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The
AUTONOMOUS REGIONAL CORPORATION
OF THE
CAUCA

and the Development of the
UPPER CAUCA VALLEY

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

November, 1955

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Report of a Mission organized by the
International Bank for Reconstruction and Development
at the request of
The Government of the Republic of Colombia
and
The Autonomous Regional Corporation of the Cauca

Washington, D. C.
November 1955

THE MISSION

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Preface

This is the report of a mission to the region of the Upper Cauca Valley in Colombia, organized by the International Bank for Reconstruction and Development at the request of the Government of Colombia and of the Autonomous Regional Corporation of the Cauca.

The purpose of the mission was to study the principal subjects of importance in the future economic development of the Cauca Region, and to make recommendations for a practical program of action to foster such development in the interest of stimulating the economic progress of Colombia as a whole and of providing a demonstration center for regional development. The mission addressed itself primarily to the role which the newly established Autonomous Regional Corporation of the Cauca could play, and to the activities and methods by which it could make a maximum contribution to the economic advance of the region and of Colombia.

The mission consisted of six members, three recruited by the Bank from outside its staff and three from the Bank's regular staff.

The mission arrived in Colombia early in February 1955 and remained for two months. Members traveled widely and conferred extensively with government officials in the region and in Bogota, and with private individuals and interests. The mission then reassembled in Washington to prepare this report. The chief of mission returned to Colombia in September 1955 to discuss the content of the report with officials of the Corporation and to obtain the latest engineering data; the recommendations contained in the report are, however, the responsibility of the mission solely. In transmitting the report to the Government of Colombia and to

the Corporation, the President of the Bank pointed out that, since the Executive Directors and the management customarily do not review recommendations of missions in detail, the report represented the views of the mission rather than positive recommendations of the Bank itself. He added, however, that the Bank believed that the findings and recommendations of the mission deserved most careful consideration and discussion.

Chapter 1 of the report presents a general view of the antecedents and nature of the Corporation, together with a summary of the activities recommended by the mission. Subsequent chapters present a more detailed discussion of those activities, the reasons why the mission thinks them desirable and appropriate, and the methods by which the mission believes that they should be undertaken. Finally, there is an Appendix setting forth engineering and other considerations in greater detail. The mission wishes to emphasize that at many points it had to utilize tentative and preliminary data, and that it is quite likely that later engineering and economic surveys and analyses may alter the figures it has used. Nevertheless, the mission believes that it has made use of the best data available, and that its findings as to the general orientation of the Corporation's work are valid.

The mission wishes to express its appreciation for the wholehearted cooperation and warm hospitality extended to it by government officials and private citizens. The mission was granted every facility for its work in Manizales, Cali, Popayan and Bogota. In particular, the mission wishes to acknowledge the initiative and understanding of His Excellency the President of the Republic, General Gustavo Rojas Pinilla, and the inspiration of

Mr. David Lilienthal, former Chairman of the Tennessee Valley Authority and now Special Adviser to the Corporation. Its work was greatly facilitated by the invaluable encouragement and assistance of Dr. Diego Garces Giraldo, Governor of the Department of Valle del Cauca and President of the Board of the Cauca Corporation, the members of the Board of the Corporation and the Corporation's Executive Director, Dr. Bernardo Garces Cordoba, with all of whom the mission worked closely.

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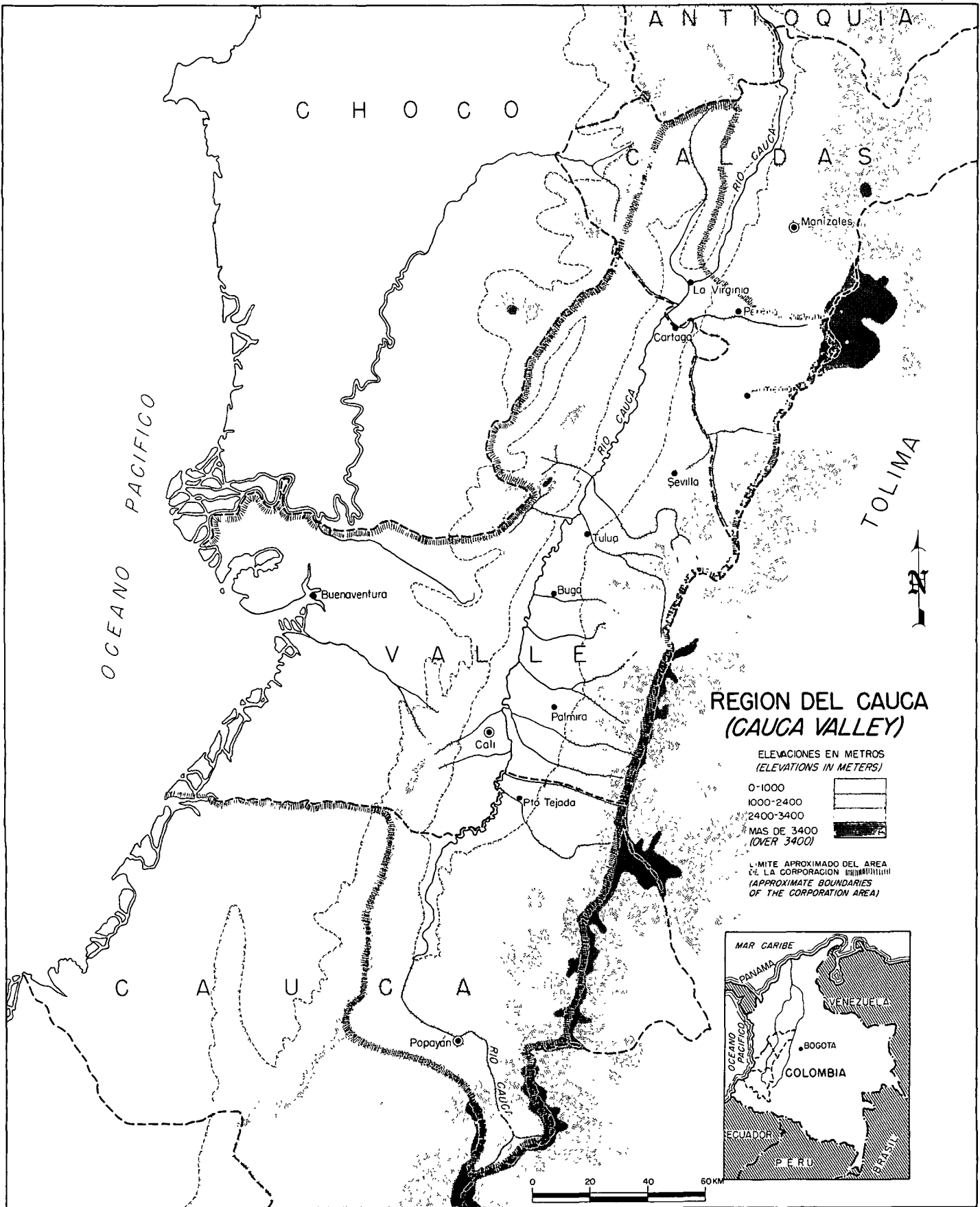
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C H A P T E R 1

OBJECTIVES, POLICIES AND ACTIVITIES OF THE CORPORATION

I. THE CREATION OF THE CORPORATION

On October 22, 1954 the National Government of Colombia approved Decree Law No. 3110 of 1954, creating the Autonomous Regional Corporation of the Cauca, and thereby gave life to an idea.

The idea was not new. For years the government and leading citizens of the Department of Valle del Cauca had sought means of quickening and spreading economic growth in their region. They were convinced, and rightly so, that the Upper Cauca River Basin was endowed with climate and soil and a geographic situation which would reward their efforts. They were animated by the belief that their people and their land could make a greater contribution to the economic strength of Colombia. As early as 1928, the Departmental Government of Valle obtained the expert advisory services of a mission from Puerto Rico on the agricultural resources of the Valley. Salvajina was first studied as a possible hydroelectric site in 1942; in 1945, Dr. Ciro Molina Garces, then Secretary of Agriculture of Valle, contracted with a New York firm for an engineering study on improved use of the water resources of Valle. Calima was first studied as a power project in 1946. In 1949 the Departmental Government contracted with the engineering firm of Olarte, Ospina, Arias, & Payan (OLAP) for a study of the electrification of Valle, and OLAP presented a full report in July 1949. OLAP also prepared an over-all irrigation plan, and in June 1952 presented a Plan for the Economic Development of the Upper Cauca River Basin which suggested the creation of a Valley Development Corporation.

This long record of engineering reconnaissance and analysis made possible a step forward. Upon the suggestion of the Cali branch of the Colombian Manufacturers Association (ANDI), the Government of Valle in June 1953 formed a Departmental Planning Committee, which turned to the National Planning Committee for assistance and advice. Accordingly, in May 1954, a Report on a Plan for the Department of Valle, with recommended development investment for 1954-58, was presented and subsequently published.

The idea was thus moving steadily towards fruition. In early 1954, Mr. David E. Lillienthal, former Chairman of the Tennessee Valley Authority in the United States, visited Colombia at the invitation of the President of the Republic, and in June 1954, submitted a Report to the President. The report reflected the experience of the Tennessee Valley and the T.V.A., which twenty years ago had faced problems and opportunities comparable in some degree to those of the Upper Cauca Valley. Mr. Lillienthal crystallized the idea in these words: "The best prospect for rapidly advancing the agricultural, industrial and educational welfare of the entire Colombian people lies in the creation of a regional development corporation or agency to serve as a demonstration of the coordinated, efficient, and modern development of natural resources of waters, land, forests and minerals, and of industrial and educational progress." The establishment of the Cauca Corporation was the first step towards converting that prospect into achievement.

Decree Law 3110 of 1954 appointed Valle's Departmental Planning Committee as the Provisional Board of the Corporation, charged with two principal tasks. The first was to draw up definitive statutes for the Corporation

and submit them to the President of the Republic. This was done in close consultation with the governments of Caldas, Valle, and Cauca; the Corporation's statutes were approved on July 5, 1955, by Decree Law 1829 of 1955 (Appendix p. 106).

The second task was to prepare a program of activities to be undertaken by the Corporation. This work is now (September 1955) in progress. The Corporation has contracted with a consortium of experienced engineering firms 1/ for the necessary engineering studies and a report evaluating the various alternatives confronting the Corporation; this report should be completed by December 1955. In addition, the Corporation requested the assistance of an International Bank mission in selecting and defining the Corporation's major activities, and in delineating the administrative and financial procedures by which its program could be implemented. This report embodies the mission's conclusions.

II. THE REGION

The area in which the Corporation will operate covers the drainage area of the Upper Cauca River Valley, and the neighboring Pacific slopes. Substantially, this means part of the Departments of Cauca and Caldas, and all of the Department of Valle del Cauca,2/ but for some purposes the Corporation's sphere of action will extend to the whole of the three Departments.3/

1/ Tippetts, Abbett, McCarthy, & Stratton; Gibbs & Hill; and OLAP

2/ Called in this report the "Corporation area."

3/ Called in this report the "Region."

The Region is old in history, but young in the modern world. Popayan and Cali were founded in 1534 and 1536, respectively. For the greater part of its history, however, the Region was extraordinarily isolated, both from other regions of Colombia and from the world. Bogota could be reached by land only by crossing the Cordillera Central, descending to the valley of the Magdalena River, and then climbing the flank of the Cordillera Oriental to reach the high plateau of Cundinamarca. Within living memory, the trip involved two to three weeks on mule-back. Today, Bogota and Cali are one hour apart by air. For centuries the connection between Cali and the Pacific port of Buenaventura was a wretched track across the Cordillera Occidental, and the bulk of the Region's trade with Spain moved through Quito. Not until 1915, two years after the opening of the Panama Canal, was the Region connected to Buenaventura by railroad. Thirty more years passed before there was a motor road between Cali and Buenaventura; merchandise was carried by truck from the port to Cali for the first time in 1945.

It is not too much of an exaggeration to say that in terms of modern economic systems and methods the Region is only 50 years old. Yet in those 50 years there has been notable progress. Today, in the latter part of 1955, the three Departments of Cauca, Valle, and Caldas have an estimated total population of almost 3 million, representing 24% of the population of Colombia. Since together they produce about the same percentage of the national income of Colombia, their activities now vitally affect the economic well-being of the whole Republic.

The Region's economic strength and potential arises in part from its geographic position, and in part from its diversity. It is now relatively well

linked both to the outside world and to the rest of Colombia. The climate ranges from cool temperate to warm tropical, depending upon elevation. The terrain varies from a flat river plain to steep mountainsides. The climatic range, corresponding in effect to a wide difference of latitude, makes possible a great variety of agricultural output. At the same time, some of the most modern manufacturing plants in Colombia have been established in the Region, particularly in and around Cali. In a word, conditions are opportune for continued economic development.

There has already been remarkable economic growth in the Region, but it has been unevenly distributed. All the statistical indicators show that conditions in Valle are above the national average, those in Caldas at about national average, and those in Cauca below it. Between 1938 and 1951, the population of Valle increased 4.71% annually, and that of Caldas and Cauca 2.58% and 1.72%, respectively, compared with a national average of 2.23%. In Colombia as a whole 64% of the population is rural. Whereas in Valle rural population has already fallen to 51%, in Cauca it is still 84%; Caldas, at 62%, is near the national average.

Income per head, a useful index of economic development, ranged in 1951 from Ps. 670 in Valle, through Ps. 520 in Caldas, to about Ps. 200 in Cauca.^{4/} Income per head in Valle is thus about 30% above the national average. Yet it is still 25% less than in the Department of Cundinamarca and 13% less than in the Department of Antioquia. Income per head in Caldas is about the same as the national average, while in Cauca it is only 40% of

^{4/} Income estimates for 1951, calculated from Banco de la Republica's national income estimates by applying percentage departmental distribution for 1951 presented in the 1953 Annual Report of the National Planning Committee, p. 52.

that average. Financial statistics follow the same pattern, and also confirm that rapid economic growth is under way.^{5/}

	<u>Total Income</u> (Ps. million)	<u>Income per Head</u> (Ps.)
Caldas	575	520
Valle	740	670
Cauca	<u>85</u>	<u>200</u>
Region	<u>1,400</u>	<u>535</u>
Antioquia	1,200	770
Cundinamarca	1,675	1,030
All Colombia	6,105	530

The Corporation will thus be working in a region neither uniformly rich nor uniformly poor, and one in which there is already an impulse toward growth. It has the opportunity to work from a relatively well-developed base, and a challenge to spread economic development more widely through the Region.

III. THE ROLE OF THE CORPORATION

The ultimate objective of the Corporation is to enhance the welfare of the Colombian people. We know this to be the ardent hope of those who

5/	<u>Departmental Budget Revenues</u> 1954			<u>Savings Deposits</u> end 1954		<u>Checks Cleared</u> 1954
	<u>Total</u> (Ps. million)	<u>Per Head</u> (Ps.)	<u>Total Growth</u> (1949=100)	<u>Per Head</u> (Ps.)	<u>Total Growth</u> (1949=100)	<u>Per Head</u> (Ps.)
Caldas	41.1	36	212	22	324	3,913
Valle	56.8	45	232	26	311	4,928
Cauca	9.7	<u>21</u>	<u>202</u>	<u>8</u>	<u>282</u>	<u>694</u>
Region	<u>107.6</u>	<u>37</u>	<u>221</u>	<u>21</u>	<u>315</u>	<u>3,482</u>
Antioquia	65.2	39	204	20	238	3,355
Cundinamarca	45.9	26	176	52	275	8,401
All Colombia	356.3	29	187	21	289	3,451

are working so diligently for its success. The Corporation's contribution will be made both directly and indirectly. By assisting to promote the growth of output and income in the Cauca Region, in which live 24% of the people of Colombia, its contribution will be direct. Before long, however, these economic benefits will start to diffuse throughout the country, in the form of growing demand for things produced elsewhere, and greater and perhaps cheaper production of things consumed elsewhere. Hand in hand with growth of output and income goes an increase of trade.

The indirect means by which the Cauca Corporation's work can be spread throughout Colombia is through the demonstration of modern techniques for solving old problems, and through the training of Colombians in their application. The Corporation brings together, within one responsible agency, men with skill and knowledge in many fields to help to solve a critical group of separate but related problems in the region. Power, flood protection, irrigation, drainage, soil conservation and reforestation, improved agriculture and livestock, development of mineral resources and improvement of transportation systems become the concern of a single agency of the National Government located in the Cauca Region. Under the leadership of the Corporation, men trained and experienced in these fields will find a common forum in which to study, confer and agree upon efficient and effective methods for working together in their service to the people. The spirit and skill of the men in the Corporation will largely determine whether or not it succeeds. Spirit and skill can, fortunately, be imparted to others. The mission is convinced of the importance of the demonstration and training the Corporation can provide, and recommends that it seek to recruit men from all

over Colombia, paying special attention to combining training with the analysis and execution of projects and activities. The Corporation has in fact already adopted this policy.

In drawing up an initial program for the Corporation, we have taken into account not only the nature and potentialities of the Corporation, but also the services being provided by other government agencies, and the development requirements of the Region itself. We have thought of the Corporation as a new and different instrument of government in Colombia, one that complements rather than duplicates existing agencies. The autonomy and continuity of its Board of Directors, and its removal from the day-to-day play of politics, permit it to work steadily towards long-range objectives, applying methods based on technical and economic considerations. This in itself is not new in Colombia; what is new is that this character is enjoyed by a multi-purpose regional agency. The Corporation is in effect a regional development corporation.

The projects discussed in this report, if soundly executed, will in the course of time increase the productive resources and the output of the upper Cauca region and will thereby raise the standard of living of many of the Colombian people. We believe that the continuing activities of the Corporation should emphasize principally an increase of output as the means of achieving the desired objective. In other words, we regard the Corporation as primarily, though not exclusively, an economic rather than a social institution.

Nevertheless, there will undoubtedly be opportunities for the Corporation to assist other agencies and institutions working in the field of

social welfare, in most instances by providing or obtaining technical assistance and advice. To draw a distinction between social welfare activities which the Corporation might properly assist, and those which it should not, would be arbitrary and unrealistic even if it were possible. However, there is clearly a stronger case for the Corporation's interest in matters affecting the working efficiency of the population than in matters affecting, for example, their enjoyment of leisure.

Thus it would be appropriate for the Corporation to provide engineering advice and assistance on the design and construction of sewage systems, or of potable water supplies to urban clusters, whereas it would be difficult to justify Corporation sponsorship of education in the appreciation of music. Similarly, while it would be difficult to establish a case for Corporation activities in the field of general cultural education, its assistance in raising the standards of technical education and of industrial training, as suitable opportunity offered, would be proper and desirable.

The mission believes, however, that during its initial or establishment period the Corporation must concentrate on a few well-defined activities, giving greatest emphasis to those directly in the economic field, and must avoid spreading its administrative, technical and financial resources too thin. For this reason we make no specific recommendations in the field of social welfare, even though we are well aware of the fundamental importance of welfare work.

IV. THE RECOMMENDED PROGRAM

In later chapters of this report we recommend an initial program covering the first or establishment phase of the Corporation's work.

The hard core of this program is the selection, design and construction of a major project or projects for the generation and transmission of electric power and for flood protection. Present data indicate that the first projects likely to be constructed by the Corporation are a single-purpose hydroelectric project at Calima and a multi-purpose project at Timba which would provide flood protection and some irrigation benefits as well as hydroelectric power.

However, before final selection of a project at the Timba site, it will be necessary to determine in detail the project's technical and economic feasibility and cost, as well as the extent of flooding and the probable benefits of various degrees of flood protection. Associated studies, now under way, are also necessary to refine the estimates of future demand for electric power, to determine how soon construction at Calima or Timba must be started in order to meet the expected future demand for power.

Flood protection through storage of flood waters will not, however, completely solve the flood problem for the whole valley. Additional measures such as flood bypasses, channel improvement and levees may be required, particularly in the northern end of the valley, and studies should be continued to determine their nature, cost and benefit.

The mission believes that the Corporation can usefully undertake drainage work in the flat area of the valley, but is more doubtful whether any widespread demand for additional irrigation exists under present conditions. We recommend that preliminary surveys be made to select suitable areas for compact pilot projects of drainage and of irrigation and that, if a majority of the landowners consent, such projects be designed and carried out.

In the field of agriculture, we recommend that the Corporation undertake

the administration of a regional extension service and the operation of one or more farm machinery pools. We believe that these activities could have a significant impact upon agricultural development in the Region. In addition, we recommend that the Corporation arrange for a land capability survey, both to assist in the development of its own agricultural program and to benefit other agencies. We visualize that these activities would be the responsibility of an agricultural division within the Corporation. The division would also assist in the calculation of benefits to be expected from flood protection, and drainage and irrigation works, and would maintain liaison with and promote coordination among other agencies and institutions concerned with agricultural development in the Region. The agricultural division would also act as a channel through which outside technical assistance on local agricultural problems might be obtained.

The mission found that the improvement and construction of departmental roads is lagging behind the development of other transport facilities in the Region. Accordingly, it recommends that the Corporation consult with the Departmental Governments of Caldas, Valle and Cauca, and propose to them a plan for the improvement of departmental roads, under which the Corporation would establish a road division which would make available the consultant services of experienced and qualified road engineers, with the object of assuring uniformly high standards of road construction throughout the Region. The mission also commends to the serious consideration of the Government and the Corporation a special gasoline tax to raise additional funds for departmental road construction and improvement in the Region. Finally, we suggest that the Corporation appoint an industrial services

officer whose function it would be to assist potential industrial investors who are considering locating in the region in appraising the factors relevant to their decision; and to help existing enterprise to obtain technical assistance and advice.

V. FINANCING THE PROGRAM

The mission believes that the financing of the initial program outlined above (including construction of a major project) is practicable, and within the limits of the resources that might reasonably be expected to be made available.

Execution of the program requires expenditure on three different types of purposes: first, the overhead administrative costs of the Corporation which are not assignable to any individual project or activity; second, expenditures upon the Corporation's own projects and activities; and third, expenditures upon projects or activities which the Corporation will sponsor, but will not itself execute unless requested to do so as agent for some other authority or institution. The mission visualizes different methods of finance in each case.

Until such time as the Corporation earns net profits, funds for its overhead administrative and general planning expenditures must be supplied by its "shareholders," the National Government and the three Departmental governments of the Region. The mission believes that the bulk of these funds should be provided by the Departmental governments, in recognition of the regional character of the Corporation, and that their contributions should be based partly on their relative incomes and partly on the extent of their territory which is included in the Corporation area. A contribution from the National Government is justified, in consideration of the

national interest in the Corporation, and as recompense for the training and demonstration features of the Corporation's work.

Administrative and General Planning Expenses

In the light of these considerations, the mission recommends that, until the Corporation is able to meet its administrative and general planning costs from its net profits, funds for these purposes should be contributed in the following proportions:

National Government	35%
Departmental governments - Caldas ...	10%
Valle	50%
Cauca	<u>5%</u>
	100%

Corporation Activities

Financing of the construction of engineering works, or specific activities such as agricultural machinery pools, is in a different category. In cases where the completed works would be revenue-producing (electricity) or expenditures might be recouped by benefit assessments (e.g. irrigation and drainage), it would be proper for the Corporation to seek to borrow part of their initial cost. However, some part of the cost must always be covered by the "shareholders," the National and Departmental governments, and in some cases they will have to supply all the funds. The mission recommends that the contributions of the respective shareholders be determined in the following manner:

- a) With respect to the National Government contribution, there is established Colombian precedent that the Nation contributes at

least 51% of the non-borrowed "equity" capital of major electric power installations. For many of the Corporation's other contemplated activities, however, there is no precedent, and each case will have to be considered separately. The mission believes that the Nation should always contribute some part of the cost in token of the national interest in the Corporation's work.

- b) The three Departments should together contribute 3.5% of the balance of the non-borrowed capital for every Corporation project or activity, in the following proportions: Caldas 0.5%, Valle 2.8%, Cauca 0.2%.^{6/}
- c) The remaining capital requirements should be contributed by the Departments on the basis of the direct benefits each receives from the project or activity; in the case of a power project, for example, the area into which the electricity is to be transmitted.
- d) The contribution of the Departments need not be made wholly by the Departmental governments; benefited municipalities should be called upon by the Departmental governments for some financial support, as is done today in the case of electrical generation and transmission.

^{6/} These percentages are based on the percentage which each Department's 1954 budget revenues bore to the total revenues of all three Departments (38%, 53%, and 9% for Caldas, Valle, and Cauca respectively, a proportion very close to the distribution of total income within the region), weighted by the percentage which each Department's territory within the Corporation area bears to the whole Corporation area (15%, 60%, and 25% for Caldas, Valle, and Cauca respectively). The resulting percentages for contributions from Caldas, Valle and Cauca are 14.3%, 80%, and 5.7% respectively, which is the basis upon which the mission distributed the proposed fixed contribution of 3.5% among the Departments.

Moreover, the contributions of the Departmental governments need not necessarily come from their own budget revenues; it may be possible for them to borrow some part of the required funds. Service on any loan incurred to provide the Corporation with non-borrowed "equity" capital should, of course, be undertaken by the Departments, not the Corporation.

If this formula is applied to electrical works whose benefits are located 95% in Valle and 5% in Cauca, and with 51% of non-borrowed capital contributed by the Nation, 0.25% of non-borrowed capital would be contributed by Caldas, 46.29% by Valle, and 2.46% by Cauca. For works towards which the Nation contributed 25%, and which were wholly located in Caldas, Caldas would contribute 72.75%, Valle 2.10%, and Cauca 0.15%; for similar works wholly in Valle, the contributions would be Caldas 0.38%, Valle 74.47%, and Cauca 0.15%; while for works wholly in Cauca, the contributions would be Caldas 0.38%, Valle 2.10%, and Cauca 72.52%.

The mission believes that this formula embodies several desirable principles. It recognizes that the work of the Corporation is of interest to the Nation and to the whole of the Region. The basic contributions of the Departments, expressing this interest, would be proportionate to ability to pay and to the share of each Department in the Corporation area, although in every case the area most directly benefited meets most of the cost.

Activities Sponsored by the Corporation

Some projects or activities will be sponsored by the Corporation but not executed by it except upon request of and as agent for some other authority or institution. In these cases the Corporation would either not

handle the project funds, or, if it did so, would expend monies provided by the authority or institution requesting its cooperation. In any event, it would not use its own "capital." Examples might be a Regional Agricultural Extension Service, or a Regional Fund for Departmental roads.

Projects requiring use of the Corporation's own capital cannot all be started simultaneously. One that could be undertaken soon is the establishment of agricultural machinery pools. These could be established for about U.S. \$500,000 and Ps. 300,000, or a total of about Ps. 1.5 million. Since this would be a self-liquidating operation it would be proper to seek loan finance for part of the cost. Assuming, for illustrative purposes, that Ps. 1 million can be borrowed for this project, so that non-borrowed capital amounting to Ps. 500,000 would be required, that the Nation contributed 20% of this amount, and that the benefits fell 10% in Caldas, 80% in Valle, and 10% in Cauca, the contribution of the "shareholders" under the recommended allocation formula would be:

Nation	20.00%	Ps. 100,000
Caldas	8.12	40,600
Valle	64.00	320,000
Cauca	<u>7.88</u>	<u>39,400</u>
	100.00%	Ps. 500,000

The first major construction works to be undertaken by the Corporation would be electrical generation and transmission facilities and for flood protection. These, which are large "all-or-nothing" projects, are by far the most costly part of the Corporation's program. Final costs will, of course, depend upon the projects finally selected for execution. For purposes of illustrating the orders of magnitude involved, it is assumed that Timba low dam plus channel rectification might be chosen. Construction of

these projects plus a five-year construction program of transmission lines would, on present rough estimates, cost something around Ps. 165 million with a foreign exchange content of about Ps. 70 million, or about \$28 million. If the foreign exchange costs can be borrowed, there would remain in round figures, Ps. 100 million to be found by the "shareholders," Ps. 50 million of which would be for the power program and Ps. 50 million for flood protection.

Applying the recommended allocation formula, under the assumptions that the foreign exchange costs can be borrowed, that the Nation contributes 51% of the local costs, and that the benefits were allocated as shown below, the contributions of the "shareholders" would work out as follows:

	<u>Electric Power</u>			<u>Flood Protection</u>		
	<u>Direct Benefits</u> (per cent)	<u>Contribution</u> (per cent) (Ps. million)		<u>Direct Benefits</u> (per cent)	<u>Contribution</u> (per cent) (Ps. million)	
Nation		51.00	25.500		51.00	25.500
Caldas		0.25	.125	3	1.66	.830
Valle	95	46.29	23.145	90	43.93	21.965
Cauca	<u>5</u>	<u>2.46</u>	<u>1.230</u>	<u>7</u>	<u>3.41</u>	<u>1.705</u>
	100	100.00	50.000	100	100.00	50.000

Given a four-year construction period, the above figures indicate that the annual contributions would be (in round figures) Ps. 13 million from the Nation, Ps. 0.3 million from Caldas, Ps. 11 million from Valle, and Ps. 0.7 million from Cauca. The forecast of future demand for electric power which is finally adopted as the basis for the Corporation's program may, however, call for more generating capacity than would be installed in Timba. It might then be justifiable to undertake an additional electrical project, which might

be so timed that during one or two years two projects are under construction simultaneously. This would aggravate the financial problem during a few years of overlapping construction periods without, however, greatly increasing the average annual requirement for funds over a longer, say 10-year, period.

