付　表

表-1 土地利用計画概要

Zone	Name	Main production	Natural conditions	Type of inundation	Problem of agriculture	Countermeasure for inundation	Alleviationeffect for inundation**	Countermeasure for agriculture	Target of agriculture development
1	Low precipitation area (Cotoca)	cattle ,cotton, sugar cane, Soybean	soil consisting of sand and silt.Low precipitation (1,300mm)	Uncommon (D)	- Disparity of farm income by size, - Drought	-	-	Introduction of high productive crop for small scale farmer	High productive area
2	Intensive upland crop area (Okinawa)	soybean , rice, maize, wheat, cattle	Fertile alluvial soil, Low precipitation(1,300mm)	Flood and drainage (B,C)	- Degradation of soil fertility	-Protection of overflow -Drainage improvement	A,B	Introduction of appropriate crop rotation and diversification	Diversified crop production area
3	Sugar cane production area (Montero)	sugar cane, cattle	Fertile alluvial soil, Medium precipitation(1,300-1,800mm)	Flood and drainage (B,C)	-Decreasing productivity by continuous cropping	-River improvement -Drainage improvement	A,B	Introduction of appropriate crop rotation, diversification	Diversified crop production area
4	Local colony -1 (Minero)	Sugar cane, rice	Fertile alluvial soil, Medium precipitation(1,300-1,800mm)	Flood (A)	- Severe flood damage	-River improvement	C	Introduction of water tolerant variety or crop	Stable production area
5	New developed upland crop area (Chane)	soybean, sugar cane, rice	Fertile alluvial soil, Medium precipitation(1,300-1,800mm)	Flood (A)	- Severe flood damage	-Protection of overflow	C,D	Introduction of water tolerant variety or crop	Stable and high productivity area
6	Intensive diversified agricultural area (San Juan)	rice ,egg soybean , cattle, fruits	Poor drainagesoil, High precipitation(more than 1,800mm)	Drainage (B)	- Poor drainage of soil	-Drainage improvement	A	Expansion of perennial crop	Intensive mixed farming area
7	Local colony-2 (Anto Fagasta)	soybean,rice, cattle	Poor drainage, High precipitation (more than 1,800mm)	Drainage (B)	- Poor drainage - Damage of rat	-Drainage improvement	B	Introduction of high productive crop	Stable production area
8	Grazing area (Chane)	cattle ,soybean	Low fertile soil, Medium precipitation (1,300-1,800mm)	Uncommon (D)	- Low fertility	-	-	Introduction of high productive pasture	Intensive cattle raising area
9	Forest area (Sara)	timber,cattle	Low fertile soil, High precipitation (more than 1,800mm)	Partially flood (B,C,D)	- Decreasing of useful timber	-Local drainage improvement	D	Reforestation of useful tree	High productive forest area

* :Severity of inundation=A>B>C>D

**:Alleviationeffects for inundation=A>B>C>D

表-2 施工計画：CHANE - PAILON 地区(代替案 I)

ALTERNATIVE I

Sub-Project	Const. Volume	Year 0	1	2	3	4	5	6	7	8	9	10
1.RIO CHANE BASIN												
Rio Chane	27.0km											
2. RIO PAILON BASIN												
Rio Pailon	32.0km											
Main Drainage	6.5km											
Secondary Drainage	50.0km2											
3. CHANE CHACRAS BASIN												
Queb. Las Chacras	36.5 km											
Main Drainage	21.5 km											
Secondary Drainage	284.0km2											
4. QUEBRADA CHANE BASIN												
Queb. Chane	18.0km											
Queb. El Toro	16.0km											
Main Drainage	8.0km											
5. OKINAWA DRAINAGE BASIN												
Main Drainage	21.0km											
Secondary Drainage	147.0km2											

表-3 施工計画：SAN JUAN - ANTOFAGASTA 地区(代替案 I)

ALTERNATIVE I

Sub-Project	Const. Volume	Year 0	1	2	3	4	5	6	7	8	9	10
1.SAN JUAN BASIN												
Arroyo Yapacanicito	14.1km											
Main Drainage	41.3km											
Secondary Drainage	115.0km2											
2. ANTOFAGASTA BASIN												
Arroyo Tacuaral	7.7km											
Arroyo Jochi	12.6km											
Road -	9.0km											
Main Drainage	10.0km											
Secondary Drainage	121.0km											

表-4 施工計画：CHANE - PAILON 地区(代替案 II)

ALTERNATIVE II

Sub-Project	Const. Volume	Year 0	1	2	3	4	5	6	7	8	9	10
2. RIO PAILON BASIN												
Rio Pailon	32.0km											
Main Drainage	6.5km											
Secondary Drainage	50.0km2											
3. CHANE CHACRAS BASIN												
Queb. Las Chacras	36.5 km											
Main Drainage	21.5 km											
Secondary Drainage	284.0km2											
4. QUEBRADA CHANE BASIN												
Queb. Chane	18.0km											
Queb. El Toro	16.0km											
Main Drainage	8.0km											
5. OKINAWA DRAINAGE BASIN												
Main Drainage	21.0km											
Secondary Drainage	147.0km2											

表-5 施工計画：SAN JUAN - ANTOFAGASTA 地区(代替案 II)

ALTERNATIVE II

Sub-Project	Const. Volume	Year 0	1	2	3	4	5	6	7	8	9	10
1.SAN JUAN BASIN												
Arroyo Yapacanicito	14.1km											
Main Drainage	41.3km											
Secondary Drainage	115.0km2											
2. ANTOFAGASTA BASIN												
Arroyo Tacuaral	7.7km											
Arroyo Jochi	12.6km											
Road	9.0km											
Main Drainage	10.0km											
Secondary Drainage	121.0km											

表－6　事業評価総括表（代替案　I）

Ranking of Viability for Priority Projects : A: High B: Marginal C: Low

Project/Sub-project	Measures	Assessment								Project Viability	
		Technical Evaluation		Economic Evaluation		Social Impact		Environmental Impact			
				Feasibility	EIRR (%)	Impact	Protected Area (km2)				
A. EASTERN AREA											
A-1 CHANE - PAILON	Structural with non-structural measures	Highly Effective	A	Feasible	11.04 A	High Impact	470.1 A	Negligibly small	B	High viability	A
1) Rio Chane	- ditto -	As the main stream area, indispensable for avoiding any adverse effect. More effective with flood control of the Rio Piray.	A	Not feasible	negative C	Same as present	0.0 B	Same as present	B	High viability for avoiding any adverse effect. More effective with flood control of the Rio Piray.	A
2) Rio Pailon	- ditto -	Indispensable as the main stream area	A	Highly feasible	14.33 A	High impact	117.8 A	Negligibly small	B	High viability as the main stream area	A
3) Quebrada Chane	- ditto -	Effect to only limited area of the tributary area	C	Feasible	12.52 A	Medium impact as the extensive landuse area	54.0 B	Negligibly small	B	Low viability as the tributary area	C
4) Chane - Chacras	- ditto -	High necessity as the tributary area	B	Highly feasible	15.38 A	High impact as wide effective area	226.4 A	Negligibly small	B	Medium viability as the tributary area	B
5) Okinawa Drainage	- ditto -	High necessity as the major drainage area	A	Feasible	12.21 A	High impact as the intensive landuse area	71.9 A	Negligibly small	B	High viability as the major drainage area	A
A-2 SOUTHERN PART	Non-structural Measures	Highly Effective		-		High impact		-		High viability	
A-3 RIO GRANDE DOWNSTREAM	Non-structural Measures	Highly effective		-		High impact		-		High viability	
B. WESTERN AREA											
B-1 SAN JUAN - ANTOFAGASTA	Structural with non-structural measures	Highly effective	A	Feasible	13.41 A	High impact	210.3 A	Negligibly small	B	High viability	A
1) San Juan	- ditto -	Necessary	B	Marginal	9.97 B	High impact as the intensive landuse area	81.4 A	Negligibly small	B	High viability	A
2) Antofagasta	- ditto -	Indispensable	A	Highly feasible	16.24 A	High impact as the local colony	128.9 A	Negligibly small	B	High viability	A
B-2 PALACIOS - PALOMETILLAS	Non-structural Measures	Effective		-		Medium impact		-		Medium viability	
C. RIO PIRAY	-	Flood control measures necessary		-		-		-		-	

Note: 1) Protected area is the mitigated area by flood control and drainage improvement for the 10-year floods.

表－7　事業評価総括表（代替案　ＩＩ）

Ranking of Viability for Priority Projects : A: High B: Marginal C: Low

	Project/Sub-project	Measures	Assessment								Project Viability	
			Technical Evaluation		Economic Evaluation		Social Impact		Environmental Impact			
					Feasibility	EIRR (%)	Impact	Protected Area (km2)				
A.	EASTERN AREA											
A-1	CHANE - PAILON	**Structural with non-structural measures**	**Highly Effective**	A	**Feasible**	**14.00** A	**High Impact**	**470.1** A	**Negligibly small**	B	**High viability**	A
1)	Rio Chane	Non-structural measures	Highly effective		-	-	High impact	-	-		High viability	
2)	Rio Pailon	Structural with non-structural measures	Indispensable as the main stream area	A	Highly feasible	14.33 A	High impact	117.8 A	Negligibly small	B	High viability as the main stream area	A
3)	Quebrada Chane	- ditto -	Effect to only limited area of the tributary area	C	Feasible	12.52 A	Medium impact as the extensive landuse area	54.0 B	Negligibly small	B	Low viability as the tributary area	C
4)	Chane - Chacras	- ditto -	High necessity as the tributary area	B	Highly feasible	15.38 A	High impact as wide effective area	226.4 A	Negligibly small	B	Medium viability as the tributary area	B
5)	Okinawa Drainage	- ditto -	High necessity as the major drainage area	A	Feasible	12.21 A	High impact as the intensive landuse area	71.9 A	Negligibly small	B	High viability as the major drainage area	A
A-2	SOUTHERN PART	**Non-structural Measures**	**Highly Effective**		-		**High impact**		-		**High viability**	
A-3	RIO GRANDE DOWNSTREAM	**Non-structural Measures**	**Highly effective**		-		**High impact**		-		**High viability**	
B.	WESTERN AREA											
B-1	SAN JUAN - ANTOFAGASTA	**Structural with non-structural measures**	**Highly effective**	A	**Feasible**	**12.51** A	**High impact**	**206.1** A	**Negligibly small**	B	**High viability**	A
1)	San Juan	- ditto -	Necessary	B	Marginal	8.48 B	High impact as the intensive landuse area	77.2 A	Negligibly small	B	High viability	A
2)	Antofagasta	- ditto -	Indispensable	A	Highly feasible	16.24 A	High impact as the local colony	128.9 A	Negligibly small	B	High viability	A
B-2	PALACIOS - PALOMETILLAS	**Non-structural Measures**	**Effective**		-		**Medium impact**		-		**Medium viability**	
C.	RIO PIRAY	-	**Flood control measures necessary**		-		-		-		-	

Note: 1) Protected area is the mitigated area by flood control and drainage improvement for the 10-year floods.

付　図

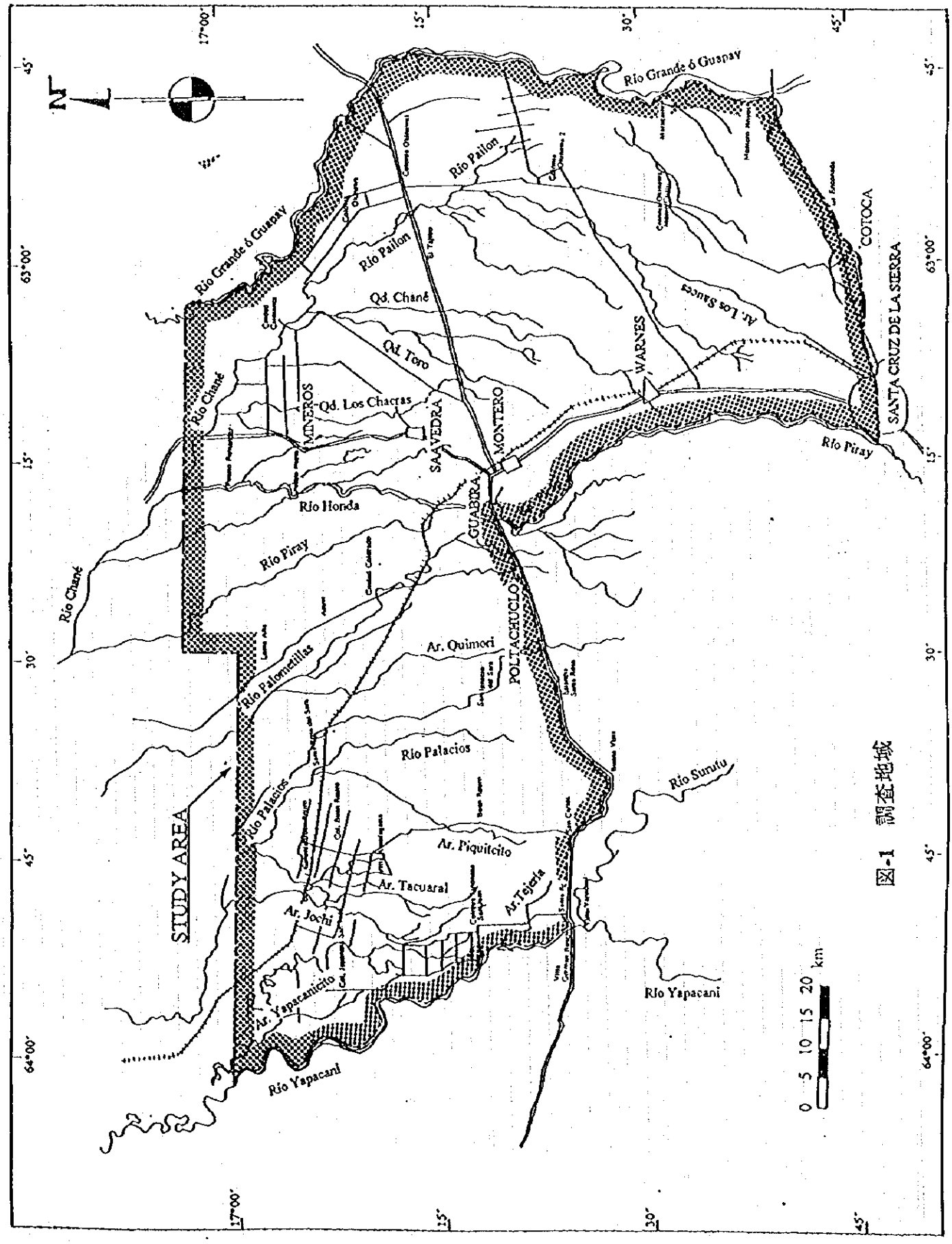

N
Río Grande ó Guapay
Río Pailon
Río Pailon
Río Grande ó Guapay
Qd. Chané
Qd. Tero
Río Chané
Qd. Los Chacras
MINEROS
SAAVEDRA
MONTERO
WARNES
Ar. Los Sauces
COTOCA
SANTA CRUZ DE LA SIERRA
Río Piray
Río Honda
GUARAYOS
Río Piray
Río Chané
POLTACHUCLO
Ar. Quimori
Río Palometillas
Río Palacios
Río Palacios
Río Sunutu
STUDY AREA
Ar. Piquitcito
Ar. Tacuaral
Ar. Jochi
Ar. Tajeria
Ar. Yapacanicito
Río Yapacani
Río Yapacani
0 5 10 15 20 km
17°00'
15'
30'
45'
63°00'
64°00'

