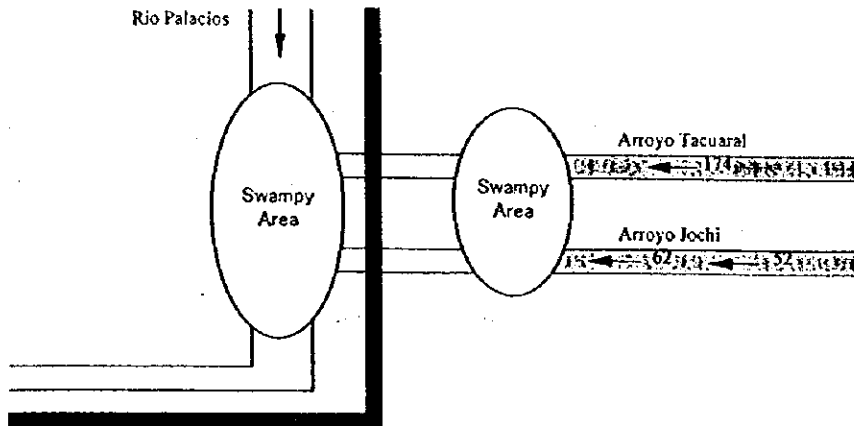


CHANE-PAILON SCHEME

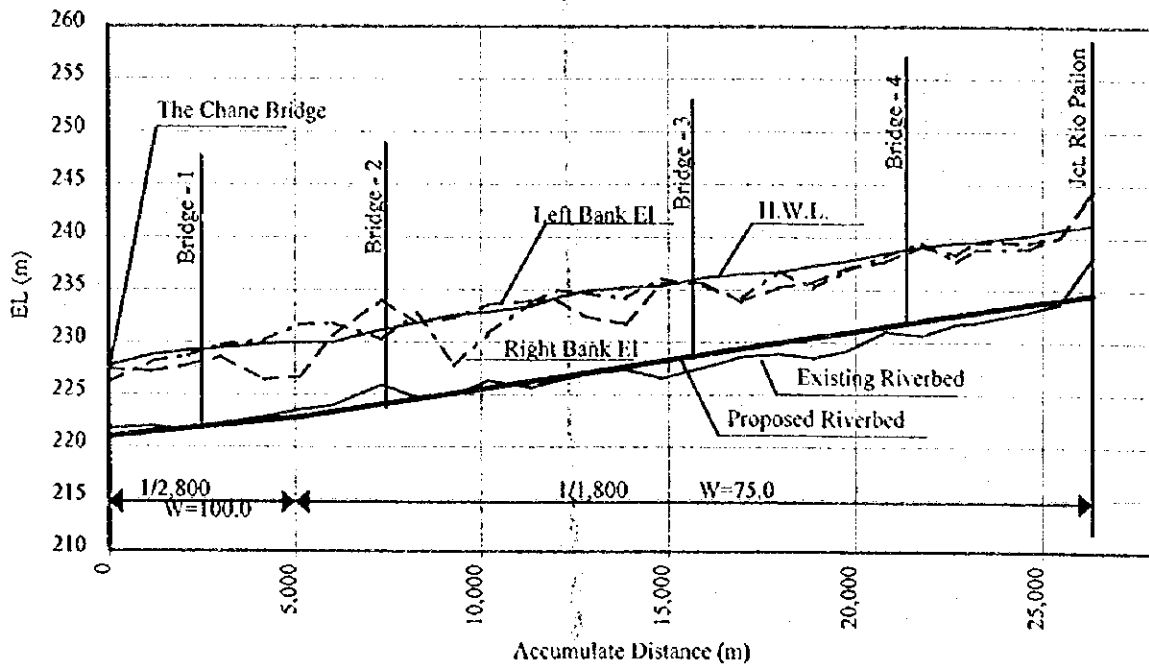


SAN JUAN-ANTOFAFASTA SCHEME

- Legen
- ← : Design Discharge (m³/sec)
 - : With River Improvement
 - : Without River Improvement
 - - - : Rehabilitation of Drainage
 - : With Drainage Improvement

FIG. 6.1.2 DESIGN DISCHARGE DISTRIBUTION OF 10-YEAR FLOODS

Rio Chane



Rio Pailon

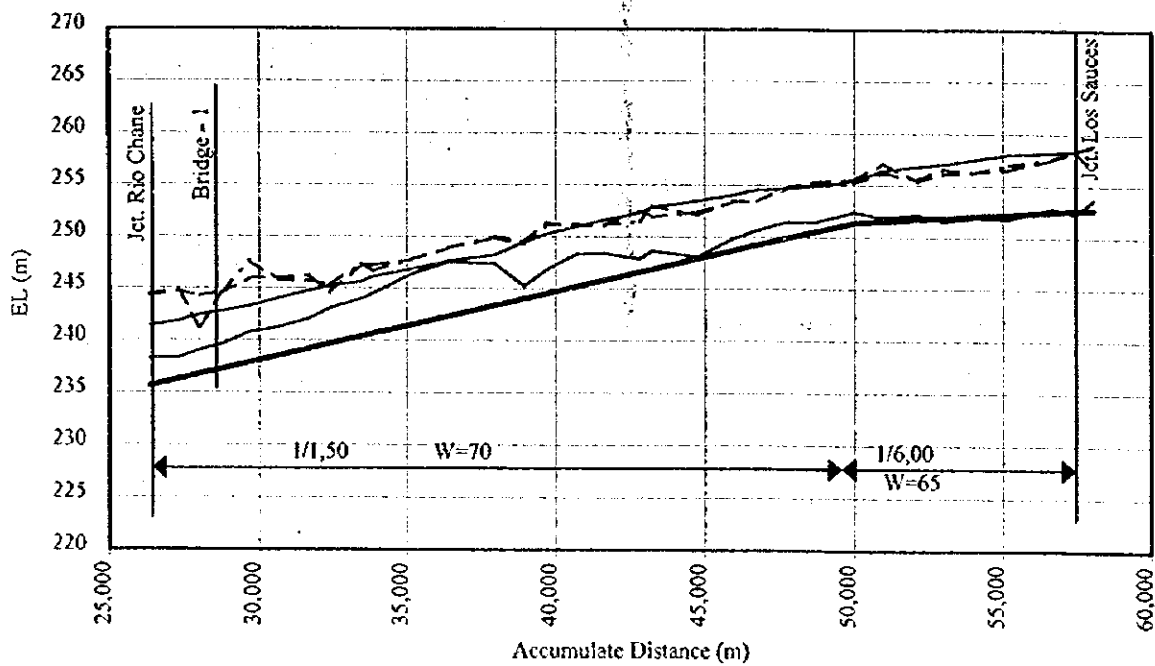
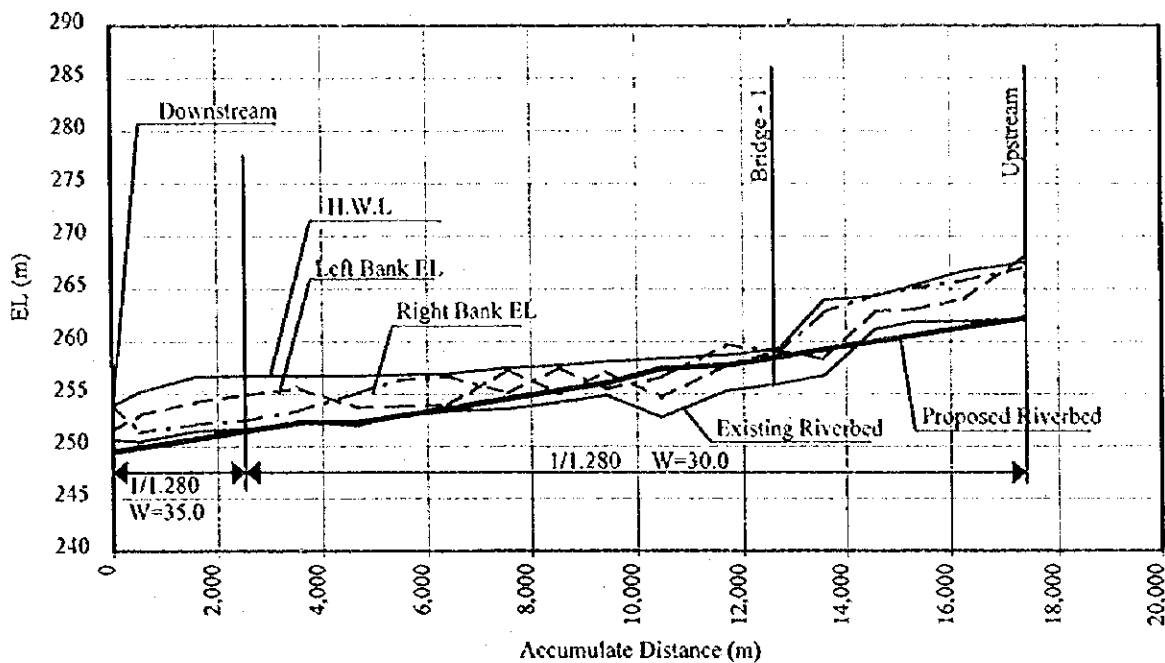


FIG. 6.1.3 (1) LONGITUDINAL PROFILE OF RIO CHANE AND RIO PAILON

Arroyo Yapacanicito



Arroyo Jochi

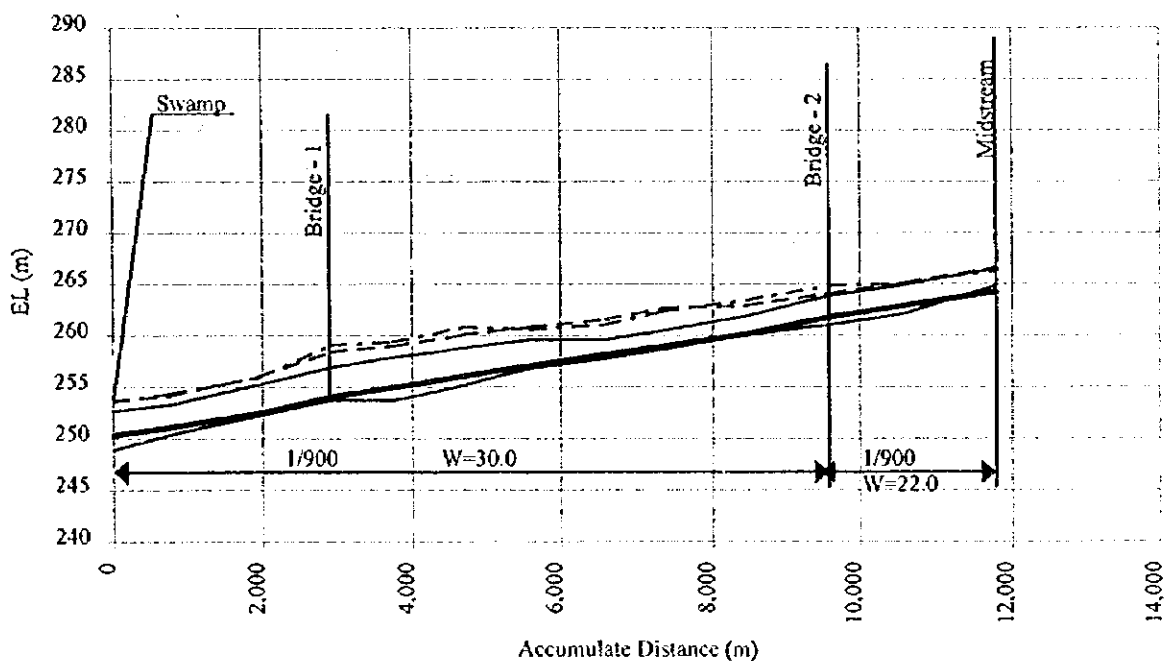


FIG. 6.1.3 (2) LONGITUDINAL PROFILE OF ARROYO YAPACANICITO AND JOCHI

Arroyo Tacuaral

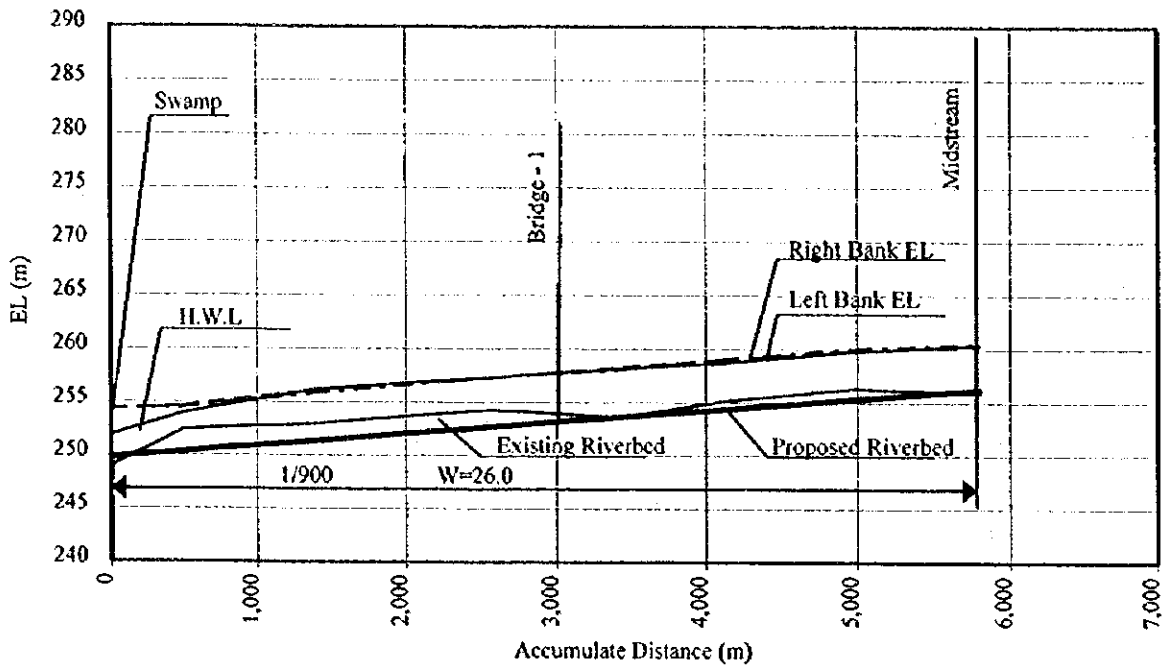


FIG. 6.1.3 (3) LONGITUDINAL PROFILE OF ARROYO TACUARAL

PROFILE : ROAD-CUM-EMBANKMENT

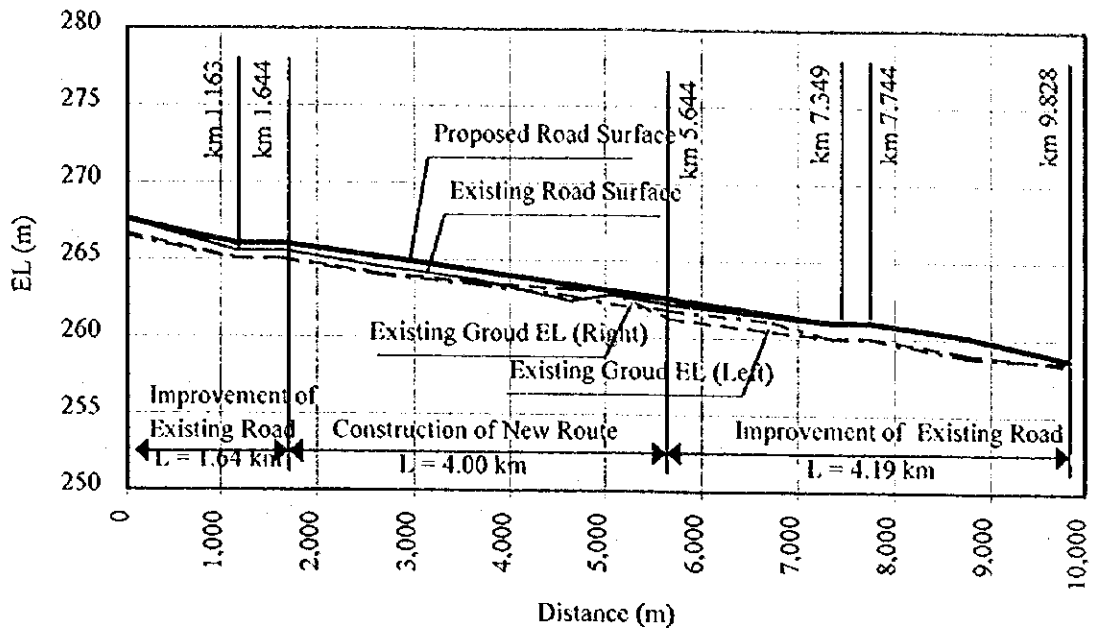


FIG. 6.1.4 LONGITUDINAL PROFILE OF ROAD-CUM-EMBANKMENT

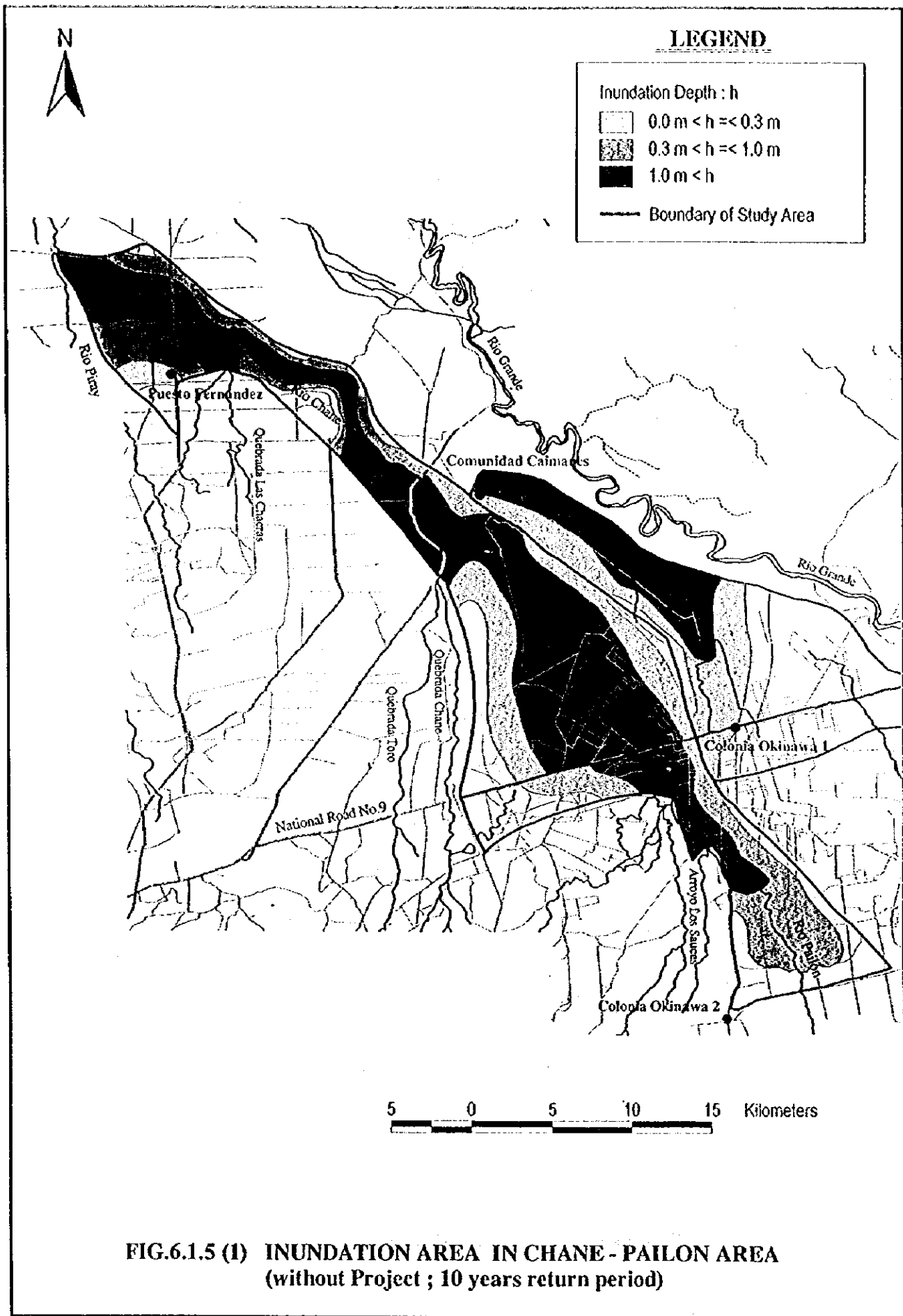


FIG.6.1.5 (I) INUNDATION AREA IN CHANE - PAILON AREA (without Project ; 10 years return period)

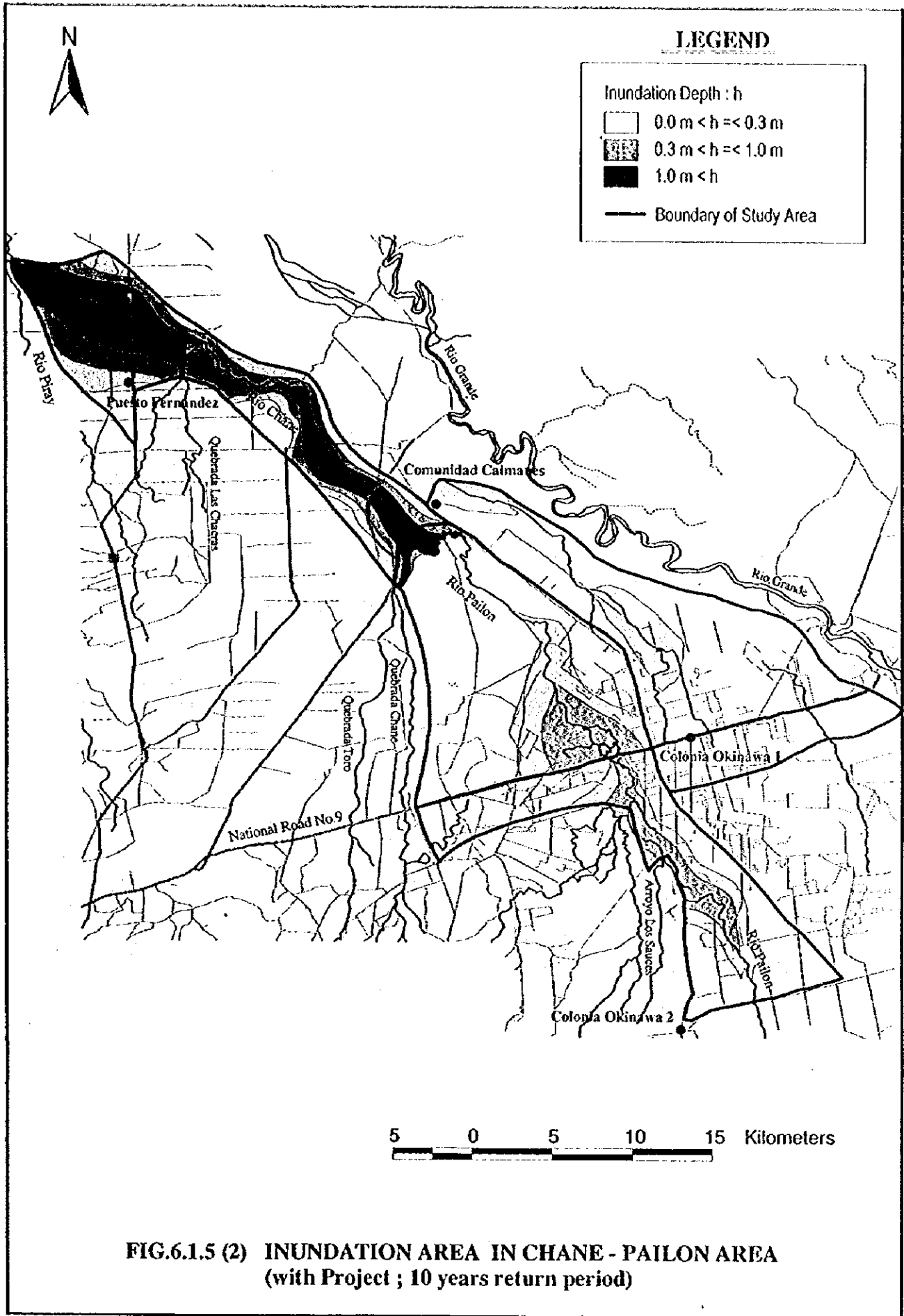






FIG.6.1.5 (2) INUNDATION AREA IN CHANE - PAILON AREA (with Project ; 10 years return period)



