

under the technical and financial assistance from foreign countries and international organizations such as JICA, WHO and UNICEF.

Provincial WES in Champasak has 16 staff including 8 staff for Rural Clean Water Supply Sub-Section and 3 staff for Environmental Sanitation Sub-Section as shown in Figures 3.3.6a and 3.3.6b. Provincial WES in Saravan Province has 14 staff including 9 staff for Rural Clean Water Supply Sub-Section and 3 staff for Environmental Sanitation Sub-Section.

District Public Health Office is delivering medical services and health promotion and preventive services in each District. Organization chart of District Public Health office is presented in Figure 3.3.6c. Medical services are provided through a District Hospital and 22 Dispensaries located at Sub-District level. Health promotion and preventive services include rural water supply and sanitation, malaria control, mother and child care, and tuberculosis control. Each District Public Health Office has some WES staff, of which only one or two staff is responsible for rural water supply. Activities for rural water supply at District level is limited due to lack of staff and equipment.

(3) Budget for Provincial Health Departments

Annual budget of Public Health Department Office in Saravan Province was K 289.4 million in 1994 fiscal year (from October 1993 to September 1994) which was increased to Kip 472.8 million in fiscal year 1995. The 1995 budget consists of Kip 230.25 million for the Provincial Office and Kip 242.59 for 8 District offices. The budget for Provincial office includes Kip 1.5 million of the administration cost for water supply and sanitation program which will be used for transportation, per diem, and other allowances.

Annual budget of Public Health Department Office in Champasak Province increased from Kip 496 million in 1994 fiscal year to Kip 1,025 million in fiscal year 1995. The main reason for the increase is due to doubled increase in salary of staff. The 1995 budget consists of Kip 607.57 million for salary, Kip 50 million for the administration, Kip 107.58 for basic construction and the remaining for other expenses such as purchase of medicine, repair and purchase of equipment and social welfare. The administration cost includes Kip 2.5 million for water supply and sanitation activities which will be used for transportation, per diem, and other allowances.

Budget for Champasak and Saravan PHDs are tabulated in Tables 3.3.6e and 3.3.6f.

3.4 Present Water Supply in the Villages

3.4.1 Water Service Level

The Village Survey conducted by the Study Team in April, 1994 indicated that about 80% of the villagers in the Study Area (200 villages) obtain water from traditional sources such as river, springs, ponds and shallow dug well which are often unreliable and polluted. There is only one piped water supply system at Laongam town, supplying water without treatment for 237 households. It is estimated that the coverage for tube well with hand pump is 17% in Champasak Province and 19% in Saravan Provinces. Present water source situation in Champasak and

Saravan Provinces is presented in Figures 3.4.1a and 3.4.1b. Present water source situation by District is presented in Figure 3.4.1c.

Users of river water alone accounted for 58% in Champasak Province and 66% in Saravan Province. The Xedong river and its tributaries are mostly utilized in both two provinces. The Xedon river is effluent and usable all the year round, however, it becomes turbid in the rainy season. Its tributaries are intermittent and dry up in the dry season. The Mekong river is also utilized for domestic water in several villages in Champasak province.

Use of river and spring are found in Bachian district of Champasak province and Lao-ngam district of Saravan province. These districts are located in the western Basaltic slope of the Boloven Plateau where the tributaries of the Xedon river originate. Many springs are found in the valley.

Several villages are utilizing the pond as a main water source although combined with other water sources such as river, dug well and tube well with hand pump. However, water supply of 2 villages, namely B.Bak and B.Samkhanaboua mainly rely on pond though they have several tube wells with Lucky hand pumps. Three villages are utilizing canal water combined with use of hand pump wells. Combined use of surface water and groundwater is found in many villages.

Groundwater is being utilized by means of dug well and tube well. The dug wells, generally less than 10 m in depth, are constructed by digging. Diameters of dug wells are usually 0.5 to 2 m. The dug well is lined with a casing of wood staves, brick or concrete. Most of dug wells, however, have either no casing nor concrete seal and well cover. Generally, hand pump is not installed. Some of dug wells are no more than irregular hole in the ground. Many holes are found in the river bed where river water dries up in the dry season.

Tube wells are constructed by drilling. Depth of these wells are from 20 m to 50m and the well diameter is 50 to 150 mm. Some tube wells were constructed by the USAID in 1960s. They are equipped with Dempster hand pump and still being used in some villages, but the others are either broken or not functioning. Recently, the PHD is constructing the tube well and installing Tara or Inidia Mark III hand pumps upon request from the village. A number of Lucky hand pumps are being used in the tube wells and some of dug wells.

3.4.2 Target Villages in Champasak Province

Target villages in Champasak Province are 100 having a total population of 53,297 as of April 1994. These villages are distributed in five Districts as depicted in Figure 3.4.2. Data on existing water source by District are tabulated in Table 3.4.2.

(1) Sanasomboon District

Target villages in Sanasomboon District are 36 with a total population of 24,780. Of the target villages, most of the villages are located along the route No. 13 and the remaining villages are located along the Mekong river and its tributaries.

Population served by the river, dug-wells, and handpumps account for 13,743 (56%), 4,067 (16%), and 6,059 (24%), respectively. River is the main source of domestic water, supplemented by handpumps and dug-wells.

In the villages located along the route No. 13, main water source is handpumps supplemented by the tributary of the Mekong. However, most of handpumps are not sustainable enough to supply water during the dry season. Therefore, the inhabitants of these villages are suffering from shortage of water during the dry season.

(2) Baching District

Target villages in Baching District are 25 with a total population of 8,195. Of the target villages, most of the villages are located along the route No. 20 which is the all weather asphalted road connecting Pakse and Saravan. Some tributaries of the Mekong, such as Huay Cahmpi, Huay Palai and Huay Kapheu are crossing the road.

River and springs are the main source of water in this district. Population served by the river and springs account for 4,732 (58%) and 2,857 (35%), respectively. Some dug-wells are found in 5 villages.

(3) Pathoumphone District

Target villages in Pathoumphone District are 15 with a total population of 7,188. Of the target villages, most of the villages are located along the route No. 13 and the Mekong river.

Population served by the river, dug-wells, and handpumps account for 4,187 (59%), 2,669 (37%), and 230 (3%), respectively. River is the main source of domestic water, supplemented by dug-wells and handpumps.

(4) Sukhuma District

Target villages in Sukhuma District are 7 with a total population of 3,950. Of the target villages, most of the villages are located along the provincial road connecting Champasak town to Sukhuma town. These villages are located far from the Mekong river.

Population served by the river, dug-wells, handpumps and pond account for 621 (16%), 310 (8%), and 2,255 (57%), respectively. Handpumps and ponds are the main source of domestic water, supplemented by dug-wells. Although handpumps and ponds are the main source of water, they are not sustainable to supply enough water during dry season.

(5) Khong District

Target villages in Khong District are 17 with a total population of 9,385. Of the target villages, only one village (Tapusy) is located on the Khong island and the remaining villages are located along the route No. 13 and the Mekong.

Population served by the river, dug-wells, and handpumps account for 7,509 (80%), 1,229 (13%), and 647 (7%), respectively. River is the main source of domestic water, supplemented by handpumps and dug-wells. Handpumps are found in 4 villages.

3.4.3 Target Villages in Saravan Province

Target villages in Saravan Province are 100 having a total population of 45,591 as of April 1994. These villages are distributed in five Districts as depicted in Figure 3.4.2. Data on existing water source by District in Saravan Province is tabulated in Table 3.4.3.

(1) Lakhongpheng District

Target villages in Lakhongpheng District are 16 with a total population of 5,768. All the villages are located along the route No. 13. Due to lack of dependable water source, the people in the villages meet serious shortage of water, particularly in the dry season.

Population served by the river, dug-wells, and handpumps account for 1,891 (33%), 812 (14%), and 2,885 (50%), respectively. Handpumps are the main source of domestic water, supplemented by river and dug-wells. Two villages utilize ponds for water.

(2) Khongxedon District

Target villages in Khongxedon District are 22 with a total population of 9,882. The villages are located along the route No. 13, the Mekong river and Xe Don river. Most of the villages have better access to dependable surface water, except some villages which are rather far from the Xe Don river.

Population served by the river and handpumps account for 6,126 (62%) and 3,574 (36%), respectively. River is the main source of domestic water, supplemented by handpumps. 6 villages utilize ponds for water.

(3) Vapy District

Target villages in Vapy District are 21 with a total population of 12,499. The villages are located along the route No. 16 and the Xe Don river. Almost all the villages have better access to dependable surface water.

Population served by the river, handpumps and ponds account for 10,434 (62%), 1,340 (36%), and 272 (2%), respectively. River is the main source of domestic water, supplemented by handpumps and ponds.

(4) Saravan District

Target villages in Saravan District are 30 with a total population of 13,031. The villages are located along the route No. 20 and No. 23. Due to long distance from the dependable river water, most of villages are suffering from shortage of water, particularly during dry season.

Population served by the river, dug-wells, handpumps and spring account for 9,229 (72%), 1,104 (8%), 726 (6%), 1,624 (12%), respectively. River is the main source of domestic water, supplemented by spring, handpumps and dug-wells.

(5) Laongam District

Target villages in Laongam District are 11 with a total population of 4,411. The villages are located along the route No. 20. Some tributaries of the Mekong river, such as Huay Tapoung and Xe Set river are crossing the road.

Population served by the river, spring, and others account for 2,676 (63%), 652 (15%), and 1,083 (25%), respectively. River is the main source of domestic water, supplemented by spring. Laongam town, which is the District capital, is served by piped water system.

Present water supply situation in 100 villages of Saravan Province is tabulated in Table 3.4.3.

3.4.4 Water Use in the Target Villages

(1) Access to Water Source

Figures 3.4.4a and 3.4.4b show the distribution of access to water source. As shown in the histogram, distance to main water source mostly ranges from 200 to 400 m in Champasak province. However, in Saravan province, the histogram shows more gentle figure and ranges from 200 to 1,000 m. According to the cumulative distribution curve, 60% distance is 350 m in Champasak province, while it is 450 m in Saravan province. A longest distance is seen in B.Maisivilai in Champasak province, where the village people resort to take water from Mekhong river about 2500 m far from the village.

(2) Water Quality

On-site measurement of water quality shows normal values for electric conductivity and pH. Muddy water is observed in several villages. Based on the bacteriological and chemical tests conducted at existing water source, several water sources have sanitary problems in water quality from the view point of the WHO drinking water standard (Refer to Chapter 6). Considering the present circumstances of the water sources, potential risk of biological pollution may always exist.

Although PHDC and PHDS are trying to increase the coverage rate of clean water supply by installing tubewells with handpumps, their activities are not functioning well due to a shortage of funds and lack of qualified staff.

(3) Water Use

According to the survey of existing water sources in 200 villages, the volume of water changes

village to village and ranges from 36 liters/day/family to 270 liters/day/family. It shows a highest value in B.Beng where a pilot water supply system was constructed. However, in B.Houakoua where a Tara hand pump is being used as a water source, volume of water use is 154 liters/day/family. On the other hand, in B. Senvang-Noy, it shows only 55.5 liters/day/family. About 60 % of water is used for washing and bathing in B. Houakoua while it is 36 % in B. Senvang-Noy. Since washing and bathing are usually done in the river side, little amount of water is collected and carried to their home (Figures 3.4.4c and 3.4.4d).

Table 3.1.1 **Population in Lao PDR**

	1985 Census	Growth Rate	Population Count '90	Growth Rate	1994 Estimate
Laos	3,584,803	0.029	4,140,000	0.029	4,641,537
Vientiane Mun.	377,409	0.042	464,000	0.029	520,211
Phongsaly	122,984	0.028	141,000	0.029	158,081
Luangnamtha	97,028	0.042	119,000	0.029	133,416
Oudomxay	187,115	0.086	283,000	0.029	317,284
Bokeo	54,925	0.031	64,000	0.029	71,753
Luangprabang	295,475	0.027	337,000	0.029	377,826
Huaphan	209,921	0.009	220,000	0.029	246,652
Xayaboury	223,611	-0.037	185,000	0.029	207,412
Xiengkhuang	161,589	0.023	181,000	0.029	202,927
Vientiane	264,277	0.029	305,000	0.029	341,949
Borikhamxay	122,300	0.032	143,000	0.029	160,324
Khammuane	213,452	0.028	245,000	0.029	274,680
Savannakhet	543,611	0.033	639,000	0.029	716,411
Saravan	187,515	0.037	225,000	0.029	252,257
Sekong	50,909	0.023	57,000	0.029	63,905
Champasack	403,041	0.024	453,000	0.029	507,878
Attapeu	69,631	0.026	79,000	0.029	88,570

Source: State Statistical Centre, Ministry of Economy, Planning and Finance

Note: Vientiane Mun. = Vientiane Municipality

Table 3.1.3a

GDP Growth Rate in Laos, 1989-1993

Unit: Million Kips at 1990 constant prices

Industry	1989 Mil. Kip	1990 Mil. Kip	1991 Mil. Kip	1992	1993	Growth 1989-1993
Agriculture	344,667	374,456	365,212	n.a.	n.a.	
Agriculture	206,529	225,099	203,114			
Livestock/Fishery	122,244	129,859	138,071			
Forestry	15,894	19,498	24,027			
Mining & Manufact'g	75,439	87,305	113,333	n.a.	n.a.	
Mining	976	896	816			
Manufacturing	51,940	59,662	80,140			
Construction	15,091	17,908	22,166			
Utilities 1/	7,433	8,839	10,211			
Services	149,542	145,724	149,807	n.a.	n.a.	
Transport/Commun.	36,181	31,687	31,736			
Commerce	41,077	44,516	44,516			
Finance/Insurance	967	1,316	3,651			
Housing	11,147	11,480	13,179			
Public Services	36,490	35,800	35,800			
NGOs	23,266	20,440	20,440			
Others	413	484	485			
Import Tax	5,053	5364	9000	n.a.	n.a.	
GDP Total	574,700	612,848	637,352	681,797	728,058	6.1

Source: Ministry of Economy, Planning and Finance

Note: 1/ Utilities include electricity, gas and water

Table 3.1.3b

Laos: Trade Balance

Unit: Million US Dollars

	1989	1990	1991	1992	1993
1. Trade Balance					
Exports	63.3	78.7	96.6	132.6	158.6
Imports	210.7	201.6	228.0	265.6	344.5
Balance	-147.4	-122.9	-131.4	-133.0	-185.9
2. Composition of Major Exports (%)					
Wood Products	24.6	23.6	42.3	32.2	24.0
Textiles	6.3	8.9	15.6	20.6	15.8
Electricity	23.7	24.4	22.0	12.8	11.5
Motorcycle	-	-	-	14.7	16.4
Coffee	13.9	10.9	3.2	2.5	n.a.
Others	31.5	32.2	16.9	17.2	32.3
3. Composition of Major Imports (%)					
Machinery/Raw Materials	6.9	14.5	26.9	35.7	53.7
Rice and other foods	15.1	9.1	12.5	11.9	8.9
Petroleum Products	15.1	14.1	9.3	9.2	5.6
Others	16.6	33.6	11.8	19.0	31.8

Source: Ministry of Economy, Planning and Finance

Table 3.1.4

Public Investment Plan for 1991-1995

Unit: US\$ Million

Sector	Total	Ratio	1991	1992	1993	1994	1995	Total
Agriculture and Forestry	96.97	13.0%	22.10	25.97	21.12	16.37	11.40	96.97
Manufacturing	22.57	3.0%	8.40	7.53	2.44	1.14	3.06	22.57
Mines	9.78	1.3%	0.00	2.32	2.46	2.50	2.50	9.78
Electricity	153.77	20.6%	17.45	14.48	25.19	39.69	56.96	153.77
Communications	280.19	37.6%	30.38	67.13	55.17	65.18	62.33	280.19
Telecommunications	33.39	4.5%	4.77	6.28	6.78	5.78	9.78	33.39
Water Supply	26.39	3.5%	0.00	2.08	4.03	8.75	11.53	26.39
Education	64.57	8.7%	4.93	11.93	15.90	17.91	13.90	64.57
Public Health	41.90	5.6%	5.18	4.62	8.39	10.57	13.14	41.90
Others	15.47	2.1%	2.97	3.37	2.21	3.32	3.60	15.47
Total	745.00	100.0%	96.18	145.71	143.69	171.21	188.20	745.00

Source: Committee for Planning and Cooperation

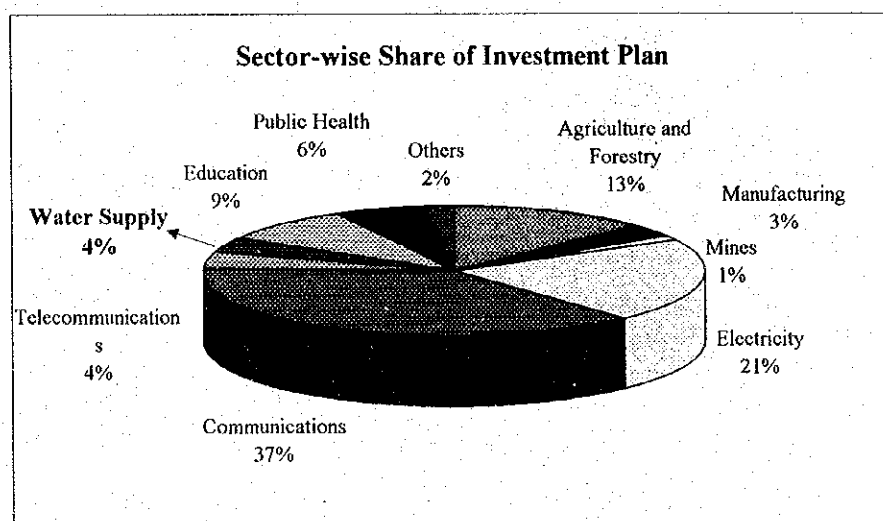


Table 3.1.6 Land Use in Champasak and Saravan Provinces

	Saravan Province	Percent (%)	Champasak Province	Percent (%)
Permanent Agriculture Land	71	7	183	13
Current Forest	562	54	879	61
Potential Forest	242	23	153	11
Other Wood Areas	129	12	133	9
Others	30	3	81	6
Total:	1,034	100	1,429	100

Source: Agriculture & Forestry Service of Champasak Province

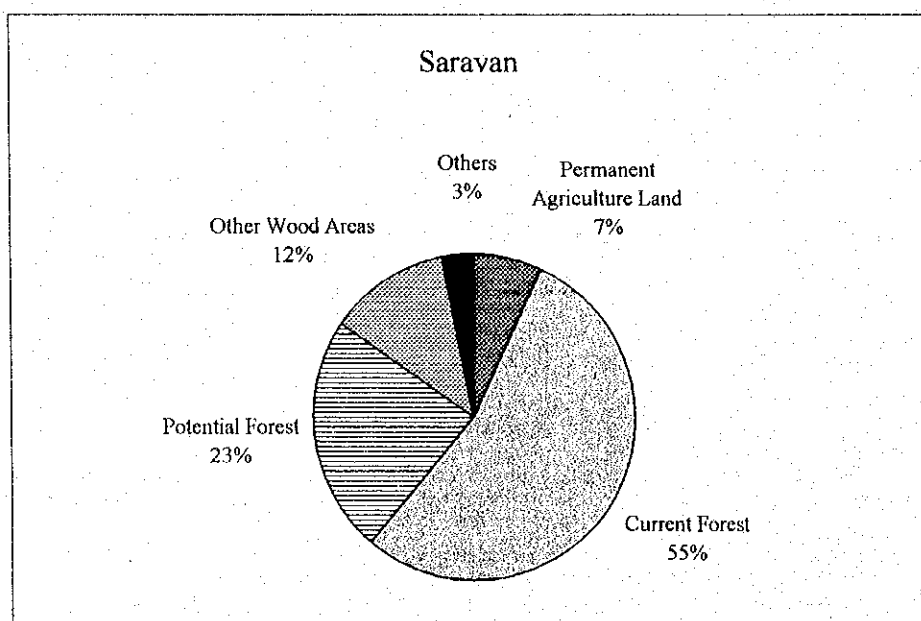
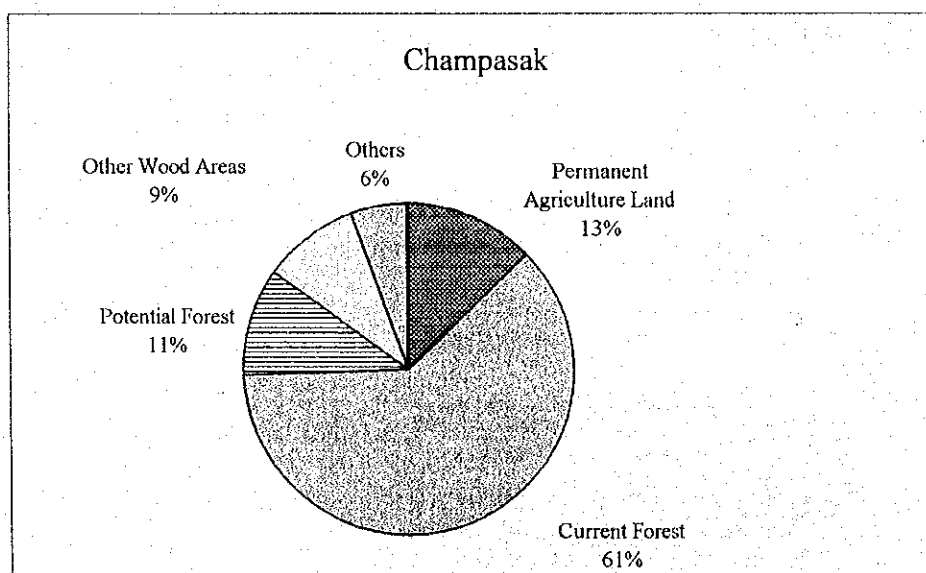


Table 3.3.1a Population Statistics in Champasak and Saravan Provinces, 1985-1995

District Name	District Population 1985 Census	Annual Growth Rate 1985-1990	District Population 1990 Count	Estimated Annual Growth Rate '90-95	District Population 1994 estimate
A. Champasak Province					
Sanasomboun	43,660	1.91%	48,000	2.36%	52,694
Bachiang	24,112	6.48%	33,000	2.36%	36,227
Pathoumpone	34,226	2.11%	38,000	2.36%	41,716
Sukhuma	30,489	1.60%	33,000	2.36%	36,227
Khong	60,404	-0.13%	60,000	2.36%	65,868
Phontong	58,682	3.29%	69,000	2.36%	75,748
Champasak	42,265	0.35%	43,000	2.36%	47,205
Mounlaoamok	23,554	3.52%	28,000	2.36%	30,738
Pakhsong	37,130	4.38%	46,000	2.36%	50,499
Pakse	48,519	2.54%	55,000	2.36%	60,379
Sub- Total:	403,041	2.36%	453,000	2.36%	497,301
B. Saravan Province					
Lakonepheng	23,167	2.33%	26,000	2.97%	29,229
Khongxedong	38,042	2.00%	42,000	2.97%	47,216
Vapy	21,266	2.45%	24,000	2.97%	26,981
Saravan	47,692	3.26%	56,000	2.97%	62,955
Laongam	28,060	5.69%	37,000	2.97%	41,595
Toumlam	12,528	2.25%	14,000	2.97%	15,739
Ta Oi	16,760	1.44%	18,000	2.97%	20,236
Samuoi	6,811	3.27%	8,000	2.97%	8,994
Sub-Total	194,326	2.97%	225,000	2.97%	252,945
Total	597,367	2.56%	678,000	2.56%	750,246

Source: Population of the Lao P.D.R, 1992, Ministry of Economy, Planning and Finance

