

Appendix 4
Meteo-hydrology and Water Resource

**MASTER PLAN STUDY
ON
INTEGRATED AGRICULTURAL DEVELOPMENT
IN
LAO PEOPLE’S DEMOCRATIC REPUBLIC**

VOLUME III

APPENDIX-4

METEO-HYDROLOGY AND WATER RESOURCE

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METEO-HYDROLOGY AND WATER RESOURCE**

CHAPTER 1 INSTITUTION AND ORGANIZATION

1.1 Agencies in Meteo-hydrology and Water Resources

There are two government's agencies responsible for providing services on the meteo-hydrology and water resources. One is the Department of Meteorology and Hydrology (DMH) of MAF that has mandate to collect, evaluate and disseminate rainfall, evaporation, river height and flow information. The other is the Department of Communication of MCTPC that is responsible for collecting hydrologic and hydrographic data on the Mekong River and its main tributaries. The DMH plays a dominant role in management of the meteo-hydrological networks over the country in providing a wide range of services from observation to forecasting.

1.1.1 Department of Meteorology and Hydrology and Department of Meteo-hydrology of PAFS

The DMH has office in Vientiane with about 75 staff, and its organization chart is shown in Figure 1.1.1. Under the DMH, 17 local meteo-hydrological offices are deployed in the respective Provinces with 135 staff belonging to PAFS and DAFO. The duties of DMH are (i) meteorological observation, (ii) aviation meteorology, and (iii) hydrological observation

Roles of DMH are to strengthen/construct meteo-hydrological station network in Lao PDR, to provide technical assistance to the Department of Meteo-hydrology of PAFS (DMHP), to compile the collected meteo-hydrological data, to provide meteo-hydrological information for public services and other government agencies concerned. Roles of the DMHP are to carry out observatory activities, to maintain meteo-hydrological stations and to send daily and/or periodical reports on the observed data to the DMH through PAFS.

1.1.2 Offices, Staff, Instruments and other Facilities

In accordance with the latest information of DMH, present conditions of offices and related facilities for observation activities of the DMH and DMHP can be summarized below.

(1) Office

Following offices concerned with meteo-hydrology observation are located overall Lao PDR.

- Meteorology station including DMH office
(Main synoptic meteo-hydrology station) 21 stations
- Agro-meteorological station and/or Secondary Synoptic
meteo-hydrology station 29 stations
- Rain gauge stations 102 stations
- Staff gauges stations 60 stations
- Gauging stations 67 stations

(2) Staffing

- (i) Most of qualified staffs such as Sr. Meteorologist, Sr. Hydrologist and Sr. Data analyst are doing main services in DMH office. Main meteo-hydrology office is respectively located at 17 PAFS, but out of 17 PAFS, only 5 PAFS namely, Provinces of Luang Prabang, Vientiane, Borikhamsay, Savannakhet and Champasak have a few meteorologist and hydrologist.
- (ii) Main workers of all DMHP are permanent field staff for data collection.

(3) Communication system

- (i) Tele-communication system has already attained all main meteo-hydrology stations, but network of tele-communication does not fully attain into all hydrological stations and agro-meteorological stations. Main communication system for data transferring is currently wireless radio system. But, wireless radio system is not unsuitable to carry out data transferring to Vientiane clearly, because of over-durability period of wireless radio equipment and worse affection from weather conditions.
- (ii) Power resource of automatic recorder, data compilation and communication is mainly electricity at all main meteo-hydrology stations. However, main meteo-hydrology station does not have the 24-hours electricity power supply in Xaiyabuly Province.
- (iii) Most of communication facilities, observatory instrument and equipment are of over-durability period, and replacement and/or renewal of facilities and instrument need.

- (4) Transportation
 - (i) Except for DMH, all DMHP have very poor conditions of transportation for activities of observatory and reporting.
- (5) Meteo-hydrology instrument and equipment
 - (i) In accordance with categorization of DMH, meteorology station is broadly divided into two groups such as meteorological station and agro-meteorological station. But there is no difference on installation of instruments for observatory.
 - (ii) Most of instruments for meteorological observatory are being of over-durability period and still in use. But, it can be recommended to carry out early calibration of instruments, and renewal and/or replacement of instruments are also discussed, if necessary.
 - (iii) Most of hydrological instruments are not frequently maintained well.
 - (iv) Network of hydrological stations has not been fully expanded into mountainous area due to poor accessibility to remote areas.

Detailed information on the matters is shown in Tables 1.1.1 to 1.1.3.

1.1.3 Compilation of Meteo-hydrological Data

DMHP has responsibility to prepare and submit regular reports on meteo-hydrology observatory to DMH everyday and/or periodically. In the reporting mechanism, each main meteo-hydrology station of DMHP has to submit report on meteo-hydrological data to DMH everyday, using telecommunication system. But, in cases of secondary synoptic meteo-hydrology stations and agro-meteorology stations, it takes approximately 3 months to 6 months to send the collected data to the DMH after collection of meteo-hydrological parameters. Finally, Statistic Data Center of DMH compiles all collected data by computer. However, compiling/filing and examination of meteo-hydrological data are very poor at the DMH due to shortage of manpower and no updated management of computer. For examples, it was identified that runoff data such as water level and river discharge have been collected and compiled at more than 35 stations, but longer-term data of more than 10 years are compiled at only 11 stations of 9 river basins.

1.2 Water Resources Coordination Committee

The Water and Water Resources Law, enacted in October 1996, sets out the principles, rules and measures in administration, exploitation, use and development of water and water resources. The Law is composed of ten provisions with 49 articles, containing protection of water resources and their

watersheds, water resources planning, and the prevention of water pollution. Ministries active in water resources have been instructed to formulate ministerial regulations to reflect the intent of the Law.

With setting of legal framework on water and water resources, GOL established the Water Resources Coordination Committee (WRCC) in April 1998 as a national apex body with an aim at improving the coordination of multi-sectoral activities involving various water uses and also defining and managing water allocations. ADB provided GOL with a technical assistance in 1997-1998 for institutional strengthening of the WRCC. The WRCC is composed of the vice-chairperson of STEA as the Chairperson of WRCC and representatives of the seven organizations nominated by the Prime Minister's Office. These are MAF as the vice-chairperson of WRCC, MIH, MCTPC, Ministry of Public Health (MPH), Ministry of Justice (MJ), Lao National Mekong Committee (LNMC) and STEA. The WRCC has its own Secretariat located within STEA.

1.3 Water Resources Policy

There have been no clear overall policy for the water sector in Lao PDR, but it could be gradually set up by augmenting and adjusting the individual policies of water related sectors with the establishment of WRCC. GOL is undertaking further development of the legal and regulatory framework for water and water resources and for the preservation of the environment. The development aims at reducing the conflicts between the sectors caused through development. The water related sectors are; hydropower, irrigation, navigation, fisheries, urban water supply and waste disposal, and rural water supply. The respective sectors' development policies related to water and water resources are briefly summarized below.

Development Policies related to Water and Water Resources

Sector	Development Policy
Hydropower	<ul style="list-style-type: none"> - reduce imported fuel; - support rural development and reduce regional power imbalance; - encourage private investment in hydropower development; - earn foreign currency for socio-economic development; - minimize environmental impacts; and - develop watershed management.
Irrigation	<ul style="list-style-type: none"> - achieve food self-sufficiency, increase commodity production and reduce shifting cultivation; - involve all the stakeholders in irrigation development and management; - coordinate irrigation schemes with other means of increased agricultural production; and - protect against flood damage.
Navigation	<ul style="list-style-type: none"> - maintain current transport capability by river; - improve navigation aids and information for safety travel; - encourage use of river transport in wet season instead of poor roads; and - protect riverbanks from erosion
Fisheries	<ul style="list-style-type: none"> - collect information on the extent and nature of capture fisheries; - develop infrastructure and human resources in fisheries management; - promote development of aqua-culture; and - regulate fishing activities.
Urban water supply and waste disposal	<ul style="list-style-type: none"> - increase amenity of life in urban areas by providing affordable, reliable and quality services in commercial water supply and in sanitation.
Rural water supply	<ul style="list-style-type: none"> - improve water supply and environmental health in rural areas; - focus on inaccessible, poverty-ridden areas; and - encourage private water supply and sanitation ventures in easy-to-reach areas.

CHAPTER 2 METEO-HYDROLOGICAL OBSERVATION

2.1 Climate in Lao PDR

The tropical climate of Lao PDR is mainly dominated by south-west monsoons and typhoons. The rainy season starts in mid-April and lasts until mid-October, and the rest period is the dry season. Average annual rainfall ranges from 1,650 mm to 1,950 mm. Rainfall of more than 90 % is concentrated into the rainy season in the each area. In accordance with isohyetal map shown in Figure 2.1.1, rather higher annual rainfall of more than 2,500 mm is identified in two regions such as (i) northern and eastern area of Vientiane Province to western area of Borikhamxai Province and (ii) Boloven Plateau. On the contrary, the regional area of Xaignabouri Province to southern area of Louangphrabang Province has comparatively lower annual rainfall of less than 1,300 mm.

Mean temperature ranges 22.4°C to 29.1°C. Mean Maximum temperature increase more than 32°C in low land areas during transition period from dry season to rainy season. Mean Minimum temperature come down several times less than 10°C in low land area in dry season, and a few occurrence of frost can be identified in high mountainous area of more than 1,200 m above mean sea water level in dry season.

2.2 Meteorological Observation Network

Meteo-hydrological stations of Lao PDR are classified into 3 types such as main meteo-hydrology station (main synoptic station), agro-meteorology station and Secondary synoptic meteo-hydrology station. However, there are no deference of the roles and functions between the agro-meteorology station and the Secondary synoptic meteo-hydrology station. There are 50 meteorological stations over the country with a classification of 21 main synoptic meteo-hydrology station and 29 secondary synoptic meteo-hydrology station and/or agro-meteorology station. The meteorological observation activities by DMH consist of general meteorological observation and aviation meteorological observation.

The observation items of meteorological stations are; temperature (max. & min.), humidity, evaporation, solar radiation, wind speed and direction, and underground temperature at the depth of 5 cm, 10 cm, 20 cm, 50 cm and 100 cm. Of 35 stations, 16 stations operated by the provincial office transfer the observed records to the DMH in Vientiane by wireless transmission at 7 AM everyday. Those at the rest stations are reported on a monthly basis with a delay of one month in general. All the meteorology stations are listed in Table 2.2.1.

The DMH in Vientiane convey the weather forecast to the media at 10 AM and 11 AM everyday, and this information is broadcast three times a day at 7 AM, 10 AM and 7 PM. This forecast is based on the meteorological information transmitted from the Hong Kong sub-stations of the World Meteorological Organization (WMO) at 7 AM, meteorological data from neighboring countries regularly transmitted at 7 AM, 10 AM and 1 PM, photographic information of Japanese satellite “Himawari”, and partly additional meteorological data observed locally.

The DMH operates 12 meteorological stations at Vientiane airport and other 11 local airports; Bokeo, Oudomxai, Luang Namtha, Viengxai, Xiangkhouang, Louangphrabang, Xaignabouri, Savannakhet, Saravan, Pakse and Attpu. These stations provide aviation meteorological information including visibility, cloud conditions, rainfall, atmospheric pressure and air temperature.

The DMH made inventory survey on all the rain gauging stations over the country with a technical guidance of a JICA expert in 1997, together with collecting daily rainfall records for six year period from 1991 to 1996. The results of inventory survey are shown in Table 2.2.2. The results of survey revealed that the management of rainfall gauging stations is in very poor conditions. The stations which properly observed and hold the record during 1991 - 1996 are as low as about 40%, and about half of stations are out of functions. Those in the northern mountain area are remarkably poor.

2.3 Hydrological Observation Networks

Hydrology stations have been established at 116 sites over the country for observatory of the Mekong River and its main tributaries as shown in Table 2.3.1. However, observation activities are stopped at 12 of water level gauge stations due to technical and management reasons such as insufficient maintenance works of equipment/instrument, shortfall of consumable materials, lack of staff, shortage of budget, etc. The operating hydrology stations consist of 60 stations managed by DMH and the other 42 stations operated by the MCTPC. The observatory items are shown in the following table.

Observatory Item of Hydrology Station

Observatory Item of Hydrology Station

Observatory Item	No. of Station	DMH Station	MCTPC Station
Water Level, Discharge, Silting and Water Quality	10	6	4
Water Level, Discharge and Silting	8	4	4
Water Level and Discharge	32	17	15
Water Level	54	33	21
Total	104	60	44

Water quality has to analyzed once a month at the laboratory of the Department of Irrigation (DOI) for 13 items including pH, EC, Ca+Mg, Ca, Mg, Na, CO₃, HCO₃, Cl, SC₄, SAR, and B. However, only a few stations follow the required observatory operation as designated above, and most cases are only water level observation. Water level has to be observed five times a day at 7:00, 10:00, 13:00 and 16:00 in the rainy season of May to September, and twice at 7:00 and 19:00 in the dry season. However, twice a day is prevailing.

The DMH carried out the measurement of river flow discharge of the Mekong's tributaries in the dry season with an assistance of JICA expert, and this result are reported in May 1998 as shown in Table 2.3.2. Although all the measured records do not indicate the least dry season discharge, these are very valuable date in assessment of river characteristics in the dry season. These data revealed that the characteristics of river basins, in terms of unit runoff (lit/sec/km²), are not always similar in the adjacent basins.

2.4 Constraints and Proposed Development Programs

2.4.1 Constraints of Meteo-hydrology Observation

Present constraints of meteo-hydrology observation are summarized below.

- (i) Observation activities of each meteo-hydrological station have been suffered from insufficient type/kind of instrument/equipment, deterioration of instrument/equipment and facilities, lack of qualified staff and shortfall of budget.
- (ii) Density of meteo-hydrological stations is insufficient to provide a meaningful interpretation of local weather mechanism as well as weather and flood forecast.
- (iii) Functions of agro-meteorology station are very poor and agro-meteorological information has not been obtained sufficiently to support farmers' agricultural activities due to deterioration of instrument/equipment and facilities and lack of qualified staff.

- (iv) Weather forecast does not timely and effectively run due to insufficient information on regional meteo-hydrology. This conditions are caused by no access to the Global Telecommunication System (GTS), which supplies wide range meteo-hydrological data in and around the Lao PDR, no upper-air stations and weather surveillance radar center.
- (v) Reliability and quality of meteo-hydrological data is very poor, because of lack of facilities for calibration and maintenance of meteo-hydrological instruments.

2.4.2 Development Strategies and Programs on Meteo-hydrology Sub-sector

In accordance with Draft Development Program on Meteo-hydrology Sub-sector, Vision 2020 prepared by DMH (2000), the DMH has proposed the following main development strategies and programs to encounter the constraint mentions above.

- (i) Strengthening weather forecast and flood forecast through rehabilitation of facilities and renewal and/or upgrading of instruments at meteo-hydrology stations located in the 7 granary plains of Lao PDR
- (ii) Strengthening weather and flood observation activities in remote areas of Lao PDR through expansion of meteo-hydrology stations
- (iii) Strengthening wide and high weather forecast through establishment of upper air observatory and upgrading of satellite observatory
- (iv) Strengthening data collection through improvement of transportation and updating of data compilation through improvement of communication system and upgrading of data base system
- (v) Capacity building of DMHP staffs through implementation of 1.5 year-training program at DMH and other training programs
- (vi) Strengthening quality of the collected data through establishment of meteo-hydrology laboratory

CHAPTER 3 INSTALLATION OF NEW METEO-HYDROLOGY STATIONS

3.1 General

Contracts on construction of hydrology stations consisting of 11-slope gauge and 15-rain gauge stations have been mutually agreed in October 2000 between JICA Lao Office and the Contractors. The contracts are broadly divided into (i) construction works and (ii) procurement works of hydrological instruments and other goods.

Under these conditions, the technical assistance services were carried out in respective implementation stage of the works including transfer of knowledge to counter personnel and DMH staff concerned. Hydrologist of the JICA Study Team has provided and given the following technical assistance in the each stage such as plan, design and supervision of construction of hydrological stations, supervision of installation of hydrological instruments, communication equipment and other goods

- (a) Technical review on the 15 hydrological station sites proposed by JICA Expert of DMH,
- (b) Modification of site selection based on the field survey,
- (c) Preparation of additional materials for contract documents on construction works of hydrological stations and installation works of hydrological instrument, communication equipment and other goods,
- (d) Preparation of necessary materials for supervision of construction works,
- (e) Preparation of technical instructions, suggestions and recommendation on the construction work and the installation works,
- (f) Transfer of technical knowledge on construction and management of hydrological stations to the counter personnel and DMH staff concerned.

3.2 Review of Site Selection and Modification of Sites

3.2.1 Review of Site Selection

JICA Expert of DMH has already selected 15 hydrological stations consisting of 11 slope gauge stations and 15 rain gauge stations. Main purpose of establishment of these stations is to strengthen hydrological data collection for agriculture development and mitigation of flood damage. In reply to the JICA Expert's request on technical review, the Hydrologist of the JICA Study Team has carried out field investigation, especially local conditions and suitability of the selected stations. The technical review has been carried out through technical discussion with DMH, Provincial Agriculture and Forestry Service Office (PAFS) and JICA Expert and field investigation. It was evaluated that the originally proposed sites for slope gauge station and rain gauge station are generally appreciated for

construction, while some problems and subjects for construction and management were identified at some stations as summarized below.

(1) Slope Gauge Station

- (i) Site selection has been carried out without any consideration on water allocation and relationships of river facilities such as hydropower station, dam, intake structures of irrigation. (In case of Hongluay Station/Nam Tha River)
- (ii) Axis of slope gauge is not vertically aligned against main current of river, and/or slope gauge is aligned within area to be affected by main current of river during high water level. These problems were caused due to shortage and lack of detailed topographical information. (in cases of Hat Pha Ot Station/Nam Xuang River, Pak Beng Station/Mekong River and Xiengkok Station/Mekong River)
- (iii) It was identified that some slope gauge stations have been aligned in rather wide section of river, comparing to other sections of upper and/or down streams. Technical difficulty on measurement of river discharge will be occurred during high water level. (in case of Pak Ngum Station/Lower reach of Nam Ngum River)
- (iv) Some mismatching on plan and design of slope gauge station, which were caused due to any special attention and consideration on soil characteristics of riverbanks, were identified at some stations. (in case of Kengkok Station/Xe Champong)
- (v) Very poor sustainability on the project management mentioned below budget is identified at some Meteo-hydrology Office of the each PAFS:
 - (a) Insufficient understandings of high position PAFS officer on the necessity of meteo-hydrological observation activities,
 - (b) Low incentive situation for the officers/workers of Meteo-hydrology Office, insufficient number of staff,
 - (c) Low knowledge of technical staff,
 - (d) Lack of transportation for observation and
 - (e) Small budget amount for full operation.

(2) Rain Gauge Station

- (i) DMH did not carefully considered a development plan on network of rain gauge stations. It was identified mismatching allocation of new rain gauge stations, and the newly proposed station overlapped with the operating rain gauge station.
- (ii) DMH did not take any administrative procedure for construction such as negotiation and confirmation on land use with local government, staff arrangement for operation to PAFS, etc after selection of sites for rain gauge stations,

Results of review and field identifications are summarized in Table 3.2.1, and Field Reports on review of site selection are shown in Attachment No. 4.1.

3.2.2 Modification of Site Selection

The subjects and problems have been discussed with DMH, JICA Expert and DMHP, and some modifications on construction plan of the originally proposed stations have been made as shown below. Modified location of the each station is shown in Figure 3.2.1.

(1) Slope gauge Station

No.	Originally Proposed Location		Finalized Location	
	Village Name	River Basin	Village Name	River Basin
	Xieng Kok	Mekong	same	Confluence of Mekong with Nam Tha
	Luang Nam Tha	Nam Tha	Ban Hongluay	Nam Tha
	Ban Pak Beng.¥	Mekong	same	same
	Ban Sopchek	Nam Suang	Ban Hat Pha Oth	Nam Suang
	Xieng Khouang	Nam Ngum	Ban Phieng Luang	Nam Ngum
	Ban Naluang	Nam Ngum	same	same
	Vientiane Nabong	Nam Ngum	Ban Hai	Nam Ngum
	Paksane	Mekong	same	same
	Thakhek	Mekong	same	same
	Attapeu	Xekong	same	same
	Xekong	Xekong	Ban Vieng Thong	Nam Lik

(2) Rain Gauge Station

No.	Originally Proposed Location		Finalized Location	
	Village	Province	Village	Province
1	Xieng Kok	Luang Nam Tha	same	same
2	Luang Nam Tha	Luang Nam Tha	Ban Hongluay	same
3	Ban Pak Beng	Oudomxay	same	same
4	Ban Sopchek	Luang Prabang	same	same
5	Xieng Khouang	Xieng Khouang	Ban Nam Neun	Xam Nua
6	Ban Naluang	Xai Songbung S.Z.	same	same
7	Vientiane Nabong	Vientian	Ban Hai	same
8	Paksane	Borikhamxay	Ban Pha Muang	same
9	Thakhek	Khammouane	Ban Hin Beun	same
10	Mahaxay	Savannhket	Ban Phonesi	Borikhamxay
11	Kengkok	Savannhket	Ban Chun La	Xekong
12	Xepon	Salavan	Ban Namon	Xayabuli
13	Lahanam	Savannhket	Muang Et	Xam Nua
14	Attapeu	Attapeu	Ban Ken Say	same
15	Xekong	Xekong	Ban Tang Vay	same

3.3 Topographical Survey and Detailed Design of Hydrology Stations

3.3.1 Topographical Survey of Slope Gauge Station

Original design of hydrology stations was made without detailed topographical information. It was not clarified whether axis of slope gauge station was properly selected to mitigate damage of slope gauge facility, which will be affected by main current of river discharge during high water level. And furthermore, it was doubtful whether the axis of slope gauge station was properly selected to measure river discharge properly. Therefore, counterpart personnel and staff of DMH have carried out topographical survey under technical supervision of Hydrologist of the JICA Study Team to make more sure design of slope gauge station. Topographical survey started during review works on site selections of hydrology stations.

3.3.2 Detailed Design

Tender drawings of hydrology stations were prepared based on preliminary design. In accordance with the Contract document, the Contractor should make detailed design. However, the Contractor's activities on these matters were much delayed due to poor capacity of the Contractor. Actually, the Contractor had no qualified engineers to carry out topographical survey and made detailed design.

The DMH started detailed design under technical assistance of Hydrologist of the JICA Study Team to solve the management problems of the Contractor. The works was completed in the middle of January 2001. The DMH supplied the detailed design drawings (sample drawings) shown in the Attachment No. 4.2 to the Contractor together with technical specifications on January 17, 2001.

3.3.3 Preparation of Technical Specifications

Technical specifications on construction of slope and rain gauge stations were not included into the Contract documents, which have already been distributed to the Contractor, and there are no standards to supervise the construction works of slope gauge and rain gauge stations. Therefore, the DMH and the JICA Expert prepared technical specifications based on the results of the detailed design under technical supervision of Hydrologist of the JICA Study Team and supplied to the Contractor as a part of the Contract documents.

3.4 Construction Management

Construction works of slope gauge and rain gauge stations were managed under the following organization.

- i) Project owner : Representative of JICA Laos Office,
- ii) Engineer appointed by Project owner : JICA Expert of DMH,

- iii) Coordinator of the Project : Director General of DMH,
- iv) Supervisory Team of DMH : Counterpart personnel of JICA
Expert and other staff concerned
- v) Technical Advisor to
Engineer and Coordinator : Hydrologist of the JICA Study Team,
and
- vi) Contractor

Engineer (Project Manager) has basically managed all project activities and works progress together with Coordinator of the Project and Technical Advisor at DMH office, Vientiane. The Project Manager prepared and dispatched the Supervisory Team of DMH to the each site together with Technical Advisor. In occasion of technical and management issues of the works at the each station, the Engineer also carried out field inspection together with the Supervisory Team of the DMH.

3.5 Work Progress of Construction and Final Mutual Checks

After handing over detailed drawings and technical specifications to the Contractor, the JICA Expert and the DMH have strongly requested smooth and prompt actions of construction works. But, commencement of construction works has much delayed due to very poor mobilization management of the Contractor, and the works started at the each station in the middle of February 2001. The Contractor could not accomplish all construction works until the expire date of the Contract (March 8, 2001), and the Contractor requested to extend the contract period up to the end of March 2001.

The Supervisory Team of DMH started supervision on construction of hydrology station as shown in the Attachment No. 4.3. Final mutual checks on construction works of hydrology stations carried out since the beginning of April 2001, and the Engineer issued temporary construction certificate to the Contractors together with technical comments on outstanding works and maintenance works on April 25, 2001.

3.6 Procurement of Automatic Recorder

Automatic recorder of hydrological data (data-loga system) has been procured for operation of slope gauge and rain gauge stations since November 2000. Procurement of all the instruments has been completed at Vientiane in the end of February 2001. Installation and test operation of the automatic recorder (data-loga system) have been completed in April 2001 after accomplishment of concrete works of slope gauge and rain gauge stations. Observation activities started at all station using the recorder. While, it is necessary to carry out minor adjustment of calibration of the automatic recorder after this rainy season.