LEGEND

Inundation Depth : h	
	0.0 m < h ≤ 0.3 m
	0.3 m < h ≤ 1.0 m
	1.0 m < h
	Boundary of Study Area





**FIG.6.1.6 (1) INUNDATION AREA IN SAN JUAN-ANTOFAGASTA AREA
(without Project ; 10 years return period)**




LEGEND

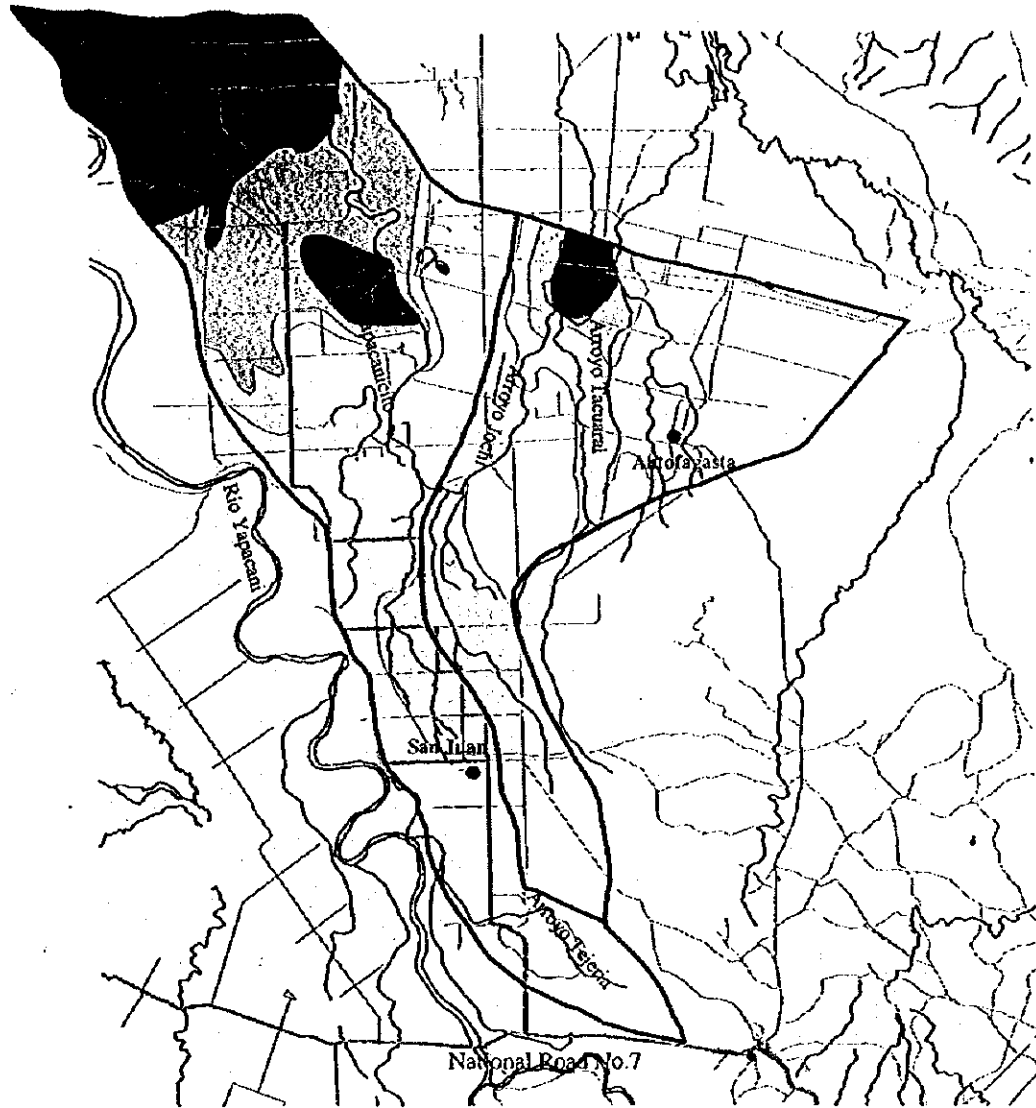
Inundation Depth : h

 0.0 m < h ≤ 0.3 m

 0.3 m < h ≤ 1.0 m

 1.0 m < h

 Boundary of Study Area



5 0 5 10 15 Kilometers

**FIG.6.1.6 (2) INUNDATION AREA IN SAN JUAN-ANTOFAGASTA AREA
(with Project ; 10 years return period)**



Study Area

Road
River

Drainage Problem Area

Class II_IV

Class V_VII

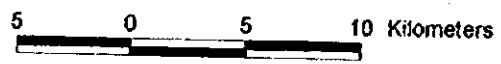
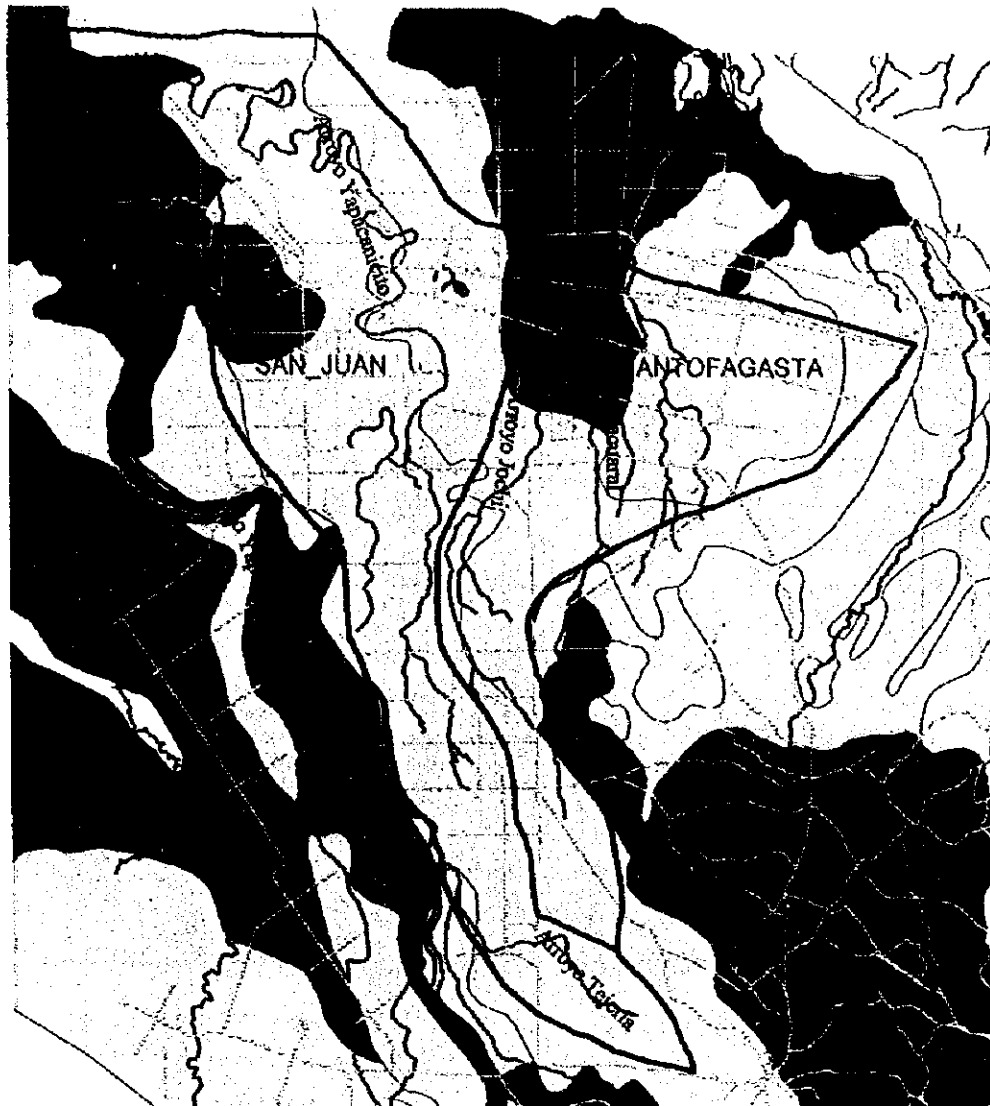


FIG.6.2.1(I) DRAINAGE CONDITION OF THE STUDY AREA (CHANE-PAILON AREA)



Study Area

Road
River

Drainage Problem Area

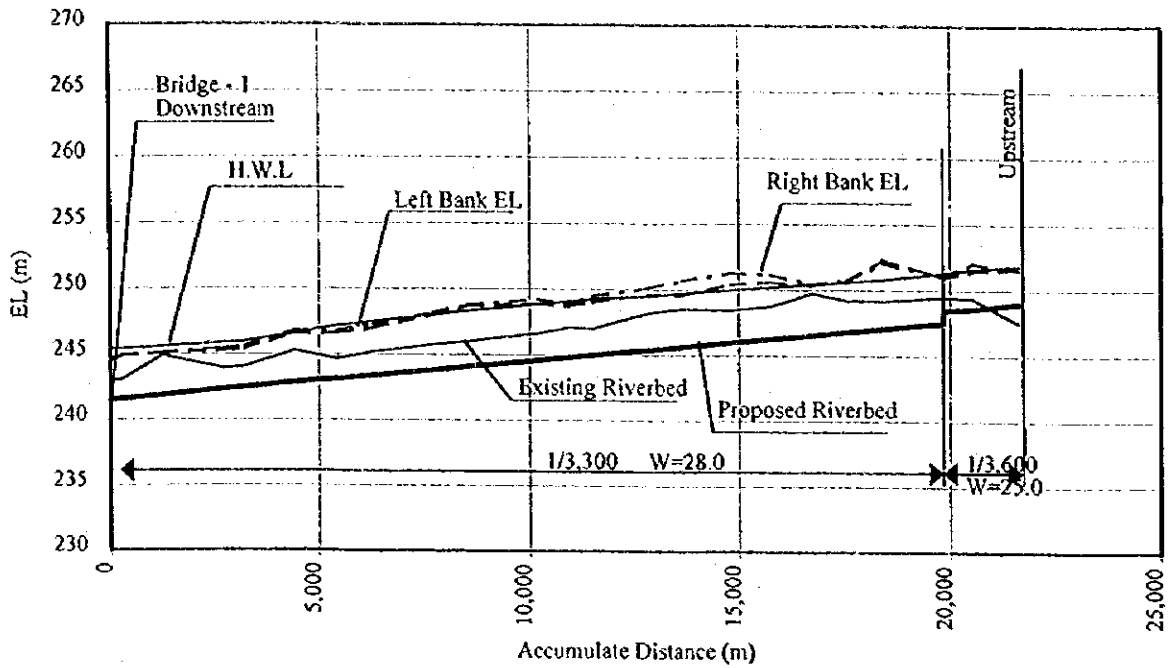
Class II_IV

Class V_VII

5 0 5 10 Kilometers

FIG.6.2.1(2) DRAINAGE CONDITION OF THE STUDY AREA
(SAN JUAN-ANTOFAGASTA AREA)

Okinawa Main Drainage



Rancha Chico

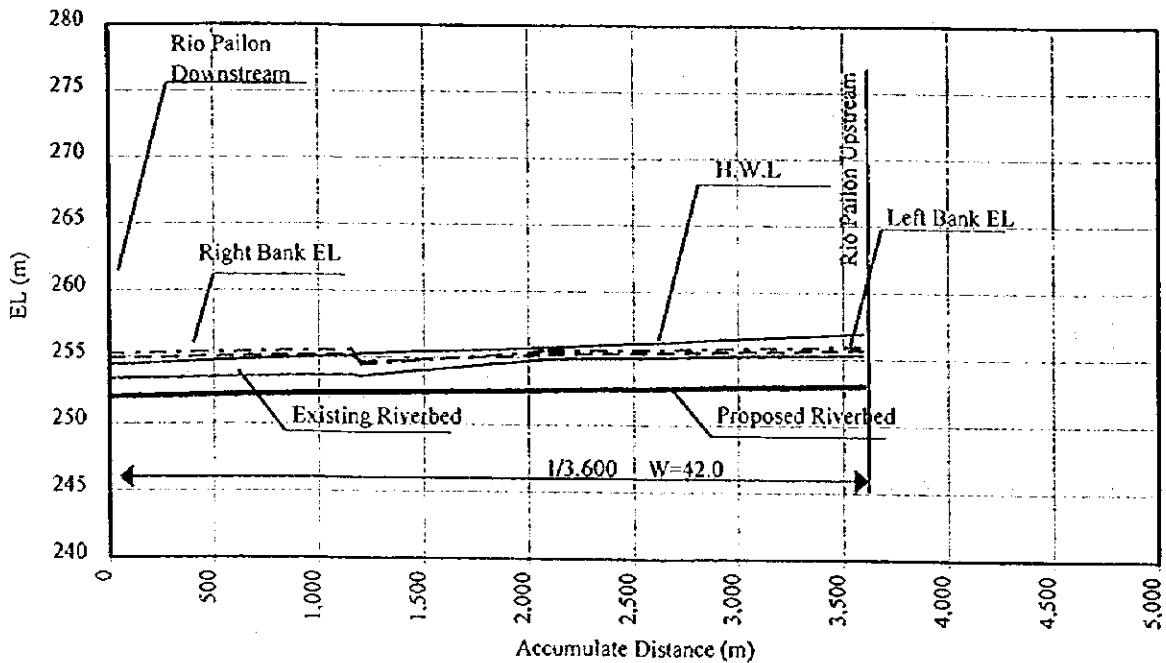
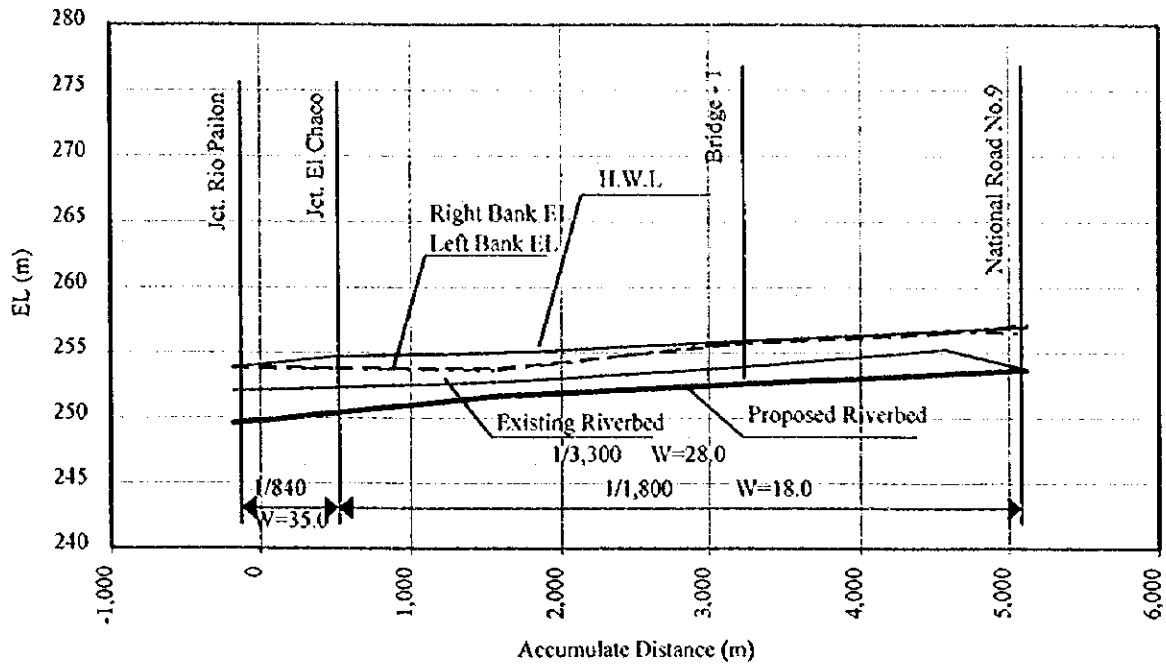


FIG. 6.2.2 (1) LONGITUDINAL PROFILE OF DRAINAGE IMPROVEMENT

El Empalme II



El Chaco

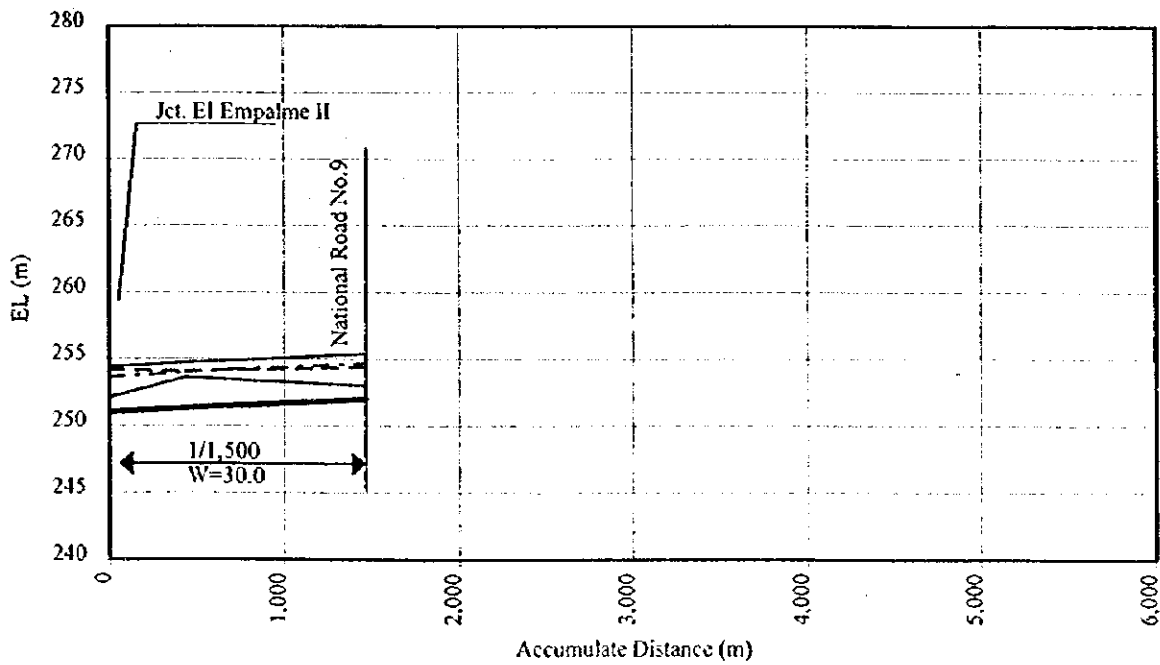
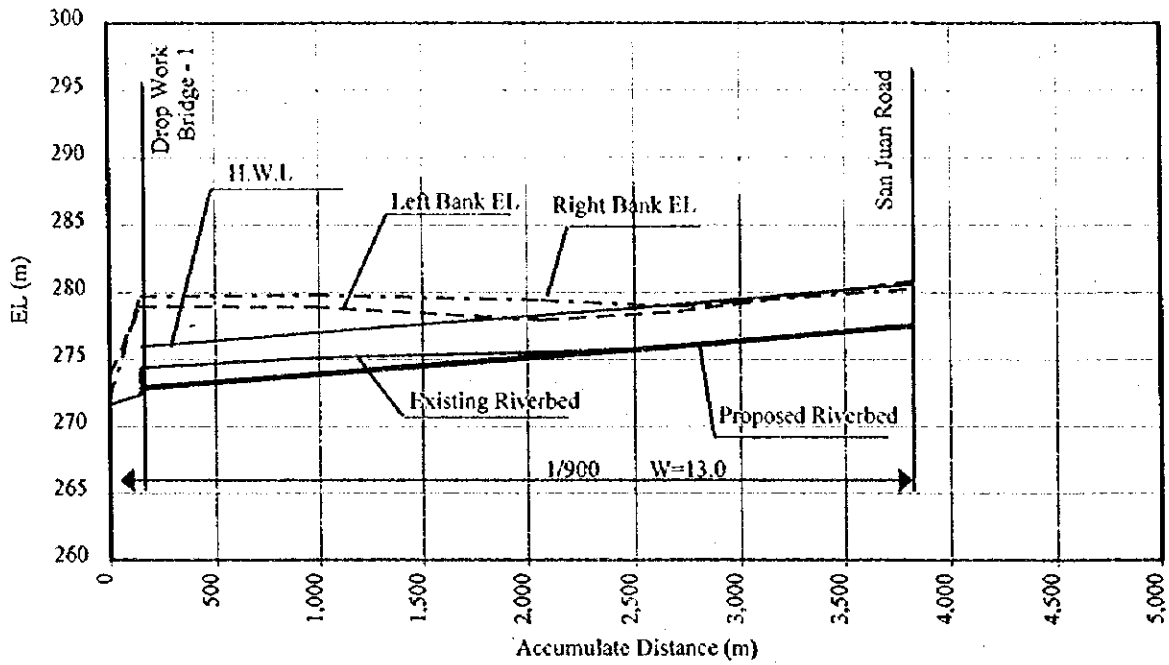