Clearly, both Valle and Cauca would need to make every effort to mobilize resources, seeking maximum assistance from the municipalities. The mission knows this will not be easy, but believes it should be possible, provided the benefits to the people of the area are clearly demonstrable. If electric power rate policies are adopted which yield revenues adequate to amortize debt, and benefit assessments for flood protection are levied, again providing a basis for borrowing, it may be possible for the Corporation to borrow some part of the peso costs as well as the foreign exchange costs, thereby lightening the immediate call on the "shareholders."

More studies are needed on such flood protection measures as channel improvement, flood by-passes and levees, and it will be some time before construction can start. Irrigation and drainage works must await the completion of preliminary surveys and the consent of landowners; moreover, in some places drainage work cannot be undertaken before flood protection works are completed. No detailed cost estimates exist for any of these works, but they can be begun modestly and expanded as experience is gained and circumstances permit.

The Corporation's requests for funds to carry out construction projects or its own direct activities are likely to be viewed in the light of its own reputation for sound judgment and efficiency. Underlying sound

judgment is a refusal to act until sufficient and reliable facts are available on which to base decisions, and basic to efficiency are records and reporting systems adequate to check performance and eliminate waste. The mission strongly recommends, as being fundamental to the validity of all our other recommendations, that the Board and staff of the Corporation pay close and constant attention to the administrative efficiency of the Corporation itself, and to the adequacy of its own records and reports.

We believe that the Corporation's financial policies should be guided by certain principles. The accounts should show the revenues, expenses, assets and liabilities of each activity separately, so that the financial costs and results of each can be ascertained. A clear distinction should be kept between activities which can be fully self-liquidating, and those which are wholly or partly non-reimbursable. The revenues accruing to a self-liquidating activity, such as, for example, the supply of electric power or the provision of farm machinery services, should be applied first to sustain that activity. Only net profits, after allowing for full depreciation and maintenance of physical facilities, should be transferred to the Corporation's general funds.

The Corporation's main source of funds will be "aportes" (non-voting grants of capital without interest or dividend rights) and borrowing from banks and through bond issues. "Aportes" in any form other than cash should be recorded in the accounts at their current market value. In particular, "aportes" made in the form of "pagares" (I.O.U.'s) or bonds should be entered in the amount at which they can be discounted or sold for cash, not at their face value. The Corporation cannot in the beginning borrow

for general purposes on the security of its own credit as an institution, since initially it will have neither assets nor revenues. It can therefore borrow in its own name only against specific activities or assets whose expected revenues and/or repayments will be sufficient to service loans or bond issues.

So long as the Corporation has no assets or revenues of its own, wholly non-reimbursable expenditures should not be financed from borrowed funds. Partly reimbursable activities, such as flood protection works for which benefit assessments are levied on property owners, should not be financed by borrowing to an amount greater than the anticipated returns from assessments, or upon service schedules under which the Corporation would repay faster than it will itself recover funds.

If these principles are followed, the Corporation will maintain a sound balance-sheet position, and at the same time the source and disposition of any funds entrusted to it will be clearly revealed.

VI. THE GOVERNMENTS AND THE CORPORATION

The National Government, which created the Corporation, and the Departmental governments of Caldas, Valle, and Cauca which have supported and endorsed it, bear great responsibility for its success. For them, the Corporation is important both for its own sake and as a test-demonstration of a new approach and method in Colombian public administration. The demonstration, however, cannot succeed without the continued and active support of the governments concerned.

In a word, the Corporation must be given a reasonable opportunity to prove its success or failure. The mission has little doubt that,

given the opportunity, the Corporation will succeed. There are, however, certain indispensable requirements.

The first is that the National Government and the Departmental governments of Caldas, Valle and Cauca give adequate financial support to the Corporation. Without resources, the Corporation can achieve nothing. Acceptance by the governments of a program proposed by the Corporation carries a commitment to provide the necessary resources, either directly by way of grants ("aportes") or indirectly by guaranteeing the Corporation's financial obligations, at least for the first few years. This does not necessarily mean a net increase of official development expenditures in the region. Many of the items for which the Corporation will request funds will represent expenditures the governments would have made in any event. For example, there would be a government-financed expansion of electrical facilities even if there were no Corporation.

Nevertheless, neither the Corporation nor the Departmental governments can expect the National Government, which has heavy responsibilities for developmental expenditures all over Colombia, greatly to expand the proportion of its outlays in the Cauca Region simply because the Corporation exists. If, therefore, there is to be any real increase in the level of governmental investment for economic development in the Region, the Departmental governments must provide most of the additional funds. The mission strongly suggests to the governments of Caldas, Valle, and Cauca that they carefully scrutinize their revenues and expenditures, and take appropriate action enabling them to give effective financial support to the Corporation. The mission does not wish to offer specific recommendations on this matter,

believing that it is something for each government to determine in the light of its own situation. It might be possible, if the governments so desired, for the Corporation to obtain the services of an expert in fiscal administration, to give technical advice upon this problem. We suggest in Chapter 5 that additional gasoline taxation would be an effective method of raising funds to speed road construction and improvement.

The second requirement is that the four governments must permit the Corporation to be in fact what under its statutes it is in law, namely, autonomous and non-political. No public institution can or should be autonomous to the point of independence, but the Corporation is not by law or structure independent. Its programs must be submitted to the approval of the National Planning Committee in Bogota, a provision designed to achieve harmony between national development programs and the Corporation's actions. At a second stage the governments themselves will review the Corporation's programs when requested to assist in financing them by providing capital or guaranteeing the Corporation's financial obligations. Once, however, any program has been reviewed and accepted by the governments, its execution should be left to the Corporation without interference. The Corporation is a responsible government institution, and should be entrusted with responsibility.

Finally, we believe that the National and Departmental governments should regard the Corporation as a regional development corporation, not merely as an executive agency entrusted with a few defined functions. Its whole purpose is the promotion of economic development. Within a short time, its directorate and staff will have invaluable knowledge and

experience in the economic problems and potentialities of the Region. Failure to consult with the Corporation on regional development problems, and to give due weight to its views, would constitute a waste of a considerable asset.

CHAPTER 2

FLOOD PROTECTION AND ELECTRIC POWER

Protection against floods and the provision of electric power must be considered together by the Corporation. Both are aspects of the single problem of the effective and productive management of water resources; in the Cauca Valley they are the two most important aspects. They need to be planned together, in order to arrive at a combination of flood control and power programs that will maximize total benefits for least cost, to the greatest advantage of the economic development of the area.

The Corporation faces a planning task of great magnitude and complexity. The economic and engineering studies already completed and those under way represent a good start, but they must be completed and analyzed before decisions can be firm enough so that work may begin.

We do not mean to suggest, however, that the actual construction must be something for the distant future. The planning can be sound and at the same time prompt. The important point is that it cannot be avoided or passed over lightly.

I. FLOOD PROTECTION

Floods are a deterrent to the better utilization of much excellent land in the Cauca Valley and protection against them is prima facie desirable. The question is not whether there should be any flood protection at all, but how much there should be, and how soon. The answers must be based both on engineering data as to the technical feasibility and project costs of possible flood protection measures and on careful economic analysis of the benefits likely to accrue.

On an average flood year, a total of about 87,000 ha, or 24%, of the flat area of the Valley is inundated, partly by overflow of the Cauca River (57,000 ha) partly by flooding of the tributaries (15,000 ha) and partly by rainfall in low areas for which natural drainage is inadequate (15,000 ha). During exceptionally bad floods, say once in 20 years, the Cauca River alone floods about 85,000 ha, or almost 30,000 ha more than it does during average floods.

Rainfall and river flow records are not sufficiently complete to give a full picture of the frequency of the unusually great floods. The season 1949-50 was extremely wet from October to July and river stages in the Valley reached the highest levels in many years. From an inspection of the rainfall record at La Manuelita, which extends from 1900, it appears that floods of comparable magnitude may have occurred in the years 1922 and 1928 and that major floods of somewhat less magnitude probably occurred in 1903, 1916 and 1921.

Apparently heavy storms of long duration do not simultaneously occur over the entire Valley, otherwise the floods would be much greater than any which have occurred during the period of actual or historical record. For example, the maximum discharge recorded for the Cauca River at Juanchito near Cali in February 1950 was only about one-eighth of the maximum which might be expected for a drainage area of similar size and comparable annual precipitation in the eastern United States. For this reason, a much greater flood than has been recorded in the past may be experienced some time in the future.

Economic Effects of Floods

Flooding of the Cauca River does not cause much loss or damage to existing wealth. The early Spanish settlers located their cities and villages on high ground primarily for health reasons and the frequent flooding of low areas has

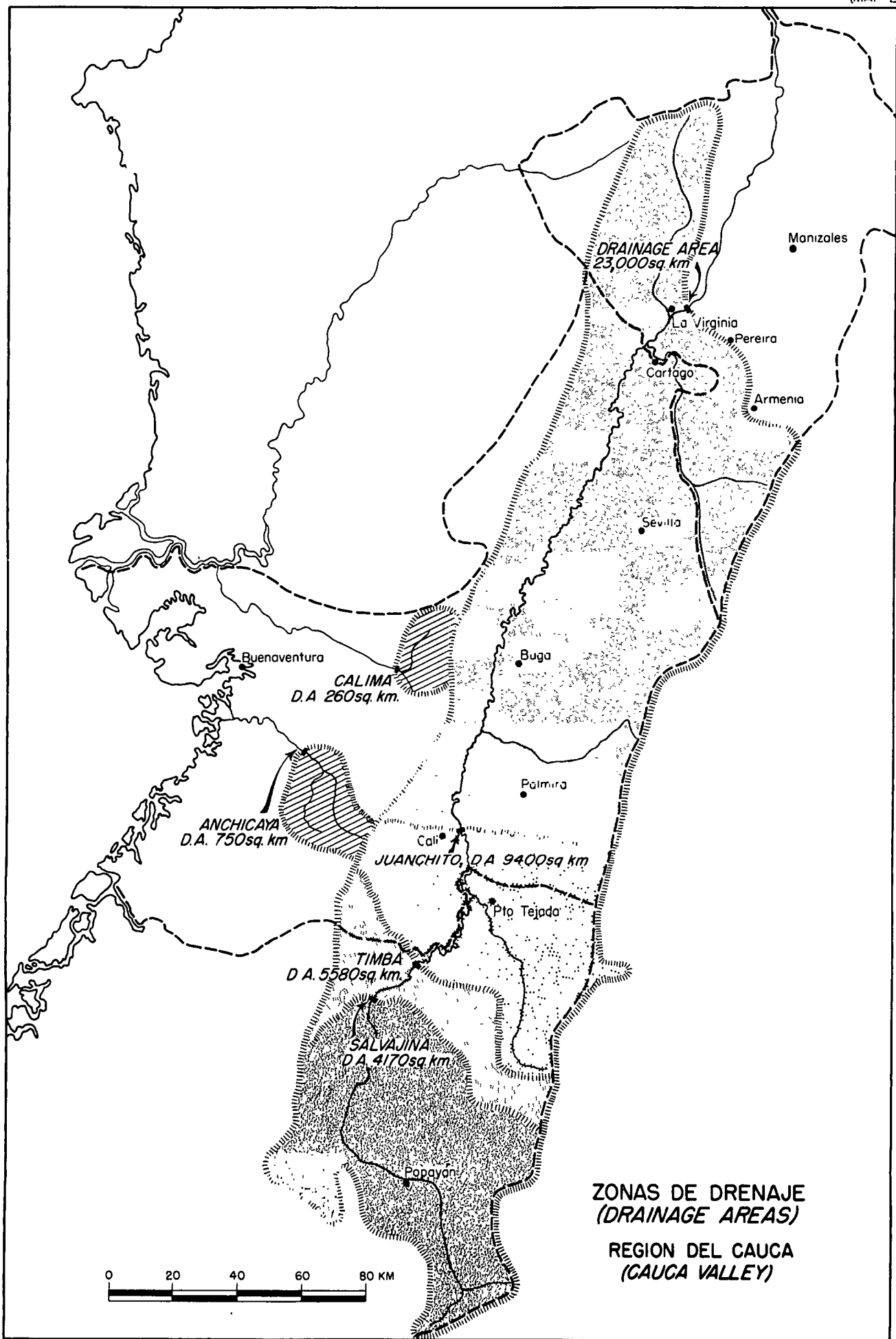
discouraged subsequent urban or industrial development there. Neither does the Cauca cause loss of life or destroy any great amount of agricultural wealth by destruction of existing crops or drowning of cattle. The areas subject to annual floods are used principally for cattle-grazing, not for crops. During flood periods, the cattle move to higher ground. Flooding of the tributaries, however does at times cause some damage in towns.

Thus the benefits of protection from flooding of the Cauca River are to be found in the future increase of output made possible by such protection rather than the avoidance of losses of present output or wealth. Specifically, if protected, the land now subject to flooding could be used much more intensively for cattle-raising or be planted to crops.

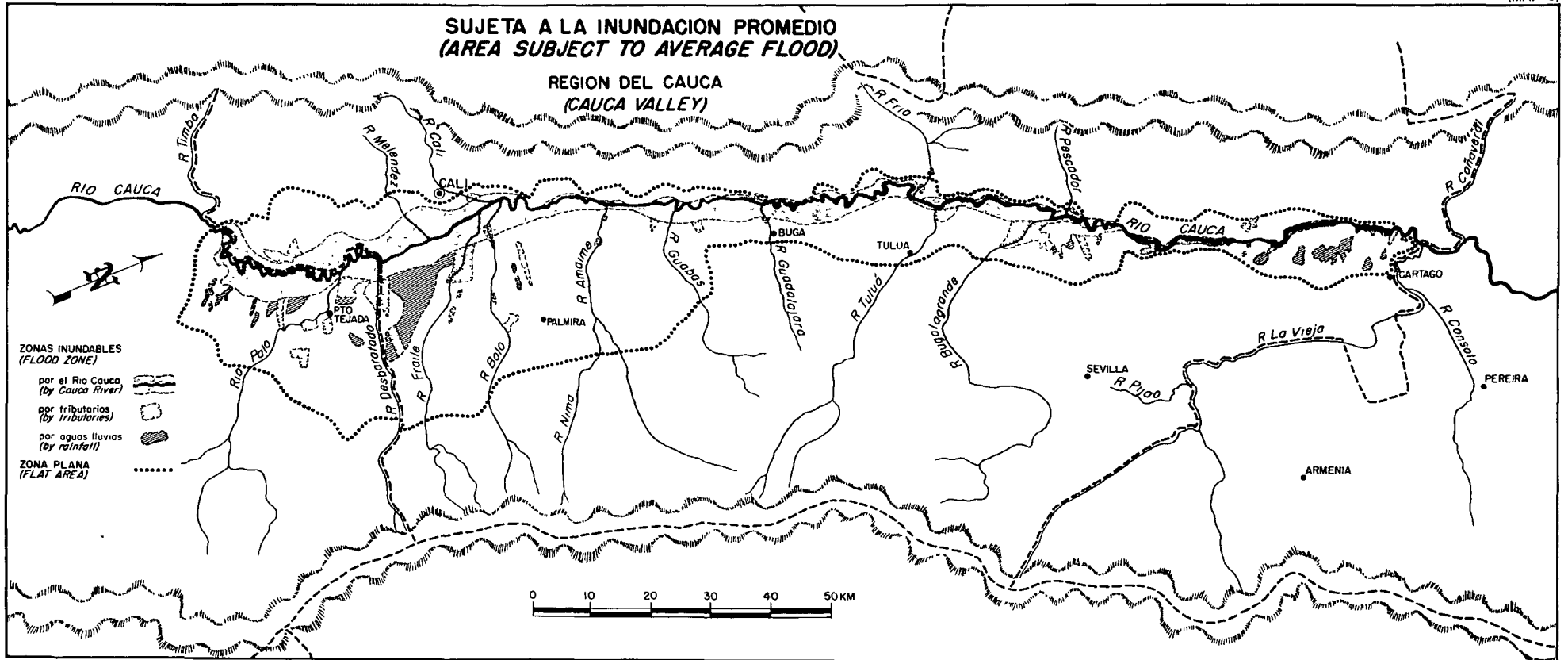
Determining the Benefits of Flood Protection

Actual, as contrasted with potential, future increase of output in the Cauca area will depend on many factors in addition to security from floods and it would be a mistake to assume that the full benefits will quickly or automatically accrue. This is a principal reason why the Corporation is necessarily interested in wider problems of the development of the Region and why this report discusses such matters as agriculture and transport. It means also that any computation of flood control benefits will have to be based on various assumptions as to the speed at which benefits will be realized; benefits cannot be expressed in advance as a single figure but only estimated within a probable range of minimum and maximum amounts.

The Corporation's decision on flood control projects will necessarily depend on an estimate of the benefits, to be compared with costs. The accepted method is to compare the annual benefits with the cost of providing the desired



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(DRAINAGE AREAS)
REGION DEL CAUCA
(CAUCA VALLEY)**



degree of flood protection. The method of computing these benefits in money terms is complex. It is explained in some detail in the Appendix (p. 134); the main points of the approach can be summarized here to demonstrate the steps that the Corporation will need to take to get a reliable figure for purposes of firm planning.

The starting point is an accurate survey of the present use of the land which is subject to flooding and which flood control projects would protect. The survey would provide an estimate of the total net value of the present output of this land. It would also provide essential data for later engineering plans by defining the area and site of lands now actually affected by floods of various heights and durations, and facilitate estimate of the area which would remain subject to flood with different degrees of flood protection in operation. Furthermore, by including a cadastral survey of the present ownership and value of flooded land, it would be the basis of any benefit assessments that might be determined. No such survey has yet been completed in the Cauca Valley.

The next step is to estimate the output which would be technically and economically possible on land protected against floods. Estimates should be made under varying assumptions regarding land-use and agricultural practices since increase in output will depend on the extent and speed of change in benefited areas. Allowance will have to be made for such factors as changes in the costs of production that may accompany the increase in output. If in some districts drainage projects must accompany flood protection, the full annual cost of drainage must be treated as an associated cost.

Finally, a judgment must be made as to how quickly these net benefits may be realized, that is to say, how soon and how extensively changes in land-use and improvements in farm practices will come about. Benefits realized only

gradually over five or ten years, for instance, do not justify the same investment in flood protection as benefits accruing sooner.

A tentative computation of benefits is given in the Appendix (p. 137), principally to illustrate the method to be followed. Obviously, the figures are tentative to the point of being hypothetical since much of the necessary basic information, especially the land-use survey, does not exist. This computation indicates that the net benefits of full flood protection, without allowing any associated cost for drainage, may range from 220 pesos per hectare-year with no change in land-use or practices, up to 590 pesos per hectare-year if all possible benefits are realized.

If the study of the benefits of flood protection confirms that without changed land-use they compare favorably with the final estimates of flood protection costs, the question of the length of time before the benefits are realized would not arise. If, however, costs are such that benefits must be higher than this to justify expenditure on the project, the question of how long it is likely to be before actual change of land-use occurs, yielding higher benefits, becomes of central importance. The lapse of time before benefits are realized can be expressed arithmetically by discounting future benefits to their present-day value. If, for example, future benefits are discounted at 10%, benefits worth 590 pesos per hectare-year in five years' time are worth 366 pesos today, while if the benefits are not realized until ten years, their present-day worth is 227 pesos.

The decision whether to undertake flood protection measures, and if so on what scale, depends to an important extent upon the estimate of expected benefits, which is placed alongside the cost estimates, as discussed below. The mission therefore recommends that work be started at once to assess the possible benefits of a flood protection program.

II. ELECTRIC POWER

The starting point in formulating a power program is an estimate of the probable future demand for power, under appropriate assumptions regarding selling prices for various uses.

Future Demand

In its 1954 Calima report, OLAP presented an estimate of the power demands in the Department of Valle, excluding Cartago and some other towns in the north, for the 12-year period 1955 through 1966. Cali was estimated to have a peak demand of 65,500 KW in 1960 and 126,100 KW in 1965. The total peak was predicted to be 97,200 KW in 1960 and 190,200 KW by 1965. The Corporation's engineers are currently engaged upon a new analysis of future power demands in the Cauca Valley, including more towns than the OLAP study, and the preliminary results indicate much higher future demand in Cali and elsewhere than OLAP's 1954 estimate. For example, the engineers estimate peak demand for the Valley in 1960 at 177,000 KW, compared with 97,200 KW shown in the earlier forecast.

Estimates of this character are basic in the appraisal of an electrical project or program, for they indicate the size and the timing of required construction work. They should therefore be very carefully scrutinized, with special reference to their assumptions, before being used as a basis for action. The engineers' estimates for Cali may be somewhat high. They assume the city's continued growth at the present high rate of 8% annually and an annual increase in demand of 6% per inhabitant. If a growth rate of 5% instead of 6% had been assumed, the estimated demand in Cali in 1965 would have been 9%, or more than 11,000 KW less, without any change in the assumption as to population.

Power Supply to 1960

It appears to the mission that existing generating facilities, and the facilities now under construction which will come into operation by 1960, would meet the demand up to that time as estimated by OLAP, but would be inadequate if a higher estimate is adopted. The principal existing power generating facilities are tabulated in the Appendix (p. 120). They show that in early 1955 Cali had a total installed capacity of about 30,000 KW, including 12,000 KW of public power, a contract with the Compania Colombiana de Electricidad to purchase up to 4,500 KW from its Palmira system, and around 15,000 KW of privately generated power. Capacity in the Valley outside of Cali is 15,745 KW.

The Central Hidroelectrica del Rio Anchicaya (CHIDRAL) has under construction a power plant on the Anchicaya River about 90 kilometers from Cali which will ultimately provide for an installed capacity of 64,000 KW (Appendix, p. 121). The first two units of 12,000 KW each have come into operation. The third and fourth units of 20,000 KW will be ready for operation in early 1958. CHIDRAL is also constructing a steam generating plant near Yumbo, about 15 kilometers downstream from Cali, which will be used to firm up the power generated at Anchicaya. The first unit of 12,500 KW is expected to be in operation by 1958.

Thus by 1958, with four Anchicaya units producing 64,000 KW, Cali hydro and diesel installations 12,000 KW and Yumbo No. 1 12,500 KW, and with purchases from Compania Colombiana de Electricidad terminated, the Cali public utility capacity will be 88,500 KW. Because of transmission losses, this is equivalent to 85,000 KW at distribution substations in Cali. If we assume that private generation of power will decrease as

public power becomes available so that private plants will generate only 7,500 KW, or one-half the present supply, there would be 92,500 KW in 1960.

The total capacity of this combined system would not, however, be entirely firm or reliable. In the first place, during the periods of low-river flow at Anchicaya, the system would be unable to supply power to the limit of installed capacity. In the worst year of record, Anchicaya could have supplied average continuous power of only 13,300 KW, peaking for short periods to 44,000 KW. Under these conditions, peak supply would just meet Cali's 1960 peak demand as predicted by OLAP in 1954, but would fall short of later estimates now being developed.

There is, however, a further consideration. The combined system described above would lack reserve steam capacity, should a machine break down at Yumbo. The fourth unit will provide the necessary reserve hydro capacity at Anchicaya. It may be desirable to install additional steam capacity at Yumbo before 1960, both as reserve and as stand-by for use during low-river flow at Anchicaya.

Three small projects totalling 1,850 KW are under construction outside Cali, bringing total capacity in the Valley outside Cali to 17,595 KW. Adding this amount to the expected CHIDRAL capacity of 88,500 KW, total public power capacity of the Valley becomes 106,095 KW, which is about 9,000 KW more than the 1954 OLAP forecast for total peak load in the Valley in 1960, but 71,000 KW less than the current estimates of the Corporation's engineers.

Demand for Power after 1960

After 1960, major additional power facilities will be needed. OLAP forecast a total increase of 93,000 KW from 1960 through 1965, while the

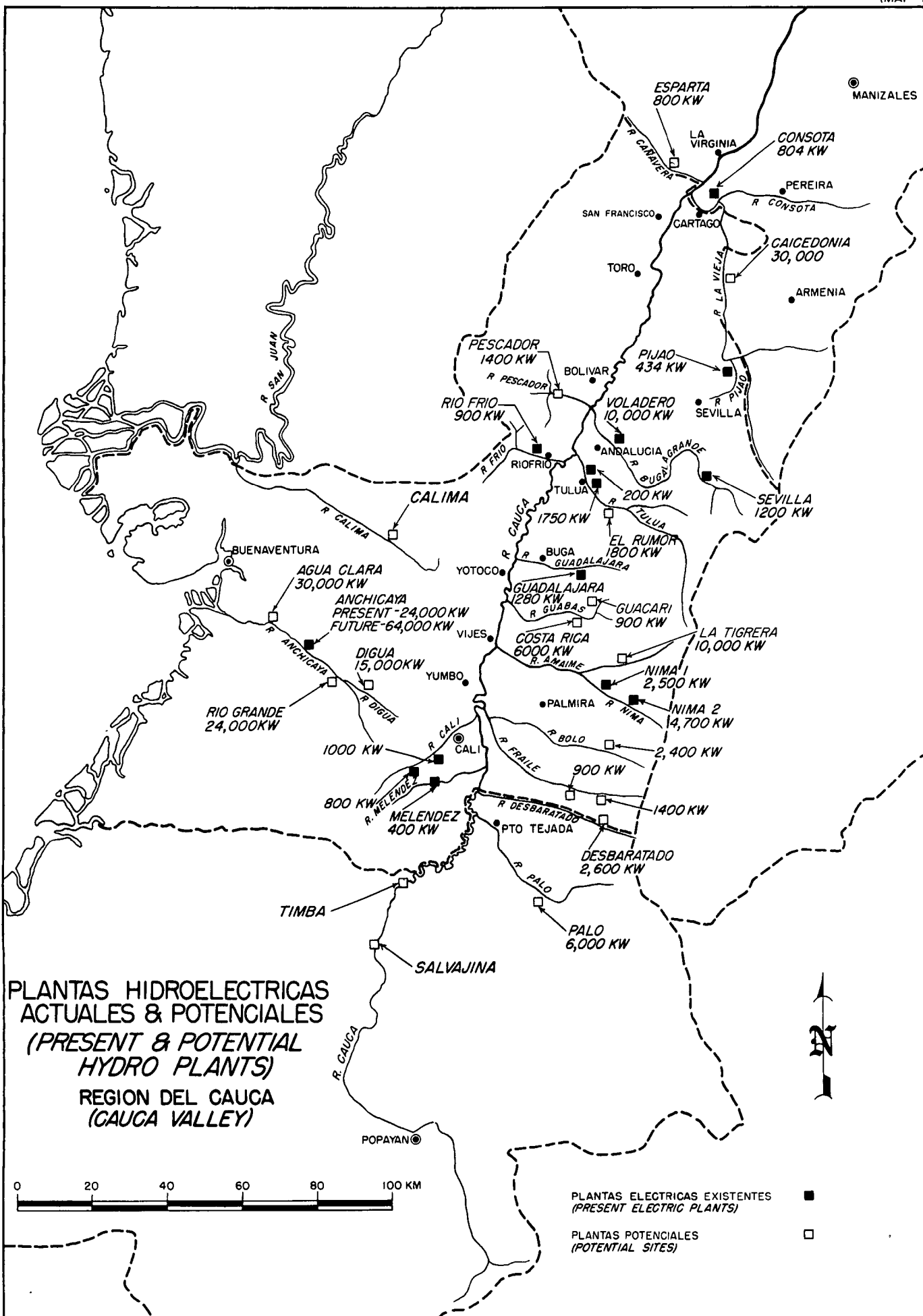
current estimates of the Corporation's engineers indicate an increase of about 150,000 KW. The scale, and in particular, the timing of the construction of generating facilities by the Corporation will depend upon the forecast of future demand which is finally adopted as a basis for action.

Major Engineering Possibilities

There are a number of possible major electrical projects capable of supplying power to the Cauca Region. Multi-purpose projects providing both power and water storage for flood protection are possible at Timba and Salvajina. In addition, there are two major single-purpose projects, hydro power at Calima and thermal power presumably at Yumbo, using coal. These will be described below in terms of their combined relationship to power production and flood protection.