3.7 Installation of Equipment for Communication and Data Compilation

In line with construction of hydrology stations and procurement of hydrological instruments, other equipment for operation and management such as transceiver and computer have been procured and respectively being installed at 27 meteo-hydrology stations and/or offices as shown in Tables 3.7.1 to 3.7.2. Locations of those facilities installed are shown in Figure 3.7.1 to 3.7.2.

3.8 Operation of Hydrology Station and Data Collection

Observation on water level of river and rainfall started at the each hydrology station in April 2001 using data - loga system. Transferring and compilation of hydrological data started as a test run of operation, but collection of hydrological data, especially transferring the data from automatic recorder to computer system are much suffered from heavy rainfall conditions and transportation problems due to land sliding of partial sections of national roads. The hydrological data collected at the 19 stations are summarized in Table 3.8.1.

CHAPTER 4 WATER RESOURCES

4.1 Surface Water

4.1.1 River Basin

Main rivers of the Lao PDR dominantly consist of the first and second tributaries of the Mekong River. There are about 39 main tributaries in the Mekong River basin. Main rivers that have bigger catchment area of more than 5,000 km², are the following 10 rivers.

(i) Nam Tha, (ii) Nam Ou, (iii) Nam Xuang, (iv) Nam Khan, (v) Nam Ngum, (vi) Nam Kading, (vii) Xe Banfai, (viii) Xe Bang Hiang, (ix) Xe Done and (x) Xe Kong

Total watershed area of the main tributaries is estimated at about 183,000 km².

On the other hand, only 2 main rivers, namely Nam Ma River and Nam Ka River are located outside of the Mekong River Basin and expanded in the eastern area of Provinces of Houaphan and Xieng Khuang. Both the rivers flow into the Vietnam area directly. Total watershed area of both the rivers is approximately 15,000 km².

Nam Ngum River has huge dam reservoir in Vientiane Province. Total storage capacity of the dam is 7,000 MCM, and surface water area of dam reservoir attains 370 Km² in rainy season. Hydrological information concerned of the each river is summarized as shown in Table 4.1.1. Locations of main rivers and boundaries of river basins are shown in Figures 4.1.1 to 4.1.2.

4.1.2 Hydrological Data

For estimation of surface water resources, hydrological data of more than 10 years was obtained from the DMH and MCTPC. The data obtained were only rainfall data of 59 rain gauge stations and 11 water level gauge stations. It was very a few hydrological data taking into consideration current observation conditions under the hydrological network. Furthermore, it was identified that some data on river discharge have much discrepancies and discontinuity of seasonal sequence, which can not be theoretically explained. This was caused due to very poor conditions of examination and compilation of hydrological data.

4.1.3 Monthly Rainfall in Ordinary Hydrological Year

Monthly rainfall is estimated at the each rain gauge station mentioned above, based on the statistic analysis on the collected data. The monthly rainfall widely ranges from 1,240 mm to 3,770 mm overall Lao. PDR as shown in Table 2.4.2.

Annual rainfall of the each rain gauge station has similar tendency of rainfall amount shown in Figure 4.2.1 isohyetal-maps.

4.1.4 Drought Rainfall and Estimation of Rainfall in River Basin

Probable drought annual rainfall of 80 % chance is theoretically estimated at each rain gauge station by normal distribution method. A year which, the annual rainfall is the most similar to the estimated probable drought annual rainfall, is selected as drought year of 80 % chance, and it's annual rainfall is assumed as drought rainfall of 80 % chance as summarized in Table 2.4.3.

Furthermore, drought rainfall of the each river basin is estimated by Thiessen method as summarized in Table 2.4.4. Drought rainfall of river basin is very roughly assumed in some river basins located in the Provinces of Bokeo, Phongsaly, Luang Nam Tha, Oudomxay, Houphan and Xayabuli, because of shortfall of hydrological data and poor network of rain gauge stations in the province areas.

Drought rainfall of river basin generally ranges from 1,300 mm/year to 1,800 mm/year in over whole LAO PDR. But, rather higher drought rainfalls of more than 2,000 mm/year are identified in the river basins of the Nam Ngiep, Nam Xane, Nam Hinboun and Xekong. On the contrary, there are lower drought rainfall of less than 1,200 mm/year in the river basins of Xayabuli Province and southern area of Luang Prabang Province

4.1.5 Annual Runoff Ratio

It was informed that river discharge data were available at 40 stations of 19 river basins from the DMH and the MTCPC. But, the data were actually provided at 11 stations of 9 river basins, namely Nam Lik, Nam Ngum, Nam Song, Nam Sane, Nam Nhiep, Nam Theun, Xe Banfai, Xe Done and Xe Kong for this period.

Annual runoff ratios of 9 river basins are estimated using data of the observed runoff and the estimated rainfall of river basin. As a result of analysis, annual runoff ratio of the river basins is mostly ranged from 0.5 to 0.6. Runoff ratio of Xe Done River is extremely low. On the contrary, runoff ratio of Nam Kading, Nam Xane and Nam Lik are comparatively higher and estimated at more than 0.8. It is considered that physical aspects of river basin such as geological conditions of the river basin, soil characteristics, vegetation of upper reaches and reliability of discharge data influence the lower and higher runoff ratios of these river basins.

For estimation of average annual runoff of all river basins, runoff ratio of each river basin is roughly assumed taking into consideration locations among other river basins and topographical conditions. The assumed runoff ratios are summarized as shown in Table 2.4.5.

4.1.6 Annual Runoff in Ordinary Hydrological Years

Total annual runoff of main rivers of Lao PDR is roughly estimated at 229,900 MCM in ordinary hydrological year, as shown in Table 2.4.5. Annual runoffs of main tributaries of the Mekong River are estimated at approximately 214,500 MCM in total and dominantly covered over 93 % of the total annual runoff mentioned above. Annual runoff of bigger than 1,000MCM are identified in some big tributaries of the Mekong River, namely Nam Ngum, Nam Kading, Xe Bang Hiang and Xe Kong. Annual runoffs of other rivers that directly flow into Vietnam area are respectively estimated at approximately 7,185 MCM of Nam Ma River and 8,196 MCM of the Nam Ka River. In addition, mean monthly discharge of major rivers is also shown in Table 2.4.6.

4.1.7 Specific Drought Discharge of Main Rivers

Specific drought discharges of main rivers are estimated using runoff data of the 11 stations of 9 river basins. The specific drought discharge is estimated using minimum discharge of river in the following manners.

- (a) to assume drought year of 80 % chance based on annual rainfall
- (b.1) to select minimum river discharge to conform the selected drought year of 80 % chance as drought runoff, and
- (b.2) to estimate drought river discharge of 90 % chance based on statistic analysis, and
- (c) to divide the minimum river discharge/drought river discharge by river basin area.

Most of specific drought discharge of 80 % chance estimated with a range from 0.7 lit. /sec./km² to 4.5 lit. /sec./km². Specific discharges of rivers of Nam Lik, Lower Nam Ngum and Xe Kong are comparatively higher of than 5.9 lit. /sec./km². Specific drought discharges of 90 % chance range approximately 0.3 lit. /sec./km² to 3.lit. /sec./km² in the most of rivers. However, the specific drought discharge of rivers of Nam Lik and Lower Nam Ngum are respectively estimated at 4.7 lit. /sec./km² and 9.5 lit. /sec./km².

Taking into consideration conditions of topography, vegetation, soils and geology, specific drought discharge of other rivers are assumed based on the results of analysis as shown in Table 2.4.7.

On the other hand, the DMH and the JICA Expert of DMH has surveyed runoff of main rivers in 29 big rivers during the end of the each dry season from 1998 to 1999. The survey resulted that the runoff ranges from 1.1 lit. /sec./km² to 3.7 lit. /sec./km² during low water level of the each river. It can be considered that the runoff is as one of base flows of the each river.

Taking into account that most of the specific drought discharges estimated in this moment are similar to the runoff surveyed by the JICA Expert, the specific discharges of other rivers assumed based on data analysis of the 9 rivers will be accepted.

4.2 Groundwater ^{1/}

The information on hydrogeology presently available and covering the whole of Lao PDR is only “Preliminary Appraisal of the Hydrogeology of the Lower Mekong Basin” published by the Interim Mekong Committee in 1986. This shows that Lao PDR is divided into two geological areas: (i) the Annamian Strata occupying most of northern and eastern part of the country; and (ii) the Indosinian sediments mainly along the Mekong River. The Annamian region includes granites, metamorphics and palaeozoics. The Indosinian region consists of sandstones, siltstones, shales, mudstones, limestones, conglomerates and basalt. There are three different aquifer systems:

- (i) The Annamian aquifers occur randomly. These are local systems that discharge locally to the river or its tributaries. As local flow systems, they are not part of the regional flow system and will not carry pollution into the regional groundwater system. The potential water supply from groundwater in the northern part of the country is considerable in view of the high amount of recharge available. Water quality should be reasonably good and for the most part potable but will be iron rich. Yields up to 5 lit./sec can generally be anticipated.
- (ii) The Indosinian group of aquifers, which have regional flow, includes rock of the Indosinian Moyennes and Superieures and is relatively young. They are mostly freshwater sediments, although there are horizons of brackish water, and one major zone of saline water. Yields of 12 - 24 lit./sec can be developed.
- (iii) The alluvial aquifers associated with the sedimentary deposits of the Mekong River are not rated highly as aquifers.

Limestones in the central Lao PDR is strictly Annamian in age, but its location places it logically in the Indosinian flow system. It has been described as having enormous groundwater resources.

To date no notable investigation and study on the groundwater seem to have been conducted in Lao PDR. In the early 1990's, the Mekong Secretariat carried out a project “Review of Groundwater Data in the Lower Mekong Basin”, and installed 18 observation wells in Lao PDR. Ten wells are installed in Vientiane plane and the rest are located along the Mekong River. The observation revealed an

^{1/} This text is mainly based on “National Water Sector Profile”, ADB in December 1998.

interested fact that the Mekong River has very little influence over the aquifer in the Vientiane plane.

The groundwater will be further developed as the main source of urban and rural water supply and small scale irrigation in lowland areas located far from the surface water resources such as the southern and western part of Champassak Province, the hinterlands of the Sebang Fai, Sebang Hieng and Sedone valley.

4.3 Water Quality

The monitoring of water quality on the Mekong River and its tributaries is the responsibility of the Water Quality Laboratory of the DOI, MAF. The monitoring started in 1985. At present, there are 34 monitoring stations in operation: 4 stations on the Mekong and 15 on 9 major tributaries. The remaining 10 stations are at various locations potentially exposed to water quality degradation, such as downstream of existing reservoirs and That Luang wetland in Vientiane Municipality. Water samples are usually collected on a monthly basis for chemical and biological analysis.

In general, the water quality of rivers within the Lao PDR and the Mekong is considered to be good based on Global Environmental Monitoring Standards. The level of oxygen is high and the nutrient concentration is low. The sediment loads in the tributaries vary considerably from 41 tons/km²/year to 345 tons/km²/year. High levels of suspended sediment occur during the rainy season. Tributaries and river reaches with high sedimentation are the Sebang Hieng, Se Done, Nam Ou and the upper and lower stretches of the Mekong River.

Table

Table 1.1.1 Present Staffing of DMH and Provincial Meteo-Hydrology Division

Expertise	Number of Expertise at Central and Provincial Office																		Total
	DMH	Provincial Meteo-Hydrology Division																	
		Phongsali	L. Namtha	Oudomsay	Bokeo	L.Prabang	Houaphan	Xieng Khouang	Sayabouli	Vientiane	Vientiane Municipality	Borikham say	Khammou ane	Savannak het	Saravane	Sekong	Champasak	Attapeu	
Sr. Meteorologist	4																		4
Jr. Meteorologist	5					1					1						1		8
Sr. Hydrologist	7																		7
Jr. Hydrologist	10					2				1				2				1	16
Sr. Data Analyst	5																		5
Jr. Data Analyst	4																		4
Computer Operator	19																		19
Sr. Researcher for weather forecasting	1																		1
Jr. Researcher for weather forecasting	3																		3
Permanent field staff for data collection	6	4	4	4	3	4	8	6	8	7	4	4	6	14	11	2	18	5	118
Field staff for data collection (Part timer)																			0
Administrator	6	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	25
Accountant	3																		3
Office Worker (Permanent)																			0
Office Worker (Part timer)	3																		3
Driver	3					1													4
																			0
Total	79	5	5	5	4	9	9	7	9	10	5	6	7	17	12	3	22	6	220
Permanent Staff	76	5	5	5	4	9	9	7	9	10	5	6	7	17	12	3	22	6	217
Part Timer	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3

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Table 1.1.2 Present Conditions of Office and Communication System of DMH and Provincial Meteo-Hydrology Division

Description	unit	Number of Office and Communication System at Central and Provincial Office																		Total
		Provincial Meteo-Hydrology Division																		
		DMH	Phongsavath	L. Namtha	Oudomsay	Bokeo	L. Prabang	Houaphan	Xiengkhouang	Sayabouli	Vientiane	Vientiane Municipality	Borikhamxay	Khammouane	Savannakhet	Saravane	Sekong	Champasak	Attapoue	
1 Office and Other Buildings																				
- Meteorological station	location	1	1	1	1	1	1	2	2	1	1		1	1	1	1	2	1	20	
- Agro-meteorological station	location			2	1		1		1	4	4	2	2	3	2	2	4		28	
- Hydrological station	location	1	2	2	4		3	2	5	1	10	6	10	1	2	4	7	3	63	
- Number of staff at main/Provincial office including part time worker	person	76	4	4	5	5	8	9	7	9	10	6	7	9	12	3	21	6	201	
- Total Number of staff at stations including part time workers	person	3					1							8		1		13		
1) Main/Provincial Office (only meteo-hydrological division space)																				
Present condition	m ²	360	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	
		U	U&R	U&R	U&R	U	U	U	U	U	U&R	U	U	U	U	U	U	U	U	
2) Filed/Station Office (Total office space)																				
Present condition	m ²	10000																		
		U																		
3) Staff quarter																				
Present condition	m ²	400	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	
		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
4) Training room																				
Present condition	m ²	240																		
		U																		
2 Communication System & Power Source																				
1) Communication system at Main/Provincial Office																				
- Telephone	nos.	6	1	2	1	1	1	1	1	1	1	1	1	1	2	1	1	1	24	
Present condition		U&R	R	U&R	U&R	R	U&R	U&R	U&R	R	U&R	U&R	R	U&R	U&R	R	U&R	R		
- Facsimile	nos.	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16	
Present condition		U&R		R	R	R	R	R	U&R	R	R	R	R	R	R	R	R	R		
- Wireless Radio System	nos.	3	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	20	
Present condition		U&R	R	R	R	U&R	R	U&R	U&R	R	R		U&R	U&R	R	U&R	U&R	U&R		
- Mail	nos.																			
Present condition		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U		
- Others (man power, other transportation)																				
2) Communication system at Filed/Station Office																				
- Telephone	location														1				1	
Present condition																				
- Facsimile	location																		0	
Present condition																				
- Wireless Radio System	location	3	1	2	1	1	4	1	1	2	3	2	4	2	2	2	2	1	34	
Present condition		U&R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R		
- Mail	location																			
Present condition																				
- Others (man power, other transportation)																				
Present condition																				
3) Power Source for communication																				
- Electricity	location	3	1	1	1	1	1	2	1	1	1	1	1	3	1	1	1	1	23	
Present condition					1															
- Generator	location		1			1												1	4	
Present condition			R			U&R											R	R		
4) Transportation for observation activities and data collection																				
- Car	location	6					1				1			1	1		1		11	
- Motorcycle	location	7								1				2					10	
- Bicycle	location																			
- Navigation	location																			
- Other (on foot)	location																			

Remarks U In use NU & R No use and need of urgent renovation of office
 U & R In use, but need of renovation of office NU & NR No use and no need of urgent renovation of office

Table 1.1.3 Instrument and Equipment for Observation at DMH and PMHD (1/2)

Description		Present Conditions and Number of Instrument and equipment at DMH and DMHP																		
		DMH	Department of Metro-hydrology of PAFS																	
			Phongsali	L. Namtha	Oudomsay	Boko	L.Prabang	Houaphan	Xieng Khouang	Sayabouli	Vientiane	Vientiane Mun.	Borikhamsay	Khammouane	Savannakhet	Saravane	Sekong	Champasack	Attapou	Total
3 Equipment and Instrument																				0
1) Meteorological Observatory																				0
Digital Barometer module Model F4771	location	2																		2
Present condition		R																		0
Mercury Barometer (Fortin,Tonnellot)	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		21
Present condition		U&R	U&R	U&R	U&R	U&R	U&R	U&R	R	U&R	R	U&R	U&R	U&R	U&R	R	U&R	U&R	U&R	0
Barograph (Weekly)	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		21
Present condition		U&R	R	R	R	U&R	U&R	U&R	U&R	U&R	R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	0
Hydrograph (weekly)	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		21
Present condition		U&R	U&R	R	U&R	U&R	U&R	U&R	R	U&R	R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	0
Thermograph (weekly)	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		21
Present condition		U&R	U&R	R	U&R	U&R	U&R	U&R	R	R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	0
Hair Hygrometer	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		20
Present condition		U&R	R		R	R	U&R	R	R	R	R	U&R	R	R	R	R	U&R	R	U&R	0
Wind speed-Direction (Plane type)	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		21
Present condition		U&R	R	U&R	U&R	U&R	U&R	U&R	U&R	R	U&R	U&R	U&R	U&R	R	U&R	U&R	U&R	U&R	0
Wind speed-Direction (Wild type)	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		8
Present condition		U&R	R			R	R		R				R	R						0
Wind Speed -Direction (Ey-1 Model)	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		14
Present condition		U&R	R	R	R	R	R	U&R	R	R	R	R	R	R	R	R	U&R	R	R	0
Totalizing Anemometer (Model 2511)	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		20
Present condition		R	R		R	R	R	R	R	R	R	R	R	R	U&R	R	R	R	R	0
Raingauge	location	3	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		23
Present condition		U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	0
Sunshine recorder (Campbell Stokes type)	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		21
Present condition		U&R	U&R	R	R	R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	R	U&R	U&R	U&R	0
Liquid - in- glass thermometer ordinary	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		21
Present condition		U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	0
Liquid - in- glass thermometer ordinary (maxi)	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		21
Present condition		U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	0
Liquid - in- glass thermometer ordinary (mini)	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		21
Present condition		U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	0
Soil thermometers in different dept	location	5	5	5	5	5	1	10	5	5	5	5	5	15	5	5	10	1		97
Present condition		U&R	U&R	U&R	U&R	U&R	U&R	R	R	R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	0
Evaporation Piche	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		21
Present condition		U&R	U&R	R	U&R	U&R	U&R	R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	0
Evaporation PAN (Class.A)	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		21
Present condition		U&R	R	U&R	U&R	U&R	U&R	R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	0
Psychrometer	location	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	2	1		21
Present condition		U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	0

Remarks U In use
 U & R d of renewal of equipment
 NU & R furgent renewal of equipment
 NU & NR of urgent renewal of equipment

Table 1.1.3 Instrument and Equipment for Observation at DMH and PMHD (2/2)

Description		Present Conditions and Number of Instrument and equipment at DMH and DMHP																		
		DMH	Department of Metro-hydrology of PAFS																	
			Phongsali	L. Namtha	Oudomsay	Bokeo	L.Prabang	Houaphan	Xieng Khouang	Sayabouli	Vientiane	Vientiane Mun.	Borikhamsay	Khammouane	Savannakhet	Saravane	Sekong	Champasack	Attapoue	Total
2) Agro-meteorological Observatory																				
Psychrometer	location			1	1		1		1	4	3	3	1	1	1	2	1	4		0
	Present condition			U&R	U&R		U&R		U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R		24
Raingauge	location			1	1		1		1	4	3	3	1	1	1	2	1	4		24
	Present condition			U&R	U&R		U&R		U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R	U&R		0
Liquid - in- glass thermometer ordinary (maxi)	location			1	1		1		1	4	3	3	1	1	1	2	1	4		24
	Present condition			R	R		U&R		R	R	R	U&R	U&R	U&R	R	R	U&R		0	
Liquid - in- glass thermometer ordinary (mini)	location			1	1		2		1	4	3	3	1	1	1	2	1	4		25
	Present condition			R	R		U&R		R	R	R	U&R	U&R	U&R	R	R	U&R		0	
Thermograph (weekly)	location			1	1		1		1	4	3	3	1	1	1	2	1	4		24
	Present condition			R	R		U&R		R	R	R	R	R	R	R	R	R	R		0
Hygograph (weekly)	location			1	1		1		1	4	3	3	1	1	1	2	1	4		24
	Present condition			R	R		U&R		R	R	R	R	R	R	R	R	R	R		0
Soil thermometers in different dept	location			5	5		5		5	20	15	15	5	5	5	10	5	20		120
	Present condition			R	R		U&R		R	R	R	R	R	R	R	R	R	R		0
Ground Thermometers (Maxi)	location			1	1		1		1	4	3	3	1	1	1	2	1	4		24
	Present condition			R	R		U&R		R	R	R	R	R	R	R	R	R	R		0
Ground Thermometers (Maxi)	location			1	1		1		1	4	3	3	1	1	1	2	1	4		24
	Present condition			R	R		U&R		R	R	R	R	R	R	R	R	R	R		0
Sunshine Recorder (Cambell Stockes type)	location			1	1		1		1	4	3	3	1	1	1	2	1	4		24
	Present condition			R	R		R		R	R	R	R	R	R	R	R	R	R		0
Evaporation Piche	location			1	1		1		1	4	3	3	1	1	1	2	1	4		24
	Present condition			R	R		U&R		R	R	R	U&R	U&R	U&R	U&R	U&R	U&R	U&R		0
Evaporation PAN (Class.A)	location			1	1		1		1	4	3	3	1	1	1	2	1	4		24
	Present condition			R	R		U&R		R	R	R	R	R	U&R	R	U&R	R	R		0
3) Hydrological Observatory																				
- Rain gauge	location	3	3	1	3		3		5				6	5	2	2		7	2	52
	Present condition	U&R	U&R	U&R	U&R		U&R		U&R			U&R	U&R	U&R		U&R		U&R	U&R	0
- Vertical staff gauge	location		2	2	4		3	3	5	1	10		6	4	2	2	4	7	1	56
	Present condition		U&R	U&R	U&R		U&R	U&R	U&R	U&R	U&R		U&R	U&R		U&R	U&R	U&R	U&R	0
- Slope staff gauge	location	1												3	2	1				7
	Present condition	U&R											U&R		U&R					0
- Floating gauge	location																			0
	Present condition																			0
- Curley 622	location	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	19
	Present condition	U&R	R	R	R	R	R	R	R	R	U&R	R	R	R	R	R	R	R	R	0
- Boat	location	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
	Present condition	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	0
- Engine Boat	location	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
	Present condition	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	0

Remarks U In use
 U & R d of renewal of equipment
 NU & R furgent renewal of equipment
 NU & NR of urgent renewal of equipment

AP4T-4

Table 2.2.1 Meteorology Stations in Lao PDR

Main Synoptic Meteorology Station

No.	Name of Station	District	Location		Altitude (EL. m)	Average Rainfall	
			Lat.	Long.		(mm/year)	Period
1.	Luang Prabang		19° 53'	102° 08'	305	1,350	1989-98
2.	Xieng Khouang		19° 28'	103° 08'	1,050	1,327	1988-97
3.	Vieng Say (Houaphan)		20° 25'	104° 14'	913	1,723	1989-98
4.	Xam Neua						
5.	Sayabouly		19° 16'	101° 44'		1,313	1988-97
6.	Oudomsay		20° 41'	102° 00'	550	1,353	1988-97
7.	Houeisai (Bokeo)		20° 16'	100° 25'	360	2,126	1996-98
8.	Vien Tiane	Sikho Tabong	17° 57'	102° 34'	171	1,707	1989-98
9.	B. Na Long Khoun	Phone Hong	18° 28'	102° 24'	171	2,391	1988-97
10.	Pak Sane	Pak Sane	18° 22.3'	103° 40'	155	2,900	1988-98
11.	Thakhek	Thakhek	17° 23.6'	104° 49.4'	153	2,267	1989-98
12.	Savannakhet	Khan Tha Bouly	16° 33'	104° 45'	150	1,457	1988-97
13.	Seno	Seno	16° 40.2'	104° 59'			
14.	Sepone						
15.	Pak Se	Pakse	15° 07'	105° 47'	102	2,050	1989-98
16.	Meuangkhong						
17.	Phongsaly	Phongsaly	21° 42'	102° 45'	1,000	1,690	1990-92/96
18.	Luang Namtha	Namtha	20° 56.7'	101° 24.2'		1,507	1994-98
19.	Saravanne	Saravanne	15° 41'	106° 25'	170	1,921	1988-97
20.	Attapeu	M. May	14° 48'	106° 50'	105	2,558	1989-98
21.	Sekong	Sekong prov.	15° 05'	106° 15'	126	1,279	1991-98

Secondary Synoptic Meteorology Station

No.	Name of Station	District	Location		Altitude (EL. m)	Average Rainfall	
			Lat.	Long.		(mm/year)	Period
1	Meuang Sing						
2	Meuang Viengphoukha						
3	Xieng Ngeun	Luang Prabang	19° 45'	102° 10.5'	304		
4	Meuang Houn						
5	Meuang Kharm						
6	M. Paklay	Sayabouly	18° 12.5'	101° 24.8'			
7	Namtarm	Sayabouly					
8	Botene						
9	Kemethao						
10	Xaisomboun						
11	M. VangVieng	Vang Vieng	18° 55.4'	102° 26.9'	296	3,316	1989-98
12	B. Napheng	Thoulakhom	18° 25'	102° 33'	168	1,772	1988-97
13	Kasy						
14	B. Thangone	Saythany	18° 10'	102° 40'	170	1,781	1988-97
15	Veunkham	Saythany	18° 09'	102° 39'		1,690	1989-98
16	Naphork						
17	B. Hatddorkeo	Hat Sai Fong	17° 52'	102° 36'	169	1,275	1991-96
18	Larksao						
19	Donghene	Artsaphangthong					

Table 2.2.2 Rain Gauging Stations in Lao PDR (1997) (1/3)

No.	Name of Station	Code No.	Year Started	Record in 1991-1996
1. Vientiane Municipality				
1	Vientiane	170203	1907	Available
2	Veunkham	180217	1988	Available
3	Thangone	180202	1970	Available
4	Haddockeo	170207	1966	Available
5	Naxone	180203		Available
6	salakhm			N.A.
7	Naphok		1987	N.A.
8	Maknao			N.A.
2. Phongsaly Province				
1	Pongsaly	210201	1921	Available
2	B. Hatsa			N.A.
3	Muangkhua			N.A.
4	M. Ounua			N.A.
5	M. Yo or M. Bounxay			N.A.
6	B. Outai (M. Gnot Ou)			N.A.
3. Luangnamtha Province				
1	M. Namtha	80101	1929	Available
2	M. Sing			N.A.
4. Oudomxay				
1	Oudomxay (Muangxay)	200204	1929	Available
2	Pakbeng			N.A.
5. Borkeo Province				
1	Houayxai		1921	1996 oly
6. Luangprabang Province				
1	Luangprabang	190202	1901	Available
2	Muangngoi	200201		1992-96
3	Xiengngeun	190205	1929	1993 missing
4	Sengkhalok	190101	1988	Available
5	Nambak			N.A.
6	Pakxeng	190206		1995-96 only
7	Siengmuak			N.A.
8	Kokvan			N.A.
9	B. Se			N.A.
10	B. Hatgna	190208		1995-96 only
11	B. Latkhok (M. Chomphet)			N.A.
12	B. Mout			N.A.
13	B. Phonesaat (M. Nambak)		1987	N.A.
14	B. Khoklin (M. Pak Ou)			N.A.
15	B. Pakgna (M. Phonexay)			N.A.
16	SamGnek (Phoukhoun)			N.A.
7. Huaphanh Province				
1	Viengxay	210104	1976	1995-96 only
2	Xamnua			N.A.
8. Xayabuly Province				
1	Xayabuly	190103	1969	Available
2	Paklay			N.A.
3	Thaduai			N.A.
4	Boten			N.A.
9. Xiengkhuang Province				
1	Xiengkhuang (M. Pek)	190302	1929	Available
2	Phiengluang			N.A.
3	M. Khoun			N.A.
4	M. Phoukout			N.A.