FIG. 6.2.2 (2) LONGITUDINAL PROFILE OF DRAINAGE IMPROVEMENT

San Juan Main Drainage km 13



San Juan Main Drainage km 17

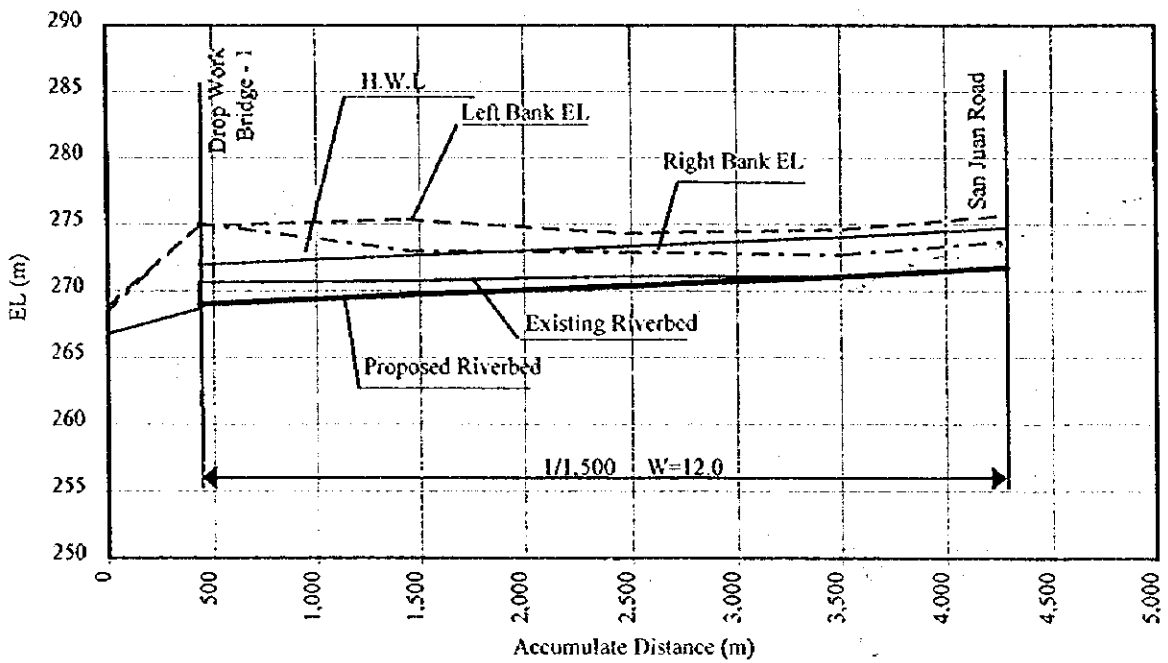
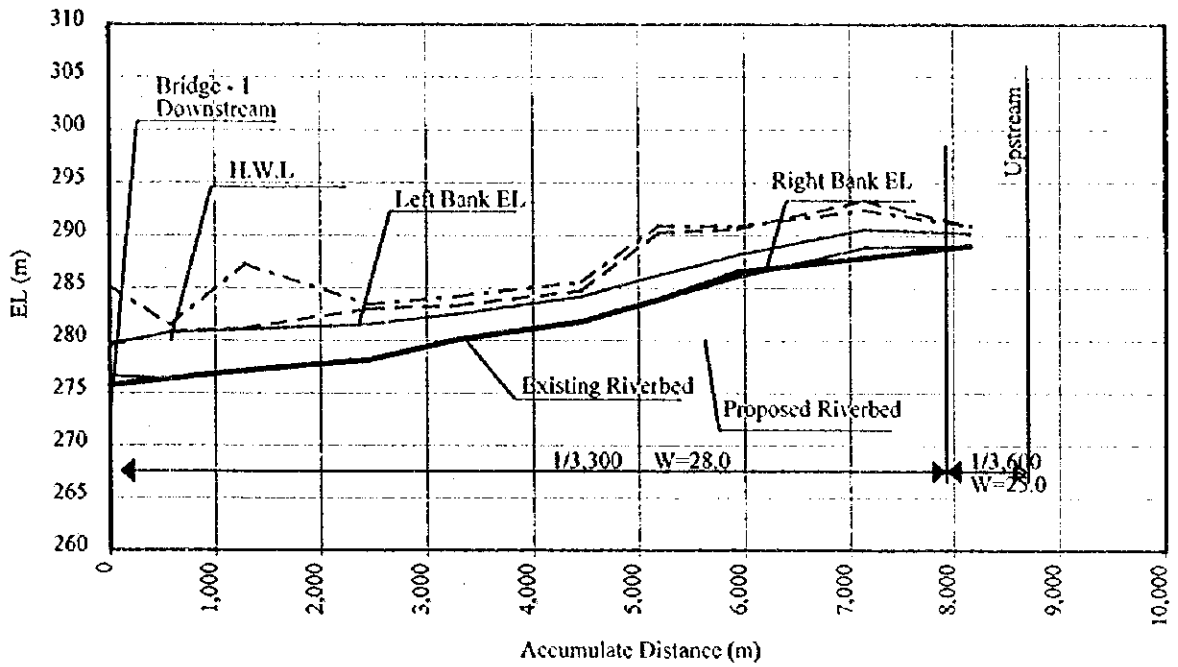


FIG. 6.2.2 (3) LONGITUDINAL PROFILE OF DRAINAGE IMPROVEMENT

Arroyo Tejeria



Antofagasta Main Drainage

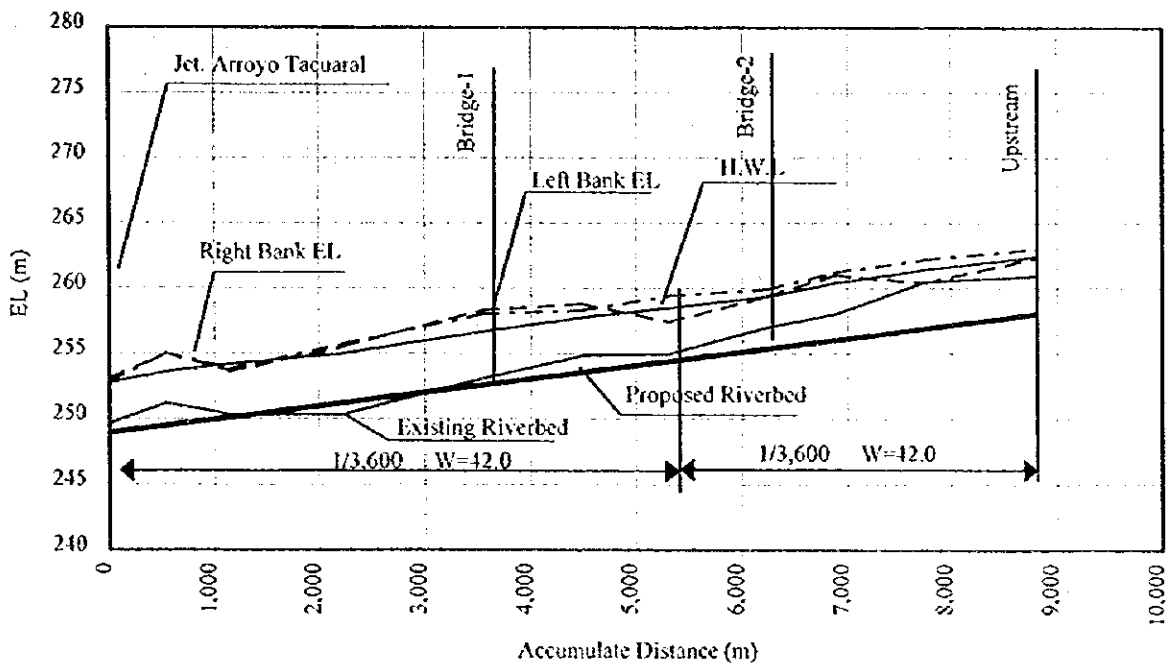


FIG. 6.2.2 (4) LONGITUDINAL PROFILE OF DRAINAGE IMPROVEMENT

5 0 5 10 15 20 Kilometers

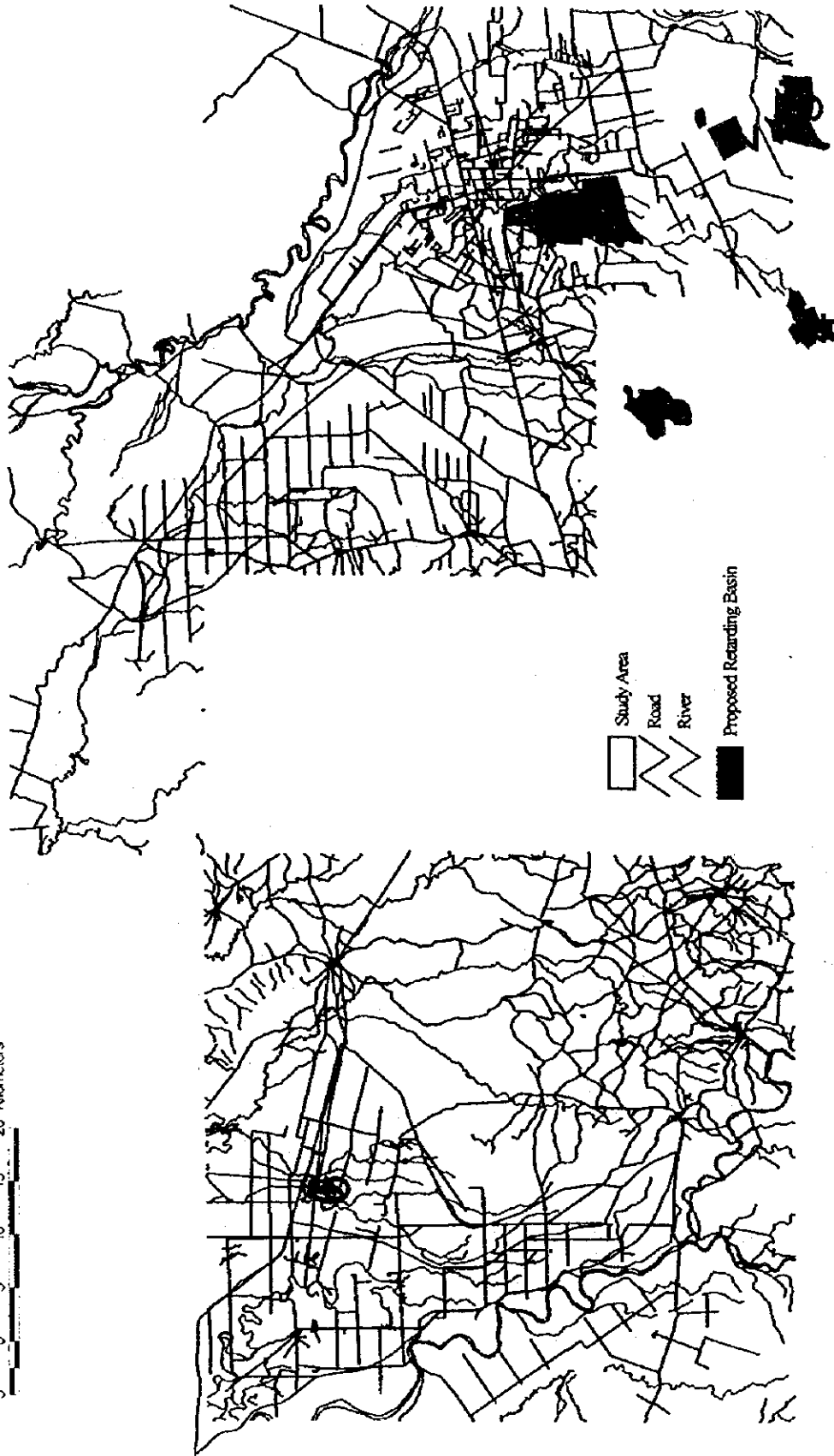
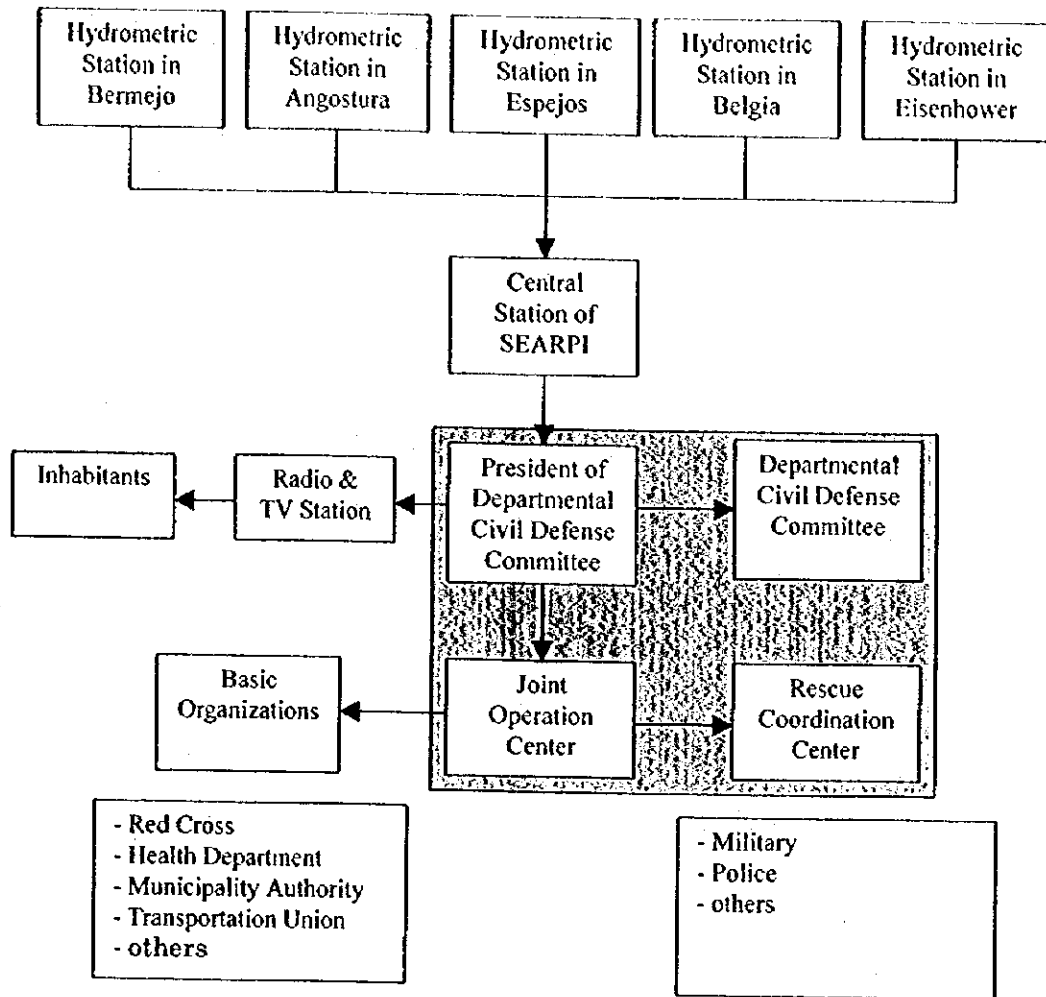


FIG.6.4.1 PROPOSED RETARDING BASINS




 To be integrated into the new Operation Center of Departmental Emergency under the prefecture level Civil Defense on 1998.

FIG.6.4.2 INFORMATION AND ACTION NETWORK FOR EMERGENCY ACTION PLAN FOR FLOOD OF RIO PIRAL

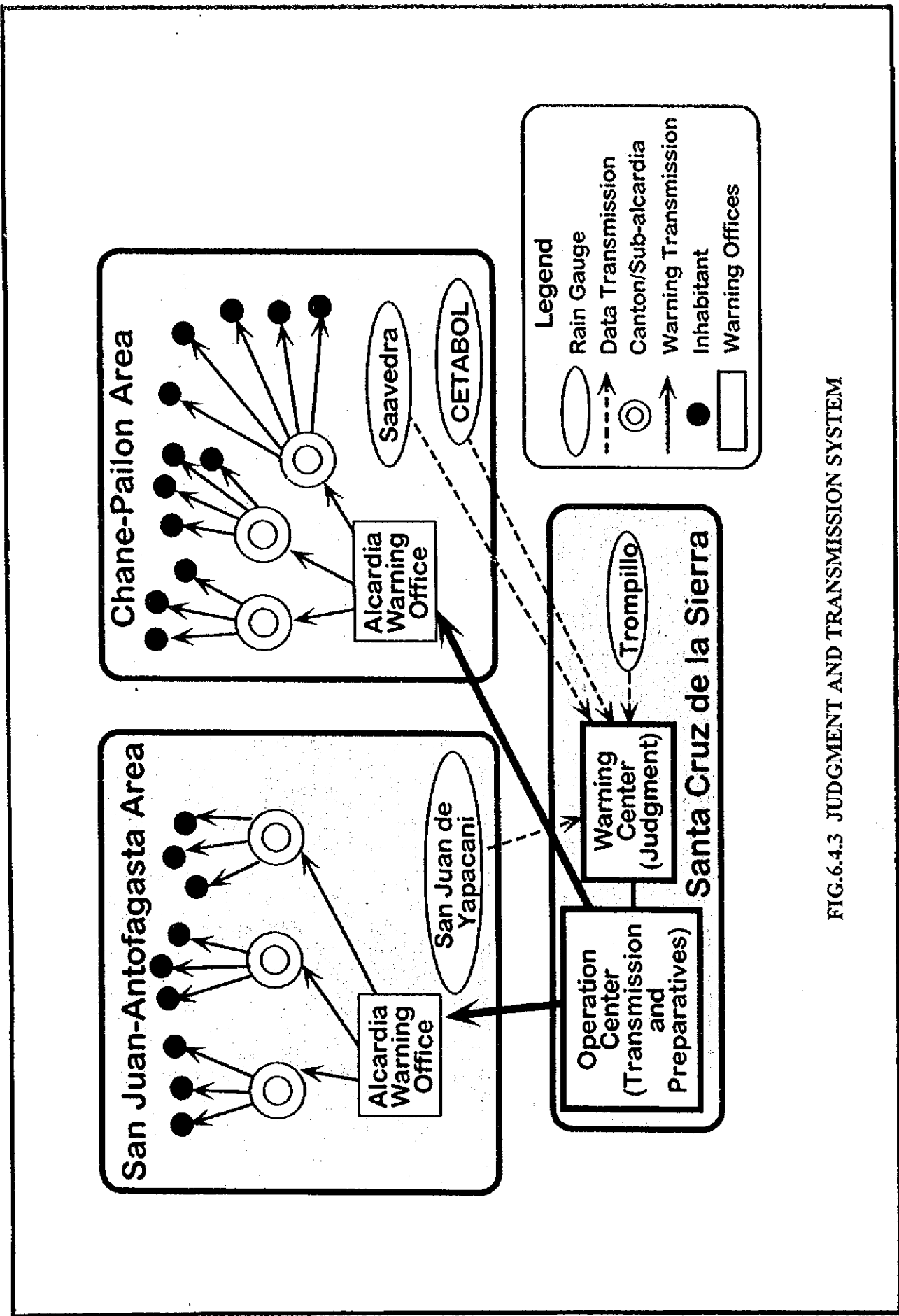


FIG.6.4.3 JUDGMENT AND TRANSMISSION SYSTEM

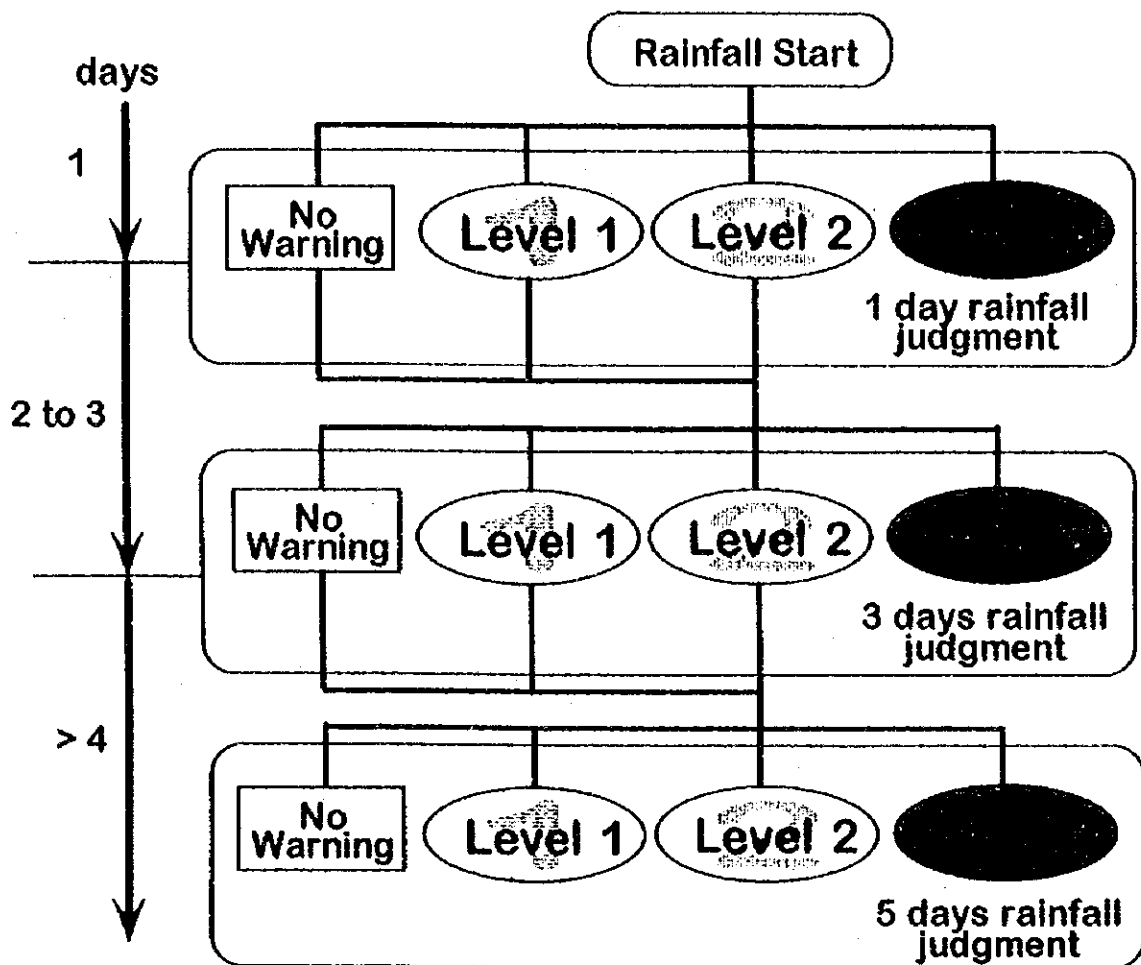
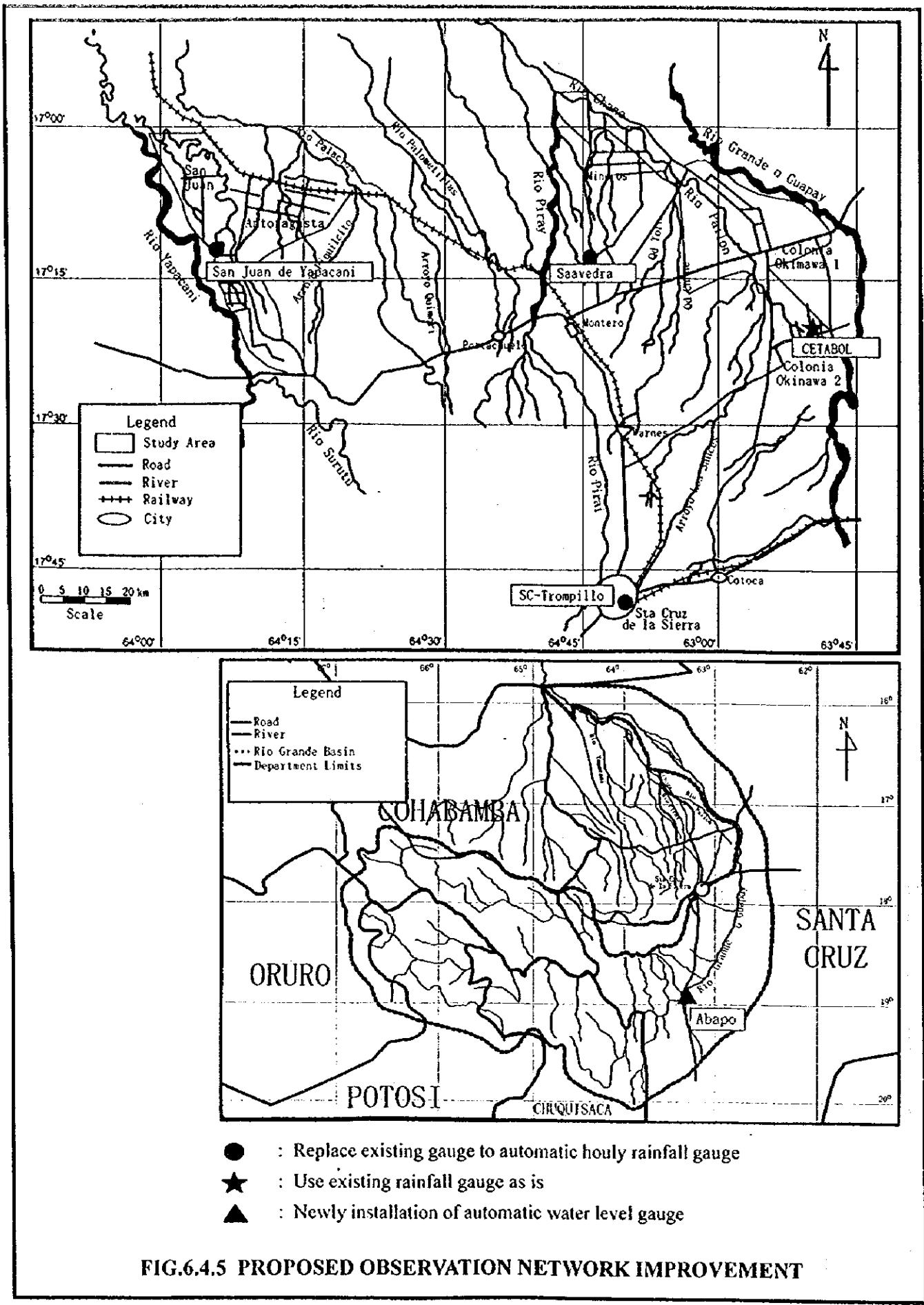