In addition to these major projects, a number of potential power possibilities exist on the tributary streams which flow into the Valley. These are of limited capacity, practically without storage facilities, and would not offer appreciable help in solving the flood problem. They would require steam support to carry the system load during dry periods. Several such plants are listed in the OLAP-Calima report and are described in some detail in the 1949 OLAP report entitled "General Power Survey." While some may possibly be constructed in the future after the more attractive major projects have been completed, they do not appear favorable for construction at the present time. A further description is given in the Appendix (p.123).

Calima Project. This is a single-purpose hydro power project located on the Pacific slope of the Cordillera Occidental range about 75 kilometers from Cali. OLAP and KTAM made a preliminary study report on this project in 1954. Its main features as outlined in that report are described in the Appendix (p. 124).



The project involves a dam 91 meters in height with a storage reservoir of 408 million CuM capacity. The proposed installation would provide a total of 144,000 KW which can be brought in in four stages of 36,000 KW each. It should be borne in mind that this project is not in the Cauca River drainage system and would not help to solve flood protection problems. The project is currently being re-studied by the Corporation engineers, to develop a peaking plant which might be built in a shorter period and at less cost than the original project. Data on this alternate Calima project are not yet available.

Yumbo Projects. It would be feasible to provide power by construction of steam plants as an alternate to hydro development provided an adequate coal supply is developed. The site near Yumbo where CHIDRAL is presently constructing one 12,500 KW unit is adequate to accommodate an ultimate installation of 100,000 KW. The location, about 15 kilometers from Cali, is close to the major point of use and would require a minimum of transmission expense. It has good rail and truck access to most of the local coal deposits, and an adequate supply of condensing water.

A comparison with Calima (original project) which would furnish firm power not requiring steam support provides a fair basis of evaluation.

CHIDRAL estimates that additional capacity can be installed at the Yumbo site for Ps. 550 per KW (see Appendix, p. 126). The estimated cost for 144,000 KW at Calima is Ps. 103,059,000 or about Ps. 720 per KW, which is 31% higher than the cost of an equivalent steam plant. Furthermore, the steam plant can be constructed in less time, and in increments sized to meet the growth in load as it develops.

However, this favorable showing for the steam plant is completely reversed when operating costs are considered. With coal at Ps. 20 per metric ton, and with suitable provision for other operating costs, depreciation and fixed charges, the estimated cost of steam plant energy at 60% load factor is 2.86 centavos per KWH (see Appendix, p. 126). This cost could be reduced somewhat by installation of more efficient (and more expensive) units than the one presently being installed. In comparison, the cost of hydro power from Calima (3 units, 108,000 KW), delivered at Cali, is 1.82 centavos per KWH. Percentagewise the steam power will cost 57% more than the hydro power. The Calima plant could with three units deliver 540 million KWH annually to Cali, and the excess cost of this amount of power if generated by steam would be about 5.6 million pesos per year. In general, where hydro power at moderate cost is available, a combination of steam and hydro will provide power at lower cost than will either source taken singly.

Timba Projects. The projects which have been proposed at Timba would be multi-purpose, providing both for flood protection and for the generation of power. The dam site is located near La Balsa at the head of the Cauca Valley just below the junction of the Timba and the Cauca rivers. A "low" dam, 40 meters in height, with a storage capacity of 694 million CuM, was apparently first suggested as a flood protection project in 1950 but was not originally studied as a power possibility. With a power installation of 75,000 KW, effective storage available for flood protection would be reduced to 506 million CuM (Appendix pp. 127-128).

The mission has also made a preliminary analysis of a "high" dam project at this site, to provide as much flood storage as possible in this one reservoir. This would be a dam of 50 meters in height with 856 million CuM of

effective flood storage capacity, and producing 75,000 KW of power; a standby steam plant of 25,000 KW would be needed to produce continuous power at the system load factor (Appendix pp. 127-130). In neither of these Timba studies was the effect of Salvajina storage upstream taken into account.

Salvajina Projects. These would be multi-purpose projects. The dam site is located in the canyon of the Cauca River immediately above the upper end of the Timba reservoir and is about 65 kilometers from Cali. In its 1947-49 power studies, OLAP made a preliminary report on a proposed "low" dam, 112.5 meters in height with about 350 million CuM of effective flood control storage. The proposed power installation would provide a peak output of 122,500 KW and a standby steam plant of about 25,000 KW would be needed.

After the record-breaking flood of 1949-50, OLAP in a report of 1954 proposed construction of a "high" dam of 150 meters at Salvajina to provide net flood protection storage of 1,050 million CuM. The assumed power installation was 220,000 KW, and a steam plant of 85,000 KW capacity would be required to firm up the hydro power. The OLAP report proposed combining this dam with the "low" dam at Timba to provide protection against floods of the size of the one in 1949-50 (Appendix, pp. 131-133).

III. THE APPRAISAL OF ALTERNATIVES

Substantial additional generating capacity will be required by 1965. In addition, flood protection would benefit the Valley. The problem is to select the project or combination of projects which will provide the most favorable combination of low costs on the one hand and highest benefits on the other, taking into consideration both of the principal purposes to be served.

A final selection among the major engineering alternatives confronting the Corporation can be made only after more facts are available and further analysis has been undertaken. The selection involves the choice not only among projects at different sites but also among different types or sizes of projects at the same site, including, possibly, other sites or projects in addition to those discussed in this report.

Comparison of Costs

On the basis of presently available information, tentative estimates can be made of the total costs (including transmission to Cali) of the major projects under consideration. It should be pointed out that the information on which these figures are based leaves much to be desired; some of the data are several years old and many of the estimates should be supported by further engineering studies.

The costs shown below charge total project costs against power; certain facts become clear from these figures even before proceeding to the consideration of flood protection possibilities. From the point of view of power generation alone, Calima and the Salvajina low dam are the best projects in terms of low cost for power.

	Cost (Ps. Million)	Firm Power Capacity (KW)	Cost per KW (Ps.)	Cost per KWH (Centavos)
Timba high (with 25,000 KW steam) ^{a/}	145 15 <u>160</u>	75,000	2,133	4.15
Timba low (with 25,000 KW steam) ^{a/}	110 15 <u>125</u>	75,000	1,666	3.44
Salvajina high (with 85,000 KW steam) ^{a/}	200 50 <u>250</u>	220,000	1,141	2.70
Salvajina low (with 25,000 KW steam) ^{a/}	75 15 <u>90</u>	122,500	735	1.26
Calima (2 units)	66.6	72,000	926	1.90
(4 units)	103.0	144,000	716	1.62

^{a/} To firm up hydro capacity (see Appendix, pp. 127, 131).

Cost Allocation between Power and Flood Protection

Obviously the costs given in the Table above do not give a fair comparison of the projects since they allocate the entire cost to power generation and none to flood protection. For example, Calima furnishes power inexpensively but provides no flood protection while the dams at Salvajina and Timba offer useful flood storage capacities.

Of the various methods of distributing costs between two purposes, the mission has used the "alternate cost" method as the one which will give the Corporation the soundest basis for reaching its conclusions. Under this method, the cost per KWH of the project which produces energy most cheaply is used as a base. For the other projects a proportion of the total cost is

allocated to flood protection in an amount sufficient to reduce the cost per KWH of power generation to that of the base project. Under this method, the Calima project including two units is used as the base for comparison with Timba high, and Calima with four units for comparison with Salvajina. The allocation of costs would be as follows:^{1/}

	Total Cost	Allocated to Power (Ps. Million)	Allocated to Flood Control
Timba high	160	71.6	88.4 ^{a/}
Timba low	125	64	61.0 ^{a/}
Salvajina high	250	124.3	125.7
Salvajina low	90	90	--

^{a/} Including irrigation, arbitrarily allocated Ps. 10 million for purposes of discussion.

The Cost of Flood Protection

On the basis of these computations, it is possible tentatively to determine the total cost of flood protection, the unit cost, and the relation between costs and benefits.

	Effective Flood Storage (M/CuM)	Allocated Cost (Ps. Million)	Unit Storage Cost (Cent. per CuM)
Timba high	856	88.4	10.33
Timba low	506	61.0	12.05
Salvajina high	1,050	125.7	11.97
Salvajina low	372	nil	nil

^{1/} See Appendix, pp. 134-137.

The high dam at Timba provides storage at the lowest unit cost. These figures must be used, however, in relation to the amount of storage necessary for adequate flood protection. This in turn will depend on the rate of flow of water in the river. At present a flow of 570 cubic meters per second at Juanchito, near Cali, represents bank full stage at that point, and is about the maximum which, with the assistance only of some low levees, can be confined to the channel. The rate of flow could, however, be increased by channel improvement works, which would reduce the amount of up-river storage necessary to prevent overflow of the river.

The records show that, without channel improvement, the Timba high dam alone would have kept the Cauca River within banks at Juanchito in every year since 1934 except during March to June of 1950. The rainfall records suggest that there may have been two other years since 1900 when the Timba high dam would not have prevented floods at Juanchito. In other words, this dam would give protection against everything except the exceptional flood occurring on the average about once in 20 years (Appendix, p. 129).

The Timba low dam of smaller flood storage capacity affords less protection. Studies have not been made which would determine the flood risk that would remain with this dam alone, without channel improvement, but it seems a safe assumption that it would protect on the average against all but the flood occurring once in five years.

The Salvajina high dam would naturally give greater protection than the Timba high dam because of its greater storage capacity. This dam alone, however, would not have protected against the flood of 1949-50. Records are not adequate to tell whether the dam would have provided protection against the floods of 1922 and 1928, but to be safe, it should be

assumed that with Salvajina alone floods would still occur from once in 20 years to once in 50 years.

Without channel improvement, the Salvajina high dam and the Timba low dam operating together would have protected against the exceptionally prolonged flood of 1949-50. It can therefore be assumed that these two dams operating together would offer complete flood protection. (Appendix, p. 132).

With channel improvements adequate to increase the flow of the river at Juanchito to about 850 CuM/S, it is believed that Timba low dam would on the average provide sufficient storage to prevent flooding of the Cauca River nine years out of ten.

Under present conditions, the larger the flood the greater the area flooded. An average flood on the Cauca River inundates about 57,000 ha, while the exceptionally great floods cover about 85,000 ha. We have assumed that the intermediate, once in 10 years flood would cover 70,000 ha. With up-river storage, the areas remaining subject to risk of flood would be reduced to an extent dependent upon the amount of storage capacity (or channel improvement) provided. In the lack of an engineering study of this problem, the mission has assumed that the flood risks remaining after construction of the projects discussed would be as shown in the Table below.

Using these rough estimates, the costs and benefits of different degrees of flooding by the Cauca River can be expressed as follows:

	Timba			Salvajina High plus Timba Low
	Low	Low with Channel Improvement	High	
Floods per 20 years	4	2	1	none
Area flooded: (hectares)				
No protection	57,000	70,000	85,000	85,000
With protection	20,000	15,000	10,000	nil
Cost: (Ps. million)				
Allocated cost of dam ^{a/}	51.0	51.0	78.4	125.7
Additional works	<u>10.0^{b/}</u>	<u>25.0^{c/}</u>	<u>10.0^{b/}</u>	<u>61.0^{d/}</u>
Total	<u>61.0</u>	<u>76.0</u>	<u>88.4</u>	<u>186.7</u>
Cost-benefit ratio: ^{e/}				
With unchanged cultivation	23%	19%	17%	8%
With intensive cultivation	72%	60%	52%	25%

^{a/} With Ps. 10 million arbitrarily allocated to irrigation.

^{b/} Levees only, unchanged river flow.

^{c/} Channel improvements to increase river flow to about 850 CuM/S.

^{d/} Timba low dam and levees.

^{e/} Computation shown in the Appendix, pp. 137-142.

It should be emphasized that the areas shown above as remaining subject to flood after a dam has been built are completely arbitrary, and that a change in those areas would change the cost-benefit ratios. A final decision cannot be reached until the necessary technical data are available.

These figures suggest, however, that the benefits of protection against the extent of flooding of the Cauca River which occurs frequently would justify the costs involved, but that it may be more difficult to establish that the additional benefits gained by protection against the larger but less frequent floods warrant the additional cost.

IV. SUMMARY OF CONCLUSIONS ON ENGINEERING POSSIBILITIES

Obviously a forecast of future power demand in the Cauca Region is basic to the planning of a program and to the formulation of decisions on the works to be undertaken. When the engineer's final estimate is available, it should be possible to proceed promptly to the necessary review, so that all parties concerned can agree on a demand forecast which can serve as a basis for action.

The tentative appraisals of this chapter suggest the following conclusions; their validity depends entirely upon whether the fragmentary estimates of costs and benefits which have been utilized are approximately close to reality.

- a) Salvajina high dam is apparently eliminated as an early construction possibility. Its ultimate generating capacity exceeds the estimated growth of electrical demand, and its flood protection benefits do not justify its flood protection costs.
- b) The mission does not believe that Salvajina low dam should be seriously considered at this time, since its construction would either prevent or make unnecessarily costly the possible future construction of Salvajina high dam. The scale of development at the Salvajina site should, we think, be left to future determination, at a later stage of the Valley's economic development.
- c) The advantage of Calima is that it provides low-cost hydro power from a single project that can be constructed in stages as power demand grows. Its disadvantages are that it provides no flood protection, and that its construction would postpone the completion of Timba.

- d) The disadvantage of Timba is that its generating capacity requires supplementary steam support. But Timba high dam offers flood protection benefits which on present information appear to be sufficiently valuable to justify further engineering and economic investigation to make possible a final determination on the basis of firm estimates.

The mission generally recommends, therefore, that all possible efforts be made to define the project costs of Timba, determine its engineering feasibility, and assess the prospective benefits of flood protection and the nature and cost of any associated works such as levees and channel improvement. The Corporation is already making the necessary investigations. With this information and on the basis of analytical methods described in this report, it will be possible to make firm decisions and proceed with construction.

V. FINANCIAL CONSIDERATIONS

The previous sections describe two of the tests which must be applied to projects: whether they are technically feasible and whether they are economically justifiable. But there are also administrative and financial aspects of constructing and operating a project which are no less important. In the Cauca Valley the administrative aspect offers no real problem, thanks to the existence of the Cauca Corporation. The financial aspect remains.

Construction of electrical generating and transmission facilities presents no new or unusual financial problems. In this aspect of its work, the Corporation is in fact a publicly owned power utility corporation, different in legal structure from, but very similar in essence to, established Colombian

public utilities such as CHIDRAL and CHEC. As and when the Corporation has good, justifiable power projects, it will turn to its "shareholders", the National and Departmental governments, and invite them to contribute the non-borrowed capital necessary to construct the proposed facilities. They, in their turn, will act on the basis of their own financial position and the merits of the proposed project as compared with other development projects seeking finance, as would any domestic or foreign lender who might be approached by the Corporation.

In contrast with electric power, the finance of flood protection presents problems which are somewhat new and unusual in Colombia.

The first question is how to obtain the required initial capital to construct flood protection works. Since it is clear that no private group can undertake the larger works, particularly those involving multi-purpose projects, it is again, as with power, a question of presenting a good, justifiable project to the "shareholders" and inviting them to finance it. Flood protection, however, yields no direct revenues to the Corporation, and therefore lacks this basis for the use of borrowed funds. Unless the Corporation can recover part of the cost of flood protection works, it cannot itself assume any repayment obligations on account of them. Its "shareholders", however, could utilize their general fiscal revenues for that purpose.

The second question is, therefore, whether the owners of land which is benefited by flood protection works should be required to pay any of the cost of those works and if so, how much. The mission believes that landowners should pay the full cost of local works whose benefits are directly assignable to their lands, such as drainage, leveeing of low points of the river

bank, etc. Individual landowners or groups of landowners are in a position to decide whether or not they want such reclamation work done upon their land, and indeed in some cases could undertake it by private contract or with their own equipment. There is no reason why they should not pay the full cost when the work is undertaken by a public authority such as the Corporation.

The case is different for general works such as the Timba dam, or channel improvement, or bypass floodways. In the United States the cost of flood control on main rivers is undertaken almost entirely by the Nation. But the situation in the Cauca Valley is not at all like typical situations in the United States, where floods cause actual losses to a great many people, both city dwellers and relatively small landholders. In the Cauca, floods mainly affect a comparatively few large landowners, more by preventing them from putting their land to better use than by destroying existing wealth.

The mission is strongly of the opinion that the possibility should be explored of requiring landowners, other than those with quite small holdings, to pay by valorization assessment some part of the cost of general flood protection works benefiting their land. Such a policy would return to the Corporation part of the cost of constructing the works, which would ease the problem of securing initial construction funds by providing resources with which to service borrowed funds. And it would impose upon landowners some compulsion to improve their land-use, similar in effect to additional taxation on under-utilized land.

If this policy of levying valorization assessments for general flood protection works is adopted, it remains to determine what proportion of total costs should be repaid by landowners, and how long they should be given to pay.

These are separate but interrelated questions. The mission feels that the assessments should recover not less than half and probably not more than three-quarters of general flood protection costs -- for example, of that part of the cost of Timba dam which is allocated to flood protection.

The time given to pay, or in other words the amount of the annual valorization payment, can only be determined after analysis of the private financial position of affected land. This would involve looking from another point of view at the net benefits (expressed on a per hectare basis) estimated in the cost-benefit analysis of the project. Such benefits accrue directly to the landowners, not to the Corporation. But from them the landowner must also meet the costs of other land improvement work such as drainage, and should be allowed to retain a portion as a reward for better farm management. These amounts should be deducted in order to arrive at a residual representing private repayment capacity. That residual, divided into the total assessment, gives the maximum number of years of payment. It would probably be desirable that the first payment be made, say, two years after the completion of the flood protection work being assessed, to give the owner a period within which to increase his farm output and income and thus be better able to meet payments.

Power Rate Policies

An important decision for the Corporation is its policy regarding power rates. The mission believes that there are certain important principles which should be adhered to in this field.

Cheap electric power is desirable in any country, but in underdeveloped areas undergoing rapid growth it is more important that power supply be ade-

quate and reliable than that it be cheap. Power rates should be determined after careful calculation of all the elements of cost and recognition of the necessity of obtaining capital to expand power supply to meet increases in demand. Thus power rates should be sufficient (after the initial load building period) to cover all operating and maintenance costs, including interest on outstanding debt, depreciation of plant investment over the useful life of the facilities and, in addition, to provide a reasonable net return. The net return should be sufficient to meet contractual debt retirement in excess of the depreciation rate and to make possible accumulation of reserves for financing at least part of a further expansion of service. This is no less true for publicly than for privately owned capacity. Any system under which public power utilities incur losses not only involves a subsidy to power consumers at the expense of the tax-paying community as a whole, but also increases the difficulties of financing the maintenance and expansion of facilities. The total financial requirements for the development of power throughout Colombia are so great that if the costs are not ultimately met in the rates paid by the consumers of power, who are the immediate beneficiaries, it will become more and more difficult to attract or justify more capital investment for future expansion and power supply will never meet demand. These principles of utility planning, accounting and pricing simply describe a prudent, practical and far-sighted formula for constructive management.

Many factors need study, such as present generating costs in comparison with costs estimated for the Corporation's new power plants, the present pattern of retail rates, the margins between wholesale and resale levels and the adequacy of such margins to meet the financial requirements of distribution systems. Other questions need careful thought, such as the

advantages of uniform rates over the area, thereby eliminating one of the barriers to a dispersal of industrial growth (a policy applied with marked success in the Tennessee Valley), and whether the Corporation should sell power direct to individual industries and in large loads, and if so how this should be coordinated with the municipal and cooperative distribution systems also selling power purchased from the Corporation.

The answers will have profound effect upon the success of the Corporation, and will directly affect the rate of growth of the Region and the location of industry there.

It is therefore not too early for the Corporation to undertake thoughtful study of these matters. The experience of the T.V.A. in this field, as in many other features of regional development, can provide a fruitful source of information and suggestion, bearing in mind that the Corporation's policies and rates must fit the needs of the Cauca area and the physical and financial resources available to it.

VI. TRANSMISSION AND DISTRIBUTION

Transmission

Power transmission to distribution points is necessarily associated with generation, and is therefore a direct function of the Corporation. Efficient transmission requires careful planning and design to assure an adequate system with no unnecessary duplication of facilities. The Cauca Corporation, CHIDRAL and the Compania Colombiana de Electricidad at Palmira must cooperate closely to ensure that the plans of all are fully coordinated.

Moreover, the efficient use of several generating facilities all feeding into an integrated transmission system requires close and continuous coordin-

ation of their daily operations. It is important that the necessary close and cooperative relationships be established between the Compania Colombiana de Electricidad, CHIDRAL, and the Cauca Corporation, and be extended later to include CHEC and any other power authorities with whom transmission becomes interconnected.

In fact, the situation appears to justify merging CHIDRAL and the Cauca Corporation, since it seems inappropriate to have two publicly-owned utilities operating in the same area.

At present, the only interconnected transmission system in the Cauca Valley is a 33 KV line owned and operated by the Compania Colombiana de Electricidad extending from its generating plants on the Nima River to the cities of Palmira, Cali and Buga. A 110 KV double-circuit tower line has been constructed from Anchicaya to Cali, and is now in operation.

The present power capacity in Caldas, which has just kept pace with the demand, is about 45,000 KW of which 93% is hydroelectric. The only integrated system in the Caldas area is the CHEC system of about 20,000 KW which serves Manizales and several adjacent cities. CHEC has made plans for the construction of the Esmeralda Plant on the Campoalegre River with an installed capacity of 26,200 KW, to be followed later by the San Francisco Plant with 82,400 KW. It also proposes to extend its transmission system to Cartago, Pereira, and Armenia at the northern end of the Cauca Valley.

It will be necessary to construct a double-circuit high-voltage transmission line running the length of the Cauca Valley with distribution lines connecting each of the communities to be served. Studies are now being

made by the engineering firms employed by the Corporation to determine the justification, route, voltage, cost and proposed schedule of construction for these lines. The main transmission lines should be planned for ultimate interconnection with Manizales and Medellin, and possibly Bogota. This will probably dictate that the voltage should be not less than 166 KV although this problem will require careful study. CHIDRAL is currently planning a transmission line from Cali to Cartago, and this affords an immediate case where close cooperation between CHIDRAL and the Cauca Corporation is essential if the facilities serving the Valley are to be properly integrated.

It has generally been found that 33 KV is too low a voltage for secondary transmission in areas where loads assume considerable magnitude. Voltages of 46 KV and 66 KV should be seriously considered since the difference in cost is not very great. For example, the difference in line-cost between 33 KV and 46 KV is of the order of 5% and the difference in transformer-cost around 4%, while the increase in the amount of power that can be transmitted with the latter for a given distance with equal regulation is 350%. The extent of the transmission system required to serve the Valley is diagrammatically indicated by Map 5.

A very substantial investment will be required for construction of a transmission network to serve the Valley. It is not possible to estimate the cost with any degree of accuracy until a plan is developed. A rough working estimate, indicative of orders of magnitude, might be Ps. 15 million for the construction of transmission facilities up to 1961.

VII. ELECTRICAL DISTRIBUTION

Distribution is important to the Corporation, directly affecting its market for electric power. Distribution constitutes the retail outlet for

power, whereas transmission is its outlet at wholesale. The mission believes that the Corporation should not itself permanently own and operate distribution facilities, but that it should instead encourage and assist municipalities, or cooperative groups which might include several small towns and rural consumers, to construct and operate their own distribution systems, as Cali does today.

The Corporation could assist municipalities or cooperate in establishing distribution undertakings (empresas) and in introducing efficient administration and sound financial methods in their management. It could assist them in designing suitable distribution facilities, and in obtaining bids and letting contracts for the work. It might be able to assist, where required, in obtaining finance, either in Colombia or abroad. It may be practicable for the Corporation to borrow, on behalf of municipalities but in its own name, part of the cost of construction or expansion of distribution facilities, entering into contracts with municipal empresas under which the latter would repay the Corporation (from retail power revenues) somewhat in advance of the Corporation's own repayment schedule. The Corporation cannot, however, in any way financially subsidize the construction of distribution facilities unless it receives special funds for this purpose.

VIII. ADDITIONAL FLOOD PROTECTION MEASURES

The banks of the Cauca River, like all rivers in alluvial valleys, have been built up by silt to a higher elevation than the adjacent area behind the banks. When the river overflows it creates great ponds of water along its course which temporarily store a part of the flow. This so-called "valley storage" reduces peak flood flows further downstream. As a corollary, when

this valley storage is eliminated by levees, and tributaries are also leveed and conducted directly into the main river, the previously recorded flood peak stages down river will be substantially increased.

As is indicated by Map 2, the drainage area at Juanchito is 9,400 square kilometers, and at La Virginia gauge near Cartago at the northern end of the Valley, 23,300 SqKm. It is improbable that two reservoirs at the southern end of the Valley, which control only 25% (5,580 SqKm) of the Valley drainage area, will provide sufficient regulation to prevent the northern part of the Valley from flooding. The flood crests will be materially reduced but for complete protection other works such as levees, channel improvement, and possibly bypasses or floodways which would function only in great floods, will be required. Such bypasses normally remain dry and can be cultivated in most years, but an occasional crop is lost, and they are not suitable for human habitation or industrial development. The necessary engineering data regarding channel capacity, slope, or flood stages from which the extent and cost of such flood control works for the northern river can be determined, are not presently available. Several additional gauging stations are now being established on the river between Juanchito and La Virginia and bank profiles are being obtained which will provide information necessary to the development of a flood control plan for the northern valley.

DRAINAGE, IRRIGATION AND RIVER POLLUTIONI. DRAINAGE

All the drainage problems of the Cauca Valley cannot be solved until the river is confined to its channel and the tributary streams are prevented from flooding adjacent lowlands. After this has been accomplished, and an adequate supply of electric power for pumping is assured,^{1/} many present marshy areas can be drained and made suitable for agriculture.

Outside the flooded areas rainfall forms ponds in low areas of the valley floor, which cannot be drained into the tributary streams by gravity drainage canals and will have to be pumped. These ponds and swamps constitute a substantial area about 15,000 hectares, which lies below river grade and can be reclaimed only by pumping. The bottom of some of the ponds may be below the water table level and will require continuous pumping. Wherever irrigation is practiced, the water used on higher levels is certain to collect in low spots and in many cases to waterlog the bottom lands. It has become an axiom in irrigation practice that "irrigation and drainage go hand in hand".

There are no drainage projects ready for analysis. Engineering work is now being done to determine the methods of drainage appropriate in different situations, and the costs of construction, annual operation and maintenance. One important question is the minimum size of a practicable drainage project. The

^{1/} Electric power for this purpose could be carried as "off-peak" load, and would not add to total peak demand for electricity. It would, however, call for distribution facilities in the rural areas affected.

answer, of course, will depend largely on geography, which determines the natural drainage units. There may be cases where a block of land under a single ownership can be drained as a unit, and others where cooperation among several or many landowners is necessary because the canals draining one holding must cross others.

Another question requiring clarification is the actual benefits of drainage, because the benefits must justify any proposed expenditure whether public or private. There is probably no single answer to this question. There may be cases where flood protection can yield no benefits without associated drainage, others where drainage alone would reclaim fertile land, and still others where drainage, while not essential, would permit improved land-use. Just what the benefits, expressed in financial terms, might be in each case has not yet been even roughly estimated.

The only recommendation the mission can make at this time is that the Corporation should actively continue the preliminary investigations necessary to establish the approximate scale, costs, and benefits of possible drainage projects. We suggest that these investigations also seek to ascertain whether there are natural drainage districts, each capable of constituting a separate drainage project. If so, we further suggest that in each district in which drainage benefits appear to be greater than drainage costs,^{2/} the Corporation convene a meeting of all landowners in the district, as ascertained by a cadastral survey.

At this meeting, the Corporation's representatives would present and explain their proposals, including preliminary estimates of costs and benefits.

^{2/} Analyzed by similar methods as outlined for flood protection.

If, after full discussion, the owners of 70% of the land to be benefited agreed,^{3/} the Corporation would undertake to prepare detailed project proposals. This meeting could also elect a committee which could act as a voluntary drainage board, available for continuing consultation and advice between the landowners and the Corporation.

The Corporation would then design or arrange for the design of a detailed project, with accurate cost estimates and a scheme of valorization assessments. This, when completed, would be submitted to a second general meeting of landowners. If the proposals are accepted by the owners of 70% of the land to be benefited (on the same assumption as to landowners not attending), the Corporation would enter into contracts with the landowners voluntarily acquiescing,^{4/} and if necessary levy compulsory valorization assessments on the minority of dissidents. The Corporation could then either undertake the work itself, utilizing the agricultural machinery pools recommended later in this report, or contract out the work with private construction firms.

We suggest this procedure because we think that landowners should not be asked to agree to pay the full cost of works when only preliminary estimates of costs and benefits are available. On the other hand, the Corporation would not be justified in incurring costs for the detailed design of district drainage projects unless it had reasonable assurance of the support of the majority of the landowners.

^{3/} Experience elsewhere has shown that in making this computation, it should be assumed that landowners not attending the meeting agreed to the proposals, because those objecting are more likely to attend meetings than those consenting.