Table 3.3.1b Population in the Study Area, 1994

(1) 100 Villages in Champasak Province

Village Code	Village Name	District	Household	Population	Male	Female	Sex Ratio
			1994	1994			
C-1	B.Nakha	Sansomboun	153	863	405	458	0.88
C-2	B.Phothet	Sansomboun	28	135	67	68	0.99
C-3	B.Nosavan	Sansomboun	122	615	279	336	0.83
C-4	B.Nongphai	Sansomboun	98	553	273	280	0.98
C-5	B.Souvanasakhi	Sansomboun	170	839	366	473	0.77
C-6	B.Nai	Sansomboun	118	629	304	325	0.94
C-7	B.Nongdou	Sansomboun	74	378	173	205	0.84
C-8	B.Houay	Sansomboun	109	618	313	315	0.99
C-9	B.Pongsan	Sansomboun	70	337	167	170	0.98
C-10	B.Dong	Sansomboun	63	311	145	166	0.87
C-11	B.Hangsan	Sansomboun	62	354	176	178	0.99
C-12	B.Nongkham	Sansomboun	93	419	187	232	0.81
C-13	B.Khangpheng	Sansomboun	133	987	450	537	0.84
C-14	B.Khangthom	Sansomboun	39	256	86	170	0.51
C-15	B.Nongkham	Sansomboun	55	256	116	140	0.83
C-16	B.Loy	Sansomboun	32	150	65	85	0.76
C-17	B.Solo-Onai	Sansomboun	225	1025	375	650	0.58
C-18	B.Solo-Noy	Sansomboun	116	635	310	325	0.95
C-19	B.Nongphak	Sansomboun	226	1230	578	652	0.89
C-20	B.Khamouang	Sansomboun	52	266	128	138	0.93
C-21	B.Siboun	Sansomboun	82	422	200	222	0.90
C-22	B.Mouang	Sansomboun	210	1285	636	649	0.98
C-23	B.Oukuang	Sansomboun	180	1117	598	519	1.11
C-24	B.Bourgha	Sansomboun	150	1010	223	787	0.28
C-25	B.Lahna (Nongm)	Sansomboun	58	317	161	156	1.03
C-26	B.Nak	Sansomboun	230	1376	660	716	0.92
C-27	B.Dongphong	Sansomboun	59	374	189	185	1.02
C-28	B.Nak	Sansomboun	281	1696	922	774	1.19
C-29	B.Nak	Sansomboun	219	1398	676	722	0.94
C-30	B.Thangomphai	Sansomboun	85	310	90	220	0.41
C-31	B.Norai	Sansomboun	51	293	148	145	1.02
C-32	B.Dongphak	Sansomboun	68	412	119	293	0.41
C-33	B.Dua-Nua	Sansomboun	155	856	426	430	0.99
C-34	B.Kengro	Sansomboun	96	498	246	252	0.98
C-35	B.Ngouang	Sansomboun	183	1053	518	535	0.97
C-36	B.Pakon	Sansomboun	255	1497	704	793	0.89
Sansomboun Dist (36 Villages)			4,446	24,780	11,469	13,311	0.86
C-37	B.Nongnai	Bachang	70	368	152	216	0.70
C-38	B.Bachang	Bachang	52	278	163	115	1.42
C-39	B.Makro	Bachang	57	259	124	135	0.92
C-40	B.Nongphak-Noy	Bachang	105	578	263	315	0.83
C-41	B.Nongphak-Onai	Bachang	117	646	271	375	0.72
C-42	B.Thongphou	Bachang	70	310	301	209	1.44
C-43	B.Kengro	Bachang	54	300	138	162	0.85
C-44	B.Thongphou	Bachang	72	368	170	198	0.86
C-45	B.Mouangkhai	Bachang	63	394	119	275	0.43
C-46	B.Pakouy	Bachang	42	270	144	126	1.14
C-47	B.Oudomouk	Bachang	65	336	98	238	0.42
C-48	B.Phasoun	Bachang	37	157	70	87	0.80
C-49	B.Lak-21	Bachang	127	567	332	235	1.41
C-50	B.Phi	Bachang	99	467	216	251	0.86
C-51	B.Lak-23	Bachang	71	391	166	225	0.74
C-52	B.Lak-25	Bachang	81	379	172	207	0.83
C-53	B.Nongkhamkhao	Bachang	33	117	43	74	0.58
C-54	B.Senke	Bachang	24	136	61	75	0.81
C-55	B.Houayfan	Bachang	65	320	125	195	0.64
C-56	B.Talan (B.Lak-17)	Bachang	32	195	100	95	1.05
C-57	B.Nomsat	Bachang	36	218	105	113	0.93
C-58	B.Nongmak-Euk	Bachang	35	184	83	101	0.82
C-59	B.Lak-13	Bachang	23	120	63	57	1.11
C-60	B.Nongkhouydu	Bachang	58	334	178	156	1.14
C-61	B.Kamro	Bachang	58	283	135	148	0.91
Bachang Dist (25 Villages)			1,446	8,095	3,792	4,303	0.88
C-62	B.Lak-19	Pathomphone	80	451	217	234	0.93
C-63	B.Lak-20	Pathomphone	36	178	100	78	1.28
C-64	B.Mophou	Pathomphone	179	881	420	461	0.91
C-65	B.Lak-24	Pathomphone	99	448	205	243	0.84
C-66	B.Saenxaytoek (L-25)	Pathomphone	59	299	136	163	0.86
C-67	B.Houkhoua (L-39)	Pathomphone	53	270	133	137	0.97
C-68	B.Lak-31	Pathomphone	61	289	140	149	0.94
C-69	B.Lak-34	Pathomphone	44	258	131	127	1.05
C-70	B.Khouayouy (L-36)	Pathomphone	148	759	411	348	1.18
C-71	B.Tom-Nak	Pathomphone	117	670	335	335	0.91
C-72	B.Tao-Tai	Pathomphone	156	629	240	389	0.62
C-73	B.Nakha-Noy	Pathomphone	43	259	115	143	0.83
C-74	B.Thangphong	Pathomphone	110	633	312	321	0.97
C-75	B.Nongphak	Pathomphone	85	468	218	250	0.87
C-76	B.Napbo	Pathomphone	112	667	307	360	0.85
Pathomphone Dist (15 Villages)			1,382	7,108	3,343	3,765	0.89
C-77	B.Chakhangro	Sukhama	61	397	197	200	0.99
C-78	B.Bak	Sukhama	43	230	115	115	1.00
C-79	B.Sankhanaboua	Sukhama	123	682	337	345	0.98
C-80	B.Phongpheng	Sukhama	111	726	351	375	0.94
C-81	B.Pako	Sukhama	108	596	263	333	0.79
C-82	B.Thapchan	Sukhama	146	793	388	405	0.96
C-83	B.Koutabon	Sukhama	109	526	272	254	1.07
Sukhama District (7 Villages)			701	3,950	1,925	2,025	0.95
C-84	B.Hou-Tai	Khong	132	833	340	492	0.69
C-85	B.Kong	Khong	99	517	267	250	1.07
C-86	B.Phothasat	Khong	128	856	331	525	0.63
C-87	B.Hang	Khong	45	268	132	136	0.97
C-88	B.Maivai	Khong	50	366	211	155	1.36
C-89	B.Naraphan	Khong	112	563	264	299	0.91
C-90	B.Naxak (Hing)	Khong	97	496	220	276	0.80
C-91	B.Nongphay	Khong	46	252	122	130	0.94
C-92	B.Namhong	Khong	105	657	325	332	0.98
C-93	B.Dong	Khong	80	415	189	226	0.84
C-94	B.Hangphou	Khong	175	1,159	610	549	1.13
C-95	B.Vanikha	Khong	92	502	252	250	1.01
C-96	B.Phongpheng	Khong	63	370	167	203	0.82
C-97	B.Kadan	Khong	130	836	416	420	0.95
C-98	B.Khinak	Khong	135	780	370	410	0.90
C-99	B.Setsak	Khong	65	371	189	182	1.04
C-100	B.Tapay	Khong	18	113	57	56	1.02
Khong District (17 Villages)			1,562	9,264	4,461	4,803	0.91
100 Villages Total			9,637	53,297	24,991	28,306	0.88

Source: Village Survey, April 1994

(2) 100 Villages in Saravane Province

Village Code	Village Name	District Name	Household 1994	Population 1994	Male	Female	Sex Ratio
S-1	B.NongSavang	Lakhoiphong	105	522	267	255	1.05
S-2	B.Nakou	Lakhoiphong	113	602	301	301	1
S-3	B.Nakoumai	Lakhoiphong	109	579	246	333	0.74
S-4	B.Houayphong	Lakhoiphong	160	543	241	302	0.8
S-5	B.Lakhoi-Tai	Lakhoiphong	50	289	122	167	0.73
S-6	B.Lakhoi-Nua	Lakhoiphong	29	170	58	112	0.51
S-7	B.Khouay	Lakhoiphong	24	134	59	75	0.79
S-8	B.Kengphak	Lakhoiphong	68	366	148	218	0.68
S-9	B.Nongphay	Lakhoiphong	85	456	233	223	1.04
S-10	B.Nakha-Nai	Lakhoiphong	53	322	167	155	1.08
S-11	B.Phoudechang-Noy	Lakhoiphong	85	426	213	213	1
S-12	B.Nongphay	Lakhoiphong	41	231	115	116	0.99
S-13	B.Phoudechang-Onai	Lakhoiphong	73	356	169	187	0.9
S-14	B.Thangphong	Lakhoiphong	73	316	95	221	0.43
S-15	B.Bouaphan	Lakhoiphong	62	310	125	185	0.68
S-16	B.Houayphong	Lakhoiphong	38	186	92	94	0.98
Lakhoiphong Dist (16 Villages)			1,169	5,768	2,651	3,117	0.85
S-17	B.Hapong	Khongkedon	198	1182	571	611	0.93
S-18	B.Vang Kan Hong	Khongkedon	54	315	160	155	1.03
S-19	B.Napheng-Onai	Khongkedon	103	515	237	278	0.85
S-20	B.Khong Noy	Khongkedon	158	835	397	438	0.91
S-21	B.Nongraphang	Khongkedon	90	439	203	236	0.86
S-22	B.Nongkhetang	Khongkedon	63	346	154	192	0.8
S-23	B.Nongluang	Khongkedon	34	178	86	92	0.93
S-24	B.Doonuang	Khongkedon	80	398	174	224	0.78
S-25	B.Kindou	Khongkedon	100	502	236	266	0.9
S-26	B.Thabho	Khongkedon	28	121	51	67	0.81
S-27	B.Khok Houaxang	Khongkedon	53	288	135	153	0.88
S-28	B.Namouang	Khongkedon	121	625	285	340	0.84
S-29	B.Khangphong-Onai	Khongkedon	102	573	271	302	0.9
S-30	B.Nongsaen	Khongkedon	26	171	82	89	0.92
S-31	B.Nongphou	Khongkedon	24	152	68	84	0.81
S-32	B.Thadong	Khongkedon	47	268	128	140	0.91
S-33	B.Nangang	Khongkedon	43	227	153	174	0.88
S-34	B.Houayphong	Khongkedon	85	492	222	270	0.81
S-35	B.Hakou	Khongkedon	77	400	183	217	0.84
S-36	B.Nakhaou	Khongkedon	162	806	378	428	0.88
S-37	B.Kouangphong	Khongkedon	70	418	180	238	0.76
S-38	B.Kouangphong	Khongkedon	80	525	247	278	0.89
Khongkedon Dist (22 Villages)			1,798	9,879	4,604	5,275	0.87
S-39	B.Nongphong	Vay	74	466	231	235	0.98
S-40	B.Donkha	Vay	128	817	395	422	0.94
S-41	B.Nakai	Vay	78	501	208	293	0.7
S-42	B.Houayphou	Vay	116	603	211	392	0.54
S-43	B.Vayy-Nua	Vay	116	586	265	321	0.83
S-44	B.Vayy-Tai	Vay	116	571	283	288	0.98
S-45	B.Nakang	Vay	19	118	49	69	0.71
S-46	B.Bangkh	Vay	69	383	167	216	0.77
S-47	B.Saphai	Vay	139	753	336	417	0.81
S-48	B.Mouang	Vay	159	885	419	466	0.9
S-49	B.Hai	Vay	85	469	198	271	0.73
S-50	B.Sama	Vay	156	893	449	444	1.01
S-51	B.Khouma-Lai	Vay	49	223	105	118	0.89
S-52	B.Nongpho	Vay	49	257	131	126	1.04
Vay District (11 Villages)			1,352	7,525	3,445	4,080	0.82
S-53	B.Bangkhom	Saravane	235	1,371	751	740	0.99
S-54	B.Nongai	Saravane	130	1,250	510	740	0.69
S-55	B.Bangrai	Saravane	300	1,691	810	100	0.83
S-56	B.Chong	Saravane	31	183	83	38	0.89
S-57	B.Phongkham	Saravane	13	72	34	36	1.09
S-58	B.Koutouang	Saravane	21	117	61	49	0.84
S-59	B.Nongbou-Noy	Saravane	13	90	41	10,024	0.85
S-60	B.Dong-Nong	Saravane	64	315	151	164	0.92
S-61	B.May-Silail	Saravane	23	131	62	69	0.9
S-62	B.Nakha-Nai	Saravane	92	556	256	300	0.83
S-63	B.Nithon	Saravane	100	624	287	341	0.84
S-64	B.Phongph	Saravane	147	1,034	510	524	0.97
S-65	B.Nadon	Saravane	27	115	53	62	0.85
S-66	B.Nadonkhong	Saravane	39	224	100	124	0.81
S-67	B.Thumang-Kao	Saravane	75	452	212	240	0.88
S-68	B.Napheng-Onai	Saravane	70	310	215	295	0.73
S-69	B.Napheng-Noy	Saravane	18	117	55	62	0.89
S-70	B.Sakadi-Tai	Saravane	66	350	190	260	0.73
S-71	B.Dan-Onai	Saravane	113	739	298	441	0.68
S-72	B.Kengto-Tai	Saravane	56	365	185	180	1.03
S-73	B.Nobon-Tai	Saravane	46	212	101	111	0.91
S-74	B.Thai-Noy	Saravane	36	255	110	140	0.79
S-75	B.Nakhaou	Saravane	99	717	342	335	1.01
S-76	B.Ko	Saravane	63	326	161	165	0.98
S-77	B.Phao-Onai	Saravane	164	884	372	512	0.73
S-78	B.Song	Saravane	120	780	365	415	0.88
S-79	B.Thonglakot	Saravane	14	112	52	60	0.87
S-80	B.Naka-Onai	Saravane	60	396	190	206	0.92
S-81	B.Naka-Noy	Saravane	88	471	234	247	0.91
S-82	B.Makso	Saravane	30	178	91	87	1.05
S-83	B.Dongko-Nua	Saravane	62	318	149	169	0.86
S-84	B.Beng	Saravane	107	580	230	350	0.66
S-85	B.Khangphoukhong	Saravane	76	385	220	165	1.33
S-86	B.Kadap	Saravane	120	613	301	312	0.96
S-87	B.Lavang	Saravane	107	549	278	271	1.03
S-88	B.Savang-Noy	Saravane	76	368	208	160	1.3
S-89	B.Houkhong	Saravane	47	256	119	137	0.89
Saravane District (37 Villages)			2,954	15,003	8,417	18,792	0.82
S-90	B.Kangai	Laosang	68	287	144	143	1.01
S-91	B.Naman	Laosang	40	237	110	127	0.87
S-92	B.Kanarakot	Laosang	31	171	80	91	0.88
S-93	B.Balthang	Laosang	56	237	120	117	1.03
S-94	B.Vangyay	Laosang	60	300	125	175	0.71
S-95	B.Sangkhong-Tai	Laosang	24	125	56	69	0.81
S-96	B.Sangkhong-Onai	Laosang	36	410	188	222	0.85
S-97	B.Laong	Laosang	250	1140	465	675	0.69
S-98	B.Lhong	Laosang	179	653	300	347	0.87
S-99	B.Dang	Laosang	82	411	214	197	1.09
S-100	B.Hong-Tai	Laosang	73	438	172	266	0.65
Laosang District (11 Villages)			919	4,411	1,982	2,429	0.82
100 Villages Total			8,218	45,588	21,099	35,693	0.86

Table 3.3.1c Population in the Study Area and Prioritized Area

District Name	District Population (1994)	No. of Village within Study Area	Population in Study Area (1994)	No. of Village within Prioritized Area	Population in Prioritized Area (1994)
A. Champasak Province					
Sanasomboun	52,694	36	24,780	8	3,705
Bachiang	36,227	25	8,095	5	1,719
Pathoumpone	41,716	15	7,108	3	1,186
Sukhuma	36,227	7	3,950	2	912
Khong	65,868	17	9,364	2	929
Sub-Total	232,732	100	53,297	20	8,451
B. Saravan Province					
Lakonepheng	27,884	16	5,768	2	774
Khongxedong	43,293	22	9,879	5	1,999
Vapy	26,912	14	7,525	4	2,427
Saravan	58,980	37	18,005	7	3,948
Laongam	41,849	11	4,411	2	849
Sub-Total	198,918	100	45,588	20	9,997
Total	431,650	200	98,885	40	18,448

Source: (1) District Population is based on Table 3.2.1a.

(2) Village Population is based on the Village Survey, April 1994.

Table 3.3.1d Population Projections in Champasak and Saravan Provinces, 1994-2005

District Name	Growth Rate	1994	1996	1998	2000	2002	2005
A. Champasak Province							
Sanasomboun	2.36%	52,694	55,211	57,847	60,610	63,505	68,108
Bachiang	2.36%	36,227	37,957	39,770	41,669	43,659	46,824
Pathoumpone	2.36%	41,716	43,708	45,796	47,983	50,274	53,918
Sukhuma	2.36%	36,227	37,957	39,770	41,669	43,659	46,824
Khong	2.36%	65,868	69,013	72,309	75,762	79,381	85,134
Phontong	2.36%	75,748	79,365	83,156	87,127	91,288	97,905
Champasak	2.36%	47,205	49,460	51,822	54,296	56,889	61,013
Mounlaoamok	2.36%	30,738	32,206	33,744	35,356	37,044	39,729
Pakhsong	2.36%	50,499	52,910	55,437	58,085	60,858	65,270
Pakse	2.36%	60,379	63,262	66,283	69,449	72,766	78,040
Sub- Total:		497,301	521,051	545,934	572,007	599,324	642,765
B. Saravan Province							
Lakonepheng	2.97%	29,229	30,991	32,859	34,840	36,940	40,331
Khongxedong	2.97%	47,216	50,063	53,080	56,280	59,673	65,149
Vapy	2.97%	26,981	28,607	30,332	32,160	34,099	37,228
Saravan	2.97%	62,955	66,750	70,774	75,040	79,564	86,866
Laongam	2.97%	41,595	44,103	46,761	49,580	52,569	57,393
Tounlam	2.97%	15,739	16,688	17,693	18,760	19,891	21,716
Ta Oi	2.97%	20,236	21,455	22,749	24,120	25,574	27,921
Samuoi	2.97%	8,994	9,536	10,111	10,720	11,366	12,409
Sub-Total		252,945	268,193	284,360	301,502	319,677	349,014
Total		750,246	789,243	830,294	873,508	919,001	991,779

Source: Population of the Lao P.D.R, 1992, Ministry of Economy, Planning and Finance

Table 3.3.1e

Population Projections in the Study Area, 1994-2005

District Name	No. of Villages within District	Growth Rate	1994	1996	1998	2000	2002	2005
A. Champasak Province								
Sanasomboun	36	2.36%	24,780	25,963	27,203	28,503	29,864	32,028
Bachiang	25	2.36%	8,095	8,482	8,887	9,311	9,756	10,463
Pathoumpone	15	2.36%	7,108	7,447	7,803	8,176	8,566	9,187
Sukhuma	7	2.36%	3,950	4,139	4,336	4,543	4,760	5,105
Khong	17	2.36%	9,364	9,811	10,280	10,771	11,285	12,103
Sub-Total:	100		53,297	55,842	58,509	61,303	64,231	68,887
B. Saravan Province								
Lakonepheng	16	2.97%	5,768	6,116	6,484	6,875	7,290	7,959
Khongxedong	22	2.97%	9,879	10,475	11,106	11,775	12,485	13,631
Vapy	14	2.97%	7,525	7,979	8,460	8,970	9,510	10,383
Saravan	37	2.97%	18,005	19,090	20,241	21,461	22,755	24,843
Laongam	11	2.97%	4,411	4,677	4,959	5,258	5,575	6,086
Sub-Total	100		45,588	48,336	51,250	54,339	57,615	62,903
Total	200		98,885	104,178	109,759	115,643	121,846	131,789

Source: Population of the Lao P.D.R., 1992, Ministry of Economy, Planning and Finance

Table 3.3.2

Population of Ethnic Group in Champasak Province, 1991

	Lao Loum	Lao Theung	Lao Soung	District Population (1991e)
Sanasomboon	44,454	0	0	44,454
Bachiang	15,064	13,420	6	28,490
Pathompone	35,900	0	0	35,900
Sukhuma	24,996	5,037	0	30,033
Khong	66,811	757	0	67,568
Phontong	60,374	0	0	60,374
Champasak	41,498	0	0	41,498
Moonlaoamok	26,058	0	0	26,058
Pakhsong	19,096	15,202	5	34,303
Pakse	46,002	0	0	56,365
Total	380,253	34,416	11	425,043

Source: Public Health Service of Champasak Province, 1994

Note: 1991e = estimated figure for 1991

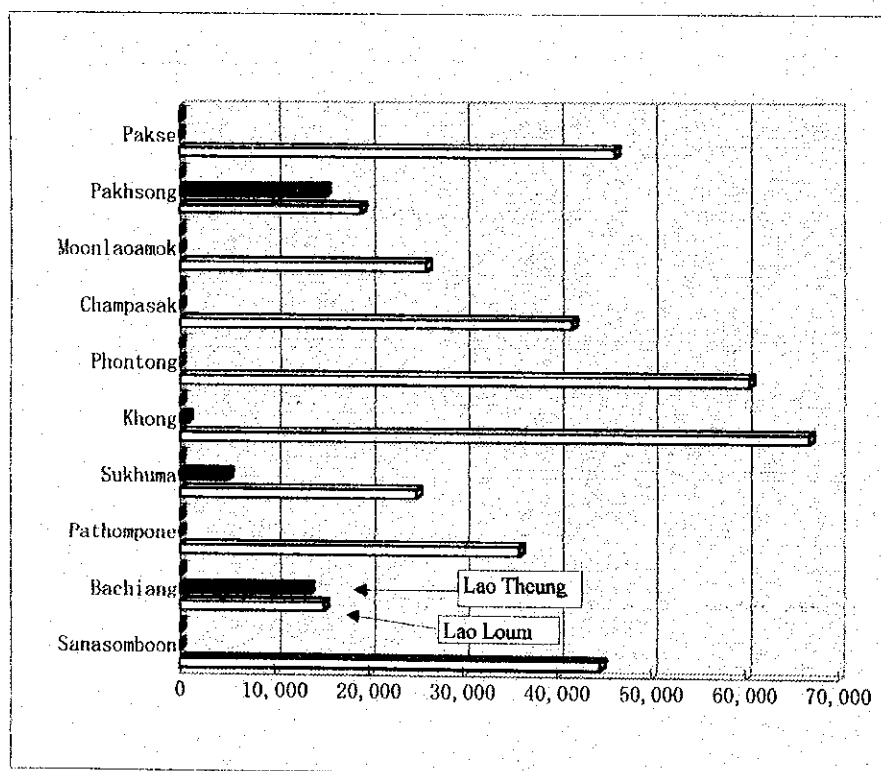


Table 3.3.3a Agricultural Production in Champasak Province, 1994

Unit: Ton

District	Wetland Rice	Upland Rice	Green Bean	Ground-nut	Coffee	Cardamon	Soy-bean	Sugar-cane	Tobacco
Sanasomboon	24,571	260	11	10	0	8	61	0	13
Bachiang	8,108	5,738	2	235	365	11	306	94	0
Pathompone	18,043	224	26	10	192	4	1	240	0
Sukhuma	26,009	0	8	18	0	0	0	156	8
Khong	29,317	0	15	38	0	0	29	1,053	249
Phontong	48,436	0	0	0	0	0	0	0	0
Champasak	26,690	0	11	7	0	0	9	149	4
Moonlaoamok	16,200	0	72	23	0	0	0	30	4
Pakse	6,327	0	0	0	0	0	0	0	0
Pakhsong	879	819	0	0	13,398	41	0	0	22
Total	203,701	6,222	144	341	13,955	23	406	1,722	299

