ラオス人民民主共和国

南部州農村給水プロジェクト開発調査

プロジェクト　ファインディング調査

報　告　書

平成４年８月

社団法人 海外農業開発コンサルタンツ協会


LOCATION MAP
LAO P.D.R.
SOUTH CHINA SEA
PACIFIC OCEAN
INDIAN OCEAN
VIETNAM
Tonkin
Gulf
N
LAO PEOPLE'S DEMOCRATIC REPUBLIC
SARAVANE
CHAMPASSAK
BOLOVENS PLATEAU
KONTUM PLATEAU
104°
105°
106°
107°
108°
20°
19°
18°
17°
16°
15°
14°

－目　次－

ま　え　が　き

海外農業開発コンサルタント協会（ＡＤＣＡ）は 樋 口 政 男（㈱建設企画コンサルタント）及び 小 西 正 純（ニチメン㈱）の２名からなる調査団を現地に派遣し、南部州農村給水プロジェクト開発調査に係わる事前調査を実施した。

調査団は平成４年８月２日より８月８日までの７日間同国に滞在し、関係資料の収集及びラオス政府担当者との協議等を行なった。今回の事前調査の主な目的は、当初ラオス政府農林省より計画された『南部州における地下水開発による農村給水プロジェクト』に対して当プロジェクトのラオス側の受け入れ機関をどの省が担当するのか、また地下水資源関する基本的調査（マスタープラン／フィージビリティ調査等）の有無、に関して不明確な点があったため、この点を確認し、さらに開発調査の目的，調査項目，調査方法に関して技術的アドバイスをすることであった。

現地滞在中に、農林省，厚生省，対外経済協力省，経済省の担当者及び副首相との協議を重ね、以下

1）受け入れ機関　：　厚 生 省
2）目　　的　：　地下水資源開発可能性に関する調査
3）基 本 方 針　：　フィージビリティ調査の調査結果に基づいて、農村給水とその余剰水によるかんがいプロジェクトの実施を目指す。

のラオス側の本プロジェクトに関する基本的方針を確認した。

最後に、調査団は、今回の現地調査に際し、積極的に協力・支援を頂いたラオス政府関係省庁担当者諸氏に心から謝意を表明するものである。

平成４年８月　　ＡＤＣＡ事前調査団
樋 口 政 男
小 西 正 純

1．背　景

ラオス国の面積は 236,800㎢で東側をベトナム，北側を中国とミャンマー，西側をタイ，南側をカンボジアと接する内陸国で、人口は1990年現在、約 417万人で人口密度は17.6人／㎢である。

1975年12月王制を廃止し、社会主義体制としたが、経済立て直しのため近年外交関係はロシア・東欧等の東側諸国のみならず、西側先進国やＡＳＥＡＮ各国とも友好関係を維持している。

ラオス国の一人当りのＧＤＰは約180US$（1988）と極めて低く、世界最貧国の一つに数えられる。農業はＧＤＰの約60％を占め、ＦＡＯの推定値によれば1989年には、農林水産業は全人口の72％を占めている。ＦＡＯの推定値によれば1986年の耕地面積は90万ha、永年牧草地が80万haで、森林面積は 1,310万haとなっている。以上のように、農林業が主要産業であるが、その開発は極めて低いのが現状である。つまり、農業国ラオスにとって、その経済は自然に頼っていると云える。国民のほとんどを占める農民の社会と経済及び文化は非常に低い水準にあり、経済基盤の向上が急務となっている。

ラオス国の開発の基本は1988年10月に開かれた第４回党大会で決められた市場経済を前提とした新経済政策である。

この政策による経済革新は経済基盤である農民家庭に対して、生活経済の向上を促進すると同時に、国家からの生活サービスが不可欠であると強調している。特に、飲料水供給についてはラオス政府の“国連水の10年計画”の目標達成が遅れ、この最終年度を2000年に延長した。その際、厚生省は公共サービスに重点を置く政策を策定した。

2．計画地域

2-1　地域の選定

基幹産業としての農業が、経済を左右することから、平地が最も多いラオス南部の農民経済の基盤整備が急がれている。また、ラオス国の輸出主要農産物のコーヒー生産には大きな期待がかけられており、政府は当地域への生活給水のみでなく、コーヒー園へのかんがいも小規模的に導入したい意向をもっている。

このため、南部4県の中でも人口が多く、コーヒー栽培も盛んな Champasak及び Saravanの2県を計画対象地域に選定した。

尚、各県の人口及び全人口比は1990年現在で以下の通りである。また、添付資料6として Champasak県の各村落の社会・経済データを示す。

	人　口（千人）	全人口比（%）
Champasak 県	469	11.2
Saravan 県	211	5.0
ラオス全国	4,170	100

2-2　自然条件

調査地域は、地形学的に、タイ国から広がるコーラート高原の東端部に位置し、メコン川流域の標高 100m～ 200mの平地であり、この中央部にテーブル状の溶岩台地が分布している。

地質学的に、この平坦面は先カンブリア紀の基盤浸食面の上に中生代ジュラ紀の赤色砂岩が水平に覆ったものである。さらに、玄武岩の噴出によりテーブル状の台地が形成された（添付資料7）。

また、この地域は亜熱帯性のサバンナ性の気候区に属する（添付資料8）。

夏のモンスーンは西縁の山脈に妨げられ、冬の季節風はチョンソン山脈に、遮られるため、雨季と乾季が明瞭であり、しかも地区により降雨量に著しい差異が生じている。

計画対象地域の中の主要3地点における年雨量及び月平均気温は以下の通りである。

Saravan	1,908mm／年	23～31℃
Pakse	1,989mm／年	23～29℃
Paksong	3,202mm／年	17～23℃

雨期は４月から９月であり、この間に年降雨量の90％が降り、乾期には水無川が生じる。

2-3　給水現況

計画対象地域のうち、 Champasak県の県庁所在地 Pakseでは水道が普及している。残りの地方都市及び地方においては、若干のハンドポンプ設置井戸、手掘り浅井戸がみられるが、ほとんどが溜池や河川より取水して、数百ｍの水運搬を余儀なくされている。

一般的に国民の衛生観念は低く、行政当局の指導にもかかわらず、不衛生な水をろ過したり、煮沸したりすることなくそのまま飲用する人が多い。

このため、水因性伝染病の発生率が高く、肝臓や胃腸疾患による幼児死亡率は1000人中 141人と高率となっている。

計画対象地域のほとんどは、タイのコーラート高原から続くジュラ紀の赤色砂岩により構成されており、地表面から硬い岩盤となっている。このため、手掘り井戸は数少なく、特に風化の激しい場所に掘られており、水量は少なく乾季は水無しとなる。また、深度も２～５ｍ程度で、井壁は木製が多く、ヒューム管製は稀れである。バケツにロープをつけて水を汲むスタイルで、基本的に衛生的ではない。

ラオスでの機械堀りによる深井戸は全国で 406ヶ所に設置されている。これは、1960年代アメリカの援助で約 100本掘られており、その後ＦＡＯのファンドで購入されたソ連製のトラック搭載ボーリングマシンとともに 300本ほど掘られた。
深度は40～50ｍで 100ｍを越えることはない。井戸口径は 150m～ 200mで、鋼管がセットされている。アメリカ時代の井戸には、風車によるピストンタイプのポンプ及びエンジン駆動のレシプロポンプが設置され使用されていたが、現在はほとんど放棄されている。また、ハンドポンプを設置された井戸は、数回の取り換えが行なわれてはいるが、使用中のものもかなりある。ハンドポンプのスペアパーツ供給も大きな問題の一つであり、手に入らない場合、ポンプをはずして戦争に使用された弾丸のShell(シェル) をバケツ変わりに使用しているケースもある。又タンクローリーによる売水も行われており値段は 200ℓのドラム缶一杯で 150キップである。

しかし、このポンプ設置井戸からの給水を受けている国民は、都市を含めても総人口の14％にすぎない。

教育が普及した今日、飲料水用に屋根に降る雨をドラム缶に貯える家庭もみられるが、今だほとんどの国民が不衛生な飲料水を使用している。

また、生活用水としても量的に充分なものがなく、不衛生な生活環境を余儀なくされているのが現状である。

一般的にコーラート高原の赤色砂岩中の地下水は塩分濃度が高いと報告されている。計画対象地域に設置された深井戸でも若干塩分が感じられる井戸がある。しかし、ほとんどは飲料水として使用されている。

3．国家計画における水行政

3-1　開発計画

1986年から始まった第２次５ヶ年計画は、国民総生産を平均年間成長率10％という目標を掲げて実施している。そしてこの主要課題としては、

(1)食糧自給　(2)林業開発　(3)工業・手工業の発展　(4)都市・農村の開発　(5)運輸・通信網の充実　(6)商業網拡大　(7)公営企業の拡大、国家財政安定　(8)教育の質の向上　(9)科学技術の利用　(10)諸国との経済社会関係の拡大を掲示している。そして、また1986年は新経済運営計画として、貿易の自由化、経済運営の合理化、国営企業の自主性重視及び民間部門の育成、民営化に重点努力することとなった。

1991年から始まる第３次５ヶ年計画も、現行と同様な目標を設定する予定で現在政府部内で審議中である。そして、特に

(a)　全ての食料につき自給と備蓄の確保

(b)　民間部門の一層の自由化

(c)　外資の一層の導入に重点を置いている。

つまり農業が基幹産業であり、経済の基盤として、生産を向上させることが基本方針である。

3-2　開発計画における給水施設の位置付け

農業における生産性の向上は、徐々に成果があがっているものの、農村での生活向上は依然として、改善が進んでいないのが現状である。この生活水準のうち、給水に関しては、直接国民の健康に係わるものであるが、安全な水を飲用している人は、人口の20％に過ぎない。また、現金収入源とする換金作物の栽培にはかんがいが必要で、このための水源確保も、生活水準の向上に不可欠である。また、水運搬にかかる労働力を軽減できることにより低就学率の改善への寄与が期待できる。

3-3　"DRINKING WATER AND SANITATION PROJECT"

政府は、1982年標記計画を策定した。この計画による目標は普及率を1986年までに25％、1990年までに76％とした。しかし、1988年時点での普及率は都市部において総人口の６％、地方部で14％にしか達していない。（ラオス国全人口は約 400万人、その15％は主要都市に住み、その他の85％の人は各地に散在して居住している）

このため、衛生的な水供給を76％の国民にという目標達成を2000年へ延長した。水行政の（基本）方針は、都市水道を管轄する建設省水道局が関係行政機関（厚生省、農林省等）と協議・作成し（添付資料９）、概要は次の通りである。

1) 水利用状況

① 水　源 …… 表流水、地下水

② 水供給の普及率 …… 都市部６％、地方部14％

③ 水利用 …… 都市部１人当り 200ℓ／日、地方部50ℓ／日

2) 目　標

1989年－2000年の国家開発計画を実行するにあたり、全人口の76％に衛生的な水を供給するために、水道拡張プロジェクトの計画が策定された。これは、技術や規模の点から以下のカテゴリーに分けられる。

・17県の県庁所在地において、水道が利用できるようにする。

・252ヶ村において、井戸を水源とする水道を建設する。

・郡・村では、120ヶ村において乾季のための地下水システムや雨水貯留タンクを設置する。

・水源保全計画

3) 実施方法

① 全国的なフィージビリティ・スタディのためのマスタープランの策定

② プロジェクトの提案

③ 建設工事のための技術者、労働者の確保

④ 機材及び運送手段の確保

⑤ プロジェクトに必要な資金のアロケーション

4) 資 金 源

① 大中規模水道建設に関する国家予算

② 国際機関や、友好国からの無償資金

③ ＡＤＢ、ＩＤＡ等国際機関からの低金利貸付金

④ 小規模水道建設に関する地方予算及び国庫補助金

5) 給水プロジェクトの恩恵

① 政　治 …… 党及び国家に対する人民の信頼

② 社　会 …… 国民の健康増進、疾病の撲滅

③ 経　済 …… 生産性の向上、医療費の節約

④ 国際機関に対する義務 …… 国連10ヶ年計画への寄与

具体的なプロジェクトとしては、建設省 Water Supply Lao Company が計画した都市水道事業がある。

しかし、農村地域における給水計画は、従来厚生省が所管してきたが、具体的な実施計画は明確でなかった。

よって、ここに厚生省の方針に基づき、具体的な農村給水計画を南部州を対象として実施することとした。

3-4 厚生省の行政組織

農村地域における給水行政を担当している厚生省の行政組織図を添付資料10に示す。

4．地下水開発計画調査

4-1　調査の目的

ラオス国南部州２県の農村における生活用水拡充のための地下水利用の給水計画を推進するにあたり次の目的で調査を行う。

① 対象地域における地下水資源の開発可能賦存量を評価する。

② 対象地域における地下水資源の開発利用の基本計画を策定する。

③ 開発優先地域における地下水開発利用の実施計画を立案する。

また、ラオスの地下水開発技術のレベルアップのため

④ ラオス側カウンターパートへの技術移転を行う。

4-2　調査の基本方針

ラオスにおける地下水利用は1960年代のアメリカによる援助に始まりＦＡＯやＵＮＤＰ／ＵＮＩＣＥＦの資金により全国で 400本余りの深井戸が掘られてハンドポンプや風車利用の揚水機、レシプロポンプが設置されている。しかし、これらの施設についてはその老朽化が甚だしく、リハビリテーションに耐えられる井戸は少ない。このため基本計画では、新設の井戸を主体として検討する。

