.13	93.13	15.25	59.51	59.51	38.46	34.17	57.24	140.24	140.24	13.10	3.92	309.80
	Wet	195.96	365.86	868.60	1145.90	1145.90	70.63	324.74	324.74	133.18	105.88	179.55	566.44	566.44	117.53	34.48	2189.09
	Total	215.76	393.96	941.95	1239.04	1239.01	85.88	384.24	384.24	171.64	140.05	236.79	706.68	706.68	130.63	38.40	2498.90
1983	Dry	20.74	29.41	77.03	98.12	98.42	16.12	62.26	62.26	39.35	34.98	58.60	144.51	144.51	14.55	4.23	323.96
	Wet	104.70	174.89	434.12	580.68	580.68	63.16	308.81	308.81	121.12	109.59	183.26	564.80	564.80	92.00	25.24	1671.53
	Total	125.43	204.34	511.15	678.80	679.09	79.28	371.07	371.07	160.47	144.57	241.86	709.31	709.31	106.55	29.47	1895.49
1984	Dry	21.23	30.37	79.31	101.96	101.96	16.63	66.21	66.21	39.22	34.79	58.29	147.83	147.83	15.61	4.53	336.12
	Wet	165.06	292.96	710.27	952.34	952.33	90.53	452.00	452.00	191.91	143.46	244.98	788.40	788.40	146.75	39.39	2378.88
	Total	186.29	323.33	789.58	1051.28	1054.28	107.15	518.20	518.20	231.18	178.25	303.27	936.23	936.23	162.36	43.93	2715.00
1985	Dry	22.30	32.15	83.85	108.51	108.51	17.59	71.06	71.06	41.09	38.23	63.74	161.05	161.05	16.57	4.95	362.14
	Wet	32.71	53.03	131.90	177.98	177.98	30.32	201.36	201.36	79.70	60.51	103.18	352.97	352.97	38.81	11.68	782.80
	Total	55.01	85.18	215.71	286.49	286.49	47.91	272.42	272.42	120.79	98.74	166.93	514.02	514.02	55.38	16.63	1144.94
1986	Dry	22.12	31.80	83.09	108.25	108.25	18.15	76.24	76.24	41.46	36.25	60.82	161.30	161.30	18.20	5.27	369.25
	Wet	123.07	173.12	465.21	639.55	633.55	123.84	682.50	682.50	189.52	237.30	385.66	1243.29	1243.29	155.51	42.72	2763.59
	Total	145.20	204.92	548.33	747.79	741.79	141.99	758.73	758.73	230.98	273.55	446.48	1404.59	1404.59	173.74	47.99	3132.84
1987	Dry	23.99	34.33	90.13	117.66	117.66	19.78	83.16	83.16	45.45	39.57	66.41	176.10	176.10	19.01	5.67	401.69
	Wet	131.77	190.77	506.22	661.73	661.73	102.97	383.41	383.41	274.93	254.26	424.23	987.06	987.06	93.95	26.65	2155.89
	Total	155.76	225.10	596.35	782.39	782.39	122.75	466.57	466.57	320.41	293.83	490.64	1163.16	1163.16	112.96	32.32	2557.49
1988	Dry	26.25	37.66	98.98	129.29	129.29	21.60	85.42	85.42	48.79	43.41	72.65	186.82	186.82	19.96	5.92	427.41
	Wet	155.42	220.39	590.66	784.65	784.65	313.53	352.66	352.66	284.05	313.27	513.88	1092.03	1092.03	87.62	24.56	2320.91
	Total	181.67	258.05	689.64	893.31	893.31	335.13	438.07	438.07	332.85	356.67	586.54	1278.85	1278.85	107.57	30.49	2748.32
1989	Dry	27.53	39.28	103.69	135.45	135.45	22.05	87.37	87.37	51.53	45.67	76.52	194.36	194.36	20.58	6.13	443.89
	Wet	117.88	169.49	413.97	580.58	580.58	94.58	352.41	352.41	223.44	246.97	405.37	936.98	936.98	77.00	22.93	1969.89
	Total	145.41	208.77	547.66	716.03	716.03	116.63	439.78	439.78	274.98	292.65	481.89	1131.33	1131.33	97.58	29.06	2413.78
1990	Dry	28.93	41.09	108.83	142.36	142.36	23.75	91.74	91.74	55.75	49.29	82.56	207.15	207.15	22.19	6.38	469.81
	Wet	177.38	260.83	687.02	901.11	904.11	142.14	495.81	495.81	384.50	347.50	580.17	1320.65	1320.65	128.11	34.56	2888.25
	Total	206.30	301.91	795.86	1016.42	1016.42	165.90	587.55	587.55	440.24	396.79	662.73	1527.79	1527.79	150.30	40.95	3353.06
1991	Dry	31.45	45.01	119.01	155.63	155.63	25.63	96.20	96.20	59.45	53.03	88.68	220.16	220.16	22.71	6.70	501.38
	Wet	86.96	111.13	316.43	401.42	401.42	73.21	212.16	212.16	211.98	228.57	375.85	762.69	762.69	44.54	13.18	1441.99
	Total	118.41	159.17	435.48	560.05	560.05	98.84	313.36	313.36	271.41	281.60	464.53	982.83	982.83	67.25	19.88	1943.38
1992	Dry	31.61	41.99	110.31	156.16	156.16	26.05	96.17	96.17	59.87	53.53	89.50	220.99	220.99	23.26	6.71	503.29
	Wet	156.29	247.53	630.91	831.11	834.11	103.93	392.85	392.85	278.76	228.90	386.16	935.40	935.40	115.13	31.35	2308.84
	Total	187.90	292.52	750.21	990.27	990.27	129.98	489.02	489.02	338.63	282.44	475.66	1156.38	1156.38	138.38	38.07	2812.13
1993	Dry	31.45	45.00	119.11	156.01	156.01	25.33	94.98	94.98	57.82	51.91	86.19	215.95	215.95	23.31	6.73	496.98
	Wet	125.11	211.51	523.25	691.22	691.22	69.41	266.68	266.68	159.34	144.32	241.16	603.73	603.73	85.42	23.99	1671.04
	Total	156.59	256.51	642.36	847.23	847.23	94.75	361.66	361.66	217.17	196.22	327.35	819.68	819.68	108.73	30.72	2168.02
Average	Dry	19.50	27.57	73.91	95.07	95.07	15.89	61.02	61.02	38.37	34.48	57.86	142.08	142.08	14.27	4.19	0.00 316.61
	Wet	130.70	202.18	516.25	681.02	681.02	98.52	392.40	392.40	264.98	228.67	383.87	940.15	940.15	99.00	27.86	2140.48
	Total	150.20	229.75	589.36	776.11	776.11	114.41	453.42	453.42	303.34	263.15	441.53	1082.22	1082.22	113.27	32.06	2457.10

Table-C-4 Water Balance for After Development Condition

Unit:MCM

Year	Season	Huai Mong Basin (2,715sq.km)				Total	Nam Suai Basin (1,315sq.km)		Total	Huai Luang Basin (4,100sq.km)				Total	Others (482sq.km)		Grand Total (Whole Basin) (8,607sq.km)
		M1	M2	M3	M4		S1	S2		L1	L2	L3	L4		NK	OT	
1974	Dry	2.38	2.46	8.28	11.48	11.48	1.65	6.28	6.28	9.69	9.41	14.17	28.66	28.66	1.47	0.62	48.41
	Wet	96.90	107.08	316.37	411.23	411.23	93.54	339.02	339.02	431.19	318.93	540.69	1133.03	1133.03	54.50	18.35	1956.12
	Total	99.27	109.54	324.66	422.71	422.71	95.19	345.31	345.31	440.88	328.34	554.86	1161.69	1161.69	55.96	18.97	2004.53
1975	Dry	4.74	5.01	16.12	22.91	22.91	3.98	14.00	14.00	14.79	10.83	16.92	38.86	38.86	3.35	1.05	80.17
	Wet	124.53	146.25	462.67	707.29	707.29	152.80	688.12	688.12	511.52	389.87	658.80	1643.54	1643.54	163.91	47.15	3250.00
	Total	129.27	151.29	486.14	730.21	730.21	156.78	702.12	702.12	526.31	400.69	675.72	1682.39	1682.39	167.25	48.20	3330.17
1976	Dry	8.74	10.20	32.09	46.16	46.16	6.73	25.26	25.26	18.68	17.33	26.97	64.87	64.87	6.10	2.06	144.45
	Wet	99.00	132.88	361.99	450.26	450.26	59.37	255.53	255.53	214.90	185.27	308.81	712.39	712.39	48.16	16.37	1482.69
	Total	107.74	143.08	397.08	496.43	496.43	66.10	280.79	280.79	233.58	203.10	335.78	777.26	777.26	54.26	18.42	1627.14
1977	Dry	8.72	8.42	29.10	40.44	40.44	6.89	28.25	28.25	19.35	21.42	36.85	84.95	84.95	6.66	2.33	161.90
	Wet	44.92	52.51	118.10	193.90	193.90	29.44	182.96	182.96	77.61	74.56	120.47	365.60	365.60	31.84	11.91	789.21
	Total	53.64	60.92	147.20	234.35	234.35	36.34	211.21	211.21	96.99	98.99	157.31	450.54	450.54	40.99	14.01	951.11
1978	Dry	9.84	10.16	32.20	42.40	42.40	7.39	31.74	31.74	21.31	22.05	32.40	80.46	80.46	6.26	2.15	163.01
	Wet	155.07	190.91	490.33	568.56	568.56	124.48	552.66	552.66	474.04	415.48	692.85	1583.35	1583.35	73.47	25.26	2803.70
	Total	164.90	201.10	522.52	610.97	610.97	131.87	584.40	584.40	495.37	436.23	725.26	1664.21	1664.21	79.73	27.41	2966.72
1979	Dry	12.16	11.96	37.99	18.99	18.99	8.57	37.51	37.51	24.55	24.33	36.97	93.40	93.40	7.17	2.47	189.51
	Wet	106.27	172.20	465.47	653.11	653.11	52.10	213.46	213.46	138.15	100.95	168.46	448.56	448.56	28.39	24.89	1418.44
	Total	118.43	189.15	503.45	702.12	702.12	60.67	250.98	250.98	162.71	125.28	205.43	541.96	541.96	85.56	27.36	1607.95
1980	Dry	11.53	16.61	38.62	62.61	62.61	10.05	41.77	41.77	27.10	25.85	40.10	101.19	101.19	8.92	2.85	217.37
	Wet	322.03	523.18	1291.91	1663.21	1663.21	162.62	666.04	666.04	573.82	409.01	698.76	1667.07	1667.07	198.16	57.38	4251.87
	Total	336.57	539.82	1330.56	1725.85	1725.85	172.67	707.81	707.81	600.72	434.86	738.86	1768.25	1768.25	207.08	60.23	4469.24
1981	Dry	12.89	20.88	60.18	77.96	77.96	11.12	49.41	49.41	29.46	28.86	45.31	116.70	116.70	10.36	3.52	257.94
	Wet	65.39	71.50	228.66	337.33	337.33	77.62	401.74	401.74	195.30	181.84	299.65	842.31	842.31	82.31	25.23	1688.93
	Total	83.28	92.38	288.84	415.29	415.29	88.74	451.15	451.15	224.76	210.70	344.97	959.01	959.01	92.66	28.75	1946.87
1982	Dry	18.96	21.99	63.90	82.55	82.55	12.60	56.32	56.32	32.56	31.40	51.15	131.07	131.07	11.47	3.92	285.33
	Wet	192.51	342.46	839.16	1110.72	1110.72	55.39	307.32	307.32	109.12	94.58	155.88	530.23	530.23	110.13	34.48	2092.88
	Total	211.50	364.45	903.06	1193.27	1193.27	67.99	363.64	363.64	141.68	125.98	207.02	661.30	661.30	121.60	38.40	2378.21
1983	Dry	19.86	23.01	67.22	87.38	87.38	12.76	58.34	58.34	33.21	32.10	50.89	133.60	133.60	12.80	4.23	296.35
	Wet	101.90	145.78	397.66	540.13	540.13	53.50	297.36	297.35	103.92	101.21	164.08	536.20	536.20	86.54	25.24	1485.46
	Total	121.76	168.78	464.87	627.51	627.51	66.25	355.71	355.71	137.13	133.30	214.95	669.80	669.80	99.33	29.47	1781.82
1984	Dry	20.36	23.64	69.01	90.37	90.37	13.17	62.20	62.20	33.13	31.91	50.31	136.65	136.65	13.75	4.53	307.50
	Wet	160.42	268.93	676.28	912.40	912.40	76.80	435.32	435.32	169.84	131.74	220.41	750.43	750.43	139.12	39.39	2276.65
	Total	180.78	292.62	745.29	1002.76	1002.76	89.97	497.52	497.52	202.97	163.65	270.72	887.08	887.08	152.86	43.93	2584.15
1985	Dry	21.38	23.47	70.53	94.00	94.00	13.95	66.83	66.83	34.65	35.21	55.49	149.44	149.44	14.55	4.95	329.76
	Wet	30.51	38.85	100.79	153.39	153.39	23.29	192.93	192.93	65.32	53.62	85.49	327.58	327.58	34.06	11.68	719.63
	Total	51.89	62.33	180.32	247.38	247.38	37.24	259.76	259.76	99.97	88.83	140.98	477.02	477.02	48.61	16.63	1049.40
1986	Dry	21.19	25.32	72.95	96.70	96.70	14.40	71.89	71.89	34.93	33.18	52.41	149.48	149.48	16.05	5.27	339.39
	Wet	119.60	129.98	414.32	580.09	580.09	109.74	666.18	666.18	165.10	225.84	360.56	1205.47	1205.47	145.97	42.72	2640.44
	Total	140.79	155.30	487.26	676.80	676.80	124.14	738.07	738.07	200.02	259.02	412.97	1354.95	1354.95	162.02	47.99	2979.83
1987	Dry	23.07	27.77	80.01	106.08	106.08	16.35	79.15	79.15	39.73	36.79	58.80	165.39	165.39	16.72	5.62	373.00
	Wet	125.70	158.69	461.28	612.41	612.41	85.11	361.68	361.68	248.90	239.82	394.57	940.79	940.79	84.92	26.65	2026.46
	Total	148.77	186.46	541.32	718.49	718.49	101.47	440.83	440.83	288.63	276.66	453.37	1106.18	1106.18	101.64	32.32	2399.47
1988	Dry	25.52	33.91	91.91	120.69	120.69	18.16	81.51	81.51	41.48	40.26	66.10	174.85	174.85	17.60	5.92	400.58
	Wet	152.74	189.62	552.79	721.47	721.47	101.03	338.45	338.45	247.48	198.39	481.89	1044.19	1044.19	81.92	24.56	2210.59
	Total	178.26	223.53	644.70	842.16	842.16	119.19	419.96	419.95	288.95	338.65	545.99	1219.04	1219.04	99.52	30.49	2611.16
1989	Dry	26.43	31.35	91.57	125.07	125.07	18.29	82.91	82.91	45.11	42.49	68.01	182.26	182.26	18.49	6.13	414.86
	Wet	113.56	126.90	397.20	526.63	526.63	84.82	339.90	339.90	206.53	237.30	386.22	906.64	906.64	67.76	22.93	1863.85
	Total	139.99	161.25	488.77	651.70	651.70	103.11	422.81	422.81	251.64	279.79	454.29	1088.90	1088.90	86.24	29.06	2278.72
1990	Dry	28.09	37.48	102.15	135.28	135.28	19.93	87.38	87.38	49.12	46.28	74.92	196.09	196.09	20.06	6.38	445.20
	Wet	175.57	225.41	648.81	860.09	860.09	137.57	490.09	490.09	374.64	362.50	569.44	1304.27	1304.27	123.54	34.56	2819.56
	Total	203.67	262.88	748.96	995.37	995.37	157.50	577.48	577.48	423.76	388.79	644.36	1500.37	1500.37	143.60	40.95	3251.76
1991	Dry	30.97	38.80	110.33	146.30	146.30	21.71	91.98	91.98	52.54	50.24	80.78	209.27	209.27	20.10	6.70	474.36
	Wet	83.56	86.48	280.80	364.35	364.35	64.16	205.95	205.95	197.09	220.43	359.24	736.71	736.71	39.44	13.18	1359.63
	Total	114.53	125.28	391.19	510.65	510.65	85.87	297.93	297.93	249.63	270.68	440.02	945.98	945.98	59.54	19.88	1833.99
1992	Dry	31.14	33.51	105.60	141.11	141.11	21.23	91.05	91.05	51.41	50.23	80.74	208.75	208.75	20.64	6.71	468.27
	Wet	153.63	212.30	589.29	789.20	789.20	98.39	385.62	385.62	282.42	220.93	368.22	908.53	908.53	108.60	31.35	2223.29
	Total	184.77	245.80	694.89	930.31	930.31	119.61	476.67	476.67	333.83	271.16	448.96	1117.28	1117.28	129.24	38.07	2691.56
1993	Dry	30.69	40.02	111.88	147.48	147.48	20.45	89.61	89.61	49.40	48.35	77.43	202.76	202.76	20.79	6.73	481.37
	Wet	122.50	174.86	438.31	613.02	613.09	60.05	255.64	255.64	140.66	135.56	221.27	574.13	574.13	79.80	23.99	1576.66
	Total	153.19	214.89	550.30	760.57	760.57	80.50	345.25	345.25	190.06	183.91	298.71	776.89	776.89	100.60	30.72	2058.03
Average	Dry	18.83	22.15	65.35	86.30	86.30	12.97	57.67	57.67	32.96	32.03	50.73	132.43	132.43	12.64	4.19	293.24
	Wet	132.32	175.09	480.42	639.95	639.95	85.09	378.80	378.80	245.37	218.90	362.79	908.07	908.07	91.28	27.86	2026.45
	Total	166.15	197.51	515.67	726.24	726.24	98.06	436.47	436.47	278.33	250.93	413.52	1040.50	1040.50	103.92	32.06	2319.69

