



UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT
U.S.A.I.D. Mission to Northeast Brazil

Praça do Apolo 243, Caixa Postal 2365
Recife, Pernambuco, Brazil.



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April 13, 1966

Mr. Karl Kohler LA/CD
2252 NS (AID)
Department of State
Washington, D.C. 20523

Dear Karl:

In case you haven't seen Jack Sparks' report, I am enclosing same. It is a useful paper.

All the best,

Cordially,

Donor M. Lien
Associate Director
USAID/Brazil

Encl.

REPORT
ON
WATER RESOURCES PROGRAM
BRAZIL
by

Jack L. Sparks
Water Resources Engineer, Planning
January 31, 1966

I. GENERAL INTRODUCTION

The promotion of economic and social development in Brazil has in the past and continues to depend in a large measure upon the investigation and use of Brazil's abundant land and water resources as well as other natural resources. Progress in recent years has been rapid and there is reason to anticipate continuing acceleration of development. This in itself creates new problems and requires rapid progress in technical know how, in institutional capacity to manage planning and development and in coordination and cooperation.

Until now most development has been on a state by state or on a regional basis. However, the rapid development of power facilities, the urgent demands for increased food and other agricultural production and the resources required for an expanding industrial development make it imperative that both studies and development be approached in the future on a much broader basis leading to national planning and coordination.

Any program for the development of Brazil's water resources and the land relative thereto will be very complex and will involve the coordination, cooperation and services of a number of different Brazilian Ministries, agencies, and

organizations who are either directly or indirectly responsible for their development. This complexity was recognized in the "Programa de Ação Econômica do Governo, 1964-1966", published by the Ministry of Planning in November 1964. This document does, however, consider to a limited degree their importance and plans that their development will be implemented through a number of sectors of the Plan. The most important of these sectors relative to water and land resources are:

1. Agriculture
2. Infrastructure-Electric Energy, Transportation and Communications
3. Industrialization
4. Natural Resources-Hydrology and Soils

Since there is no central organization responsible for planning and development of the land and water resources, the only plans that may have any validity are those prepared by the various regional organizations which are charged through various governmental decrees and orders with their development within a given area or national agencies with plans limited to specific projects or activities. The most important of these are:

1. SUDENE (Superintendency for the Development of the Northeast)
2. DNOCS (National Department for Works Against Droughts)
3. CVSF (São Francisco Valley Commission)
4. COM. SUDOESTE
5. CHESF (São Francisco Hydro-Electric Company)
6. CIVAT (Inter-State Commission for the Araguaia-Tocantins Valley)
7. DIVISAO DE AGUAS, MIN- M. & E. (Water Division)
8. DNOS (National Department of Sanitation)

A. Objectives

All plans of the various agencies do have, to a limited degree, the same general objective: "The development of Brazil's water resources and lands relative thereto in an effective and orderly manner to help build a better economy in Brazil." Each plan, however, varies and is tailored to the traditions and immediate objectives.

B. Basis of Plan

The national plan is very vague as to what and how objectives are to be accomplished. As an example, in the Electric Energy sector the program 1965|1970 is for development of over 7,000,000 kilowatts, while in the Hydrologic Resources sector figures of 17,000,000 KW are quoted, but neither sector gives details as to the use of water for power generation.

Under the Agriculture sector, irrigation and hydraulic energy are mentioned but no details given on the use of water.

The agencies mentioned above have made some basic plans, most of which are vague as to details on the goals and implementation.

C. Criticism

1. The national plan does not recognize water as one of the most important resources that Brazil possesses and that it should be dealt with as a single item. By having a single nation-wide coordinated program, many of the complexities which now exist can be minimized and handled as sub-activities.

2. The objective of as stated above is sound, but should be spelled out.

Report on Water Resources Program

3. There is no national plan for water resources development.

The main contributing factor is that there is no one agency or even ministry responsible for a national program. Each of the agencies mentioned above with the possible exception of the Divisão de Águas and DNOS, have developed their plans independently of each other. It is realized that the plans of SUDENE, DNOCS, CVSF, and CHESF should all be coordinated, but they are not.

D. Recommendations

It has already been stated that any program for the development of Brazil's water resources and the land relative thereto will be very complex and will involve the coordination, cooperation and services of a number of different ministries, agencies and organizations, both governmental and private, which are presently at work in the field of land and water resources development. In the absence of 1) a nation-wide program for their development, and 2) a single Brazilian entity with which to work, it is recommended that the plans of the agencies listed above be analyzed and used as a guide in the preparation of a nation-wide plan. The development of a total coordinated plan would be greatly facilitated if one Brazilian agency were responsible.

USAID could assist Brazil in the development of this entity, by strengthening existing agencies and developing a coordinating mechanism in which one would have the principal role. This will be one of the primary goals and can be achieved through a sound program of institutional development.