揚水施設は基本的にハンドポンプを使用することとするが、スペアパーツの現地調達の可能性などを検討する。また、集落の形態により共同水栓による簡易水道を検討するが、メンテナンスの容易性などからソーラーポンプの利用も考慮すべきである。

水理地質学的および水文学的調査により地下水の賦存量、開発可能性を検討して、開発可能性の優先地域を選定する。

選定された優先度の高い地域について精査を行い、地下水を水源とする給水施設の実施計画を立案する。

4-3　調査対象地域

対象地域	Champasak 県	Saravan 県
県　都	Pakse	Saravan
対象面積	15,415 ㎢	10,385 ㎢
対象人口	469,000 人	211,000 人

4-4　調査内容

①　地形地質判読及び地表踏査

・地形地質に関する資料収集、整理

・空中写真の判読、リモートセンシング解析

・地表地質踏査

②　水理地質調査

・電気探査……データが不足している地域での帯水層状態等地下地質構造を把握して水理地質図作成の資料とする。

・電磁探査……同様な地域での岩盤内部の亀裂や破砕帯に賦存する裂ヵ水型地下水のポテンシャルを把握する。

・資料収集……調査ボーリングや井戸の地質柱状図のデータを収集し整理して、水理地質図作成の資料とする。

③　利水・水文調査

地下水の賦存形態、流動方向、涵養状況、開発・利用状況、地下水障害の現況、水文学的水循環の現状を把握して地下水開発可能量を試算するために次のような調査を行う。

・井戸利用状況調査

・表流水利用状況調査

・地下水水位の一斉観測（雨季1回、乾季2回）

・地下水水位の長期観測

・主要河川の流量測定

・水質分析（地下水・河川・池等）

・気象調査

・水収支試算

・データベースの作成

④　試掘・揚水試験

地下水開発の可能性が高いと推定された地区において量的確認のための試掘および揚水試験を行う。

浅－中層地下水	深度　50m	20ヵ所	延深度 1,000m
深層地下水	深度 100m	5ヵ所	延深度　500m

⑤ ハンドポンプ・簡易給水施設による給水実証調査

調査において必要な試掘井の内、水量・水質等給水に利用し得るものについては、地域特性に応じて数箇所にハンドポンプやソーラーポンプを設置して、メンテナンス等の問題点を把握する。

⑥ 給水計画基礎調査

給水計画の立案に当たって、対象となる地域の社会（人口構成、分布状況、村落形態、環境、自治組織）、経済状況（職業、所得、支出バランスなど）を調査する。

4-5 調査結果及び検討事項

① 地質および地下構造の解明

- 水理地質図及び解説
- 地下水源評価図及び解説

② 地下水開発基本計画策定

③ 給水実施計画の策定

4-6 調査期間

雨季による4月からの6ヵ月間は現地作業は困難となる。しかし本計画は実施が大幅に遅れており、国家経済計画にも大きな支障を及ぼすことから調査期間は最短で行うこととする。

第一次調査 ： 9ヵ月（現地作業1993. Jan.／Mar. 国内作業 May／Sep.）

第二次調査 ： 11ヵ月（現地作業1993. Oct.／Mar. 国内作業 May／Aug.）

総調査期間 ： 20ヵ月

5．給水計画への無償資金協力要請

地下水開発計画調査による給水実施計画は速やかな日本政府の無償資金協力での実現をラオス政府は望んでいる。

〔添付資料〕

1）調査員の略歴

ヒグチ　マサオ
樋口政男

昭和23年10月14日生

昭和47年 3月	東京教育大学理学部地理学科卒業
昭和53年 3月	筑波大学理学研究科博士課程卒業
S.54. 4 ～ S.60. 3	立正大学地理学科助手
S.60. 4 ～ S.61.10	中央開発㈱　海外事業部
S.62. 9 ～ 現　在	㈱建設企画コンサルタント 海外本部　次長

コニシ　マサズミ
小西正純

昭和35年 2月 5日生

昭和58年 3月	麗沢大学卒業
S.58. 4 ～ 現　在	ニチメン㈱
H. 4. 7 ～ 現　在	㈱建設企画コンサルタント嘱託

2）調 査 日 程

日　　程　　表						
日数	年月日	曜日	出発地	到着地	宿泊地	備　　考
1	H4. 8. 1	土	成　田	バンコク	バンコク	移動、ＴＧ６４１
2	8. 2	日	バンコク	ビエンチャン	ビエンチャン	移動、ＴＧ６９０
3	8. 3	月	——	——	ビエンチャン	厚生省、農林省、他
4	8. 4	火	——	——	ビエンチャン	ＵＮＤＰ他、資料収集
5	8. 5	水	——	——	ビエンチャン	UNICEF他、資料収集
6	8. 6	木	——	——	ビエンチャン	厚生省、他打合せ
7	8. 7	金	——	——	ビエンチャン	大使館報告
8	8. 8	土	——	——	ビエンチャン	厚生省、農林省、他報告
9	8. 9	日	ビエンチャン	バンコク	バンコク	移動、ＴＧ６９１
10	8.10	月	バンコク	成　田	——	帰国、ＴＧ６４２

3）資料収集リスト

① Country Report : Indochina (Vietnam, Laos, Cambodia) by The Economist Intelligence Unit

② Development Cooperation 1989 Report by UNDP

③ Geological and Mineral Occurrence Map Lao PDR (1/1000000) by United Nations, 1990

④ BASIC STATISTICS, Lao PDR '91, by Ministry of Economy Planning and Finance State Statistical Center

⑤ Lexicon (Words and Phrases in Selected laws and Regulations of Lao PDR) by UNDP

⑥ Law on Foreign Investment in Lao PDR 1989 by The Foreign Investment Management Committee

⑦ Map Prepared for Unicef Water and Environmental Sanitation Study, 1991 (Geologically Based Ground Water Potential Map)

4）面談者リスト

1) 日本大使館

長　嶋　伸　治	1等書記官
大豆生田清志	2等書記官

2) ラオス政府

Dr. Som Ock KINGSADA, MD	Deputy Chief of Cabinet Ministry of Health
Dr. Nouanta Maniphousay	Deputy Director, Institute of Hygiene and Epidemiology Ministry of Health
Mr. Langsy SAYVISITH	Director, Irrigation Dep. Ministry of Agriculture & Forestry
Mr. Alom THAVONESOUK	Deputy Director, Cabinet Ministry of Agriculture & Forestry
Mr. Sila VIENGKEO	Cooperation Planning Officer Ministry of Economy, Planning & Finance
Mr. Himmakone MANODHAM	Vice-Minister, Ministry of Communication, Transport, Post and Construction
Dr. Bountheuang MOUNLASY	Deputy Director, Dep. of Bilateral Cooperation Ministry of External Economic Relations

3) 国際機関

Mr. Peter H. Dwan	Assistant Project Officer UNICEF

5) 現 地 写 真

パクソンからサラワンへ向う23号線（両側はコーヒーの古木）

新しいコーヒー園

ボロベン高原の草原地帯

既存の浅井戸

（井壁は木枠のみ）

既存の浅井戸

（コンクリート壁）

既存の浅井戸

ハンドポンプ

ハンドポンプ

リグ

6）Champasak県における各村落の社会•経済データ

Socio-economic data in Champasak Province (1/4)

as of 1990

Name of village	No. of family	No. of population	No. of buffalo	No. of cow
M. Phonethong District				
T. Kadkeung				
B. Nonoboua	80	483	95	15
B. Nava	176	1,012	234	315
B. Tak	29	144	50	23
B. Phone Savanh	116	602	116	62
B. None Savang	71	410	117	50
B. Thona Khoa Muang	47	327	55	31
T. Phokham				
B. Phang Dang	148	765	271	543
B. Nond At	119	701	102	67
B. Oupalat	81	449	203	128
B. Mn 12	41	246	39	34
B. None Hin	72	439	135	110
B. Sabeng	95	562	42	54
B. None Saat	67	358	210	265
B. Phone Thong	190	1,120	39	727
B. Phone Kham	221	762	201	277
B. Phone San	40	231	25	25
B. Koong	120	664	110	456
B. Ke	91	522	90	147
B. Chik	112	594	129	224
B. Phone Savanh	119	606	146	320
B. Nong Mai	154	932	296	165
B. Mixay	150	790	233	28
B. Doo	140	773	210	165
B. Bok	148	895	296	856
B Khok Koong	66	384	95	25
B. Done Chik	83	408	172	64
B. Mo	83	935	172	64
B. May	155	1,273	321	72
B. Dong Agnang	76	518	156	187
B. Ou Sou	147	923	346	436
B. Vang Tao	90	435	202	330
B. Asila	36	222	56	238
B. Khoksavang	29	158	74	71
B. Nongsala	47	273	79	76
B. Dannavian	67	385	105	131
B. Phone Pheng	29	148	43	88
B. Bane Chot	42	272	103	107
B. Keng Kang	118	660	280	570
B. Thong Kwang	61	257	111	122
B. Ou Dom	225	120	45	130
B. Hai Tong	58	341	99	259
None Khoone				
B. Pong	60	285	221	400
B. Khao Thong	64	304	138	245
B. Katin	81	486	110	220
B. None Sub	37	224	50	84
B. Phone Ngam	35	183	87	889
B. None Khoone	155	913	221	400
B. Nong Te Noy	91	538	884	108
	123	692	148	153
B. Sat	217	1,277	374	365
B. Chane	80	478	108	38
B. Phone Noy	55	323	56	58

Socio-economic data in Champasak Province (2/4)

as of 1990

Name of village	No. of family	No. of population	No. of buffalo	No. of cow
B. Phone Gnai	150	798	364	351
B. Phat Lome	82	482	92	113
B. Nong Mek	63	375	72	207
B Nasavang	35	192	28	42
B. Nong Pheu	75	482	148	223
B. None Saat	61	851	65	55
B. Tha	154	829	65	82
B. Boung Ke	77	378	152	238
B. Kang Gnao	91	419	67	93
B. Ang Phone	67	348	47	73
B. Song Khone	154	796	124	97
B. Noe Koong	49	274	79	191
B. None Phachad	57	313	83	518
B. Mai Mixay	34	202	72	69
M. Champasak				
B. Mai	50	50	318	11,131
B. Phan Tha Kham	66	376	61	55
B. Nong Viane	66	393	5	65
B. Phone Sao Ei	83	503	110	111
B. Nong Ho	73	340	96	83
B. Huay Sa Houa	175	660	169	166
B. Phone Ngam	101	591	158	123
B. Khok Kong	27	724	724	222
B. Sang Khan	63	350	103	64
B. Done Thang Khuay	54	277	74	68
B. Nong Thone	71	427	100	75
B. Nong Nok Khian	106	555	130	102
B. Nong Na	17	78	130	100
B. Sene To	66	384	51	39
B. Mai Kang	124	715	150	140
B. Done Xiang La	83	502	138	139
B. Mai Tha	85	540	160	142
B. Done Koy	95	476	131	143
B. Na Khway	75	368	163	151
B. Dong Hi	119	715	147	202
B. Nax Dong	76	487	157	171
B. Sene Sook	136	864	107	128
B. Sompasong	98	591	111	177
B. Done Talat	130	720	167	193
B. Kham Teut	103	684	125	242
B. Done Kong	129	740	224	246
B. Na Sanang	117	634	137	233
B. None Thai	66	363	130	77
B. Nong Keo	36	211	85	125
B. Tha Teng Theuang	72	418	148	155
B. Nonga Hin	89	495	117	120
B. Lak Beng	62	348	95	90
B. Thang Ngo	48	300	70	54
B. Thome Chane	91	510	63	40
B. Nong Bona Khao	26	188	30	45
B. None Saat	153	791	245	243
B. None Dy	59	265	108	209
B. Nong Ho	47	191	98	180
B. Ngoua Ba	136	582	312	287
B. Meui	151	765	373	200
B. Done Dai	90	479	164	314

