

PROJECT PROFILE

*Fluvial Interconnection Between the
Paraguay and Paraná Rivers*

Paraguay



*República del Paraguay
Ministerio de Obras Públicas y Comunicaciones
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FLUVIAL INTERCONNECTION BETWEEN THE PARAGUAY AND PARANÁ RIVERS

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1.0 INTRODUCTION

This Project Profile for the Fluvial Interconnection Project for the country of Paraguay, gives a brief overview of the main socio-economic, financial, and technical characteristics of the project.

This profile describes the channelization project based on preliminary studies, its benefits, importance and necessity.

The reason for this Project Profile is to present it to International Funding Organizations, in order to obtain a non-reimbursable credit to perform the necessary studies required for the preparation of the Feasibility Study. With this Feasibility Study in hand, the government can then pursue the solicitation of loans to implement the Fluvial Interconnection Project Between the Paraguay and Paraná Rivers.

The final route and possible alternatives for the fluvial interconnection project will be determined by the Feasibility Study, in addition to the geological, hydraulic, and environmental studies, which are necessary for the completion of the final study.

From the 1950's to the present time,, emphasis has been placed on road transport in Paraguay. In 1965 a road was constructed from Asunción to the port of Paranaguá, Brazil, and has been the preferred route for both imports and exports; however, transportation costs are very high. On the other hand, the bulk of trade that involves Paraguay with Brazil, is accomplished by crossing the Puente de la Amistad that joins Ciudad del Este (Paraguay) with Foz de Iguazú (Brazil) creating traffic congestion that lasts several hours. Trucks transporting soy beans , lumber products, and cotton mix with tourist buses and smaller size vehicles. This situation may be corrected for the short term by constructing another bridge over the Paraná River a few kilometers downstream of the Amistad Bridge , connecting the cities of Presidente Franco (Paraguay) with Foz de Iguazú (Brazil).



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Almost all the trading with Argentina is by trucks crossing Pilcomayo River (through Clorinda-Puerto Falcon) and connecting with the roads in the Argentine Chaco. On a smaller scale, the transportation between both countries is accomplished by crossing the bridge located on the Paraná River between the cities of Posadas and Encarnación. The waterway transportation system of Paraná-Paraguay is used exclusively for transporting petroleum and lumber products.

Due to these transportation problems, the government of Paraguay considers this project as a priority and of the utmost importance. It will not only benefit the economy of Paraguay, but also of Brazil, Argentina and Bolivia, which share with Paraguay the burden of the lack of a proper navigable transportation infrastructure.

1.1 National Background

Paraguay is located in the interior of southern South America. It has an area of 406,752 km² with a population of about 4.8 million. Almost 78 % of the national population is made up of persons 34 years old or younger. The boundary with Argentina is made up of the Paraná, Paraguay, and Pilcomayo rivers half encircling the country. The Paraguay River divides Paraguay into two parts and in its upper course forms much of the eastern boundary with Brazil. West of the river is the Paraguayan Gran Chaco, with 60 % of Paraguay's territory and less than 2 percent of its total population.

Paraguay is divided into 17 departments, in addition to the capital district of Asuncion. The departments are divided into districts that correspond to an administrative municipal level, which are subdivided into rural districts.

The capital city of Asuncion, located on the left bank of the Paraguay River, has an area of 117 km² and a 1995 estimated population of 542,000 inhabitants.

Paraguay is governed under a constitution written in 1992. The President serves as head of state and government and is popularly elected for a five-year

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term. The 80 members of the Senate and the 60 Representatives form the National Congress and are elected for five-year terms.

1.2 Climate, Land, and Natural Resources

With the Tropic of Capricorn crossing the north-central part of the country (about 70 km north of Concepción), Paraguay has a semi-tropical climate with high temperature and humidity in spring, summer, and fall. Winters are generally warm but are interrupted by a few cold periods when cold air masses sweep in from the Argentine Pampas and Patagonia.

Rainfall is well distributed over eastern Paraguay exceeding, 152 cm per year, except along the Paraguay River. Average annual rainfall in the Chaco plains exceeds 127 cm along the river, but decreases steadily westward to less than 40 cm. The Chaco is also subject to severe droughts in which surface water either evaporates or filtrates into the ground. There are extensive areas over which wells only produce salt water.

Two different air masses affect the country. Most of the time a hot humid mass drifts southward from the Amazon Basin. The weather is stifling, but rain normally does not precipitate until a cold air mass comes in from the south. Then, torrential rains occur followed by a few days of pleasant – or in winter, cold – weather.

The Chaco plain is a nearly featureless plain that slopes imperceptibly upward toward the west. The Andean foothills lie beyond the Paraguay border. Land near the Paraguay River frequently floods and carries a marsh grass vegetation and clumps of palm trees. This area can be pastured, but during floods, the cattle is moved 16 or 32 km westward. Where floods do not occur, a drought-resistant, semideciduous, often thorny forest alternates with wetland areas. Trees reach a height of 15 meters (m) in the eastern region, but decline to 3 meters in the western regions. In the eastern 130 km of this forest is found the quebracho trees, which are rich in tannin. At one time tannin was Paraguay's

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principal export. These trees grow very slow, and for that reason, they are depleted.

The eastern half of eastern Paraguay is the western extension of the Paraná Plateau of Brazil, separated from that country and Argentina by the canyon of the Paraná River. The plateau is 300 to 600 m above sea level and is composed principally of basaltic rock. The basaltic rock have weathered into deep red soils that are quite fertile. Until recently, this plateau was covered with a great forest of semideciduous tropical hardwoods. Agricultural colonies have been established in the cleared land, some by immigrant communities—European and to a lesser degree Asians. Brazilian investors have purchased extensive farms for growing soybean , wheat, cattle breeding, citrus farming and horticulture .

This volcanic plateau is without mineral deposits, but the hydroelectric potential of the Paraná canyon and its tributaries may be Paraguay's greatest natural resource. The Acaray Dam was the first hydroelectric project in Paraguay. Presently, the operation of the Itaipú Dam and the turnkey operation of the Yacyretá Dam (both over the Paraná River) have sufficient energy to supply the consumption of Paraguay, selling the excess energy to neighboring countries which are co-owners of these power plants. The Itaipú power plant stimulated fast growth and regional modernization. The cities of Hernandarias, Ciudad del Este, and President Franco stand out as they presented a cumulative annual population growth of approximately 10 % .

The Governments of Paraguay and Argentina recently agreed on June 19,1995 on the construction of a third dam over the Paraná River, which is the Corpus Dam, with a proposed capacity of 2880 MW.

Two wide belts of irregular terrain extend from the Paraguay River eastward to the volcanic plateau; one located in Asuncion and the other near the northern border of eastern Paraguay. There is a flat area in between and south of it, covered with grass, and subject for the most part to flooding. Raising cattle is the principal economic activity in this area.

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The irregular terrain that extends eastward from Asuncion to the agriculture farming area are marshlands used for grazing cattle and steep slopes that have second-growth forests. On the hills prevail small farms with agricultural crops and cattle raising for self consumption and commercialization of the surplus.

