LAO PEOPLE'S DEMOCRATIC
REPUBLIC
MINISTRY OF AGRICULTURE
AND FORESTRY

JAPAN INTERNATIONAL
COOPERATION AGENCY
(JICA)

THE STUDY
ON
THE INTEGRATED AGRICULTURAL AND RURAL DEVELOPMENT PROJECT
IN
BOLOVEN PLATEAU

VOLUME-III

ANNEXES

September, 1996

NIPPON KOEI CO., LTD.
NAIGAI ENGINEERING CO., LTD.

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THE MASTER PLAN STUDY

I INTRODUCTION

Agricultural development will achieve its target through both direct measures for increasing production and indirect ones for improving rural living conditions. Together there will be an integrated balanced agricultural development. However, considering the very poor present conditions of rural infrastructure in the study area, a priority of this master plan study will be given to basic infrastructure development as village /farm roads, domestic water supply, power supply, schools , village clinics and village community facilities. In formulating a development plan, consideration is given to the present conditions of topography, existing infrastructure, and villages distribution patterns for more economical and effective impact. Development level will be improved to target of better developed regions.

II PRESENT CONDITIONS OF THE STUDY AREA

2.1 Road Network

2.1.1 Trunk road

National road No. 23 runs approximately in the center of the study area from west to east, connecting Pakxong town, the center of the study area, with Pakxe city, the capital of Champasak province over a distance of 50 km. Road No.23 further extends northward to Thateng town, the capital of Thateng district, over a distance of 38 km and connects with road No. 20 at B.Beng 20 km away. From Pakxong town one more trunk road extends to the east, reaching national road No.16 at B.Khoumkham 72 km away. On the way to B.Khoumkham (Road No.16), an access road to Houay Ho dam site extending 75 km branches off at B.Thaot.

National road No. 20 branches off at B.Lak 21 of road No.23 northwards, leading to Salavan, the capital of Salavan province via Laongam. The distances between Lak 21 and Laongam, and Laongam and Salavan are 50 km and 37 km respectively. From Thateng town, road No.16 branches off eastwards, leading to Sekong, the capital of Sekong province and Attapu, the capital of Attapu province. The distances between Thateng and Sekong, and Sekong and Attapu are 50 km and 74 km respectively.

At present, a whole stretch of the road No.20 (B.Lak 21 to Salavan) and a part of the road No.23 (B.Lak 8 to B.Lak 28), with a total length of 107 km, are asphalt-paved with a 7.0 m width of roadway and 1.5 m of shoulders on both sides. The people are provided with very good road conditions. The remaining stretch of road No.23 form B.Lak 28 to Pakxong town is now under construction by the road No.20 construction company, and will be completed by the end of 1995. The roads to Houay Ho dam site and to road No.16 from Pakxong town are laterite paved with 7.0 m of roadway and 1.0 m of shoulders on both sides and well maintained by Daewoo (Korean contractor of Houay Ho Hydropower Project). It is in good condition and motorable throughout the year.

The stretch of road No.23 from Pakxong to Thateng is seriously damaged, only passable by 4WD vehicle in only the dry season. Rehabilitation of this road is already financed by the ADB and asphalt pavement works will be started in the end of 1995 and be completed in 1997. The road No.16 from Thateng to Attapu via Sekong is a gravel road and motorable throughout the year at present. The rehabilitation and asphalting of this road is also financed by the ADB, and will be completed in 2000.

As for provincial roads, only road No.161 is playing an important role in the study area, connecting Laongam with Khongxedon over 42 km. The road is laterite paved with 6.0 m of roadway and 1.0 m of shoulders on both sides and well maintained by the province, motorable throughout the year.

The distances of trunk roads in and around the study area are summarized below and illustrated in Figure VII-1.

Trunk roads in and around the study area

Road No.	Distance of Sections	Total (km)
Road No.23	Pakxe - (50 km) - Pakxong - (55 km) - B.Beng (Road No.20)	105
Road No.20	Lak 21(Road No.23) - (50 km) - Laongam - (37 km) - Salavan	87
Road No.16	Thateng - (50 km) - Sekong - (74 km) - Attapu	124
Road No.161	Laongam - (42 km) - Khongxedon	42

2.1.2 Feeder road

In the study area, there are a total length of 736 km of district roads/village roads. Of these, 252 km are in Pakxong, 58 km in Bachiang, 314 km in Laongam/Salavan and 77 km are in Thateng. Almost those district roads are earth roads with a 3.0 to 5.0 m width and not properly functioned. No drainage facilities such as pipe culvert and road side ditch are found. The provincial authorities are responsible for maintenance work of these district roads. However, because of the limited budget, as a result, little or no maintenance works are carried out in the study area. These roads are motorable only in the dry season. Because of such poor condition of village roads, the farmers are facing difficulty, not only for agricultural products transportation but even for daily activities of themselves especially in the rainy season.

Laongam Coffee Roads are an exception, which were constructed in 1988 financed by The World Bank with a total length of about 100 km , with a 4.5 m of laterite paved roadway and 1.5 m of both shoulders. These roads were rehabilitated in 1994 by the provincial authority and are well maintained. In addition to the Laongam Coffee Roads, coffee feeder roads are under construction under the Upland Agriculture Development Project financed by the World Bank. The total length of the coffee feeder roads is about 315 km, of which 117 km are in Pakxong district, 91 km in Laongam district and 107 km in Thateng district, respectively. The road construction was expected to be completed in 1995 in the primary schedule. However, the progress is delayed because of some engineering problems, it is expected to be completed within two (2) years. Presently, the responsibility of the coffee feeder road construction is transferred to the provincial transportation services.

In addition to the district roads/village roads, farm roads (farm to village road) are identified in the study area. These are all earth roads with a 2.0 to 4.0 m of width, mostly constructed by farmers themselves. Only ox-cart or hand tractors can be used on these roads in the dry season. The total length of the farm road is estimated at 843 km in the study area,

out of which 303 km are in Pakxong, 137 km in Bachiang, 355 km in Laongam/Salavan and 48 km in Thateng. These farm roads are maintained by the farmers themselves according to necessity. The condition of these roads is very poor; in other words these are almost like footpaths.

The total length of both village and farm road, and coffee feeder road construction, are summarized below and illustrated in Figure VII-2 and VII-3.

(km)

	Pakxong	Bachiang	Laongam *)	Thateng	Total
Village road	252	58	349	77	736
Farm road	303	137	355	48	843
Coffee road	117	0	91	107	315

Note: *) Including some part of Salavan district

Table VII-1 and VII-2 show more detailed inventory of village/farm roads and coffee feeder roads.

2.1.3 Transportation

(1) Public transportation

Public transportation service is available, operated by only private individual taxi, truck bus in the study area, which is under the supervision of the provincial authority, CTPC service. It is common that pick-ups (one to two ton-class with 12 seats) be used for the people's transportation within some short distances and truck bus (6 to 8 ton-class with 45 seats) for some long distance transportation.

In Pakxong area, pick-up taxies or truck buses depart every morning from four (4) main villages such as B.Houaykhong, B.Sekhot, B.Maixaysomboun and B.Thongset to Pakxe via Pakxong. Because of poor road conditions, daily operation of these taxies or truck buses is available only in the dry season. In Laongam area, daily operation of public transportation is available all the year round between Pakxe and four (4) main villages such as B.On, B.Phokhem, B.Phakout and B.Muangthe. Public transportation on main routes such as Pakxong-Pakxe, Salavan-Laongam-Pakxe, Salavan-Thateng-Sekong, Laongam-Kongxedon is also daily available with 2 to 4 trips a day. Transportation charges vary with the distance, for example 600 kip/passenger between Pakxe and Pakxong and 500 kip/passenger between Pakxong and each village.

(2) Transportation of farm products

Transportation of farm products from farm to villages is made by various means; human labor, ox-cart, horse and hand tractor/small tractor with trailer according to the topographical condition, farm road condition and the farmers' economic means. Almost all farmers depend on human labor or ox-cart to transport coffee from fields to the village. In the mountainous area however, if they have the means farmers intend to purchase small tractors with trailers for compensating labor shortage. The farmers travel in the study area by motorcycle or bicycle, because almost all farmers have them and farm roads are narrow and muddy in the rainy season.

2.2 Rural Water Supply

Almost all villages in the study area depend entirely on nearby streams and rivers for their drinking and domestic water. These villages are usually located near the perennial streams and rivers, not more than a few hundred meters. However, some villagers are facing difficulty to carry water with more than 1.0 km walk especially in the dry season. These water sources mostly are facing fecal pollution and other types of contamination problems from human and animal origins. Only limited villages have access to spring water and most of them are not protected against contamination by surface run-off. In some areas of the outskirts of the Boloven plateau, especially in Thateng area, the people have sufficient clean water from springs for drinking purposes. Primitive piped water systems are found here. Shallow dug wells are very rare and most of the existing ones are not properly protected and maintained. Tubewells with hand pumps are gradually being developed in the study area by the provincial public health service, with supporting from UNICEF.

2.2.1 Gravity flow piped water system

Wherever a water source is available at an effective distance from the village, the gravity flow piped system is preferred by the villagers. The water sources of existing systems are two (2) to four (4) km far from the villages to get clean water. The provincial public health service considers that five (5) km is the maximum distance between the village and water source. The existing intake facilities (small reservoir) are very primitive; often only a small stone masonry dam with a height of a half meter (0.5 m) without any protection from contamination. Some water sources are connected to a reservoir tank by steel pipe or HDP pipe, for stable water supply. From the reservoir tank or directly from the intake facilities, the water is distributed to the villages where common taps are installed.

Laongam town water supply system is different from the other piped water supply systems in the villages above. The water source is a spring at B.Tekit and main distribution pipe is about 7 km long. A total number of 312 taps are installed in each household or for some communal use among several households, equipped with counter meter in each tap. The operation and maintenance is done by a water supply state company Salavan under the provincial industry and handicraft service and collecting water charge at a rate of 120 kip/m^3. The system is so primitive that no water quality control and no protection from contamination are done. Some contamination is unavoidable in the rainy season.

There are 15 gravity flow piped water systems in the study area, out of which 3 systems are in Pakxong, one in Bachiang, 4 in Laongam and 7 in Thateng. These systems are mainly supported by the provincial public health service and UNICEF or AICF (one of the NGOs). Normally, the province and some donor organizations provide construction materials and the beneficial farmers supply their labor force for the construction of the system. However, in some villages such as B.Muangthe, B.Vangyao and B.Dong in Laongam district the farmers get some credit from the agricultural promotion bank for purchase of construction materials supported by various kind of village community strengthening programs.

The number of communal taps in the villages are much different between the systems which supported by the government and the systems which are constructed by farmers credit. The former is one tap per 38 households and the latter is one tap per 4 households.

2.2.2 Other water supply facilities

There are 36 tubewells with hand pumps in the 12 villages of the study area, out of which 19 tubewells are in Pakxong, 11 tubewells in Bachiang, one tubewell in Salavan, 3 tubewells each in Laongam and Thateng. Almost all these tubewells are supported by the provincial public health and UNICEF or NGOs. Eight (8) tubewells in B.Thongset in Pakxong district are an exception. These are privately constructed by the villagers themselves, digging holes by hand and installing hand pumps without proper casing. This is because these villages are located in some particular areas which may be advantageous from the hydro-geological viewpoint.

The user's ratio for one tubewell is estimated at one per 45 households at present. This figure is still low comparing the target figure of the provincial authority of one tubewell per 30 households. The constraints for tubewell development work are lack of drilling machines in the province in addition to the limited provincial budget. The available number of drilling machines is 7 in total, out of which 5 are in Champasak province, 2 in Salavan province and none in Sekong province at present. Almost all drilling machine are Thai made (PAT Drill 101, 201, 301) with a drilling depth capacity of 30 to 80 m.

There are not many concrete ring dug wells in the study area. Out of a total of 19 recorded dug wells, 13 wells are in Pakxong district, while 6 are in Thateng district. All concrete rings are supported by UNICEF or NGOs funds. There are, although not recorded, some unknown shallow dug wells constructed by the farmers themselves especially in the lower area of Bachiang and Laongam and most of them are not properly protected from contamination and maintained.

A water jar project is now underway in Bachiang, supported by World Vision (one of NGOs) under the "Bachiang Integrated Rural Development Project". Concrete made water jars with a capacity of 1.0 to 1.5 m^3 are provided to the farmers at a cost of 18,000 kip/unit. In 1994, 80 units have been provided and in 1995, 204 so far. The project is just at the starting stage and the effectiveness of water jar is not known at the moment because of the poor housing conditions, especially roof catchment system.

Features of existing domestic water supply facilities are shown in Table VII-3 and summarized below:

(nos.)

Facilities	Pakxong	Bachiang	Laongam	Salavan	Thateng	Total
Piped Water	3	1	4	0	7	15
Tubewell	19	11	3	1	3	36
Dug well	13	0	0	0	6	19
Water jar	0	284	0	0	0	284

2.3 Power Supply

The extension of 22kV transmission lines is being carried out in and around the study area based on the Provincial Grid Integration Project (PGI) by MIH and EDL. Presently, a 22 kV transmission line reaches Laongam town from Xe Set and another one comes to B.Ito (Lak 35) from Pakxe. By 1996/2000 the lines will be extended to Pakxong, Bachiang and Thateng. In the above areas, 48 villages will be supplied with 0.4 kV distribution lines in 1996/2000. Of these, 11 villages are in Pakxong, 12 in Bachiang, 7 in Laongam, 4 in

Salavan and 14 villages are in Thateng. The selection of these villages has been based on the study of PGI.

An extension plan for 22 kV transmission lines up to the year of 2000 has already been announced by EDL, suggesting that the extension work will be concentrated in the southern part of Champasak after reaching Pakxong, Bachiang and Thateng.

The number of villages to be installed with 0.4 kV distribution lines is summarized below and illustrated in Figure VII-4.

District	Pakxong	Bachiang	Laongam	Salavan	Thateng
No.of villages	11	12	7	4	14

There are two (2) micro-hydropower plants for rural electricity supply in the study area; one is operating in Pakxong town and the other one in B.Phakout (Laongam district), has broken down and has not been used since 1990. The Pakxong micro-hydro power station was constructed in 1987, supported by East Germany and now operated by the district staff. Two (2) units of generators with a capacity of 60 kW and 25 kW are installed in Pakxong. Because of insufficient water only 8 hours operation is possible in the dry season. Generation of power is estimated at 9,000 kWH/month in the rainy season and 3,000 kWH/month in the dry season. The total number of users is 220 households, paying an electricity charge of 37 kip/kWH. At present, the facility is operated with difficulty, because of spare parts problem. According to district officers, the operation of the power station will be stopped after the transmission line to Pakxong town is constructed.

A micro-hydro power station with a capacity of 30 kW in B.Phakout was constructed in 1988 by a Vietnam company. The funds for construction were provided by the villagers themselves. However, after 2 years use, the generator has not been used because of insufficient maintenance service and technical support to the farmers. Features of existing micro-hydropower stations are summarized in Table VII-4.

2.4 Social Infrastructure

2.4.1 Health care facility

Health care situations in the Study area are as follows:

Facilities	Pakxong	Bachiang	Laongam	Salavan	Thateng	Total
District Hospital	1	1	1	0	1	4
Village Clinic	9	11	1	3	2	26

District hospitals are entirely managed by the provincial public health service though, the village clinics are not supported sufficiently or effectively by the province because of limited budget. District hospitals are furnished with 10 to 40 beds, and have some rooms for consultation, examination, laboratory, dispensary and staff. The buildings of district hospitals are of wood or brick masonry, with a zinc roof and concrete floor. Clean water is insufficient in all hospitals and electricity is not available at present, except at the Laongam district hospital.

As for village clinics, almost all village clinics are in poor condition, having 1 to 3 rooms and furnished with 0 to 5 beds and no clean water supply systems. According to the provincial public health service, the minimum size required for a village clinic is a 9 m by 6 m house. It needs three rooms for use as dispensary, ward and medicine store room. Provincial officers state that one village clinic is proposed for a population of 1,500. However, when compared with the minimum requirement, present village clinics are insufficient in number and below standard in facilities. Both institutional and budgetary support for the village clinics are weak.

2.4.2 School facilities

The school facilities situation is summarized below:

School	Pakxong	Bachiang	Laongam	Salavan	Thateng	Total
Primary school w/class-3	61	34	36	25	25	181
Primary school w/class-5	30	13	7	5	1	56
Secondary school	9	5	1	0	1	16
Teacher's college	1	0	0	0	0	1

School facilities such as buildings, desks, benches and blackboards are very poor in the study area. Construction and maintenance of primary schools are the responsibility of the village people. Therefore, conditions of primary schools vary much among the villages. In order to improve the present poor condition of school facilities, the provincial education service is providing the people with construction materials as zinc roofs, nails and cement. This is supported by UNICEF. The budget of supporting organizations is also limited and the progress of primary school rehabilitation is always far below, comparing the annual target of the province. Required space of one class room of primary school is 7 m by 8 m with an area of 56 m^2 and a maximum capacity is 30 to 33 students. Almost all primary schools have no water supply facilities, which are so essential. Both institutional and budgetary support for the primary schools are weak.

2.4.3 Community hall

Community halls in good condition are not found in the study area, but some activities are under taken at some places. The farmers generally use such facilities as temple, school and some open spaces for village level communication.

2.4.4 Communication facilities

There are 8 radio communication facilities in the study area; 2 of which are of private companies in Pakxong and Bachiang. Of the remaining 6 facilities two are meteorology stations of MAF located in Pakxong and Laongam. The remaining four belong to district office, post office, police and propaganda office in Laongam. Telegraph facilities are available in the post office, military office and police office in Pakxong and in the post office in

Thateng. Post offices are available in Pakxong, Laongam and Thateng. Mass communication in the study area is presently restricted to transistor radios and television.

Facilities	Pakxong	Bachiang	Laongam	Thateng	Total
Radio communication	2	1	5	0	8
Telegraph facilities	3	0	0	1	4
Post Office	1	0	1	1	3

III RURAL INFRASTRUCTURE DEVELOPMENT PLAN

3.1 Physical Constraints

The main constraints on rural infrastructure which will affect directly and/or indirectly profitable agricultural development are summarized as follows:

a. The village road network (district road) is of limited number and is also in poor condition.

b. Almost no maintenance work of village roads is done.

c. The farm roads are also limited in number.

d. Effective telecommunication facilities are of limited number and are also in poor condition.

e. Availability of electricity is limited in the study area.

f. Potential for micro-hydropower is not fully developed yet.

g. Maintenance problems such as lack of spare parts and technical support, are being faced at the existing micro-hydropower plants.

Lack of good transport and a communication system constrain, especially to increase crop production as well as farm income. In the study area, only trunk roads such as Road No. 20 and No. 23 and some district roads, namely coffee roads are available for effective all year transportation of commodities, farm inputs and outputs, as well as for the people's movement from village to village by vehicles. The lack of good transport will also restrain the introduction and expansion of crop diversification by the farmers, especially cultivation of cash crops. In addition, the lack of a good communication system prevents the farmers from responding quickly to market signals and being able to transport their produce to the markets quickly in order to either meet a shortfall or to obtain favorable prices.

In addition, there are the following constraints to the expansion of education and health control, and development of other human needs for the people.

h. Water supply facilities such as tubewells with hand pumps and gravity flow piped water systems are not sufficient in relation to the need.

i. Water which is used for drinking purposes at present is below quality in some places especially in the rainy season, when compared with the minimum requirement.

j. The village clinics are not sufficient in relation to the government target of one clinic per 1,500 people.

k. Almost all village clinics have no clean water supply facilities.

l. The facilities of the primary schools such as buildings, desks, benches and blackboards are in poor condition.

m. Almost all primary schools have no water supply facilities, which are so essential.

n. Both institutional and budgetary support for the basic public service facilities such as village clinic and primary schools are weak.

3.2 Development Plan

3.2.1 Development concept

Development of rural infrastructure, especially the facilities for people's welfare, education and for promotion of farmer's progressive activities related to the increase in agricultural productivity, should also be taken into consideration in connection with the proposed agricultural development. Such facilities required are as follows:

(1) The lack of good transportation also restrains the introduction and expansion of improved farming and crop diversification by farmers, as well as marketing of farm inputs and outputs. The first priority will be given to the rehabilitation and grade-up of existing district roads (village to village roads) network in the study area. High priority is also given to construction / rehabilitation of farm roads (farm to village/trunk road).

(2) Villages where rural water supply system is already available are still very limited in the study area. These are also of a primitive nature. Provision of rural water supply will ease the burden of women and children, who now have to bring water from streams or rivers. Good water also means better health. The actual provision of good water depends on the availability of good quality in the natural state. Priority will be given to gravity flow piped systems. Consideration will also be paid to the construction of tubewells with electric pumps and overhead tanks.

(3) According to the Provincial Grid Integration Project (PGI) by MIH and EDL, the extension of 22 kV transmission lines will cover only 50 villages in the study area by 2000. It shows about 12.5 % of electrification rate compared with 399 of total villages of the study area. In this master plan, both further extension of transmission line from Xe Set hydropower station and development of micro-hydropower potential are proposed.

(4) Although most of the villages in the study area have their own primary school facilities, the buildings and equipment are in a very poor state. Rehabilitation of schools is studied as one of the program components. The rehabilitated school buildings could

be used not only for education of children, but of adults, as well, especially women, to improve their literacy level.

(5) Strengthening of village clinics is also considered as a component of this integrated rural development program. In addition to the minimum requirement of the buildings, and facilities to keep it clean, both institutional and budgetary support by the provincial government are essential for continuous effective operation. Water supply facilities and electricity supply are also indispensable for effective operation of the clinic.

(6) The construction of community hall will be considered for villages where not accommodated. The hall can be utilized for several purposes such as cooperative work, agricultural extension services, farmer training, health care services, meeting, propagation of rural life improvement and women's social status, etc.

3.2.2 Target setting and phasing

As mentioned above, the development plan for this project component includes, (i) rural road network, (ii) domestic water supply, (iii) rural power supply, and (iv) other social infrastructure. The targets for each plan are set out below and implementation will be phased. These are described as follows:

(1) Target setting

Targets for rural infrastructure in this master plan were studied and set for each component as follows:

i) Rural road networks

- Rehabilitation and up-grading of existing district roads (village to village roads) by laterite pavement, with a total length of 736 km, to be motorable throughout the year.

- Rehabilitation and up-grading of existing farm roads (farm to village roads) by laterite pavement, with a total length of 843 km, to be motor able throughout the year.

ii) Domestic water supply

The following three (3) water supply systems are proposed considering such conditions as hydro-geology, topography, availability of electricity and number of households:

- Gravity flow piped water system;
- Village water supply system by tubewell and elevated tank using electricity; and
- Tubewell with hand pump.

iii) Rural power supply

The following two (2) components are proposed based on water resource potential for micro-hydropower and accessibility to villages in the case of transmission lines:

- Extension of existing high voltage transmission lines; and
- Development of micro-hydropower generation.

iv) Social infrastructures

The following three (3) components are proposed based on present rural infrastructure conditions:

- Rehabilitation and/or construction of primary schools;
- Rehabilitation and/or construction of village clinics; and
- Construction of community hall.

(2) Phasing

Phasing of infrastructure development is studied in accordance with the overall agricultural development strategy and also taking into consideration such weight components as beneficiary population, agricultural potential and availability of water resources.

i) Master plan development (up to year 2010)

The master plan development strategy for rural infrastructure will be to concentrate in 16 priority project areas, which were selected mainly based on agricultural and water resources development potentials, described below in detail. These selected areas are expected to be models for further extension into the surrounding areas in a future development plan.

ii) Future development

The future development strategy for rural infrastructure will be to expand the project's activities, which were selected as models for surrounding areas. The future programs will be also implemented in combination with agricultural development programs aiming at an integrated balanced rural development. Operation and maintenance of model projects, constructed in the master plan development period, should serve as case studies for implementing more practical programs in the future.

3.3 Overall Development Plan

3.3.1 Rural road network

(1) Village roads (District roads)

Improved village roads will provide not only permanent access from Road Nos.20, 23 and 16 to each village, but also allow continued access to light traffic to serve the agricultural and social needs of the people. These roads will also provide access to potential areas for future irrigation development. In the study area, there are a total length of 736 km of village roads under poor conditions described in the previous chapter. One hundred km of Laongam Coffee Roads, completed in 1988 and 315 km of Coffee Feeder Roads presently under construction by LUADP, will hopefully be a model for the proposed village road development program in this master plan.

(2) Farm roads (Farm to village road)

There are farm roads, mostly constructed and maintained by farmers themselves with a total length of 843 km in the study area. The condition of these roads is very poor; in other words these are almost like foot paths. Improvement of these roads is also important for transport of farm inputs and outputs.

(3) Maintenance system

Almost no maintenance work of the district road network is carried out by the provincial office because of limited budget, staff and equipment. Very limited maintenance work is done only by manpower of the village people. As shown in the table below, activity for district road maintenance and new construction to be carried out by the provincial communication services by 2000 is estimated at about 80 km/year for maintenance work and about 17 km/year for new road construction work in the study area.

