

Document of  
**The World Bank**

**Report No. 15354-AR**

**STAFF APPRAISAL REPORT**

**ARGENTINA**

**FLOOD PROTECTION PROJECT**

**October 29, 1996**

**Infrastructure and Urban Development Division  
Country Department I  
Latin America and the Caribbean Region**

## **CURRENCY EQUIVALENTS**

Currency - Peso (Arg\$)  
US\$1.0 = Arg\$1.0

## **FISCAL YEAR**

January 1 to December 31

## **MEASURES AND EQUIVALENTS**

Metric System

## **PRINCIPAL ABBREVIATIONS AND ACRONYMS**

CEU	Central Execution Unit of SSAP
DNRH	Dirección Nacional de Recursos Hídricos
GDP	Gross Domestic Product
GIS	Geographical Information System
GPP	Gross Provincial Product
ICB	International Competitive Bidding
ICR	Implementation Completion Report
IDB	Interamerican Development Bank
IERR	Internal Economic Rate of Return
INCYTH	Instituto Nacional de Ciencia y Técnica Hídrica National Institute of Hydrological Sciences and Technology
JEXIM	Export-Import Bank of Japan
MERCOSUR	Common Market Agreement among Argentina, Brazil, Paraguay and Uruguay
NCB	National Competitive Bidding
NGO	Non-Governmental Organization
OSN	Obras Sanitarias de la Nación
POM	Project Operational Manual
SSAP	Sub-Secretaría de Asistencia a las Provincias Under Secretariat for Assistance to the Provinces
SOE	Statement of Expenditures
SUCCE	Sub-Unidad Central de Coordinación para la Emergencia
SUPCE	Sub-Unidad Provincial de Coordinación para la Emergencia

**ARGENTINA**  
**FLOOD PROTECTION PROJECT**  
**STAFF APPRAISAL REPORT**

**Table of Contents**

LOAN AND PROJECT SUMMARY .....	iii
1. THE REGION .....	1
A. Background .....	1
Geographic and Climatic Features of Argentina .....	1
Flood Zones and Frequency .....	1
Demographic, Economic, and Social Factors .....	3
B. Institutional Framework for Flood Control .....	4
Legal Framework .....	4
Institutional Framework .....	8
2. FLOODS IN THE RIO DE LA PLATA BASIN .....	11
A. Background .....	11
Characteristics of the Basin .....	11
Past Floods in the Basin .....	13
The 1992 Flood .....	15
B. Future Prospects: A River Basin Approach .....	18
Improved Management of the Basin .....	18
Structural Measures .....	21
Nonstructural Measures .....	22
C. Past Bank Lending .....	24
Previous Bank Involvement .....	24
Lessons from Completed and Ongoing Projects .....	24
3. THE PROJECT .....	27
Project Origin .....	27
Rationale for Bank Involvement .....	27
Project Objectives .....	27
Project Description .....	28
Project Costs .....	31
Financing Plan .....	33
Status of Project Preparation .....	34
Implementation Arrangements .....	35
Monitoring and Reporting .....	36

This report is based on the findings of an appraisal mission consisting of Messrs./Mmes. Armando Araujo (Task Manager, LA1IU) Rita Rivas-Gonzalez (Consultant, LA1IU), Herman Nissenbaum (Consultant), Juan David Quintero (Environmental Specialist (LATEN), Luis Carlos Garcia Lozano (Consultant, Environmental Aspects) which visited Argentina in December 1995. Mr. William Mayville, Consultant, also assisted in report preparation. Peer reviewers were Messrs. Klas Ringskog (LATAD), and Abel Mejia (LA1IU). Mr. Orville Grimes, Projects Adviser (LA1DR), reviewed the document. Mmes. Iris Moreno and Margarita Lannon assisted in the production of the report. The Managing Division Chief and Department Director are Asif Faiz and Gobind T. Nankani, respectively.

Accounts and Audits . . . . .	36
Procurement . . . . .	37
Disbursements . . . . .	40
Project Benefits . . . . .	40
Economic Impacts . . . . .	41
Project Sustainability . . . . .	42
Program Objective and Poverty Categories . . . . .	43
Environmental Impacts . . . . .	43
Participatory Approach . . . . .	44
Program Risks and Safeguards . . . . .	44
Financial Benefits . . . . .	45
 4. AGREEMENTS REACHED AND RECOMMENDATION . . . . .	 47

#### ANNEXES

1. Legal and Institutional Framework . . . . .	51
2. The Halcrow Study . . . . .	55
3. Provincial Master Plans . . . . .	59
4. Shelters and Housing . . . . .	79
5. Environmental Assessment . . . . .	87
6. Project Description and Costs . . . . .	97
7. Project Operational Manual (POM) . . . . .	107
8. Supervision Plan . . . . .	109
9. Implementation Plan . . . . .	111
10. Economic Analysis . . . . .	119
11. Community Participation . . . . .	125
12. Project Monitoring and Auditing . . . . .	127
13. Selected Documents and Data Available in the Project File . . . . .	131

MAPS IBRD No. 27719, 27720, 27721 and 27722



**ARGENTINA**  
**FLOOD PROTECTION PROJECT**  
**Loan and Project Summary**

**Borrower:** The Argentine Republic

**Implementing Agency:** Ministry of Interior, Beneficiary Provinces and the city of Buenos Aires

**Beneficiaries:** Ministry of the Interior, the Provinces of Buenos Aires, Chaco, Corrientes, Entre Rios, Formosa, Misiones, Santa Fé, and the city of Buenos Aires

**Poverty:** Not Applicable

**Amount:** US\$200.0 million (including up to US\$20 million of retroactive financing)

**Terms:** Repayment in 15 years, including five years of grace, at the Bank's standard interest rate for LIBOR-based US dollar single currency loans

**Commitment Fee:** 0.75% on undisbursed loan balances, beginning 60 days after signing, less any waiver

**Onlending Terms:** Most proceeds of the loan would be onlent to provincial governments and to the city of Buenos Aires from the national government under the same terms and conditions as the Bank loan. The provinces would assume the foreign exchange risk and the full cost of the central executing unit (SUCCE). Each province's revenue-sharing funds from the national government would serve as a guarantee for repayment of subsidiary loans

**Financing Plan:** See para. 3.16

**Estimated Rate of Return:** 20.4%

**Maps:** IBRD No. 27719, 27720, 27721 and 27722

**Project Identification No.:** AR-PA-6052

Vice President:	Shahid Javed Burki
Director:	Gobind T. Nankani
Division Chief:	Asif Faiz
Task Manager:	Armando Araujo



# **ARGENTINA**

## **FLOOD PROTECTION PROJECT**

### **1. THE REGION**

#### **A. Background**

##### **Geographic and Climatic Features of Argentina**

1.1 Argentina is South America's second largest country. It consists of four distinct geographic regions covering about 2,800,000 km<sup>2</sup>. Also, its length is impressive: its Atlantic coastline stretches over 2,850 km; the northern border with Paraguay extends over 1,500 km; and the river border with Brazil is estimated at 1,000 km.

1.2 Distinct variations in terrain and climatic zones occur beginning with its slope from the Andes on its western boundary (including the highest peak on the continent) to the Atlantic seaboard in the east. The Andean "cordillera" bordering Chile forms nearly one-quarter of the country. It is low and deeply glaciated, but includes a high, largely dry plateau. Its northern region encompasses the Gran Chaco, a warm lowland area of tropical forest alternating with broad plains. Elevations in this region vary from 600 to 800 feet above sea level. In the central seaboard are rich steppes (pampas) comprising the most extensive plain in the southern hemisphere. Patagonia's plateaus extend over the rest of the country. This region is distinguished by its colder climate, semiaridity, and continuous winds.

1.3 Although climates vary, the southern temperate zone is pervasive: tropical in the north, temperate in the central region, cold in the south, humid in the east and northeast, and semiarid in the west and southwest. The large northern plain is subtropical, with the Gran Chaco posting the highest temperatures in South America, between 49 and 50 degrees centigrade. At the other extreme, conditions are subarctic in the southern-most areas, and subpolar in parts of Patagonia. High atmospheric humidity dominates the subtropical area while dry air generally characterizes the remaining regions--except for the southern Andean cordillera.

1.4 There is no mountain chain of sufficient size to shield air movements in this part of the southern hemisphere; consequently, winds flow freely from Ecuador to the South Pole and back, producing abrupt temperature changes. Another important phenomenon is the incidence of rainfall above historic levels in cycles of 10 years or more.

##### **Floods Zones and Frequency**

1.5 While two-thirds of the country is essentially dry, Argentina experiences heavy rainfall largely concentrated in the east and the southern "cordillera" (the latter recording over 3,000 mm of rain annually). Rainfall also has ranged between 1,700 and 1,800 mm in northern part of the Province of Misiones and as high as 2,000 mm in the northwest. The most striking rainfall

gradients occur in the Patagonian Andes and in areas of intensive rains in the northwest--where annual totals range between 2,000 mm and 100 mm over the same distance and in the same direction. During winter, heavy rain may occur over the lower watershed of the Rio de la Plata, which strongly influences the weather in the Province of Buenos Aires because of cyclones over Mesopotamia and associated strong winds from the southeast. These "sudestadas"-- or unusually heavy rainstorms lasting several days--frequently impede drainage of the La Plata River and its streams, and often contribute to widespread and severe flooding.

1.6 Rainfall totals vary greatly. More rainfall can occur in a single month of a "wet" year than during the entire 12 months of a "dry" year. At times rainfall has been heavy enough to inundate large areas of the pampa and Gran Chaco. The rainfall in northeastern Argentina has totalled between 12 mm and 150 mm in a day; but monthly amounts of 750 mm have been recorded in subtropical Misiones. This province (along with some Atlantic coastal zones) is also reported to have more than 100 rainy days per year, which is twice that of Buenos Aires.

1.7 Rainfall is most intense in areas close to eastern Paraguay. More than 30 days per year precipitation is greater than 10 mm, compared to less than 5 days on average in the dry western regions. In addition, the rain density (rain totals/rain days) in the northeastern region exceeds 20 mm/day during the wettest months, with a yearly maximum in 24 hours of 70 mm--both of which greatly exceed levels in other regions. Moreover, the subtropical region experiences more thunderstorm activity, averaging 50 or more days a year.

1.8 In essence, about one-fourth of the national territory is repeatedly flooded. Moreover, flood effects are commonly judged as extremely severe in the northeast, the pampa pasture, and metropolitan Buenos Aires, which conforms to regional patterns. Latin America overall historically has experienced many natural, especially water-related disasters (perhaps second only to Asia); however, only recently has sustained public attention been mobilized and led to a national program to defend against the consequences of flooding.

1.9 Previous inattention to flooding as an issue to be addressed stems largely from the implicit belief in the rich natural resources of the country and lack of population pressure. Argentines also perceive themselves to be a "baja cuenca" country, that is, substantially subject to higher waters than neighboring nations because much of the country is low-lying; in addition, floods have not taken many lives. Moreover, hurricanes, tornados, seaquakes, and the like have not been important factors, and the relatively few vulnerable volcanic and seismic zones are far from population centers. Another factor is that much of the population has a relatively narrow environmental perspective, reflecting the country's urban bias--even though an important segment of its economy is rooted in agriculture and related industries.

1.10 Gradually, this inattention to natural disasters has begun to change in the wake of more frequent and higher floods. Also, significant migration to urban areas now exposes much larger numbers of people and important economic activity to the consequences of floods. When Buenos Aires was founded in 1580, buildings were deliberately located on highlands distant from historically flooded zones; however, that settlement now represents only 10% of the capital city.

1.11 Exacerbating the region's vulnerability to floods and their aftermath, conservative population projections at critical points in this century led to serious underdimensioning of major drainage and sewer construction in the city of Buenos Aires. The result is that more 10 million people rely on a system meant to serve only a tenth of this number, a large proportion of whom live in low-lying flood plains.

### **Demographic, Economic, and Social Factors**

1.12 Argentina became heavily urbanized before World War I, and remains one of Latin America's most urban countries. In 1991, 87% of its population lived in urban areas of 2,000 or more people, mirroring a steady decline in the rural population (8% per year since 1980). Most people live in five highly urbanized jurisdictions--Buenos Aires, Cordoba, Mendoza, Santa Fé, and the Municipality of Buenos Aires--where national economic activity is concentrated. Significantly, population growth rates and gross provincial product (GPP) of less urbanized provinces began to exceed those of the "big five" during the 1970s and 1980s. Total share of GPP for the latter declined from 82.5% to 73.1% between 1970 and 1989 as other provinces become more economically important.

1.13 Provincial demographic, economic, and social diversity is exemplified by the differences among the seven Paraná Basin provinces which would participate in the proposed project: Buenos Aires, Chaco, Corrientes, Entre Rios, Formosa, Misiones, and Santa Fe. Buenos Aires and Santa Fe provinces collectively account for 16% of the national territory, while Formosa and Misiones each only comprise between 1% and 3%. Nearly half of the population lives in Buenos Aires and Santa Fé. The residents of the other five Basin provinces total only 12%. On the other hand, relatively small Misiones (with less than 29,800 km<sup>2</sup>) has a comparatively high population density of 26.5 persons/km<sup>2</sup>, more than twice the national average (11.7).

1.14 Economically and socially, Buenos Aires and Santa Fe are much more advanced than the other Basin provinces. Chaco, Corrientes, Formosa, and Misiones (constituting most of the northeast region) spread across one of the most economically underdeveloped areas of the country. Entre Rios also has relatively small output and population, and even greater incidence of poverty. The combined GPP of these five provinces represents less than 9% of total national GPP and only 27% of that of Buenos Aires Province. Not surprisingly, Chaco, Corrientes, Formosa, and Misiones produced less than 4 percent of total 1994 exports, while Misiones ranked twenty-first out of twenty-four provinces in per capita income. As for infrastructure services, a 1993 national assessment found much worse street paving, water and sewer mains, and street lighting in these five poorer provinces.

1.15 Unemployment figures in 1994 in the (more rural) Basin provinces was as high as 12.4%, compared to 8.7% in the Buenos Aires metropolitan area. Partly on this account, employment in the Basin area appears excessively dependent on the public sector as the employer of last resort. May 1995 statistics show that the ratio of civil servants to population in the Province of Formosa is 80 per 1,000 residents--almost four times greater than Buenos Aires--with Misiones at almost 41 per 1,000 and Corrientes 51 per 1,000. Average provincial wage levels

last year were as low as US\$695 equivalent, compared to US\$1,187 equivalent in the Buenos Aires metropolitan area.

1.16 Poverty also worsened between 1990 and 1992, with the proportion of the poor located in the northern provinces rising from 24% to 29%. The highest rates (averaging 40%) were registered in these provinces as well, along with the slowest rates of poverty reduction. The 1992 indices of poverty for city dwellers in Chaco, Corrientes, Formosa, and Misiones were in the 31.7% to 44.2% range, compared to the national average of 22.6. In the same year, over 13% of northeastern area residents lived in poverty compared to 11.3% in 1990. The poor constitute over 30% of the populations of Corrientes, Formosa, and Misiones.

1.17 Paraná Basin infant mortality rates in 1992 exceeded 33.5 per 1,000 live births, compared to less than 15 per 1,000 in metropolitan Buenos Aires. Fewer children between the age of 5 and 12 attended school in the northeastern area in 1991 than in all but one other province (Santiago del Estero), the same as in 1980, with the schooling rate among students between ages 13 and 17 also showing no improvement. The same was true for housing without water or flush toilets. Between on-half and two-thirds of inhabitants in four of these provinces in 1991 lived in unsatisfactory housing, compared to about 5% in the Buenos Aires metropolitan area.

1.18 Decades of underfunding of the country's infrastructure has led to a steep decline in public assets and quality of services. The 1994 World Development Report alluded to this deterioration, citing Argentina as having one of the lowest levels of infrastructure quality and quantity among upper-middle-income nations. The Government now plans to rehabilitate and expand the capital stock by raising the level of gross capital investment from US\$6.6 billion equivalent in 1993/94 to US\$8.9 billion in 1996. These plans call for over US\$425 million to be invested in provincial water projects and US\$840 million for provincial road works over two years.

1.19 The multiyear investment program, "Argentina en Crecimiento 1995-99," seeks to underwrite this effort. It includes several transport activities to facilitate Paraná Basin province exports--mainly from Corrientes and Misiones--to markets in Paraguay and Brazil, improved rural roads within these provinces, and, importantly, flood protection works to defend productive assets throughout the northeast. This strategy will address many of the current development constraints in this region.

## **B. Institutional Framework for Flood Control**

### **Legal Framework**

1.20 Background. Addressing and overcoming the foregoing problems inherently involves issues regarding the role of the provinces. These issues are deeply rooted, originating in the historic divisions between Argentines who espoused a federal over a centralized political system. Such differences led to a sharp split between the country's coastal and interior populations for more than 50 years after the nation gained its independence.

1.21 Ultimately, Argentina chose a federal system that separates powers and responsibilities among different segments and levels of government. The founding Constitution divided governmental authority among the legislature, executive, and the judiciary. It also allocated certain powers between federal and provincial officials. Differentiations however were based on the general concept that power emanates from the provinces, which, until adoption of the 1853 Federal Constitution, were relatively autonomous politically. The provinces then relinquished numerous functions, with the federal authorities authorized to establish general laws and regulations. On the other hand, the provinces retained substantial self-governance powers safeguarded by their respective constitutions, as well as all powers not specifically relinquished. In practice, this serves to limit the Central Government's scope for independent action.

1.22 Legal Framework. Each province maintains control over its natural resources and is responsible for preserving and protecting their quality (Article 124, Federal Constitution). However, the division of powers does not vest complete control in the hands of any single governmental jurisdiction. The Federal Constitution authorizes central government actions to foster development throughout the country--even where provincial jurisdiction would otherwise apply. Different interpretations of the relevant clause of the Constitution (known as the "progress" clause) and various provincial constitutions created ambiguities with regard to responsibilities for financing and delivery of public services. Also, Article 41 calls for national norms to achieve at least minimum standards to protect rivers, including their banks and beds.

1.23 The result is a somewhat fragmented definition of ownership rights governing Argentina's water resources, among others. National officials regulate water use within international boundaries, the federal territory, or in interprovincial commerce. Provincial officials govern water resources within their jurisdictions. However, there are also overlapping responsibilities with little coordination among federal, provincial, and municipal authorities.

1.24 This has hindered water resource management and recently caused the Government to reexamine sector legislation. Consultant studies identified key deficiencies in the legal framework, particularly problems related to floods and similar emergencies. A substantial number and variety of provincial laws were identified that govern the regulation of water and natural resources related to it. Typically, they fail to define clear geographic boundaries for when to adopt preventive measures--as do corresponding federal laws.

1.25 Fortunately, changes are underway with the introduction of proposed new national laws, which now await final legislative action. The pending flood control and protection measures would modify existing distinctions between Federal and provincial sovereignty over river-related matters, and provide additional, long-needed clarifications. They also set forth as national policy the requirement to rapidly evacuate flood waters, as well as recommending the application of land-use restrictions near flood zones. Another proposal is a civil defense law, which is the first Federal legislation prescribing a national system in the context of natural resource protection. In connection with these measures, to enhance the legal framework, the proposed project would support the creation of provincial laws and regulations on issues related to floods.

**1.26 Strengthened Role of Provinces.** Under the current Administration, intergovernmental relationships have been altered with a rejuvenation of provincial importance. Political power and resources have moved increasingly away from Greater Buenos Aires. In part, this has been sparked by resurgent federalist and decentralization actions, resulting in progressive transfers of expenditure responsibilities to local levels. These trends go back many years but have gained momentum recently. There also have been fundamental changes in the management and ownership of Argentina's infrastructure as a result of the privatization of many federal functions. Central Government agencies and public enterprises lost considerable authority and resources; many are now either totally or nearly privatized or no longer exist.

**1.27** These changes have frayed the already thin local institutional capacity. One illustration is the City of Buenos Aires's management of its chronic flooding problem. As long as the Federal authorities dominated infrastructure and public services, that problem was reasonably well handled. For some time, "Obras Sanitarias de la Nación (OSN)" built and maintained stormwater drainage networks for the capital. In the last few years, though, OSN has been dismantled, which has also coincided with rising flood levels and considerable damage. The Government of the city of Buenos Aires has struggled unsuccessfully since the late 1980s to cope with this situation, and has developed plans for drainage works in several basins.

**1.28** The provinces today are the major providers of core public services in health, education, security, water and sanitation, electricity, and other infrastructure--either directly or through concessions to the private sector. These governments, including the city of Buenos Aires, accounted for half of all public expenditures for goods and services in 1993 and employed about 40% more staff than the federal administration.

**1.29** However, local authorities have experienced problems meeting their new responsibilities. As a result, generally low quality and coverage of public services persists. Most of these governments were not prepared to fulfill their expanded roles and have not yet sufficiently modernized to take up their new responsibilities. Part of this is attributable to diffused jurisdictional rights and obligations. Perhaps an even more important factor is that the intergovernmental arrangements poorly match provincial expenditure responsibilities with available resources. This has compromised provincial accountability.

**1.30 Financial Constraints.** Provincial financial constraints are affected by a high level of central financing of provincial expenditures, and the resulting lack of incentives for provinces to manage operations effectively. Since 1986, there has been a Federal revenue-sharing arrangement that provided the basis for the financial relationship between the nation and the provinces. The arrangement then called for distribution of almost 57% of shared revenues to the provinces; other special funds are also available. The result has been that even the relatively well-administered provinces rely on the central government for most of their revenues--and this dependence is considered excessive.

**1.31** Federal (coparticipation) revenue transfers in 1992 financed on average 60% of all provincial spending, and additional discretionary transfers provided another 6%. For the five



poorest Paraná Basin provinces, national transfers averaged 82% of expenditures (the highest being 92% in Formosa). These transfers involved considerable resources, particularly because beginning in 1991 central government revenue collections greatly increased. As a consequence, the statutory revenue-sharing formula prompted much higher "coparticipation" transfers, which rose from 5.9 billion to 10.7 billion pesos (in 1993 real terms) between 1990 and 1992. Now, provincial own-source revenues are increasing but are still insignificant in many provinces compared to previous central governmental transfers.

1.32 Similar weaknesses can be seen in provincial spending priorities. Provincial revenues were 26% higher in 1991 and 47% more in 1992 over previous years, rising to the equivalent of 9% of GDP. But when provincial revenues dropped, administrations cut capital expenditures in half while maintaining current expenditures roughly constant. Public investment declined by 60% on a per capita basis between 1981 and 1990, when they represented 19% of provincial spending. Even with the subsequent increase in overall provincial revenues, capital expenditures further declined in 1992/93 to 15% of provincial spending. The share of provincial investment financed by Federal transfers grew from 35% in 1983 to an average of 53% between 1990 and 1992.

1.33 These financial problems generally apply to the seven Basin provinces. In 1994, all showed primary operating deficits (overall fiscal balance less net interest payments and capital revenues) with one exception, Corrientes. The latter's positive level was only 1% of current expenditures. There are however some encouraging trends: as of April 1995, only Buenos Aires, Formosa, and Misiones continued to show further primary operating deficits. Moreover, data show larger shares of provincial current expenditures were financed by locally-generated revenues between 1992 and 1994. However, that share remained below 20% for four of the seven Basin provinces over this period. This low level of internally generated resources is a bad sign, given the pressure on the Federal Government to reduce its transfers, while at the same time additional health and education functions are being decentralized.

1.34 Recent Initiatives. The Federal Government has launched efforts to improve provincial finances. It has been trying to rationalize coparticipation transfers; reduce discretionary transfers that reward poor fiscal performers; decentralize more service responsibilities in health and education to the provinces; reform and take responsibility for provincial social security systems; improve local resource mobilization and trim provincial public administration; eliminate Central Bank rediscounts; and promote privatization of provincial banks. To achieve these, the Ministry of Interior has established the Under-Secretariat for Assistance to the Provinces (SSAP) to oversee this process.

1.35 These efforts have met with some success. Chaco, Entre Rios, and Misiones, for example, have recently approved legislation supporting Federal-inspired tax reforms. These provinces have also formulated plans for reducing redundant civil servants and auditing their largest taxpayers. They also approved legislation for privatizing provincial banks and public enterprises. Corrientes, Entre Rios, and Santa Fé are reported to be advancing privatization transactions. There are strong imperatives for additional reforms, particularly by the northern

and northeastern provinces. However, provincial fiscal adjustment is unlikely to be implemented on the scale or at the pace of the Federal Government's recent successful effort.

1.36 Consequently, the Bank has been providing provincial and municipal loans directed at overcoming these obstacles. Beginning with the first Provincial Development Loan (Ln. 3280-AR), SSAP has been supported in stimulating improvements in local resource mobilization and improvements in the efficiency of local expenditures. The Provincial Reform Loan (Ln. 3836-AR) is providing additional support, particularly to the Federal Government to meet its objectives of tightening discretionary transfers and improving incentives for greater fiscal progress and accountability.

1.37 Similarly, the Second Municipal Development Project (Ln. 3860-AR) limits access to a US\$600-million equivalent program of infrastructure improvements to localities where current revenues (excluding discretionary grants) exceed current expenditures and where creditworthiness can be demonstrated. The provinces also would need to meet these criteria for access to the Second Provincial Development Project (Ln. 3877-AR). Other Bank-financed activities are geared toward developing alternative approaches to facilitate provincial access to Argentine capital markets and to strengthen the financial autonomy of provincial service providers so as to reduce their operational subsidies.

### **Institutional Framework**

1.38 The institutional framework for dealing with floods needs to be improved at both the federal and provincial levels. The federal agency in charge of river basin management and water rights control is the "Dirección Nacional de Recursos Hídricos (DNRH)", a department of the "Secretaría de Obras Públicas" of the Ministry of Economy and Public Works and Services. It is in charge of preparing and executing national water resources policy, while the bulk of responsibilities rests with the provinces. Civil defense actions at the federal level are under the "Dirección Nacional de Defensa Civil", Ministry of Interior. Accordingly, especially as the provinces have not delegated to Federal agencies the majority of water management and civil defense actions, a stronger institutional framework is now needed in the provinces.

1.39 Currently, river basin management is not strong. Some provinces have regulations and one agency assigned to control basin management, while the majority have no control, with actions taken only during flood emergencies, causing low efficiency and high costs. Further, recent studies identified five areas needing improvement for adequate flood preparedness. These are: (i) a well-defined defense strategy; (ii) good maintenance of flood defense installations and enforcement of flood defence strategy; (iii) creation of a well- conceived early flood-warning system; (iv) environmental guidelines that take into account recurrent floods in the area; and (v) civil defense preparedness for flood emergencies. The proposed project would address all of these needs.

1.40 The proposed project would classify areas by flood risk to facilitate each province having a suitably-tailored strategy to cope with recurrent flood events. In addition, each province would

prepare a Master Plan for flood-zone areas that defines the defense works needed to protect vital economic investments, as well as areas for expansion with the intent of containing the effects of future floods (see Annex 3). Responsibilities for maintenance of flood defense installations would be identified by each province and municipality, depending on the various arrangements that exist there, although every province would be responsible for supervising the quality of maintenance services. To assure this is done, each province would assign responsibility to one agency (coordination unit) to continuously update the Master Plan, assure its implementation, and the quality of maintenance of flood defense installations. Accordingly, during negotiations it was agreed that in the onlending subsidiary agreement a clause will be included by which each of the seven provinces would establish such a coordinating unit and would assign to them responsibilities satisfactory to the Bank.

1.41 A well-conceived early flood-warning system--including coordinated efforts of the Federal Government and all seven provinces--would be created. Currently, only flood forecast activities are performed by the "Instituto Nacional de Ciencia y Técnica Hídrica (INCYTH)". The Flood Rehabilitation Project (Loan 3521-AR) funded new hardware, software, and communication equipment for INCYTH to improve its ability to forecast floods. This was an emergency action given the disastrous flooding in 1992, when INCYTH's computational equipment was only partially in operation, could not communicate with the affected provinces, and was supported by obsolete software. Loan 3521-AR also funded an assessment of the installations for measuring stream flows in the river basin and the flood warning system existing in the basin. The proposed project would improve the physical installations by financing a new data collection system, new communication systems, and new computer installations for INCYTH and for the provinces, in addition to the requisite training (see para. 3.4). To ensure the effectiveness of this technical upgrading, a network of agencies responsible for data gathering in each province will be created, specifically to provide flood forecasts and, when needed, warning local authorities and the affected population of possible floods and their predicted effects. This proposed early warning system would consist of: flood forecasting (local and in the basin); frequent coordination meetings among the provinces to share perspectives and innovations; and local actions to warn and mobilize the population. To assure its success, the subsidiary loan agreement of the proposed loan of each province would assign to the coordinating unit referred to in paragraph 1.40 the responsibility for flood warning. Those agencies, together with INCYTH, would constitute the flood warning system network for this basin.

1.42 An adequate system of civil defense also would be created in each province. The subsidiary loan agreement of each province would assign the responsibility to coordinate civil defense actions to one of its agencies. The proposed project would finance the construction of a system of multiuse community shelters (equipped with emergency hardware) for flood emergencies (see para. 3.4). Consultants would be hired to implement emergency procedures to be followed during floods. Equipment and training for the civil defense teams would be provided.



## **2. FLOODS IN THE RIO DE LA PLATA BASIN**

### **A. Background**

#### **Characteristics of the Basin**

2.1 The consequences of the factors described in the previous section have special importance for Argentina's most distinctive geographic feature--the Plate River (Rio de la Plata) system. The latter is composed of the conjunction of three great rivers (the Paraguay, Paraná and Uruguay) in the northern part of the country. The Paraná and Uruguay form a 100 mile-long estuary (the Plate) by their confluence above the city of Buenos Aires, which takes in one fourth of the waters of South America. The entire Basin system, an area of over 3.1 million square km, includes substantial parts of four neighboring states.

2.2 Approximately 84% of its terrain is made up of the Paraná/Paraguay River Basin, which contains a wide range of natural resources. The area has the most developed agricultural and industrial zones on the continent. In addition, it holds some of the most important hydroelectric dams in Latin America (Itaipú and Yacyretá). It moreover contains an extensive riverine and terrestrial transportation network; generates about 89% of the gross domestic product of the countries; and is home to some 100 million people. The Basin covers more than a third of Argentina, and is populated by about 79% of its inhabitants.

2.3 The most important segment is the Paraná River Basin, in view of the magnitude of its discharges, extension of its area and its overall length. The Basin, located between latitude 16° and 34° South, encompasses an important area of Argentina and Brazil, the whole of Paraguay and part of Bolivia. It has a total area of 1.5 million km<sup>2</sup>. The main tributary of the Paraná River is the Paraguay River, whose basin covers 1.1 million km<sup>2</sup>. The Paraguay River runs for about 2,500 km from its origins in southwestern Brazil until joining the Paraná north of Corrientes. Meanwhile, the Uruguay River, also originating in Brazil, flows almost parallel to the Paraná until joining it in its delta, northeast of Buenos Aires.

2.4 The Paraná River originates at the confluence of the Paranaíba and Grande Rivers. Its width varies dramatically from 4,000 m north of Guaira Falls to 60 m below these falls. Near Posadas in Argentina, its width ranges between 150 and 2,500 m. However, its flood plain gradually increases, especially over its right bank (which is lower). The width of this flood plain varies between 13 km near Corrientes and about 56 km near Rosario-Victoria. The delta of the river is 18 km wide at its beginning, growing to a width of about 60 km. Then the Paraná flows into the de la Plata River through its numerous branches.

2.5 The runoff basin of the Paraná is in an area of heavy precipitation almost throughout the year as a result of rain-producing systems of tropical and extra-tropical (frontal-type) origins. Average precipitation in the Paraná River Basin varies between 200 mm per year in the western part, the mountain range of the Andes, and 2,000 mm in the southeastern part, consisting of the

Iguazú River basin. The rains are almost constant during the year in the southern and southeastern parts of the basin. This rainfall distribution produces high river flows in the Paraná that begin in October/November and peak between February and June/July. Consequently, flood plains along the Paraná are periodically inundated. Records show floods in two of every three years at the city of Corrientes, the locale of the critical discharge above which flooding occurs.

2.6 The associated Paraguay River Basin encompasses 1,095,000 km<sup>2</sup>, 17% of which is in Argentina. It stretches over an immense alluvial plain, with very slight slope and extensive flood plains. In the River's upper stretches, the river banks are low and prone to floods (creating a close to 100,000 km<sup>2</sup> zone known as the "Pantanal," periodically covered by water). However, the Pantanal wetlands (one of the world's largest) act like a huge sponge, soaking up the floodwaters of the Paraguay and releasing them slowly. This is beneficial because seasonal rains simultaneously reach the headwaters of the Paraná and Paraguay Rivers, and these would normally converge. But the Pantanal delays the annual rise of the lower Paraguay by about six months. Subject to the same precipitation forces as the Paraná, the Paraguay Basin's average mean rainfall varies from 400 mm to 1,800 mm.

2.7 Within Argentina, the major constituents of the aforementioned basin area are the following:

(a) Gran Chaco: The lowlands of the north include the provinces of Chaco, Formosa, Santiago del Estero, and northern Cordoba and Santa Fe, comprising the lower portion of the tropical Gran Chaco. This hot, thorny scrub region consists mainly of flat jungle plains. Subtropical in character, its rainfall averages between 650 mm and 1,300 mm yearly. Its numerous high-volume, navigable watercourses generate annual floods during the rainy season, sometimes to considerable depths. Cattle, cotton, tobacco, and subtropical fruits are important products.

(b) Mesopotamia: The northeastern lowlands include the Provinces of Entre Rios, Corrientes, and Misiones, which are characterized by rolling hills and high rainfall. This is the wettest section of the country. The narrow northeastern segment of this region constitutes Argentina's section of the Paraná plateau. It is the major source of all Argentine citrus output and beverage crops (tea and yerba mate), besides having sizeable forestry resources.

(c) Greater Buenos Aires: The 2,500-square-km Greater Buenos Aires area is situated on the southern banks of the Rio de la Plata. Although it occupies less than 10 percent of the national territory, it has been the basis of one of South America's largest metropolitan concentrations when combined with interconnected urban areas. This urban corridor (the "Litoral") stretches 500 km along the Paraná and de la Plata Rivers. Equally important is the "humid pampas" segment of the area, a rich agricultural plain of some 45 million ha. This zone accounts for almost all of Argentina's cereal production and the bulk of livestock output. Its climate is temperate with most of the area having 600 mm to 1,000 mm rainfall, rising cyclically to higher levels, particularly in the northwest of Buenos Aires Province. In the eastern half, shallow lagoons are numerous and standing waters render millions of acres unfit for cultivation.

Some areas are constantly underwater, since, as in the Chaco and Mesopotamia regions, they are generally poorly drained.

2.8 The area of the proposed project has been studied several times. Among these, the most representative was a study carried out by the Organization of American States ("Cuenca del Rio de la Plata-Estudio para su Planificación y Desarrollo," 1969-1971). It provided an assessment of the hydro-meteorological data of the Basin and its natural resources, including those of all the countries involved.

### **Past Floods in the Basin**

2.9 Most of northeastern Argentina consists of extensive, low-sloping plains. Their soils have little capacity for water retention. Rainfall patterns (elaborated below) are so irregular that they cause both seasonal surpluses and shortfalls. These factors pose high risks of respective episodes of pervasive flooding and droughts, from which the Paraná Basin historically has suffered. However, there has been an important change: in recent decades, the flooding pattern has been noticeably atypical. In both the 1980s and the 1990s, the floods were large, repetitive, and so costly as to provoke widespread concern.