^{4/} The mission understands that under present Colombian law, Drainage Districts cannot be incorporated, capable of entering into obligations binding on their members.

If, as is probable, the drainage method used involves system operation and maintenance charges, the final contract could also provide that the Corporation would undertake to operate and maintain the drainage system in return for specified annual payments by the benefited landowners. There should also of course be provision whereby the operation and maintenance charges could be adjusted in the future to changes in cost.

There remains, however, a financial problem for the Corporation in finding the capital required to construct the drainage projects even though that capital will later be returned to it in the form of valorization assessments. It would be very helpful if it proved possible for landowners to pay some proportion of the cost before construction was completed. It might be possible for them to do this in the form of land rather than cash; the Corporation could immediately sell the land to farmers wishing to own drained land. For the remaining funds, the Corporation can turn to its "shareholders," presenting to them a drainage project or group of projects constituting a program, or it can borrow. As the Colombian capital market develops, drainage bonds, secured against legally enforceable valorization assessments, might prove attractive to some investors. To the extent this method is used, amounts equal to the interest for the entire life of the bonds must be recovered by the Corporation, either as an addition to the capital cost of the works or to their annual operation charges.

In cases where drainage works are constructed by using the Corporation's own machinery pools, the immediate requirements for new funds may be somewhat less, depending on how those pools are themselves financed. Although the machinery pools must receive full payment for work done by them, it may be possible under some circumstances for them to accept deferred payments without

injuring their own financial position.^{5/} Machinery pool services should not, however, be rendered under any arrangement which constitutes a hidden subsidy to drainage works.

The preliminary investigation which we have recommended may reveal one or more potential drainage districts where the necessary work would be relatively simple, the landowners few and willing to cooperate, and the benefits substantial. In that case, we would recommend that the Corporation proceed first with them, as test-demonstrations, during which the legal, administrative, and financial problems involved could be met and resolved. The experience gained could then be applied in an enlarged drainage program.

II. IRRIGATION

The average rainfall in the Valley, if uniformly distributed, would be adequate for most crops with the exception of rice and sugar cane. In some years, a deficiency of precipitation causes crop failures, but this is true in every country where agriculture is wholly dependent on rainfall. In the Cauca Valley, the benefits of irrigation appear to reside in the greater security of crops rather than in higher continuous yields, and in the possibility of expanding the output of high value crops such as rice.

OLAP estimates that the flat floor of the Valley has an area of 370,000 hectares, of which about 230,000 hectares or 60% may be considered irrigable. This is in fair agreement with an estimate of 240,000 hectares of irrigable land in the bulletin entitled "Censo Agropecuario del Valle del Cauca." The present irrigated area which is served by side streams is roughly estimated to be 15,000 plazas in rice and 25,000 in sugar cane or a total of 25,000 hectares. Not all of the land for which a water supply

^{5/} See p. 69.

is presently readily available is being irrigated, partly because the necessary drainage is lacking.

In its 1952 report, OLAP proposed an irrigation project to cover most of the irrigable land of the Valley. Such a comprehensive undertaking would necessarily have to be preceded by construction of flood control and drainage works to prevent the frequent inundation of large areas of river bottom land. This irrigation plan proposed construction of a large canal to be served either by pumping, or by a gravity diversion from the Cauca River at Timba Dam, which would supply water to the large tract of irrigable land on the east side of the Valley extending downstream nearly to Buga. The land below Buga on the east side of the Valley would be irrigated by canals supplied by pumping from the Cauca River. This would require a substantial use of electric power, which would, however, be "off-peak" load. The upper rim of the Valley would be irrigated by diversion from the side streams. This would undoubtedly involve a considerable adjustment of existing water rights on the tributaries which are now being used to some extent for irrigation of crops on valley bottom land. The narrow belt of irrigable land on the west side of the river could be supplied by diversion from tributary streams entering the Valley from the east slope of the Cordillera Occidental and by pumping from the Cauca River. The natural stream flow of the Cauca River and tributaries during the low-water periods is almost sufficient to irrigate all of the land without storage. The regulation afforded by the release of storage from the Salvajina and Timba Reservoirs would make the water supply more than adequate.

This irrigation system was estimated in 1948 to cost around Ps. 120 million, to cover a total of 240,000 hectares, resulting in an average cost of

Ps. 500 per ha. for irrigation, not including the landowners' cost for laterals and preparation of land. The average increase in annual gross income for intensive farming of irrigated lands is estimated at Ps. 500 per ha. The yearly cost of irrigation to the farmer was estimated to be from 50 to 70 per ha. These figures make irrigation appear attractive.

We doubt, however, whether all the facts are available to demonstrate that long canals are the best irrigation alternative. It may well be that pumping, either from underground water or from the Cauca and its tributaries, into short canals would provide cheaper solutions in smaller projects of more manageable size. This, in turn, however, would require an adequate supply of off-peak electric power. Taking this into account, we think that the Corporation should wait at least until the first phase of its electrification program is nearing completion before sponsoring any sizeable program of irrigation.

We do not mean, however, that the Corporation should be inactive in irrigation. The field work required for the preliminary drainage survey we have recommended is very similar to that required for a preliminary irrigation survey, and the two might well be combined. If it should appear that there are districts in which relatively small irrigation projects would be technically feasible and in which the great majority of the landowners appear to be willing to pay for irrigation, we suggest that the Corporation consider proceeding in exactly the same way as with drainage works. The formation of voluntary irrigation boards could be sponsored, and the same sequence followed of a preliminary design contract with the landowners, followed by a definitive construction contract. Again, a few such projects, relatively simple and small scale, could embody useful test-demonstration features. The mission was

informed that there are several tracts of land not subject to flooding which could be irrigated by diversion from tributaries or by pumping short distances from the Cauca River.

We therefore recommend that the Corporation be receptive to undertaking irrigation projects, as and when justified and desired by farmers.

III. RIVER POLLUTION

River and stream pollution by domestic sewage and trade wastes does not as yet constitute a serious problem in the Cauca Valley. The Cauca River has a sufficiently high sustained flow to handle safely the pollution from these sources at the present time.

There is a danger, however, that sewage from the larger cities, which is usually discharged into small tributaries, will become very objectionable. The sewage from Cali enters a small side stream which is in filthy condition. Sewage treatment plants should be required for all larger cities as is being generally done in the United States. It is very much easier to keep a stream in sanitary condition than to rectify conditions after it becomes grossly polluted.

Trade wastes frequently constitute the most serious form of pollution encountered in stream sanitation work. The Cauca Valley as yet has few industries which contribute any substantial amount of trade wastes. After an industry is established it becomes difficult to force the adoption of treatment measures. A satisfactory method of disposal for trade wastes should be required at the time an industry is established.

The Cauca Corporation can profitably take the lead in developing reasonable sanitary standards for municipalities and industry to follow and in providing for effective enforcement.

We recommend that the Corporation inform any municipality whose sewage wastes are in danger of becoming a nuisance that the Corporation, exercising the power conferred upon it by its statutes, requires that municipality to install a satisfactory sewage disposal system before the expiration of a specified period, say five years. This will give the municipality time to find a site for a sewage disposal plant, and to plan any expansions or additions to its sewage system so that the plant can be connected with the system at the lowest possible cost.

CHAPTER 4

AGRICULTURE AND FORESTRY

I. SUMMARY OF RECOMMENDATIONS

While the mission was in the Cauca, considering the role which the Corporation could play in the development of the Region, another International Bank mission came to Colombia to advise the National Government on the agricultural development of the country as a whole. It is to be expected that many of the policies and programs which that report will propose will be applicable to the Cauca Region, as well as to other parts of Colombia.

No single and spectacular action by either the Corporation or the governments can meet the region's agricultural needs. Quite a number of organizations, official and semi-official, are working in the agricultural sector at the national and local level. In formulating our recommendations, we had in mind the desirability both of avoiding duplication of activity and of filling gaps where needed.

Specifically, we recommend that the Corporation organize one or more farm machinery pools, whose services would be available to farmers in the region on a contract basis; and that a regional extension service be established under the auspices of the Corporation, possibly with the assistance of the United States International Cooperation Administration. In the field of agricultural credit, we believe that the Corporation cannot make much of a contribution beyond permitting payments for the use of its agricultural machinery to be made on an installment basis; we comment on the credit

program of the Caja Agraria in this connection. We make no recommendation for affirmative action by the Corporation in the fields of livestock sanitation or forestry, believing that National or Departmental Government agencies can more appropriately act with respect to these matters, and that the Corporation's role should be limited to stimulating necessary action and coordinating action of these agencies.

We think that the Corporation's responsibilities, as we envisage them, could be most effectively carried out if it were to set up an Agricultural Division, which would have responsibility for -

- a) Establishing close contacts with landowners and farmers in the area, particularly those likely to be benefited by Corporation activities.
- b) Administering a Regional Extension Service.
- c) Organizing and supervising operation of farm machinery pools.
- d) Arranging for a survey of soil types and land capabilities in the area, and providing a permanent soil analysis and advice service.
- e) Undertaking to estimate the agricultural benefits to be anticipated from proposed flood protection, drainage and irrigation works and similar projects.
- f) Maintaining liaison with, and helping to coordinate the activities of, other governmental organizations whose activities affect agriculture in the Region (agricultural credit, marketing, forestry, livestock sanitation).
- g) Serving as a channel in recruiting outside technical assistance for Departmental governments and government agencies on specific agricultural problems.

With such a Division functioning, the Corporation should be in a position to keep itself currently informed on all aspects of agricultural activity in the Region, and should be able to offer its assistance in promoting good husbandry and farm management as occasion may arise.

II. PRESENT AND POTENTIAL REGIONAL AGRICULTURAL ACTIVITY

The total area of the drainage basin of the Upper Cauca River is about 2.3 million hectares (ha.); the Pacific slopes of the Western Cordillera within Valle add another 0.7 million hectares. Almost all farming is concentrated in the basin area; apart from coffee, the slopes are now of little agricultural importance.

There are three principal zones of climate in the river basin, permitting a variety of agricultural activity. The warm flat alluvial plain, about 334,000-370,000 ha. (15%-17% of the basin area), has fertile soil. It is suited to cattle-raising and the production of sugar cane, beans, corn, rice, cacao, tomatoes, yuca, platanos, and tropical fruits. The temperate zone, lying between 1,000 and 2,400 meters, mostly on the west flank of the Central Cordillera, is about 1 million ha. in size. The soil is typically very acid; coffee is one of the few crops that does well without liming. The cold zone, also about 1 million ha. in size, lies between 2,400 and 3,400 meters, on the flanks and plateaus of the two Cordilleras. Crops grown in this zone are mainly barley, corn, potatoes, wheat and vegetables.

The following Table shows the pattern of land-use and farm production in the Region, indicating that more land is devoted to pasturing of livestock than to crops, although the value of crop production is greater. Among the crops, coffee, grown almost entirely on hillsides, produces most income; the value of hillside production, if the value of the coffee crop were deducted, would be somewhat less than that for the plains.

LAND-USE AND FARM PRODUCTION
IN THE CORPORATION AREA, 1954

	<u>Area</u>			<u>Value of Farm Production</u>		
	<u>Pastures</u>	<u>Crops</u>	<u>Total</u>	<u>Pastures</u>	<u>Crops</u>	<u>Total</u>
	(thousand hectares)			(Ps. million)		
Plain	227	107	334	100	200	300
Hillsides	<u>731</u>	<u>316</u>	<u>1,047</u>	<u>180</u>	<u>550</u>	<u>730</u>
Total	958	423	1,381	280	750	1,030

We think that over the next 5-10 years official policies and activities relating to agriculture should be directed toward encouraging and facilitating more intensive use of land, under production techniques which steadily increase yields per hectare. This is particularly true for the flat area, but also necessary for the higher country. It appears likely that ultimately most of the flat land will be in crops, rather than pasture, but at this stage of the Region's agricultural development, official emphasis should be placed on assuring more intensive use of land, whether pasture or crop, rather than on attempting to force the shift of present pasture land into crops.

If this is done, and if the recommendations in this report are adopted, we would expect agricultural production in the Region to expand considerably, at a rate somewhat faster than the rate of population growth. Climate and soil in the Cauca Valley are generally very favorable for intensive farming, permitting high yields per unit area. At present, however, yields of both crop and pasture land are less than they could be, because of certain inadequacies in water management and a rather low level of farming techniques. In Chapters 2

and 3 we recommended improvements in water management, which should affect primarily farm production in the plain. Our comments on land-use and many of the recommendations, not only in this chapter but elsewhere in the report, should result in increased output from the hillsides.

Livestock production should rise markedly, not necessarily by enlarging the area under pasture but because use of pasture will be intensified, more fodder will become available through increased crop production and there will be an improvement in the quality of the animals. We would expect that the area under pasture would decrease on the plain and increase on the hillsides. As for crops, we would not expect acreage planted to coffee to increase at more than the present rate, whereas production of such import-saving commodities as cacao and cotton should rise sharply. So should the production of fruits, vegetables and rice. Output of fruits, platanos, sugar cane, potatoes and beans should also increase slightly. Production of staples such as corn and yuca will probably show no marked change. The increase in production will not cause a sizeable increase in export commodities, but it will, on the other hand, mean that the diet of the growing population of the area may include more meat, milk, fruits and vegetables than it does at present, and it will permit a sizeable saving in imports of agricultural commodities.

III. LAND OWNERSHIP AND USE

There are about 75,000 farmers in the Region, mostly small farmers. The number of large farm owners is not inconsiderable, however, and these farmers own most of the land. Statistics for Valle indicate that of the Department's approximately 58,000 farms, 68%, representing 10% of the farming area, are smaller than 10 ha., while 4% are larger than 100 ha.

and represent 60% of the total farming area. Actually, land ownership is probably even more concentrated than is suggested by these figures, since a large owner frequently owns more than one farm.

Land-use patterns must change if agricultural development of the Region is to proceed; a change in land-use in the flat area of the Valley could result in increased production even if flood protection measures were not taken, whereas flood protection, without a change in land-use, would do little by itself to increase production. But the desire for change cannot be imposed; we can only hope that it will be the logical consequence of some of the actions we have recommended for the governments and the Corporation. The recommended extension services will acquaint the farmers, both large and small, with new techniques; the recommended improvements in Departmental roads will facilitate the bringing of products to market and add to the economic incentive to raise output; better agricultural credit facilities would enable the small farmer to make needed improvements; the machinery pools will permit more intensive cultivation. We would also hope that those large landowners who are not interested in improving their properties themselves might rent them for terms substantially longer than two years; this would give the tenant sufficient security to make him more willing to improve the land he cultivates and would permit the landlord to continue to enjoy the security of land ownership.

It is noteworthy that change towards improved farm practices and more intensive land-use is already under way. The Corporation, through its program, can hasten and intensify this shift.

We turn now to an elaboration of the recommendations summarized at the beginning of this chapter.

IV. FARM MACHINERY SERVICE

The mission recommends that the Corporation establish one or more machinery pools, composed of various types of tractors and other machines and implements necessary for land reclamation and perhaps for soil tilling. In the first category we have in mind machinery required in connection with local flood protection and drainage, leveling of farm fields, deep plowing to destroy para grass, soil conservation, water storage, construction of roads on farms, forest and brush-clearing, and boring of wells to draw on ground water for irrigation. For the secondary category, the tillage work, we have in mind machinery suitable for preparing ground for crops and perhaps for harvesting.

An increase in agricultural production is essential to meet the demands of the growing population of the Region and of Colombia. The flood protection, drainage and irrigation works and the more effective extension services recommended elsewhere in this report will facilitate such an increase. But a greater degree of mechanization in agriculture is also called for. At present the use of agricultural machinery is limited. In the flat area of the Region, about 110,000 ha. are in crops although another 100,000 ha. of non-flooded flat land could be tilled. But in the cropped area only 1,200-1,500 tractors with an average of 25 HP are in use, which means as much as 70-90 ha. of cultivated land per tractor. The low degree of mechanization is due in part to the prevailing pattern of short-term land rental already mentioned, under which even those tenants who have some capital are reluctant to invest in a tractor and accessories. Other factors are the shortage of trained tractor operators and the inability of most agricultural machinery dealers to provide quick service and spare parts.

There is a real need for the land reclamation services we propose. It may be that there is also demand for soil-tilling services; this can be determined by field enquiries. The pools would serve the dual purpose of demonstrating that mechanization can contribute to an increase in agricultural output and that machinery services can be offered on a commercial basis by private enterprise. To achieve the second purpose, the pools must be financially self-supporting, without subsidy from the Corporation or elsewhere. Services should be provided to farmers on a contract basis, the farmer to pay the full commercial cost of the services rendered, including administrative and operating expenses, taxes to which similar private operations would be subjected, and depreciation and maintenance of the machinery. If the Corporation can arrange to borrow what it needs to buy the machinery, it can then make the pool's services available on deferred payments. The land reclamation services might be paid for over a period of several years, and tillage services after harvest. Terms should be so arranged that cash income of the pools corresponded to cash outlays, including repayment of loans incurred for machinery purchases. Each pool should have its own separate financial accounts.

The program should begin modestly and expand as demand for services grows and as personnel can be trained to operate and maintain the machines. Experience elsewhere indicates that the pools will not be economical unless there is sufficient work to keep 10 heavy earth-moving machines and 10 plowing tractors and related implements steadily at work. We have little doubt that work can quickly be found in the Region for this number of machines. It is estimated that this amount of equipment, plus necessary parts and shop equipment, will cost between U.S. \$250,000-\$300,000, depending on the particular type

of earth-moving equipment. However, at least U.S. \$500,000 should be available, since we anticipate that it will be necessary to expand the program rapidly, probably before a year has passed. While the services of the tillage machinery pool should be available to any holding, irrespective of its size, it is to be hoped that in time farmers with holdings large enough to justify purchasing their own machinery will realize the advantages of doing so.

Use of machinery should be so scheduled as to assure a minimum of idle time. The Corporation's representatives should meet with farmers who wish to engage the services well in advance of the time the services will be provided, to work out an orderly schedule of operations. It may be necessary, particularly in the reclamation work, to undertake preliminary engineering, as for example designing the contour layout of irrigation and drainage ditches or dykes, leveling land, etc.; this work could be undertaken by the Corporation's engineering department. If such services are performed for an individual farmer, he should be charged for them under his contract with the Corporation; if undertaken in connection with a district drainage and irrigation project, it should be charged against the project contract with the group of benefited farmers.

The action we have recommended for the Corporation will require the following preliminary steps:

- (a) Making a survey to determine the need and the actual demand both for reclamation and for tillage services;
- (b) Analyzing the anticipated effect on agricultural production, both regional and national, of the proposed services, having in mind that the initial capital must come from a source other than Corporation funds;

- (c) Estimating, on the basis of the survey, the types and quantity of machinery required to meet need and demand, and its landed cost;
- (d) Obtaining bids from all qualified suppliers of machinery;
- (e) Estimating operating income and expenses of the pools and analyzing their likely over-all cash position;
- (f) Drawing up plans for actual administration and operation of the pools, including maintenance of machinery and training of operators.

V. AGRICULTURAL EXTENSION SERVICES

The contribution which good extension services can make to an area by raising agricultural output and improving conditions of rural life is sufficiently well known to require no elaboration here. Briefly, well-trained and energetic agents help the farmer realize a greater return for his outlay of money and effort by teaching him new and proven techniques; help the farmwife to improve her family's diet; and instruct the children in the rudiments of good farm practices. This can all be achieved relatively cheaply, being mainly educational work. The principal items of expense are the salaries of qualified technicians, adequate transport facilities, and some demonstration equipment.

Successful extension work requires that the agent have the confidence of the people with whom he works, and this in turn means that he must have no official connection with regulatory or tax aspects of government, and no official police or enforcement duties. Several of the recommendations we make elsewhere, such as those for forestry and livestock improvement, can be effectively supplemented by extension work. Indeed, extension services can be

useful in implementing any agricultural policy requiring a modification of existing farm practices.

There are extension services in the Region, but they leave much to be desired. The National Ministry of Agriculture and the Departmental Secretaries of Agriculture have extension programs in the Region on which they spend a total of about Ps. 1 million annually. But the National program is carried out by agents who are employees of the Ministry and who are in that capacity associated with control and enforcement activities of the Ministry; this impairs their effectiveness as extension agents. On both the National and Departmental levels, the programs suffer from being subject to governmental administrative regulations, to political changes and at times to lack of funds.

Extension services are also provided by such agencies as the National Coffee Growers Federation, but these understandably carry on only limited programs.

In order to provide the Region with improved extension services, we recommend establishment of a semi-autonomous Regional Extension Service to operate within the three Departments and to serve as a test operation for what we would hope would eventually become a regional agricultural extension system patterned on the extension services of the land-grant colleges of the United States. In the Cauca Region, we have in mind that the Faculty of Agronomy at Palmira, now part of the National University which in turn is under the Ministry of Education, could ultimately become the main College of Agriculture for the Region, undertaking agricultural research and education programs, and administering extension services. This, however, is for the future.

We envisage, as immediate action, that the National and Departmental governments would contract with the Corporation for regional extension services to be financed by contributions from the four governments; municipal participation would be expected in this situation as well, and would permit expansion of the program over the years. Even by spending no more, or little more, than the governments have been spending on extension services in recent years, a valuable beginning could be made on an independent service whose performance, for reasons already indicated, should be an improvement over that of existing services.

It would greatly assist in establishing this regional service if technical assistance could be obtained from the Institute of Inter-American Affairs (IIAA), which is part of the United States International Cooperation Administration (formerly the Foreign Operations Administration). The IIAA has been collaborating with several Latin American governments in the operation of very successful extension service programs during the past twelve years. The National Government, acting through the Corporation as agent, should, we recommend, seek to obtain assistance from IIAA for an extension service project to be carried out in the region, which would include five main elements, namely:

1. field offices;
2. a technical advisers' pool, to assist the field agents, agricultural organizations, and farmers;
3. test-demonstrations on private farms, and perhaps demonstration farms operated by the extension service;
4. home economics programs; and
5. juvenile agricultural clubs.

Some discussions have already been conducted with IIAA officials in Colombia and it is understood that IIAA is in principle prepared to enter into a contract for technical assistance. Preliminary estimates, based on IIAA experience in other countries and on the experience in Boyaca of the Ministry of Agriculture indicate that a program as outlined would cost about Ps. 1.2 million for the first year, exclusive of salaries of United States technicians which, under the usual provisions of IIAA contracts, would be assumed by IIAA. IIAA customarily expects that the host country will contribute most if not all the funds necessary to start a program, IIAA's own contribution being mainly the salaries of United States technicians. Thus the Colombian contribution would be only slightly more than is now being spent on extension services in the Region. The estimate of Ps. 1.2 million covers the cost of about 23 field offices, plus transportation facilities and demonstration equipment, the salaries of Colombian technicians to work in the technical advisers' pool for field agents, and the costs of personnel and facilities to start the home economics and juvenile agricultural club programs.

IIAA's practice is gradually to reduce its participation in such programs, in terms of both money and personnel, so that Colombia's contribution would have to rise each year until ultimately it would provide all expenses and services. This would be consistent with the mission's hope that eventually a land-grant college system would be instituted. The increasing participation by Colombia, and an expansion of the program itself, could be achieved in part by contributions from the municipalities which benefit from the program, in the form of rent-free office and living accommodations for field agents and the assumption of part of the cost of agents' salaries and administrative

expenses. In Peru and Costa Rica this type of local participation in extension services has been growing.

VI. AGRICULTURAL CREDIT

The mission suggests that the Corporation's activities in the field of agricultural credit be confined to making its machinery pool services available under deferred payment arrangements, provided that it is itself able to purchase the machinery on credit. It would be neither desirable nor administratively or financially feasible for the Corporation to operate a rural credit banking business, which should be left to the appropriate agencies, such as the Caja Agraria.

The mission does, however, have some observations to offer with respect to activities of the Caja Agraria in the Region. The Caja appears to be meeting satisfactorily the need for short-term production loans and loans for the purchase of cattle and machinery, although there seems to be room for further speeding up on the processing of loan applications. It should also be said that the volume of credit which has been extended to farmers in the Region is small, in comparison with the value of agricultural production. At the end of 1954, the Caja had about Ps. 50 million of credit outstanding in the Cauca Region, while agricultural production in the Region was valued at Ps. 1,050 million. There appears to be a great need for medium- and long-term credit for crop-growing, livestock and capital improvements. It may be desirable that the Caja divert to longer-term lending some funds now being used for short-term credits. However, this is a matter of national policy and as such outside the scope of this report.

We understand that the Agricultural Mission to Colombia recently sponsored by the International Bank will recommend a reorientation of the credit

policies of the Caja with the specific purpose of directing credit into areas and crops where production costs are relatively low and the injection of credit is likely to result in a maximum increase in output. Another aspect of the proposed reorientation of the Caja's credit policy would involve making extension of credit conditional on the adoption, where appropriate, of specific soil conservation and progressive farm management practices and technology. We are confident that the Cauca Valley area will benefit from all these changes in Caja policies, and that the proposed creation of regional Caja offices will permit better planning and coordination of directed credit in the Cauca Valley area and a close cooperation between the Caja regional office, the proposed Regional Extension Service, and the proposed Agricultural Division of the Corporation.

VII. MARKETING

The mission makes no specific recommendations for action by the Corporation with respect to marketing of agricultural products, beyond the general one that it should keep itself continuously informed of developments in this field, because we think action must be taken on an ad hoc basis, as problems arise. It does not mean that we found marketing arrangements in the Region satisfactory. Should the occasion present itself, the Corporation might make suggestions to appropriate public agencies concerned with marketing and offer its services in obtaining expert advice on problems with which these agencies are working, such as the adequacy of marketing facilities and practices.

In our opinion agricultural marketing facilities are at present extremely unsatisfactory and disorganized, at both the wholesale and retail level. There is no system for disseminating market information to producers and merchants. The food distribution system is poor. Storage facilities are especially

deficient, particularly for perishable commodities, with the result that prices for these foods fluctuate widely from week to week and season to season; this tends to discourage their production. There are a number of separate local markets in the Region, with little interchange of commodities between them; prices at these markets differ markedly one from the other. For the most part, the markets may be said to be inconvenient, wasteful and unsanitary.

Unquestionably there is need for improvement in the system, in the interests of the consumer, the producer and the merchant. The difficulty is that improvements call for action on many fronts. Public authorities can do little directly about the "institutional" aspects of marketing, such as trade practices and extent of competition. But they can do something about the physical aspects of the problem, specifically by providing collection centers, storage facilities, public market places, and market information.

Storage of staple crops such as rice, beans and grain will improve during 1955 when two storage plants, at Buga and Cartago, are expected to be opened. Facilities for storing perishable crops will, however, continue to be inadequate, and we recommend that governmental (National, Departmental or municipal) agencies seek to encourage their construction and operation by semi-official producers' associations or by private enterprise. If these attempts are without result, perishable storage facilities could be built and operated by public agencies as a demonstration that they are commercially feasible. If publicly built and operated, storage facilities should therefore be self-liquidating, charging appropriate fees for services. The storage facilities might adopt practices which make trading easier, such as issuing transferable receipts for commodities deposited with them.

The Departmental Secretaries of Agriculture could arrange to disseminate information as to demand and prices to the principal markets in the Region by radio or in the press.

Other action by governmental authorities in the Region might include adoption of a trading code to protect interests of both buyers and sellers, legislation prescribing forms of purchase and sale contracts for wholesale dealers, standardization of weights and measures, and regulation of public markets generally.

VIII. FORESTRY

The mission has given careful consideration to the question whether the Corporation should undertake an active forestry program and has concluded that it would not be desirable or appropriate for the Corporation to do so at this time. The National and Departmental governments have forestry programs, and we recommend that both the conservation and re-forestation aspects of the programs be expanded. The extension services which we have recommended could carry the re-forestation campaign to individual farms. The Corporation should limit its activities in this field to providing technical assistance to the governmental campaigns, as for example helping to find needed experts, and participating in sponsoring regional re-forestation demonstration projects.

IX. LIVESTOCK SANITATION

A considerable increase in the output of beef and dairy products should be possible if a livestock sanitation campaign were to be conducted in the Region. Here again, however, the mission considers that such a campaign is a function more appropriate to the Departmental governments, with the cooperation and support of the National Ministry of Agriculture, than of the Corporation. We do recommend that the Corporation call the attention of the Regional

and National agricultural authorities to the need for action.