District Road Development Plan 1996 - 2000 by Provincial Communication Service

(Unit : km)

Work Item	Pakxong	Bachiang	Laongam	Salavan	Thateng	Total
Maintenance	189	52	84	-	77	402
New road construction	56	25	-	-	-	81
Asphalt pavement	3	3	-	-	-	6
(Coffee feeder road)	117	-	91	-	107	315

(4) Design standard

The following design standard, commonly applied to rural tertiary roads in Laos, is applied for the master plan study:

- Design speed : 20 - 40 km/hour
- Carriage way width : 3.5 m (Village road)
  : 3.0 m (Farm road)
- Shoulder width : 1.0 m x 2 sides
- Pavement : Laterite pavement

(5) Overall development plan

Based on the budgetary conditions of the provincial communication services, the target for village/farm road improvement (reconstruction) is proposed at 50 km/year. Considering the importance of these roads to the economic development of the villages, it is proposed to maintain periodically these roads at least every 3 years. The network of existing village/farm roads which are proposed to be improved is shown in Figure VII-2. The plan of development is shown in Table VII-5. The followings are summary of road improvement:

- Target of annual completion for village/farm road development : 50 km
- Total length of proposed village road construction : 736 km
- Total length of proposed farm road construction : 843 km
- Periodical maintenance : every 3 years

Based on the target of 50 km/year, the village/farm road development program expects to complete 750 km at the end of 15 years. As far as road development concerned, the proposed road development program (the target of 50 km/year) will also take place to some extent outside the boundaries of the priority area in order to encourage development of the surrounding villages. Periodical road maintenance is also very important to mininize maintenance cost. It is proposed to strengthen/organize the road maintenance system in the districts and involve the village people also. It is also proposed to seek more budgetary support from the province. Periodical maintenance should be done every three (3) years as a minimum requirement. After completion of 1,579 km of total length of proposed village/farm road, the average annual length for maintenance will reach about 500 km.

3.3.2 Rural water supply

Three (3) water supply systems are proposed, considering such conditions as hydro-geology, topography, availability of electricity and number of households in a region or village. These are :

- Gravity flow piped water system;
- Village water supply system by tubewell and elevated tank using electricity; and,
- Tubewell with hand pump.

(1) Gravity flow piped water supply system

Among these water supply systems, "gravity flow piped water system " is the most suitable if the water resource is available within an convenient distance from the village. In the study area, 12 sources of water are identified for gravity flow piped supply, covering 61 villages with about 33,000 people. The table below summarizes the development potential of each water source in the study area.

Summary of Potential Gravity Flow Piped Water Development

Water source	District	Available water (lowest flow) (m3/sec)	No.of villages	No.of households	Predicted population in 2010
1. H. Champi	Pakxong	0.03	10	1,054	7,630
2. H. Last	Bachiang	0.005	6	484	3,368
3. H. Kouang	Bachiang	0.26	9	661	3237
4. H. Makngeo	Bachiang	0.12	1	57	401
5. H. Lapi	Bachiang	0.23	1	117	841
6. H. Palai	Bachiang	0.17	4	363	2,793
7. H. Kapheu	Laongam	0.04	9	842	6,620
8. H. Tapoung	Laongam	0.05	9	443	3,314
9. H. Pao	Laongam	0.06	5	706	4,446
10. Xe Set	Salavan	1.73	5	358	3,082
11. H. Latan	Salavan	0.005	1	22	176
12. H. Kaphouy	Thateng	0.005	1	28	206
(Total)			61	5,136	33,059

Table VII-6 shows more detailed features of potential gravity flow piped water development and the location of each water resource is shown in Figure VII-5.

In designing a piped water system, the construction of an intake structure with a sand filter tank, is proposed for a continuous supply of clean water. It is also recommended to construct one distribution tank in each village for a stable supply. The distribution network should cover as many villages as possible, depending on village location and water availability. Unit domestic water consumption of 60 lit./day/person will be applied as a minimum requirement for planning and design of the village water supply system, making reference to the standard of MPH. A population growth for 2010, based on a 2.7 % increase, was used in designing the water demand. A communal stand tap is proposed for each of five (5) households to reduce women's daily chore of carrying water.

Where a gravity flow system is not suitable because of topographical conditions, village water supply system with elevated tank using electricity should be considered. Water from the river/stream or spring is pumped up to an elevated tank and is distributed through gravity to communal stand taps.

(2) Groundwater

Where a gravity flow piped system is not suitable because of inadequate water availability and/or difficult topographical conditions, the possibility of groundwater development should be considered. Recently, "The Study on Groundwater Development for Champasak and Salavan Provinces" was carried out by a JICA study team in an area partly covering Bachiang, Laongam and Salavan districts. Preliminary Groundwater Potential Map in the progress report of the above study shows that the groundwater resource is basically classified into four (4) classes. These are from A to D in diminishing order. However, class D, which is a low potential, is not found in the Boloven plateau study area. The hydrogeologic features of the above three (3) districts are summarized as follows:

Type of Hydrogeologic Features

1)	Symbol of hydrogeologic features	:	Ba1, Ba2, Ba3
2)	Geomorphology	:	Basalt Slope 1, 2, 3
3)	Lithology	:	Basaltic lava flows, Jurassic shales under the lava
4)	Geologic age	:	Neogene - Quaternary Paleogene - Neogene
5)	Aquifer type	:	Intergranular and Fissured Aquifer
6)	Water table depth	:	5 - 35 m, High - Low, 4 - 12 m
7)	Existing well yield	:	4 - 84 m3/h, Mid - Low, 6 - 9 m3/h
8)	Water quality	:	pH 5 - 7, EC 11 - 250 µs/cm
9)	Groundwater potential	:	A - C, B - C, B - C

The groundwater potential map shows that Pakxong and Thateng districts are also classified into Ba1 and Ba2 symbols of hydrogeologic feature respectively. Further, the yield data of existing wells indicate that groundwater development is possible, although more detailed study will be done before implementing. At this moment, it is considered that groundwater development is generally possible in the study area and proposed two (2) types of water supply system by tubewell, namely (i) village water supply system by tubewell and elevated tank using electricity and (ii) tubewell with hand pump.

i) Village water supply system by tubewell and elevated tank using electricity

This village water supply system is proposed under the following conditions from the economical view point.

- Availability of electricity; and,
- More than 50 households per village.

It is proposed that the distribution network of this system will cover only one village with each tubewell, because of the ease with which small users' organizations can be managed. Operating costs will be slightly higher than that of a gravity flow piped water system. Water from the tubewell is pumped up to an elevated tank and is distributed through gravity to communal stand taps, each for five (5) households in the village.

ii) Tubewell with hand pump

Where the above village water supply system is not possible, tubewell with hand pump is preferable. Tubewells will be constructed with washing bases each for ten (10) households.

3.3.3 Rural power supply

Although rural electrification is one of the main requirements of the people, as well as for socio-economic development, the main constraints are lack of data and information on the availability of water sources and locations. At present, several large scale hydropower

projects are under construction or are being studied such as Houay Ho, Xepian-Xenamnoy, Xe Katam No.1 and No.2 in the eastern part of the plateau, mainly for the purpose of selling electricity to Thailand. However, a study of micro-hydropower has not been done until now, except for two or three water sources by the provincial industry services. In this section, two (2) components are considered for rural power supply , they are 1) extension of existing high voltage transmission line from Xe Set Hydropower Station, and 2) development of micro-hydropower generation.

(1) Extension of existing high voltage transmission line from Xe Set Hydropower Station

As mentioned in Chapter 2, the EDL plans to supply electricity to a total of 50 villages with 0.4 kV distribution lines by 2000. A further extension of high voltage transmission line will be studied in the future by MIH and EDL, based on an economic comparison with local micro-hydropower development. However, a rough estimate of required length of transmission line network is made for covering almost all the villages in the study area , as indicated below:

Overall Development Plan of Extension of Transmission Line Network (Unit : km)

District	Pakxong	Bachiang	Laongam	Salavan	Thateng	Total
Length	250	90	180	70	80	670

It is estimated that high voltage transmission lines will be constructed along the trunk roads and main district roads so as to minimize the total length of the line, as shown in Figure VII-6. The line is expected to cover more than 90 % of a total of 373 villages in the study area.

(2) Development of micro-hydropower generation

At present, no detailed data is available about micro-hydropower development potential in the study area. The provincial industry services are responsible for the development and investigated only two (2) potential sites such as Houay Xe at B.Setkhot in Pakxong district and Houay Tapoung at B.Houayseng in Laongam district. Based on interviews with provincial officials and field surveys by the JICA study team, twelve (12) potential sites are proposed for micro-hydropower development, including one (1) rehabilitation site of B. Phakkout, which has broken down and has not been used since 1990.

Potential generation capacity is calculated based on such factors as the lowest discharge and effective head, in combination with other purposes of irrigation, domestic water supply and maintenance flow. Tentative plan is made based on a discharge, ensured at least 275 days in a year with 1/5 probability of the water sources for this master plan. The estimated potential generation capacity of proposed sites varies from 20 kW of Houay Palai to 160 kW of Houay Xe in both Pakxong district, totaling 1,110 kW of potential generation. Micro-hydropower potentials of each proposed site are summarized in Table VII-7 and their locations are shown in Figure VII-7.

3.3.4 Social Infrastructure

(1) Rehabilitation and/or construction for primary school

As described in Chapter II, there are 237 primary schools among total 399 villages in the study area, out of which 181 schools are *Pathomsomboun* (primary school with class 3) and 56 schools are *Munpathom* (primary school with class 5). In order to improve the present poor condition of school facilities, the provincial education services are providing the people with construction materials however, the progress of primary school rehabilitation is always far below, as compared with the annual target of the provinces. The proposed target of primary schools rehabilitation is 60 % of present primary schools, which includes sufficient space, necessary equipment, water supply facilities and latrines. The total number of primary schools to be rehabilitated is 143, of which class-3 primary schools are 109, and class-5 schools 34, respectively. These are summarized below:

Overall Development Plan of Primary School

District	Pakxong	Bachiang	Laongam	Salavan	Thateng	Total
No.of Villages	105	76	110	58	50	399
Existing Primary School						
- with class-3	61	34	36	25	25	181
- with class-5	30	13	7	5	1	56
Proposal to be rehabilitated						
- with class-3	37	20	22	15	15	109
- with class-5	18	8	4	3	1	34

(2) Rehabilitation and/or construction of village clinic

There are four (4) district hospitals and 23 village clinics in the study area. The district hospitals are entirely managed by the provincial public health service, though the village clinics are not supported sufficiently or effectively by the province because of limited budget. Provincial officers state that one village clinic is proposed to command a population of 1,500. Rehabilitation/construction of the clinic will be made according to the above rate with sufficient space, necessary equipment, water supply facilities and latrines. The total number of village clinics to be rehabilitated/constructed is 94, summarized below:

Overall Development Plan of Village Clinic

District	Pakxong	Bachiang	Laongam	Salavan	Thateng	Total
No.of Villages	105	76	110	58	50	399
Population	41,758	22,275	41,122	20,623	14,403	140,181
Existing Village Clinic	9	11	1	3	2	26
Proposal to be Strengthened	28	15	27	14	10	94

(3) Construction of community hall

Community halls in good condition are not found in the study area, but some activities are under taken at some places. The farmers generally use such facilities as temples, schools and even open spaces for village level communication. Community halls at village level are not only for social communication among the villagers, but for agricultural development

activities such as marketing of agricultural outputs, farmers' training and farmers' association. It is proposed that one community hall should be constructed in each village with necessary equipment and furniture such as tables, benches, blackboards. The total number of community halls to be constructed is 399, and is summarized below:

Overall Development Plan of Community hall

District	Pakxong	Bachiang	Laongam	Salavan	Thateng	Total
No.of Villages	105	76	110	58	50	399
No.of Community halls						
- Existing	0	0	0	0	0	0
- Proposal	105	76	110	58	50	399

3.4 Priority Development Plan

3.4.1 General

The development plan for rural infrastructure in the selected sixteen (16) areas was studied. Six (6) components were considered for each priority area. These are i) Domestic water supply, ii) Village/farm road, iii) Electricity, iv) Primary school, v) Village clinic, and vi) Community hall.

(1) Domestic water supply

Three (3) water supply systems are proposed, considering such conditions as hydro-geology, topography, availability of electricity and number of households in a region or village, as described below:

i) Gravity flow piped water system.

Water from a river/stream will be taken through an intake facility and is diverted to a sand filter tank and then introduced to a main pipe line, covering all the villages. Distribution tanks will be installed in each village for a better distribution. Communal stand taps will be installed at the rate of one to five (5) households.

ii) Village water supply system by elevated tank using electricity

This system will be further divided into two (2), depending on water sources, namely surface water and groundwater. If surface water available, the water filtered will be pumped up to elevated tanks in each village. If water source is groundwater, the water will be pumped from tubewell directly to an elevated tank. The water then will be distributed to communal stand taps by gravity.

iii) Tubewell with hand pump

Where no power supply is expected, a water supply system "tubewell with hand pump" is recommended to be provided as an urgent program component. Tubewell with hand pump is also proposed in the villages, having less than 50 households. The estimated number of tubewells is based on a minimum requirement of one well per 10 households.

(2) Village/farm road

Both village roads, connecting villages and farm roads, connecting the village with farm, will be rehabilitated/constructed. River crossing and drainage facilities such as box culverts, pipe culverts and side ditches are proposed to be constructed where needed in order to maintain good road condition.

(3) Electricity

Two (2) components are considered for rural power supply, described below:

i) Extension of existing high voltage transmission line

If the area is located within about 30 km from the 22 kV transmission line, power supply system from the transmission line will be considered to be provided for the area in the proposed priority project. If not, it will be considered in a future plan. Distribution line of 0.4 kV is also considered in the project for the use of individual households.

ii) Micro-hydropower generation

Micro-hydropower generation is proposed where water source and topographical condition are suitable. Power demand is estimated based on 200 W for each household. Design power generation is also estimated based on a discharge, ensured at least 275 days in a year with 1/5 probability of the water sources. The power station comprises basically intake facility, a head tank, penstock and turbines and generators. Two (2) units of generators with the same capacity for each site are proposed, considering convenience of maintenance.

(4) Social infrastructure

As for primary school development, two (2) types of schools, namely class-3 and class-5, are recommended based on the existing conditions. Village clinics are classified into two (2) types; type-I and type II. Type-I has a building space of 54 m^2, which is for villages having a predicted population of less than 1,000 people in 2010. Type-II has a building space of 72 m^2, for villages having a population of more than 1,000 people. Each primary school and village clinic are equipped with a tubewell. The proposed community halls are also classified into three (3), type-I, type-II and type-III. The building spaces of those types are 100 m^2, 200m^2 and 300m^2 respectively, which are for villages having predicted numbers of household of less than 100, between 100 and 200, and more than 200 in the year of 2010, respectively.

3.4.2 Priority projects

The proposed rural infrastructure development for the priority areas is summarized in Table VII-8 and detailed descriptions for each area are as shown in Table VII-9 (1/16) to Table VII-9 (16/16). Tables VII-9 (1/16) to (16/16) describe the number and names of target villages, present and predicted number of households and population, and proposed rural infrastructure development components.

IV PRESENT CONDITION OF THE PRIORITY SCHEME AREA

4.1 Rural Road Network

Two (2) of the selected priority areas, Upper Champi and Lower Xe Set are located along the national road either of No.23 or No.20 respectively and have good accessibility. These national roads have a 6 m width of asphalt paved roadway and 1.5 m of shoulders on either side (Lao Standard Class-IV).

Upper Tay-Un area has also good accessibility connected with the national gravel roads No.23 and No.16. The road No.23 in this section is now under rehabilitation and its asphalt pavement work will be completed in 1997. The rehabilitation and asphalting of the road No.16 is also financed by the ADB, and will be completed in 2000.

Upper Tapoung area is about 10 km away from road No.23 at Pakxong. This priority area is connected through a district road (Coffee Feeder Road), with a 5.5 m of laterite paved roadway and 0.5 m shoulders (Lao Standard Class-V). This road was recently improved by the province of Champasak under "Coffee Feeder Road Improvement Program", newly financed by ADB. These coffee feeder road construction under the Upland Agriculture Development Project, financed by the World Bank, had been delayed until 1995 because of some engineering problems. And finally all the above coffee feeder road construction programs were transferred to the three (3) respective provinces of Champasak, Salavan and Sekong with new finance from ADB, and are expected to be completed within two (2) years.

Upper Kapheu area is also located about 4 km away from the road No. 20 at B.On-Beng (the entrance point of this priority area). This area is connected with a district road (one of Laongam Coffee Roads constructed in 1988) with the same width of the above Coffee Feeder Road and well maintained by the province of Salavan.

In addition to the above national and major district roads, village roads (village to village) and farm roads (village to farm) are identified in the areas. These are all earth roads with a 2.0 to 4.0 m of width, mostly constructed by farmers themselves. The condition of these roads is very poor. Only ox-cart or hand tractors can be used on these roads in the dry season. These village and farm roads are maintained by the farmers themselves according to necessity. Besides these farm roads, a lot of footpaths are networked in the farm land for mainly agricultural activities. The total lengths of these roads in the priority areas are summarized below and detailed in Table VII-10. The road densities are very low, varying 1.9 to 12.4 km/km^2 in each area and 3.0 km/km^2 on average in all priority areas, even though the farm roads are included in the calculation.

Road Length and Density

Priority Scheme Area	Net Area (ha)	Road Category				Total Length (km)	Road Density (km/km^2)
		National	District	Village	Farm		
Upper Champi	730	13.8	3.1	4.5	8.8	30.2	4.1
Upper Tapoung	80	0.0	6.4	0.0	3.5	9.9	12.4
Upper Kapheu	1,000	0.0	6.3	3.7	10.2	20.2	2.0
Lower Xe Set	1,000	4.4	5.6	8.9	0.0	18.9	1.9
Upper Tay-Un	330	1.6	2.8	1.7	7.7	13.8	4.2
(Total)	3,140	19.8	24.2	18.8	30.2	93.0	3.0

4.2 Rural Water Supply Facility

Almost all villages in the priority areas rely entirely on nearby streams or rivers for drinking and domestic water. These villages are usually located near perennial streams and rivers, not more than few hundred meters. However, some villagers face difficulty in carrying water for more than 1.0 km, particularly in the dry season. In Upper Champi and Upper Kapheu areas the people are also facing difficulty in fetching water from the deep valley of the river. These water sources mostly are facing fecal pollution and other types of contamination problems from human and animal origins.

Only limited villages have access to other water sources and these are gravity flow piped water system, spring, dugwell and tube well with hand pump. There are two (2) gravity flow piped water systems in B.Lak40 and B. Lak38 of Upper Champi area. These are supported by the provincial public health service and UNICEF. The number of communal taps are 19 in B.Lak40 and 16 in B.Lak38, with an average ratio of six (6) households per tap. In addition, one (1) private pipe system exists in B.Lak42, which covers seven (7) households with one (1) communal tap. This system consists of a generator, a motor pump, a concrete reservoir tank (8 m^3) and 500 m of pipe line

The villagers of B.Lak43 of Upper Champi area rely on ten (10) dug shallow wells because of the long distance to the stream. These wells are about 13 to 15 m deep and protected by brick masonry at the ground level. Almost all the wells face contamination in the rainy season and insufficient water in the dry season.

There is one (1) spring development water system in B.Khamkok of Upper Tay-Un area. This system was constructed in 1995 supported by AICF (one of NGOs). The system consists of a water collecting facility protected by concrete walls, a washing/bathing platform and is without distribution pipelines. The pipes are directly installed and the water is flowing out continuously.

There is one (1) tube well with hand pump with a depth of 30 m in B.Chakam-mai of Upper Tay-Un area. This well was newly constructed in 1996 supported by the provincial public health service and UNICEF. The village people also shared the cost of installation by providing 100,000 kip. This well is used only for drinking purposes by the people. H. Tit, about 200 m away from the village is the water source for bathing and washing purposes.

Number of villages by main water source are summarized below and also detailed in Table VII-11. The figures in the table below show that 20 villages or 80 % of villages in the whole priority areas are relying on nearby streams or rivers for drinking and domestic proposes with an average distance of 200 m for fetching water.

Number of Villages by Main Water Source

Priority Areas	Upper Champi	Upper Tapoung	Upper Kapheu	Lower Xe Set	Upper Tay-Un	Total
No.of Villages	8	3	5	6	3	25
Water Source						
(1) Gravity Flow Piped Water System	2	0	0	0	0	2
(2) Spring Development System	0	0	0	0	1	1
(3) Shallow Dug Well	1	0	0	0	0	1
(4) Tubule with Hand Pump	0	0	0	0	1	1
(5) River/Stream/Spring	5	3	5	6	1	20

4.3 Water Supply Management

The existing village water supply systems in B.Lak40 and B.Lak38 are very simple gravity flow piped systems and the people have insufficient water during the dry season because of the limited water flow of source. Both systems are managed by the village committees and no specific water user's association exists. Water charges are not collected regularly and some are collected in case of necessity of repair. In the event of major repair village people wait for government assistance. According to the interview survey, water supply is not properly distributed to the people. In other words, the people located near the water source get more water than those located far downstream. Therefore, some complain about unfair distribution of water.

4.4 Power Supply

Among total 25 villages in all priority areas, only one (1) village B.Lak35 in Upper Champi area, is electrified with two (2) units of transformer (22kV to 0.4 kV, 100kVA). The total number of house connections is 111 among 121 of total households, showing 92 % of user's ratio in the village. The power rates by categories are summarized below:

Power Rate

Category	Power Rate (kip/kWH)	
(1) Office, Hotel, Market, Restaurant		47
(2) Residence	0 - 100 kWH	8
	101 - 200 kWH	15
	201 < kWH	25
(3) Irrigation		7
(4) Factory		30

The extension of 22 kV transmission lines is being carried out in and around the priority areas based on the Provincial Grid Integration Project (PGI) by MIH and EDL. According to the extension plan above, 8 villages or 32 % of total villages in all priority areas will be electrified by the year 2000. In addition, once the above extension plan is realized, 12 more villages can be electrified with an installation of a transformer (22kV to 0.4 kV) in each village. However, one condition is that the beneficiaries should pay 30 % of the total cost for extension. The transmission extension plan related to the priority areas is summarized below:

Transmission Extension Plan

Priority Area	Upper Champi	Upper Tapoung	Upper Kapheu	Lower Xe Set	Upper Tay-Un
Total No.of Villages in the Priority Area	8	3	5	6	3
Province	Champasak	Champasak	Salavan	Salavan	Sekong
District	Pakxong	Pakxong	Laongam	Salavan	Thateng
(1) PGI Champasak, 1/	4 (8), 4/	1 (3), 4/			
(2) PGI Salavan, 2/			3		
(3) PGI Sekong, 3/				(3), 4/	(3), 4/

Note :

1/ : (1) PGI of Champasak province (Plan for Pakxong district up to the year 2000):
A total of ten (10) villages will be electrified, out of which four (4) villages are in Upper Champi area and one (1) village is Upper Tapoung area. They are B.Lak33, B.Lak38, B.Lak40, B.Lak43 and B.Xetapoung. However, 22 kV transmission line will cover all the villages in Upper Champi and Upper Tapoung.

2/ : (2) PGI of Salavan province (Plan for Laongam district in 1997):
A total of ten (10) villages will be electrified, out of which three (3) villages are in Upper Kapheu area. They are B.Ong-gnai, B.On-noi and B.Phouak-noi.

3/ : (3) PGI of Sekong province (Plan for Thateng district in 1998):
22 kV transmission line with a total length of 37 km will be extended from B.Beng to Thateng district, which may cover Upper Tay-Un area. Because the line will be further extended to Sekong in near future by way of Upper Tay-Un area.

4/ : The figures in parenthesis are showing the number of possible electrified villages, if 0.4 kV of transformer are installed with a burden-share of the villagers.

4.5 Other Rural Infrastructure Facilities

(1) Health care facilities

There is only one (1) village clinic in the all priority areas, located in B.Lak35 of Upper Champi area. This clinic consists of one room, 4.0m by 6.0m with wooden walls and galvanized iron roofing and has no water supply facilities. It is far below the standard requirement of a village clinic building, which is a space of about 42 m^2 (6m x 7m), consisting of a consultation room, examination room, stock room, toilet and dinning room. One (1) assistant doctor and two (2) nurses are assigned by the provincial public health department to this village clinic. However, the assistant doctor is mainly working at Pakxong district hospital about 15 km away and the two nurses are generally on-call in their houses. This may happen because of the poor condition of the clinic and the people prefer to go to the district hospital in Pakxong or the provincial hospital in Pakse.

The people in the other priority areas also go to the district or provincial hospitals nearby the when they get ill. According to the public health department officer in Champasak, the government health services are concentrating not only on medical treatment of patients but on rural health care. The rural health service activities are based on such programs as MCH(Mother Child Health Care), vaccination for six (6) diseases in the 0 - 5 year age group, malaria control, environmental sanitation, health education and water supply programs.

However, there are no permanent health units established in the villages. The government assigned a village midwife "Mae Thamnae" in each village to help the government health services in the rural areas. The village midwives are not supported by the government but supported by the villagers voluntarily. The personnel from the district devote usually very few days a month or year to visit these areas because of lack of manpower. The village midwives concentrate their efforts in the rural areas. There are no specific permanent buildings for such rural health care services. Instead, these villages use vacant school rooms, or private houses for to conduct basic health care services to the people.