2.10 Average precipitation in the Basin in normal years varies between 200 mm per year in the western part and 2,000 mm in the southeastern basin, where rains are almost constant. This distribution produces high river flows beginning in October/November that peak between February and June/July. In most flood years, torrential downpours in the upper part of the Paraná Basin between January and May produce massive flows in the Paraná River. Records of these flows date back to 1901, and there is also relatively good land-use data extending over some 40 years; however, the meteorological data contains serious gaps.

2.11 Numerous studies of recent flooding frequently have concluded that there have been substantial changes in the region's climate. Under this hypothesis, two main alternatives are commonly suggested. One underscores extra-regional influences (e.g., "El Niño") that affected average rainfall between 1985 and 1987 without modifying its basic pattern. The second suggests that the rainfall structure of the region has changed (among other possibilities, by the consequences of the alleged "global warming" of the earth), thus leading to a more humid regional climate.

2.12 To further understanding the problem, the Bank carried out a study to review these apparent changes ("An Analysis of Flooding in the Paraná/Paraguay River Basin," September 1993). Findings suggested that 5 of the 10 most severe floods (measured in terms of annual daily peak discharges) recorded in this century have occurred since 1982. The most notable events occurred between November 1982 and July 1983, when area rainfall and flooding far exceeded expectations. The study concluded that:

- (a) flooding was both more frequent and more severe in the latter half of this century than previously experienced;

- (b) extreme flows were both less frequent and less extreme in the latter part of this century than before;
- (c) total streamflow was greater and its intra-annual distribution different than in the latter part of the sample period than during the early years;
- (d) variations in precipitation explain much of the variation in streamflows and flooding;
- (e) changes in intra-annual variation in streamflow appear to be caused by a combination of changes in the intra-annual distribution of precipitation, as well as in the operation of reservoirs on the Paraná that delay the propagation of floods; and
- (f) there is no consistent evidence that changes in rainfall/runoff dynamics associated with land use changes have played an important role in recent flooding in the Basin.

2.13 A subsequent independent report prepared by consultants (Sir William Halcrow and Partners) agreed with these conclusions (Annex 2). The consultant team particularly examined the unusually heavy rainfall that occurred between late 1982 and mid-1983, drawing on hydrologic data gathered near the confluence of the Paraguay and Paraná Rivers. Its report concluded that the 1982/83 flood was the greatest recorded in the 20th Century, noting four to five peaks which exceeded 50,000 m<sup>3</sup>/sec. It calculated that the 1983 Basin figures showed: (a) rain-fall volumes during November to July, 43% higher than normal levels, and (b) stream-flow volumes for the same period, 2 1/2 times greater than usual.

2.14 It also found that, beginning in the 1960s, there were significant increases during this century in the incidence and severity of area flooding within the overall La Plata Basin. The report stated that post-1965 floods constituted 6 of the 10 greatest in this century, affecting the Paraná River, and 8 of the 10 affecting the Paraguay River. For the Uruguay River, the conclusion was that the four greatest floods since 1898 occurred after 1972. The study noted that more extensive flooding in every two of three years' higher waters had caused damage, and that appreciable damage was occurring on average every ten years. The Halcrow report furthermore concluded that during 1992 flood levels at Corrientes reached the second highest levels of the century, recorded at 55,000 m<sup>3</sup>/sec. On these bases, the report concluded that the incidence and severity of La Plata flooding had changed significantly since 1960.

2.15 The consultant assessment of the Paraná River pattern drew a distinction between the magnitude of flood peaks and the frequency of such events. The former were considered not exceptional while the latter constituted a significant change. The Halcrow report singled out Paraná Basin rains in June and November 1982, and January and May 1983 as the highest recorded in those months since the beginning of this century. The study associated these La Plata regime developments with evidence of changes in regional rainfall patterns.

2.16 The economic and social impact of flooding in the Basin has been notable largely for two reasons. First, the development of many Paraná Basin population centers is concentrated in



flood-prone areas. Their cities have continued to grow but consist of infrastructure and services for dry zones, and with buildings that have little adaptive capacity if floods occur. Second, a serious deterioration in water and related services is also in evidence. For example, excluding the Federal Capital, 1993 estimates suggest that 58% (4.6 million people) of the population of Greater Buenos Aires lacked public water supply, and three-quarters (5.9 million) of them were without sewerage service.

2.17 The 1982/83 floods affected an estimated 4.5 million residents of the "litoral," where some 177,000 persons were evacuated. These floods were also reported to have affected half the population of Chaco Province. In May 1985, an estimated 308 mm of water fell in Buenos Aires in 24 hours. This seriously affected more than 305,000 inhabitants, of whom 71,000 were evacuated, with more than 69,000 homes suffering damage. These events are believed to have mainly hit lower-income groups, estimated to constitute over 60% of the total population inundated. Then in March 1988, 240 mm of rainfall fell in four days, prompting more mass evacuations.

### **The 1992 Flood**

2.18 At the end of 1991, unusually heavy rains began to fall in the catchment areas of the Paraguay, Paraná, and Uruguay Rivers. As in most normal flood years, these torrential downpours in the Basin produced massive flows into the Paraná River. On this occasion, however, there were two other unusual circumstances. As the Basin soils were already saturated by earlier rains, the discharge into the Paraná River increased more rapidly than was customary. In addition, heavy rains in the middle to lower Paraguay River Basin that began in March 1992 led to peak flows in this river as well. These coincided with the peak Paraná flows. Ultimately, the combined flows crested in May/June 1992 at almost four times the yearly average, affecting the seven Paraná Basin provinces and contiguous areas in Brazil, Paraguay, and Uruguay. The Province of Formosa was hardest hit, followed by Chaco, Corrientes, and Entre Rios.

2.19 A consultant study carried out in conjunction with project preparation assessed the effects of this flood in six Basin provinces (excluding Buenos Aires), and compared them with the 1982/83 event. The findings show that the 1992 flood was smaller and less damaging--but that both were exceedingly costly. The study calculated the economic costs of the 1992 flood at US\$905 million, while the 1982/83 flood was nearly twice as destructive at US\$1.79 billion (both in December 1993 dollars). By comparison, the toll in 1966 and 1977 was found to be about US\$750 million and US\$266 million, respectively. The study estimated that 3.1 million ha were inundated in 1992, 16% less than in the 1980 events, causing the evacuation of more than 121,000 persons, compared to over 177,000 the decade before. Some 59,000 houses and buildings were damaged, compared to 85,000 previously.

2.20 The 1992 damage tally also showed substantial output losses and capital stock disarray. An estimated 1.5 million head of cattle were affected, as well as 30% of soybean plantings in Formosa and Misiones, and Chaco's cotton crop. Nearly one-third of the damage occurred to commerce and industry. Furthermore, living conditions in urban centers--especially in the cities

of Santa Fe and Clorinda--were hard hit, with disastrous consequences for the poor. In fact, the study judged the "social" ramifications to be more adverse than the effects on productive sectors in this case.

2.21 These consequences and the prospects for further damage from new floods are particularly onerous for the poorer Basin provinces. As noted, they generally have weak economies and heavy poverty burdens. Their public financial capacity is also weak. Nevertheless, there are some hopeful signs of economic growth that could help mitigate the prospect of diminished Federal revenue. The 1994 export growth rate of the northeast provinces was greater than that of any other region, reflecting good cereals, cotton, petroleum, and tea expansion, particularly in Chaco and Corrientes.

2.22 Flood Rehabilitation Project. To mitigate the 1992 disaster, the Central Government established a national program. It first defined and launched relief and rescue operations concentrated on evacuation of the affected population, as well as providing shelter, food, and blankets. River defenses were fortified in all cities and towns near the rivers; dikes and other embankments were also shored up.

2.23 Shortly thereafter, the Government launched the Flood Emergency Rehabilitation Project (Ln. 3521-AR). This was aimed at meeting the reconstruction needs of the afflicted provinces as well as providing a sound institutional framework for coordination and implementation of the overall Government rehabilitation program. The intention was to restore normal economic activity in this troubled area. Project activities were defined as rehabilitating essential infrastructure (transport, energy, emergency flood defenses, education and health, housing, water supply and drainage). In addition to these activities, technical assistance was arranged to facilitate long-term flood forecasting and related activities.

2.24 The design of this operation was based on lessons learned during the 1992 flood together with Bank-assisted flood-related reconstruction efforts in other countries. The most important lessons include: (a) a quick response to flood-emergency conditions through speedy implementation of restoration works, along with consideration of long-term prevention aspects; (b) precisely defined components; (c) enlisting strong Government and beneficiary commitments; and (d) creation of a well-structured implementation framework and transparent assignment of responsibilities for coordination and implementation at the outset. The organizational scheme should entail decentralizing project operations to the local level but with central coordination.

2.25 The design also set strict bounds for the operation. One was that there should be no intention to attain complete or optimal protection against similarly severe future flooding. Accordingly, the project included only repairs and restoration-type works. A second reflected the considerations that the damaged provinces accounted for nearly half of national GDP, and that the flood damage threatened to set back Argentina's then fragile economic recovery and still-tentative fiscal balance. On these accounts, the project focused on productive infrastructure and only the most urgent social facilities. Third, because of administrative weaknesses in the

provinces concerned, it was decided to engage local government institutions experienced in the management of relatively uncomplicated, short-term civil works.

2.26 The project work plan reflected the seven provinces' own identification and judgment about priorities among their reconstruction needs. Emergency flood defense works were ranked highest, for which some 37% of project costs were allocated. For example, repairing and strengthening dikes, and reinforcing and raising bridges that impeded water flows, were considered urgent. Further, many flood control facilities failed because some dikes had not been raised high enough, and some pumping equipment was inoperable. Transport and energy facilities followed close behind in importance. Housing, education, and water supply/sewerage components were lesser priorities, with average ranking of between 9% and 12%.

2.27 The project is being implemented using the existing organizational framework established for the Provincial Development Project, which was suitable for the new tasks. Moreover, to help ensure the project's success, the necessary operational autonomy was provided by the creation of an independent subsidiary of SSAP. A free-standing Central Emergency Coordination Subunit ("Sub-Unidad Central de Coordinación para la Emergencia--SUCCE") was set up to direct the new activity. General coordination and central administration of the program were assigned to SUCCE.

2.28 In addition to employing a capable manager, SUCCE has been staffed with a procurement expert to help oversee time-sensitive purchasing requirements, along with a team of experienced, adequately-paid consultants in the several infrastructure sectors of the operation. An individual consultant, reporting to SSAP, was hired for independent monitoring of the program. Recognizing that the project's success depended equally on provisions for speedy implementation and the engagement of maximum provincial capacity, similar offshoots of the established provincial units ("Sub-Unidad Provincial de Coordinación para la Emergencia--SUPCE") were created in the provincial governments to devote equally autonomous, full-time energy to carrying out the rehabilitation program. These units were also granted considerable operational flexibility.

2.29 Project activities began relatively promptly in late 1992 because of the availability of a portion of the Provincial Development Loan proceeds--which had been reprogrammed to use for addressing flood damage. There were procedural delays however in meeting the conditions of effectiveness of the loan (3521-AR). In addition, some of the participating provinces lagged considerably behind others in initiating their works. These were partially caused by renewed flooding of the Paraguay River in December 1992--the highest on record in the cities of Clorinda and Formosa. Also, there were administrative delays in mobilizing project activity in Buenos Aires and Misiones.

2.30 Despite these initial impediments, assessments of the project's actions and status during 1994 increasingly found that the operation was well implemented. By December 1995, all programmed contracts had been signed. Furthermore, they are being carried out satisfactorily and at a good pace. Encouragingly, the time-sensitive flood defense works generally had been

speedily and well executed. And the lagging Buenos Aires operation had then achieved normal project execution velocity. A notable feature of the project, as planned, was the reconstruction of area residents housing, which had been carefully targeted at low income families. On the other hand, counterpart financing shortages flared up periodically. Disbursements under both loans on August 31, 1996 were 93% of their respective totals. The works are scheduled for completion by April 1997.

2.31 The progress made to date has validated the assumptions about the project design and implementation methods. It also reflects: (a) the fact that some 80% of the works were identified at the start of the project; (b) the benefits of SUCCE's staff, which employed experienced sector specialists; (c) the additional services of the engineering consultant responsible for independent oversight of the operation; and (d) the utility of streamlined arrangements with civil works contractors.

2.32 In addition to carrying out these activities, the Government began preparation for longer-term measures aimed at enhancing flood protection in the future, as well as sustainable development in the Paraná Basin. With assistance provided under Ln 3521-AR, several studies were commissioned (discussed below) that largely constitute the basis for the proposed project and program. Moreover, the same loan funded new hardware, software, and communication equipment for the National Institute of Hydrological Sciences and Technology (INCYTH) to improve its flood-forecasting capacity. This was in response to the need that existed in 1992 when INCYTH's computational equipment was inadequate and the Institute effectively was not in contact with the provinces. In this regard, an expert recently assessed INCYTH's installations for measuring Basin stream flows and "early-warning" capacity.

### **B. Future Prospects: A River Basin Approach**

2.33 The Government has designed a new strategy to cope with Paraná River Basin flooding. The strategy calls for:

(a) improved management of the Basin's major natural resources through improved coordination of flood-related actions within and among the provinces;

(b) "structural measures" consisting of well-defined, long-term investments in defending the area's most important assets, replacing present "emergency" reactions; and

(c) "nonstructural measures" consisting of a combination of actions for "living-with-floods," including flood warning and civil defense measures in lesser priority areas.

2.34 Improved Management of the Basin. To prepare for future floods, the Government has decided to revise various underlying concepts and mechanisms. In the past, water has been treated as an abundant resource (as elsewhere in Latin America) with relatively little concern about it. However, this view is now considered as misguided. This change has been stimulated partially by growing land water-use problems, as well as recurrent flooding, increased

competition for water supply, and contamination. In addition, the management of these issues has been impeded by the disparate interests of numerous sectoral groups.

2.35 Moreover, the change in focus in Argentina coincides with the advent of broader natural resource concerns, which have attracted considerable popular interest. Perhaps the principal aspects are indications that the factors causing extraordinary flooding are becoming more prevalent, which results in costly damage. In addition, the Government has come to appreciate that, despite some gains in limiting vulnerability to natural disasters, many of the flood mitigation techniques are themselves very expensive.

2.36 These concerns have triggered a Government decision to address flood protection issues more forcefully in an effort to reduce vulnerability to flood effects. The authorities also decided to adopt a river basin management approach for this process, given the need for coordinated policies and actions by provinces most affected by floods. Furthermore, a basin-wide approach is needed to overcome the dispersion of local institutions and inconsistent policy frameworks. It is also compatible with and supports the recent increased devolution of governmental responsibilities to local authorities. Experience under the Flood Rehabilitation Project (see paras. 2.22 to 2.32) has shown encouraging interprovincial collaboration on common problems concerning Paraná Basin resources.

2.37 Conceptually as well the river-basin approach has been identified throughout the world as a useful means of dealing with the externalities of water (e.g., diversions for hydropower, irrigation, navigation) and non-water activities. It likewise facilitates comprehensive consideration of broader water issues and flow-regulation alternatives, and optimal choices among flood-control alternatives. This approach is supported by the Bank water resource policy in countries such as Argentina, where provincial governments have primary authority over water resource management.

2.38 On the basis of findings concerning river-basin management, the Halcrow study recommended two alternatives to establishing an institutional framework: (a) an agreement between the provincial governments and the central government on the framework to be ratified by their respective legislatures; or (b) separate provincial laws. The authorities selected the second alternative, and also decided to strengthen coordination of the management of the Basin's natural resources under a decentralized scheme. The key is reliance on each province assuming responsibility for the planning, implementation, and management of project works, with only limited Federal oversight.

2.39 An important corollary of these new arrangements would be to strengthen local rules and their administration in such a way as to overcome current deficiencies in flood protection of the Basin and related environmental concerns. The Basin provinces already have wide authority to provide a better framework for flood protection, which has not been fully exploited. However, current provincial legislation does not adequately provide clear restrictions on land and water resource use, which has led to development of areas highly vulnerable to flood damage. Nor

have current laws produced effective enforcement of pertinent regulations, which has impeded the prevention or reduction of flood damage (para. 1.24).

2.40 Reforming these shortcomings should be facilitated by passage of the proposed new national flood protection law (para. 1.25) that permits more comprehensive local rules concerning land and water use and related environmental matters. The proposed law would charge the provinces with determining river margins and the clear demarcation between private and public zones. It commensurately encourages the establishment of land use restrictions based on these zone distinctions to discourage development in flood-prone and high flood-risk areas.

2.41 To facilitate this approach, a consultant reviewed existing provincial legislation related to flooding and drafted a new legal framework for each province that encompasses: (a) preparing maps of flood-prone areas classified by type of risk; (b) requiring private property owners to demarcate their lands according to this classification; (c) adapting tax rules and Government-supported credit or subsidy programs to discourage development in flood-risk areas; (d) introducing requirements for evaluation of environmental impact in the preparation of proposed new hydraulic works; (e) introducing requirements for cost recovery from beneficiaries of flood control works, covering maintenance as well as construction; (f) arranging for the coordination among different provincial organizations of water resources and flood protection; and (g) establishing areas for appropriate protection of wildlife and vegetation. Agreement on the proposed law was reached during project preparation. During negotiations it was agreed that each province would submit this law to its legislature, as a condition of disbursement of the proceeds of the proposed loan for the respective province. To allow reasonable time for discussions on this law by the legislature, keeping, however, incentives for its approval and enforcement, during negotiations it was agreed that the SUCCE will not authorize any new commitments for contracts for "structural" sub-projects in excess to 50 percent of the evaluated total cost of all first priority sub-projects for a participating province unless the Flood Protection Law has been enacted in that province. "Non-structural" measures could be implemented without restrictions. Additionally it was agreed to adopt as a condition of effectiveness that this law be submitted in the first participating province.

2.42 Subsequently, the provinces would create regulatory controls to enforce these policies.

These would apply, for example, to prohibition of certain building construction and repairs; similar prohibitions on specific types of land; building standards for flood security purposes, e.g., waterproofing requirements; obligations to destroy obstacles to floodways; obligations to build and maintain private drainage and sewage disposal systems with suitable protection against flood damage. Agreement was reached during negotiations on a timetable of actions for each province to enact satisfactory regulations to meet these requirements.

2.43 Further, under the proposed project, each province would classify its areas according to the extent of vulnerability to flood risk. The flood risk in each area would be made public to facilitate private flood insurance providers to assess their risks and estimate insurance premiums. This risk assessment, in addition to legal and regulatory controls (para. 2.42), and the

educational actions on floods included in the environmental component of the project (see para. 3.14) would prompt landowners to seek flood insurance.

2.44 After designating flood-risk areas, each province would update its master plan so as to protect important economic investments in such areas for existing priority zones and to define those expansion areas that will be of equal importance to minimize future flood effects. Further, the provinces and municipalities would assign responsibilities for maintenance of flood defense installations. A single agency would be designated with coordination responsibilities, e.g., continued updating of master plans, enforcing their application, and supervising maintenance of the defense installations. In addition, the seven provincial agencies would meet periodically to exchange information and coordinate their efforts within the Basin.

2.45 Plans for the future call for merging these responsibilities with those for the maintenance of existing flood control operations and facilities, the execution and maintenance of new flood control operations and facilities, flood-warning and related environmental protection functions, and expanded civil defense activities. To achieve this, ideally each province would need to charge the existing SUPCE organizations with responsibility for the internal coordination functions indicated above. This would be an effective way of drawing on the valuable experience and competence of the SUPCE staffs--in addition to their linkage with pertinent provincial governmental and private organizations. It would also provide useful continuity of the existing arrangement of SUCCE's central administration and supervision, and the individual SUPCEs representing their provinces, with the expansion of their functions to encompass implementation and monitoring of river-valley management. However, each province would be free to assign this responsibility elsewhere, as long as central coordination is assured. Provincial authorities would have to ensure adequate resources for discharging these functions.

2.46 To bring about these organizational changes, as well as to place them on a permanent basis, each Province would have to ensure that there is adequate legislation in effect for this purpose. Provinces which elect to use SUPCEs to coordinate the Basin coordination and management approach described above will need to place these organizations on a permanent basis, since they now exist only for the remaining execution period of the Flood Rehabilitation Project. During negotiations, agreement was reached on continuity of provincial coordinating units and the installation of a river-basin management framework, including the provincial laws referred to in para. 2.41.

2.47 Structural Measures. After extended and harmful floodings in 1982/83 and 1992, Argentina made significant investments in structural and nonstructural flood defenses. They are concentrated mainly around the Paraná and Paraguay Rivers, with only a few applying to the Uruguay River. Since measures taken were implemented as part of an emergency program, in reaction to damage suffered during the 1983/82 and 1992 floods, they lack a well-structured and permanent planning framework and related technical support.

2.48 A study of past floods in the alluvial valleys of the Paraná, Paraguay, and Uruguay Rivers (see para. 2.13) concluded that investments in flood protection would be justified in

comparison with only emergency-type rehabilitative actions. The study, which provides the basis for the proposed project, also produced a mapping of the region that demonstrated varying degrees of risk and recommendations for its zoning relative to economic values (Annex 2). Following these assessments, the provinces proceeded with the preparation of local master plans addressing the defense of their most important physical and economic, following the types of interventions and methodologies recommended in the Halcrow study. The specific objectives of these plans were to identify measures that would reduce the period and areas of flooding, improve the related infrastructure, and upgrade the preparedness for dealing with flood emergencies. The works proposed include small dikes, river-side embankments, drainage channels, and pumping systems. In each plan, several alternatives were developed and analyzed, and their environmental consequences assessed. The results form a list of sub-projects. These were scaled down and rationalized on the basis of technical, environmental, and economic criteria and constitute two priority groups. The proposed loan would provide sufficient financing to cover the higher priority of the two. When project implementation would be advanced (around 50%), another operation would be prepared for the implementation of the second round group.

2.49 Nonstructural Measures. Most prior efforts to manage the effects of floods have focused on structural measures involving large-scale, and therefore capital-intensive, flood-control projects. However, the Government has concluded that it is averse to extending these measures to the whole Basin for the following reasons: the fear that large flood control works would yield low returns, be unduly expensive, and could engender a false sense of security in the floodplains; anxiety about damage to ecosystems in normally flooded areas.

2.50 The innovative approach used in this project combines the aforementioned physical controls in some areas with nonstructural measures in others--which is sometimes referred to as a "living-with-floods" strategy. The latter approach stems from the growing international recognition that vulnerability to flood damage is largely the consequence of human actions and choices instead of acts of nature. Attention is focused on decisions such as where people live, where industry and commerce settles, acts of cutting forests, developing marginal lands. On this basis, the nonstructural approach is a strategy that encourages residents of rural areas and small communities to adapt to floods, and even to capture their benefits when possible. It seeks to offset the negative effects of floods, and also to mitigate any negative effects that flood control measures may cause, while at the same time complementing land use restrictions. The "living-with-floods" strategy furthermore is particularly appropriate for riverine floods. These are difficult to control. The area of flooding can be predicted on the basis of topography and past history.

2.51 Flooding also may benefit some areas. It can bring rich silt deposits and topsoil nutrients vital to agriculture as well as nutrients that stimulate fish development. It can improve natural varieties of food grains, recharge shallow aquifers, seed sandbars to form barrier islands, and permit mining of silt deposits (if not sand).



2.52 This approach implies greater importance to the requirement for the traditional defense measures undertaken by the affected communities. Accordingly, the Government's plan calls for a more organized response than the customary mitigation measures Basin residents are accustomed to, as well as an enhanced supporting legal and institutional framework. Its strategy envisages a more participative and decentralized early-warning system throughout these provinces in three main areas: (i) a new institutional framework would be implemented in each province to deal with recurrent floods; (ii) a new early-flood-warning system to ensure more adequate and extensive flood warning capacity in the provinces; and (iii) creation of flood preparedness capacity and improvements in civil defense for vulnerable areas not considered to warrant further investment in structural defenses, including construction of shelters (multipurpose installations) and improved housing for lower-income families.

2.53 The new institutional framework would result in : (i) plans and regulations to rationalize land usage in flood-prone areas, including classification of areas according to their vulnerability to flood risk, thus leading landowners to seek private flood insurance (see para. 2.41, 2.42, and 2.43); (ii) creation of a unit that would coordinate civil defense, flood warning, consultation on hydraulic works, maintenance of flood defense facilities, and provision of environmental safeguards related to flooding issues (see para. 2.45 and 2.46).

2.54 The provincial early flood warning system would be improved including installation of a new network of hydrometering stations with satellite communications to a central computer for gathering a central data bank with open access to all participating provinces, which would have their local computers connected to a central one. Local flood warning teams would be trained and equipped with adequate software to make timely, effective local forecasts. The provincial early-warning units will need to enlist their community in applying preventive measures, and in spreading early-warning information quickly in flood situations.

2.55 To assist the population in areas without defense works, a network of shelters would be constructed and equipped with the necessary emergency supplies required. They would be multipurpose installations that could be used during normal years as community centers, annexes to schools, or sport centers. Since they would be actively used by communities during non-emergency times this would help ensure their routine maintenance. Annex 4 provides additional details on the shelter system.

2.56 The studies of the Paraná Basin experiences underscores the usefulness of improving the housing conditions of populations subject to flooding. Houses constructed inappropriately or of very low quality were totally destroyed. However, houses constructed in better locations or that took flooding into consideration as a factor when designed survived much better. The Government's plan therefore provides for improved housing in areas where no flood defense is planned. The housing component would follow the same principles of the previous project by providing funding for a voluntary program of self-construction of houses by the community. The same voucher system employed successfully in the previous project would be used again (see paras. 3.10 to 3.12 and Annex 4).

### **C. Past Bank Lending**

#### **Previous Bank Involvement**

2.57 Bank lending to Argentina over the past several years has changed sharply from its largely federal orientation to a focus on the provinces. This new thrust resulted from the following reorientation of country assistance strategy: (a) consolidate macroeconomic reforms by extending the adjustment process to the provinces; (b) strengthen the greatly weakened public institutions (especially those responsible for social service delivery); and (c) rebuild Argentina's deteriorated infrastructure base. The Provincial Development Project (Loan 3280-AR) and the Second Provincial Development Project (Loan 3877-AR) seek to stabilize provincial public finances by modernizing public administration and provisions for urgent investments. Similarly, the First and Second Municipal Development Projects (Loans 2920-AR and 3860-AR) pursue the strengthening of local public sector institutions, and mobilize resources for badly needed municipal infrastructure through a more rigorous management of municipal expenditures. In FY95, the Board approved the Provincial Reform Loan (Loan 3836-AR), which supports fundamental policy changes to reform provincial finances, including increased accountability in the use of federal transfers. Recently there have been other provincially-oriented operations in various social services, agriculture, and infrastructure. During FY 1995/96, however, these long-term directions were complemented by actions taken to respond to the Fall 1994 Latin American regional crisis, centered on banking system restructuring.

#### **Lessons from Completed and Ongoing Projects**

2.58 While the rationale and short-term nature of disaster remediation activities do not equally apply in this case, some of their characteristics are nonetheless pertinent. In this connection, experience of past recovery assistance has provided a number of useful lessons:

(a) reconstruction by itself is not enough. Hence, measures must be taken to reduce the risk of future disaster damage as well as to safeguard people and communities at risk. The proposed project is directed to help lessen this vulnerability.

(b) the June 1993 OED audit of the Mexico Earthquake Rehabilitation Project pointed out the importance of quick responses to disaster. However, this review and the March 1994 audit of the Sfax Flood Protection Project (Tunisia) stressed that it was also important to take account of other elements that otherwise might be overlooked and, which might reduce long-term benefits. In the Tunisian case, the acceleration of works design resulted in inadequate attention to such underlying problems as the disposal of storm water. By contrast, the proposed Argentine project is based on an early Government appreciation of the inherent risks entailed in these potential tradeoffs. Therefore, as noted, in parallel with the Flood Rehabilitation repair works, the authorities promptly undertook activities to address the basic causes of the accelerated Paraná Basin flooding and how best to contain them. The proposed project is designed to address these long-term issues.

2.59 Regarding sectoral experience, the Bank's Policy Paper on Water Resources Management (April 30, 1993) noted that past Bank operations showed that severe damage to water resources had occurred internationally as a consequence of extensive exploitation. The use of fiscal incentives, control of land use and management practices, and sound governmental policies and programs designed to avoid further environmental degradation were recommended. It also stated that these approaches to prevention and mitigation of vulnerability were less costly and more effective than restoration and recovery measures. In this connection, more seriously flood-prone countries (such as Bangladesh) have gradually abandoned reliance on large embankments and other "heavy" controls because of doubtful economic viability, perverse effects, and environmental shortcomings. Recent attention concentrates on fewer physical barrier measures, restricting development in flood plains, and preserving ecosystems. The Bank Policy Paper also endorsed early, the full participation of beneficiaries and affected parties in planning, designing, implementing, and managing the project. The proposed project follows this approach.

2.60 Also relevant for the proposed project are the lessons learned from previous Bank-supported provincial and municipal operations in Argentina, as well as the on-going Flood Rehabilitation Project (Loan 3521-AR). The main factors contributing to the greater success of the former have been: (a) concentration on simple and easy-to-implement investments; (b) coverage of a large number of interested provinces (or municipalities); (c) maintenance of highly competent local executing units; and (d) the flexibility of shifting funds among competing provinces. These projects have, at the same time, shown that most provincial procurement practices are cumbersome and antiquated.

2.61 The Flood Rehabilitation Project's successful advances are largely attributable to applying these lessons in its design and manner of implementation, as well as to the creation of a well-structured implementation framework with a very capable implementation unit (SUCCE), staffed by a cohesive team of experienced consultants in several infrastructure sectors of the operation, recruited in the market and paid under market standards. Loan 3521-AR activities also have progressed well because of substantial latitude given to provincial implementation units (rather than the past excessive central Government direct action), the strong technical and supervisory leadership of SUCCE, and the fact that the provincial implementing units (SUPCE) remained small and oriented to collaboration with normal line agencies. The proposed project also would benefit from the current one, in that there are now trained and experienced implementation agencies.



### **3. THE PROJECT**

#### **Project Origin**

3.1 The need for the proposed project was identified during the preparation of the Rehabilitation Project, when the Government and the Bank agreed on improving the afflicted provinces' long-term preparedness to deal with severe flooding alongside of an immediate rehabilitation operation. Accordingly, the proposed project was prepared during the implementation of the Rehabilitation Project and the necessary studies were funded under Loan 3521-AR and from a Japanese Grant.

#### **Rationale for Bank Involvement**

3.2 The Bank's country assistance strategy (CAS - discussed at the Board on May 4, 1995, and an update discussed on April 25, 1996) aims to: (a) consolidate macro reforms by extending the adjustment process to the provinces; (b) rebuild the infrastructure base; and (c) strengthen public institutions (especially those for social services). The proposed project is fully supportive of these CAS objectives. It would advance Government actions to remedy the adverse impact of harmful practices and patterns in the use of natural resources, improve the infrastructure base in flood-prone areas, and further enhance the natural resource base on which future growth depends. This is especially important in the flood-affected areas because of their economic significance and the sizeable populations they contain--in addition to important health and environmental implications. Further, the experience gained in implementation of the Flood Rehabilitation Project makes the Bank uniquely qualified, in the Government's view, to guide a more comprehensive flood protection effort. This experience is especially relevant due to the limited administrative capacity of the Government in this field. In addition, the investments required are unlikely to be mobilized from private sector sources.

#### **Project Objectives**

3.3 The project would help improve the security of economic assets and persons living in the flood-prone area by constructing in defense facilities to reduce future losses due to floods, and by strengthening national and provincial institutions and systems for dealing with future floods as a next phase after the Flood Rehabilitation Project to restore the assets lost in the recent floods. The specific objectives would be to enhance provincial capacity to deal with periodic flooding by upgrading their flood preparedness and mitigation systems, as well as strengthening coordination within the Basin. The aim is to provide technically sound and cost-effective flood-protection coverage of the most important economic areas, and to develop satisfactory institutional mechanisms to sustain them. The project also would help create the legal and institutional framework for each province to develop a well-defined strategy to cope with recurrent floods, including preparation and implementation of master plans for flood defense systems in areas in where flood protection works are not economically or environmentally justified.

## **Project Description**

3.4 The project would support the first phase of a two-stage Flood Protection Program. It would include the following components:

(a) Structural Measures: Consisting of construction works to protect important areas of the flood plain. It would include fortification of flood defenses in geographic areas with strong economic activity and greatest vulnerability to serious repeated flood damage. These investments would not attempt to control flows of the major rivers (Paraná, Paraguay and Uruguay). Instead, they would protect the cities against floods caused by the rivers through works that would prevent water invasions without interfering with the rivers. Works would concentrate on raising bridges, improvement of existing and construction of new drainage channels, embankments and small flood control works. These investments would follow the master plans developed for each flood-prone area (75.9 percent of base costs).

(b) Nonstructural Measures (24.1 percent of base costs): Consisting of:

(b1) New Institutional Framework: Technical assistance would be provided to help create and implement an institutional framework in each province to deal with recurrent floods. This would help: (i) develop plans and regulations to rationalize land usage in flood-prone areas, including classification of areas according to their vulnerability to flood risk, thereby stimulating property and land owners to obtain private flood insurance; (ii) create a unit to coordinate civil defense, flood warning, consultation on hydraulic works, maintenance of flood defense facilities, and coordination of environmental actions on flooding issues; and (iii) institutional development actions that would support the coordinating units in their initial operation through technical assistance and equipment (0.7 percent of base costs);

(b2) Upgrading of Flood Preparedness: For vulnerable areas not considered to warrant further investment in structural defenses, the proposed assistance would provide shelters (multi-purpose installations) and improved housing for lower-income families in flood-prone zones. The housing component would follow the same principles of the previous project, providing funding for a voluntary program of self-construction of houses by the community. Improvements in the civil defense arrangements are also envisaged (12.1 percent of base costs);

(b3) Early Flood Warning System: This component would aim to ensure the development of a more comprehensive flood warning system linking the National Institute of Hydrological Sciences and Technology (INCYTH) and provincial systems. It would include a new hydro metering system, new computational equipment, new software, a new communication system, the creation of local flood warning systems in each province, and training of staff on this new technology (1.0 percent of base costs);

(b4) Project Implementation and Administration: Technical assistance would be provided to help implement the project and carry out a related training program for improving the provinces' capabilities in flood forecasting, early warning, civil defense and environmental activities. The project would

include consultant services for the design of the flood defense works, supervision of construction and implementation of four environmental programs (10.3 percent of base costs).

**3.5 Structural Measures (Defense Works):** A complete list of physical improvements related to flood protection works was first prepared based on comprehensive provincial protection strategies expressed in individual provincial master plans. These were scaled down and rationalized on the basis of technical, environmental, and economic criteria, i.e., they had to comply with minimum criteria for environmental impact and have internal economic rates of return of 12% or higher. As the investment required to implement the whole list would be quite substantial, the Government decided to implement the program in two phases. The proposed loan would finance the higher priority group of the two. The priority criteria was to select from eligible candidate sub-projects (those that met the minimum environmental and economic criteria) those which would defend, in each province, the most important economic assets (normally the most populated cities), but limit the amount of investment in each province in accordance with its counterpart funding capacity. This criteria would also allow all affected provinces to participate in the project. This is required for implementation of the "nonstructural" measures whose effectiveness would require participation of all provinces in the Basin.

