TABLE 2 PROJECT SUMMARY OF FEASIBILITY STUDY ON FLOOD CONTROL IN THE NORTHERN RURAL REGION OF SANTA CRUZ

AREA / SUB-AREA	FLOOD MITIGATION AND DRAINAGE IMPROVEMENT MEASURES				PROJECT EVALUATION										
	STRUCTURAL MEASURES			NON-STRUCTURAL MEASURES	Technical Efficiency (Reduction of flooded area more than 30 cm depth in 10-year frequency flood : km²)			Economic Efficiency (EIRR : %)			Embironmantal Impact			PROJECT VIABILITY	
	Coponent of Structure Measures	Dsitance (km)	Project Cost (1,000 Bs)								Living Environment	Economic Environment	Natural Environment		
1. CHANE-PAILON AREA			698,584			279.00			12.1						
(1) Rio Chane Basin	Improvement of Rio Chane	26.350	234,627		Indispensable for avoiding any adverse effect. More effective with flood control of the Rio Piray.	21.10	A	Not feasible	3.8	C	High	Medium	Negligibly small	High viability for avoiding any adverse effect.	A
(2) Rio Pailon Area	Improvement of Rio Pailon	31.680	344,624	- Protection of retarding basin -Flood warning -Flood plain management -Flood evacuation plan -Protected forest -Preparation of flood hazard map	Indispensable as the main stream area. One of the most effective component for the flood mitigation.	167.50	A	Highly feasible	16.4	A	High	High	Negligibly small	High viability as the main steram area.	A
	Improvement of Rancha Chico Drainage	3.600	8,113		Necessary to mitigating the adverse effect of the bridge construction along Route 9.		B				High	Medium	Negligibly small	Midium viability for avoiding adverse effect of the bridge construction.	B
	Improvement of El Chaco Drainage	1.470	1,118		Necessary to mitigating the adverse effect of the bridge construction along Route 9.		B				High	Medium	Negligibly small	Midium viability for avoiding adverse effect of the bridge construction.	B
	Improvement of El Empalme II Drainage	5.290	7,304		Necessary to mitigating the adverse effect of the bridge construction along Route 9.		B				High	Medium	Negligibly small	Midium viability for avoiding adverse effect of the bridge construction	B
	Development of Secondary Drainage	18.500	12,998		Necessary to make river and drainage improvement effective.		B				Medium	Medium	Negligibly small	Midium viability to make river and drainage improvement effective.	B
(3) Okinawa Drainage Basin	Improvement of Okinawa Main Drainage	21.650	61,891		High necessaity as the major drainage area. It will contribute to mitigate the flood damege of Rio Grande.	90.40	A	Highly feasible	18.4	A	Exclusive High	High	Negligibly small	High viability as the major drainage area for mitigating the flood damege of Rio Grande.	A
	Development of Secondary Drainage	35.500	27,909		Necessary to make river and drainage improvement effective.		B				Medium	Medium	Negligibly small	Midium viability to make river and drainage improvement effective.	B
2. SAN JUAN-ANTOFAGASTA AREA			207,912			197.70			18.2						
(1) San Juan Area	Improvement of Arroyo Yapacanicito	17.360	37,350		Necessary for improving the northern area of San Juan.	91.60	B	Feasible	12.4	B	Exclusive High	High	Negligibly small	Midium viability as the intensive land use area.	B
	Improvement of San Juan Main Drainage (km 13, 17)	7.500	8,474		High necessity as the restoration of the main drainage.		A				Exclusive High	High	Negligibly small	High viability as the intensive land use area.	A
	Rehabilitation of San Juan Main Drainage (km 11, 15, 24, 28)	27.450	14,136		Necessary to rehabilitate the drainage functions.		B				Exclusive High	Medium	Negligibly small	Midium viability as the intensive land use area.	B
	Improvement of Arroyo Tejeria	8.160	8,215		Necessity as the drainage area.		B				Medium	Medium	Negligibly small	Midium viability as the intensive land use area.	B
	Development of Secondary Drainage	35.000	33,304		Necessary to make river and drainage improvement effective.		B				Medium	Medium	Negligibly small	Midium viability to make river and drainage improvement effective.	B
(2) Antofagasta Area	Improvement of Arroyo Jochi	11.800	25,010		Indispensable to improve flooding condition in the Antofagsta Area.	106.10	A	Highly feasible	23.4	A	High	Medium	Negligibly small	High viability as the intensive land use area.	A
	Improvement of Arroyo Tacuaral	5.800	18,272		Necessary to improve flooding condition in the Antofagsta Area.		B				High	Medium	Negligibly small	Midium viability as the intensive land use area.	B
	Development of Road-cum-embankment	9.830	6,071		Indispensable for project phasing in the San Juan - Antofagasta Area.		A				Medium	Medium	Negligibly small	High viability for project phasing.	A
	Development of Antofagasta Main Drainage	8.800	21,389		Necessity as the drainage area.		B				High	Medium	Negligibly small	Midium viability as the intensive land use area.	B
	Development of Secondary Drainage	26.500	35,691		Necessary to make river and drainage improvement effective.		B				Medium	Medium	Negligibly small	Midium viability to make river and drainage improvement effective.	B

Remarks : Ranking of viability of project components A : High B : Medium C : Low

TABLE 3 IMPLEMENTATION PROGRAM

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

FIGURES

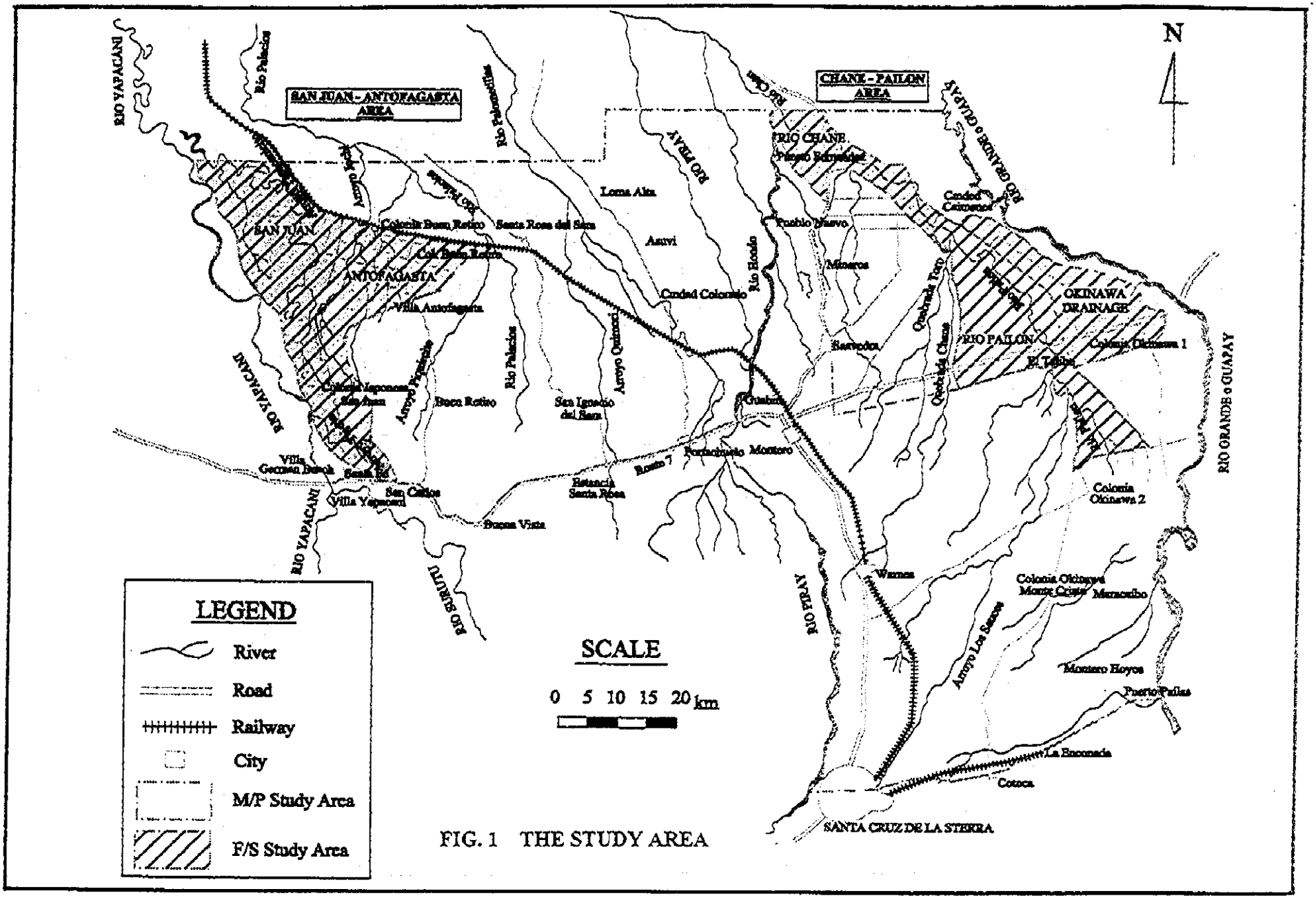


FIG. 1 THE STUDY AREA

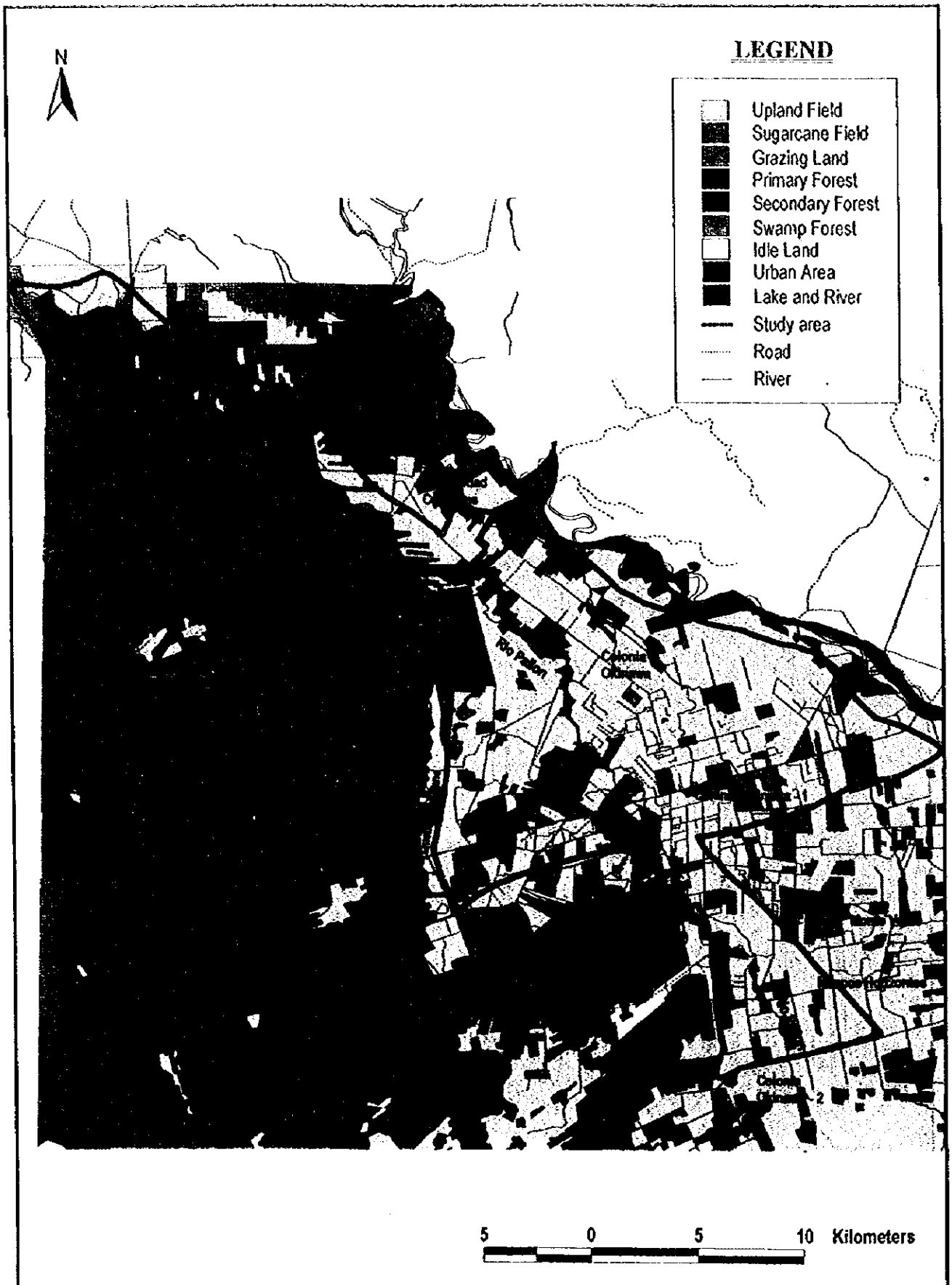


FIG. 2 LAND USE MAP IN 1998
(CHANE-PAILON AREA)