The acute lacks of facilities and equipment including vehicles greatly limit the delivery of rural medical service both in quality and scope .

(2) School facilities

The school facilities situation is summarized below:

Primary and Secondary School

Priority Area	Upper Champi	Upper Tapoung	Upper Kapheu	Lower Xe Set	Upper Tay-Un	(Total)
Total No.of Villages in the Priority Area	8	3	5	6	3	25
Class-III Primary School	3	2	3	4	1	13
Class-V Primary School	4	1	1	0	0	6
(Total)	7	3	4	4	1	19
Secondary School	2	0	0	0	0	2

Among 25 villages of all the priority areas, five (5) villages have no primary school. Generally, the children in the villages without schools do not go to school because of the long distance to the nearest school. And some of the parents in these villages are not interested in, or do not understand the importance of their children's education. Poor accessibility to the village, poor school building facilities and poor living conditions in the rural areas make it difficulty to station a school teacher in the village. Anyhow, the most important thing is the people's intention to the education of their children.

Almost all class-III primary schools are constructed and maintained by the villagers themselves. These class-III primary school building facilities are very poor, consisting of one room, having wooden or bamboo walls, galvanized iron roof and earth floor, with an average floor area of 50 m^2. The class-V primary schools are in a little better condition because almost class-V schools are supported by the provincial education service and UNICEF, providing construction materials such as galvanized roofs, nails and cement. Among 19 of existing class-III and class-V primary schools, only two (2) schools have concrete flooring.

As for secondary schools, there are two (2) schools in both B.Lak35 and B.Lak43 of Upper Champi area. Both of them also have poor building facilities, consisting of three (3) rooms, made of wooden walls, galvanized iron roof and earth floor with an average total floor area of 130 m^2.

Almost all primary schools have no water supply facilities and latrine facilities, which are so essential. Not only school buildings but other school facilities such as desks, benches and blackboards are also in very poor condition. School teachers' rooms are also required especially for both primary and secondary schools. Both institutional and budgetary support for the primary schools are weak.

(3) Village community hall

Among 25 villages of all the priority areas, there are two (2) village community halls in both B.Lak45 and B.Lak42 of Upper Champi area. Both of them have poor facilities, consisting of one (1) room, having wooden walls, galvanized iron roof and wooden floor with an average floor area of 50 m^2. The other villagers generally use such facilities as temple, school, village leader's house and even open spaces for village level communication.

V RURAL INFRASTRUCTURE DEVELOPMENT PLAN

Figures VII-8 to VII-12 illustrate and Table VII-12 summarizes the proposed rural infrastructure development plan including rural road, water supply, primary school and village community hall. Details are descried in the following sections.

5.1 District and Village Road

5.1.1 Development plan

It is proposed that district and village roads with a total length of 34.6 km be rehabilitated as a model in improving the district/village road network in the future, taking into account the function of these roads. The proposed roads will be of all-weather type. These roads will have side ditches with sufficient capacity to drain on either side and an appropriate number of cross drains to avoid damage to road by rainfall. The proposed roads to be rehabilitated are summarized as follows:

Priority Area	Road section (village to village)	District road (km)	Village road (km)
1. Upper Champi		-	-
2. Upper Tapoung	Pakxong to B.Xetapoung	12.9	-
3. Upper Kapheu	Road No.20 to B.Sixiangmai	9.3	-
	B. Sixiangmai to B.Phouak-gnai	-	1.8
	B.Phouk-noi to B.Phouk-gnai	-	1.9
4. Lower Xe Set	Road No.20 to Xe Set power station	3.2	
	Road No.20 to B.Natou		3.8
5. Upper Tay-Un	Road No.16 to B.Chakamlit		1.7
(Total)		25.4	9.2

5.1.2 Design

(1) Design policy

Because both district and village roads have a primary function of connecting a village to a district center or the national road, as well as contributing to the farmers' day to day economic activities, it should be of all weather type. In addition, economical construction and elimination of any environmental problem should also be taken into consideration in the design of the road rehabilitation. Therefore, attention is paid to design so as to minimize volume of earth work, using the existing road alignment as munch as possible.

Drainage facilities such as river crossing, road crossing drain and side drains are indispensable to maintain the rainy season traffic. Sufficient capacity of drain is required for each drainage facility. In addition, maintenance work should be taken into consideration in deciding the size of drainage facilities, especially pipe culverts. It is proposed to connect side ditch drains with natural drains (river) or the proposed drainage system in the field to drain excess water as soon as possible. A proper drainage system is one of the effective counter measure for soil erosion.

(2) Design standard

The Lao standard Class-V and Class-VI of MCTPC (*) are applied for the design of cross sections of proposed district and village roads. As for the pavement method, penetration macadam for district roads and gravel pavement for village roads are proposed, considering the heavy rainfall in the area and poor maintenance work.

Lao standard	Class-V	Class-VI
Daily traffic (unit / day)	300 - 50	less than 50
Carriage way (m)	4.5	3.5
Shoulder (m)	3.0 (1.5 m x 2)	2.5 (1.25 m x 2)
Total width (m)	7.5	6.0

Proposed road	District road	Village road
Pavement	Penetration macadam	Gravel
Pavement width = carriage way (m)	4.5	3.5
Shoulder (m)	3.0 (1.5 m x 2)	2.5 (1.25 m x 2)
Total width (m)	7.5	6.0

Note: (*) MCTPC = Ministry of Communication, Transportation, Post and Construction

It is proposed to use the two (2) existing bridges without any rehabilitation considering the present condition of these bridges. One is the bridge over the Champi river along the district road from Pakxong to B.Houaisan in Upper Tapoung scheme area. The other is the bridge on the Houn river along the district road from Road No.20 (B.On-Beng) to B. Sixiangmai in Upper Kapheu scheme area.

On the other hand, there are four (4) river crossing points without any crossing facilities among the proposed village roads. The first point is at the Houn river along the village road from B.Sixiangmai to B.Phouak-gnai in Upper Kapheu scheme area. The second point is the small stream along the village road from Road No.20 (B.Houakhoua) to Natou in Lower Xe Set scheme area. The third and fourth points are on the Thon river and its tributary along the village road from Road No.16 (B.Chakam-mai) to B.Chakamlit in Upper Tay-Un scheme area. Construction of river crossing facilities at these four (4) points is expected to contribute to the farmers' day to day economic activities. The box-culvert type will be utilized for economical construction.

Side drains with sufficient capacity are indispensable to drain excess water from the road surface. Protection work of side drains such as lining by stone masonry will be proposed in steep longitudinal section to prevent soil erosion .

In addition to side drains, cross drains are required according to the topography. The pipe culvert type having a minimum diameter of 0.6 m will be utilized for this purpose. This is necessary considering maintenance, particularly desilting. For large cross drains two sets of 0.6 m culverts or more, as required, will be utilized.

The proposed road improvement plan is summarized in Table VII-13 and typical cross sections of proposed district and village roads are shown in Figure VII-13.

5.2 Rural Water Supply

5.2.1 Development plan

On the basis of field survey results of topographical condition and water availability, the following nine (9) water supply systems are proposed, covering a total of 25 villages.

Model scheme area	Water supply system	Water source	No.of covering villages
(1) Upper Champi	One (1) gravity flow piped water system	Champi river	8
(2) Upper Tapoung	Two (2) water systems with electric pump	Kapheu / Tapoung river	3
(3) Upper Kapheu	One (1) gravity flow piped water system	Kapheu river	5
(4) Lower Xe Set	One (1) gravity flow piped water system	Xe Set river	6
(5) Upper Tay-Un	Four (4) water systems with electric pump	Thon/Tit river	3, (*)
(Total)	9 systems		25 villages

Note: (*) For B.Chakam-mai, two (2) systems are required because the village comprising two (2) groups, is located at two points

5.2.2 Design

(1) Water requirement

The following design assumption is applied for gravity flow piped water system based on the discussion with the provincial officers of health service and information on similar types of rural water systems in other parts of Lao PDR, constructed by UNDP and UNICEF.

- Daily water consumption : 60 lit./day/capita
- Population design : Year 2010 with 1.7 % to 3.6 % (*) of growth rate
- Daily demand pattern :

Time period	Allocation of demand
6:00 - 8:00 (2 hours)	30 % of total daily demand
8:00 - 16:00 (8 hours)	40 % of total daily demand
16:00 - 18:00 (2 hours)	30 % of total daily demand
18:00 - 6:00 (12 hours)	negligible

- Users' loss and pipe transmission loss: 30 % of design requirement

Note: (*) Population annual growth rates are applied based on the census in 1985 and 1995, 1.7% for Upper Champi and Upper Tapoung areas, 2.7% for Lower Xe Set and Upper Tay-Un areas and 3.6% for Upper Kapheu area, respectively.

Based on the above assumption, total daily water demand for proposed nine (9) water supply systems will vary from 359 m^3 to 11 m^3, requiring from 5.41 lit./sec. to 0.15 lit./sec. of flows, as shown below:

Water supply system, 1/	No.of villages	Total popu-lation	Popu-lation design	Daily demand (m^3)	Required daily flow ,2/ (lit./s)	Required pumping flow,2,3/ (lit./s)
(1) Gravity flow piped system, Upper Champi	8	4,731	5,990	359	5.41	
(2) Water system w/ e.p., Upper Tapoung No.1	1	283	358	22	0.32	(1.29)
(3) Water system w/ e.p., Upper Tapoung No.2	2	1,195	1,513	91	1.36	(5.46)
(4) Gravity flow piped system, Upper Kapheu	5	2,393	3,926	236	3.54	
(5) Gravity flow piped system, Lower Xe Set	6	2,218	3,221	193	2.91	
(6) Water system w/ e.p., Upper Tay-Un No.1	1	160	232	14	0.21	(0.84)
(7) Water system w/ e.p., Upper Tay-Un No.2	1	470	682	41	0.62	(2.46)
(8) Water system w/ e.p., Upper Tay-Un No.3	1	118	171	11	0.15	(0.63)
(9) Water system w/ e.p., Upper Tay-Un No.4	1	123	179	11	0.16	(0.63)

Note : 1/ w/ e.p. : with electric pump
2/ with 30% of pipe transportation loss
3/ a half day's consumption with a 3 hours pump operation

(2) Hydraulic design

The following Hazen-Willams formula is used for hydraulic design of pipe line system:

$$h = 10.666 * L * C^{(-1.85)} * D^{(-4.87)} * Q^{(1.85)}$$

Where,

h = Head loss (m)
L = Pipe length (m)
C = Coefficient (100 = GI pipe, galvanized iron pipe)
D = Diameter (m)
Q = Quantity of flow (m^3/s)

Other design assumption applied is as follows:

- Design requirement of tap : 5 households / tap
- Tapstand discharge : 0.20 lit. / sec.
- Pressure rating of pipes : GI pipes = 10 kg / cm^2
- Velocity limits in pipes : Max.= 3.0 m/sec., Min.= 0.7 m /sec.
- Head loss in fitting : negligible
- Residual head of tapstand : Max.= 6 m, Min.= 3 m

Details of the hydraulic design of each system are shown in Tables VII-14 to VII-18.

5.2.3 Distribution system

(1) Upper Champi scheme

A gravity flow piped water system is proposed in this area. This system will cover eight (8) villages with a total of 828 households and 4,731 people. Water from H.Champi

will be taken through an intake facility, which will also be used for irrigation purposes. The demand of water is estimated at 5.41 lit./sec. The water is diverted to a sand filter tank with a capacity of 54 m^3 and then introduced to transmission pipe lines, covering all the villages. Eight (8) distribution tanks will be installed for better distribution in each village. Each distribution tank has a capacity of a half day's water supply. The capacities of the distribution tanks vary from 44 m^3 to 13 m^3 based on the populations in each village. From each distribution tank, distribution main and branch pipe lines are networked in the village areas. A total length of 35,410 m of trunk/main pipelines (GI pipe) and 4,280 m of branch pipe lines (PVC pipe) are required for distribution of water. Communal tapstands with washing basin will be installed along the distribution lines at the rate of one to five (5) households, totaling 138 taps in this area.

Since there are existing gravity flow water supply systems in B.Lak40 and B.Lak38, water supply to these existing distribution tanks and some supplemental distribution facilities are proposed for both villages, as shown below:

Target village	B.Lak 40	B.Lak 38
Capacity of the proposed distribution tank (m^3)	32	16
Required flow to the distribution tank from transmission pipeline (lit/s)	0.96	0.49
Pipe from the distribution tank to the existing tank (m)	200	1,000
Supplemental distribution pipe (m)	300	1,000
Supplemental tapstand (nos.)	3	13

The transmission and main distribution pipe lines of Upper Champi scheme are illustrated in Figures VII-14 and VII-15. Typical drawings of filter tank and tapstand are shown in Figure VII-16.

(2) Upper Tapoung scheme

Two (2) water systems with electric pumps are proposed considering topographical condition and water source location. One (1) system (Water System with electric pump, Upper Tapoung No.1) will cover B.Phoulangkeo with a total of 45 households comprising 283 people. The other system (Water System with electric pump, Upper Tapoung No.2) will cover B. Houaisan and B.Xetapoung with a total of 217 households, having 1,195 people.

For No.1 System, water from H.Kapheu will be pumped through an intake pipe to the sand filter tank with a capacity of 9 m^3 located at highland of B.Phoulangkeo. The pumping head from the water source to the filter tank is estimated at 54 m. The demand of water is estimated at 0.32 lit./sec. Then the water is diverted to a distribution tank (11 m^3) and introduced to a distribution main pipe, covering the village. A total length of 1,010 m of trunk/main pipelines and 90 m of branch pipelines are required for distribution of water. Nine (9) communal taps are required for this area.

For No.2 System, water from H.Tapoung will be pumped through an intake pipe to the sand filter tank with a capacity of 24 m^3 and then to a ground level distribution tank (27 m^3) located at B.Houaisan. The pumping head from the water source to the filter tank is estimated at 16 m. The demand of water is estimated at 1.36 lit./sec. The water will be pumped up again to the elevated tank with a height of 15 m. Then the water is distributed through a distribution main pipe, covering all the villages. A total length of 7,450 m of trunk/main pipelines and 1,030 m of branch pipelines are required for distribution of water. A total of 43 communal taps with washing basin are proposed to serve this area.

Six (6) hours of pump operation per day, three (3) hours each in the morning and the

evening will be required to maintain a simple operation system of the facilities for both systems.

The transmission and main distribution pipe lines of Upper Tapoung scheme are shown in Figures VII-17 and VII-18.

(3) Upper Kapheu scheme

A gravity flow piped water system is proposed in this area. This system will cover five (5) villages with a total of 456 households with 2,393 people. Water from H.Kapheu will be taken through an intake facility, which will also be used for irrigation purposes. The demand of water is estimated at 3.54 lit./sec.. The water is diverted to a sand filter tank with a capacity of 38 m^3 and then introduced to transmission pipe lines, covering all the villages. Five (5) distribution tanks will be installed for better distribution in each village. Each distribution tank has a capacity of a half day's water consumption for each village. The capacities of the distribution tanks vary from 36 m^3 to 13 m^3 based on the populations in each village. From each distribution tank, distribution main and branch pipe lines are networked in the village areas. A total length of 14,300 m of trunk/main pipelines and 3,620 m of branch pipe lines are required for distribution network of water. Communal tapstands with washing basin will be installed along the distribution lines at the rate of one to five (5) households, totaling 91 taps in this area.

The transmission and main distribution pipe lines of Upper Kapheu scheme are illustrated in Figures VII-19 and VII-20.

(4) Lower Xe Set

A gravity flow piped water system is proposed in this area. This system will cover six (6) villages with a total of 386 households with 2,218 people. Water from Xe Set will be taken through an intake facility and diverted to the regulating pond, which will also be used for irrigation purposes. The demand of water is estimated at 2.91 lit./sec..

The water is diverted from the regulating pond to a sand filter tank with a capacity of 30 m^3 and then introduced to three (3) transmission pipe lines, covering five (5) of the six (6) villages. Five (5) distribution tanks will be installed in each village for better distribution. Each distribution tank has a capacity of a half day's water consumption. The capacities of the distribution tanks vary from 35 m^3 to 8 m^3 based on the population in each village. From each distribution tank in B.Sengvang-gnai, B.Sengvang-noi and B.Houakhoua, distribution main and branch pipe lines are networked in the village areas. Communal taps with washing basin will be installed along the distribution lines at the rate of one to every five (5) households, totaling 42 taps in the three (3) villages.

For B.Konleng and B.Natou, distribution tanks, where communal taps and washing basins are directly installed, are proposed because of insufficient water head. Five (5) communal taps installation for B.Konleng and ten (10) taps for B.Natou are proposed, based on the number of the households.

Water supply for B. Natteu is an exception. This will be taken from the proposed irrigation canal directly because of topographical conditions. A filter tank with a capacity of 6.0 m^3 and a distribution tank (6m^3) with five (5) communal taps and a washing basin are proposed in this village.

A total length of 14,660 m of trunk/main pipe lines and 1,940 m of branch pipe lines are required for the total water distribution system in this scheme.

The transmission and main distribution pipe lines of Lower Xe Set scheme are shown in Figures VII-21 and VII-22.

(5) Upper Tay-Un scheme

Four (4) water systems with electric pump are proposed considering topographical conditions and water source location. One system is proposed to cover one village. For B.Chakam-mai, two (2) systems (Water System with electric pump, Upper Tay-Un No.3 and No.4) are required because the village comprising two (2) groups, is located at two points. Water source of No.1 system is H.Thon and water sources of No.2 to 4 are H.Tit. For all the systems, water will be pumped through an intake pipe to the sand filter tanks located at each village site. The pumping head from the water source to the filter tank is estimated at 10 m in each site. Then the water is diverted to a distribution tank, connected to the sand filter tank. This type of distribution tank consists of communal taps, directly installed with the tank, a washing basin and is without distribution pipelines. A total of four (4) tanks of this type are proposed in this area. The features of the above systems are summarized below:

Water system	No.1	No.2	No.3	No.4
Target village	Chakamlit	Khamkok	Chakam-mai (1)	Chakam-mai (2)
Water source	H.Thon	H.Tit	H.Tit	H.Tit
Length of intake pipe line (m)	100	150	200	300
Required flow (lit./sec.)	0.84	2.46	0.63	0.63
Capacity of distribution tank (m^3)	10	20	10	10
Capacity of filter tank (m^3)	6	14	6	6
No.of taps	5	10	5	5

The transmission and main distribution pipe lines of Upper Tay-Un scheme are shown in Figure VII-23.

The proposed water supply systems in five (5)priority scheme areas are summarized in Table VII-19.

5.2.4 Operation and maintenance

(1) Policy

In the proposed water supply program, two (2) water supply systems, namely "gravity flow piped system" and "water system with electric pump" will be constructed. Since each proposed gravity flow system will cover 5 to 8 villages, well organized operation and maintenance (O/M) is strongly required for fair distribution of water. The proposed water system with electric pump will cover one (1) or two (2) villages. However, well organized O/M is also required because of the importance of effective pump operation.

As described in the section of "present conditions", there are two (2) existing gravity flow piped water systems in the priority scheme areas. These are in B.Lak40 and B.Lak38. Both villages are not collecting regular water charges and do not have any specific water users' associations. Since these systems cover only one (1) village each, the O/M work is managed by each village authority. The O/M are generally done on the basis of minimal requirement. Once some maintenance problem occurs, the village people normally wait for governmental assistance. The water supply facility in B.Beng (Salavan district, about one (1) km from B.Phouak-noi in the proposed priority scheme of Lower Se Xet) is a special pilot case. This

water supply facility is composed of a submersible pump, an elevated tank and communal taps, constructed during the master plan study on groundwater development in Salavan and Champasak by JICA in 1993. Since construction, the village chief has continuously collected the monthly water charge at a rate of 100 kip/household for electricity and repairs.

In Lao PDR, urban water supply is operated by Nam Papa (state water supply company) and all consumers pay a water charge. On the other hand, in rural water supply, the village people pay the government the cost for well drilling and hand pump installation. As for gravity systems, normally the province and some donor organizations provide construction materials and beneficiary farmers supply their labor for construction of the system. In some villages farmers get some credit from the agricultural promotion bank for purchase of construction materials based on different kinds of village community strengthening programs. However, there is no O/M arrangement by the government after completion of these systems. It is also true that the government cannot afford to do O/M work without revenue. A major short coming is that the village community usually does not understand the importance of maintenance.

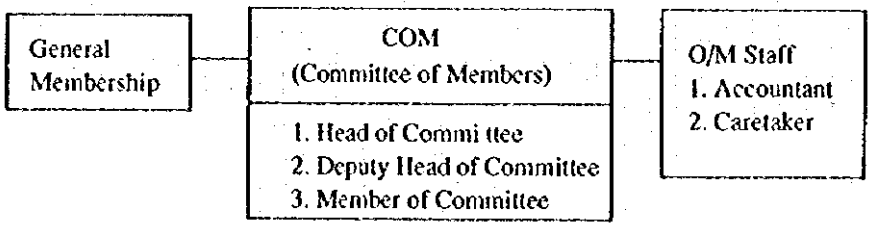
Unless there is proper maintenance, the water supply system will deteriorate and eventually become unworkable within a few years. The only possible solution is that the village people should maintain the system themselves. The responsibility of maintenance must be felt by them. However, it is unrealistic to expect the community to take over all maintenance duties as it is still difficult for village people to repair even a minor fault without a skilled technician, necessary tools and spares. It is therefore proposed that maintenance should be a shared responsibility of the government and the community, with the government providing reliable technical support.

(2) Organization

(a) Village Water User's Group for water supply (VWUG-water supply)

It is proposed that every village community should establish a "Village Water User's Group for water supply (VWUG-water supply)". The VWUG-water supply is responsible for the operation and maintenance of water supply facilities. The VWUG-water supply is formed after the prospective members are fully informed about their duties and responsibilities in the group. In the formation process, community members will be assisted by the provincial health service. The VWUG-water supply is managed by a committee of members (COM). The members of the committee will be elected by the general assembly of the members.

The proposed organizational structure of Village Water User's Group for water supply will be as below:



Organizational structure of VWUG-water supply

The responsibilities of VWUG-water supply are:

- Properly operate and maintain the water supply facilities;
- Attend all meetings and training conducted by the provincial health service, relevant to the viability of the association and upkeep of the system;
- Collect fees from members;
- Adopt policies and procedures approved by the committee of members; and,
- Observe sanitary practices.

The main duties and responsibilities of the committee of members (COM) and the O/M staff are summarized below:

(i) COM

- Formulate policies and procedures to carry out the affairs of VWUG-water supply
- Elect its O/M staff (accountant and caretaker)
- Attend all meetings of the committee and the general assembly

(ii) Head of COM

- Conduct and preside over the general assembly
- Preside over all meetings of the COM
- Execute policies relative to the management of the VWUG-water supply and the upkeep of the facility
- Act as an arbiter in the settlement of conflict relevant to the operation and maintenance of the VWUG-water supply and members
- Represent the group in any endeavor affecting the operation of the VWUG-water supply
- Investigate the current condition of the VWUG-water supply and recommend solution as required

(iii) Deputy Head of COM

- In the event of death, incapacity or refusal of the Head to perform his/her duties and responsibilities, the Deputy Head shall perform the duties of the Head, and such other duties that may be assigned by the committee

(iv) Accountant

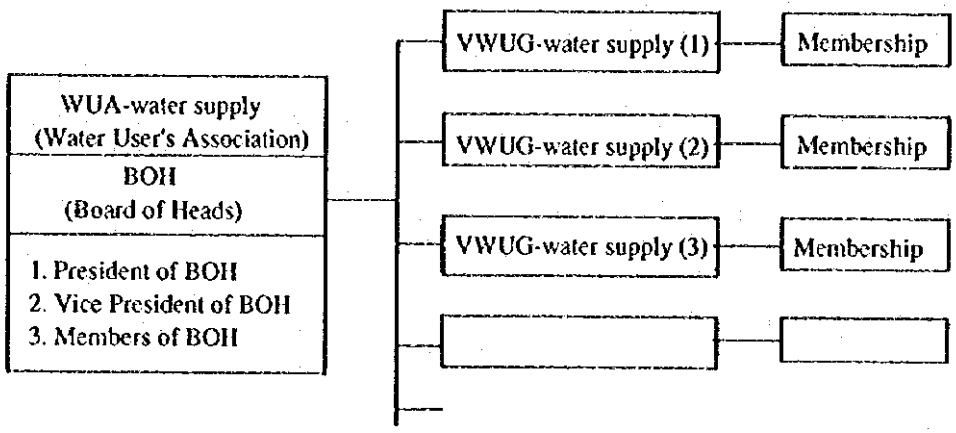
- Assure the proper custody of all funds and properties of the VWUG-water supply
- Collect water fees from members and issue corresponding receipts
- Keep the financial records of the VWUG-water supply
- Deposit all such moneys of the VWUG-water supply
- Submit report on the financial status of operations to the Committee
- Post list of members who paid fees including date of payment

(v) Caretaker

- Oversee the operation and maintenance of the water facility
- Report damage or need for repair of the facility to the Committee
- Repair the facility whenever needed
- Inform and train members on the proper use of the facility
- Assist in the collection of water fees

(b) Water User's Association for water supply (WUA-water supply)

Since most proposed water supply systems cover more than two (2) villages, cooperation with relevant VWUGs-water supply is very important for fair distribution of water. For this purpose, it is proposed to establish Water Users' Association for water supply (WUA-water supply) in each water system. The WUA-water supply is managed by the board of heads (BOH). The member of BOH will be a representative of each VWUG-water supply, and should be a head of VWUG-water supply. The proposed organizational structure of WUA-water supply will be as shown below:



Note : VWUG-water supply (Village Water User's Group -water supply)

Organizational structure of WUA-water supply)

The main duties and responsibilities of BOH are summarized below:

- Formulate policies and procedures to carry out the affairs of the WUA
- Coordinate and settle conflict relevant to the VWUGs-water supply
- Cooperate with the technical support by the provincial health service
- Coordinate with the Water User's Association for irrigation (WUA-irrigation)

(3) Technical support by the provincial health service

The role of the provincial health service is to monitor the condition of the water system, to encourage and motivate the community to carry out maintenance work, to ensure the availability of spares, and to carry out major repairs beyond the capacity of the community.