II. METHODS

A. Administration

1. General

A policy statement by the Federal Government with regard to administration of a nation-wide water resources development program necessary to clarify the situation. The program should for optimum efficiency be administered by one central agency of the Federal Government and in this statement the role to be taken by those Federal, Regional, State and local agencies and private organizations should be spelled out, especially with respect to:

- a) Long range planning;
- b) Collection, interpretation and publication of basic data;
- c) Preliminary and reconnaissance investigation of basic data;
- d) Pre-construction surveys and designs;
- e) Construction;
- f) Operation and maintenance of constructed facilities;

At the present time there is no single agency or ministry of the Brazilian Government that has the technical knowledge, man-power, or the facilities to plan and implement a nation-wide program for water resources development.

2. Creation of a Water Resources Council

In the absence of a single Brazilian entity to take the leading role in the development of a nation-wide Water Resources Program, it may be necessary to create a Water Resources Council to coordinate the activities and efforts of the various organizations, both government and private, presently working

in the field of water resources development. The final construction of this council will depend upon many factors which are unknown at this time. Because a number of Ministries are already involved, it may be desirable to have each appoint a member to the council. Ministries presently involved are:

- a. Ministry of Agriculture
- b. Ministry of Mines & Energy
- c. Ministry of Planning and Economic Coordination
- d. Ministry of Transportation and Public Works
- e. Ministry of Coordination of Regional Organizations (Interior)
- f. Ministry of the Navy

3. Training of Personnel

There is a definite need to train more people in the various technical and skilled fields as related to water resources development. There is a great lack of technicians for carrying out planning and preliminary investigations and for the collection and interpretation of basic data. Without good, reliable basic data, and the technical know-how of making efficient use of it in the performance of planning and preliminary investigation, there can be no firm basis for detailed designs and surveys and construction.

A second problem is the lack of skilled personnel to operate and maintain the facilities after they are constructed. A sound training program in operation and maintenance is a must. It can be carried out in a number of different ways depending upon the needs of the program.

4. Laws and Regulations

The present laws and regulations governing water resources development should be studied and as the program develops it may be necessary to change the laws and regulations to meet the modern needs and to take advantages of new techniques.

III. FOREIGN ASSISTANCE

A. Countries and Agencies

There are many foreign countries and agencies working in Brazil in the field of water resources. Listed below are those presently known to USAID|Brazil and it is felt that there are others that are not known. However, it should be stated that every effort is being made by USAID|Brazil to prevent any duplication of efforts which would reduce the efficiency of the Brazilian agencies involved. USAID|Brazil has expressed its willingness on numerous occasions to cooperate with any free world group.

The known foreign countries and agencies other than USAID and the Alliance for Progress are:

1. France
2. West Germany
3. Italy
4. Israel
5. United Nations, both FAO and Special Fund
6. CAS
7. IBRD
8. IDB

In addition to the above, offers have been made by Portugal, Spain, Japan, Russia and Czechoslovakia.

B. Form of Assistance

1. France is providing technical assistance to SUDENE on a comprehensive investigation of the Jaguaribe River Basin and is providing technical assistance in the field of hydrology to CIVAT. France also has a participant training program.

2. West Germany is furnishing technical assistance in hydrology and hydro-electric development to the German colony group in the State of Rio Grande do Sul, financial assistance to SUDENE in the field of meteorology and has offered technical assistance in hydrology, hydro-electric development, flood control and navigation and in training of Brazilians in these activities.

3. Italy is providing technical assistance to an Italian group in Rio Grande do Sul in water and land resources development.

4. Israel is providing some technical assistance. The type of assistance and who is receiving it is not known.

5. The United Nations is providing technical assistance through FAO and the Special Fund to SUDENE on irrigation development on the Lower Middle reaches of the São Francisco Valley. Technical assistance is being furnished through the Special Fund to Electrobras and the States of Minas Gerais, São Paulo, Rio de Janeiro and Guanabara on hydro-electric development. (Note: The UN is furnishing other assistance; details not fully known).

6. Details of the OAS assistance are not fully known.
7. Details on IBRD assistance are not fully known.
8. Details on IDB assistance are not fully known.

Details relative to the others made by Portugal, Spain, Japan, Russia and Czechoslovakia are not known. It is known, however, that technical assistance and some participant training has been offered by all five. In late 1963 and early 1964 both Russia and Czechoslovakia offered assistance in the field of hydro-electric development.

IV. U.S. PROGRAM

A. General

The Water Resources program for Brazil as visualized by USAID|Brazil could and probably should be divided into a number of sub-activities with each having its own goals and at the same time being an integral part of an over-all program. It would be very difficult to include them in one over-all descriptive statement; therefore to provide a clear picture of the water resources program, each sub-activity is listed below.

1. Collection of basic data
 - a) Hydrologic
 - b) Meteorologic
2. River basin studies for multi-purpose use of the land and water resources.
3. Hydrogeology and well rehabilitation and testing.
4. Irrigation development, primarily in the Northeast area, utilizing existing facilities.
5. Construction of small water impounding structures (Small Dams).