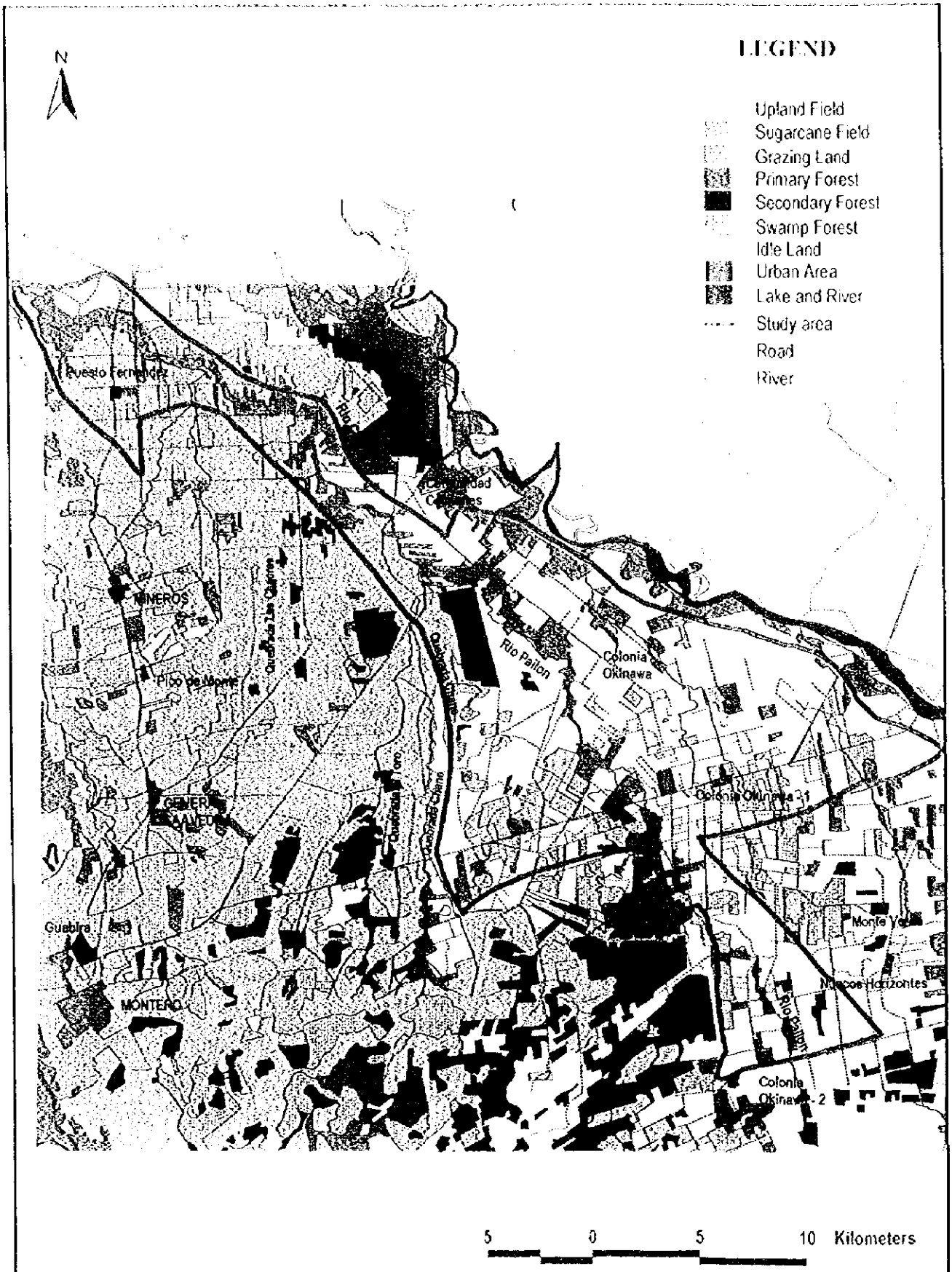


FIG. 2 LAND USE MAP IN 1998
(CHANE-PAILON AREA)

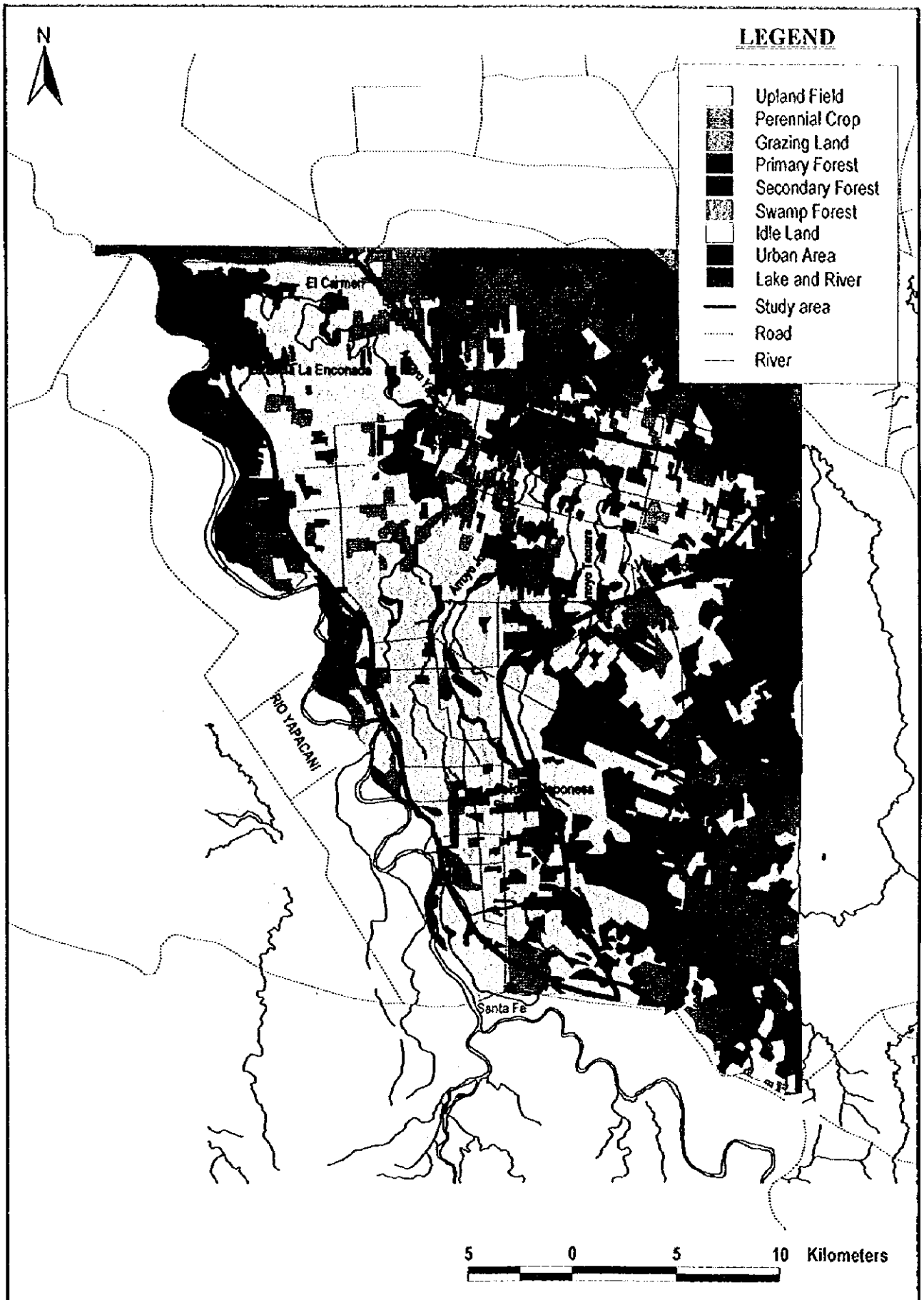


FIG. 3 LAND USE MAP IN 1998 (SAN JUAN-ANTOFAGASTA AREA)

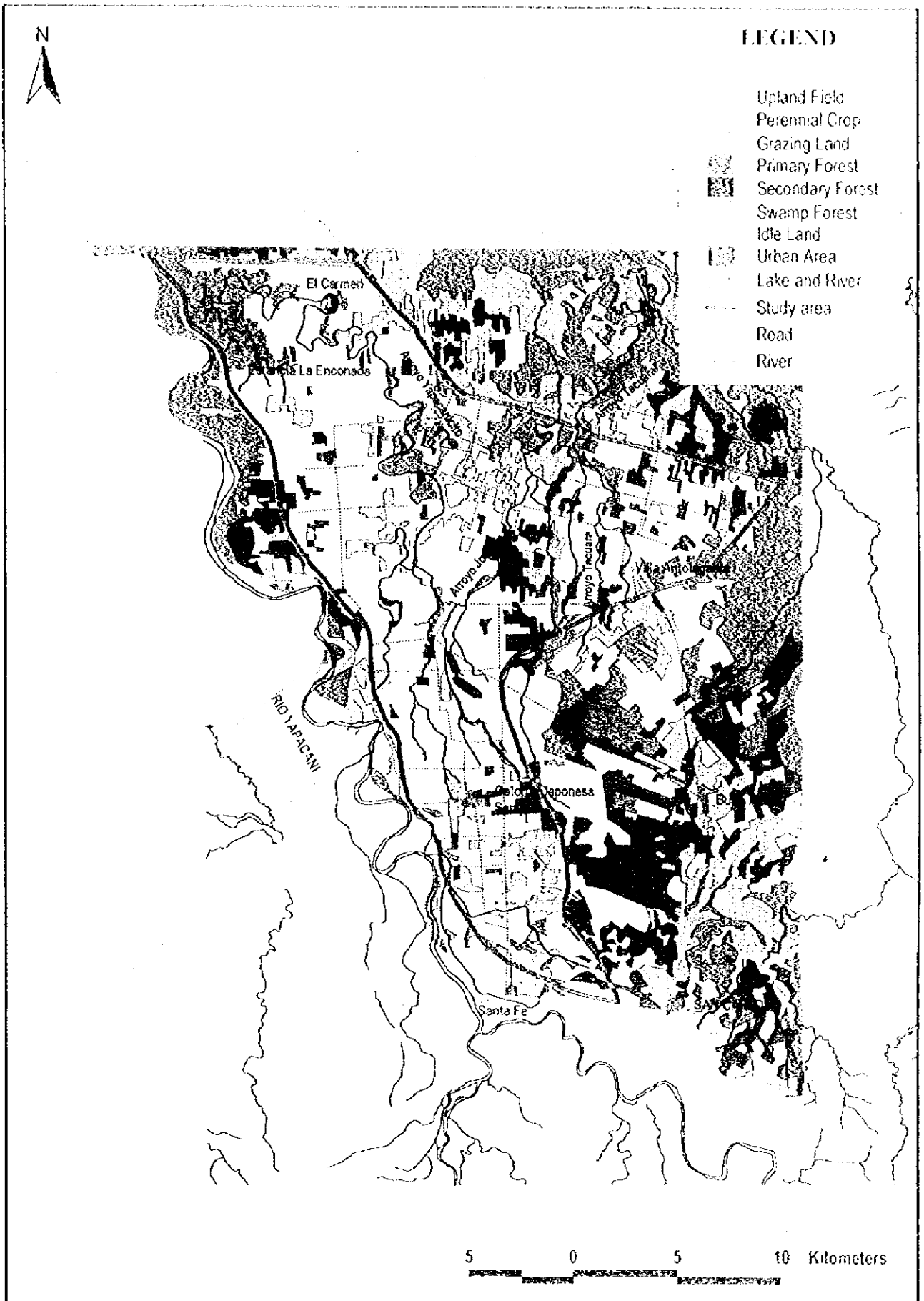


FIG. 3 LAND USE MAP IN 1998 (SAN JUAN-ANTOFAGASTA AREA)

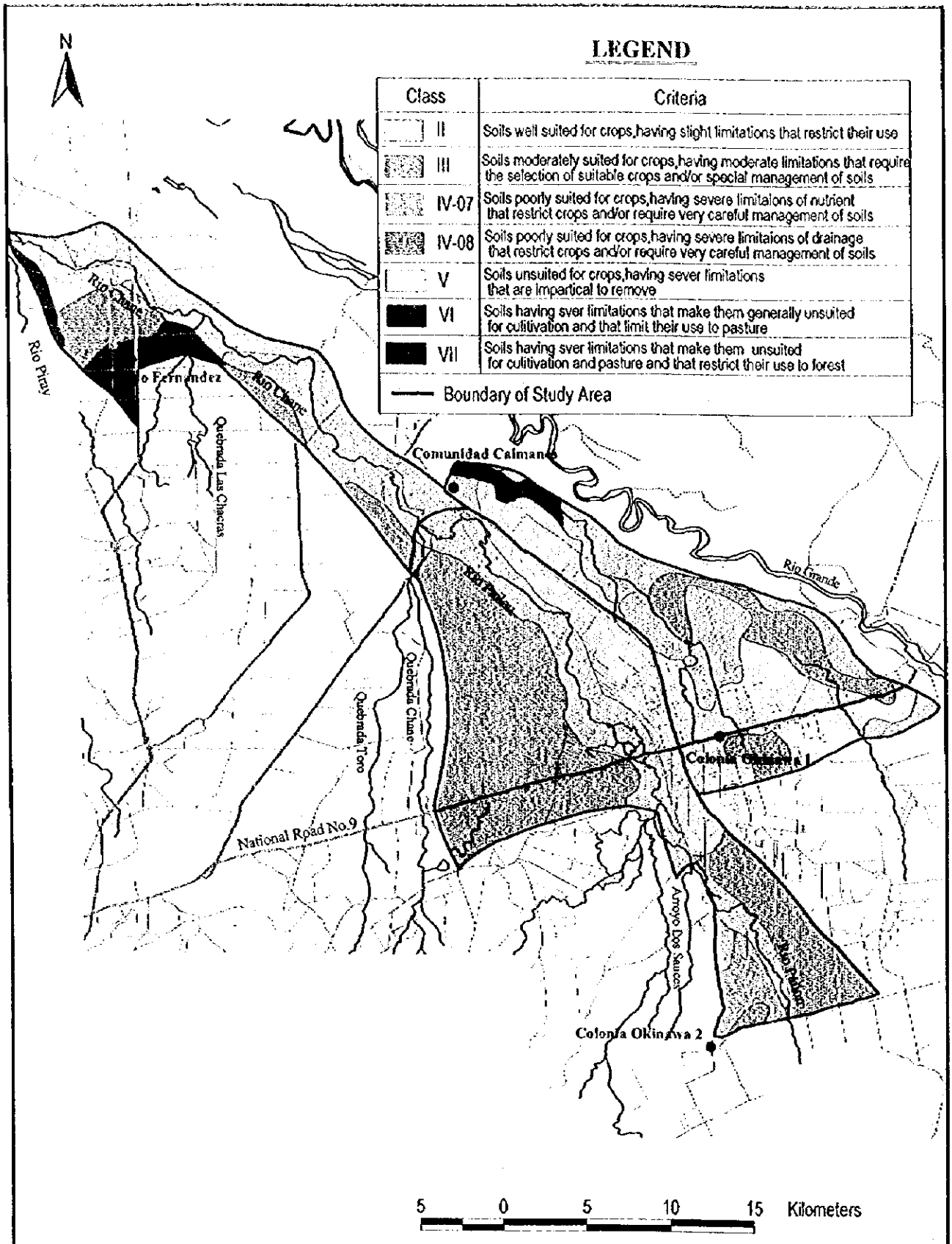


FIG. 4 LAND CLASSIFICATION MAP (CHANE-PAILON AREA)