Source: Agriculture & Forestry Service of Champasak Province, 1994

Production of Wetland Rice by District

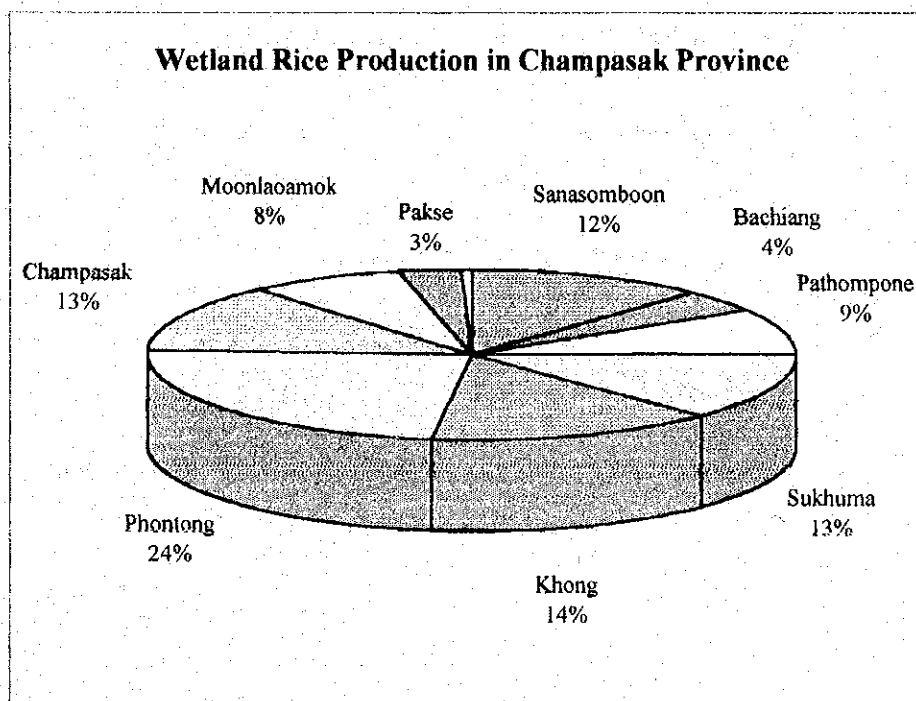


Table 3.3.3b Agricultural Production in Saravan Province, 1994

Unit: Ton

District	Wetland Rice	Upland Rice	Soybean	Groundnut	Coffee	Cardamon	Banana
Lakonepheng	17,074	0	0	0	0	0	0
Khongxedon	30,863	353	0	0	0	0	0
Vapy	15,130	153	21	0	0	0	0
Saravan	33,224	1,839	0	152	11	11	197
Laongam	1,247	7,432	759	249	1,240	95	2,400
Toumlam	6,375	0	0	0	0	0	0
Ta Oi	117	1,320	0	0	0	0	0
Samuoi	111	1,080	0	0	0	0	0
Total	104,030	11,097	780	401	1,251	106	2,597

Source: Agriculture & Forestry Service of Saravan Province, 1994

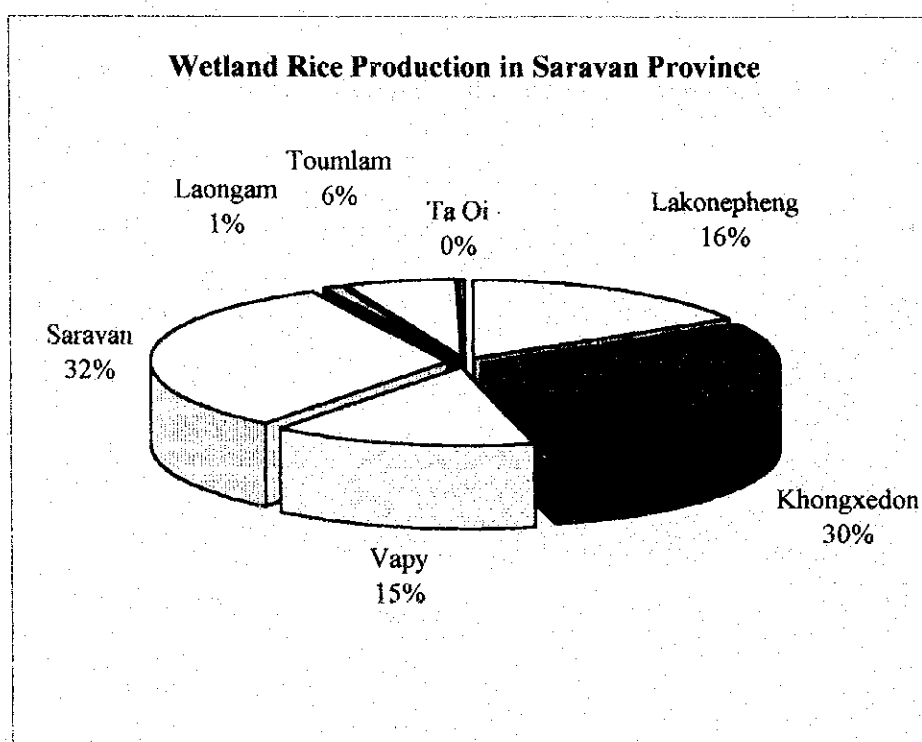


Table 3.3.4a

Rural Income Survey, 20 Samples in Saravali Province, 1995

Unit: Monetary Unit in Kip

Sample No.	Village Name	Family Size	Adult (15over)	Child (0-14)	Land-holding (Ha)	Rice Income	Other Crops Income	Crops Income Total	Livestock Income	Off-farm Income	Gross Income (A)	Farm Expenditure	Household Expenditure (B)	Net Income (A)-(B)
Sa-1	Houan-Tai	11	6	5	3	80,000	250,000	330,000	0	0	330,000	6,800	185,000	138,200
Sa-2	Houan-Tai	6	2	4	6	120,000	240,000	360,000	70,000	0	430,000	17,000	384,000	29,000
Sa-3	Houan-Tai	19	11	8	7.5	240,000	460,000	700,000	390,000	100,000	1,190,000	12,200	700,000	477,800
Sa-4	Houan-Tai	8	2	6	3.2	40,000	560,000	600,000	0	1,100,000	1,700,000	6,300	906,300	793,700
Sa-5	Beng	7	2	5	1.7	232,000	17,500	249,500	100,000	300,000	649,500	7,140	337,000	305,360
Sa-6	Beng	8	5	3	1	80,000	0	80,000	0	120,000	200,000	4,800	105,000	90,200
Sa-7	Beng	7	4	3	3	24,000	0	24,000	58,000	530,000	612,000	6,600	259,000	346,400
Sa-8	Beng	7	2	5	1.5	136,000	22,000	158,000	60,000	60,000	278,000	7,600	179,000	91,400
Sa-9	Nakasao	7	3	4	2.2	240,000	0	240,000	40,000	50,000	330,000	37,160	282,000	10,840
Sa-10	Nakasao	11	6	5	1.7	320,000	0	320,000	0	70,000	390,000	23,060	328,000	38,940
Sa-11	Nakasao	8	3	5	2.1	480,000	0	480,000	17,000	70,000	567,000	8,570	461,000	97,430
Sa-12	Nakasao	8	7	1	2.5	480,000	0	480,000	43,000	80,000	603,000	15,600	544,000	43,400
Sa-13	Phonpai	3	3	0	2	320,000	0	320,000	210,000	0	530,000	38,300	450,000	41,700
Sa-14	Phonpai	8	6	2	4	320,000	0	320,000	320,000	1,000,000	1,640,000	12,800	830,000	797,200
Sa-15	Phonpai	3	3	0	1.5	240,000	0	240,000	21,000	150,000	411,000	9,200	390,000	11,800
Sa-16	Phonpai	7	4	3	2	240,000	0	240,000	5,000	210,000	455,000	8,600	400,900	46,400
Sa-17	Chong	10	8	2	2.5	560,000	0	560,000	0	0	560,000	17,000	516,000	27,000
Sa-18	Chong	7	4	3	1.5	240,000	0	240,000	21,000	100,000	361,000	10,400	269,000	81,600
Sa-19	Chong	3	2	1	1	240,000	0	240,000	120,000	0	360,000	6,800	300,000	53,200
Sa-20	Chong	8	2	6	1.5	240,000	0	240,000	10,000	0	250,000	10,200	225,000	14,800
Sub-total		156	85	71	51.4	4,872,000	1,549,500	6,421,500	1,485,000	3,940,000	11,846,500	266,130	8,044,000	3,536,370
Average		7.8	4.25	3.55	2.57	243,600	77,475	321,075	74,250	197,000	592,325	13,307	402,200	176,819

Source: Rural Income Survey conducted by the Study Team, March 1995

Table 3.3.4b Rural Income Survey, 20 Samples in Champasak Province, 1995

Unit: Monetary Unit in Kip

Sample No.	Village Name	Family Size	Adult (15over)	Child (0-14)	Land-holding (Ha)	Rice Income	Other Crops Income	Crops Income Total	Livestock Income	Off-farm Income	Gross Income (A)	Farm Expenditure	Household Expenditure	Total Expenditure (B)	Net Income (A)-(B)
Ch-1	Nasenphan	10	5	5	1.5	216,000	0	216,000	64,000	857,600	1,137,600	4,500	746,000	750,500	387,100
Ch-2	Nasenphan	11	5	6	4	288,000	0	288,000	190,000	1,350,000	1,828,000	78,000	1,338,000	1,416,000	412,000
Ch-3	Nasenphan	4	4	0	6	192,000	0	192,000	30,000	500,000	722,000	33,800	154,000	187,800	534,200
Ch-4	Nasenphan	5	2	3	1.5	120,000	0	120,000	5,000	150,000	275,000	31,300	130,000	161,300	113,700
Ch-5	Lak-21	6	3	3	1	48,000	100,000	148,000	15,000	170,000	333,000	2,400	175,000	177,400	155,600
Ch-6	Lak-21	6	5	1	0.5	160,000	180,000	340,000	10,000	230,000	580,000	2,400	440,000	442,400	137,600
Ch-7	Lak-21	3	3	0	3	0	250,000	250,000	0	1,350,000	1,600,000	22,000	1,700,000	1,722,000	-122,000
Ch-8	Lak-21	5	3	2	0.2	0	30,000	30,000	0	420,000	450,000	0	420,000	420,000	30,000
Ch-9	Lak-24	3	2	1	1	48,000	0	48,000	0	85,000	133,000	1,200	56,000	57,200	75,800
Ch-10	Lak-24	3	3	0	1	48,000	0	48,000	0	150,000	198,000	4,000	125,000	129,000	69,000
Ch-11	Lak-24	6	3	3	1	144,000	0	144,000	100,000	30,000	274,000	2,600	60,600	63,200	210,800
Ch-12	Lak-24	9	6	3	5	240,000	736,000	976,000	0	200,000	1,176,000	4,000	816,000	820,000	356,000
Ch-13	Louy	7	3	4	1	80,000	0	80,000	65,000	150,000	295,000	3,000	280,000	283,000	12,000
Ch-14	Louy	7	5	2	1.5	80,000	0	80,000	50,000	210,000	340,000	3,000	272,000	275,000	65,000
Ch-15	Louy	4	2	2	0.9	288,000	0	288,000	35,000	50,000	373,000	1,000	40,000	41,000	332,000
Ch-16	Louy	3	3	0	0.5	0	6,000	6,000	26,000	150,000	182,000	1,250	75,000	76,250	105,750
Ch-17	Nongphai	5	2	3	3	576,000	0	576,000	50,000	450,000	1,076,000	60,000	331,000	391,000	685,000
Ch-18	Nongphai	5	3	2	2	176,000	0	176,000	202,500	5,000	383,500	4,000	145,000	149,000	234,500
Ch-19	Nongphai	6	4	2	2.2	192,000	10,000	202,000	34,000	0	236,000	18,100	120,000	138,100	97,900
Ch-20	Nongphai	2	2	0	0	0	0	0	130,000	600,000	730,000	0	641,000	641,000	89,000
Sub-Total		110	68	42	36.8	2,896,000	1,312,000	4,208,000	1,006,500	7,107,600	12,322,100	276,550	8,064,600	8,341,150	3,980,950
Average		5.5	3.4	2.1	1.84	144,800	65,600	210,400	50,325	355,380	616,105	13,828	403,230	417,058	199,048

Source: 40 Sample Households Interview Survey, March 1995

Table 3.3.6a

**Medical Services Infrastructure and Staff
in Champasak Province, 1994**

	No. of Bed	High Level Doctor	Medium Level Doctor	Nurse	Other Staff
Provincial Hospital	250	41	97	117	154
Sanasomboon	25	1	12	39	36
Bachiang	30	1	9	40	26
Pathompone	25	4	10	47	41
Sukhuma	20	2	9	36	29
Khong	50	2	20	52	52
Phontong	26	5	19	52	77
Champasak	30	2	6	36	16
Moonlaoamok	30	2	10	26	154
Pakhsong	48	2	12	46	2
Pakse	5	4	18	39	137
Total	539	66	222	530	724

Source: Public Health Service of Champasak Province, 1994

Note: Each District has a District Hospital at District capital town and has several Dispensaries at Sub-District level. For example, Sanasomboon District has a District Hospital at Huaxe and 4 Dispensaries at Sub-District level.

**Table 3.3.6b Medical Services Infrastructure and Staff
in Saravan Province, 1994**

	No. of Bed	High Level Doctor	Medium Level Doctor	Nurse	Other Staff
Prov. Hospital	250	41	97	117	154
Lakhonepheng	25	1	12	39	36
Khongxedon	30	1	9	40	26
Vapy	25	4	10	47	41
Saravan	20	2	9	36	29
Laongam	50	2	20	52	52
Toumlam	26	5	19	52	77
Ta Oi	30	2	6	36	16
Samuoi	30	2	10	26	154
Total	486	60	192	445	585

Source: Public Health Service of Saravan Province, 1994

Note: Each District has a District Hospital at District capital town and has several Dispensaries at Sub-District level. For example, Khongxedon District has a District Hospital at Khongxedon and 5 Dispensaries at Sub-District level.

Table 3.3.6c **Leading Causes of Morbidity in Champasak Province, 1994**

	Malaria	Diarrhea	Influenza	Dysentery	Pneumonia	Tuberculosis
Prov. Hospital	1,575	132	11	31	154	37
Sanasomboon	398	85	26	134	36	60
Bachiang	236	40	13	41	26	4
Pathompone	402	28	38	19	41	4
Sukhuma	447	26	5	4	29	1
Khong	543	676	422	504	52	26
Phontong	212	350	115	34	77	1
Champasak	203	33	29	11	16	0
Moonlaoamok	988	121	142	198	154	3
Pakhsong	192	6	0	0	2	0
Pakse	268	313	406	195	137	0
Total	5,464	1,810	1,207	1,171	724	136
Ranking	1	2	3	4	5	6

Source: Public Health Service of Champasak Province, 1994

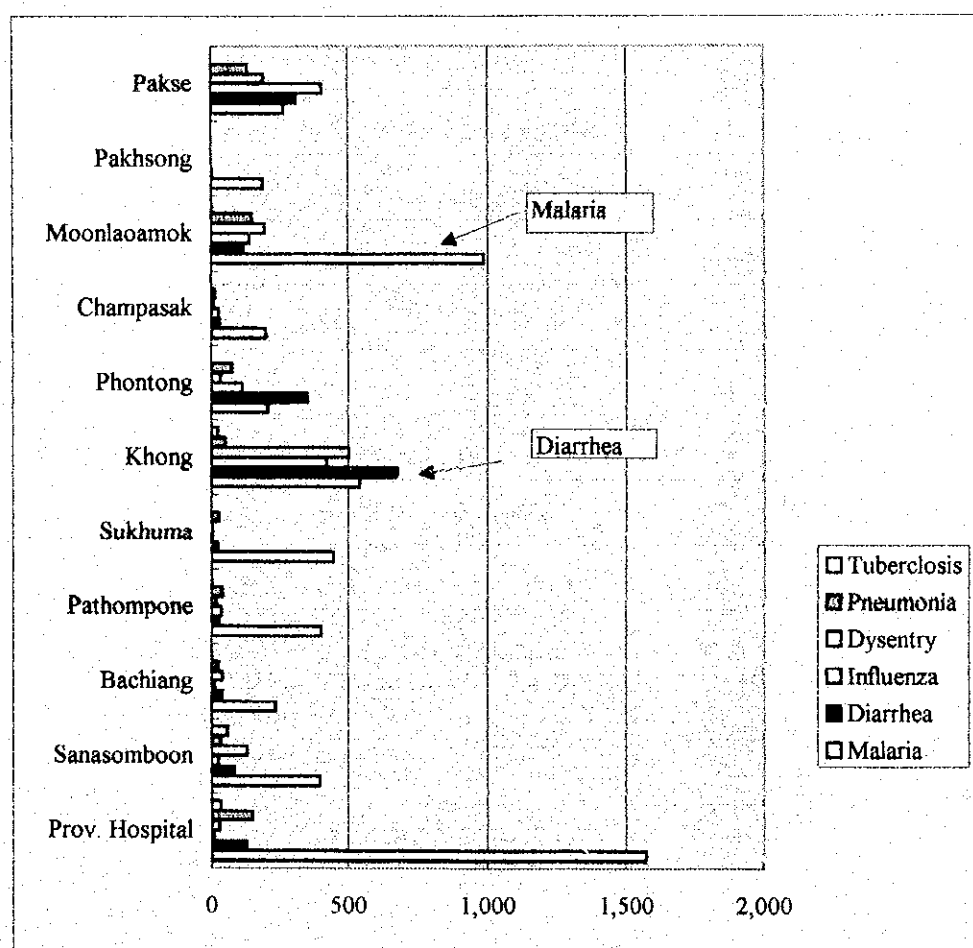


Table 3.3.6d Leading Causes of Morbidity in Saravan Province, 1994

	Malaria	Diarrhea	Influenza	Dysentery	Pneumonia	Tuberculosis
Prov. Hospital	2,191	281	n.a.	75	523	59
Saravan	1,821	1,071	1,518	605	353	9
Laongam	364	62	n.a.	n.a.	114	n.a.
Vapy	925	634	n.a.	74	125	n.a.
Khongxedon	210	n.a.	n.a.	n.a.	n.a.	n.a.
Lakhongpheng	71	n.a.	n.a.	n.a.	n.a.	n.a.
Toumlam	267	344	n.a.	15	106	n.a.
Ta Oi	121	76	n.a.	22	34	n.a.
Samuoi	50	63	n.a.	30	72	n.a.
Total	6,020	2,531	1,518	821	1,327	68
Ranking	1	2	3	4	5	6

Source: Public Health Service of Saravan Province, 1994

Note: The above figures indicate the number of out-patients during Oct. 1993 to Sep. 1994

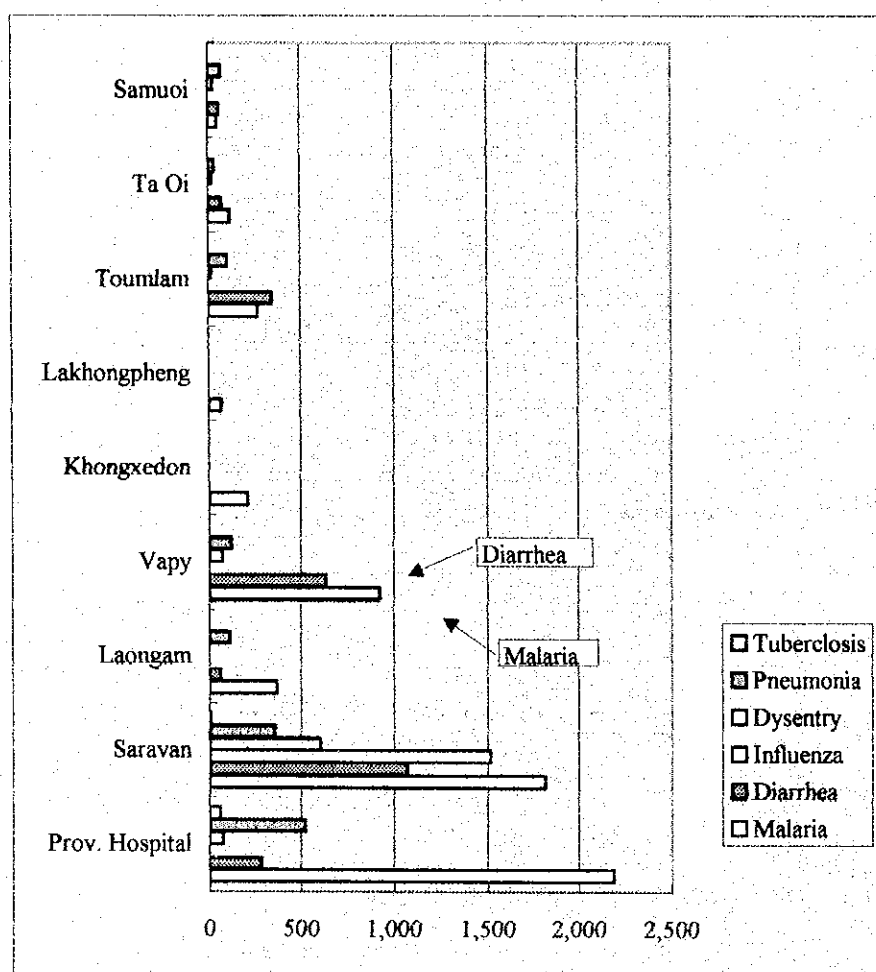


Table 3.3.6e

Budget for Provincial Health Department, Champasak, 1994-95

Unit: Million Kip

Description		1993-1994	1994-1995	Increase
		Budget	Budget	
1	Salary	260.00	607.57	347.57
2	Social Welfare	26.50	37.68	11.18
3	Administration	50.00	50.00	0.00
4	Reparing and Purchasing	41.30	44.00	2.70
	4.1 Medical Equipment for Provincial Hospital	6.50	7.00	0.50
	4.2 Medical Equipment for District Hospitals	6.80	7.00	0.20
	4.3 Other reparing and Purchasing	28.00	30.00	2.00
5	Per Diem for Students	18.80	20.00	1.20
6	Medicine Purchasing	73.40	86.50	13.10
	6.1 Medicine for Provincial Hospital	26.00	30.00	4.00
	6.2 Medicine for District Hospitals	30.00	32.00	2.00
	6.3 Medicine for Mother and Children	0.00	3.50	3.50
	6.4 Medicine for Malaria Control	0.00	3.50	3.50
	6.5 Medicine for Skin Disease	0.00	2.00	2.00
	6.6 Medicine for T.B.	0.00	1.50	1.50
	6.7 Patient's Health Improvement for Prov. H.	9.00	8.00	-1.00
	6.8 Patient's Health Improvement for Dist. H.	8.40	6.00	-2.40
7	Basic Construction	26.00	179.30	153.30
	7.1 Domestic Capital	26.00	20.90	-5.10
	7.2 Foreign Capital	0.00	158.40	158.40
Total		496.00	1,025.05	529.05

Source: Provincial Health Department, Champasak, 1995

Table 3.3.6f Budget for Provincial Health Department, Saravan, 1994-95

Unit: Million Kip

Description	Amount	Salary	Social Welfare	Admini- stration	Equipment	Others
1.1 Provincial Health Department	160.85	128.73	6.92	16.90	0.00	55.94
1.2 Provincial Hospital	63.10	0.00	0.00	3.30	18.50	41.30
1.3 Nursing School	6.30	0.00	0.00	0.30	6.00	0.00
Sub-Total (Province)	230.25	128.73	6.92	20.50	24.50	97.24
2.1 Saravan	16.50	10.90	1.10	1.30	2.30	0.90
2.2 Laongam	36.60	27.50	1.40	2.00	4.40	1.30
2.3 Khongxendon	52.70	33.60	2.80	2.00	5.40	8.90
2.4 Vapy	35.90	28.00	1.00	1.20	4.70	1.00
2.5 Lakhonepheng	52.70	17.20	1.00	1.00	5.70	27.80
2.6 Toumlam	21.90	14.30	1.60	1.00	3.70	1.30
2.7 Ta Oi	14.84	10.90	0.69	0.50	2.15	0.60
2.8 Samooi	11.45	7.80	0.40	0.50	2.15	0.60
Sub-Total (District)	242.59	150.20	9.99	9.50	30.50	42.40
Total	472.84	278.93	16.91	30.00	55.00	139.64

Source: Provincial Health Department, Saravan, 1995.

