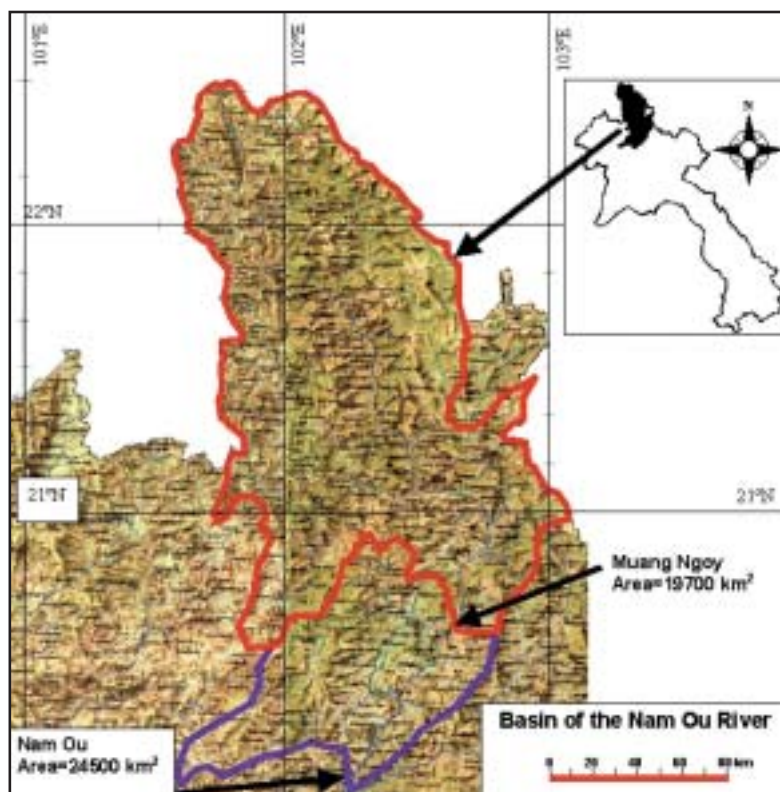


## Nam Ou

### Map of River



### Table of Basic data:

<b>Name(s):</b> Nam Ou River		<b>Serial No. :</b> Lao-7
<b>Location:</b> Northern region, Lao PDR	E 101° 40' - 103° 08'	N 19° 55' - 22° 30'
<b>Area:</b> 19,700 km <sup>2</sup>	<b>Length of the main stream:</b> 390 km	
<b>Origin:</b> Ban Uan Touy-Gnai (1,263 m)	<b>Highest Pt:</b> 1,865 m	
<b>Outlet:</b> Mekong at Pakou	<b>Lowest Pt:</b> B. Pakou 350 m	
<b>Main base rock:</b> Mesozoic to Palaeozoic limestone, sub-volcanic		
<b>Main tributaries:</b> Nam Leng (1,451 km <sup>2</sup> ), Nam Phak (2,716 km <sup>2</sup> )		
<b>Main base lakes:</b> none		
<b>Main reservoirs:</b> none		
<b>Mean annual precipitation:</b> 1,600 mm (1988-2000)		
<b>Mean annual runoff:</b> 389.3 m <sup>3</sup> /s at M. NGoy 19,700 km <sup>2</sup> (1988-2000)		
<b>Population:</b> 54,685 (1995)	<b>Main cities:</b> Phonsaly, Oudomxai, M. Ngoy	
<b>Land use:</b> Forest (38%), Agriculture (20%), Urban (1%), other (41%)		