1.3 Economic Development

For more than 400 years the Paraguay and Paraná rivers were Paraguay's main connection with the world. In the 1860's a railroad was constructed from Asuncion toward the southeast region, but it was not until 1913 that it was connected with the Argentine rail system by a ferry from Encarnación to Posadas, Argentina. These modes of transportation were both expensive and slow. Only non-perishable goods could be transported in this manner.

Due to the transportation problem, Paraguayan industry has been developing mainly in the processing of agricultural products, forestry, and textiles, etc., mainly for internal consumption. The export products that could bear the transport cost were: Mate Tea , quebracho, vegetable oils, beef extract and wool. Consequently, Paraguay's industrial development focused on the processing of agricultural and forest products, clothing, etc.; primarily for local consumption. Imports were limited to essential industrial products and luxury items.

The increase in the export of hardwood logs to Brazil from the nearly primeval forests of easternmost Paraguay is rapidly depleting the country's forest reserves. Cattle raising is Paraguay's greatest agricultural resource. During and immediately following World War II, beef was exported to world markets. The availability of hydroelectric energy has lead to increased industrialization, even though, the internal market is small.

Main Manufactured and Mined Products: Woven cotton fabric, processed meat, gasoline, beer, soft drinks, cement; sugar, wheat flour and quick lime.

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Main Agricultural Products: Cassava, sugarcane, soybeans, seed cotton, corn (maize), citrus fruits. Livestock—cattle, pigs, chickens.

1.4 Social-Economic Aspects

Paraguay has the most racially homogenous population in South America. A large majority of the people are of mixed white (specially Spanish) and Guaraní Indian descent. Spanish and Guaraní are the official languages of Paraguay.

The estimated population of Paraguay in 1995 is 4.83 million inhabitants, of which 48 % is urban and 52 % rural. The average density is only about 12 persons per km², which is one of the lowest in South America. The highest population density occurs in the eastern part of the country and most sparse in the Chaco region, except near the riverbanks of the Paraguay River and the capital city.

The population is very concentrated in the Asuncion Metropolitan Area, and Central Department, where 33 % of the total national population lives. The rural population is very concentrated in the central-south Department of the western region (Caaguazú, Guairá, Paraguari, Ñeembucú and Cáazapá) in which 36.5% of the total rural population is concentrated. Because of heavy losses of life during the Paraguayan War (1864-70) and the Chaco War (1932-35), Paraguay is underpopulated and, therefore, has welcomed immigration, especially of farmers.

1.5 Project Area

The preliminary Project Area comprises 65,986 km², which includes the Departments of Canindeyú, Alto Paraná, Cordillera, Caaguazú and San Pedro. The Study Area is located in the north-central zone of the western region of Paraguay. Refer to table 1 and map 1.

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TABLE 1
Population

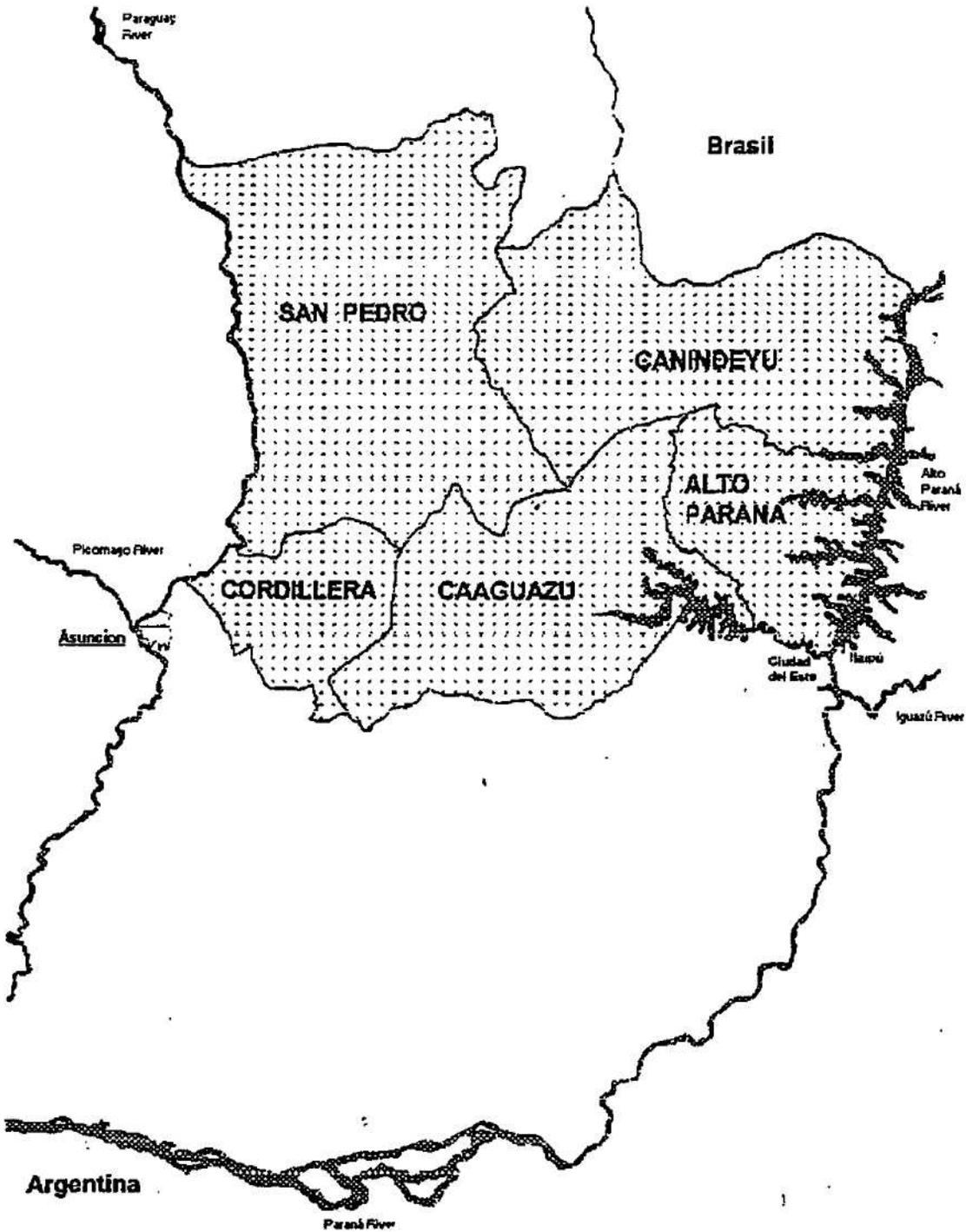
| Departments | Capital | Surface Km² | Population (19925) |
|--------------------|-----------------------------|-----------------------------------|-------------------------------|
| Canindeyú | Salto de Guairá | 14,667 | 124,978 |
| San Pedro | San Pedro de Ycuamandyyú | 20,002 | 314,446 |
| Alto Paraná | Ciudad del Este | 14,895 | 530,812 |
| Cordillera | Caacupé | 4,948 | 215,394 |
| Caaguazú | Coronel Oviedo | 11,474 | 428,718 |
| | Total | 65,986 | 1,614,348 |

The population of the project area represents 33.4 % of the nation's total estimated population for the year 1995. With the construction of the Itaipú Dam, the Paraná River became navigable near Salto del Guairá, a natural obstacle that was obstructing navigation. As the water level has risen because of the damming of the river, some of the tributaries also became navigable.