Table 3.4.1 Existing Water Source by District in Champasak Province

Village Code	Village Name	District Name	Household 1994	Population 1994	Existing Water Source						Served Population						Total
					River	Well	Pump	Pond	Spring	Other	River	Well	Pump	Pond	Spring	Other	
C-1	B Nakhon	Sanasombon	153	863	100%							863	0	0	0	0	863
C-2	B Phonthat	Sanasombon	28	135		100%						0	0	135	0	0	135
C-3	B Nonsavan	Sanasombon	122	615		100%						0	0	615	0	0	615
C-4	B Nongphai	Sanasombon	98	553	20%		80%					111	0	442	0	0	553
C-5	B Souvanakhithi	Sanasombon	170	830	100%							830	0	0	0	0	830
C-6	B Nanai	Sanasombon	118	629	100%							629	0	0	0	0	629
C-7	B Nongdou	Sanasombon	74	378		100%						0	378	0	0	0	378
C-8	B Houaxee	Sanasombon	109	628	85%	5%	10%					531	31	63	0	0	628
C-9	B Pengsan	Sanasombon	70	337		100%						0	337	0	0	0	337
C-10	B Dong	Sanasombon	63	311	90%		10%					280	31	0	0	0	311
C-11	B Hangam	Sanasombon	62	354		100%						0	354	0	0	0	354
C-12	B Nongkham	Sanasombon	93	419		60%	40%					0	251	168	0	0	419
C-13	B Khampheng	Sanasombon	153	987		85%	10%			5%		0	839	99	0	49	987
C-14	B Khamngoua	Sanasombon	39	256	95%		5%					243	13	0	0	0	256
C-15	B Nongkhen	Sanasombon	55	256		100%						0	256	0	0	0	256
C-16	B Louy	Sanasombon	32	150	100%							150	0	0	0	0	150
C-17	B Soli-Gnai	Sanasombon	225	1025	90%		10%					923	0	103	0	0	1,025
C-18	B Solo-Noy	Sanasombon	116	635	100%							635	0	0	0	0	635
C-19	B Nongphak	Sanasombon	226	1230	75%		25%					923	0	308	0	0	1,230
C-20	B Khamlouang	Sanasombon	52	266	70%	30%						186	80	0	0	0	266
C-21	B Sithouan	Sanasombon	82	422	40%		60%					169	0	253	0	0	422
C-22	B Mouang	Sanasombon	210	1285	100%							1,285	0	0	0	0	1,285
C-23	B Ohnuang	Sanasombon	180	1117	80%	15%	5%					894	168	56	0	0	1,117
C-24	B Boungkha	Sanasombon	150	1010	95%		5%					960	0	51	0	0	1,010
C-25	B Latsua (Nongnuek)	Sanasombon	58	317	95%		5%					301	16	0	0	0	317
C-26	B Nalak	Sanasombon	250	1376	30%	70%						0	413	963	0	0	1,376
C-27	B Dongkalong	Sanasombon	59	374	80%	20%						0	299	75	0	0	374
C-28	B Nalong	Sanasombon	287	1696	35%	65%						594	0	1,102	0	0	1,696
C-29	B Naxon	Sanasombon	219	1398		43%	57%					0	601	797	0	0	1,398
C-30	B Thangbengsilala	Sanasombon	85	310		15%				85%		0	0	47	0	264	310
C-31	B Nongxat	Sanasombon	51	293	30%	70%						88	0	205	0	0	293
C-32	B Dongphak	Sanasombon	68	412		100%						0	0	412	0	0	412
C-33	B Dua-Nua	Sanasombon	155	856	98%	2%						839	0	17	0	0	856
C-34	B Kengkeo	Sanasombon	96	498	100%							498	0	0	0	0	498
C-35	B Ngouadong	Sanasombon	183	1053	100%							1,053	0	0	0	0	1,053
C-36	B Pakxay	Sanasombon	255	1497	50%	10%				40%		749	0	150	0	0	1,497
Sanasombon District			4,446	24,780								13,743	3,067	6,059	0	0	21,780
C-37	B Nongsai	Bachiang	70	368	100%							368	0	0	0	0	368
C-38	B Bachiang	Bachiang	52	278	40%	59%	1%					111	164	0	3	0	278
C-39	B Malongro	Bachiang	57	259	100%							259	0	0	0	0	259
C-40	B Nongbok-Noy	Bachiang	105	578	100%							578	0	0	0	0	578
C-41	B Nongbok-Gnai	Bachiang	117	646	100%							646	0	0	0	0	646
C-42	B Thongkhi	Bachiang	70	510	100%							510	0	0	0	0	510
C-43	B Kengnaso	Bachiang	54	300			100%					0	0	0	0	300	300
C-44	B Thongsala	Bachiang	72	368	50%		50%					184	0	0	0	184	368
C-45	B Mouangkhai	Bachiang	63	394	40%	20%						158	79	0	0	158	394
C-46	B Pakonay	Bachiang	42	270	22%	56%						59	151	0	0	59	270
C-47	B Oudomsouk	Bachiang	65	356	42%		42%	16%				150	0	0	0	150	356
C-48	B Phasoun	Bachiang	37	157	50%		50%					79	0	0	0	79	157
C-49	B Lak-21	Bachiang	127	567	42%		42%	16%				238	0	0	0	238	567
C-50	B Phan	Bachiang	99	467			100%					0	0	0	0	467	467
C-51	B Lak-23	Bachiang	71	391	50%		50%					196	0	0	0	196	391
C-52	B Lak-25	Bachiang	81	379	50%		50%					190	0	0	0	190	379
C-53	B Nongkhamkha	Bachiang	33	117	50%	50%						59	59	0	0	0	117
C-54	B Simke	Bachiang	24	136	50%		50%					68	0	0	0	68	136
C-55	B Houayten	Bachiang	65	320	50%		50%					160	0	0	0	160	320
C-56	B Tan (B Lak-17)	Bachiang	32	195	50%		50%					98	0	0	0	98	195
C-57	B Nomsat	Bachiang	36	218	50%		50%					109	0	0	0	109	218
C-58	B Nongmak-Euk	Bachiang	35	184	50%		50%					92	0	0	0	92	184
C-59	B Lak-13	Bachiang	23	120	50%	50%						60	60	0	0	0	120
C-60	B Nonhouayda	Bachiang	58	334	100%							334	0	0	0	0	334
C-61	B Kampo	Bachiang	58	283			100%					0	0	0	0	283	283
Bachiang District			1,546	8,125								4,703	513	0	3	2,879	8,125
C-62	B Lak-19	Pathomphon	80	451	70%	30%						316	135	0	0	0	451
C-63	B Lak-20	Pathomphon	36	178	40%	10%			50%			71	18	0	89	0	178
C-64	B Mephou	Pathomphon	179	881	99%		1%					872	0	9	0	0	881
C-65	B Lak-24	Pathomphon	99	448	100%							448	0	0	0	0	448
C-66	B Sanasaysouk (L-25)	Pathomphon	59	389	60%	10%	30%					233	39	117	0	0	389
C-67	B Houakhoue (L-29)	Pathomphon	53	270	50%	50%						135	135	0	0	0	270
C-68	B Lak-31	Pathomphon	61	289	40%	40%	20%					116	116	58	0	0	289
C-69	B Lak-34	Pathomphon	44	256	40%	60%						102	154	0	0	0	256
C-70	B Khousouay (L-36)	Pathomphon	148	759	100%							759	0	0	0	0	759
C-71	B Tomo-Nak	Pathomphon	117	620	30%	70%						186	434	0	0	0	620
C-72	B Tao-Tai	Pathomphon	156	629	15%	80%	5%					94	503	31	0	0	629
C-73	B Nakhon-Noy	Pathomphon	43	250	60%	40%						150	100	0	0	0	250
C-74	B Thangbeng	Pathomphon	110	633	97%	1%				2%		0	614	6	0	13	633
C-75	B Nongkhe	Pathomphon	85	468	8%	90%	2%					37	421	9	0	0	468
C-76	B Napho	Pathomphon	112	667	100%							667	0	0	0	0	667
Pathomphon District			1,382	7,188								4,187	2,669	230	89	0	7,188
C-77	B Chikhangro	Sukhuma	61	397		5%	95%					0	20	377	0	0	397
C-78	B Bak	Sukhuma	43	230			5%	95%				0	0	12	219	0	230
C-79	B Samkhanabou	Sukhuma	123	682			20%	80%				0	0	136	546	0	682
C-80	B Phonpheng	Sukhuma	111	726		40%	60%					0	290	436	0	0	726
C-81	B Piko	Sukhuma	108	596	60%		40%					358	0	238	0	0	596
C-82	B Thapchan	Sukhuma	146	793			100%					0	0	793	0	0	793
C-83	B Koumaboun	Sukhuma	109	526	50%	50%						263	0	263	0	0	526
Sukhuma District			701	3,950								621	310	2,255	764	0	3,950
C-84	B Boun-Tai	Khong	132	832	100%							832	0	0	0	0	832
C-85	B Keng	Khong															

Table 3.4.3 Existing Water Source by District in Saravan Province

Village Code	Village Name	District	Household Population	Existing Source					Served Population				
				1994	1994 River	Well	Pump	Pond Spring Other	River	Well	Pump	Pond Spring Other	Total
S-1	B NonSavong	Lakhonpheng	105	522	60%	35%		5%	313	0	183	0	26 522
S-2	B Nadoi	Lakhonpheng	113	602	10%	90%			60	0	542	0	0 602
S-3	B Nadoi	Lakhonpheng	109	579	40%	60%			232	0	347	0	0 579
S-4	B Houaylapho	Lakhonpheng	160	543	20%	60%	20%		109	0	326	109	0 543
S-5	B Lakhosi-Tai	Lakhonpheng	50	289	60%	10%	30%		173	29	87	0	0 289
S-6	B Lakhosi-Nua	Lakhonpheng	29	130	100%				130	0	0	0	0 130
S-7	B Khousay	Lakhonpheng	24	134	95%	5%			127	0	7	0	0 134
S-8	B Kengpradek	Lakhonpheng	68	366	45%	40%	15%		165	146	55	0	0 366
S-9	B Nondaxay	Lakhonpheng	83	436	10%	80%	10%		46	0	363	46	0 436
S-10	B Nakhadai	Lakhonpheng	53	322	85%	15%			274	0	48	0	0 322
S-11	B Phoudaocheng-Noy	Lakhonpheng	85	426	10%	40%	50%		43	170	213	0	0 426
S-12	B Nongsoo	Lakhonpheng	42	231	65%	35%			0	150	81	0	0 231
S-13	B Phoudaocheng-Gnai	Lakhonpheng	73	356	100%				0	0	356	0	0 356
S-14	B Thangbeng	Lakhonpheng	73	316	100%				0	316	0	0	0 316
S-15	B Bountaphan	Lakhonpheng	62	310	50%	50%			155	0	155	0	0 310
S-16	B Houaythen	Lakhonpheng	38	186	35%	65%			65	0	121	0	0 186
Lakhonpheng District			1,169	5,768					1,891	812	2,885	154	0 26 5,768
S-17	B Napong	Khongxetdon	198	1,182	5%	95%			59	0	1,123	0	0 1,182
S-18	B Vang Kan Hong	Khongxetdon	54	315	75%	25%			236	0	79	0	0 315
S-19	B Napheng-Gnai	Khongxetdon	103	515	45%	50%	5%		232	0	258	26	0 515
S-20	B Khong-Noy	Khongxetdon	158	835	100%				835	0	0	0	0 835
S-21	B Nongsaphang	Khongxetdon	90	439		95%	5%		0	0	417	22	0 439
S-22	B Nongkoxong	Khongxetdon	63	346	100%				346	0	0	0	0 346
S-23	B Nongkhou	Khongxetdon	34	178	100%				178	0	0	0	0 178
S-24	B Donnuaeng	Khongxetdon	80	398	100%				398	0	0	0	0 398
S-25	B Hinxiou	Khongxetdon	100	505	80%	20%			404	0	101	0	0 505
S-26	B Thakho	Khongxetdon	28	121	100%				121	0	0	0	0 121
S-27	B Khok-Houatang	Khongxetdon	53	288	5%	90%	5%		14	0	259	14	0 288
S-28	B Nannouang	Khongxetdon	121	625		98%	2%		0	0	613	13	0 625
S-29	B Khanthong-Gnai	Khongxetdon	102	573	100%				573	0	0	0	0 573
S-30	B Nonsantani	Khongxetdon	26	171	100%				171	0	0	0	0 171
S-31	B Nonghalou	Khongxetdon	24	152	100%				152	0	0	0	0 152
S-32	B Thatsouang	Khongxetdon	47	268	100%				268	0	0	0	0 268
S-33	B Nongong	Khongxetdon	43	327	100%				327	0	0	0	0 327
S-34	B Houayxao	Khongxetdon	85	495	100%				495	0	0	0	0 495
S-35	B Hantou	Khongxetdon	77	400	100%				400	0	0	0	0 400
S-36	B Nakadiao	Khongxetdon	162	806		90%	10%		0	0	725	81	0 806
S-37	B Koutlamphong	Khongxetdon	70	418	100%				418	0	0	0	0 418
S-38	B Koutabeng	Khongxetdon	80	525	95%		5%		499	0	0	26	0 525
Khongxetdon District			1,798	9,882					6,126	0	3,574	181	0 0 9,882
S-39	B Nongong	Vapv	74	466	90%	10%			419	0	0	47	0 466
S-40	B Dorkha	Vapv	128	817		80%	20%		0	0	654	163	0 817
	B Naxat	Vapv	78	501		90%	10%		0	0	451	50	0 501
S-42	B Houaythou	Vapv	116	603	100%				603	0	0	0	0 603
S-43	B Vapv-Nua	Vapv	121	586	100%				586	0	0	0	0 586
S-44	B Vapv-Tai	Vapv	116	571	100%				571	0	0	0	0 571
S-45	B Nakang	Vapv	19	118	90%	10%			106	0	0	12	0 118
S-46	B Bangkha	Vapv	60	383	100%				383	0	0	0	0 383
S-47	B Saphat	Vapv	139	753	100%				753	0	0	0	0 753
S-48	B Mouang	Vapv	159	885	100%				885	0	0	0	0 885
S-49	B Hat	Vapv	85	469	100%				469	0	0	0	0 469
S-50	B Sautia	Vapv	156	893	100%				893	0	0	0	0 893
S-51	B Khouta-Laf	Vapv	49	223		60%		40%	0	0	134	0	89 223
S-52	B Nongho	Vapv	49	257		30%		70%	0	0	77	0	180 257
Vapv District			1,358	7,525					5,669	0	1,315	272	0 269 7,525
S-53	B Bangkha	Saravan	235	1,571	100%				1,571	0	0	0	0 1,571
S-54	B Nongai	Saravan	130	1,250	95%	3%	2%		1,188	38	25	0	0 1,250
S-55	B Bungai	Saravan	300	1,691	100%				1,691	0	0	0	0 1,691
S-56	B Chong	Saravan	31	183	20%	80%			37	146	0	0	0 183
S-57	B Phokham	Saravan	13	72	100%				72	0	0	0	0 72
S-58	B Koutmoung	Saravan	21	117	100%				117	0	0	0	0 117
S-59	B Nongbou-Noy	Saravan	13	90	100%				90	0	0	0	0 90
S-60	B Dong-Nong	Saravan	64	315	100%				315	0	0	0	0 315
S-61	B Moy-Sivlai	Saravan	23	131	100%				131	0	0	0	0 131
S-62	B Nakathian	Saravan	92	556	100%				556	0	0	0	0 556
S-63	B Kathon	Saravan	100	628	100%				628	0	0	0	0 628
S-64	B Phonphai	Saravan	147	1,034	100%				1,034	0	0	0	0 1,034
S-65	B Nadoi	Saravan	27	115	100%				115	0	0	0	0 115
S-66	B Nadoi-Khong	Saravan	39	224		100%			0	0	224	0	0 224
S-67	B Thamuang-Kao	Saravan	75	452	10%	90%			45	0	407	0	0 452
S-68	B Napheng-Gnai	Saravan	70	510	100%				510	0	0	0	0 510
S-69	B Napheng-Noy	Saravan	18	117	100%				117	0	0	0	0 117
S-70	B Sakodi-Tai	Saravan	66	450	100%				450	0	0	0	0 450
S-71	B Dan-Gnai	Saravan	113	739	100%				739	0	0	0	0 739
S-72	B Kengim-Tai	Saravan	56	365	100%				365	0	0	0	0 365
S-73	B Nobon-Tai	Saravan	42	212	100%				212	0	0	0	0 212
S-74	B That-Noy	Saravan	46	250	100%				250	0	0	0	0 250
S-75	B Nakasoo	Saravan	99	717	50%	5%	45%		359	0	36	323	0 717
S-76	B Ko	Saravan	63	326	100%				326	0	0	0	0 326
S-77	B Phao-Gnai	Saravan	164	884	60%	40%			530	354	0	0	0 884
S-78	B Soung	Saravan	120	780	5%	95%			39	741	0	0	0 780
S-79	B Thongkhopok	Saravan	14	112	100%				112	0	0	0	0 112
S-80	B Naxat-Gnai	Saravan	60	396	85%	15%			337	0	59	0	0 396
S-81	B Naxat-Noy	Saravan	88	471		2%		98%	0	0	0	462	0 471
S-82	B Makao	Saravan	30	178	100%				178	0	0	0	0 178
S-83	B Dongko-Nua	Saravan	62	318	100%				318	0	0	0	0 318
S-84	B Deng	Saravan	107	580	100%				580	0	0	0	0 580
S-85	B Khiaenghouklong	Saravan	76	385	100%				385	0	0	0	0 385
S-86	B Kadap	Saravan	120	613				100%	0	0	0	613	0 613
S-87	B Lavang	Saravan	107	549				100%	0	0	0	549	0 549
S-88	B Senvang-Noy	Saravan	76	368	100%				368	0	0	0	0 368
S-89	B Houakhoua	Saravan	47	256	90%			10%	230	0	0	0	26 256
Saravan District			2,951	18,005					13,094	1,288	751	323 1,624	26 18,005
S-90	B Kiangtai	Laongam	68	287	50%			50%	144	0	0	0	0 287
S-91	B Xamun	Laongam	40	237	50%			50%	119	0	0	0 119	0 237
S-92	B Xamunok	Laongam	31	171	100%				171	0	0	0	0 171
S-93	B Bolkdeung	Laongam	56	237	100%				237	0	0	0	0 237
S-94	B Vangpauy	Laongam	60	300	100%				300	0	0	0	0 300
S-95	B Sanghong-Noy	Laongam	24	125	50%			50%	63	0	0	0 63	0 125
S-96	B Sanghong-Gnai	Laongam	86	410	100%				410	0	0	0	0 410
S-97	B Laongam	Laongam	250	1,140	5%			95%	57	0	0	0 1,083	1,140
S-98	B Hokong	Laongam	179	655	50%			50%	328	0	0	0 328	0 655
S-99	B Deng	Laongam	82	411	100%				411	0	0	0	0 411
S-100	B Houm-Tai	Laongam	73	438	100%				438	0	0	0	0 438
Laongam District			919	4,411					2,676	0	0	0 652 1,683	4,411
Total			8,228	45,591					30,356	2,100	8,526	930 2,276 1,404	45,591