Table-C-5-1 Water Balance for Huai Mong Reservoir

Huai Mong Reservoir Operation
(1974-93)
(Capacity= 12.20MCM, D. Storage= 1.10MCM, Crop Intensity= 140%)

Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)	Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)
74	0.517	0.016	11.70		75	0.441	0.021	7.50	
74	0.517	0.015	11.20		75	0.450	0.020	7.07	
74	0.662	0.015	10.55		75	0.645	0.021	6.45	
74	0.633	0.012	9.93		75	0.531	0.018	5.94	
74	0.588	0.011	9.35		75	0.447	0.018	5.51	
74	0.424	0.008	8.94		75	0.351	0.014	5.17	
74	0.336	0.009	8.61		75	0.089	0.017	5.10	
74	0.167	0.007	8.45		75	0.190	0.017	4.93	
74	0.096	0.006	8.36		75	0.068	0.017	4.88	
74	0.097	0.005	8.27		75	0.069	0.015	4.82	
74	0.097	0.003	8.17		75	0.069	0.013	4.77	
74	0.097	0.002	8.08		75	0.069	0.012	4.71	
74	0.086	0.002	7.99		75	0.061	0.012	4.66	
74	0.086	0.002	7.91		75	0.061	0.013	4.61	
74	0.093	0.004	7.82		75	0.066	0.062	4.61	
74	0.080	0.019	7.76		75	0.057	2.849	7.40	
74	0.080	0.006	7.68		75	0.080	2.498	9.82	
74	0.894	0.006	6.80		75	1.138	1.230	9.91	
74	0.778	0.006	6.02		75	0.074	0.289	10.12	
74	1.322	0.006	4.71		75	0.449	1.187	10.86	
74	0.281	0.008	4.43		75	1.040	0.806	10.63	
74	0.515	0.035	3.95		75	1.089	0.122	9.66	
74	0.049	1.758	5.66		75	0.070	0.060	9.65	
74	0.075	2.240	7.83		75	0.221	0.037	9.47	
74	0.557	2.525	9.80		75	0.067	0.122	9.52	
74	0.067	2.095	11.82		75	0.795	0.921	9.65	
74	1.106	0.532	11.25		75	0.441	0.707	9.91	
74	1.074	0.070	10.24		75	0.068	0.395	10.24	
74	0.462	0.065	9.85		75	0.084	1.084	11.24	
74	0.303	0.050	9.59		75	0.392	0.370	11.22	
74	0.140	0.026	9.48		75	0.085	0.049	11.18	
74	0.070	0.026	9.44		75	0.085	0.045	11.14	
74	0.070	0.025	9.39		75	0.085	0.045	11.10	
74	0.366	0.024	9.05		75	0.381	0.044	10.76	
74	0.510	0.023	8.56		75	0.525	0.043	10.28	
74	0.664	0.024	7.92		75	0.680	0.045	9.65	

Table-C-5-2 Water Balance for Huai Mong Reservoir

Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)	Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)
76	0.502	0.040	9.18		77	0.417	0.053	9.88	
76	0.502	0.039	8.72		77	0.502	0.052	9.43	
76	0.645	0.041	8.12		77	0.645	0.056	8.84	
76	0.294	0.036	7.86		77	0.616	0.049	8.27	
76	0.616	0.036	7.28		77	0.616	0.048	7.71	
76	0.424	0.032	6.89		77	0.424	0.037	7.32	
76	0.336	0.034	6.58		77	0.099	0.045	7.26	
76	0.190	0.032	6.43		77	0.169	0.043	7.14	
76	0.096	0.033	6.36		77	0.096	0.047	7.09	
76	0.097	0.029	6.30		77	0.097	0.042	7.04	
76	0.097	0.029	6.23		77	0.097	0.042	6.98	
76	0.097	0.027	6.16		77	0.097	0.042	6.93	
76	0.086	0.305	6.38		77	0.086	0.043	6.88	
76	0.086	0.137	6.43		77	0.086	0.043	6.84	
76	0.093	0.042	6.38		77	0.093	0.046	6.79	
76	0.080	0.498	6.79		77	0.080	0.042	6.75	
76	0.080	0.118	6.83		77	0.080	0.041	6.71	
76	1.246	0.049	5.64		77	0.752	0.041	6.00	
76	0.478	0.033	5.19		77	0.402	0.042	5.64	
76	1.304	0.034	3.92		77	0.550	0.043	5.13	
76	0.057	0.038	3.90		77	0.636	0.189	4.69	
76	0.399	0.370	3.87		77	0.285	0.112	4.51	
76	0.049	0.345	4.17		77	0.049	0.114	4.58	
76	0.053	0.256	4.37		77	0.053	1.221	5.75	
76	0.712	0.572	4.23		77	0.229	1.436	6.95	
76	0.284	0.599	4.54		77	0.969	0.933	6.92	
76	0.048	2.173	6.67		77	1.275	0.717	6.36	
76	0.874	4.371	10.17		77	1.248	0.211	5.32	
76	0.112	1.182	11.24		77	0.710	0.060	4.67	
76	0.090	0.419	11.57		77	0.354	0.064	4.38	
76	0.085	0.226	11.71		77	0.049	0.057	4.39	
76	0.085	0.065	11.69		77	0.049	0.056	4.40	
76	0.085	0.057	11.66		77	0.049	0.055	4.40	
76	0.381	0.056	11.33		77	0.347	0.054	4.11	
76	0.525	0.055	10.86		77	0.370	0.053	3.79	
76	0.680	0.059	10.24		77	0.644	0.057	3.20	

Table-C-5-3 Water Balance for Huai Hong Reservoir

Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)	Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)
78	0.481	0.051	2.77		79	0.509	0.069	9.57	
78	0.481	0.050	2.34		79	0.502	0.068	9.13	
78	0.598	0.054	1.80		79	0.638	0.073	8.57	
78	0.567	0.047	1.28		79	0.436	0.065	8.20	
78	0.567	0.046	1.10		79	0.604	0.065	7.66	
78	0.315	0.036	1.10		79	0.400	0.051	7.31	
78	0.281	0.044	1.10		79	0.336	0.063	7.04	
78	0.033	0.042	1.11		79	0.190	0.061	6.91	
78	0.036	0.047	1.12		79	0.096	0.065	6.88	
78	0.036	0.042	1.13		79	0.097	0.057	6.84	
78	0.036	0.042	1.13		79	0.097	0.056	6.80	
78	0.036	0.042	1.14		79	0.097	0.055	6.75	
78	0.032	0.538	1.64		79	0.086	0.055	6.72	
78	0.032	0.929	2.54		79	0.086	0.117	6.75	
78	0.066	0.461	2.93		79	0.093	0.423	7.08	
78	0.057	0.094	2.97		79	0.080	1.133	8.13	
78	0.057	0.048	2.96		79	0.080	4.764	12.20	0.62
78	0.057	1.085	3.99		79	0.590	1.933	12.20	1.34
78	0.053	0.777	4.72		79	0.091	0.934	12.20	0.84
78	1.567	0.613	3.76		79	0.521	1.584	12.20	1.06
78	0.057	0.831	4.54		79	0.830	0.124	12.09	
78	0.539	1.387	5.38		79	0.085	0.191	12.20	
78	0.070	2.646	7.96		79	1.005	0.732	11.93	
78	0.277	2.173	9.86		79	1.028	0.269	11.17	
78	0.067	0.997	10.79		79	0.082	0.260	11.34	
78	0.564	1.149	11.37		79	0.468	0.203	11.08	
78	0.082	1.012	12.20	0.10	79	0.438	0.425	11.07	
78	0.830	0.742	12.11		79	1.264	0.262	10.06	
78	0.786	0.213	11.54		79	0.818	0.090	9.34	
78	0.226	0.085	11.40		79	0.073	0.094	9.36	
78	0.085	0.077	11.39		79	0.070	0.085	9.37	
78	0.085	0.076	11.38		79	0.070	0.085	9.39	
78	0.085	0.074	11.37		79	0.070	0.083	9.40	
78	0.381	0.073	11.06		79	0.366	0.082	9.12	
78	0.525	0.072	10.61		79	0.510	0.081	8.69	
78	0.680	0.078	10.01		79	0.664	0.087	8.11	