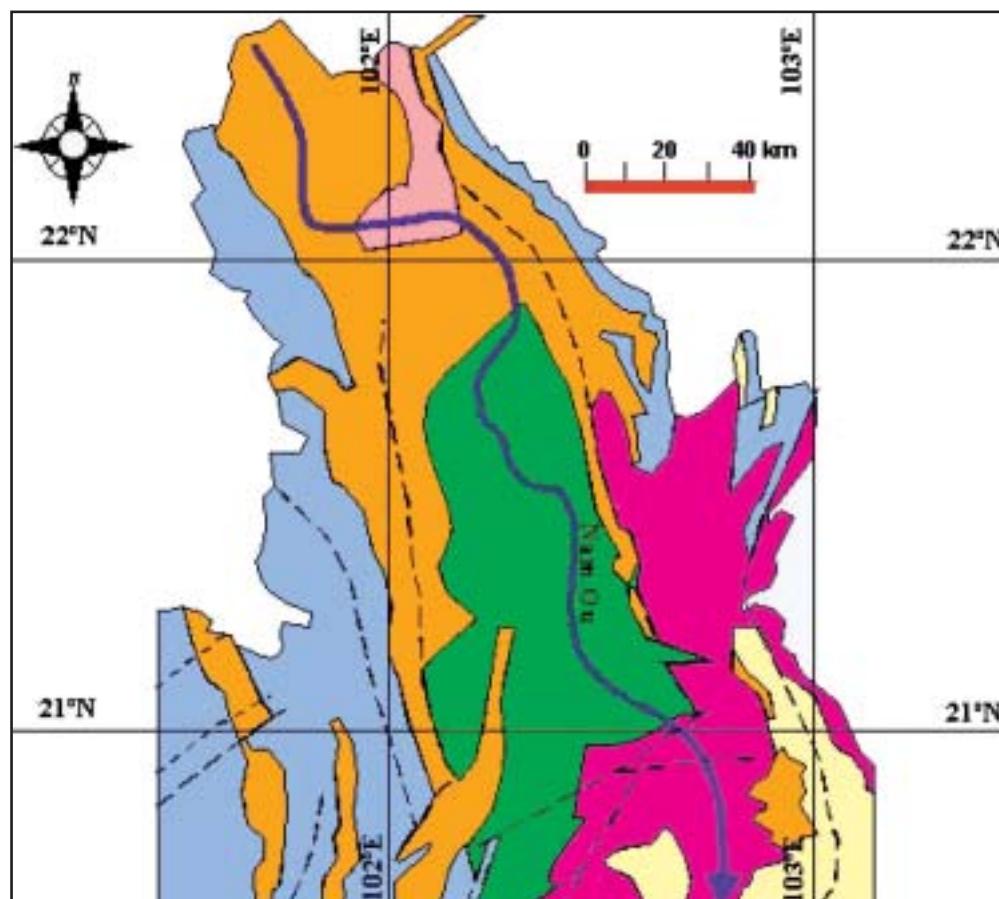
## 1. General Description

The Nam Ou is the longest river in the northern region of Lao PDR. It originates at Ban Lantoug Gnai near the Lao-China border and flows to the south. It has a total length of 390 km to the confluent point with the Mekong river. The total drainage area is 25,000 km<sup>2</sup> covering Phongsaly province, one third of Oudomxay province, and one half of Luang Prabang province. The geology is mostly red continental sandstone and clays with middle limestone. The climate is subtropical monsoon with a significance change in rainfall caused by the traditional practice of shifting cultivation by slash and burn practised by the local, mostly, nomadic people. The mean annual rainfall at Phongsaly for the period 1921-1929 was 1,739 mm and has decreased to 1,511 mm for the period 1988-2000.

Under an integrated rural development scheme, Phongsaly province has several micro-projects for water resources development in irrigation, hydro-electric power, water supply and environment protection. All these projects are now on going.

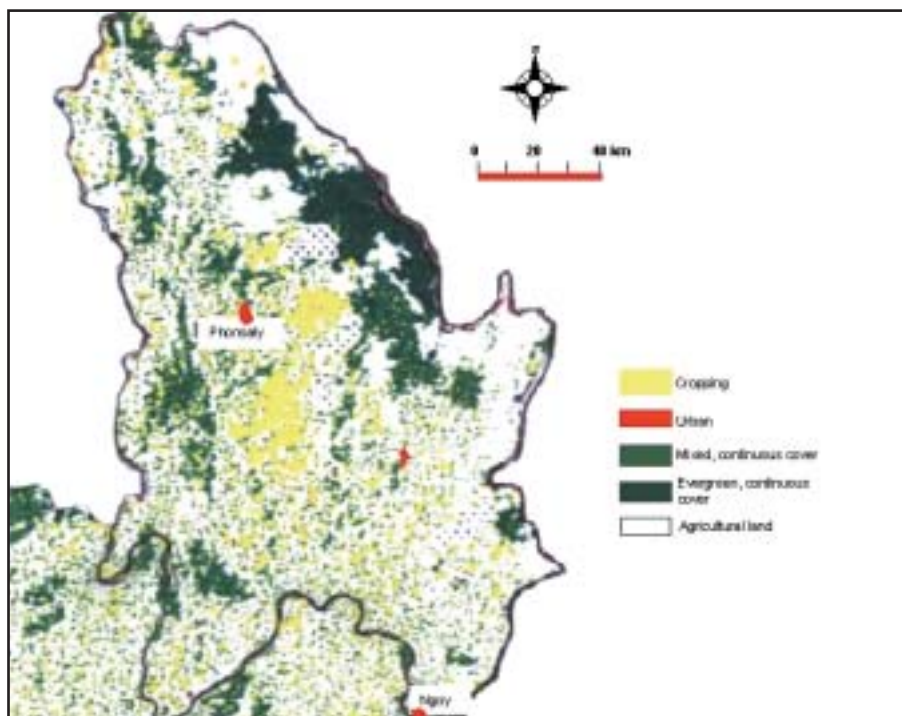
## 2. Geographical Information

### 2.1 Geological Map



MESOZOIC	Cretaceous	3	Mz <sub>2</sub>	<p>Mostly red continental sandstones and clays, with lagoonal mudrocks in the upper levels bearing evaporite units of halite and gypsum.</p> <p>Mostly continental sequence with local water marine facies persisting from Upper Palaeozoic. Continental red clayey arenites with occasional thin coal seams and conglomerates. Middle Triassic marine limestone units occur at the base of this interval interbedded with clays in NE and NW Marine Liassic in SE.</p> <p>Shallow shell sea sequence interdigitated with a volcanosedimentary sequence.</p> <p>Mostly sandstone, siltstone, and shale in the N and NW. Some silicic, intermediate and mafic extrusive rocks (v) associated with subvolcanic intrusive centres.</p> <p>Bedded to massive dark grey to light grey marine limestone (c) form extensive karst tracts in N and E, and in the E are intercalated with siltstone, mudstone and some coal seams. Epiclastic rocks predominate over limestone in the W and S.</p> <p>Mostly shallow sea sequence of muddy limestone (c). Some continental Carboniferous in Vientiane basin. Salavan (S Central) and Phongsali Devonian(N).</p>
		2		
		1		
	Jurassic	3		
		2		
		1		
Triassic	3	Mz <sub>1</sub>		
	2			
	1	Pz <sub>3</sub>		
PALAEOZOIC	Permian	2	vPz <sub>3</sub>	
		1		
	Carboniferous	2	cPz <sub>3</sub>	
		1	cPz <sub>2</sub>	
		3		
	Devonian	2		
		1		