B. Present Activities

As the result of requests from various Brazilian agencies and organizations for assistance in the planning, studying and development of Brazil's water resources and the lands relative thereto USAID and Brazil have entered into agreements to provide technical and financial assistance for the following programs:

<u>PROJECT</u>	<u>ProAg Approval Date</u>
1. Piranhas River Basin Study	September 8, 1962
2. Rio Grande Basin Study	July 25, 1963
3. Hydrologic Data	July 25, 1963
4. Rio Acaraú Basin Study	September 4, 1963
5. Rio Moxotó Basin Study	September 4, 1963
6. Technical Assistance-Irrigation Development	September 20, 1963
7. Meteorology	October 10, 1963
8. São Francisco River Basin	March 12, 1964
9. Pre-Reconnaissance Survey of the Araguaia-Tocantins River Basin	(PIO/T not ProAg) April 20, 1964
10. Hydrogeology (Groundwater) Studies	April 30, 1964
11. Northeast River Basin Studies	May 22, 1964
12. Well Rehabilitation & Testing	May 30, 1964
13. Small Dams for Drought Relief-Bahia	December 22, 1964
14. Expansion of Well Drilling Facilities Bahia-ECOSAMA	February 2, 1966

A resumé of each project is given below:

P R O J E C T1. PIRANHAS RIVER BASIN STUDY

In addition to the ProAg which was signed on September 8, 1962, a PIO|T was also prepared and approved. This PIO|T enabled the Water Resources Branch to obtain the services of a team of four technicians from the Bureau of Reclamation to make a preliminary study of the Piranhas River Basin. A report of this project is in the files of the Water Resources Branch. In addition, a study of the Piranha dam was made by an expert from the Bureau of Reclamation Chief Engineer's office in Denver. His report is also in the files of the Water Resources Branch. The reports made by the Bureau of Reclamation have been accepted by SUDENE and DNCOS and plans are being made to implement some of the recommendations made by the above mentioned experts.

2. RIO GRANDE RIVER BASIN STUDY

The ProAg for this project was signed on July 25, 1963. It calls for a reconnaissance survey of the Rio Grande River Basin which is a tributary of the São Francisco River Basin. The executing Brazilian agency was CVSF. A PIO|T was prepared and thru this PIO|T the services of six DuRec technicians was obtained. These technicians arrived in Brazil the first of January 1964 and completed their study on April 6, 1964. The information obtained while in Brazil was taken back to the United States and a report covering their findings and recommendations was made. This report is in the files of the Water Resources Branch. The information obtained by this group is being used and will be made a part of the overall plan for the São Francisco Valley.

3. HYDROLOGIC DATA PROGRAM

The ProAg for this project was approved on July 25, 1963. This project was primarily aimed at developing a program for the collection of Hydrologic Data namely, streamflow and rainfall information throughout the Polygon area. A PIO/T was prepared and thru this PIO/T the services of three USGS technicians were to be obtained to carry out the plan as stated in the ProAg and in the PIO/T; however, because of recruitment difficulties by the USGS only two full time USGS technicians were made available and one TDY. In addition to the PIO/T, a PIO/C was prepared in which US dollar funds were made available for the purchase of certain scientific equipment such as: stream gage recorders, rain gage recorders, and other equipment necessary for the collection of hydrologic data. This program was being implemented through the Hydrologic Division of SUDENE. However, during the past year the functions of the Division are being shifted to the Divisão de Águas which has the responsibility for the use of water throughout Brazil. A hydrologic Data Program is being developed on a National scale and will replace the present program.

One of the major problems facing the program has been the lack of SUDENE's interest in the installation of the equipment purchased by the PIO/C. As of this writing it is estimated that there are still more than sixty thousand dollars worth of equipment in SUDENE's warehouse that has not been installed.

One other phase of the program being carried out is the compilation and interpretation of back rainfall and streamflow information. This information is being placed on IBM cards and will be published for the use of all agencies in

Northeast Brazil. It is hoped that this part of the program will be finished by July 1, 1966 and that the publications will be made available shortly thereafter.

The present time Mr. Robert Martin, USGS Surface Water Engineer, can furnish the background on this particular project.

4. & 5. RIO ACARAÚ & RIO MOXOTÓ BASIN STUDY

The ProAg for these projects were signed on September 4, 1963. These two projects along with the São Francisco River Valley project and the Technical Assistance-Irrigation Development project were made a part of a PASA with the Bureau of Reclamation which was signed in June 1964. However, because of certain difficulties in recruitment of personnel as related to the time element for the Rio Acaraú and Rio Moxotó studies the funds amounting to a total of \$84,000 dollars, \$42,000 for each project were lost to the PASA. These two river basins are under the jurisdiction of DNOCS and may be studied at a later date for the utilization of the waters presently stored within the boundaries of the basins. No plans at this time are being made by USAID to either furnish technical or financial assistance for these two projects.

6. TECHNICAL ASSISTANCE-IRRIGATION DEVELOPMENT

A ProAg for this project was approved on September 20, 1963. The purpose of this project was to furnish technical assistance to a joint work group to be developed and established within DNOCS. The technicians were to be made available to the work group from SUDENE and DNOCS. A PIO/T was prepared for this project and thru this two Bureau of Reclamation technicians were made available to assist in the Irrigation Development Program throughout Northeast Brazil.

The technical group referred to above was never established. The two Bureau of Reclamation technicians who were assigned to the project have been working with DNOCS, have made numerous field inspections to various facilities already constructed by DNOCS and have developed preliminary plans for the utilization of these facilities.