Table-C-5-4 Water Balance for Huai Mong Reservoir

Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)	Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)
80	0.502	0.078	7.69		81	0.517	0.107	10.36	
80	0.502	0.077	7.26		81	0.517	0.106	9.95	
80	0.645	0.083	6.70		81	0.645	0.115	9.42	
80	0.616	0.074	6.16		81	0.616	0.103	8.91	
80	0.616	0.073	5.61		81	0.616	0.101	8.40	
80	0.328	0.064	5.35		81	0.358	0.080	8.12	
80	0.336	0.070	5.08		81	0.222	0.099	7.99	
80	0.109	0.069	5.04		81	0.089	0.099	8.00	
80	0.096	0.074	5.02		81	0.096	0.108	8.02	
80	0.097	0.067	4.99		81	0.097	0.097	8.02	
80	0.069	0.066	4.99		81	0.097	0.096	8.01	
80	0.069	0.066	4.99		81	0.097	0.094	8.01	
80	0.061	0.079	5.00		81	0.086	0.093	8.02	
80	0.086	0.073	4.99		81	0.086	0.093	8.03	
80	0.066	5.190	10.11		81	0.093	0.279	8.21	
80	0.098	2.505	12.20	0.32	81	0.080	0.492	8.62	
80	0.098	2.109	12.20	2.01	81	0.189	0.385	8.82	
80	0.098	3.208	12.20	3.11	81	0.080	0.213	8.95	
80	0.353	1.808	12.20	1.46	81	0.074	0.414	9.29	
80	1.443	0.730	11.49		81	0.800	0.789	9.28	
80	0.098	1.687	12.20	0.88	81	0.900	0.695	9.07	
80	0.541	1.908	12.20	1.37	81	0.126	0.231	9.18	
80	0.085	1.014	12.20	0.93	81	0.070	0.294	9.40	
80	0.092	1.538	12.20	1.45	81	0.075	0.205	9.53	
80	0.082	4.118	12.20	4.04	81	0.067	0.424	9.89	
80	0.082	5.950	12.20	5.87	81	1.081	0.380	9.19	
80	0.726	5.059	12.20	4.33	81	0.803	0.146	8.53	
80	0.972	1.939	12.20	0.97	81	0.068	0.236	8.70	
80	0.766	0.725	12.16		81	0.068	0.658	9.29	
80	0.392	0.171	11.94		81	0.375	0.482	9.40	
80	0.085	0.114	11.97		81	0.070	0.142	9.47	
80	0.085	0.113	12.00		81	0.070	0.121	9.52	
80	0.085	0.112	12.02		81	0.070	0.121	9.57	
80	0.381	0.111	11.75		81	0.366	0.119	9.33	
80	0.525	0.109	11.34		81	0.510	0.118	8.93	
80	0.680	0.119	10.78		81	0.664	0.129	8.40	

Table-C-5-5 Water Balance for Huai Mong Reservoir

Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)	Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)
82	0.502	0.115	8.01		83	0.469	0.125	9.21	
82	0.502	0.114	7.62		83	0.502	0.123	8.83	
82	0.645	0.124	7.10		83	0.584	0.135	8.39	
82	0.616	0.111	6.60		83	0.616	0.121	7.89	
82	0.616	0.110	6.09		83	0.436	0.120	7.57	
82	0.424	0.087	5.75		83	0.313	0.095	7.35	
82	0.336	0.107	5.53		83	0.190	0.117	7.28	
82	0.190	0.105	5.44		83	0.089	0.115	7.31	
82	0.096	0.113	5.46		83	0.096	0.124	7.34	
82	0.097	0.101	5.46		83	0.097	0.111	7.35	
82	0.097	0.099	5.46		83	0.097	0.109	7.36	
82	0.097	0.098	5.47		83	0.097	0.107	7.37	
82	0.086	0.096	5.48		83	0.086	0.105	7.39	
82	0.086	0.095	5.48		83	0.086	0.104	7.41	
82	0.093	3.057	8.45		83	0.093	0.114	7.43	
82	0.080	2.029	10.40		83	0.080	0.104	7.45	
82	0.098	2.117	12.20	0.22	83	0.080	0.220	7.59	
82	0.232	1.137	12.20	0.90	83	0.080	0.946	8.46	
82	0.113	0.910	12.20	0.80	83	0.858	1.807	9.41	
82	0.407	2.190	12.20	1.78	83	0.484	0.599	9.52	
82	0.488	4.488	12.20	4.00	83	0.080	0.558	10.00	
82	0.685	1.576	12.20	0.89	83	0.070	1.711	11.64	
82	0.085	1.553	12.20	1.47	83	0.337	1.754	12.20	0.86
82	0.092	3.824	12.20	3.73	83	0.198	1.203	12.20	1.00
82	0.112	1.563	12.20	1.45	83	0.082	1.440	12.20	1.36
82	1.074	1.006	12.13		83	0.812	1.256	12.20	0.44
82	0.082	0.423	12.20		83	0.854	0.416	11.76	
82	1.204	0.360	11.36		83	0.758	0.178	11.18	
82	0.786	0.155	10.73		83	0.676	0.156	10.66	
82	0.290	0.146	10.58		83	0.242	0.143	10.56	
82	0.085	0.132	10.63		83	0.085	0.130	10.61	
82	0.085	0.131	10.67		83	0.085	0.128	10.65	
82	0.085	0.129	10.72		83	0.085	0.127	10.69	
82	0.350	0.128	10.50		83	0.381	0.126	10.44	
82	0.525	0.127	10.10		83	0.525	0.124	10.04	
82	0.680	0.138	9.56		83	0.667	0.135	9.50	

Table-C-5-6 Water Balance for Huai Mong Reservoir

Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)	Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)
84	0.502	0.122	9.12		85	0.517	0.135	9.70	
84	0.502	0.120	8.74		85	0.502	0.134	9.33	
84	0.645	0.131	8.23		85	0.381	0.146	9.09	
84	0.531	0.117	7.82		85	0.559	0.133	8.67	
84	0.536	0.116	7.40		85	0.547	0.133	8.25	
84	0.424	0.104	7.08		85	0.391	0.106	7.97	
84	0.336	0.114	6.85		85	0.336	0.130	7.76	
84	0.190	0.112	6.78		85	0.190	0.129	7.70	
84	0.096	0.121	6.80		85	0.096	0.139	7.75	
84	0.097	0.110	6.81		85	0.097	0.125	7.77	
84	0.097	0.109	6.83		85	0.097	0.123	7.80	
84	0.097	0.108	6.84		85	0.097	0.121	7.82	
84	0.086	0.108	6.86		85	0.086	0.120	7.86	
84	0.086	0.109	6.88		85	0.086	0.120	7.89	
84	0.093	0.711	7.50		85	0.093	0.133	7.93	
84	0.080	2.126	9.55		85	0.080	0.121	7.97	
84	0.080	2.605	12.07		85	0.080	0.122	8.01	
84	1.090	0.918	11.90		85	0.530	0.122	7.60	
84	0.091	0.913	12.20	0.52	85	1.114	0.123	6.61	
84	0.407	4.207	12.20	3.80	85	0.678	0.123	6.06	
84	0.592	1.758	12.20	1.17	85	0.886	0.142	5.31	
84	1.275	0.685	11.61		85	1.028	0.137	4.42	
84	0.085	2.459	12.20	1.78	85	0.049	0.203	4.58	
84	0.726	2.337	12.20	1.61	85	0.807	0.376	4.14	
84	0.234	0.931	12.20	0.70	85	0.294	0.261	4.11	
84	0.444	0.538	12.20	0.09	85	0.048	0.943	5.01	
84	0.686	0.407	11.92		85	1.115	0.440	4.33	
84	0.886	0.289	11.32		85	1.228	0.154	3.26	
84	0.226	0.190	11.29		85	0.048	0.134	3.34	
84	0.392	0.172	11.07		85	0.052	0.157	3.45	
84	0.085	0.143	11.13		85	0.049	0.140	3.54	
84	0.085	0.142	11.18		85	0.049	0.135	3.62	
84	0.085	0.141	11.24		85	0.049	0.134	3.71	
84	0.381	0.139	11.00		85	0.347	0.133	3.49	
84	0.525	0.138	10.61		85	0.491	0.131	3.14	
84	0.680	0.150	10.08		85	0.644	0.143	2.63	

Table-C-5-7 Water Balance for Huai Hong Reservoir

Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)	Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)
86	0.481	0.129	2.28		87	0.502	0.139	6.38	
86	0.458	0.127	1.95		87	0.502	0.138	6.02	
86	0.598	0.138	1.49		87	0.645	0.150	5.52	
86	0.567	0.124	1.10		87	0.616	0.135	5.04	
86	0.567	0.123	1.10		87	0.496	0.133	4.68	
86	0.365	0.097	1.10		87	0.405	0.106	4.38	
86	0.281	0.120	1.10		87	0.172	0.132	4.34	
86	0.134	0.118	1.10		87	0.110	0.131	4.36	
86	0.036	0.128	1.19		87	0.068	0.142	4.43	
86	0.036	0.115	1.27		87	0.069	0.128	4.49	
86	0.036	0.113	1.35		87	0.069	0.128	4.55	
86	0.036	0.112	1.42		87	0.069	0.129	4.61	
86	0.032	0.123	1.51		87	0.061	0.129	4.68	
86	0.032	0.295	1.78		87	0.061	0.145	4.76	
86	0.035	0.533	2.27		87	0.066	0.142	4.84	
86	0.030	0.383	2.63		87	0.057	1.686	6.47	
86	0.057	1.223	3.79		87	0.080	1.550	7.94	
86	1.177	0.847	3.46		87	1.280	1.332	7.99	
86	0.177	0.182	3.47		87	0.788	0.346	7.55	
86	0.493	0.161	3.14		87	1.078	0.152	6.62	
86	0.133	1.033	4.04		87	1.264	0.156	5.51	
86	0.103	0.812	4.75		87	0.152	0.149	5.51	
86	1.031	0.806	4.52		87	0.070	0.530	5.97	
86	0.053	0.564	5.03		87	0.115	1.575	7.43	
86	0.067	0.776	5.74		87	0.243	0.855	8.04	
86	0.067	2.338	8.01		87	0.847	0.522	7.72	
86	1.303	1.858	8.56		87	0.067	0.900	8.55	
86	1.202	0.455	7.82		87	0.068	2.553	11.04	
86	0.584	0.147	7.38		87	0.818	1.120	11.34	
86	0.073	0.172	7.48		87	0.392	0.234	11.18	
86	0.070	0.174	7.58		87	0.085	0.156	11.25	
86	0.070	0.144	7.66		87	0.085	0.156	11.32	
86	0.070	0.143	7.73		87	0.085	0.154	11.39	
86	0.252	0.142	7.62		87	0.381	0.153	11.16	
86	0.510	0.142	7.25		87	0.525	0.152	10.79	
86	0.664	0.154	6.74		87	0.680	0.165	10.28	

Table-C-5-8 Water Balance for Huai Wong Reservoir

Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)	Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)
88	0.517	0.149	9.91		89	0.509	0.161	10.77	
88	0.502	0.148	9.55		89	0.517	0.160	10.42	
88	0.645	0.161	9.07		89	0.585	0.175	10.01	
88	0.616	0.145	8.69		89	0.633	0.158	9.53	
88	0.560	0.143	8.18		89	0.616	0.156	9.07	
88	0.369	0.128	7.94		89	0.412	0.124	8.78	
88	0.336	0.141	7.74		89	0.318	0.153	8.62	
88	0.123	0.139	7.76		89	0.089	0.152	8.68	
88	0.096	0.152	7.82		89	0.096	0.166	8.75	
88	0.097	0.136	7.85		89	0.097	0.151	8.81	
88	0.097	0.135	7.89		89	0.097	0.150	8.86	
88	0.097	0.136	7.93		89	0.097	0.149	8.91	
88	0.086	0.204	8.05		89	0.086	0.148	8.97	
88	0.086	2.717	10.68		89	0.086	0.147	9.03	
88	0.114	1.545	12.11		89	0.093	0.174	9.11	
88	0.098	2.310	12.20	2.12	89	0.080	0.172	9.20	
88	0.098	1.266	12.20	1.17	89	0.080	0.184	9.31	
88	1.186	0.555	11.57		89	0.226	0.191	9.27	
88	0.161	0.184	11.59		89	0.368	0.237	9.14	
88	0.407	0.837	12.02		89	1.750	0.211	7.60	
88	0.958	1.219	12.20	0.08	89	1.032	0.169	6.74	
88	1.055	0.408	11.55		89	0.070	0.155	6.82	
88	0.615	0.187	11.12		89	0.148	1.301	7.98	
88	0.342	0.187	10.97		89	0.075	1.994	9.90	
88	0.210	0.301	11.06		89	0.187	1.943	11.65	
88	0.456	0.448	11.05		89	1.116	1.200	11.74	
88	1.034	0.351	10.37		89	0.082	1.248	12.20	0.70
88	0.084	0.977	11.26		89	0.402	1.176	12.20	0.77
88	0.084	1.444	12.20	0.42	89	0.084	0.990	12.20	0.91
88	0.392	0.980	12.20	0.59	89	0.392	0.467	12.20	0.08
88	0.085	0.209	12.20	0.12	89	0.085	0.175	12.20	0.09
88	0.085	0.168	12.20	0.08	89	0.085	0.172	12.20	0.09
88	0.085	0.167	12.20	0.08	89	0.085	0.171	12.20	0.09
88	0.381	0.166	11.98		89	0.379	0.169	11.99	
88	0.525	0.164	11.62		89	0.525	0.168	11.63	
88	0.680	0.179	11.12		89	0.680	0.183	11.14	