## 2.2 Land Use Map

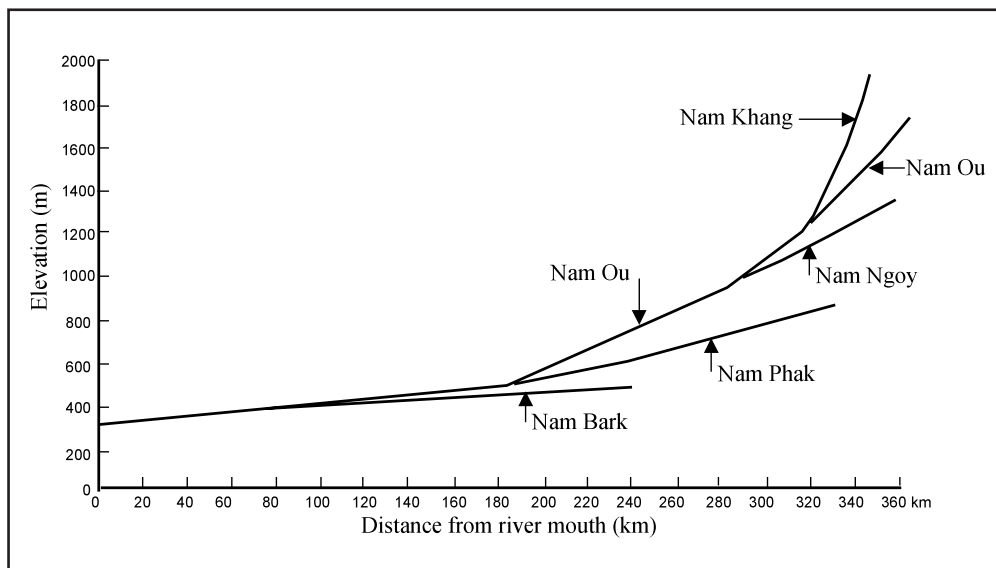


### 2.3 Characteristics of the River and the Main Tributaries.

No.	Name of river	Length [km] Catchment area [km <sup>2</sup> ]	Highest peak [m] Lowest point [m]	Cities Population (year)	Land use [%]
1	Nam Ou	390 19,700	1,865 350	Phongsaly	F (38) A (15) U (1.5) O (43.5)
2	Nam Phak	120 2,716	550 400	Oudomxay	F (35) A (20) U (1.5) O (43.5)

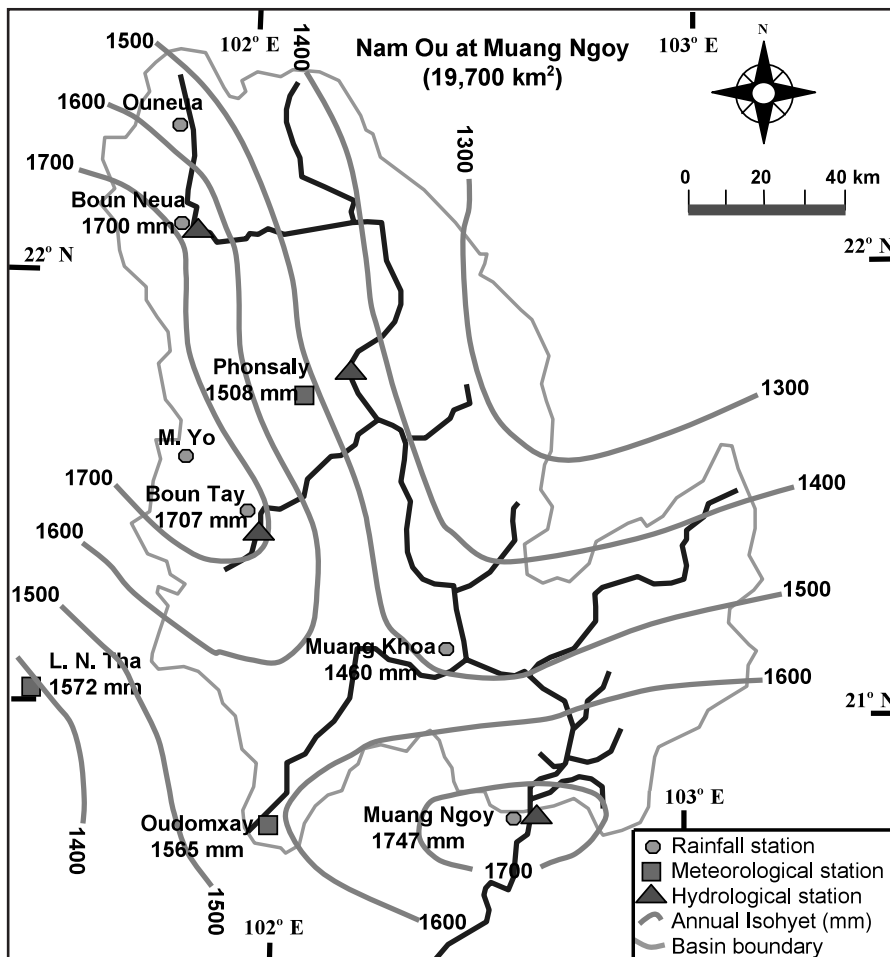
F: Forest; L: Lake, river, marsh; P: Paddy field; U: Urban  
O: Orchard; A: Agricultural field (vegetable field, grass field)

### 2.4 Longitudinal Profiles



### 3. Climatological Information

#### 3.1 Annual Isohyetal Map and Observation Stations



#### 3.2 List of Meteorological Observation Stations

Number	Station	Elevation [m]	Location	Observation period	Mean annual Precipitation [mm]	Mean annual evaporation [mm]	Observation Items*
1	Phongsaly	1,000	N 21° 44' E 102° 12'	1988 - 2000	1,511	1,200	P, E
2	Oudomxay	550	N 20° 57' E 101° 24'	1929 - 1938 1988 - 2000	1,611	1,300	P, E, DS
3	Muang Khoa	400	N 21° 05' E 102° 30'	1988 - 2000	1,460	-	P
4	Muang Ngoy	380	N 20° 42' E 102° 40'	1988 - 1998	1,749	~	P