For this purpose, it is proposed that the provincial health service should set up maintenance organization with an appropriate budget and full-time staff. A mobile maintenance team will be appointed to carry out periodical preventive maintenance according to a specified schedule and curative maintenance upon request from the village. The maintenance technicians will be selected from among the experienced field technicians or provided with a quick training after recruitment.

It is desirable to train a technician of the provincial health service to carry out some of the maintenance and repair functions. He will work as an assistant during the construction of the water supply system so that he can become familiar with the system and learn the skills

required to repair and replace spares.

(4) Maintenance record

It is proposed that the maintenance record of the system should be prepared in each village. The caretaker of VWUG is responsible for maintaining operation records and minor system maintenance. The provincial health service is responsible for the record of major maintenance work. These reports will record any breakdowns that had occurred and been repaired, as well as spares that had been used. These records form useful data of the causes of breakdowns, which can be used for future evaluation and design improvement.

5.3 Primary School

5.3.1 Development plan

School facilities such as buildings, desks, benches and blackboards are very poor in the priority scheme areas because of insufficient supporting budget from the provincial authority. Construction and maintenance of primary schools are supposed to be the responsibility of the village people. However, the village people generally cannot afford to construct and maintain their schools without governmental assistance.

More complete education is essential for raising the living standards of people. Improvement of school facilities will be one of big supporting measures for this purpose. It is proposed that the existing primary schools should be improved and new primary schools be constructed in the villages, where primary schools do not exist at present. In order to select target villages, the following are taken into account:

- Existing primary schools with a concrete floor are considered to be satisfactory level and are therefore excluded from the proposed plan.
- Class-III primary schools are proposed to be newly constructed, where primary schools do not exist at present.
- If two (2) villages are located within a short distance and one of them does not have a primary school, the village without a school is expected to use the school in the other village.
- Since almost all existing primary schools to be improved are in very poor condition, new schools are proposed instead.

The proposed primary schools to be renewed or newly constructed are summarized as follows:

Priority area	Upper Champi	Upper Tapoung	Upper Kapheu	Lower Se Xet	Upper Tay-Un	(Total)
No.of village	8	3	5	6	3	25
Class-III primary school	3	2	3	5	2	15
Class-V primary school	4	1	1	0	0	6
(Total)	7	3	4	5	2	21

5.3.2 Design

The proposed class-III primary school has three (3) class rooms and one (1) teacher's and school administrative room, which consists of slate sheet roof and brick masonry walls and

concrete floors. Slate sheet roofing is emphasized to provide more comfortable conditions for the students particularly in the hot season. One room will have a floor area of 42 m^2 (6m x 7m) and is enough to accommodate 45 students based on the provincial standard.

The proposed class-V primary school has five (5) class rooms and one (1) teacher's and school administrative room. One room for the class-V school will have a floor area of 56 m^2 (7m x 8m), which is enough to accommodate 55 students.

Each room will be equipped with the required number of desks, chairs and blackboard. The rooms will be linked with each other with a terraced passage way at the front side. All the proposed schools will be facilitated with water supply facility and toilet.

The proposed class-III and class-V primary schools are illustrated in Figure VII-24 and 25.

5.4 Village Community Halls

5.4.1 Development plan

Well organized village community and coordination among the village communities are indispensable for raising the living standards of people and the future development of rural area. The village community halls will provide different village organizations with facilities to conduct their meetings.

- Management of village administration
- Operation and maintenance of irrigation facilities
- Operation and maintenance of water supply facilities
- Extension of agricultural technology
- Enlightenment of rural health and sanitation; and
- Adult education

A village community hall is proposed to be newly constructed in each village of the priority scheme areas. It is proposed that one village in each scheme will be a central point and will play a coordinating role of the whole area.

5.4.2 Design

Three (3) types of village community halls are proposed based on the number of households in the village. They are type-A, -B and -C with floor areas of 168 m^2, 252 m^2 and 336 m^2, respectively. The coordinating center will be of the C-type.

The type-A village community hall has three (3) rooms, with slate sheet roof and brick masonry wall and a concrete floor. One room with a floor area of 42 m^2 (7m x 6m) will be used as the village administrative room. The other two (2) rooms will be used as meeting rooms, and will have floor areas of 42 m^2 (7m x 6m) and 84 m^2 (14m x 6m).

The type-B village community hall has also three (3) rooms, which consists of the same materials as that of type-A. One room with a floor area of 42 m^2 (7m x 6m) will be a village administrative room. The other two (2) rooms will be used as meeting rooms, and have floor areas of 84 m^2 (14m x 6m) and 126 m^2 (14m x 9m).

The type-C village community hall has four (4) rooms, which consists of the same materials as that of type-A and -B. One room with a floor area of 42 m^2 (7m x 6m) will be a village administrative room. The other three (3) rooms will be used as meeting rooms, with a floor areas of 42 m^2 (7m x 6m), 84 m^2 (14m x 6m) and 168 m^2 (14m x 12m).

Each room will be equipped with the required number of desks, chairs, bookracks and blackboards. The rooms will be linked to each other with a terraced passage way at the front side. It is proposed that each central village community hall will be equipped with a radio communication facility. This facility will be used for the following purposes:

- Operation and maintenance activities for irrigation facilities
- Operation and maintenance activities for water supply facilities
- Communication among the villages

The distribution of village community halls is summarized below and the floor plans are also shown in Figure VII-26.

Priority scheme	Upper Champi	Upper Tapoung	Upper Kapheu	Lower Se Xet	Upper Tay-Un	(Total)
No.of village	8	3	5	6	3	25
Proposed village community hall						
type-A (3 rooms, 168 m^2)	4	1	3	5	2	15
type-B (3 rooms, 252 m^2)	3	1	1	0	1	6
type-C (4 rooms, 336 m^2)	1	1	1	1	0	4

5.4.3 Proposed use of the facility

The village community halls will be used for the following community development programs:

(1) Management of village administration

The village administrative room will be permanently used for village administration by the head and deputy heads of each village. Official community records will be stored here. Information and instructions from the provinces and districts will also be systematically arranged, for which a cupboard which can be locked is necessary.

(2) Operation and maintenance of irrigation facilities

Village user's group for irrigation will be organized for the operation and maintenance of irrigation facilities. The meetings will be either of the members or of the committees for better operation of the facilities. Conflicts relevant to the operation and maintenance of the user's group will be also settled in this meeting. The village community hall, which will be a center of the scheme will be equipped with a radio communication facility. This radio communication facility will be useful for effective operation of irrigation facilities.

(3) Operation and maintenance of water supply facilities

Village user's group for water supply will be also recommended to be organized for the operation and maintenance of water supply facilities. The meetings for this purpose will also use the village community hall.

(4) Extension of agricultural technology

The strengthening of agricultural extension services will be provided by the district extension officer and his staff, who will use the hall to make their programs.

(5) Awareness on rural health and sanitation

The village community halls will be used for conducting a health class, supported by the health nurses of the village clinic or district hospitals, to educate on nutrition, child care, health and hygiene, sanitation, and family planning. First aid facilities, including basic medicines, will be kept here and managed by the health worker for the convenience of the people of the remote area.

(6) Adult education

Adult education for villagers (farmers, women, and youth) including practical life-skills and leadership training will be held here. These programs are implemented in collaboration with the provincial and district authorities, the Lao Women's Union (LWU), international organizations and NGOs.

5.5 Micro-hydropower generation

In the master plan, the micro-hydropower development in Upper Kapheu area is listed as one of potentials. However, considering economical view points through the following recent information, it is proposed that the micro-hydropower development in Upper Kapheu area should be excluded from the proposed priority scheme.

Among total five (5) villages in Upper Kapheu priority scheme area, three (3) villages of B.Ong-gnai, B.On-noi and B.Phouak-noi will be electrified by 1997 based on PGI Project in Salavan province. In addition, the other two (2) villages of B.SiXiangmai and B.Phouak-gnai can be electrified with an extension of 2.5 km additional transmission line for each village.

Tables

Table VII-1 Inventory of Village and Farm Roads (1/2)

(A) VILLAGE ROAD (Village to Village)

	Village	(to)	Village	(to)	Village	Length (km)	Remarks		
Pakxong district									
1	Paksong	-	B. Houayxang	-	B. Kapheu	15.0	D, 1)	E/R, 3),	5)
2	B. Kpheu	-	B. Phoudin	-	B. Mai-Xaisomboun	14.0	D	E/R	5)
3	B. Mai-Xaisomboun	-	B. Kenglou			8.0	D	E/R	5)
4	B. Mai-Xaisomboun	-	B. Houaytao	-	B. Houaychiat	14.0	D	E/R	5)
5	B. Phakhout-noi	-	B. Somsanuk-mai	-	B. Houaychiat	11.0	D	E/R	5)
6	B. Nongkhali	-	B. Khotnoi	-	B. Lak 36	19.0	D	E/R	5)
7	B. Houayxan	-	B. Nongya	-	B. Setkhot	17.0	D	E/R	
8	B. Khongtoun-mai	-	B. Houayvay	-	B. Setkhot	12.0	D	E/R	
9	Paksong	-	B. Nongluang			12.0	D	E/R	5)
10	Paksong	-	B. Xepian	-	B. Phanuan-gnai	22.0	D	E/R	
11	B. Thongkatai	-	B. Houaytcuy			7.0	D	E/R	
12	B. Pakyong	-	B. Hinlap	-	B. Houayxey	9.0	D	E/R	
13	B. Setkhot	-	B. Thongset	-	B. Nonghinkao	11.0	D	E/R	
14	B. Thongset	-	B. Lak 6 (Houay Ho Road)			8.0	D	E/R	
15	B. Nongpoy	-	B. Lak 8 (Houay Ho Road)			3.0	D	E/R	
16	B. Thongkarong	-	B. Lak 18 (Houay Ho Road)			8.0	D	E/R	
17	B. Nongkhuang	-	B. Thongvay			9.0	D	E/R	
18	B. Nongkin	-	B. Khuang-Gnai			5.0	D	E/R	
19	B. Thongvay	-	B. Namtang			18.0	D	E/R	
20	B. Houaykong	-	B. Nongmek	-	B. Namhoung	8.0	D	E/R	
21	B. Nongmek	-	B. Nongthuam			8.0	D	E/R	
22	B. Houaytao	-	B. Nongbok (Bachiang)			14.0	D	E/R	
					(Sub-total)	252.0			
Bachiang district									
1	B. Khengtan	-	B. Makngeo (Road No.20)			5.0	D	E/R	
2	B. Nongbok-gnai	-	Road No.20			2.0	D	E/R	
3	B. Kongxi-gnai	-	Road No.20			6.0	D	E/R	
4	B. Khenlay	-	Road No.20			3.0	D	E/R	
5	B. Lak 12	-	B. Nongdindam	-	B. Champi	24.0	D	E/R	
6	B. Nongdindam	-	B. Phelat			4.0	D	E/R	
7	B. No.8	-	B. Phouthong			8.0	D	E/R	
8	B. Kengkia	-	B. Kapheu			2.0	D	E/R	
9	Bachiang	-	B. Nonghouakhoay			4.0	D	E/R	
					(Sub-total)	58.0			
Laongam district (Including some parts of Salavan district)									
1	B. Ben (Road No.20)	-	B. Sixiangmai	-	B. Phakkout	17.0	R/D, 2)	L/P, 4),	5)
2	Laongam	-	B. Phakkout	-	B. Kapheu (Pakxong)	23.0	R/D	L/P	5)
3	B. Sangthong-noi	-	B. Phokhem	-	B. Setkhot (Pakxong)	18.0	R/D	L/P	5)
4	B. Vanggnao	-	B. Nongtom	-	B. Phokhem	10.0	R/D	L/P	5)
5	B. Phouak-noi	-	B. Nabeng	-	B. Mai-Xaisomboun (Pakxong)	14.0	R/D	L/P	5)
6	B. Nongchoua	-	B. Phoudin (Pakxong)			8.0	R/D	L/P	5)
7	Laongam	-	B. Takit-gnai	-	B. Dondou	8.0	R/D	L/P	5)
8	B. Vangpuay	-	B. Meuanteup	-	B. Impeng	4.0	R/D	L/P	5)
9	B. Meuanteup	-	B. Mouanthe			2.0	R/D	L/P	5)
10	B. Sangthong-gnai	-	B. Takit-gnai	-	B. Khagnongkhek	7.0	D	E/R	5)
11	B. Kengkia	-	B. Nonghoy			4.0	D	E/R	
12	B. Paktho	-	B. Laonong			7.0	D	E/R	
13	Road No.20	-	B. Baktheung	-	B.Dondou	8.0	D	E/R	5)
14	B. Dong	-	B. Phouak-gnai			4.0	D	E/R	
15	Road No.20	-	B. Hokong			1.0	D	E/R	
16	B. Dong	-	B. Dong-noi			4.0	D	E/R	
17	B. Daxia-noi	-	B. Nongtom			4.0	D	E/R	
18	B. Kachit	-	B. Dongxouang			8.0	D	E/R	5)
19	B. Phoneuang	-	B. Ngiou			12.0	D	E/R	
20	B. Kiangtat	-	B. Natum			10.0	D	E/R	

Source: Provincial CTPC Service

Note: 1) D : Motorable in only the dry season (passable by 4WD vehicle in the rainy season with some difficulty)
2) R/D : Motorable in both the rainy and dry seasons
3) E/R : Earth Road
4) L/P : Laterite Pavement Road
5) : Coffee Feeder Roads by " Coffee Development Project in 1986/88" or " Upland Agriculture Development Project in 1990/95"

Table VII-1 Inventory of Village and Farm Roads (2/2)

	Village	(to)	Village	(to)	Village	Length (km)	Remarks		
Laongam district (Including some parts of Salavan district)									
21	Laongam	-	B. Dongluang			8.0	D	E/R	
22	B. Ten	-	B. Nongkhem			8.0	D	E/R	
23	B. Dongxouang	-	B. Nami	-	B. Naxai (Salavan dis.)	20.0	D	E/R	
24	B. Nongken	-	B. Natham	-	B. Khanao	20.0	D	E/R	
25	B. Houakhoua	-	B. Soutabali			8.0	D	E/R	
26	B. Vangpuay	-	B. Phonuan			2.0	D	E/R	
27	B. Sangthong-gnai	-	B. Lavat			4.0	D	E/R	
28	B. Sangthong-gnai	-	B. Nabon	-	B. Dongxouang	12.0	R/D	L/P	
29	Laongam	-	B. Len			2.0	D	E/R	
30	B. Kachit	-	B. Nongkoung			5.0	D	E/R	
31	B. Phialat	-	B. Nongkoung			4.0	D	E/R	
32	B. Nongbouathaxang	-	Road No.20			4.0	D	E/R	
33	Laongam	-	B. Nongtakai			3.0	D	E/R	
34	B. Baktheung	-	B. Xanum-noi	-	B. Kiangtangle	11.0	D	E/R	
35	B. Sandong	-	B. Xanum-noi			3.0	D	E/R	
36	B. Xanumnok	-	B. Baktheung			2.0	D	E/R	
37	B. Sevang gnai	-	B. Nateu			5.0	D	E/R	
38	B. Don-noi	-	B. Don	-	B. Phouak-gnai	8.0	D	E/R	
39	B. Phao	-	B. Pakitho			1.0	D	E/R	
40	B. Ko	-	B. Kouay	-	B. Nankathung	6.0	D	E/R	
41	B. Ko	-	B. Phao-gnai	-	B. Viangkham	7.0	D	E/R	
42	B. Nakasao	-	B. Nalat			4.0	D	E/R	
43	B. Nakasao	-	B. Thouay			8	D	E/R	
44	B. Naxai	-	B. Phakpheoxet			12.0	D	E/R	
45	B. Dongko-nua	-	B. Xapon			4.0	D	E/R	
46	B. Donko-nua	-	B. Naxai-noi			5.0	D	E/R	
					(Sub-total)	349.0			
Thateng district									
1	B. Pong-nua	-	B. Mun-mai			7.0	R/D	E/R	5)
2	B. Houase	-	B. Nong-nok	-	B. Sen-nua	8.0	R/D	L/P	5)
3	B. Sen-tai	-	B. Kohouaphou-gnai			5.0	R/D	E/R	5)
4	Road No.16	-	B. Kapeu		B. Nongnok	3.0	D	E/R	5)
5	B. Kapeu	-	B. Toklok			7.0	D	E/R	5)
6	B. Kong	-	B. Thongvay			15.0	D	E/R	5)
7	B. Chakam-gnai	-	B. Gnokthong			8.0	D	E/R	5)
8	B. Kub	-	B. Thongnai-mai			14.0	D	E/R	5)
9	B. Kafe	-	B. Saihou	-	B. Gnokthong	7.0	D	E/R	5)
10	B. Houaylang-mai	-	B. Thong-noi			3.0	R/D	E/R	5)
					(Sub-total)	77.0			
					(Total length of [A] Village road)	736.0			

[B] FARM ROAD (Farm to Village)

	District	Length (km)	Remarks	
1	Pakxong	303.0	D	E/R
2	Bachiang	137.0	D	E/R
3	Laongam (including some part of Salavan district)	355.0	D	E/R
4	Thateng	48.0	D	E/R
	(Total length of [[B] Farm road)	843.0		

Source: Provincial CTPC Service

Note: 1) D : Motorable in only the dry season (passable by 4WD vehicle in the rainy season with some difficulty)
2) R/D : Motorable in both the rainy and dry seasons
3) E/R : Earth Road
4) L/P : Laterite Pavement Road
5) : Coffee Feeder Roads by " Coffee Development Project in 1986/88" or " Upland Agriculture Development Project in 1990/95"

Table VII-2 Coffee Feeder Roads

[A] Feeder Road Network Construction Plan under going by Upland Agriculture Development Project

Pakxong district

	Village	(to) Village	(to) Village	Length (km)	Remarks
1	B. Ito	- B. Lak 38		5.0	Completed
2	B. Lak 36	- B. Khotgnai		8.0	Under construction
3	Paksong	- B. Maixaysonboun		25.0	Under construction
4	Paksong	- B. Nongluang		13.0	Under construction
5	B. Houaychiat	- B. Nongkhali		18.0	D/D finished
6	B. Lak 48	- B. H. Banglieng		7.0	D/D finished
7	B. Lak 45	- B. H. Banglieng		5.0	D/D finished
8	B. Lak 40	- B. H. Banglieng		6.0	D/D finished
9	B. Houaykenglou	- B. Maixaysonboun		8.0	Surveying
10	B. Houaychiat	- B. Phakhout-noi		12.0	Surveying
11	B. Khotgnai	- B. Maixaysonboun		10.0	Surveying
			(Sub-total)	117.0	

Laongam district

1	B. Phoudin	- B. Laogna		5.0	D/D finished
2	B. Maixaisomboun	- B. Namben		7.0	D/D finished
3	Road No. 20	- B. Bakteun	- B. Dongdu	8.0	Completed
4	B. Vangpuay	- B. Inpeng		4.0	D/D finished
5	Road No. 161	- B. Nongke	- B. Dongxouang	10.0	D/D finished
6	B. Sangthong-gnai	- B. Nabon	- B. Dongxouang	12.0	Partly completed
7	Provisional			45.0	Surveying
			(Sub-total)	91.0	

Thateng district

1	Road No.23	- B. Toumgno		2.0	1)
2	Road No.23	- B. Takiao		3.0	1)
3	Road No.23	- B. Paleng-tai		2.0	1)
4	Road No.23	- B. Meun-mai		4.0	1)
5	B. Houase	- B. Nongnok		6.0	Completed
6	Road No.16	- B. Kapeu	- B. Sen-nua	6.0	1)
7	B. Sen-tai	- B. Kohouaphou-gnai	- B. Kohouaphou-noi	6.0	1)
8	B. Kapeu	- B. Lik	- B. Toklok	8.0	Completed
9	B. Chakam-gnai	- B. Chakmlik	- B. Gnokthong	7.0	1)
10	B. Chakmlik	- B. Chakout	- B. Kafe	6.0	1)
11	B. Kafe	- B. Sathou		4.0	1)
12	B. Kabu	- B. Thounla	- B. Satheu-mai	16.0	1)
13	B. Toklok	- B. Chakmlik		3.0	1)
14	B. Kong	- B. Nongkan	- B. Thongvay	14.0	1)
15	B. Thongvay	- B. Khamkok		11.0	1)
16	B. Takiou	- B. Munkang		1.0	1)
17	B. Munkang	- B. Mun-mai		4.0	1)
18	B. Toumgno	- B. Takiao		4.0	1)
				107.0	
			(Total Length of [A])	315.0	

[B] Laongam Coffee Road, 2)

1	B. Santong-gnai	- B. Phokem	- B. Vangyao	27.0	Rehabilitated
2	Laongam	- B. Dong	- B. Phakout	17.0	Rehabilitated
3	B. Ben	- B. Sixiangmai	- B. Phakout	17.0	Rehabilitated
4	B. Phouak-noi	- B. Namben		6.0	Rehabilitated
5	B. Nongchoua	- B. Laogna		4.0	Rehabilitated
6	B. Sangthong-gnai	- B. Takit-gnai	- B. Dongdu	7.0	Rehabilitated
7	Others			22.0	
			(Total Length of [B])	100.0	

Source : Upland Agriculture Development Office and CPC of Salavan

Note : 1) D/D completed for a total length of 45 km, and the remaining parts are under surveying
2) Completed in 1988 with a finance by The World Bank, with a total length of 100 km and rehabilitated by the province in 1994

Table VII-3 Existing Domestic Water Supply Facilities

	Facilities	(Unit)	District					Total
			Pakxong	Bachiang	Laongam	Salavan	Thateng	
[A]	Gravity flow piped water system	(system)	3	1	4	0	7	15
[B]	Tubewell with hand pump	(nos.)	19	11	3	1	3	37
[C]	Concrete ring dugwell	(nos.)	13	0	0	0	6	19
[D]	Water jar, 1)	(nos.)	0	284	0	0	0	284

[A] Gravity flow piped water system

	Village	District	Households	Population	Water source	Length of pipe (km)	No.of taps	Reservoir tank	Management	Remarks
(1)	B. Lak 40	Pakxong	174	807	Stream	0.5	6	10 m3 x 1 no.	Village farmers	UNICEF
(2)	B. Lak 38	Pakxong	76	487	Stream	1.5	1	-	Village farmers	UNICEF
(3)	B. Lak 30	Pakxong	98	468	Stream	1.0	1	10 m3 x 1 no.	Village farmers	DAFI, 2)
(4)	B. Latbok	Bachiang	67	370	Houay Kha	2.8	2	50 m3 x 2 nos.	Village farmers	Province
(5)	Laongam town	Laongam	271	1,444	Houay Tekit	7.0	312	-	Nam Papa Lao	120 kip/m3, 3)
(6)	B. Muangthe	Laongam	125	705	Houay Lanuang	0.7	20	5 m3 x 1 no.	Village farmers	Credit from bank, 4)
(7)	B. Vangyao	Laongam	63	378	Houay Namook	1.5	30	-	Village farmers	Credit from bank
(8)	B. Dong	Laongam	173	881	Houay Namook	2.5	40	-	Village farmers	Credit from bank
(9)	B. Kapeau	Thateng	83	475	Spring	1.3	2	-	Village farmers	AICF/UNICEF, 5)
(10)	B. Kodakan	Thateng	45	315	Spring	2.5	1	-	Village farmers	AICF/UNICEF
(11)	Thateng town	Thateng	178	1,200	Houay Dakann	3.7	4	-	Village farmers	AICF/UNICEF
(12)	B. Houaxe	Thateng	135	875	Spring	0.3	4	-	Village farmers	AICF/UNICEF
(13)	B. Dongsa	Thateng	73	421	Spring	1.0	3	3 nos.	Village farmers	AICF/UNICEF
(14)	B. Thongnyao	Thateng	27	158	Spring	0.3	1	-	Village farmers	AICF/UNICEF
(15)	B. Kokungtai-mai	Thateng	34	169	Spring	0.03	1	-	Village farmers	AICF/UNICEF
			1,622	9,153			428			