Table-C-5-9 Water Balance for Huai Hong Reservoir

Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)	Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)
90	0.517	0.165	10.78		91	0.517	0.177	10.83	
90	0.517	0.164	10.43		91	0.517	0.176	10.49	
90	0.662	0.179	9.95		91	0.662	0.192	10.02	
90	0.616	0.161	9.49		91	0.633	0.173	9.56	
90	0.442	0.160	9.21		91	0.616	0.171	9.12	
90	0.361	0.128	8.98		91	0.424	0.136	8.83	
90	0.267	0.159	8.87		91	0.304	0.168	8.69	
90	0.089	0.158	8.94		91	0.089	0.263	8.87	
90	0.096	0.173	9.02		91	0.096	0.185	8.95	
90	0.097	0.156	9.07		91	0.097	0.168	9.03	
90	0.097	0.154	9.13		91	0.097	0.168	9.10	
90	0.097	0.152	9.18		91	0.097	0.171	9.17	
90	0.086	0.151	9.25		91	0.086	0.168	9.25	
90	0.086	0.150	9.31		91	0.086	0.420	9.59	
90	0.093	0.607	9.83		91	0.093	0.349	9.84	
90	0.080	2.344	12.09		91	0.080	0.348	10.11	
90	0.098	2.984	12.20	2.78	91	0.148	0.269	10.23	
90	0.606	1.042	12.20	0.44	91	0.722	0.173	9.68	
90	0.497	0.542	12.20	0.04	91	0.074	0.203	9.81	
90	0.899	0.259	11.56		91	1.322	0.221	8.71	
90	0.098	0.274	11.74		91	0.080	0.439	9.07	
90	0.261	1.764	12.20	1.04	91	1.136	0.424	8.35	
90	0.751	1.162	12.20	0.41	91	0.070	0.282	8.57	
90	0.092	0.778	12.20	0.69	91	0.075	0.768	9.26	
90	0.816	1.303	12.20	0.49	91	0.195	0.957	10.02	
90	0.082	0.971	12.20	0.89	91	0.082	0.997	10.94	
90	0.120	1.469	12.20	1.35	91	0.648	1.264	11.55	
90	0.084	1.665	12.20	1.58	91	1.190	0.688	11.05	
90	0.784	1.240	12.20	0.46	91	0.676	0.233	10.61	
90	0.344	0.328	12.18		91	0.392	0.211	10.43	
90	0.085	0.184	12.20	0.08	91	0.085	0.191	10.53	
90	0.085	0.184	12.20	0.10	91	0.085	0.190	10.64	
90	0.085	0.183	12.20	0.10	91	0.085	0.188	10.74	
90	0.381	0.181	12.00		91	0.081	0.187	10.85	
90	0.525	0.180	11.66		91	0.381	0.185	10.65	
90	0.680	0.196	11.17		91	0.531	0.203	10.32	

Table-C-5-10 Water Balance for Huai Mong Reservoir

Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)	Year	Demand (MCM)	Inflow (MCM)	Balance (MCM)	Spill (MCM)
92	0.355	0.184	10.15		93	0.469	0.184	9.59	
92	0.517	0.183	9.82		93	0.502	0.183	9.27	
92	0.645	0.200	9.37		93	0.584	0.200	8.88	
92	0.616	0.181	8.94		93	0.616	0.180	8.45	
92	0.616	0.179	8.50		93	0.616	0.178	8.01	
92	0.265	0.160	8.40		93	0.424	0.142	7.73	
92	0.336	0.177	8.24		93	0.336	0.175	7.57	
92	0.190	0.175	8.22		93	0.190	0.174	7.55	
92	0.096	0.191	8.32		93	0.096	0.195	7.65	
92	0.097	0.171	8.39		93	0.097	0.173	7.73	
92	0.097	0.169	8.46		93	0.097	0.172	7.80	
92	0.097	0.168	8.53		93	0.097	0.170	7.87	
92	0.086	0.166	8.61		93	0.086	0.169	7.96	
92	0.086	0.182	8.71		93	0.086	0.474	8.34	
92	0.093	0.195	8.81		93	0.093	1.456	9.71	
92	0.080	0.208	8.94		93	0.080	1.064	10.69	
92	0.080	0.845	9.70		93	0.098	0.454	11.05	
92	1.280	0.805	9.23		93	0.098	0.475	11.42	
92	0.074	0.224	9.38		93	0.875	1.683	12.20	0.03
92	0.390	1.963	10.95		93	0.501	1.761	12.20	1.26
92	0.098	2.219	12.20	0.87	93	0.098	0.688	12.20	0.59
92	0.085	4.621	12.20	4.54	93	0.085	0.669	12.20	0.58
92	0.085	2.181	12.20	2.10	93	0.337	0.710	12.20	0.37
92	0.292	1.635	12.20	1.34	93	0.198	0.732	12.20	0.53
92	0.222	1.063	12.20	0.84	93	0.082	2.180	12.20	2.10
92	0.408	0.600	12.20	0.19	93	0.812	1.514	12.20	0.70
92	0.930	0.461	11.73		93	0.854	0.790	12.14	
92	0.776	0.297	11.25		93	0.758	0.238	11.62	
92	0.818	0.217	10.65		93	0.676	0.197	11.14	
92	0.392	0.212	10.47		93	0.242	0.216	11.11	
92	0.085	0.192	10.58		93	0.085	0.196	11.22	
92	0.085	0.191	10.68		93	0.085	0.194	11.33	
92	0.085	0.189	10.79		93	0.085	0.193	11.44	
92	0.381	0.188	10.59		93	0.381	0.192	11.25	
92	0.525	0.186	10.26		93	0.525	0.190	10.92	
92	0.588	0.204	9.87		93	0.667	0.208	10.46	

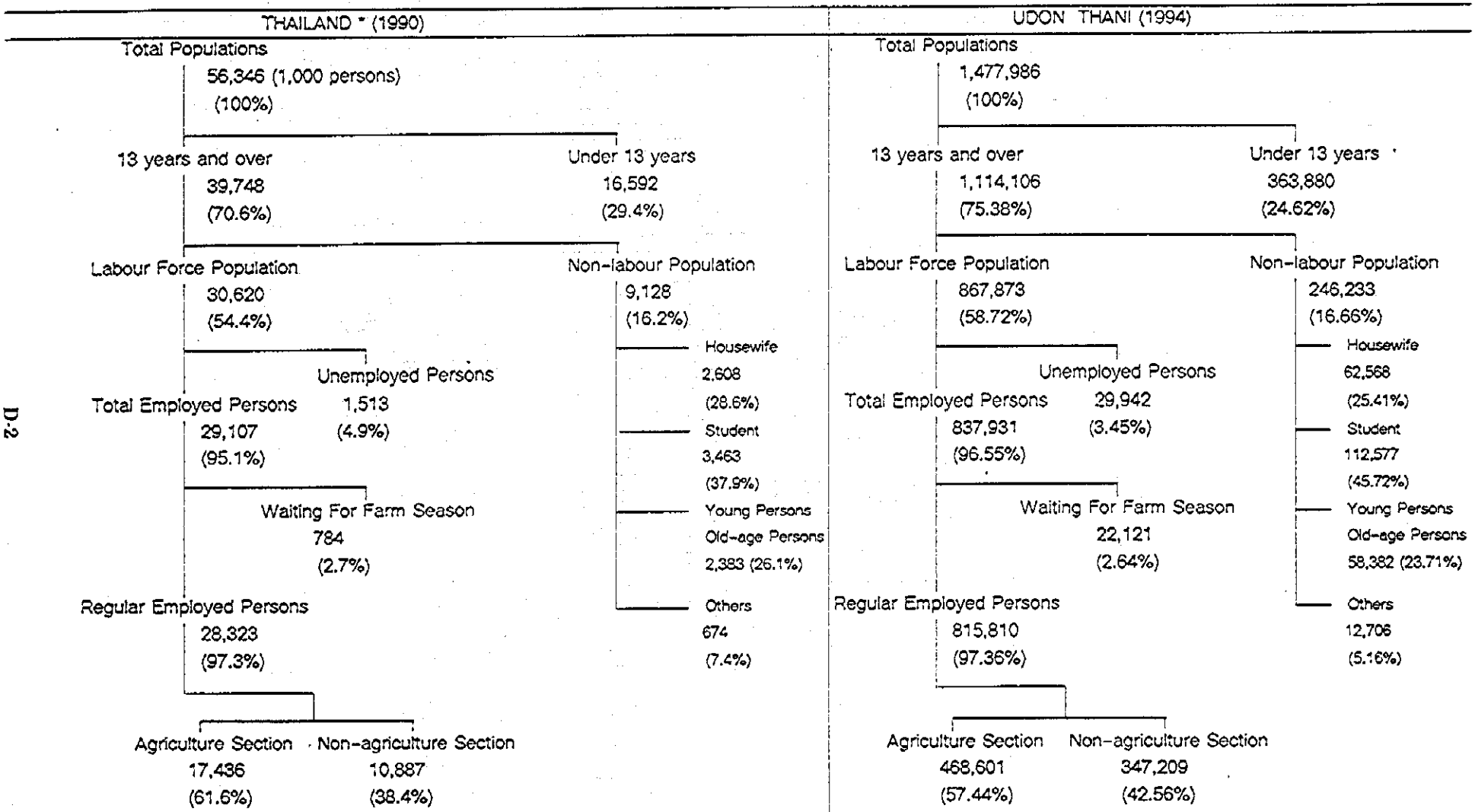
APPENDIX D. SOCI-ECONOMIC CONDITION

APPENDIX D. SOCIO-ECONOMIC CONDITION

Table D.1-1 Adminsitrative Division, Area, Population and Household by Amphoe in the Study Area

Province	Amphoe	Administrative Division Whole Amphoe				Study Area		
		Tambon	Village	Municipalities	Sanitary district	Land Area (Km²)	Population	Household
Udon Thani	Muang Udon Thani	20	229	1	6	849.06	300,009	50,000
	Kut Chap	7	85	-	4	475.48	53,490	10,306
	Kumphawapi	16	188	-	3	41.75	6,905	1,304
	Thung Fon	4	32	-	1	54.64	4,893	970
	Ban Dung	13	128	-	1	341.96	37,863	7,309
	Ban Phu	12	140	-	1	1,090.02	91,362	18,405
	Phen	11	138	-	1	903.38	95,650	17,495
	Sang Khom	6	50	-	1	264.90	26,134	4,579
	Nong Wua So	7	67	-	2	603.18	48,570	8,717
	Nong Han	12	148	-	3	502.19	70,516	13,322
	Nam Som	7	66	-	2	190.31	11,892	2,412
	Phibul Rak	3	27	-	-	195.52	18,465	3,674
Nang Khai	Muang Nong Khai	15	151	1	1	596.70	101,871	19,826
	Tha Bo	10	90	-	2	353.01	70,346	13,575
	Phon Phisai	21	225	-	1	449.70	77,343	15,689
	Si Chiang Mai	7	63	-	1	262.51	39,975	8,153
	Sang Khom	5	35	-	1	86.56	3,776	814
	Sra Khrai	N.A.	N.A.	-	N.A.	134.14	19,250	3,659
Nong Bua Lam Phu	Muang Nong Bua Lam Phu	15	155	-	3	51.87	6,427	1,229
	Na Klang	9	102	-	2	262.15	38,735	6,918
	Suwanna Khuha	7	77	-	2	868.40	55,325	10,955
	Na Wang	N.A.	N.A.	-	N.A.	29.77	2,704	498
Source : Village Survey, 1994, NSO					Total	8,607.20	1,181,501	219,809

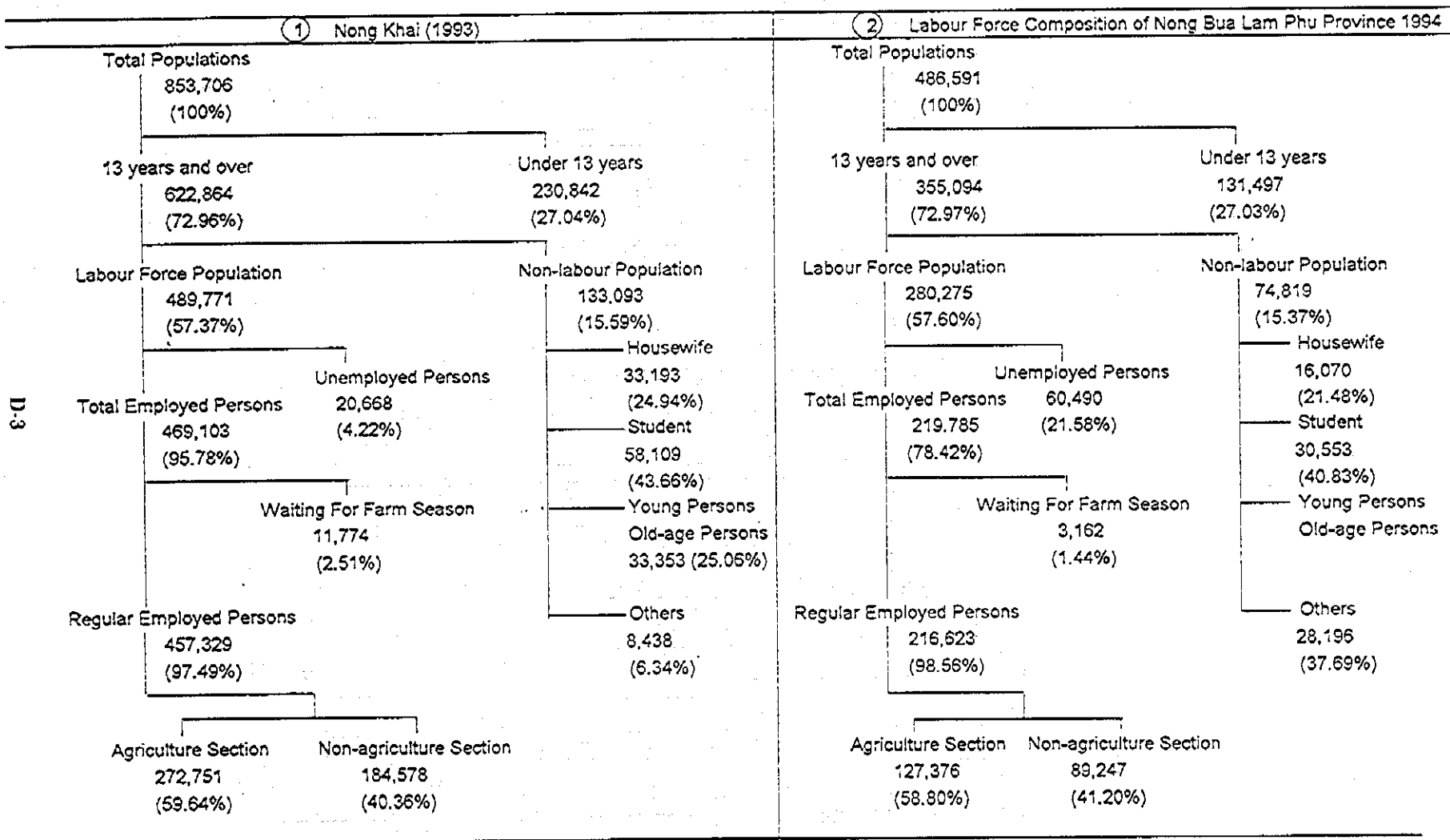
Table D.1-2 LABOUR FORCE COMPOSITION OF UDON THANI PROVINCE, 1994



Notes * is 1990 population and Housing Census

Source : Provincial Office of Employment Service, Udon Thani Province

Table D.1-3 Labour Force Composition of Nong Khai Province and Nong Bua Lam Phu Province



Source : ① Provincial office of Labour Protection and Welfare, Nong Khai Province
② Investment Opportunities in Nong Bua Lam Phu

PART-2 GROSS PROVINCIAL PRODUCT AND INCOME LEVEL

The Northeastern region's economy is mainly based on agriculture since former time. In 1993 (at constant 1988 prices) the Gross Regional Product of the Northeastern region had a value of 255,585.77 million baht, with the average annual growth rate at 5.21% during 1989-1993. The share of agricultural sector in GRP has gradually declined from about 29.32% in 1989 to 24.23% in 1993. Table D.2-1 shows the Gross Regional Product of the Northeastern region at current market prices and at constant 1988 prices during 1989-1993.