\* P: Precipitation, E: Evaporation, DS : Duration of sunshine

### 3.3 Monthly Climate Data

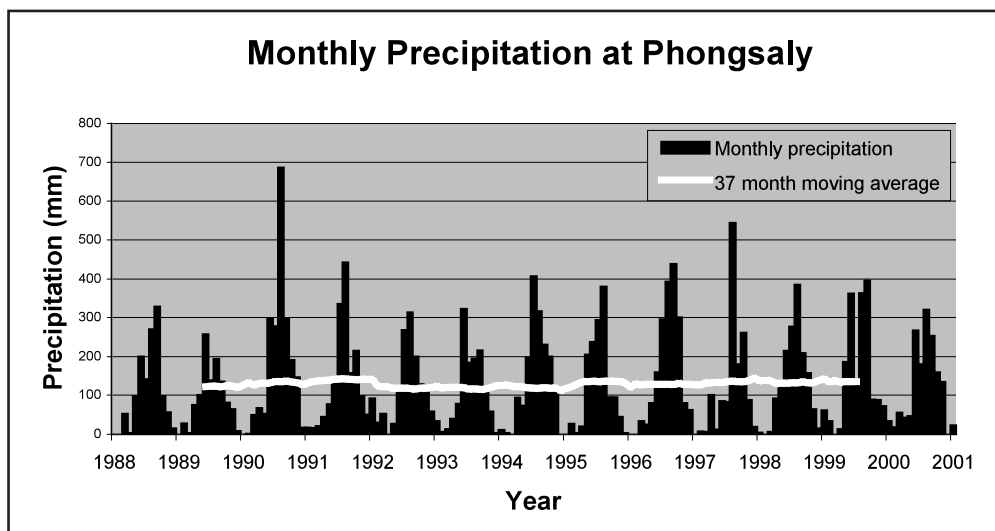
#### Station: Phongsaly

Observation station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for mean
Temperature [°C]	15.9	17.6	21.1	22.0	22.0	21.9	21.6	22.0	21.4	19.9	17.2	14.6	19.8	1990 - 2000
Precipitation [mm]	12.8	24.2	51.0	75.5	218.8	231.1	368.9	240.8	160.8	87.3	24.5	21.0	1,511	1988 - 2000
Evaporation PET [mm]	40	58	93	121	136	133	134	123	117	100	63	47	1,165	1990 - 2000

#### Station: Oudomxay (550)

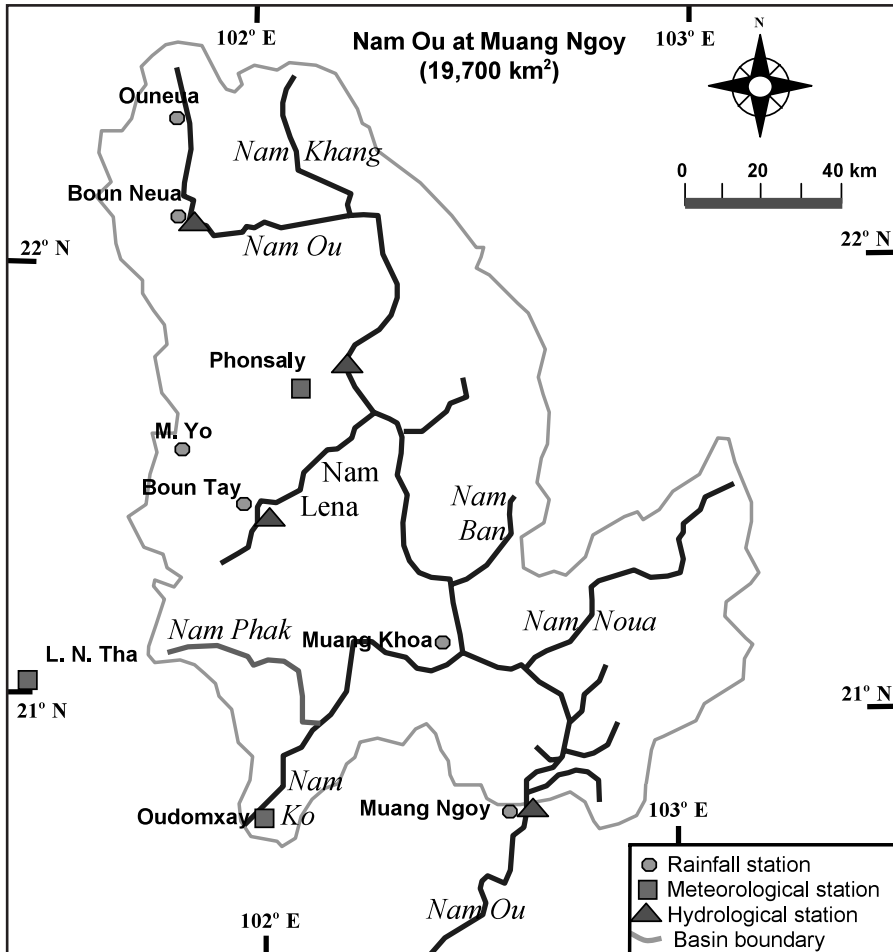
Observation station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for mean
Temperature [°C]	18.2	19.0	22.5	25.0	25.8	26.2	25.8	25.5	25.0	23.3	20.4	17.8	22.9	1990 - 2000
Precipitation [mm]	6.4	28.1	43.1	94.8	172.7	350.1	335.1	329.8	171.1	76.8	29.2	23.3	1,607	1929 - 2000
Evaporation PET [mm]	70	75	102	125	120	115	120	110	109	115	100	70	1,230	1990 - 2000