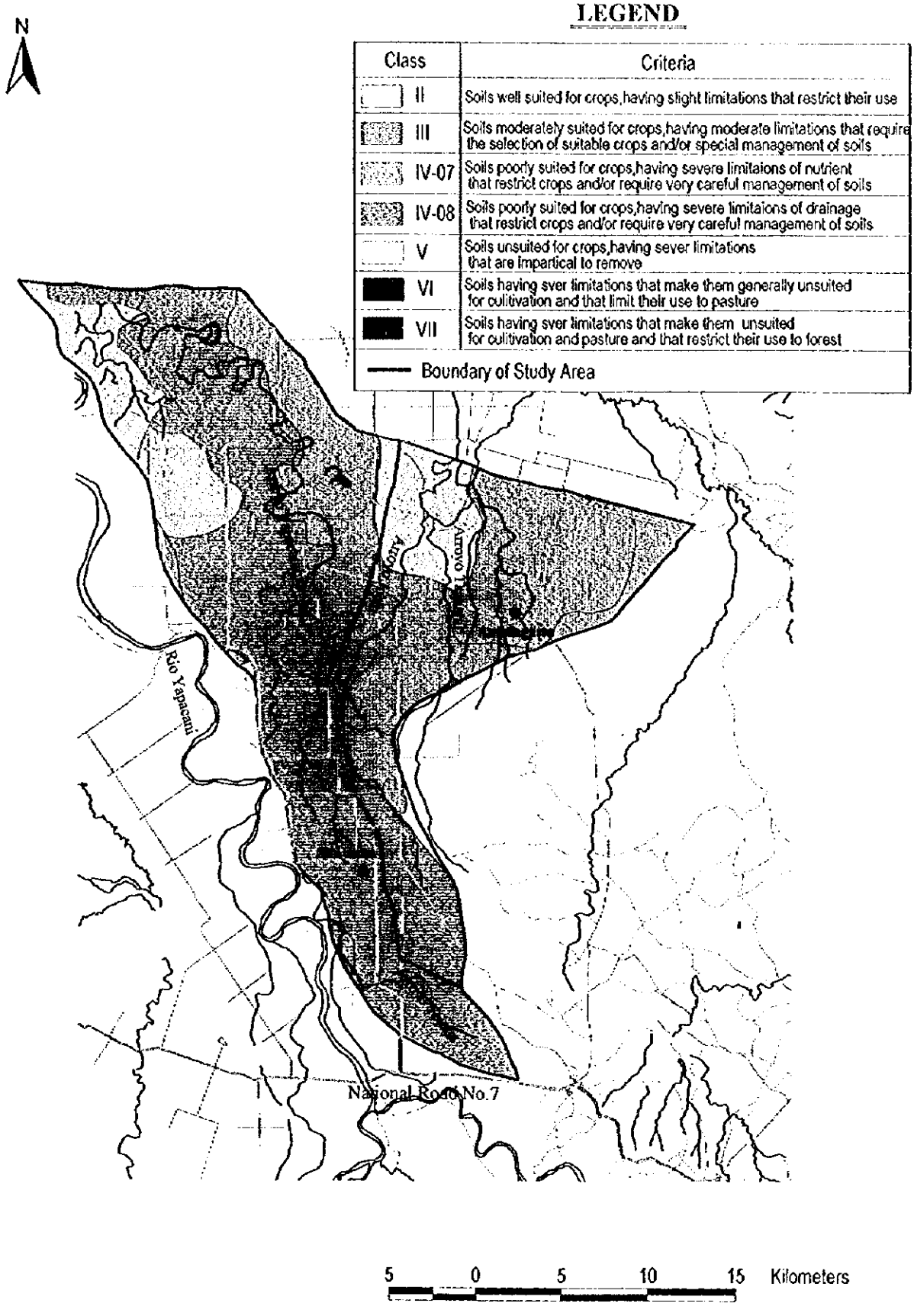


FIG. 5 LAND CLASSIFICATION MAP (SAN JUAN-ANTOFAGASTA AREA)

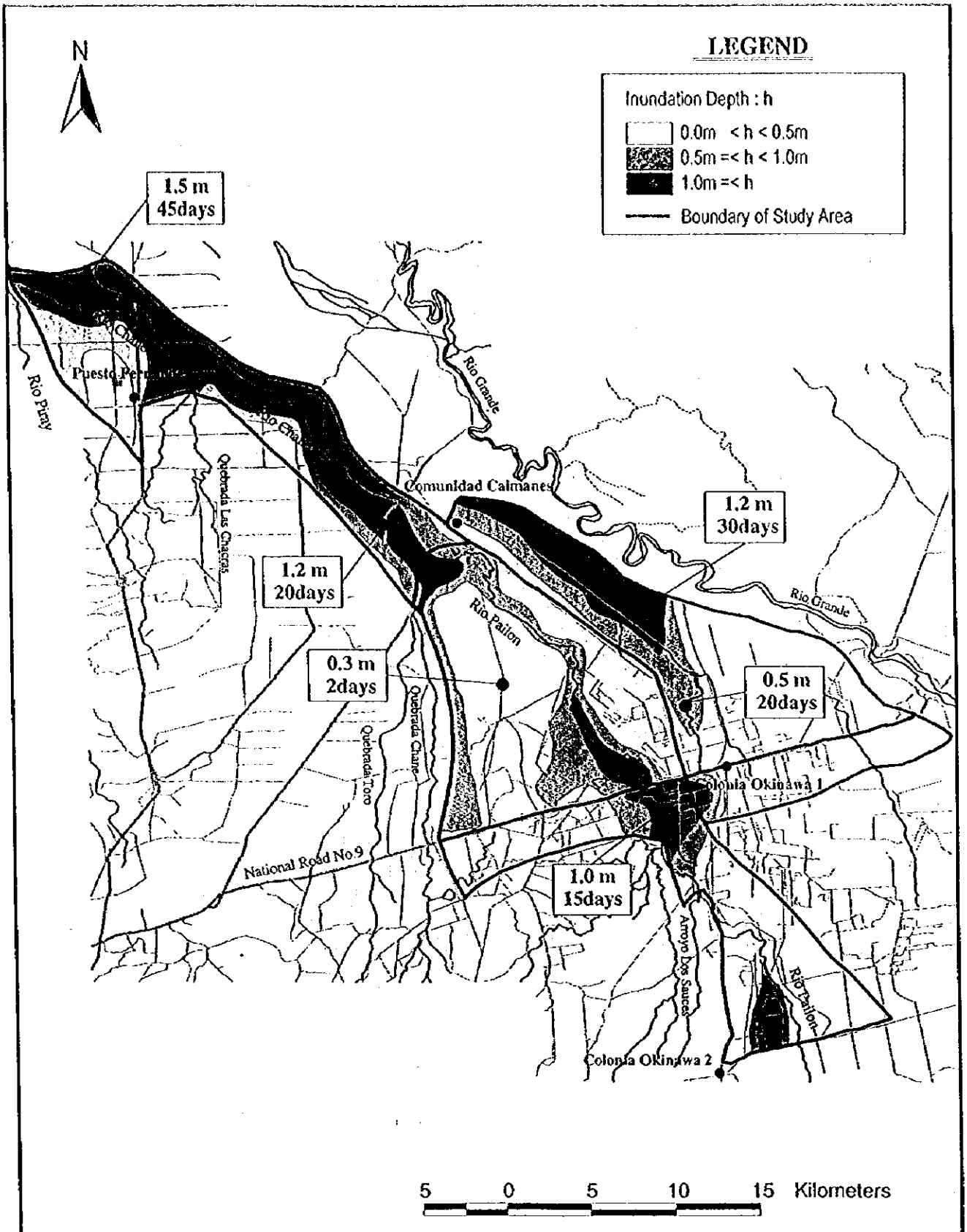


FIG. 6 INUNDATION AREA IN THE CHANE-PAILON AREA
(BY THE FLOODS DURING NOVEMBER TO DECEMBER 1997)

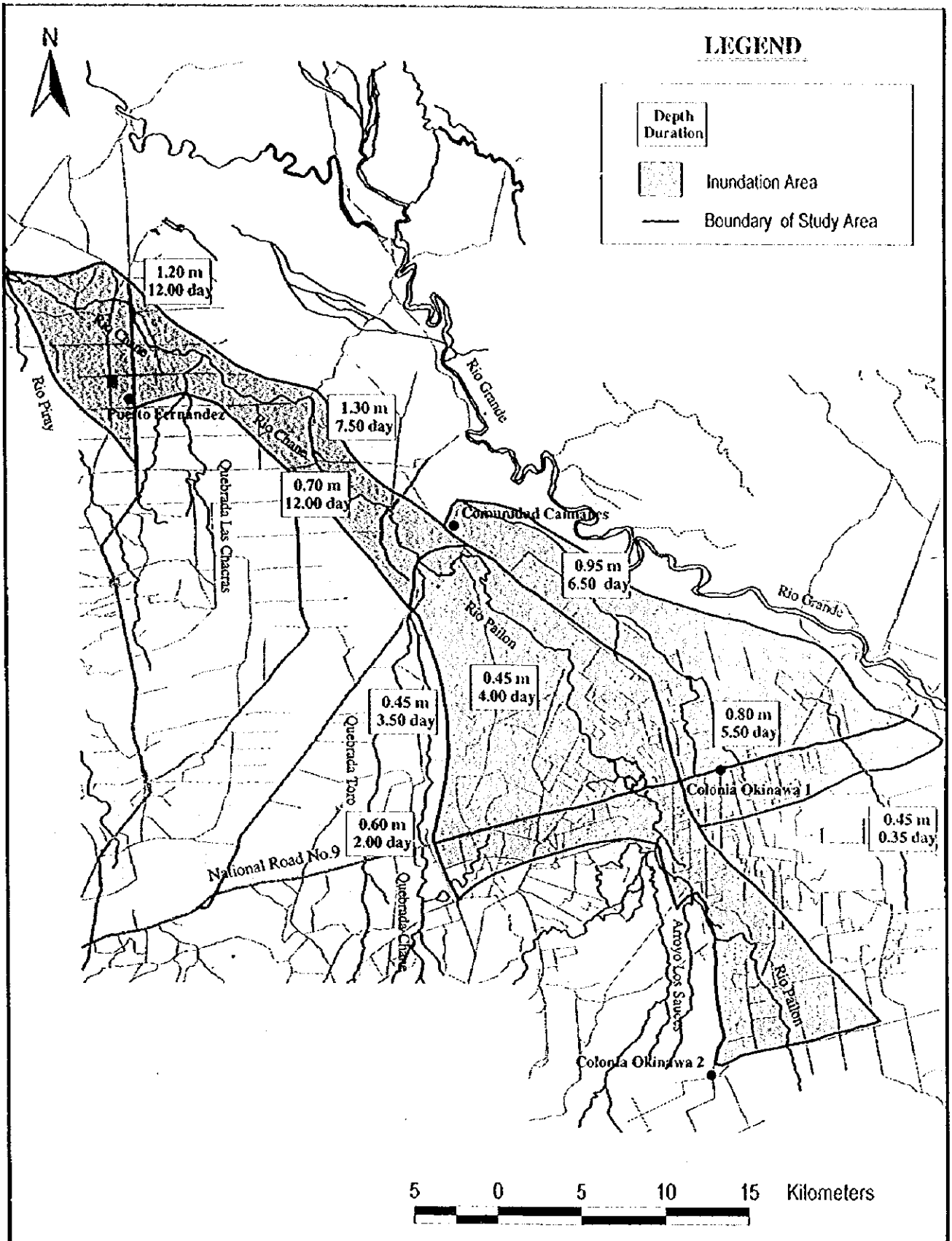


FIG. 7 INUNDATION AREA IN THE CHANE-PAILON AREA
(BY THE FLOODS IN THE MASTER PLAN)

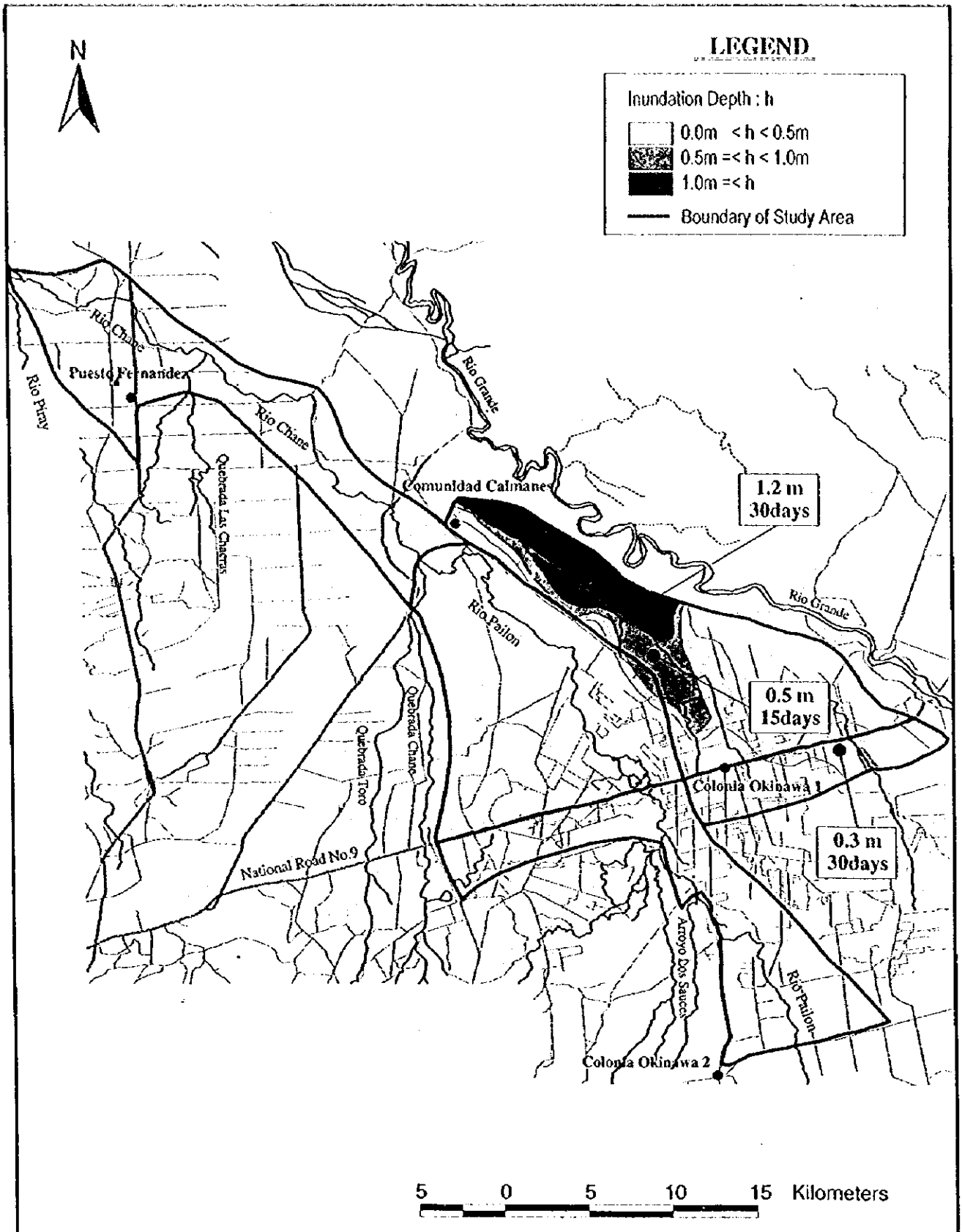


FIG. 8 INUNDATION AREA IN THE CHANE-PAILON AREA (BY THE FLOODS DURING FEBRUARY TO MARCH 1997 FROM RIO GRANDE)