The study area covers three provinces of Udon Thani, Nong Khai and Nong Bua Lam Phu. The economic status in terms of Gross Provincial Production and income level are summarized as follows:

1) Udon Thani Province

Gross Provincial Product (GPP) of Udon Thani in 1993 at constant 1988 prices amounted to 23,051.88 million baht or about 9.0% of the Gross Regional Product of Northeast Thailand. Udon Thani ranges third in the Northeast in the GPP as same as Ubol Ratchatani. During 1989-1993, the GPP at constant 1988 prices has increased at the average rate of 4.92% per year. The share of agricultural sector in GPP has gradually declined as the same as the regional trend. The agricultural sector had a total value of 5,125.37 million baht in 1993 (at constant 1988 prices) or about 22.23% of GPP of the province. During 1989-1993 this sector has gradually declined from 30.19% of GPP in 1989 to 22.23% of Gpp in 1993, while wholesale and retail trade sector is the second biggest sector and it increased annually.

In 1993, the average per capita income in Udon Thani province amounted to 16,424 baht per annum closed to the regional average (16,818 baht). In recent year, the province set up the target that 70% of total population should have per capita income about 15,000 baht per year, however about 27% of total population can get at this rate at the present.

Table D.2-1 GROSS REGIONAL PRODUCT OF THE NORTHEASTERN AT CURRENT MARKET PRICES

Unit : 1,000 Baht

	1989	1990	1991	1992	1993
Agriculture	64,900,316	67,577,490	75,381,209	81,759,754	67,975,330
Crops	47,421,280	48,505,041	55,921,099	59,474,079	46,604,977
Livestock	8,500,897	9,478,833	9,952,611	11,053,968	10,554,167
Fisheries	961,726	1,281,119	1,206,409	1,041,273	1,169,103
Forestry	445,626	416,709	115,923	87,980	26,677
Agricultural services	2,783,600	2,825,941	2,756,480	3,168,192	2,767,038
Simple agri.processing products	4,787,187	5,069,847	5,428,687	6,934,262	6,853,368
Mining and quarrying	690,423	1,467,409	3,305,433	3,703,669	4,174,106
Manufacturing	20,119,568	21,384,634	25,224,410	22,803,059	25,237,448
Construction	15,913,250	20,270,622	24,608,906	26,346,752	26,808,076
Electricity and water supply	3,252,965	3,457,596	3,878,670	4,755,226	5,619,069
Transportation and communication	7,777,402	9,699,299	10,804,180	13,736,054	15,917,727
Wholesale and retail trade	47,564,971	55,987,934	61,978,218	67,743,488	75,363,731
Banking,Insurance and realestate	5,892,626	6,906,736	8,387,258	10,897,938	14,344,448
Ownership of dwellings	12,760,579	13,811,135	14,745,704	14,800,552	15,911,746
Public administration and defence	14,903,507	17,920,235	21,232,761	25,115,125	27,819,238
Services	31,088,793	36,294,762	42,492,578	50,745,559	58,065,630
GRP	224,864,400	254,777,852	292,039,327	322,407,176	337,236,549
Percapita GRP(Baht)	11,793	13,187	14,927	16,277	16,818
Population(1,000 persons)	19,068	19,321	19,564	19,807	20,052

GROSS REGIONAL PRODUCT AT CONSTANT 1988 PRICES

Unit : 1,000 Baht

	1989	1990	1991	1992	1993
Agriculture	61,236,298	63,484,161	63,547,557	65,960,294	62,064,951
Crops	44,724,932	46,452,816	47,416,233	48,004,657	44,111,455
Livestock	8,327,054	8,845,512	8,485,650	9,801,523	10,256,544
Fisheries	932,317	1,030,420	1,030,826	924,934	996,520
Forestry	392,523	362,759	91,512	68,299	21,470
Agricultural services	2,479,186	2,426,401	2,330,553	2,496,597	2,198,456
Simple agri.processing products	4,380,286	4,366,253	4,192,783	4,664,284	4,480,506
Mining and quarrying	567,626	1,065,083	2,438,130	2,724,638	2,899,312
Manufacturing	16,776,447	19,197,704	21,879,729	20,455,679	20,615,467
Construction	14,898,767	17,410,833	19,462,746	19,347,543	18,744,575
Electricity and water supply	3,243,583	3,421,408	3,758,695	4,184,074	4,687,909
Transportation and communication	4,562,440	9,497,164	10,385,970	12,142,163	12,905,634
Wholesale and retail trade	45,661,194	49,729,747	52,899,236	54,309,855	58,149,978
Banking,Insurance and realestate	5,597,383	6,194,008	7,114,407	8,878,833	11,299,085
Ownership of dwellings	12,351,716	12,695,604	12,983,540	12,493,017	12,768,419
Public administration and defence	13,209,764	14,363,810	15,940,141	15,800,184	16,102,588
Services	27,754,061	29,301,096	31,907,062	33,604,126	35,347,848
GRP	208,859,279	226,360,618	242,317,213	249,900,406	255,585,766

Source : NESDB, office of Prime minister

Table D.2-2 shows Gross provincial Product of Udon Thani at current market prices and at constant 1988 prices.

2) Nong Bua Lam Phu Province

Nong Bua Lam Phu is the newest province in the study area. It was established in 1993 by separating several Amphoe from Udon Thani. Therefore economic data concerning GPP are very few.

The GPP of Nong Bua Lam Phu at 1993 prices was estimated at 4,859.58 million baht or about 1.44% of GRP of Northeast Thailand, which is comparable with those of other new provinces of the Northeast. However, the annual growth rate of GPP in 1992 to 1993 was about 9.1%. In 1993, the agricultural sector had a value of 2,732.90 million baht accounting for 56.24% of the GPP of Nong Bua Lam Phu. The other sectors are still relatively small as a result of the new status of the province. The average per capita income is estimated at about 10,702 baht per annum, which is the lowest of the Northeast in 1993. The economic indicators of Nong Bua Lam Phu in 1993 are shown as follows:

Indicator	value (Million baht)	% of GPP
Gross Provincial Product	4,859.58	
Agriculture sector	2,732.90	56.24
Non-Agricultural Sector	2,126.68	43.76
Mining	73.91	1.52
Manufacturing	36.14	0.74
Construction	99.10	2.04
Services and others	1,917.53	39.46
Per capita income/year (baht)	10,702.00	

Source : NESDB, Office of Prime minister

Table D.2-2 GROSS PROVINCIAL PRODUCT OF UDON THANI PROVINCE AT CURRENT MARKET PRICES

Unit : 1,000 Baht

	1989	1990	1991	1992	1993
Agriculture	6,218,157	5,999,627	6,454,369	7,101,170	5,558,038
Crops	4,576,477	4,342,359	4,649,435	4,969,956	3,667,385
Livestock	804,033	766,961	908,120	989,665	987,691
Fisheries	80,835	108,259	85,801	74,056	83,148
Forestry	15,969	2,563	55	308	0
Agricultural services	315,145	314,746	322,063	427,107	311,749
Simple agri.processing products	425,698	464,739	488,895	640,078	508,065
Mining and quarrying	30,919	30,386	24,263	24,632	30,508
Manufacturing	1,783,177	1,883,751	2,308,048	2,443,956	2,490,747
Construction	1,187,413	1,581,545	1,894,595	1,930,524	1,972,556
Electricity and water supply	336,120	355,785	381,815	436,200	507,097
Transportation and communication	830,525	974,185	1,272,110	1,922,691	1,852,763
Wholesale and retail trade	4,395,020	5,182,030	5,727,510	6,250,107	6,941,403
Banking,Insurance and realestate	663,317	732,485	886,225	1,163,953	1,463,576
Ownership of dwellings	1,103,790	1,200,188	1,297,622	1,403,233	1,504,290
Public administration and defence	1,336,221	1,604,233	1,909,969	2,254,238	2,563,915
Services	2,871,386	3,347,609	4,060,187	4,633,568	5,401,509
GRP	20,756,045	22,891,824	26,216,713	29,564,272	30,286,402
Percapita GRP(Baht)	11,867	12,875	14,516	16,262	16,424
Population(1,000 persons)	1,749	1,778	1,806	1,818	1,844

GROSS PROVINCIAL PRODUCT AT CONSTANT 1988 PRICES

Unit : 1,000 Baht

	1989	1990	1991	1992	1993
Agriculture	5,816,749	5,702,909	5,621,508	5,848,017	5,125,376
Crops	4,276,544	4,271,357	4,177,131	4,171,667	3,556,403
Livestock	777,781	684,636	722,162	851,730	926,507
Fisheries	78,363	87,074	73,313	65,782	70,873
Forestry	14,685	2,210	49	264	0
Agricultural services	282,728	271,657	273,833	341,202	249,426
Simple agri.processing products	386,648	385,975	375,020	417,372	322,167
Mining and quarrying	25,374	21,533	15,097	17,710	21,633
Manufacturing	1,505,569	1,639,657	1,945,683	2,197,058	2,073,827
Construction	1,111,962	1,360,376	1,502,083	1,423,848	1,384,534
Electricity and water supply	336,046	354,429	374,251	389,766	428,521
Transportation and communication	803,676	955,110	1,196,324	1,648,577	1,487,037
Wholesale and retail trade	4,219,110	4,602,796	4,888,506	5,010,701	5,355,925
Banking,Insurance and realestate	630,081	656,897	751,730	948,301	1,152,655
Ownership of dwellings	1,068,423	1,103,248	1,142,552	1,184,457	1,207,121
Public administration and defence	1,184,364	1,285,859	1,433,877	1,418,164	1,484,069
Services	2,563,727	2,712,120	3,054,985	3,098,709	3,330,989
GRP	19,265,081	20,394,934	21,926,596	23,185,308	23,051,887

Source : NESDB, office of Prime minister

3) Nong Khai Province

Gross Provincial Product of Nong Khai at constant 1988 prices in 1993 amounted to 12,187.14 million baht, or about 4.76% of CRP of North-east region. The average growth rate of GPP is estimated at 6.03% per annum during 1989-1993. The agricultural sector had a total value of 2,690.26 million baht in 1993 (at constant 1988 prices) or about 22% GPP of the province. During the past five years (1989-1993), this sector has gradually declined from 31.71% of GPP in 1989 to 22.07% in 1993. While, the services sector increased from 10.49% to 11.39% during the same period. In 1993, total share of manufacturing, wholesale and retail trade, and services sector account for 44.09% of GPP, making the provincial economy more dependent on the commercial, manufactoring and services sectors.

In 1993, The average per capita income is estimated at 19,705 baht per year. The average increasing rate is abot 12.68% per year during 1989-1993.

The Gross Provincial Product of Nong Khai Province during 1989-1993 at current market prices and at constant 1988 prices are shown in Table D.2-3.