Source: Village Survey, April 1994

Figure 3.2.1a Organization Chart of Ministry of Public Health

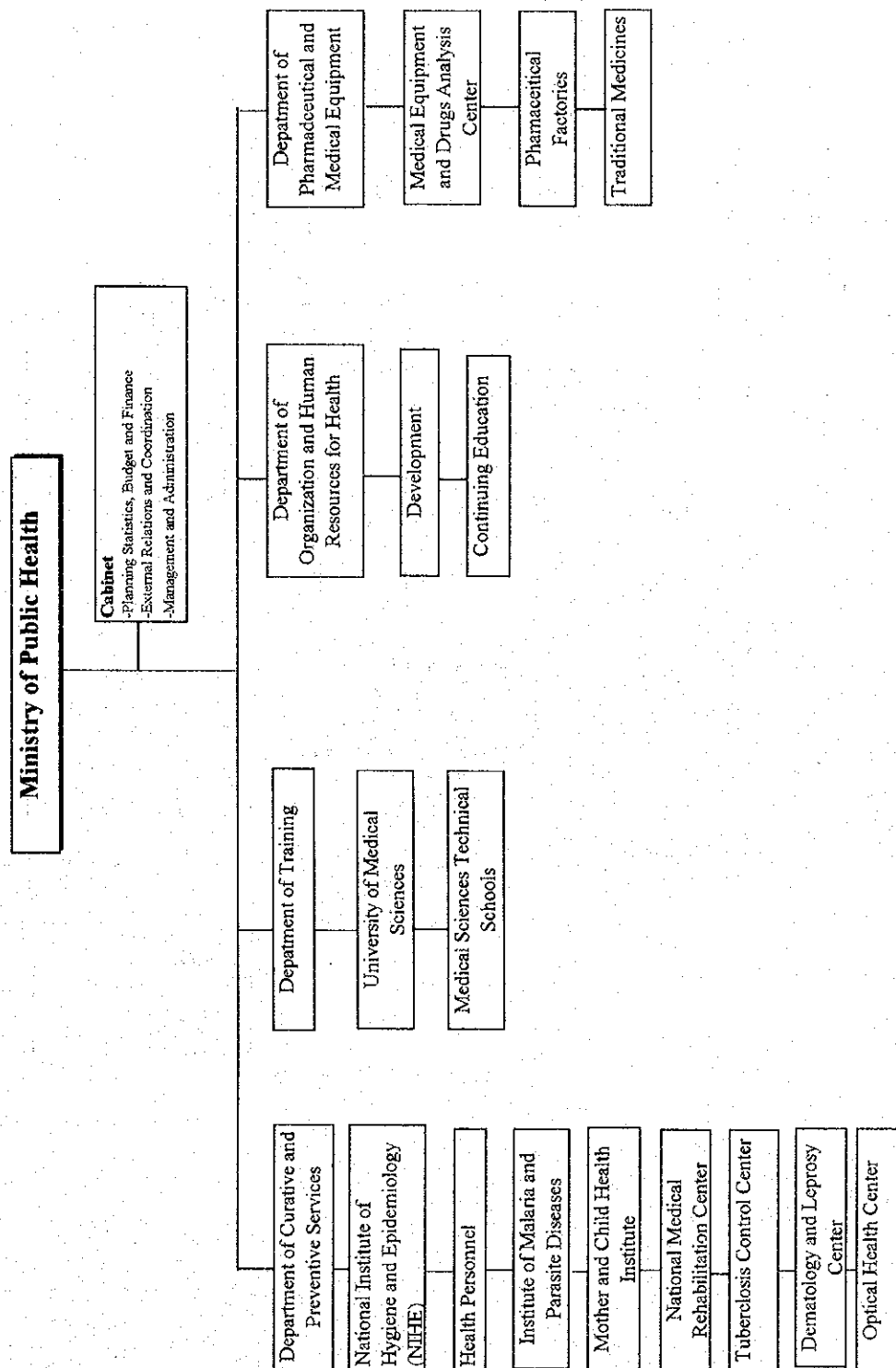
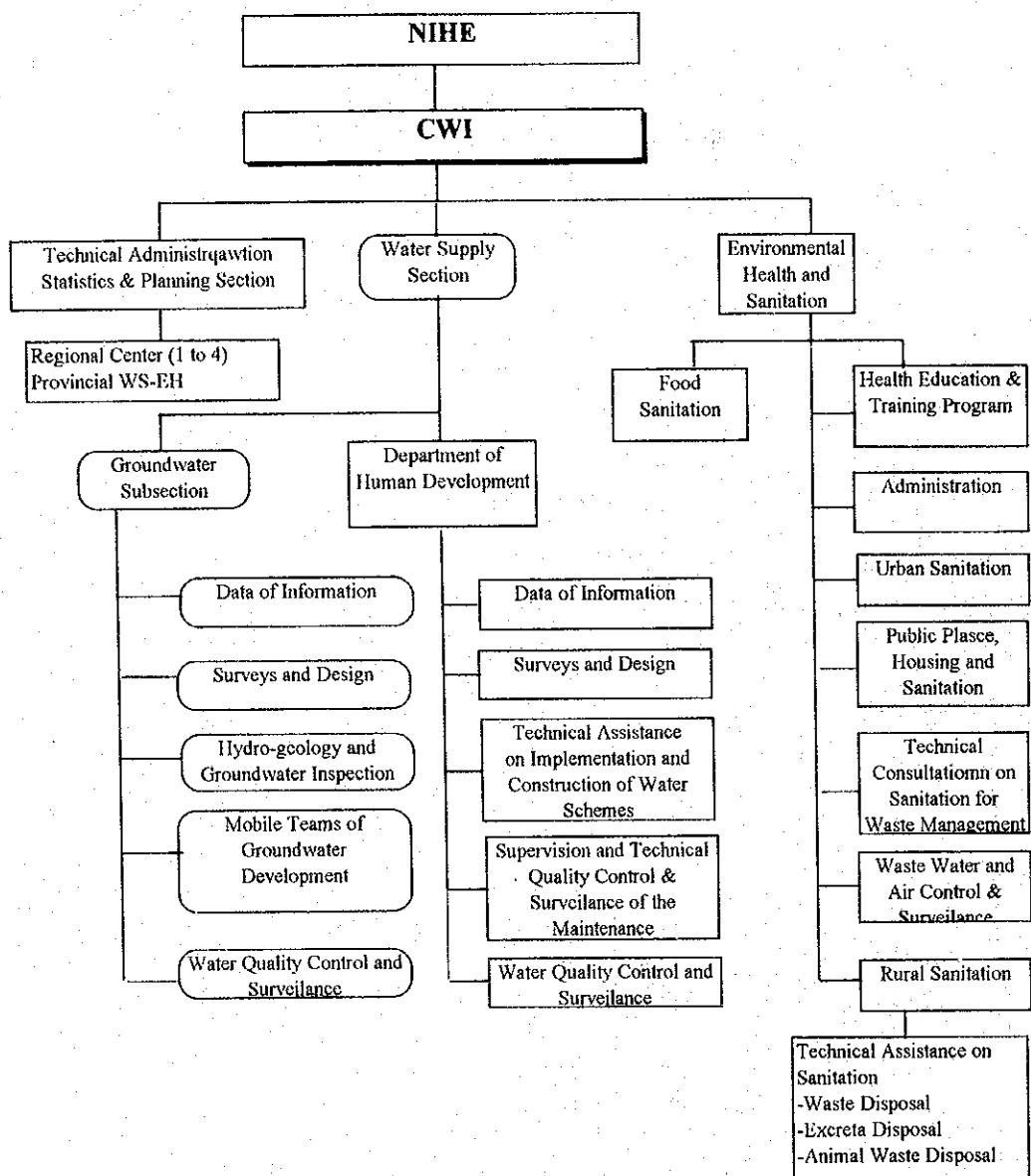


Figure 3.2.1b Organization Chart of Clean Water Institute (CWI)



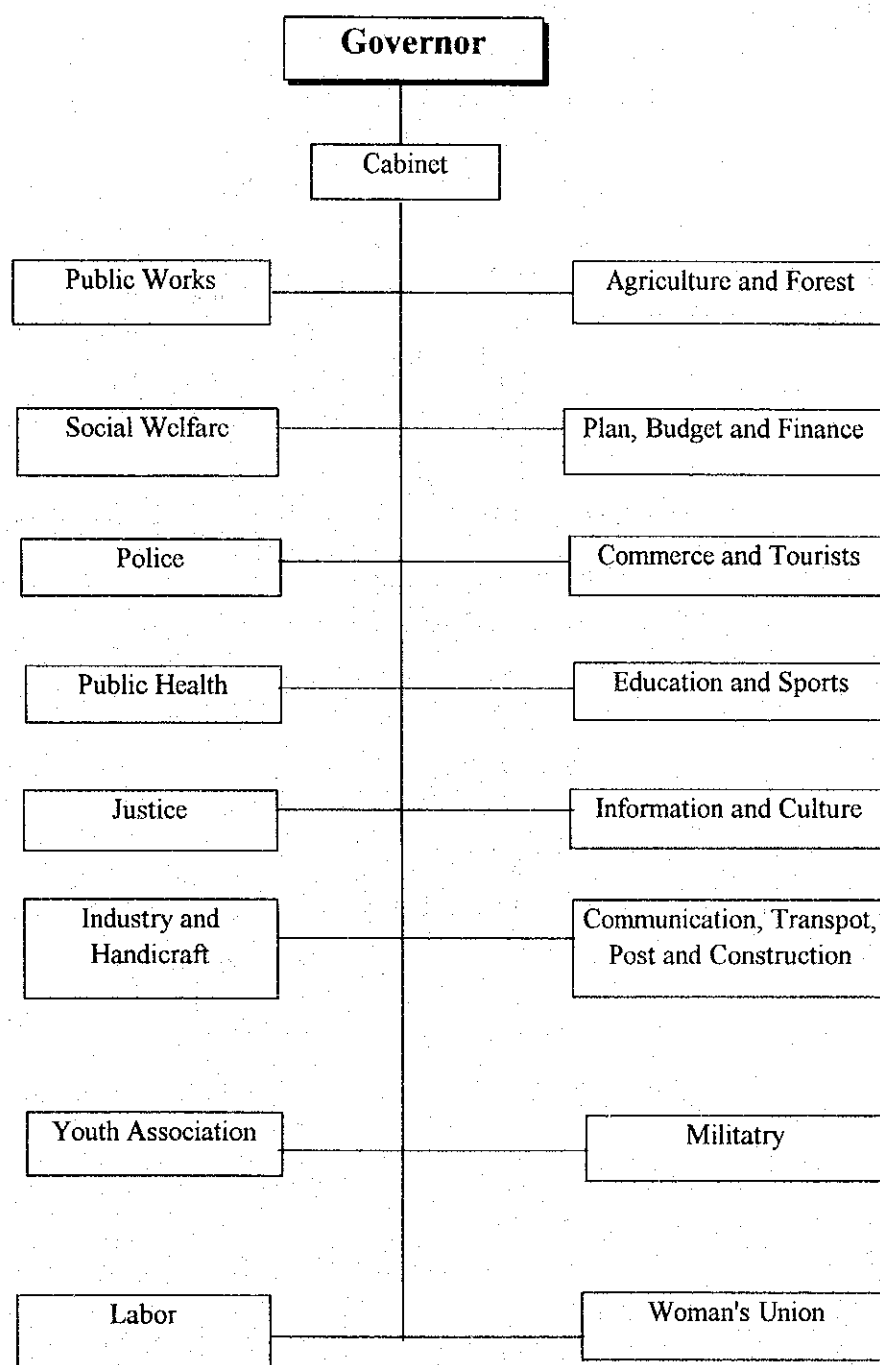
Note:

NIHE = National Institute of Hygiene and Epidemiology

CWI = Clean Water Institute

Figure 3.3.5

Organization Chart of Provincial Administration



**Figure 3.3.6a Organization Chart of Provincial Health Department
in Champasak Province**

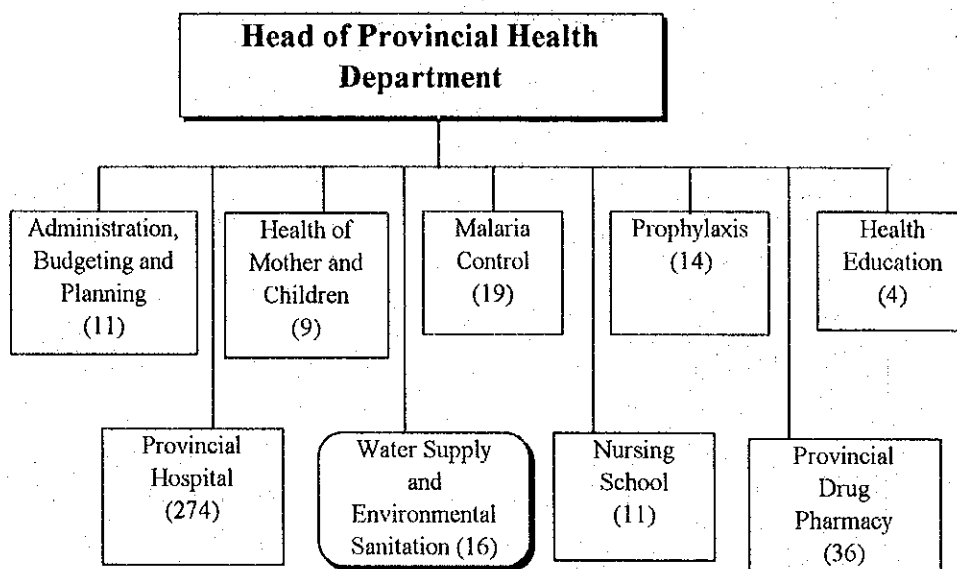


Figure 3.3.6b Organization Chart of Water Supply and Environmental Sanitation Section in Champasak Province

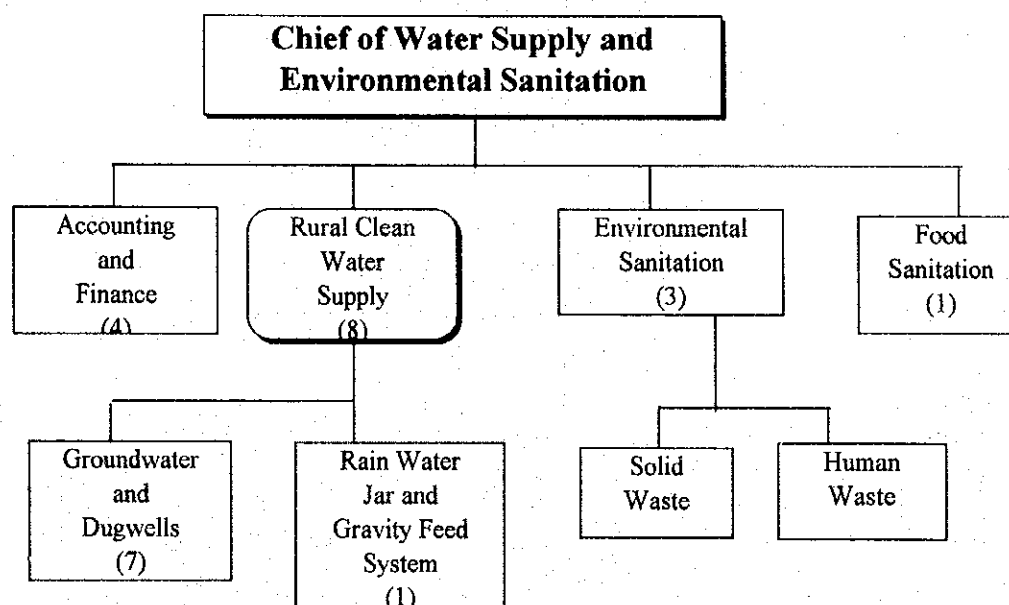


Figure 3.3.6c Organization Chart of District Public Health

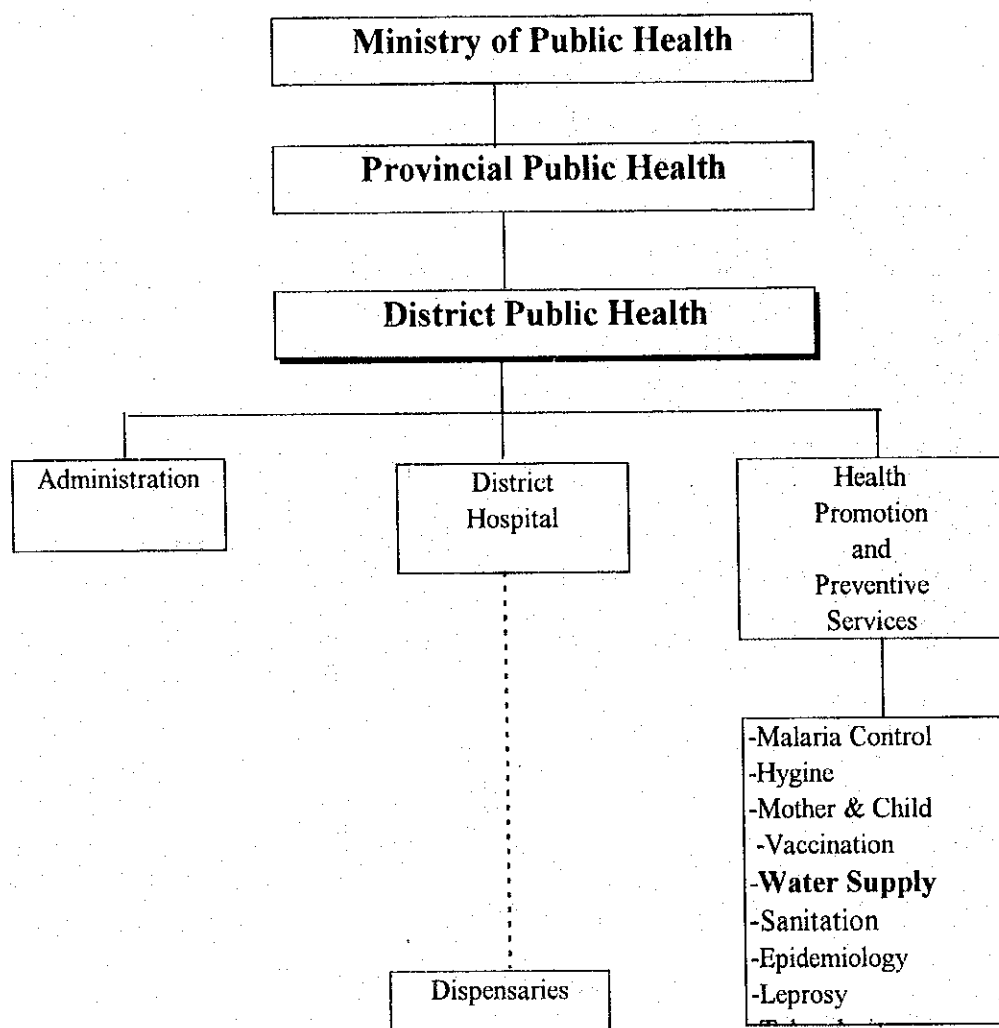


Figure 3.4.1a

Water Source in 100 Villages, Champasak Province

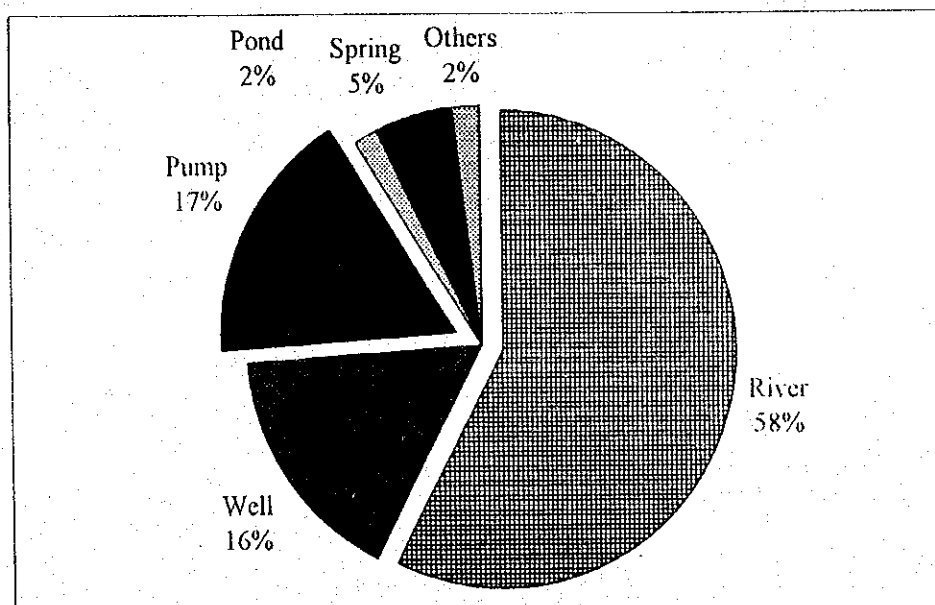


Figure 3.4.1b

Water Source in 100 Villages, Saravan Province

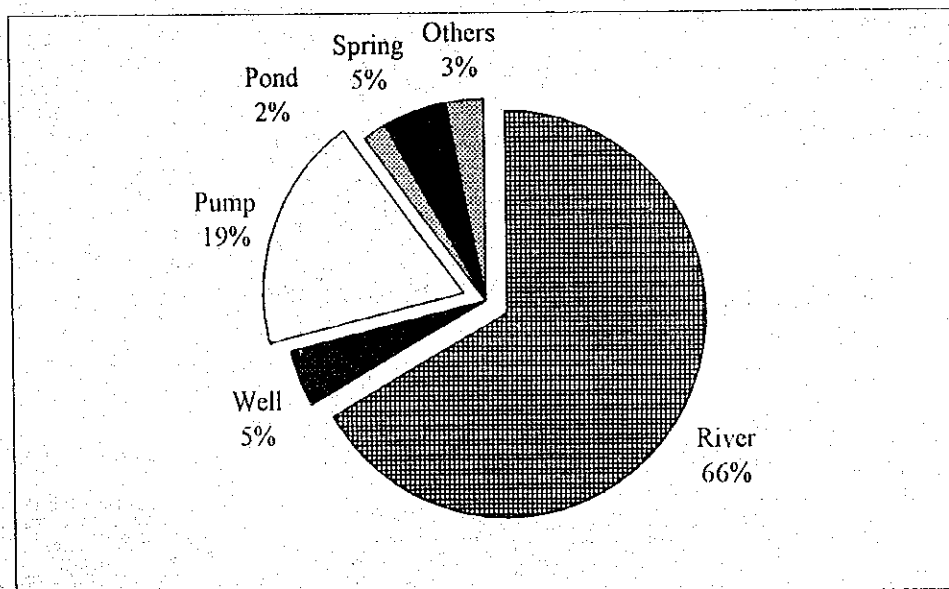


Figure 3.4.1c Existing Water Source by District in the Study Area (1994)