It must be pointed out that at one time in the program, late 1964 and early 1965, there was some opposition from SUDENE for its continuance. Part of this difficulty was due to the fact that the Technical Assistance-Irrigation Development ProAg expired on December 31, 1964 and the technical group was never established; therefore SUDENE was reluctant to continue the program as such. However, since the two men were already on the board to implement the program, and the PIO/T was a part of the Bureau of Reclamation PASA, the work as outlined in the ProAg was continued. The work of these two individuals, Technical Assistance for Irrigation Development, is now made a part of the Northeast River Basin. Letters are in the files of the Water Resources Branch stating that DNOCS with SUDENE's approval have agreed to continue the program under this latter project.

7. METEOROLOGY

The ProAg for this project was approved on October 10, 1963. To implement the project, a PIO/T was prepared and through the PIO/T the services of a short time specialist from the US Weather Bureau was obtained. The purpose of his services was to inspect the present meteorology program and installations and to make recommendations for the expansion of the program, to meet the needs of the Water Resources program and other programs in Northeast Brazil. This program has

been completed and a report is in the files of the Water Resources Branch giving findings and recommendations of the short time specialist from the U.S. Weather Bureau.

It should be pointed out at this time that a national program for meteorology is being considered. This program will be financed through a loan which will be obtained through the FINEP arrangement. More details on this program can be obtained through the Natural Resources and Engineering Office in Rio.

8. SÃO FRANCISCO RIVER BASIN

A ProAg for the São Francisco River Basin study was approved on March 12, 1964. The executing Brazilian agencies were CVSF, and CHESF. The purpose of this ProAg was to make a preliminary reconnaissance type of survey of the entire São Francisco River Basin, a basin which is approximately the size of the State of Texas, and to develop guidelines for the development of a water and land resources within the valley. To implement this program a PIO/T was prepared and approved and made a part of a Bureau of Reclamation PASA which was referred to in 5 above. The project is presently being implemented by a team of 9 Bureau of Reclamation technicians.

With the change in USAID administration in Rio there was a change in the emphasis of how the BuRec should implement the program.

The original plan was for a BuRec team to come to Brazil and work with the CVSF and CHESF; to make a study as they did for the Piranhas and Rio Grande

River Basin and prepare a report with recommendations as to the development of the land and water resources. Now the emphasis is being placed on Institutional Building and as such the project, which originally was scheduled to be completed within six month time, has been extended for a longer period of time to give the Bureau of Reclamation technicians a chance to train technicians of CVSF, CHESF, ELECTROBRAS, SUDENE and others who may be assigned in various technical fields of river basin development for multi-purpose uses.

This project has run into some difficulties from time to time because of the inability of the Brazilian entities involved to furnish full time technicians for counterparts to the Bureau of Reclamation. The project is under the leadership of Mr. M. J. Greer, Project Manager, Bureau of Reclamation. Any future information regarding the program can be obtained from Mr. Greer. It is planned that this program will be completed by June 30, 196

9. PRE-RECONNAISSANCE SURVEY OF THE ARAGUAIA-TOCANTINS RIVER BASIN

There was no ProAg prepared for this project because the Araguaia-Tocantins River Basin does not fall within the jurisdiction of SUDENE; therefore, the Araguaia-Tocantins administrative group, CIVAT, The Inter-state Commission for the Development of the Araguaia-Tocantins Valley, agreed to work through a PIO|T. Through this PIO|T a team of three experts were obtained from the Bureau of Reclamation to make a preliminary reconnaissance of the Valley. These three technicians arrived in Brazil in July 1964 and completed their studies in Brazil by the end of September 1964. The teamleader, Mr. Harold Nelson, took the information obtained and returned to the United States and finished the report there.

Copies of this report are in the files of the Water Resources Branch.

Based on recommendations stated in the BuRec report, plans are now being formulated to make a detailed reconnaissance survey of the Araguaia-Tocantins River Basin. This study will be financed through a loan to be obtained from FINEP. This plan calls for a number of technical groups to be obtained from various US Government agencies to assist in implementation. At the present time this program appears to be one of the largest programs of this type ever undertaken in Brazil.

10. HYDROGEOLOGY or GROUNDWATER STUDIES

A proAg for this project was approved on April 30, 1964. This project is being implemented by three USGS Groundwater Geologists who are assigned to the Northeast office by the Natural Resources Branch of the Rio office. This program has not been tied in as close as it should to other Water Resources programs namely: the Well Rehabilitation and Testing program. It is the writer's opinion that in order to make maximum use of the three groundwater geologists a very close working relationship is a must between this group and the Well Rehabilitation and Testing group. It is hoped that these two programs will be closely coordinated in the future. The Water Resources Branch does not have too much information on the activities of the project; however, Mr. Stuart Schoff, Chief of the Group for the U.S.G.S. has all the necessary information.

11. NORTHEAST RIVER BASIN STUDIES

A ProAg for this project along with a worksheet PIO|T was approved on May 22, 1964. This project as originally discussed and approved mentions 18 river

basins requiring studies in Northeast Brazil. However, it was realized at the time the ProAg was developed that it would be impossible to make a study of all 18 river basins at one time; therefore, the ProAg calls for the selection of certain basins to be studied.