Cattle are raised at present in both the flat area of the Valley and on the higher flanks and plateaus of the two Cordilleras. The cold higher areas, from 2,400-3,400 meters, being almost entirely free from parasites, would permit the raising of high-producing European breeds. At present, the cattle are principally native, with some crossing with Holstein, Brown Swiss Shorthorn, Normando and Ayrshire. However, there are great difficulties in raising pure-bred European cattle on the flat area of the Valley, for it is infested with cattle parasites and infectious animal diseases. Some farmers in the flat area have sought resistance to disease by crossing native cattle and some of the European breeds with Cebu (Brahma) cattle, because of the latter's characteristic resistance to infectious diseases and parasites (particularly ticks), and their ability to thrive despite poor feeding conditions and prolonged exposure to a warm climate. Only a few farmers have made use of modern techniques for preventative sanitation, or of modern feeding, farm management and herd improvement practices as a means of increasing production and farm income; the rest have taken the easier, though in the long run less profitable, way of raising cattle adjusted to existing conditions. As a consequence, the average weight of a four-year-old animal ready for slaughter in the Corporation area is 400 ks. live weight, although a beef animal on a well-managed farm should produce at least 500 ks. live weight by the time it is 2 1/2 or 3 years old. Similarly, for the dairy cattle, which represent about 20% of the more than one million cattle in the Region, average annual milk production is 800 liters per cow, whereas a good cow under good management should produce at least 3,000 liters. Farmers individually cannot make much, if any, headway toward freeing the flat land

of diseases. It will require an organized livestock sanitation campaign by governmental authorities, who should, however, seek the cooperation of the Cattle Breeders' Association. When parasites and infectious diseases are eradicated, or at least brought under control, the flat area of the Cauca River Basin (with the planting of shade trees) would be an excellent habitat for the high-producing European breeds of dairy and beef cattle.

The improvement of pasture and herd management should be a function of the Regional Extension Service discussed elsewhere. Some farmers in the Region have already shown what can be accomplished by such simple techniques as providing dry places for new-born calves, rotating grazing to improve pasture and control parasites, regular dipping and treating for control of internal parasites, selective breeding, etc. On their farms, cattle mortality has been reduced and production increased four to five times over the average for the area.

C H A P T E R 5

TRANSPORT

I. GENERAL

Rail, port, air and road facilities in the Region have all been improved in the last few years and there are governmental plans for continuing their development. The Departmental road system, about which more is said below, is an exception to the general adequacy of transport facilities, and the mission's recommendations for action by the Corporation in the transport field relate exclusively to Departmental roads.

A program for rehabilitation of the National Railroads was begun by the National Government about three years ago, based in part on financing from the International Bank. New equipment has been purchased, the permanent way has been improved, and some of the workshops have been reorganized and re-equipped. Various administrative and operational reforms have also been introduced. As a result, the performance of the National Railroads has generally improved. In The Pacifico Division, which runs through the Region from north to south and has three main junctions for interchange of traffic with other parts of Colombia, the turnaround time of cars has been shortened, the ratio of serviceable equipment has been increased and the financial results are better.

The railroad rehabilitation program was extended to the port of Buenaventura, where operations have also been greatly improved. The average turnaround time of vessel is less than half what it was three years ago and there has been a great reduction in losses from breakage and pilferage. The port is reasonably well equipped and desirable further

improvements can be made at little cost. These would include better organization of gang work, faster customs procedures, provision of proper maintenance and repair facilities for forklift trucks, and repaving of the area between sheds 1-4. The mission understands that such improvements are planned.

Facilities for air travel in the Corporation area are in general adequate; several airports can accommodate relatively frequent local and national flights, usually performed with medium-sized Douglas aircraft (DC-3's). At Cali, the center of international traffic in the Region, aircraft up to DC-6 B's can be accommodated. The National Government is carrying out a country-wide program with the cooperation of the United States Civil Aeronautics Board, for the extension and improvement of runways, terminal facilities and navigational equipment.

There are both National and Departmental roads within the Region. The former are built and maintained by the National Government. Since 1951, the National Government has been engaged in improving its road system, with financial assistance from the International Bank. In Valle, almost the entire length of the north-south National trunk road has been paved; some paving has been completed in Caldas, and paving of other sections is in progress; and in Cauca, realignment and widening are being carried out between the southern end of the river plain and Popayan, and improvements are being made or are planned for the eastern sections crossing the central Cordilleras. The most urgent National road project in the Region is the completion of the Buga-Buenaventura road and a shortcut for southbound traffic over Espinal and Dagua to Cali. Driving conditions on

the existing heavily travelled road between Cali and Buenaventura are hazardous, and the rough surface, steep grades and curves cause considerable wear and tear to vehicles. An estimated 450,000 - 500,000 tons of imports and exports are hauled by truck over the road annually, besides which there is an appreciable amount of local traffic. On the basis of traffic density alone, the new road warrants high, if not top, priority in the National road program.

The picture is rather different in the case of Departmental roads in the Region, however. Development of Departmental roads has not kept up with improvements in the National trunk roads and the Departmental roads do not adequately fulfill their primary function of feeder systems for the National roads. The inadequacy of these roads is a severe drain on the economy of many areas, being the principal element in high transportation costs, and hampers the growth of agricultural production in these areas.

Moreover, the benefits of improved roads do not stop at the purely economic. They penetrate all aspects of community life, making for enlarged outlooks and opportunities. The one-room school becomes obsolete; children can be brought by bus to larger schools with better facilities. Hospital service is within physical reach of everyone on or near an adequate road. Conditions of personal safety and security of property in the countryside improve as the forces of law and order gain mobility. And social intercourse at all levels of the community quickens. It has been truly said that you pay for roads, whether you have them or whether you do not.

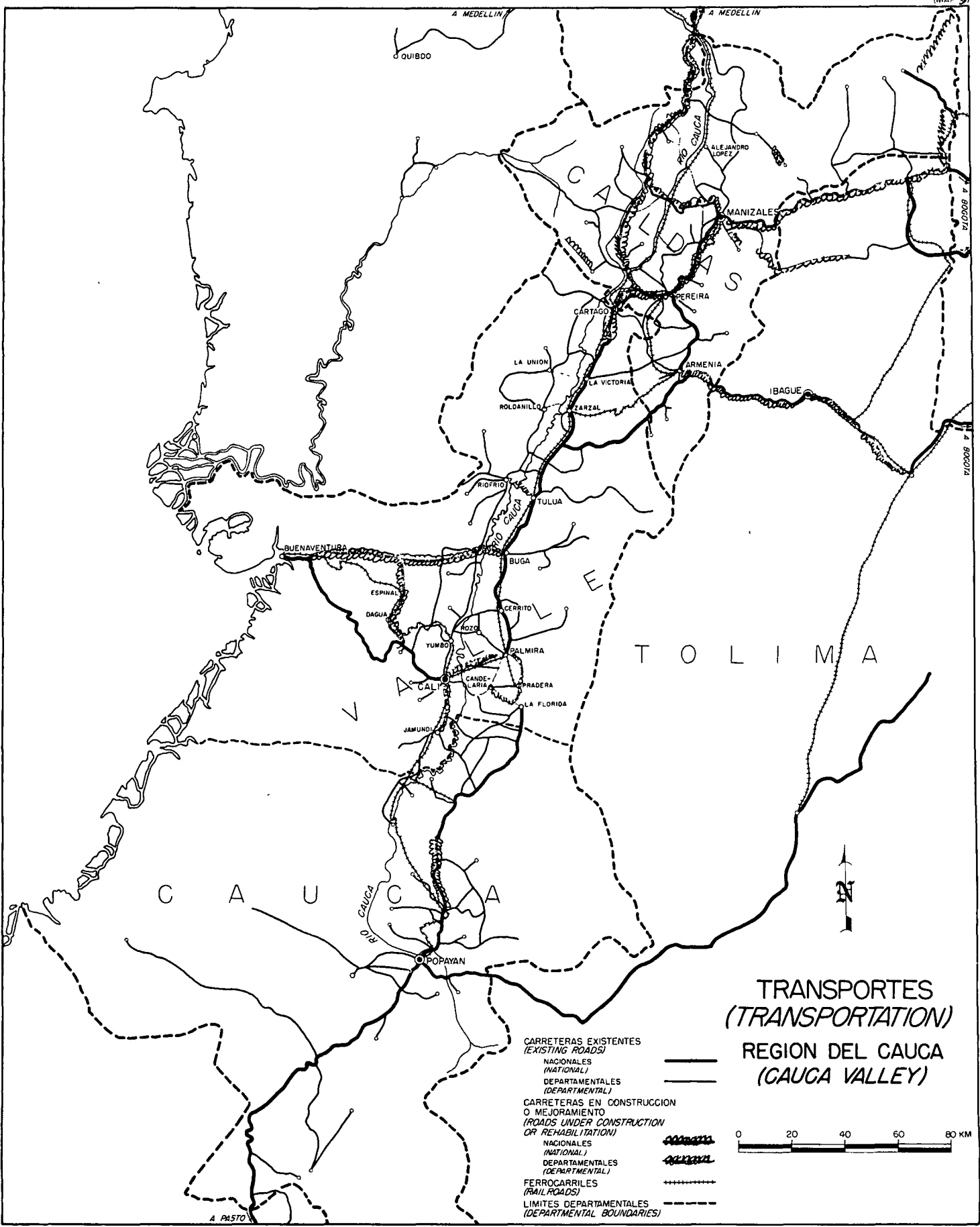
A somewhat more detailed discussion of Departmental roads is warranted, since it is in this field that the mission believes the Corporation can be of assistance.

II. DEPARTMENTAL ROADS

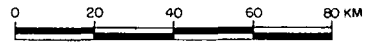
The Departmental roads are intended to serve as feeders to the National roads. Each Departmental government builds and maintains the Departmental roads within its territory, financing the work out of Departmental resources, and the road standards vary greatly. The mission was not able to make a survey of the entire road network in each of the three Departments, but field trips gave it a general impression of conditions. Departmental roads range from short lengths of paved road to earth tracks passable by vehicle only in the dry season. Most are rough all-weather gravel roads. Heavy grades and curvature and inadequate bridges add to the difficulties of travel. In Caldas only about 50 Km are improved annually, out of a total of 950 Km; in Valle, the figure is only about 60 Km out of about 1,300 Km, while in Cauca very little improvement work is being undertaken. The roads reach most of the populated districts, but there are areas with good agricultural possibilities, mainly in Cauca and Valle, which lack road connections, and where mules serve as the only transportation link with the exterior. Moreover, routine maintenance of existing roads is inadequate in many areas.

As might be expected, the situation differs in each of the three Departments in the Region.

Valle. This Department is the most advanced, having established an efficient road administration and started a program of construction and equipment. The program was launched about a year ago, based on an engineering report prepared for the Department. Staff of the Departmental Highway Division has been built up to about 4/5 of the recommended force and additional appointments are being considered. Appropriations from Departmental revenues



**TRANSPORTES
(TRANSPORTATION)
REGION DEL CAUCA
(CAUCA VALLEY)**



for road purposes have been increased from about Ps. 4.7 million in 1954 to about Ps. 10 million, or roughly 14% of anticipated Departmental revenues, in 1955. Of the total, about Ps. 6.5 million will be spent on construction and improvements, the balance on maintenance.

Contracts have been let for the widening and paving of 115 Km, of which 83 Km are in the Cali area and the rest in the central and northern parts of the Department. About 68 Km will be paved with asphalt, the remaining 47 Km with concrete. Past experience with asphalt paving has been unsatisfactory; although, in the mission's opinion, this was due to inadequate design and faulty construction standards, some governmental authorities are not enthusiastic about asphalt roads.

A few problems remain to be solved: the average per Km cost of new roads is high, and work on the roads is behind schedule. The Department is attempting to deal with these and other problems. A qualified highway engineering adviser has been taken on the staff of the Highway Division, and the Department intends to renegotiate all construction contracts as soon as feasible. The Department deserves great credit for its significant achievements within a relatively short period.

Cauca. This Department does not have a separate road administration; maintenance of about 280 Km of Departmental roads and some minor improvement works are administered by the technical personnel of the Ministry of Public Works. Finances have limited road development: total Departmental revenues for 1955 are estimated to be only Ps. 10 million, of which about Ps. 1 million has been appropriated for road works.

Caldas. This Department likewise has no separate highway division and administers its road works through the Technical Section of the Ministry of

Public Works. About Ps. 4.3 million has been appropriated for road works for 1955, representing about 10% of Departmental revenue. Ps. 1.4 million is allocated to maintenance of the 450 Km of Departmental roads, and the balance mainly for construction of local penetration roads of varying standards, mostly in the northern and central parts of the Department. About 140 Km of local roads are being built, in part by the Department's own force and in part under contract. The engineering staff assigned to highway administration consists of one road inspector in the technical division and four regional engineers in the field. This is not adequate for efficient handling of the volume of works being undertaken. The central repair shops at Manizales seem insufficiently equipped, and road construction equipment is often out of commission for an unreasonably long period, sometimes because spare parts are lacking.

The three Departments have recently contracted for loans totalling U.S. \$1.33 million from the Banco Cafetero for purchases of construction and maintenance equipment from the United States. The loans will bear 6% interest and will be repayable in 10 years.

It is apparent from the foregoing that the unsatisfactory state of the Departmental road network stems from two causes: administrative inadequacies in connection with the planning and execution of road programs and insufficient funds for road work. The problem is the same for each of the three Departments, although there are differences in degree. Presently isolated areas should be connected by new roads with their potential markets. Existing roads must have better maintenance, to enable them to keep up with demands of growing traffic. In all Departments, the scale of improvements should be determined by traffic densities. All-weather gravel roads, properly designed and constructed and ade-

quately maintained, can carry heavy traffic. Costly concrete or less costly asphalt paving should be employed only on the most heavily travelled sections. Improvement of an existing road is done at the cost of not building a new road for an equivalent expenditure, and this consideration must be kept in mind.

It is highly desirable that there be at least an effort in the direction of achieving Region-wide uniformity in standards of road construction and maintenance and that such funds as are available for road purposes be employed as efficiently and advantageously as possible. The Corporation can make a valuable contribution to the achievement of these objectives, and can also be useful in connection with the raising of additional revenues for road works. It can, and should, accomplish this without taking over entire responsibility for Departmental roads, and without duplicating Departmental activities by instituting a road program of its own. We therefore recommend that the Corporation provide the Departmental governments with technical assistance and that it make its services available, as outlined below, to assure the best possible use of money spent on Departmental roads.

III. TECHNICAL ASSISTANCE

We have noted that neither Caldas nor Cauca has a separate road administration and that road programs are supervised by small technical staffs in the Public Works ministries. The Corporation can help the two Departments to organize adequate road programs. We suggest that this can best be accomplished by making available to the Departments the services of a qualified road engineer who would be appointed to the Corporation's staff. He would familiarize himself with the road situation in both Departments, and would

advise each as to the optimum size and composition of a highway division, suggest the lines of research to be followed before outlining a highway program, and assist the Departments in working out precise programs, and in letting and supervising the execution of contracts. Eventually, it might become necessary to supplement the engineer's services with additional staff so that the Corporation would itself have a small Highway Division. We have in mind that the Departments would contract with the Corporation for the services of the engineer (and any other staff) on a reimbursable basis.

Such an arrangement would provide the two Departments with expert consultant services for relatively little cost. The Corporation would be able to provide similar services to the highway administration in Valle, although here the need is less.

It would, of course, be necessary that the Departments acquiesce in this arrangement and we therefore recommend that the Corporation promptly consult with the three Departments. The obvious advantages of this means of assuring uniformly high standards for road construction and maintenance throughout the Cauca Region should make the proposal attractive to them.

IV. FINANCING OF ROAD WORKS

Cooperation between the Departmental Governments and the Corporation would offer good prospects of sound administration, technical design and execution of Departmental road programs, and attention could then be turned to means of raising additional funds for road works. While the Corporation could not itself directly provide any part of the additional revenues, it could lend its support to necessary governmental action and could be of assistance in assuring that the additional funds were devoted efficiently to road purposes. The possibili-

ties for added road revenues considered by the mission include road tolls, benefit assessment taxes, additional vehicle license fees, and a special gasoline tax. For reasons set forth below, it is the mission's view that the last is the best of the alternatives.

Toll System. The institution of toll road system has been much discussed in Colombia. Main traffic arteries of high standard and high traffic density in the United States are frequently made toll roads, the toll revenues being used to service medium- and long-term bond issues which have financed actual construction. However, the lack of an adequate capital market in Colombia makes this type of financing impracticable. Moreover, there are few, if any, roads in the Region with a traffic potential sufficient to assure, within a reasonable period, returns equivalent to construction costs, if the toll charge is also to be reasonable. In Cauca and Caldas, virtually no paved Departmental roads exist or are under construction; no Departmental road in Cauca has a high enough traffic potential.

Some of the roads in Valle are, as already noted, of higher standard, but our calculations indicate that a toll system would be impracticable in that Department as well. We have assumed that roads presently paved or being paved were made toll roads and that the average revenue per vehicle on these relatively short routes would be 50 centavos. On the basis of traffic counts made in 1954, we estimate gross revenue at Ps. 1.5 million - Ps. 1.8 million annually. Assuming a 24-hour watch at checking points, at least 15% of revenues would go for salaries and administrative expenses. Net revenues would thus hardly be very large. Moreover, they would have been raised principally from tolls paid by travellers in the vicinity of Cali, although the bulk of the revenues would

be expended on roads elsewhere in the Department. A third objection is that a toll system would add appreciably to the cost of truck haulage on toll roads. A toll of 50 centavos on the 16 Km paved road between Cali and the Yumbo industrial center, for example, would increase total operating cost for a standard truck using that road by approximately 8%.^{1/}

But although a toll system as the primary source of additional revenues for speeding road development seems impractical, the introduction of tolls might be considered in particular cases. A bridge-crossing near Mulalo and improvement of the Mulalo-Cerrito road appears desirable to provide a needed short-cut between Cali-Yumbo and the north and to facilitate the daily marketing traffic from the Rozo area to Cali. Some of the initial construction cost of the bridge-crossing might be recovered by putting a toll station at the crossing.

Benefit Assessments. A general system of benefit assessment taxes is subject to much the same objections as a toll system, with the added disadvantages that the revenue would be probably even more limited and the administrative problems more complex. Here again, however, imposition of such a tax in special cases might be considered, as for example where a proposed new road or road improvement is to be undertaken in an area where the beneficiaries, although not numerous, are able and willing to make some financial contribution to the cost. In other situations, residents in the vicinity might be prepared to contribute labor voluntarily; this has been done successfully in Mexico and Peru in connection with local penetration roads.

^{1/} Or about five times as much as an additional 10 centavos per gallon gasoline tax; discussed below.

Vehicle License Fees. The imposition of additional vehicle license fees is open to the practical objection that only about 25,000 vehicles are registered in all three Departments, which means that only very limited additional revenues would be collected.

Special Gasoline Tax. A special gasoline tax of 7 or 10 centavos per gallon would provide substantial additional revenues without imposing a heavy burden on taxpayers generally and, if the mission's recommendations are adopted, without presenting any administrative difficulties.

Gasoline consumption in the three Departments has increased rapidly since the war; during the last four years the volume has apparently doubled. According to the best estimates available to the mission, total consumption in the three Departments rose from 47.5 million gallons in 1953 to 59 million gallons in 1954. Assuming a conservative increase of 10% in 1955 and in 1956, total consumption in the three Departments would be about 70 million gallons in 1956. A 10 centavos per gallon tax would then produce revenues of about Ps. 7 million (Ps. 4.5 million in Valle, Ps. 2 million in Caldas and Ps. 0.5 million in Cauca).^{2/} This would be an increase of 70% over revenues presently available for road construction and improvement in the three Departments (Appendix, p.145).

Gasoline prices in the Region vary with the distance from Buenaventura in Cali, gasoline costs 59.5 centavos per gallon; the highest retail price in Armenia is 67 centavos per gallon.^{3/} Converted at the official rate, retail prices

^{2/} Calculated on the basis of 1954 estimated consumption of 37.6 million gallons in Valle, 17.1 million gallons in Caldas and 4.3 million gallons in Cauca.

^{3/} The retail price is the total of the landed cost at Buenaventura, plus an 8 centavos per gallon National Government tax, 4 centavos per gallon for the retailer, and the cost of haulage inland.

are on the average lower than in the United States, less than half the European price, and compare favorably with those in most Central and South American countries. Even with the addition of a 10 centavos per gallon tax, the price would be, on the average, only the equivalent of, or perhaps slightly less than, the United States average.

We recommend a 7 or 10 centavos tax for several reasons. As already stated, a 10 centavos tax would yield an estimated Ps. 7 million in 1956, A 7 centavos tax would yield an estimated Ps. 4.9 million and a 5 centavos tax, Ps. 3.5 million (See Appendix, p. 145). The yield from a 5 centavos tax would hardly be enough to finance a proper road program, even though it would represent a 35% increase over the totals budgeted for road improvement and construction by the three Departments in 1955. Substantial proportions of Departmental budgets are already allotted to road works, and in view of the other urgent claims on limited Departmental funds, it cannot be expected that general Departmental revenues could support any appreciable expansion of road expenditures. The yield from a 7 centavos tax would be 49% more than was budgeted by the three Departments for 1955; this would be satisfactory. Not less than a 7 centavos tax should, therefore, be levied. A 10 centavos tax would be preferable.

The mission has taken into account the fact that an additional gasoline tax would add to the cost of truck haulage. Its calculations (see Appendix, pp. 143, 144), admittedly illustrative of an order of magnitude only, indicate that a 10 centavos increase in the price of a gallon of gasoline would increase the cost of operation by less than 1.5%. This would be more than offset by the reductions in other truck operating costs which would result

from the road improvements financed by the tax proceeds. We estimate that charges could be reduced by about 40%, assuming that existing rough gravel roads are replaced with paved roads.^{4/}

The Departments have no authority to levy gasoline taxes; this can only be done by the National Government. We recommend that the Departmental governments request the National Government to levy an additional 10 (or at least 7) centavos per gallon tax on gasoline sold in the three Departments. If the Departments are prepared to take this action, the Corporation should lend its support to the request.

We suggest that the following administrative arrangements should be incorporated in the legislation imposing the tax:

(a) Although the tax would be levied by the National Government, the proceeds would be turned over directly to the Corporation, acting as agent for the National Government. Collection should present no administrative problems, since only one oil company supplies the area at present.

(b) The Corporation, as agent, would deposit all revenues so received into a special Road Fund, which would be kept separate from its other resources. Reports on receipts and expenditures would be published regularly by the Corporation.

(c) Withdrawals from the Road Fund could be made only to finance proposed Departmental road construction or improvements approved by the Corporation, acting again for the National Government. The Corporation would be required to withhold its approval if it found that a Department

^{4/} Although the mission could not estimate possible reductions in haulage cost made possible by improvements to gravel roads, it seems reasonable to assume that they would also be substantial.

had reduced its expenditures from its own budget for road works (particularly for maintenance) below the present proportion of total budget expenditures devoted to those works, or was making inefficient use of road funds.

(d) From 88-90% of revenues would be earmarked for expenditure in the Department in which they were collected; Ten per cent could be expended in another Department. Thus road improvements in Cauca, where the need is greatest and the resources least, could receive some assistance from Caldas and Valle.^{5/}

(e) Up to 2% of the revenues could be utilized by the Corporation for administrative expenses, including salaries of its road engineers. In the event the Corporation should exercise this authority, its contractual arrangements for reimbursement from the Departments for the services of its road consultants should thereupon terminate.

We have in mind that the tax would apply to all gasoline, except aviation gasoline, sold in the three Departments. The benefit to towns from improvements in the surrounding road network is clear, while farmers paying a tax on gasoline consumed for farm purposes will find the markets for their produce made more accessible by better and less costly road transport.

^{5/} Assuming a 10 centavos per gallon tax, allocation of 10% of the revenue to Cauca would give the latter Ps.1.15 million, Valle Ps. 4.05 million and Caldas Ps. 1.80 million. This would represent increases of 192%, 62% and 62% respectively, over the 1955 Departmental budgets for construction and improvement (see Appendix, p.145).

CHAPTER 6

MINERALS, INDUSTRY AND TECHNICAL ASSISTANCE

I. MINERALS

The National Geological Institute recently undertook to prepare a geologic map of Valle and Cauca, and expects to complete it in about a year. This will greatly aid in the interpretation of the mineral resources of the Region. Geological surveys made thus far reveal surprisingly little, other than coal, by way of mineral deposits susceptible of commercial exploitation. The extensive reaches of the Central and Occidental Cordilleras in the region of the Upper Cauca Valley have not yet been adequately explored.

On the basis of present data, the one known relatively substantial mineral resource is the coal series which crops out in the western mountains from Yumbo to Tambo, and between Buenos Aires and Caloto, the so-called "Cauca formation." The best deposits are in the vicinity north and south of Cali. The Geological Institute estimates that there are 400 million tons in this general area (half of which is minable) and perhaps twice that quantity in the plain below these foothills. Here again proving has not been extensive, and the plain deposits have not been examined specifically. Coal in the area is known generally to have a high ash and low sulphur content and to consist of mixed grades and qualities. Coal has been mined manually in this area for years. On the basis of available sales figures, it may be roughly estimated that the average annual production in the area is about 200,000 metric tons. About 1,700 miners are employed, each

producing about 0.35 tons per day. Railroads purchase about three-quarters of the production, at an average (in 1954) of about Ps. 24 a metric ton. The remainder is sold to industry at a slightly higher price delivered in Cali.

Obviously, if the domestic or foreign market for coal is to expand, production must be increased, the quality improved, and prices lowered. Steps to accomplish these objectives have been taken by the National Government, through the Caja Agraria and the Instituto de Fomento Industrial. By virtue of a U.S. \$3 million loan from the Bank of Paris and the Low Countries, the Caja Agraria has been able to lend U.S. \$1 million to each of three mines for the purchase of mechanization equipment. The contract requires monthly delivery from each mine to the Washing Plant (Planta de Lavado) of from 3,000 to 8,000 tons, at a price fixed by a formula. It is expected that each mine will be able to raise its production to about 10,000 tons per month. The Institute has undertaken the construction of a coal washing plant, at a cost of about Ps. 4.5 million. This plant will reduce the sulphur, slate and rock mixed with the coal, standardize the size and quality of the coal, and mix the grades as required. It will have a first-stage capacity of 1,000 tons per eight-hour shift, which can be raised to 50,000 tons per month using two shifts. Washing will cost Ps. 4 per ton.

Most if not all of this washed coal can be absorbed locally, by the increased use of coal by industrial consumers such as Cementos del Valle, Carton de Colombia, the breweries and the Celanese Corporation. The export market potential ought not to be overemphasized. It appears possible that

Argentina, and perhaps Chile and Japan, may be interested in coal for coking purposes, but this will largely depend on the price. A study of the export market, and of the potentialities of a pipeline to carry coal from Cali to Buenaventura, is now under way by U.S. companies. Coupled with additional geological exploration to establish the extent of the reserves, this study should provide a basis for determining the next steps for the further development of the resource.

A small layer of limestone apparently suitable for agricultural purposes is known to exist north of Santander at the foot of the Central Cordillera at Corinto in the Cauca. Another deposit, estimated at 30 million tons and evidently suitable for Portland cement, is known to exist northeast of Popayan. Limestone could be transported by aerial cable from this deposit to a proposed cement plant at Piendamo, with coal taken from the Suarez area. The large La Concha deposit of 6 million tons in Caldas is not of good quality for Portland cement, according to a study made by the Instituto de Fomento Industrial. It is said to be highly dolomitic, but if properly mixed would be good for agricultural fertilizer. It is also likely that additional geological exploration will uncover other deposits useful for both cement and fertilizer.

Other isolated deposits of valuable mineral resources have been located. The Purace sulphur mine east of Popayan contains about 6 million tons of agglomerate with 30-40% sulphur of excellent quality, and is the richest sulphur deposit in the country. Owned by a private company (Industries Purace) it is currently producing from 600-700 tons per month, on a three-shift basis, using a relatively inefficient autoclave process. Recent experiments with newer equipment have not as yet proved successful.

Small quantities of mercury are being produced at the privately owned La Esperanza mine, north of Aranzazu in Caldas. It is thought by geologists to be a relatively rich deposit which is currently underexploited.

Copper, lead, and zinc may exist in quantity at the La Esmeralda mine in Cauca. Development was begun by private owners, and then suspended, presumably because of the high cost of additional drilling and tunneling needed to explore the extent of the deposits.

It is possible, in view of the marine character of the coal deposits, that some oil and gas lie under the plain.

We do not, however, believe that the Corporation should embark upon any immediate activity in the field of minerals. We recommend only that it lend its support and stimulus to the efforts of the National Geological Institute to prepare a geologic map of the region. It may be possible to coordinate any geographical aerial photography the Corporation may undertake for water resource purposes with this geologic survey. At a later stage, the Corporation might wish to consider whether it would be useful for it to obtain the services, either by direct employment or through technical assistance agencies, of a competent geologist to undertake a more detailed survey of promising areas revealed by the initial survey.

II. INDUSTRY

The economic area centered around Cali is experiencing rapid industrial growth. There are other well-developed business and industrial communities in the region, such as Manizales, Armenia and Pereira in Caldas, to which we will refer later. As a whole, the Upper Cauca Region contributes a little more than 25% of the manufacturing output of Colombia.