Socio-economic data in Champasak Province (3/4)

as of 1990

Name of village	No. of family	No. of population	No. of buffalo	No. of cow
B. Sisoulat	27	125	32	60
B. Khamcha Leune	31	164	28	34
B. Nong Phot	137	164	28	34
B. Huay Na	136	582	211	204
M.Khong				
B. Ban Na Veng	72	343	158	127
B. Phone Saat	168	904	409	329
Na Sane Phan	68	440	276	93
Phone Vixay	33	204	134	51
Na Seuak	87	483	354	120
Na Sam Hong	52	326	211	71
Nong Khane	51	329	207	70
Hat Sat Khoon	150	1,173	257	155
Sat Nam Ome	82	601	224	100
Sat Tao Lek	57	384	156	80
Sat Sa Vanh	34	206	93	61
Na Song Peude	12	87	33	31
Sot	239	917	379	201
Na Pak Kiab	113	558	308	159
Bung Ngam	63	290	172	96
Na Kasang	243	1,532	658	330
Phone Sa Vunh	63	347	172	95
Phosi	29	134	45	29
Phosai	52	148	80	45
High School		350		
B. Oudom Khinak		300		
Hospital		70		
M. Paksong				
B. Bang Lian	123	646	12	562
Phou Oi	50	82	87	316
Km 48	79	407		109
Se Pian	52	314	192	259
Thong Ka Thai	57	139	84	130
Houa Xang	65	258		138
Kha Novan Dong	124	542		227
Hin Lap	42	208	16	123
Nong Poy	64	340	120	294
Km 11	26	340	120	294
Nong Soung	998	541	74	341
Nong Hin	90	327	89	18
Km-45	122	666		76
Km-5	52	322	200	214
Km-42	22	125		214
Km-12	72	383		243
B. Km-35	124	696		
B. Nong Kheuang	124	575		174
B. Km-33	98	518		162
B. Hday Kong	103	567	39	63
B. Km-28	66	408		107
B. Nam Tang	101	530	30	168
B. Huat Sat	562	562	12	471
B. Ou Pasa	56	259	49	3
Beng	21	91		108
Pha Nouane	79	360	45	88
Katat	60	284		153
Nong Le	12	70		125

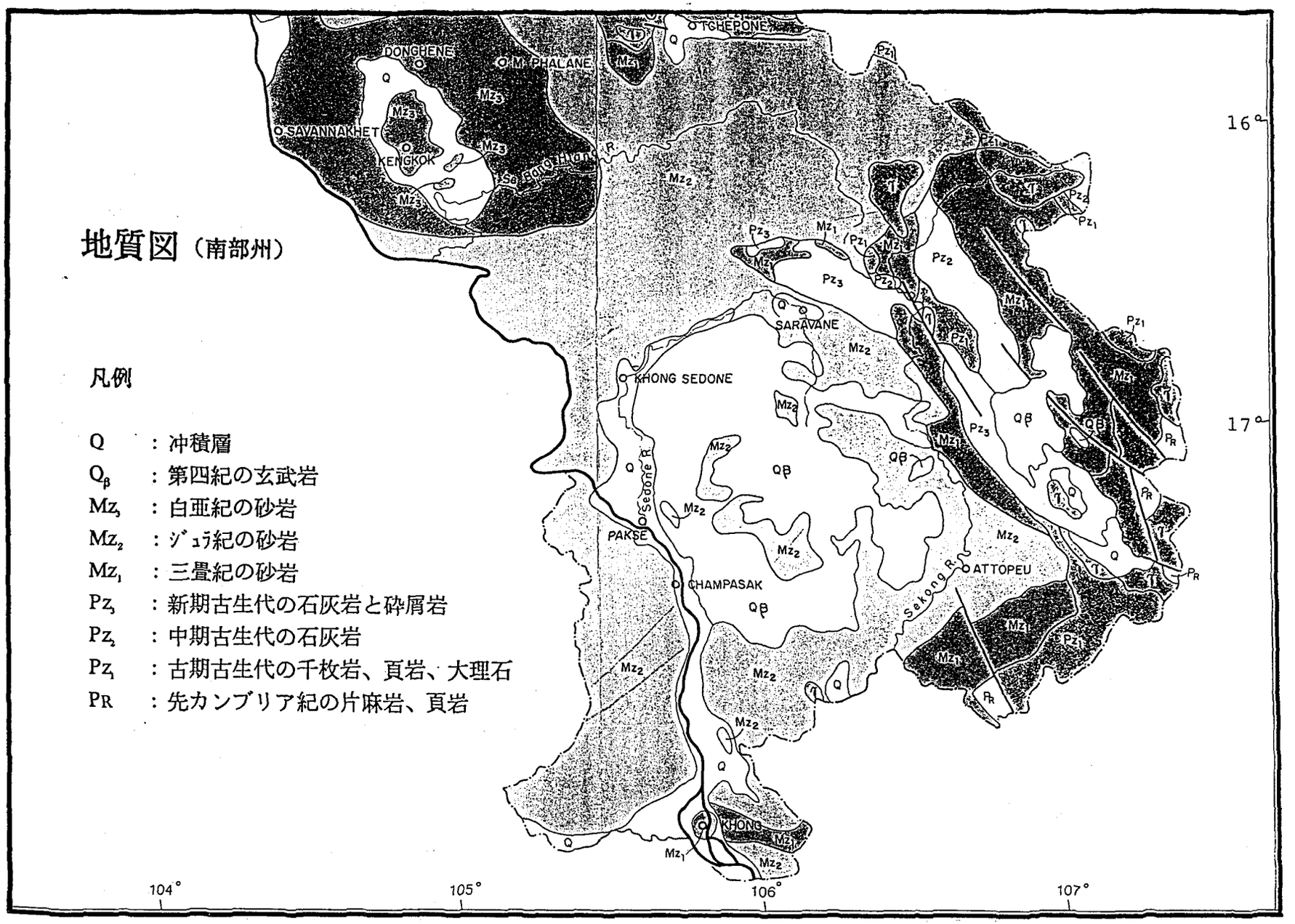
Socio-economic data in Champasak Province (4/4)

as of 1990

Name of village	No. of family	No. of population	No. of buffalo	No. of cow
B. Kongtoune	32	227		73
B. Nong Kaly	50	253	11	207
B. Nong Hin Khao	85	408		150
B. Huay San	93	555		313
B. Set Khot	225	1,358		653
B. Se Ta Pong	425	129		201
B. Nong Gha Teuang	52	374	4	265
B. Khot Noy	264	78		248
B. Ka Pheu	93	406		196
B. Ka Phou	43	255		100
B. Khot Gnai	96	497		178
B Phak Koot	92	390	14	184
B. Huay Tao	80	445	2	144
B. Soom Sa Nook Kao	35	169		94
B. Soom Sa Nook Mai	123	508		349
B. Mai Xay Somboon	65	348	37	164
B. Nong Bone	52	225	7	143

7）地質図（南部州）

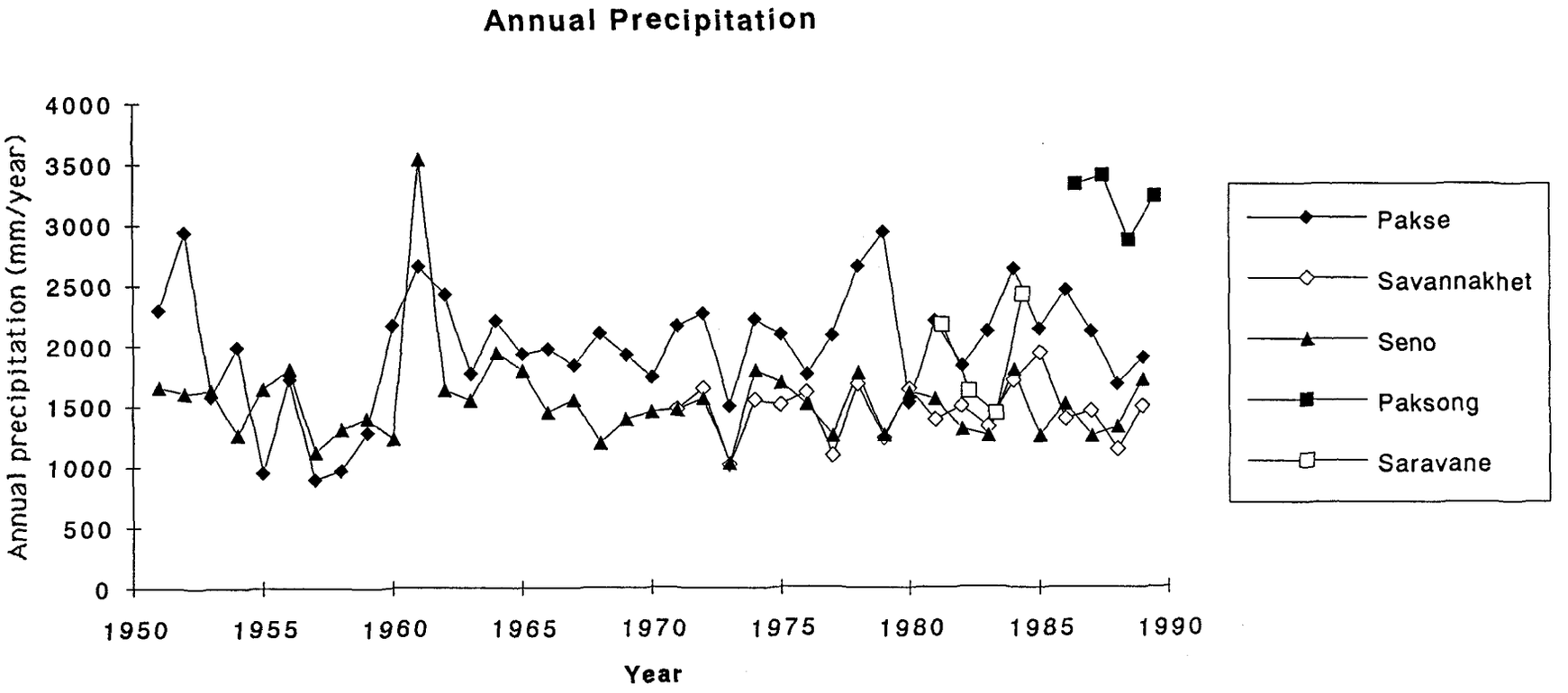
地質図（南部州）

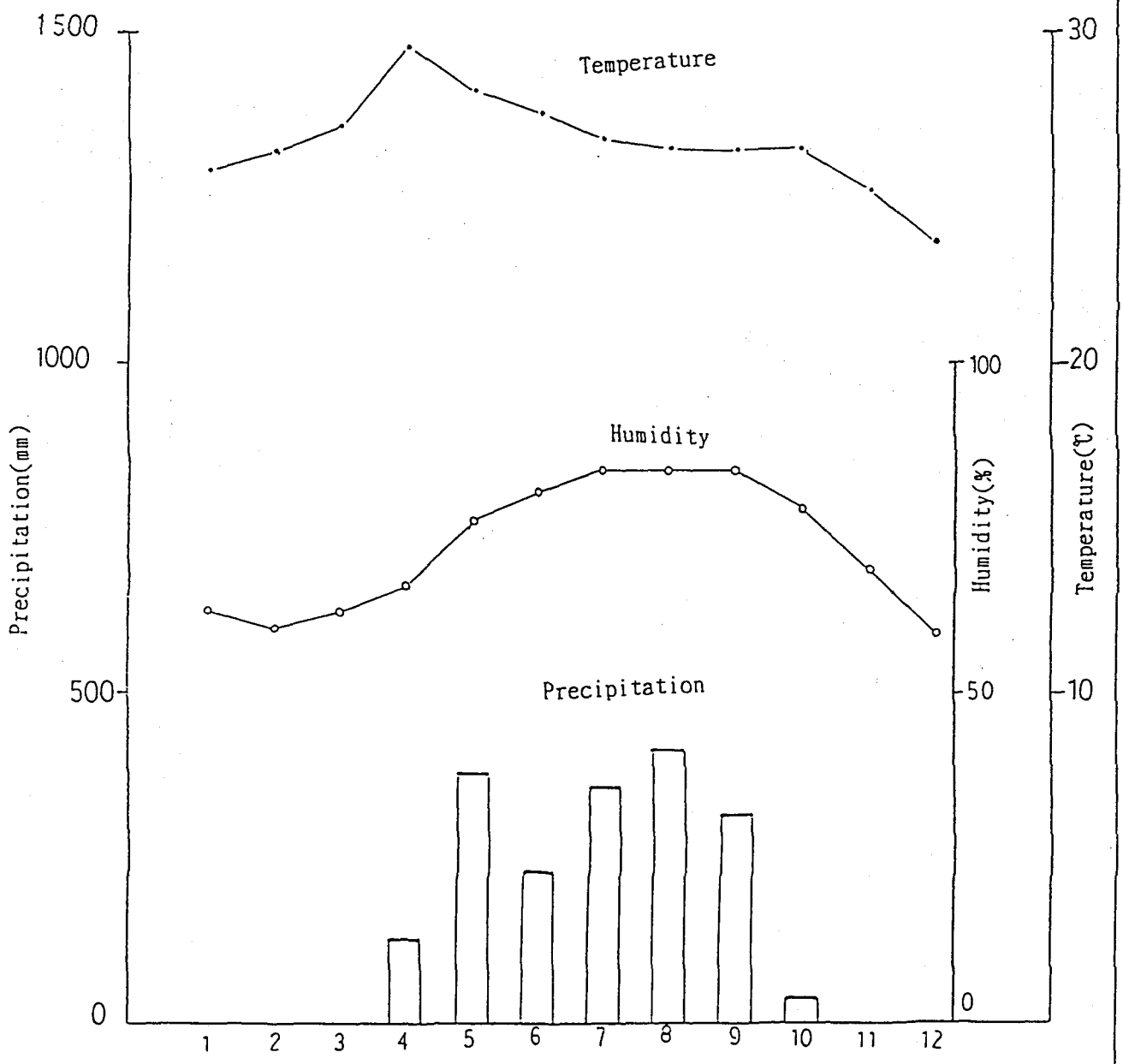

凡例
Q : 冲積層
Qβ : 第四紀の玄武岩
Mz3 : 白亜紀の砂岩
Mz2 : ジュラ紀の砂岩
Mz1 : 三畳紀の砂岩
Pz3 : 新期古生代の石灰岩と砕屑岩
Pz2 : 中期古生代の石灰岩
Pz1 : 古期古生代の千枚岩、頁岩、大理石
PR : 先カンブリア紀の片麻岩、頁岩
TCHEPONE
DONGHENE
M. PHALANE
SAVANNAKHET
KENGKOK
SARAVANE
KHONG SEDONE
Sedone R.
PAKSE
CHAMPASAK
Sekong R.
ATTOPEU
KHONG
16°
17°
104°
105°
106°
107°