This project has been the one that has been of concern to many people not only here in Recife but also in Rio and Washington. This is brought out by the fact that as of January 12, 1966 the PIO/T for one reason or another had not been issued and made a part of the BuRec PASA. It is felt, however, that this has been overcome and it has been issued and made Amendment No 2 to the PASA.

The present activities of the two BuRec technicians originally assigned to the Technical Assistance-Irrigation Development Project are being carried out under this project. The program has been reoriented to a degree to make use of the present constructed facilities of DNOCS. It is felt that as the program proceeds and every effort is made to utilize the facilities presently constructed, which according to the best figures available have enough storage capacity if properly utilized could furnish irrigation water to approximately 300,000 hectares of land. The same information indicates that the present irrigation area is less than 9,000 hectares of land. It can be seen that this amount is less than 3% of the potential and it is felt by the technicians of the Bureau of Reclamation and the Water Resources Planning Engineer of USAID that until every effort is made to utilize the presently stored waters no new studies or construction should be undertaken by DNOCS. To degree the same thoughts are expressed in DNOCS' new

Three Year Plan. This plan is the first such plan that DNOCS has developed and it calls for the utilization of these waters to irrigate approximately 10,000 hectares of land within the next three years.

This Three Year Plan has been used by DNOCS as the basis for requesting a loan from USAID to carry out certain studies, provide technical assistance and to purchase certain equipment which DNOCS feels it necessary in order for them to proceed and implement their Three Year program.

Information on this project and the working of the Bureau of Reclamation Group in Northeast Brazil can be obtained from the BuRec Resident Engineer, Mr. Carroll F. Wilcomb. Although Mr. Wilcomb was assigned to Brazil under the São Francisco Valley ProAg, most of his time has been spent in Recife as Resident Engineer and working with DNOCS.

12. WELL REHABILITATION AND TESTING

A ProAg for this project was approved on May 30, 1964. The work on this particular program was initiated early in 1963 with the arrival of a direct hire Groundwater Geologist, Mr. John A. Logan. After much confusion and rewriting of programs, e.g. ProAgs, PIO|Ts, PIO|Cs, etc., Mr. Logan finally got the program approved. However, the program was not implemented until early in 1965, in fact Mr. Logan's two years tour was up before the first of two Well Drilling Advisors arrived in Brazil. The program is now underway and some results are beginning to show.

The purpose of this particular program is threefold: (a) a program for training of well drillers in the drilling of new wells; (b) a program for rehabilitation of existing wells; and, (c) a program for testing of new and rehabilitated wells. The program also includes the rehabilitation of existing drilling equipment and establishing certain procedures for their maintenance. Most of the spare parts needed to repair present drilling equipment and for the rehabilitation of existing wells was furnished through funds made available by the ProAg.

Well Rehabilitation and Testing Program is probably one of the few programs that has shown physical accomplishments during the past year. The two Well Drilling Advisors are now on board, Mr. Ralph C. DeDominicis who is stationed here in Recife and working primarily with CONESP and ECOSAMA and Mr. Richard B. Erdman who is stationed in Fortaleza and working primarily with DNOCS. These two gentlemen have established on-the-job type of training programs which from all reports are satisfactory and are showing results. Mr. Erdman, because of the large area under the jurisdiction of DNOCS, has had drillers from some of the outlying areas report to DNOCS in Fortaleza and take part in the training program in that general area. One other phase of the program that should be mentioned is the Well Rehabilitation. This phase has produced some very satisfactory results in some areas and very poor results in other areas. Through a machine, primarily designed by Mr. Logan, DNOCS has been able to rehabilitate a number of wells in Bahia area and in some other areas. However, because of the lack of funds or because of the lack of proper supervision after the wells were rehabilitated, the wells have not been made functional. The major primary cause was a lack

of pumps and motors or wind mills or some type of motivation to get the water to the surface. It has been my recommendation that any time they rehabilitate a well and they do not have the necessary pumps and other equipment available to go ahead and make it a functioning well, the well should be capped and if necessary the cap should be welded in place to make sure that it will not be made nonfunctional by people dropping rocks down the well.

CONESP using another type of machine has had more favorable results in that they will not rehabilitate a well unless they are able to go ahead and make it a functional well. Reports have been received that during the month of December 1965 eight wells, some of which have been in existence for a period of over 15 years, were placed in operation. Nine or ten will be placed in operation during January. CONESP has requested additional funds to buy pumps which are made locally so that when a well is rehabilitated it can be made into a functional well. Funds in the amount of Cr\$ 500,000,000 have been requested from CONTAP for this function.

13. SMALL DAMS for DROUGHTS RELIEF - BAHIA

A ProAg for this project was approved on December 22, 1964. This program is unique in there it does not call for any dollar expenditures and is a cooperative program with the Food for Peace work program. The ProAg as written, mentioned the construction of sixteen small dams; however, during the preparation of plans and specifications and the selection of the dam site, it was determined that the constructions cost would not allow for the construction of more than six dams. Inflation has further reduced the number to three.