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Regional Map





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Department of Canindeyú

This Department is located in the Northeast part of the country. The physical aspects of the region vary. For example, in the Department of Canindeyú there are two zones; one zone is formed by the Amambay and Mbaracayú mountain ranges and the other by the San Joaquín mountain range and Ytambey River. These mountain ranges have an elevation of between 300 to 400 meters above sea level. In this Department, there are two main watersheds: the Paraguay and Paraná rivers.

The area has a desirable climate because of the high altitude. The annual precipitation is about 1700 mm which is one the highest in the entire country. Most of this region is made up of basaltic rock and sandy soils. About 50% of the soils are considered suitable for agricultural activities such as; soybeans, wheat, sugar cane, rice, cotton, tobacco, coffee, yerba mate, beans, mint, heart of palm and cattle raising.

Department of Alto Paraná

This Department is located in the eastern part of the country. The majority of this Department is formed by highlands and rolling hills. There are areas along the Paraná River which have steep cliffs. Originally the area was covered by forests; however, due to deforestation because of lumbering and agriculture and cattle raising activities, the area has suffered a reduction in forest cover. Presently, there are pine tree nurseries used for reforestation. The main mountain ranges are San Rafael and San Juan Nepomuceno.

The watershed is formed by the Paraná River and its tributaries: Ytambey, Acaray, Monday, and Ñacunday. The Paraná and Acaray rivers have been used for the construction of the Itaipú and Acaray hydroelectric power plants.

The average annual temperature is 21°C, with maximum temperatures of 39°C in the summer and minimum temperature of -5 °C in the winter months. The

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annual precipitation is 1725 mm which is higher than in the Department of Canindeyú.

Most of the fertile soils are of basaltic origin except on the terrain adjacent to the Paraná River which is formed by cliffs and ridges.

Agricultural activities increased with the introduction of soybeans, sunflower and wheat. Cotton, sugar cane, rice and corn are also harvested, and cattle raising is very important.

Department of San Pedro

This Department is located in the central part of the country, east of the Paraguay River. This Department is bordered to the North and North-East by the Departments of Concepción and Amambay respectively; to the East and South-East by the Departments of Amambay and Canindeyú; to the South and South-West by the Departments of Caaguazú and Cordillera; and to the West by the Paraguay River that separates it from the Department of Presidente Hayes in the Western Region.

There are two distinct topographic zones; the first is along the banks of the Paraguay River, consisting of low lands with lakes, and the second, consists of high lands full of vegetation and rich in waterways.

Cattle production in this region is the second most important in the country. Sugar cane, cotton, corn, soybeans, rice, wheat, and tobacco are the most important agricultural products of the region. The most important industries in this region are: lumber mills, cooking oil factories, cotton gins, yerba mate mills, steel mills, petit-grain distilleries, vegetable carton manufacturers, etc.

The average temperature is 23°C with an absolute maximum of 41 °C and a minimum of -1 °C. The average annual precipitation is 1324 mm. In all of Paraguay, the Department of San Pedro has the largest rural population at 83.9%.

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Department of Cordillera

This Department is located in the central zone of the southern region of the country. Its borders are: Department of San Pedro to the North, Department of Paraguari to the South, Department of Caaguazú to the East, and the Central Department to the West, while the Paraguay River separates it from the Department of Presidente Hayes.

The Northeast has a flat topography and is covered by farms and cattle ranches. The other area borders the Altos mountain range, with a mixture of flatlands and rolling hills, with soil that is especially suitable for agriculture (tobacco, sugarcane, bananas, citrus fruits and vegetables).

The climate is mild and dry. The average temperature is 23°C, with a maximum temperature of 41°C and an absolute minimum of -1°C. The average annual precipitation is 1400 mm.

Department of Caaguazú

This Department is located in the central zone of the western region of the country. Its borders are: Department of San Pedro and Canindeyú to the North, Departments of Guairá and Caazapá to the South, Department of Alto Paraná to the East, and Department of Cordillera to the West.

The Caaguazú mountain range crosses the Department from North to South. To the North and West of this mountain range, there are lowlands with abundant fields for cattle grazing. To the East, there are highlands covered with forests which have been partially depleted due to deforestation. The central area is the most populated and is mostly agricultural.

The average annual temperature is approximately 22°C, the absolute maximum is 40 ° C and the absolute minimum is -3°C. This area is very humid with high precipitation (1500 to 1600 mm annually).

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Among the economic activities, forestry, lumber mills, steel mills, cattle raising and dairy farming stand out, the diversified agricultural products produced are: soybeans, wheat, corn, cassava and citrus fruits.)

The capital city of the Department occupies 11th place among the main population centers nationally, having had a population growth of 5.7 % annually during the period 1982/1992..

1.6 Project Objectives

The objective of this Project Profile is to evaluate the utilization of waterways and determine the feasibility for interconnection between the Paraná and the Paraguay Rivers. Another objective is to evaluate establishing a navigable waterway for the cargo barges and tugboats.

This project would include channelization to promote navigation, flood control and irrigation along the riverbanks.

1.7 Preliminary Alternative Routes

The necessary studies required to determine the optimum route that a interconnection canal would take have not been prepared. According to preliminary studies, 3 possible alternatives have been evaluated which can give an overall view of how these rivers might be interconnected.

Following is a brief summary of these alternatives. It is important to note that these alternatives are not final and additional technical studies are required.

The three alternatives are:

- Jejuí-Guazú River / Ytambey River
- Manduvirá River / Limoy River
- Manduvirá River / Ytambey River

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The general concept was to utilize the natural waterways as much as possible, trying to affect as little as possible the natural environmental and social balance, specifically of certain Indian communities that live on reservations through which the canal might be routed.

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Alternative 1:

Jejuí-Guazú River to Ytambey River

Approximate Length:

- 374 km

Advantages:

1. Two hundred kilometers (200 km) that are navigable with a depth of at least 3.0 m;
2. Information exists about the location and profile of the rivers.