Table D.2-3 GROSS PROVINCIAL PRODUCT OF NONG KHAI PROVINCE AT CURRENT MARKET PRICES

Unit : 1,000 Baht

	1989	1990	1991	1992	1993
Agriculture	3,333,655	3,332,233	3,498,045	3,720,563	3,178,923
Crops	2,611,644	2,514,664	2,692,985	2,817,615	2,283,515
Livestock	281,593	310,640	312,668	339,546	327,177
Fisheries	94,114	125,321	110,181	95,099	106,774
Forestry	4,061	20,341	4,663	16,788	6,903
Agricultural services	99,727	105,373	93,232	108,809	99,587
Simple agri.processing products	242,516	255,894	284,316	342,706	354,967
Mining and quarrying	56,547	590,865	1,159,914	1,311,248	1,601,358
Manufacturing	1,399,582	1,540,429	1,826,355	1,587,061	1,749,364
Construction	762,580	914,475	1,125,316	1,325,300	1,285,081
Electricity and water supply	98,307	105,756	117,874	134,965	162,100
Transportation and communication	359,461	396,304	395,604	522,502	633,172
Wholesale and retail trade	2,046,426	2,356,822	2,633,519	2,905,373	3,262,162
Banking,Insurance and realestate	187,146	202,900	260,094	344,624	684,945
Ownership of dwellings	518,080	559,351	603,099	632,781	693,262
Public administration and defence	505,436	610,076	719,996	882,578	1,026,072
Services	1,129,790	1,335,779	1,547,596	2,157,874	2,315,233
GRP	10,397,010	11,944,990	13,887,412	15,524,869	16,591,672
Percapita GRP(Baht)	12,232	13,954	15,981	18,179	19,705
Population(1,000 persons)	850	856	869	854	842

GROSS PROVINCIAL PRODUCT AT CONSTANT 1988 PRICES

Unit : 1,000 Baht

	1989	1990	1991	1992	1993
Agriculture	3,050,349	2,904,777	2,635,665	2,760,698	2,690,256
Crops	2,360,722	2,183,127	1,974,190	2,034,696	1,967,401
Livestock	279,782	288,416	265,204	306,438	310,123
Fisheries	91,236	100,797	94,145	84,474	91,012
Forestry	3,739	17,409	4,015	13,073	5,316
Agricultural services	89,494	90,329	78,836	85,917	79,037
Simple agri.processing products	225,376	224,699	219,275	236,100	237,367
Mining and quarrying	46,484	413,664	721,703	803,349	865,259
Manufacturing	1,265,574	1,400,338	1,591,114	1,377,261	1,468,170
Construction	714,075	786,492	892,308	972,525	902,985
Electricity and water supply	98,530	105,620	115,888	120,862	137,526
Transportation and communication	344,695	392,700	381,678	465,980	527,534
Wholesale and retail trade	1,964,518	2,093,383	2,247,744	2,329,233	2,517,055
Banking,Insurance and realestate	177,770	181,964	220,620	280,775	539,527
Ownership of dwellings	501,480	514,172	531,027	534,125	556,310
Public administration and defence	447,995	489,001	540,525	555,239	593,921
Services	1,008,897	1,077,065	1,158,060	1,420,979	1,388,601
GRP	9,620,367	10,359,176	11,036,332	11,621,026	12,187,144

Source : NESDB, office of Prime minister

PART-3 SOCIAL INFRASTRUCTURES

1) Road

The highways and road traffic within the study area and the interlinkage with the neighbouring provinces are well served by a good main road networks. There are many networks of road linking the principal Urban centers and local roads serving the smaller towns.

Most of the people travel by bus. Public buses and private buses are available. There are many ordinary and aircondition buses connected to Bangkok and many provinces.

The main roads linking the study area with the neighbouring provinces are summarized as follows

Highway No.	Route	Total Distance (Km.)
2	Links between the central and northeast region from Saraburi to Nong Khai and conected to friendship bridge Thai Lao PDR.	524
22	Udon Thani-Sakon Nakhon-Nakhon Phanom	238
210	Udon Thani-Nong Bua Lam Phu-Loei	104
211	Nong Khai-Loei	226
212	Nong Khai-Nakhon Phanom	303

2) Railway

In the northeast region, there are two principal routes of railway namely, Bangkok-Nong Khai route and Bangkok-Ubol Ratchatani route. In the study area, Udon Thani and Nong Khai province are well served by the railway networks. The total distance of Bangkok-Nong Khai route is 624 Km. It runs through Khon Kaen, Udon Thani and Nong Khai. Travelling by

train is popular among the people in the study area whereas goods traffic from study area to Bangkok is mainly agricultural products.

The present time tables of train service in the study area are as follows :

Bangkok-Nong Khai	
Aircondition Diesel	4 Trips/day
Fast train	4 Trips/day
Express train	2 Trips/day
Na Khon Ratchasima-Nong Khai	
Aircondition Diesel	2 Trips/day
Nakhon Ratchsima-Udon Thani	
Aircondition Diesel	2 Trips/day

3) Air Transportation

At the present, there are 6 commercial airport in the northeast region namely, Khon Kaen, Ubol Ratchathani, Nakhon Ratchasima, Sakon Nakhon, Loei and Udon Thani airport. Travelling by plane is popular among government officials, bussiness men and tourists.

Udon Thani has a new airport which was opened on August, 1992 with the service capacity of 243 departing passengers and 230 arrivals. Thai International Airlines service from Bangkok to Udon Thani are 21 flight per week. Nowadays, there is a private airline, Orient Express Air, operating daily flight from Udon Thani to Chiang Mai province since August, 1993.

4) Water Transportation

Water Transportation in the study area is much less popular than the other modes. The water transportation in the Mae Khong river is for interconnection between Thai and Lao PDR at the border of both countries.

5) Electricity Supply

At present, the northeast region relies for baseload principally on energy imported 115 Kv. and 230 Kv. tie lines. Gas turbine plant with the installed capacity of 15 MW, the capability of 33 Gwh/yr. has been established in Udon Thani. In addition to the power supply in the country, power is imported from Lao PDR via a100 MW interconnector over the Mae Khong river near Vientiane

As a result of the extensive programme of power distribution projects in the past, the rate of electrification in each province in study area is overed 98% on the village basis. Electricity supply is adequate and stable. In 1993, the total number of electricity sale in Udon Thani Nong Khai and Nong Bua Lam Phu are summarized as follws :

Province	Sale Unit (GWH)
Udon Thani	322.21
Nong Khai	123.49
Nong Bua Lam Phu	52.36

6) Telephone

Telephone Organization of Thailand (TOT) is responsible for the telephone service as the whole country. In the study area, telephone service is available in every Amphoe and some public telephones are also provided in the principal urban centers. However, the telephone network has not covered to all tambon and village levels. In addition to the telephone network of TOT, mobile handy telephone service is also available. At the present, the project of telephone network expansion in upcountry with one million numbers is under construction by the private sector. It is expected to complete the project in 1996.

The distribution of telephone system in 1995 and network expansion in the study area by province are summarized as follows :

Province	No.of Line Capacity	No.of Subscribers	Public Telephone	No.of Line Expansion by 1996
Udon Thani*	18,804	17,070	345	15,872
Nong Khai	8,400	8,017	183	6,144
Nong Bua Lam Phu	3,432	2,261	92	-

Notes : * is the data of year 1994
Source : Telephone organization of Thailand

7) Post and Telegraph

The communication Authority of Thailand (CAT) is responsible for postal and telecommunication services. The post offices are operated at every Amphoe by gevernment and private post offices are permitted at tambon and village level where connot be served by the Amphoe post office. As a result of the extensive communication system, it can be concluded that within the study area and intercommunication with elsewhere in Thailand are well served by existing postal and telecommunication services.

8) Public Health

The public health services are fairly well in urban areas. There are provincial hospital, community hospital, health station and public health service station in each province. Aside from the government services the private hospitals and health centers are available in the city or some urban centers.

The record of hospitals, health stations, number of beds and the ratio of physician versus population in the study area by province in the fiscal year 1993 are shown in Tables D.3-1 and D.3-2 respectively.

Table D.3-1 Number of Hospitals, Beds, Health stations and public Health service stations in the study Area by Province in the Fiscal year 1993

Province	Gov't Hospital		Private Hospital		No.of Health Stations	No.of Public health Sta.
	No.of Hospitals	No.of Beds	No.of Hospitals	No.of Beds		
Udon Thani	16	1,093	6	240	156	NA.
Nong Khai	12	594	1	50	112	12
Nong Bua Lam Phu	5	180	1	26	56	1

Source : Ministry of Public Health

Table D.3-2 The ratio of Physician, nurse and bed for patient versus Population in the study area by Province in the Fiscal year 1993

Province	Physicians	Dentists	Pharmacists	Nurses	Nurs - Assistants	Bed for Patients
Udon Thani	1:10,287	1:51,814	1:35,872	1:2,743	1:2,921	1:1,004
Nong Khai	1:14,228	1:55,357	1:37,118	1:3,246	1:3,127	1:1:326
Nong Bua Lam Phu	1:19,743	1:75,684	1:50,455	1:7,324	1:5,748	1:2,390

Source : Ministry of Public Health

9) Water Supply

The Provincial Waterworks Authority (PWA) is the principal institution responsible for water supply in upcountry provinces. Aside from the PWA waterworks, there are many waterworks in Urban areas operated by municipalities, sanitary districts and other entities. In order to

achieve full integration of provincial water supply, the Government had a resolution for PWA to take over all municipality waterworks scheme within 1991. In practice only some waterworks have been taken over.

Waterworks in Udon Thani, Nong Khai and Nong Bua Lam Phu are under PWA Region 7, Udon Thani, which covers the service areas of 7 provinces. There are namely Udon Thani, Nong Khai, Nong Bua Lam Phu, Loei, Sakon Nakhon, Nakhon Phanom and Mukdahan.

Most of the existing PWA water supply facilities are provide to serve for urban areas only. In the rural areas, the people are mainly relied on rainwater collection, local shallow wells, shalllow well with hand pumps and deep wells with electric pump including piped water supply systems. The responsibility of providing water supply to rural communities not serviced by PWA, is handled by many agencies. However, the principal agencies involved in rural water supply are Deptartment. of Mineral Resources, Accelerated Rural Development office, Department of Health, and Department of Public Works. The construction of small water supply in the rural areas are financed from the Government. After completion of the systems, these are turned over to the community concerned to manage and operate themselves under the providing technical assistance from the agencies concerned.

Most of the raw water resources for urban water supply in the study area are surface water resources but the all waterworks in Nong Bua Lam Phu utilize groundwater as the raw water resources. In Udon Thani province, Huai Luang reservoir of RID is the main water resource for waterworks systems in city municipality area, while most of waterworks in Nong Khai utilize raw water from Khong river.

Total water consumption of PWA from Huai Luang reservoir is about 7.859 MCM per annum in 1994. According to the statistics during 1988-1994 the average growth rate of water comsumption of PWA from Huai Luang reservoir was estimated at about 5.45% per annum. The water consumption of PWA from Huai Luang reservoir during 1988-1994 are summarized as follows :

Year	1988	1989	1990	1991	1992	1993	1994
Water Consumption (MCM/Year)	5.714	6.044	6.299	6.860	7.194	7.569	7.859

Table D.3-3 shows the number of water consumption, the capacity and customers of waterworks related to the study area in the fiscal year 1993, 1994 and 1995.

Based on the statistics of consumption rate per customer in 1994, it was estimated that the consumption rate per capita in Muang Udon Thani, Muang Nong Khai and Muang Nong Bua Lam Phu are amount to 200-250 lpcd, 170-212 lpcd and 100-125 lpcd respectively.

Table D.3-3 Statistics of Waterworks in the Study Area in the fiscal year 1993 and 1994

Province	Water works name	Raw Water Resource	Production Capacity M /hr	year 1993		year 1994		year 1995	
				ater Consumption MCM/yr.	Customer	ater Consumption MCM/yr.	Customer	ater Consumption MCM/yr.	Customer
Udon Thani	Udon Thani	Huai Luang, Nong Prachak	1,565	7.460	21,372	7.749	22,969	7.318	26,024
	Kumphawapi	Nong Pakao, Huai Kemg	200	0.808	3,964	0.915	4,818	0.958	5,245
	San Phu	Groundwater, RID Dreservoir	210	0.436	2,627	0.478	2,920	0.563	3,062
	Ban Dung	Huai Jeam, Groundwater	120	-	-	0.240	1,401	0.308	1,992
Nong Khai	Nong Khai	Khong River	450	1.806	5,912	1.875	6,446	2.048	7,081
	Sri Chiang Mai	Groundwater	175	0.422	2,332	0.500	2,438	0.522	2,596
	Phon Phi Sai	Khong River	130	0.238	1,684	0.341	3,113	0.588	3,355
Nong Bua Lam Phu	Nong Bua Lam Phu	Groundwater	265	0.599	3,505	0.543	4,278	0.726	4,539
			Total	11.769	41,396	12.641	48,383	13.031	53,894

Source : PWA, Region 7, Udon Thani Province

Table D.4-1 Key Elements of Udon Thani Development Guidelines

No.	Items
1.	Agricultural Sector a. Restructure agricultural production in line with the market demand and diversifying production structure from primary agriculture products to higher value added products. b. Increase efficiency in the agricultural production per unit area and improve product quality. c. Formulate land use plan and accelerate land reform programme. d. Promote and support establishment of farmer's organization and training programme for local agricultural technicians. e. Developing marketing information, administration and dissemination system for the farmers.
2.	Infrastructure Sector a. Developing water resources for domestic and agricultural water uses. b. Improving public utilities and land use in the city by using town-plan system. c. Request Central government to support industrial promotion in the province.
3.	Tourism Sector a. Formulate public relation of tourist attraction and major events regularly. b. Develop the province to be the center for tourism in the Upper Northeastern region of Thailand.
4.	Natural Resources and Environment a. Create awareness of people in forest conservation, and saline soil prevention. b. Campaign and install waste water treatment system for houses, factories and the others. c. Encourage people in the community and private sector involve in natural resources management and to cooperate with the government in natural resources conservation efforts. d. Formulate environmental plan at province, Amphoe and Tambon levels.
5.	Quality of Life Sector a. Campaign family hygiene and family planning programme. b. Improve public health and provide education programme for the people. c. Improving the basic needs of the people and provide social welfare.
6.	Human Resource Sector a. Support women's right and social opportunity. b. Support and encourage development and services for youth. c. Encourage training and labour skills development in line with the needs of markets. d. Support establishment of university in the province.
7.	Community Administration a. Increase work efficiency of government staffs. b. Encourage private sector involve in provincial development activities such as to be members of various committees and sub-committees. c. Strengthening planning, information service and evaluation activities in the government agencies.