At the present time two dams are under construction and when the writer visited the dam sites in August 1965, it was his opinion that constructions of this particular type of dam was not in the original thinking for the small dam construction program, therefore, during the past three months the Water Resources Branch and the Natural Resources Division of SUDENE have changed the specifications for the construction of small dams using the new specifications construction cost for each dam is estimated to be about 20 million cruzeiros; thus if these specifications had been used, it would have been possible to construct the 16 dams for the Cr\$200 million (Cr\$100 million USAID funding) made available to the project. The reason for this statement is that 40 percent of the cost of labor is being paid for in the form of food through the Food for Peace program.

It is the writer's opinion that this is a very good program and offers some possibilities for expansion into other states throughout the Northeast. In fact, is now being planned to extend the program through the use of CONTAP funds into two more states, Piauí and Sergipe.

For information on this project one should contact Paulo Sá, a local Brazilian engineer who has been monitoring the project for USAID.

14. EXPANSION OF WELL DRILLING FACILITIES IN BAHIA

This is a latest project and a project which will be financed through CONTAP funds. An agreement has been reached by all parties concerned namely, SUDENE, USAID, State of Bahia, ECOSAMA, and CONTAP, during the month of January 1966 to implement the program. This project has a long history and to a certain degree

has been a political one. A history of the project and what has hapened is on file in the Water Resources Branch and in the Capital Development Division. Originally ECOSAMA requested or made application to USAID for a loan and then because of the loaning procedures it was decided to make it a grant and from then on the program has been changed from one type of project to another as far as funding. Here again information on this project may be obtained from Paulo Sá.

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Of the 14 projects mentioned above 12 are either being implemented or plans are in the process for their implementation. All of these projects should play an important part in the development of the land and water resources in Brazil, especially in the Northeast area. As can be seen by reading over the information cited above these projects have long range goals.

It is realized that irrigation development and the furnishing of water to the land as soon as possible should and could have a vast effect upon the social and economic development in Brazil. However, it must be pointed out that in any program involving water and land for all the purposes use is a program that takes considerable amount of study and therefore requires a lot of basic data in order to develop sound realistic programs which will have a long range effect on the economy of Brazil. It is hoped that the above programs and the programs to be mentioned under future programs will have an everlasting effect in Brazil.

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C. Future Projects

In outlining the future projects for Brazil I am starting with projects which preliminary discussion have been held but no agreements have been reached. The future projects will include the seven loans in which the Water Resources Branch of the Northeast office have been either directly or indirectly responsible for their conception. A brief statement on each of the seven loans is as follows:

- 1) DNOCS Loan - This loan is for the purchase of equipment supplies, spare parts and materials and for technical assistance. This is the largest of the loans which are being considered in the field of water resources. The loan is based on a Three Year Plan developed by DNOCS and in this Three Year Plan the emphasis is placed on the utilization of presently stored water, the completion of facilities already under construction and in the betterment of operation and maintenance practices of heavy construction equipment used by DNOCS. DNOCS and the Water Resources Group have discussed the program and it was felt that any program of this nature should have a "built-in-part" covering technical assistance which would include engineering, map making, agronomy, economy, operation and maintenance, and other phases of land and water resources development. The status of this program as of February 1, 1966 is that an IRR has been prepared and sent to Washington and work started on the intensified review to develop a sound realistic Capital Development Paper which will back up the loan and which will agree in principle to the Three Year Plan as developed by DNOCS.

COMMENTS:

Although DNOCS does have a reputation of being an agency that has not exercised sound engineering nor given economic considerations to the

various projects constructed to date, it is an agency that has done a lot of work which has benefitted Northeast Brazil. Most of this work has been done during the time of droughts emergencies and therefore engineering and economic principles were by-passed in order to provide work for the relief of the people in the drought stricken areas. It is the opinion of the writer that since the revolution in April 1964, DNOCS has undergone a certain amount of management and administrative changes and does have the technical ability in the present staff to carry out a sound and realistic program; however, the big problem facing DNOCS and other agencies throughout Brazil is the fact that most of the employees, by even local standards, are underpaid and work a 3 or 4 hour day. Therefore, the job suffers and indirectly the program suffers. Another point which should be brought out is that the regulations as related to drought relief projects of DNOCS, state that of the vast number of people hired for construction, a certain percentage must be retained to operate and maintain the facility. So during each drought DNOCS adds more people to their payroll. It has been reported that as of December 1, 1965 there were over 15,000 employees on DNOCS payroll. Of these it was also estimated that only about 400 could be considered effective. From these figures it can be seen that until something has been done in order to improve the conditions and regulations changed so that DNOCS can reduce this tremendous number of unskilled people there is very little hope of carrying out sound long range programs.

Another problem that I have noticed is the reluctance of certain DNOCS officials to delegate authority to the people working under them.

Even when this authority is delegated the person to whom the delegation is given seems to be very reluctant to act upon his own, he still feels that he must go back to the boss in order to get the job cleared and to proceed accordingly.

As stated before the present DNOCS' staff is fairly well qualified technically and to a certain degree does have the administrative, management and supervisory capacity to carry out their three year program.