8）気象データ

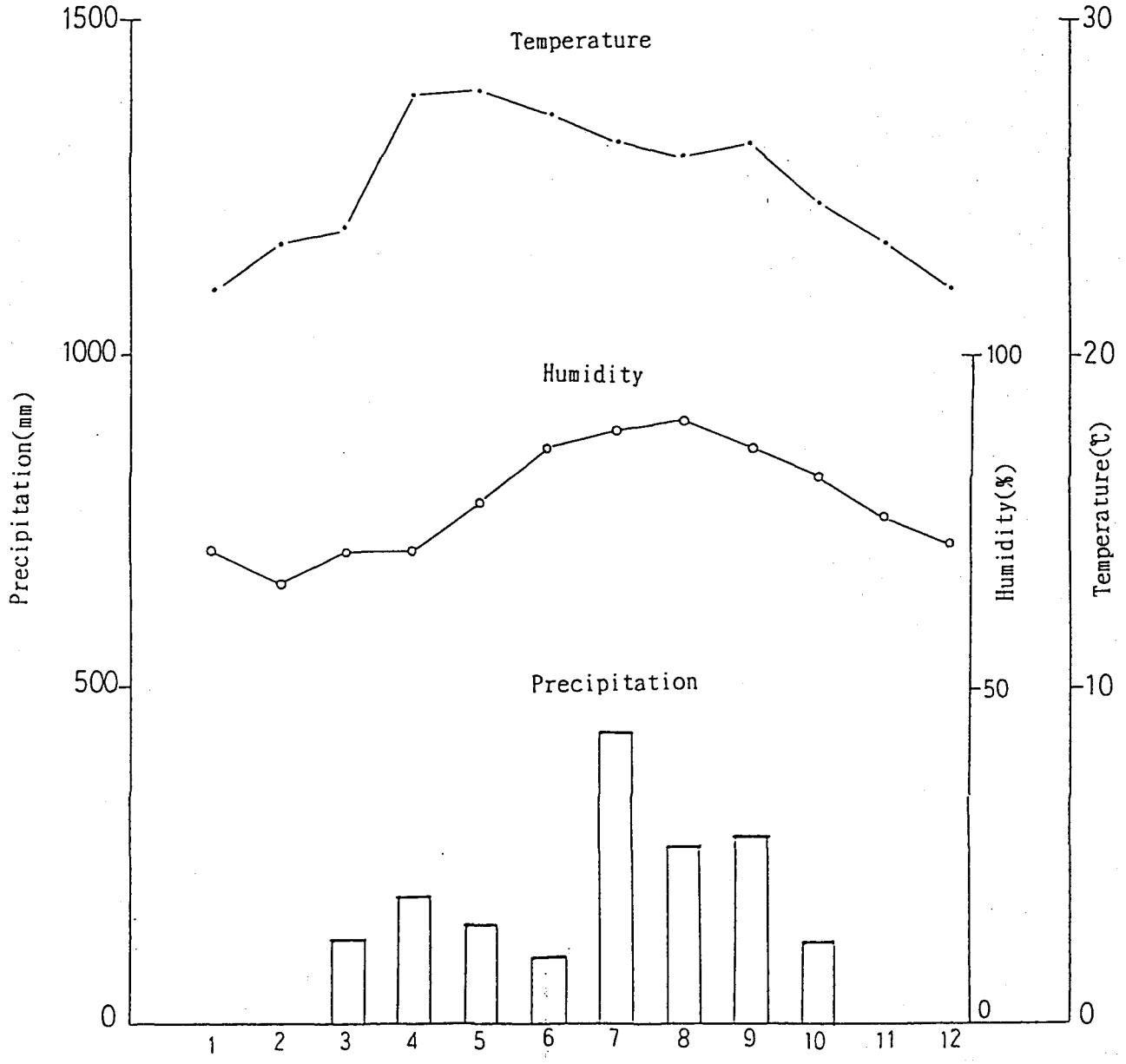
Table Annual precipitation data in Lao

Year	Pakse	Savannakhet	Seno	Paksong	Saravan
1951	2298		1662		
1952	2946		1614		
1953	1586		1636		
1954	1993		1268		
1955	952		1646		
1956	1721		1809		
1957	893		1121		
1958	970		1312		
1959	1286		1407		
1960	2168		1230		
1961	2654		3536		
1962	2424		1633		
1963	1766		1547		
1964	2207		1942		
1965	1928		1794		
1966	1973		1446		
1967	1837		1552		
1968	2102		1192		
1969	1919		1392		
1970	1734		1446		
1971	2162	1476	1471		
1972	2267	1644	1564		
1973	1500	1017	1029		
1974	2219	1551	1796		
1975	2085	1502	1688		
1976	1751	1604	1511		
1977	2075	1083	1250		
1978	2655	1681	1772		
1979	2938	1235	1265		
1980	1525	1636	1611		
1981	2201	1381	1558		2168
1982	1823	1491	1303		1614
1983	2112	1321	1249		1430
1984	2631	1710	1797		2420
1985	2132	1934	1252		
1986	2449	1384	1512	3326	
1987	2112	1454	1248	3398	
1988	1676	1134	1325	2864	
1989	1895	1489	1711	3218	
Average	1988.8	1459.3	1540.9	3201.5	1908.0
Max.	2946.0	1934.0	3536.0	3398.0	2420.0
Min.	893.0	1017.0	1029.0	2864.0	1430.0
Stan. devi.	481.53	230.98	395.14	236.85	463.56

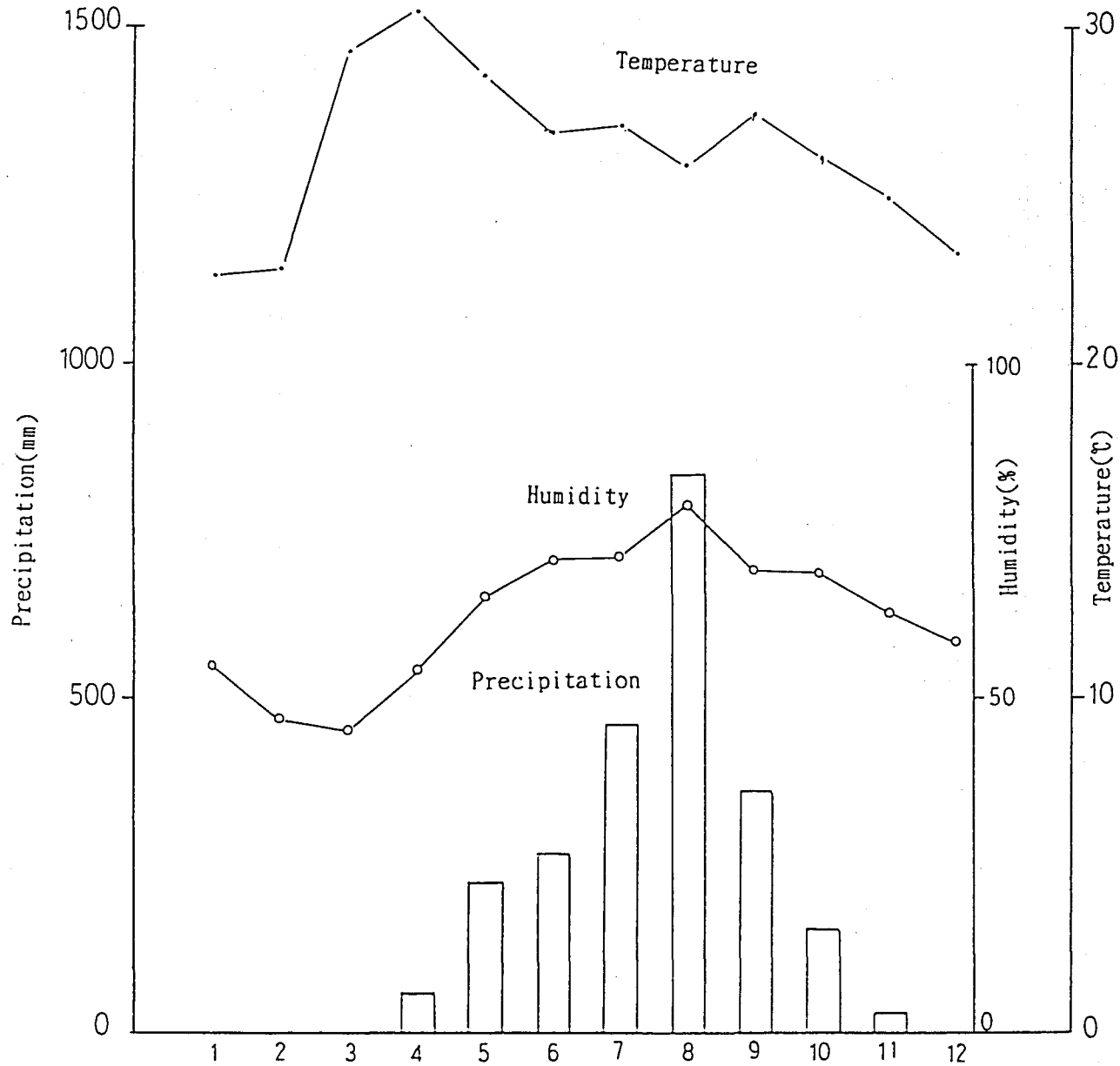

Annual Precipitation
Annual precipitation (mm/year)
4000
3500
3000
2500
2000
1500
1000
500
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
Year
Pakse
Savannakhet
Seno
Paksong
Saravane