**3.6** It is proposed to structure the Loan so as to facilitate the possible incorporation of some "second priority" list activities during project execution. In view of the provinces' disparate implementation capabilities and performance, two annual reviews at early stages of implementation would be convened to determine if the initial provincial allocations from the proposed loan require revision. During these reviews, it would be possible to transfer funding from a slow-moving province to better performing provinces. Also, when project implementation would be further advanced (to around 50%), a second operation might be prepared for the implementation of the remaining economically sound sub-projects (future "second priority" group). Annex 3 (Provincial Master Plans) gives details on the technical, economical and environmental analysis of all sub-projects made during project preparation. Annex 6 (Project Description and Financing) gives a complete list of sub-projects included in group one (first priority) and in group two (second priority). Annex 10 (Economic Analysis) gives details on the methodology used for the economic analysis and a ranking list of sub-projects by their internal rate of returns.

**3.7 Institutional Framework:** This component would cover technical assistance for creating and implementing the institutional framework in each province. It would fund consultants to help create those frameworks and equipment (mainly computers and software) for the province's coordination units on flood-related activities (see para. 2.34 to 2.46).

**3.8 Flood Warning:** The project would include: (i) installation of a new hydro-metering network consisting of waterflow gauging stations with satellite connection to a central station at INCYTH for input in a central data bank; (ii) installation of local computers connected to the central station to allow every province to have unrestricted access to the data bank; (iii) improvements in the software for flood forecasting, including its adaptation to allow some provinces to forecast local sub-basins. This mathematical model will be installed in INCYTH's central computer and in each province's local computer; and (iv) creation of a provincial group responsible for flood-warning activities (see paras.

1.41, 2.52 and 2.54, and Annex 6). A training program for INCYTH's and provincial staff on the new system would also be included in the project (see para. 3.13).

**3.9 Shelters:** This component would fund the construction of 155 shelters (multi-purpose installations) to protect affected population during floods in areas where "structural" works are not justified. Those installations would follow prototypes developed by SUCCE and would be located adjacent to existing schools or community centers to allow them to be used by the population in non-emergency periods, as well as to facilitate their maintenance by the local municipalities (see paras. 2.52 and 2.55 and Annex 4).

**3.10 Housing:** In more remote areas where shelters would not be justified, the project would finance the material for an estimated 5,000 self-constructed houses, following the successful experience with the same number of units under the Rehabilitation Project. The same implementation team of the previous project would be used; benefiting from the experience of a program that has really achieved its objectives and helped the intended beneficiaries--poor families located in flood-prone areas. The units would follow the same prototypes which are appropriate to meet flood conditions (either in higher land or on piles), as well as the sanitary facilities not included in the previous project. They would be 43 square meters, with two bedrooms and a multiuse room. Approximately US\$31 million would be provided as grants to the low-income families. Building materials (about US\$6,200 per house) are expected to comprise about 80% of the construction cost. The provinces would provide land, infrastructure, and technical and social assistance to the beneficiaries. The beneficiaries, who are among the poorest families in the affected areas, would finance the remaining 20% through their labor input. The units would be constructed on the same site or in the same neighborhood where the beneficiary already lives to avoid resettlement problems (see Annex 4). The project would also finance the services of specialists who would help organize community groups for mobilizing beneficiaries in carrying out the program.

**3.11** In order to avoid possible abuses, the voucher system employed in the previous project would be used again. Beneficiaries would receive vouchers for tranches of materials for the unit construction. These vouchers will be non-transferable, and could be drawn from any hardware supplier participating in the program. They would specify the value, tranche limit, types of materials that can be purchased and the sequence of such purchase. Hardware suppliers would redeem the vouchers locally under conditions to be specified, and they would have to show proof of delivery of the materials to the beneficiaries.

**3.12** Local social workers would verify whether applicants meet program eligibility criteria. These criteria, agreed upon during appraisal, would basically consist of the location of the existing house and the flood-risk of the area, its adequacy to resist floods, the income level of the dweller, and agreement to the program. All beneficiaries would be required to sign a document stating, among other things, that they: lived on the site for more than five years; the old unit was their only residence and they had no other property; have legal possession of the land for the new unit; and plan to live on the new site for at least five more years. If the land on which they plan to build the new unit belongs to someone else, the beneficiary must provide the signed approval of the owner allowing them to use the land. The



beneficiary would also agree to use the voucher system as stipulated and to comply with all of its conditions, including that they would provide the labor for construction of the unit.

**3.13 Project Implementation and Administration:** This component would fund technical assistance from consultants to help design the civil works and help supervise their construction. Consultant services would also be used for reviewing and installing improved civil defense and emergency procedures to be used during floods. In addition, technical assistance for the establishment and organization of community construction groups would be provided to help the beneficiaries of the housing component in their joint self-construction effort. The project would also include a training program for INCYTH's and each province's staffs in the new flood warning system, and the civil defense provincial groups to learn the new procedures. Additionally, the project would finance four environmental programs. This component would also finance the services of project supervision and the external auditors' regular audits of the project.

**3.14** The environmental programs included in the project emerged from the environmental assessment carried out during preparation. They would consist of: (i) environmental education and public awareness in communities benefiting from flood protection works; (ii) strengthening of environmental management capacity of the implementing agencies as well as environmental agencies; (iii) technical assistance to communities and municipalities to improve urban environmental management and monitoring, especially regarding the sound disposal of solid waste; and (iv) improvement in baseline knowledge of ecology and dynamics of the riverine and floodplain ecosystem and in protection and management of wetlands within the project region, especially near the urban areas (see Annex 5).

### **Project Costs**

**3.15** The total project cost, excluding interest during construction, is estimated at US\$420.0 million, of which US\$251.3 million would be foreign costs. Costs are expressed in January 1996 prices and are based on experience with the previous project (Loan 3521-AR) and other similar projects in the country. Physical contingencies are 10% of base cost for goods and works (flood defense and shelters). Price contingencies assume: (i) project execution in 1997-2001; and (ii) price escalation on base costs and physical contingencies of 3.3% in 1996, 2.3% in 1997, 2.5% in 1998, 1999, 2000, and 2001. A summary of project costs is presented in Table 3.1. Project costs are expressed in US dollars because of the parity between the dollar and the peso.

**Table 3.1: Estimated Project Costs**  
(US\$ million, January, 1996)

Component	Local	Foreign	Total	Foreign as % of Total	% of Total Base Cost
A) Structural Measures	110.5	167.0	277.5	60.2	75.9
B) Non-Structural Measures					
B1) New Institutional Framework	0.5	2.0	2.5	80.0	0.7
B2) Upgrading Flood Preparedness					
(i) Shelters	4.4	8.0	12.4	64.5	3.4
(ii) Housing	18.0	13.0	31.0	41.9	8.5
(iii) Civil Defense	0.2	0.5	0.7	71.5	0.2
B3) Early Flood Warning	0.8	3.0	3.8	78.9	1.0
B4) Project Implementation					
(i) Environmental Programs	0.6	3.0	3.6	83.3	1.0
(ii) Consultants	4.7	16.0	20.7	77.3	5.7
(iii) SUCCE	5.0	4.2	9.2	45.6	2.5
(iv) Auditing	0.5	1.0	1.5	66.6	0.4
(v) Training		0.5	0.5	100.0	0.1
(vi) Housing T.A.	2.0		2.0	0.0	0.6
<b>Total Base Cost</b>	<b>147.2</b>	<b>218.2</b>	<b>365.4</b>	<b>59.6</b>	<b>100.0</b>
Physical Contingencies	11.0	18.0	29.0	62.0	8.0
Price Contingencies	10.0	15.6	25.6	60.9	7.0
<b>Total Project Cost</b>	<b>168.2</b>	<b>251.8</b>	<b>420.0</b>	<b>59.8</b>	<b>115.0</b>
Interest during Construction		68.0	68.0	100.0	18.6
<b>Total Financing Required</b>	<b>168.2</b>	<b>319.8</b>	<b>488.0</b>	<b>65.4</b>	<b>133.6</b>

## Financing Plan

3.16 The total financing requirements (including interest during construction of US\$68 million equivalent), are estimated at US\$488 million (of which US\$319.3 million in foreign exchange). They would be financed according to the plan shown in Table 3.2. The proposed Bank loan of US\$200 million would meet approximately 41% of total financing requirements. Cofinancing from the Export-Import Bank of Japan (JEXIM) is at final stage of approval and, would finance US\$120 million to cover 24.6% of the requirements. The provincial governments, would provide the US\$168 million equivalent balance, representing 34.4%. Retroactive financing for eligible expenditures incurred after January 15, 1996, (but not earlier than 12 months before loan signing) in an amount not to exceed US\$20 million is recommended.

**Table 3.2: Financing Plan**

Source	Amount (US\$million)	Percentage
Bank	200.0	41.0%
JEXIM (Japan)	120.0	24.6%
Provincial Governments	168.0	34.4%
<b>Total Financing Required</b>	<b>488.0</b>	<b>100.0</b>

3.17 During appraisal an allocation of financing resources by type of actions contemplated in the project was agreed resulting in table 3.3--Sources of Financing.

**Table 3.3: Sources of Financing**  
(in US\$ millions and %)

Category	Provinces		Bank		JEXIM		TOTAL	
	\$	%	\$	%	\$	%	\$	%
Works & Goods	96.1	28.4	122.7	36.2	120.0	35.4	338.8	100.0
Housing Grants	3.5	10.0	31.8	90.0			35.3	100.0
Technical Assistance & Training			41.5	100.0			41.5	100.0
Flood Warming	0.4	10.0	4.0	90.0			4.4	100.0
Interest during Construction	68.0	100.0					68.0	100.0
<b>Total</b>	<b>168.0</b>		<b>200.0</b>		<b>120.0</b>		<b>488.0</b>	

3.18 The Bank loan would be made to the Argentine Republic. During appraisal, the Government indicated its preference for a US-dollar single currency loan repayable over 15 years, including a five-year grace period, at the Bank's standard LIBOR-based variable interest rate for US dollar single currency loans. This was confirmed during negotiations. Before negotiations, JEXIM confirmed that the Japanese Government approved its participation in the co-financing. In the event JEXIM's funds are not available, the government of Argentina would seek cofinancing from another source or the project's size would be reduced with consequent postponement of some sub-projects to the second phase. The Bank loan proceeds would finance all technical assistance, 90% of the housing grants, and joint-finance with JEXIM the procurement of works and goods (at nearly similar proportions).

3.19 Proceeds of the Bank loan would be lent to provincial governments eligible under this loan with the same terms and conditions as Bank lending to the Argentine Republic. Provinces would assume foreign exchange risk and would guarantee repayment with their revenue-sharing ("coparticipation") funds and each participating province would pay loan commitment fees. For onlending to Provinces, the Borrower would enter into a satisfactory Subsidiary Loan Agreement with each province. This agreement would also include provisions allowing the Central Government to send part of the province's revenue-sharing ("coparticipation") funds directly to the SUPCEs to provide adequate counterpart funding (in the event that a province is unable to mobilize such finance).

3.20 As conditions of disbursement of the subsidiary loans, each participating province would:

- (a) establish and ensure continuation of adequate staffing of its SUPCE;
- (b) execute a satisfactory Subsidiary Loan Agreement;
- (c) exempt all contracts for goods, works and services to be financed under the loan from all legal and regulatory provisions limiting the international procurement of goods, works, and services;
- (d) create the coordinating unit for flood-related aspects in the province assigning responsibilities for coordinating actions with entities in charge of civil defense, flood warning, hydraulic works, maintenance of flood-defense facilities, and environment (see para. 1.40, 2.44 and 2.53);
- (e) submit to its legislature the law defining institutional arrangements for flood-related actions in flood-prone areas (see para. 2.41); and
- (f) provide a satisfactory legal opinion on the validity of the Subsidiary Loan Agreement.

### **Status of Project Preparation**

3.21 Project preparation is completed. The Paraná Basin area hydrological study has been completed. So has the Halcrow study which produced simulation models, flood probability scenarios, and risk assessment estimates, as the basis for selecting the project sites and investments. A review of

the effects of past flooding likewise has been concluded, along with an assessment of the adequacy of the existing legal framework for dealing with flood emergencies. Similarly, INCYTH's forecasting capability was scrutinized, and this analysis identified requirements for modernizing early-warning and other information systems, as well as interconnecting national data facilities with the Basin provincial services. In addition, the environmental assessment of the area, including the environmental analysis of the proposed sub-projects (first and second priority groups) has been completed. Provincial master plans have been prepared to identify and address flood protection priorities. A special Bank mission took place after pre-appraisal but before appraisal, to carry out public consultations on the project and to visiting the most sensitive sub-project sites to assess local environmental issues. Finally, the economic analysis for the whole project and for each individual sub-projects has also been completed.

### **Implementation Arrangements**

3.22 Implementation arrangements would remain essentially the same as in the ongoing Flood Rehabilitation Project, except for changes to incorporate lessons of experience. SUCCE would remain within the Under Secretariat for Assistance to the Provinces, and be the national executing agency for the proposed project. SUCCE would retain its responsibility for overall project management, including orientation and technical assistance to the provinces (directly and through the Project Operational Manual) in the preparation, approval, control, and monitoring project implementation, as well as for all financial and reporting transactions with the Bank. SUCCE would also retain its responsibility for all aspects concerning sub-project evaluation, approval, and procurement, as well as reporting and obtaining Bank approval of acquisitions and disbursements. SUCCE would also continue to provide proper coordination and policy consistency between the proposed operation and other sector-specific projects proposed by the provinces (see paras. 2.27, 2.28 and Annex 7).

3.23 SUCCE would continue to be subordinated to the Central Executing Unit (CEU) of SSAP. SUCCE would continue to be headed by a chief executive assisted by a team of high-level consultants in the several infrastructure sectors of the operation. An individual consultant would continue to act as General Supervisor with responsibility for monitoring the project independently and reporting to SSAP.

3.24 In each province the project would be implemented by the corresponding SUPCE (Sub-Unidad Provincial de Coordinación para la Emergencia). The SUPCEs would be responsible for formulation, implementation, and supervision of provincial sub-projects. The SUPCEs would be responsible for procurement, contracting, and submission of disbursements, subject to review by SUCCE. A Project Operational Manual (POM), agreed upon during appraisal, will provide guidance and establish standards for all aspects of project implementation (see Annex 7). Agreement has also been reached on project performance indicators (see Annex 12). All those agreements were confirmed during negotiations.

## Monitoring and Reporting

3.25 SUCCE and each SUPCE would keep adequate records as detailed in the POM. Successful implementation of project objectives also will require intensive monitoring of actual performance by both the SUCCE and the Bank. To facilitate this supervision, the SUCCE will prepare and furnish to the Bank a progress report on project execution of such scope and detail as the Bank shall reasonably request not later than April 30, August 31, and December 31 of each year. The terms of reference for these reports would be basically the same as for the previous project. SUCCE would use the monitoring indicators described in Annex 12 to evaluate project implementation in the progress reports.

3.26 Several lessons of experience from the previous project and other lending related to provincial development in Argentina have been incorporated to streamline project execution. To increase the cost-effectiveness of review of technical proposals and procurement documents, thresholds for prior review by SUCCE and the Bank were carefully reviewed in the development of the POM so as to balance cost with risk. In addition, procedures for review of procurement documents were streamlined, and all provinces will be required to use standard procurement documents approved by the Bank (para. 3.29), copies of which will be included in the POM. To improve sub-project management, the POM will require that all sub-project proposals contain a timetable for all main stages of sub-project execution in an agreed format. These timetables are expected to provide SUCCE with more reliable information, thereby permitting more adequate projections needed to plan sub-project review.

3.27 The timely implementation of the project depends on adequate financial resources being available when needed and on good performance (especially quality and speed) of the local implementation units (SUPCE). For this reason, Government-Bank meetings would take place every year, within three months of the conclusion of each fiscal year, to review project progress and assess its implementation in each province. Three meetings would be of particular importance: the one to be held not later than March 31, 1998, (the "first mid-term review meeting") another to be held not later than March 31, 1999, (the "second mid-term review meeting") and a third to be held not later than March 31, 2000 (the third mid-term review meeting). As discussed in para. 3.6, the Bank and the Government then might move some investment sub-projects from the second group (e.g., in provinces with a good implementation record) to replace sub-projects in the first group (in provinces showing delays in project implementation). In view of the experience during the implementation of the previous project, frequent Bank supervision would be required, particularly during the first year of implementation when very frequent field missions (four in one year) are recommended. Planned Bank supervision inputs are shown in Annex 8.

## Accounts and Audits

3.28 An audit of the financial status of the program would take place once a year for the SUCCE components and for each participant province (SUPCEs). Audits would be carried out by an independent auditor acceptable to the Bank, under terms of reference (TORs) similar to those used in the previous project (Annex 12 presents draft TORs prepared during appraisal). The audit reports would be sent to the Bank not more than six months after the end of the calendar year. The report would include, *inter alia*, specific opinions on: (a) sources of financial resources and their use; (b) Statements of Expenditures (SOEs); and (c) implementation of contracting clauses, including the application of eligibility criteria, and compliance with procurement procedures and other financing conditions included in the POM.

## **Procurement**

3.29 Procurement would be undertaken by the SUPCE of each participating province and reviewed and supervised by SUCCE, which would also be responsible for procurement actions for the Nation's part of the project. International Competitive Bidding (ICB) purchasing would use the Standard IBRD Bidding Documents for the procurement of works and goods. National Competitive Bidding (NCB) purchasing would be based on agreed standard bidding documents for the procurement of works and goods. For works, those documents would be a Spanish version of the Bank standard bidding documents for procurement of works for small contracts dated January 1995. For goods, the Spanish version of the Bank bidding document for ICB would be used. All of these documents would be included in the POM whose approval by the Borrower on terms satisfactory to the Bank would be a condition of effectiveness.

3.30 The housing grants would follow the same successful scheme used in the previous project. The SUPCEs would divide the cost of construction material into six vouchers corresponding to the main stages of construction. Then, the SUPCEs would select suppliers for the corresponding materials through a procurement process on the basis of quotations obtained from at least three qualified local suppliers in response to a written invitation. Based on the price of the lowest bidder, all suppliers who decide to follow that price would sign an agreement to supply materials at that price. The beneficiaries would be free to select the supplier from those so selected by the SUPCEs to deliver the material. This system has worked very successfully in the previous project when houses were constructed in 92 different locations.

3.31 Contracts for civil works expected to cost US\$5 million or more (to account for approximately US\$106.4 million, or 33% of total civil works costs) and for goods expected to cost US\$350,000.00 or more (to account for approximately US\$16.2 million, or 99% of total costs of goods) would be awarded on the basis of ICB procedures in accordance with Bank guidelines. Contracts for works expected to cost US\$350,000 or more, but less than US\$5 million (to account for approximately US\$215.4 million, or 66% of total civil works costs), and contracts for goods expected to cost more than US\$100,000, but less than US\$350,000 (approximately US\$0.2 million, or 1% of total project costs), would be awarded on the basis of NCB procedures acceptable to the Bank. Procurement for goods costing less than US\$100,000 (up to an aggregate amount of US\$200,000) would be carried out through national shopping. Works costing less than US\$350,000 (approximately US\$1.0 million) would be procured under lump-sum contracts awarded on the basis of quotations obtained from at least three qualified contractors in response to written invitation. The invitation would include detailed description of the works, specifications, in a form acceptable to the Bank. The award would be made to the contractor with the lowest evaluated bid. Satisfactory procedures for NCB and for procurement of small works would be included in the POM.

3.32 Technical assistance consisting of consultant and auditing services, expected to cost approximately US\$45 million, or 12% of total project costs, would be procured in accordance with the corresponding Bank Guidelines. This amount includes the development of the new flood warning system which would comprise the development of a turn-key package of software and hardware, as well as transfer of technology and specific training. This system would be procured under ICB. Other

training expenditures would be approximately US\$0.5 million. All procurement arrangements are summarized in Table 3.4.

**Table 3.4: Procurement Method by Category**  
(US\$ millions, January 1996)

Category	Procurement Method <sup>a/</sup>			N.B.F <sup>a/</sup>	Total Cost
	ICB	NCB	Other <sup>b/</sup>		
Civil Works	106.0 (36.5)	215.4 (79.5)	1.0 (0.3)		322.4 (116.3)
Goods	16.2 (6.3)		0.2 (0.1)		16.4 (6.4)
Technical Assistance			41.0 (41.0)		41.0 (41.0)
Flood Warning System	4.4 (4.0)				4.4 (4.0)
Housing Grants			35.3 (31.8)		35.3 (31.8)
Training			0.5 (0.5)		0.5 (0.5)
Total Project Cost	126.6	215.4	78.0		420.0
Bank Total	(46.8)	(79.5)	(73.7)		(200.0)

<sup>a/</sup> Figures in parentheses are the respective amounts financed by the Bank.

<sup>b/</sup> National shopping, small works, special procedure for housing materials, and hiring of auditors and consultants in accordance with Bank guidelines.

<sup>c/</sup> Not Bank financed.

3.33 Rehabilitation, completion of works, and new investments would be undertaken in accordance with Bank guidelines. To ensure that the agreed procurement procedures are properly carried out, the SUCCE and the Bank would review *ex-ante* all procurement procedures, documents, bid evaluations and contract awards for ICB procurement of goods and works during the entire project implementation period. In addition, the SUCCE would review *ex-ante* the procedures for all other procurement of goods, works and consulting services in each province. The Bank would review *ex-ante* the TORs and all documents of each contract for hiring consultants, except for contracts in which: (i) individual consultants are hired on a competitive basis for amounts less than US\$50,000 or (ii) consulting firms are hired on a competitive basis for amounts less than US\$100,000, when the Bank would review *ex-ante* only the TORs. Prior Bank and SUCCE review of procurement procedures of work, goods and consulting services is summarized in Table 3.5. Following the procedures defined in this table, the Bank would review *ex-ante* about 40% of the total cost of all procurement done under the project (and SUCCE would take over Bank's prior review based on past project experience).

3.34 In all cases not subject to Bank *ex-ante* review, however, the Bank would review contracts awarded under NCB, limited NCB procedures, and consultant selections on an *ex-post* sample basis.



If it were determined that procurement was not carried out following agreed procedures, no expenditures for such items would be financed from the proceeds of the loan, the Bank would cancel the corresponding loan amount, and the Special Account would be reimbursed accordingly by the Borrower. This effort should not only streamline project execution but also reduce the Bank's supervision burden. However, if a particular province fails to comply with the agreed procedures, their project proposals would be required to return to *ex-ante* review.

**Table 3.5: Summary of Procurement Review Procedures**

Category	Procedure to be used by the SUPCEs	Prior Review by SUCCE	Prior Bank Review
<b>Works</b>			
Less than US\$350,000	Three Quotations	All	two/year <sup>1</sup>
US\$350,000-US\$5 million	NCB	All	two/year
US\$5 million or more	ICB	All	All
<b>Goods</b>			
Less than US\$100,000	Shopping	All	two/year <sup>1</sup>
US\$100,000-US\$350,000	NCB	All	two/year
US\$350,000 or more	ICB	All	All
<b>Consulting Services</b>			
<b>a) Individual</b>			
Less than US\$50,000	Contract	All	TOR only <sup>2</sup>
US\$50,000 or more	Contract	All	All
<b>b) Firms</b>			
Less than US\$100,000	Contract	All	TOR only <sup>2</sup>
US\$100,000 or more	Contract	All	All

/1 The Bank would review the evaluation report.

/2 Full Bank prior review will also apply to all consulting contracts of a critical nature and to single selection of firms regardless of the value of contract.

3.35 The capacity of SUCCE and the SUPCEs for effective implementation review of procurement documents has improved greatly during the execution of the previous project, and there is now a strong core of professionals in SUCCE. SUCCE would continue to have an expert on procurement and a legal advisor satisfactory to the Bank for prior review of the SUPCE's procurement actions, reducing therefore the Bank prior review burden. The experience with the previous project has also allowed the provincial implementing agencies (SUPCEs) to develop good capacity for procurement actions and thorough familiarization with Bank guidelines. To expedite procurement, during appraisal the procurement was divided into 93 bid packages for works and six bid packages for goods as detailed in the procurement plan also agreed during appraisal and described in Annex 9. During negotiations, agreement was reached that, as a condition of disbursement of the subsidiary loan agreement for each province, all contracts for goods, works and services to be financed under the subsidiary loan would be exempted from all legal and regulatory provisions that would otherwise prevent procurement of goods, works, and services according to Bank guidelines.

## **Disbursements**

3.36 The proceeds of the proposed loan are expected to be disbursed over five years. The disbursement schedule reflects the experience with the previous project. To withdraw the proceeds of the proposed Bank loan, the following categories and disbursement percentages are proposed:

- (a) 100% of total expenditures for technical assistance (consisting of consultant services, institutional strengthening, audits, and training);
- (b) 90% of total expenditures for acquisition of the Flood Warning System including equipment, software, consultant services and associated training for transfer of know-how;
- (c) 36% of expenditures for works and goods under all categories; and
- (d) 90% of expenditures of amounts disbursed in vouchers for housing materials.

3.37 A Special Account in US dollars would be established in the Banco de la Nación Argentina with a maximum deposit of US\$12 million, estimated to cover four months of average expenditures to be financed from the Special Account. The account would be replenished monthly according to Bank procedures. The Special Account would be managed by SUCCE. All disbursements against contracts for less than US\$5 million for works, for less than US\$350,000 for goods and services, for less than US\$100,000 for consultant firms, and for less than US\$50,000 for individual consultants, and for all housing vouchers expenditures would be made on the basis of certified Statements of Expenditure (SOEs). The documentation for SOEs would not be sent to the Bank but would be retained by SUCCE and made available for inspection by Bank staff. All other disbursements would be made against standard documentation. The POM will specify that SUCCE would continue to monitor financing over the life of the project to assure that satisfactory central and provincial government counterpart financing is maintained. The expected completion date would be December 31, 2001, and the closing date would be June 30, 2002. Attachment 6 of Annex 9 shows the estimated disbursement schedule.

## **Project Benefits**

3.38 The proposed project would reduce the loss of life and devastation of property during major floods. Major benefits would accrue from the fuller restoration of the damaged infrastructure in one of the most productive areas of the country and the area closest to Brazil and Paraguay, two of Argentina's partners in MERCOSUR. The reduction of the frequency and range of flood-caused damage would improve the efficiency of the productive and commercial sectors in this area and reduce the damage to transport facilities, thus facilitating Argentina's competitiveness within MERCOSUR. The project works also would reduce health hazards and waterborne diseases in flood-prone areas. Other benefits would include the provision of substantially more flood-secure housing and the generation of sizeable civil works and construction employment.

## **Economic Impacts**

3.39 The negative economic impact of previous floods was very high. Conservative estimates of the 1983 flood indicate losses of about US\$1,790 million (in 1993 US\$ dollars) and US\$905 million (also in 1993 values) for the 1992 flood. These estimates include only direct costs suffered by the local economy due to damage caused by floods, such as the: cost of evacuation, rehabilitation of houses and public buildings, rehabilitation of transport systems (roads, bridges, railways, and ports), rehabilitation of water and sewerage systems, losses of crops and animals, and losses of industrial products manufactured. No social cost or indirect cost associated with reduction of economic activity was evaluated. As part of the preparation of this proposed project, a first approximation was made under conservative economic assumptions (considering only the above-mentioned direct damage avoided costs as a lower bound evaluation for benefits) of a flood protection program in the Basin. This study concluded that for an investment level of up to US\$800 million the expected internal economic rate of return (IERR) of the project would be around 30%, or a net present value of US\$1,324 million at a discount rate of 12%. These preliminary estimates were later confirmed by the Halcrow study (see Annex 2).

3.40 The proposed project includes flood-defense works in different provinces. Each sub-project was analyzed from its technical, environmental and economic aspects. The proposed sub-projects met minimum criteria of positive net present value at a discount rate of 12%. All represent the alternative with the highest net present value for overcoming the local problem. In all economic calculations, both at regional analysis and sub-project analysis, cost streams include the capital cost of proposed works and the maintenance costs associated with their future operation. Investments were considered to have 50-year life spans.

3.41 Benefits were estimated as the direct "avoided damage cost" of future floods. Those direct costs refer only to the estimated rehabilitation costs of existing facilities and infrastructure, like roads, houses, lost crops, etc., calculated from data on past floods. No indirect, economic or social costs associated with past floods (or likely to result from future ones) were considered, resulting therefore in a lower bound of benefits for the project. To evaluate the direct avoided damage costs, an analysis was made to assess the flood risk (using the river mathematical model developed by Halcrow). This analysis generated a risk curve associating probability versus damage associated with that probability. Correspondingly, the average or expected damage cost was calculated for conditions with and without the project (considering the expected degree of flood protection from the project, also calculated from the risk study). The difference was considered as an estimate of the benefits. Using this methodology, the sub-projects were ranked as indicated in Annex 10. For the project as a whole, SUCCE hired a consultant who reviewed the results of the preliminary study, however using more conservative criteria for evaluation of benefits (only direct damage costs caused by floods). These studies gave a final estimate of an IERR of 22.2% for the "structural" component of the project investments in flood protection) and of 20.4% for the project as a whole. The IERR of each sub-project was calculated (see Annex 10 for a complete list) and ranged from 79.2% to 11.8%, with the following distribution:

IERR (%)	No. of Sub-projects	Percentage
11.8-15.0	7	15.2
15.0-20.0	16	34.8
20.0-25.0	5	10.9
25.0-30.0	7	15.2
30.0-40.0	6	13.0
over 40.0	5	10.9
Total	46	100.0

3.42 Sensitivity analyses were also carried out in the project economic assessment to evaluate the variation of the IERR in the cases of: (i) an increase in investment costs of 17.4% (contingencies used); (ii) an increase in benefits considering indirect benefits limited to 20% of the direct ones; (iii) a delay in beginning project implementation of five years (continuing the country to support to flood risk evaluated as the annual "avoided cost" by the project). The results of this analysis was:

Scenario	IERR (%)
Whole Project	
Base Case	20.4%
Costs increased by 17.4%	17.4%
Benefits increased by 20%	24.6%
Costs increased by 17.4% and Benefits increased by 20%	20.9%
Project delayed five years	7.5%
"Structural Measures" only	
Base Case	22.2%
Costs increased by 17.4%	19.0%
Benefits increased by 20%	30.6
Costs increased by 17.4% and Benefits increased by 20%	22.5%

3.43 An additional sensitivity analysis was carried out to estimate the deviation of the IERR due to risk of data used in the evaluation. A mathematical model using Montecarlo probabilistic approach was used. It makes a statistical analysis of data with a variance coefficient of 7% and using stochastic calculations generates a series of NPVs and IERRs. As this analysis aimed to assess the sensitivity to data risk, it was only carried out for the "structural" measures. The result of this analysis indicated an average IERR of 22.2% (equal to the deterministic value calculated before) and a range of variation between a maximum of 32.0% and a minimum of 15.5%.

3.44 Annex 10 also describes the economic assessment of the project's housing and shelter component. The IERR which these studies estimated for solely direct benefits were 14.7% for housing and 16.0% for the shelter activities.

### Project Sustainability

3.45 The investments in civil works would aim at protecting existing infrastructure. Their sustainability would be enhanced by the proposed project conditions governing future operations and

maintenance of these facilities. The required new local laws and river-basin-wide coordinating arrangements should help strengthen the provincial governments' flood preparedness and mitigation systems. The proposed carryover of the experience and competent staff of SUCCE and the SUPCEs should provide a strong basis for sustaining project works. The amount of investment in each province and the financing plan (with JEXIM participation) were taken into consideration to adapt provincial counterpart requirements to their financial implementation capacities in order to assure sustainability of implementation.

### **Program Objective and Poverty Categories**

3.46 The project aims to help the environmentally sustainable development of the provinces (Category EN) by reducing and, to some extent, avoiding the economic losses caused by frequent floods throughout the Paraná Basin. It would also stimulate employment generation in the construction sector, and improve physical and social infrastructure. Project implementation is expected to generate about 33,500 person-years of construction employment, or the equivalent of 6,700 persons permanently employed during the five-year project period. Other sectors would also benefit from new jobs in transport, and supply of goods and other services to the project. The housing component, in particular, would improve the living conditions of lower-income segments of the population.

### **Environmental Impacts**

3.47 This project is classified as category A. Positive environmental consequences are envisaged from the fuller restoration of damaged health, water, sewerage, and housing facilities. The provision of additional security against floods would improve environmental conditions, e.g., lessen soil erosion and reduce or eliminate drainage congestion duration with consequent reductions in health hazards. Positive benefits also accrue from fuller public participation, especially regarding environmental aspects of flood protection proposals. A regional environmental assessment for the entire Basin was carried out in accordance with terms of reference approved by the Bank. A seminar for public consultation on the project and for comments on the preliminary environmental assessment report was held in Buenos Aires in May 1995. The seminar included participation of provincial public entities and national and provincial Non-Governmental Organizations (NGOs). Regional environmental issues--associated with floods--will be addressed through the provision of technical assistance, training and some basic equipment to SUCCE and to the provinces to: (i) promote urban environmental infrastructure diagnostics and urban expansion planning; (ii) improve wetland protection; (iii) strengthen environmental assessment capacity of flood protection projects; and (iv) develop environmental education programs in communities benefiting from flood protection works (see para. 3.14). The final environmental assessment report has been completed and was discussed at a public seminar during appraisal. The final report is available to the public in Buenos Aires and at the Bank's Public Information Center. An executive summary was prepared by the Government and was circulated to the Board prior to appraisal. Annex 5 "Environmental Assessment" summarizes the principal findings and recommendations of the environmental work carried out during project preparation.

3.48 Each sub-project included in the project (either in the first and second priority group) was subjected to a detailed environmental assessment during project preparation. Sub-projects were screened

for: (i) compliance with the project's basic philosophy of protection of existing infrastructure and non-promotion of urban expansion in high risk areas; (ii) minimum interference with natural flood processes; and (iii) minimum effects on sensitive ecosystems. All sub-projects selected met these conditions. These studies concluded that the sub-projects' negative effects would mainly be highly localized and short-lived. Moreover, the areas affected are so small in relation to the total floodplain as to virtually preclude any regional impact at the macro level. Nonetheless, the design and construction of those sub-projects with adverse implications include mitigation and monitoring measures, which will be included in the bidding documents. In addition, the POM will include suitable guidance for contractors to follow.

3.49 While some housing would be built under the project, there is no resettlement involved (as discussed in para. 3.10 and Annex 4), particularly as participation in this aspect of the program is entirely voluntary. In addition, the main civil works were thoroughly screened to avoid any involuntary resettlement.

### **Participatory Approach**

3.50 Project preparation took into consideration the results of extensive consultations with local communities and all affected municipalities. The consultants who prepared the Master Plans were responsible for gathering data and obtaining feedback from the communities involved. The SUPCEs also made contacts with all municipalities in the affected areas. Public hearings were held in areas in which works are envisioned. They were very productive, resulting in modifications to the original engineering solution in some locations due to suggestions from local communities (e.g., in Gualeguay, Resistencia and Goya). Two seminars with participation of several governmental agencies units (central and provincial) and NGOs were held during the pre-appraisal and appraisal missions to discuss the project and its environmental assessment report. Project implementation will also seek strong community participation, especially in: (i) the installation of the emergency family shelters; (ii) the housing component based on self-construction by community groups; (iii) the maintenance and operation of some components of the early flood warning system; and (iv) enforcement of the regulations on land utilization, particularly where it includes restricted use of land (see Annex 11).