- 2) CONESP Loan - This loan as presented in the application from CONESP to USAID through the Water Resources Branch is to be used for the purchase of U.S. made equipment, materials and supplies and for obtaining a certain amount of technical assistance. The equipments, materials, and supplies would basically be pumps, motors, well casing, parts for U.S. made well rigs and other supplies that are necessary in the well drilling rehabilitation and testing program of CONESP. From the information received to date this will be part of a large loan, somewhere in the neighborhood of 20 million dollars, which CONESP plans to borrow from International sources to carry out a vast program for extension of the exploration drilling and rehabilitating water wells throughout the Northeast area of Brazil. The U.S. part of this particular loan will be somewhere in the neighborhood of 4 1/2 million dollars. There will be a technical assistance component built into

the loan which provide funds for: (a) three well drilling advisors of the type that are presently in Brazil; (b) one ground water hydrologist who is experienced in location of wells, developing of wells making pump tests, and making other type of tests as related to the quantity and quality of the water, aquifers, ect.; and (c) one equipment mechanic who should have an overall knowledge of well rigs and will be used primarily for the training of Brazilians in the maintenance of the equipment. The loan application as originally presented to USAID is being rewritten along the lines of the one which was presented by DNOCS and incorporating some of the ideas that were in the IRR of the DNOCS loan.

CONESP is classified as a mixed company. The major stockholder is SUDENE and the major part of the working capital is derived from the budgets of SUDENE. SUDENE has assigned CONESP the responsibility of coordinating all well drilling activities in Northeast Brazil.

3) ECOSAMA Loan

The ECOSAMA loan will be another multi-purpose loan in that it will include funds for the purchase of U.S. made equipment, supplies, spare parts, and materials and for technical assistance. The loan application as written request a loan of 1.5 million dollars, of which approximately \$200,000 is for technical assistance. The major part of this loan as stated above is for the purchase of American made equipment which is not available in Brazil. One of the major items will be the purchase of pumps and motors and well casing. Also to be

purchased include certain types of drilling equipment such as fishing tools, driving heads, etc. The technical assistance part will probably amount to two well drilling advisors and one equipment maintenance man. ECOSAMA is another mixed company in which the principal shareholder is the State of Bahia. ECOSAMA has the responsibility for the construction of any facilities pertaining to water resources development, primarily small dams and water wells.

4) SUDENE MAPPING Loan

The SUDENE Mapping Loan is in connection with the National Mapping program for Brazil. The loan as such will be for making a contract, probably with U.S. firms for the establishment, through use of HIRAN or other types of electronic computers, the necessary horizontal control throughout the western 2/3 of the SUDENE area. This program is a must in that unless it is carried out the other parts of the National Mapping Program, especially photogrammetry part and the compilation of maps for the use of everybody throughout the Northeast area will be useless. In order to be able to make a decent map after having obtained very good photography which will be done through an agreement that has been reached with the Government of Brazil and the Government of the United States of America in which the U.S. Air Force will make the necessary aerial pictures, or I should say will fly the area taking the necessary aerial photography that will be used later in the making of maps. Without sound and very reliable ground control the whole mapping program could come to nothing. This program has primarily been

handled through IAGS and with the Water Resources Group working to SUDENE, DNOCS, and other agencies to push it through to a conclusion.

It is vital that controls be established throughout the entire SUDENE area as soon as possible in order to expand to other areas on further to the west which have a tie in with the coastal area, and in that way to have a continuing type of program. Mr. Ernest Schlomann has the necessary information on this program.

Also includes a program for the rehabilitation of existing drilling equipment and establishing certain procedures for maintenance. Most of the spare parts needed to rehabilitate drilling equipment and for the rehabilitation of existing wells was furnished by funds of the project area.

The other three loans mentioned below are not in the SUDENE area but are loans in which the Water Resources Branch of the Northeast Office have taken an active part in obtaining the information and in assisting the Brazilians with their applications. All these loans are to be through FINEP and will be in the nature of data gathering studies, or what has been classified as pre-feasibility studies.

- 1) CIVAT LOAN - The loan is primarily for technical assistance to obtain more information on the natural resources of the region. The details of the required investigations are to be worked out at a later date; however, it must be stated that any program of this nature will require the cooperation of numerous agencies and technicians having various skills. The program as now written will require a group of

fifteen American technicians with experience in a number of different fields. CIVAT is hoping to obtain them through the following U.S. Government agencies:

Bureau of Reclamation, Bureau of Land Management, Geologic Survey, Weather Bureau, IACS, Department of Agriculture, Bureau of Public Roads and there may be others such as Army Engineers for short term assignments related to flood control and river regulation studies.

Any program involving an area the size of the Araguaia-Tocantins Basin which by comparison is approximately the size of the combined area of the states of California, Washington, Oregon, and Nevada. It will be a difficult assignment in that there are little or no transportation facilities throughout the area except possibly air. There are virtually no roads in the area; however, BR-14 does traverse the area from north to south, from Brasilia to Belém. The A-T area has been described by many people and by the Bureau of Reclamation in their pre-reconnaissance survey as having probably the largest number and variety of underdeveloped resources of any area in the world. Therefore, it could become a very important area in the future development of Brazil.