図-1 調査地域

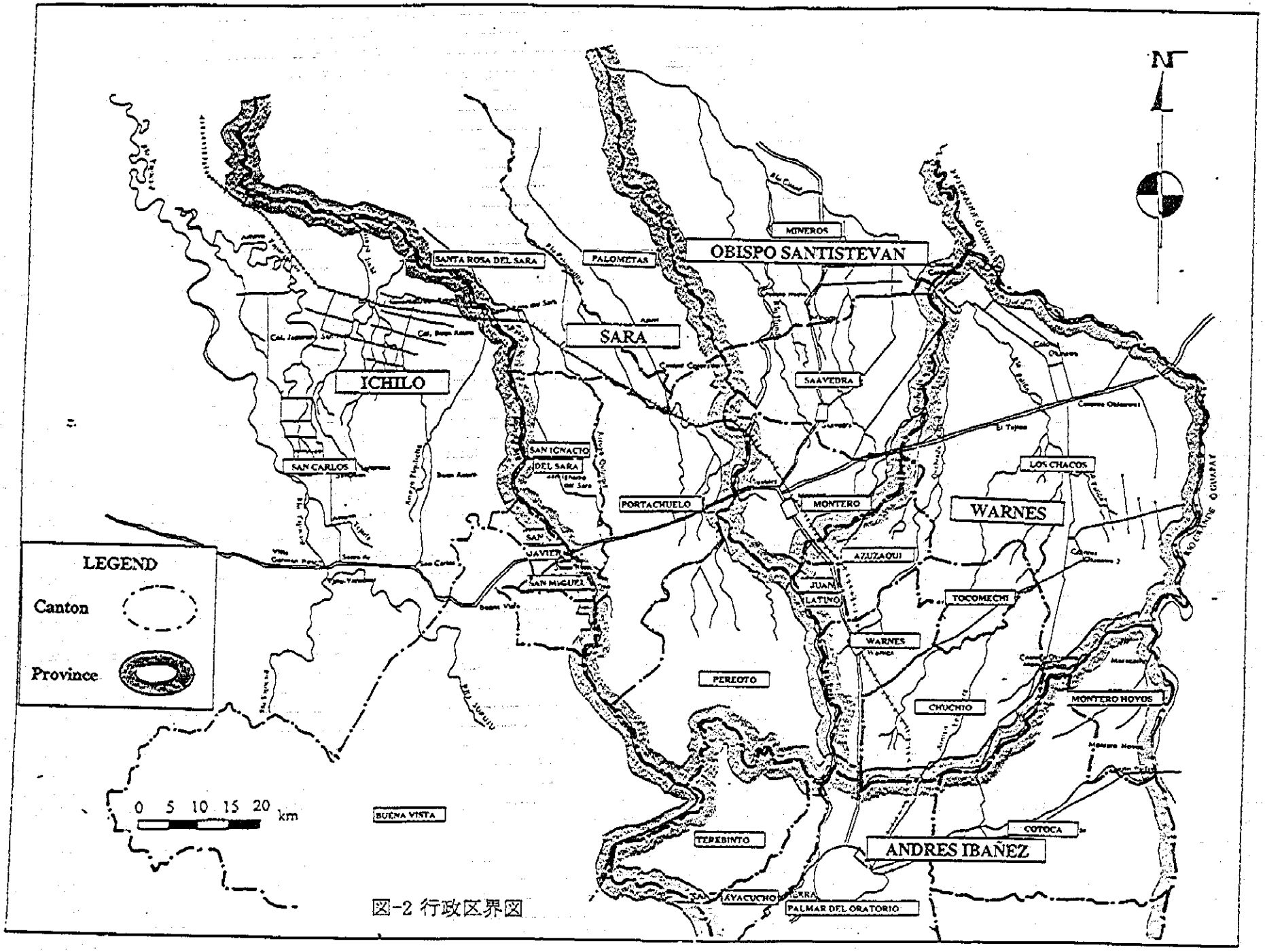
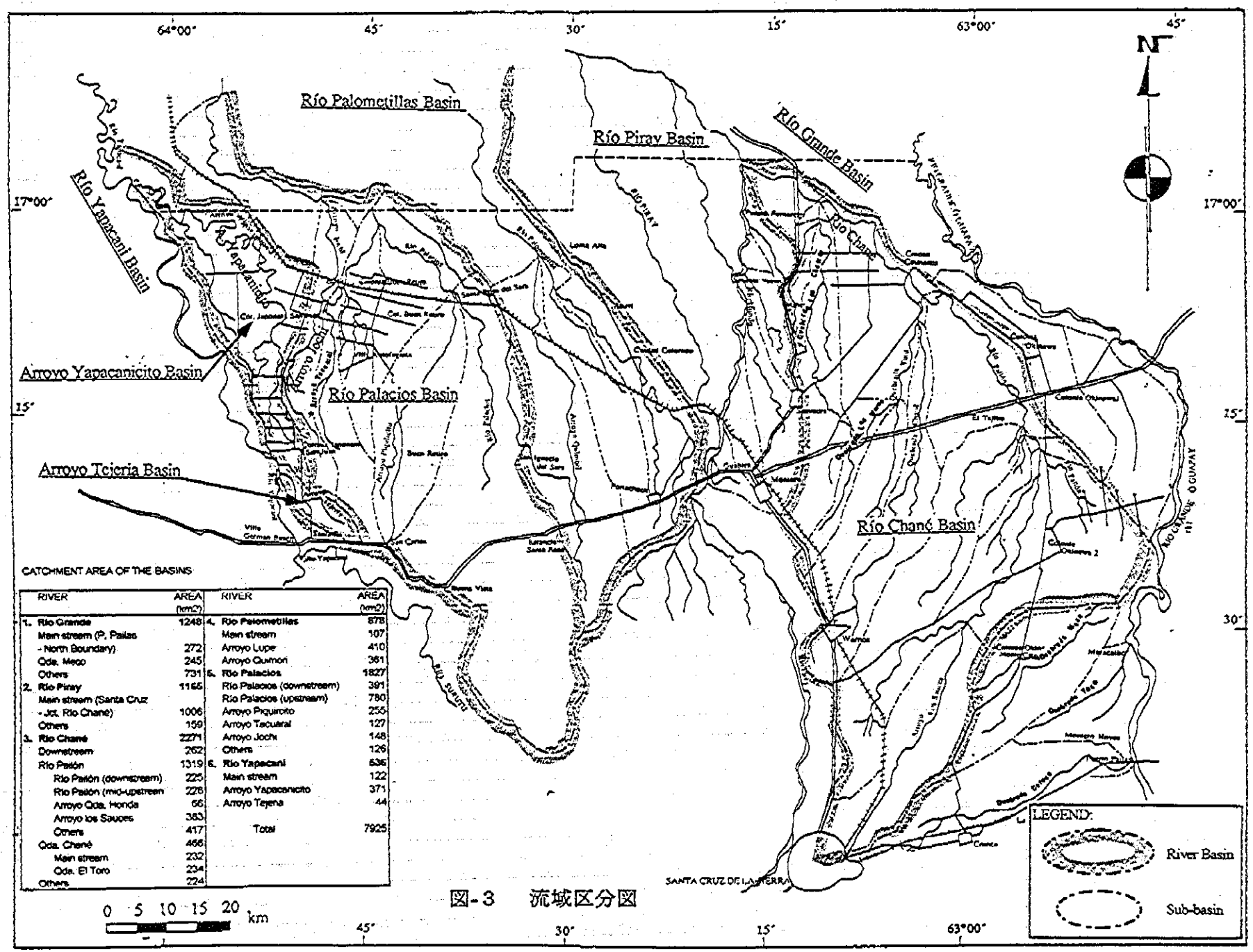

N
OBISPO SANTISTEVAN
MINEROS
PALOMETAS
SANTA ROSA DEL SARA
SARA
ICHILO
SAAVEDRA
SAN IGNACIO DEL SARA
SAN CARLOS
PORTACHUELO
MONTERO
WARNES
LOS CHACOS
AZUZAQUI
SAN JAVIER
SAN MIGUEL
JUAN LATINO
TOCOMECHI
WARNES
PEREOTO
CHUCHIO
MONTERO HOYOS
COTOCA
ANDRES IBAÑEZ
TERESINTO
AYACUCHO
PALMAR DEL ORATORIO
BUENA VISTA
LEGEND
Canton
Province
0 5 10 15 20 km

図-2 行政区界図



CATCHMENT AREA OF THE BASINS

RIVER	AREA (km2)	RIVER	AREA (km2)
1. Río Grande	1248	4. Río Palometillas	878
Main stream (P. Palas - North Boundary)	272	Main stream	107
Qda. Meco	245	Arroyo Lupe	410
Others	731	Arroyo Quimori	361
2. Río Piray	1165	5. Río Palacios	1827
Main stream (Santa Cruz - Jct. Río Chané)	1006	Río Palacios (downstream)	391
Others	159	Río Palacios (upstream)	780
3. Río Chané	2271	Arroyo Piquiricito	255
Downstream	262	Arroyo Tacuaral	127
Río Pailón	1319	Arroyo Jochi	148
Río Pailón (downstream)	225	Others	126
Río Pailón (mid-upstream)	226	6. Río Yapacani	636
Arroyo Qda. Honda	66	Main stream	122
Arroyo los Sauces	383	Arroyo Yapacanicito	371
Others	417	Arroyo Tejena	44
Qda. Chané	466	Total	7925
Main stream	232		
Qda. El Toro	234		
Others	224		