### **Program Risks and Safeguards**

3.51 There are four possible risks: (a) time and cost overruns; (b) inadequate management and control due to weak, bureaucratic public entities in the provinces; (c) possible abuses in the housing component; and (d) lack of counterpart funds for project implementation. During preparation, steps were taken to address these issues and design suitable safeguards. The major risk concerns timely project implementation. Therefore, project management was streamlined based on the experience gained in risk management during the previous project. In this connection, the project would be implemented by the same units (SUCCE in the central government and the SUPCEs in the provinces) that are successfully implementing the Flood Rehabilitation Project (Loan 3521-AR). Additionally, a full-time, independent supervising engineer reporting to SSAP would again be hired. Adequate funding for technical assistance has been included in the project to help reduce implementation risks. The housing component was designed following the excellent experience with the use of vouchers for acquisition of material used in the previous project. The same management systems would be used (no cases of abuse have occurred in the previous project). To reduce counterpart funding constraints, cofinancing is being pursued to design a financing plan of the project which would permit the provinces to ensure sufficient

resources for project works, as well as transfers of Federal "coparticipation funds" to the SUPCEs' accounts. The aforementioned contingent arrangements for possible transfer of funding from slow-moving provinces to better performing provinces (ref. para. 3.6) should contribute to effective project implementation.

### **Financial Benefits**

3.52 The borrower has considered the Bank's alternative loan term options--currency pool loan, LIBOR-based single currency loan and fixed rate single currency loan terms--and has indicated his preference for LIBOR-based US dollar single currency loan terms, in order to improve the management of its external liabilities. The choice of US dollar terms was motivated by a better match between cash inflows and outflows in that currency, which is the base of the country's external commerce. The Argentine peso is also legally tied to the US dollar under the convertibility law that govern the basic principles of the Argentine economy. The LIBOR-based single currency loan was considered preferable because of the long grace period and maturity offers. The borrower estimated that the risk posed by the volatility of LIBOR-based single currency loan rating rate would be mitigated in the medium range; short period higher rates would be compensated by subsequent periods of lower ratio, averaging a rate in the same order of the fixed rate. However, the much better grace period and maturity would match better the life span of the proposed investments.





#### **4. AGREEMENTS REACHED AND RECOMMENDATION**

##### **4.1 During negotiations, the following assurances were obtained:**

(a) in the Subsidiary Loan Agreement with each province the Government will include a clause by which the province will assign to its SUPCE (or to another agency acceptable to the Government and to the Bank) permanent responsibility for coordination of actions of units in charge of civil defense, flood warning, hydraulic works, maintenance of flood-defense facilities and environment on flood-related issues (paras. 1.40, 2.44 and 3.20);

(b) in the Subsidiary Loan Agreement with each province the Government will include a clause by which the province will assign to one of its agencies the responsibility for maintenance of the flood-defense facilities and of the shelters (or show agreement with municipalities accepting this responsibility), as well as to coordinate with the Coordination Unit (SUPCE) (para. 1.40);

(c) in the Subsidiary Loan Agreement with each province the Government will include a clause by which the province will assign to one of its agencies the flood warning responsibilities and of taking part in the Basin flood warning system created among provinces and the Central Government, as well as to coordinate with the Coordination Unit (SUPCE) (para. 1.41);

(d) in the Subsidiary Loan Agreement with each province the Government will include a clause by which the province will assign to one of its agencies the civil defense responsibilities and of coordination with the Coordination Unit (SUPCE) (para. 1.42);

(e) in the subsidiary Loan Agreement with each province the Government will include a clause by which SUCCE will not authorize any new commitments for contracts for implementation of "structural" sub-projects in excess to 50% of the evaluated total cost of all first priority sub-projects unless the Flood Protection Law has been enacted in that province. "Non-structural" measures could be implemented without restrictions (para. 2.41).

(f) proceeds of the Bank loan will be onlent to eligible provinces under the same terms and conditions as the Bank loan, with each participating province's revenue sharing serving as a guarantee for repayment of sub-loans (para. 3.19);

(g) the implementation unit (SUCCE) will continue to be adequately staffed and otherwise supported in the implementation of its responsibility under the project (paras. 3.20 and 3.23);

(h) an individual consultant will continue to act as the General Supervisor with responsibility for monitoring independently the project and reporting to SSAP (para. 3.23);

- (i) the project will be implemented in accordance with the Project Operational Manual (POM), satisfactory to the Bank, which will not be amended without the Bank's prior consent (para. 3.24);
- (j) the SUCCE will prepare and furnish to the Bank a progress report on project execution of such scope and detail as the Bank shall reasonably request not later than April 30, August 31, and December 31 of each year (para. 3.25);
- (k) the national government and the Bank will exchange views annually on the status of project implementation. During the mid-term reviews to take place in March 1998, March 1999 and March 2000, the Bank and the Government would agree on the possible moving of some investment sub-projects from the second priority group to the first group (para. 3.27);
- (l) the Project Accounts and the Special Account will be audited according to procedures, TORs and with auditors acceptable to the Bank (para. 3.28);
- (m) procurement will be carried out in accordance with Bank guidelines (paras. 3.29 to 3.35);
- (n) the national government will open and maintain, a Special Account in US dollars (para. 3.37); and
- (o) the SUCCE and SUPCEs will carry out project implementation, in a manner consistent with the Bank's environmental policies and procedures (para. 3.48).

**4.2 The following Conditions of Effectiveness were agreed:**

- (a) that for the participating province referred to in para. 4.2(b) below (except for the city of Buenos Aires), a draft provincial law defining the institutional arrangements for flood-related actions in flood-prone areas is submitted to the legislature of said province (para. 2.41);
- (b) that a satisfactory subsidiary Loan Agreement has been entered between the Borrower and at least one province (para. 3.19);
- (c) approval of the POM by the Borrower on terms satisfactory to the Bank (para. 3.24); and
- (d) exemption by said participating province of all contracts for goods, works and services to be financed under the loan from all legal and regulatory provisions that would otherwise prevent procurement of goods, works, and services according to Bank guidelines.

**4.3 It was agreed that the Conditions of Disbursement with respect to each province will be (para. 3.20) to:**

- (a) establish and ensure continuation of adequate staffing of its SUPCE;

- (b) execute a satisfactory Subsidiary Loan Agreement;
- (c) exempt all contracts for goods, works and services to be financed under the loan from all legal and regulatory provisions limiting the international procurement of goods, works, and services;
- (d) create the coordinating unit for flood-related aspects in the province assigning responsibilities for coordinating actions with entities in charge of civil defense, flood warning, hydraulic works, maintenance of flood-defense facilities, and environment;
- (e) submit to the legislature the provincial law defining institutional arrangements for flood-related actions in flood-prone areas; and
- (f) provide a satisfactory legal opinion on the validity of the Subsidiary Loan Agreement.

**4.4 Recommendation.** With the above assurances and conditions, the proposed project would be suitable for a Bank loan of US\$200 million to the Argentine Republic.



## **ARGENTINA**

### **Flood Protection Project**

#### **Legal and Institutional Framework**

##### **Flood Protection**

1. Argentina's national legislature is now considering passage of a law which would have a significant effect on the legal framework for water resource management. It would better define the rules which govern sovereignty over the country's rivers, and provide long-needed clarification in this area. The proposed law spells out the respective jurisdictions of national control (for interprovincial navigation purposes) and provincial control for all other uses. It would also serve to clarify the distinction between the provincial and federal governments over the control and uses of natural resources in general.

2. The proposed legislation states that provinces have the obligations and the rights to determine river margins, demarcating private vs. public zones. Following on this, the new law would encourage the provinces to demarcate borders and zones in order to establish land usage restrictions. In addition, the new law recommends as a matter of public interest the rapid evacuation of flood waters and the maintenance of adequate facilities for these purposes, making use of the land use restrictions. In fact, the provinces already have the authority to create local laws to provide a better framework for flood control and protection. Nonetheless, the clarification that would result from the new Federal law would be useful in strengthening provincial rules regarding water and land uses, as well as making them more comprehensive. This would also provide a better basis than now exists for making plans and taking actions for development of the long term economic use of the Paraná Basin flood plains, along with a better footing for environmental considerations.

3. Further, the proposed new Federal law should help overcome one of the deficiencies of existing provincial legislation with regard to flood controls: the absence of clear lines of limits and restrictions on particular geographic areas. This gap has in several cases resulted in the development of housing, industry and agricultural, as well as commercial activity in areas highly vulnerable to flood damage. Furthermore, present provincial legislation does not adequately provide for effective administration of these desirable rules, which impedes prevention or reduction of flooding losses. Given this situation, the proposed project supports the creation in each province of a law for the following purposes:

- definition and preparation of maps of flood-prone areas classified by varying degrees of risk, e.g., prohibited zones, zones with severe restrictions, zones with partial restrictions, zones with warnings concerning floods and others;

- ability of private property owners to demarcate their lands under the same categories, using the same procedures;
- establishment of areas for appropriate protection of wildlife and vegetation;
- adaption of tax rules and Government-supported credit or subsidy programs to discourage development in risky areas;
- introduction of requirements for evaluation of environmental impact in the preparation of proposed new hydraulic works;
- introduction of requirements for cost recoveries from beneficiaries of flood control works, covering their maintenance as well as their construction; and
- arrangements for coordination among different provincial organizations concerning water resources and flood protection.

4. In addition to the aforementioned provincial law, it would also be important for the provinces to create and administer regulatory controls enforcing these policies. These would apply, for example, to prohibitions on certain kinds of building construction and repairs, building standards for security purposes, e.g., waterproofing requirements, obligations to destroy obstacles to floodways, obligations to build and maintain private drainage and sewage disposal systems with suitable protection against flood damage. The proposed project would provide the required technical assistance for accomplishing these purposes.

### **Civil Defense**

5. A new proposed law referring to the civil defense system is also under consideration in the Federal legislature. This relates to the circumstances of natural disasters and similar emergencies, as opposed to war-time situations. This would be the first law providing for a national system covering these circumstances. Its provisions cover the areas of coordination of activities at all government levels, assistance to the provinces in these cases, and the elaboration of training programs for public education. The law also attempts to combine the various individual laws that now cover scattered portions of this topic. Another new element is the designation of responsibility at the national level for these emergency-type cases in the Ministry of Interior, while the Ministry of Defense retains the responsibility for war-related functions.

6. For the first time also, the law defines responsibilities of individual civic organizations for assisting in these cases, e.g., voluntary fire departments, private radio operators and the general public. It does not provide for any financial or other resources to be supplied for relieving natural emergencies. On the other hand, it would stimulate the development of broader public education and provincial systems in these circumstances. To complement these actions, the proposed project would help the provinces to establish emergency provisions for civil defense actions as well as to supply adequate training.

## **Institutional Setting**

7. There is a need for changes in the existing institutional arrangements for managing flooding in the river basins and the related uses of lands and other resources. This is needed both for the enforcement of the policy changes referred to above and the execution of the program comprising the proposed Flood Protection project. In addition, suitable organizational machinery does not now exist to bring together the different technical agencies concerned with flood protection needs, as well as with decisions on land and water resources and their environmental consequences.

8. Chaco, Santa Fe, Corrientes and Entre Rios Provinces have an inter-provincial pact relating to these matters. However, this is limited to inter-provincial collaboration in such extreme emergencies that would overtax any single province's capability. Similarly, the "Comité Hídrico de la Cuenca del Plata" established in 1983 did not meet the requirements, and in any event is reported to have ceased to function.

9. Therefore, it is proposed under this project to construct a framework which would provide for:

--within each province, creation of a system of central coordination of the proposed regulatory changes, the maintenance of existing flood control operations and facilities, the execution and maintenance of new flood control operations and facilities, the related flood warning and environmental protection measures, the expanded civil defense functions, and planning of future measures in these fields; and

--among the provinces, a system of information contacts and exchanges designed to produce coordination of planning, carrying out and evaluating policies and programs in these various fields.

10. The provincial scheme calls for a central coordinating unit to rely on individual organizational entities (which mainly already exist) for carrying out their assigned functions in these fields, e.g., public works, planning, irrigation, hydropower, etc. The proposed central unit would oversee these technical and other entities, rather than replace or duplicate them. Similarly, the scheme calls for essentially collaborative ties among the seven Paraná Basin provinces in order to coordinate policies and exchange information on matters of mutual interest, e.g., the monitoring of meteorological data about possible storms. Should two or more provinces wish to undertake new hydraulic projects in their areas, they could establish separate organizations for developing and carrying out such activities.





## **ARGENTINA**

### **Flood Protection Project**

#### **The Halcrow Study**

1. The preparation of the proposed project was basically founded on a new river basin-wide assessment, the "Study of the Regulation of the Alluvial Valley of the Paraná, Paraguay and Uruguay Rivers for Flood Protection." This was carried out by an international consulting firm (Sir William Halcrow & Partners Ltd. of England) under financing from the Flood Rehabilitation Project (Loan 3521-AR). The study was conducted during April-September 1994.
2. The study's terms of reference called for:
  - (a) examination of the Basin from physical, socio-economic and legal aspects;
  - (b) preparation of a methodology for assessing Basin flood risk, including development of a mathematical model and construction of maps showing different risks in the flood plain; and
  - (c) proposal of measures to reduce the Basin's susceptibility to flood damage and losses.
3. The consultants' report comprised twelve volumes. The portion dealing with the definition of the Paraná Basin problems covered geomorphology, hydrology, hydraulics, the area's socioeconomic resources, its urban and regional planning, environmental aspects, and flooding damages and losses. The volume which addressed management and regulation policies for the alluvial valley recommended a methodology for these purposes. It also treated valley planning, regulation of regional natural resources utilization, pilot area studies and a geographic information system. It furthermore made proposals on legal and institutional aspects. An additional volume dealt with the development and evaluation of "structural" protection measures, and the final volume recommended actions in the fields analyzed.
4. The highlights of the Halcrow study include the: (a) analysis of the frequency and severity of the atypical Basin flooding over the previous 15 years, concentrated on their causes and consequences; and (b) the diagnosis of the past measures regarding Paraná Basin management and proposals for its better integration.
5. The study provides a comprehensive definition of flood risk levels in different Basin areas. It developed the mathematical model required for that purpose, including simulations based on and analyses of existing hydrological data and mathematically generated series to cover large periods of recurrence. Maps defining areas of flood risk were developed based on hypotheses of recurrence of 20 and 100 years, and the largest area of flood coverage ever recorded (limit of the alluvial valley). These maps also indicated the maximum extent of the surface and area

of influence of the river that could be expected during a normal year. The study also encompassed proposals for a river basin-wide approach, requisite legal and institutional framework reforms, and a preliminary hydrological and environmental assessment of the region.

6. Significant features of the study include the intention through the river basin approach to achieve more coordinated management of the alluvial valley. This, among others, represented an effort to break away from the previous "vicious cycle" of "investment-damage-new-structural protection investment." The study made another important contribution in examining the costs of past floods in the Basin's river valley, and relating these findings to a determination of which additional investments in protection works would be economically justified. Moreover, the consultants linked the application with these justifiable flood control measures for urban centers or strategic sites with a "living with flood strategy" for rural and other less important centers, concentrating the latter on improved prevention and warnings.

7. A more detailed account of the Halcrow study follows:

### **Flood Risks**

8. The study mapped Basin areas in terms of various flooding risks, based on assumptions of recurrence of 20 and 100 years. This is illustrated in the attached maps IBRD No. 27720, 27721, and 27722. Map IBRD No. 27720 gives the general localization of flood risk maps, showing the whole region studied and how it was divided in sub-regions, each covered by one specific map. Map IBRD No. 27721 shows the flood risk zones for the area of Corrientes, Chaco and Formosa, corresponding to the area of map 3 indicated in the previous map (IBRD 27720). This map shows line limiting zones of different flood risk recurrence times--annually (blue), 20 years (dotted red), and 100 years (red). Map IBRD No. 27722 shows the flood risk zones in the vicinities of the city of Formosa in greater detail (greater scale). These studies will enable SUCCE and SUPCEs to determine the principal land-use sectors to be mapped for the flooding damage analysis. They also led to the Province's preparation of the Master Plans reflecting the different extent of damage vulnerability of the population and strategic infrastructure.

### **Institutional and legal framework**

9. The study proposed legal and institutional instruments, which enabled SUCCE to prepare a draft of recommended new provincial legislation (see Annex 1). This was done based on the result of the flood risk analysis carried out and on extensive analysis of the legal framework of the water sector in Argentina. Accordingly, the study recommended a methodology for regulating natural resource utilization of the areas affected by Basin flooding. The study also recommended measures for coordinating regional agencies and enforcing land and related resource use regulations.

### **Data base and communications**

10. The study gathered valuable data in the areas of geomorphology, hydrology, socioeconomic resources, and past flooding damages and losses. In all these areas, the study recommends actions to improve information sources and update the data base. These recommendations form the basis of the proposed project's investments in the establishment of hydrological measurement stations, and interconnecting and concentrating the information in INCYTH facilities. They also underlie the proposals for provincial entities concerned with flood protection to: (a) monitor geomorphologic changes in the area, with special emphasis on the places with potential instability and subject to erosion; and (b) maintain a continuing system to update socioeconomic resources data and to obtain other useful information.

### **Hydraulic models and geographic information**

11. The study defined flood-risk levels in different Basin areas using a hydraulic mathematical model. The study also developed a Geographic Information System (GIS) and used it for the modeling. (The consultants subsequently transferred the model and the GIS to the provincial entities and INCYTH). The study recommended including other cities and more accurate information in the GIS at a later stage, and continued improvement of the models. For better future coordination of Basin management, the GIS would provide definitive flooding maps, regional natural resources utilization regulations, environmental area classification, and accounts of impact mitigation measures.

### **Environmental mitigation**

12. The study presented a preliminary environmental assessment of the whole Basin and recommended the necessary measures to reduce the impact of flood protection actions, especially in those zones where the periodic floodings affect sensitive ecosystems. It provided an environmental map at the regional level, defined ecosystems in terms of their importance and ecological vulnerability, and established criteria for the uses of these areas.

13. The consultants' proposals have also helped in the assessment of the provinces' master plan works. The Halcrow study also recommended a long-term monitoring program of environmental changes in the rivers and the flooding valleys.

### **Provincial master plans**

14. The study recommended local Master Plans for smaller areas in the provinces and a methodology for their development. The main objectives of these plans were to evaluate the flood mitigation measures to be implemented, propose several alternatives and recommend the best options. These evaluations were to examine, among others, structural conditions of embankments, the economic feasibility of proposed defense works and their environmental impacts.



## **ARGENTINA**

### **Flood Protection Project**

#### **Provincial Master Plans**

1. As a result of the Halcrow Study preliminary identification of areas to be defended, each participating province carried out studies to develop Provincial Master Plans. Those plans recommended the necessary works to reduce the effects of recurrent floods in each area studied. Those recommendations were based on engineering studies, economic analysis, environmental considerations and public consultation. However, due to the high investment necessary to implement all works, they were divided in two phases: the first phase, included in this project, and a second phase, to be considered in a future project. Both phases are described below since the design of this project may allow to advance some sub-projects from the second phase to be included in this project (see para. 3.6 of main text).

#### **PROVINCE OF BUENOS AIRES**

2. In the northeastern part of the Province of Buenos Aires, hydrological problems are largely caused by Paraná River flooding originating from heavy spring and summer rainfall. Its major difficulty is the flooding's long duration. Such effects as unusually high water levels can last for several months in some zones. The second generic problem consists of high tides and winter storms from the southeast ("sudestadas") in the Plate River area. These cause significant increases in average water heights, at times of flood proportions.

3. The "sudestadas" phenomena impedes drainage of flat surfaces of the area in the Province's river basins, which affects urban centers in the riverside regions. They also impede drainage of the Paraná River too, causing flooding in the interior of the zone. When the "sudestadas" occur, and the Paraná and Uruguay rivers are high, the combination of the two can reach critical dimensions.

4. Third, the area's flat surfaces interfere with its drainage, particularly when river levels are low. This situation is complicated when it occurs simultaneously with heavy rains. Furthermore, the Delta area formed by the confluence of the Paraná and Uruguay Rivers produces flows into the Plate River. Flooding in the Delta itself complicates the situation, just as untreated wastes from its municipalities impedes public health protection in the area. In addition, Paraná River flooding problem is worsened by periodic, very intense rains that increase the overflowing of internal tributaries. This contributes to the erosion of river margins that have been reducing the coastal band and defenses.

5. The Province's flooding problem in the riverside cities has been partially addressed under the Flood Rehabilitation Project (Loan 3521-AR). The provisional works executed include defense, surface drainage, pumping stations and coastal erosion control. In

addition, there have been rehabilitation of communications facilities plus new paving of surfaces and water supply and sewage systems.

6. In view of its large number of inhabitants and considerable sized area, the Province of Buenos Aires has devoted a sizeable effort to identifying a set of measures and works for improving the situation in the medium and long term. Based on these, the Province has targeted remedial measures for the numerous Delta islands, which constitute the largest segment of its proposed works under the recommended project. The works would mainly consist of construction of embankments which would enable area residents to maintain contact with (and if necessary, evacuate to) the mainland, together with small culverts and bridges. In the second priority, defense embankments also figure prominently in the proposed sub-projects for the adjacent Tigre, San Fernando and San Pedro, and Escobar zones.

7. A summary description of the sub-projects proposed for this province is given below. They include works to be done in the first-phase of the program (funded by this project), and in the second-phase for a possible future operation. They are:

8. ISLAS DEL DELTA (DELTA ISLANDS)

First phase (Sub-project 100) Construction of embankments to maintain communication with the mainland and to evacuate population, if necessary, during floods. Total soil movement 8,694,446 m<sup>3</sup>. Also, construction of culverts and small bridges along the embankment.

Second phase (Sub-project 115) Defense construction for isolated public buildings of high importance to the community with "tablestacado" (stake-wall) and complementary works.

9. CAMPANA

First phase (Sub-project 103): San Cayetano neighborhood (defense embankment construction, including pumping stations, and slope surface protection with fertile soil and vegetation); and, Colleta and SE neighborhood (construction and upgrading of rainfall drainage system including the main conduct, which goes along Colleta street).

Second phase (Sub-project 110): Construction and upgrading coastal defense for Campana waterfront with "tablestacado" (stake-wall) and raising the coastal road. In addition, raising internal roads in Campana.

10. ZARATE

First phase (Sub-project 101): Villa Bosch neighborhood (raising surrounding streets transforming them in defenses); Villa Florida (construction and upgrading defense embankments, rainfall drainage system, pumping stations and culverts); and, Villa Angus neighborhood (continuation of the works carried out under the previous loan, including construction and upgrading defense embankments, rainfall drainage system and pumping stations).

Second phase (Sub-project 109): Construction of south coastal defense in Zarate, to protect the bank slope from erosion using sand bags and concrete blocks. Also in Zarate, rectification (conduction capacity improvement increasing cross section) of Santa Lucia creek, defense construction and upgrading of the defense in Santa Lucia, and construction and installation of culverts and pumping stations.

11. SAN PEDRO

First phase (Sub-project 103): Construction and upgrading of embankments, rainfall drainage system and pumping stations in “Canaletas” and “Bajo Puerto” neighborhoods. These works are complementary to the project carried out under the previous loan.

Second phase (Sub-project 113): Construction and upgrading of embankments, rainfall drainage system and pumping stations in Cazadores neighborhood. Also, the construction of the riverside main sewer. These works are complementary to the project financed under the previous loan.

12. BARADERO

First phase (Sub-project 104): Construction of concrete drains to conduct the rainfall discharge to Baradero river and bank slope surface protection, where the discharge is located, to avoid erosion.

13. ESCOBAR

First phase (Sub-project 105): Construction and upgrading of defense embankments, pumping stations and rainfall drainage system in San Miguel neighborhood. Cleaning and rectification of the main natural drain in Bedoya neighborhood.

Second phase (Sub-project 114): Construction of coastal protection with “tablestacado” (stake wall), raising the access road to School No. 22.

14. TIGRE

First phase (Sub-project 106): Construction of defense embankments and pumping stations in “Dique Lujan” y “Villa La Nata” neighborhoods.

15. SAN FERNANDO

Second phase (Sub-project 112): Construction of coastal protection with “tablestacado” (stake wall).

## **PROVINCE OF CHACO**

16. The Province of Chaco encounters perpetual flooding problems largely because of adverse hydrologic factors, complicated by a combination of intense rains and river overflow. One of its manifestations is most visible in the case of the capital city of Resistencia, which is located on the floodbed of the Paraná River and its tributary, the Rio Negro. This makes it particularly vulnerable to heavy flooding when the two rivers peak, which sometimes happens simultaneously.

17. The Province also faces heavy rains, especially in the Tapenaga Basin. These take place during brief intervals, e. g., less than 15 days. The attendant flooding is exacerbated by the lack of natural drainage under conditions of very flat topography and limited soil permeability.

18. These are aggravated, as evident in the urban center of the Tapenaga Basin, Saenz Pena, (as well as Resistencia), by the past investment in inadequate drainage systems. Worst still has been the build-up of housing, commercial and industrial facilities in badly located and often low lying areas. Road and rail infrastructure development have served to hinder natural evacuation of water movements.

19. The on-going Flood Rehabilitation Project includes some activities in the areas of Resistencia worst hit during the 1992 floods. These include investments in provisional defenses, surface drainage, control structure on the Rio Negro, emergency pumping stations, and coastal erosion control.

20. The proposed project draws on the provincial authorities' "Plan Hídrico Integral" as revised by the specific master plan for the province. In it, the Province decided to first concentrate on investments in Resistencia and the Tapenaga Basin, followed by upgrading of bridges. The first mentioned was particularly recommended in the "Halcrow Study" as meriting priority remedial attention because of these areas' vulnerability.

21. The Resistencia sub-project consists mainly of sizeable reinforcement of existing city embankments and other defenses, construction of new ones and expansion of rainfall drainage systems. Construction of several canals and pumping stations is planned as well. These investments were selected from among several alternatives keyed on reducing flood dangers in urban zone of the capital city, economic rate of return, environmental concerns and local community discussion and participation.

22. Another Bank project is addressing the Tapenaga Basin's low-lying, subterranean conditions.

23. A summary description of the sub-projects proposed for this province is given below. They include works to be done in the first-phase of the program (funded by this project) and in the second-phase for a possible future operation. They are:



24. RESISTENCIA

First phase (Sub-project 200): Construction and reinforcement of the following defenses: "north defense" which protects the Nicolas Avellaneda route; "northwest defense" which protects the area between Route 11 and the Rio Negro; "Laguna Blanca" defense and water intake defense on the Rio Negro; "southwest", "southeast" and "island" defenses which protect other routes and human settlements. Also, construction of a rainfall drainage system (north and south areas, including equipment), enlargement of existing canals, construction of embankments for urban protection, pumping station installations, and road raising and complementary installations. Construction of control infrastructure works at the interception point of the Rio Negro and the Paraná, including pumping stations and gates.

Second phase (Sub-project 201): Reinforcement of "Canal Soberanía Nacional" and "Canal 16"; enlargement of pondage south; rehabilitation of Salado basin; improvements in "Terraplen perimental Rio Negro" and "Terraplen Puerto Barranqueras"; and improvements in "Control of Soberanía Nacional".

25. LAS PALMAS Y LA LEONESA

Second phase (Sub-project 202): Construction of embankments and urban rainfall drainage to protect the cities of Las Palmas and La Leonesa.

26. BRIDGES

Second phase (Sub-project 203): Raising and upgrading of bridges and accesses.

PROVINCE OF CORRIENTES

27. The Province of Corrientes is bounded by the Parana River on the north and west, the Uruguay River on the east, and their tributaries on the south. Its internal basins moreover have several creeks, and lagoons covering more than a third of the Province's territory. These overly abundant water resources, as well as the intensive area rains, contribute to extensive flooding.

28. Further, flooding of the Parana and Uruguay Rivers tends to be simultaneous, reflecting the proximity of their high basins. Other disturbing natural phenomena are the Province's poor structural conditions for flood protection: its generally low lying slopes and the closed character of its natural depressions. These have been aggravated by the erosion of the slopes of the Parana in the wake of sustained discharges during a typical river flooding. In port areas, the sharp angle of riverside slopes has also been troublesome.

29. As a consequence, flooding occurs in all the riverside urban centers in the wake of the high water levels of the Parana and Uruguay. This problem is particularly severe in the province's two largest urban centers: Corrientes and Goya. Other riverside urban areas affected

are Ituzaingo, Itati and Paso de la Patria (Parana River), and Santo Tome, Paso de los Libres and Monte Caseros (Uruguay River).

30. These shortcomings have been aggravated by deficiencies in past measures taken to deal with these problems. The most troublesome of these are the insufficient drainage facilities to handle the volume of flood waters stemming from the Parana's overflow and heavy rains. Also, the temporary character of existing defenses has impeded natural surface flows as well, especially affecting Esquina, Saladas, Bella Vista, Mercedes and Curuzu Cuatia. Further, in several riverside urban centers, there have been problems due to the instability of coastal defenses and the port infrastructure. In addition, there has been a lack of adequate erosion control and surface protection of existing defenses.

31. These conditions led to the Halcrow Study recommendation that major attention be given to cities such as Goya because of their great vulnerability to flood damage. Fortunately, there has already been some provisional relief provided to these cities under the Flood Rehabilitation Project (Ln. 3521-AR). Its works have included defense, surface drainage, pumping stations and coastal erosion control. In addition, there has been rehabilitation of surface paving and communications and water supply systems.

32. In addressing these problems, the provincial authorities have had master plans developed mainly for Corrientes' principal cities. These emphasize defenses of Corrientes and Goya, improvement of the principal works of the drainage system, reconstruction of coastal defenses and port infrastructure, stabilization of riverside slopes, and raising of key bridges and their accesses. Their plans additionally envisage housing and shelter improvements to protect provincial residents who would not be covered by the proposed structural improvements.

33. In line with this strategy, the proposed project includes a program of US\$41.4 million for Corrientes Province. Its major components center around a US\$31 million total of improvements of urban defenses and drainage and erosion control works in Corrientes and Goya. In the former, defense works would be limited to the flood-prone area of Barrio Anahi. The envisaged sub-projects in Goya would focus on the present urban center plus the area of residential expansion outside the alluvial valley. The works would consist largely of upgrading embankments to consolidate the enclosure of recent provisional defenses and upgrading of existing embankments plus rainfall drainage works.

34. Other activities would include: (a) Bella Vista- defense works, urban stormwater drainage and erosion control works; (b) Curuzu Cuatia- defense works, stormwater system and canals; (c) Esquina-urban and rural drainage system and canals; and (d) Mercedes- urban drainage and canals.

35. A summary description of the sub-projects proposed for this province is given below. They include works to be done in the "first-phase" of the program (funded by this project) and in the "second-phase" for a possible future operation. They are:

36. BELLA VISTA

First phase (Sub-project 300): Construction of a subterranean rainfall drainage system for this urban center, which evacuates the water to the Parana river in the INVICO (Instituto de la Vivienda de Corrientes) neighborhood. Embankment surface protection with fertile soil and vegetation, and with concrete structures where drains discharge in the Correa lagoon area.

Second phase (Sub-project 307): The same components mentioned above, for the following areas: Entre Rios, San Martin, Belgrano streets, Canale Av., and Cemetery zone. Drain discharge protection in several sectors.

37. CITY OF CORRIENTES

First phase (Sub-project 301): Upgrading of rainfall drainage system and construction of new ones in the following urban areas: F.J. de la Quintana, Laguna Seca, Hipódromo, Industrial, Canal 13 y Bañado Norte. Canalization of Pirayui creek and conditioning of other existing canals. Embankment construction in the north and south of the city. Construction of pumping stations in Anahi neighborhood.

Second phase (Sub-project 307): Construction of rainfall drainage system in Limita creek basin and "3 de abril" Av., pumping stations in Salamanca and Poncho Verde creeks.

38. CURUZU CUATIA

First phase (Sub-project 302): Upgrading and construction of rainfall drainage system for Soler, Sarmiento, Rodriguez Peña, Azcuenaga, Alberdi, Rivadavia, Pujol and Las Heras streets.

Second phase (Sub-project 308): Canalization and cleaning of Curuzu Cuatia creek, and defense embankment on its right bank with the associated access for maintenance.

39. ESQUINA

First phase (Sub-project 303): Upgrading of rainfall drainage system and construction of new ones in urban (San Antonio neighborhood) and rural areas.

Second phase (Sub-project 309): Construction of a canal surrounding the urban center and Port infrastructure rehabilitation.

40. MERCEDES

First phase (Sub-project 304): Upgrading of rainfall drainage system and construction of new ones in urban areas. Canalization of "Las Garzas" creek and upgrading of the Bailey bridge.

Second phase (Sub-project 310): A second stage of the rainfall drainage system which complements the works initiated in the first phase.

41. GOYA

First phase (Sub-project 305): Upgrading and construction of rainfall drainage system and pumping stations. Defense construction of the city and upgrading of existing embankments, raising them and protecting the slopes with vegetation.

Second phase (Sub-project 311): Canalization and upgrading of streams, construction of culverts and bridges around the city. Upgrading of the defense, expanding the protection against floods with longer periods of recurrence.

42. BRIDGES

Second phase (Sub-project 312): Raising and upgrading of existing bridges, and the associated upgrading of the accesses. In several cases, the construction of new bridges would be required because the existing ones are obsolete and cannot be repaired.

PROVINCE OF ENTRE RIOS

43. The Province of Entre Rios, which comprises the central nucleus of the Rio de la Plata basin valley, is a flat undulating plain. It is distinguished for its dense, extensive hydraulic network, with more than two thousand bodies of water and countless canals. This complex network includes the two major basins of the Parana and Uruguay Rivers plus six smaller basins (including a delta). Nearly twenty percent of the Province's 78,781 km area consists of lands subject to flooding and islands.

44. The Parana runs against embankments of 60 to 80 meters above sea level, and registers flows with mean value of 14,000 m<sup>3</sup> per second and elevations over the normal water level of seven meters. The Uruguay River widens in its southern section, developing low margins with extensive sand banks and low slopes. An additional feature is the 300-km meandering course of the Gualeguay River with many tributaries. This causes the nearby soil to be easily saturated, impeding river movements.

45. Entre Rios' problems largely derive from the high flows of the Parana and Uruguay Rivers and the "sudestadas" (southeastern winds of high velocity that raise the water level). In addition, the periodic, very intensive rains increase flows from internal tributaries. The subtropical climate in the northern part is marked by very abundant rainfall, e.g., La Paz Department records show annual rains of 1,114 mm. The equally humid climate in southern areas has never less than 900 mm of rainfall per year.

46. The volume of river overflow from these sources increase its velocity and erosive effects, continuously damaging the river bed and riverside coast. In some zones, very few areas

are free of erosion. Moreover, these natural causes have been worsened by extensive exploitation of Entre Rios' natural resources. As a result, a large part of the Province now has severely eroded sections, perversely in areas devoted to high value crops.

47. One prime consequence of these factors is recurrent flooding in all the cities adjacent to the rivers and several urban centers in the internal basins. The problem has been exacerbated by unsuitable urban planning and drainage, along with the temporary nature of existing flood defenses (which have impeded natural surface flows). Over the last two decades there has been a steady movement of population into urban areas, now calculated to total 86 percent of all provincial residents.

48. In several riverside urban centers too, there have been problems caused by the instability of coastal defenses, poor port infrastructure and the sharp angle of the riverside slopes. In addition, there has been a lack of adequate erosion control and of surface protection of the existing defenses. All these forces have caused the emigration of part of the active working population and an accelerated reduction of rural residents. With the aforementioned population concentration in provincial cities, the floods and heavy rains have overtaxed water and sanitation facilities and caused deficiencies in their and other urban services.

49. These difficulties are being partially addressed under the Flood Rehabilitation Project. Its works have included short run improvements in river defenses, surface drainage, pumping stations and coastal erosion control. However, more permanent works need to be undertaken.