Disadvantages:

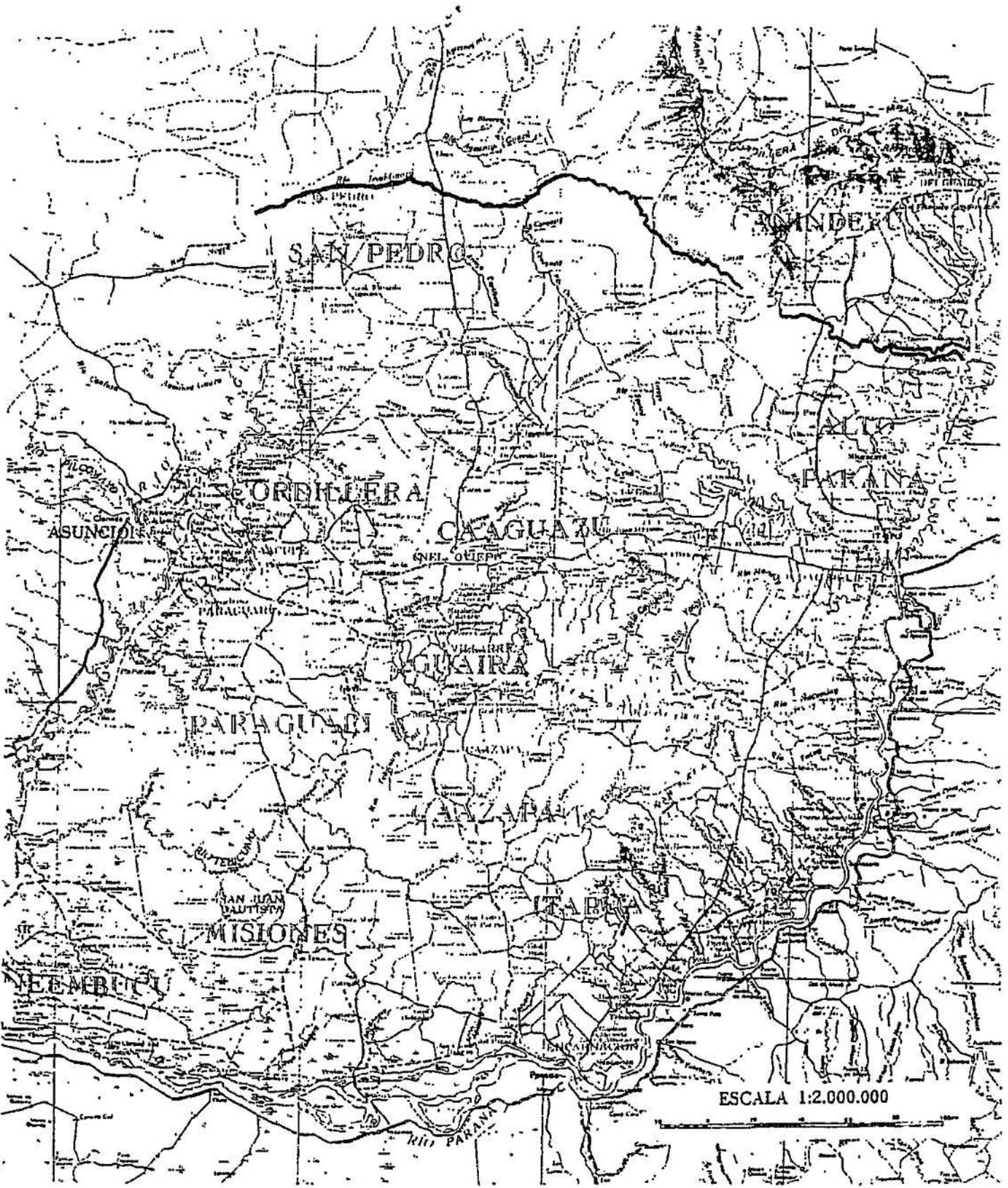
1. There are three (3) bridge crossings which may need to be modified;
2. Potential environmental problems due to the excavation needed to pass through the San Joaquín Mountains and the Rivers;
3. About five (5) navigable locks would be needed at the crossing with Route 10 because this is the highest elevation along the connection to both rivers (Jejuí-Guazú and Ytambey);
4. Very high cost due to rock excavation.
5. There are sparsely populated Indian communities which may be affected by the location of the canal;

Remarks:

1. Possibility of crossing under Route 10 by constructing a tunnel.

ALTERNATIVE JEJUI-GUAZU RIVER / YTAMBEY RIVER

374 Km



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Alternative 2:

Manduvirá River to Limoy River

Approximate Length:

- 370 km

Advantages:

1. If the soil classifications and the environmental conditions allow for open trench excavation, the number of navigable locks can be reduced;
2. Lake Yguazú is navigable;
3. The water level elevations between both rivers are the same; therefore, fewer navigable locks may be required than in Alternative 1

Disadvantages:

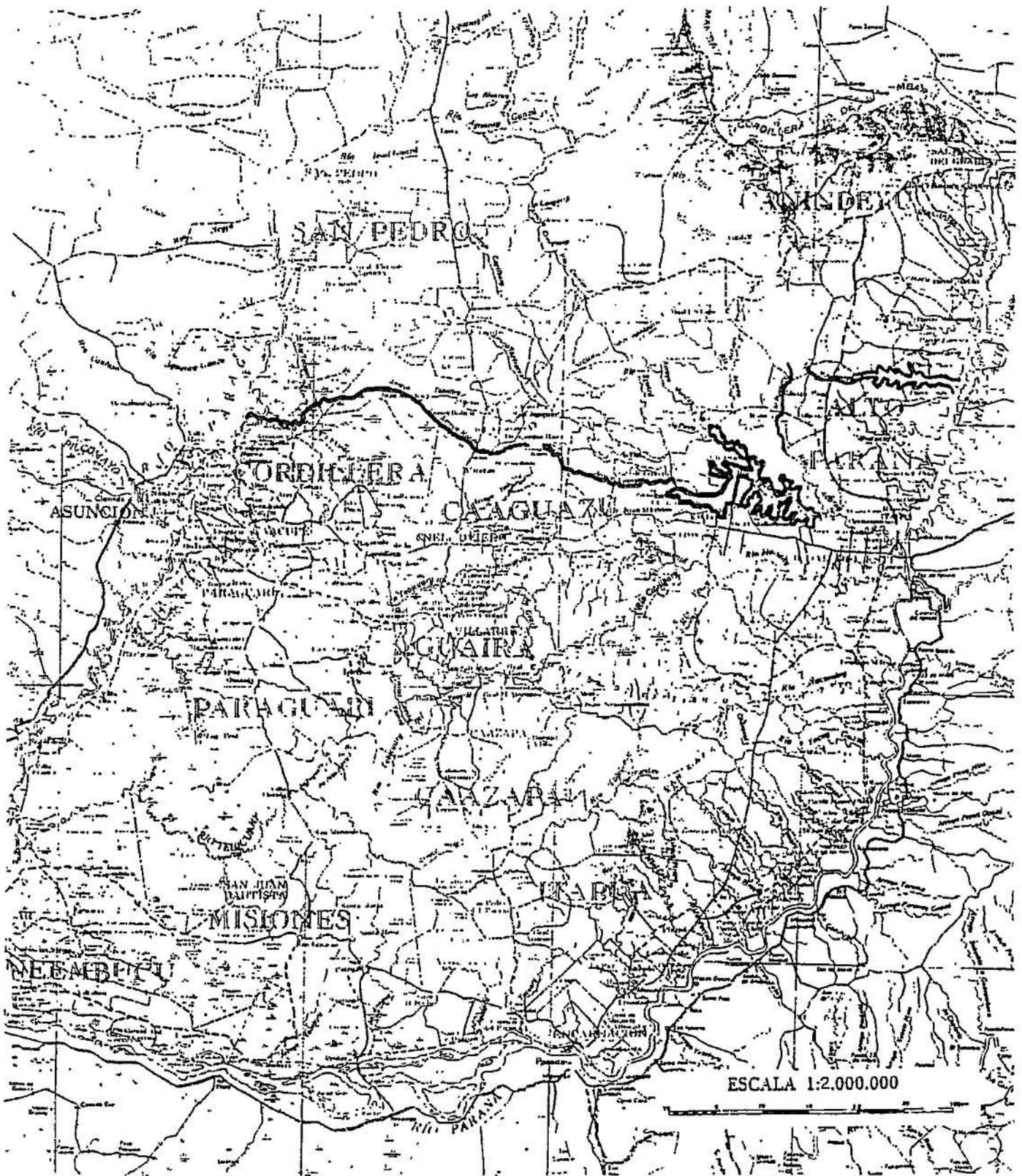
1. Environmental impact on Yguazú Lake and the rivers during construction.
2. High cost of excavation since there may be sections that are not navigable.