FIG.6.4.4 WARNING JUDGMENT PROCESS



SCALE



0 Km. 10 Km. 20 Km.

1 : 500,000.00

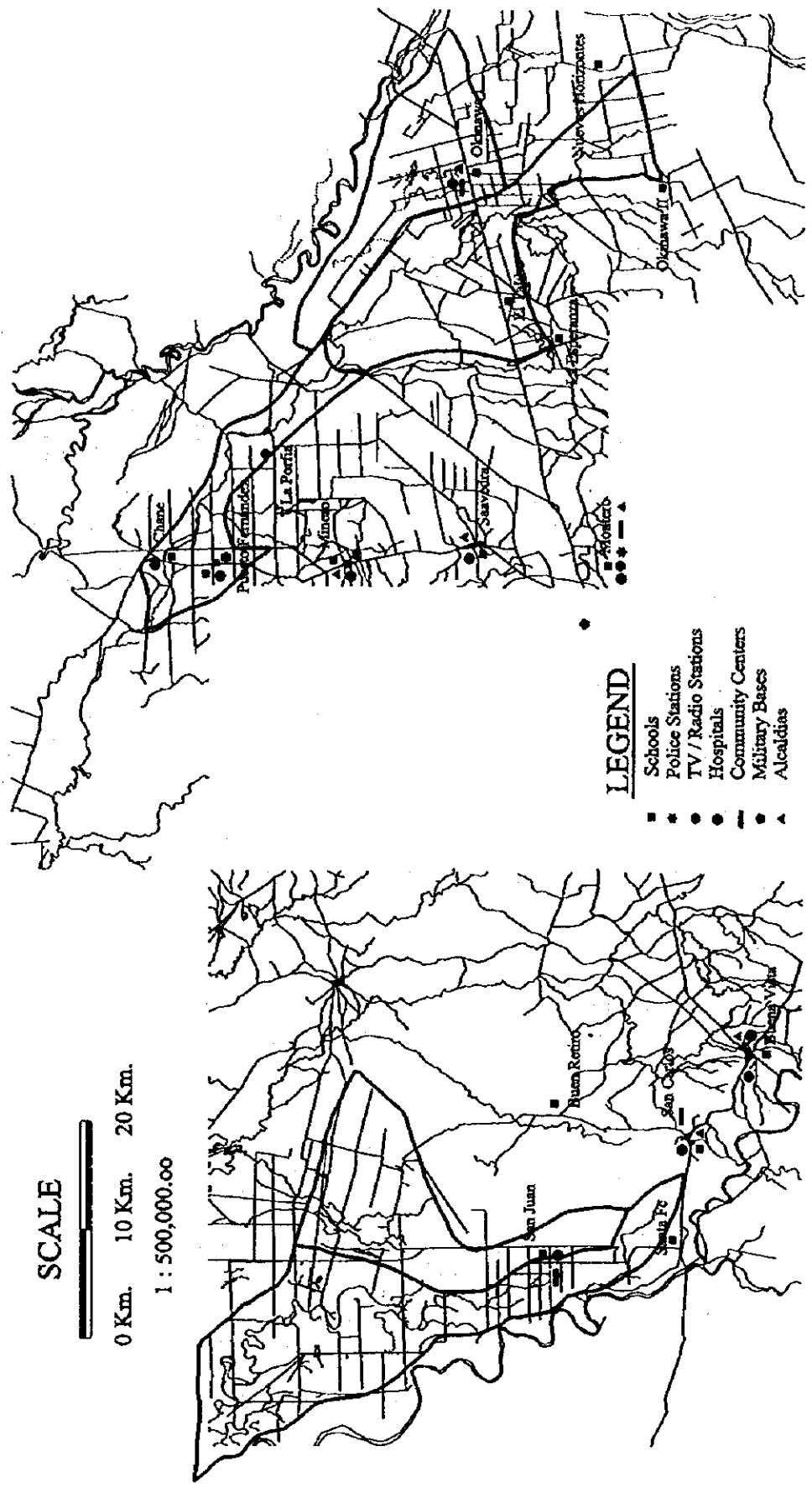


FIG.6.4.6 MAJOR PUBLIC FACILITIES IN AND AROUND THE STUDY AREA

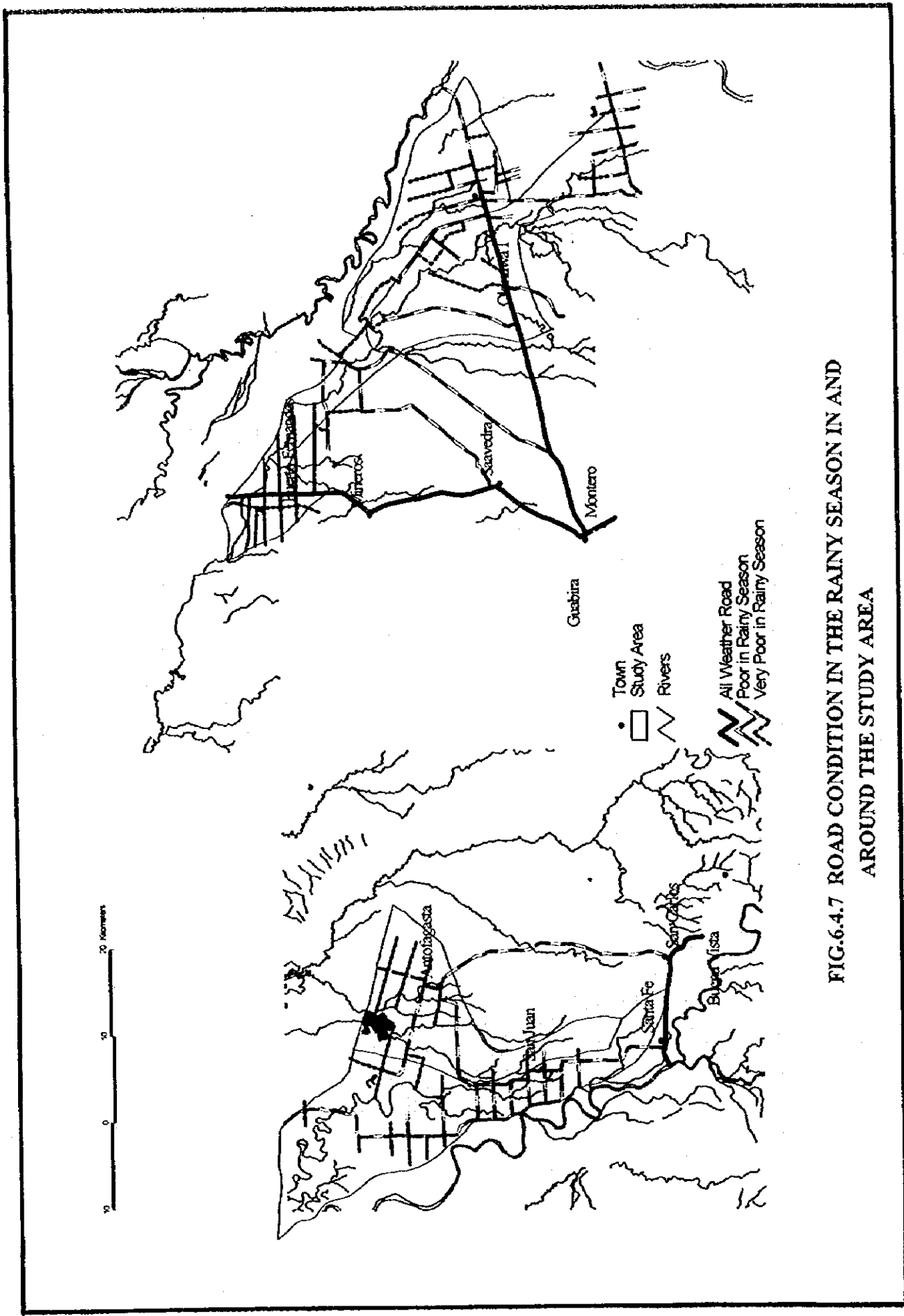


FIG.6.4.7 ROAD CONDITION IN THE RAINY SEASON IN AND AROUND THE STUDY AREA

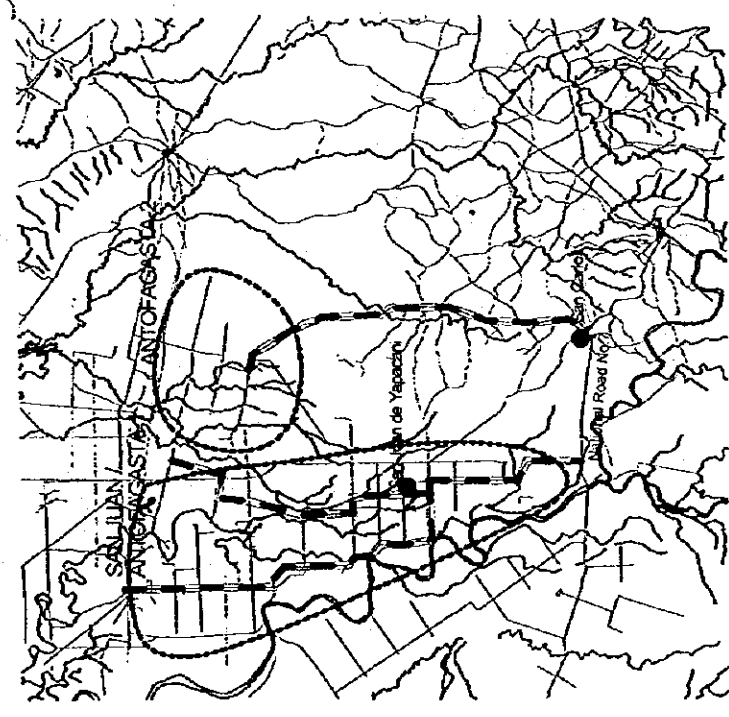
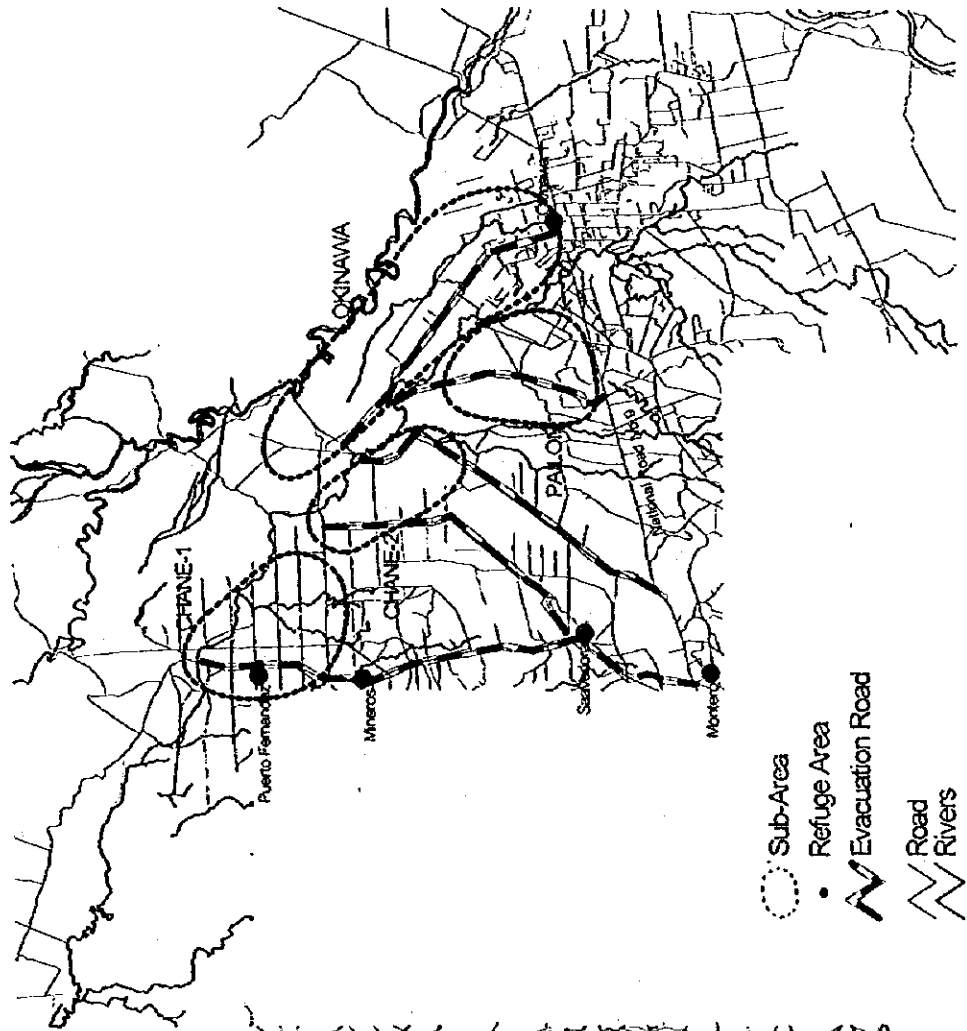
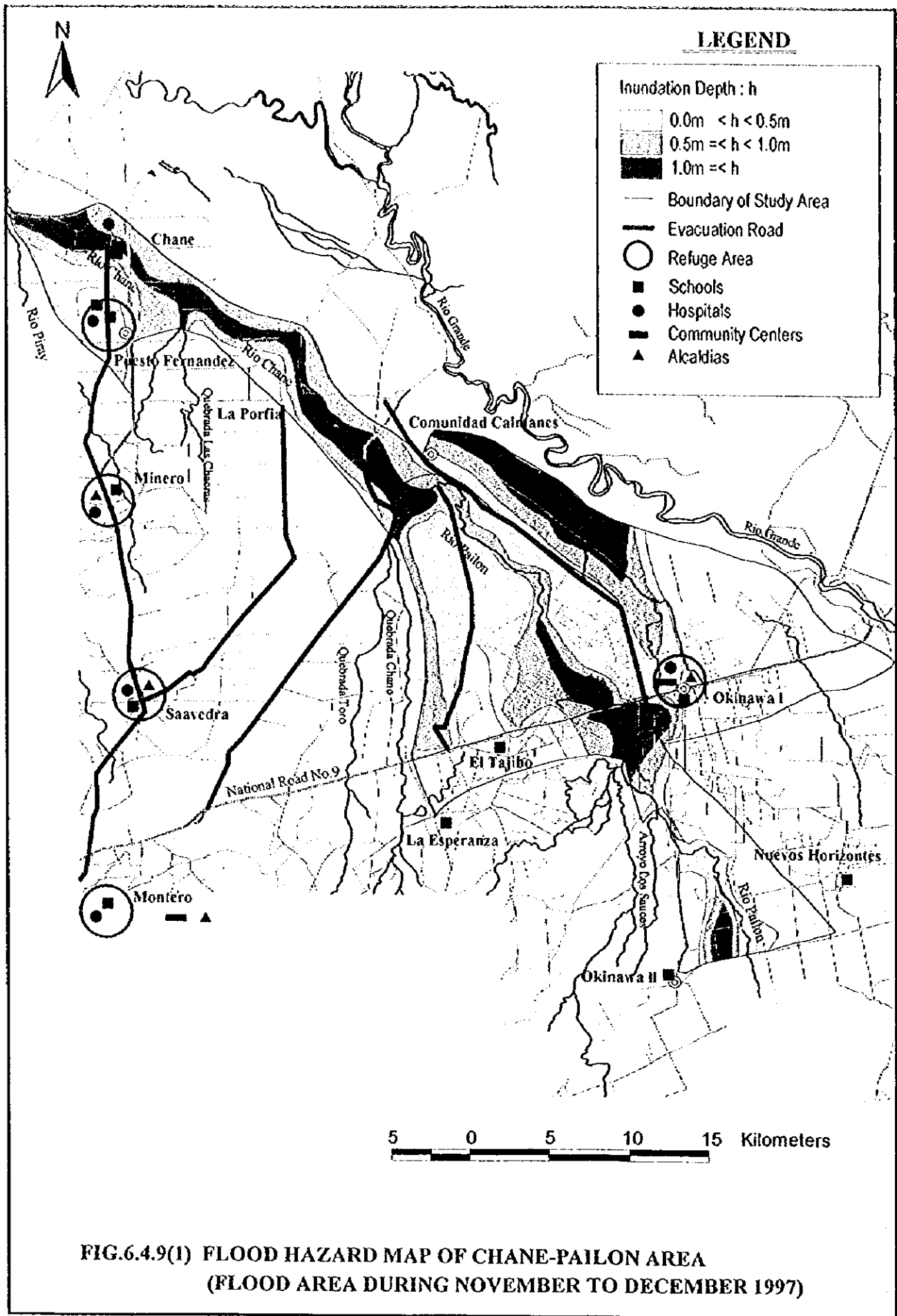
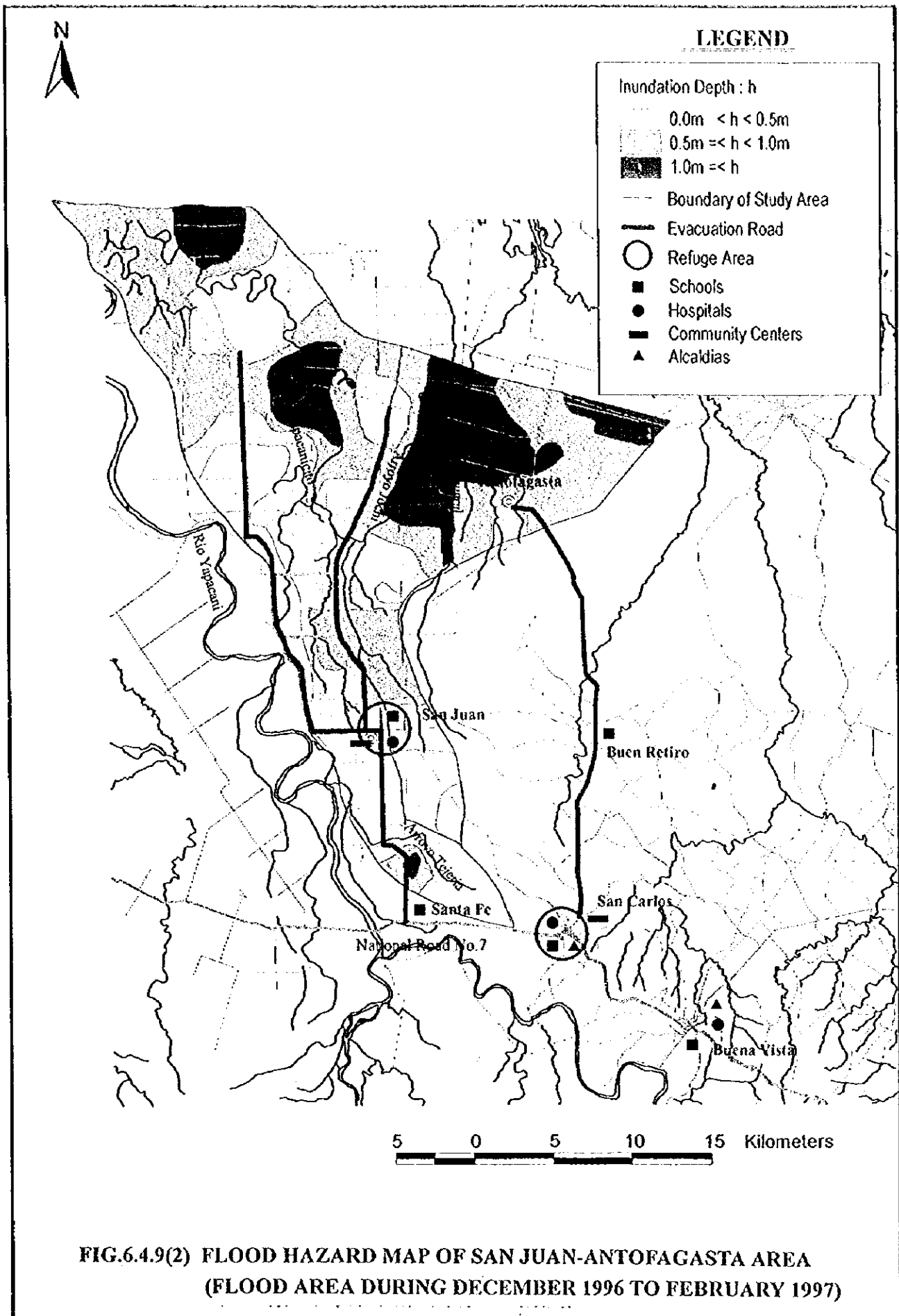


FIG.6.4.8 PROPOSED EVACUATION PLAN





CHAPTER 7
ENVIRONMENTAL STUDY

CHAPTER 7 ENVIRONMENTAL STUDY

7.1 Environmental Regulation

The Environmental Law (Ley General del Medio Ambiente, DL 1333 del April 27, 1992) is the initial document to deal with the environmental issues in a global and systematic manner. Objective of the law is the protection and conservation of the natural environment and resources.

The law consists of the following regulations (Reglamento):

- Environmental control,
- Environmental conservation,
- Air pollution,
- Water pollution,
- Radioactive dangerous objective.

Other related laws are as follows:

- The forest law (Promulgation in 1996),
- The mining law (Promulgation in 1925),
- The law of decentralization (Promulgation in 1996).

Main regulation related to the Study is described as follows:

7.1.1 Regulation of Environmental Impact Assessment

The regulation of the environmental impact assessment is enacted in the Article 25 of the Environmental Law. According to the regulation, all projects or activities, irrespective of public or private, require an environmental sheet (Ficha Ambiental) and must be classified as follows.

Category I	:	Require integrated EIA
Category II	:	Require specific EIA
Category III	:	Require no EIA but advisable conceptual EIA
Category IV	:	Require no EIA

The National Secretary of Natural Resources and Environment, Ministry of Sustainable Development and Planning, is in charge of the classification. The environmental unit of

the departmental office has been responsible for it since 1997, after the decentralization. However, the Ministry evaluates only the project implemented by the department to avoid the same organization both for the implementation and for the evaluation.

7.1.2 Regulation of Land Use

The Article 35 of the New Forest Law (Nueva Ley Forestal No. 1700, del 12 de Julio de 1996) regulates a right to use land for conservation and sustainable use of the natural resources. The areas regulated by the Act in the Study Area are as follows:

- Humid soil, swamps, marsh and their 50 meters around, except temporary flooding area,
- 20 meters on both banks of the flooded stream,
- 100 meters of both banks of the flooded river.

7.2 Environmental Organizations

The organization of the department in charge of environment is attached to the Natural Resource and Environmental Direction, consisting of following six divisions and main roles of the divisions are as follows:

(1) Natural Resources and Territorial Arrangement Division

- Coordinating and supervising national and departmental policies of environment,
- Integrated management of protected areas, bio-diversity and river basin.

(2) Environmental Education Inspection and Follow Up Division

- Implementing environmental education and inspection for appropriate use of natural resources.

(3) Environmental Management Division

- Evaluating Ficha Ambiente,
- Monitoring of air, water and soils.

(4) Forestry Division

- Management and development of forest resources for the sustainable use,

- Investigation of forest species.
- (5) Irrigation Division
- Research and development of irrigation.
- (6) Native Affairs and Originally People Division.
- Providing supporting services for consolidation of the native municipal districts,
 - Studying characteristics of native costumes.