50. Given the serious, extensive nature of these difficulties, the Province chartered the preparation of master plans in thirteen of its entities to address these problems. These included Colon, Concepción del Uruguay, Concordia, Diamante, Federación, Gualaguay, Gualaguaychu, Ibicuy, La Paz, Parana, Santa Elena, Victoria and Villa Parancito. After a critical assessment of possible remedial measures and good selection from various options, the Province has prepared an ambitious program. Based on its quality and Entre Rios' flood situation within the overall Basin, the Government has accorded the provincial program substantial priority. The Entre Rios activities' total US\$51.9 million.

51. The provincial strategy is substantially concentrated on strengthening and adding to riverside embankments and other defenses. Investments in these facilities are prominent in the plans of nine of the 13 areas. They constitute almost 60 percent of the planned expenditures for works in Entre Rios under the proposed project. Three prime examples include a US\$11.5 million defense system in Gualaguay, a US\$7.8 million coastal defense sub-project in Concepción del Uruguay and a US\$10.4 million sub-project centered around three new jetties to protect 800 m of the river coast around Parana City.

52. The second main strand of activity centers on widespread canal construction in the numerous streams and brooks. Its principal case is the proposed US\$17 million sub-project for this purpose, combined with a new small reservoir, in the Concordia area. The remainder

of the provincial program is focused on urban drainage systems, other erosion control activities and drainage and pumping stations.

53. A summary description of the sub-projects proposed for this province is given below. They include works to be done in the first-phase of the program (funded by this project) and in the second-phase for a possible future operation. They are:

54. CONCEPCIÓN DEL URUGUAY

First phase (Sub-project 400): canalization of "Las Animas" creek. Construction of a defense embankment sufficient for protection against a 100-year flood height, including wave effect and a safety margin, up to elevation 11.6 m , to protect Las Animas creek from Parana river floods. Defense embankments would be provided with security illumination and electricity connection, in particular for the water intake area. Reinforcement and raising of the existing concrete walls protecting the water intake, and replacement of its electromechanical equipment with a submersible pump.

55. DIAMANTE

First phase (Sub-project 401): River bank and bed protection, rainfall drainage system rehabilitation and road restorations. Two lines of vertical drainage holes along river bank on a total length of some 1,500m; a drainage canal 300m long and eight m wide at the bottom, with sand replacement of the clay on the bed surface; rehabilitation of existing drainage canals and construction of new canals (270m long) with geotextile and concrete cover; construction of flexible culverts under the access roads; reconditioning of the Port access road and the railroad; and rehabilitation of an 800m Port access road from Diamante city.

56. SANTA ELENA

Second phase (Sub-project 406): River bank and bed stabilization, and the construction of a coastal embankment for 100-year flood recurrence. This embankment would allow direct access to the water intake for proper operation and maintenance. It would have a length of some 1,400 m, a level of 7,83m and width of 11 m. Also, there would be train rail protection, illumination of the area, and slope protection through the installation of flexible structure of concrete blocks connected by a geotextile net. Works also include a stormwater drainage system with a sub-surface drain 365m in length, located 3m below the surface. Rain drainage would be accomplished placing soil on the river bank and bed, and building drains to the river.

57. LA PAZ

First phase (Sub-project 402): Construction of sand embankments in two areas along the Parana river coast. The first would extend some 600m downstream from the port area and would have a width of 3.5m and height of 24m. A rock cover and metal support (spikes) would stabilize the river side of the embankment. Works would be complemented with rainfall drainage

installations. The second embankment, which extends from “9 de julio” Street to “25 de mayo” Av., would have a width of 7m and height of 24m. This would also include rain drainage installations, embankment surface protection, and river bank and bed stabilization. This project is complementary to the works already carried out under the previous loan.

Second phase (Sub-project 409): Restoration of the existing embankments and protection walls in “Puerto Márquez” coastal side. This component is also complementary to the works already carried out under the previous loan.

#### 58. FEDERACION

Second phase (Sub-project 408): Coastal defense, rainfall drainage system improvement, protection of bridge support structure from erosion and rehabilitation of the open drain over “La Virgen creek.

#### 59. GUALEGUAY

First phase (Sub-project 403): Complement the embankments already built under the previous loan for the protection of Gualeguay City from river floods, on an extension of some 5,700 m, and construction of associated culverts. Embankment would be five m wide at the top. In addition, construction of culverts and pumping stations to remove floodwater from the protected area.

Second phase (sub-project 409): Construction and upgrading of urban rainfall drainage systems in the north sector. Also, water intake protection, including the replacement of the foundation material, margin protection and intake pipe support.

#### 60. GUALEGUAYCHU

Second phase (Sub-project 410): Construction of water intake defense 100m long, protecting the south of the city from erosion by concrete blocks on a geotextile bed. In the north basin, construction of rainfall drains of variable cross section. Total drain length would be 5,525 km and the area to be drained would be 390Ha. Discharge would be over Gaitan creek. In the south basin, construction of rainfall drains of variable cross section. Total drain length would be 5,285 km and the area to be drained would be 436,41Ha. Discharge would be over the “Munilla” creek.

#### 61. IBICUY

Second phase (Sub-project 411): Construction of embankments to complete the defense belt around Ibicuy town, which was initiated under the previous loan. The defense would be 3,320 m long and 8 m wide at the proposed height of 7m. Construction material would be sand extracted from the river (“refulado”), covered with fertile soil and vegetation. Rain water would be evacuated beyond the defense by culverts (gravity drains) and pumping stations.

62. PARANA

First phase (Sub-project 404): Coastal protection against erosion and river bed movement vertical structural supports or spikes, "gaviones" and sand filling. Placement of supports upstream and downstream of Parana city for 600 m. Upstream, the river bank would be restored and its slope surface protected for some 200 m.

Second phase (Sub-project 412): Canalization and stabilization of Antoñico creek, between the "25 de junio" Street and the connection of this creek and the Parana river. The canal would be open and of structural concrete, and would connect to the closed canal that already covers a section.

63. VICTORIA

Second phase (Sub-project 413): Construction of the water intake tower and defenses, and installation of electromechanical equipment and piping. Rehabilitation of the Victoria Port with demolition and removal of concrete pavements, removal of the loose material in the bank, sand fillings and compacting collapsed zones, geotextile placement over the sand where the pavement was removed, flexible protection of the bank with structural concrete elements, gullies (side channels) construction, dug at the back of the existing "tablestacado" (stake-wall) to place geotextile and compacted sand, and installation of security lighting.

64. CONCORDIA

First phase (Sub-project 405): Construction and upgrading of the rainfall drainage system and construction of a small reservoir, on Concordia creek, to regulate the peak flows. Construction of south defense including embankment, rainfall drainage system, culverts and pumping stations. Construction of first phase of north defense.

Second phase (sub-project 414): Adjustment of the cross canal section and realignment of Manzores creek. Construction of second phase of north defense to complete the 4.5 km of embankment, rainfall drainage and culverts.

65. VILLA PARANACITO

Second phase (Sub-project 415): Elevation of several streets in the urban area by constructing embankments with vegetation for slope protection, 7m wide at the top and with a total volume of some 51,600m<sup>3</sup>. The flood recurrence period selected was 10 years to lower the risk of defense failure. Works would also include culverts and pumping stations.



## **PROVINCE OF FORMOSA**

66. The Province of Formosa exemplifies the widespread, persistent flooding problems of those Parana Basin provinces which are affected by overflows of the Paraguay River combined with extensive rainfall. In particular, the main provincial cities--Clorinda and Formosa--are located on the floodplain of the Paraguay and its tributaries. This explains their vulnerability to the high flooding caused by the periodic peaking of these rivers. The rivers normally peak at separate intervals; however, the phenomenon is sometimes simultaneous.

67. Other contributing factors include the area's heavy rains and flat topography. The former reflect the Province's humid tropical climate (with only some four dry months yearly) and annual precipitation of some 1,370 mm. Moreover, in the basin in which Clorinda is located, the terrain precludes natural drainage of the surface flows arising from the substantial rainfall, especially when combined with river flooding discharges. Another aggravating condition is the poor permeability of area soils (especially in farming sections). This and the very limited capacity of urban surface drainage produce high water accumulations. Urban planning deficiencies in Clorinda and Formosa have worsened these factors still more.

68. Thus, the Province has suffered major flooding problems as a result of these topographic conditions, as well as the locations of its two major cities. These problems are being mitigated somewhat by operations of the Flood Rehabilitation Project. These have included defenses, surface drainage, pumping stations and coastal erosion controls. There also is some activity in rehabilitation of communications, surface paving, and water supply and sewerage systems.

69. The Province's recent assessment of its flooding problems concluded that the highest priorities need to be given to improved protection of the cities of Clorinda and Formosa. This judgment coincided with the recommendations of the Halcrow study, on which the proposed project is largely based. This study classified these two cities as being among the Parana Basin areas most vulnerable to flood damage. Much of this was attributed to the fact that they had grown without adequate urban development controls, notwithstanding their central location in the Paraguay River floodplain.

70. Following this determination of priorities, the Province commissioned master plans for better protection of its two major cities. Based on these, the activities planned under the proposed project focus on reinforcement of existing defenses and construction of rainfall drainage systems, canals and pumping stations in areas with the greatest flood risks. The aim of the investments is to raise the protection levels, e.g., upgrading those raised under emergency conditions and restoring some which had been altered during past floods. This was determined to be more economic than building additional defenses.

71. A summary description of the sub-projects proposed for this province is given below. They include works to be done in the first-phase of the program (funded by this project) and in the second-phase for a possible future operation. They are:

72. CLORINDA

First phase (Sub-project 500): Reinforcement of existing defenses for permanent protection, adoption of lower angles on the external side of the embankments and improvement of material compacting. These works (15.4 km of defenses) protects from the Pilcomayo river floods. Also, construction of Porteño Norte river defense of some 6.3 km and rainfall drainage systems.

73. FORMOSA

First phase (Sub-project 501): Reinforcement of existing defenses to adequate them for permanent protection. Raise their existing level, adopt lower angles on external side, restore interior side, protect their surface, and add a layer of cohesive soil at the top to allow access of the operation and maintenance equipment. These works were initiated under the previous loan. The southern defense extends for some 12km and the northern defense for 6.5 km. In addition, construction of rainfall drainage systems, culverts and pumping stations would be carried out.

Second phase (Sub-project 502): North coastal defense embankment, including pumping stations and river bank protection. Also, construction of control infrastructure works to regulate peak flows, including small reservoirs, culverts and pumping stations.

PROVINCE OF MISIONES

74. The Province of Misiones is surrounded by the Parana, Uruguay and Iguazu Rivers. Their overflows, especially from the Parana and its tributaries, characteristically cause persistent flooding throughout the Province. This is complicated by the pattern of heavy provincial rainfall. These two factors reinforce each other, on average, twice per year.

75. Substantial flooding resulting from these factors has long affected the Province's urban centers. The floods generally surpass the capacity of the local facilities for evacuating these flows, and often even engulf embankments built for defenses as well as water systems. Simultaneously, Uruguay and Iguazu river overflows have affected rural settlements in internal basins, where their spillover merges with local streams.

76. The river flooding phenomenon has mainly caused problems in securing adequate supply of potable water and the quality of its service in urban areas (especially Posadas, Wanda, Puerto Esperanza and Obera). These have been complicated by the Province's lack of sufficient drainage and sewerage facilities, notably in the cities of San Javier and Puerto Iguazu. Flooding has also affected roads and bridges in rural areas, at times causing some of these zones to be isolated.

77. Some mitigation of these problems will result from works constructed under the Flood Rehabilitation Project. This project has included investments in pumping stations and water intakes and supply systems, particularly for the city of Posadas. For the long-term

protection of key assets, the Province has designed a US\$10-million program which is included in the proposed project.

78. Almost two-thirds of the value of its sub-projects is directed to improved drainage systems for the centers of Puerto Igauzu, San Javier and the Yarara and Bonito basins. Most of the remainder will be allocated to better safeguards of water intakes and other water/sewerage systems in Posadas and three other cities. The balance would be used for the preparation of additional bridge works in rural areas, including the raising and strengthening of accesses to these bridges, with some replacements as well as water underpasses.

79. A summary description of the sub-projects proposed for this province is given below. They include works to be done in the first-phase of the program (funded by this project) and in the second-phase for a possible future operation. They are:

80. POSADAS

First phase (Sub-project 600): Construction of a new water intake system, to replace the old one which was flooded and could not be rehabilitated, including acquisition and installation of electromechanical equipment.

81. PUERTO ESPERANZA

First phase (Sub-project 601): Construction of a new water intake system, to replace the old one which was flooded and could not be rehabilitated, including installation of pipes, and acquisition and installation of electromechanical equipment.

82. WANDA

First phase (Sub-project 602): Construction of a new water intake system, including installation of pipes, acquisition and installation of electromechanical equipment, and treatment plant installation. Upgrading of the existing rainfall drainage system to improve its capacity on the Tubicua creek (cleaning and realignment), construction of new drains and improvement of existing ones.

83. OBERA

Second phase (Sub-project 608): Construction of a new water intake system, in Ramón creek, including installation of pipes, acquisition and installation of electromechanical equipment, and construction of a small water reservoir to regulate water flows during dry seasons.

84. PUERTO IGUAZU

First phase (Sub-project 603): Upgrading of the existing rainfall drainage system to improve its capacity on the Tacuara creek (cleaning and realignment), construction of new drains and improvement of the existing ones.

Second phase (Sub-project 609): Complementary drainage works.

85. SAN JAVIER

First phase (Sub-project 604): Upgrading of the existing rainfall drainage system to improve its capacity (cleaning and realignment), construction of new drains and improvement of the existing ones. Also, construction of embankments, and slope surface protection with fertile soil and vegetation.

86. YARARA CREEK

First phase (Sub-project 605): Upgrading of the existing rainfall drainage system to improve its capacity on the Yarara creek (cleaning and realignment), construction of new drains and improvement of existing ones. Also, construction of embankments, and slope surface protection with fertile soil and vegetation.

87. BONITO CREEK

First phase (Sub-project 606): Upgrading of the existing rainfall drainage system to improve its capacity on the Bonito creek (cleaning and realignment), construction of new drains and improvement of existing ones. Also, construction of embankments, and slope surface protection with fertile soil and vegetation.

88. BRIDGES

First phase (Sub-project 607): Raising and upgrading of existing bridges. In several cases, the construction of new bridges would be required because the existing ones are obsolete and cannot be repaired.

•

## **PROVINCE OF SANTA FE**

89. The Province of Santa Fe confronts recurrent periods of flooding that adversely affect its important, largely agricultural productive areas. This partly derives from the flat topography of the extensive plain which comprises most of the region's land surface. In some areas there is no natural exit for excessive surface water flows, which have exceeded the capacity of natural reservoirs. The region generally in fact lacks adequate natural drainage capacity, especially in the Linea Parana basin. These have caused sizeable land areas to be submerged for extended periods, with considerable subsequent soil erosion.

90. Changes in climatic conditions have likewise been influential, as well as costly. Historically, Santa Fe has had successions of drought and heavy rainfall. Provincial records over the last 30 years though have shown a nearly unrelieved pattern of virtual hyper-humidity. Consequently, Santa Fe has had seasonally heavy rains, which have varied from 700-1,000 mm to 1,970 mm annually over the past 20 years. This pattern has resulted in the steady growth of groundwater levels, in one area rising 17 meters from 1970 to 1981. To worsen matters, some provincial zones have encountered considerable droughts at the same time as their neighbors had to overcome flooding.

91. These factors have been exacerbated by the ways in which the Province has grown. The capital city, Santa Fe, typifies the pattern of its urban development. Its location on the floodbed of the Parana River has made it particularly vulnerable to the heavy overflows which result from this river's peaking. In this connection also, Santa Fe's location makes it vulnerable to water flows coming from neighboring regions.

92. Santa Fe's flood problems are concentrated in ten parts of the Province. These regions' difficulties derive basically from the above-mentioned excessive water flows, heavy rainfall, and the flatness of land surfaces. There also are substantial concentrations of population in these flood-prone zones. Other contributing factors have consisted of the poor condition of underpasses in principal drainage networks, and retrograde erosion causing the backward movement (from downstream to upstream) of a water fall along the Saladillo stream.

93. Furthermore, the Parana River's overflow westward has severely damaged the heavily trafficked Route No. 1 and its bridges, which also has caused substantial erosion in adjacent streams and lagoons. In addition, substantial problems with erosion controls have damaged the bridge over Leyes stream, which requires its relocation.

94. To help ease these difficulties, the provisional works being executed under the Flood Rehabilitation Project include improvements in river defenses, surface drainage, pumping stations and coastal erosion control. For the longer term future, the Province has developed master plans for its most vulnerable areas. These include the Colastine, Cululu, las Conchas, Monje Carrizales, Pavon, Saladillo and San Antonio sections, and areas adjacent to the Carcarana river, the Linea Parana basin, and Setubal lagoon system.

95. There is a roughly similar strategy depicted in the plans for these zones. It forms the basis of most of Santa Fe's sub-projects in the proposed new project. One of its major elements emphasizes the reconditioning of existing canal structures plus the adjustment or replacement of urban and rural drainage and sewerage systems, erosion controls, pumping systems and water underpasses. Sub-projects costing US\$66.5 million are included in the new project for these kinds of activities in 10 of the above-mentioned priority areas of the Province.

The second principal element of Santa Fe's program involves the elevation of bridges in diverse rural areas and improvements in their accesses, mainly in the Setubal basin system. These would constitute the remaining US\$21.5 million of works in the Province.

96. A summary description of the sub-projects proposed for this province is given below. They include works to be done in the first-phase of the program (funded by this project) and in the second-phase for a possible future operation. They are:

97. LAS CONCHAS CREEK

First phase (Sub-project 700): Construction of new canals and upgrading of existing ones, for a total of some 230 km; embankment construction (some 70,000 m<sup>3</sup>); construction and rehabilitation of culverts and bridges along several routes, roads and railroads. In addition, placement of metallic fences to designate limits of protection works and facilitate its preservation.

Second phase (Sub-project 708): Construction of embankments and regulatory spillways in "Verde" and "La Tigra" lagoons.

98. SAN ANTONIO CREEK

First phase (Sub-project 701): Upgrading of existing canals, improving their conduction capacity, for a total of some 140 km; construction of culverts and bridges in several principal and secondary routes, railroads, private and community roads; also, construction of gullies (side channels), raising of roads, and placement of metallic fences. In addition, the urban drainage system would be improved. Bridge on provincial route 92, over San Antonio creek. Upgrading of canals: Principal 2, and Secondary Curupaity and Capivara. Improvement of gravel roads and gully (side channel) construction.

99. CULULU CREEK

First phase (Sub-project 702): Construction of new canals and embankments, and upgrading of existing canals and embankments, and the corresponding upgrading of culverts and bridges over the drainage network. Canals total some 380 km and embankments some 186,000 m<sup>3</sup>. Also, placement of metallic fences. Complementary works for Retiro creek, Principal 1 canal and Prusianas creek. (Upgrading of secondary canals and urban protection for small communities).

100. COLASTINE CREEK

Second phase (Sub-project 709): Construction of embankments to protect urban centers, construction of new canals and upgrading of existing canals, with the corresponding upgrading of culverts and bridges over the drainage network, on roads, routes and railroads. Canal construction and upgrading total some 400 km. Also, placement of metallic fences. Complementary works for Colastine creek and Coralitos principal canal. Upgrading of secondary canals and urban protection for small communities.

101. MONJE-CARRIZALES CREEK

First phase (Sub-project 703): Construction of embankments to protect urban centers, construction of new canals and upgrading of existing canals, with the corresponding upgrading of culverts and bridges over the drainage network, on roads, routes and railroads. Canal construction and upgrading total some 600 km and the new canals are for Las Bandurrias and Las Estacas creeks, which are tributaries of the Cañada Carrizales creek. Also, placement of metallic fences.

Second phase (Sub-project 710): Canal upgrading of Cañada Carrizales creek and urban protection for small communities.

102. CARCARAÑA RIVER

First phase (Sub-project 704): Construction of embankments to protect urban centers, construction of new canals and upgrading of existing canals, with the corresponding upgrading of culverts and bridges over the drainage network, on roads, routes and railroads. Canal construction and upgrading total some 160 km. Also, placement of metallic fences. Upgrading of culverts and bridges (second stage), and protection of small communities (embankments and pumping stations).

103. SALADILLO CREEK

First phase (Sub-project 705): Waterfall stabilization with a canal, spillways and control structures to avoid further erosion (Saladillo creek). In addition, upgrading of existing canals (around 4.5 km), with the corresponding upgrading of culverts and bridges over the drainage network, on roads, routes and railroads (Casilda and Fuentes communities). Also, placement of metallic fences.

104. PAVON CREEK

Second phase (Sub-project 711): Upgrading of the existing rainfall drainage system with the capacity conduction improvement on 46 km of a natural streams (Pavon creek), and with the new construction and improvement of existing structures on 84 km of canals. Also, upgrading or

complete replacement of culverts, bridges and associated embankments to the main drainage system.

105. LINEA PARANA

Second phase (Sub-project 712): Reconditioning of existing canals (222 km), embankments (772,368 m<sup>3</sup>), drains, pumping stations, access roads, and embankment surface protection. Construction and upgrading of culverts and bridges.

106. SETUBAL SYSTEM

First phase (Sub-project 706): Construction of a bridge on the Provincial Route 1 (PR1), over the Leyes creek (length 400 m), with associated access roads. Construction of a bridge on the PR1, over the Potrero creek (length 400 m), with the associated access roads.

Second phase (Sub-project 713): Defense embankments to protect Provincial Route 1 (55 km and 967,948 m<sup>3</sup>), associated culverts and upgrading of access roads.

107. BRIDGES

First phase (Sub-project 707): raising and upgrading of existing bridges of high priority and strong internal economic rate of return. In several cases, the construction of new bridges would be required because the existing ones cannot be repaired.

Second phase (Sub-project 714): Raising and upgrading of additional existing bridges, or complete replacement depending on the case, of the remaining bridges.

BUENOS AIRES CAPITAL CITY

108. BUENOS AIRES CITY (Sub-project 800): Construction of infrastructure works to decrease/alleviate the rainfall drainage flow to Maldonado creek, which is one of the main drainage outlets for Buenos Aires. These works include drainage (closed sub-terrain canals or tunnels) and reservoirs. Works include four reservoirs of 1 ha each for a total storage capacity of 314,733 m<sup>3</sup>, and two tunnels of 4 m diameter located 25 m below the surface.



## **ARGENTINA**

### **Flood Protection Project**

#### **Shelters and Housing**

#### **Introduction**

1. This component of the project derives from the overall strategy of not making substantial flood protection investments in areas which risk assessments have shown to be uneconomic or of low priority otherwise. The "living with floods" philosophy which has been applied in these areas generally excludes reconstruction of homes and other buildings there. However, the project design recognizes the implications of this philosophy for the residents of these flood-prone areas and the need to mitigate some of their problems. Accordingly, the project tries to minimize the damage involved. For this purpose, the project includes funding for: (a) a program of voluntary self-construction of safer houses by the affected communities, and (b) the construction of shelters for the protection of families evacuated during flood conditions. Therefore, while these populations would not be protected by the structural defense works, they would benefit from these alternative long-term protective measures.

2. The housing component would also aim at providing better protection for residents of very isolated areas who are distant from river defense structures, or who live outside the scope of economically justified river defenses. Similarly, the shelter component will serve the needs of those families who live outside the scope of these facilities. It would also put in place emergency protection for families reluctant to abandon permanently their risky home sites or who move into the area in the future despite the warnings and land use regulations discouraging development there.

#### **Housing**

3. This Housing component would extend and expand on the ongoing activity which has the same objective under the Flood Rehabilitation Project (Ln. 3521-AR). It would apply the same criteria and methods of implementation which were successfully carried out under the previous project, as well as the strong role in it played by community groups. The component also would follow the same procurement provisions and safeguards which likewise contributed to the effective implementation of this component under the Rehabilitation Project.

4. The basic concept remains that housing be provided for low-income families located in areas highly vulnerable to floods. Their new houses would be constructed in higher areas close to their present sites or in their present sites with elevated foundations, if possible, to minimize dislocation. An additional criterion was the absence of any environmental problems at the new site.

5. The housing units would be 43 m<sup>2</sup>, with two bedrooms, a multi-use room, a shaded area, and water and drainage installation for the kitchen and bathroom. This unit represents an enlargement of the previous project prototype (32m<sup>2</sup>), with more living space as well as better climatic protection. The new water and drainage installations for the kitchen and bathroom are based on the experiences with the families who occupied the units built thus far.

6. In order to accelerate the process of land acquisition, a new feature of the project would be the establishment of a data bank, which contains information on property ownership. This would help overcome the delays encountered in the first project due to uncertainties of the legal availability of the sites for the new homes.

7. The seven riverside provinces would participate in this project component, applying the previous experience. The houses will be constructed with the materials obtained through the same system of vouchers to cover their cost. The new cost of about US\$6,200 per unit compares to the approximately US\$4000 for the previous prototype, with the difference representing the cost of the new services and the enlarged area. Even at the new higher cost, it still represents a much less expensive construction cost than normally applies in Argentina today. By comparison, units of the same size as those to be financed under the project, but which are provided under the Government's FONAVI construction program cost some US\$20,000. The latter figure, however, includes access to water and electricity, as well as the basic land cost, which total some US\$3,000.

8. The beneficiaries would provide the labor to build their own houses or undertake a task with the equivalent labor where they lack expertise in housing construction. Also under the system, housing experts posted in the central and provincial units would work with provincial technicians to provide technical assistance to the beneficiaries in the field. In addition, the new project would contain an additional feature that builds upon the Flood Rehabilitation Project. Under the new project, the housing beneficiaries would be assisted by the technical and social services provided by community organizations. These would consist of help in the selection of the beneficiaries, their organization for the community "self-help" character of the construction, design and orientation of the component, the functioning of the voucher system, and the provision of practical information for the needs of the beneficiaries. Previous experience has shown the necessity of this assistance for the success of the housing component.

9. This would be complemented by assistance which the local officials would provide from other sources. Under this, municipal technicians assist groups of beneficiaries with the construction of their homes, which provides some on-the-job training and improved skills. The housing beneficiaries would also be assisted by technical trainers to help prepare them for future productive employment. This additional training would be provided under community auspices with the help of the Municipal projects (Loans 2920-AR and 3860-AR). This training would be complemented with the practical employment opportunities of home building under this project. This joint venture results from coordination arrangements of local officials with other assistance projects.

10. The Project Operational Manual (POM), which defines the procedures for project execution, covers the eligibility criteria for housing benefits, the house design, monitoring and supervision requirements, and other measures to assure transparency and accountability (see Annex 7). The agreed eligibility criteria are designed to ensure that beneficiaries are among the poorest families and that their current settlements are vulnerable to floods. In addition, the housing improvements and new construction would be restricted to those families which have voluntarily applied for such assistance in order to meet their individual needs. These and the other criteria which govern this component also follow the experience of the previous project; they are virtually unchanged. One amendment calls for the beneficiaries to have lived in their homes for five (rather than three) years prior to their application for inclusion in the project, as well as to commit themselves to remain in the houses being constructed or improved for an additional five years compared to three years presently. The longer period is intended to help restrict this component to those with a greater commitment, i.e., those who would maintain long-term residence in the houses, rather than to sell them for personal profit. In addition, it would restrict the benefits to a more selected group, and would amortize the benefits more fully.

11. Municipal social workers would visit applicants and would verify that they meet program criteria. Technical and social workers would be guided by technical and social assistants of SUCCE in complying with the program. All beneficiaries would be required to sign a document certifying, among other things, that all relevant family members have lived on the site considered highly vulnerable to floods and their current house is not waterproof; the unit they currently have is their only residence and they have no other property; have no savings or other resources to move to a safer place and improve their sanitary conditions; and plan to live in the area for at least five years. If the land on which they plan to build belongs to someone else, the beneficiary must provide signed approval from the owner allowing them to use the land for at least five years. Also, the beneficiaries have to agree to use the voucher as stipulated and comply with all of its conditions and requirements; agree to provide the labor needed to assemble their units; and agree to follow the instructions of the field technicians to ensure that the units are constructed in accordance with safety requirements. Beneficiaries would also affirm their understanding that if they make any false declaration or misuse the material received, they will be subject to judicial proceedings and will have to make full restitution if found guilty of such abuses. Beneficiaries who receive assistance through the voucher program would not be eligible for additional complementary and/or concessionaire assistance from the government for the units received.

12. Receipt of the vouchers would be annotated in a Registry of Beneficiaries. These registries would show the number of vouchers registered by SUPCEs, given to beneficiaries and recovered in the process (received from the provider and paid to them). This closed circuit would allow proper control by SUCCE and the auditors. They would also show the amount of the vouchers and the stage of construction to which they apply. They would be numbered and printed so as to avoid fraud, and would bear the identification of the participants (names, addresses, identification, date of receipt of the certificate and the amount of each portion). These vouchers would be non-transferable and would be drawn down in tranches from any hardware supplier participating in the program. They would specify the value, tranche limits,

type of material that can be purchased, and the sequence of such purchases to ensure a minimum waiting period between purchase and installation of the material. These registers would be kept available for the review of SUCCE and external auditors. In addition, the SUPCEs would identify and register the hardware suppliers who express interest in participating in the project.

13. Beneficiaries would have final responsibility for constructing and assembling their units, with technical assistance guidance from the field technicians to whom they would be assigned. The field technicians would be responsible for supervising the quality and value of the materials delivered by the suppliers to the beneficiaries. The hardware suppliers can redeem the vouchers under procedures and conditions specified as part of the agreement to include them in the program. The suppliers, *inter alia*, would have to show proof of delivery of the materials to the beneficiary (i.e., sales slips). These and other regulations would be included in an Annex to the POM.

14. The materials used for the houses and their design would vary in each province depending on the availability of materials and the customs of the inhabitants, following the experience of the previous loan. The use of the traditional style of brick construction has been very successful. It had the special advantage of enabling beneficiaries to build the new houses through their own personal efforts. Conversely, the previous experience has created doubts about the use of wood panels and pre-fabricated prototypes, which reduced the beneficiaries participation and sense of ownership. Therefore, the program would be implemented on the basis of traditional style brick construction, except for special cases and conditions in which the Bank would agree to a different approach.

15. Approximately US\$31 million would be available for this component. This would enable 5,000 families to benefit from the proposed new construction and improvements, approximately the same number which received such assistance under the ongoing Rehabilitation Project. As in the latter, the beneficiaries would provide the labor for the construction. Even though the labor would not be sufficient to compensate for the investment cost, it would be considered an effective way to create ownership sense of the beneficiary for the new house. Other contributions to this component would include the provision of the necessary land and the connections for the water and electricity, which would be made by federal, provincial or municipal sources. The following table shows the distribution of houses by province:

PROVINCE	QUANTITY to be financed under this loan	COST (US\$) (excluding labor)
Corrientes	1,275	7,905,000.00
Chaco	828	5,133,600.00
Misiones	445	2,758,000.00
Formosa	828	5,133,600.00
Santa Fe	1,083	6,714,600.00
Buenos Aires	286	1,773,200.00
Entre Rios	255	1,581,000.00
TOTAL	5,000	31,000,000.00

16. The above numbers reflect only a portion of the established requirement for housing improvements in the affected areas (which will not receive greater flood protection defenses under the project). However, as indicated elsewhere in this report, this project is envisaged to be the first phase of a proposed two-stage operation. Other new and improved housing would be financed under a possible follow-up operation, benefiting additional families.

### Shelters

17. The "flood preparedness and civil defense" component of this project is directed at needs in vulnerable areas which are not considered to justify further investments in structural defenses. Apart from the aforementioned housing improvements, as a new feature of the government's program, this project would add the construction of shelters for the emergency refuge of area residents during flood conditions. The functions of the shelters include protection against weather conditions, provision of basic sanitary services, storage and protection of belongings, provision of emotional support and intimacy, and support for the future reconstruction period. On the other hand, the shelters would also serve as temporary housing for families dislocated by the floods from very risky areas but who subsequently would return to their vulnerable homes rather than move to more permanent housing for the longer term.

18. In the 1982/83 floods some 177,000 people were evacuated, and in the 1992 floods about 133,000. An average of 25% of the evacuated population appear to have gone into public shelters or temporary houses. The remaining population was sheltered in the houses of relatives and friends, or rented spaces. The shelter requirements per province, for the 1982/83 and 1992 floods, were as follows:

Province	Evacuated Population	
	1982/83	1992
Santa Fe	23,054	37,794
Entre Rios	17,974	16,436
Corrientes	11,228	17,840
Chaco	68,527	6,883
Formosa	50,026	46,316
Misiones	6,226	6,584
Buenos Aires	-----	1,253
TOTAL	177,035	133,106

19. Shelters would be located in zones without flooding risks, and close to work places, schools, food supply centers and means of communication. Another criterion for the location of the shelters would be their proximity to provincial and municipal institutions involved in flood preparedness and civil defense. Almost 60% of the shelters would be concentrated in Corrientes, Formosa and Santa Fe Provinces.

20. The shelters would be used as "multi purpose facilities" to permit their serving as education or sport centers, when they are not needed for civil defense purposes. They would be constructed as annexes to existing facilities such as schools or community centers. This flexibility of serving other uses for the community while there is no emergency would help assure the maintenance and the rapid civil defense action by the entity in charge of the main installation (school or community center) annex to which the shelter would be installed. In addition, the multi-purpose function of the shelter would avoid any tendency towards the permanent stay of the people living there during the emergency.

21. Each shelter would provide, sleeping space for about 10 to 12 families of six members. In addition, the shelter would have a section of community bathrooms, kitchen, space for circulation and storage, and would be equipped with water disinfectants, blankets and water pumping among other emergency equipment, for an average total space per family of some 25m<sup>2</sup>.

22. The total space per family of 25m<sup>2</sup> including all uses mentioned above for 10-12 families per shelter, gives a total of 250-300 square meters per shelter. This space would give temporary comfort, but would discourage people from remaining in the shelter after the emergency. Restrictions would be imposed on how long they could remain, depending on the restoration of normal living conditions. With a cost per shelter of some US\$80,000 and considering 155 shelters, the total investment would be some US\$12.4 million. Their construction would be with durable materials of low maintenance requirements.

23. A prototype has been designed for the shelters by SUCCE in close consultation with the provinces, which takes into account the need for multi purpose use of these buildings. This

prototype would be adopted by all the provinces and constructed by contractors to be hired in each province through national competitive bidding.

24. The number of shelters required was determined by SUCCE and the provinces based on past experience, as well as estimates of current and future needs, considering the zones that are being protected with structural defense works, the population benefitted by the housing program and land use regulations. For the proposed project the population evacuated that would go into shelters is estimated at 8,000 people. Shelter is provided for a smaller population than in the past because of the improvements to be implemented through this loan.

25. The number of shelters and investment required per province would be:

PROVINCE	NUMBER OF SHELTERS	AMOUNT IN US\$
Corrientes	33	2,640,000.00
Chaco	20	1,600,000.00
Misiones	17	1,360,000.00
Formosa	25	2,000,000.00
Santa Fe	30	2,400,000.00
Buenos Aires	18	1,440,000.00
Entre Rios	12	960,000.00
TOTAL	155	12,400,000.00

26. In order to assure the effective implementation of this component and the subsequent multi-purpose use of the shelters and their maintenance, the provinces would designate the entity to be charged with meeting these responsibilities. Where the shelters are attached to existing facilities, the entities responsible for maintaining those facilities would also assume the maintenance of the shelters. In addition, the local entities or organizations, such as schools, hospitals, churches, municipal entities, would contribute to the maintenance of the shelters. Responsibilities for maintenance are spelled out in the Project Operational Manual.