### 3.4 Long-term Variation of Monthly Precipitation



## 4. Hydrological Information

### 4.1 Map of Streamflow Observation Stations



## 4.2 List of Hydrological Observation Stations

No.	Station	Location	Elevation [m]	Catchment area (A) [km <sup>2</sup> ]	Observation period	Observation items <sup>a</sup> (frequency)
1	Ban Hatsa	N 21° 44' E 102° 42'	800	5,894	1990, 1996	H2 daily
2	Muang Ngoy	N 20° 42' E 102° 40'		19,700	1978 - 98	Q, P, WQ

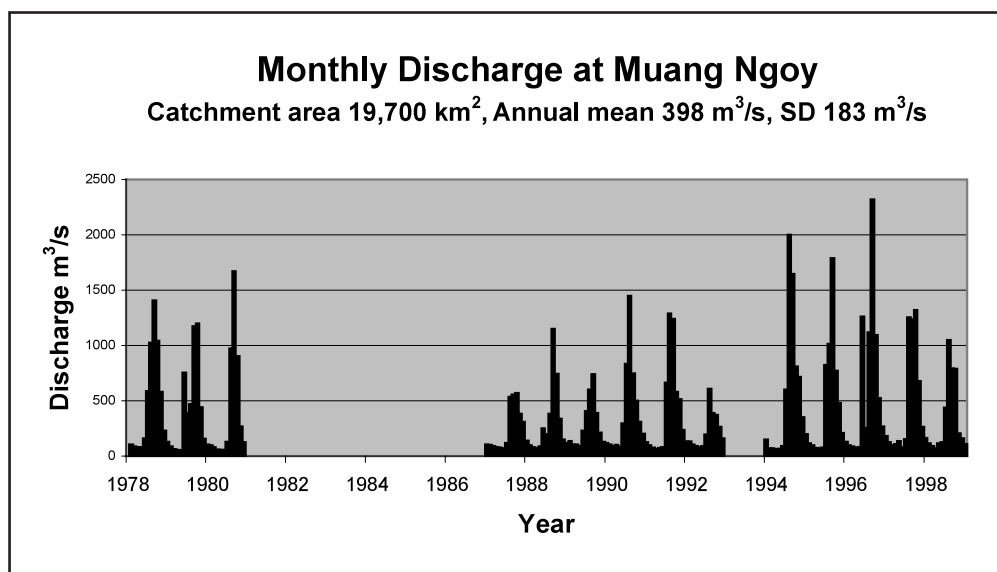
No.	Q <sup>b</sup> [m <sup>3</sup> /s]	Qmax <sup>c</sup> [m <sup>3</sup> /s]	Qmax <sup>d</sup> [m <sup>3</sup> /s]	Qmin <sup>e</sup> [m <sup>3</sup> /s]	Q/A [m <sup>3</sup> /s/100km <sup>2</sup> ]	Qmax <sup>c</sup> /A [m <sup>3</sup> /s/100km <sup>2</sup> ]	period of statistics
2	398.25	7,771	3,612	64	2.021	39.447	1978 - 98

<sup>a</sup> H2: manual water level, Q: discharge, P: precipitation, WQ: BOD etc.

<sup>b</sup> mean annual discharge    <sup>c</sup> maximum discharge    <sup>d</sup> mean annual maximum discharge

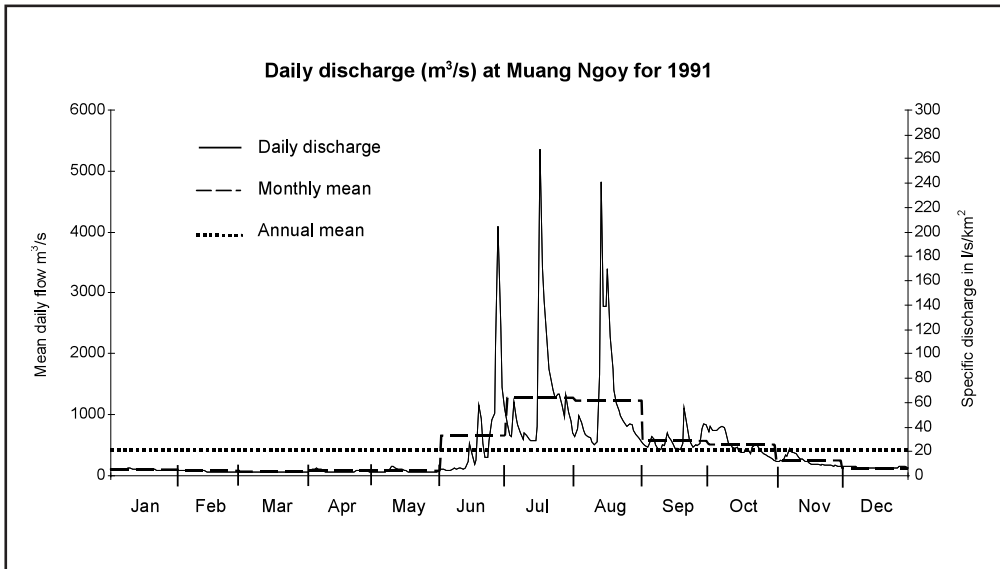
<sup>e</sup> mean annual minimum discharge