図-3　流域区分図

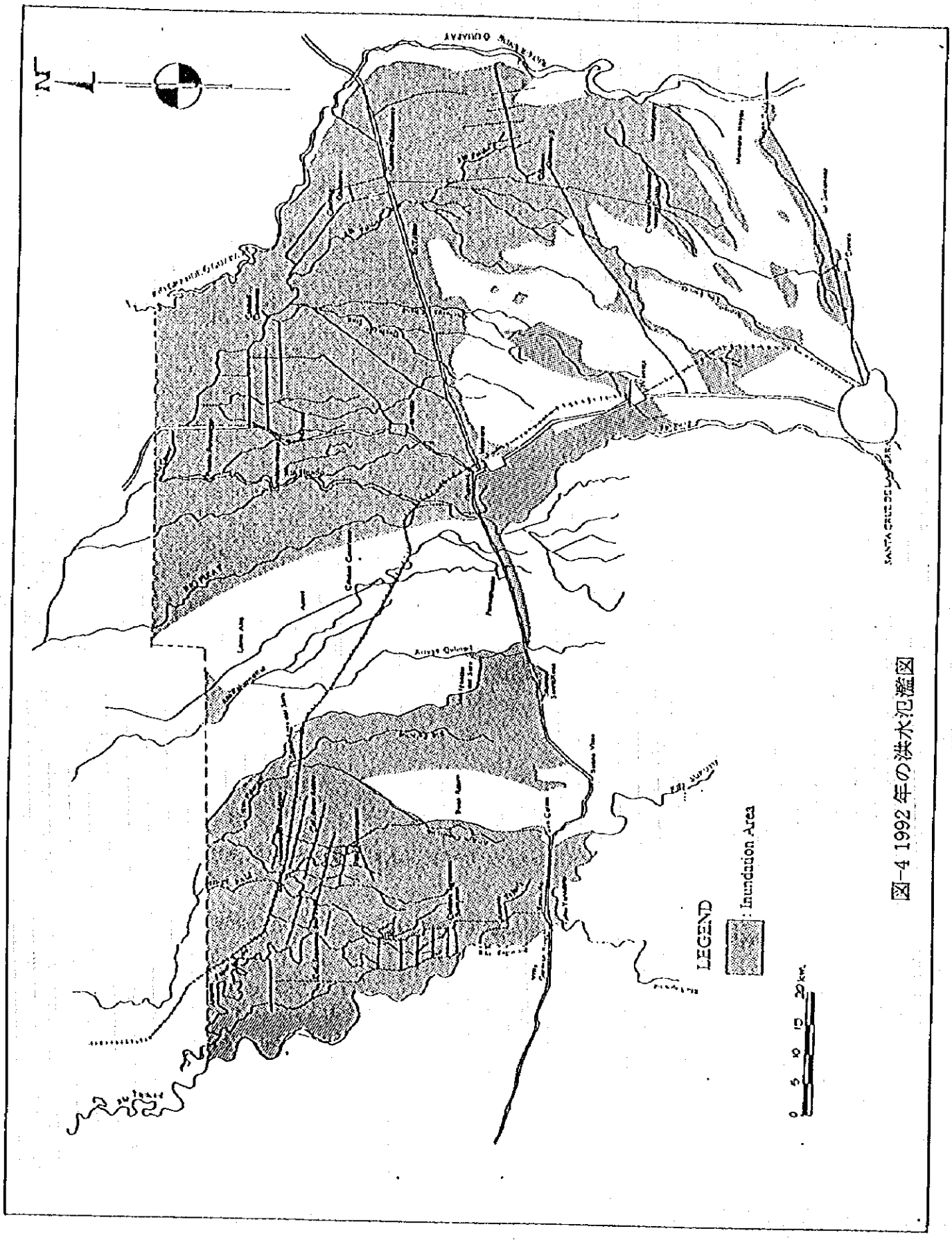


図-4 1992 年の洪水氾濫図

図-4 1992 年の洪水氾濫図

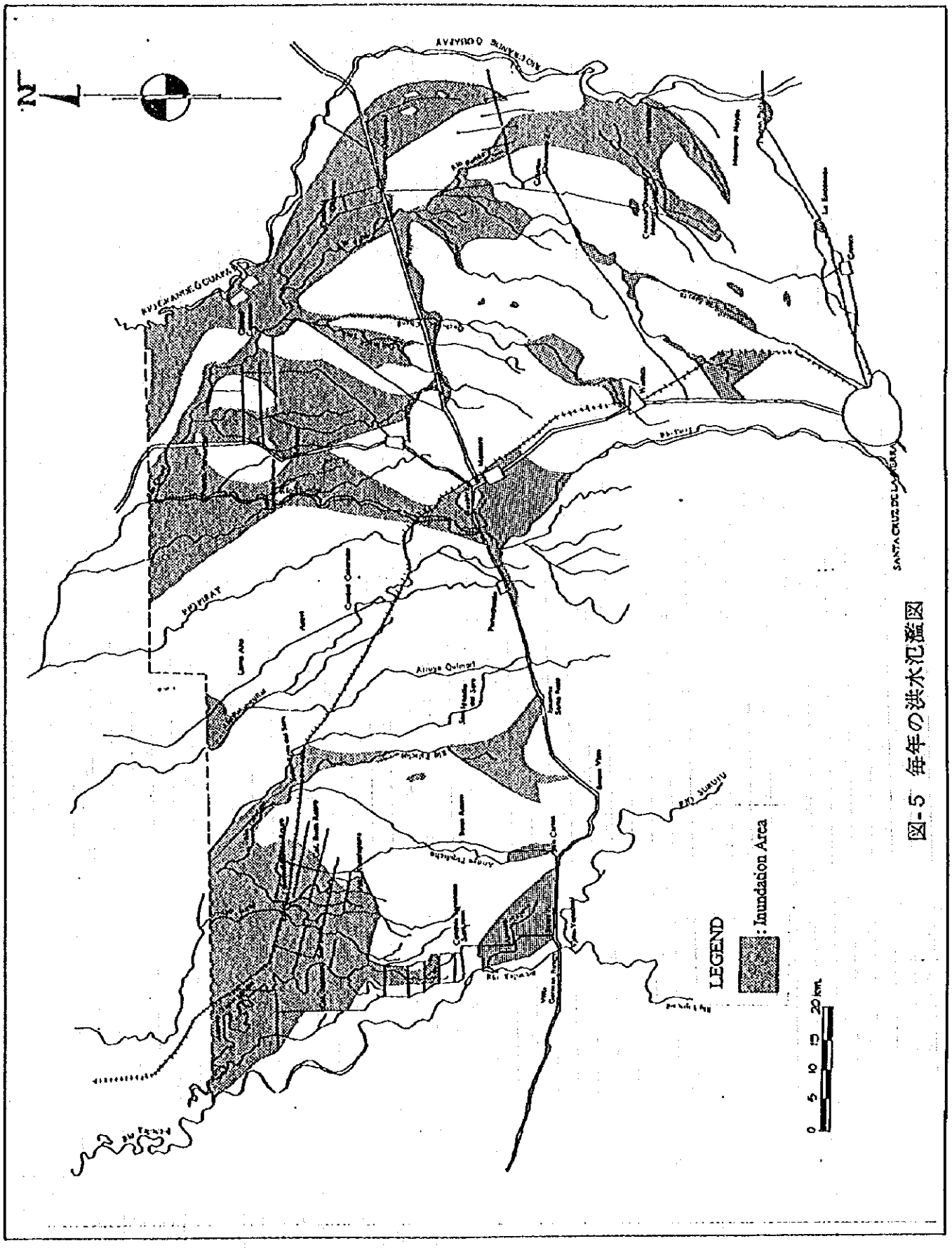


図-5 毎年の洪水氾濫図

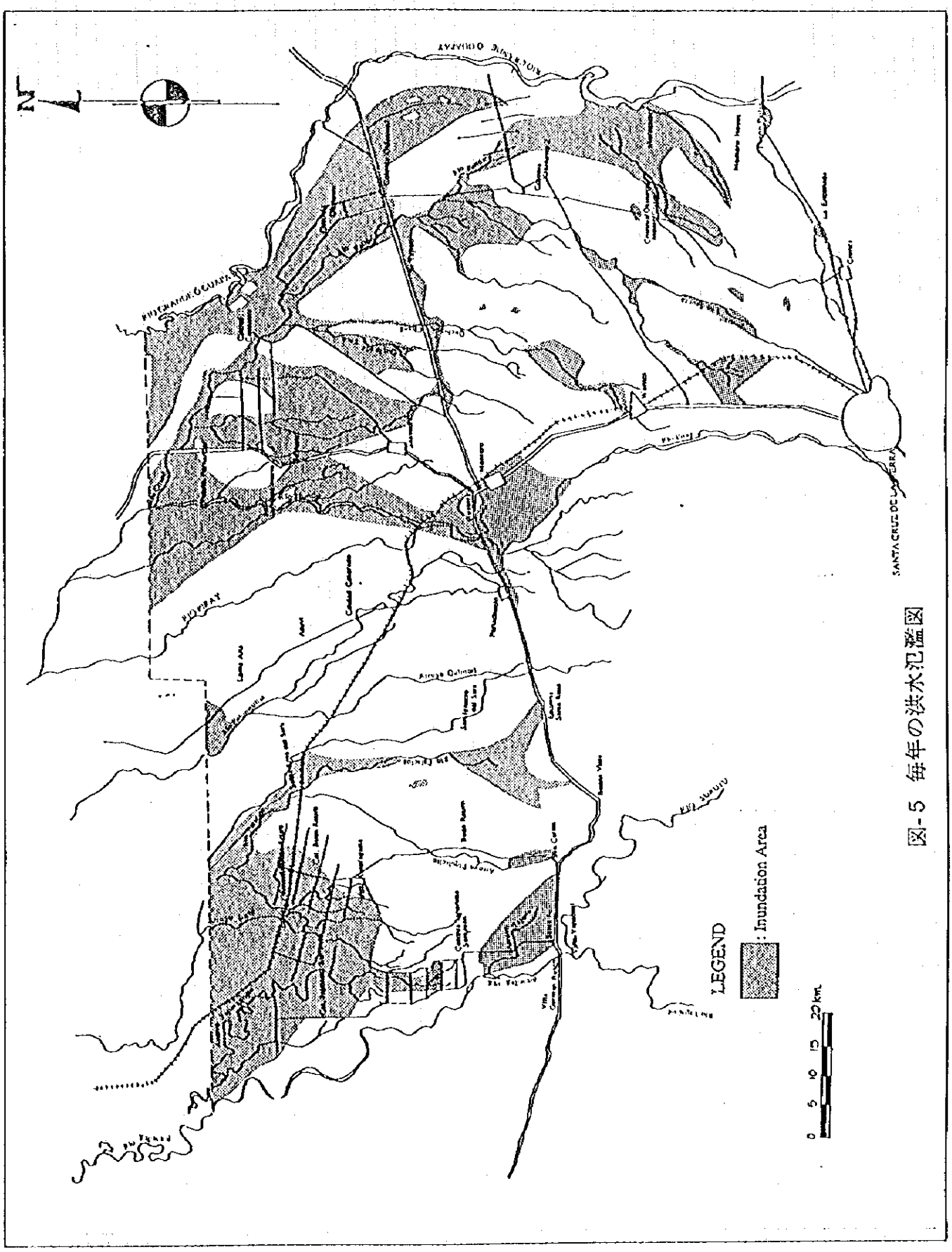


図-5 毎年の洪水氾濫図

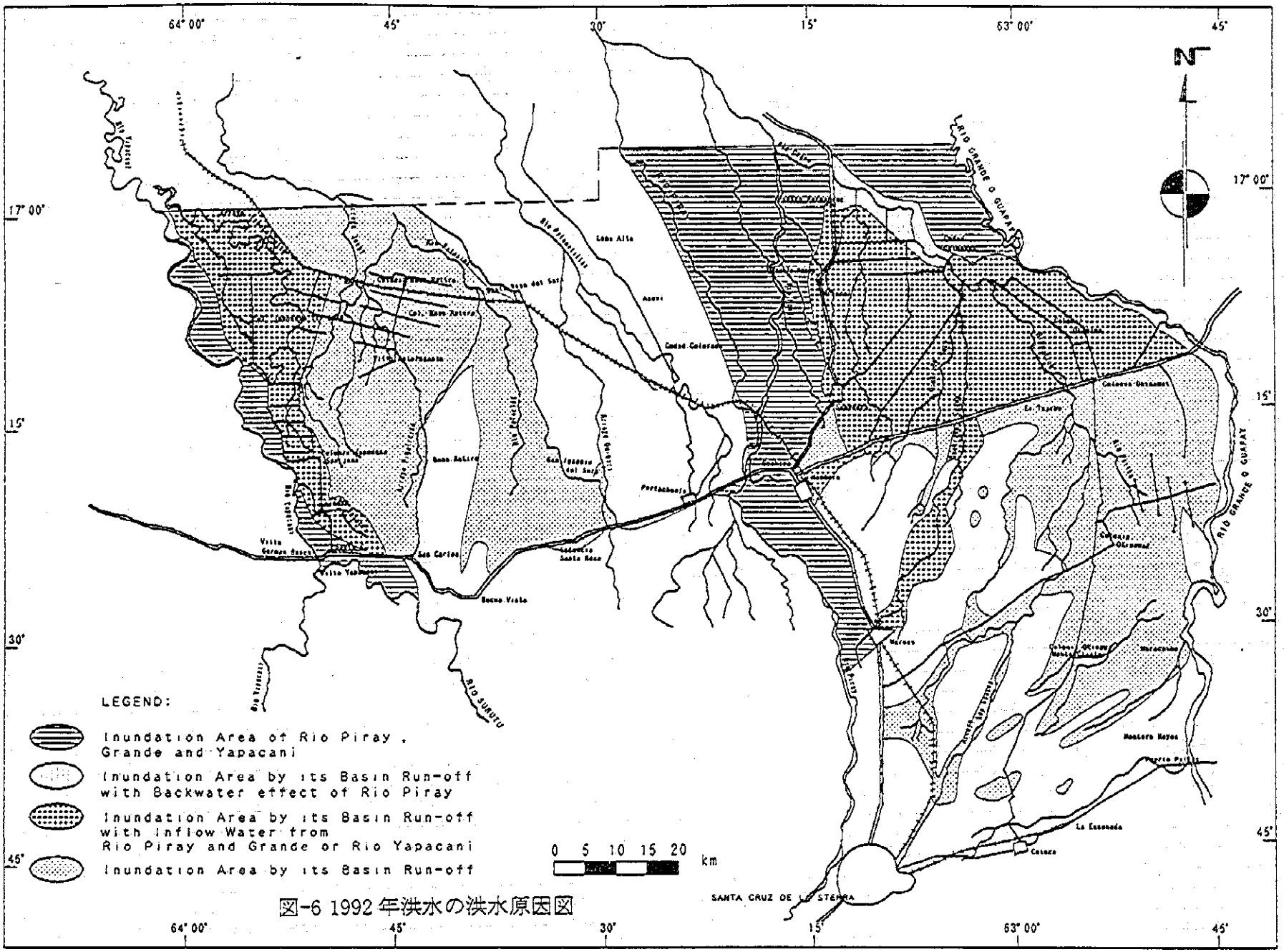


図-6 1992年洪水の洪水原因図

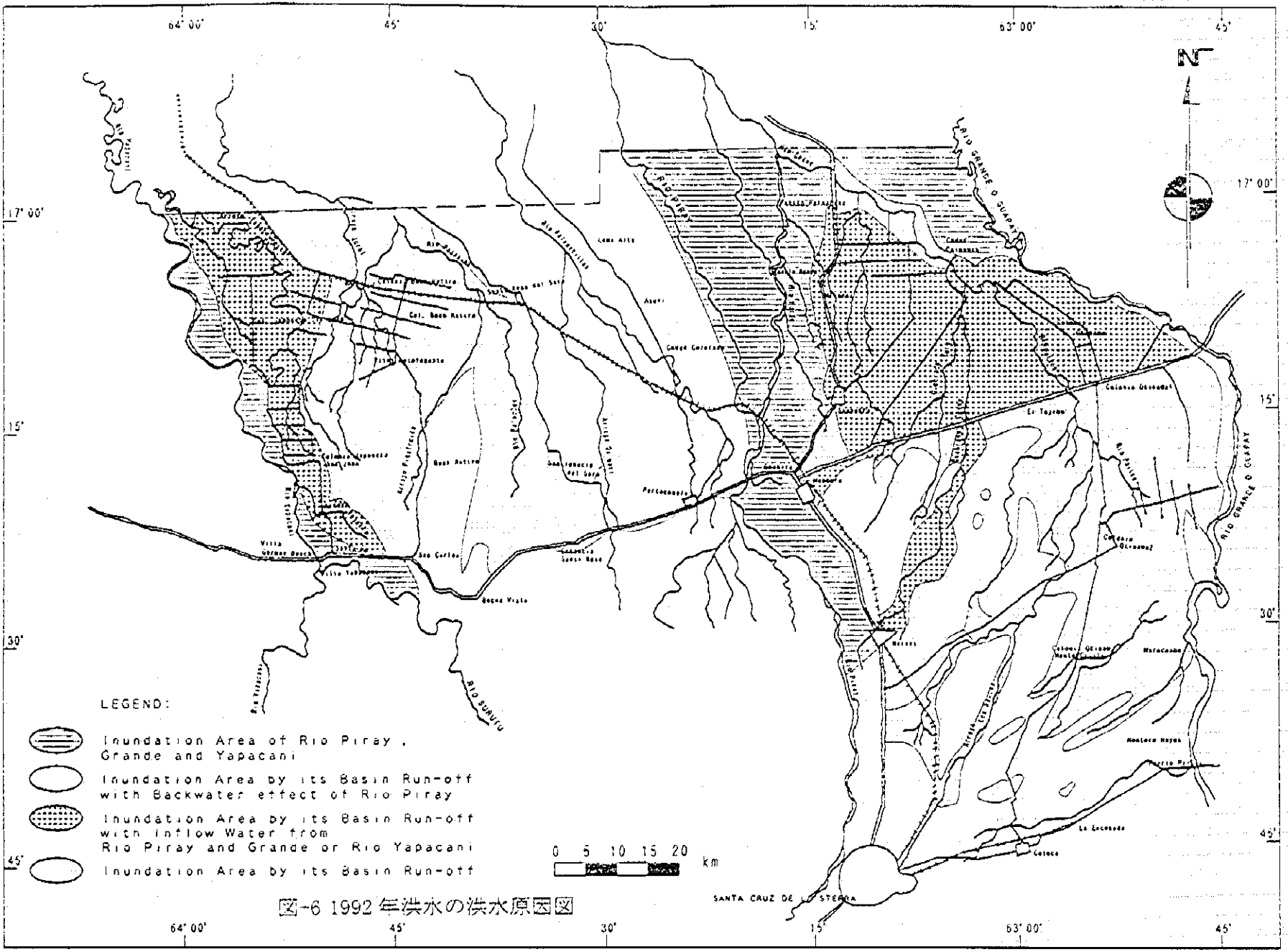


図-6 1992年洪水の浸水原因図