Table 2.2.2 Rain Gauging Stations in Lao PDR (1997) (2/3)

No.	Name of Station	Code No.	Year Started	Record in 1991-1996
10. Vientiane Province				
1	Phonehong	180210	1970	1993-96 only
2	Vangvieng	180207	1929	Available
3	Napheng	180211	1970	1995-96 only
4	Thalat	180212		1995-96 only
5	Hineheup	180205	1990	Available
6	Pakkhanhung	190203		1995-96 only
7	Kasy	180206		Available
8	M. Fuang		1985	N.A.
9	B. Phatang	190204	1984	1995-96 only
10	Sanakham		1995	N.A.
11	B. Keun			N.A.
12	B. Thinko			N.A.
11. Borikhamxay Province				
1	Paksane	180303	1929	1995-96 only
2	Pakthouay	180306	1988	Available
3	Thabok	180304	1986	Available
4	Houayleuk	180221		1995-96 only
5	Muangkao	180307	1986	Available
6	Muangmai	180308	1988	Available
7	Kengkuang	180405	1985	Available
8	Lak 20		1990	N.A.
9	Nape	180505	1992	Available
10	Phonethong (Namphao)			N.A.
11	Sensy			N.A.
12	Namthone			N.A.
13	Pakkading			N.A.
14	Phonesy			N.A.
12. Khammuane Province				
1	Thakhek	170404	1929	Available
2	Mahaxay	170502	1987	Available
3	Signo	170503	1986	Available
4	Kuanpho	170505		Available
5	Sa Ang			N.A.
6	Gnommalath			N.A.
7	Nakai			N.A.
8	Nongbok		1985	N.A.
9	Hineboun	170407		1995-96 only
10	M. Sebangfai	320101		1995 only
13. Savannakhet Province				
1	Savannakhet	160405	1900	Available
2	Seno (M. Outhoumphone)	160502	1929	Available
3	Donghen (Atsaphangthong)	160504		Available
4	Phalan (Atsaphangthong)	160540		Available
5	B. Phn (M. Phin)	160605		Available
6	B. Sepol (M. Sepol)	160601		Available
7	B. Dong (M. Sepol)	160603		Available
8	B. Boung (M. Vilabuly)			N.A.
9	B. Nanhom (N. Vilabuly)	160533		Available
10	B. Nong (M. Nong)	160606		Available
11	B. Kengkabao (M. Xaybuly)			N.A.
12	B. Veun (M. Xaybuly)	160530		1995-96 only
13	B. Paksong (M. Songkhone)	160534		Available
14	B. Sebanghieng (M. Songkhone)			N.A.

No.	Name of Station	Code No.	Year Started	Record in 1991-1996
14. Saravane Province				
1	Saravane	150602	1929	Available
2	LaoNgam	150604	1960	Available
3	Kengsim			N.A.
4	Ta Oy			N.A.
5	Toumlan			N.A.
6	Nakhonepheng			N.A.
7	Khongsedone	150506	1929	Available
8	Samouay			N.A.
9	B. Phone (M. Lamam)			N.A.
10	Vangkanan			N.A.
15. Sekong Province				
1	Sekong	150609	1990	Available
2	Thateng			N.A.
16. Champasack Province				
1	Pakse	150504	1929	Available
2	Xelabam	150508	1985	Available
3	Batieng	160510	1983	Available
4	Km 42 (Paksong)	150603	1983	Available
5	Paksong (Town)	140511	1929	Available
6	Nonghine	150605	1985	Available
7	Nikhom 34	150607	1983	Available
8	Phonethong	140510	1984	Available
9	Pathoumphone	140505	1985	Available
10	Champasack (Town)	140507	1985	Available
11	Soukhouma	140506	1989	Available
12	Mounlapamok	140504	1985	Available
13	Khong	140501	1985	Available
14	Lak 20			N.A.
15	Nongtai			N.A.
16	Nongngam			N.A.
17	Sepian			N.A.
18	Kele			N.A.
19	Itu			N.A.
17. Attapu Province				
1	Attapu (M. Xanxay)	140705	1900	Available
2	B. Pa Am (M. Xaysettha)			N.A.
3	B. Agnak (M. Phouvong)			N.A.
4	B. Mai (M. Sanamxay)			N.A.
5	B. Boungvay (M. Xaysettha)			N.A.
18. Xaysomboun Special Region				
1	Naluang	190301		Available
2	Longcheng			N.A.
3	Phonemuang (M. Longxan)			N.A.

Source : Hydrological Data Book on the Mekong River Basin in Lao PDR, DMH/JICA, MAF, Sept.1997

Table 2.3.1 Hydrology Stations in Lao PDR (2000) (1/3)

No.	Name of River	No. on Map	Name of Station	District	Location		Catchment Area (Km2)	Zero of Gauge		Observed Item	Time Started	WL Rec 1991-1'
					Lat.	Long.		EL. in meter	Agency			
1	Mekong	1	Xiengkong		20° 53' 48"	100° 38' 30"			MCTPC	H		N.A.
2	Mekong	2	Tonpheng		20° 17' 15"	100° 05' 30"			MCTPC	H		N.A.
3	Mekong	3	Huaysai		20° 16' 54"	100° 24' 20"			MCTPC	H		N.A.
4	Mekong	4	Pakbeng		19° 05' 30"	101° 06' 54"		298.852	MCTPC	H, Q, S	1976	
5	Mekong	5	Viengkham (L.prabang)		19° 53' 30"	102° 08' 12"	268.000	267.195	MCTPC	H, Q, S, W	1914	
6	Mekong	6	Sayabuly		19° 26' 00"	101° 50' 00"			MCTPC	H		N.A.
7	Mekong	7	Paklay		18° 12' 30"	101° 24' 48"		210.088	MCTPC	H		
8	Mekong	8	Sanakham		17° 54' 30"	101° 40' 00"			MCTPC	H		N.A.
9	Mekong	9	Km 4 (Vientiane)		17° 55' 42"	102° 37' 12"	299.000	158.040	MCTPC	H, Q, S, W	1895	
10	Mekong	10	Paksane		18° 22' 18"	103° 40' 00"		142.125	MAF	H	Mar. 1976	
11	Mekong	11	Thakhek		17° 23' 36"	104° 48' 24"	373.000	129.629	MCTPC	H, Q, S, W	1935	
12	Mekong	11-1	Kengkabao		16° 48' 48"	104° 45' 00"		128.000	MCTPC	H	May 1965	
13	Mekong	12	Savannakhet		16° 33' 42"	104° 44' 48"	391.000	125.410	MCTPC	H, Q, S, W	1914	
14	Mekong	13	Paktaphan		15° 56' 00"	105° 21' 00"			MAF	H	1991	N.A.
15	Mekong	14	Pakse		15° 07' 00"	105° 48' 00"	545.000	86.490	MCTPC	H, Q, S, W	1914	
16	Mekong	15	B. Channoy		14° 19' 30"	105° 53' 12"	549.000	80.224	MCTPC	H	Feb. 1960	
17	Mekong	16	B. Khontai						MCTPC	H		
18	Mekong	17	Thakho						MCTPC	H		
19	Mekong	18	Don Sadam						MCTPC	H		
20	Mekong	19	Huaysahongtaai						MCTPC	H		
21	Mekong	20	Veunkham						MCTPC	H	Jun. 1990	N.A.
22	Nam Tha	21	B. Nah Tha	Luangnamtha	21° 00' 18"	101° 25' 06"	1,519		MCTPC	H	Apr. 1976	
23	N. Leng/N. Boum	24	B. Khon/B.Gnong	Phongsaly	21° 24' 35"	101° 57' 10"	795		MCTPC	H	Jun. 1996	
24	N. Bak	25	N. Bak	M. Ngoy	20° 38' 00"	102° 27' 00"	1,743		MCTPC	H		
25	N. Ngieo		B. Phonegneng	Xien Khouang					MAF	H	Jan. 1986	
26	Nam Mat		B. Napa	Xien Khouang					MAF	H	May 1986	
27	N. Kho		B. Lat Ngone	Xien Khouang					MAF	H	1996	
28	N. Ou	22	B. Tang/Outai	Phongsaly	22° 07' 00"	101° 47' 00"	1,083		MAF	H	May 1996	
29	N. Ou	23	Hatsa Nua	Phongsaly	21° 44' 30"	102° 12' 00"	5,894		MCTPC	H	May 1996	
30	N. Ou	26	M. Ngoy	M. Ngoy	20° 45' 52"	102° 36' 53"	19,698		MCTPC	H, Q, S	1978	
31	N. Ou	78	Nong Khieu	Luang Prabang	20° 05' 00"	102° 15' 30"	24,470		MCTPC	H		N.A.
32	N. Xuang (Soung)	27	Sieao (Sibounheung)	Luang Prabang	19° 58' 12"	102° 16' 24"	5,800		MCTPC	H, Q, S	1963	
33	N. Pa	28	Kok Van	Luang Prabang	19° 57' 12"	102° 17' 54"	700		MCTPC	H, Q	1981	
34	N. Pa		B. Mixai	Sansai					MAF	H	Feb. 1999	
35	N. Khan	74	Pak Bak	Luang Prabang	19° 44' 36"	102° 16' 48"	6,503	306.896	MCTPC	H, Q	Apr. 1985	
36	N. Khan	75	B. Mixay (Mout)	Luang Prabang	19° 47' 12"	102° 10' 36"	6,777	293.830	MCTPC	H, Q	1960	
37	N. Ko		M. Xay	Oudomxay					MAF	H	Mar.1998	
38	N. Beng		M. Houne	Oudomxay					MAF	H	June 1998	
39	N. Beng		B. Phangthong	Oudomxay					MAF	H	Apr.1999	
40	N. Phak		M. La	Oudomxay					MAF	H	June 1998	

EL : MSL ko lak detum

(HD): MSL Hondau Vietnam

Source : Hydrological Data Book on the Mekong River Basin in Lao PDR, DMH/JICA, NAF, Sept.1997

Table 2.3.1 Hydrology Stations in Lao PDR (2000) (2/3)

No.	Name of River	No. on Map	Name of Station	District	Location		Catchment Area (Km2)	Zero of Gauge		Observed Item	Time Started	WL Rec 1991-1'
					Lat.	Long.		EL. in meter	Agency			
41	N. Sei		M. Nampr	Oudomxay					MAF	H	Mar. 1999	
42	N. Nga		B. Done En	Oudomxay					MAF	H	May 1999	
43	Nam Heung	89	Kenthao	Sayabuly	17° 43' 50"	101° 24' 00"			MCTPC	H		N.A.
44	N. Song	31	Vang Vieng	Vang Vieng	18° 54' 24"	102° 26' 54"	864		MAF	H, Q	1979	
45	N. Song	76	Vangkhy	Vang Vieng	18° 46' 00"	102° 24' 00"			MAF	H		
46	N. Lik	29	Kasy	Kasy	19° 13' 54"	102° 15' 24"	374		MAF	H, Q	1987	
47	N. Lik	30	Hienheup	Feuang	18° 39' 48"	102° 21' 18"	5,115	179.264	MAF	H, Q, S	1963	
48	N. Ngum	32	Phiengluang	Phonesavane	19° 31' 36"	103° 03' 54"	715		MAF	H	May 1986	N.A.
49	N. Ngum	34	Longcheng	Longcheng	19° 05' 30"	102° 52' 20"	3,770		MAF	H, Q, S, W	Jun. 1995	N.A.
50	N. Ngum	35	Naluang	Vangvieng	18° 54' 48"	102° 46' 42"	4,852		MAF	H, Q, S	Aug. 1985	
51	N. Ngum	79	Thalat	Phonehong	18° 31' 00"	102° 31' 00"	8,280	161.130	MAF	H, Q, S, W	Oct. 1963	
52	N. Ngum	37	Pakkangnong		18° 25' 06"	102° 33' 00"	13,560	159.020	MAF	H, Q, S		
53	N. Ngum	80	Veunkham	Saythany	18° 11' 00"	102° 37' 00"	15,230		MAF	H, Q	1989	
54	N. Ngum	38	Thangone		18° 08' 06"	102° 37' 18"		150.000	MAF	H, Q, S	Jan. 1960	
55	N. Ngum	39	Nabong		18° 10' 50"	102° 53' 00"	16,310		MAF	H	1987	
56	N. Ngum	81	Pakngum	Pakngum	18° 08' 42"	103° 06' 06"	16,792		MAF	H	Jun. 1960	
57	N. Xan	36	Nongmuang	Hom	18° 32' 10"	102° 57' 54"	441		MAF	H, Q	Jul. 1996	
58	N. Leuk	40	Tadleuk	Thaphabad	18° 26' 00"	103° 06' 00"	542		MAF	H, Q	1989	
59	N. Mang	41	Hatkhay		18° 24' 12"	103° 09' 48"	743		MAF	H, Q	Jul. 1985	
60	N. Ngiep	43	Muangmai	Borikhane	18° 30' 18"	103° 39' 42"	4,305	152.512	MAF	H, Q	1978	
61	N. Sane	42	Muangkao		18° 33' 42"	103° 44' 12"	2,029		MAF	H, Q	1978	
62	N. Theune	44	Signo	Nakai	17° 50' 42"	105° 03' 06"	3,370		MAF	H, Q, S, W	May 1986	
63	N. Theune	45	Dam Site		17° 59' 36"	104° 57' 20"	3,906		MAF	H, Q, S, W	Jun. 1994	N.A.
64	N. Theune	47	Kengkuang	Khamkeut	18° 14' 06"	104° 39' 42"	5,650		MAF	H, Q	1985	
65	N. Cading	48	Phonesy	Pakcading	18° 18' 06"	104° 05' 54"	14,175		MAF	H, Q	1960	
66	N. Cading	82	Pakcading		18° 19' 12"	103° 59' 48"	14,961	155.771	MAF	H	May 1984	
67	N. Gnuang	46	Sensy		18° 20' 00"	104° 54' 30"	2,280		MAF	H, Q, S, W	Jun. 1995	N.A.
68	N. Hineboune	91	Hineboune	Hinebune	17° 44' 00"	104° 34' 00"	2,057		MAF	H	Feb. 1993	N.A.
69	N. Gnom	51	S.Bounheung	Gnommalath	17° 36' 15"	105° 10' 20"	53		MAF	H, Q, S	Aug. 1994	N.A.
70	N. Gnom	50	Boungbao		17° 34' 20"	105° 13' 30"	276		MAF	H, Q, S	Jun. 1994	N.A.
71	Sebangfai	83	Khuanepho		17° 29' 48"	105° 25' 42"	3,216		MAF	H		
72	Sebangfai	52	Mahaxay	Mahaxay	17° 25' 00"	105° 11' 30"	4,520		MAF	H, Q, S	Jul. 1988	
73	Sebangfai	49	Tonhen	Sebangfai	17° 03' 54"	104° 54' 06"	8,783		MCTPC	H	May 1996	
74	Sebangfai	53	Bridge 13		17° 04' 18"	104° 59' 06"	8,560	125.000	MCTPC	H, Q	1960	
75	Sebangfai		B. Saang	Bualapha					MAF	H	Feb. 1993	
76	Se Namnoy		B. Nanhom	Vilabuly					MAF	H	Feb. 1993	
77	Sepon	84	Muangchanh	Sepon	16° 39' 36"	106° 17' 30"	1,465		MCTPC	H, Q	1976	
78	Sesangsoy	56	Phalan	Atsaphanthon	16° 39' 24"	105° 34' 06"	892		MCTPC	H, Q	1978	
79	Sethamouak	55	Bridge 9 M. Phine	Phine	16° 34' 36"	105° 54' 48"	608		MCTPC	H, Q	1977	
80	Selanong	77	M. Nong	Nong	16° 22' 12"	106° 30' 48"	2,011		MCTPC	H, Q	1978	

EL : MSL ko lak detum

(HD): MSL Hondau Vietnam

Source : Hydrological Data Book on the Mekong River Basin in Lao PDR, DMH/JICA, NAF, Sept.1997

Table 2.3.1 Hydrology Stations in Lao PDR (2000) (3/3)

No.	Name of River	No. on Map	Name of Station	District	Location		Catchment Area (Km2)	Zero of Gauge		Observed Item	Time Started	WL Rec 1991-1'
					Lat.	Long.		EL. in meter	Agency			
81	Sechamphone	58	Kengkok	Champhone	16° 26' 42"	105° 12' 12"	2,733	(HD) 130.378	MCTPC	H, Q, S	1974	
82	Sechamphone	57	Donghen	Atsaphanthon	16° 42' 00"	105° 22' 00"	1,525	(HD) 136.266	MCTPC	H, Q	1987	
83	Sebanghieng	54	Sopnam	Sepon	16° 41' 12"	106° 13' 06"	4,362		MCTPC	H, Q	1987	
84	Sebanghieng	85	Tad Hay	Phine	16° 18' 00"	105° 58' 00"			MAF	H	Feb. 1993	
85	Sebanghieng	59	Kengdone	Songkhone	16° 11' 06"	105° 19' 00"	19,400		MCTPC	H, Q	1960	
86	Sebanghieng	86	Lahanam		16° 16' 00"	105° 16' 06"	18,500	(HD) 121.826	MAF	H	1995	
87	Sebanghieng	60	Kengtagnan		16° 05' 54"	105° 17' 40"	19,850		MCTPC	H		
88	Sebangnuan	61	Bridge 13		16° 00' 20"	105° 28' 30"	1,350		MAF	H	1988	
89	Sedone	62	Saravane	Saravane	15° 42' 36"	106° 27' 00"	1,172		MAF	H, Q	Jul. 1986	
90	Sedone	63	Khongsedone	Khongsedone	15° 34' 30"	105° 48' 54"	5,152		MAF	H, Q	1967	
91	Sedone	64	Souvannakhili	Sanasomboun	15° 23' 48"	105° 49' 30"	5,760		MAF	H, Q, S, W	Jul. 1986	
92	Sedone	87	Nanay		15° 22' 42"	105° 49' 24"	6,170		MAF	H, Q	Feb. 1960	
93	Sedone	88	Donxe		15° 19' 54"	105° 49' 00"			MAF	H	1986	
94	Sedone		B. Pakhonglak	Saravane					MAF	H	Jan. 1998	
95	Huay Gngang	90	Km 8 (M. Pakse)	Pakse	15° 07' 00"	105° 52' 30"	27	158.621	MCTPC	H, Q	May 1963	
96	Huay Champi	65	Itu/Km 34	Paksong	15° 11' 06"	106° 14' 36"	54		MCTPC	H, Q	1974	
97	Huay Champi	66	Batieng	Batieng	15° 15' 00"	105° 56' 00"	204		MAF	H, Q	1995	
98	Huay Banglieng	67	Km 24 Road 13		15° 58' 48"	105° 55' 18"	460	89.003	MCTPC	H, Q	Apr. 1974	
99	Huay Tomo	68	H. Tomo (Tomonok)		14° 50' 30"	105° 57' 30"	130	95.059	MCTPC	H, Q		
100	Huay Phaling	69	Dou	Phonethong	15° 08' 00"	105° 38' 00"	145		MAF	H	Jun. 1990	N.A.
101	Huay Ke	33	B. Ke		15° 06' 00"	105° 39' 30"	110		MAF	H	May 1990	N.A.
102	Huay Khamuane	70	Soukhouma	Soukhouma	14° 38' 00"	105° 51' 48"	1,106		MAF	H		
103	N. Gngong		B. Vanghua	Thoulakhom					MAF	H	Oct. 1993	
104	Sekong	71	Sekong	Sekong	15° 26' 00"	106° 44' 00"	5,539		MAF	H, Q	1989	
105	Sekong	73	Attapeu	Attapeu	14° 48' 24"	106° 50' 36"	10,500		MAF	H, Q	Jun. 1987	
106	Sekong	92	B. Saphao	Attapeu	14° 48' 30"	106° 47' 30"	17,000		MAF	H, Q	Feb. 1997	
107	Sekong		B. Veunkhen	Attapeu					MAF	H	Feb. 1997	
108	Sekong		B. Thakho	Attapeu					MAF	H	Feb. 1997	
109	Sesou		B. Antum	Attapeu					MAF	H	Apr. 1998	
110	Sesou		B. Dong Ngui	Attapeu					MAF	H	Feb. 1994	
111	Nam Kong		B. Keng Gnoui	Attapeu					MAF	H	Feb. 1997	
112	Sekhamane	72	Fangdeng	Attapeu	14° 48' 35"	106° 56' 00"	4,454		MAF	H, Q	Dec. 1989	
113	Sekhamane		B. Hatsaikhao	Attapeu					MAF	H	Jan. 1995	
114	Sekhamane		B. Tadkoum	Xaysetha					MAF	H	June 1994	
115	Sekhamane		B. Thakhome	Attapeu					MAF	H	Jan. 1997	
116	Sepian	93	B. Mai	Attapeu	14° 42' 30"	106° 30' 00"	1,038		MAF	H	1996	

EL : MSL ko lak detum

(HD): MSL Hondau Vietnam

Source : Hydrological Data Book on the Mekong River Basin in Lao PDR, DMH/JICA, NAF, Sept.1997