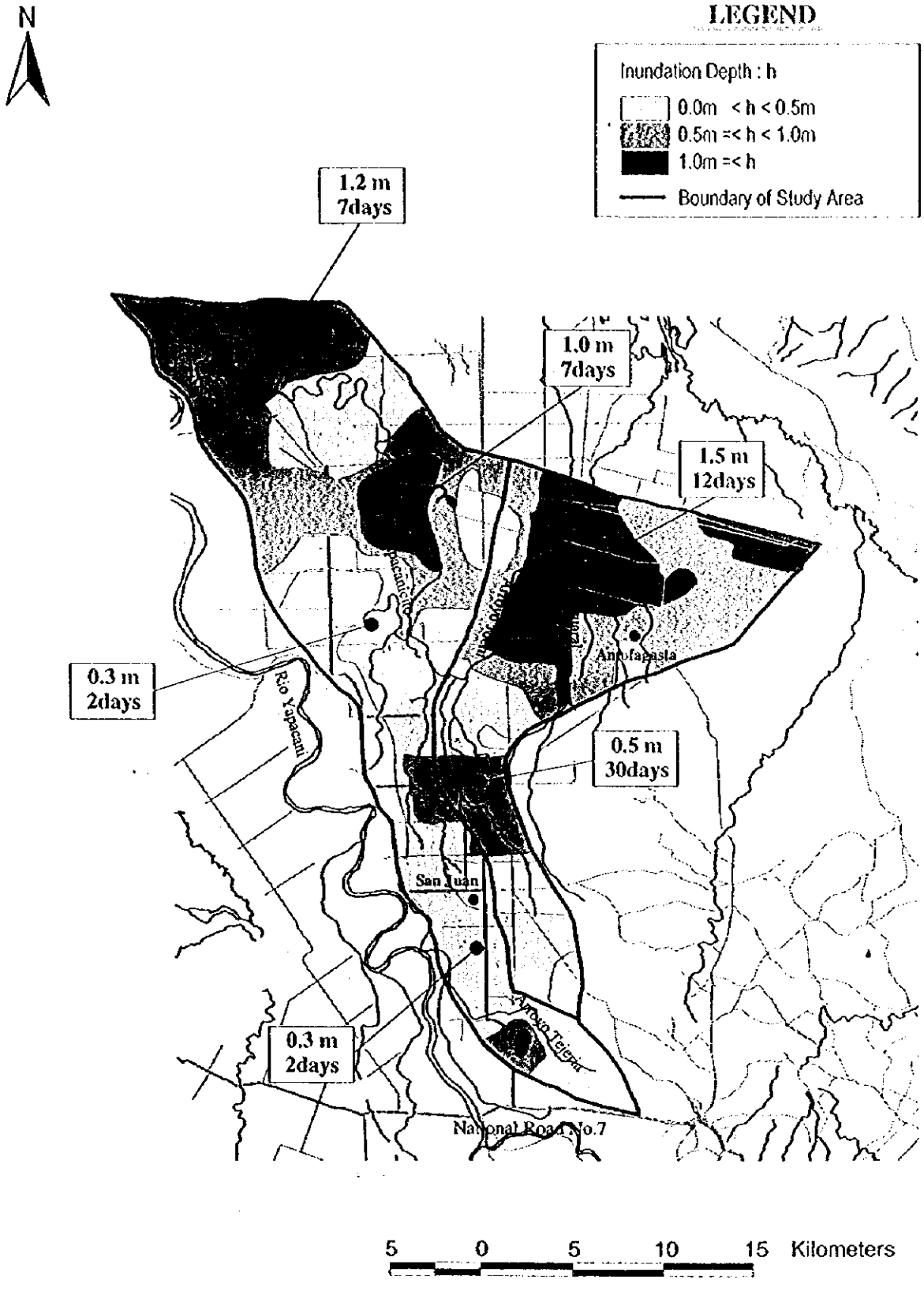


FIG. 9 INUNDATION AREA IN THE SAN JUAN-ANTOFAGASTA AREA (BY THE FLOODS DURING DECEMBER 1996 TO FEBRUARY 1997)

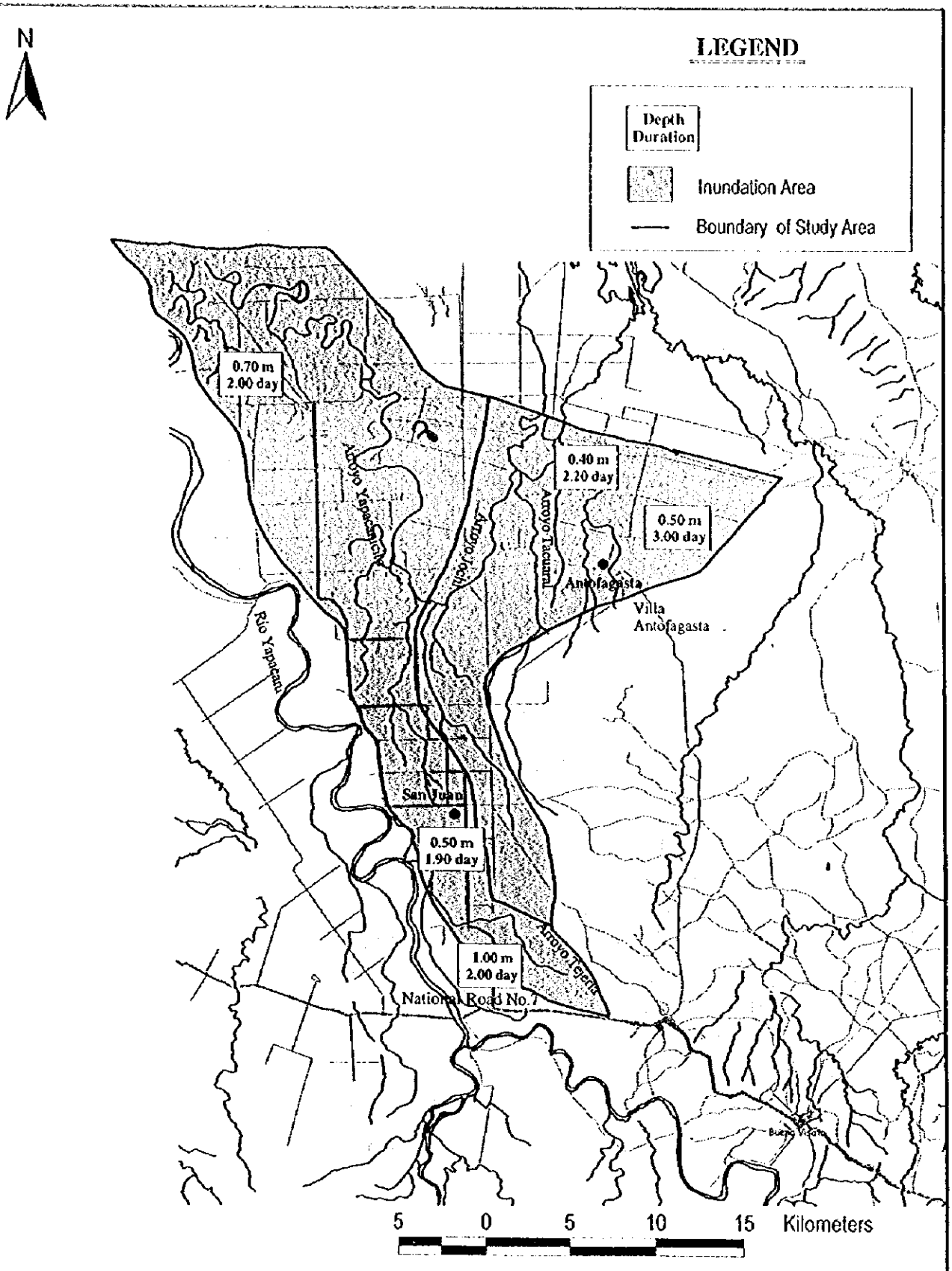


FIG. 10 INUNDATION AREA IN THE SAN JUAN-ANTOFAGASTA AREA (BY THE FLOODS IN THE MASTER PLAN)