[B] Tubewell with hand pump

	Village	District	Households	Population	No.of tubewells	Remarks
(1)	Pakxong town	Pakxong	146	881	2	UNICEF
(2)	B. Phouoi	Pakxong	65	351	3	UNICEF
(3)	B. Mai	Pakxong	-, 6)	-, 6)	6	Resettlement village
(4)	B. Thongset	Pakxong	119	855	8	Private
(5)	B. Thongsala	Bachiang	68	376	1	JICA
(6)	Others	Baciang	-	-	10	UNICEF/USAID
(7)	B. Houayhun	Laongam	68	440	1	JICA
(8)	B. Oung-noi	Laongam	93	468	1	UNICEF
(9)	B. Oung-gnai	Laongam	106	467	1	UNICEF
(10)	B. Beng	Salavan	97	608	1	JICA
(11)	B. Thounla	Thateng	114	583	1	AICF/UNICEF
(12)	B. Nongbok	Thateng	80	384	1	AICF/UNICEF
(13)	B. Kokphoung-nua	Thateng	55	195	1	AICF/UNICEF
				(Total)	37	

[C] Concrete ring dugwell

	Village	District	Households	Population	No.of tubewells	Remarks
(1)	Pakxong town	Pakxong	146	881	3	UNICEF
(2)	Others	Pakxong	-	-	10	UNICEF
(3)	B. Thongvay	Thateng	120	773	3	AICF
(4)	B. Paleng-tai	Thateng	33	182	1	AICF
(5)	B. Kokphoung-mai	Thateng	39	201	1	AICF
(6)	B. Chunghong-nua	Thateng	46	226	1	AICF
				(Total)	19	

Source : Provincial Public Health Service

Note: 1) Supported by " World Vision (NGO)" under the "Bachiang Integrated Rural Development Project"
2) State Company
3) All taps equiped with counter meter
4) Agriculture Promotion Bank, Laongam
5) One of the NGOs
6) No Data

Table VII-4 Existing Micro-hydropower Stations

1	Pakxong Micro-hydropower Station (Pakxong District)		
	- Water source	:	Houay Champi
	- Capacity of generator	:	No.1 : 60 kW , No.2 : 25 kW
	- Generating power	:	9.000 kWH/month (rainy season), 3.000kWH/month(dry season)
	- Operation	:	Rainy season = June to November, 24 hours (Day time : 6 hours operation by Generator No.2 Night time :18 hours operation by Generator No.1)
			Dry season = December to May, 8 hours/day (10 : 00 to 14 : 00 and 18 : 00 to 22 : 00 by No.2)
	- Managing	:	by a total district staff of nine(9) (3 administrators and 6 techincians)
	- No.of users	:	220 house holds
	- Electricity charge	:	37 Kip/kWH
	- Construction year	:	1987
	- Finance	:	Aid by East Germany
	- Generator, turbine	:	made in Poland
	Note: After completion of extension of Xeset Hydropower transmission line (December,1995), operation will be stoped because of spare parts problem		
2	B. Phakkout Micro-hydropower Station (Laongam District)		
	- Water source	:	Houay Namohkbo
	- Capacity of generator	:	30 kW
	- Construction year	:	1988, 24th May
	- Construction	:	by Vietnam Company
	- Generator	:	a secondhand generation motor of USA made
	- Operation hour	:	3 hours/day (18:00 - 21:00)
	- No.of users	:	90 households (2 lamps / household in average)
	- Finance	:	A charge by the farmers
	- Construction cost	:	10 million Kip in 1988
	- Using period	:	2 years
	- Problem	:	Not sufficient maintenance service and technical support to the farmers
			No availability of spare parts
3	Thateng town (Thateng District)		
	- Water resource	:	Houay Namsay
	- Capacity	:	5 kW x 2 units (private owned), 1,500 kip/lamp/month
			5 kW x 1 unit (owned by provincial office)
			0.3kW x 7 units (private owned)
	- Problem	:	Not sufficient water in the dry season

Source : Pakxong district office and interviewed with the farmers by the JICA Study Team

Table VII-5 Overall Village/Farm Road Development Plan

No.	Year	Reconstruction/New construction		Annual Maintenance Length 3) (km)
		Annual Completion 1) (km)	Cumulative Length 2) (km)	
1	1996	50	50	-
2	1997	50	100	-
3	1998	50	150	-
4	1999	50	200	50
5	2000	50	250	50
6	2001	50	300	50
7	2002	50	350	100
8	2003	50	400	100
9	2004	50	450	100
10	2005	50	500	150
11	2006	50	550	150
12	2007	50	600	150
13	2008	50	650	200
14	2009	50	700	200
15	2010	50	750	200
16	2011	50	800	250
17	2012	50	850	250
18	2013	50	900	250
19	2014	50	950	300
20	2015	50	1000	300
21	2016	50	1050	300
22	2017	50	1100	350
23	2018	50	1150	350
24	2019	50	1200	350
25	2020	50	1250	400
26	2021	50	1300	400
27	2022	50	1350	400
28	2023	50	1400	450
29	2024	50	1450	450
30	2025	50	1500	450
31	2026	50	1550	500
32	2027	50	1600	500

Note : 1) 50 km/year
2) Total length of proposed village road construction = 736 km
Total length of proposed farm road construction = 843 km
Village road construction in selected priority project area = 85 km
Farm road construction in selected priority project area = 24.5 km
3) Periodical maintenance every 3 years

Table VII-6 Potential Gravity Flow Piped Water Development (1/2)

Block		Benefical village	District	Water source	Households	Population	Predicted population in 2010	Design requirement lit./day/person)	Total demand (incl.30%loss) (m3/sec)	Available water lowest flow (m3/sec)	Percentage of lowest flow (%)
[1]	1	B. Lak 45	Pakxong	H.Champi	86	531	804	60	0.000725		
	2	B. Lak 43	Pakxong	H.Champi	211	563	852	60	0.000769		
	3	B. Lak 42	Pakxong	H.Champi	48	129	195	60	0.000176		
	4	B. Lak 40	Pakxong	H.Champi	140	823	1,245	60	0.001124		
	5	B. Lak 38	Pakxong	H.Champi	75	413	625	60	0.000564		
	6	B. Lak 36	Pakxong	H.Champi	92	468	708	60	0.000639		
	7	B. Lak 35	Pakxong	H.Champi	124	745	1,127	60	0.001018		
	8	B. Lak 33	Pakxong	H.Champi	64	331	501	60	0.000452		
	9	B. Lak 30	Pakxong	H.Champi	98	468	708	60	0.000639		
	10	B. Lak 28	Pakxong	H.Champi	116	571	864	60	0.000780		
				(sub-total)	1,054		7,630		0.006888	0.03	23.0
[2]	1	B. Lak 25	Bachiang	H. Last	89	462	699	60	0.000631		
	2	B. Lak 23	Bachiang	H. Last	86	390	590	60	0.000533		
	3	B. Lak 22	Bachiang	H. Last	35	158	239	60	0.000216		
	4	B. Houayhe	Bachiang	H. Last	131	588	890	60	0.000803		
	5	B. Phin	Bachiang	H. Last	101	473	716	60	0.000646		
	6	B. Pasouam	Bachiang	H. Last	42	155	235	60	0.000212		
				(sub-total)	484		3,368		0.001164	0.005	23.3
[3]	1	B. Kenglai	Bachiang	H. Kouang	242	55	83	60	0.000075		
	2	B. Dong	Bachiang	H. Kouang	37	158	239	60	0.000216		
	3	B. Oudomsouk	Bachiang	H. Kouang	79	380	575	60	0.000519		
	4	B. Houayseuy	Bachiang	H. Kouang	76	350	530	60	0.000478		
	5	B. Pakouay	Bachiang	H. Kouang	44	247	374	60	0.000337		
	6	B. Mouangkhai	Bachiang	H. Kouang	75	401	607	60	0.000548		
	7	B. Houayphun	Bachiang	H. Kouang	33	162	245	60	0.000221		
	8	B. Houayton	Bachiang	H. Kouang	36	179	271	60	0.000245		
	9	B. Phelat	Bachiang	H. Kouang	39	207	313	60	0.000283		
				(sub-total)	661		3,237		0.002922	0.26	1.1
[4]	1	B. Makngeo	Bachiang	H. Makngeo	57	265	401	60	0.000362		
				(sub-total)	57		401		0.000362	0.12	0.3
[5]	1	B. Nongbok	Bachiang	H. Lapi	117	556	841	60	0.000760		
				(sub-total)	117		841		0.000760	0.23	0.3
[6]	1	B. Nongbok-gnai	Bachiang	H. Palai	132	683	1,034	60	0.000933		
	2	B. Thongkim	Bachiang	H. Palai	98	477	722	60	0.000652		
	3	B. Kenggnao	Bachiang	H. Palai	65	310	469	60	0.000423		
	4	B. Thongsala	Bachiang	H. Palai	68	376	569	60	0.000514		
				(sub-total)	363		2,793		0.002522	0.17	1.5

Table VII-6 Potential Gravity Flow Piped Water Development (2/2)

[7]	1	B. Sixiangmai	Laongam	H. Kapheu	41	237	359	60	0.000324		
	2	B. Phouak-noy	Laongam	H. Kapheu	83	444	672	60	0.000607		
	3	B. On-noy	Laongam	H. Kapheu	93	468	708	60	0.000639		
	4	B. On-gnai	Laongam	H. Kapheu	153	728	1,102	60	0.000995		
	5	B. Ben	Laongam	H. Kapheu	82	410	620	60	0.000560		
	6	B. Houn-tai	Laongam	H. Kapheu	68	440	666	60	0.000601		
	7	B. Phouak-gnai	Laongam	H. Kapheu	153	728	1,102	60	0.000995		
	8	B. Hokong-gnai	Laongam	H. Kapheu	135	741	1,121	60	0.001012		
	9	B. Honkong-nook	Laongam	H. Kapheu	34	179	271	60	0.000245		
				(sub-total)	842		6,620		0.005977	0.04	14.9
[8]	1	B. Dong-noy	Laongam	H. Tapoung							
	2	B. Khagnongkhek-gnai	Laongam	H. Tapoung	116	587	888	60	0.000802		
	3	B. Khagnongkhek-noy	Laongam	H. Tapoung	25	126	191	60	0.000172		
	4	B. Louangsena	Laongam	H. Tapoung	29	157	238	60	0.000214		
	5	B. Laonong-noi	Laongam	H. Tapoung	33	158	239	60	0.000216		
	6	B. Mouangxoum	Laongam	H. Tapoung	43	233	353	60	0.000318		
	7	B. Takit-noy	Laongam	H. Tapoung	74	367	555	60	0.000501		
	8	B. Thong-noi	Laongam	H. Tapoung	33	158	239	60	0.000216		
	9	B. Thongko-gnai	Laongam	H. Tapoung	90	404	611	60	0.000552		
				(sub-total)	443		3,314		0.002992	0.05	6.0
[9]	1	B. Phokhem	Laongam	H. Pao	219	1,106	1,674	60	0.001511		
	2	B. Daxia-noy	Laongam	H. Pao	180	455	689	60	0.000622		
	3	B. Phonhin	Laongam	H. Pao	90	460	696	60	0.000628		
	4	B. Daxia-gnai	Laongam	H. Pao	162	774	1,171	60	0.001057		
	5	B. Dondu	Laongam	H. Pao	55	143	216	60	0.000195		
				(sub-total)	706		4,446		0.004014	0.06	6.7
[10]	1	B. Sengvang-gnai	Salavan	Xeset	155	893	1,332	60	0.001203		
	2	B.Houakhoua	Salavan	Xeset	47	261	389	60	0.000351		
	3	B.Sengvang-noy	Salavan	Xeset	74	431	643	60	0.000580		
	4	B.Khonleng	Salavan	Xeset	26	158	236	60	0.000213		
	5	B. Natou	Salavan	Xeset	56	323	482	60	0.000435		
				(sub-total)	358		3,082		0.002782	1.73	0.2
[11]	1	B. Nateu	Salavan	H. Latan	23	118	176	60	0.000159		
				(sub-total)	23		176		0.000159	0.005	3.2
[12]	1	B. Chakmlit	Thateng	H.Kaphouy	28	138	206	60	0.000186		
				(sub-total)	28		206		0.000186	0.005	3.7

	(Village)	(Household)	(Population)
(Total)	61	5,136	33,059

Table VII-7 Potential Micro-hydropower Development

No.	Village	District	River	Potential Generating Capacity (kW)	Lowest Discharge, 1) (m3/sec)	275 days full Discharge, 2) (m3/sec)
1	B. Houay seng	Laongam	Houay Tapoung	60	0.154	0.223
2	B. Setkhot, B. Phokhem	Paksong, Laongam	Houay Xe	160	0.399	0.578
3	B. Lak 38	Paksong	Houay Hen (Branch of H.Bangliang)	130	0.351	0.377
4	B. Phakkout , 3)	Laongam	Houay Namhok (Branch of H.Tapoung)	30	0.074	0.108
5	B. Houayxang	Paksong	Xe Pieng	100	0.262	0.362
6	B. Namthan	Paksong	Houay Namthan	130	0.282	0.468
7	B. Katouat	Paksong	Houay Set	70	0.165	0.239
8	B. Houayciat	Paksong	Houay Champi	160	0.349	0.455
9	B. Houaytao	Paksong	Houay Palai	20	0.041	0.054
10	B. Khot-gnai	Paksong	Houay Hai	70	0.148	0.193
11	B. Hanagphou-noy	Thateng	Houay Namsai	130	0.925	0.478
12	B. Sixiangmai	Laongam	Houay Kapeu	50	0.107	0.185
			(Total)	1,110		

Source : Provincial Industry and Handicraft Service and JICA Study Team
Note : 1) 1/5 probability
2) Discharge, ensured at least 275 days in a year
3) Rehabilitation of existing facility

Table VII-8 Summary fo Rural Infrastructure Development in the Selected Areas

		(Unit)	Project No.. 1)																(total)
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	Beneficial people																		
	- No.of villages 1)	nos.	7	3	2	1	3	4	1	6	5	2	11	6	13	5	5	1	75
	- No.of households	nos.	760	247	254	100	196	398	48	417	491	233	936	381	885	243	166	28	5,783
	- Population	nos.	4,152	1,388	1,257	526	821	2,041	205	2,126	2,575	1,158	4,887	2,184	5,759	1,559	851	138	31,627
2	Water supply facilities																		
	- Gravity flow piped water, 2)	system	1	0	0	0	0	0	0	0	1	1	1	2	0	0	0	1	7
	- Elevated tank with pump, 3)	system	0	1	2	1	0	1	0	0	0	0	0	0	0	0	0	0	5
	- Tubewell with elevated tank, 4)	system	0	0	0	0	0	0	0	6	0	0	6	0	11	3	2	0	28
	- Tubewell with hand pump	nos.	0	0	0	0	29	0	7	0	0	0	5	0	8	7	13	0	69
3	Village/farm roads	km	3.0	2.0	24.5	2.0	1.5	1.5	3.0	7.0	3.5	0.0	14.0	13.0	20.0	4.0	8.5	2.0	109.5
4	Electricity																		
	- Extension of 22 kV transmission line	km	0.0	15.0	0.0	20.0	0.0	0.0	0.0	14.0	0.0	13.0	22.0	8.0	23.0	4.0	19.0	0.0	138
	- Micro-hydropower development	system	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	3
5	Primary schools	nos.	7	2	2	1	2	2	1	6	3	1	7	2	11	4	2	1	54
6	Village clinics	nos.	1	1	1	1	0	1	0	0	1	0	0	0	0	1	1	1	9
7	Community halls	nos.	4	2	1	1	2	2	1	3	3	1	6	3	7	3	3	1	43

Note : 1) Project name and target villages

Project No.	Project name	Target villages
1	Upper Champi	B.Lak 33, B.Lak 35, B.Lak 36, B.Lak 38, B.Lak 40, B.Lak 42, B.Lak43
2	Upper Tapoung	B.Phoulongkeo, B.Houayxan, B.Xetapung
3	Lower Xepian	B.Panouang-dong, B.Houayxang
4	Upper Makchan	B.Chansavang
5	Middle Xekatam	B.Nonghin, B.Nongtuang, B.Nongmek
6	Middle Namtang	B.Namtouat, B.Namtang, B.Nong Ioy, B.Houaykong
7	Lower Makchan-gnai	B.Cupaxa
8	Lower Champi	B.Nonghouakhoay-kao, B.Bachiang, B.Nongkok, B.Nongsai, B.Nonxai, B.Nongson
9	Upper Kapheu	B.Phouak-noi, B.Sixiangmai, B.On-noy, B.Nongchoua, B.Phouak-gnai
10	Middle Tapoung	B.Dong-gnai, B.Dong-noy
11	Lower Tapoung	B.Nabon, B.Dongban, B.Len, B.Ngiou, B.Nongdeun, B.Pholong, B.Nongtakai, B.Laongam, B.Houaynamsan, B.Teme Sangthong
12	Lower Xeset	B.Nateu, B.Sengvang-gnai, B.Houakhoua, B.Sengvang-noy, B.Khonleng, B.Natou
13	Lower Namsai	B.Nathan-Ko, B.Nathan-Kouay, B.Nakiosao, B.Nalat, B.Maknao-noy, B.Thathouay, B.That-noy, B.Nathoun-noy, B.Dong-Nong, B.Nathon, B.Phonphai, B.Nadon, B.Nathon-gnai
14	Upper Thon	B.Tangbeng, B.Dongko-kang, B.Dongko-tai, B.Dongko-nua, B.Naxai-kokphao
15	Middle Lamphan	B.Chunghung-nua, B.Tongnai-gnai, B.Thongnai-mai, B.Satheu-tai, B.Satheu-gnai
16	Upper Tayun	B.Chakmlit

2) surface water, with distribution pipe line
3) surface water, with distribution pipe line
4) groundwater, with distribution pipe line

Table VII-9 Rural Infrastructure Development in Selected Areas (1/16)

Project Name : No.1 Upper Champi

Location : Pakxong district, Champasak province

No.of Villages : 7

Village Name :

	Name of village	Present		Predicted in 2010	
		Households	Population	Households	Population
1	B. Lak 33	65	331	97	494
2	B. Lak 35	125	745	186	1,111
3	B. Lak 36	93	468	139	698
4	B. Lak 38	76	413	113	616
5	B. Lak 40	141	823	210	1,227
6	B. Lak 42	48	261	72	389
7	B. Lak 43	212	1,111	316	1,657
	(Total)	760	4,152	1,133	6,192

Proposed Rural Infrastructure Development :

	Development Component	Quantity	Unit	Remarks (Target villages)
[1]	Water Supply			
	- Supply system : Surface water, gravity flow piped water			
	- Water source : H. Champi			
	- No.of beneficial village	7		
	- Intake facilitiy (type-I)	1		
	- Main pipeline	16.5	(km)	
	- Distribution pipeline	7.6	(km)	
	- Distribution tank	7		
	- Sand filter tank	1		
	- Communal stand taps	380		
[2]	Village/Farm Roads			
	- B. Lak 38 - B. Lak40	3		farm road
	(total)	3	(km)	
[3]	Electricity			
	- Extension of 22kv transmission line	0		
	- Extension of 0.4 kv distribution line	1.0	(km)	B. Lak36, 42
	- Beneficial household	211		
[4]	Schools			
	- Primary (class-3)	4		B. Lak33, 36, 38, 42
	- Primary (class-5)	3		B. Lak35, 40, 43
[5]	Village clinics			
	- type-II	1		B. Lak 35
[6]	Community halls			
	- type-I	1		B. Lak42
	- type-II	2		B. Lak35, 38
	- type-III	1		B. Lak40

Table VII-9 Rural Infrastructure Development in Selected Areas (2/16)

Project Name : No.2 Upper Tapoung

Location : Pakxong district, Champasak province

Village Name :

	Name of village	(Present)		(Predicted in 2010)	
		Households	Population	Households	Population
1	B. Phoulongkeo	39	271	58	404
2	B. Houayxan	112	599	167	893
3	B. Xetapung	96	518	143	772
	(Total)	247	1,388	368	2,070

Proposed Rural Infrastructure Development :

	Development Component	Quantity	Unit	Rmarks (Farget villlages)
[1]	Water Supply			
	- Supply system : Surface water, elevated tank w/pump by transmission line			
	- Water source : H. Tapoung			
	- No.of beneficial villages	3		
	- Intake facilitiy (type-II)	1		
	- Main pipeline	4.0	(km)	
	- Distribution pipeline	1.0	(km)	
	- Elevated distribution tank	3		
	- Sand filter tank	1		
	- Communal stand taps	49		
[2]	Village/Farm Road			
	- B. Houayxan - Farm	2		village road
	(Total)	2	(km)	
[3]	Electricity			
	- Extension of 22kv transmission line	15	(km)	
	- Extension of 0.4 kv distribution line	1.5	(km)	
	- Beneficial household	368		
[4]	Schools			
	- Primary (class-3)	1		B. Phoulongkeo
	- Primary (class-5)	1		B. Houayxan
[5]	Village clinics			
	- type-I	1		B. Houayxan
	- type-II	0		
[6]	Community halls			
	- type-I	1		B. Phoulongkeo
	- type-II	1		B. Xetapung
	- type-III	0		

Table VII-9 Rural Infrastructure Development in Selected Areas (3/16)

Project Name : No.3 Lower Xeplan

Location : Pakxong district, Champasak province

No.of Villages : 2

Village Name :

	Village name	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Panouang-dong	175	801	261	1,195
2	B. Houayxang	79	456	118	680
	(Total)	254	1,257	379	1,875

Proposed Rural Infrastructure Development

	Development Component	Quantity	Unit	Remark (Target villages)
[1]	Water Supply			
	- Supply system (1) : Surface water, elevated tank w/pump by micro-hydropower			
	- Water source : Xepian			
	- No.of beneficial village	1		Panouang-dong
	- Intake facilitiy (type-I)	1		
	- Main pipeline	1.0	(km)	
	- Distribution pipeline	0.7	(km)	
	- Elevated distribution tank	1		
	- Sandfilter tank	1		
	- Communal stand taps	35		
	- Supply system (2) : Surface water, elevated tank w/pump by micro-hydropower			
	- Water source : H. Toklok			
	- No.of beneficial village	1		Houayxang
	- Intake facilitiy (type-II)	1		
	- Main pipeline	0.5	(km)	
	- Distribution pipeline	0.3	(km)	
	- Elevated distribution tank	1		
	- Sandfilter tank	1		
	- Communal stand taps	16		
[2]	Village/Farm Road			
	- B. Houayxang - Pakxong	20.0		village road
	- B. Phanouan-dong - B. Houayxang	4.5		village road
	(Total)	24.5	(km)	
[3]	Electricity			
	- Micro-hydropower	90	(kW)	45 kW x 2 units
	- Distribution line	4	(km)	
	- Beneficial households	379		
[4]	School			
	- Primary (class-3)	1		B.Houayxang
	- Primary (class-5)	1		B.Panouang-dong
[5]	Village clinic			
	- type-I	0		
	- type-II	1		B.Panouang-dong
[6]	Community hall			
	- type-I	0		
	- type-II	0		
	- type-III	1		B.Panouang-dong

TableVII-9 Rural Infrastructure Development in Selected Areas (4/16)

Project Name : No.4 Upper Makchan

Location : Paksong district, Champasak province

No.of Village : 1

Village Name :

	Village name	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Chansavang (NkhL.34)	100	526	149	784
	(Total)	100	526	149	784

Proposed Rural Infrastructure Development

	Development Component	Quantity	Unit	Remark (Target villages)
[1]	Water Supply			
	- Supply facility : Surface water, elevated tank w/pump by transmission line			
	- Water source : H. Makchangnai			
	- No.of beneficial village	1		
	- Intake facility (type-II)	1		
	- Main pipeline	1.0	(km)	
	- Distribution pipeline	0.4	(km)	
	- Elevated distribution tank	1		
	- Sandfilter tank	1		
	- Communal stand taps	20		
[2]	Village/Farm Road			
	- B. Chansavang - Farm	2.0		farm road
	(Total)	2.0	(km)	
[3]	Electricity			
	- Extension of 2.2 kv transmission line	20	(km)	
	- Extension of 0.4 kv distribution line	0.5	(km)	
	- Beneficial households	149		
[4]	School			
	- Primary (class-3)	0		
	- Primary (class-5)	1		B.Chansavang
[5]	Village clinic			
	- type-I	1		B.Chansavang
	- type-II	0		
[6]	Community hall			
	- type-I	0		
	- type-II	1		B.Chansavang
	- type-III	0		

TableVII-9 Rural Infrastructure Development in Selected Areas (5/16)

Project Name : No.5 Middle Xekatam

Location : Pakxong district, Champasak province

No.of Village : 1

Village Name :

	Village name	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Nonghin	43	177	64	264
2	B.Nongtuang	66	281	98	419
3	B. Nongmek	87	363	130	541
	(Total)	196	821	292	1,224