## **ARGENTINA**

### **Flood Protection Project**

### **Environmental Assessment**

#### **Introduction**

1. The project will support the flood protection strategies and policies of participating provinces through the implementation of well coordinated programs. These programs include both structural and non-structural measures, enhancing provincial capacity to deal with periodic flooding, protecting important economic and social infrastructure, and strengthening the legal and institutional framework to sustain them. When completed, the project is expected to have provided technical assistance and financing to seven provinces which have long suffered economic and human losses from periodic flooding of the Paraná, Paraguay and Uruguay rivers. Over 120 specific investment needs were identified along the flood plains of the three rivers. These were screened according to environmental criteria agreed with the Bank and a "living with floods" strategy, resulting in the selection of some 50 priorities for the first phase of the program, supported by the project.

#### **Environmental Assessment Strategy**

2. Given the size of the areas studied (flood plains of the Paraná, Uruguay and Paraguay rivers in Argentina) and the complexity of their ecological and human interactions, the environmental assessment process included three major components: (i) a regional environmental assessment to analyze existing conditions of interacting natural and manmade systems in the floodplains; (ii) project-specific environmental assessments for each of the priority projects, as part of the technical and economic studies; and (iii) an integrated analysis of all priority projects and their cumulative impacts at the regional level. This strategy permitted the identification of regional programs that would enhance the environmental benefits of the project as well as project-specific mitigation measures to be included as part of project design and construction. All reports have been placed in the Public Information Center in Washington and made available to the public in Argentina.

3. The studies concluded that the negative impacts identified would for the most part be highly localized and short-lived. The cumulative impact in the flood plains will be of much lesser magnitude than existing environmental pressures caused by other human activities and infrastructure. The principal environmental screening criteria used for civil works was the least possible interference with natural flooding processes. The project therefore will not interfere with the quantity or quality of waterways. While the project would finance some housing construction in low income high risk areas, there is no resettlement contemplated as housing would be built largely on the families' current sites and restricted to their voluntary intentions

and self-construction plans. The main civil works were systematically screened to avoid involuntary resettlement. Although their impacts on natural ecosystems were deemed negligible, the project will finance programs for improved ecological monitoring and management of natural wetlands, especially those near urban centers and threatened by manmade activities.

## **The Project**

4. **Non-structural Measures.** Most past efforts to manage the effects of floods have focused on structural measures involving large-scale, and therefore capital-intensive, flood control projects. By contrast, following experience in Argentina and internationally, the new approach supported by this project combines physical controls in high priority areas with non-structural measures based on a "living with floods" strategy. Non-structural measures included in the project are: (i) strengthening the legal and institutional framework in each province including the preparation of new laws, a civil defense system, land use plans for the floodplains, and regulations restricting development in the most vulnerable areas, and units to coordinate civil defense, flood warning, hydraulic works, and maintenance of protection works; (ii) a flood preparedness and civil defense program targeting areas where no investment in structural defenses is warranted, and providing emergency shelter and safer housing conditions for lower income families there; (iii) a flood warning system which will provide a new hydro-metering network, improved information database, and flood forecasting models.

5. **Structural Measures.** The fortification of flood defenses in vulnerable geographic areas with strong economic activity is the principal group of structural measures to be implemented by the project. A complete list of physical improvements for flood protection was first prepared based on a comprehensive provincial protection strategy expressed in provincial master plans. This list was screened based on technical, economic and environmental criteria. These criteria included: (i) protection of important economic assets; (ii) investments with rates of return greater than 12%; (iii) non-encouragement of human settlement in or other development of flood prone areas; and (iv) least possible interference with natural flood processes.

6. The major civil works include: (i) construction, rehabilitation or improvement of defense structures (e.g., embankments and culverts); (ii) improvement of urban and peri-urban drainage canals through dredging, realignment, refuse clean-up, training works, and pumping stations; (iii) renovation or replacement of bridges and road drainage systems; and (iv) construction or improvement of gate valves and other river flow infrastructure, as well as water treatment plant intakes. The projects are distributed throughout the flood plain corridors and some internal watersheds, the latter especially in the Chaco and Santa Fe provinces. The location of priority projects is shown in map IBRD No. 27719.

## **Human and Economic Losses due to Floods**

7. The four largest flood events registered during this century occurred in 1904/05, 1982/83, 1989/90, and 1991/92. The 1982/83 flood lasted the longest. Human and economic losses due to floods have been well documented in Argentina. In 1991/92, over 120,000 people

had to be evacuated and over 30,000 housing units were affected. Urban infrastructure suffered multimillion-dollar damage. Agricultural, commercial and industrial activities were also hard hit in the region. Most floods were exacerbated by the lack of preparedness of most provinces to deal with such emergencies.

### **Regional Environmental Conditions**

8. Ecological Importance of Floods. The peaks, cyclical behavior, and relative unpredictability of flows, sediment transport and nutrient loads determine the functioning and interrelations of all aquatic ecosystems of the floodplains of the Paraná, Paraguay and Uruguay rivers - streams, swamps and lagoons - and the associated terrestrial habitats, such as islands and riverine areas. The structure and functions of the aquatic ecosystems of the flood plains and their biological communities have selectively adapted to the flood and dry season cycle. Practically all ecological events in the flood plain are related either positively or negatively to the extent and regularity of floods. The transport and deposition of sediments; the succession, development and decomposition of grasslands and the development of arboreal vegetation; the consumption and mineralization of organic matter; the activity of herbivores and carnivores; migration of fish and birds; fisheries; agriculture, cattle ranching and hunting; are all intimately intertwined with flood cycles. The interactions of ecological functions and human activities with the flood regime conform to a vast, complex macro system which is not completely understood. Most experts agree that the ecological and environmental stability of this system depends on the conservation of the natural interactions between floods and natural habitats. A schematic rendering of these interactions is shown in Figure 1.

9. The flood plains of the Paraná, Paraguay, and Uruguay rivers are perhaps the richest biodiversity areas in Argentina. Over its 60% of birds and over 50% of amphibians, reptiles and mammals of Argentina are represented in the floodplains. Floods play an important role in the dispersion of these species along the floodplain corridor. Some 26% of mammals, 28% of birds, 18% of reptiles, and 43% of amphibians of the floodplains are considered to be threatened or subject to some conservation risk. The principal threats to the conservation of the rich biodiversity of the floodplains are: (i) the destruction of or encroachment on habitats for expansion of development or commercial activity; (ii) illegal hunting, and deforestation of gallery forests; (iii) interference with natural flood processes and connections between the river and natural lagoons and other wetlands due to the construction of infrastructure and urban expansion; and (iv) pollution of small rivers and streams from untreated sewage discharges and untreated industrial effluents. The construction of hydroelectric projects in the upper basins of the rivers has probably also impaired natural ecological resources and processes significantly.

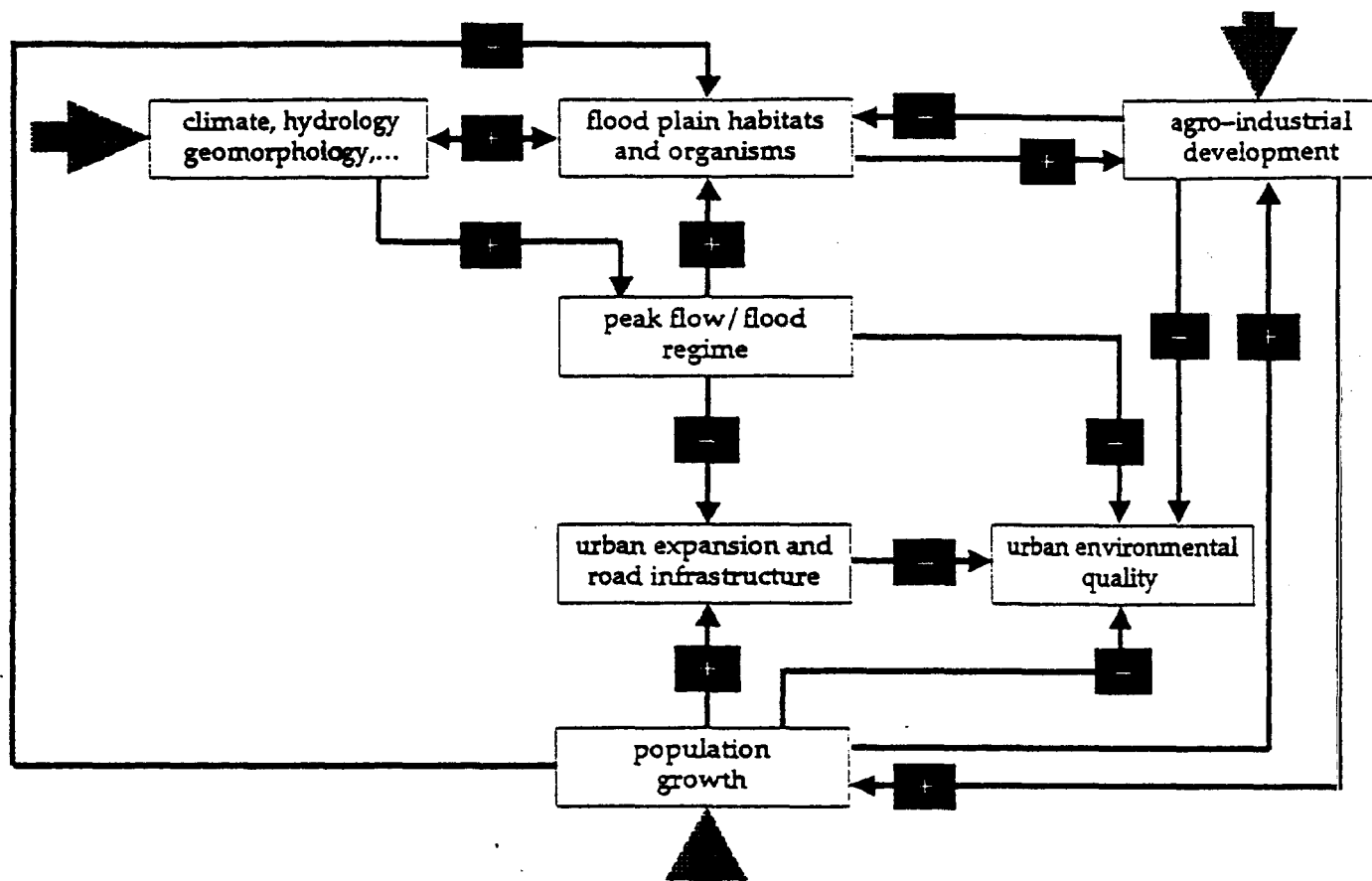


Figure 1. Ecological and Human Interactions in the Floodplains

10. The protection of important natural habitats of the floodplains is very weak in most provinces. Less than 6% of the total provincial area can be considered to have some form of protection (less than 1.6% if the Esteros del Ibera reserve with 1,000,000 hectares is excluded). Most protected areas have surface areas of less than 10 km<sup>2</sup>, which is considered insufficient to sustain stable population and communities. Most areas do not have appropriate management plans, and skilled personnel are generally non-existent.

11. **Social Environment.** Three types of human settlements can be found in the flood plains of the Parana and Paraguay rivers: (i) family groups living on the islands and riverine areas which have adapted to the flood cycle (e.g., they migrate with flooding); (ii) poor urban and peri-urban communities in high risk areas, living in precarious housing and sanitary conditions,

the hardest hit group in severe floods; and (iii) urban settlements largely unprepared for the flood conditions, which are highly dependent on flood protection infrastructure and post-flood remediation assistance.

12. The high economic and human losses of periodic flooding have not deterred the continuing growth of settlements on the flood plains of the Parana and Uruguay rivers. Nor have they materially altered the patterns of ever larger cities with services organized in ways similar to non-flooded cities; production systems based on technologies for non-flooding areas; and infrastructure (housing, roads, sanitation) equally inappropriately adapted to flood conditions. Planning for urban expansion is practically non-existent. In some cases municipal development initiatives and investments perversely provide incentives for population growth in high-risk areas.

13. Water supply and sanitation services are deficient in most cities of the flood plain. Table 1 shows the water supply and sewerage coverage in the seven provinces. Wastewater treatment is non-existent, and raw sewage is discharged directly into surface waters. Despite the large quantities of untreated sewage discharged by the major cities, the large dilution and purification provided by the rivers has prevented major pollution problems. However, pollution is localized and of some concern especially in smaller tributaries. The latter not only receive untreated sewage from small and medium sized towns but also the untreated discharges of large slaughterhouses and meatpacking industries throughout the region. Solid waste collection and disposal is also deficient in most urban centers. Garbage left or scattered in the streets and around protection infrastructure has led to the proliferation of vectors (mainly rats) with their inherent health risks, which in turn lessen the stability of the protection works.

14. The existing sanitation situation in urban centers is further exacerbated by the flood regime. Drainage systems are stressed during flood periods, therefore the accumulation of wastewater within the protection works commonly occurs in most urban centers. On the other hand, technical solutions for the protection of urban infrastructure sometimes are influenced by the lack of adequate sanitation facilities. In conclusion, protection works and sanitation infrastructure planning must be developed in a coordinated manner to fully achieve a sound urban environment. The project will provide technical assistance to municipalities to support such coordination.

**Table 1. Water Supply and Sanitation Situation**

Province	Population	% Water	% Sewerage
Santa Fe	2,776,472	89.3	28.3
Entre Rios	1,009,940	74.9	35.4
Corrientes	790,786	63.9	30.6
Buenos Aires	4,557,592	62.0	39.0
Formosa	396,428	55.0	20.3
Chaco	834,128	52.1	13.4
Misiones	782,131	35.6	7.5

## **Legal and Institutional Framework**

15. Although not all provinces are equally affected by floods, they share the same environmental problems of the floodplains. However, there are no common environmental criteria to handle such problems among them, resulting in a wide variety of institutional and legal framework for flood emergencies, natural resources management and environmental control. In general, the institutions in charge of implementing environmental regulations are understaffed and have no enforcement capacity. There is no systematic environmental assessment procedures for major flood protection or any other infrastructure projects. In addition, there is no coordination between the institutions in charge of promoting flood protection infrastructure and natural resources and environmental agencies.

## **Environmental Impact Analysis**

16. Ecosystem dynamics and communities of the floodplains are biologically adapted to flood events and present a high degree of resilience to environmental disturbance. The construction of flood protection works could cause imbalances in water dynamics in certain areas, which in turn could affect the community composition. Environmental pressures, however, will be localized in the area of influence of the civil works which are already heavily disturbed by human activities and urban expansion. Therefore, impacts on regional biodiversity are expected to be of negligible magnitude and importance.

17. Conceptually, the construction of protection works could influence the residence time of water in some segments of the river as well as induce hydrometric variations downstream of the project sites. These changes could in turn affect the productivity, and energy transfer and accumulation in different segments of the floodplain macrosystem. However, the relatively small size of the protection works in relation to the much larger area of the total floodplain, their point location and construction characteristics (mainly rehabilitation) would prevent any major negative regional impact on the floodplain ecosystems at the macro level. Therefore, changes in productivity as well as trophic structure of communities will be negligible.

18. Most environmental impacts will be confined to specific project locations. These potential impacts were systematically identified and evaluated; corresponding mitigation and monitoring measures were agreed to be included in project design and construction.

## **Analysis of Alternatives**

19. Perhaps the most important environmental protection aspect of project preparation was the systematic analysis of alternatives for each site. Alternatives included project site selection and design capacity (pumping stations, for instance). All alternatives were screened for environmental and social impacts for compliance with the project philosophy and environmental criteria of interfering to the least possible extent with natural flood processes.

## Regional Environmental Programs

20. Four regional environmental programs will enhance project benefits and ensure appropriate management of proposed and future flood protection projects. These programs are summarized in Table 2. The programs include detailed activities for: (i) environmental education and public awareness in communities with flood protection works; (ii) strengthening environmental management capacity of the implementing agencies as well as environmental agencies; (iii) improving local urban environmental management and monitoring, especially regarding the sound disposal of solid wastes; and (iv) improving baseline knowledge of the ecology and dynamics of the riverine and floodplain ecosystem and improving protection and management of wetlands within the project region, especially near the urban areas.

Table 2 Regional Environmental Programs

Existing Situation	Environmental Program	Participating Institutions
Weak environmental assessment capacity for flood protection works	Strengthening environmental assessment procedures in key institutions	Sub-Unidad Central de Coordinación de Emergencias - SUCCE, Sub-Unidad Provincial de Coordinación de Emergencias- SUPCES, provincial environmental/natural resources agencies
Deficient urban environmental infrastructure exacerbates flood impacts and limits technical solutions	Technical assistance for urban environmental management in urban centers	Municipalities, NGOs
Lack of environmental awareness in communities related to floodplain ecosystems and flood protection works	Environmental education and awareness programs in communities benefiting from protection works	Communities, NGOs
Wetland and floodplain ecosystem degradation and lack of effective protection systems	Support to protection and management initiatives for wetland and other ecosystems, especially near urban centers	Provincial natural resource agencies, research institutions, municipalities, and NGOs

21. Environmental education and awareness programs will be implemented in communities benefiting from flood protection infrastructure financed under this project. These programs will stress the ecological importance of floods, the need for the conservation of floodplain ecosystems, and the environmental impact of human activities (waste disposal on dikes for instance) on protection infrastructure. These programs will be implemented with the participation of local NGOs.

22. Participating municipalities can request technical assistance for the design and implementation of urban environmental management plans in their urban areas, specially in solid waste collection and disposal, and the management of domestic sewage. The program will stress the relationship and needed coordination between protection works and urban environmental infrastructure.

23. Deficiencies in the institutional and regulatory framework will also be addressed through the implementation of a program for strengthening the environmental management of flood protection works, which includes: preparation of environmental manuals for the design and construction of flood protection infrastructure, environmental assessment procedures for flood protection projects, and procedures for the environmental supervision of construction activities.

24. Technical assistance will be provided to provincial and municipal agencies for improvement of wetland protection systems, especially for areas near urban centers. A wide variety of activities would be financed ranging from legal assistance for the delimitation of such areas to the design of management plans for selected existing or proposed protected areas.

### **Project-Specific Environmental Measures**

25. An environmental assessment summary for each specific project site was prepared and presented in an Annex to the Environmental Assessment report. This summary includes: (i) project location and a general description of the project area, beneficiaries and sanitary conditions of the urban area; (ii) a brief description of proposed civil works and the expected flood protection benefits; (iii) an analysis of environmental processes and components likely to be impacted by the civil works and the vulnerability of infrastructure to natural processes; (iv) an identification of all mitigation and monitoring measures and activities that need to be considered as part of project design, construction and operation; and (v) a description of the expected benefits of implementation of the environmental measures.

### **Public Consultation**

26. Two forms of public consultation were carried out during project preparation. Two regional seminars were held in order to discuss the regional environmental implications of the project. Seminar participants included provincial natural resources and environmental agencies; national, regional and local NGOs; and universities and research centers. The proposed regional environmental programs were discussed in detail. There is a consensus that they would provide a much needed complement to the non-structural measures to be implemented by the project. Local public consultation took place only in those communities where major new protection infrastructure is to be built. These consultations were carried out directly by the consultants in charge of project design under the coordination of SUCCE. Two local meetings in Gualeguay



(Box 1) and Resistencia, with the participation of local NGOs, community representatives, and local institutions, resulted in changes in project design and site that would ensure community acceptance of proposed works.

**Box 1 Community Consultation in Gualeguay**

Gualeguay is an unprotected city in the province of Entre Rios which has been severely impacted by the last two flood events. The initial proposed flood protection works, a dike around the city, would have cut across a well kept metropolitan park next to a branch of the Parana river which is a main source of recreation for the local population, with ancient trees and infrastructure rooted in local tradition. Community organizations and municipal authorities rejected the proposal and were even willing to forego the construction of the works. Consultation meetings were held in Gualeguay in which the community proposed a new alignment of the dike that would cut across the river branch into an island in front of the city, cutting back again to the city limits through the same branch. Although this scheme would in principle be against the project philosophy of not promoting new development in flood prone areas, the community and the municipality made a strong case to defend their cultural heritage. The proposed realignment was accepted provided that the municipality established a natural reserve in the island (with interesting but intervened wetlands). The project will provide technical assistance for setting up this protected area.



## ARGENTINA

### Flood Protection Project

#### Project Description and Costs

**Project Description:** The proposed project would consist of:

1. (a) Structural Measures, consisting of construction works to protect important areas of the flood plain against flood effects. This component would include fortification of flood defenses in geographic areas with strong economic activity and greatest vulnerability to serious repeated flood damage. These investments would not attempt to control flows of the major rivers (Paraná, Paraguay and Uruguay). Instead, they would protect the cities against floods caused by the rivers through works that would avoid waters invading the cities without interfering with the rivers. Works would concentrate on raising bridges, improvement of existing and construction of new drainage channels, embankments and small flood control works. These investments would follow the master plans developed for each flood-prone area.
2. A complete list of physical improvements related to flood protection works was first prepared based on a comprehensive provincial protection strategy expressed in individual provincial master plans. These were scaled down and rationalized on the basis of technical, environmental, and economic criteria, i.e., they had to comply with a minimum criteria for environmental impacts and to have an internal economic rate of return of 12% or higher. As the investment required to implement the whole list of improvements would be quite substantial, the Government decided to implement the program in two phases. The proposed loan would finance the higher priority group of the two. The priority criteria for selection of sub-projects was to select from eligible candidate sub-projects (those that met the minimum environmental and economic criteria) those which would, in each province, defend the most important economic assets (normally the most populated cities) but limiting the amount of investment in the province in accordance with its counterpart funding capacity. This criteria would also allow all affected provinces to participate in the project, as is required for the "non-structural" measures whose implementation would require the participation of all provinces in the basin. It is proposed to structure the Loan so as to facilitate the possible incorporation of "second priority" list of activities during project execution. In view of the provinces' disparate implementation capabilities and performance, two annual reviews at an early stage of implementation would be convened to determine if the initial provincial allocations require revision. During these reviews it would be possible to transfer funding from a slow-moving province to better performing provinces. Annex 3 (Provincial Master Plans) gives details on all sub-projects. Map IBRD No. 27719 gives the location of each sub-project. Annex 10 (Economic Analysis) gives details on the methodology used for the economic analysis and a ranking list of sub-projects by order of internal economic rate of return.

3. SUCCE hired consultants that have carried out the Master Plans for each area identified in the consultant report (Halcrow) for the whole basin. Those reports included the plans for defense works in: Clorinda, Formosa, Internal Sub-basins in Formosa, Resistencia, Linea Tapenaga (Chaco), Corrientes (capital), Goya, Bella Vista, Curuzu-Cuatia, Esquina, Mercedes, Paraná, Gualaguay, Gualaguaychu, Colon, Concepción del Uruguay, Diamante, Federación, Ibicuy, Victoria, Villa Paranacito, Concordia, Santa Elena, La Paz, Las Conchas Basin, San Antonio Basin, Cululu Basin, Colastine Basin, Monje Carrizales Basin, Carcaraña Basin, Salladillo, Pavón Basin, Linea Paraná, Leyes Setubal, Islands of Buenos Aires, San Pedro, and Zarate.

4. The sub-projects included in the first priority group are listed in Attachments 1, 2, and 3, which also show their estimated base cost. Attachments 4, 5, and 6, show the list of sub-projects in the second priority group with their estimated base costs. Consequently, the estimated base cost of this component (considering the first priority group of sub-projects) would be US\$277.5 million, consisting of US\$263.6 million for works and US\$13.9 million for goods.

5. (b) Non-Structural Measures: Consisting of:

6. (b1) New Institutional Framework: Technical assistance would be provided to help create and implement an institutional framework in each province to deal with recurrent floods. It would result in: (i) plans and regulations to rationalize land usage in flood-prone areas including classification of areas according to their vulnerability to flood risk, therefore leading land owners to seek private flood insurance; (ii) create a unit that would coordinate civil defense, flood warning, consultation on hydraulic works, maintenance of flood defense facilities, and provision of environmental safeguards related to flooding issues; and (iii) institutional development actions that would support the coordinating units in their initial operation through technical assistance and equipment.

7. (b2) Upgrading Flood Preparedness: For vulnerable areas not considered to warrant further investment in structural defenses, the proposed assistance would provide shelters (multi-purpose installations) and improved housing for lower income families in flood-prone zones. The housing component would follow the same principles of the previous project providing funding for a voluntary program of self-construction of houses by the community. Improvements in civil defense arrangements are also envisaged.

8. This component would fund the construction of 155 shelters (multi-purpose installations) to receive affected population during floods in areas in which "structural" works are not justified. Those installations would follow prototypes developed by SUCCE and would be located adjacent to existing schools or community centers to allow them to be used by the population in non-emergency time, as well as to facilitate their maintenance. Annex 4 provides additional details on the shelters.

9. In more remote areas in which shelters would not be justified, the project would finance the material for an estimated 5,000 self-constructed houses, following the successful experience with the same number of units under the Flood Rehabilitation Project (Ln. 3521-AR). The units would follow the same prototypes which are appropriated to meet flood conditions (either in higher land or over piles), as well as the sanitary facilities not included in the previous project. They would be 43 square meters, with two bedrooms and a multiuse room. Approximately US\$31 million would be provided as grants to low-income families. Building materials (about US\$6,200 per house) are expected to comprise about 80% of the construction cost. The provinces would provide land, infrastructure, and technical and social assistance to the beneficiaries. The beneficiaries, who are among the poorest families in the affected areas, would finance the remaining 20% through their labor input. The units would be constructed in the same neighborhood where the beneficiary already lives to avoid the need of resettlement. Annex 4 provides additional information on the housing component.

10. An adequate system of civil defense would also be created in each province. Consultants would help prepare emergency procedures to be followed during emergencies by the civil defense teams. The estimated base cost of the upgrading flood preparedness component is:

	US\$ million
Shelters	12.4
Housing	31.0
Consultants (civil defense)	0.7
Total	46.1

11. (b3) Early Flood Warning System: This component would aim to ensure the development of a more comprehensive flood warning system linking the National Institute of Hydrological Sciences and Technology (INCYTH) and provincial systems. It would include: (i) installation of a new hydro-metering network consisting of waterflow gauging stations with satellite connection to a central station at INCYTH for input in a central data bank; (ii) installation of local computers connected to the central station to allow every province to have unrestricted access to the data bank; (iii) improvements in the software for flood forecasting, including its adaptation to allow some provinces to forecast local sub-basins. This mathematical model will be installed in INCYTH's central computer and in each province's local computer; and (iv) creation of a provincial group responsible for flood-warning activities. The base cost of this component is estimated as US\$3.8 million.

12. The Early Flood Warning System would be procured as a turn-key package of equipment and services including software, installation of equipment and training of local staff. Around 60 local measuring stations would be telemetered using satellite communication to send data to a central computer (PC pentium class). The communication equipment for the remote stations and the central receiver would be included in this package. The software would include the development of five models (Kalman filter; Rain-River flow; Hydrologic transit; Basin

Hydrodynamics; Flood forecast for medium and long range) and a Reporting software. The supplier would also provide training for the local staff on the models to be transferred.

13. (b4) Project Implementation: Technical assistance would be provided to help implement the project and carry out a related training program for improving the provinces' capabilities in flood forecasting, early warning, civil defense and environmental activities. The project would include consultant services for the design of the flood defense works, supervision of construction and implementation of four environmental programs.

14. The environmental programs included in the project were designed as part of the environmental assessment made during preparation and would consist of: (i) environmental education and public awareness in communities benefiting from flood protection works; (ii) strengthening of environmental management capacity of the implementing agencies as well as the environmental agencies; (iii) technical assistance to communities and municipalities to improve urban environmental management and monitoring, especially regarding the sound disposal of solid waste; and (iv) improvements in baseline knowledge of ecology and dynamics of the riverine and floodplain ecosystem and improving protection and management of wetlands within the project region, especially near urban areas (see also Annex 5).

The estimated base cost of this component is:

	US\$ million
Environmental Programs	3.6
Consultants	20.7
SUCCE	9.2
Training	0.5
Auditing	1.5
Total	35.5

15. The estimated project base cost would be US\$365.4 million, which would be distributed as follows:

Component	Cost in US\$ million
Civil Works (structural works and shelters)	276.0
Goods	13.9
Housing Grants	31.0
Technical Assistance and training	44.5
Total	365.4

ARGENTINA  
FLOOD PROTECTION PROJECT  
List of First Priority Sub-Projects (B.Aires, Chaco, Corrientes)

ANNEX 6  
Attachment 1

Sub-Project	#1	#2	#3	G or W	Description (List of Bidding Processes)	US\$ (1000)
<b>BUENOS AIRES</b>					<b>Total Contracts in the Province</b>	<b>26,672</b>
Islas del Delta					Total of Sub-Project 100	12350
	100	1	0	W	Alteo Comunicacion Sector 1	6,796
	100	2	0	W	Alteo Comunicacion Sector 2	5,554
Zarate					Total of Sub-Project 101	1,587
	101	1	0	G	Barrio Villa Bosch	167
	101	2	0	W	Barrio Villa Florida	925
	101	3	0	W	Barrio Villa Angus	495
Campana					Total of Sub-Project 102	4,454
	102	1	0	G	Barrio San Cayetano	409
	102	2	0	W	Pluviales SE y Coleta	4,045
San Pedro					Total of Sub-Project 103	1,685
	103	1	0	W	Barrio Las Canaletas	1,167
	103	2	0	W	Barrio Bajo Puerto	518
Baradero					Total of Sub-Project 104	668
	104	1	0	W	Desagues Pluviales	668
Escobar					Total of Sub-Project 105	1,389
	105	1	0	W	Barrio San Miguel	1,227
	105	2	0	W	Barrio Bedoya	162
Tigre					Total of Sub-Project 106	3,539
	106	1	0	W	Dique Lujan Villa La Nata	3,539
<b>CHACO</b>					<b>Total Contracts in the Province</b>	<b>35,470</b>
Resistencia					Total of Sub-Project 200	35,470
	200	1	0	W	Terraplen Defensa Norte	2,856
	200	2	0	W	Terraplen Perimetral Rio Negro	5,212
	200	3	0	W	Desagues Pluviales Zona Sur	5,511
	200	4	0	W	Desagues Pluviales Zona Norte	5,800
	200	5	0	G	Desagues Pluviales Equipamiento	3,451
	200	6	0	W	Control Gral San Martin	3,922
	200	7	0	G	Gral San Martin Equipamiento	4,972
	200	8	0	W	Control Soberania Nacional	2,804
	200	9	0	W	Terraplen Puerto Barranqueras	942
<b>CORRIENTES</b>					<b>Total Contracts in the Province</b>	<b>41,415</b>
Bella Vista					Total of Sub-Project 300	1,562
	300	1	0	W	Desagues Pluviales	1,562
Corrientes Capital					Total of Sub-Project 301	13,264
	301	1	0	W	Desagues Pluviales # 1	1,812
	301	2	0	W	Desagues Pluviales # 2	2,392
	301	3	0	W	Desagues Pluviales # 3	2,208
	301	4	0	W	Desagues Pluviales # 4	2,318
	301	5	0	W	Defensa Sur	1,134
	301	6	0	W	Defensa Norte	1,530
	301	7	0	G	Defensa Norte Equipment	1,870
Curuzu Cuatia					Total of Sub-Project 302	2,398
	302	1	0	W	Desagues Pluviales # 1	1,418
	302	2	0	W	Desagues Pluviales # 2	980
Esquina					Total of Sub-Project 303	1,595
	303	1	0	W	Drenaje Urbano	1,595
Mercedes					Total of Sub-Project 304	4,777
	304	1	0	W	Desagues Pluviales # 1	1,165
	304	2	0	W	Desagues Pluviales # 2	1,158
	304	3	0	W	Control Inundaciones	2,454
Goya					Total of Sub-Project 305	17,819
	305	1	0	W	Drenaje Pluvial # 1	1,000
	305	2	0	W	Drenaje Pluvial # 2	982
	305	3	0	W	Defensa contra Inundacion # 1	1,146
	305	4	0	W	Defensa contra Inundacion # 2	1,820
	305	5	0	W	Defensa contra Inundacion # 3	2,156
	305	6	0	W	Defensa contra Inundacion # 4	4,822
	305	7	0	W	Defensa contra Inundacion # 5	5,893

ARGENTINA  
FLOOD PROTECTION PROJECT

List of First Priority Sub-Projects (Entre Rios, Formosa, Misiones)

ANNEX 6  
Attachment 2

Sub-Project	#1	#2	#3	G or W	Contract	US\$ (1000)
<b>ENTRE RIOS</b>					<b>Total Contracts in the Province</b>	<b>51,953</b>
C. del Uruguay					Total of Sub-Project 400	7,767
	400	1	0	W	Defensas contra Inundacion	5,331
	400	2	0	W	Defensa Obras Complementarias	1,910
	400	3	0	W	Defensa Toma de Agua	526
Diamante					Total of Sub-Project 401	2,846
	401	1	0	W	Estabilizacion Barrancas	2,846
La Paz					Total of Sub-Project 402	2,338
	402	1	0	W	Estabilizacion Barrancas	2,338
Gualedguay					Total of Sub-Project 403	11,493
	403	1	0	W	Terraplen Defensa	8,644
	403	2	0	W	Estacion Bombeo	2,849
Parana					Total of Sub-Project 404	10,351
	404	1	0	W	Defensa Recuperacion Costera	10,351
Concordia					Total of Sub-Project 405	17,168
	405	1	0	W	Colector Pluvial	4,145
	405	2	0	W	Desagues Pluviales	6,155
	405	3	0	W	Defensa Sur	4,800
	405	4	0	W	Costanera Norte (First Phase)	2,068
<b>FORMOSA</b>					<b>Total Contracts in the Province</b>	<b>19,915</b>
Clorinda					Total of Sub-Project 500	8,040
	500	1	0	W	Defensa Principal	4,794
	500	2	0	W	Porteno Norte	868
	500	3	0	W	Drenaje Troncal	1,669
	500	4	0	W	Barrio Coronel	709
Formosa Capital					Total of Sub-Project 501	11,875
	501	1	0	W	Defensa Sur	3,089
	501	2	0	G	Defensa Norte	3,099
	501	3	0	W	Drenaje	5,687
<b>MISIONES</b>					<b>Total Contracts in the Province</b>	<b>10,057</b>
Posadas					Total of Sub-Project 600	315
	600	1	0	W	Toma de Agua	315
Puerto Esperanza					Total of Sub-Project 601	750
	601	1	0	W	Toma de Agua	750
Wanda					Total of Sub-Project 602	750
	602	1	0	W	Toma de Agua	750
Puerto Iguazu					Total of Sub-Project 603	2,000
	603	1	0	W	Desagues Pluviales	2,000
San Javier					Total of Sub-Project 604	2,000
	604	1	0	W	Desagues Pluviales	2,000
Ayo. Yarara					Total of Sub-Project 605	1,365
	605	1	0	W	Desagues Pluviales	1,365
Ayo. Bonito					Total of Sub-Project 606	1,300
	606	1	0	W	Desagues Pluviales	1,300
Alteo Puentes					Total of Sub-Project 607	1,577
	607	1	0	W	Alteo Puentes	1,577



ARGENTINA  
FLOOD PROTECTION PROJECT  
List of First Priority Sub-Projects (Santa Fe & Capital Federal)