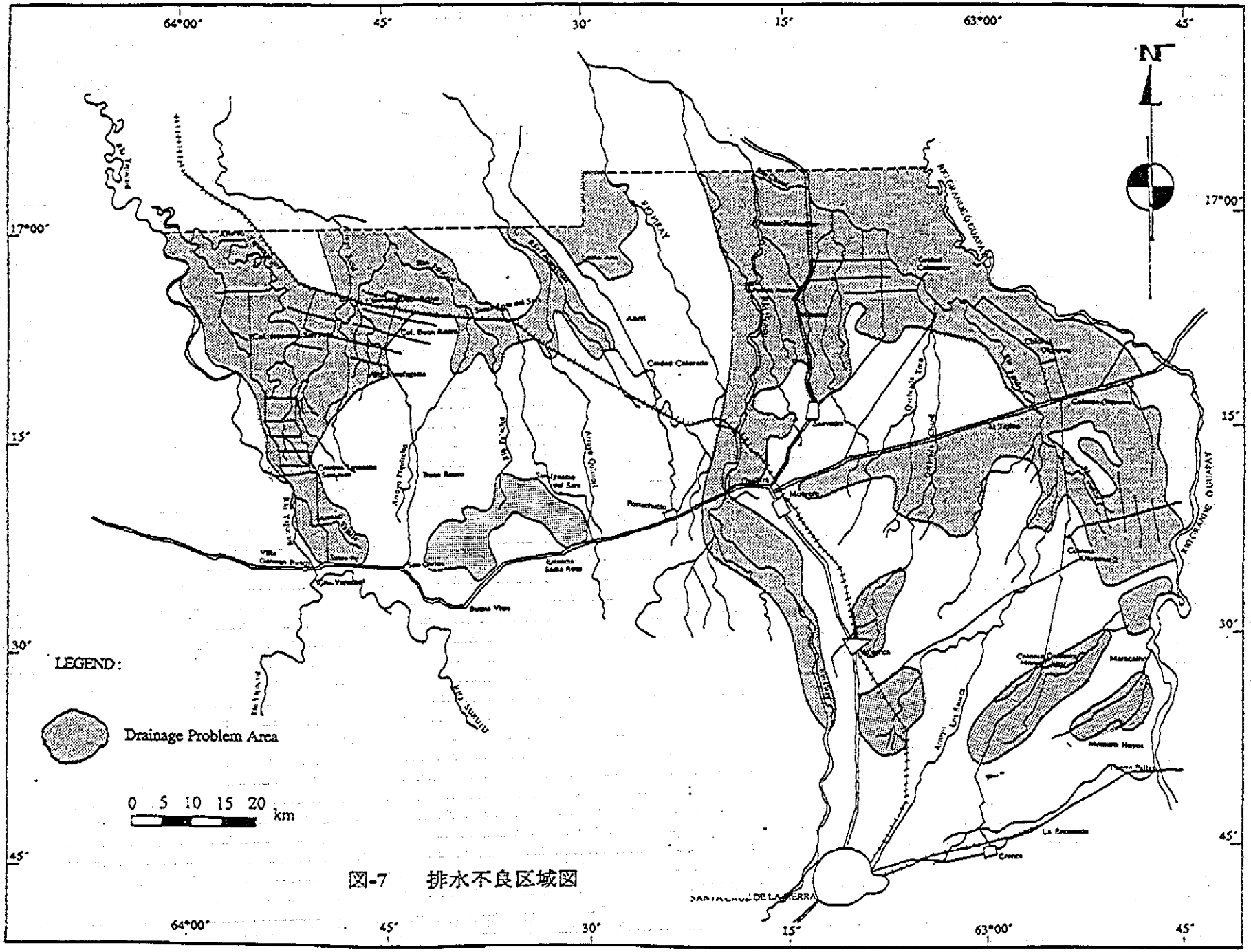

64°00'
45'
30'
15'
63°00'
N
17°00'
15'
30'
45'
LEGEND:
Drainage Problem Area
0 5 10 15 20 km

図-7　排水不良区域図

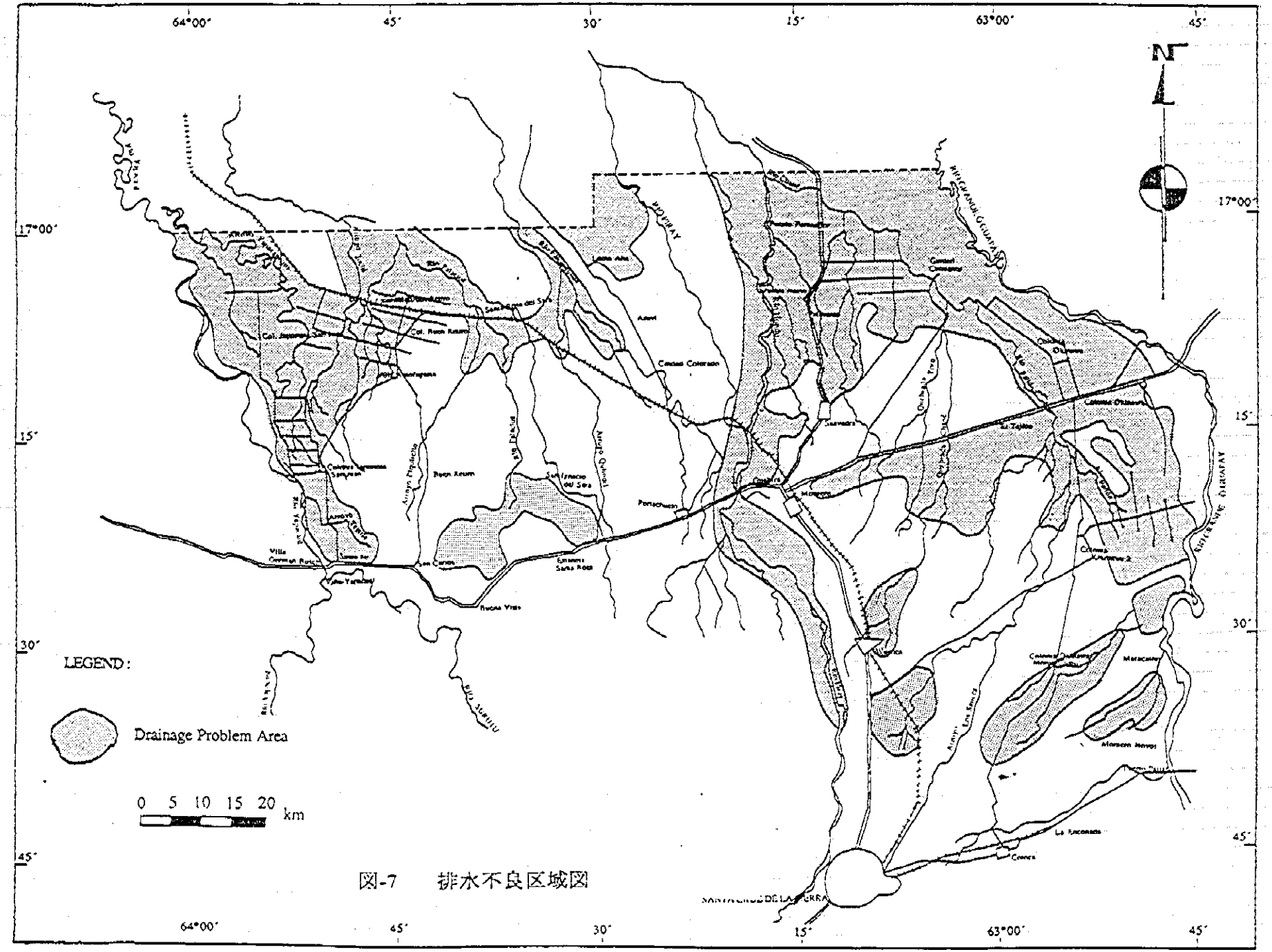
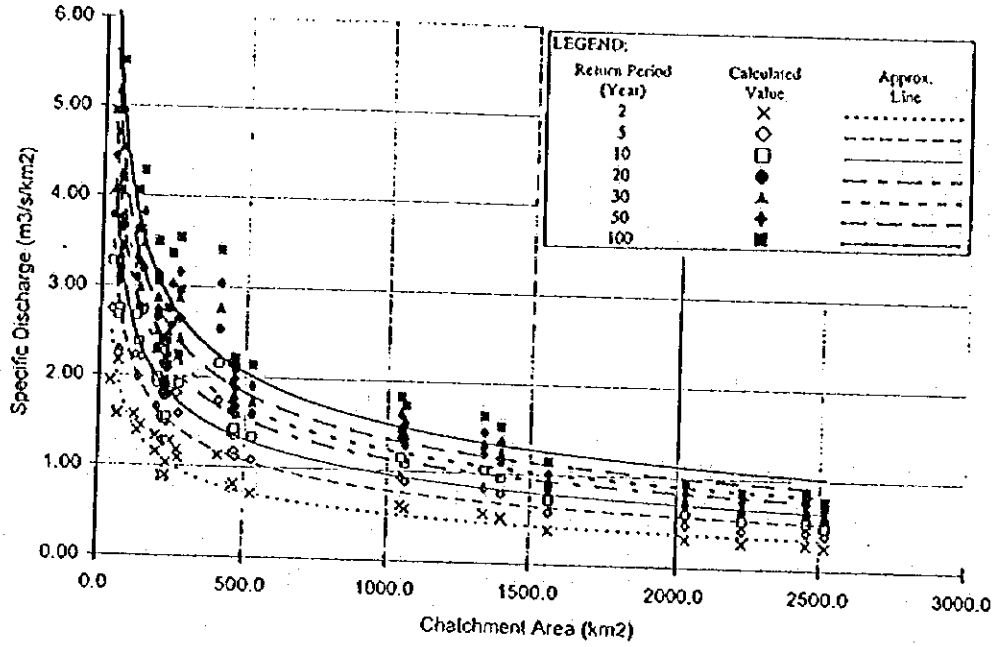

64°00'
45'
30'
15'
63°00'
17°00'
15'
30'
45'
N
LEGEND :
Drainage Problem Area
0 5 10 15 20 km