The evaluation of the F.A. by the Environmental Management Division has started since 1997 after decentralization. The Division categorized 180 cases of F.A. by 1998.

7.3 Environmental Impact Assessment

In accordance with the environmental law, the environmental impact assessment (Ficha Ambiental) of the project was prepared by the Study Team and was categorized by the Ministry of Sustainable Development and Planning. The screening sheet by project and results of the categorization are shown in the Supporting Report G.

The Ministry evaluated the project as in the category III, which does not require the Environmental Impact Assessment (EIA). According to the results, however, the Program of Prevention and Mitigation or PPM (Programa de Prevencion y Mitigacion) and the Plan of Environmental Application and Follow Up or PASA (Plan de Aplicacion y Seguimiento Ambiental) under the Articles from 29 to 32 in the regulation of prevention and control of environment, should be prepared during the final design stage to get an official permission for the implementation from the Ministry. The results also pointed out items to be considered in the feasibility study and detail design stages. The contents are described in the Supporting Report G.

It is recommended that the Department should prepare the official documents of the PPM, the PASA and the response of the items in accordance with the regulations and present to the Ministry to get the permission for the implementation.

CHAPTER 8
COST ESTIMATE AND CONSTRUCTION PLAN

CHAPTER 8 COST ESTIMATE AND CONSTRUCTION PLAN

8.1 Cost Estimate

8.1.1 Basic condition

The project cost is considered in general to compose of the following categories:

- Direct cost : Construction cost
- Indirect cost : Administration cost
Engineering service cost
Operation and maintenance cost
- Contingency : Physical contingency

The project cost was estimated based on the following criteria:

- The cost was calculated based on the market price in August 1998,
- The labor cost, material cost and the equipment unit cost included the value added tax 13%,
- The cost estimate method was in principle same as that used in the Master Plan,
- The cost was divided into the local and foreign currency portions,
- The currency exchange rate used for currency conversion purpose was
US\$ 1.0 = Bolivian Bs 5.50 = Japanese Yen 117.

The construction cost was composed of the main items as follows:

(1) Direct Construction Cost

The direct construction cost is the cost used directly for the earthwork and construction works of the structures. The earthwork includes clearing, grubbing, excavation, transportation, slope forming, construction of the operation road and reforestation. The construction of structures includes the construction of bridges and culverts.

(2) Preparation Cost

The preparation cost is the cost needed before the construction to set and clear up the construction site.

(3) Indirect Cost

The indirect cost is the cost apart from the direct and preparation cost. The estimate of this cost is in the proportional to the direct cost as follows:

- | | |
|--------------------|----------------------|
| 1) Unforeseen cost | (5% of direct cost) |
| 2) Overhead charge | (10% of direct cost) |
| 3) Profit | (15% of direct cost) |

8.1.2 Unit Cost and Compound Unit Cost

The labor cost, material cost and the unit cost for the equipment were calculated based on the cost investigation conducted in this Study, the Department of Santa Cruz and other concern organizations. The compound unit cost was considered as the summation of the labor cost, material cost and the equipment cost. The details of the unit cost are shown in the Supporting Report D, a summary is shown in Table 8.1.1.

8.1.3 Currency Portion

The currency portion is classified into the foreign and local currencies as follows:

(1) Foreign Currency Portion:

- Imported equipment, material and supplies,
- Domestic materials which were imported to the country,
- Wages of expatriate personnel and
- Overhead and profit of foreign firms.

(2) Local Currency Portion:

- Domestic materials which were exported from the country,
- Wages of local personnel,
- Overhead and profit of local personnel and
- Overhead and profit of local firms.

The portions of each component are as follows:

Item	L.C (%)	F.C (%)
(a) Labor price	100	0
(b) Equipment price	0	100
(c) Material Cost		
Fuel	100	0
Cements	100	0
Structure Steel	0	100
Gabion Mat Net	0	100
Gravel and Sand	100	0
PVC-Pipe	0	100

8.1.4 Construction Cost Estimate

The construction cost was estimated from the quantities multiplied by the unit cost as shown in the bill of quantities in the Supporting Report - D. This cost included the cost for the river and drainage improvement and the construction of road-cum-embankment. However, for the bridges and box culverts, the construction cost was estimated from the cost-curve prepared by using the data from the investigation.

8.1.5 Administration Cost

The administration cost included the cost of project management and supervision. This cost was estimated at 5 % of the construction cost and considered as a part in the local currency.

8.1.6 Engineering Service Cost

The engineering service cost covered the cost for the detailed design and the construction supervision by the consultants. This portion was about 10% of the construction cost. The ratio of the detailed design and construction supervision is 60% and 40%.

8.1.7 Contingency

(1) Physical Contingency

The physical contingency was set up to cope with some unpredictable conditions during the project implementation. A 15% of construction cost was set for this.

(2) Price Contingency

The price contingency was set up for to cope with the inflation during the project implementation. From the investigation, the price contingency was estimated at 4% per annual for the foreign currency and 7% for the local currency.

8.1.8 Operation and Maintenance Cost

The operation and maintenance cost was considered as the cost for the routine operation and maintenance. This cost was estimated at 1% of the construction cost.

8.1.9 Project Cost

The project cost is estimated as shown in Table 8.1.2 and summarized as follows:

Project	Local Bs.	Foreign Bs.	Total Bs.
The Chane - Pailon Area			
Rio Chane	91,434,000	143,193,000	234,627,000
Rio Pailon	143,084,000	231,073,000	374,157,000
Okinawa Drainage	32,120,000	57,680,000	89,800,000
Total	266,638,000	431,946,000	698,584,000
The San Juan - Antofagasta Area			
San Juan	45,724,000	61,826,000	107,550,000
Antofagasta	40,990,000	59,372,000	100,362,000
Total	86,714,000	121,198,000	207,912,000
Grand Total	353,352,000	553,144,000	906,496,000

* : Project cost consists of construction cost, administration cost, engineering cost and physical contingency.

8.2 Construction Plan

8.2.1 Basic Condition of Construction Plan

The basic conditions for determining the construction plan are as follows:

- The construction works of the proposed projects is to be completed within ten (10) years from 2001,
- The urgent works are to be commenced within five (5) years from 2001,
- The major construction works are planned to utilize the heavy equipment.

8.2.2 Major Construction Works

According to the preliminary design of the river and drainage improvement works, the major quantities of works for respective projects and sub-projects are shown below:

Work Item	Area Basin	Chané - Pailon			San Juan - Antofagasta	
		Rio Chané	Rio Pailon	Okinawa Drainage	San Juan	Antofagasta
River Improvement						
Soil Excavation (1,000m ³)		5,638	9,196	0	689	720
Bridge Construction		4	1		1	3
Road-cum-embankment						
Soil Filling (1,000m ³)					163	
Drainage Improvement						
Soil Excavation (1,000m ³)		0	398	1,838	235	433
Bridge Construction		0	1	1	3	2
Secondary Drainage						
Soil Excavation (1,000m ³)		0	416	799	998	998
Culvert Construction		0	9	17	18	21

8.2.3 Construction Method

The major work for the river and drainage improvement is soil excavation with no rock materials, therefore, all construction works except for the bridge construction are basically carried out by the conventional methods and equipment. Since the quantity of work is large, major works are planned to carry out by heavy equipment.

The basic concept of the disposal of excavated materials is as follows:

- The space for the spoiled bank from the excavation in the river improvement is prepared within one-km distance along each side of the riverbank,
- The space for the spoiled bank from the excavation in the drainage improvement is to be prepared within 0.5-km distance along each side of the riverbank,
- The excavated materials from the secondary drainage development are to be discarded onto the peripheral farmland along the drainage without transportation.

8.2.4 Land Acquisition and Protected Forest

In accordance with the New Forest Law of Bolivia, the rights of individuals to use the land with 20 - 100 m wide along both banks are controlled by the aspect of conservation and sustainable use of the natural resources. The land acquisition or compensation is not needed in the construction works of the project, since the necessary width of the river and drainage improvement works are covered by above regulated area.

The forests along the rivers proposed for the improvement are protected by the above regulation. Hence, when the protected forests are required to be cut due to the construction works, reforestation is necessary to maintain the adequate width of the protected forest.

8.2.5 Construction Schedule

(1) Basic Concept of Construction Schedule

Determination of the construction schedule of the projects is based on the following criteria:

- The period from 1999 through 2000 is set for the preparation period,
- Each project is categorized into two priority groups, i.e., the first priority group and the second priority group,
- The first priority group will be implemented from the year 2001 to 2005, and the second priority group will be implemented from the year 2006 to 2010.

(2) Study on Project Phasing

The project phasing was studied comprehensively from the impact by works, the quantity of works and the technical aspect. The major points considered are as follows:

- 1) From the impact:
 - The impact of each project was studied based on the increment of the inundation area less than 30 cm by the project, which is shown in Table 8.2.1,
 - The large impacts with the projects are expected for the Rio Pailon basin, the Okinawa Drainage basin, the Arroyo Yapacanicito basin including the San Juan Main Drainage basin and the Arroyo Jochi basin,
 - The impacts are expected comparatively to be small for the Rio Chane basin, the Arroyo Tejeria basin, the Arroyo Tacuaral basin and the Antofagasta Main Drainage basin.

- 2) From the quantity of works:
 - The improvement of the Rio Chane and the Rio Pailon should be started as soon as possible because of their large amount of earth works.

- 3) From the technical aspects
 - The Rio Chane and the Rio Pailon should be improved as a single river reach. The river improvement works should be implemented from the lower reach to the upper reach in order to reduce the negative impact along the lower reach,
 - The drainage channels to the bridges on the National Road No.9 should be implemented together with or after the river improvement for the Rio Pailon,
 - The road-cum-embankment in the San Juan – Antofagasta Area should be implemented together with the river improvement of the Arroyo Jochi in order to avoid any negative impact to the area along the Arroyo Jochi,
 - The Antofagasta Main Drainage should be implemented after the river improvement of the Arroyo Tacuaral because the drainage is to discharge to the Arroyo Tacuaral.

As a result of the study, the projects were phased as follows:

The First Priority Group	The Secondary Priority Group
1) River Improvement - Rio Chanc - Rio Pailon - Arroyo Jochi	- Arroyo Yapacnicito - Arroyo Tacuaral
2) Road-cum-embankment - Road-cum-embankment	
3) Drainage Improvement - Okinawa Drainage - San Juan Main Drainage (km 13, km 17)	- Ranch Chico - El Chaco - El Empalme II - San Juan Main Drainage (km 11, km 15, km 24, km 28) - Arroyo Tejeria - Antofagasta Main Drainage

(3) Proposed Construction Schedule

The proposed construction schedule is shown in Table 8.2.2.

TABLES

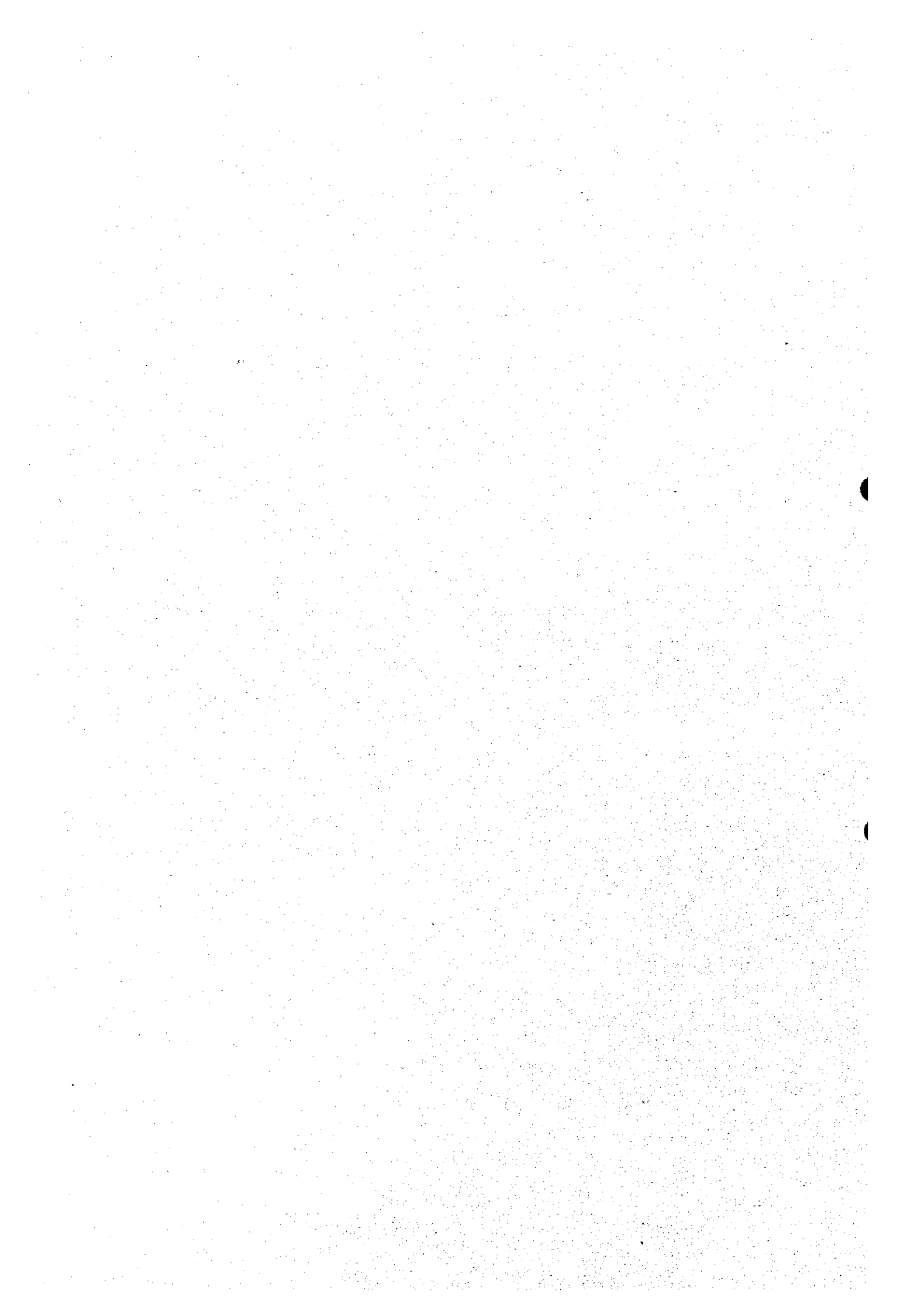


TABLE 8.1.1 SUMMARY OF CONSTRUCTION UNIT COST

Unit : Bs.

No.	Item	Specification	Unit	Unit Cost			Reference
				L/P	P/P	Total	
B-1	Truck Operation	10T	hour	53.47	88.00	141.47	
B-2	Concrete Pump Truck	90-110m3/H	hour	69.75	345.42	415.17	
E-3	Tracktor Shovel	1.8 m3	hour	37.26	222.00	259.26	
E-4	Water Truck	10.0 m3	hour	191.27	145.00	336.27	
E-5	Concrete Plant Operation	30M3	hour	19.92	17.23	37.15	
E-6	Macadam Roller	10.0 T	hour	59.96	114.00	173.96	
E-7	Motor Grader	3.1M	hour	57.38	134.00	191.38	
E-8	Buck Hoe	0.6m3	hour	79.62	203.00	282.62	
E-9	Dump Truck	11T	hour	51.50	91.00	142.50	
E-10	Rubber Tire Roller	8-20T	hour	48.95	121.00	169.95	
E-11	Tamper Operation	60kg	day	82.46	48.00	130.46	
E-12	Bulldozer	15T	hour	87.93	224.00	311.93	
E-13	Clamshell	0.6 m3	hour	76.38	223.00	299.38	
E-14	Truck Crane	15T	hour	45.29	244.00	289.29	
M-1	Concrete Mixing	$\sigma = 180(\text{kg}/\text{cm}^2)$	m3	352.88	17.23	370.11	
M-2	"	$\sigma = 240(\text{kg}/\text{cm}^2)$	m3	434.69	30.83	465.52	
M-3	"	$\sigma = 350(\text{kg}/\text{cm}^2)$	m3	507.99	56.33	564.32	
W-1	Clearing & Grubbing	Dozer & Hoe	m2	1.40	2.31	3.71	
W-2	Excavation	Bulldozer 15T	m3	1.15	2.93	4.08	
W-3	Excavation	Buckhoe 0.6m3	m3	2.08	5.32	7.40	
W-4	Road Base Course	t=20cm	m2	39.78	1.56	41.34	
W-4-S	Road Base Course	t=20cm	m2	19.85	1.56	21.41	San Juan
W-5	Road Base Course	t=15cm	m2	36.39	1.78	38.17	
W-5-S	Road Base Course	t=15cm	m2	18.35	1.78	20.14	San Juan
W-6	Slope Forming	Hoe 0.6m3	m2	5.49	6.50	11.99	
W-7-1	Surplus Soil Filling	Bulldozer 15T	m3	0.82	1.00	1.82	
W-7-2	Roadbed Compaction	Bulldozer 15T	m3	1.83	4.67	6.50	
W-8	Soil Transportation	L=0.5Km	m3	2.88	5.08	7.96	
W-8	"	L=1.0Km	m3	3.25	5.74	8.99	
W-8	"	L=2.0Km	m3	4.00	7.07	11.07	
W-8	"	L=3.0Km	m3	4.75	8.39	13.14	
W-8	"	L=4.0Km	m3	5.50	9.72	15.22	
W-8	"	L=5.0Km	m3	6.25	11.04	17.29	
W-9	Excavation Transportation	L=1.0Km	m3	6.48	13.99	20.47	
W-10	Base Layer Placing		m2	0.71	0.84	1.55	
W-11	Steel Bar Bend & Placing		ton	1,257.25	3,445.00	4,702.25	
W-12	Forming		m2	101.56	0.00	101.56	
W-13	Concrete Placing	$\sigma = 180\text{kg}/\text{cm}^2$	m3	383.82	57.18	441.00	
W-14	"	$\sigma = 240\text{kg}/\text{cm}^2$	m3	468.11	71.19	539.30	
W-15	"	$\sigma = 350\text{kg}/\text{cm}^2$	m3	547.57	113.85	661.42	
W-16	Concrete Curing		m3	8.80	0.00	8.80	
W-17	Gabion Mat	t=30cm	m2	220.16	54.78	274.94	
W-18	Foundation Bed Stone	Crushed	m3	256.35	0.00	256.35	
W-19	Excavation	Hoe 0.6m3	m3	2.19	5.58	7.77	
W-20	Embankment	Bulldozer t=20cm	m3	2.64	5.11	7.75	
W-21	Filling	Manpower	m3	25.24	13.48	38.72	

TABLE 8.1.2(1) PROJECT COST OF CHANE-PAILON

Item	L/C	F/C	Total	Unit : Bs.
				Reference
A. Construction Cost	194,883,000	333,346,000	528,229,000	
1. Rio Chane	67,089,000	110,323,000	177,412,000	
River Improvement of Rio Chane	67,089,000	110,323,000	177,412,000	
2. Rio Pailon	104,616,000	178,298,000	282,914,000	
1) Rio Pailon (downstream)	80,262,000	138,751,000	219,013,000	
2) Rio Pailon (upstream)	16,170,000	25,402,000	41,572,000	
3) Rancho Chico	2,087,000	4,046,000	6,133,000	
4) Chaco	294,000	551,000	845,000	
5) Empalme II	1,907,000	3,616,000	5,523,000	
6) Pailon Secondary Drainage	3,896,000	5,932,000	9,828,000	
3. Okinawa Drainage	23,178,000	44,725,000	67,903,000	
1) Okinawa Main Drainage	15,767,000	31,032,000	46,799,000	
2) Okinawa Secondary Drainage	7,411,000	13,693,000	21,104,000	
B. Administration Cost	26,412,000	0	26,412,000	
C. Engineering Cost	10,564,000	42,259,000	52,823,000	
D. Physical Contingency	34,779,000	56,341,000	91,120,000	
Subtotal	266,638,000	431,946,000	698,584,000	
E. Price Contingency	165,492,000	146,936,000	312,428,000	
Total	432,130,000	578,882,000	1,011,012,000	

TABLE 8.1.2(2) PROJECT COST OF SAN JUAN-ANTOFAGASTA

Item	L/C	F/C	Total	Unit : Bs.
				Reference
A. Construction Cost	64,399,000	92,813,000	157,212,000	
1. San Juan	34,067,000	47,256,000	81,323,000	
1) Arroyo Yapacanicito	12,083,000	16,159,000	28,242,000	
2) San Juan Main Drainage 1	2,245,000	4,163,000	6,408,000	km 13,17
3) San Juan Main Drainage 2	4,403,000	6,286,000	10,689,000	km 11,15,24,28
4) Arroyo Tejeria	2,173,000	4,039,000	6,212,000	
5) Road-cum-embankment	3,233,000	1,357,000	4,590,000	
6) San Juan Secondary Drainage	9,930,000	15,252,000	25,182,000	
2. Antofagasta	30,332,000	45,557,000	75,889,000	
1) Arroyo Jochi	8,425,000	10,486,000	18,911,000	
2) Arroyo Tacuaral	5,529,000	8,288,000	13,817,000	
3) Antofagasta Main Drainage	5,545,000	10,628,000	16,173,000	
4) Antofagasta Secondary Drainage	10,833,000	16,155,000	26,988,000	
B. Administration Cost	7,861,000	0	7,861,000	
C. Engineering Cost	3,144,000	12,577,000	15,721,000	
D. Physical Contingency	11,310,000	15,808,000	27,118,000	
Subtotal	86,714,000	121,198,000	207,912,000	
E. Price Contingency	44,843,000	36,307,000	81,150,000	
Total	131,557,000	157,505,000	289,062,000	

TABLE 8.1.2(3) PROJECT COST OF RIO CHANE

Rio Chane Unit : Bs.

Item	L/C	F/C	Total	Reference
A. Rio Chane Constructuon Cost	67,089,000	110,323,000	177,412,000	
River Improvement of Rio Chane	67,089,000	110,323,000	177,412,000	
B. Administration Cost	8,871,000	0	8,871,000	
C. Engineering Cost	3,548,000	14,193,000	17,741,000	
D. Physical Contingency	11,926,000	18,677,000	30,603,000	
Subtotal	91,434,000	143,193,000	234,627,000	
E. Price Contingency	36,451,000	30,539,000	66,990,000	
Total	127,885,000	173,732,000	301,617,000	

TABLE 8.1.2(4) PROJECT COST OF RIO PAILON

Rio pailon Unit : Bs.

Item	L/C	F/C	Total	Reference
A. Rio Pailon Construction Cost	104,616,000	178,298,000	282,914,000	
1) Rio Pailon (downstream)	80,262,000	138,751,000	219,013,000	
2) Rio Pailon (upstream)	16,170,000	25,402,000	41,572,000	
3) Rancho Chico	2,087,000	4,046,000	6,133,000	
4) Chaco	294,000	551,000	845,000	
5) Empalme II	1,907,000	3,616,000	5,523,000	
6) Pailon Secondary Drainage	3,896,000	5,932,000	9,828,000	
B. Administration Cost	14,146,000	0	14,146,000	
C. Engineering Cost	5,658,000	22,634,000	28,292,000	
D. Physical Contingency	18,664,000	30,141,000	48,805,000	
Subtotal	143,084,000	231,073,000	374,157,000	
E. Price Contingency	115,959,000	103,041,000	219,000,000	
Total	259,043,000	334,114,000	593,157,000	

TABLE 8.1.2(5) PROJECT COST OF OKINAWA

Okinawa Unit : Bs.

