

SECTION VII TELECOMMUNICATIONS

Vietnam's telecommunications network is a complex of diverse systems, some interconnected, some independent. The main components include the national system of the Post Office (PTT), the systems created by the GVN and US Armed Forces and other agencies, the radio, services of the National Police, the Combined Telecommunications Directorate, and subsidiary networks serving railways, highways, power, civil aviation, and others.

The dominance of military telecommunications is illustrated by the following tabulation of existing telephone connections in Vietnam:

PTT	-	42,500
ARVN	-	4,000
USAID	-	4,000
US Forces	-	55,000
		105,500

It has been estimated that investment in telecommunications by US Forces in Southeast Asia as a whole approximates to US \$2,000 millions, the bulk of this being in Vietnam*. Joint studies are being started by ARVN, MACV and USAID to evaluate the military telecommunications systems, the amounts and types of equipment which may be declared surplus and can remain in Vietnam, the components which may be removed, and the possibilities for conversion of military systems to civil use after the war.

In the military sector, Vietnam has some of the most sophisticated telecommunications equipment in the world. It has a civil system (PTT) which is poorly maintained, understaffed and physically incapable of installing additional equipment which has already been funded.

* "Post-War Telecommunications Planning," USAID, November 5, 1968.

Most of the difficulties of PTT are results of the war, and especially of the military draft which has pre-empted valuable technical personnel; but inadequate salary scales and insufficient training programs also contribute to the organization's technical staff shortages.

Through USAID a program for improving the PTT's capabilities is in progress. It includes assistance in installing additional telephones and exchanges, including international circuits. It also includes management reforms directed to the reorganization of the PTT to enable it to function without further foreign support and to produce net earnings for the Government. Credits of approximately US \$3 million are available for this program.

A concurrent five-year development program to expand the telecommunications services of the PTT has been set up and is to be financed by a loan of VN \$1,000 million from the National Bank.

Post-War Development

The PTT's own proposals for telecommunications development after the war call for an investment of about US \$74 million in the next ten years. This would cover international, interprovincial, urban and rural networks and connections. Estimates advanced by USAID are approximately the same.

The Joint Development Group, in cooperation with the Ministry of Public Works, Transportation and Telecommunications, and officials of the PTT, has reviewed telecommunications needs in Vietnam and generally supports the PTT proposals*. Before investment decisions are made, however, and firm estimates of the probable levels of public expenditures are included in post-war development budgets, more definite information is needed concerning the possible civil applications of the military systems. Firm plans for strengthening the capabilities of PTT to manage an improved national system are also needed before major investments can be considered.

* Telecommunications Development, JDG Working Paper No. 34.

For the ten years after the war, the Joint Development Group believes that a practicable target for public investment in telecommunications should probably not exceed the equivalent of US \$30 millions, of which about 70% would be in foreign exchange. Such a sum is included in the post-war infrastructural development estimates as follows:

Foreign Exchange	-	US \$21,000,000
Local Currency	-	VN \$1,062,000,000

SECTION VIII URBAN HOUSING

The war has had obvious and serious effects on urban housing in Vietnam. In total, possibly 100,000 urban buildings have been destroyed or damaged. Our investigations have taken into account not only the need to repair and replace war damage, but also desirable improvements in housing in the major cities and towns, often quite inadequate for present conditions*.

By almost any standards the urban housing requirements of Vietnam probably run into several hundred thousands of dwellings. The Joint Development Group cannot presently recommend a program for the wholesale rehousing by the Government of people living in sub-standard houses; it does recommend the establishment of appropriate and practicable policies for Government participation in this important area of development. We refer in particular to the proposal for a home mortgage bank advanced in Chapter 3 of this report.

As a start, the Joint Development Group suggests Government financing for the development (including grading, drainage, roads and utilities) of housing sites, where houses can be built by contractors or private owners. It also suggests budgetary provision for the construction of, say, one hundred thousand dwelling units over the next ten years. The budget allocation included in the post-war development estimates for these tasks, or possibly others, is the equivalent of US \$170 million, of which foreign exchange might be 30%, as follows:

Foreign Exchange	-	US \$51,000,000
Local Currency	-	VN \$14,200,000,000

* Urban Housing, JDG Working Paper No. 31.

SECTION IX POWER

The development plans and projects proposed in this section incorporate where appropriate the views and plans of agencies of the Government of Vietnam and of United States Agency for International Development. The material presented in the report of the Vietnam Electric Power Management Advisory Team of August 1967* has been considered and used to the extent that it was relevant to the program and projects presented in this section.

The objectives of this section are: a) to review the capability for generation, transmission and distribution of the existing power system; b) to present approximations of future electric load and growth requirements for the ten-year period after the war; and c) to outline briefly a development plan for this period. It is beyond the scope of this report to present detailed project plans; however, general power generating locations are discussed and cost approximations are given. Recommendations for continuing investigations and studies are included at the end of the section.

PRESENT SITUATION

Generating Capacity

There exists in Vietnam today a serious shortage of power facilities to meet present and projected power needs of the country. The total installed generating capacity, excluding privately-owned United States Military and United States Government diesel generators, is less than 350 mw. Excluding the Da Nhim hydro-electric plant (160 mw),

* "Electric Power Management Advisory Study," Vietnam Electric Power Management Advisory Team (USAID), August 1967.

which is inoperative because of damage to the penstocks and the transmission line, there remains only 190 mw of installed capacity, most of which (130 mw) is located in the Saigon-Cholon area.

Only about 85% of the installed capacity is available on a continuous basis. The installed usable generating capacity is roughly 50 watts per capita in the Saigon metropolitan area and 4 watts per capita for the rest of the nation; it is a little more than 10 watts per capita for the entire country.

To improve conditions in the rural communities, more than 50 hamlets and districts have been provided with small generating units since 1964. This program was launched under the Pacification Program of 1964-1965 and was continued in 1966 and succeeding years by the Ministry of Revolutionary Development in cooperation with Electricity of Vietnam. In addition, the National Rural Electrification Co-operative Association of the United States is sponsoring three rural electrification projects which are in partial operation.

Transmission and Distribution Systems

Throughout South Vietnam the capacity of the existing distribution systems is inadequate to supply existing and potential consumers.

The Saigon-Cholon area is served by a 66 kv transmission loop built in 1965 which is in reasonably good condition. As previously mentioned, the 230 kv transmission line from the hydro-electric plant at Da Nhim is inoperative because of damage to towers and insecurity of the area. Distribution substations (66/15 kv) vary in condition from relatively new to old and inadequate. The distribution system is under-capacity in many areas of Saigon and has not been extended to provide service to all new areas. The actual demands are limited to available generating capacity by means of interrupting non-essential loads at peak times.

The distribution systems outside Saigon are generally inadequate and lack capacity to meet present and future requirements.

Operating Agencies

Before 1964, almost all of the electric power industry in Vietnam was in the hands of four French corporations operating under concessions granted by the Colonial Government before World War II. The exceptions were seven small generating units operated by local and regional administrations.

The Government-owned company, Electricity of Vietnam (EOV), was created in 1964 with broad power to operate the existing Government utilities and to promote the electrification of the entire country. During its initial years of operation, most of the plants operated by EOV were derived from Japanese World War II reparations or from USAID.

The Saigon Power Company (SPC), with controlling shares held by the GVN, was formed in mid-1967 to operate all Government-owned electric facilities in the Saigon metropolitan area.

At the end of 1967, the most important French concessions expired. With a few minor exceptions where concessions are still in effect, particularly in the five northern provinces, the French generating plants and related facilities have now been surrendered to the Government of Vietnam. Administration of the plants was taken over by SPC in the Saigon metropolitan area and by EOV elsewhere in the country.

While the SPC was formed to operate all electrical facilities in the Saigon metropolitan area, in practice EOV operates a considerable proportion of these, primarily generators provided by USAID programs during the period 1964-1967. The 1967 decree forming SPC provided that EOV be merged with SPC only in the Saigon-Cholon area; it has been determined, however, that the remaining power facilities in the rest of Vietnam would represent at best marginal operations for EOV. Consequently, plans have been drawn up, and negotiations are under way for a complete merger of SPC and EOV into a single independent company, operating on a nationwide basis, to be called Vietnam Power Company (VPC).

POWER REQUIREMENTS

For purposes of these preliminary studies of power requirements in Vietnam, it is convenient to divide the country into three geographical regions: 1) Saigon and vicinity; 2) the area north of Saigon; and 3) the area south of Saigon. Forecasts of power requirements were made for these three areas. These forecasts are the basis for the development of a ten-year expansion and rehabilitation program for the entire country. A discussion of these forecasts follows:

Saigon and Vicinity

This area will, in all probability, continue to be the major electrical load center of South Vietnam. Several forecasts of peak demand in the Saigon-Cholon area have been made over the past four years; the most recent estimate is that of the Vietnam Electric Power Management Advisory Team (MAT) in their report of August 1967, which predicts a maximum peak demand of 559 mw in 1972 and 922 mw in 1975. These load forecasts, according to MAT, are based upon the premise that the distribution systems will be rebuilt, strengthened, and extended, and that generating facilities will be augmented so that pent-up demand for power will be supplied by the end of the period. It is assumed that funds and manpower will be available to carry out the proposed power development program. Under the above-stated conditions, the estimated power requirements were reasonable.

However, the development program suggested by MAT has not been implemented and there appears to be some very serious questions as to when it may be approved and work started. It, therefore, does not seem feasible to retain these particular calendar year estimates as realistic and capable of fulfillment. The JDG considers that a more realistic projected growth rate will require capacity in the Saigon-Cholon area to meet a need of about 500 mw in 1975 and 1,000 mw in 1980. The assumptions that capacity approximating the above figures will be available in 1975 and 1980 must take into account security conditions, the availability of funds, equipment, manpower, and required design and construction lead time. It is our opinion that a market exists to absorb the above amounts of power and that the above schedule can be met.

Area North of Saigon

Projecting the power needs for this area will be much less precise than for the Saigon metropolitan region. There is currently very little generating capacity and limited distribution of electricity for comparative purposes. The forecasts of power requirements envisage minor industrial development in the large communities and eventually a sizeable portion of the power being supplied from multi-purpose hydro-electric projects combining irrigation, flood control, and power. Existing installed capacity, excluding the 160 mw at Da Nhim, totals 38 mw. It is our estimate that the power requirements for this area will be 100 mw in 1975 and 200 mw in 1980. The market exists to absorb this power when facilities are built to supply it. The timing for completion of these facilities is dependent on the same criteria as previously mentioned.

Area South of Saigon

The power requirements for this region are estimated to be 40 mw in 1975 and 85 mw in 1980. This projection does not include the large agricultural demand which is discussed in Chapter 12 under Mekong Delta Development and which will amount to about 300 mw for drainage pumping plus additional power for irrigation pumping over a period of 30 to 40 years. Only a fraction of the ultimate demand in the Delta will be required in the initial 10 years of post-war development.

DEVELOPMENT PROGRAMS

Current Planning and Development

A number of electrification programs have been planned during the past few years by the Government of Vietnam, acting through Electricity of Vietnam, and by the United States Agency for International Development, both directly and through consulting firms under contract to it.

The Joint Development Group has considered these programs, described briefly below, in the formulation of its development program for

Saigon and vicinity, the area north of Saigon, and the area south of Saigon.

The most recent development plan for the Saigon metropolitan area is that of the Vietnam Electric Power Management Advisory Team in August 1967. This plan provides for 1,075 mw of generating capacity in 1975 without Da Nhim hydro-electric plant, and 1,031 with this plant. These figures include 132 mw of reserve generating capacity. The estimated capital expenditures for this program, which includes generation, transmission, and distribution facilities are:

	<u>1972</u>	<u>1975*</u>
<u>Plan Without Da Nhim</u>	US \$184,000,000	\$270,000,000
<u>Plan With Da Nhim</u>	162,700,000	250,000,000

*Estimated for transmission and distribution.

Since the preparation of this plan about two years ago, there has been little progress toward its physical implementation as proposed. For very practical reasons of financing and technical consideration, it will not be possible to accomplish the program within the time period presented. It is therefore the opinion of the Joint Development Group that the power needs for the Saigon metropolitan area will be met at a slower rate and at a later date than envisioned in the MAT report. Furthermore, the magnitude of capital expenditures for power in the Saigon area would represent an unbalanced allocation of resources when the rest of Vietnam is critically short of power and there are so many other post-war development and reconstruction requirements.

The MAT report is an excellent planning document, however, and it should be used in the execution of the program to meet the power needs of the Saigon-Cholon area. It considers all factors pertinent to good electric utility planning for expansion to meet the power requirements of the Saigon-Cholon area.