図-7　排水不良区域図

SPECIFIC DISCHARGE OF THE RIO CHANE BASIN



SPECIFIC DISCHARGE OF THE ARROYO YAPACANICITO-JOCHI-TACUARAL-TEJERIA BASINS

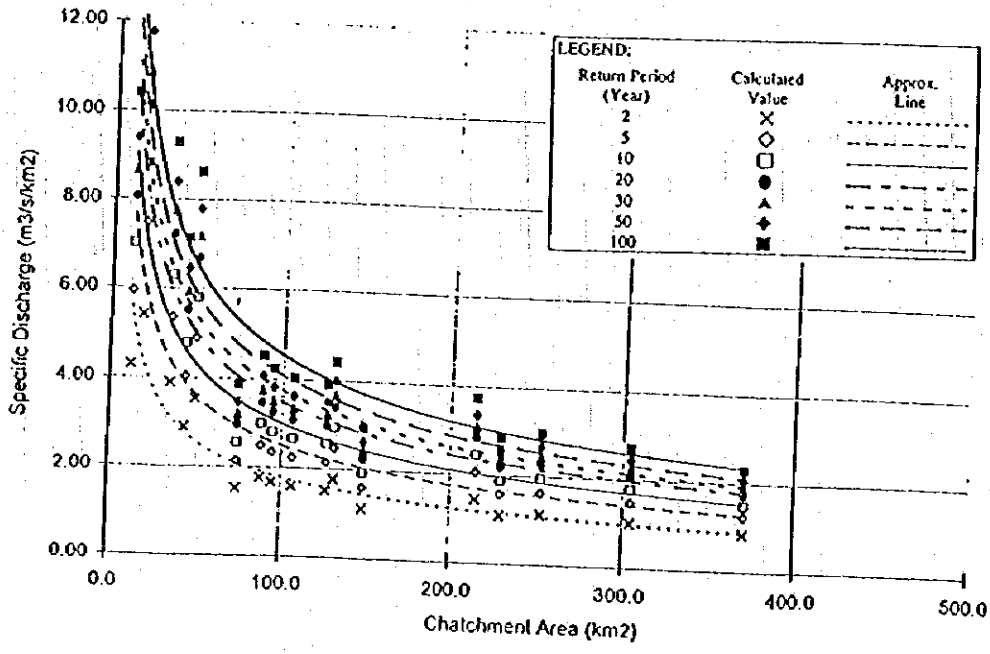


図-8 各流域の比流量

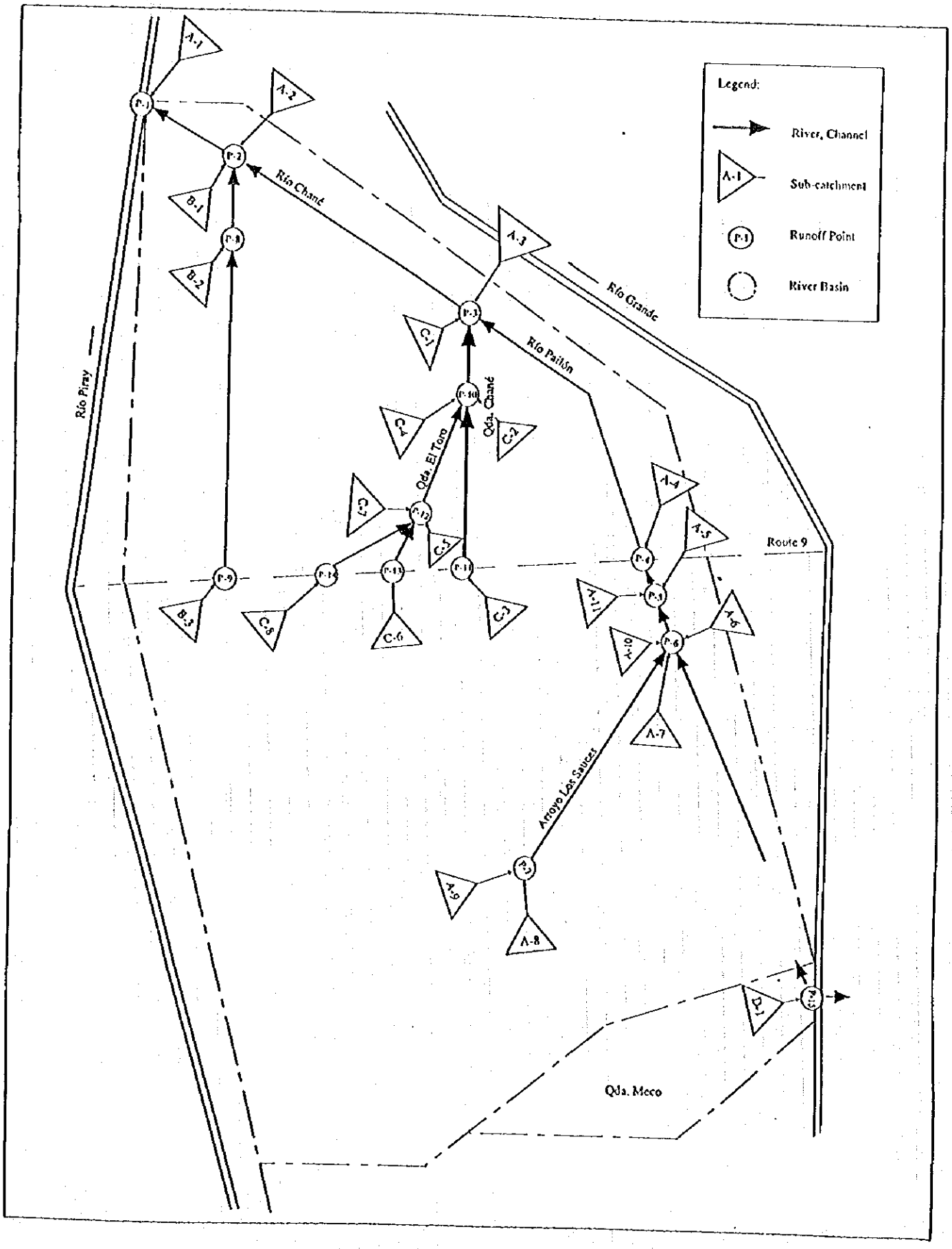


図-9 CHANE 川流域水理モデル図

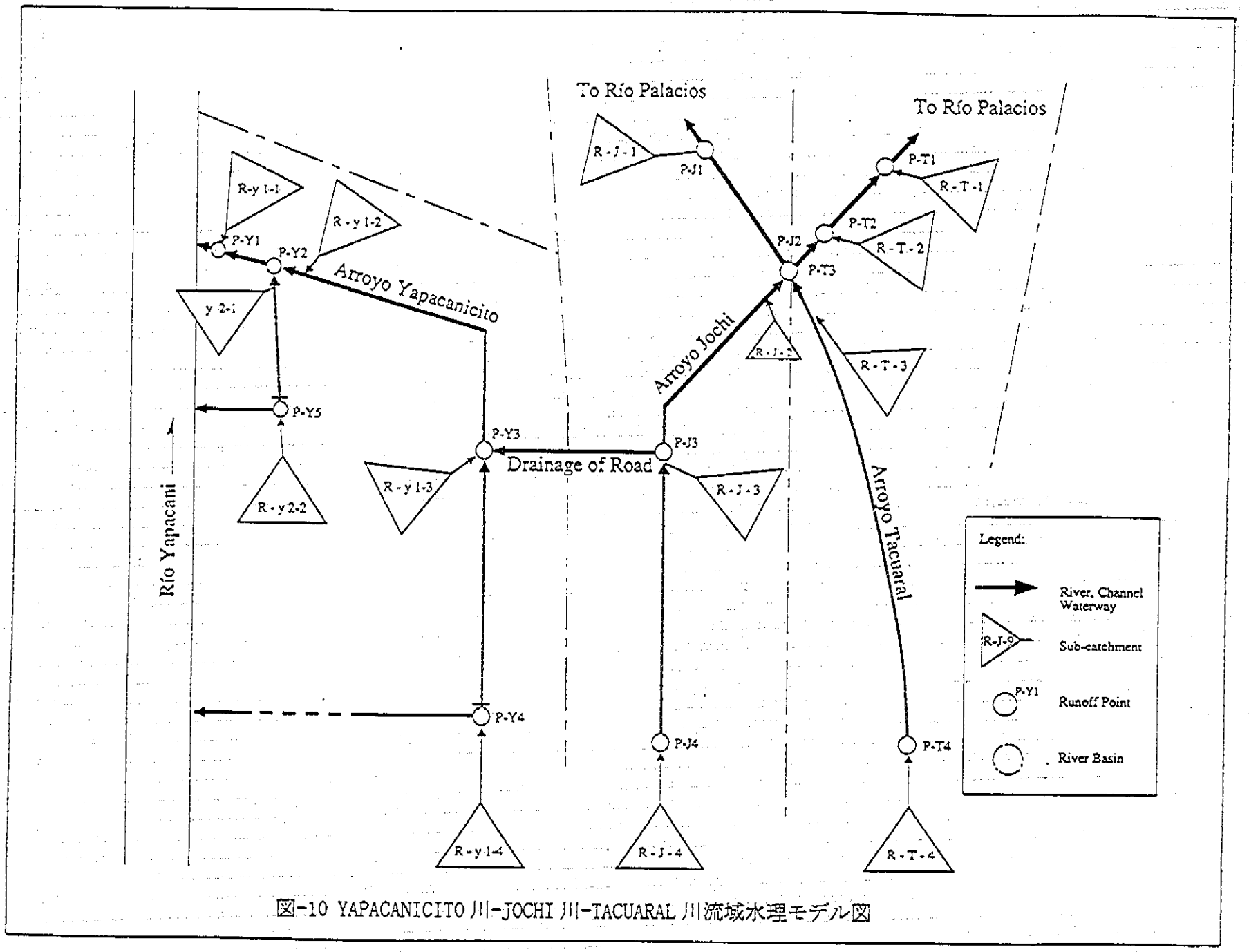


図-10 YAPACANICITO 川-JOCHI 川-TACUARAL 川流域水理モデル図

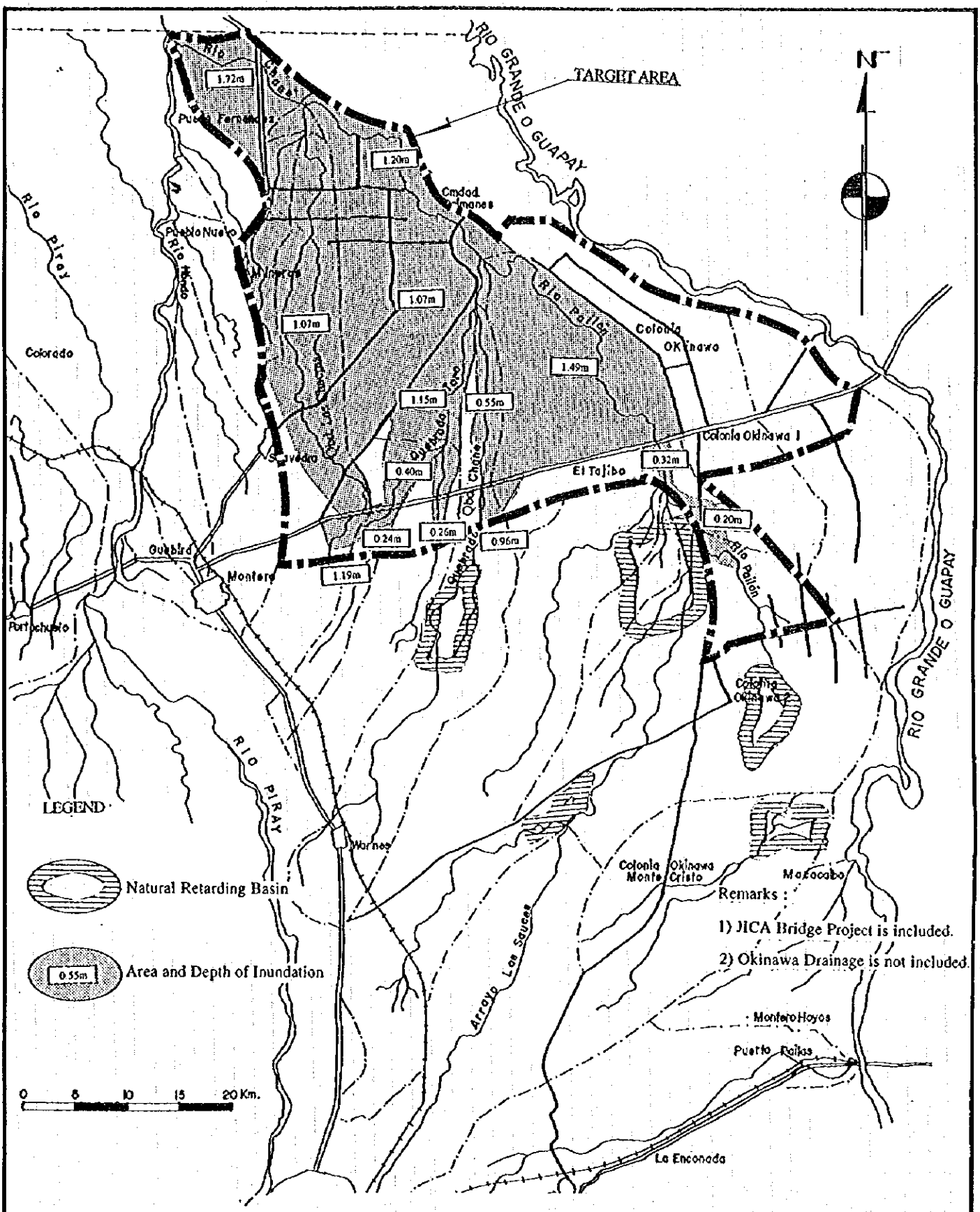


図-11 シミュレーションによるプロジェクト実施前の10年確率洪水氾濫図
(CHANE川流域)