Table 2.3.2 Dry Season Discharge of Mekong's Tributaries in Lao PDR

Region and River Basin/ Name of River	Catchment Area Km2	Discharge m3/sec	Basin Unit Discharge lit/sec/ha	Remarks
Luangnamtha & Borkeo				
Nam Ma	1 080	5.9	5.5	
Nam Pha	2 860	14.3	5.0	
Nam Ngam	1 500	2.8	1.9	
Nam Tha	8 990	15.3	1.7	
Nam Beng	2 120	2.5	1.2	
Nam Xe	1 519	1.4	0.9	
Nam Ou River Basin				
Nam Leng	1 451	4.9	3.4	
Nam Lan	656	2.0	3.0	
Nam Phak	2 716	8.0	2.9	
Nam Bak	1 162	3.6	3.1	
Nam Nga	2 375	7.2	3.0	
B. Hatsa	5 894	21.3	3.6	
M. Ngoy	19 700	70.9	3.6	
Nam Ou	24 500	76.3	3.1	
Luangphabang				
Nam Xeng	2 052	5.1	2.5	
Nam Xuang	6 580	19.1	2.9	
Nam Pa	700	2.2	3.1	
Nam Khan	7 380	17.8	2.4	
Nam Ming	1 053	4.2	4.0	
Xaiyabouly				
Nam Ngum	1 830	2.0	1.1	
Nam Houng	2 940	7.0	2.4	
Nam Pouy	1 700	4.7	2.8	
Nam Phoun	1 980	2.9	1.5	(*)
Nam Mi	1 040	0.0	0.0	(*)
Nam Heung	1 940	1.6	0.8	
Vientiane & Borlikhamxai				
Naluang	4 852	-		
B. Kasy	374	1.4	3.7	
B. Vangvieng	864	6.2	7.2	
Nam Sang	1 300	0.5	0.4	
Nam Ngum	16 790	309.0	18.4	D/S of dam
Nam Mang	1 860	13.8	7.4	(*)
Nam Ngiep	4 490	37.8	8.4	(*)
Nam Xan	2 220	20.8	9.4	(*)
Borlikhamxai & Khammouane				
Nam Cading	14 175	79.2	5.6	
Nam Hinboun	3 380	5.7	1.7	
Nam Theun	3 370	20.2	6.0	
Xe Bangfai	4 520	6.0	1.3	(*)
Xe Bangfai	9 330	20.8	2.2	
Savannakhet				
Sepan	1 979	7.8	3.9	
Xe Banghlang	4 362	29.2	6.7	
Xe Thamouak	608	0.5	0.8	
Xe Xangroy	892	0.0	0.0	
Xe Champhon	1 526	0.2	0.1	
Xe Champhon	2 733	0.8	0.3	
Xe Banglang	18 502	37.2	2.0	
Xe Banghiang	19 970	37.2	1.9	
Xe Bangnouan	1 420	0.0	0.0	
Pakse				
Salavan	1 172	1.3	1.1	
Khongsedone	5 152	7.9	1.5	
Nanai	6 170	6.5	1.1	
Kengkeo	7 069	9.4	1.3	
Xe Kong Basin				
Xe Kong	5 539	55.9	10.1	
Xe Namnoy	1 501	4.0	2.7	
Se Kong	15 641	144.5	9.2	
Sepian	1 051	5.1	4.9	
Xe Kaman	4 451	57.5	12.9	
Xe Kaman	6 316	73.3	11.6	

Note (*) Discharge measured after rainfall in the basin

Source Water Resources Map in the Dry Season on the Mekong River Tributaries in the Lao PDR
May 1998, DMH, MAF cooperated by JICA

Table 3.2.1 Identified Matters of Proposed Rain Gauge and Staff Gauge Station (2/3)

No.	Registration No. of Station	Location	River to be monitored/observed	Catchment Area (km2)	Purposes of Equipment Installation		Identified Matters of Existing Station		Works carried out during the Survey and to be carried out for construction	
					Rain Gauge	Staff Gauge	Rain Gauge	Staff Gauge	Rain Gauge	Staff Gauge
7	81	Ban Pakngum, Vientiane Municipality (new station)	Nam Ngum	16 792	For strengthening of hydrological data collection	For flood forecast in down stream area from Nam Ngum dam	There is no station.	Pakngum station has been proposed by the DMH, but it will be rather convenient for operation comparing to newly selected station. Existing staff gauge of the Pakngum station has not been functioned.	Field inspection & site selection, negotiation with village people and administration procedure.	Site has been selected at bridge of national highway No.13 located near Hai village and cross section of river slope will be surveyed.
8	10	Ban Pakxan, Bori Khamxay Province	Mekong	-	For mitigation of flood damage and agriculture development	For flood forecast	Existing meteo-station is being functioned, but no installation of recorder	Existing staff gauge has been maintained well and is being functioned in river bank protection project area.	Only renewal of rain gauge equipment at the same meteo-station	Cross section of the existing slope gauge has been surveyed to install equipment.
9	11	Thakhek, Kham Mouan Province	Mekong	373 000	For mitigation of flood damage and agriculture development	For flood forecast	Existing meteo-station is being functioned, but no installation of recorder	Existing slope staff gauge is being functioned. But owner of the existing station is MCTPC. Mutual agreement on construction of facility and the integrated operation of the station will be strongly requested.	Only renewal of rain gauge equipment at the same meteo-station	Cross section of the existing slope gauge has been surveyed to install equipment. Urgent confirmation on construction and future operation of observation / reporting system to MRC will be requested to DMH and MCTPC before commencement of construction.
10	52	Ban Mahaxay, Kham Mouan Province	Xe Bangfai	4 520	For mitigation of flood damage and agriculture development in down stream of Xe Bangfai	For measurement of river discharge & flood forecast	Existing rain gauge station is being functioned.	Existing slope staff gauge is being functioned.	No need because of management of DMH	No proposed by DMH
11	58	Ban Kengkok, Savan Nakhet Province	Xe Champong	2 733	For mitigation of flood damage and agriculture development in Xe Champon basin	For measurement of river discharge & flood forecast	Existing rain gauge station is being functioned at Kengkok village.	Existing staff gauges are being functioned at 2 sites of Kengkok village area, but river banks are formulated by erosive soils well along the Xe Champong river. It is not suitable to construct slope type of staff gauge along the river.	Only renewal of rain gauge equipment at the same station	Cancellation of construction due to survey results

Table 3.2.1 Identified Matters of Proposed Rain Gauge and Staff Gauge Stations (3/3)

No.	Registration No. of Station	Location	River to be monitored/observed	Catchment Area (km ²)	Purposes of Equipment Installation		Identified Matters of Existing Station		Works carried out during the Survey and to be carried out for construction	
					Rain Gauge	Staff Gauge	Rain Gauge	Staff Gauge	Rain Gauge	Staff Gauge
12	no	Ban Dong, Savan Nakhet Province	Xe Pon		For mitigation of flood damage and agriculture development in Xe Banghiang basin	For measurement of river discharge & flood forecast	Existing old rain gauge station is being functioned.	No existing staff gauge & newly proposed	No need because of management of DMH	No proposed by DMH
13	86	Ban Lahanam, Savan Nakhet Province	Xe Banghiang	18 500	For mitigation of flood damage and agriculture development in Xe Banghiang basin	For measurement of river discharge & flood forecast	Existing rain gauge station is being functioned at the slope staff gauge station.	Existing staff gauge is being functioned. However, the slope gauge station has been damaged by floods in the last year and PVC pipe and sensor have been damaged.	No need because of management of DMH	No proposed by DMH because of grass root project, but urgent repairing of slope gauge and re-installation of censer needs
14	73	Attapeu town, Attapeu Province	Xe Kong	10 500	For strengthening hydrological data collection in middle reach of the Xe Kong river.	For measurement of river discharge & flood forecast	Existing rain gauge station is being functioned at Attapeu meteo-station.	Existing staff gauge is being functioned, river discharge has been measured using wire cable system.	Only renewal of rain gauge equipment at Attapeu meteo-station	Plan survey on river course has been ordered to topo-survey company with technical instruction of DMH.
15	no	Ban Kaluem, Xekong Province	Xe Kong		For strengthening hydrological data collection in upper reach of the Xe Kong river	For measurement of river discharge & flood forecast	There is no existing rain gauge. Suitable site has been selected in school of Kaluem village area.	There is no existing staff gauge. Suitable site is selected approx. 3 km upper stream from Kaluem village and operation problem will be considered.	Site has been selected at school. Negotiation with village people and administration procedure on land use will be requested soon.	Discussion on future operation has been made among provincial AFSSO, DMH and survey team, and AFSSO promised to provide motor cycle at Kaluem village and special transportation budget from Xe Kong to Kaluem. Plan survey on river course has been instructed by DMH at Kaluem village site.

Table 3.7.1 Proposed Transceiver and Generator Set

No.	Station	Proposed location				Purpose	Proposed transceiver (unit)	Proposed generator (unit)	Owner	Re-location					Counter proposal by PAFSO	Judgement
		Province	District	Village	Location					Reasons	Province	District	Village	Location		
1	Attapue	Attapue				F.F for Xekong river	1	0	PHD	Existing TR has been in use at PHD since 1997. It is not necessary to install new TR.					No counter proposal	No installation
2	Xekong	Xekong				F.F for Xekong river	1	0	PHD	Existing TR has been in use at PHD since 1998. It is not necessary to install new TR.					PAFSO requests new TR at Thaten meteo-station. But, priority of installation is low under this implementation.	No installation
3	Salavan	Salavan				F.F for Xedong river	1	0	PHD	Existing TR has been in use at PHD since 19xx (?). But it is recommended to make renewal of TR for Salavan and to add new TR for Khong Xedong hydrological station in stead of installation of new TR at Attapue station for strengthening flood forecast.					PAFSO requests new TR at Khong Xedong hydrological station along Xedong river.	Renewal at Salavan PHD and installation at Khong Xedong sta.
4	-	Savannakhet				-	0	0		Existing TR has been in use at PHD since 1997. It is not necessary to install new TR. But it is recommended to install new TR at Dongheing and Palane hydrological stations for strengthening of flood forecast.					PAFSO requests to install new TR at Ban Dongheing along Xe Chanphone river.	Installation at Dongheing sta.
5	Thakhek	Khammuan				F.F for Mekong river	1	0	PHD/PCTPC	Existing TR has been in use at PHD since 1986. It is recommended to make renewal of TR. And, it is recommended to install new TR at Mahaxay hydrological station for flood forecast.					DMH/PAFSO request to install new TR at Mahaxay along Xe Banfai river	Renewal at Kamuan PHD and installation at Mahaxay sta.
6	Pakxane	Borikhamxay				F.F for Mekong river	1	1	PHD	Existing TR has been in use at PHD since 1998. It is not necessary to install new TR. It is recommended to shift installation new TR from Pakxane hydrological station to Laksao meteo-station because of communication of Laksao.					PAFSO requests new TR at Laksao meteo-station together with generator and battery. DMH/PAFSO request to install new TR at Phonsali along Nam Kading river	Installation at Laksao meteo-station and Phonsali hydrologu station.
7	Ban Hai	Vientiane		Hai	DAFSO	F.F for Num Ngum river	1	0	PHD	No need of re-location.						Installation at District Office
8	Vienthong	Vientiane		Hinheup		F.F for Num Ngum river	1	0	Hydrological station	No need of re-location.						Installation at hydrological sta.
9	Naluang	Saisomboun		Naluang		F.F for Nam Ngum river	1	0	Hydrological station	No need of re-location.						Installation at hydrological sta.
10	Phieng Luang	Xiengkhuang		Ban Phieng		F.F for Nam Ngum river	1	0	PHD	No need of re-location.						Installation at Xiengkhuang PHD
11	Hatphaot	Luangprabang		Hatphaot		F.F for Nam Suang river	1	0	Teacher's house	No need of re-location.						Installation at teacher's house
12	Pakbeng	Oudomxay		Pakbeng		F.F for Mekong river	1	0	PCTPC	Existing TR has been in use at station since 1978, and it is recommended to make renewal of TR.						Renewal of Pakbeng PCTPC
13	Hongluoy	Luangnamtha		Hongluoy		F.F for Nam Tha river	1	0	PHD	No need of re-location.						Installation at Luangnamth PHD
14	Xiengkok	Luangnamtha		Xiengkok		F.F for Mekong river	1	0	village office or teacher's house	No need of re-location.					PAFSO requests new TR together with generator and battery fro Laksao meteo-station.	Installation at village office or teacher's house

Note : PAFSO Provincial Agriculture and Forestry Service Office
 DAFSDistrict Agriculture and Forestry Service Office
 PHD Meteo-hydrology Devision of PAFSO
 PCTPC Service Office of Communication, Transportation, Post and Construction under PAFSO
 F.F Flood forecast
 TR Transceiver

Table 3.7.2 Proposed Computer and Generator Set

No.	Proposed location				Purpose	Proposed computer (unit)	Proposed generator (unit)	Owner	Re-location					Counter proposal	Balance
	Province	District	Village	Location					Reason	Province	District	Village	Location		
1	Attapue			PHD	DL for Attapue S.S & Kenxay R.S	1	0	PHD							
2	Xekong			PHD	DL for Chumla R.S	1	0	PHD							
3	Savannakhet			PHD	DL for Tang Vay R.S	1	0	PHD							
4	Khammuane			PCTPC	DL for Thakekh S.S and Hinboun R.S	1	0	PCTPC							
5	Borikhamsay			PHD	DL for Pakxan S.S, Phonsy R.S and Phamuang R.S	1	0	PHD							
6	Luangprabang			PHD	DL for Hatphaot S.S	1	0	PHD							
7	Odomxay			PHD	DL for Pakbeng S.S and Sopchek R.S	1	0	PHD							
8	Luangnamtha			PHD	DL for Xiengkong S.S/R.S and Hongluay S.S/R.S	1	0	PHD							
9	Xaiyabuly			PHD	DL for Namon R.S	1	0	PHD							
10	Xiengkhuang			PHD	DL for Phieng S.S, Nam Neun R.S and Phieng Luang	1	0	PHD							
11	Vientiane			PHD	DL for B.Hai S.S/R.S and Vienthong S.S	1	0	PHD							
12	Xumnua			DMH	DL for Muang Et R.S	-	-	DMH							
13	Xaisomboun			DMH	DL for Naluang S.S	-	-	DMH							

Note : PAFSO Provincial Agriculture and Forestry Service Office
DAFSO District Agriculture and Forestry Service Office
PHD Meteo-hydrology Division of PAFSO
PCTPC Service Office of Communication, Transportation, Post and Construction under PAFSO
F.F Flood forecast
TR Transceiver

Table 3.8.1 (1/7) Rainfall 2001

Station: Xiengkok No. 1

Date/Month	April	May	June
1	-	2.0	14.0
2	-	0.0	4.5
3	-	27.5	-
4	-	13.5	-
5	-	18.5	-
6	-	15.5	-
7	-	0.0	-
8	-	12.5	-
9	-	0.0	-
10	-	98.0	-
11	-	7.5	-
12	-	22.5	-
13	-	51.5	-
14	-	24.5	-
15	-	70.0	-
16	13.5	6.5	-
17	25.0	0.0	-
18	0.0	2.5	-
19	0.0	8.5	-
20	0.0	14.5	-
21	0.0	3.5	-
22	0.0	0.0	-
23	4.0	0.0	-
24	0.0	3.5	-
25	0.0	14.0	-
26	0.0	3.0	-
27	0.0	5.0	-
28	22.0	13.0	-
29	1.5	9.0	-
30	2.5	46.0	-
31	-	62.5	-
Total	68.5	555.0	18.5

Station: Hong leuay No.2

Date/Month	April	May	June	July
1	-	3.0	0.0	0.0
2	-	0.0	7.0	4.5
3	-	7.0	0.5	13.0
4	-	0.0	1.0	82.5
5	-	0.0	0.0	28.0
6	-	0.0	16.0	41.0
7	-	11.5	4.5	29.5
8	-	6.0	6.0	15.0
9	-	6.5	4.0	3.0
10	-	0.5	19.5	9.0
11	-	89.5	30.5	2.5
12	-	14.0	30.5	1.0
13	-	35.0	7.0	0.5
14	-	29.0	0.0	7.0
15	-	17.0	0.0	13.5
16	-	1.5	9.0	32.0
17	-	0.0	3.5	3.0
18	-	0.5	1.0	1.0
19	-	5.5	0.0	-
20	-	4.0	0.0	-
21	-	3.5	0.0	-
22	-	1.0	26.5	-
23	-	26.5	1.0	-
24	-	0.0	0.0	-
25	-	0.0	0.0	-
26	-	7.5	4.5	-
27	-	16.0	0.5	-
28	1.5	26.5	4.5	-
29	5.0	1.5	35.5	-
30	9.0	3.5	22.5	-
31	-	0.0	-	-
Total	-	316.5	235.0	-

Station: Ban Sopchek No.4

Date/Month	April
1	-
2	-
3	-
4	-
5	-
6	-
7	-
8	-
9	-
10	-
11	1.0
12	23.5
13	1.0
14	4.0
15	0.0
16	0.0
17	1.0
18	0.0
19	0.0
20	13.0
21	0.0
22	0.0
23	0.0
24	0.0
25	0.0
26	0.0
27	0.0
28	0.0
29	0.0
30	23.0
31	-
Total	-

Table 3.8.1 (2/7) Rainfall 2001

Station: Naluang No. 6

Date/Month	March	April	May	June
1	-	0.0	0.0	0.5
2	-	0.0	19.5	0.0
3	-	0.0	3.5	24.0
4	-	0.0	10.5	63.0
5	-	0.0	0.5	51.0
6	-	0.0	1.0	1.5
7	-	0.0	0.0	16.5
8	-	0.0	0.0	26.5
9	-	0.0	4.0	-
10	-	0.0	25.0	-
11	-	0.0	41.5	-
12	-	5.0	58.0	-
13	-	4.0	3.0	-
14	-	0.0	0.0	-
15	-	0.0	22.0	-
16	-	0.0	1.0	-
17	-	0.0	0.0	-
18	-	0.0	31.5	-
19	-	0.0	29.5	-
20	-	0.0	24.0	-
21	-	0.0	13.0	-
22	-	0.0	7.0	-
23	-	0.0	11.5	-
24	-	0.0	6.5	-
25	1.0	0.0	38.0	-
26	0.0	0.0	27.5	-
27	35.5	0.0	0.5	-
28	4.0	0.0	26.0	-
29	7.5	0.0	28.5	-
30	0.0	0.0	20.0	-
31	0.0	-	26.5	-
Total	-	9.0	479.5	-

Station: Ban Hay No. 7

Date/Month	May	June	July	August
1	-	29.5	0.0	0.0
2	-	32.5	2.0	47.5
3	-	40.0	15.0	37.5
4	-	0.0	29.5	3.0
5	-	19.5	29.0	0.5
6	-	1.0	0.0	12.5
7	-	14.0	0.0	31.0
8	-	18.5	11.5	2.0
9	-	7.5	70.5	32.0
10	34.5	45.0	0.0	-
11	0.0	25.5	0.0	-
12	0.0	24.5	0.0	-
13	0.0	57.0	0.0	-
14	0.0	0.0	36.5	-
15	0.0	3.0	5.5	-
16	0.0	3.0	0.0	-
17	6.5	0.0	2.0	-
18	65.0	0.0	0.0	-
19	65.5	0.0	0.5	-
20	30.0	0.0	14.0	-
21	8.0	0.0	35.5	-
22	0.5	27.0	31.0	-
23	16.5	0.0	17.0	-
24	18.5	5.5	7.0	-
25	29.5	1.5	8.5	-
26	4.0	0.0	59.0	-
27	4.5	31.0	14.0	-
28	65.5	9.0	15.5	-
29	44.0	10.5	0.0	-
30	36.0	18.5	0.0	-
31	27.0	-	9.0	-
Total	-	423.5	412.5	-

Station: Phameaun No. 8

Date/Month	April	May	June	July	August
1	-	27.0	1.5	20.0	2.5
2	-	26.0	0.0	0.0	32.5
3	-	17.5	37.5	9.0	75.5
4	-	0.5	7.0	50.5	0.0
5	-	2.0	0.5	3.0	6.0
6	-	7.0	7.0	1.0	8.5
7	-	0.0	11.5	1.0	32.5
8	-	0.0	9.0	4.0	10.5
9	-	0.0	3.0	12.5	2.5
10	-	56.0	34.5	13.5	-
11	-	0.0	33.5	0.0	-
12	-	0.0	18.0	0.0	-
13	-	0.0	15.5	47.5	-
14	-	0.0	0.0	19.0	-
15	-	9.5	52.0	44.0	-
16	-	0.0	7.5	1.5	-
17	-	64.0	0.0	63.5	-
18	-	25.0	5.5	4.5	-
19	-	25.0	8.5	24.0	-
20	-	2.0	6.5	51.0	-
21	-	11.5	5.5	25.0	-
22	-	1.0	2.0	26.5	-
23	2.5	0.0	0.0	31.5	-
24	21.0	0.0	6.5	31.5	-
25	0.0	23.0	21.5	4.5	-
26	2.0	40.5	0.0	40.0	-
27	0.0	55.5	18.5	15.0	-
28	0.0	8.5	3.0	7.5	-
29	19.0	66.0	48.5	0.5	-
30	0.0	21.0	26.0	0.0	-
31	-	27.5	-	0.5	-
Total	-	516.0	390.0	552.0	-

Table 3.8.1 (3/7) Rainfall 2001

Station: Ban Phiangdang No.15 (Nam Neun),
Xiengkhouang Province.