Remarks:

1. There is a lack of data on the river and tributary streams flows.
2. There is a lack of geotechnical information for this area.
3. There may not be environmental impact information available.

ALTERNATIVE MANDUVIRA RIVER / LIMOIY RIVER

370 Km



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Alternative 3:

Manduvirá River to Ytambey River

Approximate Length:

- 410 km

Advantages:

1. If the soil classifications and the environmental conditions allow for open trench excavation for the river connection, the number of navigable locks can be reduced;
2. Existing Lake Yguazú provides for navigable conditions;
3. The water level elevations between both rivers are the same, therefore, there may be fewer navigable locks than Alternative 1;
4. The connection of the Ytambey with the Piratíy River offers a possible solution which will depend on the selection of the final alternative.

Disadvantages:

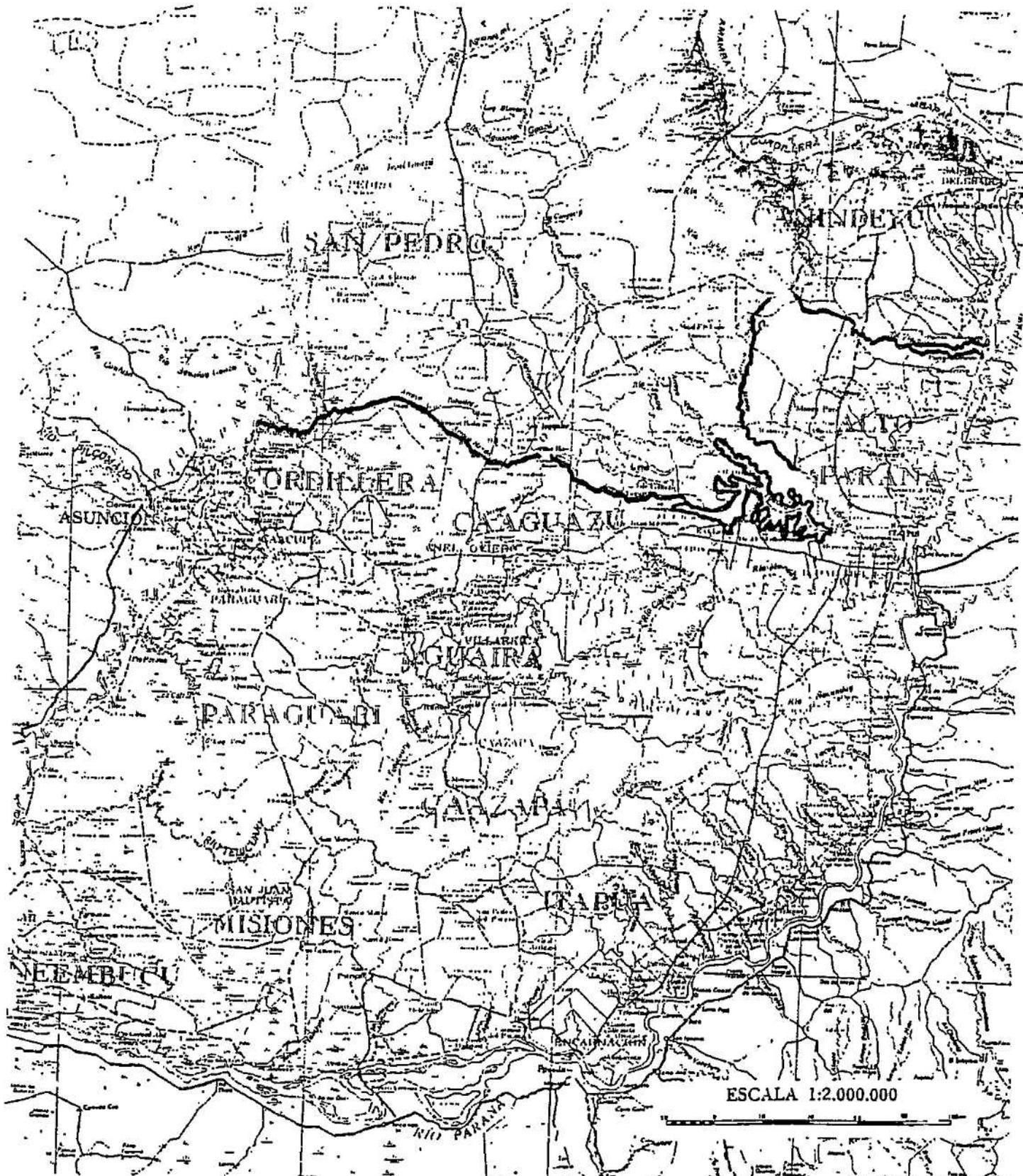
1. Environmental impact during construction upon the Yguazú Lake and the tributary Rivers;
2. High cost of excavation since there may be sections that are not navigable;
3. It is the longest Alternative ;therefore ,the costs may be higher;
4. Possible relocation of communities along the proposed project.

Remarks:

1. Lack of information for the river and tributary streams flows;
2. Lack of geotechnical information in this area;
3. There may not be environmental impact information available.

ALTERNATIVE MANDUVIRA RIVER / YTAMBEY RIVER

410 Km



ESCALA 1:2.000.000

1.8 Necessity And Importance Of The Project

The globalization of world Markets and the need to increase trade in the region between the MERCOSUR countries (Paraguay, Brazil, Uruguay, and Argentina), have stimulated interest in the interconnection of the waterways in the region. Bolivia is also very active in the markets of the MERCOSUR countries.