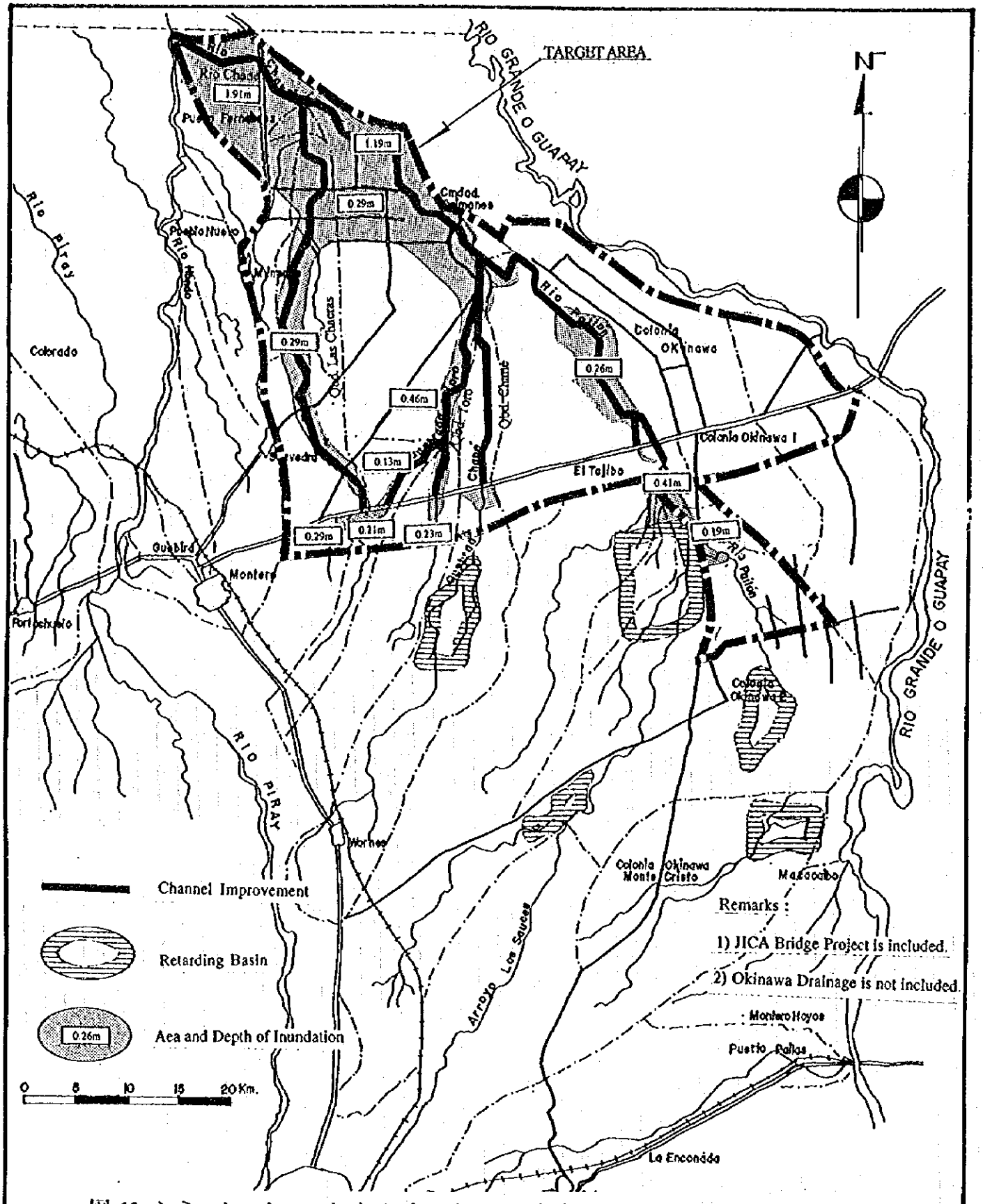


図-12 シミュレーションによるプロジェクト実施後の10年確率洪水氾濫図
（CHANE川流域：代替案Ⅰ）

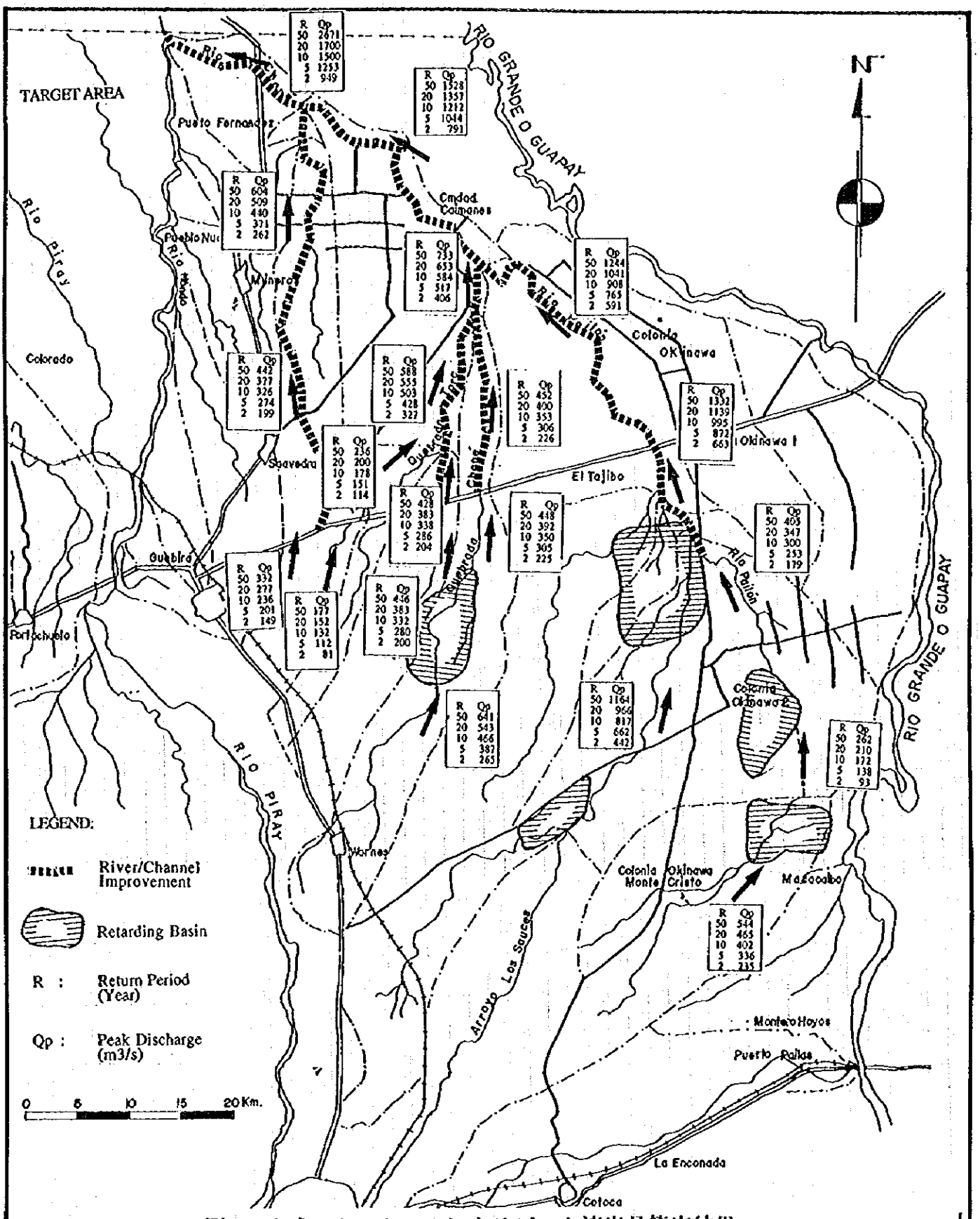


図-13 シミュレーションによるピーク流出量算定結果
(CHANE川流域：代替案Ⅰ)

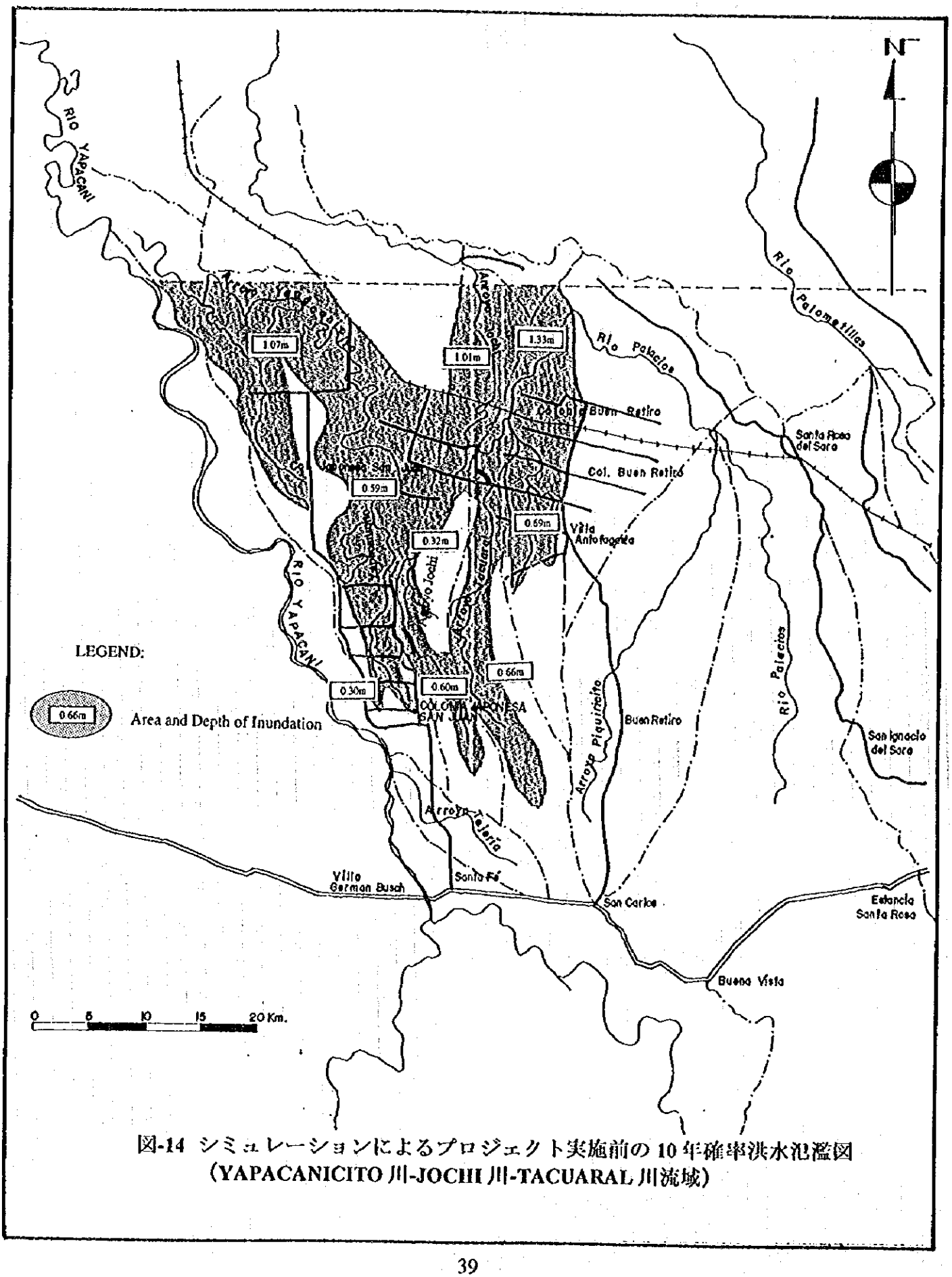


図-14 シミュレーションによるプロジェクト実施前の10年確率洪水氾濫図
(YAPACANICITO川-JOCHI川-TACUARAL川流域)

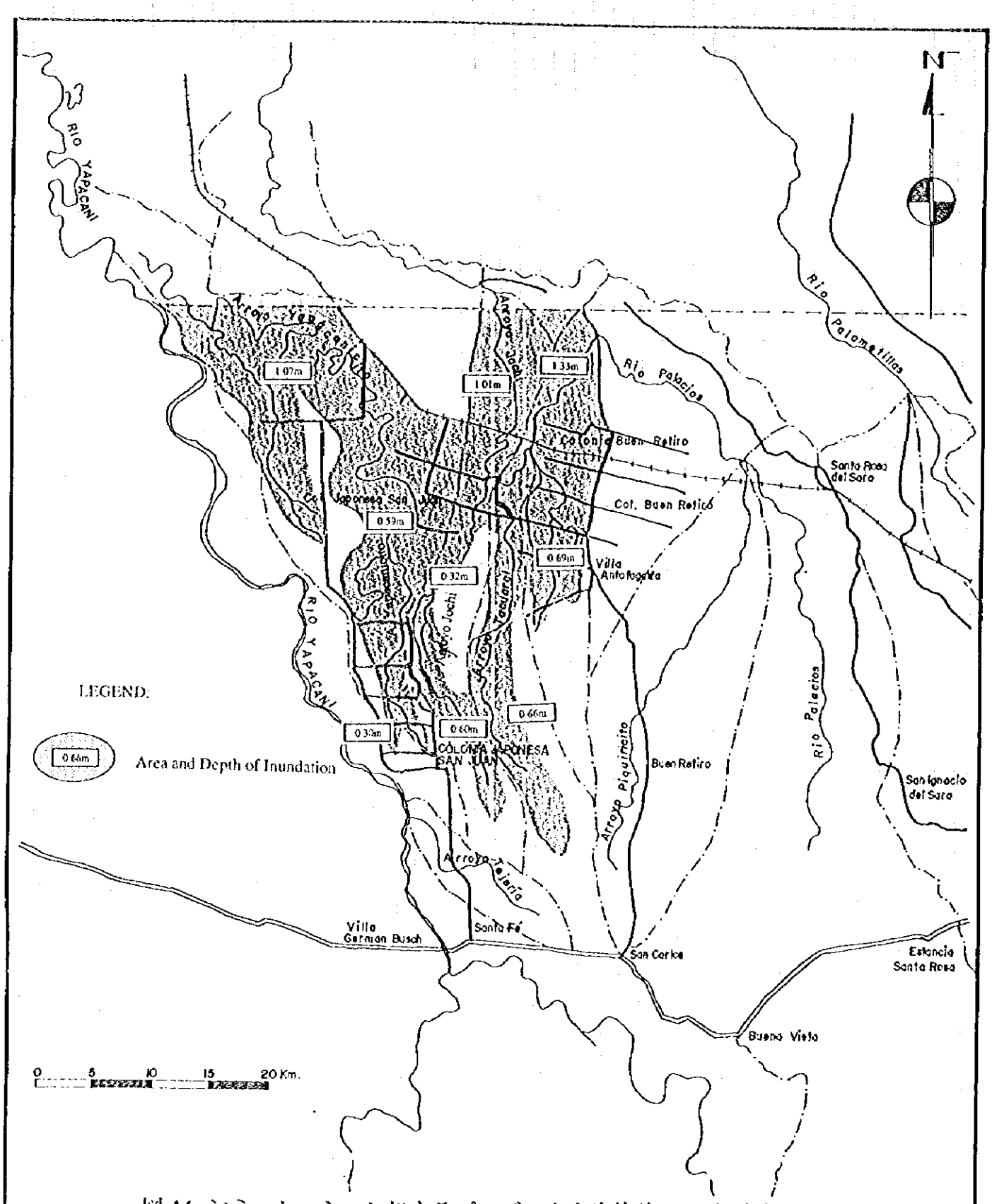


図-14 シミュレーションによるプロジェクト実施前の10年確率洪水氾濫図
(YAPACANICITO川-JOCHI川-TACUARAL川流域)