Proposed Rural Infrastructure Development

	Develpment Cmponent	Quantity	Unit	Remark (Target villages)
[1]	Water Supply			
	- Supply system : Groundwater (tubewell) w/hand pump			
	- No.of beneficial villages	3		
	- No.of tubewells with hand pump	29		
[2]	Village/Farm Road			
	- B. Nongtoun - Farm	1.5		farm road
	(Total)	1.5	(km)	
[3]	Electricity			
	- Extension of 22 kv transmission line	0		
	- Extension of 0.4 kv distribution line	0		
	- Beneficial household	0		
[4]	School			
	- Primary (class-3)	1		B.Nongtuang
	- Primary (class-5)	1		B. Nongmek
[5]	Village clinic			
	- type-I	0		
	- type-II	0		
[6]	Community hall			
	- type-I	1		B.Nongtuang
	- type-II	1		B. Nongmek
	- type-III	0		

TablVII-9 Rural Infrastructure Development in Selected Areas (6/16)

Project Name : No.6 Middle Namtang

Location : Pakxong district, Champasak province

No.of Villages : 4

Village Name :

	Name of village	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Namtouat	27	100	40	149
2	B. Namtang	124	647	185	965
3	B. Nong Ioy	113	507	169	756
4	B. Houaykong	134	787	200	1,174
	(Total)	398	2,041	594	3,044

Proposed Rural Infrastructure Development

	Development Component	Quantity	Unit	Remark (Target villages)
[1]	Water Supply			
	- Supply system : Surface water, elevated tank w/pump by micro-hydropower			
	- Water source : H. Namtang)			
	- No.of beneficial villages	4		
	- Intake facilitiy (type-II)	1		
	- Main pipeline	7.3	(km)	
	- Distribution pipeline	5.9	(km)	
	- Elevated dist. tank	4		
	- Sandfilter tank	1		
	- Communal stand taps	80		
[2]	Village/Farm Road			
	- District road - B. Namtouat	1.5		village road
	(Total)	1.5	(km)	
[3]	Electricity			
	- Micro-hydropower	120	(kW)	60 kW x 2 units
	- Distribution line	5	(km)	
	- Beneficial households	594		
[4]	School			
	- Primary (class-3)	1		B. Nong Ioy
	- Primary (class-5)	1		B. Houaykong
[5]	Village clinic			
	- type-I	0		
	- type-II	1		B. Houaykong
[6]	Community hall			
	- type-I	0		
	- type-II	2		B. Houaykong, B.Namtang
	- type-III	0		

Table VII-9 Rural Infrastructure Development in Selected Areas (7/16)

Project Name : No.7 Lower Makchan-gnai

Location : Pakxong district, Champask province

No.of Village : 1

Village Name :

	Name of village	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Cupaxa	48	205	72	306
	(Total)	48	205	72	306

Proposed Rural Infrastructure Development

	Development Component	Quantity	Unit	Remark (Target villages)
[1]	Water Supply			
	- Supply system : Groundwater (tubewell) w/hand pump			
	- No.of beneficial village	1		
	- No.of tubewells with hand pump	7		
[2]	Village/Farm Road			
	- B. Cupaxa - Farm	3		farm road
	(Total)	3	(km)	
[3]	Electricity			
	- Extension of 22 kv transmission line	0		
	- Extension of 0.4 kv distribution line	0		
	- Beneficial household	0		
[4]	School			
	- Primary (class-3)	0		
	- Primary (class-5)	1		B.Cupaxa
[5]	Village clinic			
	- type-I	0		
	- type-II	0		
[6]	Community hall			
	- type-I	1		B.Cupaxa
	- type-II	0		
	- type-III	0		

TableVII-9 Rural Infrastructure Development in Selected Areas (8/16)

Project Name : No.8 Lower Champi

Location : Bachiang district, Champasak province

No.of Villages : 6

Village Name :

	Name of village	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Nonghouakhoay-ka	45	234	67	349
2	B. Bachiang	113	571	169	852
3	B. Nongkok	87	456	130	680
4	B. Nongsai	75	373	112	556
5	B. Nonxai	49	256	73	382
6	B. Nongson	48	236	72	352
	(Total)	417	2,126	622	3,170

Proposed Rural Infrastructure Development

	Development Component	Quantity	Unit	Remark (Faget villages)
[1]	Water Supply			
	- Supply system : Groundwater (tubewell), elevated tank w/pump by transmission line			
	- No.of beneficial villages	6		
	- No.of tubewells	6		
	- Eelevated distribution tank	6		
	- Distribution pipeline	2	(km)	
	- Communal stand taps	83		
[2]	Village/Farm Road			
	- B. Nongkok - B. Nonghouakhouay-kao	5.0		farm road
	- B. Phelat - B. Nongsai	2.0		village road
	(Total)	7.0	(km)	
[3]	Electricity			
	- Extension of 22kv transmission line	14	(km)	
	- Extension of 0.4 kv distribution line	2.5	(km)	
	- Beneficial households	453		
[4]	School			
	- Primary (class-3)	4		*)
	- Primary (class-5)	2		B. Bachiang, B.Nongsai
[5]	Village clinic			
	- type-I	0		
	- type-II	0		
[6]	Community hall			
	- type-I	1		
	- type-II	2		B. Nongsai
	- type-III	0		

Note: *) B.Nonghouakhoay-kao, B.Nongkok, B.Nonxai, B.Nongson

Table VII-9 Rural Infrastructure Development in Selected Areas (9/16)

Project Name : No.9 Upper Kapheu

Location : Laongam district, Salavan province

No.of Villages : 5

Village Name :

	Name of village	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Phouak-noi	84	444	125	662
2	B. Sixiangmai	47	237	70	353
3	B. On-noi	94	468	140	698
4	B. Nongchoua	112	698	167	1,041
5	B. Phouak-gnai	154	728	230	1,086
	(Total)	491	2,575	732	3,840

Note: Water Supply : B. Phouak-noi, B. Sixiangmai, B. On-noi
Electrification by micro-hydropower : B. Sixiangmai, B. Nongchoua, B.Phouak-gnai

Proposed Rural Infrastructure Development

	Development Component	Quantity	Unit	Remarks (Target villages)
[1]	Water Supply			
	- Supply system : Surface water, gravity flow piped water			
	- Water source : H. Kapheu			
	- Nos. of beneficial village	3		B.Phouak-noi, B.Sixiangmai,
	- Intake facility (type-II)	1		B.On-noi
	- Main pipeline	7.5	(km)	
	- Distribution pipeline	0.7	(km)	
	- Distribution tank	3		
	- Sandfilter tank	1		
	- Communal stand taps	34		
[2]	Village/Farm Road			
	- B. Sixiangmai - B. Phouk-gnai	1.5		farm road
	- B. Phouak-noi - B.Phouak-gnai	2.0		farm road
	(Total)	3.5	(km)	
[3]	Electricity			
	- Micro-hydropower facilities	90	(kW)	45 kW x 2units
	- Distribution line	10	(km)	
	- Beneficial households	467		B.Sixiangmai, B.Nongchoua, B.Phouak-gnai
[4]	School			
	- Primary (class-3)	2		B.Phouak-noi, B.Nongchoua,
	- Primary (class-5)	1		B.On-noi
[5]	Village clinic			
	- type-I	0		
	- type-II	1		B.Nongchoua
[6]	Community hall			
	- type-I	1		B.Sixiangmai
	- type-II	2		B.On-noi, B.Phouak-noi
	- type-III	0		

TableVII-9 Rural Infrastructure Development in Selected Areas (10/16)

Project Name : No.10 Middle Tapoung

Location : Laongam district, Salavan province

No.of Villages : 2

Village Name :

	Village name	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Dong-gnai	174	881	259	1,314
2	B. Dong-noy	59	277	88	413
	(Total)	233	1,158	347	1,727

Proposed Rural Infrastructure Development

	Development Component	Quantity	Unit	Remark (Target villages)
[1]	Water Supply			
	- Supply system : Surface water, gravity flow piped water			
	- Water source : H. Tapoung			
	- No.of beneficial villages	2		
	- Intake facilitiy (type-I)	1		
	- Main pipeline	4.5	(km)	
	- Distribution pipeline	0.9	(km)	
	- Distribution tank	2		
	- Sandfilter tank	1		
	- Communal stand taps	47		
[2]	Village/Farm Road			
	-	0.0	(km)	
[3]	Electricity			
	- Extension of 22 kv transmission line	13	(km)	
	- Extension of 0.4 kv distribution line	1	(km)	
	- Beneficial household	347		
[4]	School			
	- Primary (class-3)	0		
	- Primary (class-5)	1		B. Dong-gnai
[5]	Village clinic			
	- type-I	0		
	- type-II	0		
[6]	Community hall			
	- type-I	0		
	- type-II	0		
	- type-III	1		B. Dong-gnai

TableVII-9 Rural Infrastructure Development in Selected Areas (11/16)

Project Name : No.11 Lower Tapoung

Location : Laongam district, Salavan province

No.of Villages : 11

Village Name :

	Village name	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Nabon	55	291	82	438
2	B. Dongban	59	305	88	455
3	B. Len	79	368	118	549
4	B. Ngiou	71	394	106	588
5	B. Nongdeun	32	156	48	233
6	B. Pholong	95	514	142	767
7	B. Nongtakai	75	364	112	543
8	B. Laongam	275	1,444	410	2,153
9	B. Houaynamsan	49	215	73	321
10	B. Teme Sangthong	87	507	130	756
11	B. Lavat	59	326	88	486
	(Total)	936	4,887	1,396	7,288

Proposed Rural Infrastructure Development

	Development Component	Quantity	Unit	Remark (Target villages)
[1]	Water Supply			
	- Supply system (1) : Surface water, gravity flow piped water			
	- Water source : Spring			
	- No.of beneficial villages	4		*)
	- Intake facility (type-I)	1		
	- Main pipeline	12	(km)	
	- Distribution pipeline	14.7	(km)	
	- Distribution tank	4		
	- Sandfilter tank	1		
	- Individual stand taps/with counter	494		
	- Supply system (2) : Groundwater (tubewell), elevated tank w/pump by transmission line			
	- No.of beneficial villages	6		
	- No.of tubewells	6		
	- Distribution pipeline	6.1	(km)	
	- Eevated distribution tank	6		
	- Communal stand taps	82		
	- Supply system (3) : Groundwater (tubewell) w/hand pump			
	- No.of beneficial villages	1		B. Nongdeun
	- No.of tubewells with hand pump	5		
[2]	Village/Farm Road			
	- B. Laongam - B. Nongtakai	2.5		village road
	- B. Laongam - B. Nongdeun	3.5		village road
	- B. Teme Sangthong - B. Lavat	3.5		village road
	- B. Ngiou - B. Lavat	2.5		village road
	- B. Laongam - B. Len	2.0		village road
	(Total)	14.0	(km)	
[3]	Electricity			
	- Extension of 22kv transmission line	22	(km)	
	- Extension of 0.4 kv distribution line	4	(km)	
	- Benificial household	783		
[4]	School			
	- Primary (class-3)	5		**)
	- Primary (class-5)	2		B.Laongam, B.Pholong
[5]	Village clinic			
	- type-I	0		
	- type-II	0		
[6]	Community hall			
	- type-I	2		B.Dongban, B.Lavat
	- type-II	4		***)
	- type-III	0		

Note: *) B.Laongam, B.Nongtakai, B.Pholong, B.Houaynamsan
**) B.Ngio, B.Len, B.Dongban, B.Nongtakai, B.Teme Sangthong
***) B.Ngio, B.Len, B.Nongtakai, B.Pholong

Table VII-9 Rural Infrastructure Development in Selected Areas (12/16)

Project Name : No.12 Lower Xeset

Location : Salavan district, Salavan province

No.of Villages : 6

Village Name :

	Name of village	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Nateu	23	118	34	176
2	B. Sengvang-gnai	155	893	231	1,332
3	B. Houakhoua	47	261	70	389
4	B. Sengvang-noy	74	431	110	643
5	B. Khonleng	26	158	39	236
6	B. Natou	56	323	84	482
	(Total)	381	2,184	568	3,257

Proposed Rural Infrastructure Development

		Quantity	Unit	Remarks (Target villages)
[1]	Water Supply			
	- Supply system (1) : Surface water, gravity flow piped water			
	- Water source : Xeset			
	- Nos.of beneficial village	5		
	- Intake facility (type-II)	1		
	- Main pipeline	13	(km)	
	- Distribution pipeline	1.4	(km)	
	- Distribution tank	5		
	- Sandfilter tank	1		
	- Communal stand taps	72		
	- Supply system (2) : Surface water, gravity flow piped water			
	- Water source : H. Latan			
	- Nos.of beneficial village	1		B. Nateu
	- Intake facility (type-II)	1		
	- Main pipeline	1.0	(km)	
	- Distribution pipeline	0.1	(km)	
	- Distribution tank	1		
	- Sandfilter tank	1		
	- Communal stand taps	5		
[2]	Village/Farm Road			
	- B. Nateu - B. Sevang-gnai - No.20	4.5		village road
	- B. Houakhoua - B. Natou	4.0		village road
	- B. Nanong - B. Sevang-gnai - No.20	4.5		farm road
	(Total)	13.0	(km)	
[3]	Electricity			
	- Extension of 22kv transmission line	8	(km)	
	- Extension of 0.4 kv distribution line	3	(km)	
	- Beneficial household	568		
[4]	School			
	- Primary (class-3)	2		B.Senvang-gnai, B.Khonleng
	- Primary (class-5)	0		
[5]	Village clinic			
	- type-I	0		
	- type-II	0		
[6]	Community hall			
	- type-I	2		B.Houakhoua, B.Natou
	- type-II	0		
	- type-III	1		B.Senvang-gnai

Table VII-9 Rural Infrastructure Development in Selected Areas (13/16)

Project Name : No.13 Lower Namsai

Location : Salavan district, Salavan province

No.of Villages : 13

Village Name :

	Village name	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Nathan-ko	56	355	84	529
2	B. Nathan-kouay	75	490	112	731
3	B. Nakiosao	106	725	158	1,081
4	B. Nalat	49	313	73	467
5	B. Maknao-gnai	26	180	39	268
6	B. Thathouay	93	574	139	856
7	B. That-noy	41	240	61	358
8	B. Nathoun-noy	59	380	88	567
9	B. Dong-nong	67	433	100	646
10	B. Nathon	97	639	145	953
11	B. Phonphai	154	1,064	230	1,587
12	B. Nadon	28	157	42	234
13	B. Nathon-gnai	34	209	51	312
	(Total)	885	5,759	1,320	8,588

Proposed Rural Infrastructure Development

	Development Component	Quantity	Unit	Remark (Target villages)
[1]	Water Supply			
	- Supply system (1) : Groundwater (tubewell) , elevated tank w/pump by transmission line			
	- No.of beneficial villages	11		
	- No.of tubewells	11		
	- Distribution pipeline	3.3	(km)	
	- Elevated distribution tank	11		
	- Communal stand taps	166		
	- Supply system (2) : Groundwater (tubewell) w/hand pump			
	- No.of beneficial villages	2		B.Maknao, B.Nadon
	- No.of tubewells with hand pump	8		
[2]	Village/Farm Road			
	- B. Kouay - B. Ko	2.5		village road
	- B. Kouay - B. Dong-nong	3.0		village road
	- B. Nakasao - B.Sanglavi	2.0		village road
	- B. Sanglavi - B. Phonphai	5.0		village road
	- B. Nakasao - B. Nalat	3.5		village road
	- B. Thathouay - No.20	2.0		village road
	- B. Nakasao - B. Nathoun-noy	2.0		village road
	(Total)	20.0	(km)	
[3]	Electricity			
	- Extension of 22kv transmission line	23	(km)	
	- Extension of 0.4 kv distribution line	5.5	(km)	
	- Beneficial household	978		
[4]	School			
	- Primary (class-3)	9		*)
	- Primary (class-5)	2		B.Nakiosao, B.Phonphai
[5]	Village clinic			
	- type-I	0		
	- type-II	0		
[6]	Community hall			
	- type-I	4		**)
	- type-II	3		***)
	- type-III	0		

Note: *) B.Nathan-ko, B.Nathan-kouay, B.Nalat, B.Maknao-noy, B.Thathouay, B.Dong-nong, B.Nathon, B.Nadon, B.Nathon-gnai
**) B.Nathan-ko, B.That-noy, B.Nathoun-noy, B. Nathon
***) B.Nakiosao, B.Thatouay, B.Nathon

Table VII-9 Riral Infrastructure Development in Selected Areas (14/16)

Project Name : No.14 Upper Thon

Location : Salavan district, Salavan province

No.of Villages : 5

Village Name :

	Village name	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Tang Beng	99	608	148	907
2	B. Dongko-kang	28	185	42	276
3	B. Dongko-tai	22	148	33	221
4	B. Dongko-nua	52	320	78	477
5	B. Naxai-kokphao	42	298	63	444
	(Total)	243	1,559	362	2,325

Proposed Rural Infrastructure Development

	Development Component	Quantity	Unit	Remark (Target villages)
[1]	Water Supply			
	- Supply system (1) : Groundwater (tubewell), elevated tank w/pump by transmission line			
	- No.of beneficial villages	3		*)
	- No.of tubewells	3		
	- Distribution pipeline	0.8	(km)	
	- Distribution tank	3		
	- Communal stand taps	39		
	- Supply system (2) : Groundwater (tubewell) w/hand pump			
	- No. of beneficial villages	2		B.Dongko-kang, B.Dongko-tai
	- No.of tubewells with hand pump	7		
[2]	Village/Farm Road			
	- B. Dongko-nua - B.Naxai-kokphao	2.0		village road
	- B. Naxai- noy - B. Naxai-kokphao	2.0		village road
	(Total)	4.0	(km)	
[3]	Electricity			
	- Extension of 22kv transmission line	4	(km)	
	- Extension of 0.4 kv distribution line	2	(km)	
	- Beneficial household	215		
[4]	School			
	- Primary (class-3)	3		**)
	- Primary (class-5)	1		B.Tang Beng
[5]	Village clinic			
	- type-I	1		B.Tang Beng
	- type-II	0		
[6]	Community hall			
	- type-I	2		B.Dongko-nua, B.Naxai-kokphao
	- type-II	1		B.Tang Beng
	- type-III	0		

Note: *) B.Tang Beng, B.Dongko-nua, B.Naxai-kokphao
**) B.Dongko-kang, B.Dongko-nua, B.Naxai-kokphao

Table VII-9 Rural Infrastructure Development in Selected Areas (15/16)

Project Name : No.15 Middle Lamphan

Location : Thateng district, Sekong province

No.of Villages : 5

Village Name :

	Name of village	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Chunghung-nua	46	226	69	337
2	B. Thongnai-gnai	28	122	42	182
3	B. Thongnai-mai	30	169	45	252
4	B. Satheu-tai	35	194	52	289
5	B. Satheu-gnai	27	140	40	209
	(Total)	166	851	248	1,269

Proposed Rural Infrastructure

	Development Component	Quantity	Unit	Remark (Target villages)
[1]	Water Supply			
	- Supply system (1) : Groundwater (tubewell) , elevated tank w/pump by transmission line			
	- Nos.of beneficial village	2		B.Chunghung-nua, B.Satheu-tai
	- No.of tubewells	2		
	- Distribution pipeline	0.3	(km)	
	- Elevated distribution tank	2		
	- Communal stand taps	16		
	- Supply system (2) : Groundwater (tubewell) w/hand pump			
	- Nos.of beneficial village	3		*)
	- Nos. of tubewell with hand pump	13		
[2]	Village/Farm Road			
	1 B. Thongnai-mai - B. Satheu-mai	2.0		farm road
	2 B. Thon-noy - B. Sathen-gnai	6.5		village road
	(Total)	8.5	(km)	
[3]	Electricity			
	1 Extension of 22kv transmission line	19	(km)	
	2 Extension of 0.4 kv distribution line	2.5	(km)	
	3 Benificial household	248		
[4]	School			
	- Primary (class-3)	2		**)
	- Primary (class-5)	0		
[5]	Village clinic			
	- type-I	1		B.Chunghung-nua
	- type-II	0		
[6]	Community hall			
	- type-I	3		***)
	- type-II	0		
	- type-III	0		

Note: *) B.Thongnai-gnai, B.Thongnai-mai, B.Satheu-gnai
**) B.Chunghung-nua, B.Thongnai-mai
***) B.Chunghung-nua, B.Thongnai-mai, B.Satheu-gnai

TableVII-9 Rural Infrastructure Development in Selected Areas (16/16)

Project Name : No.16 Upper Tayun

Location : Thateng district, Sekong province

No.of Villages : 1

Village Name :

	Village name	Present		Predicted in 2010	
		Household	Population	Household	Population
1	B. Chakmlit	28	138	42	206
	(Total)	28	138	42	206

Proposed Rural Infrastructure Development :

	Development Component	Quantity	Unit	Remarks (Target villages)
[1]	Water Supply			
	- Supply system : Surface water, gravity flow piped water			
	- Water source : H. Kaphouy			
	- Nos.of beneficial village	1		
	- Intake facility (type-I)	1		
	- Main pipeline	3	(km)	
	- Distribution pipeline	0.1	(km)	
	- Distribution tank	1		
	- Sandfilter tank	1		
	- Communal stand taps	6		
[2]	Village/Farm Road			
	- No.16 - B. Chakmlit - Farm	2		village road
	(Total)	2	(km)	
[3]	Electricity			
	- Extension of 22 kv transmission line	0	(km)	
	- Extension of 0.4 kv distribution line	0.5	(km)	
	- Beneficial household	42		
[4]	School			
	- Primary (class-3)	1		B.Chakmlit
	- Primary (class-5)	0		
[5]	Village clinic			
	- type-I	1		B.Chakmlit
	- type-II	0		
[6]	Community hall			
	- type-I	1		B.Chakmlit
	- type-II	0		
	- type-III	0		

Table VII-10 Present Road Network in the Priority Scheme Areas

Priority Development Scheme	Project net area, 1/ (ha)	National road (section)	Distance (km)	District road (section)	Distance (km)	Village road (Section)	Distance (km)	Farm road, 2/ (total length) (km)	Total road length (km)	Road density (km/km2)
(1) Upper Champi		- Road No. 23 (B. Lak33 - B. Lak45)	13.8	- B. Lak36 to (B.Houaychiat) (coffee feeder road)	1.4	- Lak38 - B. Lak42	4.5	8.8		
				- B. Lak38 to (B. Khotnoi) (coffee feeder road)	1.7					
(sub-total)	730		13.8		3.1		4.5	8.8	30.2	4.1
(2) Upper Tapoung		(Road No. 23 (Pakxong) to B. Houaisan = 9.0 km)	0.0	- B. Houaisan - B. Xetapung	3.9		0.0	3.5		
				- B. Houaisan - B. Phoulangkeo	2.5					
(sub-total)	80		0.0		6.4		0.0	3.5	9.9	12.4
(3) Upper Kapheu		(Road No.20 (B. On-Beng) to B. On-gnai = 3.0 km)	0.0	- B. On-gnai - B. Sixiangmai (Langam coffee road)	6.3	- B. Sixiangmai - B. Phouak-gnai	1.8	10.2		
						- B. Phouak-gnai - B. Phouak-noi	1.9			
(sub-total)	1,000		0.0		6.3		3.7	10.2	20.2	2.0
(4) Lower Xeset		- Road No. 20 (Xeset bridge - B. Sengvang-noi)	4.4	- B. Houakhoua - Xeset Hydropower Station (proposed weir site)	3.2	- B. Houakhoua - B. Natou	3.8	0.0		
						- B. Sengvang-gnai - B. Natteu	3.3			
						- B. Sengvang-gnai - Road No. 20	1.3			
				- Construction road for Xeset Hydropower Station	2.4	- B. Muangkhai - B. Houakhoua	0.5			
(sub-total)	1,000		4.4		5.6		8.9	0.0	18.9	1.9
(5) Upper Tayun		- Road No. 16 (B. Khammkok - BChakam-mai)	1.6	- B. Khamkok to (B. Thongvay) (coffee feeder road)	2.8	- Road No.16 - B. Chakamlit	1.7	7.7		
(sub-total)	330		1.6		2.8		1.7	7.7	13.8	4.2
(Total)	3,140		19.8		24.2		18.8	30.2	93.0	3.0