Date/Month	April	May	June	July
1	-	0.0	26.0	0.5
2	-	5.0	7.0	0.0
3	-	9.5	1.0	4.0
4	-	0.0	1.5	22.5
5	-	0.0	9.5	0.0
6	-	0.0	2.0	0.0
7	-	0.0	0.0	0.0
8	-	0.0	0.0	3.5
9	-	0.0	7.5	12.0
10	-	10.0	3.0	0.0
11	-	0.0	2.5	0.0
12	-	0.0	3.5	0.0
13	-	0.0	53.0	0.0
14	-	0.0	0.0	0.5
15	-	0.0	0.0	1.0
16	-	0.0	1.0	5.5
17	-	0.0	0.0	30.5
18	-	16.0	0.0	0.0
19	-	31.5	0.0	37.0
20	-	52.0	0.0	1.0
21	-	13.5	1.5	0.5
22	-	0.0	0.0	9.5
23	-	0.0	0.0	43.5
24	3	2.0	0.5	10.0
25	2	0.0	0.5	2.0
26	0	9.0	0.0	-
27	10.5	0.0	10.0	-
28	0	30.0	19.0	-
29	16.5	2.5	13.5	-
30	0	21.0	2.0	-
31	-	31.5	-	-
Total	-	233.5	164.5	-

Station: Chunla No. 12

Date/Month	April	May	June	July
1	-	0.0	0.0	0.5
2	-	0.0	1.0	3.0
3	-	2.5	0.0	0.0
4	-	0.0	21.5	13.5
5	-	7.5	0.5	5.5
6	-	0.0	12.0	4.5
7	-	0.0	15.0	16.0
8	-	0.0	2.0	139.5
9	-	0.5	4.5	10.5
10	-	4.0	21.5	2.5
11	-	1.0	2.0	0.5
12	-	49.0	0.0	0.5
13	-	40.0	0.0	4.5
14	-	6.5	11.0	-
15	-	0.5	2.5	-
16	-	23.0	22.0	-
17	-	25.0	3.0	-
18	8.0	4.5	4.0	-
19	0.0	0.5	0.0	-
20	8.5	1.0	0.0	-
21	6.0	0.0	10.0	-
22	0.0	0.0	0.0	-
23	0.0	0.0	23.0	-
24	0.0	0.0	30.0	-
25	0.0	9.5	14.5	-
26	0.0	36.5	7.0	-
27	0.0	3.0	4.5	-
28	0.0	1.5	22.0	-
29	0.0	5.0	33.0	-
30	0.0	18.5	5.5	-
31	-	0.0	-	-
Total	-	239.5	272.0	-

Station: Ban Pakhinboune No. 9

Date/Month	April	May	June	July	August
1	-	3.0	0.0	41.5	20.5
2	-	8.5	16.0	16.0	19.0
3	-	4.0	3.5	23.5	57.0
4	-	32.0	0.0	1.5	12.5
5	-	0.0	60.0	12.5	5.0
6	-	0.0	25.0	35.0	9.0
7	-	0.0	0.0	1.5	6.0
8	-	0.0	56.5	65.0	27.0
9	-	0.0	12.5	2.0	133.0
10	-	6.0	16.0	1.5	0.5
11	-	0.5	8.0	0.5	-
12	-	0.0	42.5	6.0	-
13	-	0.0	2.0	31.0	-
14	-	0.0	48.0	2.0	-
15	-	3.0	18.0	7.0	-
16	-	1.5	24.5	23.5	-
17	-	1.0	3.5	1.0	-
18	-	20.0	0.0	1.0	-
19	-	58.0	0.0	0.0	-
20	-	20.0	0.0	35.0	-
21	-	7.0	0.0	117.0	-
22	-	31.5	1.5	17.0	-
23	-	6.0	5.5	0.0	-
24	-	5.5	23.5	0.0	-
25	-	32.5	3.5	0.0	-
26	-	3.5	5.0	32.0	-
27	-	1.0	5.0	37.5	-
28	-	48.5	24.0	10.5	-
29	-	55.5	13.5	2.0	-
30	4.0	0.0	72.0	38.5	-
31	-	29.0	-	8.5	-
Total	-	377.5	489.5	570.0	-

Table 3.8.1(4/7) Rainfall 2001

Station: Ban Phonsy No. 10

Date/Month	April	May	June	July	August
1	-	73.0	0.0	0.5	5.5
2	-	1.5	5.0	24.5	36.0
3	-	2.0	61.5	82.5	20.5
4	-	45.0	20.5	113.5	-
5	-	0.5	24.0	2.0	-
6	-	0.0	26.5	53.0	-
7	-	0.0	14.0	19.0	-
8	-	0.0	1.0	1.0	-
9	-	0.0	3.0	63.5	-
10	-	24.0	65.5	14.5	-
11	-	0.0	59.0	0.0	-
12	-	0.0	112.5	14.0	-
13	-	0.0	122.5	11.5	-
14	1.5	0.0	7.0	17.0	-
15	0.0	7.0	0.0	48.0	-
16	0.0	0.0	42.5	50.0	-
17	16.0	4.0	1.0	38.0	-
18	0.0	22.5	8.0	0.5	-
19	0.0	13.5	0.0	21.0	-
20	0.0	14.5	0.0	24.5	-
21	0.0	77.5	1.5	42.5	-
22	0.0	2.5	0.0	23.0	-
23	0.0	74.5	5.0	2.5	-
24	27.5	47.0	27.5	10.0	-
25	0.0	1.5	15.5	32.5	-
26	0.0	6.5	46.5	20.0	-
27	0.0	7.5	99.0	40.5	-
28	0.0	27.5	53.5	12.5	-
29	16.5	39.5	34.0	6.5	-
30	0.0	58.0	28.0	0.0	-
31	-	28.0	-	26.0	-
Total	-	577.5	884.0	814.5	-

Station: Kengxay No. 14

Date/Month	April	May	June	July	August
1	-	1.5	0.0	0.0	0.0
2	-	0.0	3.0	0.0	0.0
3	-	0.0	0.0	0.0	0.0
4	-	0.0	7.5	11.0	1.5
5	-	0.0	3.0	37.0	1.5
6	-	0.0	1.0	25.5	14.0
7	-	0.0	3.5	49.0	11.0
8	-	4.5	20.0	22.0	17.5
9	-	0.0	0.0	2.0	34.0
10	-	10.0	5.0	0.0	42.5
11	-	3.5	0.5	2.0	28.0
12	-	90.0	0.0	0.0	-
13	-	58.5	0.0	0.0	-
14	-	44.5	21.0	0.0	-
15	-	0.0	4.0	2.0	-
16	-	26.0	19.0	0.0	-
17	-	10.5	0.0	0.0	-
18	-	0.0	1.0	6.5	-
19	-	9.5	2.0	0.0	-
20	28.5	0.0	4.0	53.5	-
21	0.0	0.0	4.0	6.5	-
22	0.0	0.0	10.5	1.5	-
23	0.0	0.5	12.5	0.0	-
24	0.0	0.0	44.5	0.5	-
25	0.0	0.0	2.0	8.5	-
26	0.0	2.0	2.5	2.5	-
27	2.0	1.0	3.0	3.5	-
28	0.0	5.0	6.5	1.5	-
29	15.0	0.5	7.5	0.5	-
30	0.0	0.0	19.5	0.0	-
31	-	0.0	-	1.0	-
Total	-	267.5	207.0	236.5	-

Table 3.8.1 (5/7) Average Water Level of Main Rivers 2001

Station: Paksane No. 8
River : Mekong

Average Daily Water Level (unit: m)				
Date/Month	May	June	July	August
1	-	7.125	8.973	12.765
2	-	7.194	9.186	12.617
3	-	7.217	9.185	12.445
4	-	7.661	9.250	12.549
5	-	8.217	9.919	12.753
6	-	8.217	10.338	13.016
7	-	9.161	10.598	13.347
8	-	9.353	10.975	13.615
9	-	9.792	11.132	13.762
10	3.164	10.226	11.399	13.938
11	3.259	10.262	11.624	-
12	3.468	10.052	11.635	-
13	3.513	9.781	11.579	-
14	3.527	9.740	11.556	-
15	3.577	9.540	11.619	-
16	3.654	9.016	11.838	-
17	3.807	8.738	11.852	-
18	3.943	8.660	11.799	-
19	4.219	8.660	11.866	-
20	4.481	8.615	11.965	-
21	4.902	8.545	12.234	-
22	5.371	8.367	12.631	-
23	5.858	8.109	12.857	-
24	6.265	7.797	13.059	-
25	6.390	7.505	13.041	-
26	6.307	7.333	12.923	-
27	6.512	7.620	12.822	-
28	6.674	7.950	12.794	-
29	6.715	8.130	12.851	-
30	6.900	8.371	12.887	-
31	7.054	-	12.838	-
Average	-	8.565	11.588	-
Min.	-	7.125	8.973	-
Max.	-	10.262	13.059	-

Station: Ban Hai, No.7
River : Nam Ngum

Average Daily Water Level (unit: m)				
Date/Month	May	June	July	August
1	-	6.947	9.027	13.038
2	-	7.210	9.233	12.844
3	-	7.674	9.273	12.686
4	-	7.982	9.277	12.723
5	-	8.585	9.355	13.021
6	-	9.343	9.826	13.662
7	-	9.595	10.519	14.084
8	-	9.783	11.098	14.287
9	-	10.269	11.162	14.400
10	3.983	10.594	11.314	14.484
11	4.046	10.436	11.630	-
12	4.103	10.038	11.854	-
13	4.209	9.696	11.858	-
14	4.277	9.482	11.817	-
15	4.335	9.161	11.762	-
16	4.433	8.891	11.831	-
17	4.596	8.853	11.848	-
18	4.692	8.879	11.876	-
19	4.829	8.960	11.952	-
20	5.153	9.003	12.245	-
21	5.696	8.899	12.701	-
22	6.191	8.619	12.934	-
23	6.659	8.296	13.042	-
24	6.891	7.950	13.137	-
25	6.869	7.672	13.093	-
26	6.800	7.527	13.019	-
27	6.804	7.709	12.964	-
28	6.820	8.011	12.971	-
29	6.859	8.212	13.049	-
30	6.920	8.424	13.152	-
31	6.941	-	13.151	-
Average	-	8.757	11.676	-
Min.	-	6.947	9.027	-
Max.	-	10.594	13.152	-

Station: Vienthong Station No.11,
River : Nam Lik, Vientiane Province.

Average Daily Water Level (unit: m)				
Date/Month	May	June	July	August
1	-	2.231	-	-
2	-	2.136	-	-
3	0.077	1.402	-	-
4	0.193	1.025	-	-
5	0.140	0.938	-	-
6	0.217	0.908	-	-
7	0.201	0.852	-	-
8	0.171	0.879	-	-
9	0.091	0.842	-	-
10	0.063	-	-	-
11	0.218	-	-	-
12	0.254	-	-	-
13	0.304	-	-	-
14	0.310	-	-	-
15	0.191	-	-	-
16	0.235	-	-	-
17	0.403	-	-	-
18	0.346	-	-	-
19	0.300	-	-	-
20	0.456	-	-	-
21	0.491	-	-	-
22	0.572	-	-	-
23	0.667	-	-	-
24	0.594	-	-	-
25	0.684	-	-	-
26	0.536	-	-	-
27	0.725	-	-	-
28	1.076	-	-	-
29	1.586	-	-	-
30	1.224	-	-	-
31	1.373	-	-	-
Average	0.472	-	-	-
Min.	0.063	-	-	-
Max.	1.586	-	-	-

Table 3.8.1 (6/7) Water Level of Main Rivers 2001

Station: Ban Naluang No. 6
River : Nam Ngum

Average Daily Water Level (unit: m)			
Date/Month	April	May	June
1	-	0.136	1.780
2	-	0.132	1.783
3	-	0.277	1.404
4	-	0.346	1.288
5	-	0.362	1.369
6	-	0.377	1.292
7	-	0.303	1.226
8	-	0.256	1.341
9	-	0.219	1.381
10	-	0.205	-
11	-	0.373	-
12	-	0.535	-
13	-	1.076	-
14	-	0.621	-
15	-	0.488	-
16	-	0.507	-
17	-	0.545	-
18	-	0.438	-
19	-	0.459	-
20	-	0.684	-
21	-	1.057	-
22	-	1.051	-
23	0.181	0.985	-
24	0.168	1.140	-
25	0.157	0.997	-
26	0.154	1.158	-
27	0.148	1.639	-
28	0.152	1.657	-
29	0.161	1.527	-
30	0.152	1.415	-
31	-	1.509	-
Average	-	0.725	-
Min.	-	0.132	-
Max.	-	1.657	-

Station: Ban Phiang Luang, No.5
River : Nam Ngum

Average Daily Water Level (unit: m)			
Date/Month	April	May	June
1	-	0.400	0.948
2	-	0.417	0.781
3	-	0.562	0.673
4	-	0.668	0.610
5	-	0.616	0.576
6	-	0.562	0.553
7	-	0.501	-
8	-	0.505	-
9	-	0.467	-
10	-	0.442	-
11	-	0.453	-
12	-	0.563	-
13	-	0.485	-
14	-	0.446	-
15	-	0.422	-
16	-	0.434	-
17	-	0.417	-
18	-	0.402	-
19	-	0.524	-
20	-	0.524	-
21	-	0.747	-
22	-	0.646	-
23	-	1.041	-
24	0.384	0.745	-
25	0.382	0.654	-
26	0.424	0.665	-
27	0.498	0.755	-
28	0.457	0.787	-
29	0.414	0.916	-
30	0.393	0.978	-
31	-	0.940	-
Average	-	0.603	-
Min.	-	0.400	-
Max.	-	1.041	-

Station: Hong Leuay, No.2
River : Nam Tha

Average Daily Water Level (unit: m)			
Date/Month	April	May	June
1	-	-	-
2	-	-	-
3	-	-	-
4	-	-	-
5	-	-	-
6	-	-	-
7	-	-	-
8	-	-	-
9	0.036	-	-
10	0.033	-	-
11	0.030	-	-
12	0.027	-	-
13	0.026	-	-
14	0.043	-	-
15	0.050	-	-
16	0.033	-	-
17	0.004	-	-
18	0.030	-	-
19	0.029	-	-
20	0.018	-	-
21	0.011	-	-
22	0.004	-	-
23	(0.001)	-	-
24	0.001	-	-
25	0.004	-	-
26	(0.001)	-	-
27	0.003	-	-
28	-	-	-
29	-	-	-
30	-	-	-
31	-	-	-
Average	-	-	-
Min.	-	-	-
Max.	-	-	-

Table 3.8.1 (7/7) Water Level of Main Rivers 2001

Station: Attapeu No. 10

River : Xekong

Average Daily Water Level (unit: m)				
Date/Month	April	May	June	July
1	-	0.002	0.135	2.526
2	-	0.004	0.095	2.477
3	-	0.111	0.128	3.068
4	-	0.086	0.593	3.852
5	-	0.070	0.562	4.406
6	-	0.030	0.482	4.482
7	-	0.018	0.473	6.010
8	-	0.018	0.411	7.483
9	-	-0.005	0.136	6.173
10	-	-0.002	0.158	4.543
11	-	-0.002	0.321	3.608
12	-	0.100	0.340	-
13	-	0.611	0.297	-
14	-	1.212	0.501	-
15	-	1.260	0.918	-
16	-	0.852	2.311	-
17	-	1.821	1.935	-
18	-	1.884	1.328	-
19	-	1.377	1.021	-
20	-	1.070	1.447	-
21	-	0.745	1.185	-
22	-	0.548	2.473	-
23	-	0.418	1.775	-
24	-	0.374	2.329	-
25	-	0.326	2.928	-
26	-	0.304	2.510	-
27	-	0.464	2.474	-
28	0.000	0.402	2.513	-
29	0.005	0.541	2.811	-
30	0.007	0.374	2.698	-
31	-	0.138	-	-
Average	-	0.489	1.243	-
Min.	-	-0.005	0.095	-
Max.	-	1.884	2.928	-

Table 4.1.1 Hydrological Stations and Available Data (1/2)

No.	River basin /Catchment area	Basin Area (km ²)	Rainfall station	Available data	Drought year (T-1/5)		Hydrological station	Catchment area of Station (Km ²)	Available data
1	Nam Ma	6 059	non				non		
2	Nam Pha	2 860	non				non		
3	Nam Kha	1 110	non				non		
4	Nam Ngam	1 500	non				non		
5	Nam Tha	8 990	Luang Nam Tha	1993-1999	1997		non		
6	Nam Beng	2 120	non				non		
7	Nam Ou	24 470	Phongsali	1990-1999	1999	*1	Muang Ngoy	19 700	1978(87) ?-2000 (N.A)
			Oudomxai	1991-1999	1999				
			Mouan Ngoy, Luangprabang	1992-1999	(1998)/1999*				
8	Nam Xuang	5 800	non			*1	Xiboun Heung	5 800	1967-1972, 1974-1979, 987-2000 (N.A)
						*1	Kok Vane	700	1981(88)?-2000 (N.A)
9	Nam Khan	6 770	Luangprabang	1950-1999	1998	*1	Pak Bak	6 503	1985-2000 (N.A)
			Xieng Ngeun, Luangprabang	1992-1999	1992*/(1995)	*1	Moud (Mixay)	6 777	1960-2000 (N.A)
10	Nam Ngum, Sayabouly Pro.	1 830	non				non		
11	Nam Houng	2 940	Sayabouly	1965-1999	1997		non		
12	Nam Pouly	1 700	non				non		
13	Nam Phoun	1 980	non				non		
14	Nam Heung	1 940	non				non		
15	Nam Mi	1 040	non				non		
16	Nam Sang	1 300	non				non		
17	Nam Thon	553	non				non		
18	Nam Et		non				non		
19	Nam Xan	4 328	non			*1	Nong Muang	441	1996- ?? (N.A)
20	Nam Luong		Vian Xai, Xam Nua Pro.	1994-1999	1998		non		
21	Nam Neun	3 732	non				non		
22	Nam Mat	2 052	non				non		
23	Nam Mo	1 728	non				non		
24	Nam Lik	4 980	Kasy	1969-1976, 1988-1998	1993		Kasy	374	1988-1989, 1992-1994, 1996-1999 (P.A)
			Hineheup	1968-1976, 1982-1999	(1993)/1996*		Hienheup	5 115	1963-1975, 1981, 1983-1999 (P.A)
			Thalat	1980-1998	(1987)/1998*		Vangvieng	864	1987-1995, 1997-1999
			Phatang	1997	N.A because of data				
			Vangvieng	1972-1999	1982				
25	Upper Nam Ngum		Xieng Khouang	1982-1999	1993*/(1998)		Naluang	4 852	1987-1989, 1990-1999 (P.A)
			Naluang	1987-1999	(1988)/1993*				
26	Lower Nam Ngum	16 790	Pakkagnoung	1965-1968, 1970-1976, 1989-1999	1968		Pakkanhoung	13 560	1991-1999
			Napheng	1971-1999	1980	*1	Tha Lat	8 280	1966-1983, 1985-1988 (N.A)
			Veunkha, Vientiane Municipality	1990-1998	1990	*1	Tha Ngone		1961-1985, 1987-1988 (N.A)
			Tha Ngon	1971-1995	(1983)/1988*				
			Naphok	1997-1999	N.A because of data				
			Vientiane	1951-2000	(1993)/1998*				
27	Nam Mang	1 860	Tadluek	1991-1999	1995	*1	Tat Luek	542	1991-1996, 1997-2000 ?(N.A)
						*1	Hatk Hai	743	1991-1993 ? (N.A)
28	Nam Ngiep	4 305	Muang Mai	1978-1979, 1988-1999	1989		Muang Mai	4 305	1991-1999

Note: (1992)/1998* * The nearest hydrological year to the statistic value

() The second nearest hydrological year to the statistic value

N.A : Not available

P.A : Partially available

*1 Hydrological data was not found out due to data compilation problems of DMH during the Study

Table 4.1.1 Hydrological Stations and Available Data(2/2)

No.	River basin /Catchment area	Basin Area (km2)	Rainfall station	Available data	Drought year (T-1/5)		Hydrological station	Catchment area of Station (Km2)	Available data	
29	Nam Xane	2 029	Muang Kao	1978-1979, 1985-1999	1990		Muang Kao	2 029	1987-1999 (P.A)	
			Paksane	1990-1999	1995					
30	Nam Kading	14 175	Signo	1992-1999	1993*/(1999)		Signo	3 370	1986-2000 (P.A)	
			Nape	1988-1999	(1994)/1999*	*1	Keng Kuang	5 650	1985-1986, 1990-1993 (N.A)	
			Keng Kuang	1985-1987, 1990	N.A because of data	*1	Phone Sy	14 175	1960, 1984- (N.A)	
31	Nam Thon	797	non			non				
32	Nam Hinboun	3 380	non			non				
33	Nam Don	674	Thakhek	1987-1999	1992		non			
34	Xe Banfai	9 330	Kuan Pho	1994-1995, 1997-1999	N.A because of data		Mahaxay	4 520	1988-1993, 1994-1997, 1999 (P.A)	
			Mahaxay	1993-1999	1993	*1	Highway Bridge(Xe Banfai)	8 560	1960-1985, 1994-2000 (N.A)	
			Veune, Savannakhet	1989-1999	(1993)/1995*					
35	Nam Thahao	692	non			non				
36	Houy Sompoy	448	Savannakhet	1971-1999	1983*/(1988)		non			
			Seno	1961-1999	1983					
37	Xe Bang Hiang	9 330	Muang Nong	1989-1999	(1993)/1994*	*1	Keng Kok	2 733	1978-1984, 1987-2000 (N.A)	
			Dong	1988-1999	1993	*1	Dong Hen	1 525	1990, 1993-2000 (N.A)	
			Xepon				*1	Highway Bridge(Xe Thamouak	608	1990-1991, 1993-2000 (N.A)
			Muang Phine	1988-1999	(1988)/1993*	*1	Muang Nong	2 011	1990-2000 (N.A)	
			Phalane	1990-1997	1994	*1	Sopnam (Rsepol)	4 362	1988-2000 (N.A)	
			Donghen	1988-1999	(1988)/1993*	*1	Keng Done	19 400	1960-1979, 1988-2000 (N.A)	
			Kengkok	1988-1999	1998	*1	Phalane	892	1990-2000 (N.A)	
			Kengdone	1993-1997	1993					
38	Xe Bangnouan	1 420	Xenuan	1987-1997	1995		non			
39	Xe Done	7 320	Salavan	1981-1984, 1990-1999	1993		Souvanakhily	5 760	1986-1994, 1996-1999 (P.A)	
			Laongam	1991-1992, 1994-1999	1997	*1	Itou Km35	54	1996-2000 (N.A)	
			Khongsedone	1988-1999	(1988)/1989*	*1	Saravan	1 172	1989-1992, 1994-1996 (N.A)	
			Xelabam	1988-1999	1993	*1	Kong Xedone	5 152	1989-1990, 1992, 1996-1999 (N.A)	
			Nonghine	1993-1999	1995					
			Bachian	1991-1999	1993					
			Pakxong	1992-1999	(1993)/1995*					
Pakse	1951-2000	1988*/(1990/1995)								
40	Houy Phaling	469	Phonthong	1993-1995	N.A because of data		non			
41	Houy Khannouan	1 620	Soukhouna	1993-1999	1998	*1	Mai Vang Makxeo		1995-2000 (N.A)	
42	Houy Kadian		Mounlapamok	1965-1970, 1979-1999	1969*/(1983/1993)		non			
43	Nam Lepou	1 540	non				non			
44	Houy Banglieng	508	non			*1	Banglieng	460	1994-2000 (N.A)	
45	Houy Touay	370	non				non			
46	Houy Tomo	153	Pathoumphone	1979-1986, 1993-1999	1983	*1	Tomo Km 40	130	1994-2000 (N.A)	
47	Xe Kong	22 960	Nikhom 34	1990-1999	(1990)/1993*	*1	PhoneM. Lamam	5 539	1994-2000 (N.A)	
			Xe Kong	1994-1999	N.A because of data		Attapeu	10 500	1989-1996, 1998-2000 (P.A)	
			Km 42	1990-1999	(1993)/1995*	*1	Saphao	15 641	1999-2000 (N.A)	
			Attapeu	1989-1999	(1992)/1999*	*1	Phang Deng	4 454	1991-2000 (N.A)	
				1999						

Note: (1992)/1998* * The nearest hydrological year to the statistic value

() The second nearest hydrological year to the statistic value

N.A : Not available

P.A : Partially available

*1 Hydrological data was not found out due to data completion problems of DMH during the Study

Table 4.1.2 Mean Monthly Rainfall in Ordinary Hydrological Year (1/2)

No.	River Basin	Rain Gauge Station	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	
1	Nam Ma	non															
2	Nam Pha	non															
3	Nam Kha	non															
4	Nam Ngam	non															
5	Nam Tha	Luang Nam Tha	1999	50	0	6	43	374	167	260	253	177	104	72	38	1,542	
6	Nam Beng	non															
7	Nam Ou	Phongsali	1996	0	46	24	51	165	208	426	399	156	79	40	62	1,655	
		Oudomxai	1998	28		57	146	143	291	237	221	190	43	20	9	1,384	
		Mouan Ngoy, Luangprabang	1995	0	1	14	14	79	401	281	252	94	178	60	0	1,374	
8	Nam Xuang	non															
9	Nam Khan	Luangprabang	1999	9	0	44	60	204	281	74	285	198	98	55	45	1,351	
		Xieng Ngeun, Luangprabang	(1994)/1999*	3	0	33	114	276	260	113	138	184	87	33	0	1,240	
10	Nam Ngum, Sayabouly Pro.	non															
11	Nam Houng	Sayabouly	1996	0	13	54	124	48	208	212	256	252	68	58	0	1,293	
12	Nam Pouly	non															
13	Nam Phoun	non															
14	Nam Heung	non															
15	Nam Mi	non															
16	Nam Sang	non															
17	Nam Thon	non															
18	Nam Et	non															
19	Nam Xan	non															
20	Nam Luong	Vian Xai, Xam Nua Pro.	1999	4	3	50	161	367	283	167	496	152	72	54	59	1,867	
21	Nam Neun	non															
22	Nam Mat	non															
23	Nam Mo	non															
24	Nam Lik	Kasy	(1994)/1995*	0	0	63	98	259	483	425	350	255	84	40	0	2,055	
		Hineheup	1994	0	0	75	70	364	244	186	345	258	101	1	0	1,643	
		Thalat	(1988)/1996*	0	19	51	300	87	344	253	416	231	131	0	0	1,830	
		Phatang															
		Vangvieng	1998	0	16	47	239	288	459	780	682	457	102	65	5	3,140	
25	Upper Nam Ngum	Xieng Khouang	1999	5	0	54	117	212	209	147	407	125	46	23	17	1,363	
		Naluang	1999	8	0	77	207	598	491	481	318	318	60	0	0	2,559	
26	Lower Nam Ngum	Pakkagnoung	1994	0	4	109	5	458	266	379	459	296	85	21	24	2,105	
		Napheng	1996	0	63	68	80	84	351	478	646	380	61	181	0	2,391	
		Veunkham, Vientiane Municipality	1996	3	47	119	176	182	298	244	306	436	89	82	0	1,980	
		Tha Ngon	1985	20	32	31	57	191	491	360	214	250	170	2	0	1,818	
		Naphok															
27	Nam Mang	Vientiane	1986*/(1987)	0	3	2	119	383	256	309	318	275	67	0	21	1,753	
27	Nam Mang	Tadluek	1998	0	49	64	140	432	385	509	662	576	175	0	0	2,992	
28	Nam Ngiep	Muang Mai	1990	14	61	145	123	620	884	990	628	381	55	14	0	3,916	

Note: (1992)/1998*

* The nearest hydrological year to the statistic value

() The second nearest hydrological year to the statistic value

Table 4.1.2 Mean Monthly Rainfall in Ordinary Hydrological Year (2/2)