A USAID grant of US \$32,000,000 providing for two 66 mw thermal units, extension of distribution facilities, and management advisory services in the Saigon area has been negotiated; its implementation

is contingent upon the merger of Electricity of Vietnam and Saigon Power Company into the Vietnam Power Company referred to previously. The general objective of USAID is to develop by 1972 a capability to generate and distribute about 386 mw of power to the Saigon metropolitan area. In view of the past delays in effecting this plan, it appears doubtful that the goal of 386 mw installed generating capacity in the Saigon area will be realized by 1972.

USAID financing and technical assistance have also been provided for provincial and rural electrification under two separate programs: 1) rural electric cooperatives (up to \$5,000,000); and 2) provincial and rural electrification (approximately \$2,000,000, not including amounts spent under previous programs). Under the first of these, three pilot rural electric cooperatives have been set up with technical guidance from the United States National Rural Electrification Cooperative Association (under contract to USAID). Good progress is being made and some electric service is being rendered. These three pilot cooperatives are located in different provinces - Tuyen Duc, Bien Hoa, and An Giang - and will supply eventually at least 45,000 customers. It is planned that funds collected from operation of the cooperatives will go into a revolving loan fund for formation of future electric power cooperatives.

The second program for provincial and rural electrification intends to: 1) supply diesel-electric units to provincial cities; and 2) establish rural service in hamlets by installing smaller units. USAID participation in this program is being reduced as Vietnamese financial capacity to continue it increases.

Electricity of Vietnam is presently engaged in planning activities in connection with preparation of a comprehensive program for electrification of provincial towns. In preparing this program, EOV is considering alternative means of generating power on the bases of specific project studies which have been made by its own forces and by others. Since the status of the EOV program is still very tentative, it has not been included in this report.

Joint Development Group Program

The preliminary electric power development program proposed by the JDG for implementation over a ten-year period is described briefly by areas in the following paragraphs.

1) Saigon and vicinity - The minimum objective of the JDG program for Saigon and vicinity is to provide, by 1980 or earlier, the facilities required to generate and distribute approximately 700 mw of power and energy. This amount will not cover all power needs and requirements of the area and, even if it is approved and implemented, efforts should continue to expand the facilities to meet the full prospective demand. We have estimated the projected power market for 1980 to be about 1,000 mw. The continuing USAID support program should provide 386 mw of generating capacity by 1972 or 1973, leaving approximately 300 mw to be provided in the seven to eight following years to meet the JDG's minimum objective. Generating capacity could be supplied by reactivation of Da Nhim (160 mw), plus installation of additional units at that facility, or thermal generating plants, or by some combination of those means.

The magnitude of capital investment requirements to provide the facilities required to generate and distribute 300 mw of additional power and energy in the Saigon metropolitan area after 1972 or 1973, over and above the 386 mw scheduled to be available then, is estimated to be about US \$100,000,000.

2) Area north of Saigon - The ten-year development goal for the area north of Saigon which is recommended by the JDG is to provide facilities for generating and distributing approximately 150 mw of power and related energy by 1980 or earlier. This is about 110 mw more than presently exists. The power needs for this area are projected to be about 200 mw, leaving a deficiency of about 50 mw in 1980. In this section of the country the use of hydro-electric power is one means for reaching this goal. It is recognized that some small thermal or diesel electric plants will have to be installed to meet requirements during the next few years. Over 3,500 mw of hydro-electric power capability have been identified within the Dong Nai, Upper Sre Pok, Upper Se San, Ba, Bo, and Haut Sekong River basins (Chapter 12). Insofar as may be

practicable, hydro-electric power should be developed in conjunction with multi-purpose river basin projects to achieve lowest cost development. An example is the preliminary proposal for Song Vu Gia dam and reservoir, in the Quang Nam-Quang Tin subregion of the five northern provinces, described in Chapter 12 of this report.

Capital investments to provide the additional 110 mw of power and related distribution facilities are expected to approximate US \$60,000,000, if the concept of multi-purpose projects is followed. Single purpose hydro-electric projects would result in higher costs in most cases.

3) Area south of Saigon - For this area, the objective is to provide facilities to generate and distribute a total of 85 mw of power by 1980 or earlier. This is about 70 mw more than presently exists in the area. The above additional capacity will meet substantially all of the power requirements for the area except the water control pumping needs described under the Mekong Delta Development section in Chapter 12 of this report. Since there are no hydro potentials in this area, generating capacity during the ten-year period will be supplied by thermal plants, diesel-electric generation, or EHV interconnections with other sources of supply.

Capital investment requirements for installation of the above 70 mw of power and related facilities are expected to be about US \$25,000,000.

4) System planning - The development programs described above are for the most part plans for three separate areas of the country. This will undoubtedly be the manner in which the power systems will expand to meet the needs of each of these areas.

However, during the ten-year period covered by this proposed development program, adequate system planning should be initiated to consider the various alternatives for providing the power needs of the nation. This planning should consider potential as well as existing hydro-electric plants, storage reservoirs to firm hydro capacity, EHV transmission systems, thermal and nuclear plants, and power interchange possibilities.

Future Investigations and Studies

There is a need for additional investigations concerning the future power requirements of the nation and the means by which this requirement can be met. For the Saigon area, the August 1967 report of the Vietnam Electric Power Management Advisory Team should be used for planning purposes; it should be updated so that the information and recommendations may be more helpful and useful in the future.

For the nation outside Saigon, much remains to be done to project power requirements and to make realistic plans to meet these requirements. It is understood that the group which prepared the MAT report on the Saigon-Cholon area will undertake this work in the near future for the areas outside Saigon. To the extent possible, taking into account security and other factors, these studies should develop plans for generation sites with capacities, transmission networks, and distribution system requirements. The scope and conduct of the studies and investigations should be coordinated with the JDG in order that the findings, recommendations, and proposals are realistically compatible with the overall plan and concepts now being prepared by the JDG for post-war development in all sectors of the economy.

CHAPTER 11 THE SOCIAL SERVICES: EDUCATION AND PUBLIC HEALTH

The Joint Development Group has not as yet made original studies of these topics but it has become familiar with work done by others. It seems desirable to draw attention to certain characteristics of recent and continuing developments in the social services which have important, but rarely mentioned, implications for the future. While we have no special qualifications to criticize the programs and policies, particularly in Education, which have been suggested by a variety of professional authorities and consultants since 1966, those programs and policies do not appear to us to meet the imperative need of planning for the social services, not in isolation from the rest of the economy but in the context of it. They advance, quite understandably, the objectives in their own particular fields of endeavor which good professional men know to be desirable and believe to be practicable in the short term with resources presently available; they may not necessarily represent what will be feasible in the long term, having regard to future limitations on resources, and all the other, at least equally exacting, demands for priority. There can be little argument that a more balanced and better integrated approach is wanted.

Precisely what the approach should be is a matter of some difficulty. Education especially is a politically sensitive subject in every developing country and the developed ones as well, with influential vested professional interests and some deeply rooted traditional attitudes which make objective discussion extremely difficult. Inside the Joint Development Group there is no unanimity of opinion concerning the course we might advise the Government to take, and this accounts for some difference in treatment between the corresponding chapter in the Vietnamese version of this Report and the present one. In the Vietnamese version of the report a rather full account is given of educational progress in the last ten years, of the problems likely to be met in the period immediately following the war, and of the improvements in educational services which might be brought about first in a three year period of rehabilitation and then in a seven year period of development assumed to end in 1978. In this chapter

of the English version of the Report the same information is presented in summary form, without disagreement as to what is desirable and what the priorities should be, but with rather more stress on the financial implications, and consequently some question whether it is realistic to suppose that the objectives can be achieved in so short a time.

In neither version do we advance final solutions to the difficult problems of providing Vietnam with the range and quality of social services most of its people have now come to expect: but in both we raise some fundamental questions for determination by the Government in the very early future, not, we suggest, on the advice of teachers and doctors only but also on that of economists and men of state.

THE PRESENT STATE OF THE SOCIAL SERVICES

A first observation is that in the course of the last ten years there has been considerable expansion of the nation's educational services and there has also been an improvement, in facilities for medical care.

There were nearly two million children in primary schools in 1967, double the enrollment of 1958/59, and there were almost half a million children in secondary schools as compared to 140,000. The growth of higher education was even more impressive, with 31,000 undergraduates in the three public and two private universities, as against a mere 9,000 ten years before. In a seven year period between 1959 and 1966 the numbers of facilities at which medical treatment could be obtained increased from 979 to 1,710, and the numbers of hospital beds from 19,000 to almost 27,000. In numerical terms alone, without reference at the moment to the quality of the services provided, this increase in facilities represents a remarkable achievement in time of war. The new facilities have not, of course, by any means satisfied the popular desire for progress. It is estimated that there are still at least a million children of primary school age who do not go to school, but these developments demonstrate an intention to satisfy that desire and they have raised hopes that within a reasonably early future adequate educational and public health

services will be provided throughout the nation. That there should be universal, free, compulsory primary education, for instance, is taken for granted, and this is understandable, since it is predicated in the new Constitution.

The quality of the services provided, with one or two exceptions, leaves much to be desired. The numbers of teachers in primary and secondary schools and in the universities have not increased in the same proportions as the pupils; and in the primary schools, though there are now 32,000 teachers compared with 19,600 in 1965, properly trained and qualified teachers are in a minority. Most of the nation's primary school teachers are either completely untrained or are people who, having themselves recently completed a five year elementary course, have then been given a bare 90 days of instruction to fit them to be teachers in the new hamlet schools. These men and women are paid minimal salaries, VN\$3,450 a month; they teach large classes, from 50 to 60 pupils at a time; school hours are short, since in some places two or even three sessions have to be accommodated in the same classroom in a single day. The communities concerned have put considerable effort into the construction of the hamlet schools, and the young teachers bring a great deal of spirit and enthusiasm to their work; but it is questionable whether, in the result, much more is being provided for the bulk of the country's children than the barest literacy.

A second observation concerns the cost of these improvements in the social services. The capital costs of a primary school are small, VN\$110,000 in cash, with construction materials supplied by CORDS, and labor supplied by the community. The cash costs have been met from the budget of the Ministry of Revolutionary Development, derived in large part from the AID chapter of the National Budget. At a cost of VN\$110,000 a classroom, an annual program which provides for the construction of 2,500 classrooms and rudimentary training for 2,500 teachers does not, in these conditions, present much of a financial problem. It has in fact been achieved, and there are some who think that if it is maintained at this pace it will make universal free primary education a reality in the early nineteen seventies. Generous overseas assistance has also been forthcoming for the secondary and vocational schools, for certain departments of the universities, for the construction

of a few new hospitals and improvements to others, and for other public health services including training facilities for doctors and nurses. In these circumstances the capital costs of expanding the social services have not been a strain on Vietnamese resources; indeed, if the burden of capital costs were eventually to fall entirely upon Vietnam, the probability is that they would not be so high that they could not be contained within a ten-year development program of the dimensions we presently contemplate, or met, over a reasonable period of time, from Vietnam's own internal resources; but the annually recurrent costs of maintaining and operating these installations are quite another matter.

In fact very little thought appears to have been given to them. They are, of course, very high, many times higher than the capital investments made in recent years; they already impose severe strains upon the National Budget, and they are mounting inexorably. The Budget of the Ministry of Education was only VN\$409 millions in 1955. It rose steadily to VN\$ 1,169 millions in 1962 and it was VN\$5,721 millions in 1968. To a limited extent these increases in cost reflect inflationary pressures and the declining value of the piaster, but what they represent mostly is the cost of running many more schools than there were in the totally inadequate educational system of ten years ago. The Ministry's budget rose by 26% in one year alone between 1967 and 1968, and since three-fifths of the budget is devoted to primary education it can safely be assumed that this was in large part a direct consequence of the successful prosecution of the hamlet school program.

In 1968 the budget for education did not, on the face of things, represent a very large proportion of the National Budget of VN\$93 billions, in fact it was only 6 percent of it, a very modest allocation by any standards to so important a purpose. However, comparisons are distorted by the fact that so large a share of the National Budget, roughly two-thirds, is devoted to defense, and by the probability that defense costs will continue to be very high for at least the first five years after peace returns. If the defense costs were to be excluded then expenditures on education were almost one-fifth of all Government expenditures for civilian purposes in 1968. The budget of the Ministry of Health went from VN\$2,000 millions in 1967 to VN\$2,800

millions in 1968, an increase of 40 percent, and a figure of VN\$3,467 millions has been inserted into the draft budget for 1969, though this includes provision for refugee relief. Again the ratio in 1968 of public health expenditures to total government expenditures was low, only 3 percent; but if defense expenditures were to be excluded then it was 9 percent, significantly higher. Since the budgeted costs of education and public health do not by any means represent the total costs of operating these services (they exclude the contributions from the AID Chapter of the budget and the uncotted contributions to hospital services by Allied Forces and voluntary agencies), the real costs of maintaining existing services in education and public health is probably equivalent to one-third of all governmental expenditures other than defense.