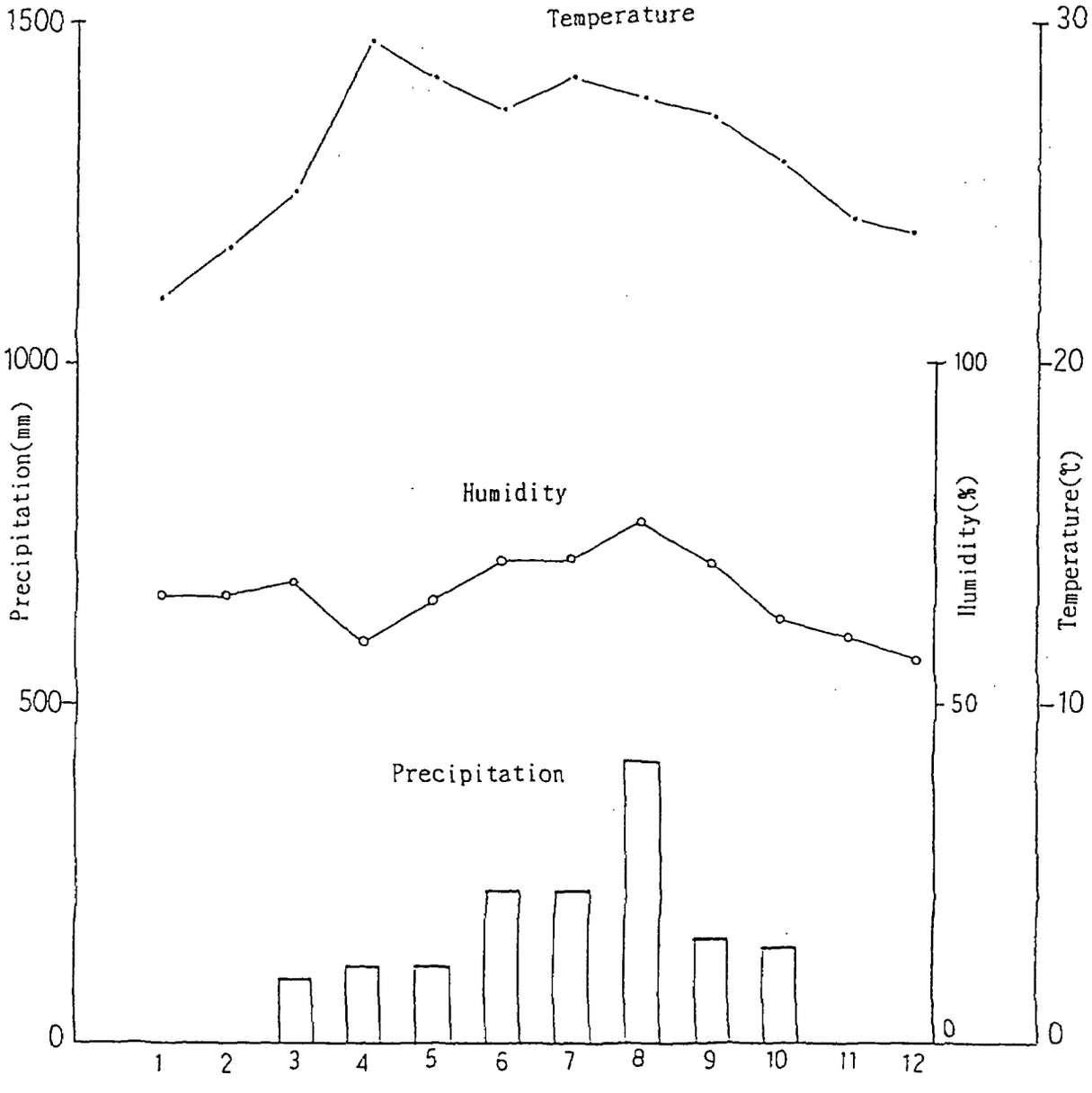
Climate graph at Pakse (1989)



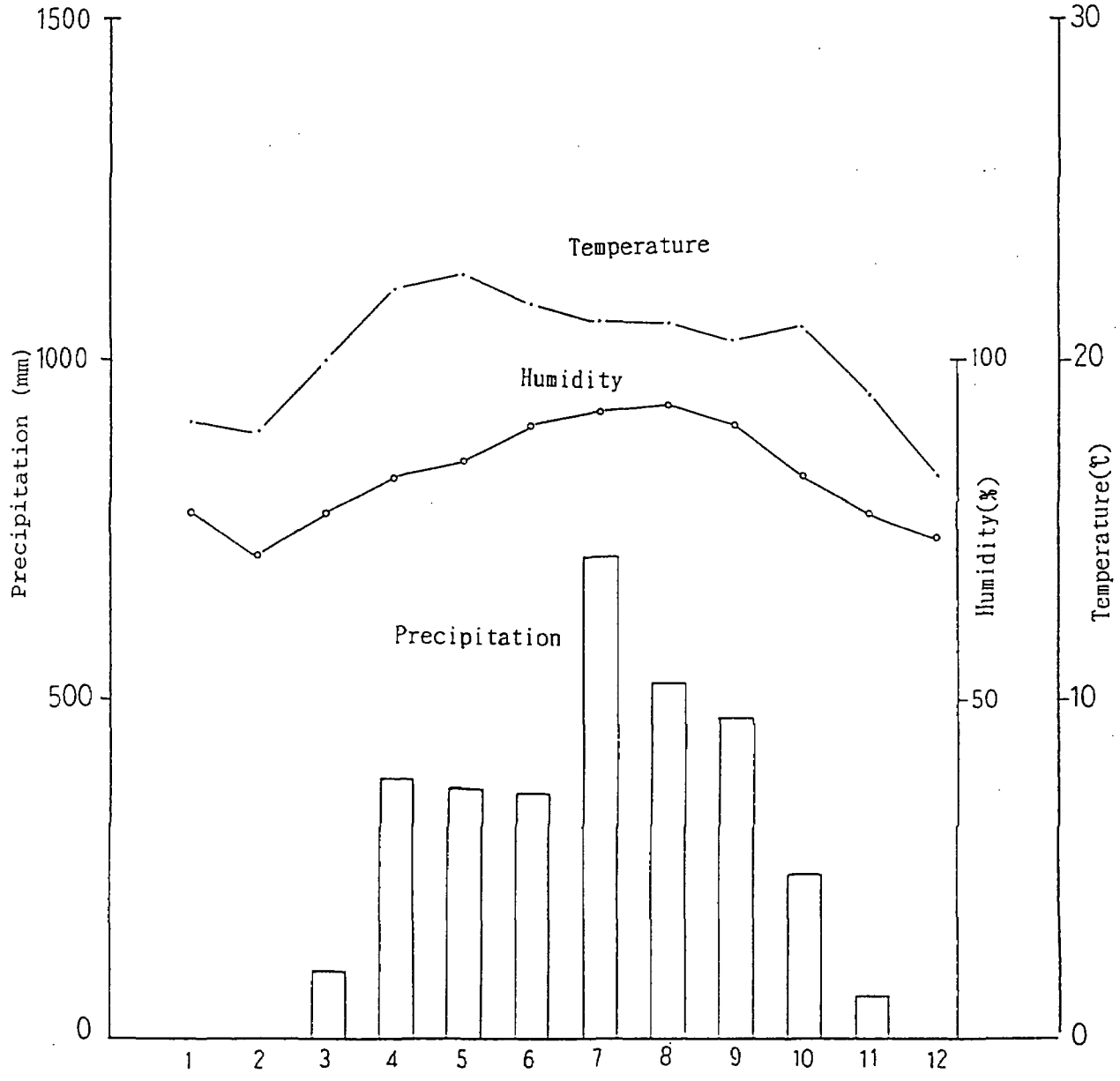
Climate graph at Seno (1989)



Climate graph at Saravan (1984)



Climate graph at Savannakhet (1989)



Climate graph at Paksong (1989)

９）水行政の基本方針（1989-2000年）

LAO PEOPLE'S DEMOCRATIC REPUBLIC

PEACE INDEPENDENCE UNITY SOCIALISM

MINISTRY OF COMMUNICATION, TRANSPORT, POST AND CONSTRUCTION

WATER SUPPLY COMPANY

STRATEGIC OF PLAN FOR A PERIOD

YEAR

1989 - 2000

WORK FOR SUPPLY OF PURE WATER TO POPULATION

IN THE SCALE OF NATIONWIDE

1988

... I ...

(This report is)

- According to the policy of the party and the state regarding the reform and construction of social economy towards the production of merchandise, and reduction of the native self-sufficiency economy.

- According to an urgent requirement of the population and multi-ethnic for solving the problem and for improving their standard of living in good condition step by step.

As we know that LPDR was recently released from the war and the difficulty caused by the flame of war made the country to fall into under developed one in the world.
Revenue of people is an average of 200$/year.
After the census in 1987, the country has approximately 4 million habitants, of which 15% are living in towns and the rest 85% in countryside.
The rate of birth is 28% or more.

I. Situation of the use of water by population

1/ Water source to be used:

- Water from water supply company through piping system.
- Water being supplied from thesource of underground water, without treatment
- Water from bored well, using the boring machine.
- Water from shallow well, underground water.
- Water from the streams, without treatment(filtering).
- Water form the ponds and lakes, without treatment(filtering) and killed antescedent.

2/ Rate of the people using the water from each kind:

- LPDR has 16 provinces and 1 prefecture(capital) and 5 of these 17 units has already water supply system. (5 units) has the population of 475,000, 29% of the whole country, and the number of people enjoying the water supply will be about 237,500, 6% of whole country.

- In the countryside there has been constructed natural water supply system, well boring and digging was made then the population got to use this kind of water at about 14% of the population of nation-wide.

- Except the above, remaining 80% of the population use natural water of stream, pond or lake which is far from sanitation.

3/ Affection by using insanitary water:

If referred to the water, it is first element for sustain and expansion or all living things.

Our people needs to use the water per person, minimum 200 liters per day in town, minimum 50 liters per day in countryside. As our people needs to use the water pure or not, their incorrect use of water not following the regulation of hygiene affects the health of people and consequently the following diseases are found in mass people:

- Typhoid
- Dysentery
- Chorera
- Hepatitis

Besides, it affects the work of population; the power and quality of production are reduced, wastes the budget for medical treatment, and more regrettably the rate and number of death of children is noticed still high in the report of Ministry of Public Health.

II. Target objectives

- In parallel with the plan of national development for 1989 - 2000, water supply expansion project puts a target to respond 76% of population in nationwide. In this, the sort of technology will be ~~de~~ divided from low to high, for example, small size, medium size and large size.
- In 17 provinces the water supply system must be introduced.
- Following various towns, it is necessary to put in 252 collectives of villages ~~the water~~ a pure water supply system by rainfall storage or by bored wells.
- By village or by its collective there must be put bored wells or rain water basin for dry season, for 120 collectives of village.
- To make a plan for the protection of water source whichever underground or surface water.

III. Method of activity

Owing that the reply (to population for the supply) of clean water is related with the construction and improvement plan of towns, with new style countryside construction plan, with public health work, and environmental protection, then it should be requested to national level committee to have a competent organization for consulting and looking for the method of solution jointly and prepare the condition of activity starting from:

1/ - Propose a plan of management: plan for surveying-inspection, collection of data for each rural area of nation wide.
2/ - Propose detailed projects by each kind of project.
3/ - Prepare man-power of technician ready for the start of construction.
4/ - Prepare materials and equipments (necessary) in service.
5/ - Prepare and look for financial source, lay out sufficient budget.

IV. Financial source

Owing that the water is important material for earning livelyhood and also is one of elements for solving the quality aspect of living condition of the people, then as an old document says: the country will have civilization and prosperity when available 3 indispensable materials like: water flow, electricity and good road, specifically in the new era. In order to prepare and enjoy the expansion of economy and society field specifically in tourism, and expansion of industry, it is necessary to have an assuring water supply system. Therefore the arrangement of funds for operation is necessary and has many methods such as:

1/ - National budget for basic construction divided for each year in case of large and medium scale water supply project.
2/ - Grant aid from international organizations or from friend countries.
3/ - Special fund loan with low interest from international organizations such as; Asian Development Bank, World Bank, etc.
4/ - Joint finance between central and rural, state and population, etc. for small scale projects.

V. Benefits of this project

1/ - Political aspect : It makes the people to increase the confidence to the lead of the party and state, and solidarity with the policy of the party towards its true way. Also it will demonstrate that the state pays attention always to the people.

2/ - Social aspect : It will give the people the sanitation, reduce the disease, give the use of pure water, improve the living condition, ensure the work, save the time used for research of water and contribute the 3 hygiene program for its realization. It prevents primary disease and contributes the rural development plan to have good results.