Table D.4-2 Key Elements of Nong Khai Development Guidelines

No.	Items
1.	Trade and Economic in Mae Khong River Countries a. Establish special economic zone near Thai-Lao friendship bridge. b. Establish and develop technical institution and training programme which provide necessary basic services to economic development of neighboring countries. c. Promote establishment of agro-processing industry by local investors or foreign investors. d. Set up an agricultural market center.
2.	Conservation of Natural Resources and Environment a. Promote and encourage private sector to cooperate with the government in natural resources conservation efforts. b. Speed up reforestation programme and demarcate area within and without forest conservation zones with clear signs. c. Encourage development of waste water treatment and garbage disposal system for communities. d. Expedite distribution of land ownership by land reform programme.
3.	Tourism Development a. Promote investment in tourism business by private sectors. b. Provide and develop related facilities to tourist attractions. c. Develop existing tourist attraction places and formulate security measures to the Tourist.
4.	Infrastructural Development a. Expansion of electricity supply and telephone. b. Provide additional raw water for water supply system from Mae Khong river. c. Develop water resources for domestic and agricultural water uses in the villages. d. Improve existing road system.
5.	Quality of Life Development a. Campaign family hygiene and nutrition. b. Promote and encourage compulsory education of the underprivileged. c. Develop skilled labors. d. Increase per capita income.

Table D.4-3 Key Elements of Nong Bua Lam Phu Development Guidelines

No.	Items
1.	Agricultural Sector a. Improve production by diversifying the kind of goods in line with the local needs and market demand. b. Increase efficiency in the production of existing goods. Emphasis will be given to increase yield per rai and improve product quality. c. Increasing value of the product by emphasizing agro-processing industry. d. Formulate soil improvement programme.
2.	Infrastructure Sector a. Encourage investment in small to medium sized factories to produce consumer goods and commodities for local consumption and export to the neighboring provinces. b. Improving public infrastructures to the needs of industrial development. c. Developing appropriate training programmes for laborers to increase their marketable skills. d. Formulate mineral resources exploration and set up plan for production to serve the local increasing demand.
3.	Tourism Sector a. Promoting publication of tourist attractions and major events regularly. b. Improving tourist attraction and related services within the province.

Table D.5-1 Statistics of PWA Waterworks in the Study Area in 1994

Province	Waterworks name	Service area (Km^2)	Production Capacity (CMD)	Water Production (mcm/yr.)	Actual Supply (mcm/yr.)	Water Sales (mcm/yr.)
Udon Thani	Udon Thani	18.80	34,320	11.207	10.790	7.749
	Kumphawapi	19.36	4,560	0.991	0.969	0.915
	Ban Phu	20.40	2,880	0.538	0.528	0.478
	Bandung	5.00	2,640	0.299	0.295	0.240
Nong Khai	Nong Khai	4.50	10,560	2.334	2.151	1.875
	Srichiang Mai	6.10	2,640	0.626	0.623	0.500
	Phon Phi Sai	13.64	3,360	0.444	0.417	0.341
Nong Bua Lam Phu	Nong Bua Lam Phu	NA.	4,080	0.675	0.663	0.543
			Total	17.114	16.436	12.641

Source : PWA Region 7, Udon Thani

Table D.5-2 Forcast Annual Domestic Water Demand in the Study Area by province in 2001 and 2006

Province	Urban Area (mcm/yr.)		Rural Area (mcm/yr.)		Total (mcm/yr.)
	year 2001	year 2006	year 2001	year 2006	year 2006
Udon Thani	20.044	21.275	11.943	12.677	33.952
Nong Khai	3.493	3.707	6.350	6.740	10.447
Nong Bua Lam Phu	1.534	1.638	1.981	2.103	3.741
Whole Study Area	25.071	26.620	20.274	21.520	48.140

Notes : 1) In 1994, Population in Udon Thani, Nong Khai and Nong Bua Lam Phu are 765,748, 312,560 and 103,192 respectively.

2) Assumed annual population growth rate
1.4 % Udon Thani and Nong Bua Lam Phu 1994-1998
1.3 % Nong Khai 1994-1998
1.2 % All 3 provinces 1999-2006

APPENDIX E. SOIL AND LAND USE

E. SOIL AND LAND USE

PART-1 OVERALL RIVER BASIN DEVELOPMENT PLAN

CHAPTER 1. SOIL

1.1 Parent Material of Soil and Landforms

1.2 Soil Classification and Characteristics

Fig. 2.6-1 shows the distribution of soil in the Study Area which were classified by USDA's standard.

Table 2.6-1 shows the some characteristics of these major soils distributed in Udon Thani and Nong Khai Provinces.

Fig. 2.6-2 shows the distribution of salt-affected soil in the Study Area.

CHAPTER 2. LAND CLASSIFICATION

Fig. 2.6-3 shows the general potential land use map in the Study Area by DLD.

Fig. 2.6-4 shows the land suitability map for small water reservoir development in the Study Area by DLD.

Table 2.6-4 shows the land classification by general potential for agricultural land use, as the legend of Fig. 2.6-3.

Table 2.6-5 shows the land suitability classes for small water reservoir development, as the legend of Fig. 2.6-4.

CHAPTER 3. LAND USE

Table 2.6-6 shows the agricultural land use in the Study Area in 1994.

Table 2.6-7 shows the ratio of agricultural land use in the Study Area in 1994.

Table 2.6-8 shows the area of each Amphoe divided in four river basin.

Fig. 2.6-5 shows the present land use map in the Study Area by DLD.

Fig. 2.6-4 shows the land use planning map in the Study Area by DLD.

Table 2.6-10 shows the present land use and the area in Nong Khai, Udon Thani and Nong Bua Lamphu, as the legend of Fig. 2.6-5.

Table 2.6-11 shows the area for land use planning in the Study Area, as the legend of Fig. 2.6-6.

PART-2 DETAILED MASTER PLAN STUDY

CHAPTER 5. HUAI MONG PROJECT

5.1 Soil and Land Classification

CHAPTER 6. HUAI VIENG KOOK AND BANG PHUAN AREAS FLOOD PROTECTION PROJECT

6.1 Soil and Land Classification

CHAPTER 7. HUAI LUANG SMALL SCALE PROJECT

7.1 Soil and Land Classification

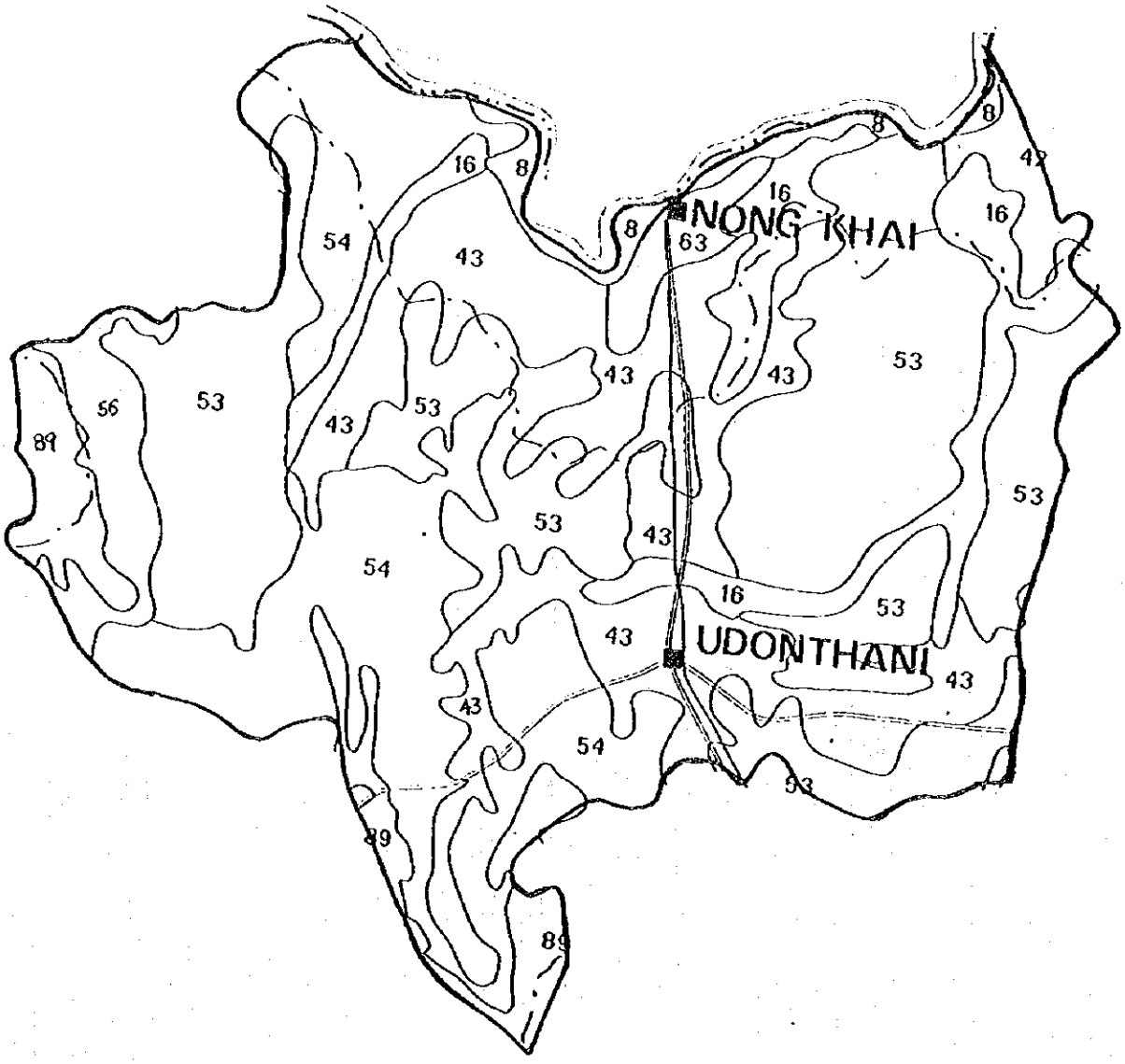


Fig. 2.6-1 Soil Distribution in the Study Area (by DLD)

LEGEND

No.	Suborder	Soil Name
8	FLUVENTS	Loamy Ustifluvents
16	AQUEPTS	Clayey Tropaquepts
42	AQUULTS	Skeletal Plinthaqualts
43	"	Loamy Paleaquults
53	USTULTS	Skeletal Plinthustults
54	"	Loamy paleustults
56	"	Skeletal Paleustults
89	FIBRISTS	Slope Complex

Table 2.6-1 Major Soil Characteristics in Udon Thani and Nong Khai Provinces

Soil Series	Area % in Province	Soil Classification	Soil Texture	Drainage	Organic matter	0-30cm CEC	Available Phosphorus	Available K	Soil pH (1:1 H_2O)
Korat	UT 25.34 NK 4.03	Gray Podzolic Soil	sandy loam over sandy clay loam	moderately well	very low to low	very low to low	low	low	5.0-6.5
Phon Phisai	UT 22.56 NK 48.48	Red-Yellow Podzolic Soil	sandy clay loam or loam	moderately well	very low to low	low to moder.low	low to mod. low	low to medium	5.0-6.0
Roi Et	UT 11.82 NK 8.55	Low Humic Gley Soil	loam or sandy loam	Poorly	very low to mo.low	low	low	low to very low	5.0-6.0
Tha Yang	UT 4.67 NK -	Red-Yellow Podzolic Soil	sandy loam to sandy clay loam	Well to excessively well	moderate low	moderate low	moderate. low	medium	5.0-5.5
Phen	UT 2.95 NK 1.83	Low Humic Gley Soil	sandy loam or loam	Poorly	very low to low	low to moder.low	very low	low	5.0-6.5
Yasothon	UT 1.43 NK -	Red-Yellow Latosol Soil	sandy loam over sandy clay	Somewhat excessively well	low	low	low	low	5.0-5.5
Udon	UT 0.03 NK 10.01	Hydromorphic Rgosols	loamy sand over sandy loam	Poorly	very low	very low	very low	very low	5.5-7.5
Si Songkhram	UT 0.72 NK 6.52	Hydromorphic Alluvial Soil	silty clay loam or clay loam	Poorly	very high	high	moderately low	high	5.0

Source: DLD Thailand.

Fig. 2.6-2 Distribution of Saline Soil in the Study Area (by DLD)

LEGEND

No.	Degrees of Affection
1	Very severely salt affected soil area (Salt crust on soil surface exceed 50 %)
2	Severely salt affected soil area (Salt crust on soil surface are 10~50 of soil)
3	Moderately salt affected soil area (Salt crust on soil surface cover 1~10 %)
4	Slightly salt affected soil area (Salt crust on soil surface cover less than 1 %)
5	High land salt source area
6	No salt affected area
7	Mountainous area

Appendix Table 2.6-4 Classification by General Potential for Agricultural Land Use (Legend for Fig. 2.6-3)

Symbol	Classes	Area in NE(km2)	(%)
A.	Areas with soils suited for upland crops in low rainfall zone		
1.	Deep, nearly level to gently sloping, moderately well to well drained, medium to fine textured soils with moderate fertility	997	0.6
2.	Deep, gently sloping, moderately well to well drained fine textured soil with moderate to high fertility and consisting mainly of montmorillonite clay	21	0.0
3.	Deep, gently sloping to strongly sloping, well to moderate well drained, fine textured soils with low or moderately low fertility.	4,825	2.9
4.	Deep, gently sloping to strongly sloping, well to moderately well drained, medium to coarse textured soil with low fertility.	41,070	24.3
5.	Shallow to moderately deep, gently sloping to moderately sloping, well to moderately well drained, fine or medium textured soils with moderate fertility and high organic matter content in surface.	2,199	1.3
B.	Areas with soils suited for paddy rice		
6.	Deep, level poorly drained, clayey soils with moderate to high fertility.	12,232	7.2
7.	Deep, level poorly drained, clayey low to moderately to low fertility.	3,663	2.2
8.	Shallow to moderately deep, level poorly drained, gravely soils that include areas with lateritic outcrops	746	0.4
9.			
10.	Deep, level to nearly level poorly drained, medium textured or loamy soils with low to moderate fertility	45,845	27.2
11.	Deep, level to nearly level poorly drained, medium textured or loamy soils of high salt content.	2,344	1.4
C.	Areas with soils suited for tree crops in high rainfall zone		
12.	13.		
D.	Areas with soils generally unsuited for cultivated crops		
14.	Shallow to very shallow, moderately sloping to steep, well to moderately well drained, gravely soils including areas with laterite or bedrock near surface.	27,448	16.3
15.	16. 17.		
18.	Deep, gently sloping excessively drained, sandy soils on beach or sandy terrace.	6,553	3.9
19.			
20.	Shallow to deep, well to excessively drained, rolling to very steep soils of hill and mountains	19,348	11.5

(Notes: No description in number are no in the Northeastern Region.