This leads to the next matter for comment, the extent to which Vietnam has now become dependent on external sources for the maintenance of its social services. As mentioned earlier, capital investment costs have been met almost entirely from funds provided by Vietnam's allies; but this is of less concern than the fact that quite a high proportion of the recurrent operating costs have been similarly met. In 1967 the Ministry of Education's budget of VN\$4,235 millions was supplemented by VN\$2,000 millions allocated by AID. Less than a quarter of this was used for investment; it was applied mostly to salaries and other operating costs. The AID supplement to the Ministry of Health's budget in 1967 was only VN\$389 millions; but this figure is not by any means representative of the value of the uncotted assistance provided for the staffing of public hospitals by the U.S. and other Allied Armed Forces and by voluntary agencies, including the American Medical Association. With more than twice as many Vietnamese doctors serving in the Army than there are remaining in the ranks of the Ministry of Health, these reinforcements from overseas have been most welcome, and undoubted improvements in the quality of hospital services have resulted. However, the heavy involvement of foreign doctors in what is, after all, a regular function of the Vietnamese Government cannot continue indefinitely, and the burden of maintaining these improved services must fall eventually upon the Ministry of Health.

To summarize, these are the characteristics of the existing social services which appear to us to be most relevant to their

development in the next ten years: generally in the country as a whole, though obviously not in insecure localities, these services are already developing very rapidly. Development of physical facilities has been achieved largely by generous foreign assistance, which has also been provided for the operation and maintenance of these facilities. In spite of this there are still serious deficiencies in the social services, the most important of which spring from the fact that the development of fully trained and qualified staff has not kept pace with the construction of physical facilities. The budgets of the Ministries concerned are insufficient for efficient operation of the physical facilities which Vietnam already possesses, but they have been mounting very rapidly and now represent a very substantial proportion of total government expenditures. In terms of post-war development the problem is not so much what the country can afford to build but what it can afford to keep up. The general framework of this budgetary problem has been discussed in Chapter 4. This is the context in which planning for the social services should now proceed.

EDUCATION

The corresponding chapter of the Vietnamese version of this Report and the tables included in it describe in some detail possible objectives for national education in the next ten years. They also describe the organizational and other measures by which these objectives may be achieved.

A population of 22,500,000 is projected for 1978, with 3,360,000 children in the primary school age group, 4,100,000 of secondary school age, and over 2,000,000 of university age. Although a system of free, universal primary education is postulated in the Report, it is not expected to be fully established during this period. Primary school enrollments are thought likely to increase to 3,159,000 (94% of the age group) as compared to a present 1,969,000 (78% of the age group). Secondary school enrollments should increase from a present 471,000 (with only 15,000, or 3% of the pupils in technical secondary schools) to 1,355,000, with a far higher proportion, about 30%, in the technical schools; and university enrollments are expected to increase from 32,600

to 95,000, maintaining their present 7% proportion of secondary school enrollments.

To provide for these greatly expanded services, many more trained teachers will be wanted, especially since it is desired to reduce class sizes and improve the quality of instruction. In the primary schools the objective is to reduce classes from the present 60 to 40; in secondary schools from 41 to 30; in technical secondary schools from 27 to 20; and in the universities from 47 to 30. The resulting requirements for teaching staff will be partially offset if a recommendation in favor of increasing the teaching hours per week is applied; in the secondary schools and the universities these are abnormally short - in the former from 16 to 18 hours a week for the average teacher, and in the latter only 3 hours a week. It is estimated nonetheless that by 1978 the required annual output of new teachers will have to reach 4,300 for the primary schools (three times as many as now), 1,600 for the secondary schools, 5,500 for the technical schools, and about 450 for the universities. Very considerable expansion is needed in training facilities of all types.

In these ten years Vietnam will make substantial progress towards elementary education of improved quality for almost all of its children and towards a system of comprehensive high school education, with adequate emphasis on technical studies, for about one-third of the children in the 11-17 age group. It is not expected, from its own resources, to make great progress in higher education, but it is thought that arrangements can be made with universities in foreign countries to meet these particular needs until the Vietnamese economy and educational system are strong enough to accommodate them.

These are certainly desirable objectives, and the emphasis on teacher training and technical education will probably find general endorsement. The targets are ambitious ones nevertheless, and some of us question whether the resources likely to be available after the war will permit them to be reached in a period as short as ten years.

It has been assumed, for instance, that Vietnam will be able to devote a steadily increasing proportion of its Gross National Product to education, and that by 1978 this will have reached the figure

of 4% which UNESCO, at its Karachi conference, suggested as a minimum objective for the Asian countries. Some of us are inclined to question the general applicability of such theoretical standards. How much of the national income can or should be invested in education depends entirely on the circumstances of each individual country, on its changing needs over time, and on its estimate, which can never be a precise one, of what the needs of the economy will be after, say, twenty years, the time required for a new educational policy to take full effect. The salient fact in Vietnam is that the country is still at war, and that even if peace were to come rather soon it is difficult to see any substantial reduction in defense costs for some years, or consequently, any diversion into the social services of the resources now devoted to the maintenance of the Armed Forces. The proposals summarized in the preceding paragraphs are, therefore, intended to be flexible in their timing; and it could be that the objectives tentatively set for 1978 will not in the event be achievable until five or ten years later.

Four percent of a projected Gross National Product of VN\$ 890 billions in 1978 amounts, as a matter of interest, to VN\$ 35 billions, considerably more than the total public expenditures, after excluding defense costs, made in 1968. Although the budgetary position should improve in the next ten years, it does not seem probable that it will improve so much that expenditures of this order of magnitude will be possible.

Moreover the estimated annually recurrent costs assume that the per capita costs per year will remain very much as they are today. Thus it is thought that the annual costs per pupil in the primary school system will rise from the present very low VN\$ 2,974 to a still very low VN\$ 3,324; that ordinary secondary school costs will rise from VN\$ 8,190 to VN\$ 9,388; that technical secondary school costs will actually decrease, from VN\$ 32,719 to VN\$ 31,719; and that annual costs of university education will increase from VN\$ 28,680 to VN\$ 30,700. Many doubts will be raised whether it is realistic to apply these figures to a period when a determined attempt is to be made to improve the quality of education by reducing the sizes of classes and providing more training - and implicitly, higher salaries - for the nation's teachers; and to a period, moreover, in which it is probable that some inflationary pressures will continue to be felt.

Some of us in the Joint Development Group would therefore prefer to treat the recommendations summarized above as a statement of objectives rather than as a plan of action to be carried out in a fixed time span. The objectives are obviously worthy ones; the methods of approach, the framing of a national plan for education by a central committee, followed by a considerable devolution of powers and responsibilities upon regional and provincial Boards of Education, supported by representative advisory councils, are well worth consideration; but it is extremely difficult to predict at this stage how far circumstances will permit Vietnam to advance towards these objectives in the first ten years after the war. In the first five years, because of continuing defense costs, it may not be able to advance as far as it wishes. Thereafter, hopefully, progress will be faster.

It is certainly desirable that some of the fundamentals of the development of the educational system be examined as early as possible, so that broad national policies can be established. There is no reason why a study of this sort should not be initiated immediately; but if it is going to serve practical purposes it will need to draw upon not only experts in education but also experts in economics, agriculture, industry and public finance.

There are some important questions to be answered. First, a fundamental one, is Vietnam satisfied that the present system of conventional education, founded upon French traditions but recently coming under strong American influences, is in fact responsive to the needs and opportunities of a society which is neither French nor American but peculiarly Vietnamese? If fundamental changes are indicated then the end of the war and the start of an era of development is the appropriate time to make them. Second, what changes ought to be made in the educational system to produce the skills needed for the development of agriculture and industry, for good government, and for the operation of the social services? Finally how much will these changes cost, how do the costs compare with the kind of budget which the Ministry of Education might realistically expect to be given in the post-war period, and to what extent can any difference between needs and resources be supplied by contributions from the communities served? Both in the Vietnamese version of the present chapter and in Chapter 6,

Institutional Development, strong arguments are presented that Vietnam will not be able to supply itself with the educational services it needs and desires without a realistic sharing of responsibilities between the central Government and the country's local authorities.

PUBLIC HEALTH

The latter assertion is probably also true, though to a less significant extent, of the public health services. Without expert knowledge of its own of this subject, the Joint Development Group cannot supply more than a few general impressions on the present state of these services and a few observations which may or may not be helpful to the authorities responsible for planning the future course of their development.

A first impression, quite possibly an erroneous and unjust one, is that in recent years curative rather than preventive medicine has dominated the thinking of the Ministry of Health and of its advisors in USAID, and has absorbed the bulk of the resources and skills allocated to public health as a whole. This has been natural, even inevitable, in a period when the countryside has been too insecure to permit the preventive health services to operate effectively, and the humane instinct to relieve suffering has been able to find expression more easily in the hospitals of the large towns.

Although outbreaks of epidemic diseases have been brought swiftly under control, - by joint action by the Ministry of Health, USAID, and the Vietnamese and Allied Armed Forces, - there is no doubt that the effectiveness of the public effort in preventive medicine has declined, while the availability and quality of medical care has improved. Large numbers of trained sanitarians have been lost to the health services, partly to the military draft, partly because of the superior attractions exerted by work opportunities offered by construction contractors and allied military bases; and these men have not been replaced, as Vietnamese physicians and surgeons have been, by reinforcements of qualified men from friendly nations overseas. In contrast considerable expenditures have been made on new hospitals, not only for the Armed Forces but also

for civilian use in certain province capitals, and on improvements and extensions to other hospitals; training facilities for physicians and nursing staff have been expanded and improved; and a very considerable effort is being made to develop the local manufacture of pharmaceuticals. Obviously this kind of development is entirely desirable; though there is still a shortage of physicians and trained nurses, the training facilities created in recent years should substantially satisfy the requirements of the medical services in years to come.

What is not so desirable is that all these developments in public health have taken place in emergency situations rather than in the context of a long term program responsive to the country's overall needs and sensitive to the limitations on its resources. Investments of capital of external origin have been made - and very much larger investments are contemplated - in new installations for medical treatment, without any consideration of the continuing costs of maintenance and operation which will fall upon the national budget. Thus plans have recently been prepared for the reconstruction of the provincial hospitals at an estimated cost, including staff housing, of US\$ 170 millions; but no estimate whatever has been provided of the cost of operating these expensive facilities in, say, ten years' time. Hopefully the operating costs, though they will be high, will be within Vietnam's means; but if they are not they will be found only by transferring resources from other activities, including activities in preventive medicine in the rural areas which might benefit larger numbers of people.

Serious planning for the future is only just beginning, and we have been informed that some preliminary conclusions on the policies to be followed will be available in the middle of 1969. There are difficult questions to be answered. The principal ones that occur to us in the context of this Report are these:

1) How much additional investment in hospital installations should the Government of Vietnam be encouraged to make - or to accept - having regard to (a) the extensive military facilities which it should be possible, in a reasonably early future, to convert wholly or partly to civilian use, and (b) the levels of cost of maintaining and operating these installations?

2) What kinds of public health services in the post-war period will procure the greatest benefits to the greatest number at the lowest cost? In putting the question we do not suggest that the correct mix of curative and preventive medicine can be determined by a simple economic equation. We do suggest that the circumstances of war have emphasized the former at the expense of the latter, that a suitable balance should be restored and that this is necessary for financial as well as technical reasons.

3) Is Vietnam now ready to establish and implement a program for the control of population growth?

References to the need for this have been made elsewhere in this Report, in Chapter 5 in relation to manpower and potential unemployment problems, and in Chapter 12 in relation to the future growth of Saigon. These references consist of statements of the adverse effects on the society if population continues to grow at the rate of 2.6% per annum, a rate which, though commonly used for population projections in Vietnam, may in fact be considerably lower than the real figure. This is the place to make a more positive recommendation: this Report is aimed at improving the living standards of the Vietnamese people; there are substantial reasons to believe that this can be done within the next ten years, but it is improbable that thereafter living standards will continue to improve if the population continues to increase at this high rate. On the encouraging results obtained from the experimental program now in progress it seems timely to consider policies of general application and to establish programs for the post-war period.

CHAPTER 12 REGIONAL DEVELOPMENT

INTRODUCTION

National, regional and local interests in economic progress are not opposed, they are complementary and mutually supporting. Within the context of a development strategy for the Republic of Vietnam, the opportunity can be taken to serve regional and local interests and to satisfy regional and local sentiments, not impairing the essential unity of the nation, but, on the contrary, strengthening it.