Note : 1/ target irrigation command area

2/ excluding footpath

Table VII-11 Present Condition of Domestic Water Use

No.	Scheme/village	No. of household	Population	Water source	Distance (m)	Remarks
	Upper Champi					
1	Lak 33	61	347	H. Chalok	100	Difficulty of fetching water from the deep valley of the river
2	Lak 35	121	674	H. Jen for drinking water	300	Deep valley; for bathing 1,000 m away to H. Champi in the dry season
3	Lak 36	80	476	H. Jen for drinking water	100	Deep valley; for bathing 1,000 m away to H. Champi in the dry season
4	Lak 38	71	431	Gravity flow piped water system Stream (a branch of H. Champi)		Supported by UNICEF Total number of communal taps = 16 (3 to 7 households/ tap) Total pipeline length = 1,500 m, one (1) concrete tank (18 m3) No collection of water charge, insufficient water for the village
5	Lak 40	144	837	Gravity flow piped water system Stream (a branch of H. Hen)		Supported by UNICEF Total number of communal taps = 19 (6 to 7 households/ tap) Total pipeline length = 500 m, one (1) concrete tank (10 m3) and no collection of water charge, insufficient water during April and May
6	Lak 42	56	263	Stream(Spring) One (1) private pipeline system	100	Difficulty of fetching water from the deep valley of the river Pumping from a stream, one (1) concrete tank (8m3) and 500m of pipe line with a communal tap
7	Lak 43	206	1,146	Dug well		Total number of wells = 10, average depth = 13 -15 m
8	Lak 45	89	557	H. Man & H. Se	50	Small pond by damming the stream
	(Total)	828	4,731			
	Upper Tapung					
9	Phoulangkeo	45	283	H.Kapheu	300	Difficulty of fetching water from the deep valley of the river
10	Houaisan	116	666	H.Tapung(Spring)	300	Origin of H. Tapung
11	Xetapung	101	529	H.Tapung(Spring) H.Tapung	50 100	Old village New village (Xetapoung-mai)
	(Total)	262	1,478			
	Upper Kapheu					
12	Phouak-noi	83	453	Spring	400	
13	Sixiangmai	49	265	H. Kapheu	50	Difficulty of fetching water from the deep valley of the river
14	On-noi	97	490	Spring	500	
15	Phouak-gnai	133	731	H.Houn	100	
16	On-gnai	94	454	Spring	500	
	(Total)	456	2,393			
	Lower Xeset					
17	Natcu	32	149	H.Lavan (July-December)	50	Xe Set (January-June), 3,000 m of fetching distance
18	Sengvang-gnai	135	796	Xe Set	50	Five (5) communal taps from the water pipeline of an ice producing plant
19	Houakboua	58	290	Xe Set	50	
20	Sengvang-noi	74	545	H. Tong	500	During the dry season, the people fetch the water from the communal tap of motor pump well at B. Beng, 800 m away.
21	Khonleng	29	179	Xe Set	600	
22	Natou	58	350	Xe Set	50	
	(Total)	386	2,309			
	Upper Tayun					
23	Chakamlit	20	160	H. Tbon	50	
24	Khamkok	50	470	H. Lo (Spring)	300	Supported by AICF in1995; communal taps and washing /bathing place
25	Chakam-mai	38	241	H. Tit One(1) tube well with hand pump	200	Insufficient water during May and June Supported by UNICEF in 1996, a burden-sharing of 100,000 kip by the village Direct Action Hand Pump (Indian make), depth = 30 m
	(Total)	108	871		209	(average water fetching distance)

Table VII-12 Proposed Rural Infrastructure Development Plan

	Priority Development Scheme	Target villages	No. of target villages (no.)	Households in 1996 (no.)	Population in 1996 (no.)	Water supply system: Gravity flow piped water system	Water supply system: Water system with electric pump	Village road improvement: Penetration macadam (km)	Village road improvement: Gravel pavement (km)	Village road improvement: Box culvert (no.)	Village road improvement: Pipe culvert (no.)	Primary school: Class-III ./1/ (no.)	Primary school: Class-V ./2/ (no.)	Village community hall: type-A ./3/ (no.)	Village community hall: type-B ./4/ (no.)	Village community hall: type-C ./5/ (no.)
(1)	Upper Champi	Lak 33		61	347							1	0	1	0	0
		Lak 35		121	674							0	1	0	1	0
		Lak 36		80	476							1	0	1	0	0
		Lak 38		71	431							1	0	1	0	0
		Lak 40		144	837							0	1	0	1	0
		Lak 42		56	263							0	0	1	0	0
		Lak 43		206	1,146							0	1	0	1	0
		Lak 45		89	557							0	1	0	0	1
			8	828	4,731	1	0	0.0	0.0	0	0	3	4	4	3	1
(2)	Upper Tapoung	Phoulangkeo		45	283							1	0	1	0	0
		Houaisan		116	666							0	1	0	0	1
		Xetapung		101	529							1	0	0	1	0
			3	262	1,478	0	2	12.9	0.0	0	26	2	1	1	1	1
(3)	Upper Kapheu	Phouak-noi		83	453							1	0	1	0	0
		Sixiangmai		49	265							1	0	1	0	0
		On-noi		97	490							0	0	0	0	1
		Phouak-gnai		133	731							1	0	0	1	0
		On-gnai		94	454							0	1	1	0	0
			5	456	2,393	1	0	9.3	3.7	1	26	3	1	3	1	1
(4)	Lower Xe Set	Natteu		32	149							1	0	1	0	0
		Sengvang-gnai		135	796							1	0	0	0	1
		Houakhoua		58	290							0	0	1	0	0
		Sengvang-noi		74	454							1	0	1	0	0
		Khonleng		29	179							1	0	1	0	0
		Natou		58	350							1	0	1	0	0
			6	386	2,218	1	0	3.2	3.8	1	14	5	0	5	0	1
(5)	Upper Tayun	Chakamlit		20	160							1	0	0	1	0
		Khamkok		50	470							1	0	1	0	0
		Chakam-mai		38	241							0	0	1	0	0
			3	108	871	0	4	0.0	1.7	2	3	2	0	2	1	0
	(total)		25	2,040	11,691	3	6	25.4	9.2	4	69	15	6	15	6	4

Note : 1/ comprising four (4) rooms, with a total floor area of 168 m2
2/ comprising six (6) rooms, with a total floor area of 336 m2
3/ applied to the village with less than 100 of households, with a total floor area of 168 m2
4/ applied to the village with more than 100 of households, with a total floor area of 252 m2
5/ applied to the village, which is proposed to be a center of each scheme area, with a total floor area of 336 m2

Table VII-13 Proposed Road Improvement Plan

Scheme	Road section (village)	to	(village)	Penetration macadam pavement (km)	Gravel pavement (km)	Pipe culvert (nos.)	Box culvert (nos.)
(1) Champi							
	(sub-toatal)			0	0	0	0
(2) Tapoung							
(2)-1	Pakxong	-	B.Xetapung	12.9	0	26	0
	(sub-toatal)			12.9	0	26	0
(3) Kapheu							
(3)-1	Road No.20	-	B.Sixiangmai	9.3	0	19	0
(3)-2	B.Sixiangmai	-	B.Phouak-gnai	0	1.8	4	1
(3)-3	B.Phouak-noi	-	B.Phouak-gnai	0	1.9	4	0
	(sub-toatal)			9.3	3.7	27	1
(4) Xeset							
(4)-1	Road No.20	-	Xeset power station	3.2	0	6	0
(4)-2	Road No.20	-	B. Natou	0	3.8	8	1
	(sub-toatal)			3.2	3.8	14	1
(5) Tay-Un							
(5)-1	Road No.16	-	B. Chakamlit	0	1.7	3	2
	(sub-toatal)			0	1.7	3	2
	(Total)			25.4	9.2	70	4

Table VII-14 Pipeline Hydraulics- Upper Champi (1/2)

Tank / Junction	Pipe line	Elevation (EL=m)	Capacity of tank, 1/ (m3)	Required flow (lit/sec)	Pipe length (L=m)	Reqired pipe size, 3/ (D=mm)	Head loss (h=m)	Residial head (H=m)	
(1) Trunk pipe line									
Filter Tank		1,217							
↓	Transmission trunk line (F-J1)			4.77	2,000	100	16.01	33.0	
Junction No.1		1,168							
↓	Transmission trunk line (J1-J2)			3.46	1,300	80	17.04	21.0	
Junction No.2		1,130							
↓	Transmission trunk line (J2-J3)			2.67	1,900	65	42.30	39.7	
Junction No.3		1,048							
↓	Transmission trunk line (J3-J4)			1.71	3,400	65	33.28	56.7	
Junction No.4		958							
↓	Transmission trunk line (J4-J5)			1.17	2,000	65	9.64	23.4	
Junction No.5		925							
↓	Transmission trunk line (J5-DT8)			0.40	2,200	40	15.33	34.7	,4/
Distribution Tank No.8 (B. Lak33)		875	13						
↓									
←←	Distribution main pipe (1)			1.43 ,2/	660	65	4.62	25.4	
↓	↓								
↓	Distribution main pipe (2)	842		0.71 ,2/	550	40	11.37	14.0	
↓									
- - →	Distribution main pipe (3)	845		0.24 ,2/	350	32	2.81	22.6	,4/
(2) Branch pipe line (F-DT1)									
Filter Tank		1,217							
↓	Transmission branch line (F-DT1)			0.64	300	50	1.69	2.3	
Distribution Tank No.1 (B. Lak45)		1,213	21						
↓									
←←	Distribution main pipe (1)	1,208		2.29 ,2/	150	65	2.52	22.5	
↓	↓								
↓	Distribution main pipe (2)	1,183		1.02 ,2/	900	50	12.14	10.3	
↓									
- - →	Distribution main pipe (3)	1,176		1.22 ,2/	1,300	65	7.33	15.1	,4/
(3) Branch pipe line (J1-DT2)									
Junction No.1		1,168							
↓	Transmission branch line (J1-DT2)			1.31	10	65	0.06	32.9	,4/
Distribution Tank No.2 (B. Lak43)		1,168	41						
↓	↓								
↓	Distribution main pipe (1)	1,130		2.99 ,2/	1,400	80	14.00	20.0	,4/
↓									
- - →	Distribution main pipe (2)	1,134		1.73 ,2/	1,400	65	13.98	6.0	
(4) Branch pipe line (J2-DT3)									
Junction No.2		1,130							
↓	Transmission branch line (J2-DT3)			0.79	10	50	0.08	20.9	,4/
←	Distribution Tank No.3 (B. Lak42 + Lak 38)	1,130	26						
↓ ↓	↓								
↓ ↓	Distribution main pipe (1)	1,112		0.20 ,2/	700	32	3.95	14.0	
↓ ↓									
↓ - - →	Distribution main pipe (2)	1,075		0.89 ,2/	1,600	40	49.25	5.8	
- → - - →									
↓									
↓	Transmission branch line (DT3-DT-5)			0.49	3,600	40	37.45	92.5	,4/
Distribution Tank No.5		1,000	16						

Table VII-14 Pipeline Hydraulics- Upper Champi (2/2)

Tank / Junction / Pipe line	Elevation (EL=m)	Capacity of tank, 1/ (m3)	Required flow (lit./sec)	Pipe length (L=m)	Reqired pipe size, 3/ (D=mm)	Head loss (h=m)	Residial head (H=m)	
(5) Branch pipe line (J3-DT4)								
Junction No.3	1,048							
↓ Transmission branch line (J3-DT4)			0.96	10	50	0.12	39.6	, 4/
Distribution Tank No.4 (B. Lak40)	1,048	32						
(6) Branch pipe line (DT4-Lak40)								
← Distribution Tank No.4	1,048							
↓ ↓ Transmission branch line (DT4-Lak40)			2.76	, 2/ 200	65	4.73	8.3	
↓ Existing water tank (B. Lak40)	1,035							
↓								
→ → → → → Distribution main pipe	1,030		0.69	, 2/ 300	40	5.80	12.2	
(7) Branch pipe line (DT4-Lak38)								
Distribution Tank No.5	1,000							
↓								
←← Distribution main pipe (1)	974		1.77	, 2/ 1,000	65	10.46	29.5	, 4/
↓								
↓ - - → Existing water tank (B Lak38)								
↓								
→ → Distribution main pipe (2)	960		0.89	, 2/ 1,000	50	10.41	19.1	, 4/
(8) Branch pipe line (J4-DT5)								
Junction No.4	958							
↓ Transmission branch line (J4-DT5)			0.54	10	40	0.13	23.2	, 4/
Distribution Tank No.6 (B. Lak36)	958	18						
↓ ↓								
↓ Distribution main pipe (1)	926		0.98	, 2/ 1,900	50	23.77	6.2	
↓								
→ → Distribution main pipe (2)	928		0.98	, 2/ 1,700	50	21.27	8.7	
(9) Branch pipe line (J5-DT6)								
Junction No.5	925							
↓ Transmission branch line (J5-DT6)			0.77	10	50	0.08	34.6	, 4/
Distribution Tank No.7 (B. Lak35)	925	26						
↓ ↓								
↓ Distribution main pipe (1)	884		1.50	, 2/ 2,200	65	16.93	24.1	, 4/
↓								
→ → Distribution main pipe (2)	836		1.27	, 2/ 1,800	65	10.17	18.8	, 4/

Note : 1/ Capacity of ground level distribution tank (gravity flow system) = a half day consumption
2/ Required flow of distribution main pipe = 30 % of total daily demand with 2 hours
3/ Standardized pipe size
4/ Pressure-reducing valve

Table VII-15 Pipeline Hydraulics- Upper Tapoung

Water source/ Tank (Target village)	Pipe line	Elevation (EL.=m)	Capacity of tank (m3)	Required flow (lit./sec)	Pipe length (L=m)	Required pipe size, 6/ (D=mm)	Head loss (h=m)	Residial head (Total pump head) (H=m)
(1) Water system with electric pump, Upper Tapoung No.1								
Spring (Houai Kaphew)		1,190						
↓	Intake pipe line			1.29 , 3/	400	50	8.38	67.4 , 7/
Filter Tank		1,244						
↓	Transmission line (F-DT)			1.29 , 3/	10	50	0.21	1.8 , 8/
Distribution Tank (B. Phoulangkeo)		1,242	11 , 1/					
↓	Distribution main pipe			1.16 , 4/	600	50	10.34	6.7 , 8/
End of Distribution main pipe		1,225						
(2) Water system with electric pump, Upper Tapoung No.2								
Spring (Houai Tapoung)		1,224						
↓	Intake pipe line (Water source - F)			5.46 , 3/	300	80	9.15	30.2 , 8/
Filter Tank /Ground level distribution tank		1,240	45 , 1/					
↓	Transmission line (F-ET)			4.92 , 5/	50	65	3.45	23.4 , 8/
(2)-1 Elevated Tank		1,255	7 , 2/					
↓								
Distribution main pipe (1) (B. Xetapung-1)		1,208		2.18 , 4/	2,500	80	13.90	33.1 , 8/
↓ ↓								
↓	Distribution main pipe (1) -1	1,208		0.65 , 4/	400	40	6.95	26.2 , 8/
↓								
- - →	Distribution main pipe (1) -2	1,208		0.44 , 4/	400	40	3.38	29.7 , 8/
(2)-2 Elevated Tank								
↓								
Distribution main pipe (2) (B. Xetapung-2)		1,230		2.18 , 4/	600	65	9.19	15.8 , 8/
↓ ↓								
↓	Distribution main pipe (2) -1	1,230		1.53 , 4/	400	65	3.18	12.6 , 8/
↓								
- - →	Distribution main pipe (2) -2	1,230		0.65 , 4/	300	40	5.21	10.6 , 8/
(2)-3 Elevated Tank								
↓								
Distribution main pipe (3) (B. Houaisang-1)		1,238		1.64 , 4/	100	50	3.26	13.7 , 8/
↓ ↓								
↓	Distribution main pipe (3) -1	1,235		0.82 , 4/	400	40	10.68	3.1 , 8/
↓								
- - →	Distribution main pipe (3) -2	1,235		0.82 , 4/	400	40	10.68	3.1 , 8/
(2)-4 Elevated Tank		1,255						
↓								
Distribution main pipe (4) (B. Houaisang-2)		1,239		0.27 , 4/	1,000	40	3.52	12.5 , 8/
(2)-5 Elevated Tank		1,255						
↓								
Distribution main pipe (5) (B. Houaisang-3)		1,241		0.82 , 4/	600	50	5.43	5.6 , 8/

Note : 1/ Capacity of ground level distribution tank (gravity flow system) = a half day consumption

2/ Capacity of elevated distribution tank (pumping system) = a 30 min. consumption in the morning time (a 1/4 of 30% of total daily consumption)

3/ Required flow to a tank : a half day consumption with a 3 hours pump operation

4/ Required flow of distribution main pipe = a 30 % of total daily demand with 2 hours

5/ Required flow to an elevated tank = a 1/4 of 30% of total daily consumption with a 30 min. pump operation

6/ Standardized pipe size

7/ Required total pump head

8/ Residial head

Table VII-16 Pipeline Hydraulics- Upper Kapheu

Tank / Junction / Pipe line	Elevation (EL=m)	Capacity of tank, 1/ (m)	Required flow (lit./sec)	Pipe length (L=m)	Required pipe size, 3/ (D=mm)	Head loss (h=m)	Residial head (H=m)	
(1) Trunk pipe line								
Filter Tank	785							
↓ Trunk pipe line (F-J1)			2.07	2,500	65	34.78	60.2	
Junction No.1	690							
↓ Trunk pipe line (J1-J2)			1.40	1,500	65	10.11	19.9	
Junction No.2	660							
↓ Trunk pipe line (J2-DT3)			0.67	1,500	40	27.75	18.3	, 4/
Distribution Tank No.3 (B. On-gnai)	614	22						
↓ Distribution main pipe (B. On-gnai)			2.42 , 2/	900	65	16.74	5.3	
End of Distribution main pipe	592							
(2) Branch pipe line (F-DT4)								
Filter Tank	785							
↓ Transmission branch line (F-DT4)			0.39	400	40	2.73	18.3	, 4/
Distribution Tank No.4 (B. Sixiangmai)	764	13						
↓ Distribution main pipe (B. Sixiangmai)			1.41 , 2/	600	50	14.79	5.2	
End of Distribution main pipe	744							
(3) Branch pipe line (F-DT5)								
Filter Tank	785							
↓ Transmission branch line (F-DT5)			1.08	2,500	65	10.49	49.5	, 4/
Distribution Tank No.5 (B. Phouak-gnai)	725	36						
↓								
←↓→ Distribution main pipe (1)	719		3.90 , 2/	100	80	1.63	4.4	
↓ ↓								
↓ Distribution main pipe (2)	716		0.60 , 2/	200	50	1.01	2.0	
↓								
→↓→ Distribution main pipe (3)	710		3.30 , 2/	700	80	8.40	0.6	
(4) Branch pipe line (J1-DT1)								
Junction No.1	690							
↓ Transmission branch line (J1-DT1)			0.67	10	50	0.06	60.2	, 4/
Distribution Tank No.1 (B. Phouak-noi)	690	22						
↓								
←↓→ Distribution main pipe (1)			2.42 , 2/	450	65	8.34	11.7	
↓ ↓								
↓ Distribution main pipe (2)	668		1.56 , 2/	550	65	4.55	7.1	
↓								
→↓→ Distribution main pipe (3)	670		0.85 , 2/	450	50	4.36	7.3	
(5) Branch pipe line (J2-DT2)								
Junction No.2	660							
↓ Transmission branch line (J2-DT2)			0.73	10	65	0.02	19.9	, 4/
Distribution Tank No.2 (B. On-noi)	660	24						
↓ ↓								
↓ Distribution main pipe (1)	638		1.93 , 2/	1,050	65	12.78	9.2	
↓								
→↓→ Distribution main pipe (2)	640		0.69 , 2/	880	40	16.95	5.0	

Note : 1/ Capacity of ground level distribution tank (gravity flow system) = a half day consumption
2/ Required flow of distribution main pipe = 30 % of total daily demand with 2 hours
3/ Standardized pipe size
4/ Pressure-reducing valve

Table VII-17 Pipeline Hydraulics- Lower Xe Set

Tank / Junction / Pipe line	Elevation (EL.=m)	Capacity of tank, 1/ (m3)	Required flow (lit./sec)	Pipe length (L=m)	Required pipe size, 3/ (D=mm)	Head loss (H=m)	Residual head (h=m)
(1) Trunk pipe line							
Regulating Pond	372						
↓ Trunk pipe line (RP-F1)			2.71	200	80	1.67	6.3
Filter Tank No.1	364						
↓ Trunk pipe line (F1-J1)			1.07	1,800	65	7.44	18.6
Junction No.1	338						
↓ Trunk pipe line (J1-J2)			0.69	2,200	65	4.05	22.0
Junction No.2	312						
↓ Trunk pipe line (J2-DT3)			0.46	1,500	50	4.61	12.4
Distribution Tank No.3 (B. Natou)	295	15					
(2) Branch pipe line (F1-DT4)							
Filter Tank No.1	364						
↓ Transmission branch line (F1-DT4)			1.04	500	65	1.96	7.0
Distribution Tank No.4 (B. Sengvang-gnai)	355	35					
↓							
←← Distribution main pipe (1)			3.76 , 2/	500	80	7.63	11.4
↓ ↓							
↓ Distribution main pipe (2)	336		0.98 , 2/	500	50	6.26	5.1
↓							
··· Distribution main pipe (3)	336		2.37 , 2/	500	80	3.25	8.1
↓							
Distribution main pipe (4)	336		0.71 , 2/	700	65	1.35	6.8
(3) Branch pipe line (F-DT5)							
Filter Tank No.1	364						
↓ Transmission branch line (F1-DT5)			0.60	3,200	50	15.93	6.1
Distribution Tank No.5 (B. Sengvang-noi)	342	20					
↓							
←← Distribution main pipe (1)			2.14 , 2/	1,100	80	5.94	9.1
↓ ↓							
↓ Distribution main pipe (2)	327		1.71 , 2/	400	65	3.91	5.2
↓							
··· Distribution main pipe (3)	327		0.43 , 2/	300	40	2.43	6.6
(4) Branch pipe line (J1-DT1)							
Junction No.1	338						
↓ Transmission branch line (J1-DT1)			0.38	50	40	0.32	18.2 , 4/
Distribution Tank No.1 (B. Houakhoua)	338	13					
↓							
←← Distribution main pipe (1)			1.37 , 2/	150	65	0.97	7.0
↓ ↓							
↓ Distribution main pipe (2)	330		0.69 , 2/	400	50	2.62	4.4
↓							
··· Distribution main pipe (3)	330		0.69 , 2/	400	50	2.62	4.4
(5) Branch pipe line (J2-DT2)							
Junction No.2	312						
↓ Transmission branch line (J2-DT2)			0.23	200	32	1.56	20.4 , 4/
Distribution Tank No.2 (B. Koulong)	312	8					
(6) Irrigation main canal to B. Natieu							
Regulating Pond	372						
↓ Irrigation main canal			0.20	3,500			
Inlet gate	369						
↓ Transmission branch line (IG-F2)			0.20	50	32	0.29	0.7
Filter Tank No.2	368						
↓ Transmission branch line (F2-DT6)			0.20	10	32	0.06	0.9
Distribution Tank No.6 (B. Natieu)	367	6					

Note : 1/ Capacity of ground level distribution tank (gravity flow system) = a half day consumption
2/ Required flow of distribution main pipe = 30 % of total daily demand with 2 hours
3/ Standardized pipe size
4/ Pressure-reducing valve

Table VII-18 Pipeline Hydraulics- Upper Tay-Un

Water source/ Tank (Target village)	Pipe line	Elevation (EL=m)	Capacity of tank, 1/ (m3)	Required flow, 2/ (lit./sec)	Pipe length (L=m)	Required pipe size, 3/ (D=mm)	Head loss (h=m)	Required residual head (rh=m)	Required total pump head (H=m)
(1) Water system with electric pump, Upper Tayun No.1									
Houai Thon		587							
↓	Intake pipe line			0.84	100	40	2.79	5.0	17.8
Filter Tank/Distribution tank (B. Chakamlit)		597	10						
(2) Water system with electric pump, Upper Tayun No.2									
Houai Tit		586							
↓	Intake pipe line			2.46	150	50	10.31	5.0	25.3
Filter Tank/Distribution tank (B. Khamkok)		596	20						
(3) Water system with electric pump, Upper Tayun No.3									
Houai Tit		585							
↓	Intake pipe line			0.63	200	40	3.28	5.0	18.3
Filter Tank/Distribution tank (B. Chakam-mai-1)		595	10						
(4) Water system with electric pump, Upper Tayun No.4									
Houai Tit		583							
↓	Intake pipe line			0.63	300	40	4.92	5.0	19.9
Filter Tank/Distribution tank (B. Chakam-mai-2)		593	10						

Note : 1/ A half of total daily demand

2/ A half of total daily demand with 3 hours pump operation (pump operation time = 3 hours x 2 times/day = 6 hours/day)

3/ Standardized pipe size

Table VII-19 Proposed Water Supply System Development Plan

Water Supply System	Target villages	No. of target villages	Households in 1996	Population in 1996	Population in 2010	Demand of water (lit./sec)	Proposed Facilities: Water source	Transmission/ main pipe, 1/ (m)	Branch pipe, 2/ (m)	Filter tank (no.)	Distribution tank (ground level) (no.)	Distribution tank (ground level) (no.), 3/	Elevated tank	Communal tap (no.)	Communal tap (no.), 4/	Pumping facility (no.)	
(1) Gravity Flow Piped Water System, Upper Champi	Lak 33 Lak 35 Lak 36 Lak 38 Lak 40 Lak 42 Lak 43 Lak 45	8	828	4,731	5,990	5.41	H. Champi	35,860	4,280	1	8	0	0	138	0	0	
(2) Water System with electric pump, Upper Tapung No.1	Phoulangkeo	1	45	283	358	0.32 (1.29), 5/	H. Kapheu	1,010	90	1	1	0	0	9	0	1	
(3) Water System with electric pump, Upper Tapung No.2	Houmaan Xetapung	2	217	1,195	1,513	1.36 (5.46), 5/	H. Tapung	7,450	1,030	1	1	0	1	43	0	2	. 6/
(4) Gravity Flow Piped Water System, Upper Kapheu	Phouak-noi Sixiangmai On-noi Phouak-gnai On-gnai	5	456	2,393	3,926	3.54	H. Kapheu	14,300	3,620	1	5	0	0	92	0	0	
(5) Gravity Flow Piped Water System, Lower Xeset	Natteu Sengvang-gnai Houakhoua Sengvang-noi Khonleng Natoa	6	386	2,218	3,221	2.91	Xeset	14,660	1,940	2	3	3	0	54	20	0	
(6) Water System with electric pump, Upper Tayun No.1	Chakamlit	1	20	160	232	0.21 (0.84), 5/	H. Thon	100	0	1	0	1	0	0	5	1	
(7) Water System with electric pump, Upper Tayun No.2	Khamkok	1	50	470	682	0.62 (2.46), 5/	H. Tai	150	0	1	0	1	0	0	10	1	
(8) Water System with electric pump, Upper Tayun No.3	Chakam-mai (1) 7/	0.5	20	118	171	0.15 (0.63), 5/	H. Tai	200	0	1	0	1	0	0	5	1	
(9) Water System with electric pump, Upper Tayun No.4	Chakam-mai (2) 7/	0.5	18	123	179	0.16 (0.63), 5/	H. Tai	300	0	1	0	1	0	0	5	1	
(Grand total)		25	2,040	11,691	16,272	14.68		74,050	10,960	10	18	7	1	336	45	7	

Note : 1/ transmission / distribution main pipe (GI pipe), including an intake pipe from a water source.
2/ distribution branch pipe (PVC pipe)
3/ with a washing basin and communal tapstands
4/ installed directly to the distribution tank
5/ a half day's consumption with a 3 hours pump operation
6/ including pumping to an elevated tank
7/ for B.Chakam-mai, two (2) systems are required because the villge comprising two (2) groups, is located at two points.