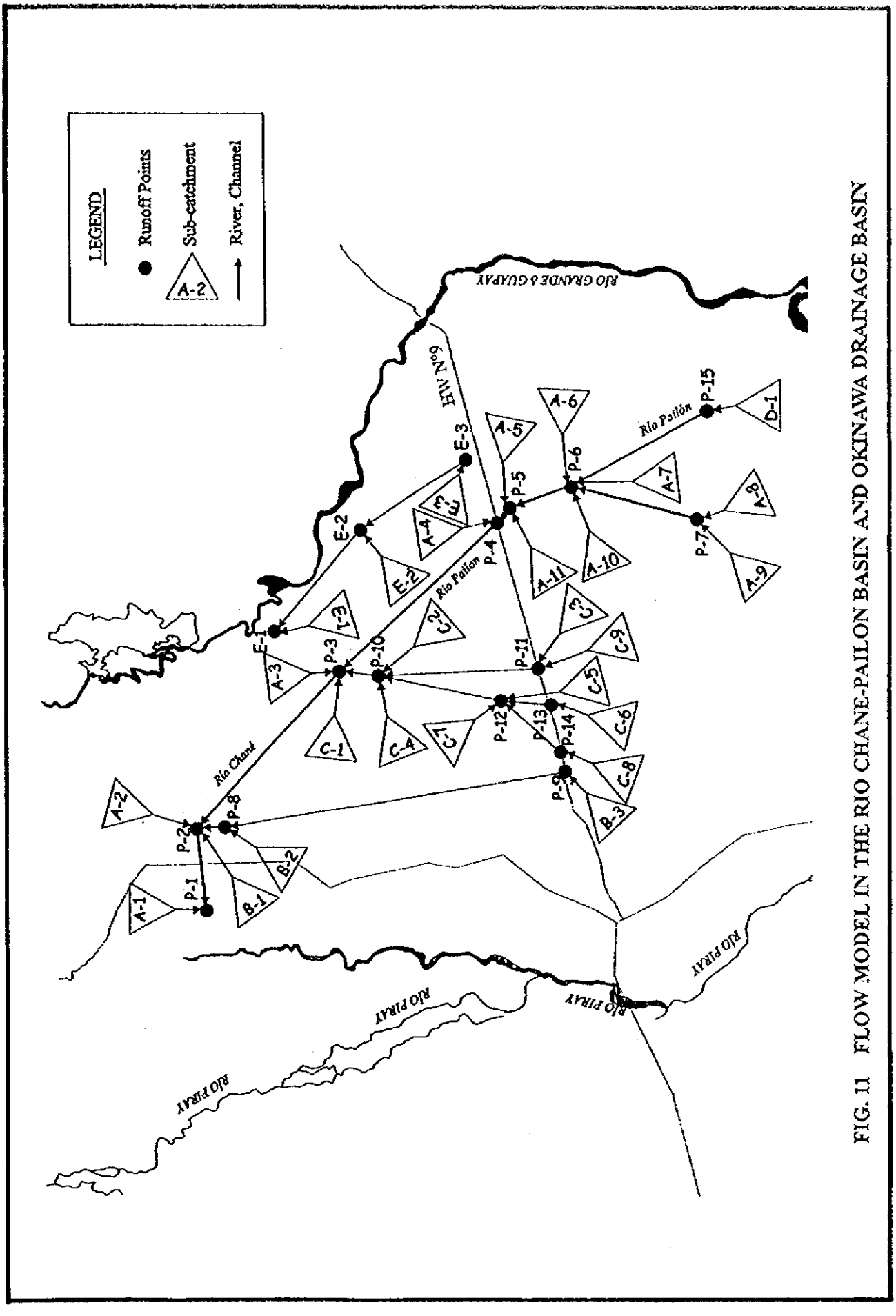


FIG. 11 FLOW MODEL IN THE RIO CHANE-PAILON BASIN AND OKINAWA DRAINAGE BASIN

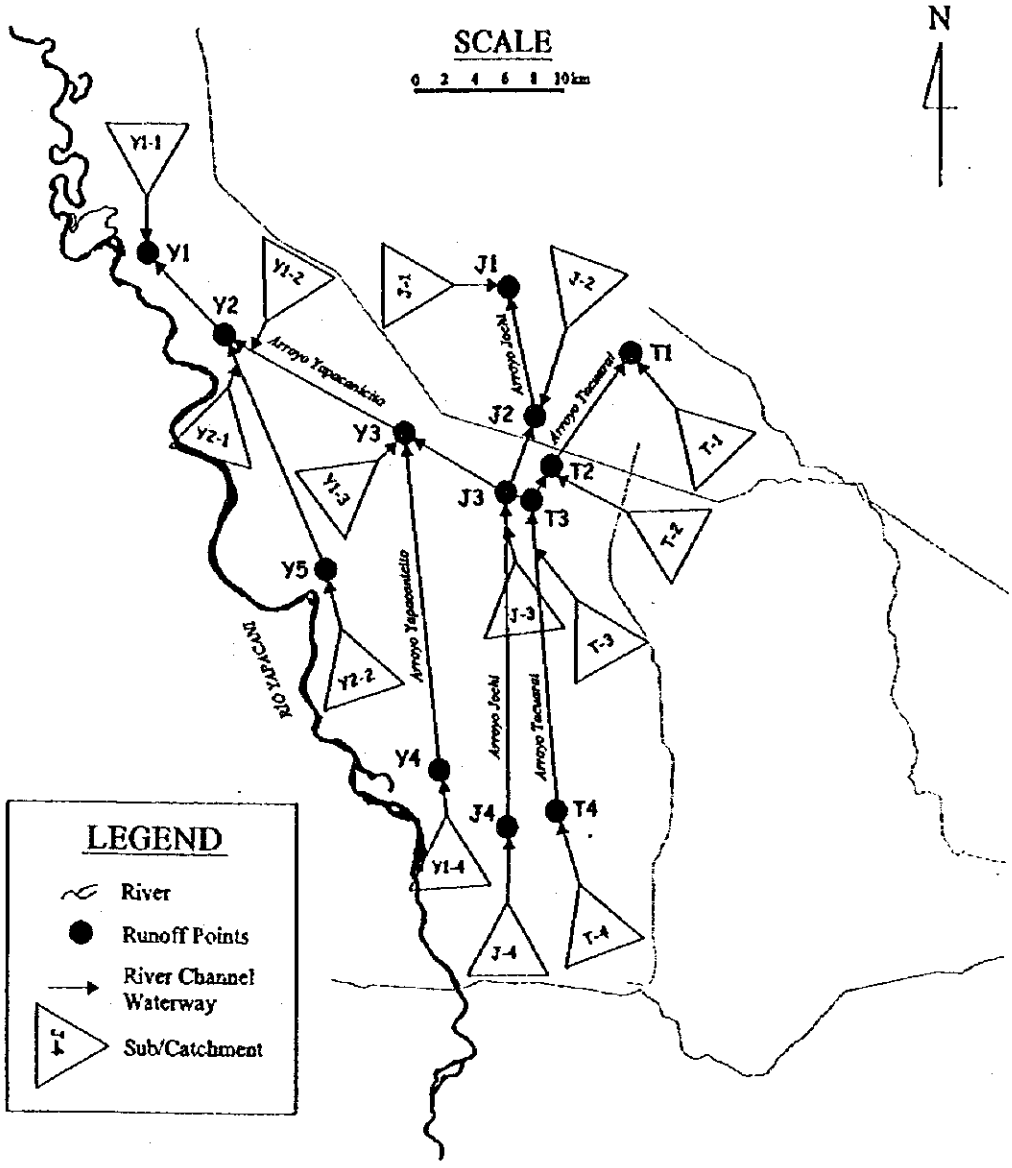


FIG. 12 FLOW MODEL IN THE ARROYO YAPACANICITO, JOCHI AND TACUARAL BASIN

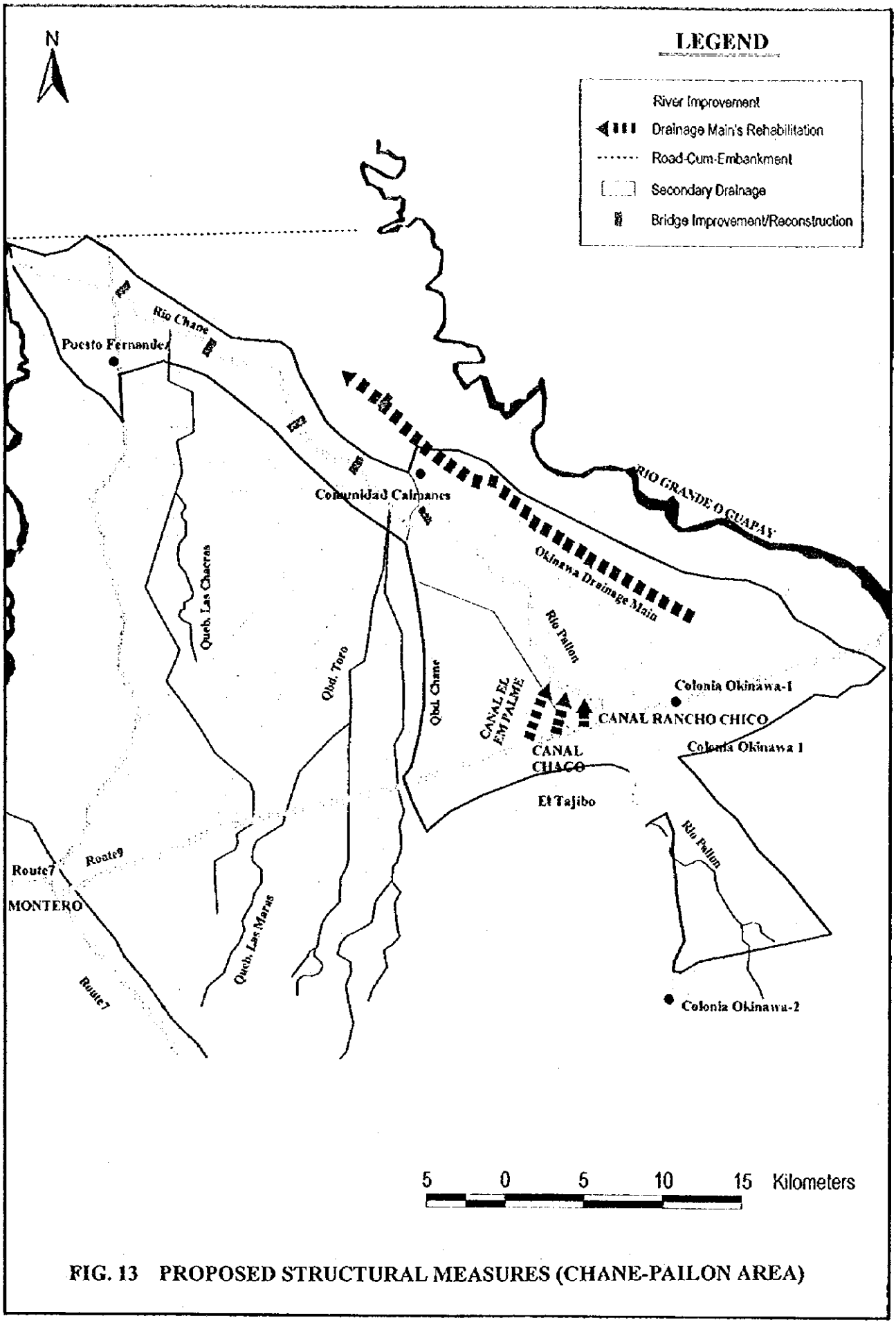


FIG. 13 PROPOSED STRUCTURAL MEASURES (CHANE-PAILON AREA)

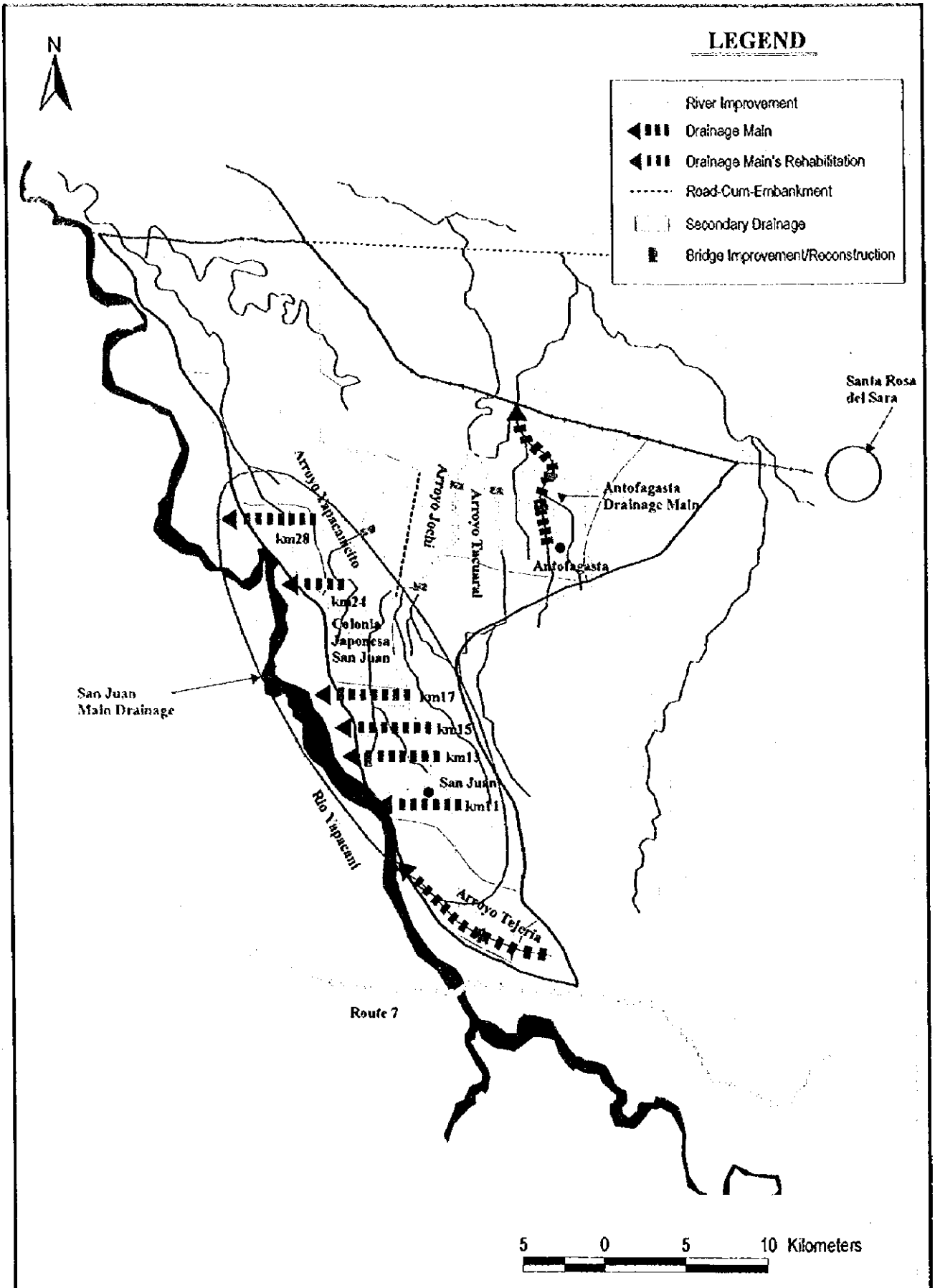
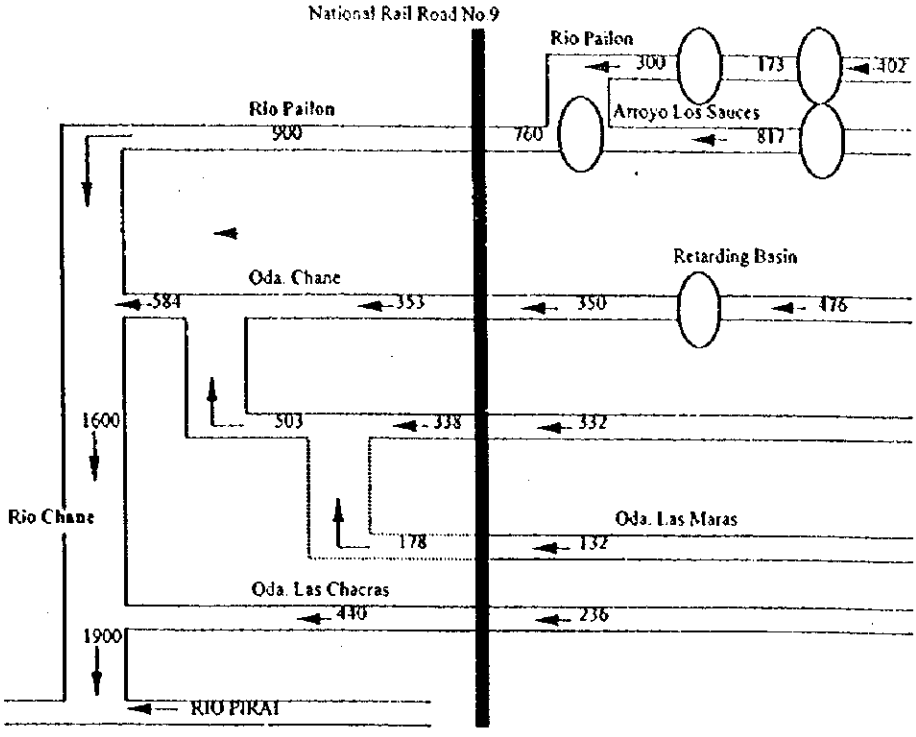
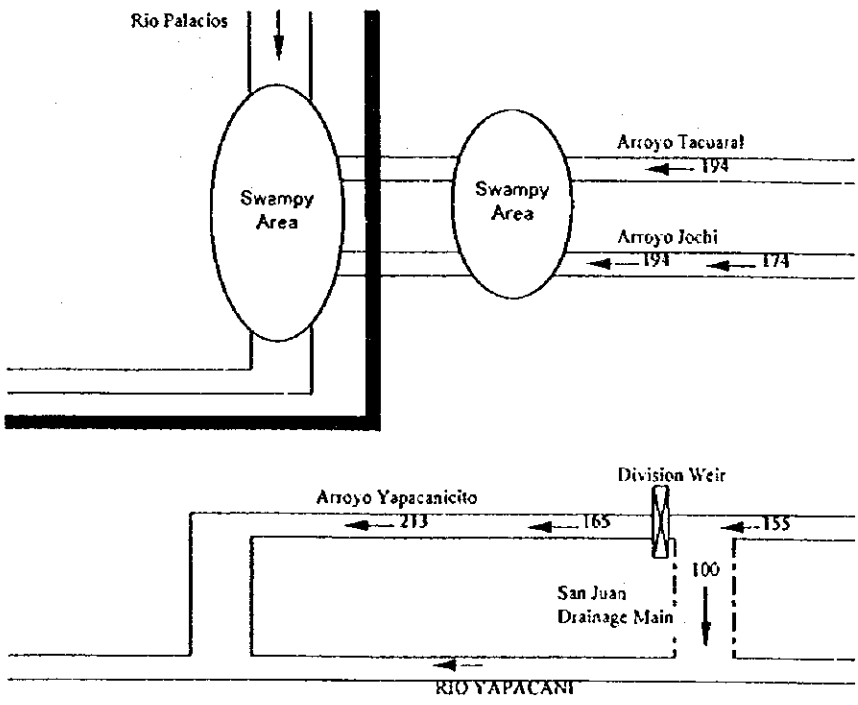


FIG. 14 PROPOSED STRUCTURAL MEASURES (SAN JUAN-ANTOFAGASTA AREA)



CHANE-PAILON SCHEME



SAN JUAN=ANTOFAFASTA SCHEME

Legen
: Design Discharge (m^3/sec)
: With River Improvement
: Without River Improvement
: Rehabilitation of Drainage
: With Drainage Improvement

FIG. 15 DESIGN DISCHARGE DISTRIBUTION OF 10-YEAR FLOODS

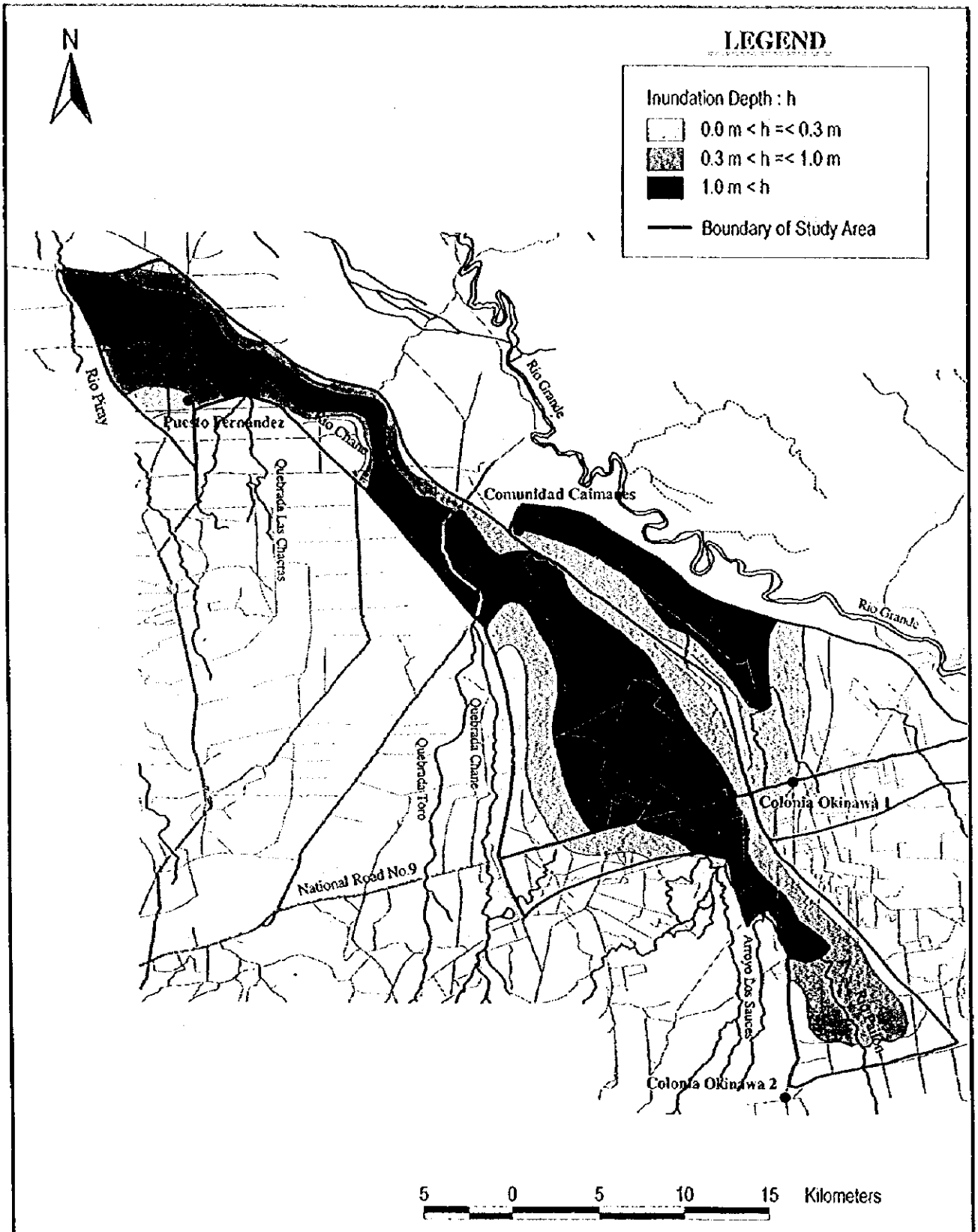


FIG. 16 INUNDATION AREA IN THE CHANE-PAILON AREA (WITHOUT PROJECT; 10 YEARS RETURN PERIOD)