Successful implementation of the programs suggested in this Report will depend on a variety of factors - stable political conditions, adequate resources in money and skills, and good, honest administration, among others; but for some of these programs one particular condition seems to us to be quite indispensable, that they engage the attention and attract the participation of the mass of the country's ordinary men and women. The interest of the general public in economic development has to be made apparent if this is to be done; and it is a fact that it can be made apparent more easily in programs directed towards regional problems and opportunities than in those which express only broad national policies and are accordingly fit to be designed and implemented only from the capital.

We believe that in terms of economic development there are substantial advantages to be gained from a policy of decentralization, under which the management of those programs which possess a regional context will be entrusted to representative bodies within the regions particularly concerned. Evidently, it will not be appropriate to apply such a policy to all the programs which we present in this report: fiscal and monetary policies cannot be planned and executed except for the country as a whole; nor can major industrial investments, the feasibility of which depends on national markets or export possibilities; nor can the reconstruction of a national transportation system. But we believe that a policy of decentralization can and should be applied to any programs which

deal primarily with regional conditions and problems and which, therefore, are likely to be welcomed and supported in the localities concerned.

We present in this chapter our views on certain programs in which a regional interest is manifest, though a national one is certainly not absent. The problems of water control in the Mekong Delta are perfectly well understood by the people who have their homes and make their livings there; and they, of course, will be the first beneficiaries (though not the only ones) from the kind of improvements we propose to the natural environment which now controls their economic activities. The urgency for a vast program of rural rehabilitation cannot be better understood than it is in the five northern provinces, which have suffered more than any others from the dislocations of war. The Central Highlands have an obvious peculiarity - substantial resources in land and water, and a population consisting mainly of minority peoples who have not yet been brought into the cash economy, and will represent a danger to the stability of the nation until they are provided with opportunities to do so. The problems of Saigon are peculiar too; although every city in Vietnam has grown unnaturally in time of war, in Saigon the changes have been immense and undigestible, so that today, well over two million people are living in a concentrated area whose amenities may be adequate for only a quarter of that number.

In the succeeding parts of the chapter, some ideas are presented on what might be done in the next ten, twenty and even thirty years, or more or less, as resources become available, to ameliorate the conditions peculiar to each of these areas. In some cases, these views have been better developed than in others. For instance, a good deal of attention has been given to the development of the Mekong Delta, and project planning is well advanced, simply because it is in this region that the best opportunities for the rapid restoration of the Vietnamese economy after the war occur. Much less attention has been given to the five northern provinces and to the Central Highlands, simply because a full and accurate assessment of the potentials for development in these areas depends upon ground investigations - of soil, subsoil, water and forest resources - which cannot be undertaken until the war is over. We recognize however, that while the potentials of the Delta are apparent and will be all-important to the country in the early post-war period, in the long term, valuable opportunities for the diversification of the economy may

appear in other regions. Some may also appear in the mass of the Central Lowlands south of Quang Ngai, for which an overall regional program is not yet suggested; it is difficult to identify, within this long, narrow area, any problems or opportunities common to the whole, which would suggest treating it as a distinct region with a development program of its own; however, there do exist many possibilities for water control and irrigated agriculture projects in the coastal basins, as discussed in Section IV of this chapter.

Some proposals are also made concerning the organization and management of such regional development programs as may be approved. In no case is it practicable or sensible to advocate the establishment of completely autonomous, independent, regional development authorities to undertake these programs. Although the problems are regional ones, the benefits of economic development will be national as well as regional, and it is impossible to suggest that the Central Government should divest itself of all responsibility for ensuring that the programs are efficiently carried out. Nor is it to be expected that the Legislature, which will be invited to allocate very considerable sums of money to these programs, should not wish to ensure that the money allocated is properly spent. Within each program there will be projects within the responsibilities of the Ministries of Government, and as long as the Ministries have the means to execute these projects - within the general framework of a regional program - there will be no point whatever in asking someone else to do so.

On the other hand, if genuine popular enthusiasm for economic development is to be excited and sustained within the regions, then something more than a purely advisory committee of local notabilities is required. The precise functions of a development agency within the regions considered in this Chapter are bound to vary with the needs and circumstances of each of them; but, as a general pattern, what we recommend is an agency with strong and respected local representation and powers not merely to advise and coordinate, but also, when the need arises, to act. We believe that this is what the ordinary people of the region, whose daily lives stand to gain if these programs are successful, and to lose if they are not, will mostly want.

What might be considered a disparity of treatment of the various regions covered is apparent in the following sections. For the five northern provinces, we have endeavored to offer a comparatively comprehensive, although still preliminary, program of development covering all major economic potential; the section on the Central Highlands, on the other hand, provides an analysis which concentrates more, at this stage, on the problems and possibilities of population resettlement and relocation and the institutional framework within which this and related developments can best be accomplished; brief outlines only are presented of the program possibilities in the coastal basins of II Corps and in Saigon and its hinterland (the former focussing on an outline of water resource development, the latter on the relationships of Saigon to its surrounding provinces and its future role as the national capital); and in the Delta the primary topic considered is the proposal to achieve very substantial increase in agricultural production through water control. This section, in fact representing a condensation of a separate report backed by 12 supplementary working papers.

This diversity of approach is due in great part, to the manner in which these regional studies have been programmed in our work. The Delta with its richness of agricultural potential was the obvious place in which to commence investigations and I Corps deserved next priority as the region which has suffered most from the degradations of war. It is the intention of the Joint Development Group in its 1969 work to continue these regional studies and to achieve, if possible a closer standardization of treatment as well as more definitive statements of the programs appropriate to each area.

SECTION II THE FIVE NORTHERN PROVINCES(I CORPS)

In the following section of this Chapter attention is given to the problems and potential of the Central Highlands south of Quang Ngai Province. The central plateau and the Annamese range also make up a substantial part of the land area of the five northern provinces of Quang Tri, Thua Thien, Quang Tin, Quang Nam and Quang Ngai. Although much that is proposed in the following section has direct application to the highland areas of the five northern provinces, because of topographical and ethnic considerations, and should be recognized as having general validity for the highlands as a whole, it has been decided to treat the politico-military administrative area now known as the I Corps zone as one region. To do otherwise would, as far as the five northern provinces are concerned, cut across provincial boundaries, inhibit the necessary complementary role which the highlands offer in relation to the coastal areas, and tend towards compartmentalization for the sake of geographical distinction and agricultural similarities, to the detriment of other factors which make up a fully coordinated unit. In the region as it is presently identified, resources should be so harnessed and so integrated that the degree of interdependence between the highlands and the lowlands is enhanced rather than diminished.

In fact from one point of view the region can be considered as a rough geographical unit. It is bounded on the west by the watershed line of the Annamese range; on the north by the de-militarized zone; on the east by the sea, and on the south by a ridge of high land which separates Quang Ngai province from Binh Dinh. This topographical layout was no doubt one factor leading to the grouping of these five provinces into one region for purposes of military and governmental control. This section of the Report is intended to describe the resources, problems and potential of the region so defined, and at least

a first approximation of the course of its future development.

With an estimated population of over 2.9 million, 18 percent of the total population of South Vietnam, the Region is characterized by a broad coastal plain, up to 30 kilometers wide, extending from Buc Pho to the 17th parallel. To the west of this plain, the land rises steeply to the mountains of the Annamese range. Nearly all the region's people live on the plains, where the main concentrations are served by the coastal highway and the railway. The upland areas are thinly populated, and although they have considerable, at present largely inaccessible, forestry resources, they are of little present agricultural significance.

Agricultural production in the region is determined principally by rainfall. The Mekong Delta receives almost daily rains during the period of the southwest monsoon (mid-May to early October), but the movement of cloud is inhibited by the Annamese range, and the coastal area of the I Corps zone receives very little rain in these months. Of an annual rainfall of over 2500 millimeters, Quang Tri receives only 720 millimeters in the eight-month period, January - September, the rest falling during the period of the northeast monsoon which is concentrated in the months of October and November. Without surface irrigation water or extensive utilization of ground water sources (wherever the water table is near the surface), rainfall for much of the year is inadequate for many crops.

Temperatures during the summer months can be nearly 10 degrees Centigrade above those obtained in the winter, but average high and low temperatures do not deviate from the mean by more than about 5 degrees Centigrade. Crop varieties are restricted to those adapted to tropical and sub-tropical climates.

THE PROSPECTS FOR DEVELOPMENT

In contrast to the natural wealth and fertility of the south of the country, the development possibilities of I Corps are limited. In terms of input they are likely to be expensive in relation to growth rates achieved, and far less certain in their efficacy.

The base for agriculture is restricted. The sandy soils along the coast appear to be relatively infertile, and a great part of the region consists of terrain where the slopes are too steep for farming. The region is a food deficit area. The rainfall is largely concentrated in a short season, and there is sometimes severe flooding. Forest resources exist, but security problems have prevented any detailed determination of their extent. Large-scale and imaginative plans for an industrial complex at An Hoa, based on utilization of nearby coal resources at Nong Son, have reached an advanced stage, but implementation of these plans has been held up by lack of security and other factors. Other than a small textile industry, with a cottage industry component for weaving, a sugar mill and lime manufacture, industrial activity is limited to the small scale manufacture of construction materials and food processing.

The population is over-concentrated on the line of the main highway through the coastal plain, and is heavily swollen by refugees. Skilled labor tends to migrate either to Da Nang or south to Saigon. Sea-fisheries are handicapped by the war, antiquated equipment and lack of knowledge of modern techniques. Access to richer fishing grounds and increased mechanization are prohibited for security reasons.

Economic criteria for the investment of resources usually dictate their utilization in an order of priority which will yield the greatest net benefit to the growth of income and employment of the entire country; and if applied to the five northern provinces this principle would argue against a large development effort in the post-war period. Such a policy leads almost inevitably to an unequal partition of development investment among regions, and an inequality of economic growth. It is true that through the mobility of certain resources, and with the spread of accruing income, total benefits may be shared to a certain extent and the degree of inequality of investment partially offset. But there are also non-economic and political criteria to be applied. Although some regions will inevitably grow faster than others - because of differences in natural resources and population distribu-

tion - what is required is a careful compromise between the extremes of maximum overall cost benefit advantage and optimum regional development for the sake of equality of growth. In the I Corps zone there should be a sensible effort to exploit such resources as are available in a way which will be complementary to the general national purpose.

In this region, some development potential can be identified. As in the Delta, there is an immediate opportunity for improved agricultural production aimed at regional self-sufficiency. In the plains and the principal river valleys substantially increased production is possible by improved control and use of water, permitting more extensive double-cropping of rice and offering opportunities for crop diversification. Increased use of high yielding rice varieties and improved farming methods, with adequate use of fertilizers and pesticides would contribute to regional self-sufficiency, and so would improvements in marketing, credit facilities and feeder roads. Some land can be reclaimed (and further erosion of fertile land prevented) by planting the sand dunes and taking measures to stop saline intrusion from the salt water lagoons. The sandy soils themselves offer some prospects for more intensive cultivation. The production and processing of tea, silk and vegetables may provide an incentive for the development of agri-business.

Forest resources may be considerable, and an inventory should be taken as soon as security considerations permit. It is known that extensive stands of valuable hardwoods occur in the forests which cover the greater part of the region, and can be exploited in order to supply an integrated timber products industry, including the manufacture of plywood, at Da Nang. The production and export of cinnamon can be resumed and should be valuable.

Restrictions have been placed on the fishing industry for military reasons. Mechanization is limited for fear that the vessels may be seized by the enemy, and in many coastal areas fishing is actually prohibited. In spite of this, I Corps still produces 16% of all marine

fish landed in South Vietnam, and can count over 88,000 fishermen, 37% of all the fishermen in the country. As these figures indicate, their productivity is low, but the rich fishing grounds of the Gulf of Tonkin offer promising prospects for a substantial industry. Fishing will have to move from in-shore to off-shore, with all the changes in technique, knowledge of navigation, larger, motorized vessels and improved equipment that this implies. But the manpower is available. Da Nang already has a useful fish landing facility (presently in military use), but ice production and marketing will need improvement, and fish processing, drying, canning and in particular the manufacture of nuoc-mam (fish sauce, of which 1,250,000 litres a year are already being produced), provide further possibilities for industrial growth. Increased use can be made of fresh and brackish water lagoons and ponds for pond-fish cultivation.

Plans exist for the exploitation of the region's main mineral resource, the Nong Son coal, for production of power, fertilizer and other products in a large industrial complex at An Hoa. The war and other difficulties have prevented the realization of this project, on which very large investments have already been made. Serious doubts have been expressed concerning its economic feasibility. This Chapter devotes some attention to this project which is of fundamental importance to the development of the region; and it has also been discussed in Chapter 9. Whether or not the fertilizer complex is realized, the coal offers a possible source of low cost energy for the whole region, and can be used to serve such industries as cement and lime manufacture, glass, bricks, clay tiles and ceramics.