Value of Manufacturing Production, 1953

	<u>Number of Establishments</u>		<u>Persons Employed</u>	<u>Value of Output</u>		<u>Added Value in % of Total</u>
	Total	Over 50 employees	(Thousands)	Gross (million Ps.)	Added	
Valle	5,425	98	43.4	670	290	19
Caldas	3,270	42	16.8	459	94	6
Cauca	706	4	2.5	24	10	0.7
Region	9,401	144	62.7	1,153	394	25.7
Antioquia	16,712	117	60.4	912	377	25
Cundinamarca	9,342	150	59.2	901	396	26
All Colombia	46,761	556	262.8	3,917	1,513	100

Industry has been attracted to Cali for several reasons: because of its equable climate, favorable for some manufacturing processes, its proximity to the port of Buenaventura, and because it is well situated for distribution throughout Colombia. These factors have outweighed an electric power shortage; in many instances private industry has installed its own electrical generation rather than forego Cali's locational and other advantages. Some 35 industrial enterprises, of considerable size, have been established in Cali with private U.S. capital. Another 12 to 15 either have part Colombian and part U.S. capital, or have important connections with U.S. business firms. These 50 companies are in the rubber, pharmaceutical, paper products, acetate and yarns, metal fabrication, textiles, food, dry batteries and other fields.

By value added to production, in Valle, food products contribute 32.3% of the Department's total; beverages, 11.6%; tobacco, 10.2%; footwear and clothing, 8.6%; pharmaceuticals, 7.9%; and non-metallic minerals, 5.6%.

The growth of an industrial community depends upon and is influenced by a variety of complex and at times interrelated factors. Cali is no exception.

The wide and growing market for domestically produced goods and services offers substantial opportunities for risk capital, which doubtless will continue to move into the area. But the possibilities for a greater flow depend upon the resolution of certain financial and technological problems.

Foremost among the technical problems is the lack of reliable power. Most industrial plants operate with their own steam or diesel generating plants. Many will continue to do so until new steam or hydroelectric power proves equally reliable and cheaper. But it is clear that significant expansion of existing industries and the development of enterprises which are substantial consumers of power will be hampered unless adequate and reliable power is available.

A second factor influencing industrial development is transportation, which Colombia's mountainous terrain makes unusually difficult. Air transport is expensive, particularly for bulk commodities, making the development of adequate roads highly important. Improved National and Departmental highway systems are essential to continued industrial growth.

A third influence is the inadequacy of technical know-how, which presently is hampering the production of products requiring complex machinery and processes. To a large extent it will be necessary to import basic techniques, but even then, the shortage of adequately trained technical and supervisory personnel to man and maintain new and complicated plants is certain to create a bottleneck. Personnel capable of developing the lesser skills is readily available; on-the-job training is quite suitable for the working force is alert and learns quickly. The development of a corps on the supervisory level, however, can only be

accomplished if enough people receive basic education to permit them to break through to this level with an understanding and ambition to coordinate and direct multiple industrial activities.

From the financial point of view, the predominant influence appears to be the scarcity of long-term credit which reflects the inadequacy of investment capital. This, of course, relates to the scale of savings, and the use to which they are put, in the country as a whole, and is a reflection of the state of development of the national economy. Furthermore, there is a pronounced but probably diminishing disinclination on the part of domestic industry to expand and diversify, and an underlying lack of a spirit of association which makes difficult the pooling of capital in private corporations.

Despite this industrial pattern and the factors influencing it, considerable progress in industrial expansion may be anticipated. Possible lines of development include food canning and processing; metal fabrication; manufacture of fertilizers, insecticides, starches and pharmaceuticals; factory production of shoes, furniture and clothing; and mass production of lightweight cement aggregates and electrical appliances. Coal by-products may be put to commercial use and new uses be found for alcohol distilled from sugar. There is room for dairy plants, more slaughterhouses and refrigerated storage facilities. A fishing industry operating out of Buenaventura offers opportunity both for distribution of fresh fish and for canning.

The opportunities for industrial expansion are not, of course, confined to Cali. Other communities in Valle, such as Palmira or Buga, will and should share in this development. Cheaper land, local tax

exemptions, the availability of labor, ready accessibility to Cali, and sharing Cali's land transport connections with the rest of Colombia, provide solid incentives. The healthy social and economic development of Valle certainly demands this balanced growth. Community development programs, such as are now under way in Candelaria, but with even greater local initiative, could help make this possible.

The Department of Cauca presents a different problem. Here little or no industry exists or is likely quickly to develop because of the area's relative inaccessibility and low income. However, it may be that producing bags from fique fiber, or the development of new textiles and chemical uses from the fique plant, would justify new industrial activity near Popayan. If market surveys should demonstrate the economic value of a cement plant, which appears possible, a favorable site might be Piendamó, which has limestone and coal deposits in reasonable proximity. Slaughterhouses, refrigerated storage and dairy plants, especially for cheese production, would be useful adjuncts to a more intensively developed cattle industry.

In Caldas, the cities of Manizales, Armenia and Pereira account for 86.3% in gross value of the production of the Department; the Department produces 6% of the total production of the country by added value. As in Cali and Popayan, the production in these cities is predominantly in food-stuffs. The principal industrial products of Caldas, aside from the state-operated rum factories, are chocolate, flour, processing of coffee for export, beverages, textiles and clothing, shoe-making, and chemical products. Manizales, located some 6,000 feet high in the mountains, is an alert community making much progress in improving urban school and home building. Because of its location, transportation costs are high; hence, it would be

natural for those industries in which transportation costs are high, and whose products will be consumed locally, to be most inclined to locate there. For industries whose output will be consumed outside the locality, transport costs on the finished product will have to be low in relation to those on the raw material. Relatively cheap electric power is in adequate supply. Textiles, wearing apparel, food processing, a small cement plant, and metal fabrication would appear to be possibilities.

Pereira and Armenia, on the other hand, are more favorably situated from the point of view of distribution. Pereira is on a main highway from Cali and Cartago to Manizales, which also is a northern route to Bogota. Armenia is at a junction of a highway from Cali, one part of which leads to Pereira and Manizales, and the other on the southern and principal route to Bogota. As the Upper Cauca region develops it may be expected that they will share in the resulting growth of industrial and commercial activity.

There are certain specific actions the Corporation might take in the industrial field.

To ensure that knowledge of new industrial opportunities and techniques is readily available, the Corporation might initially employ an Industrial Services Officer to perform two main functions. This Officer would collect information concerning, and advise on, industrial location factors of importance to prospective new industries, and act as liaison between manufacturing enterprise and such sources of technical information as the Office of Industrial Resources, or the Technical Aids Branch of the U. S. International Cooperation Administration. The Industrial Services Officer (who could be supplemented by additional staff as and when

necessary) could serve as the nucleus of a regional service which ultimately could itself provide answers to many technical industrial questions, if the demand for such services warranted the expansion.

The Industrial Services Officer could take the initiative in seeking to attract potential national or foreign investors in industries of special importance for the region. For example, an adequate source of low-cost crushed lime is of importance to agriculture. Suitable deposits are known to exist; what is needed is the capital and enterprise to exploit them.

III. TECHNICAL ASSISTANCE

If the recommendations and suggestions of this report should be adopted, the Corporation would be channelling a considerable flow of technical information and service. For some activities it would be using its own staff, as for example in the layout and design of drainage and irrigation works, or of road construction and improvement. In other fields it would have to obtain outside advice and assistance for specific purposes, as for example, agricultural marketing problems, or specific industrial techniques.

In addition, as a Regional Development Corporation, the Corporation should, we believe, stand ready to assist any serious and responsible enquirer to obtain technical assistance and advice for any purpose, rarely, if ever, itself contributing towards the cost. Taken together, the Corporation's staff will have a wide knowledge of the available national and foreign sources of technical assistance. And if, after proper enquiry, the Corporation is able to endorse a request for technical assistance, the institution receiving the request should feel considerable assurance that its resources of personnel and perhaps money will be put to good use.

APPENDIX

ABBREVIATIONS AND CONVERSIONS

Colombian peso	Ps.	Ps. 2.51 equals U.S.\$ 1
Centimeter	cm	0.394 inches
Meter	m	3.281 feet
Cubic meter	CuM	1.31 cubic yards
Million cubic meters	M/CuM	811 acre feet
Cubic meter per second	CuM/S	35.31 cubic feet per second
Kilometer	Km	0.621 miles
Square Kilometer	SqKm	0.386 square miles
Plaza		1.581 acres
Hectare	ha	2.471 acres
Horespower	HP	
Kilovolt. (1,000 volts)	KV	
Kilovolt-ampere	KVA	
Kilowatt (1,000 watts)	KW	1.341 HP
Kilowatt-hour	KWH	
Kilowatt-year	KW/yr	
Centavos per KWH	ctv/KWH	
Kilogram	kg	2.205 pounds
Metric ton		1.102 short tons
Liter		1.057 U.S. quarts
Million	M	

DECREE NUMBER 1829 OF 1955

July 5, 1955

By which the Charter of the Corporacion
Autonoma Regional del Cauca is approved.

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The President of the Republic of Colombia
pursuant to his legal powers and especially
those conferred upon him by Legislative Act
number 5 of 1954 and

W H E R E A S

Legislative Act number 5 of 1954 authorized the Government to exercise the powers granted by it to the Legislative body until the National Constituent Assembly assumes its legislative functions;

WHEREAS, by Decree 3110 (1954) and making use of the authority granted by Legislative Act #5, of the same year, was established the Corporacion Autonoma Regional del Cauca;

WHEREAS, Article 6 of said Decree ordained that the Directive Council of the Corporacion proceed to draw up its definitive Charter in order to submit it to the President of the Republic for approval; and

WHEREAS, the Council has agreed upon the said Charter, wherefore it is due for approval,

D E C R E E S

ARTICLE I - The definitive Charter of the CORPORACION AUTONOMA REGIONAL DEL CAUCA, which has been prepared by its Directive Council, is hereby approved, as hereunder:

C H A R T E R

CHAPTER I

Name, Autonomy, Domicile and Objectives of the Corporacion

Name

Article 1 - The public establishment created by Decree 3110 (1954) in order to promote the conservation and development of the territories which substantially constitute the Upper Cauca watershed, the neighboring slopes towards the Pacific and the contiguous areas which are related to it or may be affected by its activities, determined in accordance with Articles 1 and 8 letter b) of

the aforementioned Decree and Article 41, letter b) of this charter is called Corporacion Autonoma Regional del Cauca.

For distinguishing it may also be used the letters CVC.

Legal Person, Autonomy

Article 2 - The Corporacion Autonoma Regional del Cauca is a legal person of public law, which is endowed with autonomy for the administration of the matters within its jurisdiction. It has the capacity for acting as a legal person, both actively and passively.

Seat of the Corporation

Article 3 - For all legal purposes, the domicile of the Corporation is the city of Cali, but the Directive Council may establish special domiciles for the purposes that may be determined in the corresponding Resolutions. The organs of the Corporation have their seat in the domicile of the Corporation.

Objectives

Article 4 - The ends which the Corporation will seek to attain within the territory under its jurisdiction, will be the following:

- a) The generation, transmission and distribution of electric power;
- b) Achieve the coordination of the electric power systems of the region in order to obtain a greater measure of economy and efficiency;
- c) The regulation of water courses in order to prevent floods;
- d) The utilization of water resources for irrigation;
- e) The reclamation and improvement of land with drainage works and through other means;
- f) Regulation of the use of water for public and industrial consumption;
- g) The protection of waters against pollution;
- h) The improvement of river channels for their several uses;
- i) Promotion of soil conservation and of reforestation and regulation of the exploitation of forests in public lands;
- j) Preservation of wild life and plant life;
- k) Promotion of the proper use of land for agriculture and cattle raising;
- l) Promotion of development of mineral resources;
- m) Promotion of the improvement of communications and transport systems.

CHAPTER II

Basic Principles of the Corporation

Decentralization and freedom from political influences

Article 5 - The Corporation is a decentralized and autonomous body, removed from political influences and activities.

Method of Administration

Article 6 - In pursuing its ends, the Corporacion will use modern technical and business management methods.

Demonstration and Training Program

Article 7 - The activities of the Corporacion, oriented towards putting in effect an integrated plan for the development of the region's natural resources, will be carried out in such a way that they will serve as a demonstration and training program, both for the territory under its jurisdiction and for other regions in the country.

Increase in Assets

Article 8 - The Corporacion will try to obtain that the projects undertaken by it repay the investments made in them and contribute towards the formation of capital assets which will aid in putting into effect the successive steps of its program.

Promotion of Private Initiative

Article 9 - The work will be carried out with the idea of stimulating private initiative, seeking to create new opportunities for private activity in the development of the region.

Cooperation with other Persons

Article 10 - For the attainment of its ends, the Corporacion will obtain the cooperation of other bodies, either public or private, as well as that of other persons and, in turn, it may extend cooperation to other bodies or persons.

CHAPTER III

Powers of the Corporacion

GENERAL POWERS

Article 11 -For the fulfillment of its ends, the Corporacion is invested with all necessary powers and particularly as provided in the following paragraphs:

Power to Make Decisions

Article 12 -Through organisms established by the Charter, the Corporacion may determine policy and take decisions concerning the objects of its jurisdiction in accordance with legal and Charter provisions.

Competence for Entering into Agreements

Article 13 - The Corporacion may enter into all types of agreements in which it may incur obligations or acquire rights, in accordance with the provisions of this Charter and the rules which may be adopted by the Directive Council.

Capacity for Buying Property

Article 14 - The Corporacion may buy fixed and personal property and may maintain, improve, give liens on and sell it.

Power to Contract for Loans

Article 15 - The Corporacion may borrow money with or without guarantees of its property, issue bonds and notes in general for its financing; issue, endorse, accept, protest, cancel, pay or receive checks, bills of exchange, promissory notes or any other type of negotiable or non-negotiable instruments and, in general, it may enter into the commercial exchange contract in all its forms, as well as enter into all types of transactions with banking and credit institutions.

Establishment of Guarantees

Article 16 - Among the guarantees which the Corporacion may give for the fulfillment of its obligations, it is authorized to mortgage fixed property and to give liens on its personal property.

Ability to Acquire Property Without Compensation

Article 17 - The Corporacion may accept donations and legacies.

Contributions

Article 18 - Public bodies may cooperate toward formation of the Corporacion's assets, either supplying it with property of any type whatsoever, as donations, without any conditions attached, or as contributions. The contributions made to the Corporacion do not confer any right to its assets during its existence, nor the right to intervene in its administration otherwise than as provided in the Charter. A special account will be kept of the contributions, so that if these are made in property distinct from money, a value shall be agreed upon between the contributing body and the Corporacion, in order to record it in the corresponding account. The contribution account will serve, in case of dissolution of the Corporacion, to establish the proportion of the liquid assets which belongs to each of the contributing bodies.

Management and Administration of the Assets

Article 19 - The Corporacion has powers to manage, maintain, administer, develop and improve the property owned by it, building in it directly, or by agreements with other persons, the works required for its purposes.

Expropriation

Article 20 - As enacted in Articles 4 and 11 of Decree 3110 (1954), the Corporation may exercise the right of eminent domain with respect to property required to accomplish its purposes and it may expropriate it following due legal processes.

Rates

Article 21 - The Corporation may charge rates according to the schedules adopted by the Council and approved by the proper legal bodies, for those services rendered by it in which it is possible to single out the users, as in the case, for instance, with the supply of electric power or water.

Special Assessments

Article 22 - In the case of works which may require for their construction the levy of special assessments or similar dues the Corporation shall submit for approval to the National Government rules and recommendations concerning the method of establishing and collecting such assessments.

Article 23 - The Corporation may request directly and obtain the technical and financial cooperation which it may require for its operations from any organization or person, whether Colombian or foreign, in accordance with the prevailing regulations concerning economic matters.

CHAPTER IV

Organs of the Corporation

Article 24 - The Corporation will act through its organs, which are:

- a) The Directive Council
- b) An Executive Director

Directive Council

Composition

Article 25 - The Council shall be composed of seven members with their corresponding personal alternates, who shall be elected by the President of the Republic in accordance with the following procedures:

Three principal members who shall be the three Governors of the Departamentos of Caldas, Cauca and Valle del Cauca;

The three alternates for the Governors shall be elected from three lists of four names submitted by each of the Governors of the above-mentioned Departamentos;

Four principal members and four alternates elected directly by the President of the Republic.

Term

Article 26 - The term of the principal members of the Directive Council, other than the Governors, and that of all the alternates, shall be of three years. However, in order to establish the gradual renewal of its makeup, for the first Council the term of the alternate members submitted by the Governors shall be of one, two, and three years, and that of the remaining four members, both principal and alternate, shall be of two years for two of them and of three years for the other two, from the date of their election. In each case the expiration of the terms of the members will be determined by drawing lots during the first month after the installation of the Council.

Renewal

Article 27 - For renewal of the 3 alternates of the Governors in the Council, a list with four names for each place shall be presented to the President of the Republic two months before the expiration of the corresponding term; such list shall be presented by the Governor of the Departamento which shall have submitted the member to be replaced. In the case of the remaining four members and of their alternates the President of the Directive Council of the Corporacion shall notify the President of the Republic two months before the expiration of their respective terms, for the appointment of their substitutes.

Article 28 - Members of the Directive Council shall have the experience and competence required for the efficient execution of their duties.

Article 29 - No member of the Directive Council may either directly or through a third party, enter into contracts with the Corporacion.

Article 30 - Within the Directive Council, its members are entrusted with the mission of procuring the realization of the ends of the Corporacion, representing solely and exclusively its high aims of national well-being, and they shall have a deep conviction that those ends are attainable and convenient.

Meetings

Article 31 - The Council will meet at least twice a month, on the day, hour and place which it may itself determine according to its rules.

Special Meetings

Article 32 - The Council may be called to special meetings by the President or in his absence by the Vice-President, or by the Executive Director.

Persons that have a voice in the Council's Meetings

Article 33 - The Executive Director and other officials as the rules may determine shall have a voice, but no vote, in the Directive Council; this right may, in addition, be granted to other persons, by means of a Resolution, for specific occasions and in a special manner.

Re-election

Article 34 - The members of the Council may be re-elected indefinitely.

President and Vice-President

Article 35 - The Directive Council shall have a President who shall direct the meetings and a Vice-President who shall take his place in his absence. These officers shall be elected by the Directive Council for periods of one year, by a majority vote, and may be re-elected indefinitely. In case of a tie, the election will be settled by lot.

Quorum

Article 36 - The presence of three principal members will be required at any meeting of the Directive Council to form a quorum. In case one or several of these members excuse themselves or their absence is adequately established, their alternates shall be summoned and their presence will then contribute to form the quorum.

Article 37 - For any decision of the Directive Council, at least three favorable votes will be required.

Vacancies in the Council

Article 38 - Death, resignation, or unjustified absence for more than two months constitutes an absolute absence of a member of the Council. When this occurs, the procedures established in Articles 25, 26 and 27 shall be followed.

Fees

Article 39 - The Members of the Directive Council shall be paid fifty pesos per meeting; however, no matter how many meetings there are in a monthly period, their monthly remuneration shall not exceed four hundred pesos. The Corporation will not pay travelling or representation expenses for the attendance of the members at the meetings held in Cali.

Record of Proceedings

Article 40 - Minutes shall be kept of the meetings of the Directive Council, and these shall be signed by the person who presides at the corresponding meeting and by the Secretary. Each page shall be initialled and the Minutes shall be numbered consecutively; each set of fifty Minutes shall be bound in a book in order to ensure their safe-keeping. Copies issued by the Secretary over his signature shall be held to be valid as to the contents of the Minutes.

Powers of the Directive Council

Article 41 - The powers of the Directive Council shall be as follows:

a) Approve, for yearly periods, the income and expenditure budget of the Corporacion;

b) Study and submit for the approval to the National Government the territorial limits within which the Corporacion shall have jurisdiction and make proposals on the additions to or withdrawals from such territory which it may consider justified in view of the plans it may develop;

c) Prepare the plan for development of the region after a detailed analysis of existing reports and studies on the utilization of its natural resources and of additional technical opinions which it may see fit to obtain. Once the plans have been adopted, it will submit them for approval to the National Planning Board;

d) Order the additional studies, investigations and experiments that may be necessary for the attainment of the ends of the Corporacion;

e) Elect and remove the Executive Director;

f) Order the preparation of special financial statements of the Corporacion on given dates and determine the date when the yearly statement, which shall correspond to the calendar year, is to be presented;

g) Approve the financial statements and the annual report of the Executive Director, or give instructions for their alteration with reasons therefor;

h) Adopt the general chart of accounts for the Corporacion;

i) Authorize the Executive Director for the execution of all contracts whose value exceeds thirty thousand pesos (Ps. 30,000);

j) Issue regulations for the services performed by the Corporacion;

k) Adopt rates for the services performed by the Corporacion, which shall be submitted for final approval to the appropriate national authorities whenever the Law so determines;

l) Determine which of the works carried out by the Corporacion shall give rise to special assessments and regulate their distribution and the methods for levying them, in accordance with the Law;

m) Order the execution of works included in the programs it has adopted and take all types of decisions with respect to them;

n) Authorize the sale of fixed and personal property of the Corporacion as well as the constitution of guarantees on any type of property of the Corporacion, with respect to its own obligations;

o) Authorize the obtaining of all types of loans, either domestic or foreign;

p) Approve, reject or amend the plans for establishing offices departments or divisions submitted, with specification of the personnel required, by the Executive Director;

q) Approve, reject or amend the general regulations prepared and submitted by the Executive Director concerning employment, wage scales and the administration of the Corporacion's personnel;

r) Establish general bases for depreciation or depletion of the Corporacion's property and the establishment and use of reserves;

s) Authorize the Corporacion to promote, establish and take part in corporations or establishments having as their object an improved utilization of the region's natural resources;

t) Submit the differences of the Corporacion with third parties to arbitrators and arrive at transactions concerning them.

u) Enter into agreements with educational institutions to further the objectives of the Corporacion as to training and experimentation;

v) In general, the Council has the powers required to attain the aims of the Corporacion, for it is the organ entrusted with its direction and has the powers required for the execution of all acts tending to the accomplishment of its ends.

CHAPTER V

Acts of the Organs of the Corporacion

Designation

Article 42 - The decisions taken by the Directive Council which are to affect the inhabitants of the region or third parties shall be called RESOLUTIONS.

Those of the Executive Director and of other employees authorized to take them shall be called ORDERS.

Legal Character of the Council's Resolutions

Article 43 - Save when, by dispensation of the law or of the Charter, the Council's decisions are to give rise to individual legal situations or "actos condiciones", its acts will have a general and impersonal character.

Acts of the Executive Director

Article 44 - The Executive Director may, through his acts, issue regulations which will aid in carrying out the decisions and Resolutions of the Council which he is to execute. Furthermore, his acts may create legal situations, of an individual and personal character, within the field of his powers.

Other Acts

Article 45 - Subordinate employees shall have competence for executing the acts stipulated in the Council Resolutions creating their posts, and in those which supplement or modify them.

CHAPTER VI

Administrative Head

Article 46 - The Executive Director shall be the administrative head of the Corporacion, within the framework of the law and as may be determined in due course by the Directive Council;

Article 47 - The Executive Director shall be elected by the Directive Council, for three year terms computed from the date of the first election.

Removal before end of term

Article 48 - The Council may remove the Executive Director for just cause. The following shall be considered, among others, as just causes:

- a) Abandonment of the duties of his office;
- b) Violation of legal or Charter rules on the management of the Corporacion;
- c) Systematic refusal to carry out the orders which the Council is empowered to give;
- d) Neglect in the management of funds or malfeasance with same;
- e) Incompetence, in the judgement of the Directive Council, for fulfilling the duties of his post.

Prerequisites for being Executive Director

Article 49 - In order to be Executive Director experience shall be required in an important position in the management of organizations of recognized importance.

Legal Representative

Article 50 - The Executive Director shall be the Corporacion's legal representative.

Exercise of his powers

Hierarchy

Article 51 - All the officers and employees of the Corporacion, other than the members of the Directive Council, the Fiscal Auditor and his

aides, shall be directly subordinate to the Executive Director, will carry out his orders and must lend themselves to supervision by him in the performance of their duties.

Duties of the Executive Director

Article 52 - The Executive Director shall have charge of the direction and coordination of the different departments of the Corporacion, ensuring the execution of the policies and decisions of the Directive Council in accordance with their several assigned functions. He will serve as a link between the Directive Council and the different officials of the Corporacion, supervising their compliance with their assigned duties and the management methods which may have been adopted. Consequently he shall have the following duties:

- a) Represent legally the Corporacion in all matters, whether private or before judicial or administrative authorities. Consequently, he will act as such whenever convenient or necessary before all public officials of any branch; before corporations, before legal or natural persons; national, foreign or international organizations; and, in general, before any legal person, either public or private.
- b) Execute all types of contract, subject to special authority from the Directive Council in the cases provided for under letter (i), Article 41.
- c) Execute or cause to be executed all the instructions of the Directive Council.
- d) Give, with prior approval of the Council, powers of attorney for representation of the Corporacion in all matters in which such would devolve upon the Director;
- e) Delegate, in officers expressly designated by the Council, one or several powers of his office, retaining, nevertheless, responsibility for their proper performance;
- f) Prepare and present for the Directive Council's approval an annual report together with the statement covering the fiscal period from January 1 to December 31 of each year. The report must be complete in the descriptive, economic, financial and statistical aspects and must contain suggestions as to the future development which should be adopted for the Corporacion's program;
- g) Inform the Directive Council concerning the business of the Corporacion whenever requested to do so;
- h) Make proposals to the Directive Council concerning the establishment of the offices, departments or divisions required for the Corporacion's business, making regulations on their duties, specifying the personnel required and their salaries and determining their total expenditures within the corresponding budget;

- i) Appoint and remove personnel whose posts have been authorized by the Directive Council;
- j) Present for the Council's consideration proposals concerning regulations for services that may be performed by the Corporacion;
- k) Propose and present for the Council's consideration, for approval by it, rate schedules to be charged for services performed by the Corporacion;
- l) Prepare and present proposals concerning special assessments, which must include estimates on the cost of the projects and regulations for the distribution of the levy;
- m) Watch over, manage, maintain, administer, develop and improve the property controlled by the Corporacion, it being understood that these powers attach to him as head of the administration and that he is to exercise them through the subordinates appointed for this purpose, it being his duty only to supervise and perform top management functions;
- n) All other duties that the Directive Council may assign to him.

CHAPTER VII

Secretary

Article 53 - The Corporacion shall have a Secretary, who will be that of the Council and of the Executive Director.

Duties

Article 54 - Apart from the duties assigned to him by the superiors, the Secretary shall, according to this Charter, have those of preparing the Minutes and certifying them by means of his signature and also of certifying the acts of the Executive Director, furnishing certified copies of both.

CHAPTER VIII

Fiscal Auditor

Article 55 - The Corporacion shall have a Fiscal Auditor together with an alternate, to be appointed and removed by the President of the Republic.

Salary

Article 56 - The salary of the Fiscal Auditor will be determined by the President of the Republic and will be paid by the Corporacion.

Aides

Article 57 - Upon a properly supported request from the Fiscal Auditor, the President of the Republic shall determine the aides whom the Fiscal Auditor shall have for the adequate performance of his duties, together with their salaries, which will also be paid by the Corporacion.

Duties

Article 58 - The duties of the Fiscal Auditor will be those granted the Auditors of the corporations by Law 73 (1935) complemented by Decree #2521 (1950) in accordance with the provisions of Decree #1779 of July 1, 1955. He shall submit an annual report to the President of the Republic on the accounts and shall immediately deliver to the Directive Council a copy of the same report.

CHAPTER IX

Funds and Accounts of the Corporacion

Article 59 - The accounts of the Corporacion shall be kept according to the regulations which apply for the accounts of Corporations.

Article 60 - The funds of the Corporacion will be managed by the Executive Director, but the Council may appoint a Treasurer or Cashier, who will then have charge of and responsibility for the funds.

Bond

Article 61 - The officers who have charge of funds shall post bond for the amounts determined, in agreement, by the Directive Council and Fiscal Auditor.

CHAPTER X

Liquidation of the Corporacion

Administration during the period of liquidation

Article 62 - If the Corporacion is dissolved, its liquidation will be carried out and, during same, the statutory organs shall continue to function and shall be responsible for completing the liquidation as soon as possible.

Liquidation Procedure

Article 63 - In order to carry out the liquidation the liabilities will first be paid. If this is not possible, arrangements will be made so that the bodies to whom control of the assets is transferred will assume such obligations proportionally.

Disposition of Assets

Article 64 - The liquid assets of the Corporation will be divided among the Nation, States, Municipalities and other bodies in proportion to the contributions made by them as provided in Paragraph 18 of this Charter. However, any of the bodies with rights to a part of the assets may acquire any proportion of the rights of others and such acquisitions will be added to its contribution account.