No.	River Basin	Rain Gauge Station	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
29	Nam Xane	Muang Kao	1994	0	88	108	61	288	756	656	613	272	52	0	14	2,908
		Paksane	1992	0	0	1	51	97	153	416	793	792	486	303	59	3,153
30	Nam Kading	Signo	1995	0	9	32	78	374	607	483	574	224	188	8	0	2,577
		Nape	1993	0	22	21	133	336	307	261	523	142	6	47	0	1,797
		Keng Kuang														
31	Nam Thon	non														
32	Nam Hinboun	non														
33	Nam Don	Thakhek	1994	0	61	95	56	170	709	512	428	243	41	1	0	2,315
34	Xe Banfai	Kuan Pho														
		Mahaxay	1997	1	24	65	65	238	395	691	721	389	96	0	0	2,683
		Veune, Savannakhet	1994	0	70	25	55	137	422	293	488	125	18	0	0	1,633
35	Nam Thahao	non														
36	Houy Sompoy	Savannakhet	(1987)/1991*	0	0	13	5	95	251	168	403	401	169	0	34	1,539
		Seno	1994	0	53	32	97	207	194	120	455	193	20	0	0	1,370
37	Xe Bang Hiang	Muang Nong	1997	7	18	37	206	115	169	198	516	191	67	2	5	1,531
		Dong	1991	0	0	24	8	262	293	326	526	117	211	0	35	1,801
		Xepon														
		Muang Phine	1991	0	0	11	53	241	248	428	594	422	155	0	37	2,188
		Phalane	1997	1	29	125	145	89	150	236	835	109	96	0	0	1,814
		Donghen	1994	0	66	36	99	259	478	214	402	199	22	0	0	1,775
		Kengkong	1995	0	30	42	26	147	168	544	267	115	94	6	0	1,440
		Kengdone	1995	0	11	20	26	141	295	294	307	240	56	30	0	1,419
38	Xe Bangnouan	Xenuan	1997	25	61	84	72	397	131	512	293	58	66	0	0	1,697
39	Xe Done	Salavan	1997	12	49	22	140	260	309	418	514	169	41	0	0	1,933
		Laongam	1992	55	6	0	59	214	435	331	553	333	97	0	0	2,082
		Khongsedone	1999	1	0	75	181	397	281	337	179	242	107	47	1	1,847
		Xelabam	1996	0	12	5	169	388	163	287	292	604	130	28	0	2,077
		Nonghine	1999	96	0	120	264	276	363	640	451	218	223	81	0	2,733
		Bachian	1996	0	39	1	129	327	218	351	428	712	174	0	0	2,380
		Pakxong	1997	4	79	108	320	248	499	1,085	890	317	131	58	35	3,773
		Pakse	1987	0	0	14	59	139	430	663	552	167	60	28	0	2,112
40	Houy Phaling	Phonthong														
41	Houy Khannouan	Soukhouna	1994	0	0	62	58	202	281	376	304	658	93	0	2	2,035
42	Houy Kadian	Mounlapamok	1996	0	0	1	148	316	345	231	225	263	122	196	0	1,847
43	Nam Lepou	non														
44	Houy Banglieng	non														
45	Houy Touay	non														
46	Houy Tomo	Pathoumphone	1994	0	0	62	58	202	281	376	304	658	93	0	2	2,034
47	Xe Kong	Nikhom 34	1994	2	4	224	195	272	507	1,095	430	638	219	33	50	3,668
		Xe Kong														
		Km 42	1994	2	4	224	195	272	507	1,095	430	638	219	33	50	3,668
		Attapeu	1999	2	0	22	417	227	354	601	460	301	140	45	1	2,569

Note: (1992)/1998*

* The nearest hydrological year to the statistic value

() The second nearest hydrological year to the statistic value

Table 4.1.3 Drought Rainfall (Point Rainfall) T=5 years (1/2)

No.	River Basin	Rain Station	Probable Drought Year T=5	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	
1	Nam Ma	non															
2	Nam Pha	non															
3	Nam Kha	non															
4	Nam Ngam	non															
5	Nam Tha	Luang Nam Tha	1997	2	2	66	59	52	72	386	362	221	111	57	15	1,406	
6	Nam Beng	non															
7	Nam Ou	Phongsali	1999	53	31	18	186	268	170	20	463	124	82	46	44	1,505	
		Oudomxai	1999	24	9	40	142	138	151	119	192	192	77	39	34	1,154	
		Mouan Ngoy, Luangprabang	(1998)/1999*	3	1	22	63	69	239	170	346	104	9	2	0	1,029	
8	Nam Xuang	non															
9	Nam Khan	Luangprabang	1998	27	2	33	178	161	138	179	265	99	47	26	8	1,164	
		Xieng Ngeun, Luangprabang	1992*/(1995)	41	64	0	38	112	32	271	158	89	36	12	98	951	
10	Nam Ngum, Sayabouly Pro.	non															
11	Nam Houng	Sayabouly	1997	0	0	93	98	100	44	231	154	222	78	83	0	1,102	
12	Nam Pouly	non															
13	Nam Phoun	non															
14	Nam Heung	non															
15	Nam Mi	non															
16	Nam Sang	non															
17	Nam Thon	non															
18	Nam Et	non															
19	Nam Xan	non															
20	Nam Luong	Vian Xai, Xam Nua Pro.	1998	6	7	33	128	216	148	148	343	272	45	16	10	1,372	
21	Nam Neun	non															
22	Nam Mat	non															
23	Nam Mo	non															
24	Nam Lik	Kasy	1993	0	0	83	97	342	283	372	338	204	143	0	0	1,861	
		Hineheup	(1993)/1996*	2	14	42	112	93	219	160	299	215	86	41	0	1,284	
		Thalat	(1987)/1998*	0	0	22	14	225	189	339	344	202	52	9	0	1,395	
		Phatang															
		Vangvieng	1982	0	1	36	142	342	407	534	703	653	51	35	0	2,904	
25	Upper Nam Ngum	Xieng Khouang	1993*/(1998)	0	1	20	98	220	227	331	217	89	11	0	6	1,219	
		Naluang	(1988)/1993*	0	11	0	74	193	647	548	277	156	18	0	0	1,923	
26	Lower Nam Ngum	Pakkagnoung	1968	3	14	17	71	374	335	158	259	416	42	45	0	1,735	
		Napheng	1980	0	13	4	20	323	290	369	373	484	7	0	0	1,883	
		Veunkham, Vientiane Municipality	1990	0	20	33	46	331	224	171	239	369	32	23	0	1,488	
		Tha Ngon	(1983)/1988*	0	23	33	85	289	154	182	403	105	177	83	0	1,534	
		Naphok															
27	Nam Mang	Vientiane	(1993)/1998*	0	8	35	79	144	278	304	393	186	46	6	1	1,477	
28	Nam Ngiep	Tadluek	1995	5	5	18	195	175	668	627	643	9	55	0	0	2,399	
		Muang Mai	1989	0	0	8	82	350	970	511	717	303	116	0	0	3,057	

Note: (1992)/1998*

* The nearest hydrological year to the statistic value

() The second nearest hydrological year to the statistic value

Table 4.1.3 Drought Rainfall (Point Rainfall) T=5 years (2/2)

No.	River Basin	Rain Station	Probable Drought Year T=5	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	
29	Nam Xane	Muang Kao	1990	5	17	66	133	533	465	568	472	209	104	69	0	2,640	
		Paksane	1995	3	20	0	10	0	177	392	644	621	215	500	0	2,581	
30	Nam Kading	Signo	1993 [*] /(1999)	7	38	7	52	479	580	452	444	25	0	0	0	2,082	
		Nape	(1994)/1999 [*]	0	0	102	80	331	161	274	122	125	163	40	0	1,398	
		Keng Kuang															
31	Nam Thon	non															
32	Nam Hinboun	non															
33	Nam Don	Thakhek	1992	11	32	13	46	214	298	462	460	338	43	0	85	1,999	
34	Xe Banfai	Kuan Pho															
		Mahaxay	1993	7	38	7	52	479	580	452	444	25	0	0	0	2,082	
		Veune, Savannakhet	(1993)/1995 [*]	0	0	63	139	255	138	302	313	141	0	0	0	1,349	
35	Nam Thahao	non															
36	Houy Sompoy	Savannakhet	1983 [*] /(1988)	5	1	0	78	156	287	67	403	146	177	0	0	1,321	
		Seno	1983	3	1	1	23	35	217	114	325	191	240	0	0	1,149	
37	Xe Bang Hiang	Muang Nong	(1993)/1994 [*]	0	4	23	65	145	274	356	263	189	31	0	0	1,350	
		Dong	1993	0	2	69	114	211	124	253	400	120	34	0	0	1,325	
		Xepon															
		Muang Phine	(1988)/1993 [*]	0	6	57	77	316	209	183	484	204	11	0	0	1,545	
		Phalane	1994	0	9	28	52	217	263	327	259	209	23	0	0	1,389	
		Donghen	(1988)/1993 [*]	0	0	21	144	193	231	234	346	128	0	0	0	1,296	
		Kengkok	1998	0	24	1	85	175	142	183	229	332	35	5	0	0	1,211
		Kengdone	1993	0	2	53	128	203	44	126	231	155	34	0	0	0	976
38	Xe Bangnouan	Xenuan	1995	0	1	31	26	180	217	422	162	145	147	2	0	1,332	
39	Xe Done	Salavan	1993	0	0	33	122	176	96	411	466	237	15	1	3	1,560	
		Laongam	1997	0	34	83	155	142	121	265	543	213	125	0	28	1,708	
		Khongsedone	(1988)/1989 [*]	0	0	29	207	425	150	245	257	187	67	4	0	0	1,570
		Xelabam	1993	0	0	66	63	136	160	189	508	319	38	2	2	1,482	
		Nonghine	1995	8	31	251	164	364	215	581	394	250	153	28	17	2,455	
		Bachian	1993	0	10	28	57	129	121	392	564	271	139	13	6	1,729	
		Pakxong	(1993)/1995 [*]	2	35	146	183	291	290	691	465	269	180	20	55	2,625	
		Pakse	1988 [*] /(1990)/1995)	0	43	3	50	275	412	202	335	75	279	3	0	0	1,676
40	Houy Phaling	Phonthong															
41	Houy Khamouan	Soukhouna	1998	0	6	0	57	292	127	293	471	248	150	83	8	1,734	
42	Houy Kadian	Mounlapamok	1969 [*] /(1983)/1993)	3	0	0	31	177	362	441	121	395	88	0	0	1,616	
43	Nam Lepou	non															
44	Houy Banglieng	non															
45	Houy Touay	non															
46	Houy Tomo	Pathoumphone	1983	0	0	0	0	206	253	308	429	355	218	36	0	1,805	
47	Xe Kong	Nikhom 34	(1990)/1993 [*]	0	18	112	110	374	235	449	362	457	43	1	6	2,166	
		Xe Kong															
		Km 42	(1993)/1995 [*]	4	11	122	120	250	323	708	431	427	162	18	92	2,668	
		Attapeu	(1992)/1999 [*]	2	0	22	417	227	354	601	460	301	140	45	1	2,569	

Note: (1992)/1998*

* The nearest hydrological year to the statistic value

() The second nearest hydrological year to the statistic value

Table 4.1.4 Drought Rainfall estimated in the each River Basin (T=5 years) (1/3)

No.	River Basin	Rain Stations for Estimation	Applied Hydrological Year	Area Proportion	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Authorized Area	Annual Rainfall
1	Nam Ma	Luang Nam Tha	1997		2	2	66	59	52	72	386	362	221	111	57	15	1,406	1,080	1,518.7
2	Nam Pha	Luang Nam Tha	1997		2	2	66	59	52	72	386	362	221	111	57	15	1,406	2,860	4,021.7
3	Nam Kha	Luang Nam Tha	1997		2	2	66	59	52	72	386	362	221	111	57	15	1,406	1,630	2,292.1
4	Nam Ngam	Luang Nam Tha	1997		2	2	66	59	52	72	386	362	221	111	57	15	1,406	1,500	2,109.3
5	Nam Tha	Luang Nam Tha	1997		2	2	66	59	52	72	386	362	221	111	57	15	1,406	8,990	12,641.7
6	Nam Beng	Luang Nam Tha	1997		2	2	66	59	52	72	386	362	221	111	57	15	1,406	2,120	2,981.1
7	Nam Ou	Phongsali	1999	0.469	25	14	8	87	126	80	9	217	58	38	22	21	706		
		Phongsali	1999	0.006	0	0	0	1	2	1	0	3	1	0	0	0	9		
		Luang Nam Tha	1999	0.001	0	0	0	0	0	0	0	0	0	0	0	0	1		
		Luang Nam Tha	1999	0.010	1	0	0	0	4	2	3	3	2	1	1	0	16		
		Oudomxai	1999	0.200	5	2	8	28	28	30	24	38	38	15	8	7	231		
		Mouan Ngoy, Luangprabang	(1998/1999)*	0.256	1	0	6	16	18	61	44	89	27	2	1	0	264		
		Luangprabang	1999	0.058	1	0	3	3	12	16	4	16	11	6	3	3	78		
				1.000	32	17	24	137	188	190	84	366	137	64	34	30	1,304	24,500	31,957.5
8	Nam Xuang	Mouan Ngoy, Luangprabang	1998	0.705	0	2	1	100	102	102	82	116	86	10	6	0	608		
		Xieng Khouang	1998	0.097	4	6	0	4	11	3	26	15	9	4	1	10	93		
		Luangprabang	1998	0.198	5	0	7	35	32	27	35	52	20	9	5	1	230		
				1.000	9	8	8	139	144	133	144	184	114	23	13	11	930	6,580	6,118.9
9	Nam Khan	Mouan Ngoy, Luangprabang	1998	0.014	0	0	0	2	2	2	2	2	2	0	0	0	12		
		Xieng Khouang	1998	0.501	20	32	0	19	56	16	136	79	45	18	6	49	476		
		Vian Xai, Xam Nua Pro.	1998	0.001	0	0	0	0	0	0	0	0	0	0	0	0	2		
		Luangprabang	1998	0.330	9	1	11	59	53	46	59	88	33	16	8	2	384		
		Kasy (Vangvieng)	1998	0.145	0	2	7	35	42	67	114	99	67	15	9	1	457		
		Sayabouly	1998	0.008	0	0	0	1	1	1	1	1	1	1	0	0	8		
				1.000	29	35	18	116	155	132	312	270	147	49	24	52	1,339	7,380	9,884.0
10	Nam Ngum, Sayabouly Pro.	Luang Nam Tha	1997		2	2	66	59	52	72	386	362	221	111	57	15	1,406	1,900	2,671.8
11	Nam Houng	Sayabouly	1997		0	0	93	98	100	44	231	154	222	78	83	0	1,102	2,940	3,240.5
12	Nam Pouly	Sayabouly	1997		0	0	93	98	100	44	231	154	222	78	83	0	1,102	1,700	1,873.7
13	Nam Phoun	Sayabouly	1997		0	0	93	98	100	44	231	154	222	78	83	0	1,102	1,980	2,182.4
14	Nam Heung	Hineheup	1996		2	14	42	112	93	219	160	299	215	86	41	0	1,284	1,940	2,490.2
15	Nam Mi	Hineheup	1996		2	14	42	112	93	219	160	299	215	86	41	0	1,284	1,040	1,334.9
16	Nam Sang	Hineheup	1996		2	14	42	112	93	219	160	299	215	86	41	0	1,284	1,300	1,668.7
17	Nam Thon	Hineheup	1996		2	14	42	112	93	219	160	299	215	86	41	0	1,284	553	709.8
18	Nam Et	Mouan Ngoy, Luangprabang	1998	0.721	0	2	1	102	104	105	84	119	88	10	7	0	621		
		Vian Xai, Xam Nua Pro.	1998	0.279	2	2	9	36	60	41	41	96	76	12	4	3	382		
				1.000	2	4	11	138	164	146	125	215	164	23	11	3	1,004	3,410	3,422.3
19	Nam Xan	Vian Xai, Xam Nua Pro.	1998		6	7	33	128	216	148	148	343	272	45	16	10	1,372	4,328	5,936.3
20	Nam Luong	Vian Xai, Xam Nua Pro.	1998		6	7	33	128	216	148	148	343	272	45	16	10	1,372	620	850.4
21	Nam Neun	Vian Xai, Xam Nua Pro.	1998	0.916	6	7	30	117	198	136	135	315	250	41	15	9	1,257		
		Xieng Khouang	1998	0.039	2	2	0	1	4	1	11	6	3	1	0	4	37		
		Xieng Khouang	1998	0.045	2	3	0	2	5	1	12	7	4	2	1	4	43		
				1.000	9	12	30	120	207	138	158	328	257	44	16	17	1,336	3,732	4,987.2
22	Nam Mat	Xieng Khouang	1998	0.947	39	61	0	36	106	30	257	150	84	34	11	93	901		
		Vian Xai, Xam Nua Pro.	1998	0.053	0	0	2	7	11	8	8	18	14	2	1	1	73		
				1.000	39	61	2	43	118	38	265	168	99	37	12	93	973	2,052	1,997.5
23	Nam Mo	Vian Xai, Xam Nua Pro.	1998	0.593	4	4	19	76	128	88	87	203	161	27	10	6	813		
		Muang Kao	1998	0.407	0	6	21	20	73	215	412	264	50	20	0	0	1,081		
				1.000	4	10	40	96	201	303	500	468	212	46	10	6	1,894	1,728	3,273.0

Note: (1992)/1998*

Table 4.1.4 Drought Rainfall estimated in the each River Basin (T=5 years) (2/3)

No.	River Basin	Rain Stations for Estimation	Applied Hydrological Year	Area Proportion	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Authorized Area	Annual Rainfall
24	Nam Lik	Hineheup	1993	0.443	0	1	4	28	73	114	140	89	70	15	0	0	534		
		Kasy	1993	0.459	0	0	38	45	157	130	171	155	94	65	0	0	854		
		Naluang	1993	0.098	0	1	0	7	19	64	54	27	15	2	0	0	189		
				1.000	0	2	41	80	249	308	365	271	179	82	0	0	1,577	4,980	7,851.1
25	Upper Nam Ngum	Xieng Khouang	1993	0.608	0	0	12	60	133	138	201	132	54	7	0	4	741		
		Naluang	1993	0.276	0	3	0	20	53	178	151	76	43	5	0	0	530		
		Kasy	1993	0.116	0	0	10	11	40	33	43	39	24	17	0	0	217		
				1.000	0	3	22	91	226	349	395	247	121	28	0	4	1,488	4,640	6,903.5
26	Lower Nam Ngum	Naluang	1993	0.316	0	3	0	23	61	205	173	88	49	6	0	0	609		
		Tadluek	1993	0.117	0	2	2	25	60	82	105	41	74	0	0	0	391		
		Napheng (Vientiane)	1993	0.452	0	2	2	9	164	175	112	107	90	3	0	0	664		
		Hineheup	1993	0.075	0	0	1	5	12	19	24	15	12	2	0	0	91		
		Tadluek	1993	0.039	0	1	1	8	20	27	35	14	25	0	0	0	130		
				1.000	0	8	5	71	317	509	449	264	250	11	0	0	1,884	6,920	13,040.0
27	Nam Mang	Tadluek	1993	0.154	0	3	2	33	79	108	138	54	97	0	0	0	514		
		Napheng (Vientiane)	1993	0.846	0	4	3	18	306	328	210	200	167	6	0	0	1,242		
				1.000	0	6	6	50	385	436	348	254	265	6	0	0	1,756	1,860	3,266.5
28	Nam Ngiep	Xieng Khouang	1993	0.535	0	0	11	53	117	121	177	116	48	6	0	3	652		
		Naluang	1993	0.057	0	1	0	4	11	37	31	16	9	1	0	0	110		
		Muang Mai	1993	0.407	0	7	0	41	271	496	446	308	186	0	0	0	1,755		
				1.000	0	8	11	98	399	655	654	440	242	7	0	3	2,517	4,490	11,303.6
29	Nam Xane	Xieng Khouang	1993	0.081	0	0	2	8	18	18	27	18	7	1	0	1	99		
		Muang Kao	1993	0.919	2	22	128	150	373	805	828	608	459	41	0	0	3,416		
				1.000	2	22	130	158	391	823	855	626	466	42	0	1	3,515	2,220	7,803.5
30	Nam Kading	Muang Kao	1993	0.019	0	0	3	3	8	17	17	12	9	1	0	0	70		
		Paksane	1993	0.354	28	0	1	0	15	4	95	107	201	200	33	6	690		
		Nape	1993	0.383	0	8	8	51	128	117	100	200	54	2	18	0	688		
		Signo	1993*(1999)	0.245	2	9	2	13	117	142	111	109	6	0	0	0	509		
				1.000	29	18	13	67	269	280	322	428	271	203	51	6	1,957	14,960	29,277.5
31	Nam Thon	Paksane	1993		78	0	3	0	43	11	268	303	567	567	92	18	1,949	797	1,553.5
32	Nam Hinboun	Paksane	1993	0.135	11	0	0	0	6	2	36	41	77	77	12	2	264		
		Nape	1993	0.056	0	1	1	7	19	17	15	29	8	0	3	0	100		
		Signo	1993*(1999)	0.612	4	23	4	32	293	355	277	271	15	0	0	0	1,274		
		Thakhek	1993	0.197	0	3	3	42	101	138	177	69	125	0	0	0	658		
				1.000	15	28	9	81	419	512	504	411	225	77	15	2	2,296	3,380	7,761.1
33	Nam Don	Thakhek	1992	0.917	10	29	11	42	196	273	424	421	309	39	0	78	1,832		
		Mahaxay (Veun)	1992	0.083	3	4	0	0	11	26	25	28	18	3	0	1	119		
				1.000	13	33	12	42	206	298	449	450	328	42	0	79	1,951	674	1,315.2
34	Xe Banfai	Signo	1993*(1999)	0.473	3	18	3	24	227	275	214	210	12	0	0	0	986		
		Mahaxay	1993	0.236	2	9	2	12	113	137	107	105	6	0	0	0	491		
		Signo	1993*(1999)	0.011	0	0	0	1	5	6	5	5	0	0	0	0	22		
		Mahaxay	1993	0.154	1	6	1	8	74	89	70	68	4	0	0	0	321		
		Thakhek	1993	0.012	0	0	0	2	7	4	7	5	1	1	0	0	26		
		Veune, Savannakhet	1993	0.115	0	0	5	7	28	15	19	34	16	1	0	0	123		
				1.000	6	33	11	53	453	525	421	427	39	1	0	0	1,969	9,330	18,370.1
35	Nam Thahao	Veune, Savannakhet	1993	0.463	0	0	20	27	111	59	76	137	63	3	1	0	498		
		Donghen	(1988)/1993*	0.038	0	0	1	5	7	9	9	13	5	0	0	0	49		
		Donghen	(1988)/1993*	0.300	0	0	6	43	58	69	70	104	38	0	0	0	389		
		Savannakhet	1993	0.200	0	0	7	5	53	18	58	44	37	0	0	0	223		
				1.000	0	0	34	81	229	155	213	298	143	3	1	0	1,158	692	801.2

Note: (1992)/1998*

Table 4.1.4 Drought Rainfall estimated in the each River Basin (T=5 years)