Item	L/C	F/C	Total	Reference
A. Construction Cost	23,178,000	44,725,000	67,903,000	
1) Okinawa Main Drainage	15,767,000	31,032,000	46,799,000	
2) Okinawa Secondary Drainage	7,411,000	13,693,000	21,104,000	
B. Administration Cost	3,395,000	0	3,395,000	
C. Engineering Cost	1,358,000	5,432,000	6,790,000	
D. Physical Contingency	4,189,000	7,523,000	11,712,000	
Subtotal	32,120,000	57,680,000	89,800,000	
E. Price Contingency	13,082,000	13,356,000	26,438,000	
Total	45,202,000	71,036,000	116,238,000	

TABLE 8.1.2(6) PROJECT COST OF SAN JUAN

San Juan				Unit : Bs.
Item	L/C	F/C	Total	Reference
A. Construction Cost	34,067,000	47,256,000	81,323,000	142,073,000
1) Arroyo Yapacanicito	12,083,000	16,159,000	28,242,000	
2) San Juan Main Drainage 1	2,245,000	4,163,000	6,408,000	km 13,17
3) San Juan Main Drainage 2	4,403,000	6,286,000	10,689,000	km 11,15,24,28
4) Arroyo Tejeria	2,173,000	4,039,000	6,212,000	
5) Road-Cum-Embankment	3,233,000	1,357,000	4,590,000	
6) San Juan Secondary Drainage	9,930,000	15,252,000	25,182,000	
B. Administration Cost	4,066,000	0	4,066,000	
C. Engineering Cost	1,627,000	6,506,000	8,133,000	
D. Physical Contingency	5,964,000	8,064,000	14,028,000	
Subtotal	45,724,000	61,826,000	107,550,000	
E. Price Contingency	29,525,000	21,458,000	50,983,000	
Total	75,249,000	83,284,000	158,533,000	

TABLE 8.1.2(7) PROJECT COST OF ANTOFAGASTA




Antofagasta				Unit : Bs.
Item	L/C	F/C	Total	Reference
A. Construction Cost	30,332,000	45,557,000	75,889,000	
1) Arroyo Jochi	8,425,000	10,486,000	18,911,000	
2) Arroyo Tacuaral	5,529,000	8,288,000	13,817,000	
3) Antofagasta Main Drainage	5,545,000	10,628,000	16,173,000	
4) Antofagasta Secondary Drainage	10,833,000	16,155,000	26,988,000	
B. Administration Cost	3,795,000	0	3,795,000	
C. Engineering Cost	1,517,000	6,071,000	7,588,000	
D. Physical Contingency	5,346,000	7,744,000	13,090,000	
Subtotal	40,990,000	59,372,000	100,362,000	
E. Price Contingency	15,318,000	14,849,000	30,167,000	
Total	56,308,000	74,221,000	130,529,000	

TABLE 8.2.1 IMPACT OF PROJECTS

Items	Area less than 30 cm inundation		Increment of the area less than 30 cm inundation (km ²)	Rank of Impact
	Without Project (km ²)	With Project (km ²)		
1. Chane-Pailon Area				
(1) Chane Basin				
1) Rio Chane Basin	24.8	45.9	21.1	B
(2) Pailon Basin				
1) Rio Pailon Basin	62.1	229.6	167.5	A
(3) Okinawa Drainage Basin				
1) Okinwa Drainage Basin	94.6	185.0	90.4	A
2. San Juan - Antofagasta Area				
(1) San Juan Area				
1) Arroyo Yapacanicito Basin	85.1	158.9	73.8	A
2) Arroyo Tejeria Basin	23.0	40.8	17.8	B
(2) Antofagasta Area				
1) Arroyo Jochi Basin	40.8	105.3	64.5	A
2) Arroyo Tacuaral Basin	10.9	18.6	7.7	B
3) Antofagasta Main Drainage Basin	12.9	46.8	33.9	B

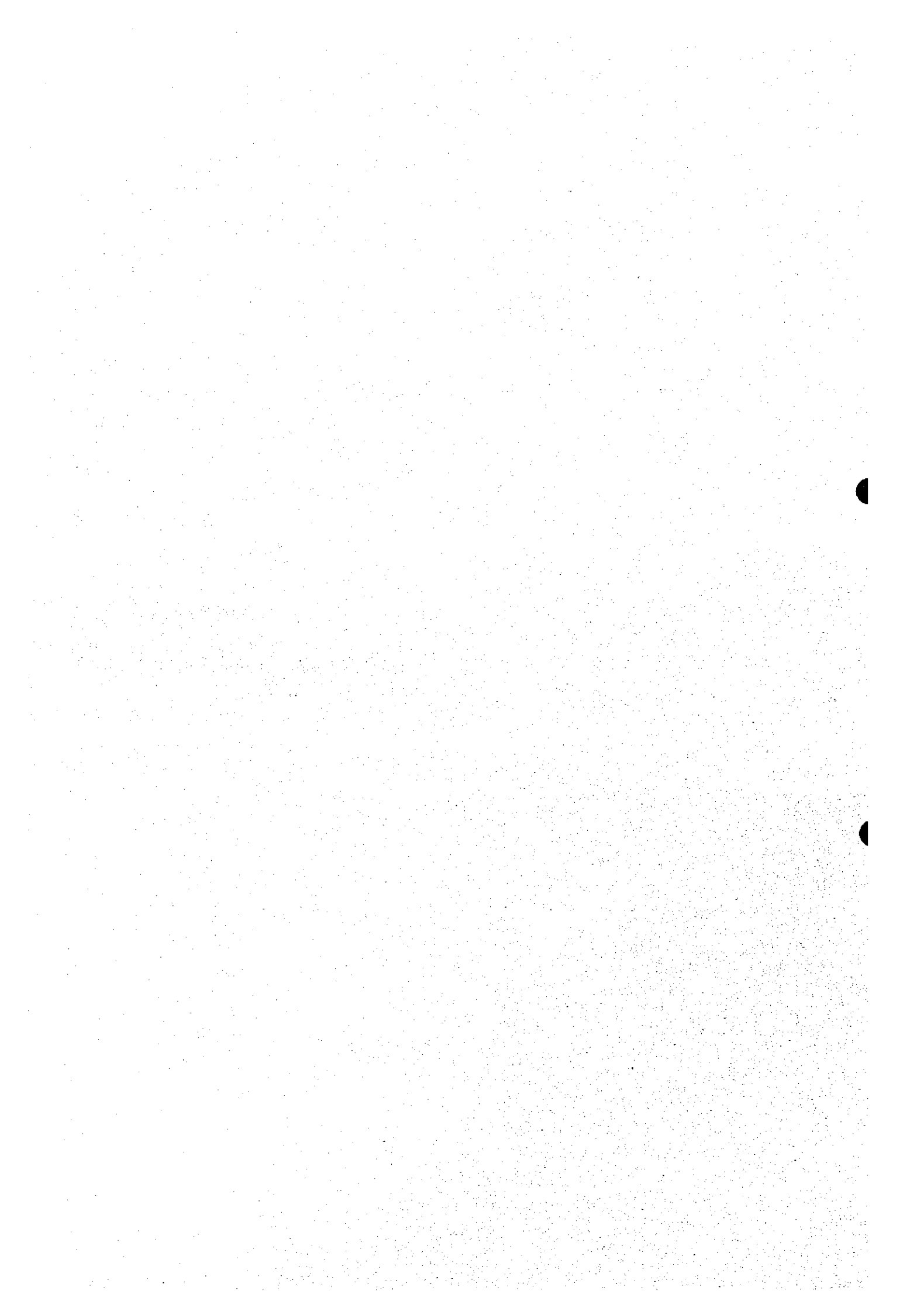
TABLE 8.2.2 WORK SCHEDULE OF RIVER AND DRAINAGE IMPROVEMENT

Work item	Distance to be improved (m)	Amount of excavation (1,000 m ³)	Fiscal Year											
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1. Chane-Pailon			Preparation of the Project											
(1) Rio Chane	26,354	5,638												
(2) Rio Pailon														
1) Rio Pailon (downstream)	23,362	7,777												
2) Rio Pailon (upstream)	8,046	1,419												
3) Rancho Chico	3,600	629												
4) Chaco	1,472	147												
5) El Empalme II	5,293	147												
6) Secondary Drainage														
(3) Okinawa Drainage	21,652	1,838												
1) Okinawa Main Drainage														
2) Secondary Drainage														
2. San Juan-Antofagasta														
(1) San Juan														
1) Arroyo Yapacanicito	17,363	689												
2) San Juan Main Drainage	34,952													
① km 13, 17	7,500	93												
② km 11,15,24,28														
3) Arroyo Tejena	8,160	110												
4) Road-cum-embankment	9,830	37												
5) Secondary Drainage														
(2) Antofagasta														
1) Arroyo Jochi	11,800	366												
2) Arroyo Tacuaral	5,799	354												
3) Antofagasta Main Drainage	8,797	433												
4) Secondary Drainage														

Remarks :  Detail Design
 Construction Work
 Implemented by inhabitants group

CHAPTER 9

INSTITUTIONAL FRAME



CHAPTER 9 INSTITUTIONAL FRAME

9.1 General

The institutions in charge of the flood mitigation are the Department of Santa Cruz, the Civil Defense and the Operation Center for Departmental Emergency, Municipalities, SENAMHI, SEARPI and MACUCY. The new administrative organization of the Department of Santa Cruz is being enforced since January 1999 under the Supreme Decree 25060.

In this chapter the new administrative organization of the Department of Santa Cruz and the related organizations are examined and the necessary functions required for implementation of the proposed flood mitigation measures are studied.

9.2 Present Organization

9.2.1 Department of Santa Cruz

The new organization of the Department of Santa Cruz is composed of seven (7) directions as shown in Fig. 9.2.1 and main roles of each direction are summarized as follows:

(1) **Administrative and Finance Direction**

- Execution of the administrative functions of the Department based on the Law 1178 of government administration.

(2) **Natural Resources and Environment Direction**

- Coordination and supervision of the appropriate use of natural resources with the application of laws,
- Preservation and management of the environment in the Department.

(3) **Productive Development Direction**

- Promotion of the investment and exportation,
- Support of the enhancement of productivity.

(4) **General Coordination Direction**

- Technical coordination of the Department,
- Technical support of the inter-institutional coordination. of the Department.

(5) Infrastructure Development Direction

- Promotion of the development of the physical infrastructure in the Department based on the program of public investment,
- Support of the economic and social development in the Department through implementation of the physical infrastructure works.

(6) Social Development Direction

- Promotion of the improvement of the quality of life of the inhabitants in the Department through providing the equal opportunities of all services such as education, health, housing, water supply, electricity and sewage services,
- Overcoming all kinds of discrimination, especially racial gender.

(7) Legal Direction

- Checking all projects and programs implemented by the Department based on the laws and regulations of the country.

In the former organization, the Planning Division of the Sustainable Development Direction was responsible for the Study as the counterpart organization (Fig. 9.2.2). In the new administrative organization, however, the former Sustainable Development Direction was divided into the two Directions, i.e., the Natural Resources and Environmental Direction and the General Coordination Direction. The General Coordination Direction and the Strategic Planning Division are responsible of the coordination of this study for the implementations.

9.2.2 Civil Defense

The Civil Defense (CD) has an important role in the flood fighting activities in Bolivia. The CD was set up on February 23, 1968 and amended to the present system after the DS.19368 issued on January 17, 1983. The Department of Santa Cruz established the Operation Center for Departmental Emergency (Centro Operativo de Emergencia Departamental: COED) under the CD on March 13, 1998. The organization of the CD and COED are shown in Figs. 9.2.3 and 9.2.4.

The CD consists of three levels, i.e., National, Departmental and Municipal levels. They are outlined as follows:

(1) National Level

There is a permanent committee of which the chairman is the Minister of National Defense and relevant Ministries including Military Commander-in-chief. The main roles are coordination and logistics. The basic activities performed at this level are the orientation and making local inhabitants in the affected areas aware of the disasters occurred as well as the reception, storage and delivery of medicine, food and emergency commodities.

(2) Departmental Level

There is a permanent committee of which the chairman is the Prefecto (the Governor of the Department). In the Department of Santa Cruz the Operation Center for Departmental Emergency (COED) was set up under the CD on March 13, 1998 based on the Agreement with relevant departmental agencies and private sectors. The COED will have an important role for flood warning. At present the COED ought to carry out the transmission of information and the other activities against floods.

The specific functions of the COED are to utilize military in case of emergency. The military force is organized in groups of 10 to 30 people who are fully trained and available for 24 hours. Their main roles are:

- To transmit the information to the anticipated flood areas,
- To participate in search, rescue, evacuation, basic life support and communications,
- To provide logistic supports like food, clothes, blankets and technical support,
- To help installation of mobile camps for refugees through delivery of tents and food.

The COED has an inter-institutional agreement with the institutions related with inundation disasters. The agreement stipulates operation group for prompt response, logistic support for suffered people etc. There is no responsible organization for observation of the flood situation such as overflow of water, dike break and flood damages.

(3) Municipal Level

The municipal committee is set up immediately under the occurrence of the natural disasters. The main roles of the committee are to transmit flood warning to the people in the flood hazard area, to guide the people for evacuation and to provide food, medicine under the CD.

9.2.3 SEARPI

SEARPI (Servicio Encazamiento de Agua y Regulaarizacion del Rio Piray) was established as an autonomous and decentralized body after the heavy flood damages of the City of Santa Cruz in 1983 based on the Law 550 of May 15, 1983. It deals with the coordination and planning of social and economic development of the Rio Piray Basin and in particular with its preservation and reclamation. The organization of SEARPI is shown in Fig. 9.2.5.

The activities of SEARPI related to flood warning are summarized as follows:

- To observe and collect water level data during floods at five stations, i.e., Bermejo, Angostura, Espejos, Belgica and Eisenhower, in the basin,
- To assess the water level data and decide three alert levels (small flood, big flood and extraordinary flood) based on the river stages,
- To inform it to Prefecto who is the President of the CD.

The CD will take responsibilities in alerting the people in the flood hazard area through radio, television and newspapers.

9.2.4 Municipal Governments

The municipal level is considered as the lowest level of the administrative structure providing public services to inhabitants. The Study Area is composed of five municipalities, i.e., Mineros, Saavedra, Warnes, Okinawa and San Carlos. The administrative boundaries of the Municipalities in the Study Area are shown in Fig. 9.2.6.

Under the Organization Law of Municipalities (Law No. 696 on 1989), the jurisdiction and competence of the Municipal Government (*Alcaldea*) is limited within the urban area. In accordance with the policy of decentralization, the municipal responsibilities are expanded to the rural area in their territorial jurisdiction, and the activities included

in their responsibilities by the Popular Participation Law (Law No, 1551) enacted in 1994 are as follows:

- To manage and control the maintenance and improvement of movable property and real estate belonging to the Municipal Governments,
- To provide and build public facilities for education, culture, health, sports, secondary roads and basic sanitation facilities including drainage,
- To contribute with maintenance of secondary roads that pass through the territory,
- To expropriate the land for public infrastructure,
- To restrict the land use for conservation of natural environment.

The relation between the central and local governments under the Popular Participation Law is illustrated in Fig. 9.2.7. A conceptual organization chart of the municipal government is shown in Fig. 9.2.8.

The number of staff varies in each Municipality due to its scale. The Warnes Municipality has more than 80 permanent staff, but the others have 15 to 20 permanent staff only. The Okinawa Municipality was established on March of 1998, but still no permanent staffs in September 1998.

Each municipal government has a technical division that is in charge of development, operation and maintenance of the public facilities. The municipal government possesses some of construction equipment such as bulldozer, motor grader and dump truck, however, the number of equipment and budget for operation are generally insufficient, even for maintenance of secondary roads. In case of equipment in short, the municipal governments request the National Road Service (Servicio Nacional de Camino: SNC) to dispatch the equipment.

The Central Government is expediting the decentralization so rapidly; therefore the Municipalities are not in time to establish their own systems or to organize their staff. Still it is in the transitional period and the municipalities are weak in budget, staff and experience.

The Municipal Government also has the responsibility to conduct the land use control for protection of the environment in its territory, however, the staff and their experience are insufficient to do that effectively.

So far as flood warning and evacuation system is concerned, encountering above difficulties, such Municipality as Okinawa endeavors to collect information of river stages from the upstream and to inform them to the representative of each small group

and to conduct evacuation, in case of emergency. The representative has a responsibility to the concerned people based on the rule decided beforehand. The communication method is by telephone in general and for the residents who have no telephone the person in charge shall visit them to inform the emergency.

9.3 Other Institutions

9.3.1 Meteorology and Hydrological Data Collection for Flood Warning

Rainfall data are collected by SENAMHI (Servicio Nacional de Meteorología e Hidrología), AASANA, SEARPI, MACUCY and CETABOL, but number of rainfall gauging stations is insufficient. As for river stage data, there are several gauging stations along the Rio Piray, one station along the Rio Yapacani and the Rio Palometillas, but there is no gauges along the Rio Grande, the Rio Chane, the Arroyo Yapacanicito, Arroyo Jochi and Arroyo Tacuaral.

The water level data of the Rio Piray are collected by SEARPI and that of the Rio Yapacani are collected by MACUCY.

9.3.2 Protection of the River Sides

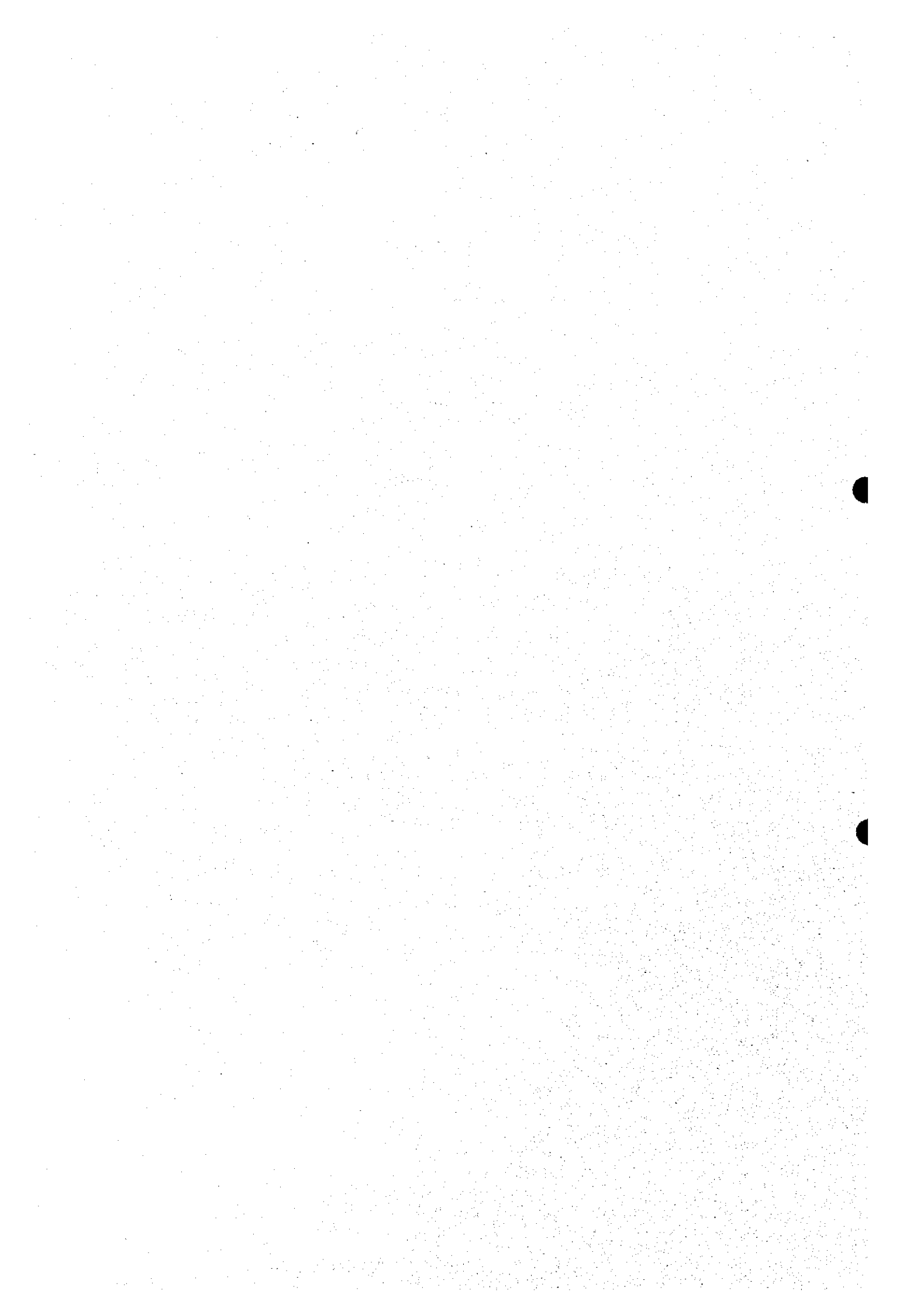
There are two laws to restrict the land use. The Law 550 restricts the land use along the Rio Piray, 500 m to 1000 m both sides. The Forest Law 1700 oriented to the preservation of forests, handles two concepts of ecological right and ecological reserve. The protection forest varies in width depending on the natural course of rivers, however, the implementation of this law is slow and the results of its application imply a process.

9.3.3 Popular Participation

The division in charge of the implementation of the Popular Participation within the competence of the Department of Santa Cruz is the Division of Municipal Strengthening which belongs to the Social Development Direction. Its main function is to strengthen technically and administratively the municipalities of the Department.

The municipalities or municipal governments are instruments those regulate the development within the territories of their jurisdiction. In this context the municipalities, for project purposes, within their legal frame should contact the inhabitants and explain the project to the representatives (one or two) of the Territorial Base Organization (OTB).