Annex 6  
Attachment 3

Sub-Project	#1	#2	#3	G or W	Contract	US\$ (1000)
<b>SANTA FE</b>					<b>Total Contracts in the Province</b>	<b>88,008</b>
Ayo. las Conchas					Total of Sub-Project 700	4,152
	700	1	0	W	Canal Principal 4/puente RP38	4,152
Ayo. San Antonio					Total of Sub-Project 701	6,390
	701	1	0	W	Canal Princ. 2/Canada Capivara	3,313
	701	2	0	W	Canal Princ. 2/Puente RP9	3,077
Ayo. Cululu					Total of Sub-Project 702	18,786
	702	1	0	W	Ayo Retiro	3,462
	702	2	0	W	Ayo. los Corrales	2,047
	702	3	0	W	Canal Principal 1	4,364
	702	4	0	W	Ayo. las Prusianas	1,805
	702	5	0	W	Ayo. las Prusianas-Rafaela	4,838
	702	6	0	W	Ayo. Retiro/Princ.1/Prusianas	2,270
Ayo. Monje Carrizal					Total of Sub-Project 703	5,604
	703	1	0	W	Ayo. las Bandurrias	2,446
	703	2	0	W	Ayo. las Estacas	3,158
Rio Carcarana					Total of Sub-Project 704	12,410
	704	1	0	W	Cuenca Propria	2,429
	704	2	0	W	Ayo. C. de Gomez	4,578
	704	3	0	W	Ayo las Tortugas	3,358
	704	4	0	W	Cuenca propia/2a etapa	2,045
Ayo. Saladillo					Total of Sub-Project 705	7,407
	705	1	0	W	Proteccion Casilda y Fuentes	868
	705	2	0	W	Estabilizacion Cascada	6,539
Sist. Setubal					Total of Sub-Project 706	11,679
	706	1	0	W	Obras de Arte Ayo Leyes	7,484
	706	2	0	W	Obras de Arte Ao Portero	4,195
Alteo Puentes					Total of Sub-Project 707	21,578
	707	1	0	W	Malabrigo s/ RP40	4,092
	707	2	0	W	Garabato s/ RP40	2,887
	707	3	0	W	Saladillo s/ RP62	4,851
	707	4	0	W	Alcantarillas y Alteo RP62	831
	707	5	0	W	Aguar s/ RP82-S	2,233
	707	6	0	W	El Rey s/ RP31	2,688
	707	7	0	W	Los Troncos s/ RP50-S	308
	707	8	0	W	El Toba s/ RP36	3,099
	707	9	0	W	El Rey s/ RP3	589
<b>Capital Federal</b>					<b>Total Contracts in the Province</b>	
	800	1	0	W	Preliminary Analysis	5,000

ARGENTINA  
FLOOD PROTECTION PROJECT  
List of Second Priority Sub-Projects (B.Aires, Chaco, Corrientes)

ANNEX 6  
Attachment 4

Sub-Project	#1	#2	#3	G or W	Description (List of Bidding Processes)	US\$ (1000)
<b>BUENOS AIRES</b>					<b>Total Contracts in the Province</b>	<b>18,810</b>
Baradero #2					Total of Sub-Project 107	1,346
	107	1	0	W	Tablestacado, proteccion, defensas	1,346
Ramallo					Total of Sub-Project 108	364
	108	1	0	W	Alteo Camino Costero	37
	108	2	0	W	Tablestacado tramo camino	242
	108	3	0	W	Alteo Camino Costa Pobre	85
Zarate #2					Total of Sub-Project 109	1,524
	109	1	0	W	Desagues Pluviales Villa Florida	352
	109	2	0	W	Arroyo Santa Lucia	584
	109	3	0	W	Defensa Costanera Sur	578
Campana #2					Total of Sub-Project 110	1,478
	110	1	0	W	Desagues Pluviales San Felipe	486
	110	2	0	W	Desagues Pluviales Giamundi y Alfieri	666
	110	3	0	W	Defensa Costanera	236
	110	4	0	W	Camino Churrinque	80
Tigre #2					Total of Sub-Project 111	7,383
	111	1	0	W	Tablestacado Rio Capitan	213
	111	2	0	W	Tablestacado Rio Carapachay	255
	111	3	0	W	Tablestacado Rio Sarmiento	170
	111	4	0	W	Tablestacado Paseo Victoria	1,300
	111	5	0	W	Desagues Cuenca Rincon de Milber	3,630
	111	6	0	W	Desagues Benavidez-R. Rojas	1,815
San Fernando					Total of Sub-Project 112	1,859
	112	1	0	W	Muelle en continente	20
	112	2	0	W	Desagues Pluviales	27
	112	3	0	W	Tablestacado 8 de Julio	600
	112	4	0	W	Muelles Parana Mini	18
	112	5	0	W	Proteccion Area B	1,371
	112	6	0	W	Table estacado del Bal	23
San Pedro #2					Total of Sub-Project 113	616
	113	1	0	W	Colectora Cloacal Rivera	606
	113	2	0	W	Barrio los Cazadores	110
Escobar #2					Total of Sub-Project 114	360
	114	1	0	W	Puerto Escobar	131
	114	2	0	W	Camino Acceso E22	229
Islas del Delta #2					Proteccion Edilicia	1,780
<b>CHACO</b>					<b>Total Contracts in the Province</b>	<b>27,728</b>
Resistencia #2					Total of Sub-Project 201	15,993
	201	1	0	W	Readecuación Canal Soberanía Nacional	4,123
	201	2	0	W	Readecuación Canal 16	1,862
	201	3	0	W	Ampliación lago compensador Sur	1,747
	201	4	0	W	Cuenca Río Salado	1,309
	201	5	0	W	Adecuación terraplén perimetral Río Negro	3,600
	201	6	0	W	Adecuación Control Soberanía Nacional	1,352
	201	7	0	W	Complemento terraplén Puerto Barranqueras	2,000
Las Palmas y La Leonesa					Total of Sub-Project 202	2,332
	202	1	0	W	Defensas	2,332
Alteo Puentes					Total of Sub-Project 203	9,403
	203	1	0	W	Alteo Diversos Puentes	9,403
<b>CORRIENTES</b>					<b>Total Contracts in the Province</b>	<b>24,852</b>
Bella Vista #2					Total of Sub-Project 306	3,876
	306	1	0	W	Desagues Pluviales Segunda Etapa	1,044
	306	2	0	W	Desagues Pluviales 3ra Etapa	1,271
	306	3	0	W	Desagues Pluviales 4ta Etapa	1,561
Corrientes Capital #2					Total of Sub-Project 307	6,435
	307	1	0	W	Desagues Pluviales # 5	1,266
	307	2	0	W	Desagues Pluviales # 6	2,561
	307	3	0	W	Desagues Pluviales # 7	1,247
	307	4	0	W	Desagues Pluviales # 8	1,361
Curuzu Cuatia #2					Total of Sub-Project 308	1,104
	308	1	0	W	Canalizaciones	1,104
Esquina #2					Total of Sub-Project 309	6,886
	309	1	0	W	Drenaje Urbano #2	3,654
	309	2	0	W	Drenaje Urbano #3	1,713
	309	3	0	W	Rehabilitación Infraestructura Portuaria	619
Mercedes #2					Total of Sub-Project 310	2,724
	310	1	0	W	Desagues Pluviales # 3	1,206
	310	2	0	W	Desagues Pluviales # 4	1,518
Goya #2					Total of Sub-Project 311	7,045
	311	1	0	W	Drenaje Pluvial # 3	1,806
	311	2	0	W	Drenaje Pluvial # 4	2,108
	311	3	0	W	Defensa contra Inundacion # 5	1,576
	311	3	0	W	Defensa contra Inundacion # 6	1,455
Alteo Puentes					Total of Sub-Project 312	7,782
	312	1	0	W	Alteo Diversos Puentes	7,782

ARGENTINA  
FLOOD PROTECTION PROJECT  
List of Second Priority Sub-Projects (Entre Rios, Formosa, Misiones)

ANNEX 6  
Attachment 5

Sub-Project	#1	#2	#3	G or W	Contract	US\$ (1000)
<b>ENTRE RIOS</b>					<b>Total Contracts in the Province</b>	<b>41,754</b>
Santa Elena					Total of Sub-Project 406	2,978
	406	1	0	W	Estabilizacion Barrancas	2,978
La Paz #2					Total of Sub-Project 407	1,175
	407	1	0	W	Puerto Marquez	1,175
Federacion					Total of Sub-Project 408	3,527
	408	1	0	W	Defensas Costeras	3,527
Guauguay #2					Total of Sub-Project 409	9,999
	409	1	0	W	Desagues Pluviales Cuencas 1,2,3	4,139
	409	2	0	W	Desagues Pluviales Cuencas 4	3,697
	409	3	0	W	Desagues Pluviales Cuencas 5	2,163
Guauguaychu					Total of Sub-Project 410	8,493
	410	1	0	W	Desagues Aguas Pluviales	8,493
Ibicuy					Total of Sub-Project 411	2,047
	411	1	0	W	Defensa Urbana	2,047
Parana #2					Total of Sub-Project 412	5,793
	412	1	0	W	Arroyo Antonico	5,793
Victoria					Total of Sub-Project 413	2,410
	413	1	0	W	Toma de Agua	1,222
	413	2	0	W	Rehabilitacion Puerto	1,188
Concordia #2					Total of Sub-Project 414	4,800
	414	1	0	W	Costanera Norte (Second Phase)	3,100
		2	0	W	Arroyo Manzores	1,700
Villa Paranacito					Total of Sub-Project 415	532
	415	1	0	W	Defensa y Drenaje	532
<b>FORMOSA</b>					<b>Total Contracts in the Province</b>	<b>12,000</b>
Formosa Capital #2					Total of Sub-Project 502	12,000
	502	1	0	W	Control Riacho Formosa	12,000
<b>MISIONES</b>					<b>Total Contracts in the Province</b>	<b>4,800</b>
Obrera					Total of Sub-Project 608	2,200
	608	1	0	W	Toma de Agua	2,200
Puerto Iguazu #2					Total of Sub-Project 609	2,600
	609	1	0	W	Desagues Pluviales	2,600

ARGENTINA  
FLOOD PROTECTION PROJECT  
List of Second Priority Sub-Projects (Santa Fe & Capital Federal)

Annex 6  
Attachment 6

Sub-Project	#1	#2	#3	G or W	Contract	US\$ (1000)
<b>SANTA FE</b>					<b>Total Contracts in the Province</b>	<b>81,353</b>
<b>Ayo. las Conchas #2</b>					<b>Total of Sub-Project 708</b>	<b>2,103</b>
	708	1	0	W	Canal Principal 4	736
	708	2	0	W	Canal Principal 4 - Obras Regulacion	1,367
<b>Ayo. Colastine</b>					<b>Total of Sub-Project 709</b>	<b>15,329</b>
	709	1	0	W	Ayo Colastine - Galvez	2,368
	709	2	0	W	C. los Corralitos - Canada Chiru	4,783
	709	3	0	W	C. los Corralitos - Canal Sastre	2,155
	709	4	0	W	Ayo. Colastine - San Eugenio	2,059
	709	5	0	W	C. los Corralitos - Canal Sastre #2	3,964
<b>Ayo. Monje Carrizal #2</b>					<b>Total of Sub-Project 710</b>	<b>4,726</b>
	710	1	0	W	Curso Principal - Cuenca Superior	4,726
<b>Ayo. Pavon</b>					<b>Total of Sub-Project 711</b>	<b>7,034</b>
	711	1	0	W	Adecuacion Obra de Arte Troncal	3,096
	711	2	0	W	Preteccion Villa Constitucion	3,938
<b>Linea Parana</b>					<b>Total of Sub-Project 712</b>	<b>13,365</b>
	712	1	0	W	Interconexcion Tramos 2 y 4	4,521
	712	2	0	W	Tramo 4	2,765
	712	3	0	W	Tramo 3	4,498
	712	4	0	W	Adecuacion Canales	1,581
<b>Sistema Setubal #2</b>					<b>Total of Sub-Project 713</b>	<b>5,116</b>
	713	1	0	W	Terraplen	5,116
<b>Alteo Puentes</b>					<b>Total of Sub-Project 714</b>	<b>33,690</b>
	714	1	0	W	Ayo Los Amores s/RP 100 S	2,597
	714	2	0	W	Ayo Dientudo s/RP38	2,925
	714	3	0	W	Alcantarillas, alteos RP38	3,692
	714	4	0	W	Ayo Yacare s/RP38	1,333
	714	5	0	W	Ayo Espin s/ RP38	1,386
	714	6	0	W	Rio Calchaqui s/RP 37	4,012
	714	7	0	W	Laguna los perros s/RP37	1,973
	714	8	0	W	Rio Salado s/ RP38	2,288
	714	9	0	W	Rio Salado- Alcantarillas y alteos	3,815
	714	10	0	W	Ayo Las Garzas s/RP 32	1,014
	714	11	0	W	Ayo El Rey s/RP295/S	1,438
	714	12	0	W	Cda Mocovi s/RP 295/S	2,630
	714	13	0	W	Ayo El Rey s/RP295/S - Seccion B	2,865
	714	14	0	W	Cda Los Amores s/RP 295/S	1,722
<b>Capital Federal</b>					<b>Total Contracts in the Province</b>	
<b>Capital Federal #2</b>					<b>Total of Sub-Project 801</b>	
	801	1	0	W	Drenaje Arroyo Maldonado	135,000

## ARGENTINA

### Flood Protection Project

#### Project Operational Manual (POM)

1. To facilitate project implementation a Project Operational Manual (POM) was prepared during project preparation. Governmental approval of the POM would be a condition of effectiveness of the proposed loan.
2. The POM would be based on the POM of the previous project with the improvements resulting from incorporating the lessons learned from its implementation (see para. 2.60-2.61 of the main text). Among other aspects the POM includes: (i) List of sub-projects eligible for financing; (ii) procurement procedures; (iii) housing grant procedures; (iv) disbursement procedures; (v) SUCCE structure and responsibilities; (vi) structure and responsibility of each SUPCE; (vii) project monitoring and auditing.
3. List of sub-projects: The POM includes a list of all sub-projects evaluated during appraisal and divided into two groups: (i) the first priority group, funded by this proposed loan; and (ii) the second priority group, to be considered for a future operation or to be selected during the mid-term reviews to replace sub-project in provinces that do not perform well in project implementation. These lists will also include the description and characterization of the sub-projects to have them well identified to facilitate the project implementation.
4. Procurement procedures: The POM includes detailed instructions to the implementation agencies (SUPCEs) to apply adequately the procurement procedures based on the Bank Guidelines for procurement of goods and works as well as for selection of consultants. The POM includes also the agreed procedures for NCB and limited NCB. The POM also includes the arrangements for SUCCE supervision of procurement actions and review of bidding documents. The agreed standard bidding documents for all procurement of goods and works are included as annexes to the POM.
5. Housing Grant Procedures: The POM describes in detail the agreed criteria and procedures for eligibility for the housing grant, as well as procedures to be followed by the SUPCEs to distribute and control the vouchers and to help the beneficiaries to construct their houses. It is an up-dated version of the housing manual used in the previous project.
6. Disbursement procedures: The POM details the procedures to be followed by the SUPCEs to disburse from the special accounts. They are based on the Bank disbursement procedures and based on the experience gained during the implementation of the previous project. The POM also includes the arrangements for SUCCE control and supervision of disbursement activities by the SUPCEs.

7. SUCCE structure and responsibilities: The POM defines SUCCE as a group of consultants funded by the loan proceeds, reporting to the UEC of SSAP. SUCCE will be headed by an executive chief and will be composed of professionals in each sector of project implementation having as minimum: (i) a project supervisor, reporting directly to SSAP and to the Bank; (ii) an accounting expert; (iii) a disbursement expert; (iv) a procurement expert; (v) an environmental expert; (vi) a flood defense expert; (vii) a civil engineering expert; (viii) a hydrology expert; (ix) a housing expert; (x) an expert for shelters and civil defense actions; (xi) a drainage expert; (xii) a counsel; (xiii) an advisor for sub-project evaluations; and (xiv) support for administrative, computational, accounting, technical and disbursement activities. All professionals in SUCCE will be hired having TORs and selection process submitted to the Bank. The POM defines as SUCCE's responsibility to oversee, supervise and control the actions of all SUPCEs, particularly in respect to sub-project designs, procurement actions, implementation, supervision, disbursement, accounting and auditing.

8. Structure and responsibility of each SUPCE: Each participating province will assign project implementation responsibility to a local SUPCE. The SUPCE will consist of a chief executive reporting to a provincial minister or directly to the governor (in some provinces), and will have experts in a similar structure to that of SUCCE. The POM establishes the arrangements for the adequate control and relationship between SUCCE and the SUPCEs.

9. Project monitoring and auditing: The POM establishes the accounting requirements to be followed by each SUPCE and by SUCCE. The monitoring system especially the quarterly reports to be submitted to the Bank, would follow the same standard and content as those used in the previous project. External independent auditors will be hired by SUCCE to audit annually all project accounts, disbursement, procurement actions and SOEs and the use of the special accounts. The TORs for the auditing services will be included in an annex to the POM.

10. Guidance to Contractors on Environmental Aspects: The POM includes an annex prepared by the environmental consultants giving guidance to contractors on procedures to be followed during execution of works to minimize environmental effects.

**ARGENTINA**

**Flood Protection Project**

**Supervision Plan**

Approx. Dates (Month/year)	Special Activity in the Supervision Mission	Skill Requirements	Staff Input (SW)
April 97	- Project Launch	Engineer Hydrologist Environmentalist	5
July 97	- Review Procurement Timetable - Review Progress Implementation Early Flood Warning System	Engineer Hydrologist Environmentalist	5
November 97	- Review Progress in Awarding Contracts	Engineer Environmentalist	4
March 98	- First Mid Term Review - Review Implementation Progress and Agree with Government Reallocation of Sub-Projects	Engineer Housing Specialist Environmentalist	5
October 98	- Review Progress of Implementation	Engineer Environmentalist	4
March 99	- Second Mid Term Review - Review Implementation Progress and Agree with Government Reallocation of Sub-Projects	Engineer Housing Specialist Environmentalist	5
October 99	- Review Progress of Implementation	Engineer Environmentalist	4
March 2000	- Review Progress of Implementation	Engineer Environmentalist	4
October 2000	- Review Progress of Implementation	Engineer Environmentalist	4
March 2001	- Review Progress of Implementation	Engineer Environmentalist	4
November 2001	- Instruct SUCCE on Preparation of ICR for the Project	Engineer	3





## **ARGENTINA**

### **Flood Protection Project**

#### **Implementation Plan**

1. **Implementation Arrangements:** The project would retain essentially the same implementation arrangements as in the previous Rehabilitation Project (Loan 3521-AR). The SUCCE would remain within the Under Secretariat for Assistance to the Provinces (SSAP), and be the national executing agency for the proposed project. SUCCE would retain its responsibility for overall project management, including orientation and technical assistance to the provinces (directly and through the Project Operational Manual) in the preparation, approval, control, and monitoring project implementation, as well as for all financial and reporting transactions with the Bank. SUCCE would also retain its responsibility for all aspects concerning sub-project evaluation, approval, and procurement, as well as reporting and obtaining Bank approval of acquisitions and disbursements. SUCCE would also continue to provide proper coordination and policy consistency between the proposed operation and other sector-specific projects proposed by the provinces.

2. **Procurement Plan:** To expedite procurement, during appraisal the procurement was divided into 93 bid packages for works and six bid packages for goods, as detailed in the procurement plan described in Attachments 1, 2, and 3.

3. **Timetable of Implementation:** Implementation of the "structural measures" would follow the timetable of the sub-projects shown in Attachments 4, and 5. The "non-structural" measures would be implemented as follows:

- (a) Civil defense emergency procedures - would be completed before 3/31/98
- (b) Shelters - would be all constructed before 12/31/99
- (c) Housing - would be all constructed before 12/31/2001
- (d) Early flood warning - would be operational before 12/31/99

4. **Schedule of Disbursements:** Attachment 6 shows the schedule of disbursements of the proceeds of the Bank loan.

5. **Monitoring:**

5.1 Key Physical Indicators: see Annex 12.

5.2 Key Performance Indicators: see Annex 12.

ARGENTINA  
FLOOD PROTECTION PROJECT  
Procurement Planning (B.Aires, Chaco, Corrientes)

ANNEX 9  
Attachment 1

Sub-Project	#1	#2	#3	G or W	Contract	US\$ (1000)	Number of Months from Project Beginning (Apr 97)					
							Design Begins	Bid. Docs. Ready	Call for Bids	Bid Open	Contract Signed	Contract Ends
<b>BUENOS AIRES</b>					<b>Total Contracts in the Province</b>	<b>25,672</b>						
Islas del Delta	100	1	0	W	Alteo Comunicacion Sector 1	6,798	1	7	8	10	12	21
	100	2	0	W	Alteo Comunicacion Sector 2	5,554	18	22	23	25	27	39
Zarate	101	1	0	G	Barrio Villa Bosch	167	1	6	7	9	11	23
	101	2	0	W	Barrio Villa Florida	925	1	8	9	11	13	25
	101	3	0	W	Barrio Villa Angus	495	15	20	21	23	25	31
Campana	102	1	0	G	Barrio San Cayetano	409	15	20	21	23	25	31
	102	2	0	W	Pluviales SE y Coleta	4,045	1	10	11	13	15	33
San Pedro	103	1	0	W	Barrio Las Caneletas	1,167	16	22	23	25	27	45
	103	2	0	W	Barrio Bajo Puerto	518	20	24	25	27	29	47
Baradero	104	1	0	W	Desagues Pluviales	668	2	6	7	9	11	19
Escobar	105	1	0	W	Barrio San Miguel	1,227	13	18	19	21	23	35
	105	2	0	W	Barrio Bedoya	162	8	10	11	13	15	21
Tigre	106	1	0	W	Dique Lujan Villa La Nata	3,539	18	24	25	27	29	47
<b>CHACO</b>					<b>Total Contracts in the Province</b>	<b>35,470</b>						
Resistencia	200	1	0	W	Terraplen Defensa Norte	2,856	26	32	33	35	37	46
	200	2	0	W	Terraplen Perimetral Rio Negro	5,212	1	7	8	10	12	24
	200	3	0	W	Desagues Pluviales Zona Sur	5,511	20	26	27	29	31	43
	200	4	0	W	Desagues Pluviales Zona Norte	5,800	7	13	14	16	18	30
	200	5	0	G	Desagues Pluviales Equipamiento	3,451	5	11	12	14	16	26
	200	6	0	W	Control Gral San Martin	3,922	13	19	20	22	24	36
	200	7	0	G	Gral San Martin Equipamiento	4,972	15	21	22	24	26	36
	200	8	0	W	Control Soberania Nacional	2,804	1	4	5	7	9	17
	200	9	0	W	Terraplen Puerto Barranqueras	942	13	16	17	19	21	29
<b>CORRIENTES</b>					<b>Total Contracts in the Province</b>	<b>41,415</b>						
Bella Vista	300	1	0	W	Desagues Pluviales	1,562	1	5	6	8	10	21
Corrientes Capital	301	1	0	W	Desagues Pluviales # 1	1,812	1	7	8	10	12	24
	301	2	0	W	Desagues Pluviales # 2	2,392	6	12	13	15	17	33
	301	3	0	W	Desagues Pluviales # 3	2,208	14	20	21	23	25	39
	301	4	0	W	Desagues Pluviales # 4	2,318	22	28	29	31	33	49
	301	5	0	W	Defensa Sur	1,134	1	5	6	8	10	20
	301	6	0	W	Defensa Norte	1,530	1	5	6	8	10	21
	301	7	0	G	Defensa Norte Equipment	1,870	12	16	17	19	21	33
Curuzu Cuatia	302	1	0	W	Desagues Pluviales # 1	1,418	1	5	6	8	10	21
	302	2	0	W	Desagues Pluviales # 2	980	12	16	17	19	21	31
Esquina	303	1	0	W	Drenaje Urbano	1,595	1	5	6	8	10	21
Mercedes	304	1	0	W	Desagues Pluviales # 1	1,165	4	8	9	11	13	23
	304	2	0	W	Desagues Pluviales # 2	1,158	14	18	19	21	23	33
	304	3	0	W	Control Inundaciones	2,454	1	5	6	8	10	27
Goya	305	1	0	W	Drenaje Pluvial # 1	1,000	1	5	6	8	10	18
	305	2	0	W	Drenaje Pluvial # 2	982	18	22	23	25	27	35
	305	3	0	W	Defensa contra Inundacion # 1	1,146	1	5	6	8	10	18
	305	4	0	W	Defensa contra Inundacion # 2	1,820	6	10	11	13	15	27
	305	5	0	W	Defensa contra Inundacion # 3	2,156	12	16	17	19	21	35
	305	6	0	W	Defensa contra Inundacion # 4	4,822	18	24	25	27	29	41
	305	7	0	W	Defensa contra Inundacion # 5	5,893	22	28	29	31	33	47

ARGENTINA  
FLOOD PROTECTION PROJECT  
Procurement Planning (Entre Rios, Formosa, Misiones)

ANNEX 9  
Attachment 2

Sub-Project	#1	#2	#3	G or W	Contract	US\$ (1000)	Number of Months from Project Beginning (Apr 97)					
							Design Begins	Bid. Docs. Ready	Call for Bids	Bid Open	Contract Signed	Contract Ends
ENTRE RIOS					Total Contracts in the Province	51,863						
C. del Uruguay	400	1	0	W	Defensas contra Inundacion	5,331	2	8	9	11	13	22
	400	2	0	W	Defensa Obras Complementarias	1,910	1	7	8	10	12	24
	400	3	0	W	Defensa Toma de Agua	526	3	4	5	7	13	25
Diamanta	401	1	0	W	Estabilizacion Barrancas	2,846	6	10	11	13	15	28
La Paz	402	1	0	W	Estabilizacion Barrancas	2,338	1	5	6	8	10	22
Gualeguay	403	1	0	W	Terraplen Defensa	8,644	8	14	15	17	19	37
	403	2	0	W	Estacion Bombeo	2,849	13	16	17	19	21	33
Parana	404	1	0	W	Defensa Recuperacion Costera	10,351	2	8	9	11	13	37
Concordia	405	1	0	W	Colector Pluvial	4,145	1	4	5	7	9	27
	405	2	0	W	Desagues Pluviales	6,155	1	5	6	8	10	28
	405	3	0	W	Defensa Sur	4,800	16	20	21	23	25	34
	405	4	0	W	Costanera Norte # 1	2,068	16	22	23	25	27	39
FORMOSA					Total Contracts in the Province	19,915						
Clorinda	500	1	0	W	Defensa Principal	4,794	10	16	17	19	21	49
	500	2	0	W	Porteno Norte	868	6	12	13	15	17	25
	500	3	0	W	Drenaje Troncal	1,669	5	11	12	14	16	28
	500	4	0	W	Barrio Coronel	709	1	4	5	7	9	15
Formosa Capital	501	1	0	W	Defensa Sur	3,089	2	8	9	11	13	37
	501	2	0	G	Defensa Norte	3,099	1	7	8	10	12	36
	501	3	0	W	Drenaje	5,687	1	7	8	10	12	48
MISIONES					Total Contracts in the Province	10,057						
Posadas	600	1	0	W	Toma de Agua	315	1	3	4	6	8	14
Puerto Esperanza	601	1	0	W	Toma de Agua	750	33	36	37	39	41	48
Wanda	602	1	0	W	Toma de Agua	750	33	36	37	39	41	48
Puerto Iguazu	603	1	0	W	Desagues Pluviales	2,000	1	4	5	7	9	19
San Javier	604	1	0	W	Desagues Pluviales	2,000	9	12	13	15	17	27
Ayo. Yarara	605	1	0	W	Desagues Pluviales	1,365	19	22	23	25	27	34
Ayo. Bonito	606	1	0	W	Desagues Pluviales	1,300	26	29	30	32	34	41
Alteo Puentes	607	1	0	W	Alteo Puentes	1,577	3	6	7	9	11	47

ARGENTINA  
FLOOD PROTECTION PROJECT  
Procurement Planning (Santa Fe)

Annex 9  
Attachment 3

Sub-Project	#1	#2	#3	G or W	Contract	US\$ (1000)	Number of Months from Project Beginning (Apr 97)					
							Design Begins	Bid. Docs. Ready	Call for Bids	Bid Open	Contract Signed	Contract Ends
<b>SANTA FE</b>					<b>Total Contracts in the Province</b>	<b>88,000</b>						
Ayo. las Conchas	700	1	0	W	Canal Principal 4/puente RP38	4,152	1	2	3	5	7	31
Ayo. San Antonio	701	1	0	W	Canal Princ. 2/Canada Capivara	3,313	1	2	3	5	7	31
	701	2	0	W	Canal Princ. 2/Puente RP9	3077	1	2	3	5	7	31
Ayo. Cululu	702	1	0	W	Ayo Retiro	3,462	1	7	8	10	12	36
	702	2	0	W	Ayo. los Corrales	2,047	1	7	8	10	12	36
	702	3	0	W	Canal Principal 1	4,364	1	7	8	10	12	36
	702	4	0	W	Ayo. las Prusianas	1,805	1	7	8	10	12	36
	702	5	0	W	Ayo. las Prusianas-Rafaela	4,838	3	9	10	12	14	38
	702	6	0	W	Ayo. Retiro/Princ.1/Prusianas	2,270	3	9	10	12	14	38
Ayo. Monje Carrizal	703	1	0	W	Ayo. las Bandurrias	2,446	12	16	17	19	21	45
	703	2	0	W	Ayo. las Estacas	3,158	14	18	19	21	23	47
Rio Carcarana	704	1	0	W	Cuenca Propria	2,429	4	10	11	13	15	39
	704	2	0	W	Ayo. C. de Gomez	4,578	1	7	8	10	12	36
	704	3	0	W	Ayo las Tortugas	3,358	4	10	11	13	15	39
	704	4	0	W	Cuenca propia/2a etapa	2,045	4	10	11	13	15	39
Ayo. Saladillo	705	1	0	W	Proteccion Casilda y Fuentes	868	1	5	6	8	10	34
	705	2	0	W	Estabilizacion Cascada	6,539	1	2	3	5	7	31
Sist. Setubal	706	1	0	W	Obras de Arte Ayo Leyes	7,484	2	5	6	8	10	35
	706	2	0	W	Obras de Arte Ao Portero	4,195	2	5	6	8	10	35
Alteo Puentes	707	1	0	W	Malabrigo s/ RP40	4,092	25	28	29	31	33	45
	707	2	0	W	Garabato s/ RP40	2,887	1	4	5	7	9	21
	707	3	0	W	Saladillo s/ RP62	4,851	23	26	27	29	31	49
	707	4	0	W	Alcantarillas y Alteo RP62	831	13	16	17	19	21	39
	707	5	0	W	Aguar s/ RP82-S	2,233	3	6	7	9	11	21
	707	6	0	W	El Rey s/ RP31	2,688	27	30	31	33	35	47
	707	7	0	W	Los Troncos s/ RP50-S	308	1	4	5	7	9	17
	707	8	0	W	El Toba s/ RP36	3,099	12	15	16	18	20	32
	707	9	0	W	El Rey s/ RP3	589	1	4	5	7	9	17
<b>Capital Federal</b>					<b>Total Contracts in the Province</b>							
	800	1	0	W	Preliminary Analysis	5,000	1	7	8	10	12	24

Legend:  Design and Project Preparation  Bidding Process  Construction

ANNEX 9  
Attachment 5

Legend:  Design and Project Preparation  Bidding Process  Construction

Estimated Disbursement Schedule  
(in US\$ million)

Fiscal Year Semester	Semester (Semt.)				Cumulative (Cum.)				%	
	Bank	JEXIM	Provinces	Total	Bank	JEXIM	Provinces	Total	Semt.	Cum.
FY 1998										
01/98	4.0	2.4	2.0	8.4	4.0	2.4	2.0	8.4	2	2
02/98	6.0	3.6	3.0	12.6	10.0	6.0	5.0	21.0	3	5
FY 1999										
01/99	16.0	9.6	8.0	33.6	26.0	15.6	13.0	54.6	8	13
02/99	24.0	14.4	12.0	50.4	50.0	30.0	25.0	105.0	12	25
FY 2000										
01/00	30.0	18.0	15.0	63.0	80.0	48.0	40.0	168.0	15	40
02/00	40.0	24.0	20.0	84.0	120.0	72.0	60.0	252.0	20	60
FY 2001										
01/01	40.0	24.0	20.0	84.0	160.0	96.0	80.0	336.0	20	80
02/01	24.0	14.4	12.0	50.4	184.0	110.4	92.0	386.4	12	92
FY 2002										
01/02	10.0	6.0	5.0	21.0	194.0	116.4	97.0	407.4	5	97
02/02	6.0	3.6	3.0	12.6	200.0	120.0	100.0	420.0	3	100





## ARGENTINA

### Flood Protection Project

#### Economic Analysis

#### Economic Analysis of Sub-projects ("Structural Measures")

1. Each structural measure sub-project included in the proposed project represents the least-cost solution resulting from a specific master plan designed to defend the selected area against floods (see Annex 3 for details on the master plans). In carrying out those master plans the consultants examined several alternatives and recommended the least cost solution, taking into account sound engineering grounds and environmental criteria, all in agreement with the overall plan for the region as described in Annex 2.
2. The economic analysis of each proposed sub-project was calculated by the consultant responsible for the master plan in which the sub-project was recommended. It was later verified by another independent consultant. The TORs for the consultants who carried out each master plan included the criteria for the economic analysis of each sub-project. However, to ensure that this criteria was used by all consultants in each master plan and to guarantee compatibility of analysis among all different sub-projects, another consultant independently reviewed the economic analysis of each sub-project. This independent consultant also carried out an overall economic analysis of the "structural" component of the project comprising all sub-projects.
3. Attachment 1 lists the sub-projects by ranking order of IERR. The sub-project for drainage of Arroyo Pavon in Santa Fe showed the highest IERR (79%) and the lowest (12%) corresponded to the sub-projects of Goya (in Corrientes) and Gualaguachu (in Entre Rios). Attachment 1 also shows the net present value (NPV) of each sub-project calculated at discount rates of 8, 10 and 12%.
4. The IERR of each sub-project was computed as the discount rate equalizing the present value of the stream of costs and benefits associated with the sub-project. The cost stream, calculated in constant 1995 prices, includes the capital cost of the investment and the associated operating and maintenance costs for the life (estimated as 50 years) of the constructed facilities. The benefit stream includes the estimated cost of direct flood damage which the sub-project would cause to be avoided (hereafter called avoided damage cost). These direct costs refer only to the estimated rehabilitation expenses of existing facilities and infrastructure, such as roads, bridges, water intakes, houses, public buildings, and lost plantations, the government would incur in the case of a future recurrent flood. Data used were based on actual cost data from past floods. No indirect, economic or social cost associated with floods was considered, resulting therefore in a lower bound of the benefits associated with the project.