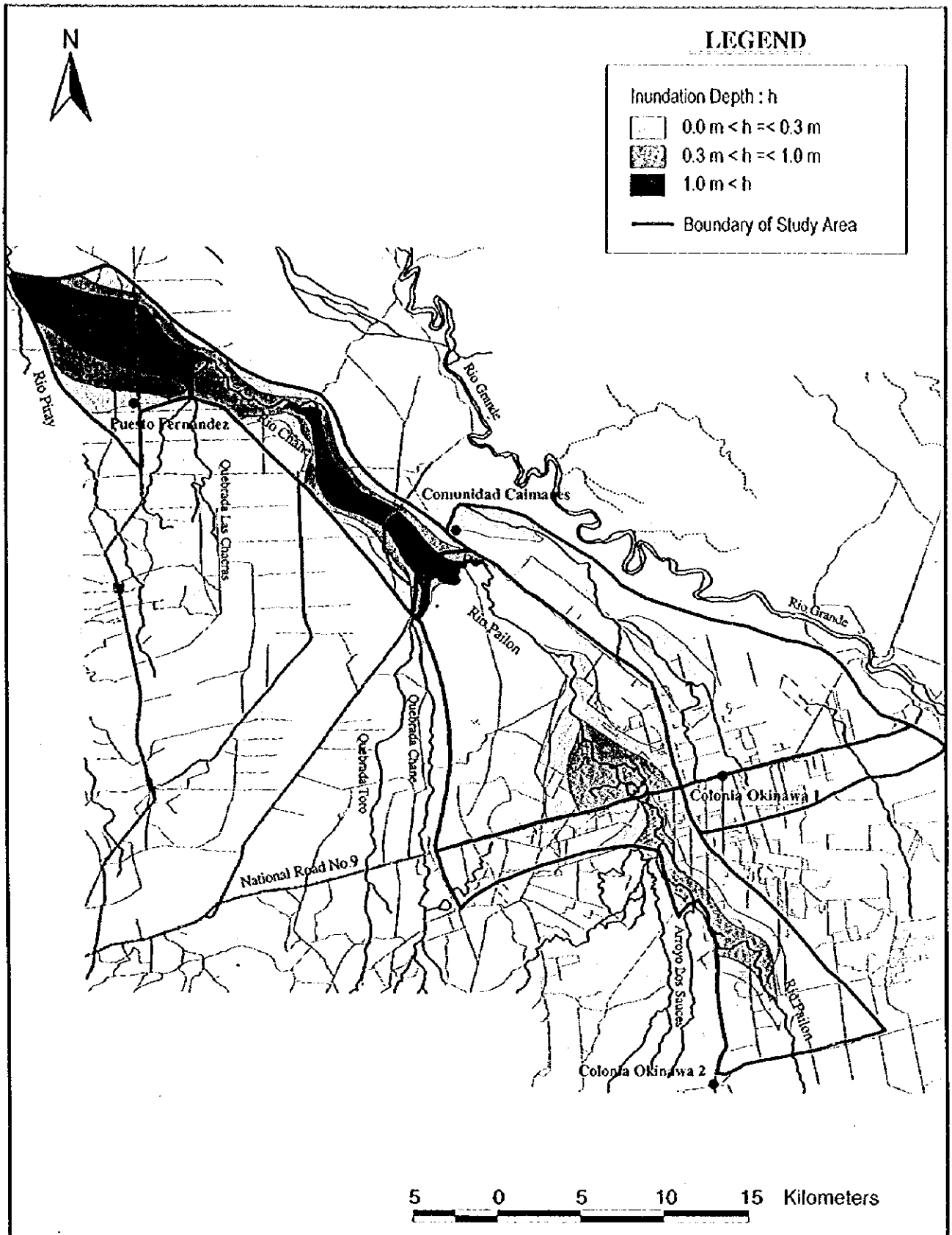


FIG. 17 INUNDATION AREA IN THE CHANE-PAILON AREA (WITH PROJECT; 10 YEARS RETURN PERIOD)

FIG. 18 INUNDATION AREA IN THE SAN JUAN-ANTOFAGASTA AREA (WITHOUT PROJECT; 10YEARS RETURN PERIOD)

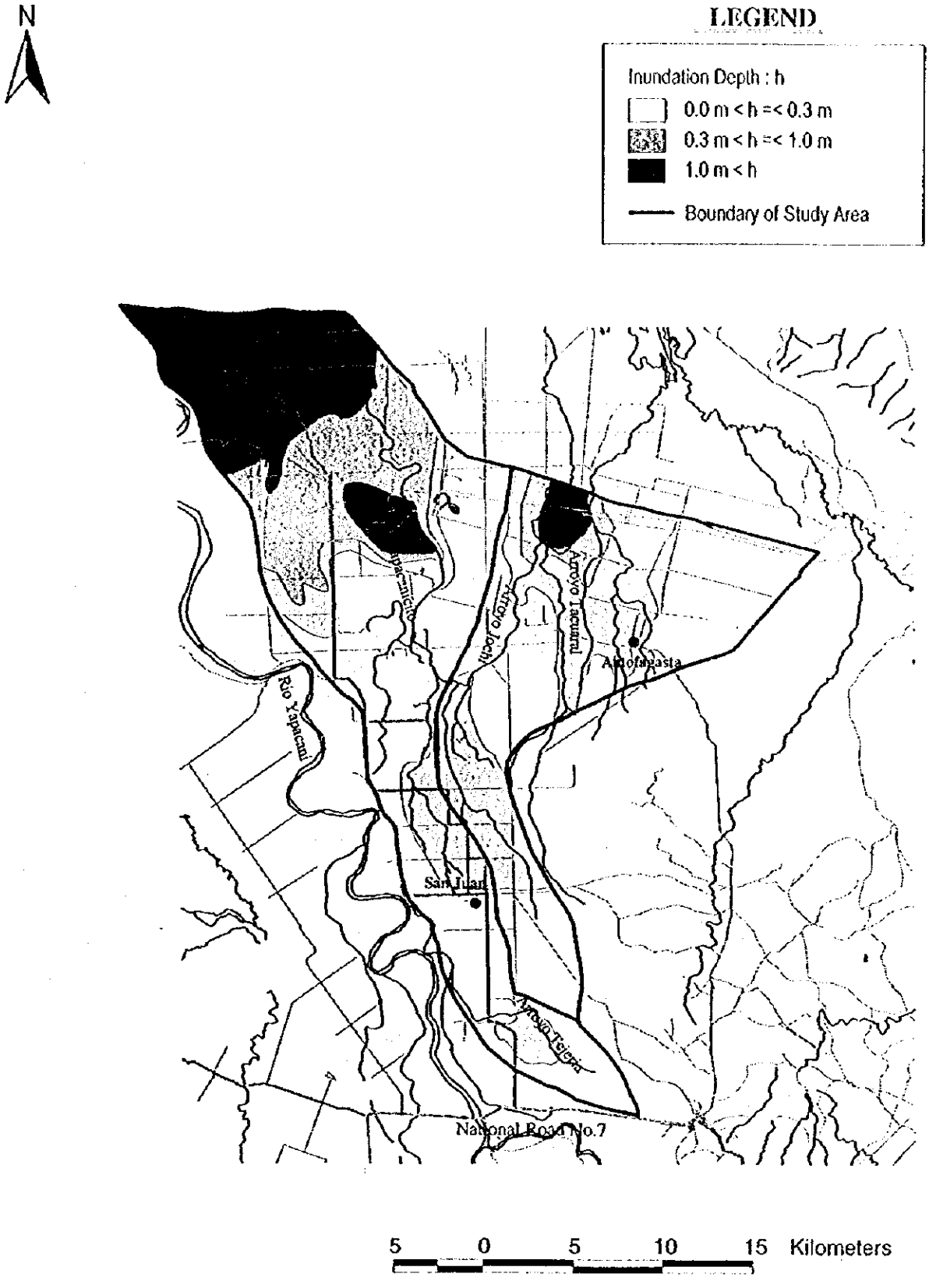


FIG. 19 INUNDATION AREA IN THE SAN JUAN-ANTOFAGASTA AREA (WITH PROJECT; 10YEARS RETURN PERIOD)