Appendix Table 2-6-5 Land Suitability for Small Water Reservoir Development
(Legend for Fig. 2.6-4)

Symbol	Classes
1.	Land well suited for small reservoir development Flat low land with somewhat poorly to poorly drained, clayey or loamy texture and good water storage capacity soil. Good quality water is yielded.
2.	Land moderately suited for small reservoir development Gently undulating to undulating upland with the soil of well drained, clayey texture throughout of clayey texture in subsoil and good water storage capacity. Good quality water is yielded.
3.	Land poorly suited for small reservoir development
3.1.	Flat low land with the soil of somewhat poorly or poorly drained, clayey or loamy texture and good water storage capacity. But it is in the slightly or potentially salt-affected area. Construction of small reservoir is risky, saline water will be yielded.
3.2.	Gently undulating to undulating upland with well to moderately well drained, loamy texture and poor water storage capacity soil.
3.3.	Gently undulating to undulating upland with well drained texture and good water storage capacity soil. But the underlying bedrock is the salt bearing rock. Construction of reservoir is risky since saline water will be yielded.
3.4	Gently undulating to undulating upland with well drained, sandy texture and poor water storage capacity soil. The underlying bedrock of the area is salt bearing rock. Construction of reservoir is risky since saline water will be yielded and the water quality will not be sufficient.
4.	Land unsuited for small reservoir development.
4.1	Low land with poorly drained soil in the strongly salt-affected area. Construction of reservoir is very risky since, in most cases, the saline water is yielded. Any kind of measures applying to prevent saline water intrusion is expected to be worthwhile.
4.2	Hilly and mountainous area with steep slope and thin covering soil material. Land is poor water storage capacity.

Table 2.6-6 Agricultu ral Land U se in the Study Ar ea (1994)

(Unit:ha)

Changwat / Amphoe	Whole Study Land Are	Total Cultiva- ble Land	Cultivabl e Land: Paddy Field	Upland Field	Fruit, Pe re. Crops	Veget ables	Flow ers	Others
Nong Khai								
Muang N.K.	59,670	36,280	33,640	565	491	493	41	1,050
Tha Bo	35,301	26,779	22,182	1,668	238	963	1	1,727
Phon Phisai	44,970	29,581	23,264	3,733	1,156	232	0	1,196
SiChiangMai	26,251	12,076	1,861	6,612	1,502	1,062	3	1,036
Sang Khom	8,656	3,168	372	2,509	274	0	0	13
Sra Khrai	13,414	6,714	6,116	238	36	30	2	292
S.Area Total	188,262	114,598	87,436	15,325	3,696	2,780	47	5,314
Whole Changwa	733,262	404,330	215,489	57,894	19,049	3,316	47	10853
Udon Thani								
Muang U.T.	84,906	40,313	30,277	7,073	2,055	891	13	0
Kut Chap	47,548	21,714	13,874	6,779	1,047	14	0	0
Kumphawapi	4,175	3,057	1,910	1,097	36	13	0	0
Thung Fon	5,464	2,485	2,230	169	67	19	0	0
Ban Dung	34,196	18,223	13,285	4,071	683	184	0	0
Ban Phu	109,002	62,284	37,677	20,391	3,479	738	0	0
Phen	90,338	49,106	47,504	1,002	426	174	0	0
Sang Khom	26,490	16,471	15,909	244	235	80	3	0
Nong Wua So	60,318	22,491	10,099	11,420	886	86	1	0
Nong Han	50,219	31,281	25,489	4,457	986	348	0	0
Nam Som	19,031	8,098	1,963	5,733	385	16	0	0
Phibul Rak	19,552	11,478	10,611	524	240	101	0	0
S.Area Total	551,239	287,000	210,829	62,962	10,524	2,668	18	0
Whole Changwa	1,173,030	591,333	355,051	211,536	20,353	4,362	31	0
Nong Bua Lamphu								
Muang N.B.L.	5,187	3,906	2,962	717	193	34	0	0
Na Klang	26,215	16;789	15,361	1,182	233	13	0	0
SuwanKhuha	86,840	36,685	18,117	17,099	1,291	178	0	0
Na Wang	2,977	1,540	543	948	39	11	0	0
S.Area Total	121,219	58,920	36,983	19,945	1,756	236	0	0
Whole Changwa	385,923	241,052	156,510	74,065	7,214	1,119	6	2,138
Whole StudyAr	860,720	460,518	335,247	98,232	15,976	5,684	65	5,314

Source : Agriicultural Statistics of Chang wat

Table 2.6-7 Ratio of Agricultur al Land U se in the Study Area (1994)

(Unit:%)

Changwat / Amphoe	Whole Study Land Area	Ratio of Cultivable Land	Ratio of Cultivable Land					
			Paddy Field	Upland Field	Fruit, Pe en. Crops	Vegetables	Flowers	Others
Nong Khai								
Muang N. K.	59,670	60.80	92.72	1.56	1.35	1.36	0.11	2.89
Tha Bo	35,301	75.86	82.83	6.23	0.89	3.60	0.00	6.45
Phon Phisai	44,970	65.78	78.65	12.62	3.91	0.78	0.00	4.04
SiChiangMai	26,251	46.00	15.41	54.75	12.44	8.79	0.02	8.58
Sang Khom	8,656	36.60	11.74	79.20	8.65	0.00	0.00	0.41
Sra Khrai	13,414	50.05	91.09	3.54	0.54	0.45	0.03	4.35
S. Area Total	188,262	60.87	76.30	13.37	3.23	2.43	0.04	4.64
Whole Changwa	733,262	55.14	53.30	14.32	4.71	0.82	0.01	2.68
Udon Thani								
Muang U. T.	84,906	47.48	75.10	17.55	5.10	2.22	0.03	0.00
Kut Chap	47,548	45.67	63.89	31.22	4.82	0.06	0.00	0.00
Kumphawapi	4,175	73.22	62.48	35.88	1.18	0.43	0.00	0.00
Thung Fon	5,464	45.48	89.74	6.80	2.70	0.76	0.00	0.00
Ban Dung	34,196	53.29	72.90	22.34	3.75	1.01	0.00	0.00
Ban Phu	109,002	57.14	60.49	32.74	5.59	1.18	0.00	0.00
Phen	90,338	54.36	96.74	2.04	0.87	0.35	0.00	0.00
Sang Khom	26,490	62.18	96.59	1.48	1.43	0.49	0.02	0.00
Nong Wua So	60,318	37.29	44.90	50.78	3.94	0.38	0.00	0.00
Nong Han	50,219	62.29	81.48	14.25	3.15	1.11	0.00	0.00
Nam Som	19,031	42.55	24.24	70.80	4.75	0.20	0.00	0.00
Phibul Rak	19,552	58.70	92.45	4.57	2.09	0.88	0.00	0.00
S. Area Total	551,239	52.06	73.46	21.94	3.67	0.93	0.01	0.00
Whole Changwa	1,173,030	50.41	60.04	35.77	3.44	0.74	0.01	0.00
Nong Bua Lamphu								
Muang N. B. L.	5,187	75.30	75.83	18.36	4.94	0.87	0.00	0.00
Na Klang	26,215	64.04	91.49	7.04	1.39	0.08	0.00	0.00
SuwanKhuha	86,840	42.24	49.39	46.61	3.52	0.49	0.00	0.00
Na Wang	2,977	51.73	35.26	61.56	2.53	0.71	0.00	0.00
S. Area Total	121,219	48.61	62.77	33.85	2.98	0.40	0.00	0.00
Whole Changwa	385,923	62.46	64.93	30.73	2.99	0.46	0.00	0.89
Whole StudyAr	860,720	53.50	72.80	21.33	3.47	1.23	0.01	1.15

Sources : Agricultural Statistics of Changwat

Table 2.6-8 Area of Each Amphoe divided in River Basin

(Unit : ha)

Changwat / Amphoe	Whole Study Land	Huai Mong Basin	Nam Suai Basin	Huai Luang Basin	Mekon Basin	Huai Mong	Nam Suai	Huai Luang	Mekon
Nong Khai	(ha)								
Muang N.K.	59,670	0	41,523	0	18,147		paddy		paddy
Tha Bo	35,301	18,294	0	0	17,007				
Phon Phisai	44,970	0	10,180	34,390	400				
SiChiangMai	26,251	22,161	0	0	4,090	upland			
Sang Khom	8,656	8,596	0	0	60	upland			
Sra Khrai	13,414	0	12,810	0	604		paddy		
S.Area Total	188,262	49,051	64,513	34,390	40,308				
Udon Thani									
Muang U.T.	84,906	0	2,894	82,012	0				
Kut Chap	47,548	2,696	0	44,852	0			upland	
Kumphawapi	1,175	0	0	1,175	0			upland	
Thung Fon	5,464	0	0	5,464	0			paddy	
Ban Dung	34,196	0	0	34,196	0				
Ban Phu	109,002	84,790	10,493	5,807	7,912	upland			
Phen	90,338	0	53,400	36,938	0		paddy	paddy	
Sang Khom	26,490	0	0	26,490	0			paddy	
Nong Wua So	60,318	0	0	60,318	0			paddy	
Nong Han	50,219	0	0	50,219	0				
Nam Som	19,031	19,031	0	0	0	upland			
Phibul Rak	19,552	0	0	19,552	0				
S.Area Total	551,239	106,517	66,787	370,023	7,912				
Nong Bua Lampho									
Muang N.B.L.	5,187	0	0	5,187	0				
Na Klang	26,215	26,215	0	0	0	paddy			
SuwanKhuha	86,840	86,840	0	0	0	upland			
Na Wang	2,977	2,977	0	0	0	upland			
S.Area Total	121,219	116,032	0	5,187	0				
Total S. Area	860,720	271,600	131,300	409,600	48,220				

Notes: Paddy means Ratic of paddy in cultivable land are over 80 %.
Upland means ratio of upland in cultivable land are over 30 %.

Appendix Table 2.6-10 Present Land Use Map (by DLD, 1990-91) and the Area in Noug Khai, Udon Thani and Nong Bua Lamphu (Legend for Fig. 2.6-5)

Symbol	Field	Area (ha)	%
A1	Paddy Field	765,998	33.4
A1-A2	Paddy Feld - Upland Field	45,497	2.0
A1/A2	Paddy Field / Upland Field	248,308	10.8
A1-M1	Paddy Field - Wild and uninhabited Field	134,785	5.9
A1 / M1	Paddy Field / Wild and uninhabited Field	34,985	1.5
A2	Upland Field	253,354	11.1
A2-A1	Upland Field - Paddy Field	291,695	12.7
A2/A4	Upland Field / Fruit trees	222	0.0
A2 - F	Upland Field - Forest	80,939	3.5
A2 - M1	Upland Field - Wild and inhabited Field	1,671	0.1
A2 / M1	Upland Field / Wild and inhabited Field	35,696	1.6
A4	Fruit Trees Field		
F1	Forest of Non-Shed Leaves trees	65,935	2.9
F1 - A2	Forest - Upland Field	1,715	0.1
F2	Forest of Shed Leaves Trees	123,142	5.4
F2 - A2	Forest - Upland Field	88,697	3.9
M1	Wild and Uninhabited Field	23,555	1.1
M1 - A1	Uninhabited - paddy Field	55,287	2.4
U1	City, Accomodation	1,464	0.1
=	Water Body	37,784	1.7
Total		2,292,167	100.0

Notes ; A - B = 70 : 30 %, A / B = 50 : 50 %.

Appendix Table 2.6-11 Land Use Planning Area by DLD
(legend for Figure 2.6-6)

Symbol	Classes	Area (rai)	Area(ha)	%
1	The Area for Conservation for Good Environment	19,755,103	3,160,816	18.71
2	Conservative Area for Forest			
2.1	Reforestration Area for the Reservation of Good Forest	4,379,659	700,745	4.15
2.2	Conservation Forest now in Forest	7,145,809	1,143,329	6.78
2.3	Completely Damaged Area for Agriculture and Preparing for Agricultural Land Use	7,180,523	1,148,884	6.80
3	The Area Developped for Agriculture and Urban Use			
3.1	Paddy Field in Irrigation	13,685,854	2,189,734	12.97
3.2	Paddy Field in Rainfed Paddy Rice	27,008,912	4,321,426	25.59
3.3	Upland Field for Upland Crops	17,157,423	2,745,188	16.26
3.4	Uplanf Field for Livestock or Grassland	8,244,357	1,319,097	7.81
	Salied Area			
=	Water Area or Fish Pond	976,323	156,212	0.93
Total Area		105,533,963	16,885,433	100.0