FIGURES



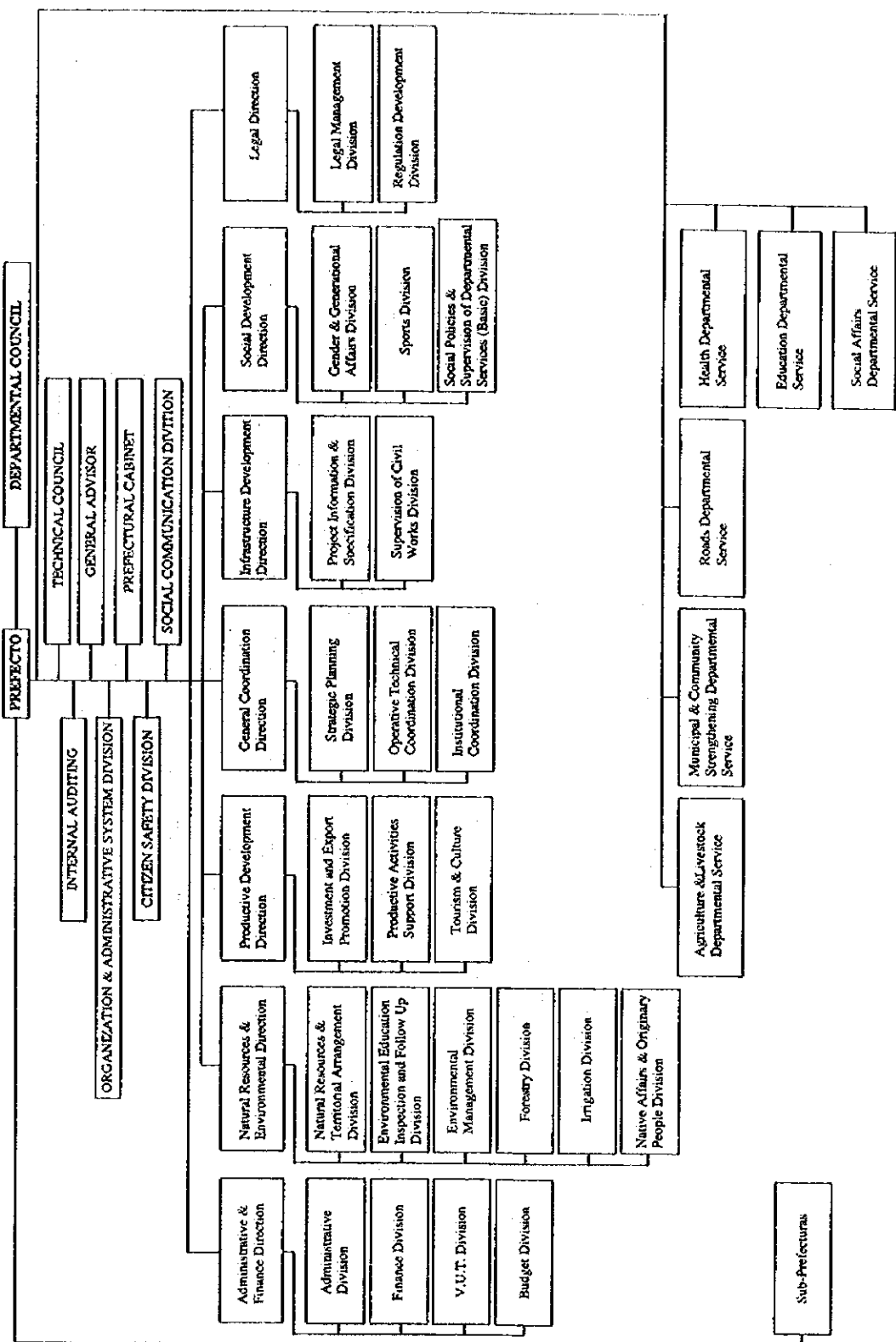
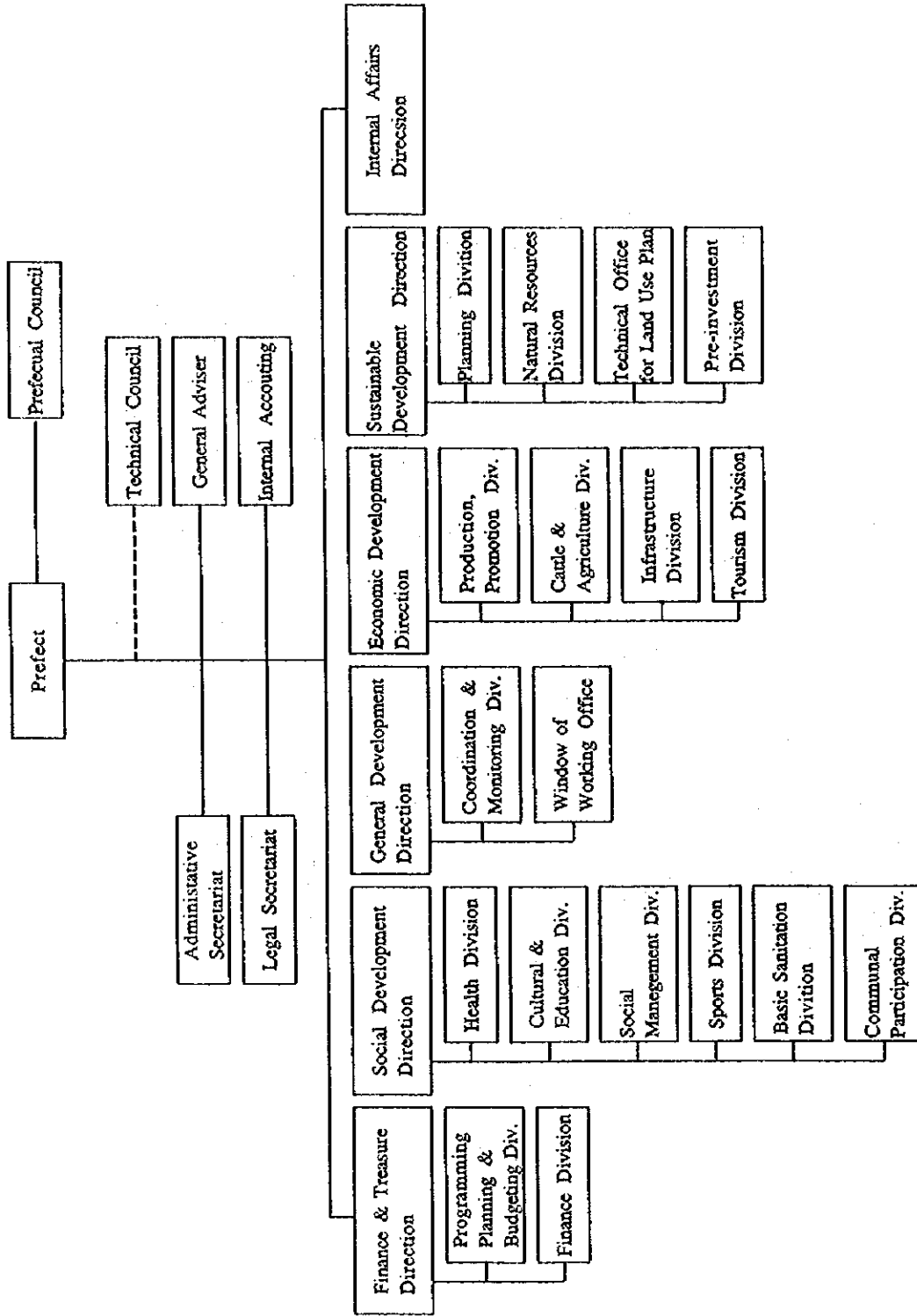


FIG.9.2.1 ORGANIZATION, DEPARTMENT OF SANTA CRUZ (D.S.25060)



Remarks : Div. is Division

FIG.9.2.2 ORGANIZATION, SANTA CRUZ DEPARTMENT(SEP.1998)

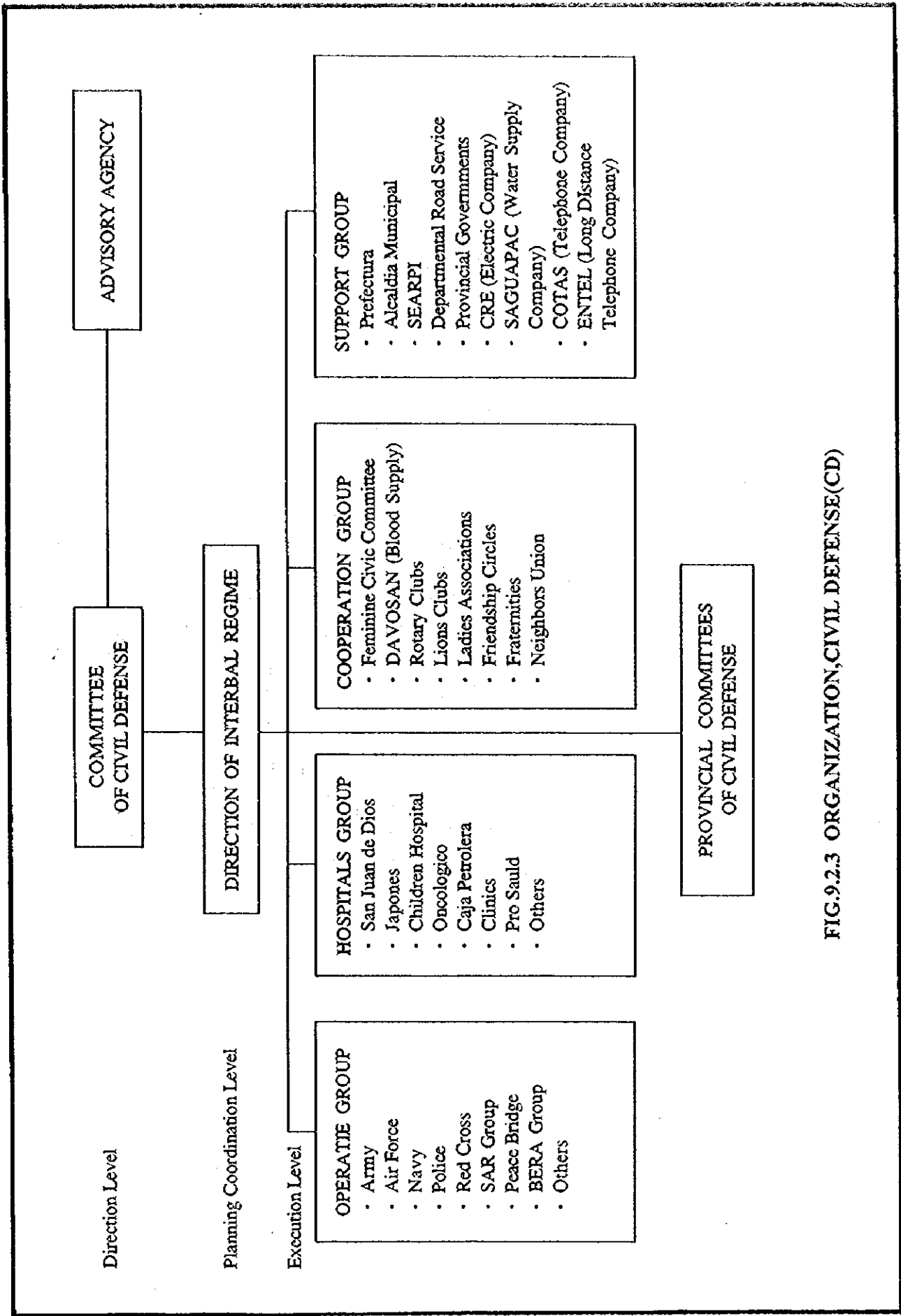


FIG.9.2.3 ORGANIZATION,CIVIL DEFENSE(CD)

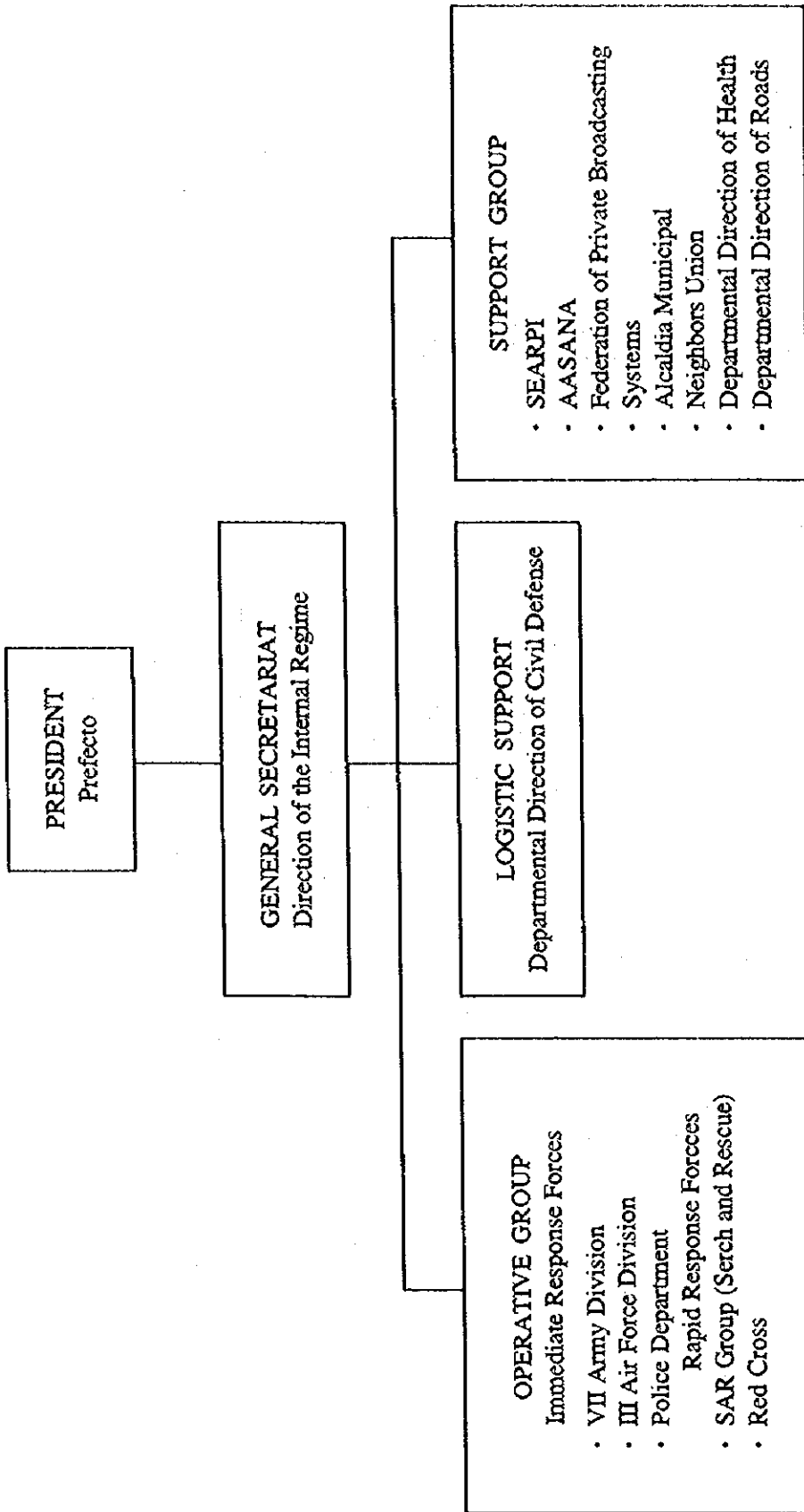


FIG.9.2.4 ORGANIZATION, OPERATION CENTER FOR DEPARTMENTAL EMERGENCY (COED)

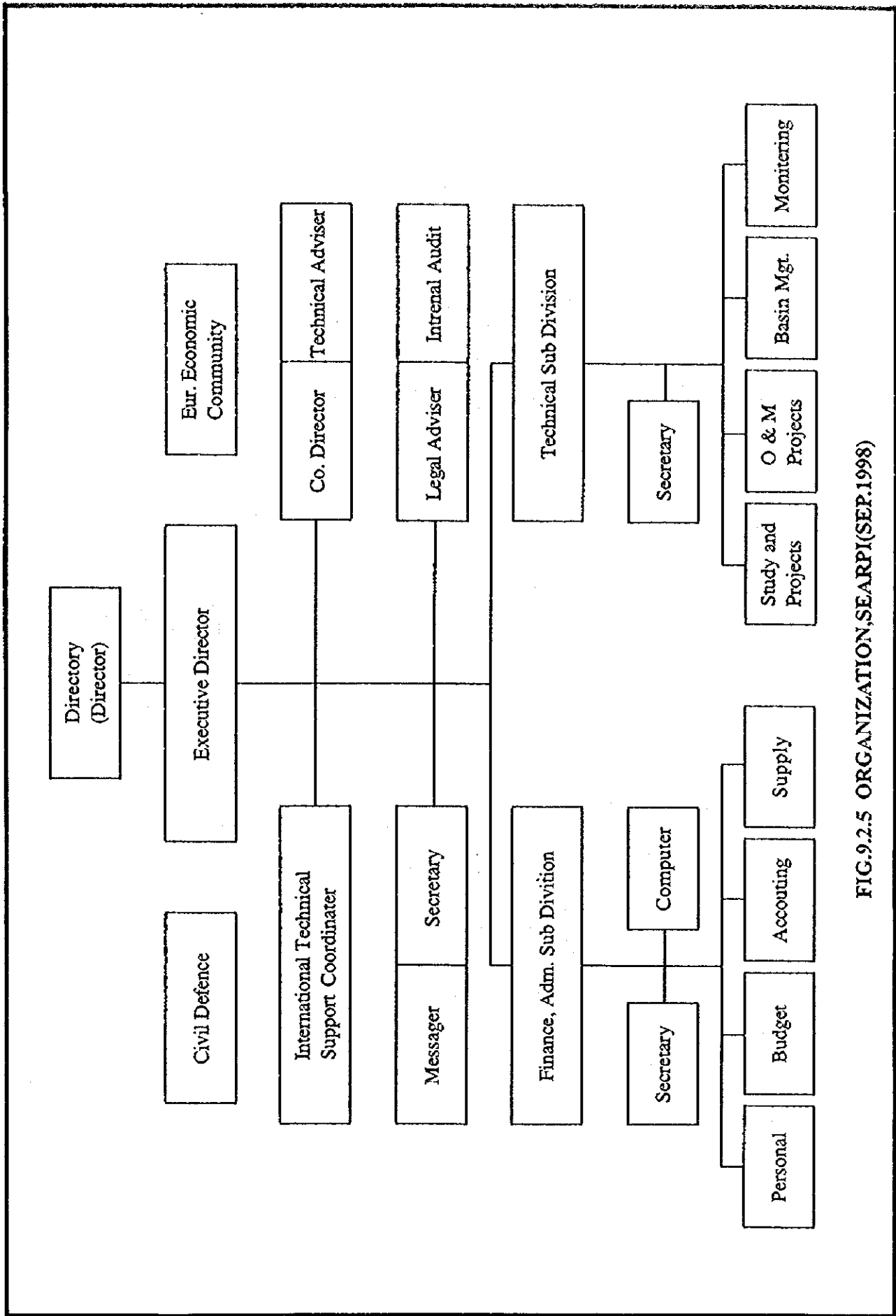


FIG.9.2.5 ORGANIZATION,SEARPI(SEP.1998)

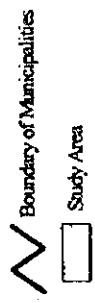
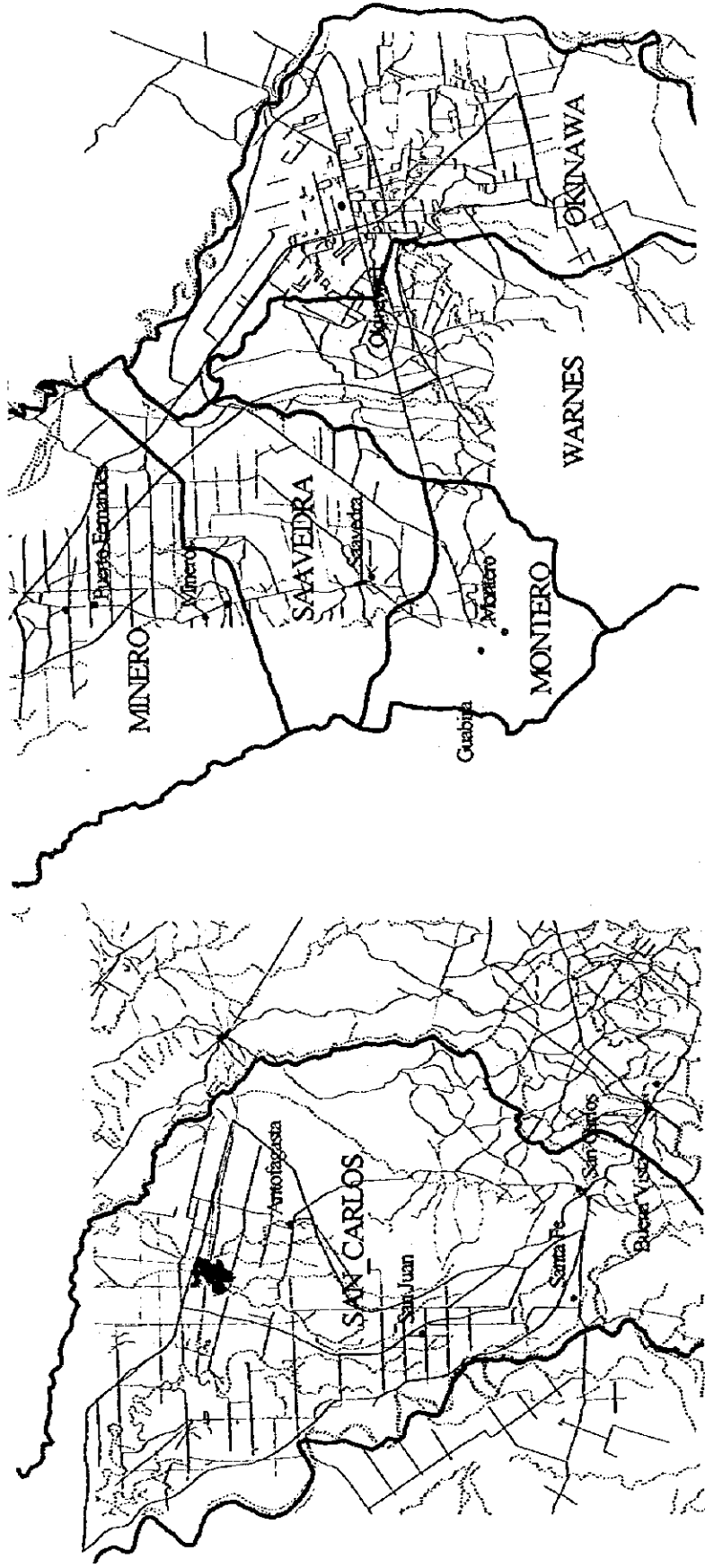
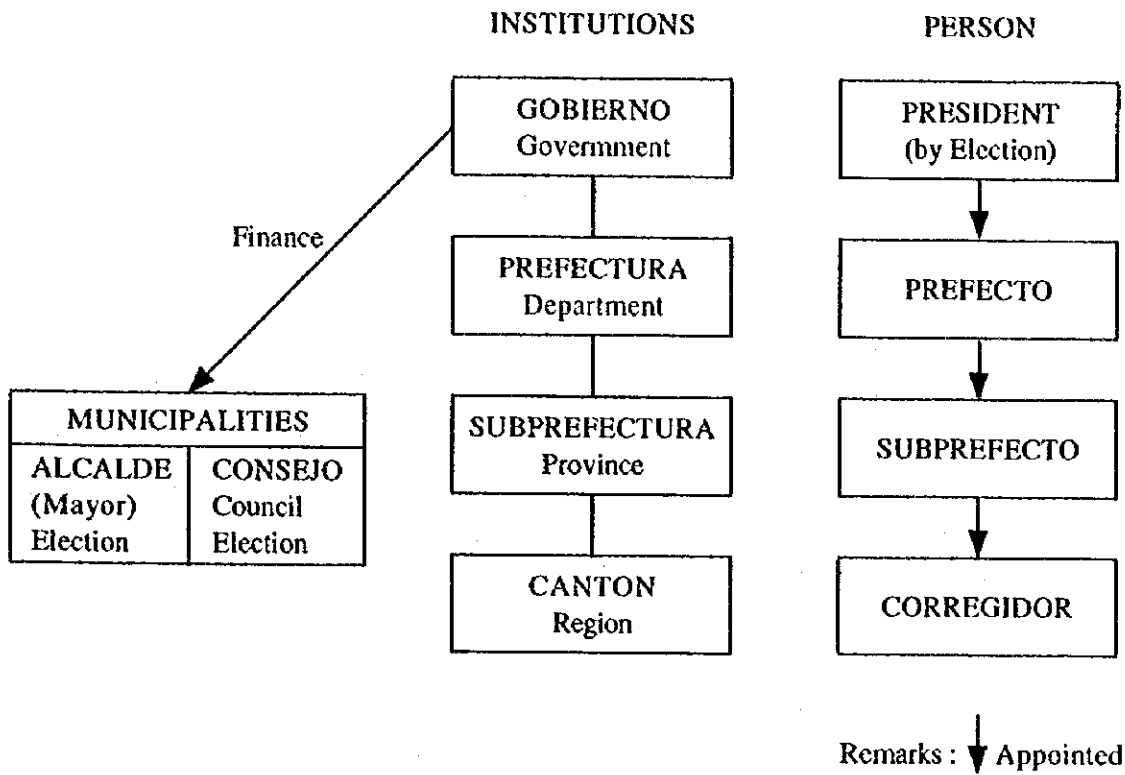