The existing route via Khe Sanh and the Se Noi valley may provide access to the sea for Laos and encourages hopes of the potential development of a Laotian-Vietnamese timber trade. The main road network, once it is repaired and maintained, is adequate and the Port of Da Nang, as now developed, will provide all the port capacity likely to be required. This deep water harbor will facilitate water-oriented industrial development as well as sea transportation for the produce of the region. The railroad has been destroyed, but, as described in

Chapter 10, it is being restored.

The region has an ample agricultural and industrial labor force. Resettlement of refugees on their abandoned lands should have high priority, and some landless people may have to be relocated in farm settlements in the more suitable highland areas and in the wider river valleys. There may also have to be assisted migration to other regions, but any movement of this kind will have to be voluntary and is unlikely to occur on a large scale.

No developing country can accept, as a deliberate economic policy, the perpetuation of depressed areas by devoting scarce investment resources solely to the more rewarding ones. Priorities will, of course, have to be carefully and wisely established, and if attention is concentrated initially on projects offering the highest yields and quickest returns, as it should be, then the full potential of the I Corps zone cannot be realized for a good many years. This preliminary account of what that potential may be is followed by a more detailed discussion of those features of it which appear to be most promising.

AGRICULTURE

The problems are much more difficult than in other regions. The analysis which follows outlines the more important characteristics of agriculture in the region and suggests some possible courses of action.

As South Vietnam was settled, the northern provinces were the first to be developed, and the lands most suitable for traditional agriculture have been exploited for many years with a resultant depletion of soil nutrients. Because population density in the coastal plain is extremely heavy, farm units are very small. The principal problem of the northern provinces results from the simple fact that too many people are attempting to practice subsistence farming on the limited area of the coastal plain, so that farm incomes are low. Population pressure has led to some double-cropping and some diversification

into animal products, but these desirable developments, though easing the problem, have not yet made any significant impact on it.

Although crops are important in the agriculture of the region, animal products and fish together actually exceed crops in value at the present time. This is because crop production consists mainly of rice, and it is rice production which has felt the most severe effects of the war. The region is a food deficit area into which large quantities of rice and other cereals, cooking oils and milk have been shipped regularly. For many years rice imports have exceeded 100,000 tons annually, and a recent estimate of imports has been over 200,000 tons.

Crops were harvested from slightly over 300,000 hectares during 1967 apparently, 11% of the total land area in the five provinces. However, the actual area cropped was probably considerably less, since some 125,000 hectares are estimated to have been double-cropped. The cultivated area has declined by 15-20 percent since 1964, a direct result of intensification of the war.

Although rice dominates the cropping pattern, just as it does in most other regions of S. Vietnam, the preponderance of rice is not as great as it is in the Delta. Other crops were harvested from over 20 percent of the cultivated lands. The region produces more than its proportionate share (in relation to population) of corn, sweet potatoes, manioc and peanuts, but far less of its proportionate share of most other crops, particularly rice, fruit and vegetables, though vegetable plantings have been increasing quite rapidly in the last five years, particularly in Quang Nam, for the Da Nang market. The northern provinces are important producers of sugar cane, tobacco and tea. The estimated value of production of 16 principal crops in the region in 1967 was slightly over VN\$9 billions.

Yields are generally below the national average. Rice, for example, averaged 1.68 metric tons per hectare, about 80 percent of the yield in the Delta. Beans, peanuts, vegetables, tobacco and sugar cane have yields close to national average, but yields from other crops

are much lower; the yields of fruit crops are extremely low.

Fertilizer trials on rice by the Ministry of Agriculture have demonstrated significant responses to chemical fertilizers. For example in 1965, in 15 places in Quang Nam province, the application of 60-60-30 fertilizer (60 kg nitrogen and phosphate, 30 kg potash per hectare) gave a 185% increase in paddy yield over check plots. This was in unimproved varieties, and better results may be expected from the new improved ones.

Production losses from insects and diseases are difficult to measure. They are certainly large. Future pest and disease control will depend, as do fertilizer programs, on education in the use of pesticides and insecticides and an efficient distribution system. Readily available sources of agricultural credit are essential to the wider use of both fertilizers and insecticides.

The average size of a farm in the region is estimated to be 0.65 hectares. Average farm size in the Delta, where population density is about 150 per sq. km., is three times this figure, 1.9 hectares. Density in the coastal plain of the I Corps zone may be as high as 750 persons per square kilometer. Less than 30 percent of farmers own all the land they operate: in the great majority of cases, these small farms are of mixed tenure, with the farmer owning a part of his holding and renting the rest. A very large number of very small parcels of land are held under various rental or leasing arrangements of a diversity which makes it almost impossible to consolidate these tiny holdings into economic sized units.

Farm incomes are therefore very low, probably only half the levels achieved in the Mekong Delta (where they are not high)*

With the possible exception of tea and tobacco, essentially all farm and fish production in the I Corps zone is consumed within the region. Where farms are only 0.65 hectare in size, and concentrate

* Rural Income and Expenditure Survey, 1964.

upon rice and other field crops, agriculture is a matter of mere subsistence, and there is little produce to sell. The only cash crop exceptions to this are small scale vegetable production near Da Nang and Hue and a little tea, tobacco and sugar cane. Animal products also provide a source of cash income, though a limited one, for many farmers in the region. But generally the average farmer in the northern provinces has little to sell.

Agricultural development in the region will, of course, depend heavily on the potential of the region's soils and the treatment that is applied to them. Most of the arable soils in I Corps are classified as wet alluvials which are waterlogged or even flooded for at least a portion of the year. These soils are ideally suited to rice production and are now usually planted to that crop. But if they were drained they would be well suited to many other crops as well. There are, in the region, some well drained to moderately well drained alluvials (brown river-level soils) which produce excellent yields of various annual crops and also fruit, peanuts, tobacco, cassava, sweet potatoes and corn, and citrus, bananas and jack-fruit. They are, unfortunately, limited in area; but the wet alluvials, which are much more extensive, would perform in much the same way if only they were drained.

Much of the land near the coast consists of regosols, reputedly of little economic value because of their poor water retaining ability and low nutrient status. Land is in such short supply in the northern provinces that even these unpromising soils are exploited, for manioc, peanuts, corn and coconuts. Yields at the present time are marginal. If full land utilization is to be achieved these indifferent soils cannot be ignored, but mulching, green manuring, and shelter planting in order to increase organic matter and control erosion will be necessary, and so will fertilizer programs and irrigation.

At the start, the principal efforts should be toward restoring production on lands that have been abandoned during the fighting, and increasing yields and production on existing farms. The development

of new lands for agriculture may come later, and should be approached with caution, for areas and soils not previously exploited may or may not be suited to present patterns of farm enterprises. Careful organization of new farms will be necessary to encourage production for which domestic or export markets exist, and to avoid uneconomically-sized farms which cannot provide satisfactory family incomes.

Within the five provinces the movement of locally produced foods is normally quite restricted, and the existing simple marketing system is satisfactorily serving the purpose of moving to the consumers such produce as farmers have available. It would be a mistake to condemn the present marketing system unless more is known about it and about the specific changes which might improve distribution. Such changes will depend upon future farm sizes, the degree to which farmers specialize, and the types of crops they decide to grow.

An obvious need is to seek crops and other farm produce or combinations of crops that will raise the incomes of farm families. Yields of existing crops can be increased, but even if rice yields were to be doubled on these small holdings incomes would still be low. Under vegetables the same size of farm would provide better incomes, but this can only be for a limited number of families. Hogs and poultry can be used more extensively to diversify the small farms of the region and to add to farm incomes. All the alternatives, including specialization and diversification, cash and subsistence crops, crops and animals, need careful study.

The consolidation of land holdings to increase the size of farms is another possible approach to the problem. It would imply either conversion of some farmers to other occupations or resettling them in other regions. There are possibilities for the latter course, but in the short term and in present circumstances the consolidation of small holdings is unlikely to make much progress.

Agricultural credit may be a more practical approach. It is not yet readily available to I Corps farmers, although the Agricultural Development Bank now has a representative in each of the five provinces. It made loans totalling VN \$133 million to 6,700 farmers in 1967. The average, almost VN \$20,000 was higher than the loans made in the Delta,

and about equal to the average for all of Vietnam. However, loans were obtained by less than 2% of the region's farmers, and on this limited scale of distribution credit will not do much to promote growth in the region as a whole.

In summary, and excluding the possibilities of irrigation, which are described later in this section, these seem to be the most promising approaches to agricultural development in the I Corps Tactical Zone.

- 1) Increased yields of crops already cultivated on existing farms by improved practices and inputs, facilitated by a more generous distribution of supervised credit;
- 2) An examination of alternative farm enterprises and combinations of enterprises to determine what could be done to raise incomes from holdings now principally devoted to rice; and
- 3) High priority for the reclamation of lands taken out of cultivation because of the war; possibly a lower priority for the development of previously unexploited lands to the extent that suitable areas exist.

FOREST RESOURCES

The forests of the region were described briefly in Chapter 8, and so were the disadvantages, in comparison with other regions, which a logging industry in the northern provinces will meet. As suggested later in this section, a plywood industry could create a market for logs sufficiently lucrative in time to overcome the problems of extraction. At this stage an inventory should measure the volume and quality of the timber resources to assess logging capacity. The Forestry Administration could then rationally propose timber reserves, and structure a plan for roads and a silvicultural system to regenerate the better species of the forests.

In the meantime, other aspects of the forest have an importance to the economy which may be greater than that of timber. Water

is one of them, for the forests are on the watersheds that supply the rice farms of the coastal plain. Logging is highly selective and by itself will probably have little effect upon flow; but forest roads and landings must be well placed to prevent soil erosion. Greater dangers come from shifting cultivation, which affects larger and larger areas as population grows and families experience increasing needs for cash earnings. One solution in the highland areas of the northern provinces may lie in the promotion of permanent crops such as coffee and cassia which Highlanders could cultivate along with or after their food crops. Thus they would acquire both the cash incomes and a more permanent attachment to the land and, at the same time, the essential forest environment would be maintained.

The region's immediate interest in its timber resources lies in the creation of several forest-based industries for export and domestic use. Two such projects are suggested; the first, dealing with cinnamon bark, has been described in Chapter 8; the second, for the manufacture of plywood, is described subsequently in this Chapter under the title Industrial Development. The economic importance of these two schemes is that they will provide cash earnings, exports, and employment. In addition, their implementation will automatically foster other forestry activities - inventory, protection, management plans and re-forestation, substantially larger sources of employment than the projects themselves.

WATER RESOURCES DEVELOPMENT

The uneconomic size of the region's farms is not the only reason why the region has to import food and most of its people live at a bare subsistence level. There are other problems: insufficient rainfall during half the year to permit intensive, year-round cultivation; inadequate base flow in the unregulated rivers and streams to enable area-wide irrigation; frequent floods; salinity intrusion into the coastal river reaches, which frequently results in salt water flooding of lower lying agricultural lands; and poor drainage conditions on the flatter lands bordering the sea.

The only solution to these problems is control and utilization of the region's water resources to permit intensive, year-round cultivation and crop diversification in the coastal plain. Many studies have

been made and plans prepared to improve agricultural conditions during the past 30 or so years - by the former colonial government, by agencies of the Government of Vietnam, and by foreign consulting firms. As a result, numerous facilities such as diversion dams, dikes and canals have been constructed. While these facilities have not been unproductive and have brought benefits to many farmers, they have all been concerned with unrelated specific projects in specific areas, and were not concerned as staged improvements within an overall regional development plan leading eventually to intensified agriculture throughout the coastal plain of the northern provinces: and major benefits to the region as a whole have not resulted.

Orderly and timely provision of water control facilities, on the basis of a regional development plan aimed at exploitation of the full agricultural potential of the irrigable lands of the coastal plain, will raise the standards of living of farm families and enable the region to meet from its own resources its requirements in food. This report does not present detailed plans for implementing water control facilities; however, general means of doing so will be discussed, and a rough order of magnitude of costs will be given.

Description of the Area

The coastal plain (see Figure 12.1), which is served by seven major rivers and numerous small streams, divides naturally into three continuous reaches: 1) Quang Tri and Thua Thien Provinces; 2) Quang Nam and Quang Tin Provinces; and 3) Quang Ngai Province. The economic passage of water between the three areas is precluded, and it is necessary to break the region into these three sub-regional units for study and eventual development of water control facilities. The sub-regional coastal plain units are similar, in that in each all streams and rivers entering the plain are inter-connected before reaching the sea, or can easily be connected, if desirable, for more economic water distribution. The total gross irrigable area in all three coastal sub-regions together is approximately 410,000 hectares.