MERCOSUR's main objectives are as follows:

- To expand the existing domestic markets;
- To achieve economies of scale;
- To foster efficiency and improve resource allocation;
- To secure access to regional markets;
- To diversify trade patterns;
- To promote regional trade in industrial goods;
- To enhance competitiveness by means of a low Common External Tariff;
- To increase the bargaining power of the member countries;
- To attract a greater flow of direct foreign investment through the appeal of a larger market.

The ultimate objective is the completion of a Common Market, including the free movement of capital and labor. The next immediate step would be the adoption of a Common External Tariff that will allow MERCOSUR to become a Customs Union. MERCOSUR has performed well since 1990, as significant growth has taken place in intra-regional trade. In 1990, total trade among MERCOSUR members amounted to little more than US\$4 billion. In 1991, it rose to US\$5 billion, in 1992 it reached US\$7 billion and for 1993, it was more than US\$10 billion. The rate of increase from 1990 to 1993 was 147%. During the same period, total MERCOSUR exports grew from US\$ 46 billion in 1990 to an estimated US\$ 56 billion in 1993, an increase of about 22%. The above data showing remarkable economic performance clearly indicates the importance of the MERCOSUR economic integration initiative.



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2.0 DESCRIPTION OF THE PROJECT

2.1 General

Paraguay has an inferior roadway system of 30,000 km that is made up of 90 % dirt and partly paved roads. Paraguay has an urgent need to improve its road infrastructure, as much to improve the internal movement of goods, as for regional trading. A similar situation is presented in the case of Bolivia, with the additional complication that River navigation is done only through the Paraguay River.

Moreover, Itaipú Dam has signified a physical barrier to river navigation on the Paraná River by obstructing the connection between the watershed of the Tieté River (Brazil) with the western and southern zones, which encompasses the territories of Paraguay, Argentina, Bolivia, and Uruguay. A navigation canal that could be constructed as part of the Itaipú Complex has a high cost (estimated US \$ 4,000,000,000) that the four governments are not eager to take on.

Likewise, it must be emphasized that the construction of the Corpus hydroelectric plant and dam, would signify an obstruction to navigation during years of its construction. This reinforces the idea that the navigation canal will be the only valid alternative to connect the high watershed of the Paraná River with the rest of the waterway, at least in the short and medium term.

The importance of this navigation system lies in lowering of transportation costs, particularly of agricultural goods and livestock, and the mineral industries, while some industrial products would also benefit.

The economic activities in the navigable waterways area of influence, include : mineral resources, steel mills, petrochemicals, agricultural goods such as, sugar cane, coffee, rice, wheat, soybeans, fruits, as well as cattle raising and cold storage facilities, among others .

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Even though a Master Plan does not exist for global development of the navigable waterways and watersheds, it would have highly favorable results on the socio-economic development of the region.

In summary, the main objective of this project is the improvement of the navigable waterways to lower transport costs for international trade (in particular with Bolivia) and for MERCOSUR regional trade, as well as the internal movement of goods and services.

The most important aspect of both rivers is the way exports are transported to Port. The Paraguay River, 2,184 km long, is navigable from Puerto Cáceres (Bolivia), and the Paraná River is navigable for 1,248 km. In Paraguay, the port cities along the river banks are: Asunción, Villeta, Concepción, and other smaller cities (Villa Hays, Rosario, Antequera, Alberdi, Humartá, Pilar e Itaipirú). The following cities are found along the river banks of the Paraná River: Ciudad del Este, President Franco, Encarnación, and Ayolas, among others.

2.2 Proposed Fluvial Interconnection Between The Paraguay And The Paraná Rivers

The control of the water course must satisfy the proposed objective, as well as other needs, each one with different priorities. The possible methods begin with dredging and leveling of the river bed, and end with the planning of the reservoirs which will serve multiple purposes.

In this project four considerations should be taken into account:

- Environmental Impacts.
- Flooding of the Agricultural Areas.
- Rock Excavation for the Canal Interconnection
- Land Acquisition and Relocation.

The various alternatives, which will further be evaluated during the Feasibility Study for the fluvial interconnection, would connect the watersheds of the

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Paraguay and Paraná Rivers from East to West utilizing already existing waterways which includes rivers, tributary streams, lakes, and reservoirs.

2.3 Other River Related Projects

The globalization of markets and need for increased regional trade and interchange among the MERCOSUR countries is what has increased the priority of the interconnection between the waterways in the region.

In the decades of 1950's and 1960's, the smaller population density and low agricultural production did not justify the construction of canals.

In the 1970's, hydroelectric power development caused the regulation of the water resources and the navigable sections of the main water courses.

Presently, two projects are of importance within the region and outside the region because of their economic and geopolitical importance. The Paraguay-Paraná and the Tieté-Paraná waterways which would facilitate commercial interchange between the five countries in the region.

The navigable waterways are important for Paraguay because they are the principal means of further economic development for the country.

For Bolivia, the Northern section of the Paraguay and Paraná waterways is the only exit waterway to the Atlantic Ocean that is available.

For Brazil, Argentina, and Uruguay, the navigable waterways are also an important means of commercial trading.

In the case of the Tieté-Paraná Rivers, a Project has been implemented in Brazil which constitutes a development factor for the region of influence that covers the States of Sao Paulo, Paraná, Mato Grosso do Sul, Goias and Minas Gerais; stimulating the creation of new industrial, commercial, and tourist centers.

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The Tieté River, with more than 1,000 km of navigable waterway, will connect the Paraná River with the water control structure at Jupiu and will extend the length of the waterway to 2,400 km to Itaipú Dam.

The possibility of joining the Tieté-Paraná watersheds with Paraguay-Paraná by waterways, thereby connecting large agricultural areas of Brazil, Argentina, Uruguay and Bolivia which have more than 7,000 km of navigable waterways and where 75% of the soil can be cultivated, will certainly improve dramatically the economies of the region.

It is important to mention that on the Tieté River, the construction of the Intermodal Terminals, such as, Pederneiras and Cochás connect agricultural and cattle raising and industrial areas with the big export and consumption regions.

In Paraguay, with the opening of the navigable waterways, the Departments of San Pedro, Canindeyú, Concepción and Amambay which are the cattle raising areas, should greatly benefit by being able to introduce their products to other markets at more competitive prices and also reduce the cost of agricultural products as a result of lower transportation costs.

2.4 Project Implementation

The Executing Agency for this Project shall be the Ministry of Public Works and Communications (Ministerio de Obras Públicas y Comunicaciones - MOPC).

MOPC is a public organization established by the Government of the Republic of Paraguay which is responsible for the operation, maintenance, and administration of public services. MOPC has experience in managing and implementing infrastructure projects.

MOPC will be responsible for all technical aspects of the implementation of this project, including but not limited to the implementation and supervision of the tendering process for the engineering design and construction, review of bids,

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award of contracts, execution and supervision of works, and reporting to the lending organizations for the progress of the project.

In this stage of the studies, MOPC will be responsible for directing the different studies that will be required in order to complete the Feasibility Study. This Feasibility Study will be prepared as part of the due diligence process required for the application for funding from the International Financial Institutions.