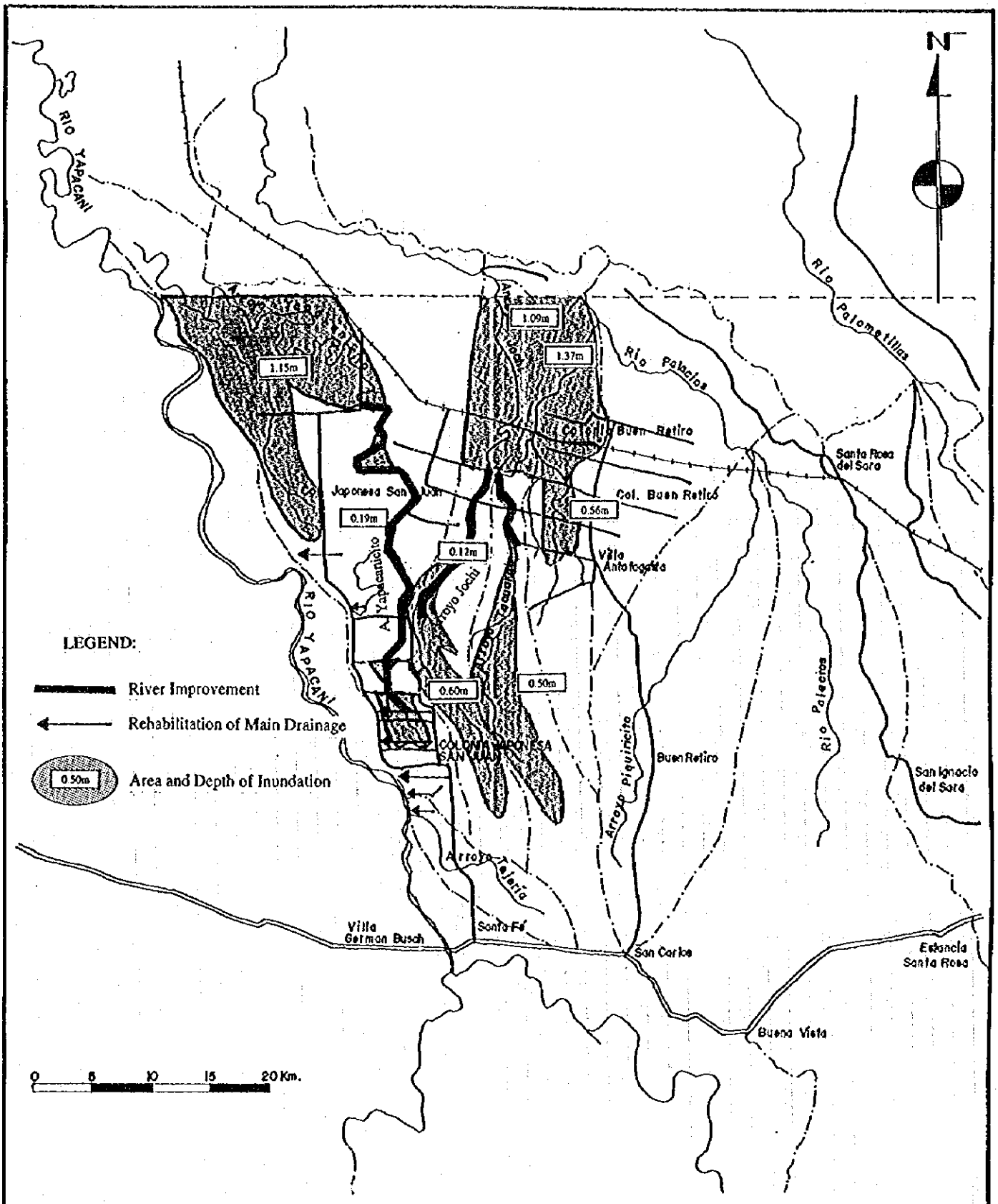


図-15 シミュレーションによるプロジェクト実施後の10年確率洪水氾濫図
(YAPACANICITO川-JOCHI川-TACUARAL川流域)

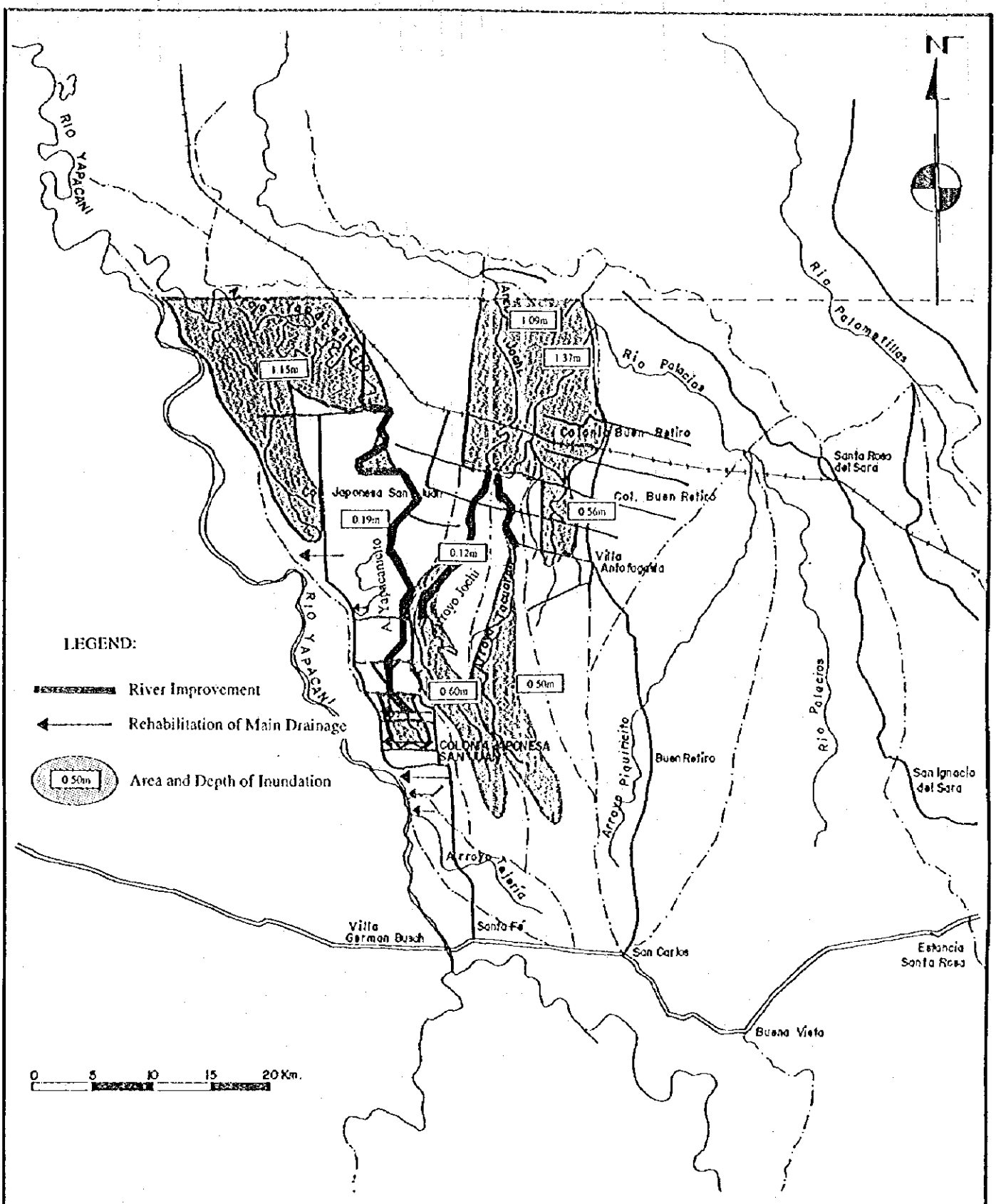


図-15 シミュレーションによるプロジェクト実施後の10年確率洪水氾濫図
(YAPACANICITO川-JOCHI川-TACUARAL川流域)