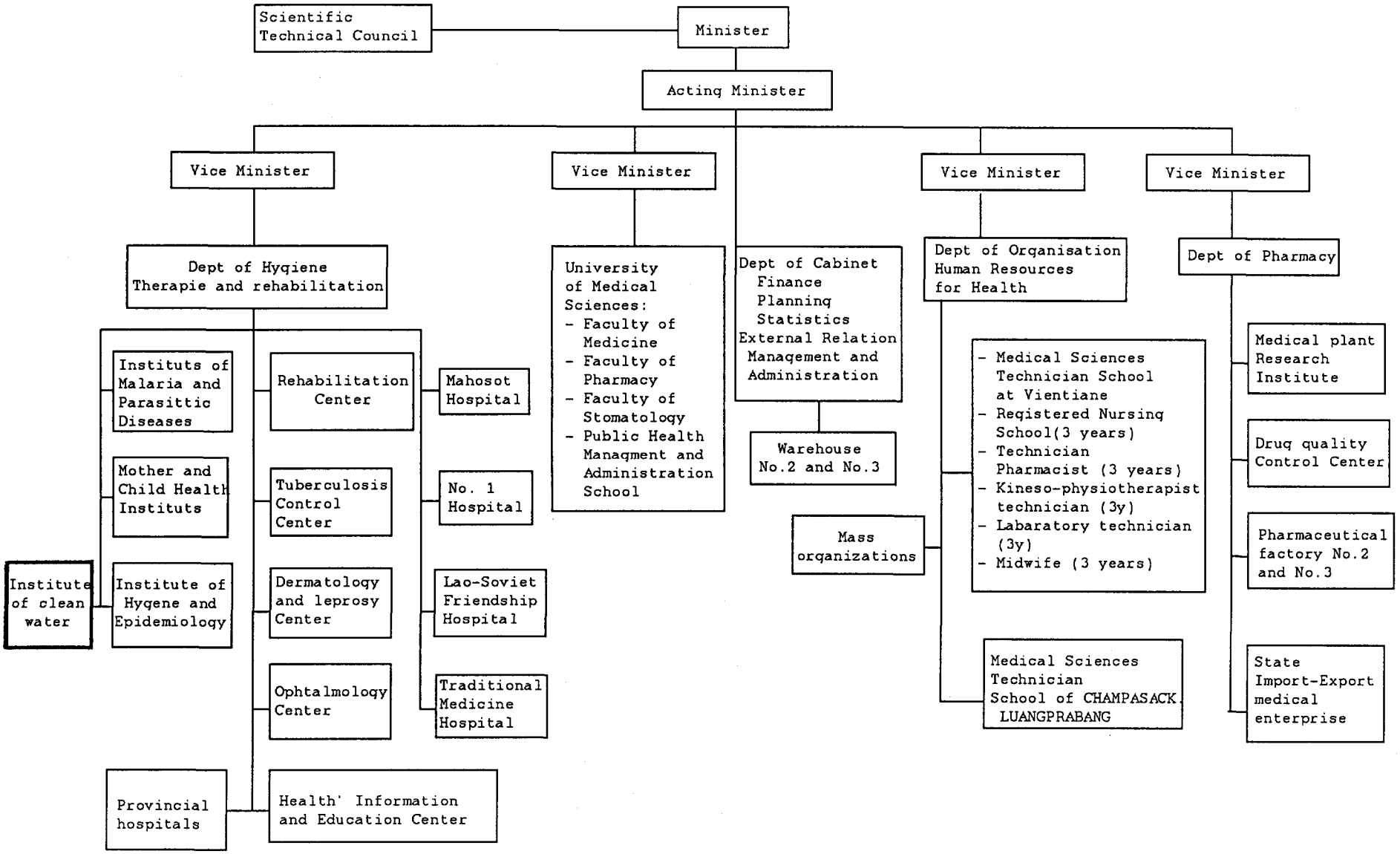
3/ - Economical aspect : Direct benefit of good health of people also increases the production power and improves the quality, saves the medicines for treatment and then reduces the budget.

4/ - International meanings:

For the period of 1980 - 1990 organization of United Nations calls "THE YEAR OF PURE WATER" then it will support to realize this type of projects in our country and in this world.

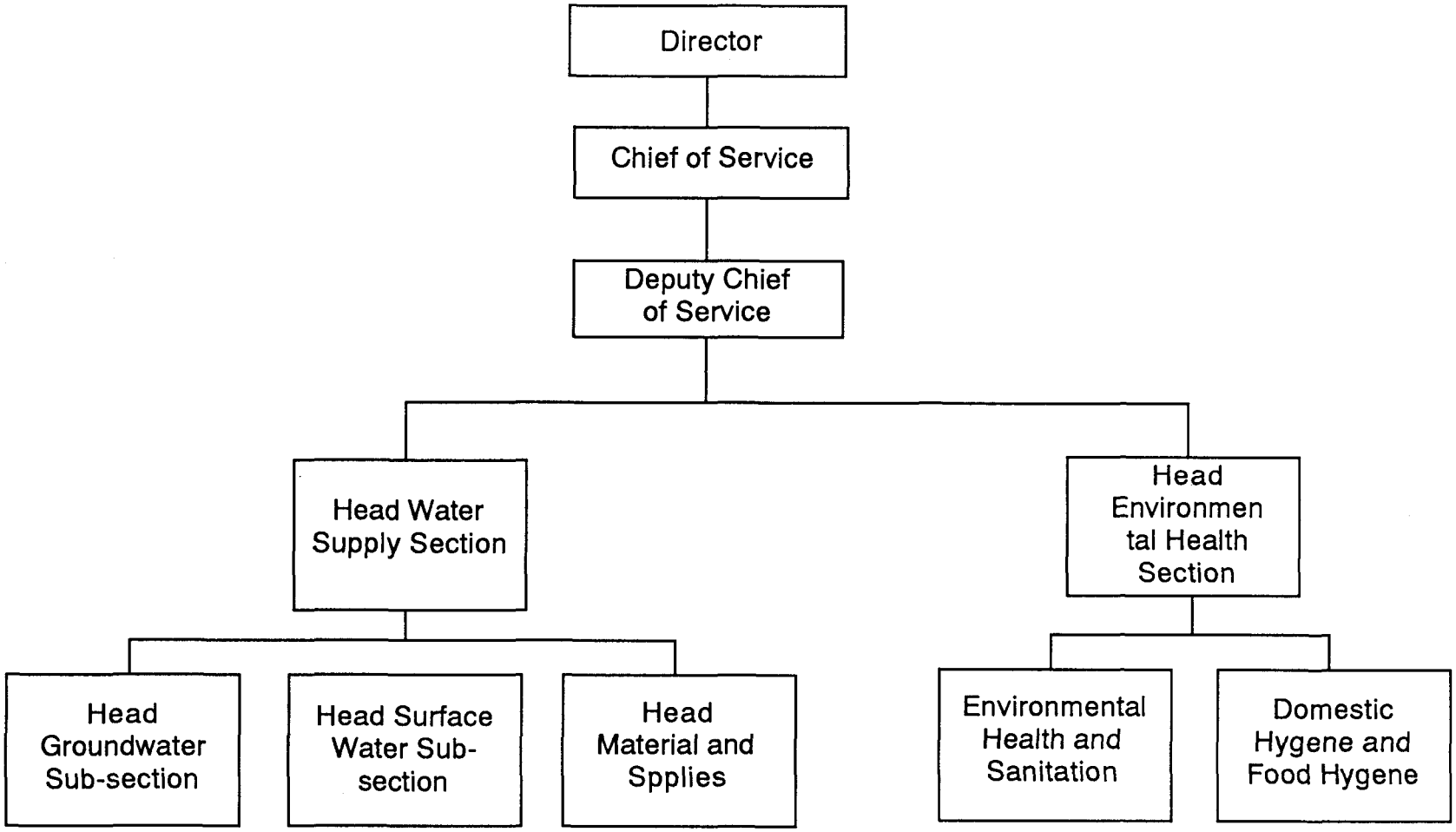
１０）厚生省と農業省の行政組織

Organization Chart of the Ministry of Health

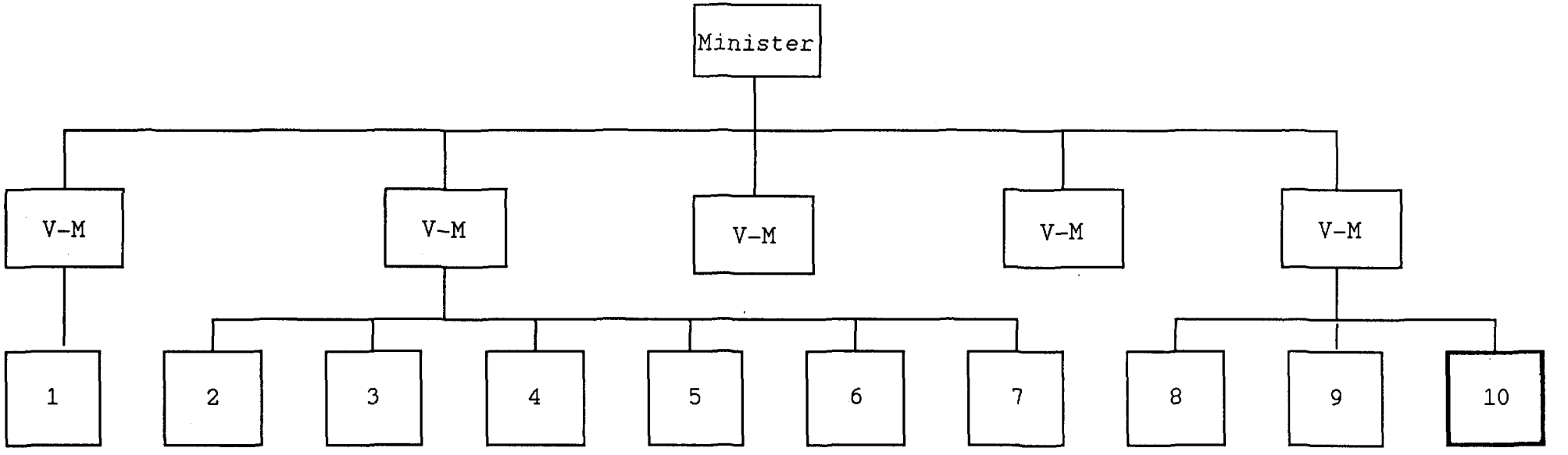


* Every three month one of four Vice-minister assums the Acting Minister's role

Institute of Clean Water

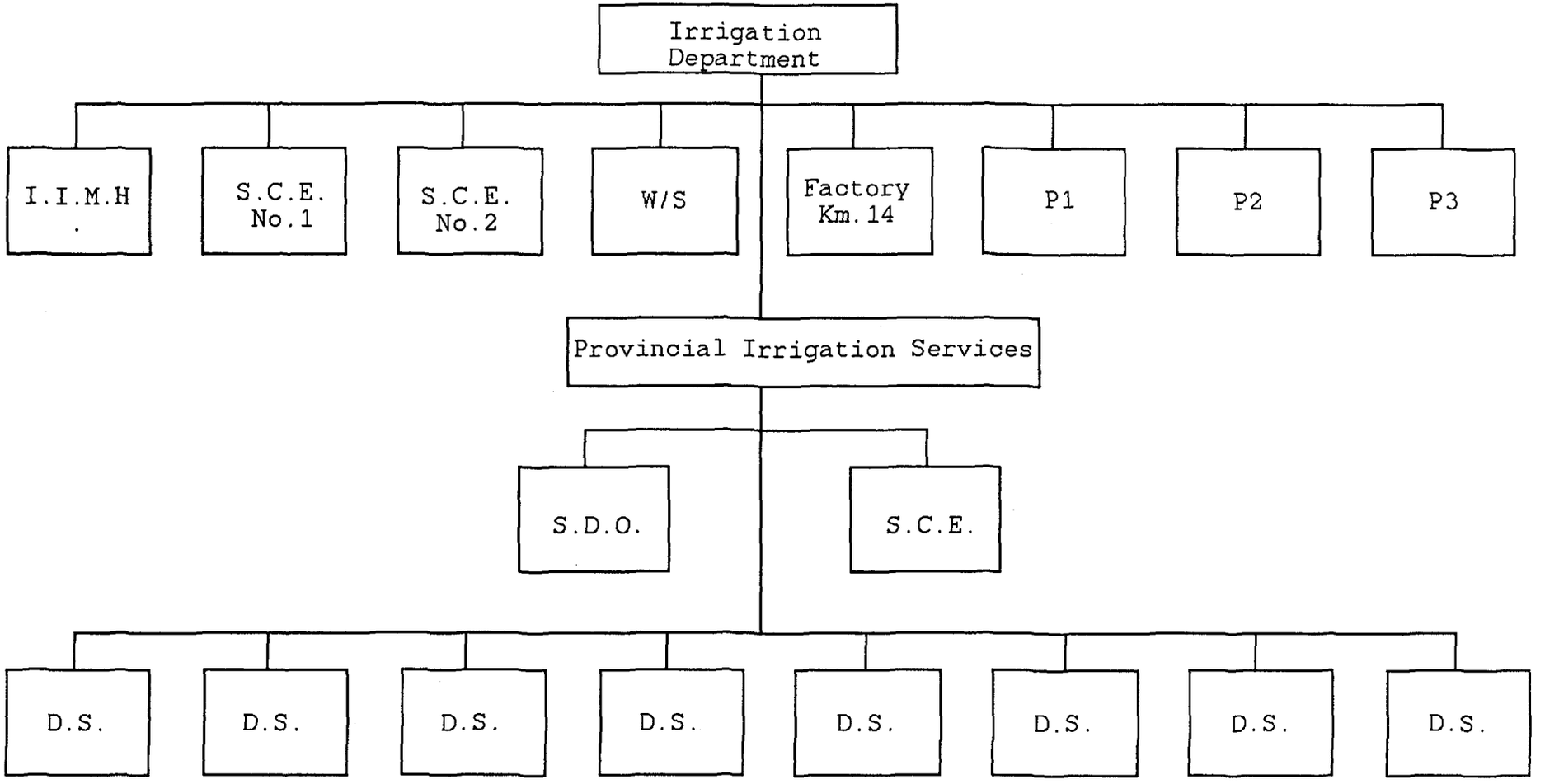


Organization Chart of the Ministry of Agriculture & Forestry



REMARKS: V-M- Vice-Minister
1 - Forestry Department
2 - Personnel Department
3 - Economic, Planning, Finance and Co-operation Department
4 - Agriculture Department
5 - Extension service Department
6 - Co-operative and Rural Development Department
7 - Livestock and Veterinary Department
8 - Meteorology Department
9 - Machinery Department
10 - Irrigation Department

Organization Chart of Irrigation Division



Remarks:
- I.I.M.H. - Institute of Irrigation and Micro-Hydropower
- S.C.E. - State construction Enterprise.
- W/S - Work Shop
- P1, P2, P3- Project
- S.D.O. - Survey-Design Office
- D.S. - District SErvices

１１）技術協力（調査）要請案

Lao People's Democratic Republic

Terms of Reference
for
Feasibility Study
on
Village Domestic Water Supply Project in the Southern Region of Lao People's Democratic Republic

1992

Ministry of Health

1. Background

Geographically, the country of Lao People's Democratic Republic represents a characteristic landscape of the Indochina Peninsula, that is to say the Indochina mountain system, of which the north edge ends up at the Himalayan southern skyline; it is an erosive plateau lying in the west against the Chonson mountains; the plateau takes the shape of the River Mekong, which cuts deeply into the Himalayan mountains.