- 2) DIVISAO DE ÁGUAS LOAN - The loan to the Divisão de Águas is one primarily for technical assistance. However, there will be a component in the loan for the purchase of certain scientific equipment to be used in the establishing stream gaging and rain gaging stations

and the like. The loan as presented will be used to finance the technical assistance which the Divisão de Águas hope to obtain from the U.S. Geological Surface Water Division. This is a relatively small loan but could be a very important one in that until Brazil knows what their Water Resources are, where they are and the quantity and quality of them no concrete planning can be made for their development.

- 3) THE METEOROLOGY SERVICE LOAN - Although the Water Resources Branch has done only a minimum amount of work on this loan it falls within the general category of water resources development. Therefore, it should be mentioned at this time. This loan is primarily to obtain the services of technicians from the U.S. Weather Bureau to assist the Meteorologic Services which is an agency under the Ministry of Agriculture to set up a sound program for the gathering of meteorological data.

All of the above mentioned loans include a training component which could prove to be very important in that there is a lack of trained competent technicians in all the phases of water resources study and development.

There are a number of other small programs which should be mentioned at this particular time. Most of them fall within the conception of a CONTAP program. Probably the most important is the continuation and extension of the Well Rehabilitation Program for CONESP. This program is proving to be very important in making water available to the masses. The rehabilitation,

for the most part, amounts to cleaning out existing wells and then after making the necessary development and test placing the proper size pump to make them functional wells. The program is proving very popular in the State of Rio Grande do Norte and to a limited degree in some areas in the State of Bahia.

Another program which we mentioned before and which will be extended in the CONTAP Program is the Small Dams Program. This program could become a very successful one in that by the change of the standards for the construction of the small dams we can reach a larger number of people than we did on the first two dams which were built in the south western part of the State of Bahia. The program as presently envisaged includes the components for use of Food for Peace for work which has proven to be a very satisfactory program.

Another program which could become very important in the development of Brazil is a program which has been proposed by SUDENE and has the concurrence of this writer is a program for the development of irrigation, research and demonstration centers. The present thinking on this particular program is that these centers should be built in connection with the Universities throughout the Northeast Brazil as part of an expanding program to enlighten the so called Engineer Agrônomos into the field of irrigated agriculture. This is a field that has been bypassed, but which is very important and it is time that the Brazilians realize and take a more active interest in the development of their land and water resources. This program is a must if Land and Water Resources are to be developed in sound basis for irrigated agriculture.

V. SUMMARY

In summarizing the activities of the Water Resources Branch from its conception late in 1962 until the present, February 1st, 1966, it can be seen from the above report that a number of various fields have been attacked in a systematic and orderly method. It also can be seen that the Water Resources Branch working with the various Brazilian agencies and organizations which have been assigned the responsibility for the development of the land and water resources in Brazil, a number of projects has been agreed upon and limited number of implementations are now under way. As stated in the introduction the field of Water Resources is probably the most complex of any one single field in the development of the country. In the Water Resources field one must not only take into account, the major land and water but must consider the human elements of the economic problems; such as education, health and welfare, marketing, farms and market facilities, industrialization, transportation and communications.

It is hard and too early to put in words the effect that the Water Resources Branch programs to date have had and will have on the Brazilian economy. We know from history that the development of any country first starts with the development of the land and water resources and gradually expands into other fields. As people develop the land and establish a stable food supply, then have a surplus to market, next comes the industrialization and in turn it might be said education and other welfare benefits. I know that there are many people who will not agree to this approach but as I stated before, if one studies the history of any country the basic conception of any move from one area to the next and in

the development of the country the first considerations were given to the land and water resources and the establishment of a stable food supply.

When one is talking and discussing food production or any other economic problem relative to production, production goals, ways and means of increasing production, training, research, marketing, etc., one must take into account one of the most important if not the most important element needed to assure production of any kind WATER. We have learned how to grow plants without soil and sunshine but as yet we have not discovered a way to grow anything without water. A man or animal may go for days without food but cannot last very long without water. The Water Resources program in Brazil is in its infancy and it must be expanded in order to reach the targets which are necessary for sound, long range planning for the development of any country lands and water resources. The steps to be taken are:

1. A physical inventory of the water resources, surface and ground water.
2. A preliminary investigation of the land resources. This means at least a reconnaissance soil survey to determine the kinds and whether or not they are suitable for agricultural development.
3. A preliminary investigation of river basins to determine possible dam sites for the use of multiple purpose developments which include hydro-electric development, municipal water supply, navigation, flood control, irrigation and production of fish.
4. Development of institution or agencies within the Brazilian government to carry out sound planning programs which will lead to efficient development of these resources.

5. Carry out a training program to provide the necessary technicians to implement the program. This program needs to be aimed, not only at the university and college graduates but also at the various skilled and semi-skilled technical personnel who are required for efficient planning and development. One must not overlook the training of the farmers in the use of the land and water resources to make maximum production and use of other God given resources.

Brazil has an abundance of land and water resources and it is with pride that I feel that I have had in a very small way a chance to establish some of the fundamentals which may be used in the development of these resources. It is possible that Brazil in time with the development of land and water resources and other natural resources could become one of the greatest nations in the world.

WR: JLSparks:Bg
January 31, 1966