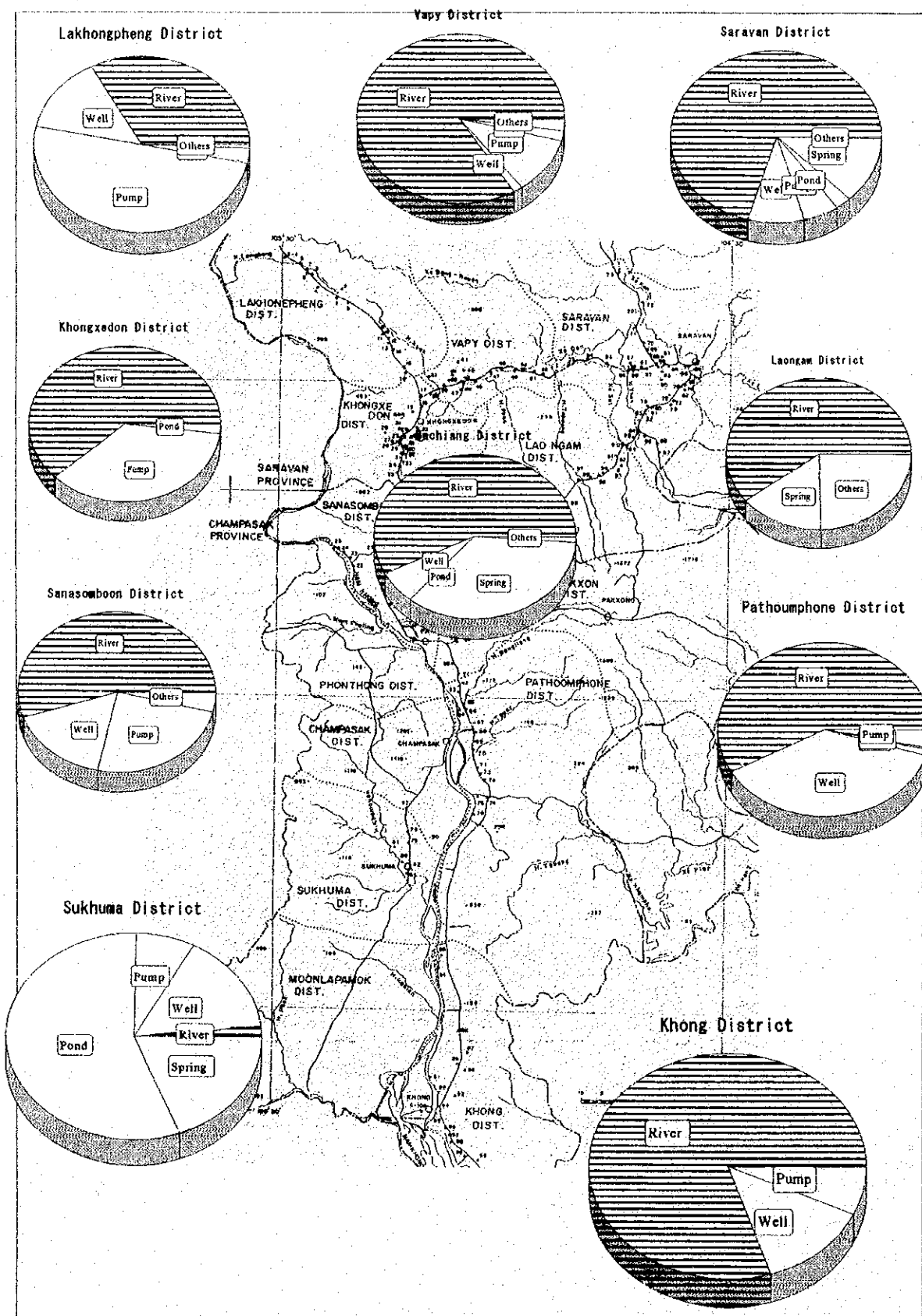


Figure 3.4.2 Location of Target Villages in the Study Area

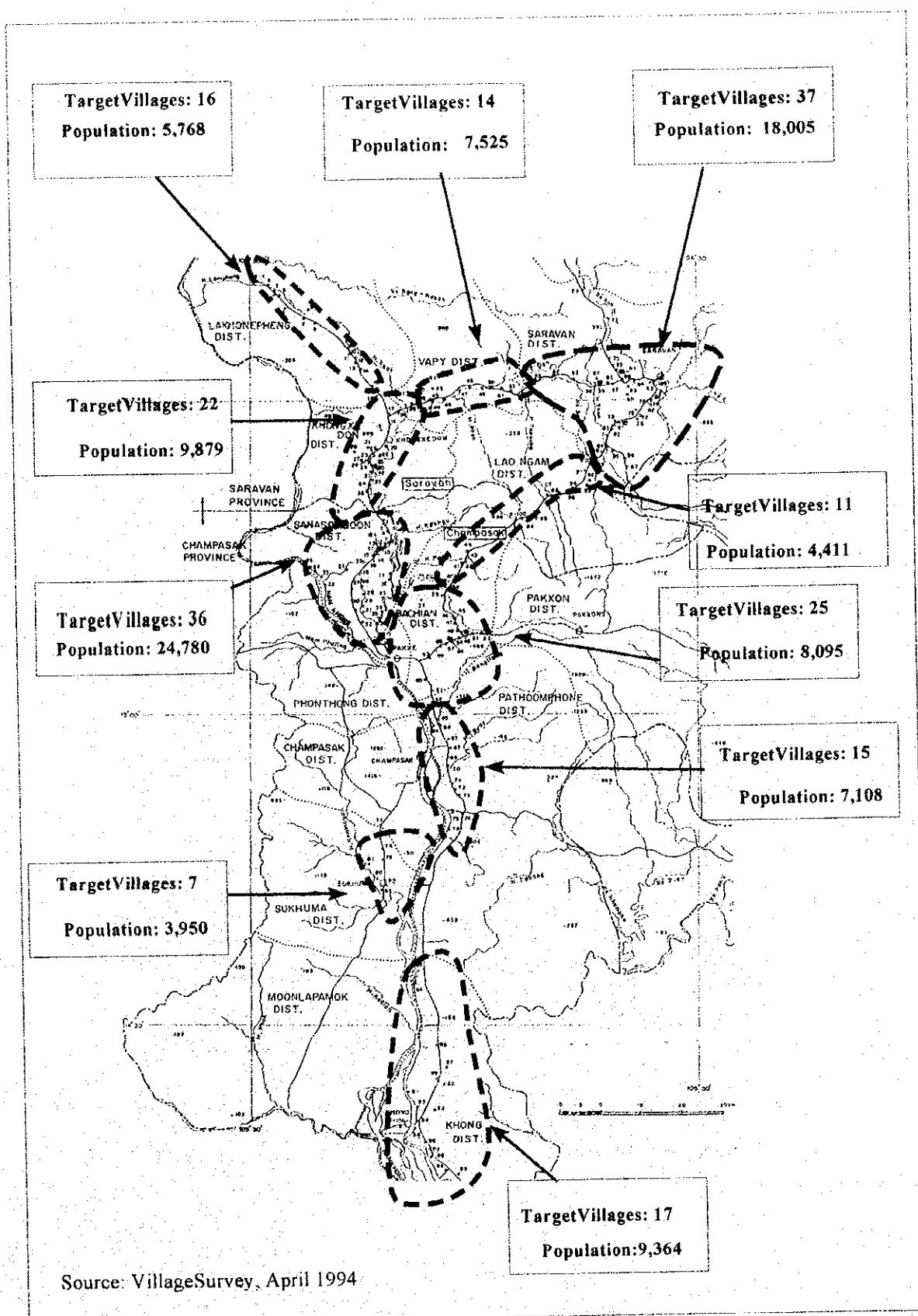


Figure 3.4.4a Access to Main Water Source

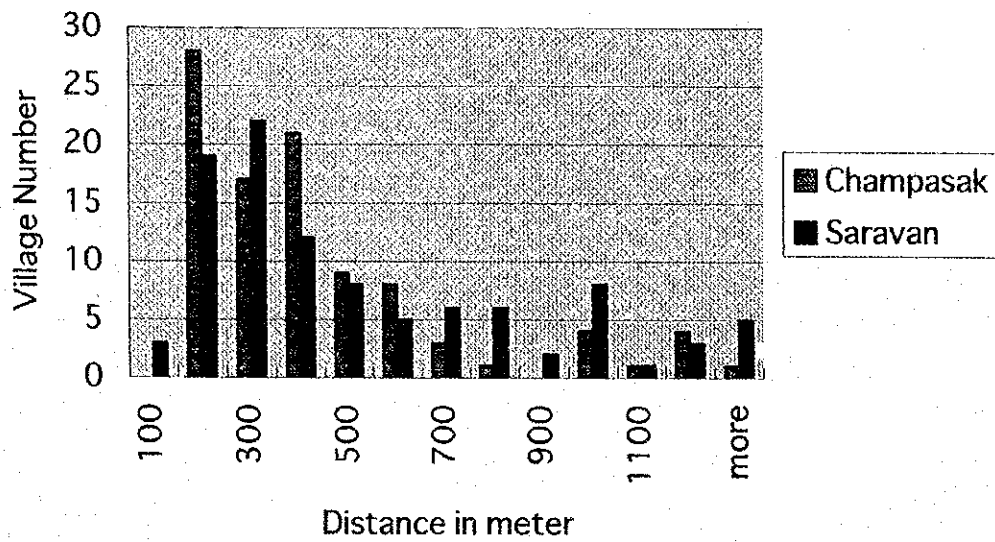
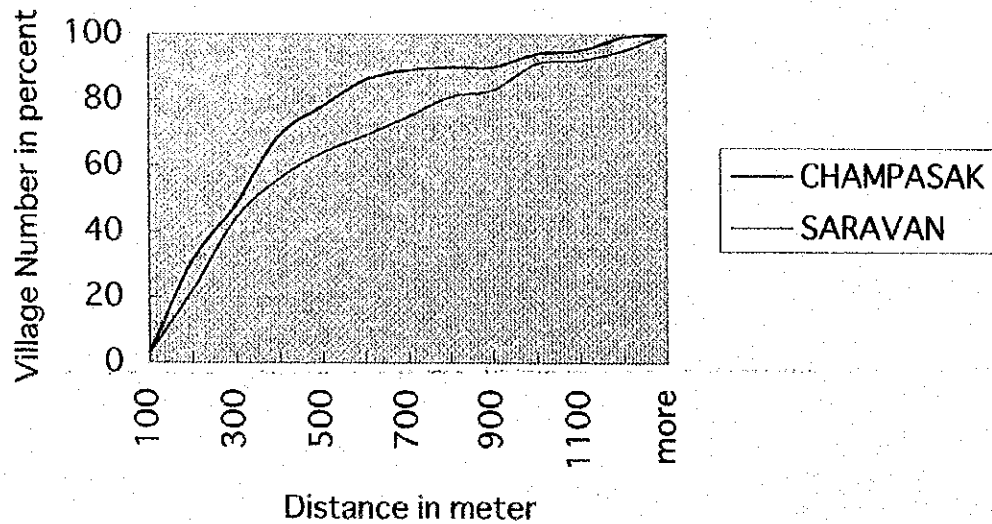
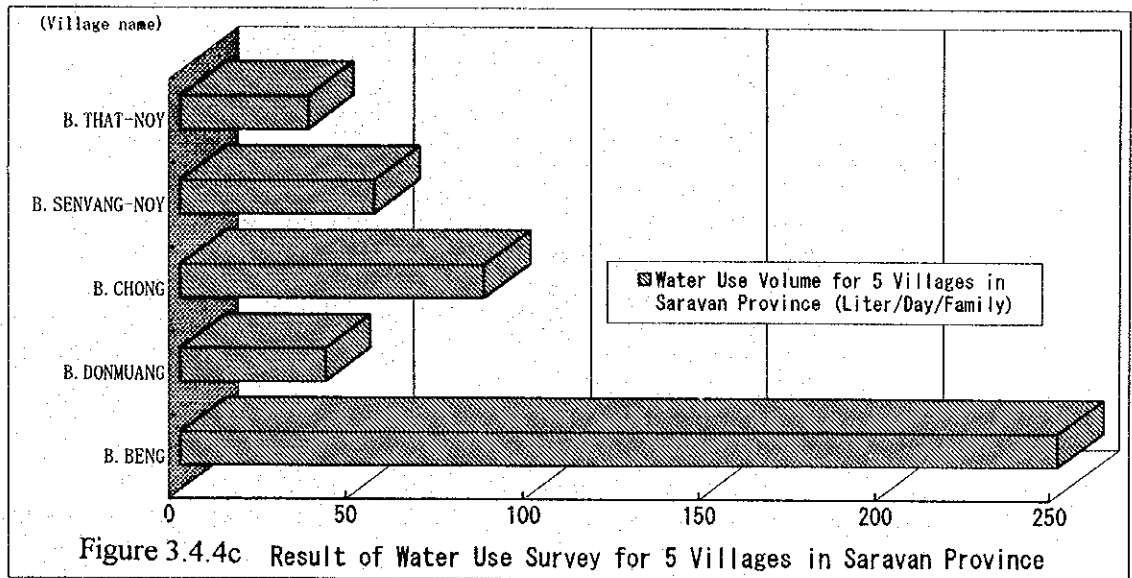


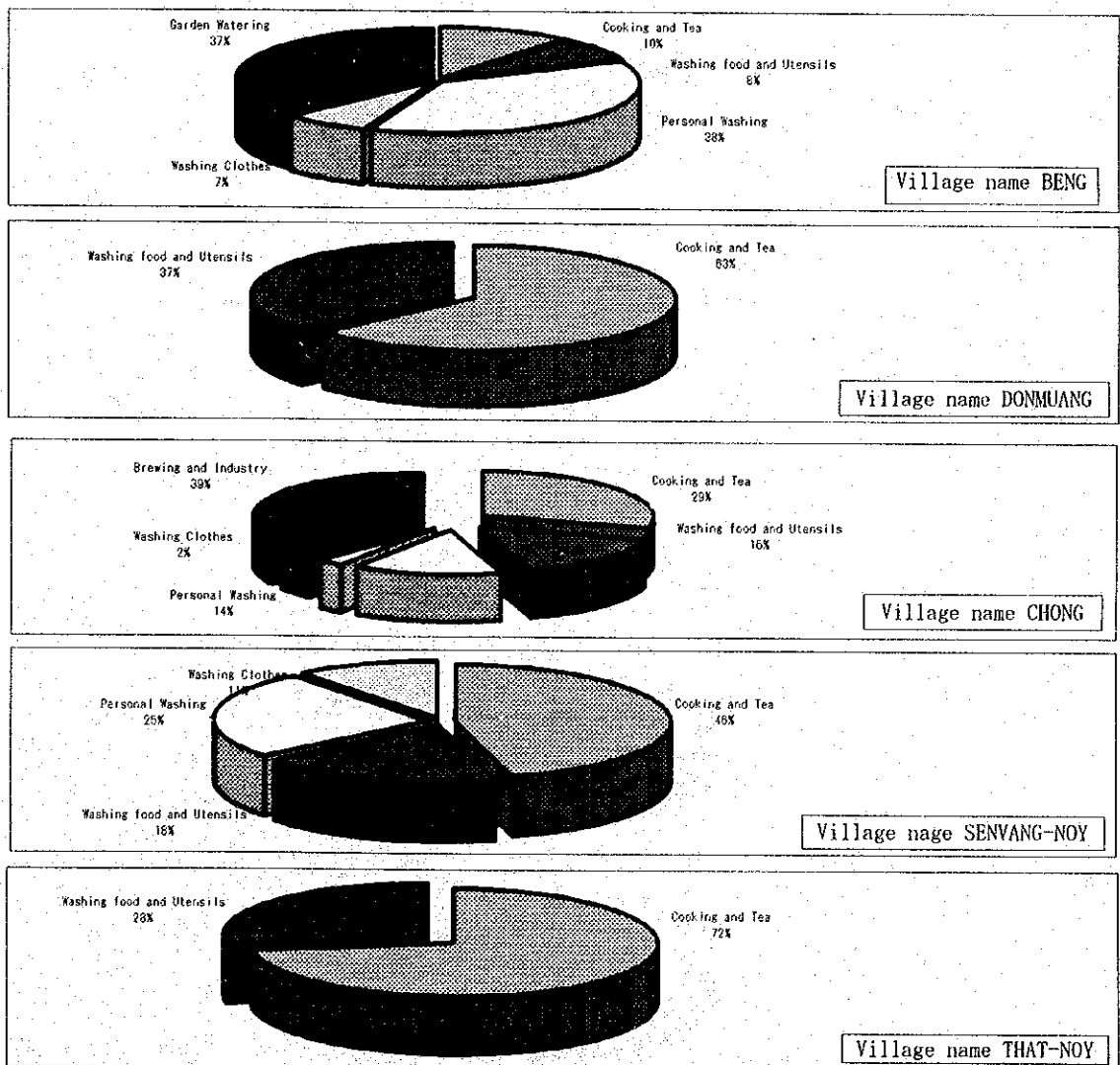
Figure 3.4.4b Distribution of Access to Water Source

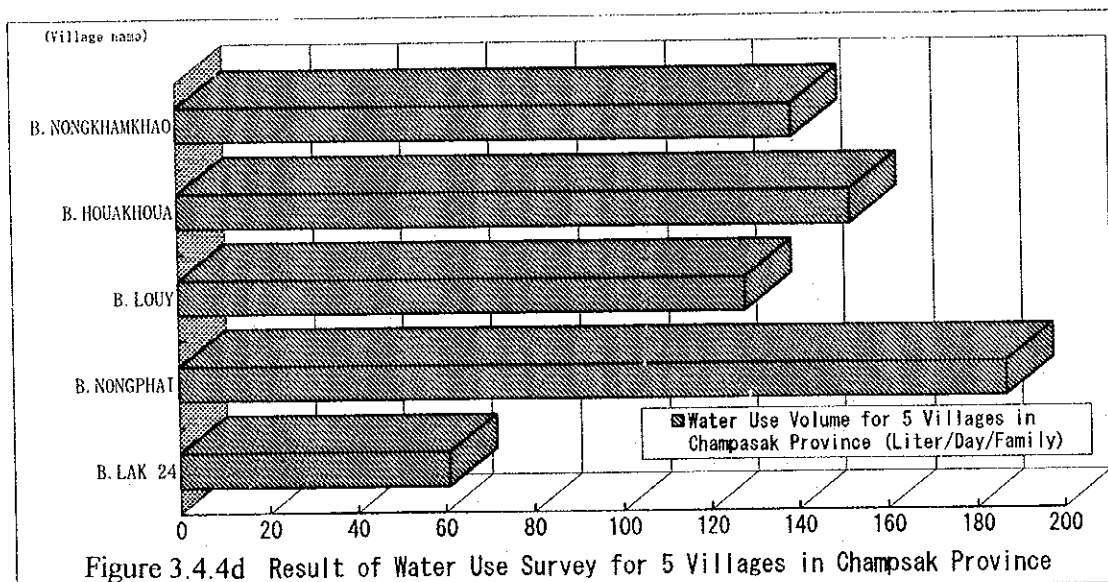




* Databased on questionnaire

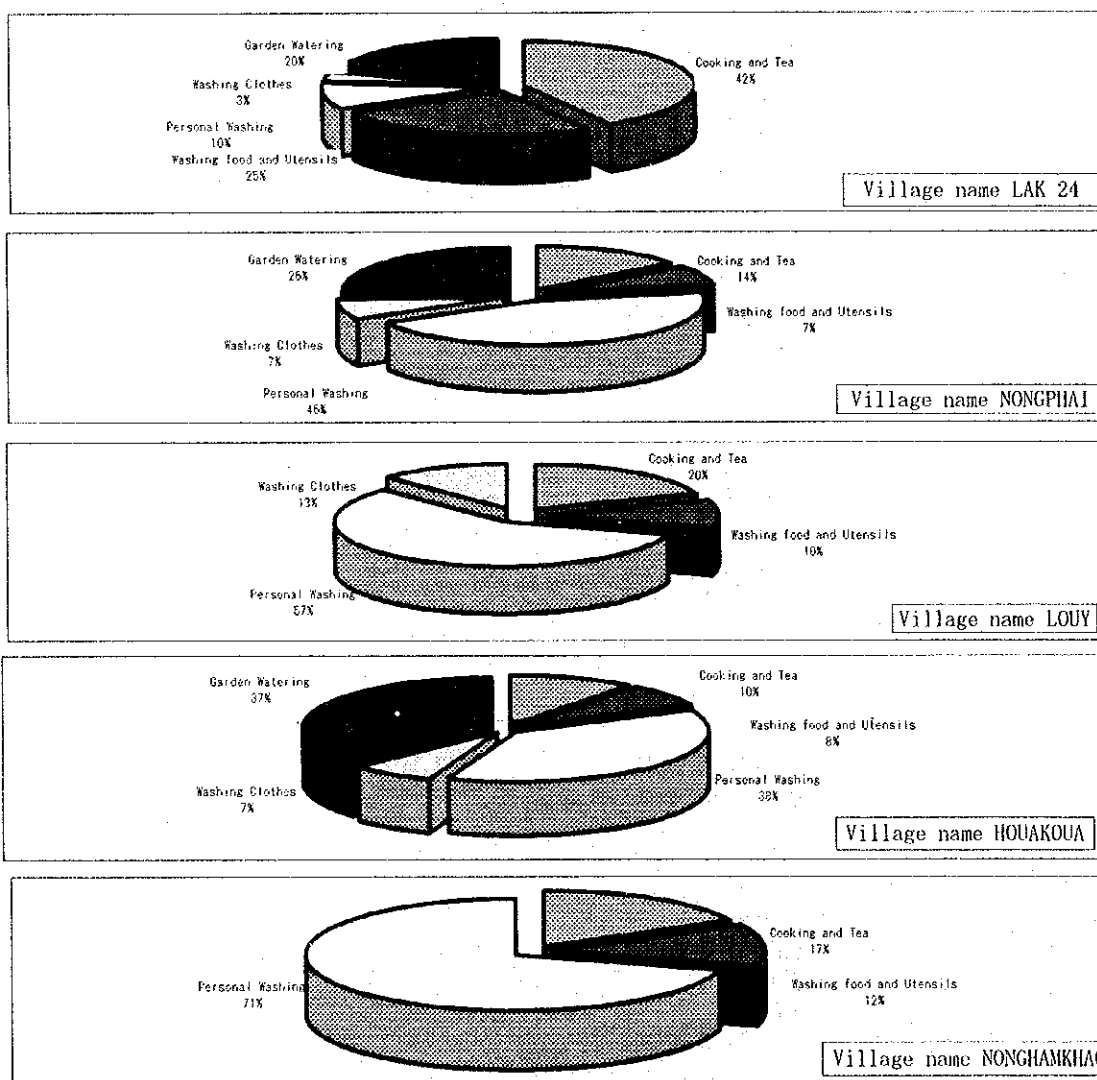
Percentage of each Water Use in Family





* Databased on questionnaire

Percentage of each Water Use in Family



CHAPTER 4 HYDROGEOLOGY

CONTENTS

4.1 Geomorphology	4-1
4.2 Drainage	4-2
4.3 Geologic and Hydrogeologic Features	4-2
4.4 Hydrogeologic Structure	4-5
4.5 Hydrogeologic Units	4-6
4.6 Test Well Drilling and Pumping Test	4-7
4.6.1 Results of Drilling	4-8
4.6.2 Pumping Tests	4-12

LIST OF TABLES

Table 4.6.1 Quantities of Drilling and Test	4-15
Table 4.6.2 Well Design of Test Wells	4-16
Table 4.6.3(1) Groundwater Level of Test Wells	4-17
Table 4.6.3(2) Groundwater Level of Test Wells	4-18
Table 4.6.4 Pumping Test Wells	4-19
Table 4.6.5 Specific Capacity of Test Wells	4-20
Table 4.6.6 Coefficient of Aquifers	4-21

LIST OF FIGURES

Figure 4.1.1 Schematic Hydrogeologic Map	4-22
Figure 4.3.1 Preliminary Hydrogeologic Map	4-23
Figure 4.3.2 Legend of Preliminary Hydrogeologic Map	4-24
Figure 4.3.3 Stratigraphy of the Study Area	4-25
Figure 4.4.1 Location Map of The Hydrogeologic Profile	4-26
Figure 4.4.2a Hydrogeologic Profile	4-27
Figure 4.4.2b Hydrogeologic Profile	4-27
Figure 4.4.2c Hydrogeologic Profile	4-28
Figure 4.4.2d Hydrogeologic Profile	4-28
Figure 4.4.2e Hydrogeologic Profile	4-29
Figure 4.4.2f Hydrogeologic Profile	4-29
Figure 4.4.2g Hydrogeologic Profile	4-30
Figure 4.5.1 Type of Hydrogeologic Features Based on Geomorphology and Geology	4-31
Figure 4.6.1 Location Map of Test Wells	4-32

Figure 4.6.2(1) Lithology and Specific Capacity of Test Wells	· · · · ·	4-33
Figure 4.6.2(2) Lithology and Specific Capacity of Test Wells	· · · · ·	4-34
Figure 4.6.2(3) Lithology and Specific Capacity of Test Wells	· · · · ·	4-35
Figure 4.6.3(1) Groundwater Level of Test Wells	· · · · ·	4-36
Figure 4.6.3(2) Groundwater Level of Test Wells	· · · · ·	4-37
Figure 4.6.4 Specific Capacities of Aquifers	· · · · ·	4-38

CHAPTER 4 HYDROGEOLOGY

4.1 Geomorphology

The Study Area is divided into six physiographic areas, i.e., mountain, low plain, high plain, basalt slope, escarpment and plateau (see Figure 4.1.1).

Mountain

Mountain area is located in the east and south of the Study Area. In the east, it covers a part of the Annamite Mountain Range. Its altitudes range from 1,000 m to 2,000 m, and it has many V-shaped valleys. The mountain area in the Cambodian border has a rather gentle slope, and the altitudes range from 300 m to 1,300 m.

Low Plain

Low plains are extensively distributed along the Mekong River and its tributaries, i.e., the Xedon River and the Xekong River. The plains are flat due to erosion, and their elevations range from 80 m to 180 m. Paddy fields are found in the plains. The low plains are contiguous to southern edge of the Savannakhet Plain, where the altitudes become higher.

Plateau

The Boloven Plateau with an elevation of about 1,300 m is located in the central part of the Study Area. The plateau consists of basalt. The surface of the plateau is gently undulated. No deep valley is formed, but many spatter cones are found on the plateau.

Basalt slope

Basalt Slope is a wide, gentle slope of the Boloven Plateau. Its elevations range from 120 m to 500 m, and its sediments are composed of basalt lava and volcanic ash ejected from the Boloven. Northwest of the Basalt Slope is being cultivated because of its fertile soil, plenty of rainfall, and accessibility to Pakse and Saravan.