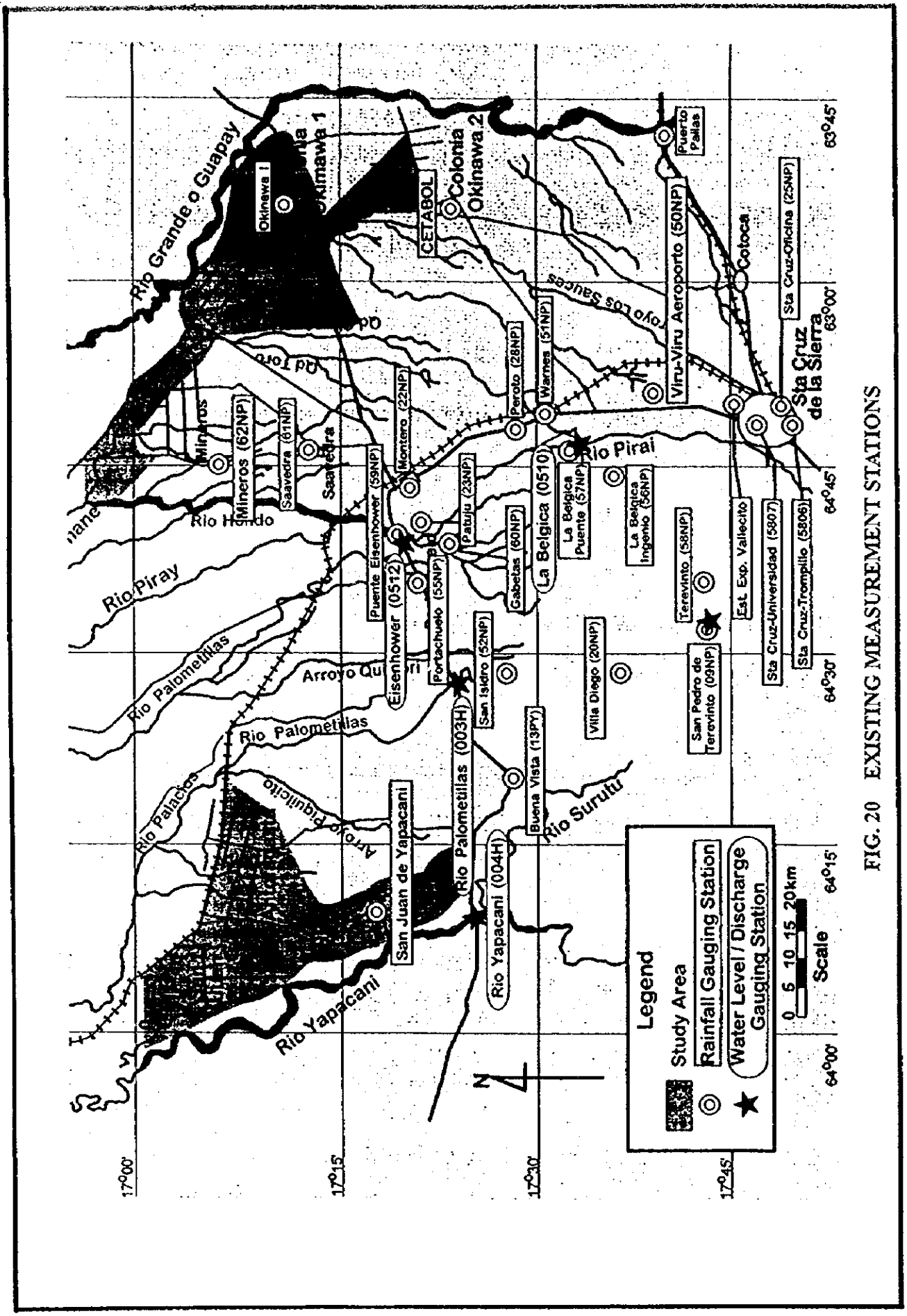


FIG. 20 EXISTING MEASUREMENT STATIONS

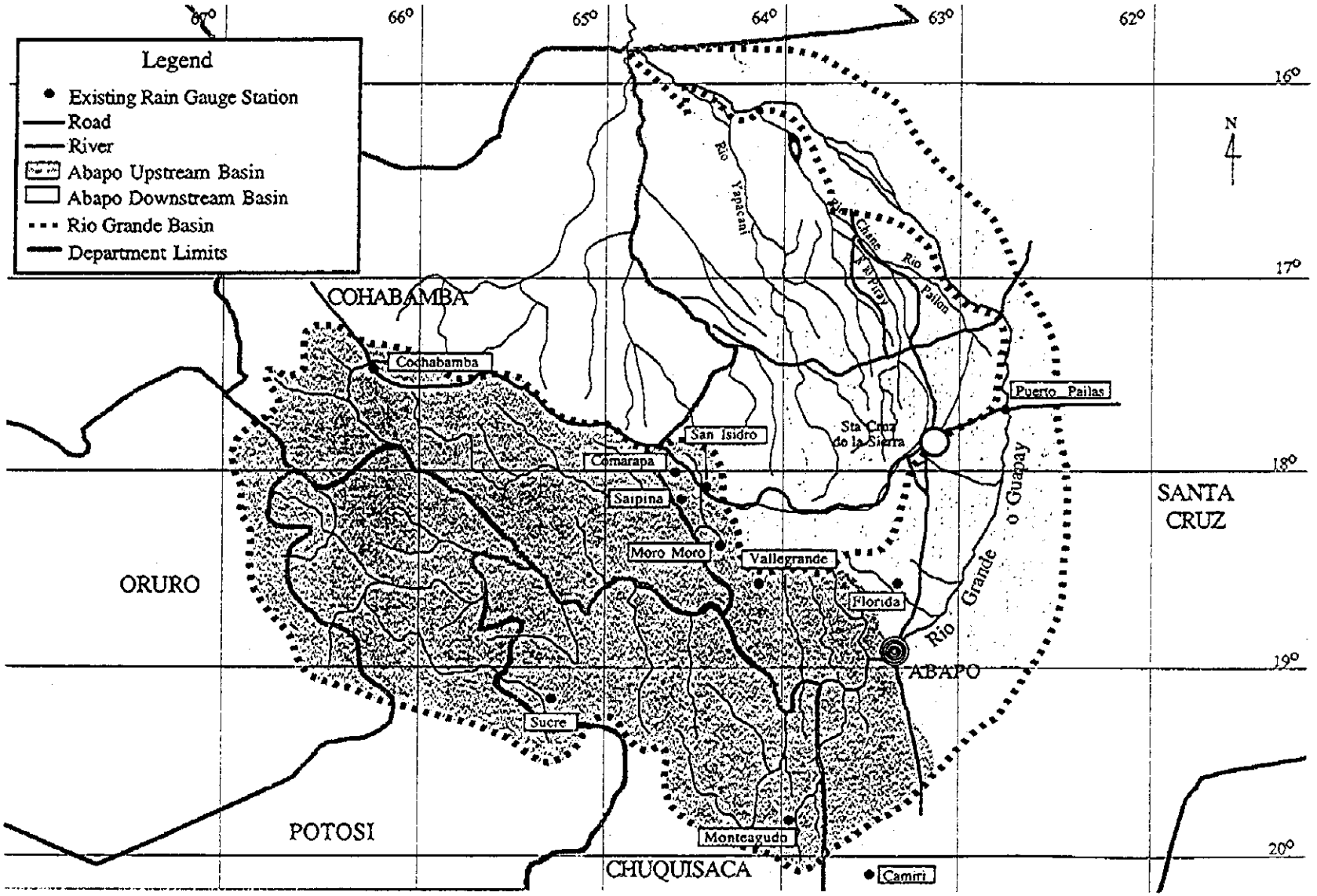


FIG. 21 RIO GRANDE BASIN

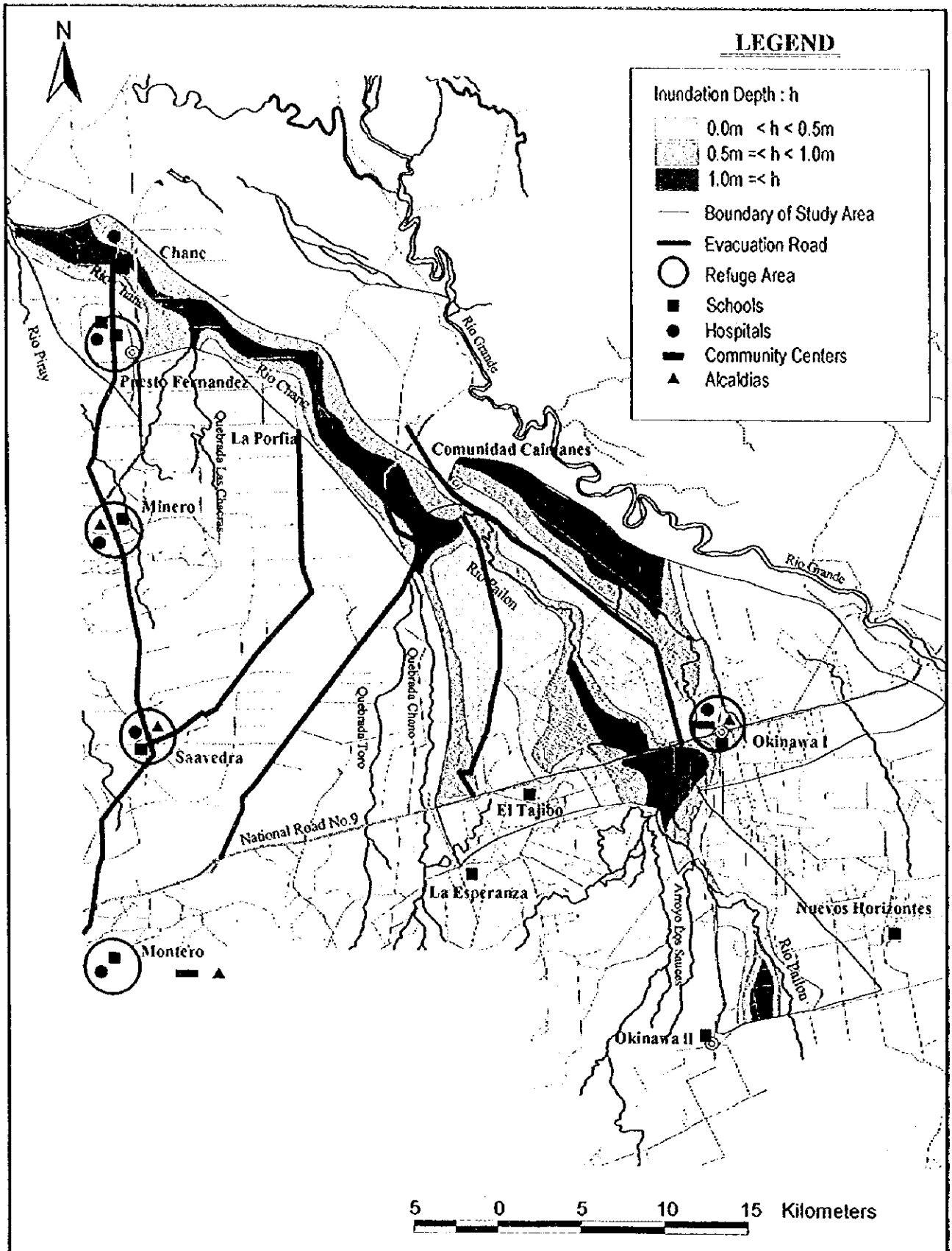


FIG. 22 FLOOD HAZARD MAP OF THE CHANE-PAILON AREA
(FLOOD AREA DURING NOVEMBER TO DECEMBER 1997)

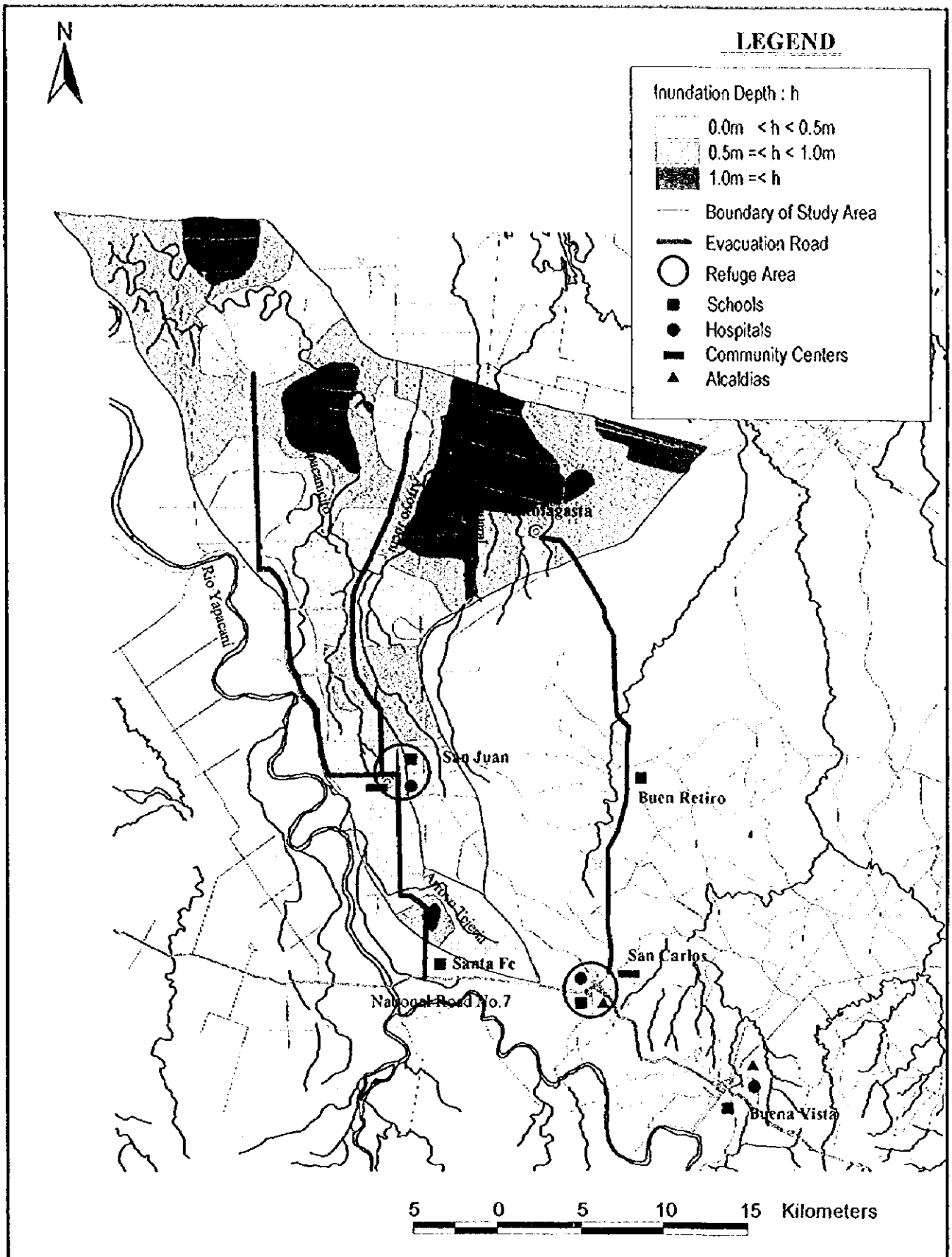


FIG. 23 FLOOD HAZARD MAP OF THE SAN JUAN-ANTOFAGASTA AREA (FLOOD AREA DURING DECEMBER 1996 TO FEBRUARY 1997)