No.	River Basin	gaging Stations for Estimation	Applied Hydrological Year	Area Proportion	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Authorized Area	Annual Rainfall
36	Houy Sompoy	Savannakhet	1988	0.870	0	0	5	63	172	132	143	268	38	165	0	0	986		
		Donghen	1988	0.130	0	1	0	12	29	24	11	64	4	52	1	0	198		
				1.000	0	1	5	75	201	156	154	331	42	217	1	0	1,184	448	530.6
37	Xe Bang Hiang	Muang Nong	1993	0.246	0	3	14	19	63	22	34	56	53	9	0	0	271		
		Dong	1993	0.134	0	0	9	15	28	17	34	54	16	5	0	0	178		
		Muang Phine	(1988)/1993 *	0.240	0	1	14	18	76	50	44	116	49	3	0	0	370		
		Phalane	1993	0.126	0	0	1	13	18	21	16	44	20	0	0	0	133		
		Salavan	1993	0.007	0	0	0	1	1	1	3	3	2	0	0	0	11		
		Xenuan	1993	0.054	0	0	1	3	11	7	11	23	8	0	0	0	64		
		Kengdone	1993	0.082	0	0	4	10	17	4	10	19	13	3	0	0	80		
		Donghen	(1988)/1993 *	0.080	0	0	2	12	16	19	19	28	10	0	0	0	104		
		Savannakhet	1993	0.002	0	0	0	0	1	0	1	0	0	0	0	0	2		
		Donghen	(1988)/1993 *	0.028	0	0	1	4	5	7	7	10	4	0	0	0	37		
				1.000	0	5	45	96	235	146	177	352	175	20	0	0	1,250	19,970	24,970.1
38	Xe Bangnouan	Salavan	1993	0.246	0	0	8	30	43	24	101	115	58	4	0	1	383		
		Xelabam	1993	0.039	0	0	3	2	5	6	7	20	12	1	0	0	58		
		Xenuan	1993	0.715	0	0	7	44	143	94	145	299	106	0	0	0	838		
				1.000	0	0	18	76	191	124	253	434	177	5	1	1	1,280	1,420	1,817.0
39	Xe Done	Salavan	1993	0.416	0	0	14	51	73	40	171	194	98	6	1	1	649		
		Nikhom 34	(1990)/1993 *	0.070	0	1	8	8	26	17	32	25	32	3	0	0	152		
		Pakxong	(1993)/1995 *	0.153	0	5	22	28	45	44	106	71	41	27	3	8	401		
		Xelabam	1993	0.296	0	0	19	19	40	47	56	150	94	11	0	0	439		
		Xenuan	1993	0.019	0	0	0	1	4	3	4	8	3	0	0	0	23		
		Pakse	1993	0.045	0	0	2	2	7	7	8	15	17	4	0	0	62		
		1.000	0	7	65	109	195	157	376	464	286	52	4	11	1,726	7,320	12,635.4		
40	Houy Phaling	Pakse	1988 */(1990/1995)		0	43	3	50	275	412	202	335	75	279	3	0	1,676	469	786.1
41	Houy Khannouan	Soukhouna	1998		0	6	0	57	292	127	293	471	248	150	83	8	1,734	1,580	2,739.6
42	Houy Kadian	Mounlapamok	1969 */(1983/1993)		3	0	0	31	177	362	441	121	395	88	0	0	1,616	700	1,131.3
43	Nam Lepou	Mounlapamok	1969 */(1983/1993)		3	0	0	31	177	362	441	121	395	88	0	0	1,616	1,760	2,844.5
44	Houy Banglieng	Pakxong	(1993)/1995 *	0.605	1	21	88	111	176	175	418	281	162	109	12	33	1,587		
		Pakse	1995	0.395	0	0	13	7	63	127	256	63	83	37	14	0	662		
				1.000	1	21	101	118	239	302	673	344	245	145	26	33	2,249	508	1,142.6
45	Houy Touay	Pakxong	(1993)/1995 *	0.476	1	17	69	87	139	138	329	221	128	86	10	26	1,250		
		Pathoumphone	1995	0.524	0	0	1	29	58	111	286	96	187	82	18	20	890		
				1.000	1	17	71	117	197	250	615	317	315	167	28	47	2,140	370	791.8
46	Houy Tomo	Pathoumphone	1983		0	0	0	0	206	253	308	429	355	218	36	0	1,805	153	276.1
47	Xe Kong	Nikhom 34	(1990)/1993 *	0.388	0	7	43	43	145	91	174	140	177	17	0	2	840		
		Attapeu	1993	0.478	0	1	66	43	79	81	146	286	211	43	3	3	962		
		Pakxong	1993	0.057	0	0	2	9	19	14	30	43	22	3	5	1	148		
		Pathoumphone	1993	0.066	0	2	2	4	6	11	11	26	18	8	0	0	88		
		Mounlapamok	1993	0.005	0	0	0	0	2	2	1	3	1	0	0	0	9		
		Mounlapamok	1993	0.006	0	0	0	0	2	2	1	3	1	0	0	0	11		
		1.000	0	10	115	98	252	201	364	501	432	71	8	6	2,058	22,960	47,242.8		

Note: (1992)/1998*

Table 4.1.5 Annual Runoff in Ordinary Hydrological Year (1/2)

No.	River Basin	Applied Hydrological Year	Rainfall in Catchment Area (mm)													Basin Area (Km2)	Annual Rainfall (MCM)	Average Annual Runoff Ratio	Average Annual Runoff (MCM)
			Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual				
1	Nam Ma	1999	50	0	6	43	374	167	260	253	177	104	72	38	1,542	1,080	1,666	0.58	966
2	Nam Pha	1999	50	0	6	43	374	167	260	253	177	104	72	38	1,542	2,860	4,411	0.58	2,558
3	Nam Kha	1999	50	0	6	43	374	167	260	253	177	104	72	38	1,542	1,630	2,514	0.58	1,458
4	Nam Ngam	1999	50	0	6	43	374	167	260	253	177	104	72	38	1,542	1,500	2,313	0.58	1,342
5	Nam Tha	1999	50	0	6	43	374	167	260	253	177	104	72	38	1,542	8,990	13,865	0.58	8,042
6	Nam Beng	1999	50	0	6	43	374	167	260	253	177	104	72	38	1,542	2,120	3,270	0.58	1,896
7	Nam Ou	1999	32	17	24	137	188	190	84	366	137	64	34	30	1,304	24,500	31,957	0.58	18,535
8	Nam Xuang	1999	5	1	29	68	109	245	149	340	125	30	14	10	1,125	6,580	7,404	0.58	4,295
9	Nam Khan	1999	6	0	55	123	271	312	199	427	200	80	47	31	1,752	7,380	12,931	0.58	7,500
10	Nam Ngum, Sayabouly Pro.	1999	50	0	6	43	374	167	260	253	177	104	72	38	1,542	1,900	2,930	0.58	1,700
11	Nam Houng	1999	0	13	54	124	48	208	212	256	252	68	58	0	1,293	2,940	3,801	0.58	2,205
12	Nam Pouly	1999	0	13	54	124	48	208	212	256	252	68	58	0	1,293	1,700	2,198	0.58	1,275
13	Nam Phoun	1999	0	13	54	124	48	208	212	256	252	68	58	0	1,293	1,980	2,560	0.58	1,485
14	Nam Heung	1999	0	0	75	70	364	244	186	345	258	101	1	0	1,643	1,940	3,187	0.58	1,849
15	Nam Mi	1999	0	0	75	70	364	244	186	345	258	101	1	0	1,643	1,040	1,709	0.58	991
16	Nam Sang	1999	0	0	75	70	364	244	186	345	258	101	1	0	1,643	1,300	2,136	0.58	1,239
17	Nam Thon	1999	0	0	75	70	364	244	186	345	258	101	1	0	1,643	553	909	0.58	527
18	Nam Et	1999	4	2	30	90	152	251	169	388	117	27	17	17	1,263	3,410	4,306	0.58	2,497
19	Nam Xan	1999	4	3	50	161	367	283	167	496	152	72	54	59	1,867	4,328	8,082	0.58	4,688
20	Nam Luong	1999	4	3	50	161	367	283	167	496	152	72	54	59	1,867	620	1,158	0.58	672
21	Nam Neun	1999	4	3	51	157	354	277	165	488	149	70	52	56	1,825	3,732	6,811	0.58	3,951
22	Nam Mat	1999	5	0	54	119	220	213	148	412	127	47	25	19	1,390	2,052	2,852	0.58	1,654
23	Nam Mo	1999	2	2	93	200	541	502	343	530	226	67	45	35	2,586	1,728	4,469	0.58	2,592
24	Nam Lik	1994	0	8	151	65	254	348	486	464	231	112	1	5	2,125	4,980	10,583	0.80	8,466
25	Upper Nam Ngum	1999	5	0	64	162	369	350	300	433	219	64	28	17	2,010	4,640	9,327	0.58	5,410
26	Lower Nam Ngum	1998	0	16	33	120	259	382	439	425	239	73	11	0	1,997	6,920	13,817	0.65	8,981
27	Nam Mang	1996	2	45	96	136	215	427	258	272	381	80	104	0	2,017	1,860	3,751	0.58	2,175
28	Nam Ngiep	1999	3	0	92	226	535	491	458	462	257	55	27	9	2,614	4,490	11,737	0.61	7,159
29	Nam Xane	1994	0	83	110	69	276	712	624	583	263	60	5	13	2,797	2,220	6,209	0.80	4,967
30	Nam Kading	1992	10	31	10	36	171	346	382	360	480	244	111	41	2,223	14,960	33,255	0.94	31,260
31	Nam Thon	1992	0	0	1	51	97	153	416	793	792	486	303	59	3,153	797	2,513	0.94	2,362
32	Nam Hinboun	1995	0	15	36	57	297	482	491	580	268	172	77	1	2,476	3,380	8,369	0.62	5,189
33	Nam Don	1994	0	62	89	56	167	685	494	433	233	39	1	0	2,259	674	1,522	0.62	944

Table 4.1.5 Annual Runoff in Ordinary Hydrological Year (2/2)

No.	River Basin	Applied Hydrological Year	Rainfall in Catchment Area (mm)													Basin Area (Km2)	Annual Rainfall (MCM)	Average Annual Runoff Ratio	Average Annual Runoff (MCM)
			Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual				
34	Xe Banfai	1995	0	13	32	87	305	471	516	568	206	152	14	0	2,363	9,330	22,049	0.62	13,670
35	Nam Thahao	1994	0	69	31	69	178	424	238	474	163	28	0	0	1,675	692	1,159	0.62	718
36	Houy Sompoy	1994	0	72	39	56	154	356	161	544	190	55	0	0	1,626	448	728	0.62	452
37	Xe Bang Hiang	1997	6	37	47	180	186	163	384	577	136	79	1	1	1,796	19,970	35,865	0.62	22,236
38	Xe Bangnouan	1997	22	58	69	88	363	175	489	347	85	60	0	0	1,755	1,420	2,493	0.62	1,545
39	Xe Done	1997	13	42	42	181	250	359	609	586	225	67	16	6	2,396	7,320	17,536	0.21	3,683
40	Houy Phaling	1987	0	0	14	59	139	430	663	552	167	60	28	0	2,112	469	990	0.21	208
41	Houy Khannouan	1994	0	0	62	58	202	281	376	304	658	93	0	2	2,035	1,580	3,216	0.21	675
42	Houy Kadian	1994	0	0	43	4	352	369	386	378	525	83	0	4	2,145	700	1,501	0.21	315
43	Nam Lepou	1994	0	0	43	4	352	369	386	378	525	83	0	4	2,145	1,760	3,774	0.21	793
44	Houy Banglieng	1997	5	79	69	229	229	490	933	797	299	122	39	21	3,311	508	1,682	0.49	824
45	Houy Touay	1997	8	46	64	234	211	381	895	681	354	108	46	17	3,045	370	1,127	0.49	552
46	Houy Tomo	1994	0	0	43	4	352	369	386	378	525	83	0	4	2,145	153	328	0.49	161
47	Xe Kong	1999	6	0	73	366	327	386	710	455	362	220	48	1	2,954	22,960	67,835	0.49	33,239
Total																			229,901
Tributaries of Mekong River																			214,519
Tributaries of Nam Ma River																			7,185
Tributaries of Nam Ka River																			8,196

Note : * Tentative assumption

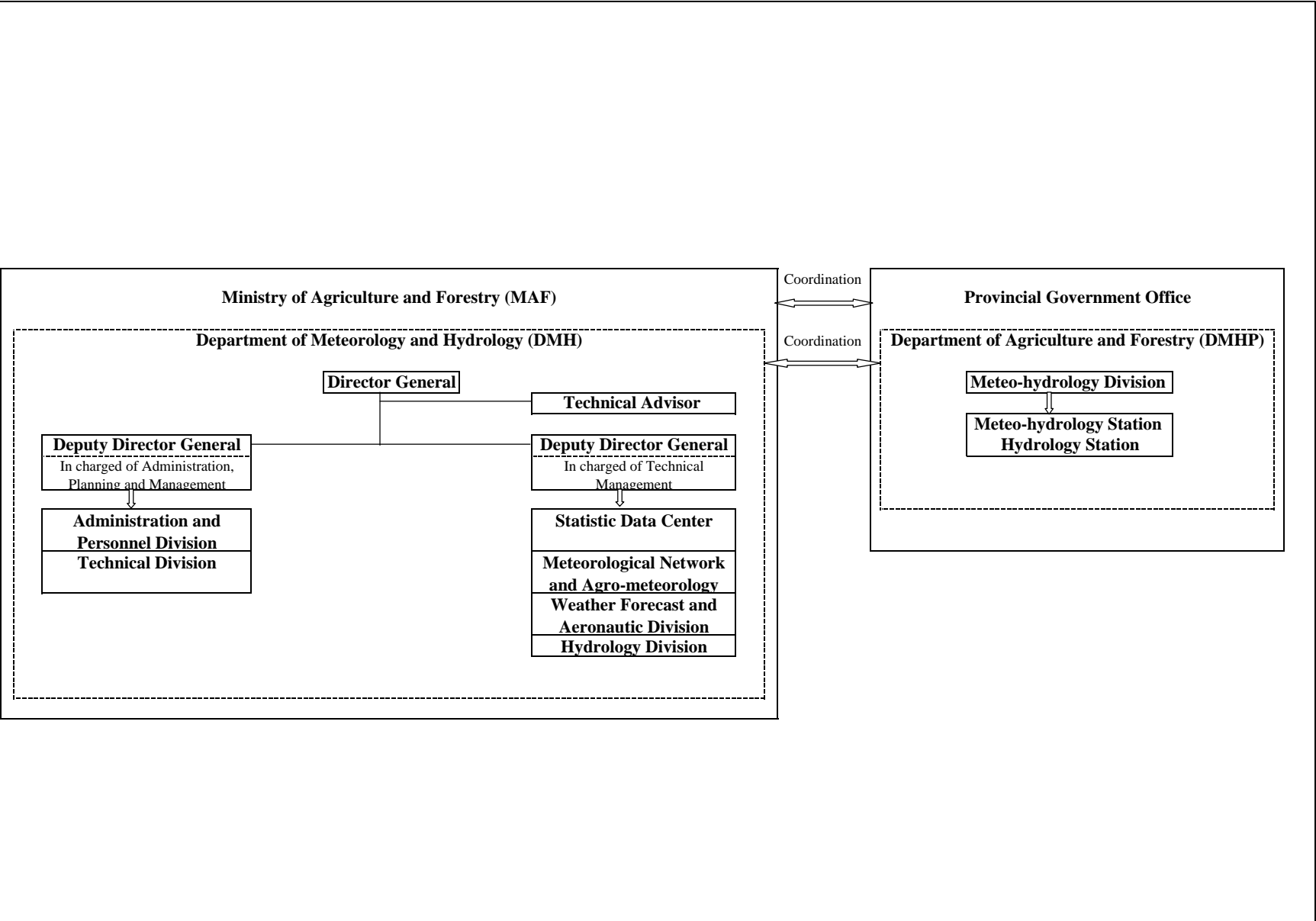
Table 4.1.6 Monthly Mean Discharge of Major Rivers in Lao PDR

Name of River	Station	C. Area (Km ²)	Observe Period	Monthly Mean Discharge (m ³ /sec)												Annual Mean (m ³ /sec)	Annual Runoff (MMC)
				Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.		
Nam Sane	Muang Kao	2,029	1991-99	21.7	18.1	15.0	17.9	47.2	190.4	432.4	514.9	317.1	105.8	55.0	34.1	148.5	4,685
Nam Ngum	Pak Kanhoung	13,560	1991-99	97.5	87.5	78.6	82.9	135.2	261.2	468.1	534.1	599.8	253.7	155.9	122.5	252.3	7,961
Xe Kong	Attapeu	10,500	1990-99	97.5	87.5	78.6	82.9	135.2	261.2	468.1	534.1	599.8	253.7	155.9	122.5	252.3	7,961
Nam Lik	Hin Heup	5,115	1991-2000	97.5	87.5	78.6	82.9	135.2	261.2	468.1	534.1	599.8	253.7	155.9	122.5	252.3	7,961
Xe Ban Fai	Mahaxay	4,520	1994-99	20.8	15.9	11.2	12.8	37.2	194.1	598.5	827.9	697.7	241.2	125.7	41.9	268.9	8,484
Nam Lik	Muang Kasy	374	1988-99	5.6	4.5	4.1	4.0	5.9	11.0	25.4	27.8	25.1	17.5	8.3	6.0	11.3	357
Nam Nhiep	Muang Mai	4,305	1991-99	54.7	43.1	39.2	40.6	83.9	232.9	430.0	598.9	543.7	187.0	107.9	71.6	203.7	6,428
Nam Ngum	Naluang	4,852	1990-99	36.1	29.5	26.1	30.5	61.2	161.2	355.4	412.1	318.1	122.8	85.5	51.6	143.3	4,521
Xe Done	Sou Van Na Khi	5,760	1993-99	20.3	16.6	11.9	19.7	56.4	112.1	443.0	615.5	495.2	114.5	65.1	32.9	168.1	5,301
Nam Theun	Singo	3,370	1990-99	38.7	31.3	25.2	24.5	42.4	208.1	502.8	611.7	524.0	267.2	125.7	68.8	207.0	6,533
Nam Song	Vang Vieng	864	1987-99	11.3	8.7	7.6	7.9	18.9	57.8	116.8	124.5	100.2	46.4	35.8	24.9	50.8	1,603

Table 4.1.7 Annual Runoff Ratio in Drought Year

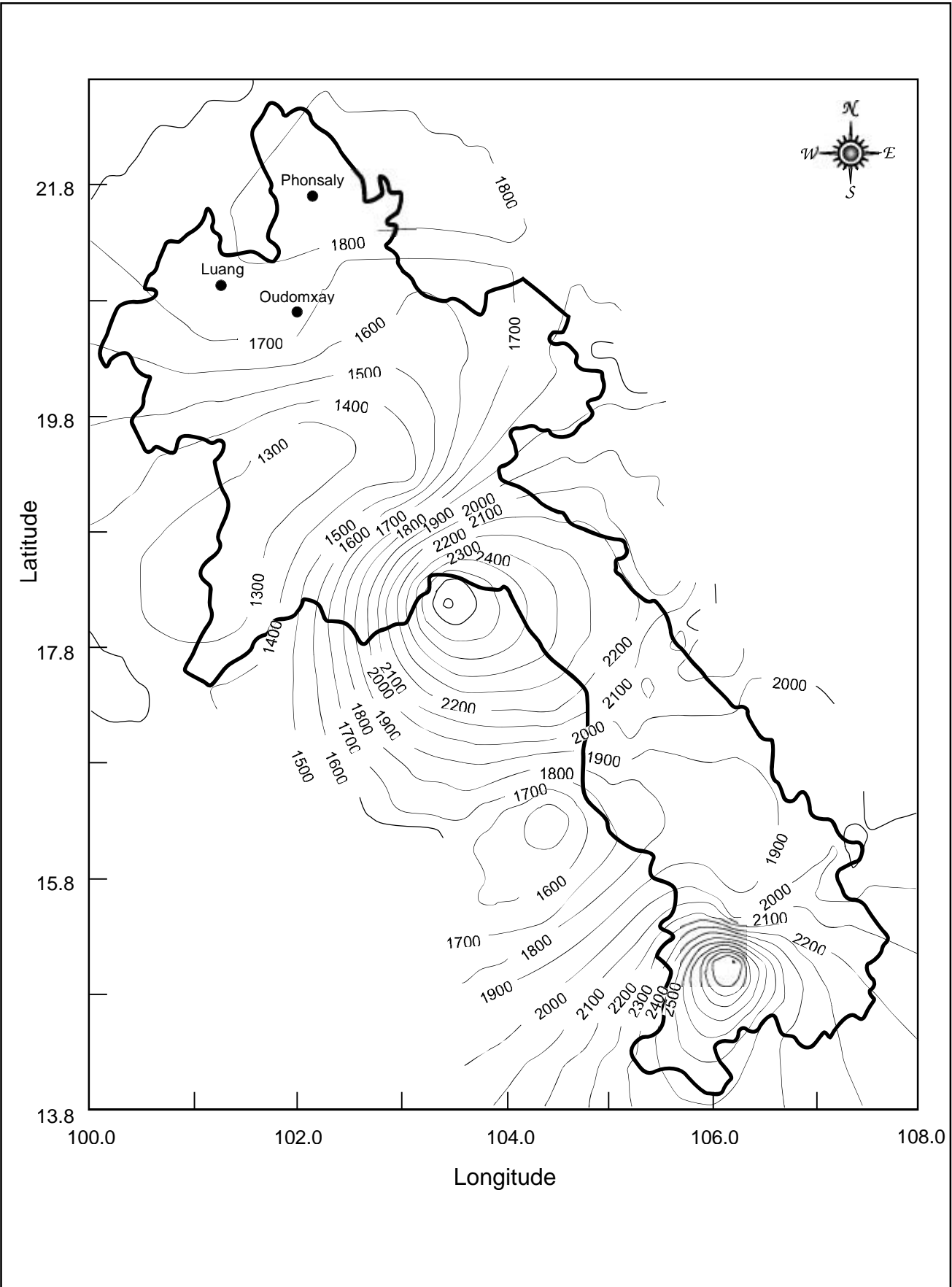
No.	River Basin	Applied Hydrological Year	Drought Rainfall (T=5 years) of Catchment Area (mm)													Basin Area (Km2)	Annual Rainfall (MCM)	Average Annual Runoff Ratio	Min. Water Flow (T=5y) (= Base Flow)		Low Runoff Surveyed by JICA Expert (lit/sec/km2)	Maintenance Flow (T=10y)	
			Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual				lit/sec/km2	(mm/day)		(lit/sec/km2)	(mm/day)
1	Nam Ma	1997	2	2	66	59	52	72	386	362	221	111	57	15	1,406	1,080	1,519	0.58	2.9	0.25	3.7	2.2	0.19
2	Nam Pha	1997	2	2	66	59	52	72	386	362	221	111	57	15	1,406	2,860	4,022	0.58	2.9	0.25	3.6	2.2	0.19
3	Nam Kha	1997	2	2	66	59	52	72	386	362	221	111	57	15	1,406	1,630	2,292	0.58	2.9	0.25	-	2.2	0.19
4	Nam Ngam	1997	2	2	66	59	52	72	386	362	221	111	57	15	1,406	1,500	2,109	0.58	2.9	0.25	1.5	2.2	0.19
5	Nam Tha	1997	2	2	66	59	52	72	386	362	221	111	57	15	1,406	8,990	12,642	0.58	2.9	0.25	0.7-1.5	2.2	0.19
6	Nam Beng	1997	2	2	66	59	52	72	386	362	221	111	57	15	1,406	2,120	2,981	0.58	2.9	0.25	1.0	2.2	0.19
7	Nam Ou	1999	32	17	24	137	188	190	84	366	137	64	34	30	1,304	24,500	31,957	0.58	2.9	0.25	1.9-3.6	2.2	0.19
8	Nam Xuang	1998	9	8	8	139	144	133	144	184	114	23	13	11	930	6,580	6,119	0.58	2.9	0.25	2.0	2.2	0.19
9	Nam Khan	1998	29	35	18	116	155	132	312	270	147	49	24	52	1,339	7,380	9,884	0.58	2.9	0.25	1.4	2.2	0.19
10	Nam Ngum, Sayabouly Pr	1997	2	2	66	59	52	72	386	362	221	111	57	15	1,406	1,900	2,672	0.58	2.9	0.25	1.1	2.2	0.19
11	Nam Houng	1997	0	0	93	98	100	44	231	154	222	78	83	0	1,102	2,940	3,240	0.58	2.9	0.25	2.4	2.2	0.19
12	Nam Pouly	1997	0	0	93	98	100	44	231	154	222	78	83	0	1,102	1,700	1,874	0.58	2.9	0.25	1.5	2.2	0.19
13	Nam Phoun	1997	0	0	93	98	100	44	231	154	222	78	83	0	1,102	1,980	2,182	0.58	2.9	0.25	1.5	2.2	0.19
14	Nam Heung	1996	2	14	42	112	93	219	160	299	215	86	41	0	1,284	1,940	2,490	0.58	2.9	0.25	0.8	2.2	0.19
15	Nam Mi	1996	2	14	42	112	93	219	160	299	215	86	41	0	1,284	1,040	1,335	0.58	2.9	0.25	0.0	2.2	0.19
16	Nam Sang	1996	2	14	42	112	93	219	160	299	215	86	41	0	1,284	1,300	1,669	0.58	2.9	0.25	-	2.2	0.19
17	Nam Thon	1996	2	14	42	112	93	219	160	299	215	86	41	0	1,284	553	710	0.58	2.9	0.25	-	2.2	0.19
18	Nam Et	1998	2	4	11	138	164	146	125	215	164	23	11	3	1,004	3,410	3,422	0.58	2.9	0.25	-	2.2	0.19
19	Nam Xan	1998	6	7	33	128	216	148	148	343	272	45	16	10	1,372	4,328	5,936	0.58	2.9	0.25	-	2.2	0.19
20	Nam Luong	1998	6	7	33	128	216	148	148	343	272	45	16	10	1,372	620	850	0.58	2.9	0.25	-	2.2	0.19
21	Nam Neun	1998	9	12	30	120	207	138	158	328	257	44	16	17	1,336	3,732	4,987	0.58	2.9	0.25	-	2.2	0.19
22	Nam Mat	1998	39	61	2	43	118	38	265	168	99	37	12	93	973	2,052	1,997	0.58	2.9	0.25	0.7	2.2	0.19
23	Nam Mo	1998	4	10	40	96	201	303	500	468	212	46	10	6	1,894	1,728	3,273	0.58	2.9	0.25	-	2.2	0.19
24	Nam Lik	1993	0	2	41	80	249	308	365	271	179	82	0	0	1,577	4,980	7,851	0.80	5.9	0.51	3.7-6.4	4.7	0.40
25	Upper Nam Ngum	1993	0	3	22	91	226	349	395	247	121	28	0	4	1,488	4,640	6,903	0.58	2.9	0.25	0.5-1.0	2.2	0.19
26	Lower Nam Ngum	1993	0	8	5	71	317	509	449	264	250	11	0	0	1,884	6,920	13,040	?	18.4	1.59	-	9.5	0.82
27	Nam Mang	1993	0	6	6	50	385	436	348	254	265	6	0	0	1,756	1,860	3,267	0.58	2.9	0.25	1.3	9.5	0.82
28	Nam Ngiep	1993	0	8	11	98	399	655	654	440	242	7	0	3	2,517	4,490	11,304	0.61	4.5	0.39	2.6-4.5	1.8	0.15
29	Nam Xane	1993	2	22	130	158	391	823	855	626	466	42	0	1	3,515	2,220	7,803	0.80	3.7	0.32	5.6	2.7	0.23
30	Nam Kading	1993	29	18	13	67	269	280	322	428	271	203	51	6	1,957	14,960	29,278	0.94	3.6	0.31	5.6	3.0	0.26
31	Nam Thon	1993	78	0	3	0	43	11	268	303	567	567	92	18	1,949	797	1,554	0.94	3.6	0.31	6.0	3.0	0.26
32	Nam Hinboun	1993	15	28	9	81	419	512	504	411	225	77	15	2	2,296	3,380	7,761	0.62	0.7	0.06	2.8	0.3	0.03
33	Nam Don	1992	13	33	12	42	206	298	449	450	328	42	0	79	1,951	674	1,315	0.62	0.7	0.06	-	0.3	0.03
34	Xe Banfai	1993	6	33	11	53	453	525	421	427	39	1	0	0	1,969	9,330	18,370	0.62	0.7	0.06	2.1-2.5	0.3	0.03
35	Nam Thahao	1993	0	0	34	81	229	155	213	298	143	3	1	0	1,158	692	801	0.62	0.7	0.06	-	0.3	0.03
36	Houy Sompoy	1988	0	1	5	75	201	156	154	331	42	217	1	0	1,184	448	531	0.62	0.7	0.06	-	0.3	0.03
37	Xe Bang Hiang	1993	0	5	45	96	235	146	177	352	175	20	0	0	1,250	19,970	24,970	0.62	0.7	0.06	0-3.9	0.3	0.03
38	Xe Bangnouan	1993	0	0	18	76	191	124	253	434	177	5	1	1	1,280	1,420	1,817	0.62	0.7	0.06	0.0	0.3	0.03
39	Xe Done	1993	0	7	65	109	195	157	376	464	286	52	4	11	1,726	7,320	12,635	0.21	1.9	0.17	1.1-1.5	0.3	0.02
40	Houy Phaling	988*/(1990/1995)	0	43	3	50	275	412	202	335	75	279	3	0	1,676	469	786	0.21	1.9	0.17	-	0.3	0.02
41	Houy Khannouan	1998	0	6	0	57	292	127	293	471	248	150	83	8	1,734	1,580	2,740	0.21	1.9	0.17	0.0	0.3	0.02
42	Houy Kadian	969*/(1983/1993)	3	0	0	31	177	362	441	121	395	88	0	0	1,616	700	1,131	0.21	1.9	0.17	-	0.3	0.02
43	Nam Lepou	969*/(1983/1993)	3	0	0	31	177	362	441	121	395	88	0	0	1,616	1,760	2,845	0.21	1.9	0.17	-	0.3	0.02
44	Houy Banglieng	1995	1	21	101	118	239	302	673	344	245	145	26	33	2,249	508	1,143	0.49	8.4	0.72	-	2.7	0.23
45	Houy Touay	1995	1	17	71	117	197	250	615	317	315	167	28	47	2,140	370	792	0.49	8.4	0.72	-	2.7	0.23
46	Houy Tomo	1983	0	0	0	0	206	253	308	429	355	218	36	0	1,805	153	276	0.49	8.4	0.72	-	2.7	0.23
47	Xe Kong	1993	0	10	115	98	252	201	364	501	432	71	8	6	2,058	22,960	47,243	0.49	8.4	0.72	1.7-8.7	2.7	0.23