2.5 Feasibility Study Preparation Time Table

The preparation of the Feasibility Study will take approximately 8 months. This period will include the time required for the preparation of the geological, hydrological, hydraulic, and environmental studies, as well as all the other studies relevant to the feasibility of the project. The following schedule describes in more detail the implementation plan for the Feasibility Study preparation.

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| | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 | Month 7 | Month 8 |
|--|---------|---------|---------|---------|---------|---------|---------|---------|
| Executive Summary | | | | | | | | |
| Chapter 1 - Introduction | | | | | | | | |
| Chapter 2 - Socio-Economic Characteristics | | | | | | | | |
| Chapter 3 - Waterway System | | | | | | | | |
| Chapter 4 - Engineering Study | | | | | | | | |
| Chapter 5 - Preliminary Design | | | | | | | | |
| Chapter 6 - Cost Estimate | | | | | | | | |
| Chapter 7 - Implementation Program | | | | | | | | |
| Chapter 8 - Economic & Financial Evaluation | | | | | | | | |
| Chapter 9 - Consideration of Environmental Impacts | | | | | | | | |
| Chapter 10 - Conclusion and Recommendations | | | | | | | | |
| Appendix 1 - Socio-Economic Studies | | | | | | | | |
| Appendix 2 - Design Criteria | | | | | | | | |
| Appendix 3 - Geotechnical Study | | | | | | | | |
| Appendix 4 - Hydrologic & Hydraulic Study | | | | | | | | |
| Appendix 5 - Alternative Type Studies | | | | | | | | |
| Appendix 6 - Route Selection Study | | | | | | | | |
| Appendix 7 - Construction Plan | | | | | | | | |
| Appendix 8 - Cost Estimation Breakdown | | | | | | | | |
| Drawings | | | | | | | | |
| First Draft F/S | | | | | | | | |
| Exhibit Preparation | | | | | | | | |
| Exhibit & Report Reproduction | | | | | | | | |
| Submission of F/S | | | | | | | | |



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2.6 Feasibility Study Estimated Cost

The following table shows the estimated cost of personnel and infrastructure required for the preparation of the Feasibility Study:

| PERSONNEL | M/M | BILLING RATE | TOTAL |
|----------------------------|-----------|--------------|--------------------|
| Civil Engineers | 8 | \$26,000 | \$208,000 |
| Structural Engineers | 2 | \$26,000 | \$52,000 |
| Water Resources Engineers | 4 | \$24,000 | \$96,000 |
| Hydraulic Engineers | 5 | \$24,000 | \$120,000 |
| Environmental Engineers | 3 | \$26,000 | \$78,000 |
| Geotechnical Engineers | 3 | \$24,000 | \$72,000 |
| Economic/Financial Analyst | 3 | \$26,000 | \$78,000 |
| Social-Economic Analyst | 2 | \$22,000 | \$44,000 |
| Surveyor | 6 | \$20,000 | \$120,000 |
| CADD Operator | 2 | \$15,000 | \$30,000 |
| Translator | 3 | \$12,000 | \$36,000 |
| Editor | 2 | \$15,000 | \$30,000 |
| Office Support | 9 | \$26,000 | \$234,000 |
| TOTAL | 52 | | \$1,198,000 |

| DIRECT COSTS | UNIT (\$) | QUAN- TITY | TOTAL |
|---|-----------|---------------|--------------------|
| a- Airfare | 4,000 | 16 | \$64,000 |
| b- Hotel Lodging (per month) | 6,000 | 10 | \$60,000 |
| c- Land Transportation (2 cars w/ driver)per month | 20,000 | 8 | \$160,000 |
| d- Reproduction of Docs.(includ. satellite. photos) | 4,000 | 8 | \$32,000 |
| e- Communications (per month) | 4,000 | 8 | \$32,000 |
| Sub-Total | | | \$348,000 |
| Total Personnel and Direct Costs | | | \$1,546,000 |
| f- Contingencies (15%) | | | \$231,900 |
| GRAND TOTAL | | | \$1,777,900 |

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2.7 Project Benefits

This project will contribute to improving trading practices between international markets and the MERCOSUR member countries. The project will also provide for adequate flood control and at the same time will have a positive effect on the physical and biological environment.

The construction of the works shall produce temporary negative environmental effects during the construction activities; however, the negative effects shall be minimized by implementing strict quality control measures. There may be certain small communities affected which may or may not need to be displaced.

The creation of jobs, related with the construction of the works, shall provide an additional benefit to the local communities. The operation of the canal shall benefit the local population by promoting the development of new skills, through technical training to the personnel.

2.8 Conclusion

To accomplish this most important project and to reap the benefits exposed in this Project Profile, the Government of Paraguay, through the Ministry of Public Works, must develop a Feasibility Study.

The reason for this Project Profile is to present it to the International Financing Institutions in order to obtain a non-reimbursable credit to perform the necessary studies required for the preparation of the Feasibility Study. With this Feasibility Study in hand, the government can then pursue obtaining loans to implement the Fluvial Interconnection Between the Paraguay and Paraná Rivers Project.



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the existence of Indian communities, guarantees the preservation of their rights, and the right to develop their ethnicity in their respective habitats.

With respect to the protection of the environment, Paraguay has enacted environmental laws and regulations (Law No. 294, of December 31, 1993) which state that construction projects (public or private) will require an Environmental Impact Study.

During the Feasibility Study for the Canal, the proper guidelines should be followed in order to assure that environmental factors will receive effective and efficient consideration in the development of adequate construction methods for protecting the environment during the planning stages of the project.

Proper environmental guidelines will have to be followed in order to ensure that environmental factors will receive effective and efficient consideration in the development of environmentally sound construction methods during the planning and preparation stages of the project. Close attention must be given to national and international guidelines, and comments on those items should be presented.

The approach to environmental aspects of the development project can be summarized in the following five (5) points:

1. Account for the environmental considerations:

When reviewing environmental factors for the development project, the following will be emphasized:

- a) Harmony between development and the environment from the perspective of sustainable development;
- b) Resolution of environmental issues by means of a continuing dialogue with the communities concerned; and
- c) Consideration of environmental factors at the earliest possible stage of the project development process.

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2. Systematic collection and coordination of environmental information:

The project development unit will compile basic information through a survey of the environmental approaches adopted by agencies such as the World Bank, IDB, OECF, and USAID.

Various criteria will be followed by the project development unit during project planning and preparation: They include:

1. Environmental pollution (air, soil and water, noise, vibration, etc.):
2. Natural environment (flora, fauna, etc.):
 - a) Legislation (i.e., natural parks laws) and rules stipulated in international conventions will be strictly adhered to;
 - b) The project shall not generate considerable adverse effects on the habitat of the main flora and fauna in the area of influence; and
 - c) Measures will be taken to protect rare and endangered species of flora and fauna in the project area of influence.
3. Human environment: The project shall not generate unacceptably adverse impacts in the existing environment.

Paraguay Federal, State, and Municipal Laws include rules on the preservation and conservation of the environment. Preservation is defined as keeping the environment in its original condition; conservation is the rational and sustainable use of natural resources.