## 4.3 Long-term Variation of Monthly Discharge

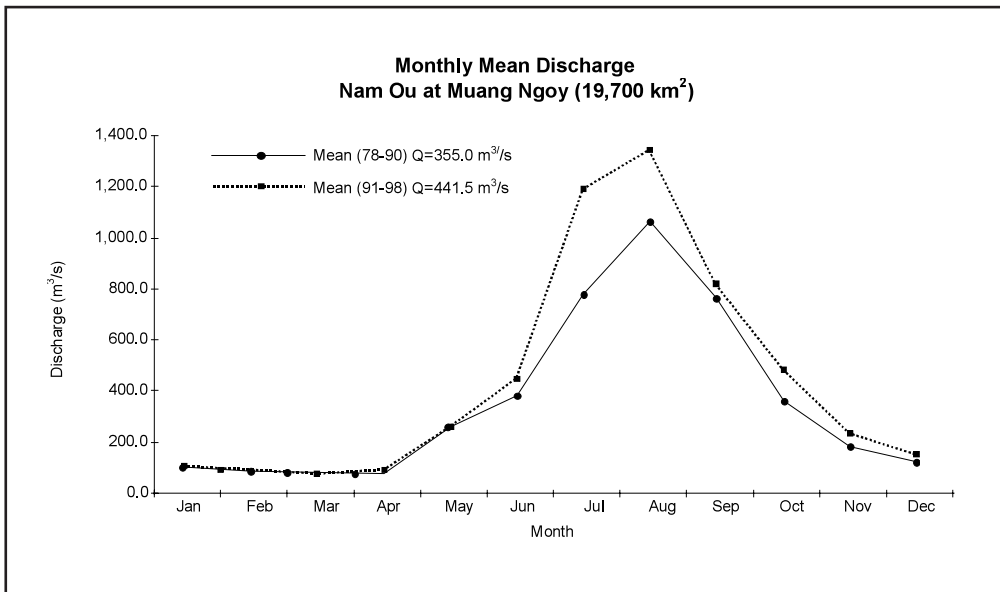




#### 4.4 Annual Pattern of Discharge



#### 4.5 Unique Hydrological Features



#### 4.6 Annual Maximum and Minimum Discharges

Nam Ou at Muang Ngoy, Catchment Area = 19,700 km<sup>2</sup>

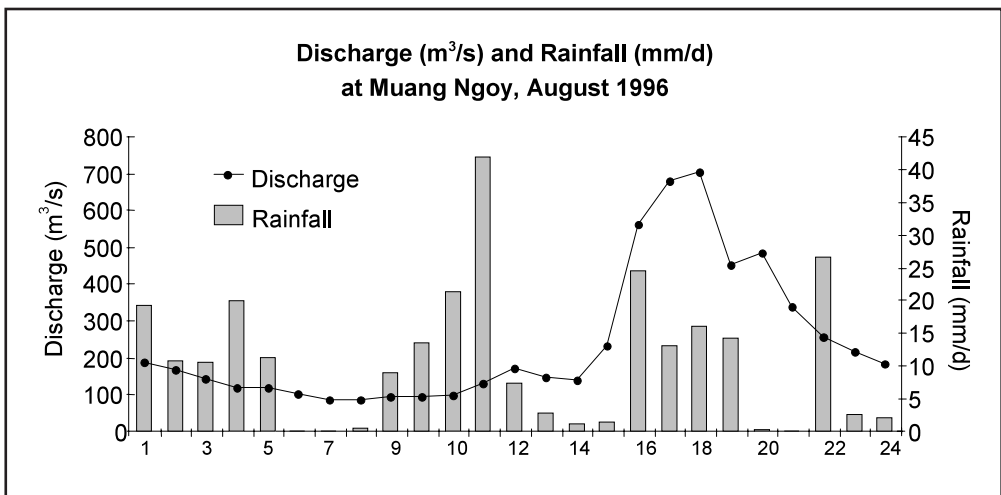
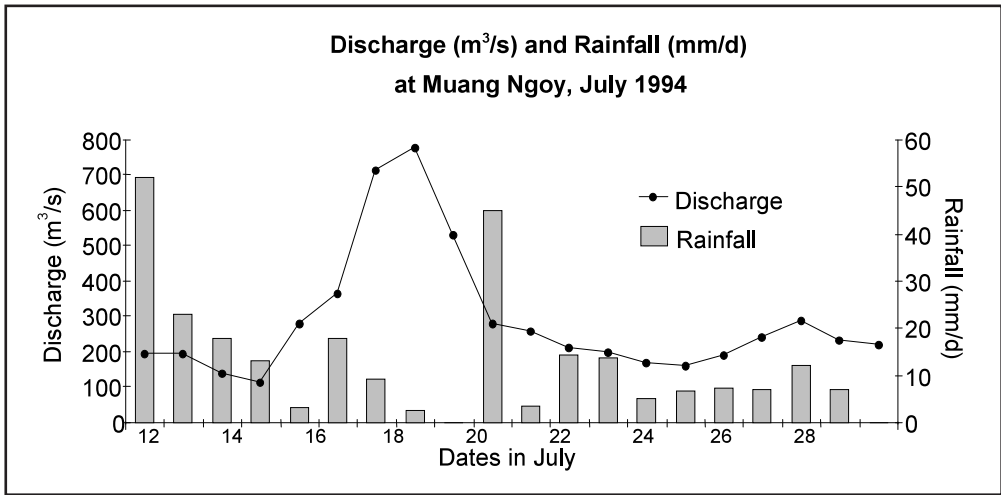
Year	Maximum		Minimum	
	Date <sup>a</sup>	Discharge <sup>b</sup> [m <sup>3</sup> /s]	Month	Discharge <sup>c</sup> [m <sup>3</sup> /s]
1978	6.29	3,900	3	58.4
1979	8.26	2,264	4	37.8
1980	8.21	3,734	5	41.0
1981	8.6	3,664	4	51.1
1985	9-1	3,200	4	63.4
1986	7.23	2,720	3	72.6
1987	9.2	2,100	5	48.2
1988	8.15	2,440	4	55.3
1989	8.15	1,950	4	85.0
1990	7.22	2,600	4	75.8
1991	7.16	5,360	4	53.6
1992	7.26	1,660	5	57.8
1994	7.18	7,771	5	74.4
1995	8-16	4,599	5	89.7
1996	8.19	7,017	5	72.9
1997	9.7	4,329	6	84.8
1998	8.31	2,095	3	63.4
<b>Sum =</b>		61,403		1,085.2
<b>Mean =</b>		3,612		63.8