Figure



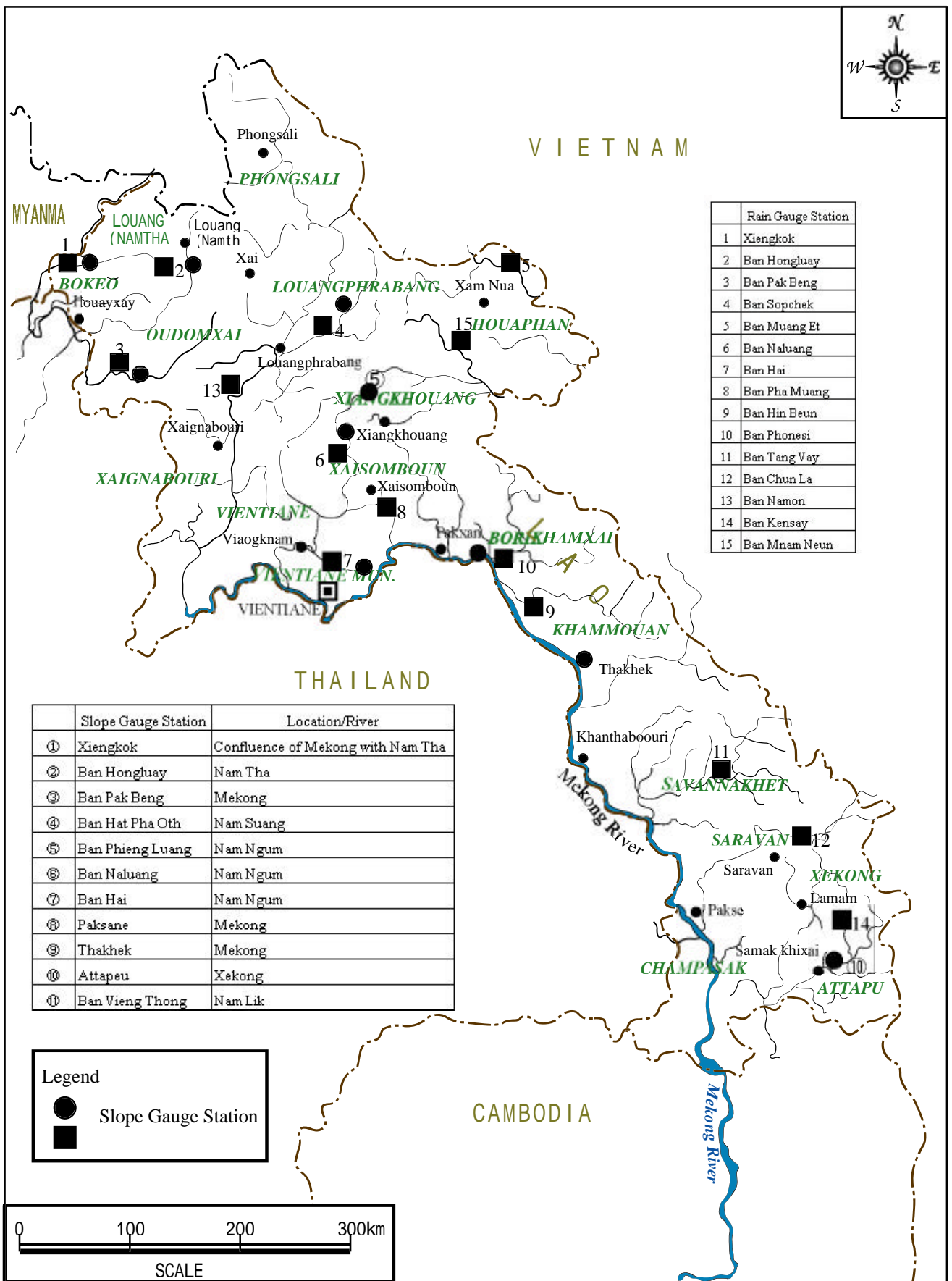
Master Plan Study on
Integrated Agricultural Development in
Lao People's Democratic Republic
Japan International Cooperation Agency

Figure 1.1.1
Organization Chart of Department of Meteorology
and Hydrology, MAF and Provincial DMH



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Agricultural Development in (Lao
People's Democratic Republic
Japan International Cooperation Agency

Figure 2.1.1
Average Annual Rainfall (mm)



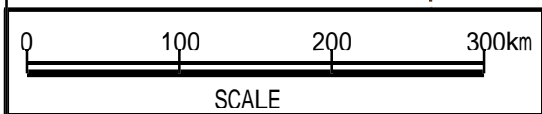
Rain Gauge Station	
1	Xiengkok
2	Ban Hongluay
3	Ban Pak Beng
4	Ban Sopchek
5	Ban Muang Et
6	Ban Naluang
7	Ban Hai
8	Ban Pha Muang
9	Ban Hin Beun
10	Ban Phonesi
11	Ban Tang Vay
12	Ban Chun La
13	Ban Namon
14	Ban Kensay
15	Ban Mnam Neun

	Slope Gauge Station	Location/River
①	Xiengkok	Confluence of Mekong with Nam Tha
②	Ban Hongluay	Nam Tha
③	Ban Pak Beng	Mekong
④	Ban Hat Pha Oth	Nam Suang
⑤	Ban Phieng Luang	Nam Ngum
⑥	Ban Naluang	Nam Ngum
⑦	Ban Hai	Nam Ngum
⑧	Paksane	Mekong
⑨	Thakhek	Mekong
⑩	Attapeu	Xekong
⑪	Ban Vieng Thong	Nam Lik

Legend

● Slope Gauge Station

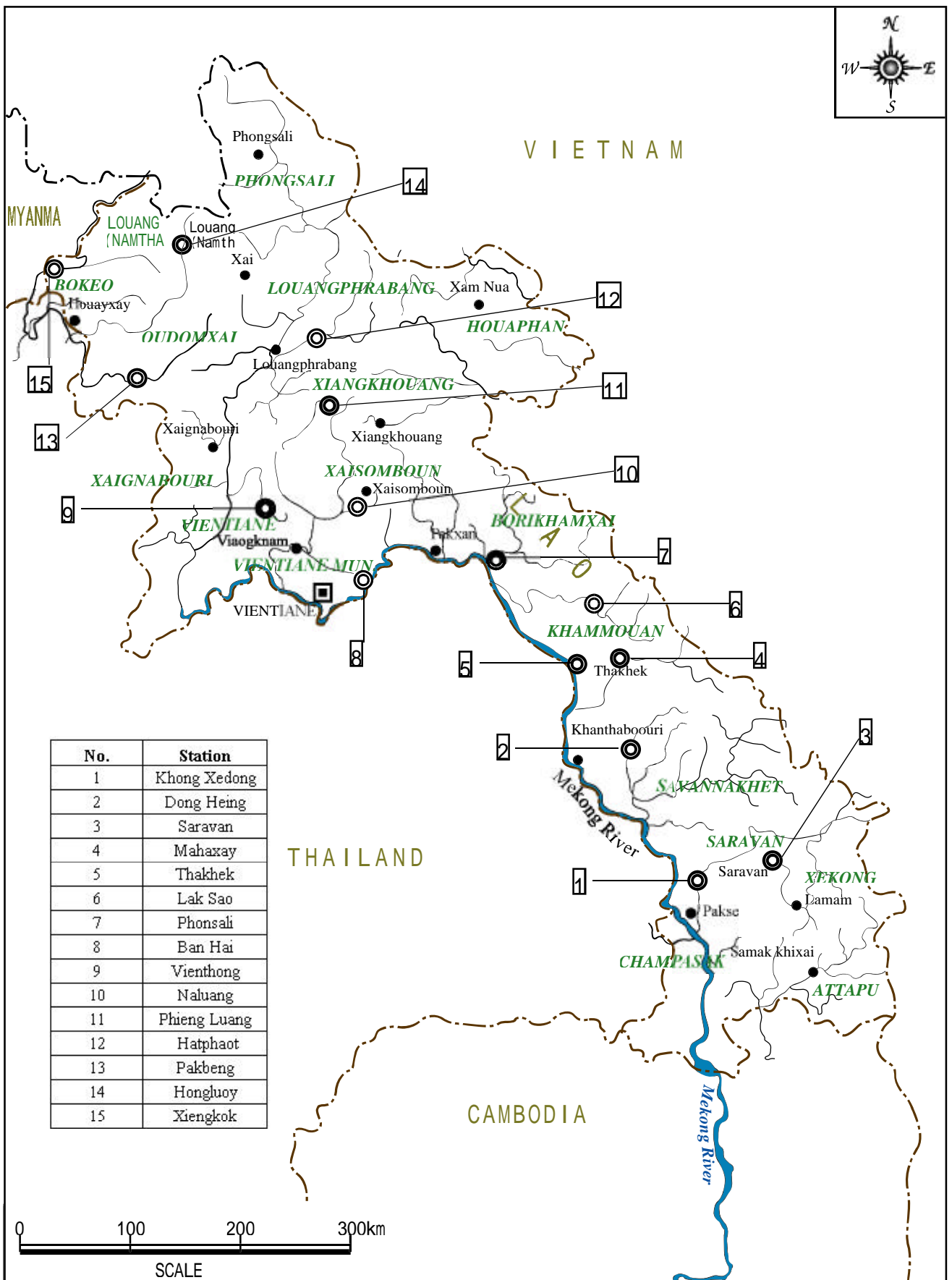
■ Rain Gauge Station



Master Plan Study on (Integrated Agricultural Development in (Lao People's Democratic Republic

Japan International Cooperation Agency

Figure 3.2.1
Location of Hydrology Station Constructed (Under JICA Program)

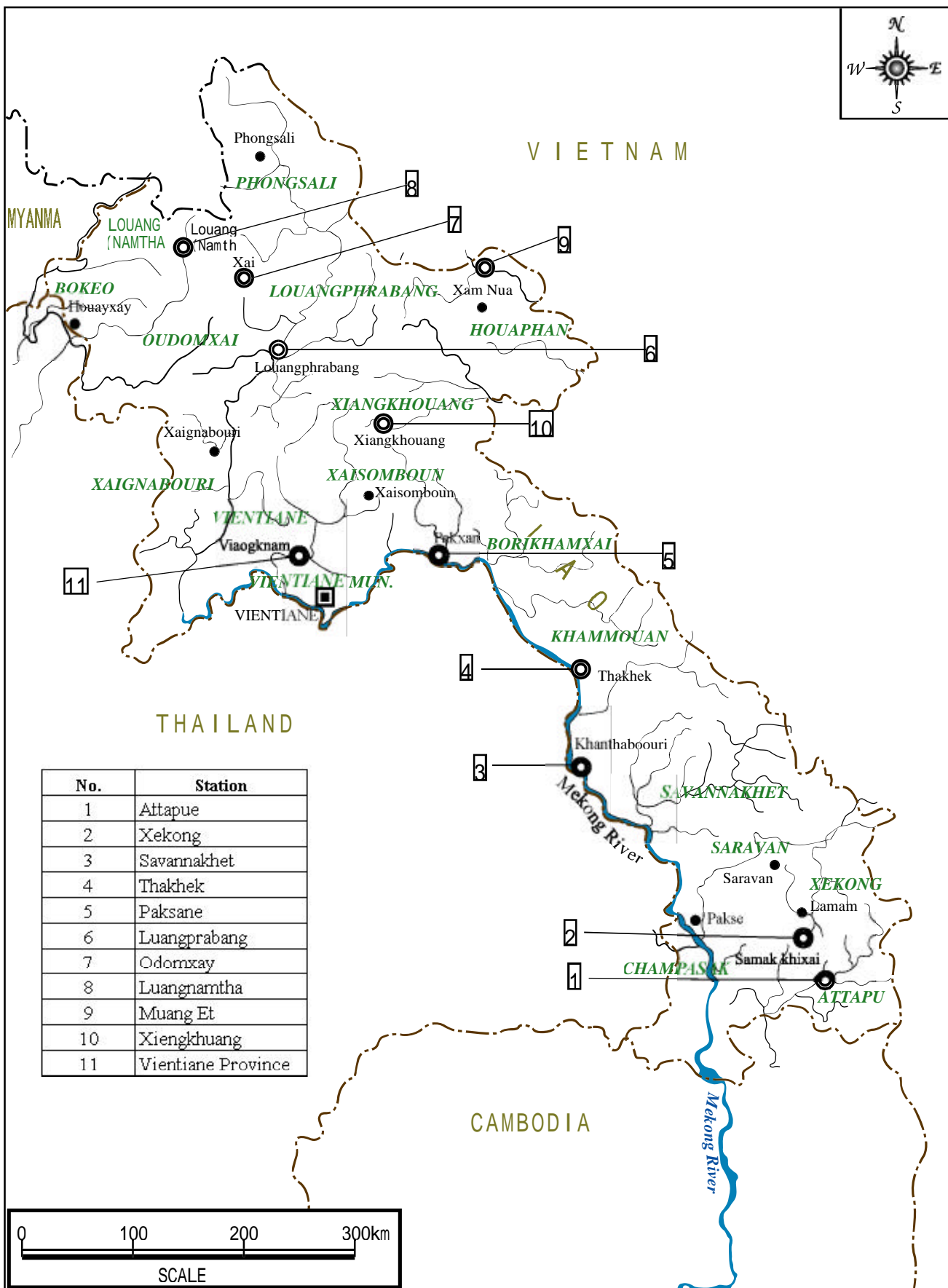


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Figure 3.7.1

Location of Transceiver Site

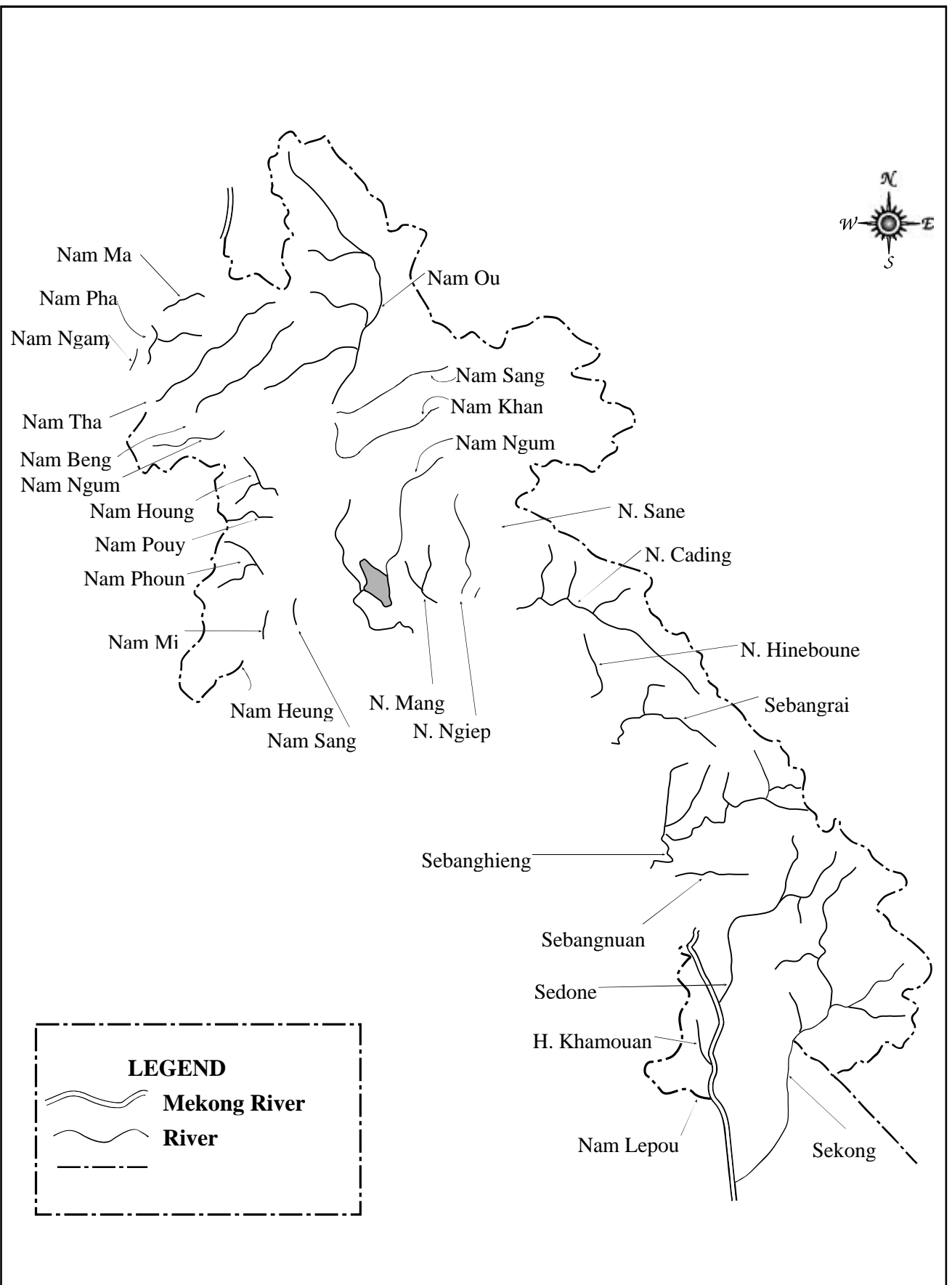


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Figure 3.7.2

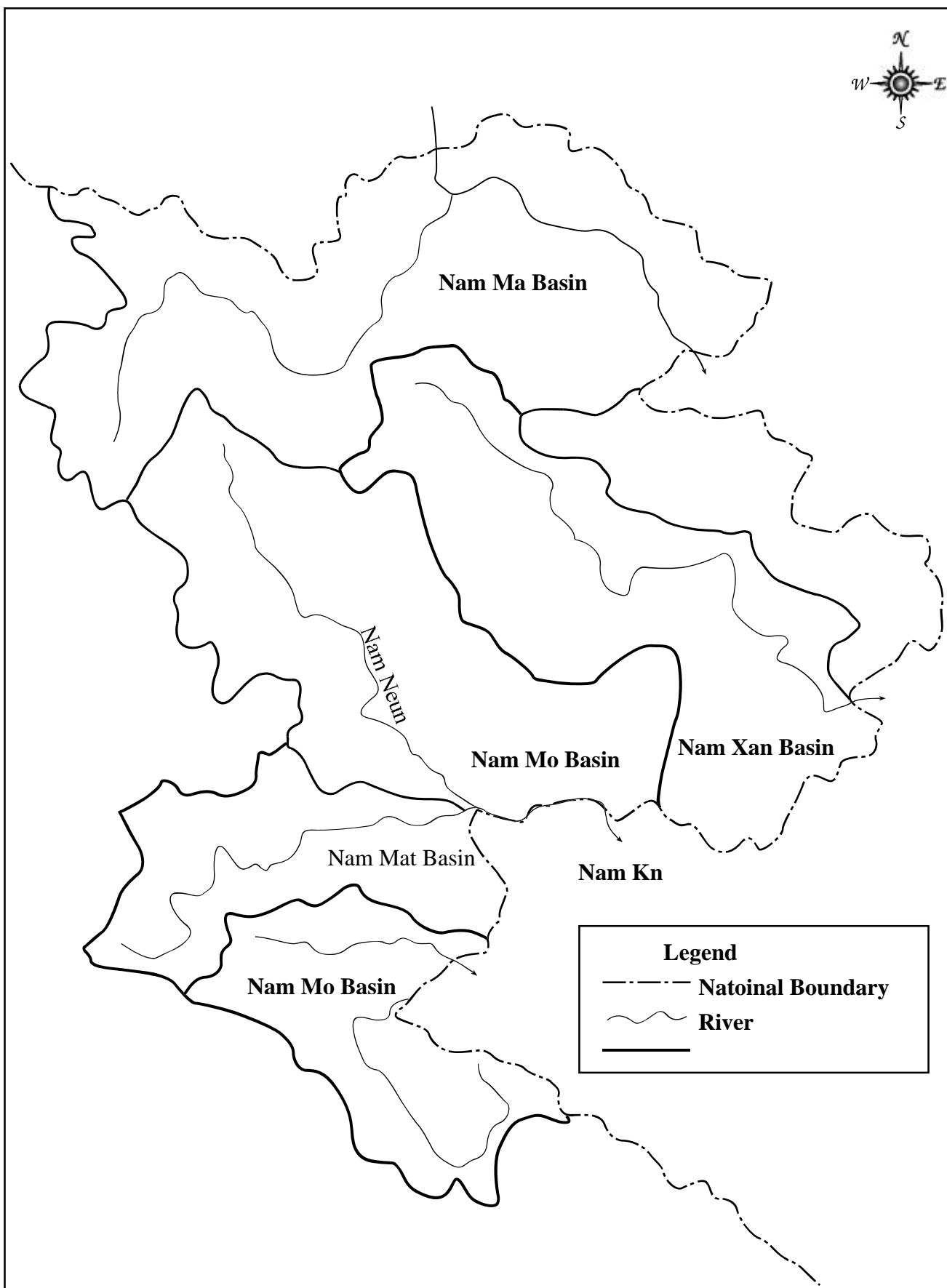
Installation of Computer Unit



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Figure 4.1.1
Location Map of the River
(The Mekong River Basin)



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Figure 4.1.2

Locatoin Map of the River ((Outside
of the Mekong River Basin)