Escarpment

Escarpment is located on the edge of plateau or high plain. West of the Study Area, the eastern edge of the Khorat Plateau, forms a long escarpment in the north-south direction and bounds the Champasak Plain. North of the Study Area, the escarpment of the Savannakhet Plain trends in the east-west direction and divides the Champasak Plain. The elevations of these escarpments range from 400 m to 500 m. The escarpment with elevations of 500 m to 1,000 m surrounds the Bolaven Plateau.

Mesa topography which was formed by differential erosion is also found on the plateau. Most of the steep escarpments are densely covered by vegetation.

High plain

This topography includes the "plain" in the Bolaven Plateau and the "mesa" which is isolated from the low plain. The high plain consists of alternating beds of sandstone and shale. Its mountain ridge is flat like a table. Since its elevation exceeds 1,000 m, and it is surrounded by escarpment, the land is not used for cultivation.

4.2 Drainage

The main rivers of the Study Area are the Mekong River and its tributaries, namely, the Xedon River and the Xekong River. The Xedon River flows towards west, while the Xekong River flows towards south. These tributaries surround the Boloven Plateau.

Inside the Study Area, the Mekong River has a width of one to two kilometers. However, it is reticulated in the downstream and has a width of about 12 km at Khong Island south of the Study Area. Rocks crop out on the river bed, but the terrace sediments consisting of sand, gravel and silt are found on the river side. Wide alluvial plain is not found along the Mekong River, except in the Nong Hai Plain and Champasak Plain.

The Xedon River originates from the Boloven Plateau and the east mountain area. It flows westward north of the Boloven Plateau. It then flows southward at Konxedon and joins the Mekong River at Pakse. Alluvial sediments are found downstream of Konxedon.

The Xekong River originates from the eastern mountains and is joined by smaller rivers from the watershed of the Boloven Plateau. This river flows down to Cambodia.

The discharge is stable in small rivers draining the Boloven Plateau. This plateau is a huge recharge zone for surface water and groundwater. Rainfall infiltrates and flows through the basalt slope. Most streams and rivers are effluent due to groundwater discharge.

4.3 Geologic and Hydrogeologic Features

This section describes the geological and hydrogeologic features of the Study Area based on the field reconnaissance survey and analysis of existing borehole data. The stratigraphic classification presented in the UNICEP report (1990) was adapted basically but modified according to the results of the survey and analysis. A hydrogeological map was prepared as a result of the survey (Figures 4.3.1, 4.3.2 and 4.3.3).

The Paleozoic (PZ, C-P)

The Paleozoic group is distributed in the mountain areas from northwest of Saravan to east of Attopeu, with elevations ranging from 1,000 m to 1,200 m. The formation is composed of slightly folded, metamorphic tuffaceous sandstone, slate and tuff (PZ). These rocks are considered as the hydrogeologic basement due to its hard and compact occurrence.

The flysh type sediments composed of sandstone and slate are distributed in the south of Khong Island. This formation can be correlated with the upper Paleozoic age (C-P). Though it is compact and hard, the formation may be found to have few fissure water.

The Mesozoic (T, J, J-K)

The Mesozoic is composed of Manggian formation, Jurassic shale beds, Champa formation and Dognhen formation in ascending order. Dognhen formation is distributed in the Savannaket area and contains evaporites.

(1) Manggian formation (T)

The Manggian formation crops out in the south of Pathoumphon, i.e., on the left bank of the Mekong River and in the south and east of Attopeu. The erosion terrace along the Mekong River and the gently undulated hill are composed of this formation.

The faults (lineament) in the northwest to southeast direction and perpendicular (northeast to southwest) direction are found; however, no continuity to Jurassic formation is observed. Therefore, this formation may be correlated with the Permian to Triassic age.

This formation consists of hard rhyolitic tuff, quartz porphyry and welded tuff. Although, fissure water may exist, the groundwater potential is low. According to existing borehole data, electric conductivity is 400 to 900 $\mu\text{S}/\text{cm}$ and pH is 7.5 to 7.8. Depths of groundwater table is 8 m to 12 m.

(2) Jurassic shale bed (J)

This formation is distributed in the Champasak Plain with elevations of 100 m to 200 m. It can be correlated with the Khorat Subgroup in Thailand. Some outcrops in Saravan and Attopeu yielded fossils, indicating that this formation may be correlated with the lower Jurassic age (Workman, 1977).

The lithology of this formation shows an evidence of marine sediments, i.e., limestone and marl, in the vicinity of the basement rock. In the Champasak Plain, however, it principally consists of alternating beds of laminated sandstone with abundant muscovite and red sandy shale. Therefore, the formation is considered as continental sediments.

The formation is composed of rhythmical alternation of thin beds with thickness of 20 cm to 30 cm. Sandstone facies is prominent in the south of Konxedon, but shale is abundant in Saravan. Sandstone and shale are medium hard and well jointed with 20 cm to 50 cm spacing. The surface is weathered along the joint. Shale is cracked dispersedly.

The formation is folded in waves with inclinations of 5 to 20 degrees. The axis of fold is parallel to the boundary of the pre-Triassic basement, i.e., the axis trends northwest to southeast in Saravan, northeast to southwest in Attopeu and west-northwest to east-southeast in the south of Konxedon. The thickness of the formation is estimated to be about 1,000 m.

Groundwater exists in the weathered zone and fracture associated with joint and bedding. In the vicinity of Saravan, however, porous sandstone is intercalated in the formation. Groundwater may exist in the intergranular of the beds.

The USAID borehole data shows well yield of 7.8 l/sec at depths shallower than 50 m with casing diameter of 150 mm. The natural groundwater level ranges from 4 m to 12 m below ground surface. Considering that the fold structure is in waves, the deep groundwater in this formation may be confined. The Study Team measured the water quality of existing boreholes: electric conductivity was 300 to 700 $\mu\text{S/cm}$ and pH was 6.5 to 8.0.

(3) Champa formation (J-K)

The mountain ridge at the Thailand border, the flat table plateau on the right bank of the Xedon River and Boloven consist of Champa formation. The formation is also distributed on the mesa topography in the northwest of Saravan. The formation may be correlated with the Khorat Subgroup of the Lower Indosinian Group of Thailand.

The formation is composed of massive, well consolidated quartz sandstone and siltstone. These rocks are anti-erosional due to their property and texture. The flat surface of the plateau and the steep cliff are the distinctive features of this formation.

The boundary between Jurassic shale beds (J) is not clear, but Champa formation (J-K) can be distinguished from its abundant sandstone facies. Springs are found along the cliff, but only few villages are located in this area. Groundwater potential may be low, and groundwater exists in the fracture or weathered zone as perched water.

The field measurement of water quality at existing wells in the northwestern part of Saravan showed an electric conductivity of 700 to 1,000 $\mu\text{S/cm}$, which is higher than in other areas. Water table was 5 m to 18 m below ground surface.

The Tertiary

The Tertiary consists of basalt lava flows which are distributed in the Boloven Plateau. Basalt lava flows can be classified into three formations, i.e., vPg, vNg and vN-Q. However, the lithologies of lava flows are the same. The age of ejection of lava is unknown, but it is later than the Mesozoic since it overlies the Mesozoic in unconformity. Volcanic activity might have continued to Quaternary age as topography of younger volcanic ejecta is well preserved.

This rock is dark gray, hard alkali basalt with columnar joint and onion structure and abundant pores due to bubbling. Occurrence of basalt lava shows volcanic breccia and autobrecciated lava in many places.

vPg is distributed north and south of the Study Area, forming a gentle slope. Surface soil is blown out. Surface slope consists of lava with abundant joints and weathered boulders. Thickness of lava is estimated to be less than 40 m, and it is underlain by Jurassic shale.

Groundwater potential of vPg is very low, but artesian groundwater can be expected in the underlying Jurassic shale.

vNg overlies vPg and is extensively distributed on the Boloven Plateau, burying the space between mountain blocks. It is composed of Jurassic shale and Champa formation. Surface soil

is rather thick. Considering the areal extent of vNg, it may constitute a closed underground basin, thereby groundwater is expected.

Typical outcrop of vN-Q is seen in the vicinity of Paxong and Pakse. The formation is composed of lava flow, scoria and mudflow. Thickness of mudflow with boulders varies from a few meters to several tens of meters, and mudflow's surface is unconsolidated. vN-Q overlies vNg and vPg. These underlying formations have groundwater, and many springs originate from these basaltic formations in the vN-Q area. However, water table is shallow, and groundwater potential varies from place to place. Water quality of existing wells and springs show an electric conductivity of less than 50 $\mu\text{S/cm}$ and pH of 5 to 6.

The Quaternary

The Quaternary consists of talus deposit, fan deposit (Qt) and Alluvial sediments (Qal) along the river. These deposits are composed of sand, silt and clay. Qt is distributed under the cliff in Champasak and Konxedon. Qt is thin and underlain by Jurassic shale.

Qal is mainly distributed in the downstream of the Xedon River and on the right bank of the Mekong River with 4 m to 30 m thickness and consists of fine sand with gravel and silt and partly intercalating clay bed. The formation constitutes good aquifers, but groundwater table is affected by river water level. Since groundwater level declines up to the bottom of the aquifer during dry season, groundwater potential depends on the water level and lithology.

4.4 Hydrogeologic Structure

This section describes the hydrogeologic structure of the Study Area. The locations of hydrogeological cross-sections are presented in Figure 4.4.1 and the cross-sections are shown in Figure 4.4.2.

A-A Section

This section shows the east-west profile along Route 16 from Konxedon to Saravan. Jurassic shale is mainly distributed in this section and overlain by thin basalt lava flow (vPg) and Alluvial sediments. Jurassic shale is folding with an axis in the northwest to southeast direction and tilting at 10 to 20 degrees.

The edge of the older basalt lava flow is distributed and having a thickness of about 40 m. Alluvial sediments with thickness of about 10 m is distributed along the Xedon River and its tributaries. Jurassic shale crops out on the river bed. The main aquifers are the Alluvial sediments and the weathered zone of Jurassic shale. Jurassic shale may have confined groundwater in the syncline area and under the basalt lava flow.

B-B Section

This section shows a profile in the north-south direction at the central part of Saravan Province. The area is mainly composed of basalt slope underlain by Jurassic shale. Basalt lava flows cover the area. They consist of older vPg to younger vN-Q. Thickness of lava flow is estimated to be

40 m and 260 m in the vicinity of Route 16 and Route 20, respectively. Surface volcanic ash and mudflow may become water table aquifers, while the formation overlying the lava flow may have confined groundwater.

C-C Section

This section shows the hydrogeological profile from Chong Mek at Thailand border to Pakse and Paxong. Jurassic shale is extensively distributed, overlying the Paleozoic basement. Jurassic shale is faulted and overlain by basalt lava flow from east of Pakse. Groundwater is recharged in Boloven and flows down towards west. Unconfined groundwater exists in the mudflow of vN-Q in the basalt slope from Boloven to Pakse, but weathered zone of Jurassic shale becomes aquifer in the west of Pakse.

D-D Section

This section shows the profile of the southwestern slope of the Boloven Plateau. The escarpment consists of Jurassic shale, and Champa formation bounds the plateau and the basalt slope. The basalt slope extends downward from the escarpment at elevations 150 m to 300 m. The southern part is underlain by the Manggian formation which constitutes the basement in this area. Basalt lava is hard and constitutes aquifuge, but the underlying Jurassic formation may have confined groundwater.

E-E, F-F, G-G Sections

These sections represent the west-east hydrogeological profiles which cross the Mekong River. The Champasak Plain edges on the right bank of the Mekong River, while either the edge of lava flow or the Triassic Manggian formation is distributed on the left bank. Alluvial sediments with thickness of 10 m to 30 m are distributed along the Mekong River. The main aquifers are composed of Alluvial sediments (Qal) and the weathered zone of the Jurassic shale. Water table is shallow, and the unconfined groundwater flows down to the Mekong River.

4.5 Hydrogeologic Units

Based on its geology and topography, the Study Area can be classified into ten (10) hydrogeological units (Figure 4.5.1). A groundwater potential map is presented in Figure 4.5.2:

Qf: This unit of Alluvial sediments with thickness of 4 m to 30 m consists of sand, gravel and silt. The basement of Alluvial sediments is composed of Jurassic sandstone and red shale. The Alluvial aquifer is thin; thus, the groundwater can be taken from the underlying Jurassic formation.

Qt: This unit consists of talus and fan deposits. The flat erosion surface underlain by Jurassic shale is covered by thin deposition. The geologic structure is similar to Qf, but its aquifer is very thin. The shallow groundwater has low potential and seasonal fluctuation.

Ep: This unit is an erosion plain with no surface deposition. Jurassic shale crops out on the surface. The weathered zone of shale constitutes an aquifer. Groundwater table is shallow. Confined groundwater may exist in deeper layers.

Eh: This hilly unit is more undulated than Ep. The weathered zone constitutes an aquifer, but the groundwater table is deep.

Ba1: Basalt slope consists of vN-Q. This unit is underlain by thick volcanic ash and mudflow with boulders. The groundwater table is deep. Unconfined water or perched water exists in the sediments. The basalt lava constitutes the hydrogeologic basement.

Ba2: Basalt slope consists of vNg. Thin volcanic deposits cover the surface. Unconfined or perched water exists in the sediments. The basalt lava constitutes the hydrogeologic basement, but confined groundwater may exist in the lower basalt lava.

Ba3: Basalt slope consists of vPg. No surface deposition is found on the slope. Groundwater may exist in the fissure. Underlying Jurassic shale may have confined groundwater.

Et: The area consists of acidic volcanic rocks of the Triassic age. The topography is an erosion terrace and plain. Thin deposits cover the surface. Groundwater may exist in the fissure.

P: This unit consists of gently undulated plain, and in the higher elevation, it is composed of hard formation (J-K). Groundwater may exist in the fissure.

M: Mountain area consists of hard and compact rock, which constitutes the hydrogeologic basement.

4.6 Test Well Drilling and Pumping Test

Test well drillings and pumping tests were conducted at twenty (20) villages in the Study Area (Figure 4.6.1). These villages were selected from 200 villages in Champasak and Saravan Provinces considering the hydrogeologic unit and conditions of existing water source. Detail of the selection procedure is explained in the Supporting Report. The planned number and depth of well are 18 wells for 50 m depth and 2 wells for 100 m depth. The drilling locations were determined by field geological and geophysical surveys considering the ease of access for village people. The quantity and testing items are presented in Table 4.6.1, and details of the well are presented in Table 4.6.2. Down-the-hole drilling method was used for all test wells. The total drilling depth is 1,146 m, and the total casing length is 1,090.5 m. The 150 mm diameter casing was used.

4.6.1 Results of Drilling

Table 4.6.2 and Figure 4.6.2 present the elevation of the ground surface, lithology, screen position, and specific capacity of the test wells.

C-4B. Nongphai

This well is located on the erosion hill and was drilled up to the depth of 50 m. The formation consists of hard, consolidated and alternating beds of sandy shale and sandstone of Jurassic age. From the surface to 5 m depth, it is covered by weathered sandstone. It consists of fine to medium sandstone from 5 m to 36 m and compact sandy shale from 36 m to 50 m. This sandstone contains groundwater and forms an aquifer. Groundwater level is 9 m below ground surface.

C-4B. Houaxe

The test well is located on the erosion hill at 115 m in elevation. The well was drilled up to the depth of 182 m because no good aquifers were encountered. The formation is composed of alternating beds of hard and consolidated sandstone, sandy shale and mudstone. The surface soil is composed of weathered sandstone. From 4 m to 35 m, it consists of very hard fine and medium sandstone. Compact sandy shale was encountered from 36 m to 110 m, and the alternating beds of sandstone and shale from 110 m to 182 m. No aquifers were encountered up to the depth of 60 m. Very poor aquifer was found at thin sandy bed at the depth of 60 m. Dark brownish gray, hard, medium sandstone was encountered at the depth of 109 m. This sandstone has thickness of 35 m and contains groundwater. However, groundwater is salinized. EC measured on-site showed more than 10,000 $\mu\text{mho/cm}$. SP logging data also indicates low potential in this sandstone. The well was drilled up to the depth of 182 m in order to obtain more productive aquifer. Another screen was set between 156 m and 180 m. Groundwater level is about 18 m below ground surface.

C-16B. Louy

The well is located on the erosion hill of 150 m in elevation. The well depth is 48 m. The formation is composed of alternating beds of hard and consolidated sandstone, conglomerate, sandy shale and mudstone of Jurassic to Cretaceous age. The surface soil consists of clay bed containing gravel with thickness of 6 m. The surface soil is underlain by gravel and laterite at about 1 m thickness. The formation consists of gravel bed from 9 m to 23 m and alternating beds of sandstone and mudstone. Groundwater is contained in the gravel and sandstone. Groundwater level is 7 m below ground surface.

C-44B. Thongsala

The well was drilled up to the depth of 43 m on the basalt slope at 220 m in elevation. The formation consists of very hard basalt lava and alternating beds of sandstone and sandy shale of Jurassic age. The surface soil is composed of the weathered basalt. The formation comprises of autobrecciated lava with rich pore spaces from the depth of 2 m to 23.5 m. It mainly consists of sandy shale intercalating sandstone from the depth of 23.5 m to 43 m. The autobrecciated lava forms an aquifer. Groundwater level is 9 m below ground surface.

C-49B. Lak-21

The well was drilled up to the depth of 60 m on the basalt slope at 442 m in elevation. The formation consists of mudflow deposits and highly weathered basalt lava. The surface soil is composed of the weathered clay of mudflow deposits. The formation comprises of clayey and

weakly consolidated mudflow deposits containing boulders, which is underlain by strongly weathered basalt. The basalt lava forms an aquifer, however, its productivity is not so high because of strong weathering. Groundwater level is 14 m below ground surface.

C-65B. Lak-24

The well is located on the erosional plain at 100 m in elevation. The well depth is 50 m. The formation consists of consolidated hard alternating beds of sandstone and reddish-purple mudstone. The surface soil is composed of a 2-m thick clay bed and underlying a 6-m thick laterite. The formation is composed of medium sandstone from the depth of 9 m to 23 m and compact sandy shale from 24 m to 44 m. The sandstone bed forms an aquifer, and groundwater level is 7 m below ground surface.

C-75 B. Nongkhe

It is located on the alluvial plain at 95 m in elevation. The well was drilled up to the depth of 50 m. The formation consists of sandy clay up to the depth of 11 m and reddish-purple mudstone of Jurassic age intercalating sandstone from the depth of 12 m to 50 m. The sandstone forms an aquifer. Groundwater level is 4 m below ground surface.

C-79 B. Samkhanaboua

The well is located on the erosion hill at elevation 96 m. The well depth is 45 m. The formation consists of sandy clay and reddish-purple shale of Jurassic age intercalating sandstone. The surface soil is composed of 7-m thick clay bed. The formation comprises of hard shale intercalating thin sandstone from the depth of 8 m to 45 m. The fissures of sandstone and shale contain groundwater and form an aquifer. Groundwater level is 7.5 m below ground surface.

C-88 B. Maisivilai

The well is located on the erosion hill and was drilled up to the depth of 50 m. The formation is composed of alternating beds of sandy shale, black shale and hard sandstone of Carboniferous to Permian age. The surface soil consists of weathered clay. The formation is mainly composed of black slate intercalating thin sandstone from the depth of 9 m to 50 m. Fissures and faults are abundant in the black slate. Groundwater may occur in these fissures and faults. Groundwater level is 9.5 m below ground surface.

C-89 B. Nasenphan

The well depth is 50 m. It is located on the erosion hill at elevation 88 m. The formation consists of sandy clay and dacitic tuff of Triassic age. The surface soil is composed of weathered clay. The formation mainly comprises of hard massive tuff from the depth of 5 m to 50 m. Joints, fissures and faults are found abundantly, and they contain groundwater. Groundwater level is 5.8 m below ground surface.

S-4 B. Houaykapho

The well is located on the erosion hill at elevation 160 m. The depth of the well is 45 m. The formation consists of alternating beds of hard consolidated sandstone, sandy shale and mudstone from Jurassic to Cretaceous age. The surface soil is composed of 7-m thick weathered sandstone. The formation consists of sandstone from the depth of 8 m to 41 m and reddish-purple mudstone from 42 m to 45 m. A part of the sandstone constitutes an aquifer, and groundwater level is 9 m below ground surface.

S-12 B. Nongsano

It is located on the erosion hill at elevation 160 m. The well was drilled up to the depth of 50 m. The formation consists of alternating beds of hard and consolidated mudstone, sandstone and sandy shale of Jurassic age. The surface soil is composed of weathered mudstone. The formation comprises of reddish-purple mudstone from the depth of 7 m to 43 m and medium sandstone from 43 m to 50 m. The sandstone forms an aquifer, and the groundwater level is 6.5 m below ground surface.

S-24 B. Donmuang

The well is located on the terrace and was drilled up to the depth of 50 m. The formation consists of hard consolidated mudstone, sandstone and sandy shale of Jurassic age. The surface soil is composed of 10-m thick clay bed of fluvial deposit. The formation comprises of alternating beds of reddish-purple mudstone and sandstone from 11 m to 50 m. A part of the sandstone forms an aquifer. Groundwater level is 10 m below ground surface.

S-38 Nongngong

The well is located on the erosional plain at elevation 140 m. The well depth is 50 m. The formation mainly consists of alternating beds of hard consolidated mudstone, sandstone and sandy shale. The surface soil consists of 6-m thick weathered sandstone. The formation is composed of alternating beds of reddish-purple mudstone, and medium sandstone. A part of the sandstone forms an aquifer. Groundwater level is about 8 m below ground surface.

S-50 B. Samia

The well is located on the terrace at elevation 145 m. The well depth is 50 m. The formation consists of alternating beds of hard consolidated mudstone, sandstone and sandy shale. The surface soil is composed of sand and clay beds of fluvial deposits. The formation comprises of alternating beds of reddish-purple mudstone and sandstone from the depth of 12 m to 50 m. Groundwater is contained in the sand bed of the fluvial deposits and Jurassic sandstone. Groundwater level is about 7 m below ground surface.

S-56 B. Chong

The well is located on the basalt slope at elevation 170 m. The well depth is 50 m. The formation consists of hard basalt lava and alternating beds of sandstone and mudstone of Jurassic age. The surface soil is composed of 6-m thick weathered basalt lava. The formation comprises of

autobrecciated basalt lava with abundant pore spaces from the depth of 7 m to 15 m. It consists of alternating beds of reddish-purple mudstone and sandstone from the depth of 16 m to 50 m. The autobrecciated basalt lava and sandstone form an aquifer. Groundwater level is 5 m below ground surface.

S-64 B. Phonphai

It is located on the erosional plain at elevation 190 m. The well depth is 50 m. The formation consists of alternating beds of hard consolidated mudstone, sandstone and sandy shale. The surface soil is composed of weathered sandstone. From the depth of 3 m to 50 m, the formation comprises of alternating beds of reddish-purple mudstone and medium sandstone. A part of the sandstone forms an aquifer. Groundwater level is 10 m below ground surface.

S-75 B. Nakasao

The test well is located on the erosional plain at elevation 194 m. The well depth is 50 m. The formation consists of hard consolidated alternating beds of mudstone, sandstone and sandy shale of Jurassic age. The surface soil is composed of weathered sandstone. From the depth of 4 m to 50 m, the formation is composed of alternating beds of reddish-purple mudstone and fine sandstone. A part of the sandstone forms an aquifer. Groundwater level is 5 m below ground surface.