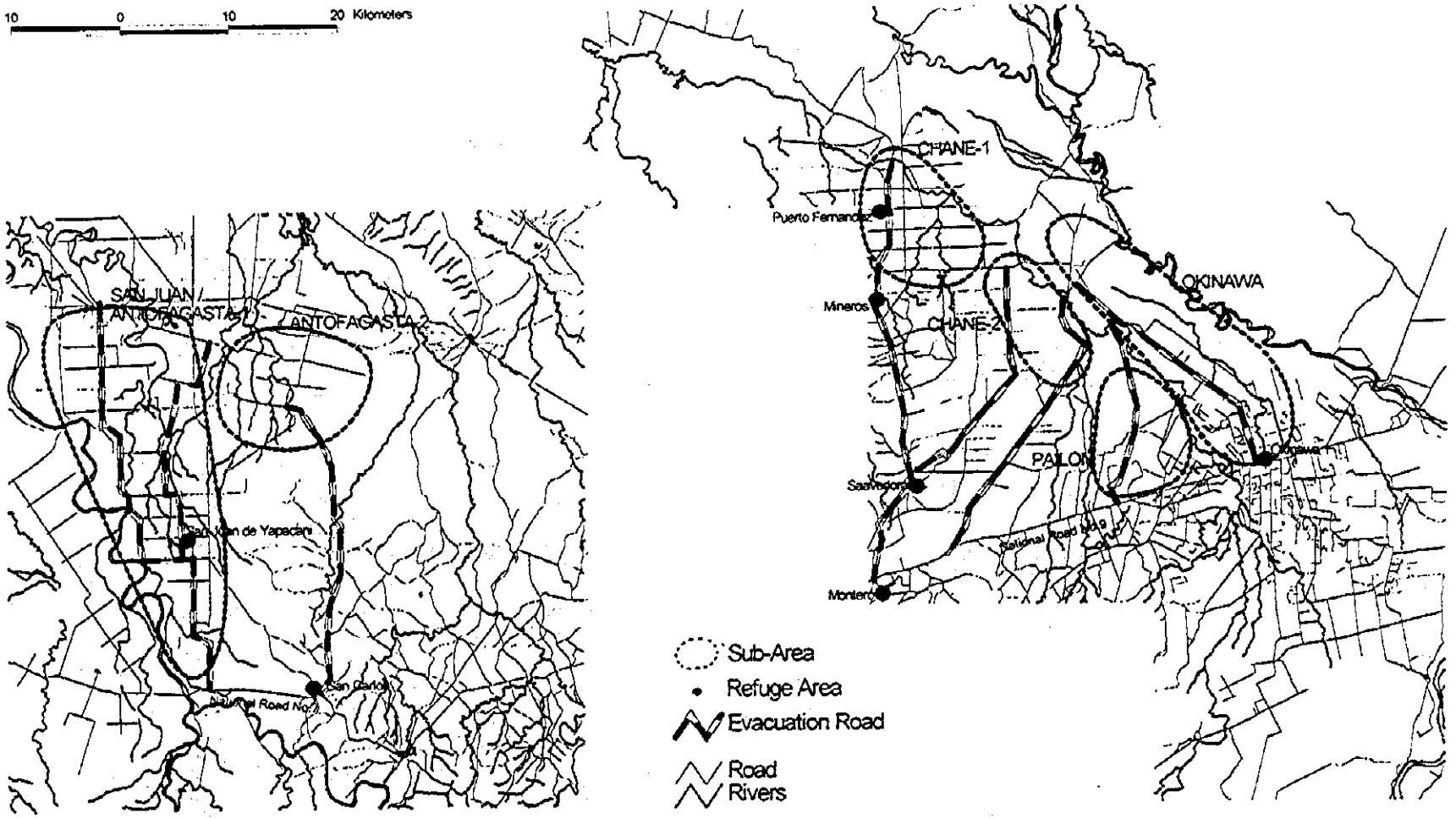


FIG. 24 PROPOSED EVACUATION PLAN

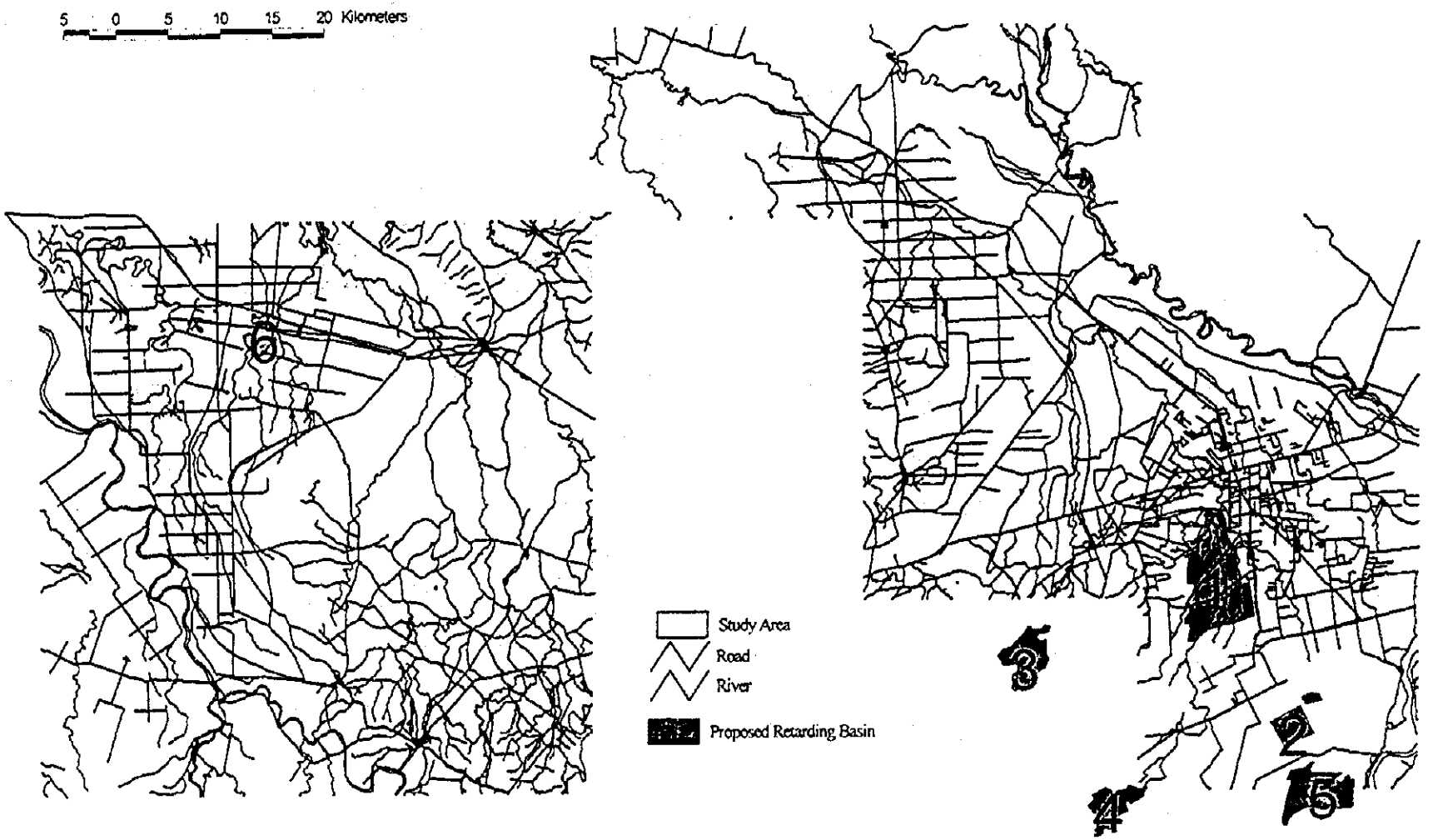


FIG. 25 PROPOSED RETARDING BASINS

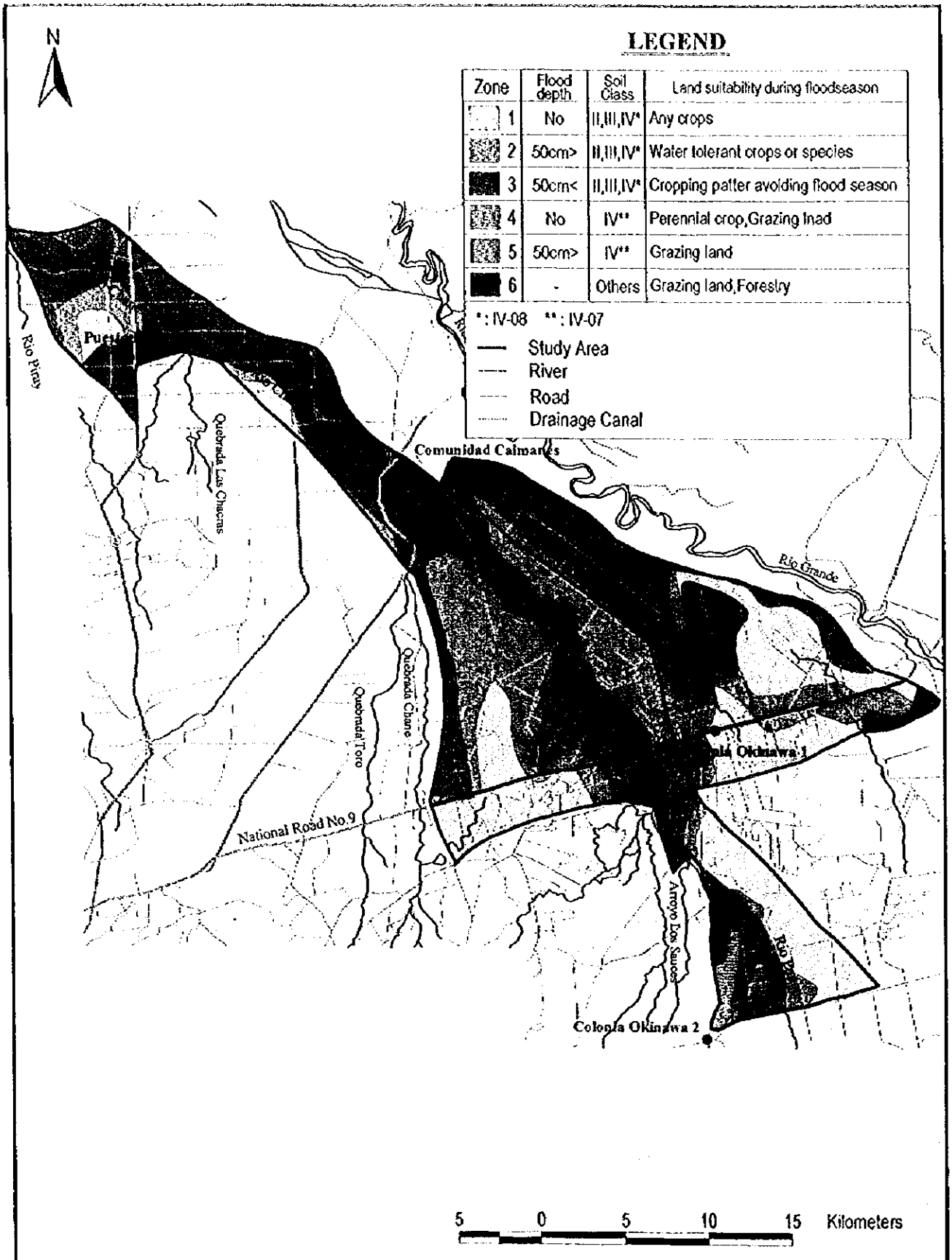


FIG. 26 ZONING FOR AGRICULTURAL LAND USE (CHANE-PAILON)

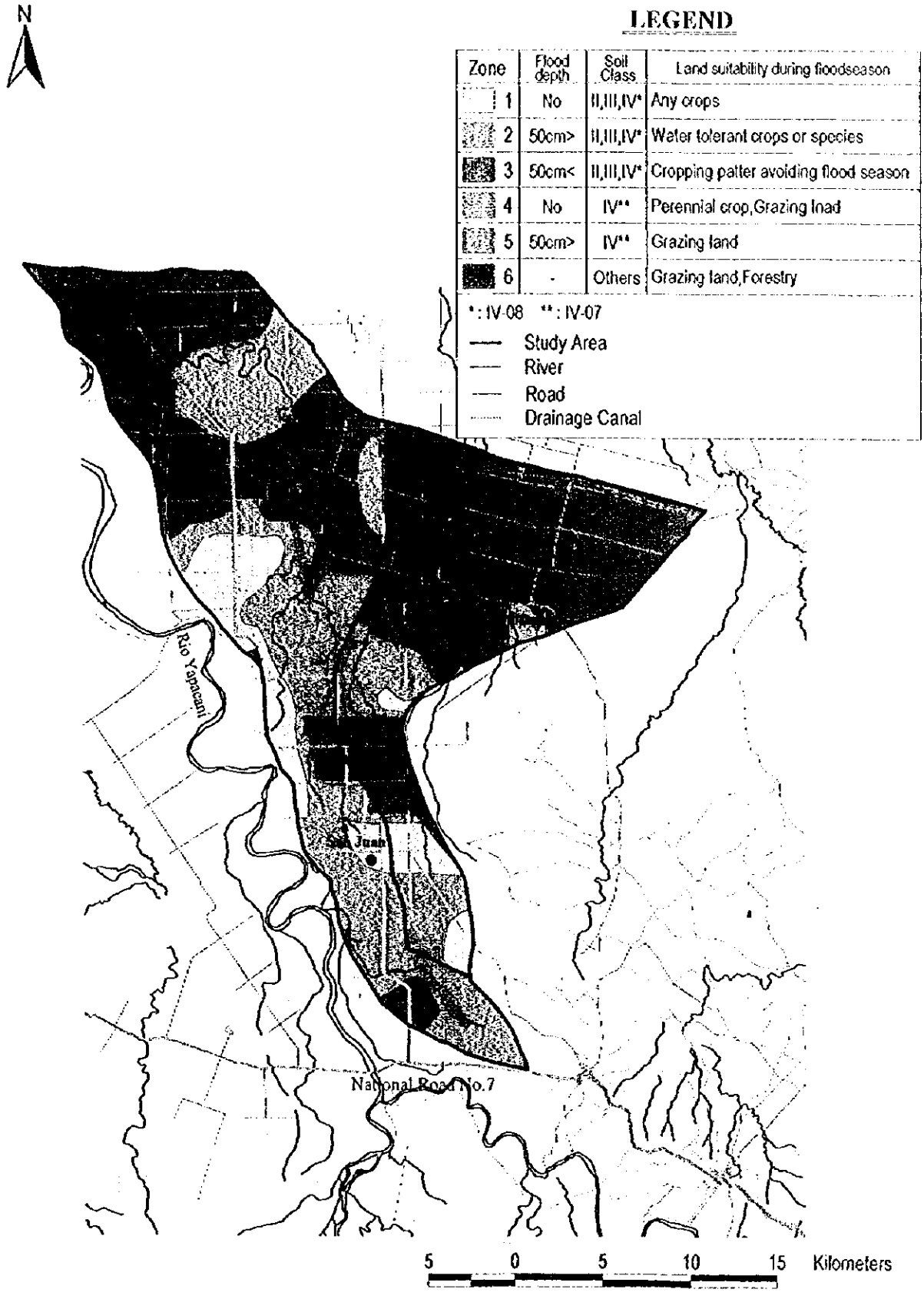


FIG. 27 ZONING FOR AGRICULTURAL LAND USE (SAN JUAN-ANTOFAGASTA)

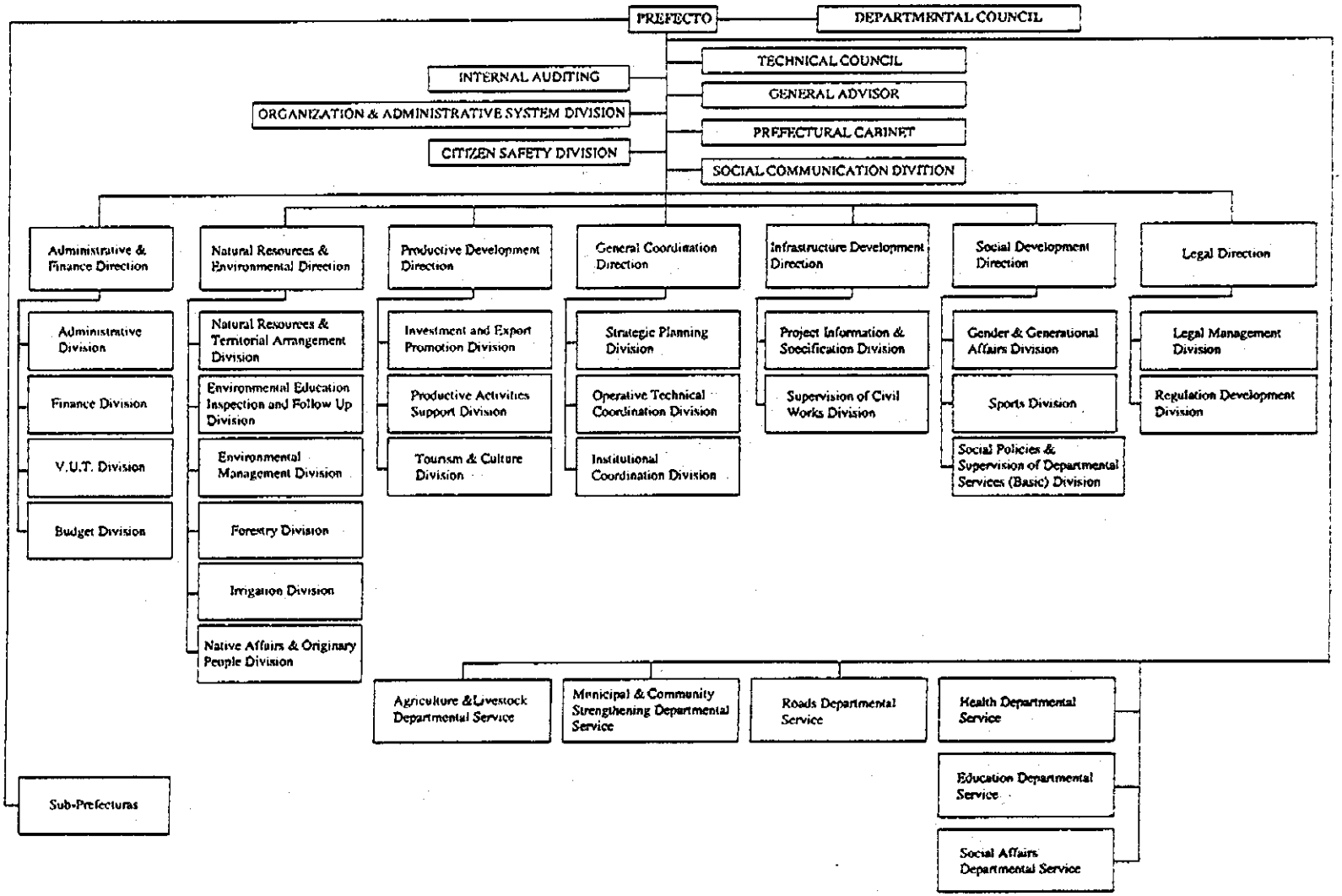


FIG. 28 ORGANIZATION ,DEPARTMENT OF SANTA CRUZ (D.S. 25060)