Hydrology

Owing to the scarcity or complete absence of streamflow records and the preliminary nature of this report, it has not yet been possible to carry out detailed hydrologic analyses of the major river basins in the region. However, estimates have been made of unit area runoff on the basis of long-term rainfall records. A runoff coefficient of 0.40 was applied to estimated average annual discharge; this was found to be conservative when compared with other areas in Vietnam having similar rainfall patterns and topographic conditions. Average monthly discharges were estimated by applying variable coefficients ranging from 0.30 to 0.50.

Long-term rainfall records (36-year period) at Da Nang, which are considered sufficiently typical of coastal plain conditions for the purpose of preliminary study, indicate the following average rainfall pattern, expressed in millimeters:

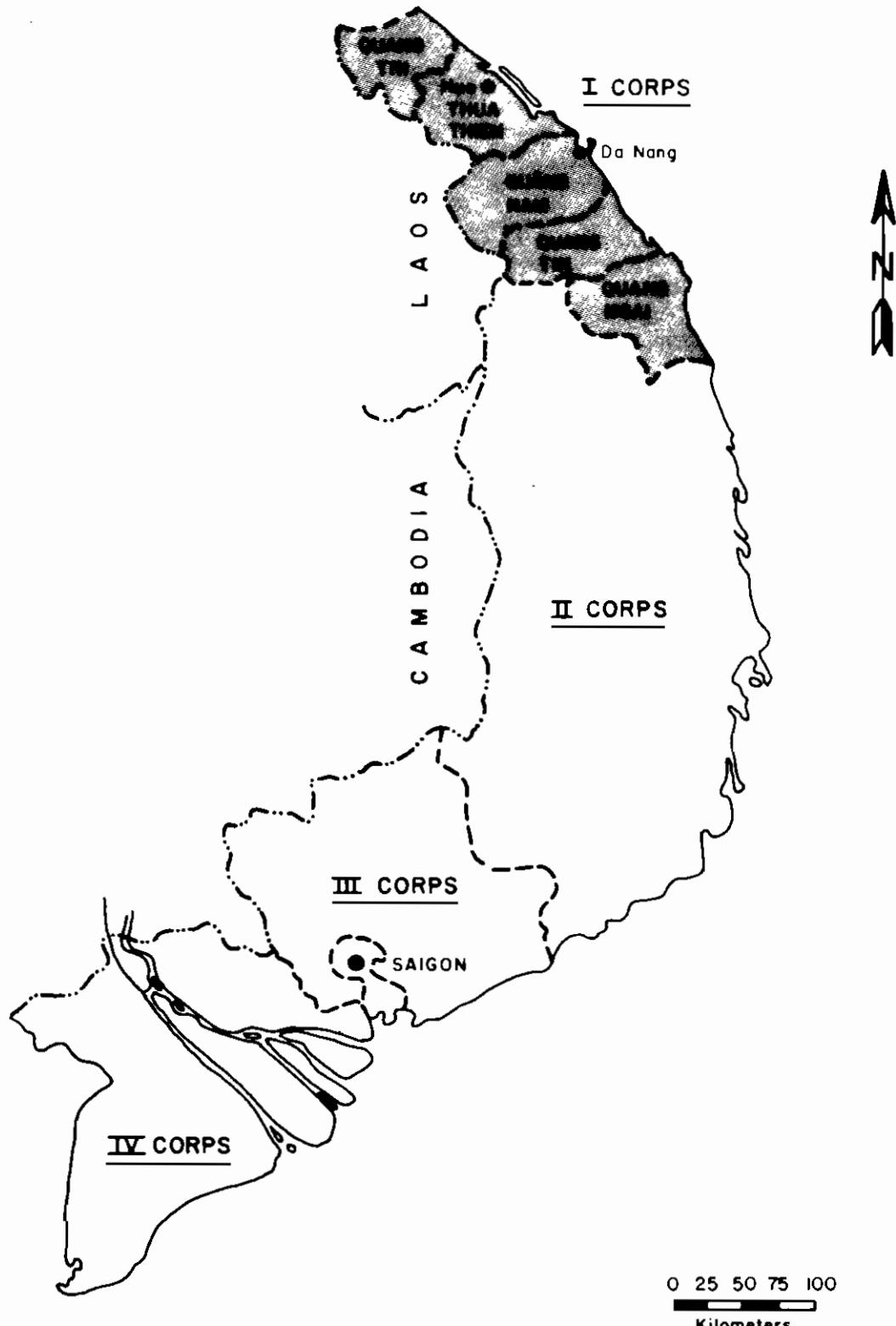
J	F	M	A	M	J	J	A	S	O	N	D	Total
115	42	26	31	61	74	76	116	390	568	386	225	2,110

This average rainfall pattern clearly demonstrates that during at least the six-month period (February through July) there is insufficient rainfall to meet the consumptive use requirements of crops. For intensive, year-round cultivation irrigation is required.

The following unit area discharges, estimated by applying the runoff coefficient 0.40 to average monthly rainfall, were used in determining approximate average monthly flows of the rivers in the region; figures are expressed in cubic meters per second per 100 square kilometers of drainage area:

J	F	M	A	M	J	J	A	S	O	N	D	Average Annual
1.9	0.7	0.4	0.4	0.7	0.8	0.9	1.5	5.3	8.5	6.7	4.2	2.7

While the above unit discharges are only approximate and are not necessarily typical of all drainage areas in the region, they are considered adequate at this early stage of preliminary study to indicate



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the general order of magnitude of streamflow and reveal whether storage is required to meet irrigation requirements during low-flow seasons.

Existing Water Control Systems

Water control is not new to the coastal plains of the I Corps zone. There exist many permanent diversion dams and the annual installation of temporary diversion dams is a widespread practice; dikes have been built to protect against floods and salt water; and there are canal systems and pumps. Some low dams to store water for dry season irrigation in water-short areas are also found. Many of these facilities are in disrepair, largely owing to neglect and insecure conditions in the countryside; however, repairs are being made and new facilities installed in many areas where security permits. The farmers in the region understand the value of water control systems, and are very willing to help in their construction; and to the extent that they have access to water in the dry season and the means to apply it, they practice double cropping as a matter of course.

The Government of Vietnam has plans, ready for implementation, which would provide or improve varying degrees of water control for nearly 70,000 hectares at an estimated cost equivalent to US \$27.5 million.

Development Program

Because of the large potentially irrigable area (410,000 hectares), and the heavy capital expenditures required to provide effective water control, the construction period to implement these works will need to be spread over a reasonably long period of time. At least a 30-year period is proposed for construction of the complete facilities, and rather less than third, about 120,000 hectares, might be developed during the first ten years after peace. In order to achieve this objective, more detailed studies should be initiated at once, so that the overall development plan can be precisely defined and priorities established for feasibility studies and engineering design. If this is done it will be possible to start action programs within a reasonable period after peace returns.

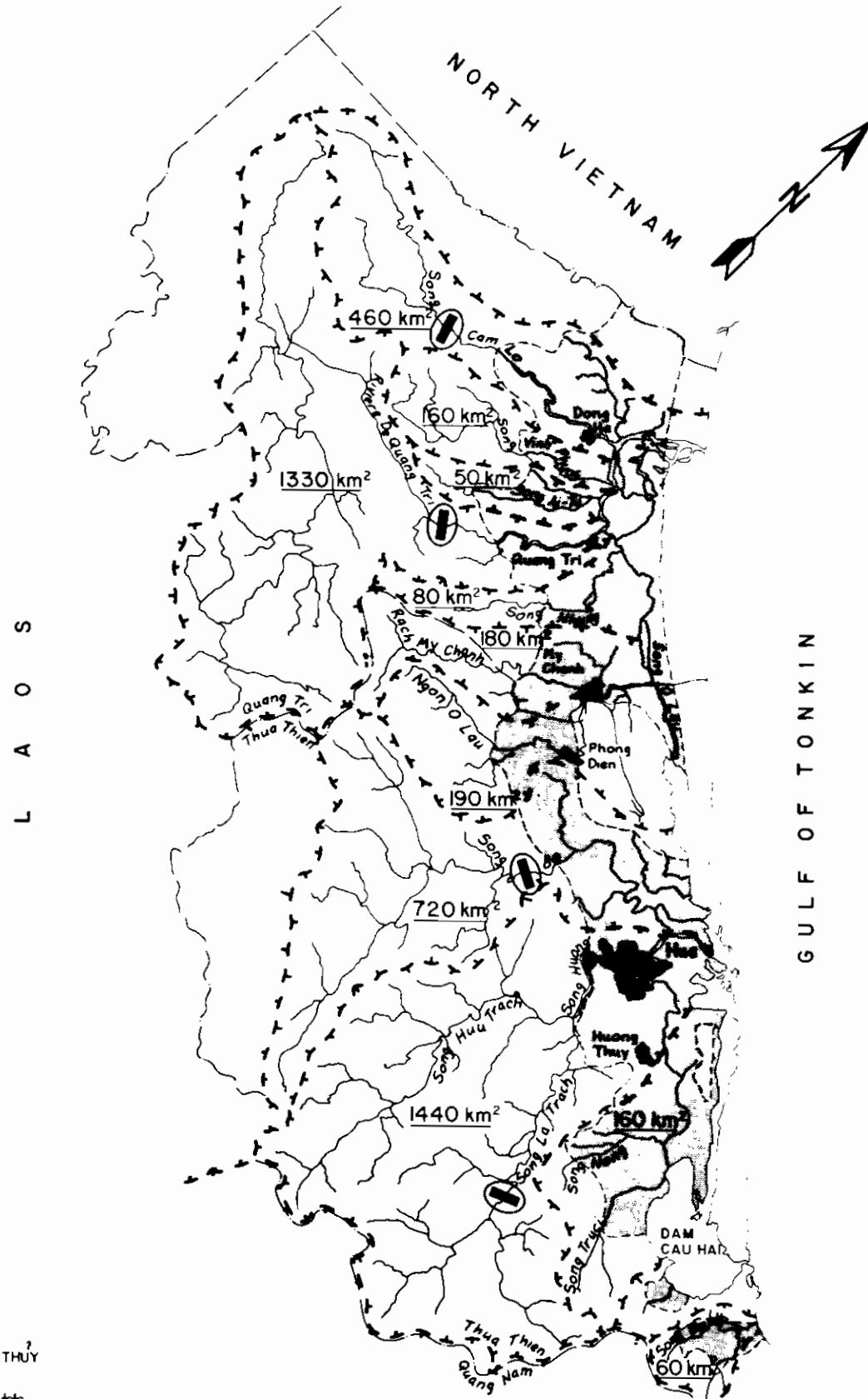
A general description of the proposed development program for each of the sub-regions previously defined is presented in the following paragraphs:

1) Quang Tri - Thua Thien sub-region - This portion of the coastal plain is continuous from the demilitarized zone to Dam Cau Hai above Da Nang. Major features of the sub-region, including rivers and their drainage areas, limits of irrigable land, potential storage dam sites, and major population centers, are shown on Figure 12.2. It is estimated that a gross area of 150,000 hectares is suitable for development for irrigated agriculture.

Water reaches the coastal area from eleven readily distinguishable watershed areas. Over 80% of the total runoff, however, comes from four rivers, the Song Cam Lo, Riviere de Quang Tri, Song Bo and Song Huong; the remaining seven have small watersheds and their catchments are almost entirely limited to the plains. The names of these streams; their drainage areas, estimated average maximum and minimum monthly discharges and average annual discharges, and the irrigable areas served are all shown in Table 12.1.

The average annual combined discharge of all eleven streams is estimated at 130 cubic meters per second which suggests that surface runoff is ample to meet crop water requirements over and above rainfall. However, the estimated average minimum monthly discharge totals only 20 cubic meters per second, which is sufficient to irrigate only about 20,000 hectares. In order to provide irrigation water supplies to the entire area, therefore, seasonal storage is required. Four potential storage dam sites have been selected and are shown on Figure 12.2. Of the four, the Riviere de Quang Tri and the Song Bo sites are by far the most favorable, since they have large reservoir and drainage areas. It is expected that dams at at least these two sites will be required to store sufficient irrigation water to meet crop requirements.