In addition to environmental impact studies, development of risk analysis for projects and activities that use potentially hazardous technologies (blasting) will be developed. The correct information should be disseminated to people, and the promotion of environmental education at all education levels in order to develop a public awareness on environmental protection and conservation.

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3.3 Environmental Agency

The Agency responsible for handling all environmental matters is the Ministry of Agriculture and Livestock. Federal Environmental regulations have been issued and all projects must prepare an environmental impact study in accordance with Law No. 294 that describes the impacts of the project on the natural and cultural environment and how these impacts will be mitigated. The government defines actions and measures to be implemented before approval for construction. The Government of Paraguay will consider the environmental factors from the beginning of the project.

3.4 Environmental Effects

The environmental effects that would need to be considered for this type of Project are as follows:

- Water Pollution resulting from decreased flow in the principal rivers.
- Lowering of the groundwater table in the vicinity of the canal.
- Effects of construction and operation of the facility on the environment.
- Effects on the surrounding landscape.
- Effects of construction of the facility on historical and cultural sites.
- Effects on existing infrastructure
- Effects on water use downstream.
- Effects on the environment during the construction period.
- Environmental monitoring.

4.0 RELEVANT INFORMATION

4.1 Organization Chart of Agencies related to the Project

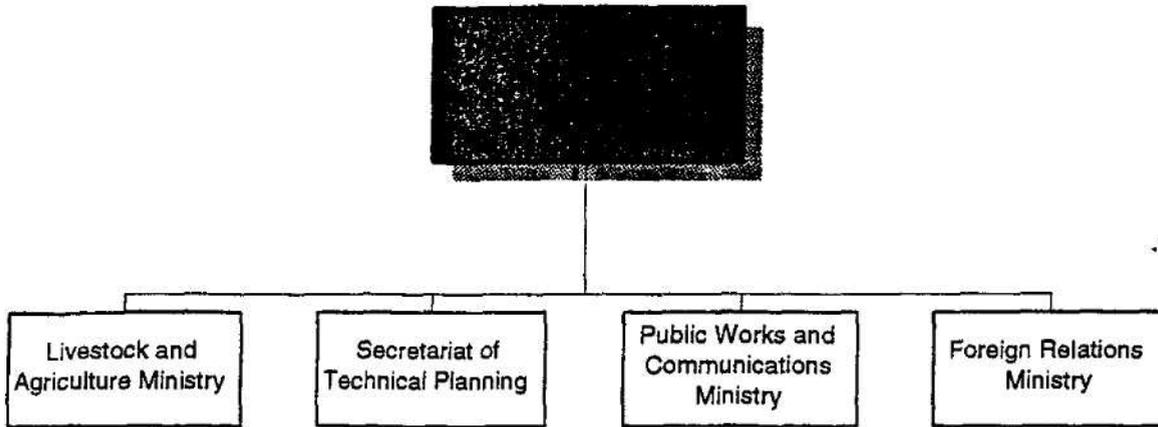
The following organization charts show the structure of the Presidency of the Republic of Paraguay and the Ministry of Public Works and Communications, regarding the agencies that would be involved in the project.

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PRESIDENCY OF THE REPUBLIC ORGANIZATION CHART

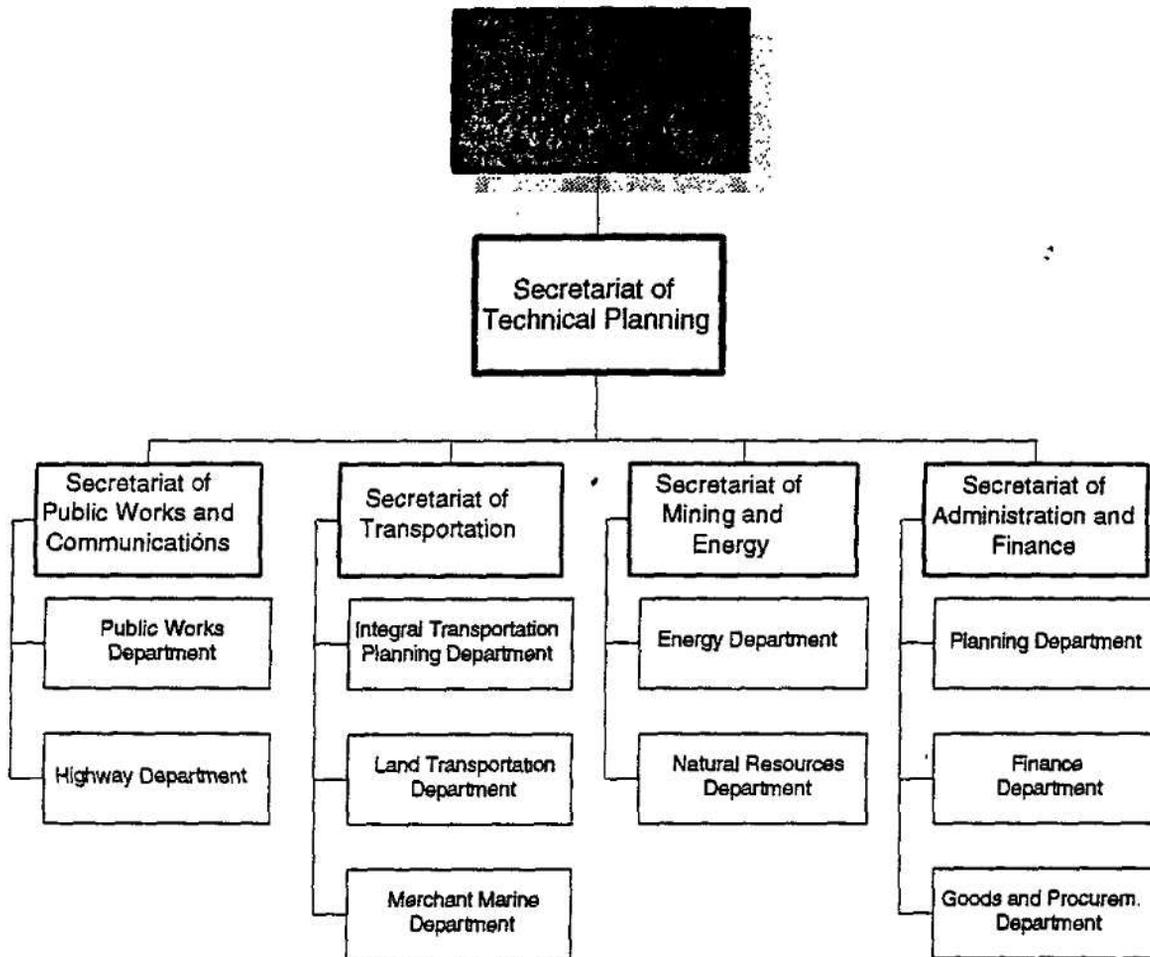


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PUBLIC WORKS AND COMMUNICATIONS MINISTRY

ORGANIZATION CHART



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