Figures

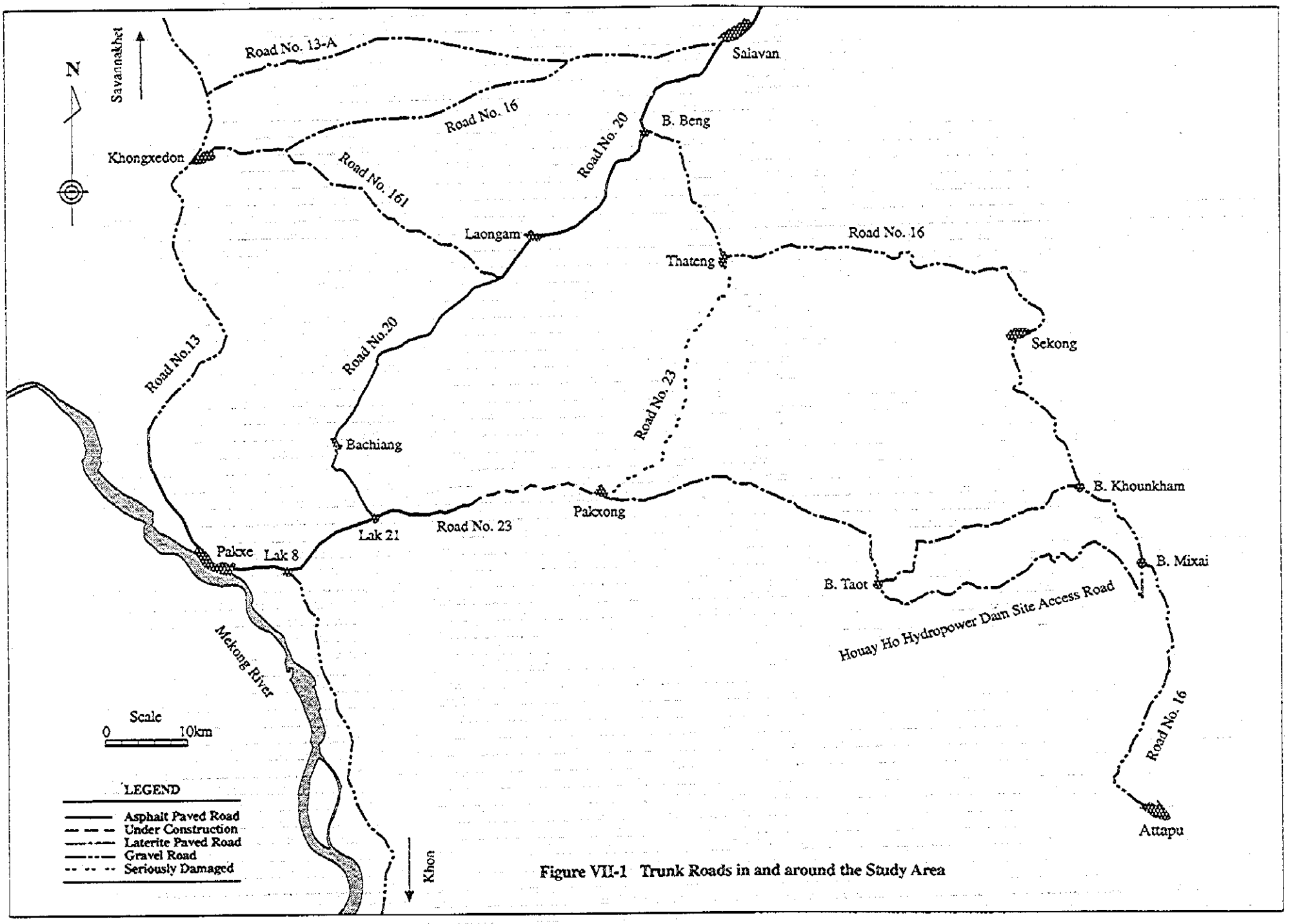


Figure VII-1 Trunk Roads in and around the Study Area

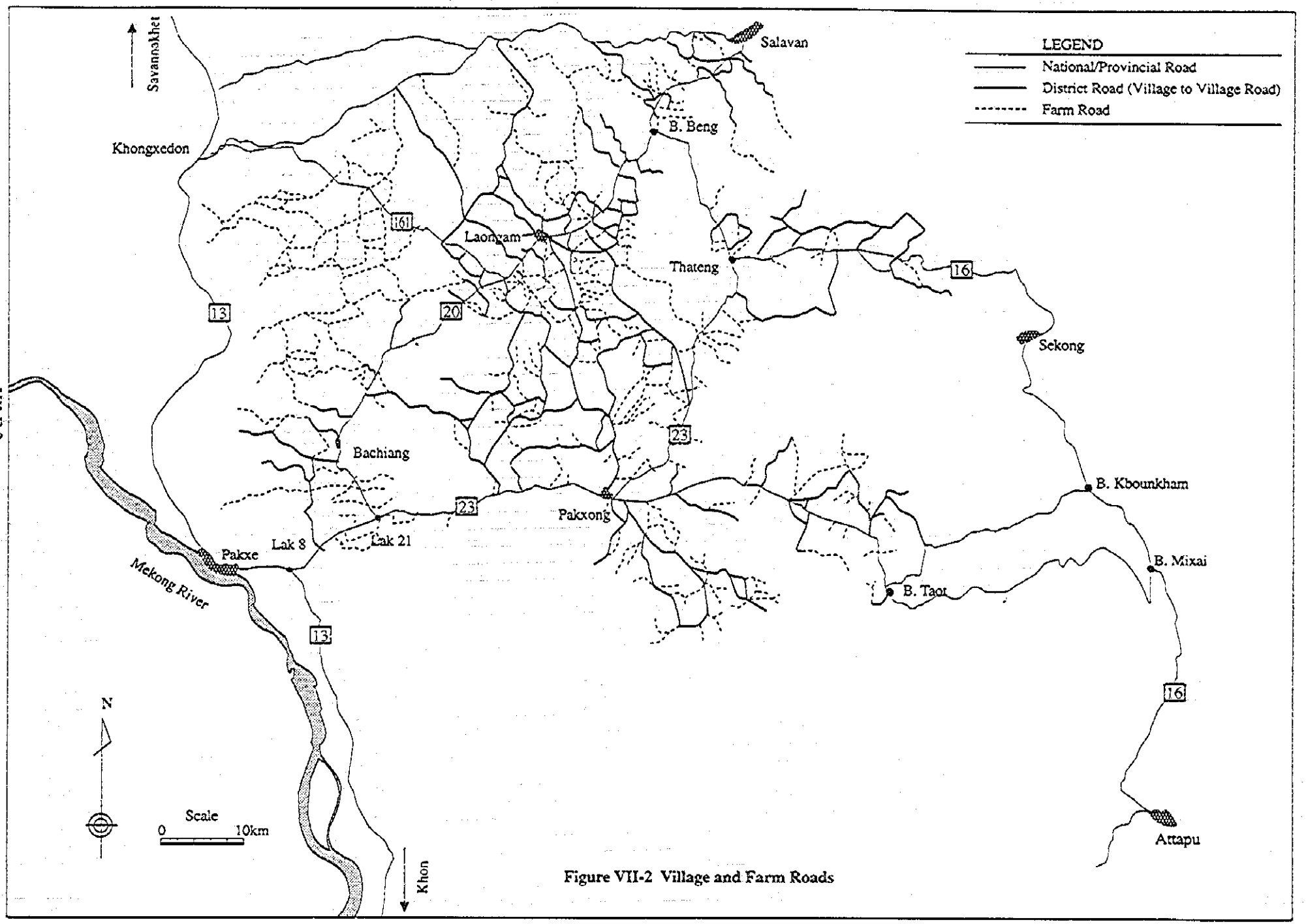


Figure VII-2 Village and Farm Roads

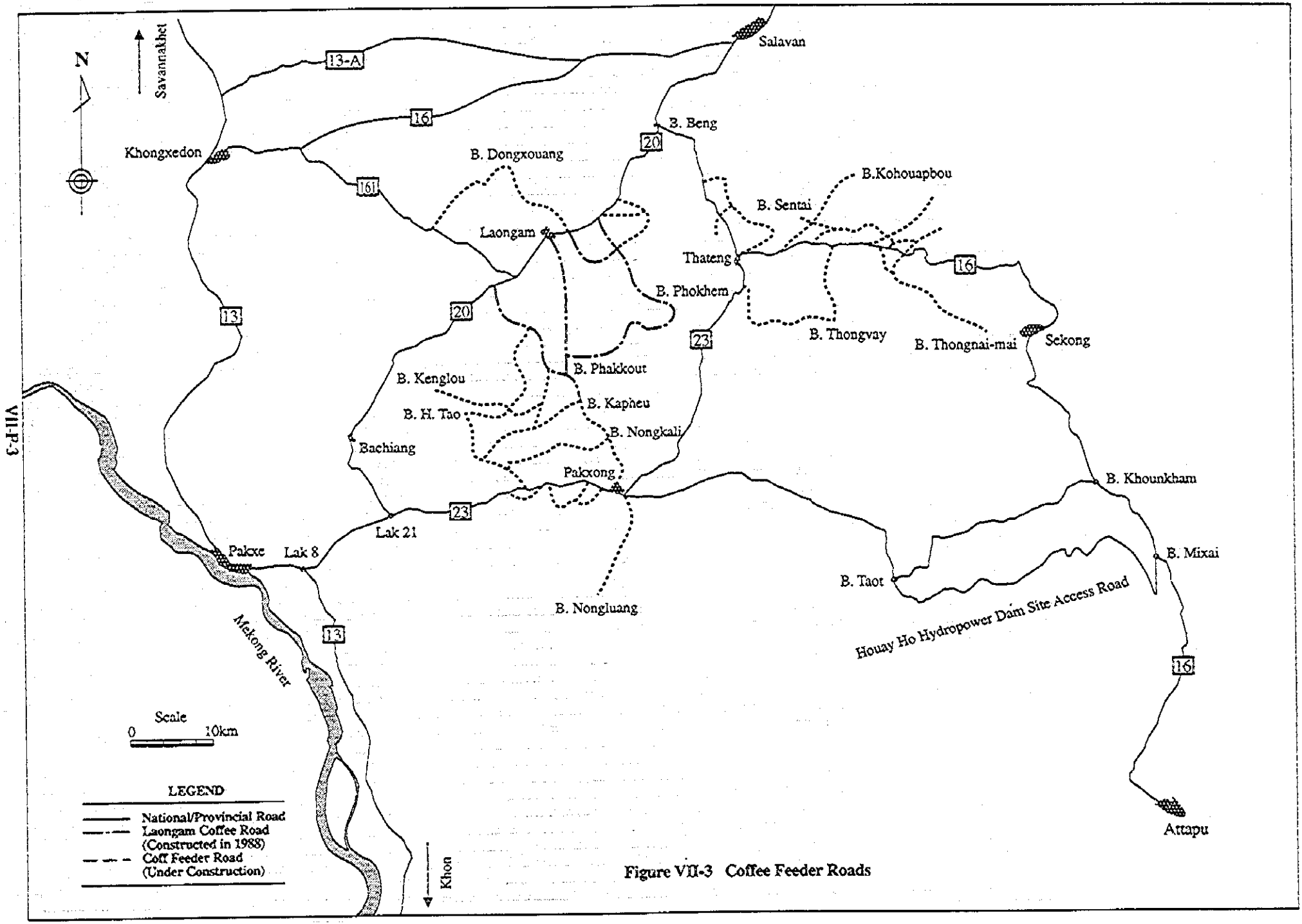


Figure VII-3 Coffee Feeder Roads

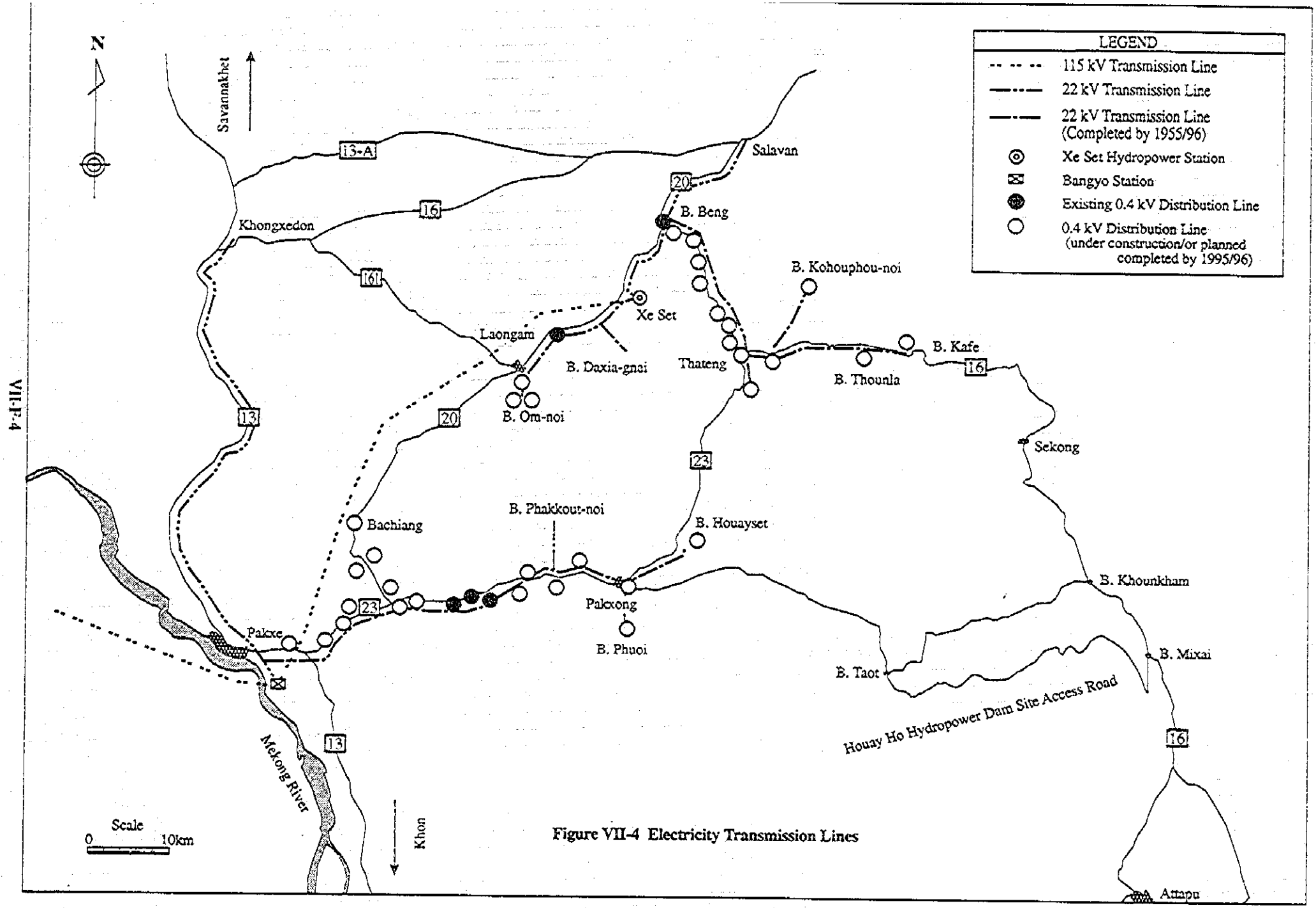
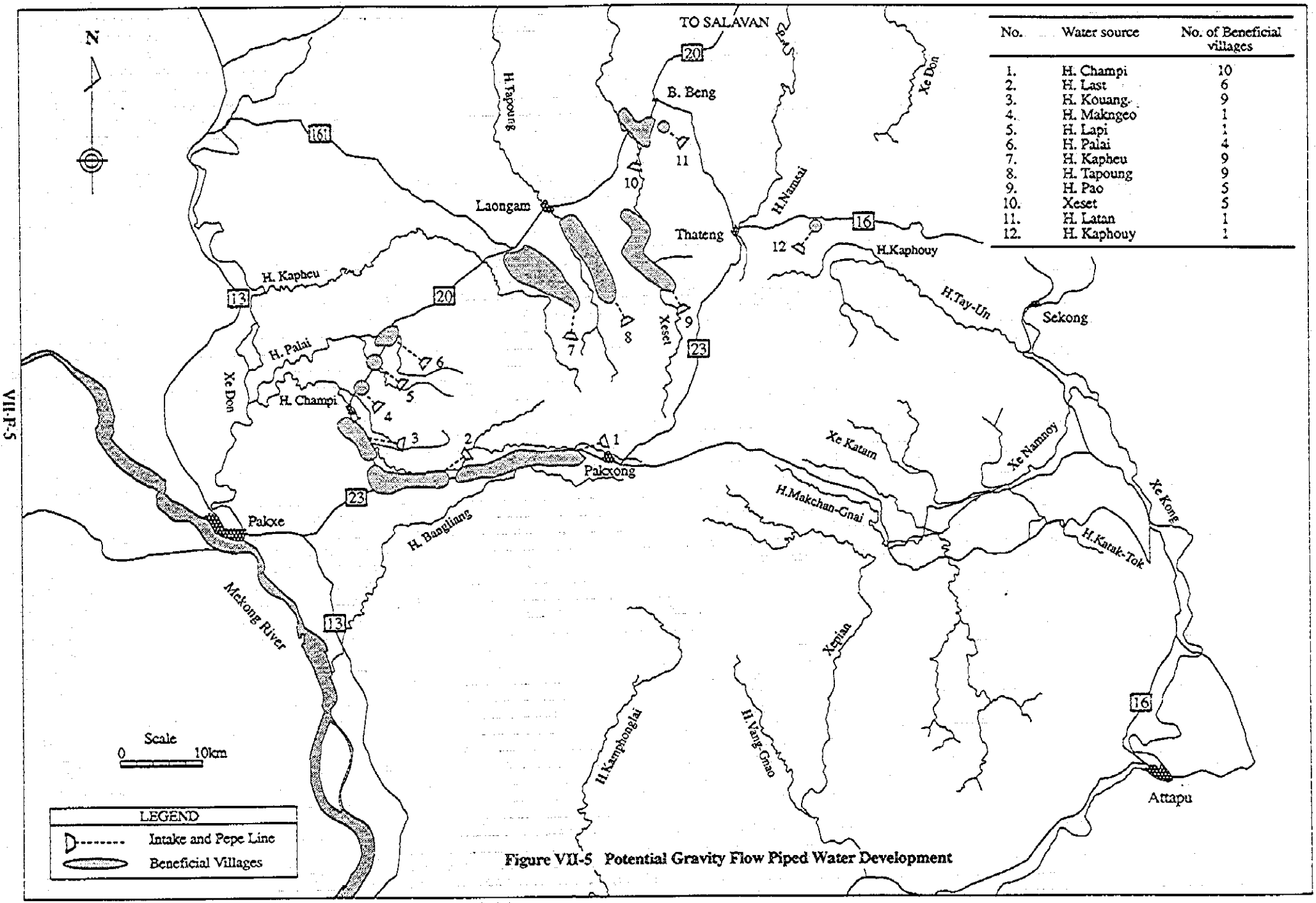


Figure VII-4 Electricity Transmission Lines



No.	Water source	No. of Beneficial villages
1.	H. Champi	10
2.	H. Last	6
3.	H. Kouang	9
4.	H. Makngeo	1
5.	H. Lapi	1
6.	H. Palai	4
7.	H. Kapheu	9
8.	H. Tapoung	9
9.	H. Pao	5
10.	Xeset	5
11.	H. Latan	1
12.	H. Kaphouy	1

Figure VII-5 Potential Gravity Flow Piped Water Development

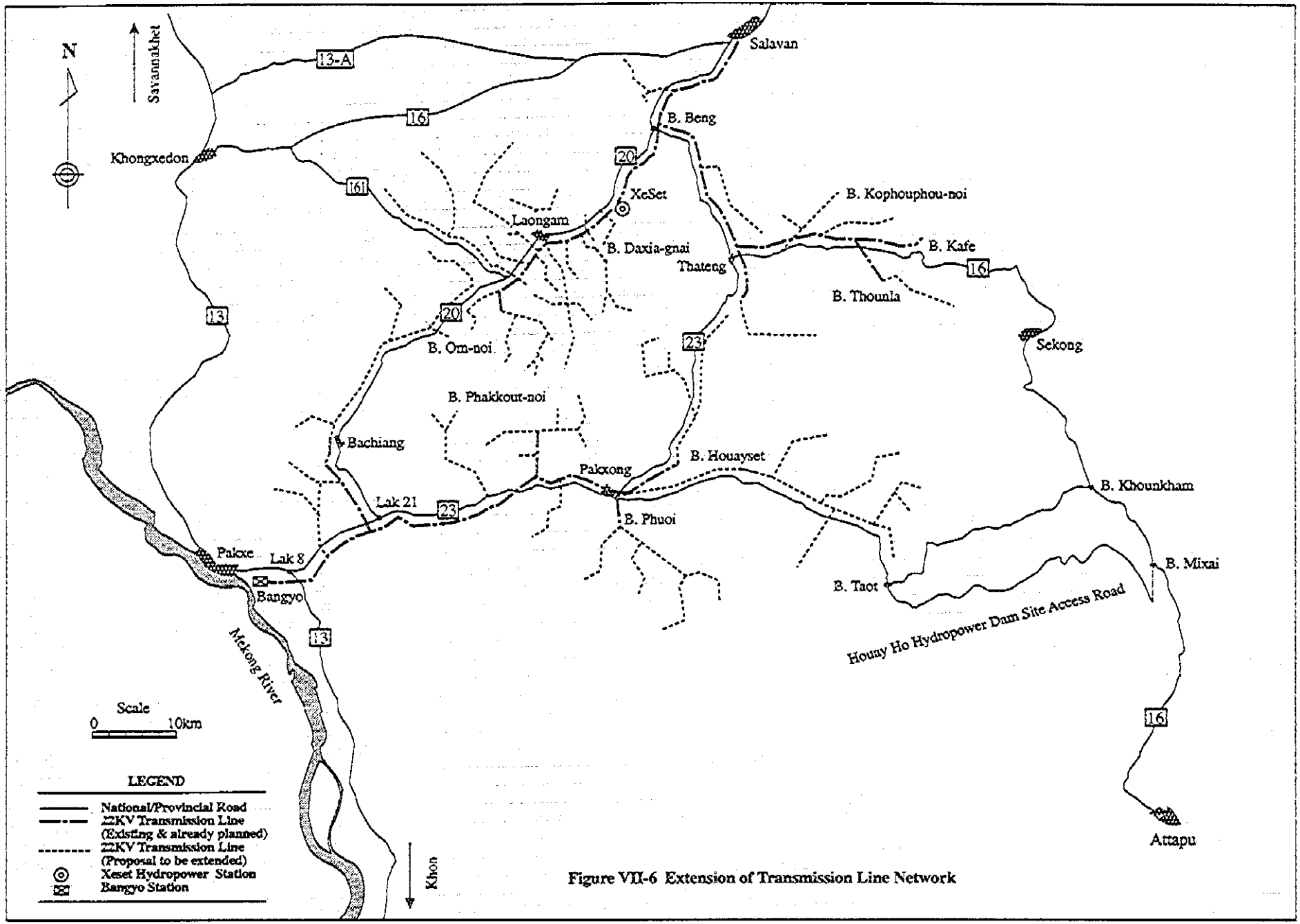


Figure VII-6 Extension of Transmission Line Network