The land-locked country Lao Republic ended its long tragic history of civil war for people's liberation in 1975 and established a new people's democratic regime. However, the nation's economy has remained far behind development due to the limited capable manpower devastated by tragic history and disadvantageous geographic configuration of the country.

The population engaged in agriculture is 62% of all workers (1.6 million) in the nation. The climate zone is semi-tropical and its' annual rainfall is between 1,500 mm and 2,000 mm. The country's key industry is agriculture, of which the main crops are rice, coffee beans and tobaccos, in addition to small-scaled livestock farming.

Under the first 5-year National Development Plan, which stated from 1981, GNP in 1985 was 154% (GDP US$ 489 mil) of the same on 1980, against the projected guideline, which is 165% to 168%. Specifically, agricultural GNP in 1985 was 142% against the projection of 123% to 125% and other industrial GNP is 142% against the projection of 200% to 220%.

Industrial development as of 1985 is far less than the desired projection, while the nation is able to achieve self-sufficiency in agricultural production under the plan. This distinctive outcome clearly indicates that business management of the industry conducted by socialist sectors have to be improved practically to perform higher productivity.

As for geographical character of the provinces, a table-top (shaped) plateau covers the plain spreading along the Mekong river, of which the height is 100 to 200 meters from sea level.

The provinces are located in the eastern edge of the Khorahat Heights of Thailand, which expands as much as 160,000 km^2. The Heights consist of red sand-rocks which were formed during the Jura period of the Mesozoic era, covering flatly above an erosional basement formed during the pre-Cambrian period. After all, the table shape plateau on the heights were formed by basalt erosion.
(refer to Exhibit 1: Geotechnical Data)

As for the regional climate state in the provinces, it is a semi-tropical savannah and the southwest monsoon in summer season blows toward the mountains lying at the west edge of the provinces and the northeast monsoon blowing to the provinces in winter is obstructed by the Chonson Mountains. Incidentally, the dry and rainy season in the region are very distinctive. Regional annual rainfall distinctively varies:

	annual rainfall	average temperature
SENO	1,541 mm	22 to 27 C
SAVANNAKHET	1,459 mm	22 to 28 C
SARAVANE	1,908 mm	23 to 31 C
PAKSE	1,989 mm	23 to 29 C
POKSONNG	3,202 mm	17 to 23 C
(for reference)		

The rainy season is from April to September, and 90% of the annual rainfall takes place during this season, while some rivers dry up in the dry season.
(refer to Exhibit 2: Meteorological Data)

Lao is an agricultural country. The nation's economy based on its agricultural harvest all but depends upon the climatic conditions and nature. The current living standard of farmers, which are a majority of the nation, is literally low in all aspects; i.e., social, economical, and cultural aspect. Constructing durable economic structure is urgently required for the nation's immediate prosperous future. From this standpoint, the people's democracy has the keen edge on prosperous expansion of the national economy, which is expected to generate a new power of production and improve the industrial productivity of the nation, simultaneously.

In terms of production technology and social standard, the natural economy of the nation still remains relatively undeveloped. Mountain dwellers are still living in moving houses or small villages isolated with families and/or relatives. For the purpose of taking this disastrous national economy, all the population are requested to make all their efforts to deviate gradually from the primitive natural economy to the advanced productive economy. By achieving self-sufficient agriculture under this reformation, economic production initiated by the farmers is expected t o increase dramatically. In order to induce a greater productivity, the whole nation is requested to conduct effective free-production and transportation of products by studying the fundamental provisions of the people's democracy and understanding the people's right of local authority.

The national economic reformation is expected to upgrade the living standard of farmers, which makes a foundation of the national economy. However, public utility services extended to the farmers are crucial to achieve the reformation successfully. Potable water supply particularly, the Ministry of Agriculture considers the highest priority among the utility services conducted by the Government because this year is coincidentally the final year of "the UN 10-year Water Development Program".

2. Project Area

2.1. Area Selection

The area of Lao People's Democratic Republic is 236,800 km2, topographically which consists of 45% mountainous area and 55% highland and plain. Regional Topographic Characteristics are briefly as follows;

The North	: Mountain district spreading along the upstream of the Mekong
The Middle	: All but the mountain district spreading against the Chonson Mountains lying from the north-east of Vientiane down to the south, some plateaus and plains spreading along the midstream of the Mekong.
The South	: Plain, of which the area is almost 25% of the whole country spreading along the midstream of the Mekong, the divide of the Chonson Mountains located in the eastern part of the area borders of Vietnam.

As agriculture, which is the major industry of the country is a crucial element to ensure a prosperous national economy, improvement of the infrastructure of the farmers economy particularly for the farmers living in the south, is considered to reserve the biggest agricultural potential because of the vast plain area.

Particularly, the following three provinces in the South have been selected for the water supply project areas because of relatively larger population than the rest of the area;

1) SAVANNAKHET Province
2) SARAVAN Province
3) CHAMPASAK Province

The population ratio of each province toward the whole country is as follows and makes 31.5% in total.

SAVANNAKHET	15 %
SARAVAN	5.2 %
CHAMPASAK	11.3 %

As aforementioned in this literature, the government's strong intention is a reformation of the national economy. Consequently, these two provinces in the South, have been selected for this water supply project. These provinces are expected to reserve vast agricultural potential for immediate development.

Statistics of the population of Lao in 1985 in 17 provinces

N: PROVINCE	1985	1986	1987	1988	1989	1990
1. VIENTIANE CITY	377409	388354	399616	411205	423130	435401
2. PHONGSALY	112954	116261	119632	123101	126671	130345
3. LUANGNAMTHA	97028	99842	102737	105717	108782	111937
4. OUDOMSAY	187115	192541	198125	203871	209783	215867
5. BOKEO	54925	56518	58157	59343	61579	63365
6. LUANGPRABANG	295475	304044	312861	321934	331270	340877
7. HOAPHANH	209921	216009	222273	228719	235352	242177
8. SAYABOURY	223611	230096	236768	243635	250700	257970
9. XIENGKHOANH	161589	166275	171097	176059	181165	186418
10. VIENTIANE	264177	271941	279827	287942	296293	304885
11. BORIKHAMSAY	122300	125847	129496	133252	137116	141092
12. KHAMMOANNH	312462	219652	226022	232577	239322	246262
13. SAVANNAKHET	543611	559376	575598	592290	609466	627141
14. SARAVAN	187515	192953	198549	204306	210231	216328
15. SEKONG	50909	52385	53905	55463	57076	58732
16. CHAMPASAK	403041	414729	426756	439132	451867	464971
17. ATAPEUA	69631	71650	73366	75366	78066	80330
TOTAL	3574803	36785143	3394917	3894917	4007870	4124095

2.2 Nature

As for the topographical character of the provinces, table-top (shape) plateau of covers the plain spreading along the Mekong river, of which the height is 100 to 200 meters from sea level.

The project area is located in the eastern edge of the Khorahat Heights of Thailand, which expands as much as 160.000 km2. The Heights consist of red sand-rocks which were formed during the Jura period of the Mesozoic era, covering flatly above an erosional soil foundation formed during the pre-Cambrian period. After all, the table shape plateau was formed by the extrusion of basalt.
(refer to Exhibit 1: Geotechnical Data)

As for the regional climatic state in the area, it is a semi-tropical savannah and the southwest monsoon in summer season blows toward the mountains lying in the west edge of the area and the northeast monsoon blowing to the provinces in the winter are obstructed by the Chonson Mountains. Incidentally, the dry and rainy season in the region are very distinctive. Regional annual rainfall distinctively varies:

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The rainy season is from April to September, and 90% of the annual rainfall takes place during this season, while some rivers dry up later.
(refer to Exhibit 2: Meteorological Data)

2.3. Current State of Water Supply

In Savannaket and Pakse, which are the major cities in the project areas, the residents are enjoying relatively improved water supply service; people living in the rest of the provinces, particularly in remote towns and farmer villages have no water works -- hand pumps or hand-dug wells. Eventually ponds and rivers are their water sources located a couple of miles away from their villages. They have to deliver water to their homes everyday.

Generally, the population is unconcerned about sanitation. In spite of administrative advise by the local authorities, people drink raw water brought out of rivers or reservoirs. Consequently, water-born diseases take place quite often and spread through the region rapidly; and the death rate of younger generations caused by the diseases, particularly with the liver and the digestive organs, reaches as much as 14.1%.

There are few hand-dug wells around the areas because of the characteristic soil structure in this region, which consists of the red sand rocks lying from the Khoraht Height in Thailand as aforementioned. Its formation from the surface is of solid rocks. Existing shallow wells, which were constructed in a heavily weathered zone are supplying a limited amount of water even during the rainy season and are likely to dry up during the dry season. The wells are only 2 to 5 meters in depth and mostly of simple wooden well-wall structure. Hume concrete pipe wells are quire few in this region. People draw water out of the wells by an old bucket and rope, which are not considered sanitary and free from contamination with germs.

There are 406 mechanical drilled deep wells in the country. In 1960, about 100 deep-wells were constructed under USAID program. In addition, about 300 deep wells were constructed by Russian manufactured truck-mounted drill rigs, which were procured under FAO Grant Aid Program . The existing deep wells, which do not 100 meters in depth, are between 40 and 50 meters in depth. Steel pipe are installed in them which are 150 to 200 mm in diameters.

The aforementioned 100 deep wells constructed under the USAID program has been furnished with wind mill driven piston pumps or diesel driven reciprocating water pumps when they were constructed in the 1960's. These pumps no longer work at all and the wells have been mostly abandoned. The other wells equipped with a hand pumps are still working. However, the old pumps originally installed have been replaced several times with new hand pumps.

It is difficult for the local authorities operating their public services with a limited budget allocated for public works to procure and store enough spare parts to keep the wells in good working condition. The people in these regions use empty bullet shells used in the last war instead of buckets to draw water out the wells; they are not able to repair mechanical trouble with hand pumps due to limited spare parts supply from an incomplete inventory.

Truck mounted mobile water tanks are distributing daily water to people living in certain remote areas, of which distribution cost charged to the residents is 150 KP[per 200 liters. However, no more than 14% of the nation are able to afford the enjoyment and benefit of disease free clean water supply from well maintained deep wells.

As the sanitary campaign conducted by the Government has been accomplished, some people are making the effort to collect clean rainfall from rooftops into steel container for drinking. However, most of the nations does not stop drinking raw water which is not sanitized. In addition, it is rather difficult for people to get enough water for domestic use.

Though ground water reserved in the red sand rocks of Khoraht Heights is reported generally to contain rather high salinity for drinking, water bailed out of the existing deep wells, which has been constructed particularly in the project areas, shows low salinity which is considered fairly tolerable for drinking.

3. Water Supply Administration under the National Development Plan

3.1 The National Development Plan in the Past

Since 1978, immediately after the new regime was established, the 3-year National Economic Development Plan under the Government of Lao People's Democratic Republic had been trying to reconstruct the devastated national economy, social structure and state of culture which were literally destroyed by the long civil war. In spite of the entire efforts, the out come as of 1981 was far below the projection; vis

Gross National Products	US$ 290,000,000.
GNP per Capita	US$ 80.

In 1981, for the purpose of long and mid-term national reformation, the government launched the First 5-year National Economy & Social Development Plan, and initiated its implementation. The major projections of the plan were as follows:

(1) to increase agricultural & forest production
(2) to increase other industrial production
(3) to improve economic infrastructure
(4) to develop manpower resources, and to upgrade the institution of national education and health.
(5) to activate domestic business and to expand trade
(6) to expand the national budgetary revenue and expenditure
(7) to upgrade and reinforce business capability of public sectors
(8) to provoke an agricultural production incentive through national farmers' union.
(9) to strengthen the business management capability of the state corporations and to improve business efficiency of the public sectors.