CHAPTER XI

Amendment of Charter

Article 65 - This charter may be amended by Resolution of the Directive Council, submitted for definite approval to the National Government.

CHAPTER XII

Publications

Article 66 - Once the statement and the Annual Report of the Executive Director have been approved by the Directive Council, these will be presented to the President of the Republic and published.

ARTICLE II - This charter, which conforms to the Decrees 3110 of 1954 and 1779 of 1955 shall completely govern the operation of the public establishment for which it is adopted.

ARTICLE III - This Decree shall have effect from the date of its enactment.

Bogota - July 5, 1955

(Signed) Commander-in-chief GUSTAVO ROJAS PINILLA
President of Colombia.

MINISTER FOR FINANCE AND PUBLIC CREDIT,

CARLOS VILLAVECES.

MINISTER FOR DEVELOPMENT,

MANUEL ARCHILA MONROY.

PRINCIPAL EXISTING PUBLIC UTILITY GENERATING FACILITIES

<u>Cali</u>	Cali River	2 hydro plants	1,800 KW	
	Melendez River	1 hydro plant	400	
	Cali	2 diesel plants	<u>9,800</u>	12,000 KW
<u>Compania Colombiana de Electricidad</u>				
(Interconnected system 33 KV between Buga, Palmira and Cali)				
	Nima River	2 hydro plants	7,200 KW	
	Guadalajara River	1 hydro plant	<u>1,280</u>	8,480 KW
<u>Buenaventura</u>		1 diesel plant		2,152 KW
<u>Tulua</u>	Tulua River	2 hydro plants	1,350 KW	
	Frio River	1 hydro plant	<u>1,600</u>	2,950 KW
<u>Cartago</u>	Consota River	1 hydro plant	804 KW	
	Cartago River	1 diesel plant	<u>800</u>	1,604 KW
<u>Sevilla</u>	Pijao River	1 hydro plant	434 KW	
	Sevilla River	1 diesel plant	<u>125</u>	559 KW
Total installed capacity				27,745 KW
Total hydro (11 plants)				14,868 KW

TABULATION OF DATA FOR ANCHICAYA PROJECT

<u>Location</u>	In a steep-walled canyon of the Anchicaya River adjacent to the Simon Bolivar Highway about 90 Km from Cali and 54 Km from Buenaventura.
<u>Drainage Area</u>	750 SqKm
<u>Stream Flow</u>	Average 90 CuM/S Minimum monthly 30 CuM/S Maximum usable 115 CuM/S Maximum recorded 1,700 CuM/S
<u>Reservoir</u>	Total capacity 5,100,000 CuM Active storage 1,500,000 CuM
<u>Dam</u>	Concrete gravity arched Crest elev. 203 m Max. height 60 m Crest length 203 m
<u>Spillway</u>	Overflow ski jump type Spill crest length 150 m Estimated discharge capacity 5,700 CuM/S elev. 201 m
<u>Outlet Tower</u>	Reinforced concrete, attached to dam Two 5' x 6' hydraulically operated sluice gates Electric-operated wheel gates control entrance to power tunnel and to sluices
<u>Power Tunnel</u>	Circular, concrete lined Diameter 6.3 m Length 1,363 m
<u>Surge Tank</u>	Spill type excavated underground to avoid surface slides
<u>Control Valves</u>	120" Butterfly for each penstock
<u>Penstocks</u>	Ultimately three of 3 m diameter each, with No. 1 branching to units 1 and 2.
<u>Head</u>	Net maximum 76 m Net minimum 64 m Est. average 72 m
<u>Installation</u>	Present - two 12,000 KW units Future - two 20,000 " " Ultimate- 64,000 " "
<u>Power House</u>	Reinforced concrete, initially constructed for first two units only.

(cont'd.)

(cont'd. from page 121)

Step-up Transformers 3 phases 15,000 KVA - 6,600/115,000 volts

Transmission Line Length 52.5 Km
Double circuit 115 KV steel towers with concrete footings
Conductor 300,000 cm ACSR

Terminal Substations Two at Cali
Combined capacity 24,000 KVA

Estimated Cost

Power Plant

First stage	24,000 KW	Ps. 40,000,000
Second stage.	20,000	4,850,000
Third stage	<u>20,000</u>	<u>2,360,000</u>
Total	64,000 KW	Ps. 47,210,000

Cost per KW Ps. 740

Transmission Line Ps. 1,712,000

Step-up Substation 124,000 KVA 687,000

Step-down Substation 24,000 KVA 1,391,000

Total cost of project Ps. 51,000,000

Average Annual Generation 397 M/KWH

Cost of Power

First stage around 3 centavos
Third stage around 2 to 2.5 centavos

UNDEVELOPED HYDROELECTRIC PROJECTS

The following tabulation lists certain data pertaining to a number of potential hydroelectric projects on tributaries of the Cauca River which have been proposed for development. Several proposed projects on the streams which flow westward into the Pacific are also included.

All of the projects are located and designated by name on Map No. 4. Data from OLAP Report "PROYECTO GENERAL DE ELECTRIFICACION" appendix II, 1947-49.

Cauca River Tributaries

Name of River	Name of Project	Gross Head : Meters	Min. Flow : CuM/S	Capacity		Annual Output : M/KWH
				Firm : KW	Installed : KW	
Palo	Palo	170	4.2	5,320	6,000	46.5
Guabas	Costa Rica	310	1.1	2,600	6,000	22.6
	Guacari	80	1.1	685	900	5.8
	Ginebra	140	1.2	1,265	1,800	11.1
Amaine	La Tigrera	270	2.0	4,040	10,000	35.4
Desbaratado	Desbaratado	250	1.0	1,880	2,600	16.5
Fraile	Alta	127	1.17	845	1,400	7.4
Fraile	Baja	83	1.17	550	900	4.8
Bolo	Pradera	252	0.8	1,500	2,400	15.1
Rio Frio	Rio Frio	44	2.2	700	900	6.1
Pescador	Pescador	274	0.3	620	1,400	5.4
Tulua	El Rumor	41	3.8	1,120	1,800	9.8
Bugalagrande	Voladero	59	2.0	4,500	10,000	39.4
Bugalagrande	Sevilla	58	2.0	816	1,200	7.2
La Vieja	Caicedonia	80	16.0	15,500	30,000	136.0
Barragan	Caicedonia	31	3.5	773	1,000	6.8
Canaveral	Esparta	55	1.4	549	800	4.8

Pacific Slope

Digua		221	4.5	7,650	15,000	66.9
Anchicaya	Rio Grande	80	13.3	12,750	24,000	112.0
Anchicaya	Agua Clara	64	20.0	15,200	30,000	133.0

TABULATION OF DATA FOR PROPOSED
CALIMA I PROJECT

Location

On the Rio Calima about 50 Km north of Cali

Drainage Area

250 SqKm

Stream Flow - At Madronal

Average 1946-53	11.8 CuM/S
Minimum daily	2.2 "
Minimum monthly	2.6 "
Maximum	122.0 "

Upper Calima plus Bravo

Average 18.3 CuM/S

Reservoir

Maximum Elevation	1,402.5 m
Minimum Elevation	1,350. m

Storage Capacity

Gross Reservoir Capacity	417 M/CuM
Dead Storage	9 "
Usable Storage	408 "

Flooded Area

1,830 ha

Dam

Type - concrete gravity or rock fill	
Crest Elevation	1,405 m
Height (concrete)	91 m

Spillway (concrete dam)

Crest Elevation	1,402.5 m
Length	37 m
Design Flood	2,000 M/CuM

Diversion Tunnel (concrete dam)

Diameter	3 m
Length	180 m
Lining	concrete

(cont'd.)

(Cont'd. from page 124)

Power Tunnel

Diameter	3.0 m
Length	6.7 Km
Lining	concrete

Bravo Diversion

Diameter	2.4 m
Total Length	7.8 Km
Tunnel	2.2 Km
Surface Conduit	5.6 Km

Surge Tank

Underground inclined with two horizontal chambers

Penstock

Inclined tunnel with 1/2" steel lining	
Diameter	2.5 m
Length	740 m

Power Plant

Maximum Net Head	584.5 m
Discharge at Maximum Head	20.7 CuM/S
Minimum Net Head	478.6 m
Discharge at Minimum Head	37.4 CuM/S
Turbines - 4 - Pelton	each 50,700 HP
Generators - 4 - 13,800 V - 85% PF	each 52,500 KVA
Peak Capacity	144,000 KW
Average Annual Generation	690 M/KWH

Transformers

4 Banks Single Phase 13.8/16 KV	each 52,500 KVA
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Transmission

Two Circuits - 477,000 cm - ACSR	
Length to Cali	74 Km

Cost of Power

<u>Installed Capacity</u> KW	<u>Load Factor</u> %	<u>Annual Generation in Plant</u> M/KWH	<u>Power Delivered to Cali</u> M/KWH	<u>Capital Investment</u> Ps.1,000	<u>Annual Cost of Power</u> Ps.1,000	<u>Cost per KWH</u> Centavos
36,000	60	189	180	59,378	6,092	3.38
72,000	60	378	360	66,583	6,838	1.90
108,000	60	568	540	95,854	9,823	1.82
144,000	54	690	655	103,059	10,594	1.62

Note: Transmission losses of 5% have been assumed.

TABULATION OF DATA FOR YUMBO STEAM PLANT

Physical data and plant costs from CHIDRAL

<u>Location</u>	On Cauca River near Yumbo, 15 kilometers from Cali			
<u>Capacity</u>	Ultimate	100,000 KW		
	Initial	12,500 KVA at 80% P.F.		
<u>Boiler</u>	Outdoor type	- pulverized coal		
	Steam cycle	- pressure 42 kg/sq.cm		
		- temperature - 440°C		
	Capacity	- adequate for continuous operation of turbine at maximum capacity		
<u>Turbo Generators</u>	12,500 KVA each at 0.8 power factor 60 cycle - 13,800 v - air-cooled			
<u>Power House</u>	Semi-outdoor covered turbine room			
<u>Condenser Water</u>	Conduit from pumping plant on Cauca River			
<u>Coal</u>	Bituminous-heat content 6,712 cal/kg Cost about Ps. 20 per metric ton			
<u>Estimated Cost</u>	(Based on actual bids)			
	First unit	Ps. 8,800,000		
	Second unit	" 4,980,000		
	Additional extensions	" 550 per KW		
<u>Estimated Cost of Power</u>	For two 12,500 KVA units			
	Calculated station heat rate about 13,500 BTU KWH			
	Fuel cost - Ps. 20 per metric ton or 1.0 ctv/KWH			
	Station cost - 20,000 KW Ps. 13,780,000			
		<u>Load Factor - Per cent</u>		
		<u>30</u>	<u>60</u>	<u>100</u>
Annual generation	M/KWH	52.5	105	175
Annual fixed charges 12%	Ps. (1,000)	1,650	1,650	1,650
Operation and maintenance 15 Ps. KW/yr.	" "	<u>300</u>	<u>300</u>	<u>300</u>
Total	" "	1,950	1,950	1,950
Annual charges per KWH	Centavos	3.72	1.86	1.11
Cost of coal per KWH	"	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>
Cost of power per KWH		4.72	2.86	2.11

TABULATION OF DATA FOR PROPOSED TIMBA PROJECTS

<u>Physical Data</u>	<u>"High"</u>	<u>"Low"</u>
Height of Dam	50 m	40 m
High Water Elevation	1,037 "	1,027 m
Maximum Drawdown Elevation	1,010 "	1,010 m
Tailwater Elevation	990 "	990 m
Gross Storage	1,044 M/CuM	694 M/CuM
Dead Storage	188 "	188 "
Effective Storage	856 "	506 "
Flooded Area	4,150 ha	3,500 ha
Minimum Power Head	20 m	20 m
Type of Dam	Earth Fill	Earth Fill
Installed Capacity	75,000 KW	75,000 KW
Estimated Cost - Including Power	Ps. 145,000,000	110,000,000
 <u>Power Calculations</u>		
Power Release During Floods	160 CuM/S	160 CuM/S
Average Annual Hydro Generation (including secondary)	430 M/KWH	376 M/KWH
Minimum Monthly Average Generation	20,000 KW	20,000 KW
Required Output - 60% load factor	45,000 KW	45,000 KW
Required Annual Generation (firm power)	394 M/KWH	394 M/KWH
Steam Plant Capacity Required	25,000 KW	25,000 KW
Average Annual Steam Generation	52 M/KWH	62 M/KWH
Estimated Cost of Steam Plant	Ps. 15,000,000	15,000,000
 <u>Estimated Cost of Power</u>		
Annual Fixed Charges on Hydro 10% Operation and Maintenance Hydro Ps. \$6 KW/yr.	Ps. 14,500,000 450,000	11,000,000 450,000
Annual Cost of Hydro Generation	Ps. 14,950,000	11,450,000
Cost of Hydro Power (Total Generation)	3.47 ctv/KWH	2.75 ctv/KWH
 <u>Cost of Firm Power Including Steam Standby</u>		
Annual Cost of Hydro as above	Ps. 14,950,000	11,450,000
Annual Fixed Charges on Steam 12% Operation and Maintenance on Steam 15 Ps. KW/yr.	1,800,000 375,000	1,800,000 375,000
Fuel - Coal at 1.0 ctv/KWH	520,000	620,000
Credit Secondary Power @ 1.5 ctv/KWH	Ps. 17,645,000 1,320,000	14,245,000 660,000
Annual Cost of Firm Power	Ps. 16,325,000	13,585,000
Cost of Firm Power (394 M/KWH)	4.15 ctv/KWH	3.44 ctv/KWH

POWER STUDY FOR TIMBA PROJECT

Assumptions (Not in conjunction with Salvajina.
 (Tailwater level 990 meters.
 (Minimum drawdown level 1010 meters.
 (Release for power 160 CuM/S except when reservoir spills, or low
 (flow governs.
 (Installed capacity 75,000 KW

	High Dam		Low Dam	
	Maximum Level 1037 m		Maximum Level 1027 m	
Year	Installed Capacity:	Output at 60% Load Factor	Installed Capacity:	Output at 60% Load Factor
1946	35,000 KW	34,000 KW	35,000 KW	34,000 KW
1947	29,000	28,000	29,000	28,000
1948	35,000	34,000	34,000	33,000
1949	47,000	42,000	46,000	41,000
1950	65,000	44,000	65,000	44,000
1951	48,000	42,000	46,000	42,000
1952	43,000	41,000	42,000	39,000
1953	44,000	41,000	43,000	41,000
1954	50,000	44,000	48,000	43,000
Mean	49,000 KW	39,000 KW	43,000 KW	38,000 KW
	430 M/KWH	342 M/KWH	380 M/KWH	332 M/KWH
60% Load Factor on Installed Capacity		394 M/KWH		394 M/KWH
Steam Support		52 M/KWH		62 M/KWH

FLOOD CONTROL AND POWER STUDY
FOR TIMBA PROJECT ALONE

This study was made to determine the flood control regulation which would be afforded by Timba reservoir alone, without Salvajina, and also the amount of power which could be generated under the assumed flood control restriction.

It was assumed that the high-water elevation in the reservoir would be increased from elevation 1,027 meters, as originally proposed, to elevation 1,037 meters; this would increase the gross storage capacity from 694 million cubic meters to 1,040 million cubic meters. In order to obtain more power output at low flow, the minimum drawdown elevation was assumed at elevation 1,010 instead of elevation 1,000 meters.

The basic assumptions regarding the reservoir are -

Maximum pool elevation	1,037 m
Minimum pool elevation	1,010 m
Tailwater elevation	990 m

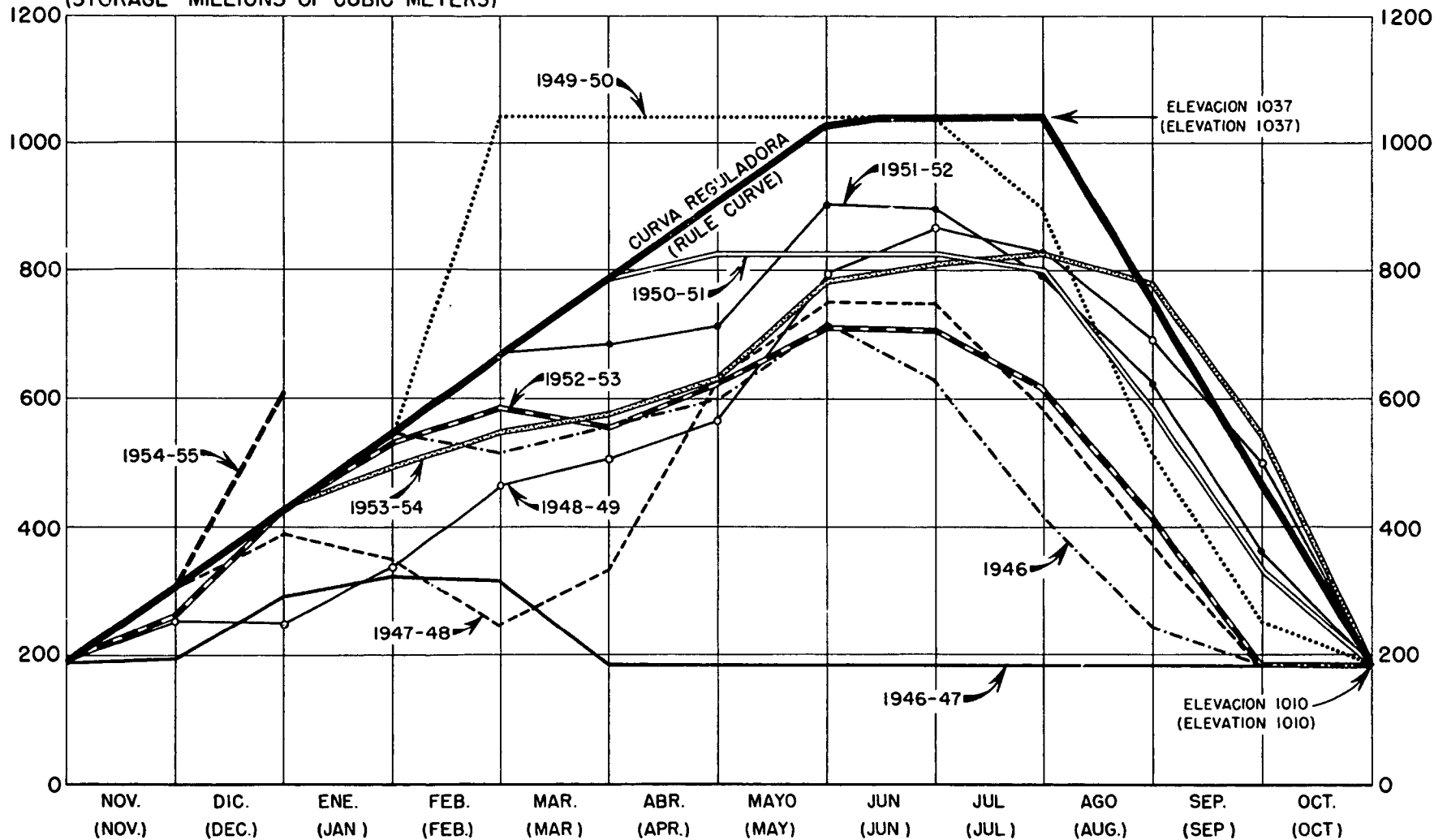
The flood control rule curve, which is shown on the chart following page 130, allows a uniform accumulation of storage each month from November 1 until June 1, and at a slower rate until June 15. The flood operation simply requires storing in Timba reservoir during floods to prevent the discharge at Juanchito from exceeding 570 cubic meters per second, and releasing the stored water to lower the reservoir to the guide or rule curve as soon as the flood subsides. A continuous release of 160 cubic meters per second was assumed for power regardless of the flow at Juanchito.

The rule curve also shows the reservoir elevations which would have been reached each month during the nine-year period of record 1946-1954. In 1950 the reservoir would have filled by March 1, and would have enabled little or no regulation from then until the middle of June when the flood subsided. In all other years the capacity of the reservoir was entirely adequate to regulate the flow, and it would not have quite filled.

The monthly average power output for Timba alone is shown by the Table on page 128, for the nine-year period 1946-1954, using the reservoir elevations shown on the flood control chart, and assuming an outflow for power of 160 cubic meters per second to be maintained as long as possible. An installed capacity of 75,000 Kw operating at 60% load factor or 45,000 Kw average continuous power output was assumed. The average annual power output for the period of record was 324 million KWH.

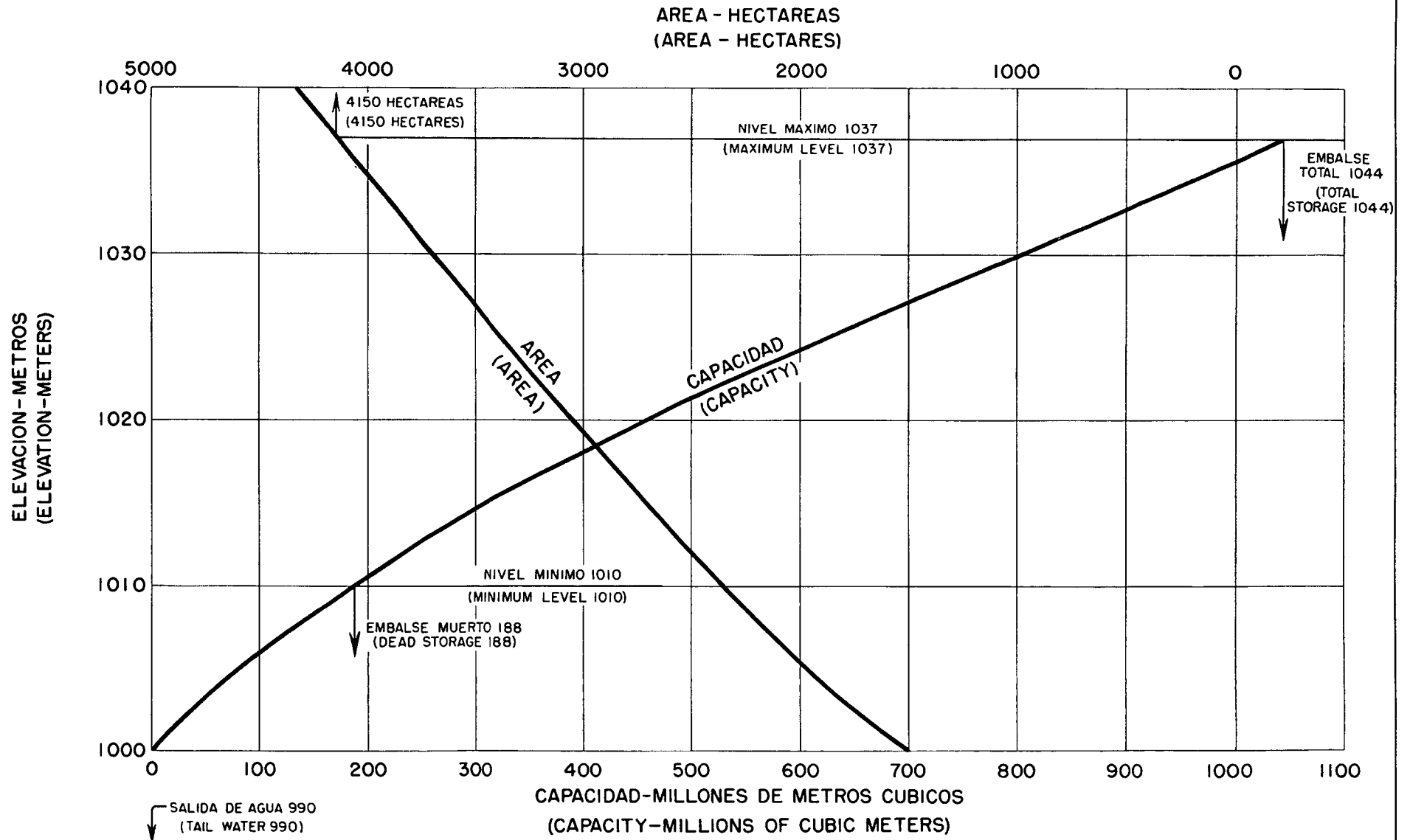
COLOMBIA: CURVA REGULADORA Y EMBALSES 1946-54, EMBALSE TIMBA (CAUCA: RULE CURVE AND STORAGE 1946-54, TIMBA RESERVOIR)

(EMBALSE - MILLONES DE METROS CUBICOS)
(STORAGE - MILLIONS OF CUBIC METERS)



NOTA. PARA CONTROL DE INUNDACIONES POR EMBALSE TIMBA SOLAMENTE
(NOTE FOR CONTROL OF FLOODS BY TIMBA RESERVOIR ALONE)

COLOMBIA: AREA Y CAPACIDAD - EMBALSE TIMBA (CAUCA: AREA AND CAPACITY - TIMBA RESERVOIR)



TABULATION OF DATA FOR PROPOSED SALVAJINA PROJECTS

<u>Physical Data</u>	<u>"High"</u>	<u>"Low"</u>
Height of dam	150 m	112.5 m
High water elevation	1,175 m	1,137.5 m
Maximum drawdown elevation	1,090 m	1,093 m
Tailwater elevation	1,025 m	1,026 m
Gross storage	1,126 M/CuM	456 M/CuM
Dead storage	76 M/CuM	84 M/CuM
Effective storage	1,050 M/CuM	372 M/CuM
Flooded area	2,500 ha.	1,350 ha.
Minimum power head	65 m	67 m
Type of dam	concrete gravity	rock fill
Installed capacity	220,000 KW	122,500 KW
Estimated cost of project	Ps. (1,000) 200,000	50,000
 <u>Power Calculations</u>		
Power Release during floods	125 CuM/S	
Average annual generation - 60% LF	897 M/KWH	625 M/KWH
Minimum monthly output	50,000 KW con- tinuous	50,000 Kw con- tinuous
Required output 60% LF	132,000 "	73,500 "
Required annual generation	1,157 M/KWH	645 M/KWH
Steam plant capacity required	85,000 KW	25,000 KW
Average annual steam generation required	260 M/KWH	20 M/KWH
Estimated cost of standby steam plant	Ps. (1,000) 50,000	15,000
 <u>Cost of Hydro Power</u>		
Annual fixed charges hydro-10%	Ps. (1,000) 20,000	5,000
Operation and maintenance hydro		
Ps. 6KW/yr	" 1,320	735
Annual cost of hydro generation	" 21,320	5,735
Cost of hydro power	2.38 ctv/KWH	0.2 ctv/KWH
 <u>Cost of Firm Power including Steam Standby</u>		
Annual charges on hydro as above	Ps. (1,000) 21,320	5,735
Annual fixed charges on steam 12%	" " 6,120	1,800
Operation & maintenance on steam		
Ps. 15KW/yr	" 1,275	375
Fuel - coal at 1.0 ctv/KWH	" 2,600	200
Annual cost of firm power	" 31,315	8,110
Cost of firm power	2.70 ctv/KWH	1.26 ctv/KWH

FLOOD CONTROL AND POWER STUDY
FOR COMBINED SALVAJINA AND TIMBA PROJECTS

The two preceding charts show guide or rule curves for accumulating storage of water in Salvajina and Timba reservoirs during the flood season. The flood control objective was to reduce the flow downstream to about 570 cubic meters per second at Juanchito. This represents a bank full stage and is considered about the maximum which, with assistance of some low levees, can be confined to the channel.