5. The "avoided damage cost" calculation results in an estimate of the differences between damage costs under conditions with and without the implementation of the sub-project. The associated damage costs vary with the intensity of the flood, which results in different water levels and corresponding different flooded areas. Therefore, those costs have to be calculated in probabilistic terms. Consequently, for each sub-project, a flood-risk analysis was first carried out using stochastic hydrological data developed from 90 years of hydrologic data and a hydraulic mathematical model for river simulation. This analysis resulted in the design of a curve of streamflow values (or water levels) versus estimated levels of probability of flood occurrence (or number of years of recurrence). Then, based on past flood damage data and on the hydraulic mathematical model developed for the river simulation and also with the help of geographic information systems, GIS (both to estimate the flooded area corresponding to each water level), it was possible to estimate damage costs caused by floods at different water levels. The result of this second analysis was a curve of damage costs versus water levels. The combination of these two first analyses resulted in a third, final curve of damage costs versus probability of occurrence (or number of year of recurrence). Finally, there was defined the level of defense desired (for example, 70 years of recurrence) to be used as project design criteria. The expected damage cost was then calculated for all floods with recurrence time lower (or probability of occurrence higher) than the desired defense level as the area (mathematical integral) under the third developed curve (see Attachment 2). This damage cost would be avoided by the implementation of the proposed sub-project since its design criteria was to protect the area for all floods with recurrence time lower (or probability higher) than the level of defense provided by the sub-project. It would therefore be an estimate of the direct benefit of the sub-project.

### **Project Economic Analysis**

6. The overall project economic analysis used the same criteria of the economic analyses of the sub-projects. Therefore, the overall IERR was also computed as the discount rate equalizing the present value of the stream of costs and benefits associated with all sub-projects included in the project. The cost stream, in constant 1995 prices, includes the capital cost of the investment and the associated operating and maintenance costs for the life-time (estimated as 50 years) of the constructed facilities. The benefit stream includes the estimated direct flood-caused damage cost avoided by all sub-projects. This calculation produced a 20.4% IERR for the base case. Sensitivity analyses were also carried out in the economic analysis to evaluate the impact on the IERR of: (i) an increase in investment costs of 17.4% (contingencies used); (ii) an increase in benefits considering indirect benefits limited to 20% of the direct ones; and (iii) a delay of five years in beginning project implementation (continuing the country to support to flood risk evaluated as the annual avoided cost by the project). The results of this analysis were:

Scenario	IERR (%)
Whole Project	
Base Case	20.4%
Costs increased by 17.4%	17.4%
Benefits increased by 20%	24.6%
Costs increased by 17.4% and Benefits increased by 20%	20.9%
Project delayed five years	7.5%
"Structural Measures" only	
Base Case	22.2%
Costs increased by 17.4%	19.0%
Benefits increased by 20%	30.6%
Costs increased by 17.4% and Benefits increased by 20%	22.5%

7. Additional sensitivity analysis was carried out to estimate the deviation of the IERR due to risk of data used in the evaluation. A mathematical model using the Montecarlo probabilistic approach was used. It takes into consideration a statistical analysis of the data used for costs and benefits evaluation. As a first step, a statistical distribution curve is fit with a mean value equal to the estimated cost of the sub-project and with a variance coefficient of 7%. The second step was to fit a statistical distribution curve for the estimated benefits having as mean value the avoided cost estimated at the deterministic analysis and with also a variance coefficient of 7%. Based on those distribution curves, a mathematical model using the Montecarlo simulation method calculated a distribution curve for the NPV and the IERR. As this analysis aimed to assess the sensitivity to data risk, it was only carried out for the "structural" measures. The result of this analysis indicated an average IERR of 22.2% (equal to the deterministic value calculated before) and a range of variation between a maximum of 32.0% and a minimum of 15.5%.

8. To evaluate the project sensitivity in the event of postponement of the initiation of project implementation, the consultant calculated the estimated flood-risk cost. The NPV of such risk cost would be US\$510 million, US\$478 million or US\$449 million, for discount rates of 8%, 10%, and 12% respectively. The IERR calculated for the project postponed five years would be reduced to 7.5%, much lower than the IERR for the base case showing the benefits of not postponing the project.

## **Housing and Shelter Components**

9. The economic evaluation of the housing component calculated direct benefits derived from: (a) the absence of damage from loss of the beneficiaries' homes, the related expenses of evacuating and maintaining these families during flood conditions; (b) the lack of necessity for their resettlement and other post-flood "emergency relief" help; and (c) the comparable lack of any need for rehabilitating the flood damaged homes. It excluded such other benefits as the loss of days in productive employment by affected families. Comparing only the above direct benefits with the costs of the housing component resulted in an IERR of 14.7%.

10. Calculating the economic return of the shelter component was more complicated, given the uncertainty of the length of time of usage for flood emergencies, the multiplicity of shelters uses for other purposes (during non-flood periods), etc. Primarily comparing the cost of alternative shelter facilities with the investment cost led to an IERR of 16.03%.

ARGENTINA  
FLOOD PROTECTION PROJECT  
Ranking of Sub-Projects by IRR and NPV

ANNEX 10  
Attachment 1

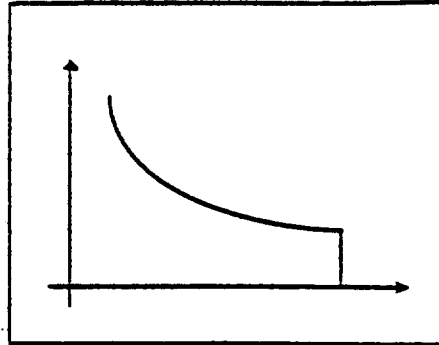
Province	Sub-Project		IRR (%)	Net Present Value (NPV)		
	Number	Name		(in US\$) at discount rate of		
				8%	10%	12%
Santa Fe	711	Arroyo Pavon	79.15	83,412,579	65,043,333	52,365,643
Santa Fe	712	Linea Parana	68.50	118,907,683	92,255,935	73,869,440
Santa Fe	704	Rio Carcarana	46.82	68,289,193	52,058,713	40,869,877
Corrientes	301/307	Corrientes Capital	41.17	78,896,106	60,351,643	46,886,341
Misiones	803/809	Puerto Iguazu	41.11	18,672,193	14,104,599	10,957,554
Misiones	804	San Javier	39.95	7,794,474	5,874,721	4,552,152
Misiones	800	Toma de Agua Posadas	39.32	692,096	526,414	411,203
Santa Fe	709	Cuenca Colastine	34.95	70,882,997	52,268,090	39,538,798
Santa Fe	703/710	Arroyo Monje Carrizales	34.14	56,521,022	51,994,754	31,993,474
Santa Fe	705	Arroyo Saladillo	33.83	52,843,933	37,996,839	28,014,118
Entre Rios	411	Ibicuy	30.46	9,161,976	6,788,632	5,140,345
Formosa	500	Clorinda	29.38	22,625,971	16,519,013	12,318,624
Santa Fe	700/708	Arroyo Las Conchas	27.82	16,835,065	12,072,213	8,822,105
Misiones	802	Wanda	27.59	4,236,998	3,068,904	2,264,133
Entre Rios	403/409	Guaquey	27.44	40,956,962	29,595,318	21,781,122
Santa Fe	701	Arroyo San Antonio	25.31	14,962,170	10,551,001	7,550,388
Santa Fe	702	Arroyo Cululu	25.23	44,668,205	31,527,819	22,566,927
Capital Federal	800/801	Arroyo Maldonado	25.04	310,676,395	219,174,802	156,651,344
Misiones	807	Alteo Puentes	23.57	2,233,760	1,569,733	1,113,390
Formosa	501/502	Formosa Capital	23.53	25,576,728	17,857,728	12,583,536
Santa Fe	707/714	Alteo Puentes	22.24	97,475,889	66,742,364	45,938,352
Misiones	801	Puerto Esperanza	21.81	2,932,041	2,026,923	1,403,628
Entre Rios	405/414	Concordia	20.75	25,593,321	18,277,468	12,502,106
Buenos Aires	100/115	Islas del Delta	19.18	17,788,578	11,695,382	7,555,644
Entre Rios	(*)	Colon	18.78	23,205,442	14,027,839	8,395,085
Chaco	202	Alteo Puentes	18.63	10,297,872	6,822,316	4,407,952
Santa Fe	708/713	Sistema Setubal	18.45	46,900,562	28,948,853	17,421,978
Misiones	808	Obrera	18.16	1,789,703	1,169,104	739,315
Corrientes	300/306	Bella Vista	17.14	5,174,241	3,227,783	1,913,690
Chaco	201	Linea Tapenaga	16.87	17,656,279	11,055,113	6,530,129
Chaco	200	Resistencia	15.85	30,345,478	18,251,262	7,555,644
Entre Rios	408	Federacion	15.83	2,872,028	1,747,596	966,678
Entre Rios	401	Diamante	15.78	2,358,795	1,431,784	787,974
Entre Rios	402/407	La Paz	15.63	7,089,533	4,250,940	2,295,997
Buenos Aires	101/102/109/110	Zarate y Campana	15.62	5,536,124	3,336,984	1,809,562
Entre Rios	400	Concepcion del Uruguay	15.52	28,111,410	15,456,918	7,704,514
Entre Rios	404/412	Parana	15.36	11,524,480	6,860,333	3,621,083
Entre Rios	415	Villa Paranacito	15.11	3,635,055	2,136,295	1,094,867
Entre Rios	406	Santa Elena	15.09	1,215,643	747,959	398,780
Corrientes	304/310	Mercedes	14.08	4,835,251	2,629,714	1,119,640
Corrientes	303/309	Esquina	13.44	4,444,886	2,277,614	795,202
Corrientes	312	Alteo Puentes	12.97	4,824,127	2,360,986	650,335
Corrientes	302/308	Curuzu Cuatia	12.49	1,748,131	794,053	131,192
Formosa	(**)	Cuencas Internas	12.46	37,424,004	16,926,960	2,691,767
Corrientes	305/311	Goya	12.36	13,654,416	5,838,550	721,374
Entre Rios	410	Guaqueyaychu	11.75	3,977,781	1,482,969	(175,016)
Entre Rios	413	Victoria	11.19	239,030	77,478	(46,571)

(\*) Cancelled by environmental Reasons

(\*\*) Needs Additional Studies

**AVOIDED DAMAGE COST****1) Flood Risk Analysis**

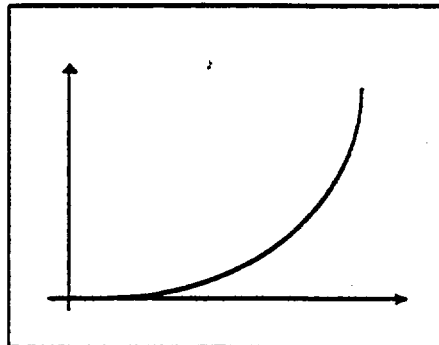
Water level (h)  
or  
Stream flow (q)



Probability of occurrence (8%)  
or  
Inverse of time of recurrence ( $1/t$ )

**2) Direct Cost of Flood Area**

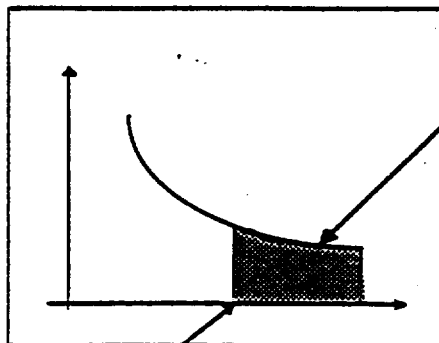
Damage Cost (\$)



Water Level (h)

**3) Avoided Damage Cost**

Damage Cost (\$)



Avoided Damage  
Cost

Damage  
level

Probability of occurrence (8%)  
or  
Inverse of time of recurrence ( $1/t$ )

## **ARGENTINA**

### **Flood Protection Project**

#### **Community Participation**

#### **Project Preparation**

1. Project preparation involved consultations with local communities and all affected municipalities. The consultants who prepared the Master Plans were responsible for gathering data and obtaining feedback from the communities involved. They contacted the municipalities in which the sub-projects will be developed. The SUPCEs also made contact with all municipalities in the affected areas. Public hearings were held in the areas where works are envisioned. They were very productive, resulting in modifications of the original engineering solution in some locations due to suggestions from local communities (e.g., in Gualeguay, Resistencia and Goya).

2. In regional terms, two seminars (with participation of several governmental, central and provincial officials and NGOs) were held during the pre-appraisal and appraisal missions to discuss the project and its environmental assessment (EA) report. These seminars were open to the public, and several NGOs were invited to participate. An annex to the EA report describes the seminars and the discussions that took place, including list of participants.

#### **Project Implementation**

3. Project implementation will also seek strong community participation, especially in: (i) the installation of the emergency family shelters; (ii) the housing component based on self-construction by community groups; (iii) the maintenance and operation of some components of the early flood warning system; and (iv) the enforcement of the regulations on land utilization, particularly where it includes restricted use of land.

4. The installation of the emergency family shelters will be discussed with the communities in order to have their location well suited for the emergency actions they would be aimed at. Additionally, community participation will be seek to help implement the civil defense procedures during emergencies including the use of the shelters.

5. The housing component would follow the successful experience of the previous project. It would be a voluntary program of self-construction of houses by community groups. Joint effort and community participation is the key for success of this type of project component.

6. The flood warning system would have remote stations which would require simple maintenance actions (such as simple inspection and battery check and battery change) that could be made by local participants.

7. The enforcement of land use regulations and use of restricted areas would profit from community participation. The project will seek to train local NGOs and communities to help enforce those regulations by reporting illegal or irregular actions to the authorities.



## ARGENTINA

### Flood Protection Project

#### Project Monitoring and Auditing

#### **Project Monitoring**

1. Three types of monitoring indicators were agreed during appraisal: (i) input indicators; (ii) output indicators; and (iii) outcome/impact indicators. The indicators described below would be used for project supervision:

##### **1..1. Input indicators:**

(a) Time-table of Works - showing execution performance as percentage of total estimated cost of each contract compared to forecast time-table included in the procurement planning (Attachments 4, 5, and 6 of Annex 9);

(b) Loan Disbursement - measured as percentage of total loan disbursements as compared to forecast disbursements in the Schedule in Annex 9 (Attachment 7);

(c) Local Counterpart Funding - measured by the number of days between invoice presentation date by the contractor and date of effective payment. This time period should be less than 60 days; and

##### **1..2. Output indicators:**

(a) Contract Cost - measured by the difference of final contract cost after completion and its estimated cost forecasted at procurement stage. It should not exceed 10% of contract estimated cost plus price adjustments (if contract includes price adjustment clause).

(b) Contract Completion Date Performance - measured by the number of days between contract real completion date and its forecast completion date included in the contract agreement. It should not exceed 15% of contract forecast execution time;

(c) Number of Houses Constructed - measured by the number of houses constructed in each province as compared with the estimated number of houses programmed in appraisal;

(d) Number of Shelters Constructed - measured by the number of shelters constructed in each province as compared with the programmed in appraisal;

1..3. Outcome/Impact Indicators:

(a) Flood Defense Works Effectiveness - measured by comparing the performance of the constructed defenses during the annual flood period of the rivers versus their forecast performance.

(b) Population Affected by Floods - measured by the number of people affected by future floods as compared with the number of people affected by the 1992 flood by province:

Province:	Population Affected in 1992
Buenos Aires	453,000
Chaco	328,000
Corrientes	659,000
Entre Ríos	883,000
Formosa	246,000
Misiones	685,000
Santa Fe	1,987,000

(c) Population Attended by the Housing Program - measured by comparing the population attended each year by the program in percentage of total population expected to be attended by the program versus the following targets:

Year	1997	1998	1999	2000	2001
Population Attended (Cumulative %)	20%	40%	60%	80%	100%

(d) Population Attended by Shelters - measured by comparing the population attended each year by the program in percentage of total population expected to be attended by the program versus the following targets:

Year	1997	1998	1999
Population Attended (Cumulative %)	10%	40%	100%

**Auditing**

2. An audit of the financial status of the program would take place once a year for the SUCCE components and for each participant province (SUPCEs). The audit reports would be sent to the Bank not more than five months after the end of the calendar year. The report would include, *inter alia*, specific opinions on: (a) sources of financial resources and their use and statement of cumulative investment of the project; (b) SOEs; (c) special account, and (d) implementation of

contracting clauses, including the application of eligibility criteria, and compliance with procurement procedures and other financing conditions included in the POM. Audits would be carried out by an independent auditor acceptable to the Bank, under terms of reference (TORs) similar to those used in the previous project. During appraisal, the TORs of the auditing work to be carried out annually in the central implementing unit (SUCCE) and in each provincial implementing unit (SUPCE) were agreed upon. The agreed TORs provide that in addition to the opinion on the Project financial statements the auditor must issue a report with opinions on:

(a) whether the Project financial statements present fairly, in all material respects, the funds received and the disbursements made during the period audited, as well as the accumulated investments as at the closing date, in accordance with international accounting standards issued by International Accounting Standards Committee (ISAC) and in accordance with the requirements of the respective agreements with the Bank;

(b) whether the supplementary financial information for the Project is fairly presented, in all material respects;

(c) the adequacy of the internal control structure of the implementing agencies in regard to the Project. The auditor should evaluate the internal control structure of SUCCE and of each SUPCE identifying reportable conditions including material weaknesses in the internal control structure. This evaluation should also include internal controls related to counterpart funds;

(d) the implementation agencies compliance with the terms of the Loan Agreement and applicable laws and regulations. The auditors should issue a positive assertion for all items tested and a negative assertion with respect to those not tested. All instances of material non-compliance must be identified;

(e) whether: (i) the statement of expenditures (SOEs) are reasonably dependable, (ii) the accounting for the preparation of the SOEs is adequate, and (iii) the Project funds have been used only for Project purposes in accordance with the Loan Agreement;

(f) whether the Special Account used for managing the funds provided by the Bank presents fairly the availability of funds at the end of the period audited, as well as the transactions made during that period, in accordance with the provisions for use of the funds in the corresponding agreements with the Bank.



## ARGENTINA

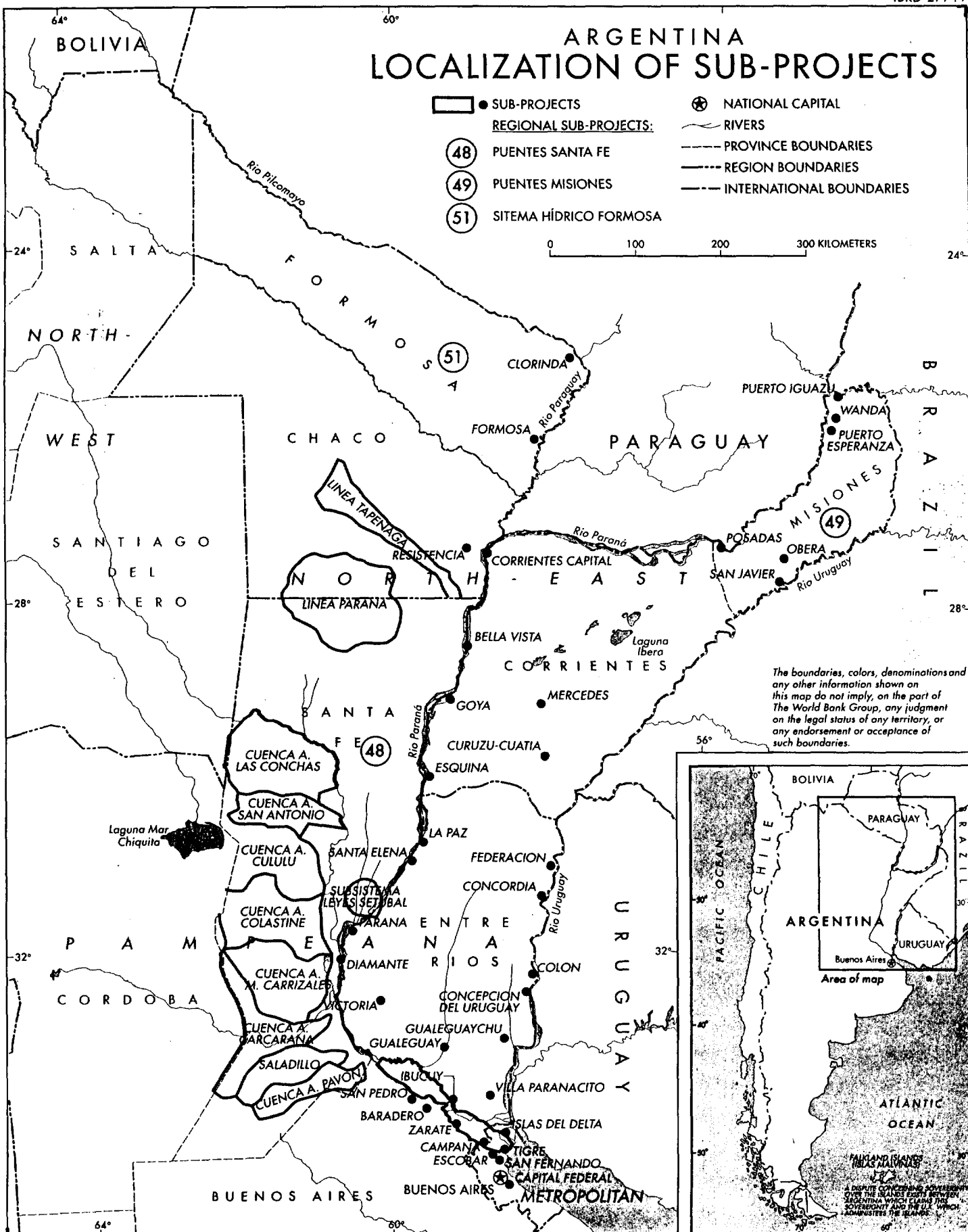
### Flood Protection Project

#### Selected Documents and Data Available in the Project File

1. Cuenca del Río de la Plata - Inventario y Análisis de la Información Básica sobre Recursos Naturales - Organization of American States (OAS), 3 Volumes, 1971
2. Cuenca del Río de la Plata - Inventario de Datos Hidrológicos y Climatológicos - Organization of American States (OAS), 2 Volumes, 1969
3. An Analysis of Flooding in the Paraná/Paraguay River Basin, The World Bank, September 1993
4. Recopilación de Antecedentes Daños de Crecidas 1983 y 1992 - Evaluación Económica, Ing. Roberto Bergman, Argentina, February 1994
5. Hidrovia - An initial Environmental Examination of the Paraguay-Paraná Waterway, Wetlands for the Americas, 1993
6. ARGENTINA - Legal Framework for the Intergovernmental Division of Responsibilities in Water Resources, Negri, Teijeiro & Incera, Argentina, September 1993
7. Estudio sobre la Legislación de Situaciones de Emergencia (Referida a Inundaciones), Dr. Rogelio Wester Vincenti, Argentina, December 1994
8. Evaluación de las Actividades Dedicadas al Alerta Hidrológico en los Ríos Paraná, Paraguay y Uruguay en la República Argentina, Dr. Juan B. Valdéz, December 1993
9. Estudio de Regulación del Valle Aluvial de los Ríos Paraná, Paraguay y Uruguay para el Control de las Inundaciones, Sir. Halcrow & Partners Ltd., September 1994, composed of 11 volumes: Report; Geomorfology; Hydrology; Floods; Socio-economic Aspects; Land Usage; Environmental Aspects; Economic Impact of Floods; Methodology to "Live with Floods"; Legal and Institutional Aspects; Flood Risk Maps
10. Environmental Assessment, composed of four volumes: Report; Technical Annex; Participatory Approach; Environmental Analysis of all Sub-Projects, Group of Consultants headed by Juan Schnack, Argentina, August 1995
11. Evaluación Económica Regional y de los Subproyectos del Programa de Protección contra Inundaciones, Econ. Andrés Carlos Planas, Argentina, December 1995



# ARGENTINA LOCALIZATION OF SUB-PROJECTS





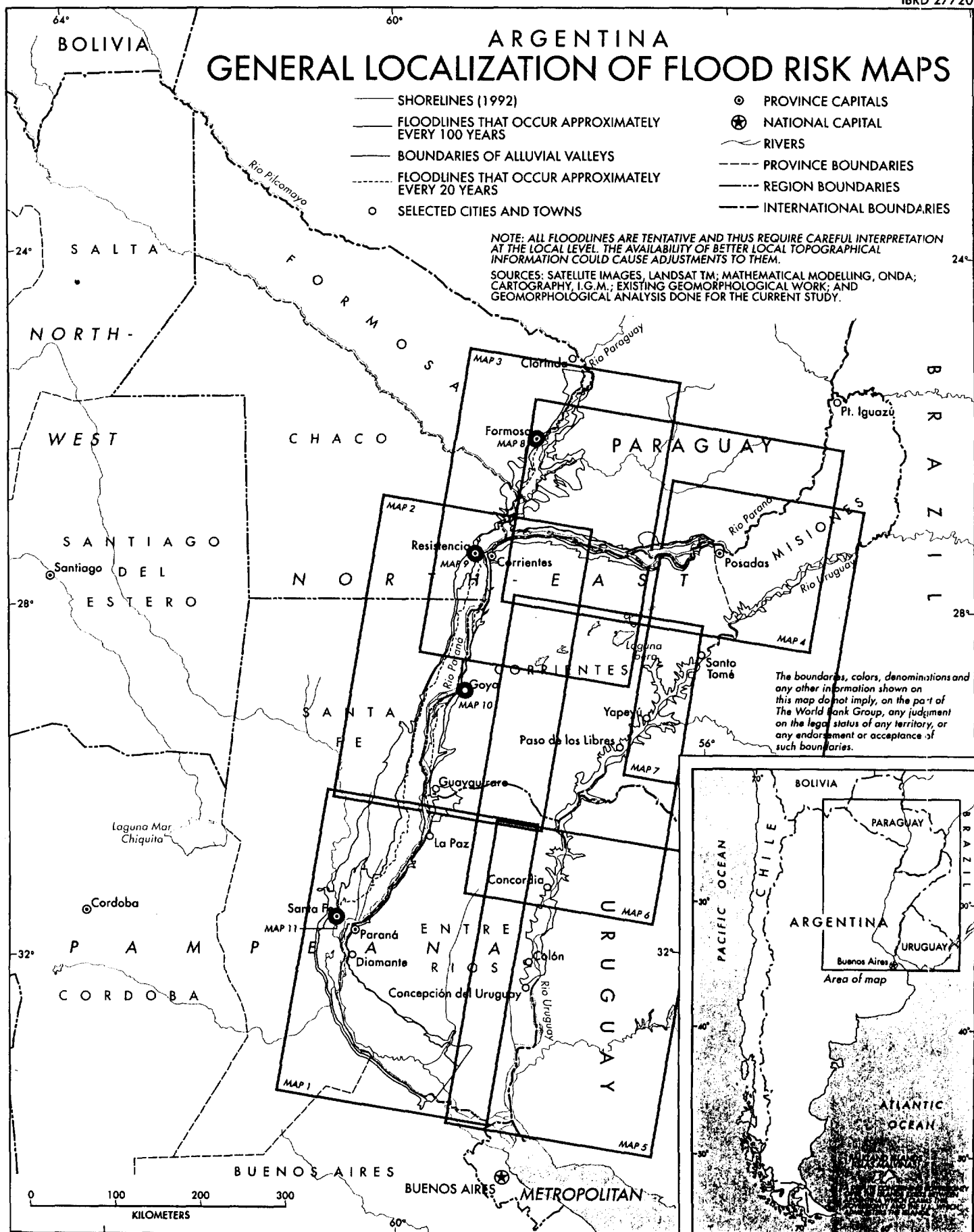


# ARGENTINA GENERAL LOCALIZATION OF FLOOD RISK MAPS

- SHORELINES (1992)
- FLOODLINES THAT OCCUR APPROXIMATELY EVERY 100 YEARS
- BOUNDARIES OF ALLUVIAL VALLEYS
- FLOODLINES THAT OCCUR APPROXIMATELY EVERY 20 YEARS
- SELECTED CITIES AND TOWNS
- ⊙ PROVINCE CAPITALS
- ⊗ NATIONAL CAPITAL
- RIVERS
- PROVINCE BOUNDARIES
- REGION BOUNDARIES
- INTERNATIONAL BOUNDARIES

NOTE: ALL FLOODLINES ARE TENTATIVE AND THUS REQUIRE CAREFUL INTERPRETATION AT THE LOCAL LEVEL. THE AVAILABILITY OF BETTER LOCAL TOPOGRAPHICAL INFORMATION COULD CAUSE ADJUSTMENTS TO THEM.

SOURCES: SATELLITE IMAGES, LANDSAT TM; MATHEMATICAL MODELLING, ONDA; CARTOGRAPHY, I.G.M.; EXISTING GEOMORPHOLOGICAL WORK; AND GEOMORPHOLOGICAL ANALYSIS DONE FOR THE CURRENT STUDY.



The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.





# ARGENTINA FLOOD RISK MAP FOR CORRIENTES - CHACO - FORMOSA AREA

0 50 100 150  
KILOMETERS

NOTES: ALL FLOODLINES ARE TENTATIVE AND THUS REQUIRE CAREFUL INTERPRETATION AT THE LOCAL LEVEL. THE AVAILABILITY OF BETTER LOCAL TOPOGRAPHICAL INFORMATION COULD CAUSE ADJUSTMENTS TO THEM.

IN SOME LOCATIONS, WHERE THERE IS NO INDICATION OF A FLOODLINE OCCURRING EVERY 20 YEARS, IT IS ASSUMED THAT IT COINCIDES WITH THE FLOODLINE THAT OCCURS APPROXIMATELY EVERY 100 YEARS.

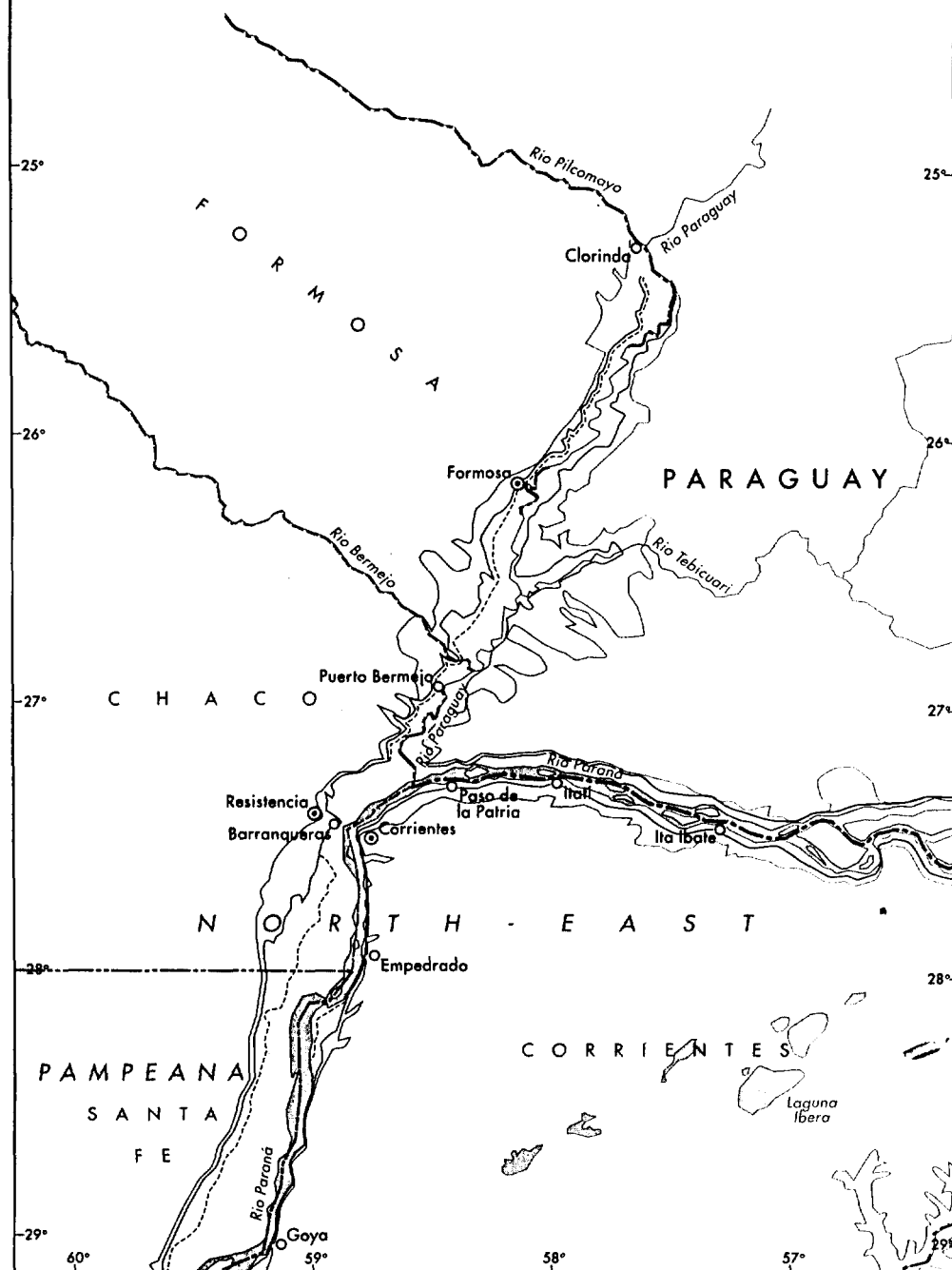
GEOGRAPHIC PROJECTION, GAUSS KRUGER

THE COORDINATES REFERRED TO ABOVE CORRESPOND TO THE FIVE BELTS OF THE PANAMA RIVER.

SOURCES: SATELLITE IMAGES, LANDSAT TM; MATHEMATICAL MODELLING, ONDA; CARTOGRAPHY, I.G.M.; EXISTING GEOMORPHOLOGICAL WORK; AND GEOMORPHOLOGICAL ANALYSIS DONE FOR THE CURRENT STUDY.

- SHORELINES (1992)
- FLOODLINES THAT OCCUR APPROXIMATELY EVERY 100 YEARS
- BOUNDARIES OF ALLUVIAL VALLEYS
- FLOODLINES THAT OCCUR APPROXIMATELY EVERY 20 YEARS
- SELECTED CITIES AND TOWNS
- ⊙ PROVINCE CAPITALS
- ⊛ NATIONAL CAPITAL (INSET)
- RIVERS
- PROVINCE BOUNDARIES
- REGION BOUNDARIES
- INTERNATIONAL BOUNDARIES

The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.





# ARGENTINA FLOOD RISK FOR CITY OF FORMOSA AREA

- 1. SHORELINE (1992)
- 2. FLOODLINE THAT OCCURS APPROXIMATELY EVERY 100 YEARS
- 3. BOUNDARY OF ALLUVIAL VALLEY
- 4. FLOODLINE THAT OCCURS APPROXIMATELY EVERY 20 YEARS
- ROADS
- INTERNATIONAL AIRPORT
- INTERNATIONAL BOUNDARIES

## NOTES:

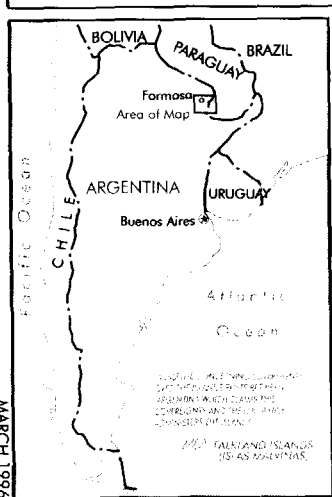
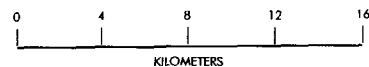
All floodlines are tentative and thus require careful interpretation at the local level. The availability of better local topographical information could cause adjustments to them.

In some locations, where there is no indication of a floodline occurring every 20 years, it is assumed that it coincides with the floodline that occurs approximately every 100 years.

Sources: satellite images, Landsat TM; mathematical modelling ONDA; cartography, I.G.M.; existing geomorphological work; and geomorphological analysis done for the current study.

GEOGRAPHIC PROJECTION, Gauss Kruger

The coordinates referred in this map correspond to the five belts of Parana River.



PARAGUAY

The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.





IMAGING

Report No: 15354 AR  
Type: SAR