FIG.9.2.6 BOUNDARY OF MUNICIPALITIES IN AND AROUND STUDY AREA



**FIG.9.2.7 CHART OF RELATION BETWEEN CENTRAL
AND LOCAL GOVERNMENT**

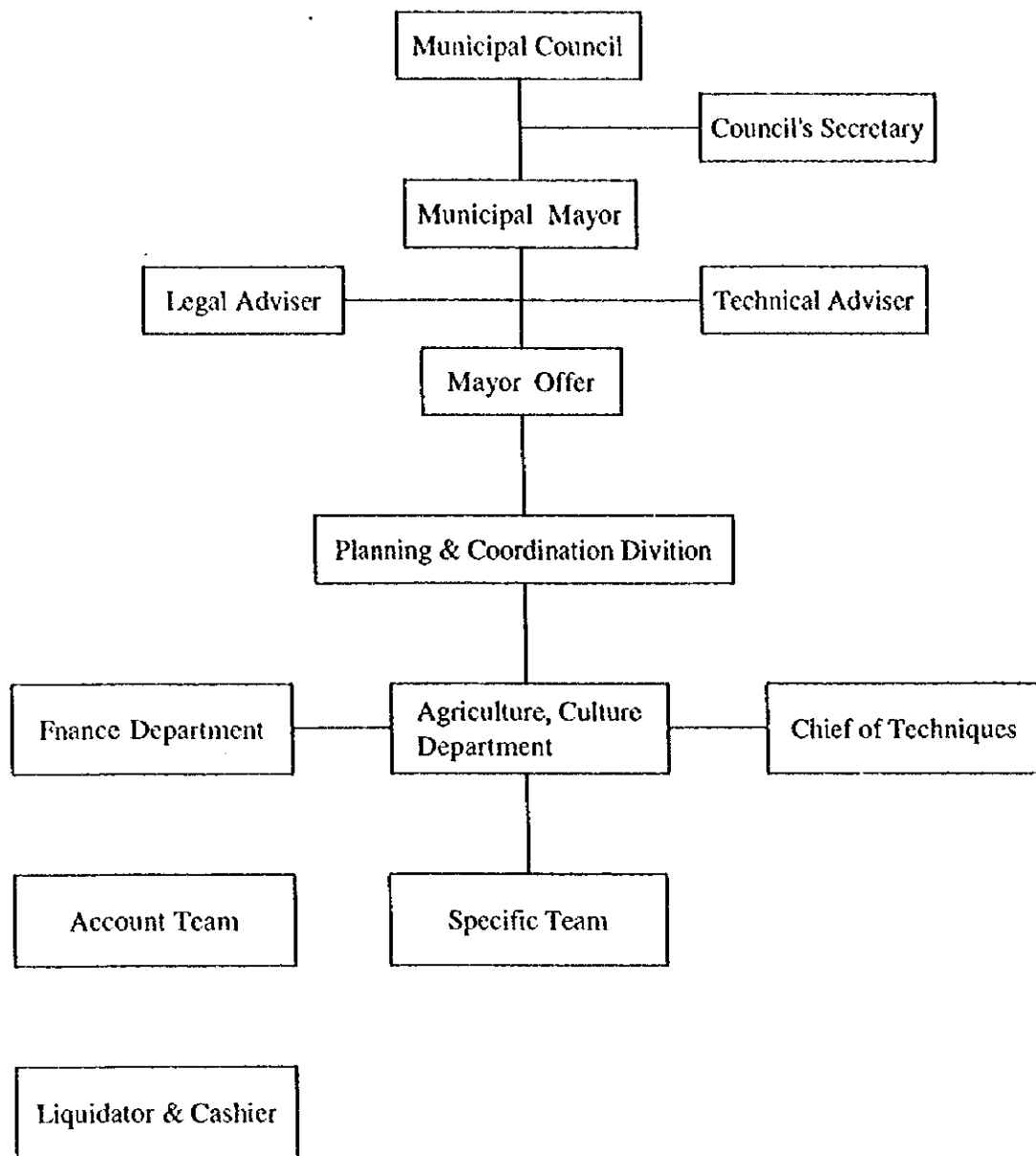
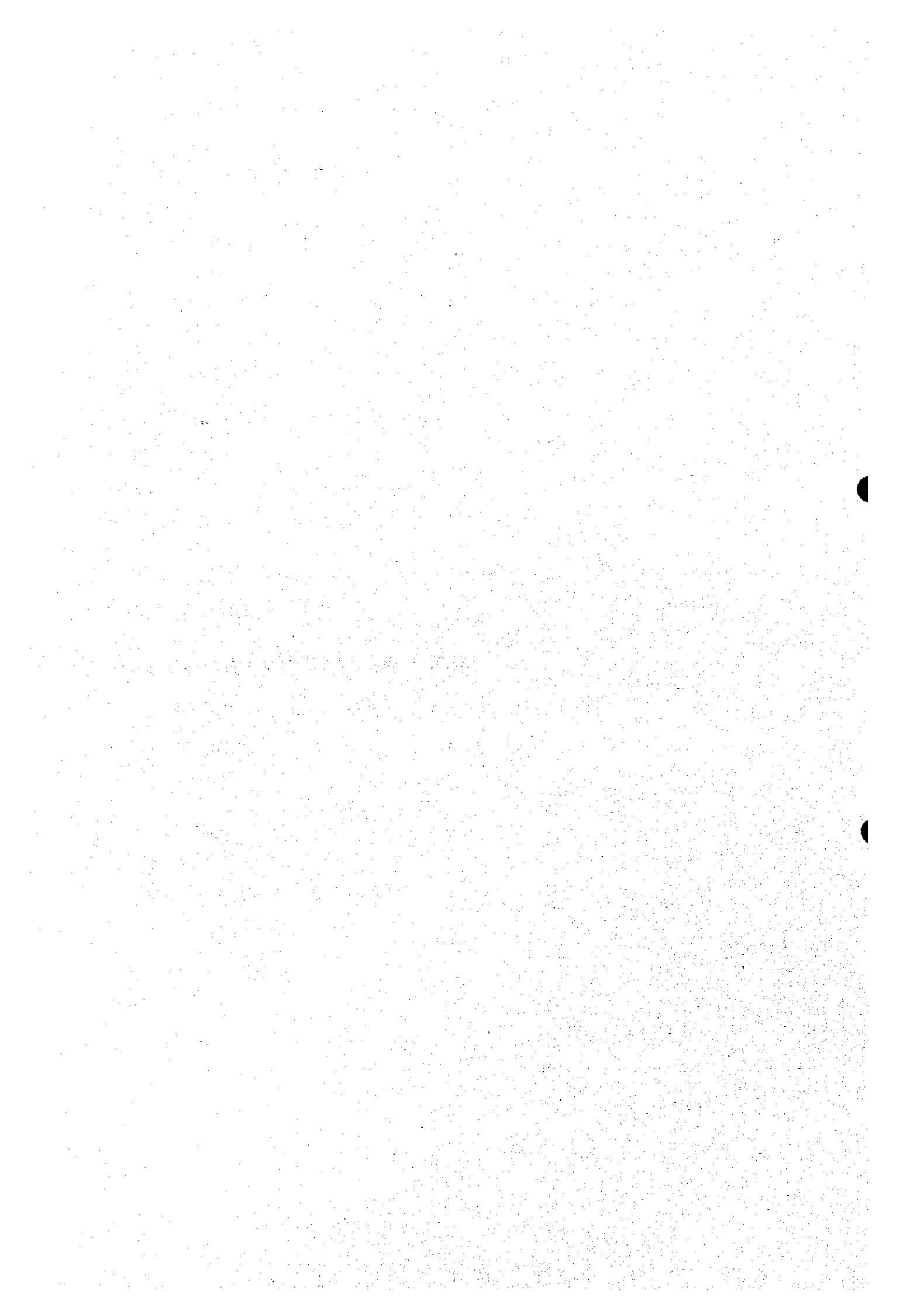


FIG.9.2.8 CONCEPTUAL ORGANIZATION OF MUNICIPALITY

CHAPTER 10
IMPLEMENTATION PROGRAM



CHAPTER 10 IMPLEMENTATION PROGRAM

10.1 General

Based on the present conditions, the implementation for the proposed structural and non-structural measures are studied. The implementation program includes the consideration of the following items:

- The project component and priority,
- The implementation agency and required activities,
- The implementation period and task,
- The implementation schedule,
- The execution of the structural measures,
- The disbursement schedule.

10.2 Project Component and Priority

Project components are composed of the structural and non-structural measures for the Chane - Pailon area and the San Juan - Antofagasta area. The priority ranking of each area and each component are evaluated from technical, economic and other potential effects. The priority sequence of the proposed major works are to be ranked in the two groups of the 1st and 2nd priority groups based on the expected reduction effects in flood damages and the economic effects that are shown in Chapter 8, Section 8.2.5 and Chapter 11, Section 11.2.3. For preparation of an implementation schedule of the proposed works, further priority orders among the 1st and 2nd priority works were studied and ranked to be the four orders of 1stA, 1stB, 2ndA and 2ndB. The proposed components and their priorities are as below:

(1) Structural Measures of Flood Mitigation

1) Chane – Pailon Area	
<u>Structural measures</u>	<u>Priority</u>
Improvement of Rio Chane	1 st B
Improvement of Rio Pailon	1 st B
2) San Juan – Antofagasta Area	
<u>Structural measures</u>	<u>Priority</u>
Improvement of Arroyo Yapacanicito	2 nd A
Improvement of Arroyo Jochi	1 st A

Improvement of Arroyo Tacuaral	2 nd A
Development of Road-cum-embankment	1 st A

(2) Structural Measures of Drainage Improvement

1) Chane – Pailon Area	
<u>Structural measures</u>	<u>Priority</u>
Improvement of Rancho Chico Drainage	2 nd B
Improvement of El Chaco Drainage	2 nd B
Improvement of El Empalme II Drainage	2 nd B
Improvement of Okinawa Main Drainage	1 st A
Development of Secondary Drainage	2 nd B
2) San Juan – Antofagasta Area	
<u>Structural measures</u>	<u>Priority</u>
Improvement of San Juan Main Drainage (km 13 and 17)	1 st B
Rehabilitation of San Juan Main Drainage (km 11, 15, 24 and 28)	2 nd A
Improvement of Arroyo Tejeria	2 nd B
Development of Antofagasta Main Drainage	2 nd B
Development of Secondary Drainage	2 nd B

(3) Non-structural Measures

<u>Non-structural measures</u>	<u>Priority</u>
Conservation of Retarding Basins1 st	
Flood Warning System	1 st A
Flood Plain Management	1 st A
Flood Evacuation Plan	1 st A
Conservation of Protected Forest	1 st A
Flood Hazard Map	1 st A

10.3 Implementation Agency and Required Activity

For the implementation of the proposed structural and non-structural measures, it is required for the Department of Santa Cruz to reinforce the present organization in function and manpower.

The new organization of the Department of Santa Cruz has been established in January 1999 under the Supreme Decree 25060. It is proposed that the responsible organization for the implementation of the proposed measures should be the General Coordination Direction (GCD) of the Department of Santa Cruz. Due to the progress of the project, the GCD should take necessary actions for smooth implementation of the proposed structural and non-structural measures in order to strengthen the function and necessary resources of the concerned organizations as follows:

- Strategic Planning Division of the General Coordination Direction:
to conduct general preparation and arrangement for implementation of the projects, with the participation of SEARPI, UTD-PLUS, SENAMHI and MACUCY,
- Infrastructure Development Direction:
to execute major structural measures,
- Municipalities:
to execute minor structural and non-structural measures and to conduct O&M activities for both structural and non-structural measures according to their legal jurisdiction and financial capabilities,
- Local groups as public participation:
to conduct O&M activities for both structural and non-structural measures.

The required responsibilities and activities of each organization are summarized as below:

Organization	For implementation of structural measures	For O/M of structural measures	For implementation of non-structural measures
The GCD	General coordination and arrangement for the projects		
Strategic Planning Division of the GCD*	- Planning and design of the river and drainage improvement works.		- Designation of development restricted area. - Conducting the flood warning and preparing the information concerning flood. - Support and guidance for execution of non-structural measures.

Organization	For implementation of structural measures	For O/M of structural measures	For implementation of non-structural measures
Infrastructure Development Direction of the Department	<ul style="list-style-type: none"> - Implementation of the river and drainage improvement works. - Coordinating local groups for the minor rehabilitation of existing drainage and the development of secondary drainage. 	<ul style="list-style-type: none"> - Responsible for the river management. - Executing the periodic maintenance and major rehabilitation of river facilities. 	/
Municipality	<ul style="list-style-type: none"> - Implementation of minor improvement and rehabilitation of existing drainage works. - Implementation of the secondary drainage development. 	<ul style="list-style-type: none"> - Responsible for the maintenance of drainage works. - Executing the inspection and regular maintenance of river facilities. - Executing the O/M activities of major drainage facilities. - Arranging the popular participation to the O&M of river and drainage works. 	<ul style="list-style-type: none"> - Execution of non-structural measures based on land use control. - Organizing local group for the activity of the non-structural measures. - Publicizing and education to individuals.
Local Groups	/	<ul style="list-style-type: none"> - Routine O&M activities 	/

Note : * with participation of SEARPI, UTD-PLUS, SENAMHI and MACUCY

10.4 Implementation Period and Tasks

The implementation period is to be divided into the following stages:

- Stage-1 : Preparatory period (1999 to 2000)
- Stage-2 : Implementation of proposed works (2001 to 2010)

The major tasks for each stage are proposed as follows:

- (1) Stage-1 : Preparatory period

The Strategic Planning Division of the General Coordination Direction shall be responsible for the preparatory works.

The Strategic Planning Division shall be reinforced from SEARPI, UTD-PLUS, SENAMHI, MACUCY and others for the execution of the proposed tasks. The major tasks for the Strategic Planning Division in this Stage will be as follows:

- To assign a team or a committee to follow up the projects for an early implementation,
- To reinforce necessary staff to the organization,
- To prepare a training program for staff,
- To arrange for installation of the proposed rain gauges and river gauges to support the proposed flood warning system,
- To establish the function of collecting data and making decision of alert levels for flood warning and informing the alert level to the COED,
- To support the COED to arrange an information network for regional flood warning system,
- To support to establish committees at Municipality level,
- To support financial arrangement for the project,
- To preparation for execution of non-structural measures, i.e., flood warning and evacuation system, flood plain management, land uses control.

(2) Stage-2 : Implementation of the proposed measures

The proposed measure will be executed by different agencies due to the types and the scales.

The GCD should take actions to arrange and support to strengthening of the Infrastructure development Direction and the Municipalities as the execution agencies for the implementation of the proposed measures. The major tasks in this Stage will be as follows:

- Institutional arrangement for execution of the proposed works,
- Execution of non-structural measures,
- Execution of the proposed structural measures, i.e., D/D, construction,
- Establishment of public participation for O&M activities.

10.5 Implementation Schedule

(1) Structural Measures

The construction works of the river and drainage improvement are planned to be executed in 2 stages mentioned above. The 1st priority components are to be

constructed or commenced in the Phase-1 from year 2001 to 2005 and the 2nd priority components are to be constructed in the Phase-2 from year 2006 to 2010 basically. The river improvement works for the Rio Chane and Rio Pailon shall be commenced in the Phase-1 and complete the Phase-2, because of their importance and large scale of the works. Some of the 2nd priority components in the San Juan – Antofagasta area might be started in the Phase-1 after the completion of 1st priority components in the phase-1. The execution schedules of the structure measures are prepared and shown in the Chapter 8.2.

(2) Non-structural Measures

The non-structural measures shall be implemented as soon as possible, since they are important and effective for mitigation of flood damages and not require financial arrangement like the structure measures. The implementation program of the non-structural measures is proposed in the Chapter 6.4.7. In the activities of the non-structural measures, the following activities are required to set up as soon as possible.

- Improvement of the observation network of rain gauges / river gauges and set up to establish a function of flood warning in the Strategic Planning Division of the GCD,
- Publication of flood hazard areas and required non-structure measures,
- Designation of the retarding basin areas to be protected and as the protected areas by the Department under the existing regulation,
- Arrangement of the human resources and budget allocation for the activities of the non-structural measures.

10.6 Execution of Structural Measures

The proposed structural measures will be divided into major works like river improvement works for the Rio Chane/Rio Pailon/Arroyo Jochi, drainage improvement of Okinawa Main Drainage and minor works like development of the secondary drainage systems according to the required amounts of investment. By considering the importance and the early implementation of the 1st priority works within a limited time, it is desirable that the project cost for the 1st priority works will be provided by the external aid. It is planned that among the 1st priority works the large scale works like the river improvement works for the Rio Chane and Pailon are to be done by the credit of external agencies and the major part of the other works are to be done by the grant of external agencies because of their emergency and the available local budget for the initial stage. However, the Department of Santa Cruz and the related Municipalities

should conduct the most of the 2nd priority works by their local budgets, and also the beneficiaries could contribute some to the 2nd priority works.

(1) Components require the external aid

- River improvement of Rio Chane / Rio Pailon,
- Drainage improvement of Okinawa Main Drainage,
- River improvement of Arroyo Jochi,
- Construction of Road-cum-embankment,
- Drainage improvement of San Juan Main Drainage km 13 and km 17.

(2) Components to be executed by the local budget

- Drainage improvement of Rancho Chico / El Chaco / El Empalme II,
- River improvement of Arroyo Yapacanicito,
- River improvement of Arroyo Tacuaral,
- River improvement of Arroyo Tejeria,
- Development of Antofagasta Main Drainage.

(3) Components to be executed by the beneficiaries' contribution

- Rehabilitation of San Juan Main Drainage km 11, km 15, km 24 and km 28,
- Development of the secondary drainage in the Chane-Pailon Area and San Juan- Antofagasta Area.

The proposed implementation schedule is shown in Table 10.6.1.

An alternative implementation schedule is planned and shown in the Annex, in case it will take time for the Rio Chane and Pailon to obtain the external credit aid in the initial stage.

10.7 Disbursement Schedule

Considering the municipal jurisdictions and engineering requirements, a detailed disbursement schedule of the proposed works for the departmental and municipal governments is shown in Table 10.7.1.

TABLES

TABLE 10.6.1 IMPLEMENTATION PROGRAM

Project	Fiscal Year											
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
I Structural Measures												
1. Chane - Pailon Area												
(1) General Coordination and Arrangement												
(2) 1 st Priority Components												
- Rio Chane / Rio Pailon												
- Okinawa Main Drainage												
(3) 2 nd Priority Components												
- R.Chico / El Chaco / El empalme II												
- Secondary Drainage												
2. San Juan - Antofagasta Area												
(1) General Coordination and Arrangement												
(2) 1 st Priority Components												
- Arroyo Jochi												
- Road-cum-embankment												
- San Juan Main Drainage (km 13, 17)												
(3) 2 nd Priority Components												
- Arroyo Yapacanicito												
- Arroyo Tacuaral												
- San Juan Main Drainage (km 11, 15, 24, 28)												
- Arroyo Tejeria												
II Non-structural Measures												
(1) General Coordination and Arrangement												
(2) Implementation of Non-structural Measures												

ANNEX

CHAPTER 10 IMPLEMENTATION PROGRAM - ANNEX

Due to the comments from the Government of Bolivia on the Draft Final Report, an alternative implementation schedule of the proposed works and the detailed disbursement schedule of them that enable the local departmental and municipal governments to consider their engineering requirements and re-arrange the implementation schedule by themselves based on the possible financial sources are proposed.

In the implementation plan in the feasibility study, the project components were classified into two priority groups, i.e., the first priority and the second priority. To assist the judgement by the Government of Bolivia, the first priority and the second priority projects were classified into 1st A, 1st B, 2nd A and 2nd B respectively in the supplemental study. The major considerations on the detail prioritization are as follow:

- The basic priority, i.e., the first and the second priority, are not changed,
- The detail priority, i.e., A and B ranking are classified by the impact of each components,
- The Rio Chane and Pailon improvement are classified into 1st B priority due to the scale of the investment and the arrangement of the international cooperation.

The prioritization of project components is as follows:

(1) Structural Measures of Flood Mitigation

1) Chane – Pailon Area	
<u>Structural measures</u>	<u>Priority</u>
Improvement of Rio Chane	1 st B
Improvement of Rio Pailon	1 st B
2) San Juan – Antofagasta Area	
<u>Structural measures</u>	<u>Priority</u>
Improvement of Arroyo Yapacanicito	2 nd A
Improvement of Arroyo Jochi	1 st A
Improvement of Arroyo Tacuaral	2 nd A
Development of Road-cum-embankment	1 st A

(2) Structural Measures of Drainage Improvement

1) Chane – Pailon Area	
<u>Structural measures</u>	<u>Priority</u>
Improvement of Rancho Chico Drainage	2 nd B
Improvement of El Chaco Drainage	2 nd B
Improvement of El Empalme II Drainage	2 nd B
Improvement of Okinawa Main Drainage	1 st A
Development of Secondary Drainage	2 nd B
2) San Juan – Antofagasta Area	
<u>Structural measures</u>	<u>Priority</u>
Improvement of San Juan Main Drainage (km 13 and 17)	1 st B
Rehabilitation of San Juan Main Drainage (km 11, 15, 24 and 28)	2 nd A
Improvement of Arroyo Tejeria	2 nd B
Development of Antofagasta Main Drainage	2 nd B
Development of Secondary Drainage	2 nd B

10-A.1 Alternative Construction Schedule

An alternative construction schedule is proposed as shown in Table A.1 based on the detail prioritization study. This schedule is proposed for the improvement works of the Rio Chane and Pailon and the related drainage works to be modified based on the economic condition of the country, considering that it is difficult to get the external credit aid from the river improvement of the Rio Chane and Pailon in the initial stage.

10-A.2 Alternative Disbursement Schedule

The alternative disbursement schedule is prepared and shown in Table A.2 based on the alternative construction schedule.




10-A.3 Project Evaluation of Alternative Plan

The cost-benefit analysis for the proposed alternative plan was also conducted by the same procedure. The results of the cost-benefit analysis are as follows:

Project	EIRR (%)
I Chane - Pailon Project	12.3
1. Rio Chane Area	3.8
2. Rio Pailon Area	16.4
3. Okinawa Drainage Area	18.4
II San Juan - Antofagasta Project	18.1
1. San Juan Area	12.3
2. Antofagasta Area	23.4

TABLE A.1 ALTERNATIVE WORK SCHEDULE OF RIVER AND DRAINAGE IMPROVEMENT

Work item	Distance to be improved (m)	Project Cost (1,000 Bs.)	Fiscal Year									
			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1. Chane-Pailon		698,584	Preparation of the Project									
(1) Rio Chane	26,354	234,627										
(2) Rio Pailon	374,157											
1) Rio Pailon (downstream)	23,362	289,645										
2) Rio Pailon (upstream)	8,046	54,979										
3) Rancho Chico	3,600	8,115										
4) El Chaco	1,472	1,118										
5) El Empalme II	5,293	7,304										
6) Secondary Drainage		12,998										
(3) Okinawa Drainage		89,800										
1) Okinawa Main Drainage	21,652	61,891										
2) Secondary Drainage		27,909										
2. San Juan-Antofagasta		207,912										
(1) San Juan		107,550										
1) Arroyo Yapacanicito	17,363	37,350										
2) San Juan Main Drainage	34,952	22,610										
① km 13, 17	7,500	8,474										
② km 11, 15, 24, 28		14,136										
3) Arroyo Tejeria	8,160	8,215										
4) Road-cum-embankment	9,830	6,071										
5) Secondary Drainage		33,304										
(2) Antofagasta		100,362										
1) Arroyo Jochi	11,800	25,010										
2) Arroyo Tacuaral	5,799	18,272										
3) Antofagasta Main Drainage	8,797	21,389										
4) Secondary Drainage		35,691										

Remarks :  Detail Design
 Construction Work
 Implemented by municipality / inhabitants group