Continuous stream flow records - except for a few breaks - are available for three critical points, at Suarez near Salvajina, at La Balsa near Timba, and at Juanchito, for the period 1946-1954. The reservoir levels and capacities used in the study are as follows:

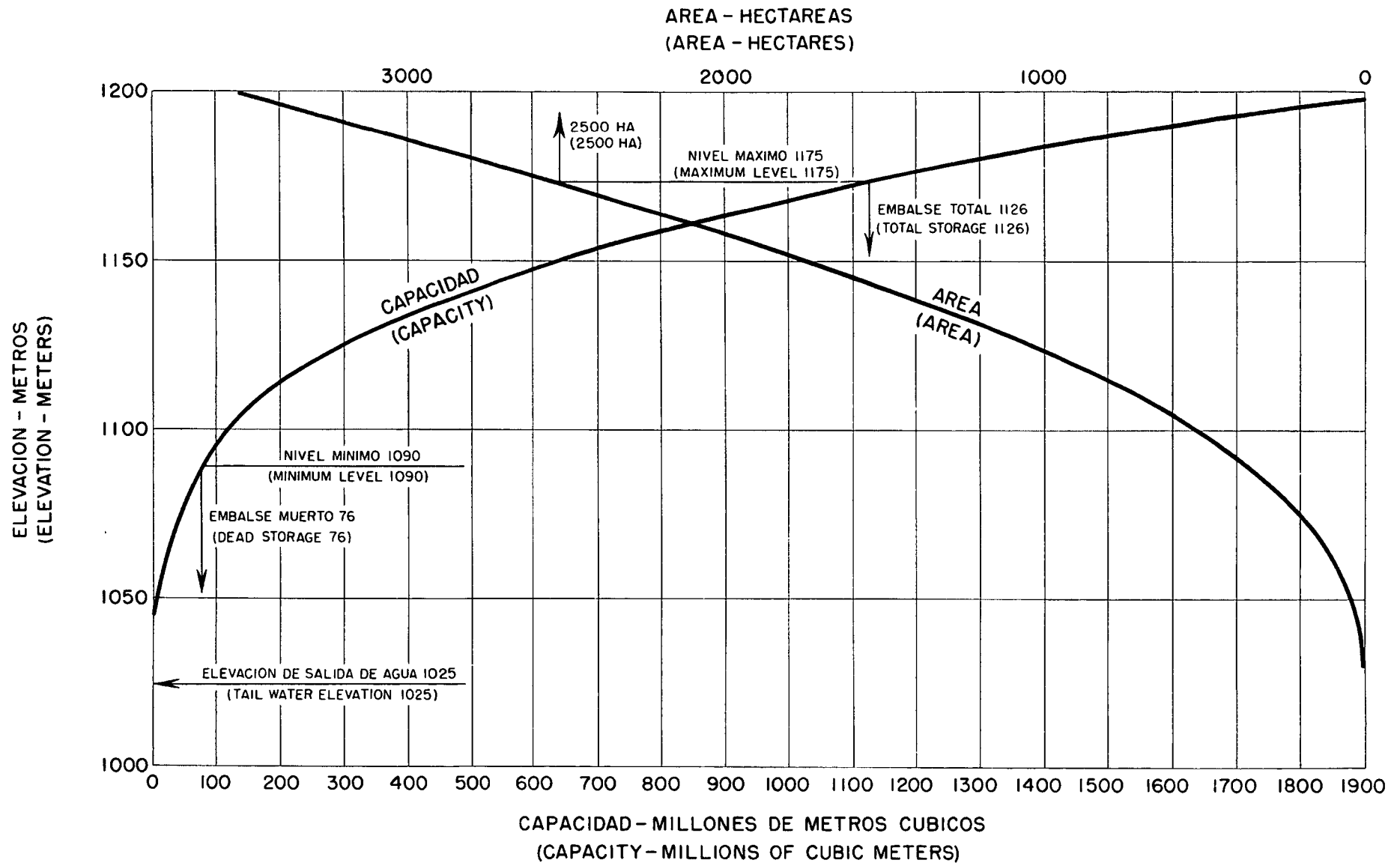
Salvajina:	Minimum elevation	1,090 m
	Maximum elevation	1,175 m
	Effective storage	1,050 M/CuM
Timba:	Minimum elevation	1,000 m
	Maximum elevation	1,027 m
	Effective storage	694 M/CuM

The seasonal guide for Salvajina shown by the solid line on the reservoir elevation curve has control elevations as follows:

<u>Date</u>	<u>Elevation</u>
Sept. 30	1,131.5 m
Oct. 31	1,090 "
Jan. 15	1,135 "
June 15	1,174 "

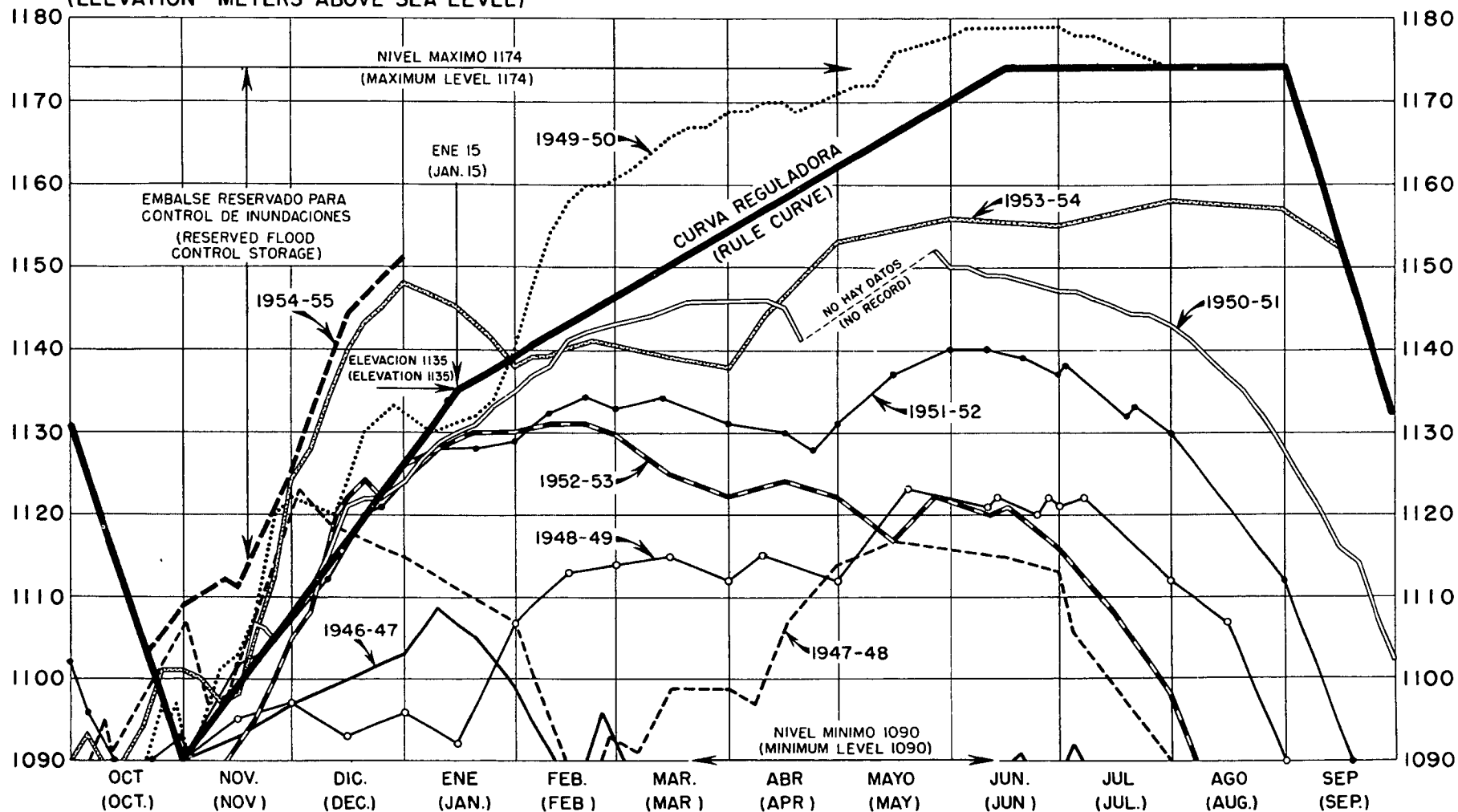
The flood operating guide shown as a solid line on the chart for Salvajina requires storing above the seasonal guide of all inflow in excess of 204 cubic meters per second, and of releasing storage to lower the water level to the seasonal guide, or attempting to do so, at the same outflow rate.

COLOMBIA: AREA Y CAPACIDAD - EMBALSE SALVAJINA (CAUCA: AREA AND CAPACITY - SALVAJINA RESERVOIR)



COLOMBIA: CURVA REGULADORA Y ELEVACIONES 1946-54, EMBALSE SALVAJINA (CAUCA: RULE CURVE AND 1946-54 ELEVATIONS, SALVAJINA RESERVOIR)

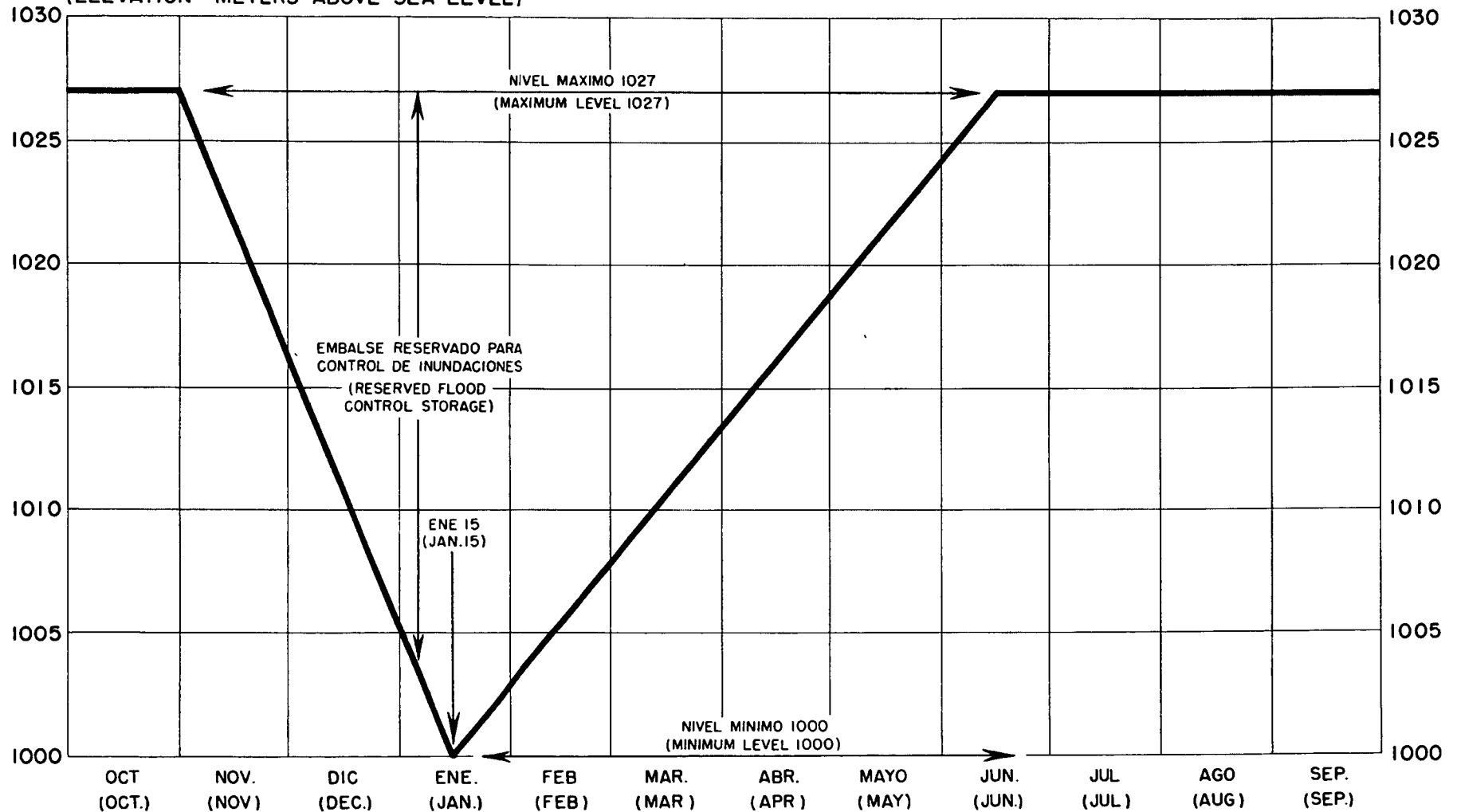
(ELEVACION - METROS SOBRE EL NIVEL DEL MAR)
(ELEVATION - METERS ABOVE SEA LEVEL)



NOTA: PARA CONTROL DE INUNDACIONES CONJUNTAMENTE CON EMBALSE TIMBA
(NOTE: FOR CONTROL OF FLOODS IN CONJUNCTION WITH TIMBA RESERVOIR)

COLOMBIA: CURVA REGULADORA - EMBALSE TIMBA (CAUCA: RULE CURVE - TIMBA RESERVOIR)

(ELEVACION - METROS SOBRE EL NIVEL DEL MAR)
(ELEVATION - METERS ABOVE SEA LEVEL)



NOTA PARA CONTROL DE INUNDACIONES CONJUNTAMENTE CON EMBALSE SALVAJINA
(NOTE FOR CONTROL OF FLOODS IN CONJUNCTION WITH SALVAJINA RESERVOIR)

The seasonal guide for Timba as shown by the solid line on the Timba reservoir elevation chart has control elevations as follows:

<u>Date</u>	<u>Elevation</u>
Sept. 30	1,027 m
Oct. 31	1,027 "
Jan. 15	1,000 "
June 15	1,027 "

The flood operating guide for Timba requires that water be stored there to prevent the flow at Juanchito from exceeding 589 CuM/S, and released to lower the reservoir to the seasonal rule curve level as soon as possible.

The 1950 flood was the greatest of modern record. According to a simple volume calculation, the two proposed reservoirs would have had sufficient storage capacity to reduce the flow at Juanchito to 570 CuM/S. Actually such perfection in operation cannot be attained. The flood control rule outlined above would have reduced the maximum peak flow at Juanchito to 589 CuM/S.

In no other year of record would either reservoir have nearly filled. The monthly level of Salvajina for the nine years of record is shown by dotted lines on the reservoir elevation chart, under the assumption that a release for power sufficient to generate 144,000 continuous Kw (240,000 Kw peak at 60% load factor) would be maintained when possible.

A parallel study (details not shown) was made for Salvajina and Timba under the assumption that the minimum storage elevation in Salvajina would be raised from 1,090 meters to 1,125 m. This would afford 35m. more head for power during low flow periods, but reduce the effective flood storage from 1,050 M/CuM to 824 M/CuM or about 21%. The result was that the maximum flow at Juanchito during a maximum flood would have been increased from 589 CuM/S to 602 CuM/S, and the average annual power output would have been increased from 805 million KWH per annum to 918 KWH per annum.

THE COSTS AND BENEFITS OF FLOOD PROTECTION

Costs

The mission has used the "alternate cost" method of allocating costs, under which no service provided by a multi-purpose project should cost more than it would if provided by an efficient alternative single-purpose project. There is an available single-purpose hydro project (Calima) capable of delivering firm power at a cost of 1.90 centavos per KWH from an installation of 72,000 KW, and at 1.62 ctv/KWH from an installation of 144,000 KW. The capital costs allocated to power in the multi-purpose projects must therefore be such that power can be generated at similar costs for projects of comparable size.

The mission's computations allocating costs are shown below:

Timba High Dam

	<u>Installed Capacity</u> KW	<u>Average Annual Generation 60% LF</u> M/KWH
Hydro	75,000	430
Steam: standy-by to firm hydro power (25,000 KW)	_____	52
Total power	<u>75,000</u>	<u>482</u>
		<u>Ps. (thousands)</u>
Allocated to: flood protection & irrigation power: hydro	56,610	88,390
steam	<u>15,000</u>	<u>71,610</u>
Total cost		<u>160,000</u>

Cost of firm power

Hydro: annual fixed charges 10%	5,661	
operation & maintenance Ps. 6 KW/yr	<u>450</u>	6,111
Steam: annual fixed charges 12%	1,800	
operation & maintenance Ps. 15 KW/yr	375	
fuel: coal at 1 ctv/KWH	<u>520</u>	<u>2,695</u>
Annual cost of power		8,806
Credit for secondary power (88 million KWH at 1.5 ctv/KWH)		<u>1,320</u>
Annual cost of firm power (394 million KWH)		<u>7,486</u>
		1.90 ctv/KWH

Timba Low Dam

	<u>Installed Capacity</u> KW	<u>Average Annual Generation 60% LF</u> M/KWH
Hydro	75,000	376
Steam: stand-by to firm hydro power (25,000 KW)	<u> </u>	<u>62</u>
Total power	<u>75,000</u>	<u>438</u>
		Ps. (thousands)
Allocated to: flood protection & irrigation		60,990
power: hydro	49,010	
steam	<u>15,000</u>	<u>64,010</u>
		<u>125,000</u>
 <u>Cost of firm power</u>		
Hydro: annual fixed charges 10%	4,901	
operation & maintenance Ps.6 KW/yr.	<u>450</u>	5,351
Steam: annual fixed charges 12%	1,800	
operation & maintenance Ps.15 KW/yr.	375	
fuel: coal at 1 ctv/KWH	<u>620</u>	<u>2,795</u>
Annual cost of power		8,146
Credit for secondary power (44 M/KWH at 1.5 ctv/KWH)		660
Annual cost of firm power(394 M/KWH)		<u>7,486</u>
Cost of firm power		1.90 ctv/KWH

Salvajina High Dam

	<u>Installed Capacity</u> KW	<u>Average Annual Generation 60% LF</u> M/KWH
Hydro	220,000	897
Steam stand-by for firm power (85,000 KW)	<u> </u>	<u>260</u>
Total firm power	<u>220,000</u>	<u>1,157</u>
	<u>Ps. (thousands)</u>	
Allocated to:		
flood protection and irrigation		125,716
power: hydro	74,284	
steam	<u>50,000</u>	<u>124,284</u>
Total cost		250,000
<u>Cost of firm power</u>		
Hydro: annual fixed charges 10% operation & maintenance Ps. 6 KW/yr.	7,428 <u>1,320</u>	8,748
Steam: annual fixed charges 12% operation & maintenance Ps. 15 KW/yr. fuel: coal at 1 ctv/KWH	6,120 1,275 <u>2,600</u>	9,995
Annual cost of firm power		<u>18,743</u>
Cost of firm power		1.62 ctv/KWH

Benefits

The engineering studies are in the preliminary stage and any estimate of the benefits of water management works is still necessarily very tentative. The estimates given below do not pretend to be a justification of flood protection; they serve only as a demonstration of the method by which such benefits can be estimated.

Four cases have been distinguished, and the returns in each of these cases have been compared with the estimated return under present conditions.

Case A. There is flood protection, but the farmers have not changed their land-use or their crop pattern, nor have they improved their techniques. The benefits of the flood protection works result solely from the elimination of frequent damage to pastures and crops by annual floods.

Case B. The farmers have not changed land-use or crop pattern, but they have improved their techniques.

Case C. The farmers have adjusted the use of their land and their crop pattern to the new situation; there is less pasture and more crop land. They have, however, not yet introduced improved techniques.

Case D. The farmers have adjusted land-use and crop pattern, and have adopted improved techniques.

TABLE 1

GROSS BENEFITS OF FLOOD PROTECTION

Present Crop Pattern		<u>Without Flood Protection</u>		<u>With Flood Protection A</u>	
		Gross Return per ha/yr	Total Gross per year	Gross Return per ha/yr	Total Gross per year
		(Pesos)		(Pesos)	
Pasture	800 ha	200	160,000	300	240,000
Corn	100	820	82,000	1,600	160,000
Pulses	100	1,160	116,000	2,300	230,000
Total	1,000 ha		358,000		630,000
Average Gross Return per ha/yr			358		630
		<u>With Flood Protection B</u>		<u>With Flood Protection C</u>	
		Gross Return per ha/yr	Total Gross per year	Gross Return per ha/yr	Total Gross per year
		(Pesos)		(Pesos)	
Pasture	800 ha	400	320,000	300	150,000
Corn	100	1,800	180,000	1,000	120,000
Pulses	100	2,400	240,000	1,600	192,000
Total	1,000 ha		740,000		420,000
Average Gross Return per ha/yr			740		420
		<u>With Flood Protection C</u>		<u>With Flood Protection D</u>	
		Gross Return per ha/yr	Total Gross per year	Gross Return per ha/yr	Total Gross per year
		(Pesos)		(Pesos)	
Pasture	500 ha	300	150,000	400	200,000
Cane	120	1,000	120,000	1,100	132,000
Corn	120	1,600	192,000	1,800	216,000
Pulses	100	2,200	220,000	2,400	240,000
Platanos	80	2,300	184,000	2,700	216,000
Fruits	80	4,000	320,000	5,000	400,000
Total	1,000 ha		1,186,000		1,404,000
Average Gross Return per ha/yr			1,186		1,404

In Case D the gross return is about four times the original figure, mainly because it is assumed that much land will be transformed from extensive pasturing to intensive cultivation. It is further supposed that the natural water supply in this area, close to the river, is so good that there will always be water for two crops per year.

The net benefit can be estimated by deducting from the increase in net returns the expected increase in costs of production. In Case B there will be hardly any extra costs, but they will be considerable in cases C and D.

The tentative estimate of benefits is summarized below:

	Average Annual Returns per Hectare (Pesos)			Net Benefits of Flood Protection
	Gross Returns	Cultivation Costs	Net Returns	
Without flood protection	360	100	260	
With flood protection:				
a) no change in land-use				
1) no improvement in practices	630	150	480	220
2) with improvement in practices	740	200	540	280
b) more cropping, less pasture				
1) no improvement in practices	1,190	450	740	480
2) with improvement in practices	1,400	550	850	590

Benefits in Relation to Costs

The principal benefit of flood protection is the increase of agricultural output thereby made possible. The potential net increase of output will vary with the degree of flood protection provided, because the area benefited will increase and the risk of crop losses will decrease, as flood protection becomes more complete. Net increase of output is related to the cost of the corresponding degree of flood protection, and can be expressed as a percentage of that cost. The computations are illustrated below:

	Timba			Salvajina
	Low	Low with Channel Improvement	High	Plus Timba Low
Floods per 20 years	4	2	1	none
<u>Area flooded (hectares)</u>				
No protection	57,000	70,000	85,000	85,000
With protection	20,000	15,000	10,000	nil
<u>Cost (Ps. million)</u> ^{a/}				
Allocated cost of dam	51.0	51.0	78.4	125.7
Additional works	10.0 ^{b/}	25.0 ^{c/}	10.0 ^{b/}	61.0 ^{d/}
Total	61.0	76.0	88.4	186.7
<u>Benefits (Ps. million)</u> ^{e/}				
With unchanged cultivation	13.8	14.6	14.8	15.0
With intensive cultivation	44.0	45.5	46.1	46.4
<u>Cost-Benefit Ratio</u>				
With unchanged cultivation	23%	19%	17%	8%
With intensive cultivation	72%	60%	52%	25%
<u>Marginal Cost-Benefit Ratio</u> ^{f/}				
With unchanged cultivation		5%	2%	0.02%
With intensive cultivation		10%	5%	0.03%

^{a/} With Ps. 10 million arbitrarily allocated to irrigation.

^{b/} Levees only, unchanged river flow.

^{c/} Channel improvements to increase river flow to about 850 Cu.M/S.

^{d/} Timba low dam and levees.

^{e/} For computation, see next Table.

^{f/} Ratio between additional benefit gained by increasing flood protection one stage, and the cost of doing so.

	<u>Timba</u>			<u>Salvajina plus Timba Low</u>
	<u>Low</u>	<u>Low with Channel Improvement</u>	<u>High</u>	
	(Ps. million)			
<u>Net Annual Returns</u>				
(a) Without flood protection ^{a/}	25.81	25.81	25.81	25.81
(b) With flood protection				
(i) Unchanged cultivation				
net returns when no flood				
(85,000 ha, 480 Ps/ha)	40.80	40.80	40.80	40.80
Annual rate of flood losses ^{b/}	<u>1.16</u>	<u>0.44</u>	<u>0.15</u>	<u>nil</u>
	39.64	40.36	40.65	40.80
Total annual benefits ^{c/}	13.83	14.55	14.84	14.99
(ii) Intensive cultivation				
net return when no flood				
(85,000 ha, 850 Ps/ha)	72.25	72.25	72.25	72.25
Annual rate of flood losses ^{b/}	<u>2.44</u>	<u>0.92</u>	<u>0.31</u>	<u>nil</u>
	69.81	71.33	71.94	72.25
Total annual benefits ^{c/}	44.00	45.52	46.13	46.44

^{a/} See next Table.

^{b/} One-half of one year's net returns, plus one-third of cultivation costs (expenditures made to prepare the land, without resulting crop), calculated on area liable to flood and frequency of flood risk under the postulated degree of protection.

^{c/} Net return minus flood losses minus net return without flood protection.

AVERAGE ANNUAL OUTPUT WITHOUT FLOOD PROTECTION

(Ps. million)

1. Zone of frequent flooding: 57,000 ha, 260 Ps/ha Annual rate of loss when land severely flooded throughout year, once in 10 years. <u>a/</u>	14.82	
	<u>1.86</u>	12.96
2. Zone of infrequent flooding (once in 10 years) net return when no flood: 13,000 ha, 480 Ps/ha Annual rate of loss due to flood once in 10 years: 13,000 ha, 290 Ps/ha. <u>b/</u>	6.24	
	<u>0.38</u>	5.86
3. Zone of rare floods (once in 20 yeaes) net return when no flood: 15,000 ha, 480 Ps/ha Annual rate of loss due to flood once in 20 years: 15,000 ha, 290 Ps/ha. <u>b/</u>	7.20	
	<u>0.21</u>	<u>6.99</u>
		25.81
		<u> </u>

a/ Loss when flooded, full year's net return plus two-thirds of cultivation costs.

b/ Loss when flooded, half of one year's net returns plus one-third of cultivation costs.

Actual approximate operating cost for standard trucks on unimproved roads.^{a/}

	<u>Pesos</u>
Purchase price ex-dealer	23,000
Resale value after 150,000 Km	<u>6,000</u>
Net depreciation over 150,000 Km	<u>17,000</u>
<u>Operating cost per Km</u>	
	<u>Centavos</u>
Depreciation: Ps. 17,000 over 150,000 Km	11
Fuel : 10 Km per gallon at P. 0.62	6
Lubricants : 2 1/2 gallons at Ps. 7.50 every 1,000 Km + 10% for grease, etc.	2
Tires & tubes: 1 set at Ps. 2,750 every 20,000 Km	14
Drivers' and helpers' salary: Ps. 350 + 150 per month, annual average mileage, 35,000 Km	17
Repairs : Ps. 3,000 per year	9
Insurance and license fees : Ps. 1,000 per year	<u>3</u>
	62
10% interest per annum on investment in truck: Ps. 2,300 over 35,000 Km	<u>6</u>
Operating cost per Km	<u>68</u>
(68)	
Operating cost per ton-Km (6.5)	<u>10</u>

^{a/} 6 1/2 ton capacity, Ford, Chevrolet, International

Approximate operating cost for standard trucks
assuming paved roads^{a/}

	<u>Pesos</u>
Purchase price ex-dealer	23,000
Resale value after 300,000 Km	<u>6,000</u>
	<u>17,000</u>
<u>Operating cost per Km</u>	
	<u>Centavos</u>
Depreciation: Ps. 17,000 over 300,000 Km	6
Fuel : 15 Km per gallon at P. 0.62	4
Lubricants : 2 1/2 gallons at Ps. 7.50 every 1,000 Km + 10% for grease, etc.	2
Tires and tubes: 1 set at Ps. 2,750 every 40,000 Km	7
Drivers' and helpers' salary: Ps. 350 + 150 per month, annual average mileage 55,000 Km	11
Repairs : Ps. 2,000 per year	4
Insurance and license fees : Ps. 1,000 per year	<u>2</u>
	36
10% interest per annum on investment in truck:	
Ps. 2,300 over 55,000 Km	<u>4</u>
Operating cost per Km	<u>40</u>
Operating cost per ton-Km $\frac{(40)}{(6.5)}$	<u>6</u>

a/ 6 1/2 ton capacity, Ford, Chevrolet, International

Estimate of funds available in 1956 for road construction and rehabilitation in the three
Departments, assuming a gasoline tax of 10, 7, and 5 centavos per gallon respectively

(Ps. million)

	A.				B.				C.			
	10 centavos per gallon:				7 centavos per gallon:				5 centavos per gallon:			
	Valle	Caldas	Cauca	Total	Valle	Caldas	Cauca	Total	Valle	Caldas	Cauca	Total
Total revenues from gasoline tax	4.50	2.00	0.50	7.00	3.15	1.40	0.35	4.90	2.25	1.00	0.25	3.50
Adjustment for 10% allocation to Cauca	<u>-0.45</u>	<u>-0.20</u>	<u>0.65</u>	<u>-</u>	<u>-0.32</u>	<u>-0.14</u>	<u>0.46</u>	<u>-</u>	<u>-0.23</u>	<u>-0.10</u>	<u>0.33</u>	<u>-</u>
Balance available	4.05	1.80	1.15	7.00	2.83	1.26	0.81	4.90	2.02	0.90	0.58	3.50
Available from ordinary Departmental revenues (1955 budgets)	<u>6.50</u>	<u>2.90</u>	<u>0.60</u>	<u>10.00</u>	<u>6.50</u>	<u>2.90</u>	<u>0.60</u>	<u>10.00</u>	<u>6.50</u>	<u>2.90</u>	<u>0.60</u>	<u>10.00</u>
Total available for construction and rehabilitation	<u>10.55</u>	<u>4.70</u>	<u>1.75</u>	<u>17.00</u>	<u>9.33</u>	<u>4.16</u>	<u>1.41</u>	<u>14.90</u>	<u>8.52</u>	<u>3.80</u>	<u>1.18</u>	<u>13.50</u>
% increase in available funds resulting from gasoline tax	62%	62%	192%	70%	49%	44%	135%	49%	31%	31%	97%	35%