<sup>a</sup> date in form month.day

<sup>b</sup> 2 readings per day

<sup>c</sup> daily reading

4.7 Hyetographs and Hydrographs of Major Floods



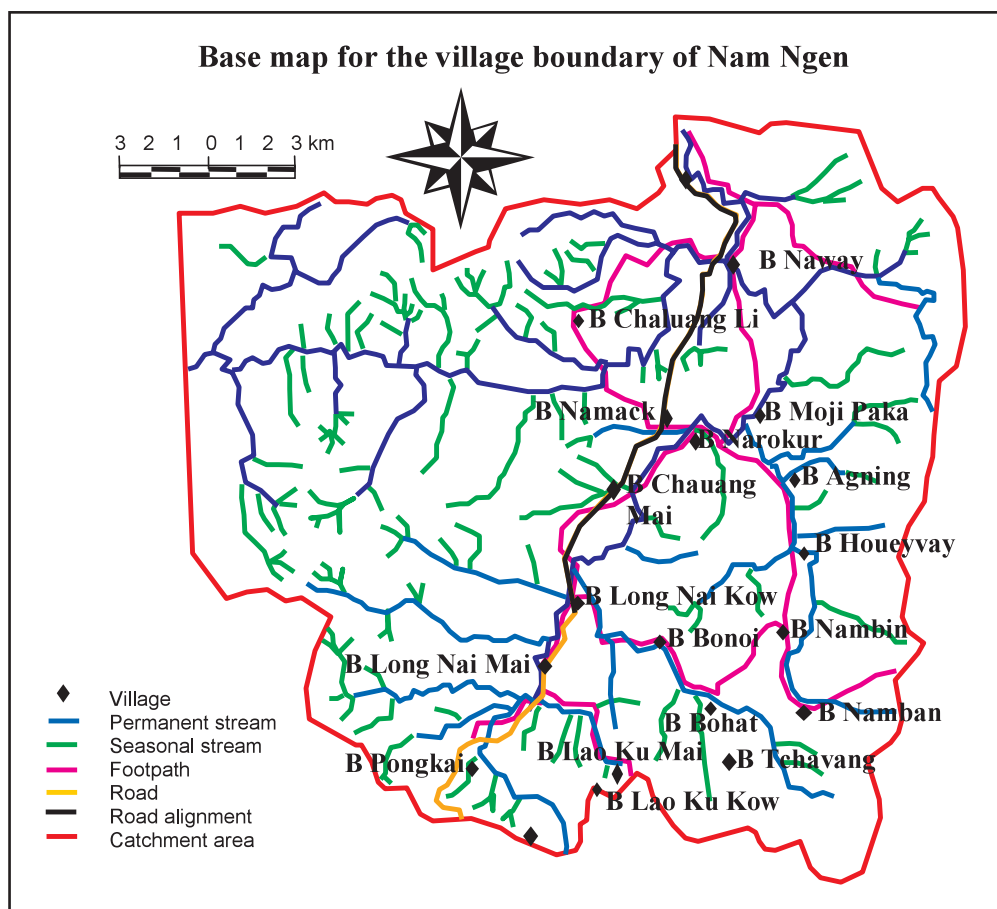
## 5. Water Resources

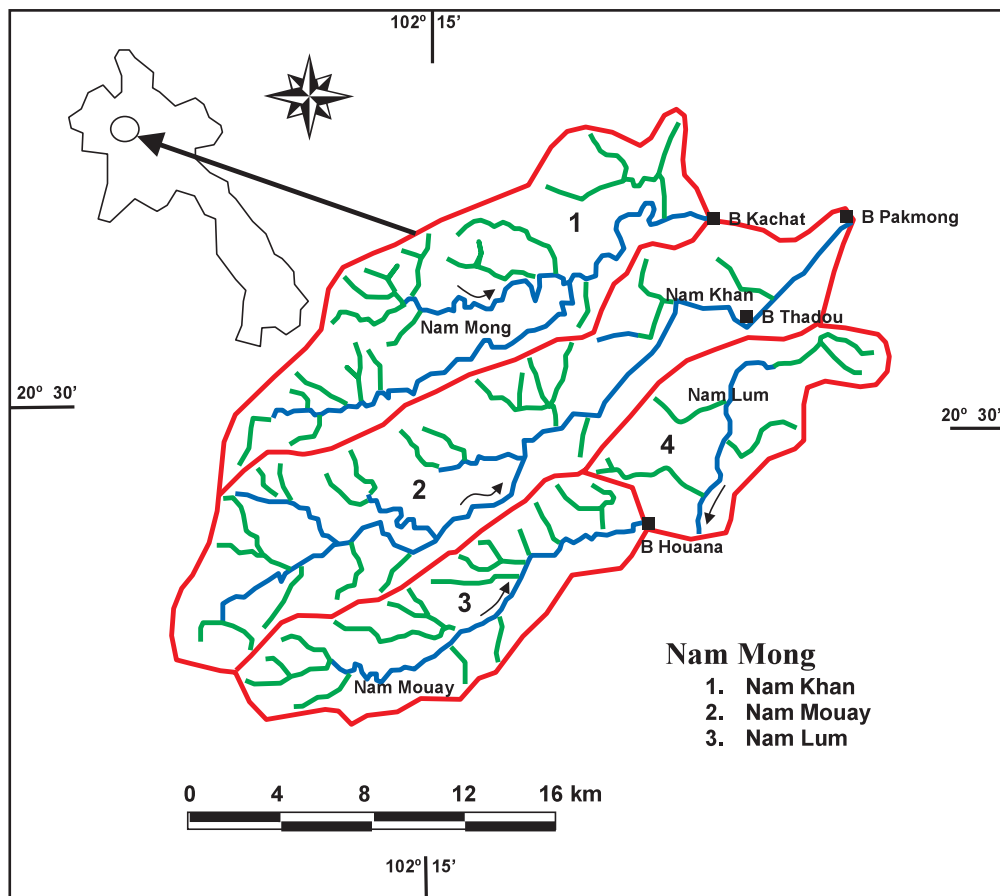
### 5.1 General Description

The water resources development in Bountay District, South west of Phongsaly (First figure in Section 5.2) aims to improve the living standard of the people in the Nam Ngen watershed by providing water supplies to all villages, and the use of the water resources of the area under the slogan of water is life.

In the lower Nam Ou, the Nam Bark area in Luang Prabang Province is the most suitable irrigable area and the rural development project is comprised of a small scale project in 4 tributaries of Nam Bark that can irrigate approximately 2,000 ha (Second figure in Section 5.2). This micro project, comprised of the Nam Khan, Nam Muang, Nam Mong and Nam Lum, will improve the two cropping cultivation of the people of the Nam Bark District.

### 5.2 Map of Water Resource Systems





#### 5.4 Major Floods and Droughts

##### Major Floods at Muang Ngoy (Catchment Area 19,700 km<sup>2</sup>)

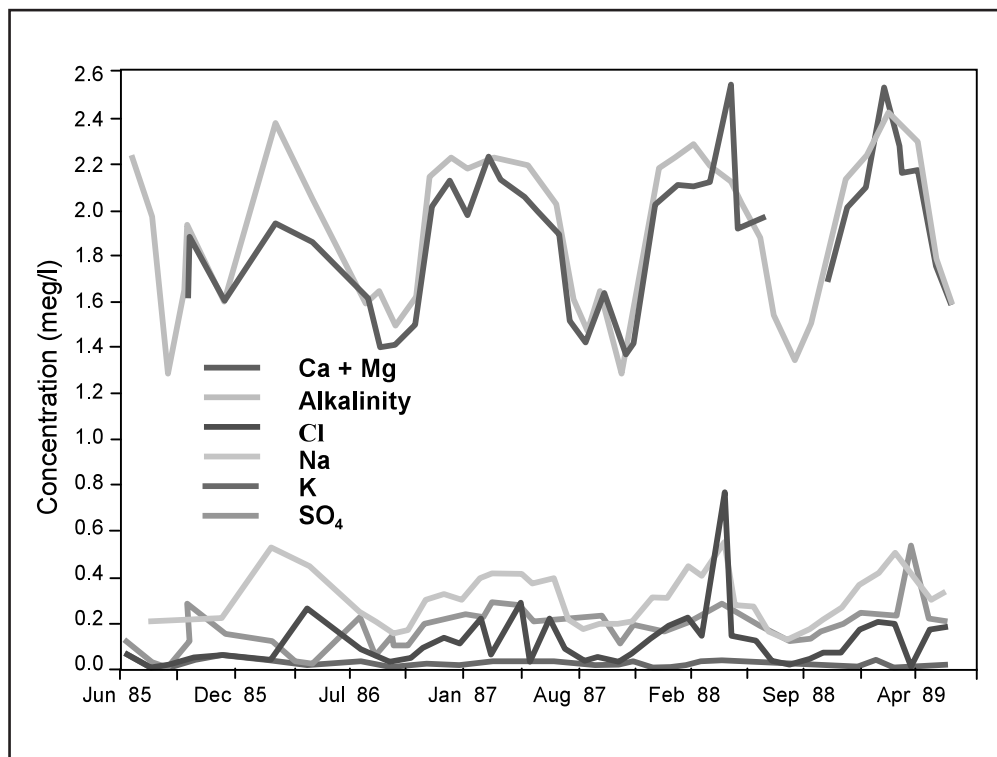
Date	Peak discharge [m <sup>3</sup> /s]	Storm rainfall [mm]	Meteorological cause	Damages