S-84 B. Beng

The test well is located on the basalt at the elevation 308 m. The well depth is 66 m. The formation consists of hard basalt lava and sandstone of Jurassic or Cretaceous age. The surface soil is composed of weathered basalt. The formation comprises of basalt lava, autobrecciated lava with abundant pores and fissures from the depth of 4 m to 57 m. From 58 m to 66 m, medium sandstone exists. The autobrecciated basalt lava forms a good aquifer. Groundwater level is 19 m below ground surface.

S-100 B. Hountai

The well is located on the basalt slope at elevation 520 m. The well depth is 54 m. The formation consists of loam (mudflow deposits) and strongly weathered basalt lava. From the surface to 10 m, it is composed of weathered mudflow deposits. Weakly consolidated weathered basalt is found from the depth of 11 m to 38 m. Hard basalt underlies from the depth of 38 m to 54 m. The basalt lava forms an aquifer, however, its productivity is not so high because of weathering. Groundwater level is 20 m below ground surface.

Groundwater levels in the test wells

Groundwater levels were measured periodically during the dry season from December, 1994 to January, 1995. The results of measurements are presented in Table 4.6.3 and Figure 4.6.3. The observation of groundwater levels suggests the following:

- a) Groundwater levels of the test wells range from 4 m to 21 m.

- b) On the basalt slope of the Bolaven Plateau (C-44, 49, S-84, 100), it ranges from 8 m to 21 m.
- c) Groundwater levels on the erosion hill and plain are generally shallower than on the basalt slope. It ranges from 4 m to 10 m.
- d) Groundwater levels have declined during the above mentioned measurement period.

The rate of decline is 0.06 m/day in the basalt slope, while it shows 0.02 m/day in the erosion hill and plain. The lowest groundwater level in the dry season can be estimated by multiplying this rate by the number of remaining days of the dry season.

4.6.2 Pumping tests

The step-drawdown, constant discharge and recovery tests were performed in order to obtain the aquifer constants. The pumping tests data were analyzed by using Theis, Jacob and Jager methods (Table 4.6.4).

(1) Transmissivity and storativity

Table 4.6.5 presents the aquifer constants Transmissivity (T), Permeability (k) and Storativity (S) by method of analysis. The mean constant was calculated by using the results of analysis by leakage method and recovery method. The mean aquifer constants of other test wells, which were not analyzed by the leakage method, were calculated using all values obtained by other methods of analysis.

The transmissivity changes from place to place, ranging from 0.8 m²/day to 1,500 m²/day (Figure 4.6.8). It shows 1,500 m²/day in B. Beng and 800 m²/day in B. Thongsala. Both villages are located on the basalt slope in the Bolaven Plateau. The lowest transmissivity is found at B. Hountai and Nongphai, 0.8 m²/day. In Nogkhe and B. Phonphai, it is 200 m²/day, while it ranges from 1.5 to 40 m²/day in other villages.

(2) Specific capacity

The specific capacity (Sc) is the expression of the unit discharge per one meter drawdown. The productivity of the aquifer and the well can be easily evaluated from the specific capacity. It was calculated by using the drawdown and the pumping rate at stable conditions during the pumping test.

The highest specific capacity is found in B. Thongsala and B. Beng, ranging from 1,700 to 1,900 m³/day/m, while the lowest is 1 m³/day/m in B. Nongphai, showing a big regional difference. Rather high values are found in B. Nogkhe and B. Phonphai, 128 and 165 m³/day/m, respectively. The specific capacity of other test wells ranges from 2.6 to 45 m³/day/m.

(3) Optimum discharge

An optimum discharge rate of the test well was evaluated by using the step-drawdown test data (Table 4.6.5). Taking the critical water level found on the linear relation between pumping rate (Q) and drawdown (s), the critical pumping rate can be determined. In addition to this, stable water level and recovery time during pumping test were considered. An optimum discharge rate was calculated by multiplying the drawdown by the specific capacity.

The results show that the 3,800 m³/day of pumping is possible in B. Beng and 1,700 m³/day in B. Thongsala. The optimum pumping rate of more than 150 m³/day is found in B. Nongkhe, B. Chong and B. Phonphai. It ranges from 9 to 140 m³/day in the other 15 villages. The lowest optimum discharge is found at B. Nongphai, 9 m³/day. This well may be dried up by a hand pump.

(4) Aquifer and hydraulic constants

The hydraulic constants by aquifer is presented in Table 4.6.6 and Figure 4.6.4. The Study Area is geologically divided into 4 units: (a) Jurassic formations consisting of sandstone, red shale and mudstone, (b) basalt in the Bolaven Plateau, (c) acidic tuff of Triassic age and (d) slate and sandstone of Paleozoic age. Groundwater occurs mainly in the fractures of sandstone, basalt, acidic tuff and slate.

(a) Jurassic sandstone, red shale and mudstone (alternating beds)

The formation forms the basement of the plain along the Mekong River and the Xedon River and a small hill.

T:	0.78 to 219 m ² /day
k:	1.59×10^{-02} to 3.26×10^{-05} cm/sec
S:	0.04 to 0.7
Sc:	1.0 to 165 m ³ /day/m

(b) Basalt zone

The basalt lava, volcanic ash and loam are distributed in the north and west of the Bolaven Plateau.

T:	0.74 to 1,500 m ² /day
k:	7.76×10^{-02} to 3.58×10^{-05} cm/sec
S:	0.1 to 0.8
Sc:	2.9 to 1,900 m ³ /day/m

The specific capacity values obtained in B. Beng and B. Thongsala ranges from 1,700 to 1,900 m³/day/m. This formation intercalates two to three layers of basalt lava (autobrecciated lava, vNg). The other two wells show very small specific capacities, ranging from 2.9 to 19.7 m³/day/m in B. Lak 21 and B. Hountai. The basalt in this area is strongly weathered, and the weathered bed is thick. The aquifer constants varies widely from place to place in the basalt zone.

(c) Acidic tuff of Triassic age

This formation is distributed in the south of the Study Area, on the left bank of the Mekong River, and consists of acidic tuff (acidic welded tuff).

T: 3.04 m²/day
k: 1.47×10^{-04} cm/sec
S: 0.047
Sc: 4.6 m³/day/m

Groundwater occurs in the fractures of rocks. The specific capacity becomes higher in those areas where the faults and fractures are abundant.

(d) Paleozoic slate

This formation is distributed in the most southern part of the Study Area. The formation is composed of hard slate and sandstone partly intercalating calcareous rocks. Groundwater occurs in the fractures.

T: 23.1 m²/day
k: 9.53×10^{-04} cm/sec
S: 0.18
Sc: 37 m³/day/m

Table 4.6.1 Quantities of Drilling and Test

No.	Location	Drilling Depth(m)	Well Depth(m)	S.W. I (G/m)	Log _e sp	Log _e port	Log _e S ₁ Lon	Log _e G area	Geo Log	P/NB st. S	P/Test Con timous	P/Test Rec overy
C-15	B. HONGHAT	50	49	9	*	*	*	*	*	4	24 h	12 h
C-16	B. HOUAT	182	180	17.75	*	*	*	*	*	4	24 h	12 h
C-16	B. HOUAT	48	48	6.52	*	*	*	*	*	4	24 h	12 h
C-24	B. THONGSAI	43	25	8.8	*	*	*	*	*	4	24 h	12 h
C-29	B. LAUK-21	60	45	13.45	*	*	*	*	*	4	24 h	12 h
C-55	B. LAUK-24	50	49	7.12	*	*	*	*	*	4	24 h	12 h
C-73	B. HONGHAT	50	50	3.06	*	*	*	*	*	4	24 h	12 h
C-73	B. HONGHAT	45	43	7.5	*	*	*	*	*	4	24 h	12 h
C-88	B. HONGHAT	50	50	10	*	*	*	*	*	4	24 h	12 h
C-88	B. HONGHAT	50	50	5.78	*	*	*	*	*	4	24 h	12 h
S-1	B. HOUAT	45	42	8.67	*	*	*	*	*	4	24 h	12 h
S-12	B. HONGHAT	50	50	6.5	*	*	*	*	*	4	24 h	12 h
S-24	B. HONGHAT	50	50	10.18	*	*	*	*	*	4	24 h	12 h
S-38	B. HONGHAT	50	49	7.55	*	*	*	*	*	4	24 h	12 h
S-50	B. HONGHAT	50	49.5	7.05	*	*	*	*	*	4	24 h	12 h
S-50	B. HONGHAT	50	49	4.29	*	*	*	*	*	4	24 h	12 h
S-50	B. HONGHAT	50	50	9.85	*	*	*	*	*	4	24 h	12 h
S-50	B. HONGHAT	53	50	5.7	*	*	*	*	*	4	24 h	12 h
S-50	B. HONGHAT	66	60	17.26	*	*	*	*	*	4	24 h	12 h
S-100	B. HONGHAT	54	52	19.4	*	*	*	*	*	4	24 h	12 h
S-100	B. HONGHAT	1146	1090.5									

Table 4.6.2 Well Design Of Test Wells

No.	Location	Elevation (m)	Drill Method	Drill Depth (m)	Water Level (G.L.-m)*	Well Depth (m)	Casing Dia. (mm)	Casing Pipe	Screen (G.L.-m)	Geo. Type	Aquifer	Pump Type	Wellers Pump (G.L.-m)	Date Completed
									Total (m)	Open Area (%)				
C-4	B. Nonghai	115	Top-300 D.H.	50	12	49	150	P.V.C.	11-31	6.7	Eh	India M3	33	Feb/'95
C-8	B. Houare	120	Top-500 D.H.	182	19	180	150, 100	Steel	66-72, 90-96, 108-132, 156-180	15	Eh	Jura. sandstone	84	Feb/'95
C-16	B. Louy	150	Top-300 D.H.	48	10	48	150	P.V.C.	6-10, 14-22, 38-46	6.7	Eh	Jura. -Creta. Sandstone	27	Feb/'95
C-44	B. Thongsala	220	Top-300 D.H.	43	13	25	150	P.V.C.	11-23	6.7	Ba2	Jura. Sandstone, Conglo.	21	Feb/'95
C-49	B. Lak-21	442	Top-300 D.H.	60	22	45	150	P.V.C.	23-35	6.7	Ba1	N-Q Basalt	36	Feb/'95
C-65	B. Lak-24	100	Top-500 D.H.	50	10	49	150	P.V.C.	11-15, 19-23, 39-47	6.7	Eh	Jura. Sandstone	30	Feb/'95
C-75	B. Nongthe	95	Top-500 D.H.	50	7.5	50	150	P.V.C.	16-20, 28-36, 40-48	6.7	Qf	Q Sand. Jura. Sandy Shale	24	Feb/'95
C-79	B. Saakhanaboua	96	Top-300 D.H.	45	10	43	150	P.V.C.	9-13, 17-29, 37-41	6.7	Eh	Jura. Sandy Shale	30	Feb/'95
C-88	B. Maisivilai	85	Top-500 D.H.	50	16	50	150	P.V.C.	20-48	6.7	Et	Paleozoic Slate	33	Feb/'95
C-89	B. Naserphan	88	Top-500 D.H.	50	7.4	50	150	P.V.C.	16-20, 28-48	6.7	Et	Triassic Acidic Tuff	30	Feb/'95
S-4	B. Houaykepbo	160	Top-300 D.H.	45	13	42	150	P.V.C.	12-28, 36-40	6.7	Eh	Jura. -Creta. Sandstone	27	Feb/'95
S-12	B. Nongsano	160	Top-300 D.H.	50	9	50	150	P.V.C.	12-20, 24-28, 32-48	6.7	Eh	Jura. Sandstone	30	Feb/'95
S-24	B. Donnuang	130	Top-500 D.H.	50	13	50	150	P.V.C.	28-44	6.7	Qf	Jura. Sandstone	24	Feb/'95
S-38	B. Nonggong	140	Top-500 D.H.	50	10	49	150	P.V.C.	23-35, 39-43	6.7	Eh	Jura. Sandstone	24	Feb/'95
S-50	B. Saia	145	Top-500 D.H.	50	10	49.5	150	P.V.C.	22.5-48.5	6.7	Qf	Q Sand. Jura. Sandstone	27	Feb/'95
S-56	B. Chong	170	Top-500 D.H.	50	7.5	49	150	P.V.C.	15-23, 31-43	6.7	Ba3	N-Q Basalt. Jura. Sandsto	30	Feb/'95
S-64	B. Phonphai	190	Top-500 D.H.	50	12.2	50	150	P.V.C.	20-24, 32-44	6.7	Eh	Jura. Sandstone	27	Feb/'95
S-75	B. Nakasao	184	Top-500 D.H.	53	7	50	150	P.V.C.	12-16, 28-48	6.7	Eh	Jura. Sandstone	27	Feb/'95
S-84	B. Beng	308	Top-500 D.H.	66	24.4	60	150	Steel	18-48	15	Ba2	N-Q Basalt	51	Feb/'95
S-100	B. Houn-Tai	520	Top-500 D.H.	54	28.6	52	150	P.V.C.	9-21, 34-46	6.7	Ba1	N-Q Basalt. Loam	42	Feb/'95

D.H. - Down-the Hole Hammer, *Dryseason (Presumed)

R.T. - Rotary Tricon Bit

* GRUNDPOS SP5A-21, H-82m, 2.2kw, 5m³/h, 2830R/min

** GRUNDPOS SP14A-10, H-48m, 3.7kw, 14m³/h, 2830R/min

Table 4.6.3(1) Groundwater Level of Test Wells (G.L.-m)

日付	観測点	観測点	観測点	観測点	観測点	観測点	観測点	観測点	観測点	観測点	観測点	観測点
日付	観測点	観測点	観測点	観測点	観測点	観測点	観測点	観測点	観測点	観測点	観測点	観測点
17/11/94												
18/11												
21/11												
24/11												
12/12												
15/12												
17/12												
22/12												
23/12												
24/12												
27/12												
30/12												
01/01/95												
04/01												
05/01												
09/01												
14/01												
18/01												
19/01												
23/01												
25/01												
26/01												
30/01												
31/01												

Table 4.6.3(2)

[illegible]

Table 4.6.4 Pumping Test Wells

N.o.	Location	Elevation(m)	Well Depth(m)	Casing(m)	Screen (G.L-m)	S.W. L. (G.L-m)	Aquifer	Pump	Generator	Date Completed
C-4	CHAMPASAK									
C-8	B-NONGPHAI	115	49.0	150	11-31	9.00	Jura Sandstone.	GRUNDFOS 1.5HP	3KW	07/Jan/95
C-16	B-HOUANE	120	180.0	150	66-72, 90-96, 108-132, 156-180	17.75	Jura-Creta Sandstone	GRUNDFOS 2.2HP	5KW	11/Jan/95
C-44	B-LOUY	150	48.0	150	6-10, 14-22, 38-46	6.52	Jura Sandst. Conglo.	GRUNDFOS 2.2HP	5KW	06/Jan/95
C-49	B-THONGSALA	220	25.0	150	11-23	8.80	N-Q Basalt.	GRUNDFOS 1.5HP	5KW	26/Dec/94
C-65	B-LAK-21	442	45.0	150	23-35	13.45	N-Q Basalt.	GRUNDFOS 2.2HP	5KW	30/Dec/94
C-75	B-NONGKHE	100	49.0	150	11-15, 19-23, 39-47	7.12	Jura Sandstone.	GRUNDFOS 2.2HP	5KW	15/Jan/95
C-79	B-SAMHANABOUA	95	50.0	150	16-20, 28-36, 40-48	3.06	Q. Jura. Sandy shale.	GRUNDFOS 2.2HP	5KW	17/Jan/95
C-88	B-MAISIVITAI	96	43.0	150	9-13, 17-29, 37-41	7.50	Jura. Sandy shale.	GRUNDFOS 1.5HP	3.5KW	19/Jan/95
C-89	B-NASEMPHAN	85	50.0	150	20.0-48.0	10.00	Paleozoic Slate.	GRUNDFOS 1.5HP	3.5KW	22/Jan/95
S-4	SARAVAN	88	50.0	150	16-20, 28-48	5.78	Triassic Acidic Tuff	GRUNDFOS 2.2HP	5KW	25/Jan/95
S-12	B-HOUATAPHO	160	42.0	150	12-28, 36-40	8.67	Jura-Creta Sandstone	GRUNDFOS 2.2HP	5KW	13/Jan/95
S-24	B-NONGSANO	160	50.0	150	12-20, 24-28, 32-48	6.50	Jura Sandstone.	GRUNDFOS 1.5HP	3KW	14/Jan/95
S-38	B-DOMMUANG	130	50.0	150	28-44	10.18	Jura Sandstone.	GRUNDFOS 2.2HP	5KW	04/Jan/95
S-50	B-NONGKONG	140	49.0	150	23-35, 39-43	7.55	Jura Sandstone.	GRUNDFOS 1.5HP	3KW	04/Jan/95
S-56	B-SAMIA	145	49.5	150	22.5-43.5	7.05	Q. Jura. Sandstone.	GRUNDFOS 1.5HP	3KW	02/Jan/95
S-64	B-PHONG	170	49.0	150	15-23, 31-43	4.29	N-Q Ba. Jura. Sandst.	GRUNDFOS 2.2HP	5KW	02/Jan/95
S-75	B-PHONPRAT	190	50.0	150	20-24, 32-44	9.85	Jura Sandstone.	GRUNDFOS 1.5HP	3KW	31/Dec/94
S-84	B-NAVASAO	194	50.0	150	12-16, 28-48	5.70	Jura Sandstone.	GRUNDFOS 1.5HP	3KW	30/Dec/94
S-100	B-BENG	308	60.0	150	18-48	17.26	N-Q Basalt.	GRUNDFOS 2.2HP	5KW	31/Dec/94
	B-HOUN-TAI	520	52.0	150	9-21, 34-46	19.40	N-Q Basalt.	GRUNDFOS 1.5HP	5KW	27/Dec/94

Table 4.6.5 Specific Capacity of Test Wells

No.	Location	Q l/min	Drawdown (m)	Sc l/min/m	Q cm ³ /s	Dd (cm)	Sc cm ³ /s/cm	Sc m ³ /day/m	s' (safty) (m)	Py(optimum discharge) Sc*s' (m ³ /day)
C-4	B. Nongphai	20	27.5	0.73	333.333	2750	0.12	1.0	9	9.4
C-8	B. Houaxe	30	16.5	1.82	500	1650	0.30	2.6	9	23.6
C-16	B. Louy	101.4	9	11.27	1690	900	1.88	16.2	4.5	73.0
C-44	B. Thongsala	120	0.1	1200.00	2000	10	200.00	1728.0	1	1728.0
C-49	B. Lak21	198	14.5	13.66	3300	1450	2.28	19.7	6.5	127.8
C-65	B. Lak24	30.6	13.5	2.27	510	1350	0.38	3.3	11.5	37.5
C-75	B. Nongkhe	198	2.23	88.79	3300	223	14.80	127.9	3	383.6
C-79	B. Samkhanaboua	50	2.4	20.83	833.333	240	3.47	30.0	2.3	69.0
C-88	B. Maisivilai	100	3.9	25.64	1666.67	390	4.27	36.9	3.5	129.2
C-89	B. Nasenphan	30.6	9.5	3.22	510	950	0.54	4.6	7	32.5
S-4	B. Houaykapho	120	10	12.00	2000	1000	2.00	17.3	2	34.6
S-12	B. Nongsano	50	4.5	11.11	833.333	450	1.85	16.0	4	64.0
S-24	B. Donmuang	198	6.4	30.94	3300	640	5.16	44.6	3	133.7
S-38	B. Nongngong	132	13.7	9.64	2200	1370	1.61	13.9	8	111.0
S-50	B. Samia	132	13.2	10.00	2200	1320	1.67	14.4	10	144.0
S-56	B. Chong	198	14.95	13.24	3300	1495	2.21	19.1	14	267.0
S-64	B. Phonphai	132	1.15	114.78	2200	115	19.13	165.3	1	165.3
S-75	B. Nakasao	40	13	3.08	666.667	1300	0.51	4.4	4	17.7
S-84	B. Beng	198	0.15	1320.00	3300	15	220.00	1900.8	2	3801.6
S-100	B. Houn-Tai	20	10	2.00	333.333	1000	0.33	2.9	7	20.2

Table 4.6.6 Coefficients of Aquifers

No.	Location	Average				S	Sc (m ³ /day/m)	Geo. Type	Aquifer	
		T (cm ² /s)	T (m ² /day)	K (cm/s)						symbol
C-4	B. Nongphai	9.03E-02	7.80E-01	4.51E-05	3.42E-01	1.0	Eh	Jura. sandstone.		Js
C-8	B. Houaxe	1.95E-01	1.69E+00	3.26E-05	2.79E-01	2.6	Eh	Jura-Creta. Sandstone.		JCs
C-16	B. Louy	1.90E+00	1.64E+01	1.00E-03	7.45E-01	16.2	Eh	Jura. Sandstone. Conglo.		Jsg
C-44	B. Thongsala	9.32E+01	8.05E+02	7.76E-02	*	1728.0	Ba2	N-Q Basalt Lava.		Ba
C-49	B. Lak21	6.09E-01	5.26E+00	5.07E-04	4.41E-01	19.7	Ba1	N-Q Basalt Lava.		Ba
C-65	B. Lak24	2.11E-01	1.82E+00	1.32E-04	7.21E-02	3.3	Ep	Jura. Sandstone.		Js
C-75	B. Nongkhe	2.32E+01	2.00E+02	1.16E-02	1.47E-01	127.9	Qf	Q Sand. Jura. Sandy Shale.		Qs/sh
C-79	B. Samkhanaboua	4.67E+00	4.03E+01	2.33E-03	9.63E-02	30.0	Ep	Jura. Sandy Shale.		Jsh
C-88	B. Maisivilai	3.63E+00	3.14E+01	1.30E-03	1.79E-01	36.9	Et	Paleozoic Slate.		Psl
C-89	B. Nasenphan	3.52E-01	3.04E+00	1.47E-04	4.66E-02	4.6	Et	Triassic Asidic Tuff.		Tt
S-4	B. Houaykapho	2.08E+00	1.80E+01	1.04E-03	1.06E-01	17.3	Eh	Jura-Creta. Sandstone.		JCs
S-12	B. Nongsano	5.53E-01	4.78E+00	1.98E-04	9.96E-01	16.0	Eh	Jura. Sandstone.		Js
S-24	B. Donmuang	4.80E+00	4.14E+01	3.00E-03	1.75E-01	44.6	Qf	Jura. Sandstone.		Js
S-38	B. Nongngong	1.79E+00	1.54E+01	1.12E-03	2.89E-01	13.9	Ep	Jura. Sandstone.		Js
S-50	B. Samia	7.81E-01	6.74E+00	3.72E-04	4.72E-02	14.4	Qf	Q Sand. Jura. Sandstone.		Qs/Js
S-56	B. Chong	4.98E-01	4.30E+00	2.49E-04	6.37E-01	19.1	Ba3	N-Q Basalt. Jura. Sandstone.		Ba/Js
S-64	B. Phonphai	2.54E+01	2.19E+02	1.59E-02	2.02E-01	165.3	Ep	Jura. Sandstone.		Js
S-75	B. Nakasao	1.80E-01	1.56E+00	7.49E-05	2.97E-01	4.4	Ep	Jura. Sandstone.		Js
S-84	B. Beng	1.74E+02	1.50E+03	5.80E-02	8.35E-01	1900.8	Ba2	N-Q Basalt.		Ba
S-100	B. Houn-Tai	8.59E-02	7.42E-01	3.58E-05	1.16E-01	2.9	Ba1	N-Q Basalt. Loam.		Ba/m