With the possible exception of providing power for irrigation and drainage pumping, installation of hydro-electric plants at the above two sites is not considered feasible, owing to lack of surplus water. Conditions for power generation are much more favorable, moreover, in



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QUANG TRI-THUA THIEN SUB-REGION**

0 5 10 15
KILOMETERS

Table 12.1

QUANG TRI - THUA THIEN SUB-REGIONRIVERS AND IRRIGABLE AREAS

River	Estimated Drainage Area	Estimated Average Maximum Monthly Discharge	Estimated Average Minimum Monthly Discharge	Estimated Average Annual Discharge	Estimated Gross Irrigable Area
	km ²	m ³ /s	m ³ /s	m ³ /s	ha
Song Cam Lo	460	39	2	12	19,000
Song Vinh Phuoc	160	14	1	4	4,000
Song Ai-Tu	50	4	<1	1	6,000
Riviere de Quang Tri	1,330	112	5	36	8,000
Song Nhung	80	7	<1	2	18,000
Rach My Chanh	180	15	1	5	14,000
Ngon O Lau	190	16	1	5	10,000
Song Bo	720	61	3	20	22,000
Song Huong	1,440	122	6	39	22,000
Song Nong and Song Truci	160	13	1	4	23,000
Song Bu Lu	60	5	<1	2	4,000
 TOTALS	 4,830	 408	 20	 130	 150,000

the Quang Nam - Quang Tin sub-region which will be discussed later.

Other major problems in this sub-region, in addition to the shortage of irrigation water, are: 1) salt water intrusion into the streams and, during floods, onto the lower lying lands; 2) frequent fresh water flooding from the rivers; and 3) inadequate drainage from much of the farm land.

During the dry season, river flows are too low to repel salt water intrusion, with the result that saline waters back up into the lagoons and channels (including the Song Hue); and owing to lack of fresh water, much of the area is thereby rendered unusable for irrigation. During the high water season, river floods frequently cause the salt water in the lagoons to spill over into extensive areas of low lying cultivated land destroying the crops; this phenomenon is aggravated by the fact that the passages by which lagoon waters enter the sea are restricted.

Flooding is frequent, widespread and severe, but of relatively short duration. Flooding to a depth of one meter or more occurred in Hue City last year (1968) but lasted for less than 48 hours. Property damage due to flooding is generally slight; however, it is reported that every few years a severe flood causes much loss of human life. The most severe floods occur when flood peaks and high tides coincide. The extent to which the restricted passages from the lagoons to the sea (at Thuan An and Dam Cua Hai) and man-made constrictions aggravate the flooding has not yet been determined. The area around Hue and the lagoons is subject to greater and more frequent flooding (including salt water flooding) than any other area in the coastal plain, and detailed studies must be made and steps taken to provide effective flood and salinity control.

To provide adequate irrigation water to meet consumptive use requirements of crops, two storage dams will be required, one on the Riviere de Quang Tri, and the other on the Song Bo. These dams will be operated primarily for irrigation storage and releases, but may also serve a flood control purpose; small hydro-electric plants may be installed to provide irrigation and drainage pumping power if found more economical than other means of supplying power.

Complete main and secondary irrigation and drainage systems, with pumping facilities as required, will be provided. Local development associations* and the farmers themselves should implement tertiary and farm systems. Maximum practicable utilization will be made of existing works, improved and modified as necessary to fit the development scheme. Diversions of water between rivers and streams on the coastal plain will provide no problem, as most are already interconnected.

It is believed that both salinity intrusion control and flood control can best be achieved through the most economical combinations of : 1) flood control allocation in the two proposed reservoirs; 2) a series of low-cost flood retention dams on river tributaries; 3) a system of low levees along rivers and lagoons; and 4) a barrage with overflow section (probably gated or provided with stop-log slots) at the Thuan An passage from the lagoons to the sea to control the flow of fresh water and prevent saline intrusion. It is recognized that the Thuan An barrage will preclude the development of a coastal vessel port at Hue, unless a costly lock structure is installed; however, the proximity of the major port at Da Nang raises considerable doubts concerning the feasibility of another port at Hue, especially if the latter were to involve increased costs for flood and salinity intrusion control.

This sub-region, under present conditions, has more numerous and more severe difficulties than the other two - less natural streamflow, more frequent flooding and much more severe salt water intrusion and saline water flooding. For these very reasons, it is in this sub-region that implementation of water control facilities should start first. The entire development will probably require over thirty years; however, a third of the irrigable, arable area, say 50,000 hectares, could and should be developed during the first ten years after peace.

While cost estimates have not yet been developed, it is believed that their general order of magnitude will be equivalent to US \$180 million for the full 150,000 hectares, and to US \$60 million for an initial 50,000 hectares.

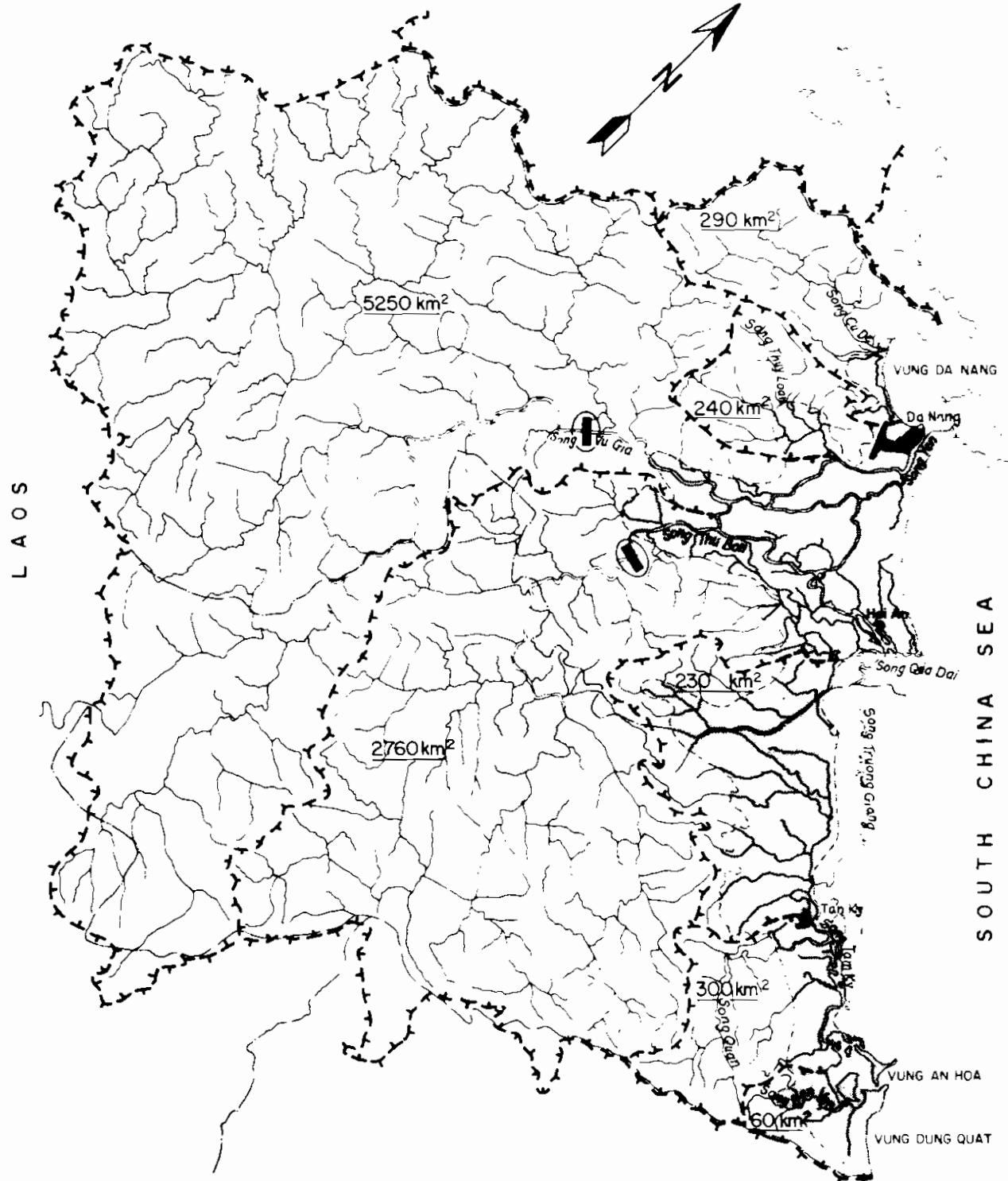
* For a description of these associations, see Section VI.

Substantial benefits should result: 1) a firm supply of irrigation water enabling year-round cropping; 2) the provision of drainage facilities; 3) effective control of flooding and salinity intrusion; 4) conditions in which improved cultural practices can be adopted by local development associations with the assistance of the agricultural extension services; 5) the use of higher yielding rice varieties, thus releasing part of the area now planted to rice to other crops; 6) crop diversification in areas formerly planted mostly to rice as well as in other areas; and 7) the exploitation of some land not now under cultivation. All these will almost certainly result in a favorable benefit-cost ratio.

2) Quang Nam - Quang Tin sub-region - This section of the coastal plain forms a continuous gross irrigable area estimated at 140,000 hectares, extending from Da Nang Bay in a southeasterly direction to Dung Quat Bay on the boundary between Quang Tin and Quang Ngai provinces. Major features, including rivers and their drainage areas, limits of irrigable land and major population centers are shown on Figure 12.3.

Seven rivers serve the coastal area and they are interconnected before they reach the sea. Of the seven rivers, two (the Song Vu Gia and Song Thu Bon) contribute nearly 90% of total annual runoff. Names of all seven, drainage areas, estimated average maximum monthly discharges, estimated average minimum monthly discharges, average annual discharges, and irrigable areas served are shown in Table 12.2.

The estimated combined average annual discharge of the seven streams is approximately 250 cubic meters per second, suggesting an ample supply of fresh surface water to meet all crop water requirements not satisfied by rainfall. However, the combined average minimum monthly flow is estimated at 36 cubic meters per second, sufficient to irrigate less than 40,000 hectares, and to meet irrigation requirements for the entire 140,000 hectares under full development storage is required. Two potential storage dam sites have been selected and are shown in Figure 12.3. One or other of these two dams would provide all the storage needed. At this preliminary stage, the site on the Song Vu Gia is preferred, because of its greater catchment area (the Song Vu Gia contributes nearly 60% of the sub-region's water supply) and its



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Table 12.2

QUANG NAM - QUANG TIN SUB-REGIONRIVERS AND IRRIGABLE AREAS

River	Estimated Drainage Area	Estimated Average Maximum Monthly Discharge	Estimated Average Minimum Monthly Discharge	Estimated Average Annual Discharge	Estimated Gross Irrigable Area
	km ²	m ³ /s	m ³ /s	m ³ /s	ha
Song Cu De	290	25	1	8	3,000
Song Thuy Loan	240	20	1	6	8,000
Song Vu Gia	5,250	445	21	142	25,000
Song Thu Bon	2,760	234	11	75	37,000
Song Tam Ky	230	19	1	6	45,000
Song Quan	300	25	1	8	13,000
Song Ben Van	60	5	<1	2	9,000
TOTALS	9,130	773	36	247	140,000

consequently greater potential as a multi-purpose structure.

A dam and reservoir on the Song Vu Gia appear ideally suited for multi-purpose development, for irrigation, power generation and flood control. It is roughly estimated that firm power potential is in the order of at least 35,000 kilowatts (installed capacity around 70,000 kilowatts). This would be enough to relieve existing power shortages throughout the coastal area of the northern provinces, and would permit a much more favorable rate structure than presently exists. Installation of a hydro-electric plant at this site would more than compensate for the possible loss of the 25,000 kilowatt thermal plant originally ear-marked for installation at An Hoa if, in the event, EOV's proposal is adopted to use this plant to supplement generating capacity in Saigon.

In this sub-region water control problems are generally less severe than in Quang Tri - Thua Thien. First, surface runoff is nearly twice as much, so water shortage during dry seasons is less critical. Secondly, while large flood flows occur nearly every year, widespread areal flooding rarely occurs, thanks to the large carrying capacities of the major streams. Thirdly, though salt water intrudes rather deeply into the channels during the dry season, the area does not experience frequent salt water flooding, as do the lands around Hue. Nevertheless, the sub-region has some real problems, and implementation of effective water control facilities is essential to realize its full agricultural potential.

To supply consumptive use requirements of crops adequately, only one storage dam will be required, preferably on the Song Vu Gia. This dam would serve to generate power, to provide some flood control, and to store irrigation water; the allocation of costs among these three purposes would result in lower water charges on farmers and cheaper power generation.

Complete main and secondary irrigation and drainage systems and required pumping facilities should be provided in the project, and construction of the tertiary and farm systems should be by local development associations and individual farmers. Existing facilities should be incorporated into the project to the maximum extent practicable, with whatever modifications and improvements may be necessary.

Any flood control needed over and above the flood control storage to be provided in the proposed Song Vu Gia reservoir can be achieved by low cost tributary flood retention dams or levees, or by a combination of both, whichever alternative is shown to be most economic. Irrigation and power releases during the dry season should rectify the existing salinity encroachment into the various channels.