1994 15 Jul - 20 Jul	7,771	1,090	Monsoon Typhoon	Agriculture and Livestocks
1996 15 Aug - 19 Aug	7,017	≈ 60 heavy rainfall from the east	Monsoon	Agriculture

##### Drought

Major droughts occur during strong ENSO events: the 1992 drought was the most severe in terms of damage for agriculture for the whole northern region. The 1997/98 El Nino was also severe with low rainfall and low runoff - rice production was below the average.

## 5.5 Groundwater and Water Quality

### Water Quality: Concentration of the major constituents for the Nam Ou



## 6. Socio-cultural Characteristics.

Most of the people of different ethnicities in the whole basin live in rural areas and depend largely on subsistence-agriculture, exchanging their products by means of fluvial navigation from Pak Ou to Ban Hatsa, Phongsaly province. Recent road network improvements are bringing a positive impact through integrated rural development. However, people of the area still preserve their traditional mode of living.

## 7. References, Databooks and Bibliography

National Geographic Department map 1:1.000.000 Scale, 1986.

Department of Geology and Mines: 1:1.000.000 Scale map of Geological and Mineral occurrence map of Lao P.D.R. 1991.

MRC Hydrologic year books available until 1995 and Forest cover map of Lao P.D.R. 1996/97.

WAD: Hydrological data of Nam Ou and Nam Suang 1990-98.