The outcome was that the agricultural industry was the only `one which has exceeded the projection and eventually provided the nation with sufficient foods for the domestic consumption. The Gross National Product (GNP), which had been achieve in 1985 received a positive financial appraisal;

GNP as of 1985	US$ 489,000,000.
GNP per Capita	*US$ 135.*

3.2. The National Development Plan at the Present

The second 5-year National Development Plan launched in 1986, projects 10% for an average annual growth rate of GNP. The major projection of the plan is as follows;

(01) Sufficient food production primary for the domestic consumption
(02) Forestry development
(03) Industrial development including handicraft industry
(04) Urban and farm village development
(05) Transportation and telecommunication development
(06) Commercial network system
(07) Public business expansion
(08) National finance stabilization
(09) Educational level upgrading
(10) Advanced technology utilization
(11) Economical and social relationship improvement with the special districts

In 1986, the government was focusing on intensifying the following business activities for the new economic management plan;

- free trading
- rationalized business management
- business independence of state-owned companies
- administrative support for private companies
- privatization

3.3. Waterworks Administration under the National Development Plan

The third 5-year National Development Plan, which is being under study and review by the relevant administrative agencies, is to be launched in 1991 and will be projecting similar objectives to the current ones. The authorities have put their keen administrative focus on intensifying the following activities;

(a) sufficient agricultural production for domestic consumption and reservation.
(b) further liberalization of private sector.
(c) progressive introduction of foreign investment

In accordance with the administrative strategy of the government agency in terms of the national development, agriculture is the key industry and accelerating the growth in agricultural production is vital for the country to establish a competent fundamental structure of the national economy.

The administrative agency is very much appreciative of the annual growth in products for the fiscal year. However, the farmers' living standard, particularly in the rural area has not been improved satisfactorily, as of the present time.

In terms of water supply, (which are a key public utility service representing the nation's living standards;) particularly drinking water, which can be considered to directly affect the nation's physical health, no more than 20% of the population can enjoy safe potable water everyday.

Irrigation facilities are vital for farmers to raise and cultivate crops, such as coffee. Consequently, abundant water sources should be required to upgrade the nation's living standards too.

The government authorities are convinced that they can contribute to solutions for the nation's tragic internal affairs, such as drastic social tendency of the population to flow into urban areas from farm villages and a limited opportunity for the nation's young to be able to receive even primary education due to hard daily water delivery, by implementing this project.

3.4. Existing Water Supply and Sanitation Project

The government launched the project captioned above in 1982.
The target projection of the plan in terms of population ratio benefitting from the drinking water supply throughout the country against the whole population is projected 25% by 1986; vis the end of fiscal 1985, and 76% by 1990; vis the same as 1989, is far below projection, (has not reached the projection, instead), which are 6% and the 14% in urban and rural areas respectively.
Accordingly, the projection has changed from 1990 to 2000 for a projected date of 76% achieved.

The Department of Water Supply Ministry of Construction has made this change upon mutual agreement with relevant ministries; (such as Ministry of Social Affairs, Ministry of Agriculture and others). The program is briefly outlines as follows:

(refer to Exhibit 3)

General:

The national population of Lao is about 4,000,000, which consists of 600,000 (15%) and 3,400,000 (85%) living in urban area and rural villages respectively.

State of Water Use:

(1) Water Sources : Surface Water and Ground Water
(2) Population benefitted by water supply:
6% in urban areas
24% in rural areas
(3) Daily consumption per head:
200 liters in urban area, 45 liters in rural areas

Target:

Pursuant to the 3rd 5-Year National Development Plan: 1989 to 2000, the Government of Lao launched the Potable Water supply Facility Development Project, which projects to supply 80% of the entire nation sanitized potable water by fiscal year 2000. The project consists of components from the aspects of technology and sectors mentioned below:

- designated 17 provinces and cities, where potable waterworks are to be constructed for residents
- designates 252 rural villages, where water supply facilities are to be constructed, for which the wells are the water source.
- designated 120 villages in rural areas, ground water extracting system and/or rainfall storage reservoirs are to be constructed for the dry season.
- Water Sources Reserving Project is to be launched

Implementation Method:

(1) Master planning for nation wide feasibility study
(2) Proposing water development related projects
(3) Recruiting technical engineers and qualified personnel for construction work.
(4) Procuring & purchasing equipment, material and transporting vehicles
(5) Funding and budgeting to implement water development related projects.

Financial Resources

(1) National budget allocated specifically to construct large-scale and/or medium-scale water supply facilities.
(2) Grant aid program provided by international institutes and/or friendly countries
(3) Low interest financing provided from ADB, IDA and other favorable international financing institutes
(4) Provincial government budget and government subsidy allocated specifically to construct small-scale water supply facilities.

Benefit Projected

(1) Political Benefit : Nation wide credit delivered from the Party and the new Regime
(2) Social Benefit : National interest in health care and elimination of disastrous diseases
(3) Economical Benefit : Increment in industrial production/saving medicare expenditure.
(4) (Diplomatic) International Obligation : Contribution to the UN 10-year Drinking Water and Sanitation Program

Pursuant to the National Plan, water Supply Lao Company launched a couple of water supply projects in urban areas, which are specified in the project list attached with this letter of request. (refer to Exhibit 3)

Incidentally, Ministry of Health has been responsible for administrative water supply projects in rural areas.
However, the Ministry had not specified a substantial implementation plan yet.

Eventually, pursuant to a guideline indicated by the Ministry of Health, the Ministry of Health is planning and expediting a substantial water supply project to farmers' villages located in the southern provinces.

4. Water Supply Plan

4.1 Basic Policy

a) Projected daily water supply in rural area per head: 45 liters
b) Water Sources : Ground Water
c) Mode of Wells : Deep Tube wells equipped with hand pumps
d) Quantity of Wells constructed : One well per 200 residents
e) In case of village population being more than 1,000:
Primitive Waterworks, which consist of tube wells, pump
station, elevated water tank and public water)

Responsibilities:
Construction:
The Government Authority/Authorities
Management, Operation & Maintenance:
Water Utility Union of each village is to be formed for tolling water charge.
Running Cost (Funds):
Water charges for water consumption

e) Beneficiary:
about 220,000 which is expected to contribute to achieving the target by 10% more or less.

f) The remained water after supplying to the population can be supplied to coffee farm

4.2 Waterworks Construction Plan

4.2.1 Tube Wells equipped with Hand pumps

(1) Tube Wells
Wells
Well Diameter : 100 mm
Well Depth : 50 meters as an average
(20 meters to 100 meters)

Material
for Casing : Fiberglass Reinforced Plastic Pipes
For Screen : Slot-type FRP

(2) Hand Pumps

Water Head	10 meters	30 meters	50 meters
Lifting Capacity in liters (30 strokes per minute)	18	12	12

Height of Pipe base-stand: 800 mm to 1,000 mm

(3) Washing Space
Structure : Concrete
Dimensions : 2,000 mm (w) x 1,500 mm (B) x 100 mm (H)

4.2.2 Provisional Waterworks

(1) Tube Wells
Well Diameter : 125 mm
Well Depth : 60 meters as an average
(30 meters to 150 meters)

Material
for Casing : Fiberglass Reinforced Plastic Pipes
For Screen : Slot-type FRP

(2) Pumping Facility
Submersible Motor Pump

Material : Stainless Steel
Lifting Head : 50 to 100 meters
Quantity : 100 liters per minute
Diesel Generator
17 KVA, 50 Hz, 220 Volts

(3) Elevated Water Tank
Water Tank : Pre-fabricated FRP Panels
Water Tower :
Structure and Material : Steel
The Height : 10 meters

Public Water Taps
Structure : Reinforced Concrete
Quantity : 4 taps

Water Pipe Lines
Conduction Lines : 50 mm (D) x 100 m (L)
Distribution Lines : 32 mm (D) x 1,000 m (L)

(4) Irrigation Facility
Water Pipe Line : 25-50 mm (D) x 1,000 m (L) x 10 point

5. Underground Water Development Program Research

5.1 Research Objectives

In promoting a water supply program that uses underground water to increase the water available for domestic use in villages in two southern provinces of Laos.
We will pursue the following research objectives:

(1) evaluation of the volume of underground water resources available for the development in the subject region.
(2) design of basic plans for the development and use of underground water resources in the subject region;
(3) practical proposals for the development and use of underground water resources in priority development regions;
and, to increase the engineering capabilities for underground water development in Laos
(4) technology transfer to counterparts in Laos.

5.2 Basic Plan of Research

Since the 1960's Laos has, with the assistance of the United States and with funding from FAO, UNDP and UNICEF, dug over 400 deep wells and installed in them hand pumps. These facilities, however, have become run-down with time and most wells are now beyond repair. Therefore, the focus of basic planning will be the construction of new wells.

Water pumping facilities generally use hand pumps, and we will examine the possibilities for local supply of spare parts. Simple waterworks utilizing joint community water tanks will be studied as well, and the use of solar pumps should also be considered as they require only simple maintenance.

Through hydrological and geological research, we will examine the available amounts of underground water and the prospects for development, determining priority areas on the basis of their potential for development.

More detailed research will be conducted in the areas given high priority, and plans for water supply facilities that use underground water sources will be offered.

5.3 Subject Region of Research

Subject Regions	Champasak Province	Saravan Province
(Provincial) Capital	Pakse,	Saravan,
Subject Land Area	15,415 km^2	10,385 km^2
Subject Population	464,971	216,328

5.4 Research Topics

1. Topographical/geological survey and reconnaissance survey.
   * Gathering and organization of topographical/geological data
   * Interpretation of aerial photograph, analysis of remote sensing data
   * Geological survey of ground surface

2. Hydrogeological Research
   * Electrical Survey - to examine underground geological structure, e.g., aquifer conditions, and to construct hydrological and geological maps for regions where present data is insufficient.
   * Electromagnetic Survey - to ascertain the potential for underground water located in cracks and fissures in the interior of the rock bed or crushed zone of the same regions.
   * Data Gathering - to gather and organize data for a geological columnar section for research boring and wells and to drawn up a hydrological/geographical map.

3. Water Usage and Hydrology Research

Research of the following nature will be made to determine the availability and condition of underground water, the direction of flow, recharge, circumstances for development and use, barriers to the underground water, and hydrological circulation as well as to determine the amounts of underground water that can possibly be developed.

* Research on well utilization
* Research on use of surface water flow
* A comprehensive survey of underground water levels (once in the rainy season, twice in the dry season)
* Long-term observation of underground water levels
* Measurement of flow volumes of major rivers and streams
* Chemical analysis
* Meteorological research
* Water absorption estimated
* Construction of a database

4. Test boring and water pumping tests

Test boring and water pumping tests will be conducted in the areas determined to have a high potential for underground water development to confirm the amounts available.

Shallow and medium-depth underground water
Depth: 50 m 20 sites Extended depth: 1000 m

Deep underground water
Depth: 100 m 5 sites Extended depth: 500 m

5. Installation of water supply facilities utilizing hand pumps and reservoirs.

Hand pumps and solar pumps will be installed in several trial boring sites and wells, in accordance with particular regional conditions, to study the amounts and quality of the water available and to address the problems such as maintenance that might arise.

6. Fundamental socio-economic Program Research

In designing a water supply plan, we will research the social circumstances of the region (population composition and distribution, community structure, the environment, self-governing groups) as well as the economic conditions (employment, income, expenditure balance, etc.)

5.5 Research Results and Matters for Investigation

1. Elucidation of Geology and Underground Structure
   - Hydrogeological map and commentary
   - Evaluation and commentary on underground resources
2. Design of Basic Plan for Underground Water Development
3. Design of Practical Plan for Water Supply

5.6 Research Period

On-site research investigations are made very difficult by the rainy season, which begins in April and lasts for six months. The considerable delay in the implementation of the "Drinking Water and Sanitation Project Lao" has had a major impact on the National Economic Plan and hence the research period will be kept to the shortest time possible.

First research period: 9 months (on-site research: Jan-Mar 1993, research in Japan, May-Sep 1993)
Second research period: 11 months (on-site research: Oct 1993-Mar 1994, research in Japan: May-Aug 1994
Total Research Period : 20 months

5.7 Assistance required

A consultant team of sufficient qualifications, number and speciality or expertise will be requested to carry out the feasibility study mensioned according to the scope of works and schedule.

A consultant team will be composed of the following experts.

Team leader	6	man-month
Hydrogeologist	16	
Geologist	4	
Hydrologist	8	
Geophysicist (I)	8	
Geophysicist (II)	8	
Drilling inspector (I)	6	
Drilling inspector (II)	6	
Water supply engineer	8	
Socio-economist	8	
Total	78	man-month

6. Appeal for Gratuitous Financial Cooperation in Implementation of Water supply Program

The government of Laos wishes the Japanese Government to provide gratuitous financial cooperation for the implementation of the water supply program that will emerge from this underground development program research.

Work Schedule