Full development of the above program (140, 000 hectares) could be carried out over a period of not less than 30 years with somewhat more than a quarter of the construction (about 40, 000 hectares) being completed during the first ten years after peace. The order of magnitude of capital investment requirements will probably be around the equivalent of US \$150 million for the full 140, 000 hectare development, and about the equivalent of US \$45 million for an initial 40, 000 hectares.

The benefits derivable from the project are roughly the same as those arising from the proposals for the Quang Tri - Thua Thien sub-region, with the important addition of an electric power generating facility serving the coastal areas of the entire region. Flood and salinity control benefits would be rather less important than in Quang Tri - Thua Thien. Again, economic evaluation should show a most favorable cost-benefit ratio.

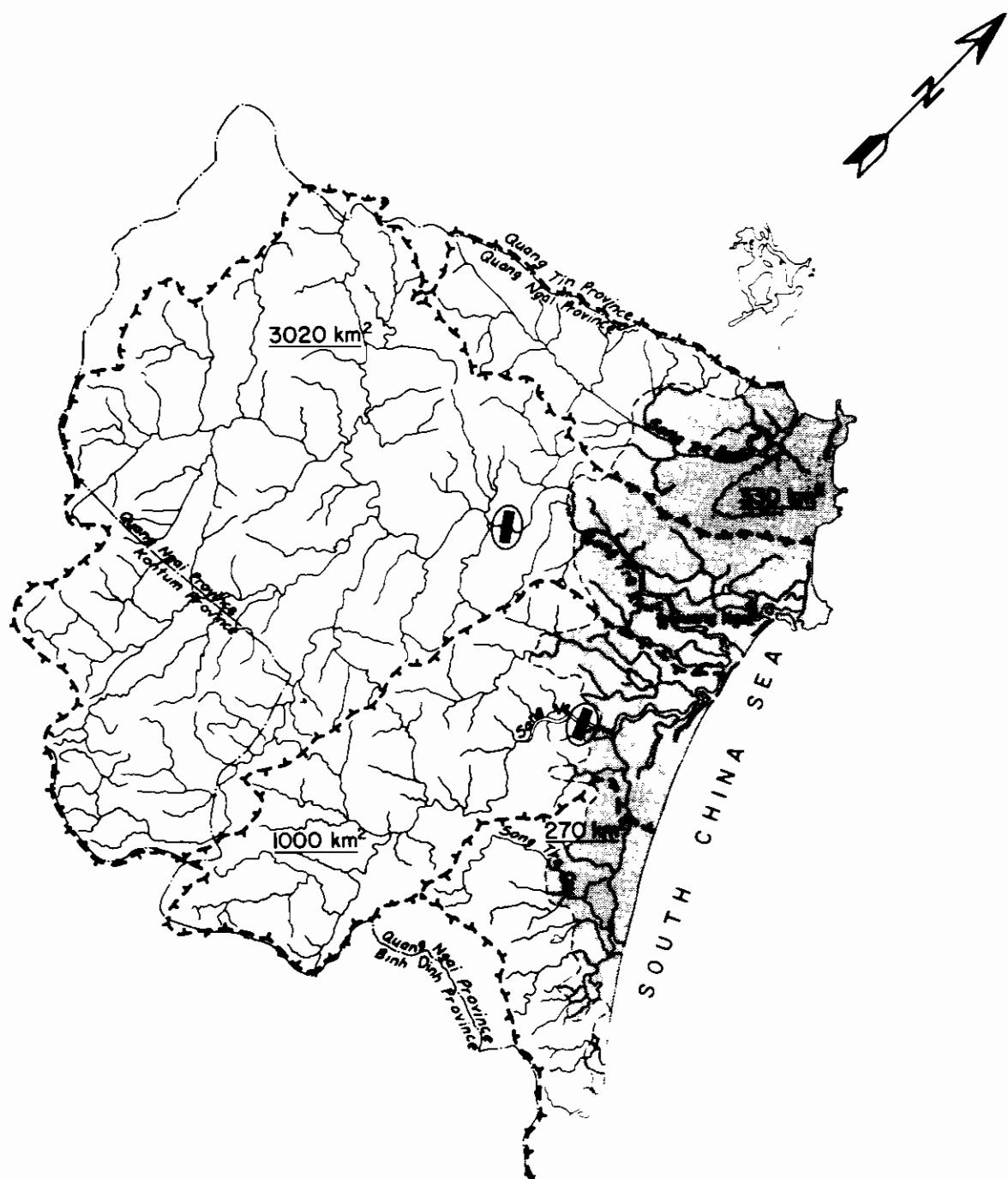
3) Quang Ngai sub-region - This southernmost part of the region's coastal plain comprises a continuous reach of irrigable land with a gross area of approximately 120, 000 hectares, between the Quang Tin - Quang Ngai province boundary on the north, and the limit of I Corps to the south. A map of the area showing major population centers, rivers and their drainage areas, and limits of irrigable lands appears as Figure 12. 4.

Four rivers serve the coastal plain, and differ from those in the two northern sub-regions in that they are not naturally interconnected; however, there should be no difficulty in providing such interconnecting channels as may be required to effect economic distribution of irrigation water. Pertinent river data, including names, drainage areas, estimated average maximum and minimum monthly flows, and irrigable areas served, are given in Table 12. 3.

Table 12.3

QUANG NGAI SUB-REGIONRIVERS AND IRRIGABLE AREAS

River	Estimated Drainage Area	Estimated Average Maximum Monthly Discharge	Estimated Average Minimum Monthly Discharge	Estimated Average Annual Discharge	Estimated Gross Irrigable Area
	km ²	m ³ /s	m ³ /s	m ³ /s	ha
Song Tra Bong	330	28	1	9	37,000
Song Tra Khuc	3,020	257	12	81	39,000
Song Ve	1,000	85	4	27	26,000
Song Tra Cau	270	23	1	7	18,000
TOTALS	4,620	393	18	124	120,000



GHI CHÚ
LEGEND

- VÙNG ĐƯỢC THOÁT THỦY
DRAINAGE AREA
- VÙNG ĐẦM THỦY ĐƯỢC
IRRIGABLE AREA
- VỊ TRÍ HỒ CHỨA CỦA ĐẬP
POTENTIAL STORAGE DAM SITE
- BIÊN GIỚI QUỐC TẾ
INTERNATIONAL BOUNDARY
- BIÊN GIỚI TỈNH
PROVINCE BOUNDARY

0 5 10 15
KILOMETERS

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The estimated combined average annual discharge of these four rivers is around 125 cubic meters per second, so ample surface runoff appears to be available to meet the water requirements of crops during periods of insufficient rainfall. The combined average minimum monthly flow, on the other hand, is estimated at less than 20 cubic meters per second, sufficient for only 20,000 hectares, and storage will be required to meet the requirements of the full 120,000 hectare area judged to be irrigable. Two apparently favorable storage dam sites are shown on Figure 12.4; of these the Song Tra Khuc site controls three times the drainage area of the site on the Song Ve and is preferred for that reason. It is believed that construction of a dam and reservoir on the Song Tra Khuc will provide adequate storage to meet all irrigation deficits during the dry season.

Except, possibly for provision of power to meet irrigation and drainage pumping requirements, installation of a hydro-electric plant at the above dam site is not recommended. This is because of lack of surplus water, and also because the proposed power installation on the Song Vu Gia will sufficiently serve regional needs for the foreseeable future.

The agricultural problems of this area are very similar to those of Quang Nam and Quang Tin.

Adequate irrigation supplies to satisfy consumptive use requirements of crops during rainfall deficit periods can, it is believed, be provided by a single storage dam on the Song Tra Khuc (though cost comparisons may indicate that two smaller dams will be more economical). If feasible, some additional storage should be provided at the site for purposes of flood control. The project should include complete main and secondary irrigation and drainage facilities, with irrigation and drainage pumping installations as required. As in the other sub-regions, tertiary and farm distribution and drainage systems should be the responsibility of farmers and local development associations, and existing works should be incorporated into the project to the greatest extent possible subject to necessary modifications and improvements.

Flood control additional to that provided by the proposed Song Tra Khuc reservoir will be achieved through simple tributary flood retention dams or levees or such a combination of both as may be shown to be most economic. Reservoir releases for irrigation during the dry

season are expected to provide effective relief from salt water intrusion into existing channels.

Development of the full 120,000 hectares will be spread over a minimum period of 30 years. Development of 30,000 hectares would be a realistic target for the first ten years. The order of magnitude of capital investment requirements will probably be about the equivalent of US \$130 millions for full development and about the equivalent of US \$35 millions for the first 30,000 hectares.

The same substantial benefits are expected to result from this project as those predicted for the neighboring provinces.

Conclusions and Recommendations

From these very preliminary investigations, it is generally concluded that the entire coastal plain of the I Corps zone can be economically developed over a minimum period of 20 years by a program of the type described in this section. The investigations will be pursued in greater detail in 1969, and they should be taken beyond that date to a point at which feasibility can be appraised with sufficient certainty to warrant full feasibility studies and design. This would afford prospects of starting construction within one year after peace returns.

The table below provides a recapitulation of the objectives of the program in terms of the land areas to be developed, and the capital investment requirements in each case:

Sub-Region	Developed Area (hectares)		Range of Capital Investment (equivalent million US \$)	
	10 years	30+ years	10 years	30+ years
Quang Tri - Thua Thien	50,000	150,000	60	180
Quang Nam - Quang Tin	40,000	140,000	45	150
Quang Ngai	30,000	120,000	35	130
TOTALS	120,000	410,000	140	460

Specific conclusions and recommendations resulting from this preliminary appraisal are as follows:

1) Conclusions:

- a) The need for effective water control and agricultural development of the entire coastal plain of the northern provinces is clear.
- b) Rainfall and natural streamflow are inadequate to permit intensive year-round cultivation of the total area.
- c) The lands selected, if properly prepared and managed, are productive and capable of yielding economic returns.
- d) There are adequate amounts of surface water to support intensive irrigated agriculture if proposed storage facilities are provided; however, streamflow records are as yet insufficient to determine individual river discharges with enough accuracy to permit design of major control structures.
- e) Drainage facilities, to alleviate conditions in the lower lying lands, are essential for full agricultural development.
- f) Flood and salinity control measures (particularly in the area around Hue) are also essential for full agricultural development and to prevent further loss of life and property.
- g) Topographic and geologic conditions are favorable for implementing the proposed program.
- h) Implementation of the program will greatly increase agricultural production and farm incomes, and will also, eventually, make the region self-sufficient in food.

- i) Within the proposed water control facilities hydro-electric potential is sufficient to meet regional needs in the early post-war period.
- j) Realization of full benefits will be contingent upon establishment of an organization to ensure development in accordance with the overall regional program, and upon formation of local development associations to implement distribution and farm water control systems and provide water control and agricultural assistance to the farmers.

2) Recommendations - The following recommendations are made with a view to more accurate definition of the development program leading into specific staged appraisals, feasibility studies, designs and construction.

- a) A network of hydrologic and meteorologic stations should be planned and established at the earliest possible date. The stations will be located to provide sufficient basic data to enable more accurate determination of flood magnitudes, salt water intrusion, drainage requirements, surface water availability and irrigation water requirements.
- b) Land use maps should be prepared covering the estimated 410,000 hectares of irrigable lands, and showing areas actually cultivated and the major crops planted thereon.
- c) The soils of the coastal plain should be further studied in order to prepare land classification maps indicating suitability for irrigated agriculture and permitting determination of best future land use.
- d) Present yields and production costs should be investigated in sufficient detail for all major crops to permit calculation of regional averages.

- e) Market studies and forecasts should be made to permit determination of the most desirable extent and nature of future crop diversification.
- f) The numerous reports on all water control projects proposed in the last 30 or so years should be reviewed.
- g) Flood and salt water damage investigations should be carried out.
- h) The possibilities of regional power generation in conjunction with regional water control facilities should be appraised.
- i) Preliminary plans should be made for provision of adequate farm-to-market road networks.
- j) General layouts and plans of proposed water control facilities (storage dams, irrigation and drainage systems and flood and salt water intrusion control structures) should be prepared in sufficient detail to permit preliminary cost determination.
- k) Preliminary benefits based on increased agricultural income under future development should be estimated.
- l) A preliminary economic evaluation of the full development of 410,000 hectares should be made on the basis of preliminary cost and benefit figures.
- m) Immediately there should be discussions with appropriate agencies of the Government of Vietnam to secure their participation in the investigative phases of this program (particularly in establishing hydrologic and meteorologic stations, gathering agricultural data, obtaining all available records and reports, preparing an inventory of existing water control facilities, and delineating present government plans for constructing and improving water control facilities).