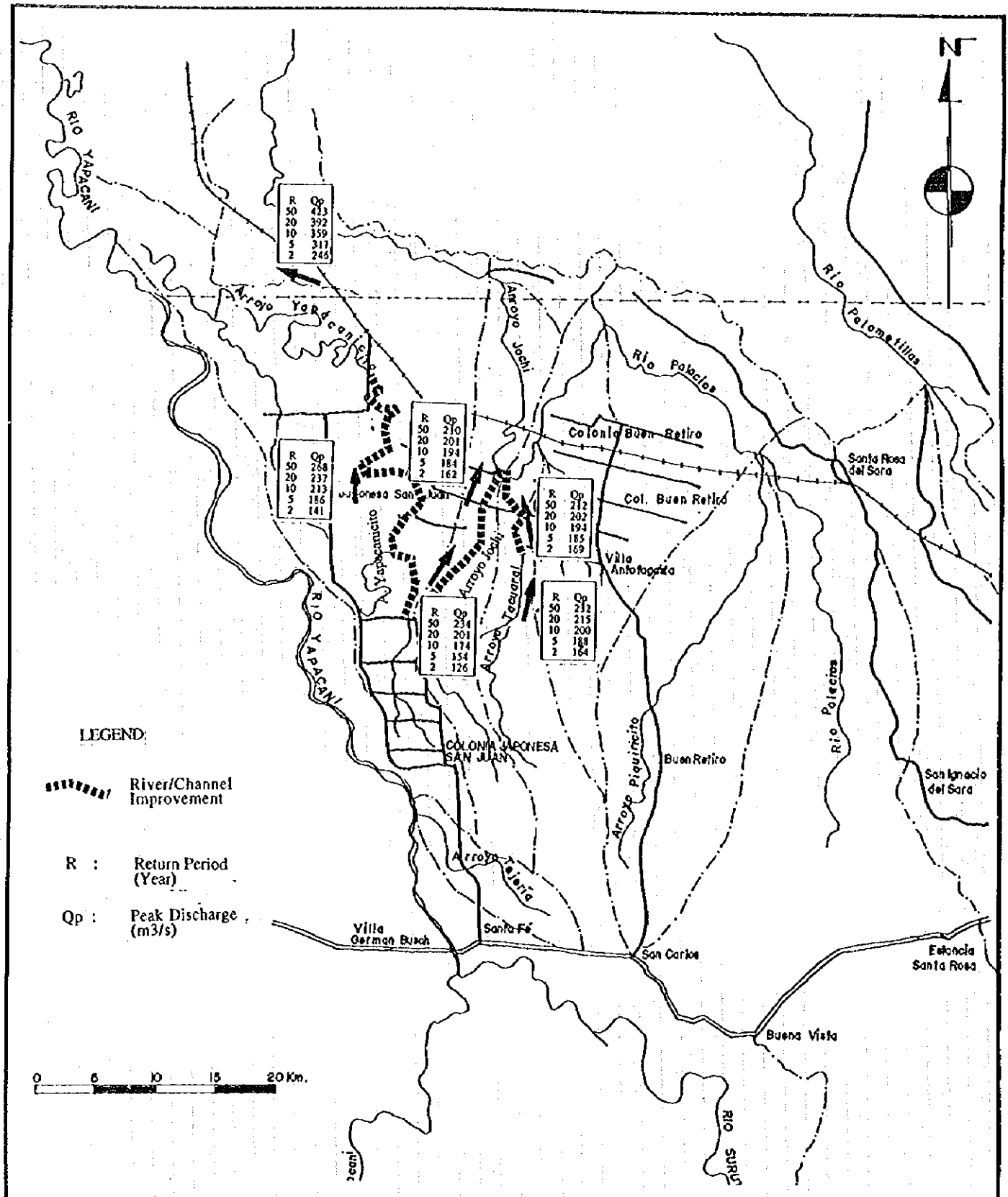


図-16　シミュレーションによるピーク流出量算定結果
（YAPACANICITO 川-JOCHI 川-TACUARAL 川流域：代替案 I）

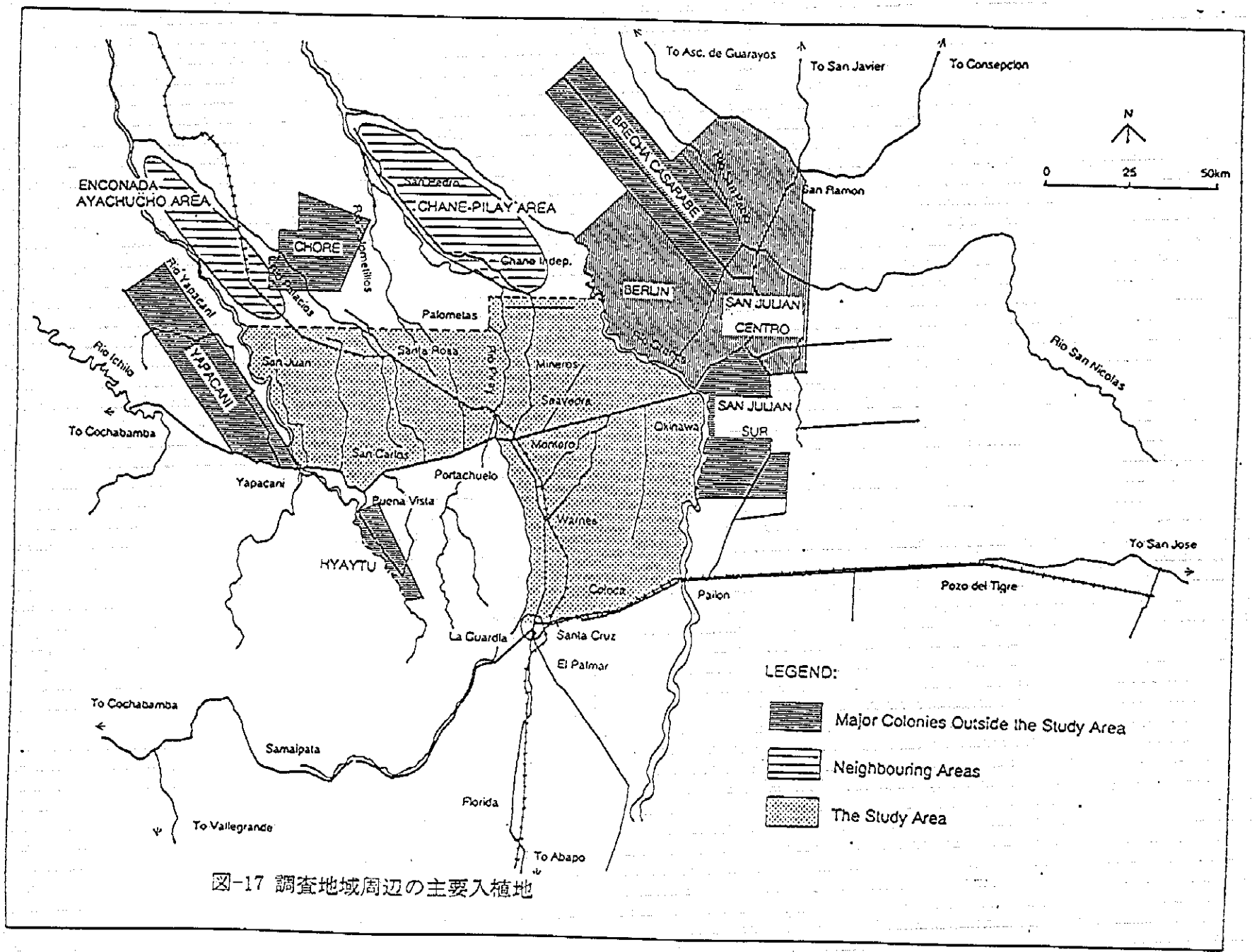


図-17 調査地域周辺の主要入植地

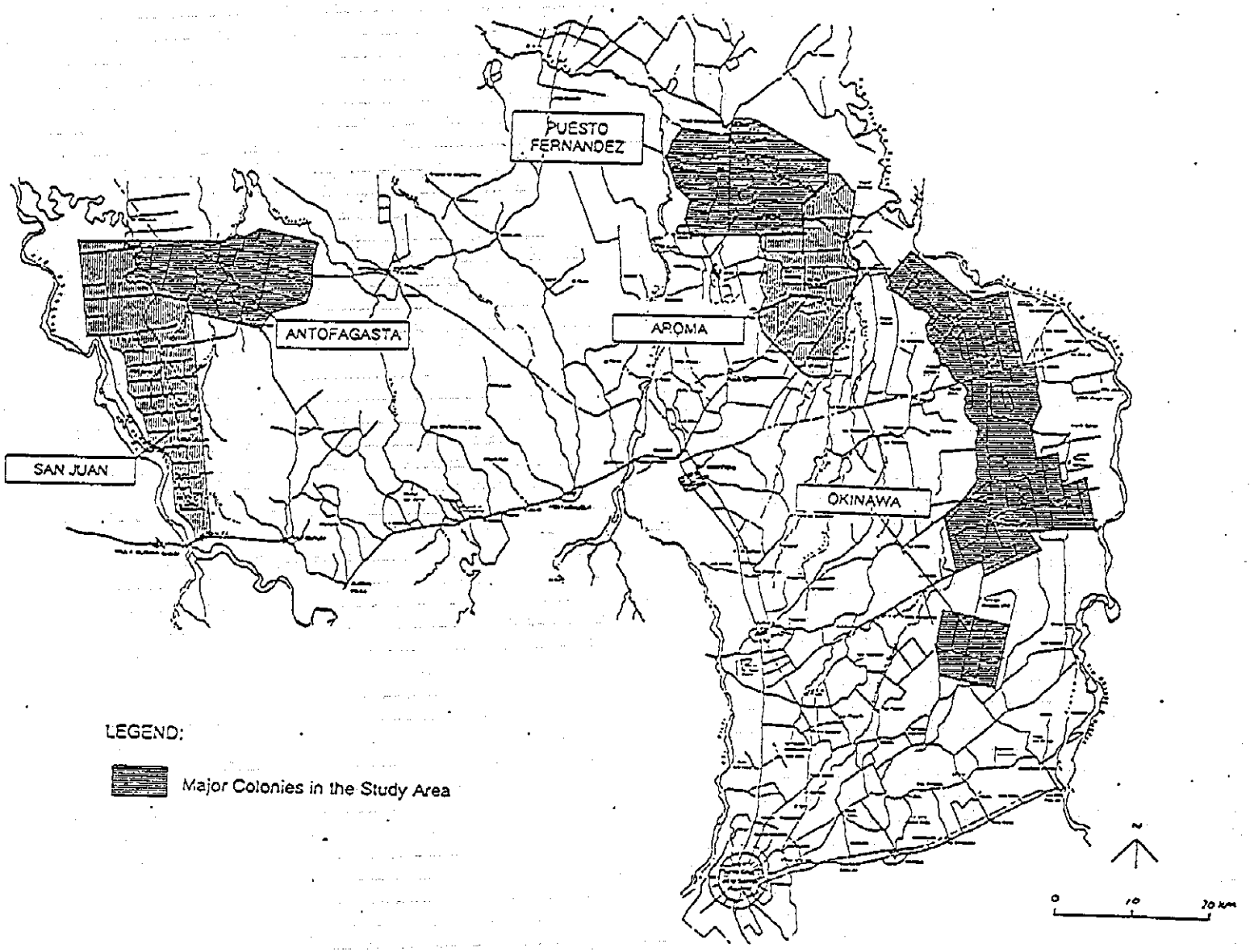


図-18 調査地域内の主要入植地

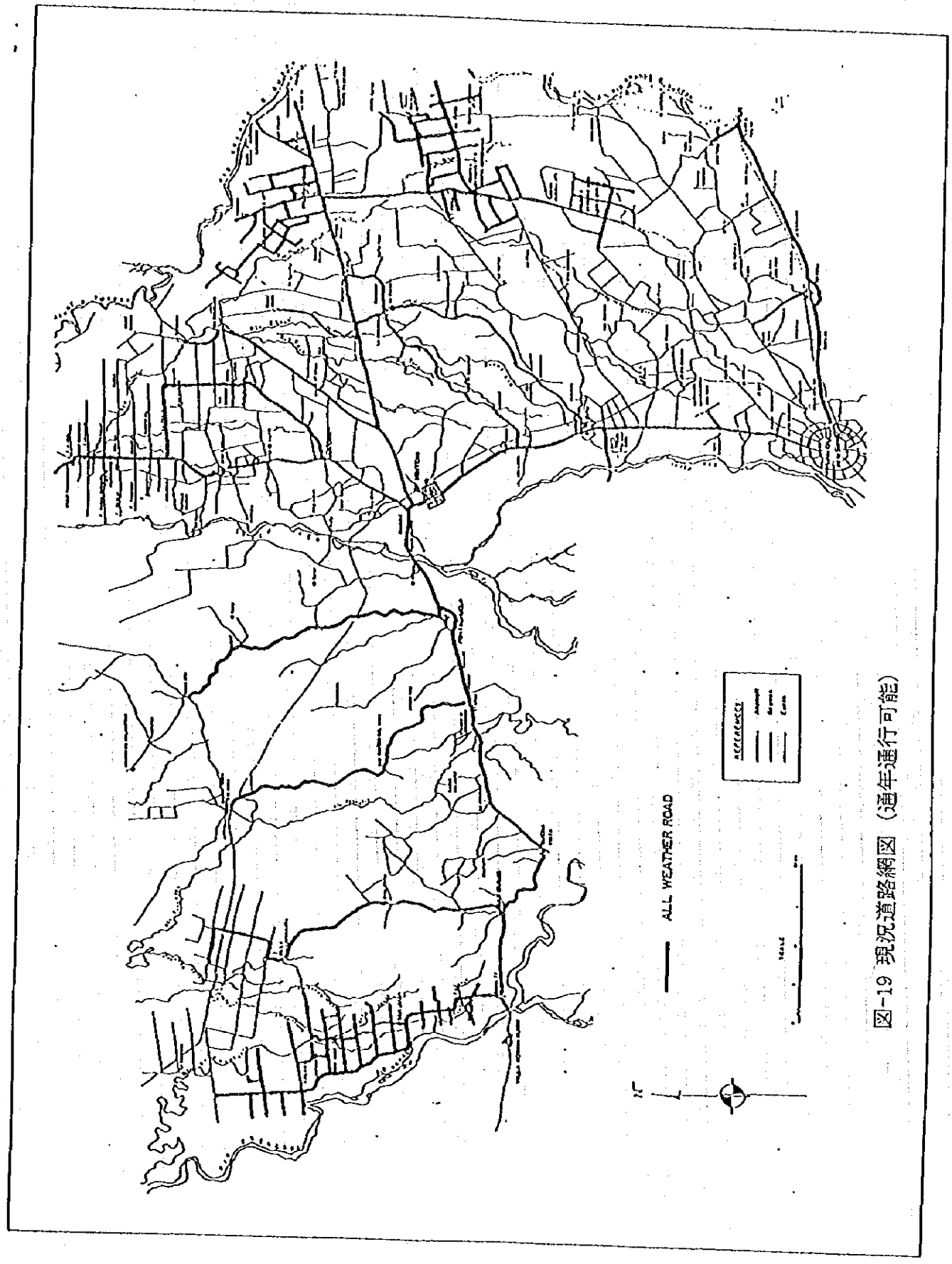


図-19 現況道路網図（通年通行可能）

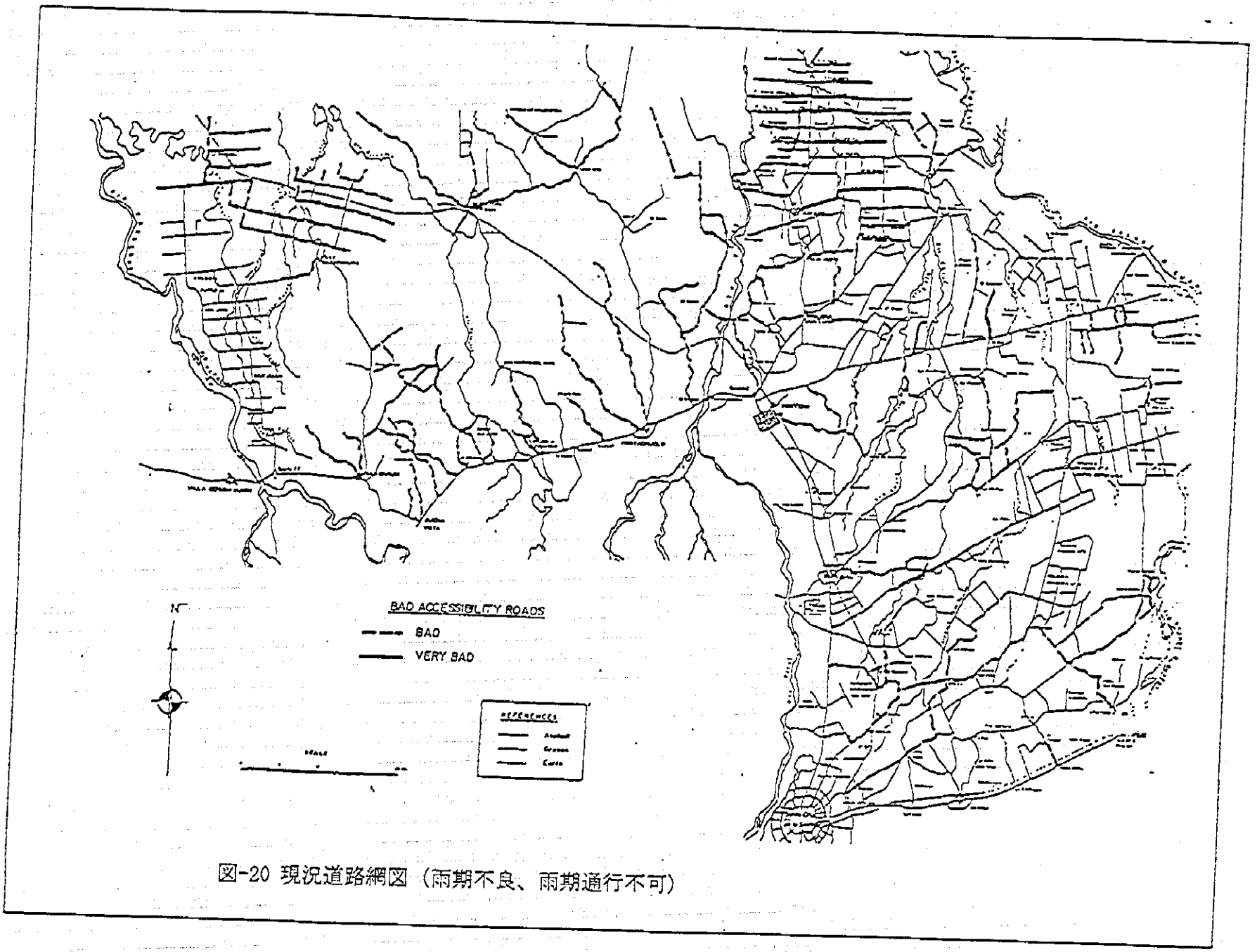


図-20 現況道路網図（雨期不良、雨期通行不可）

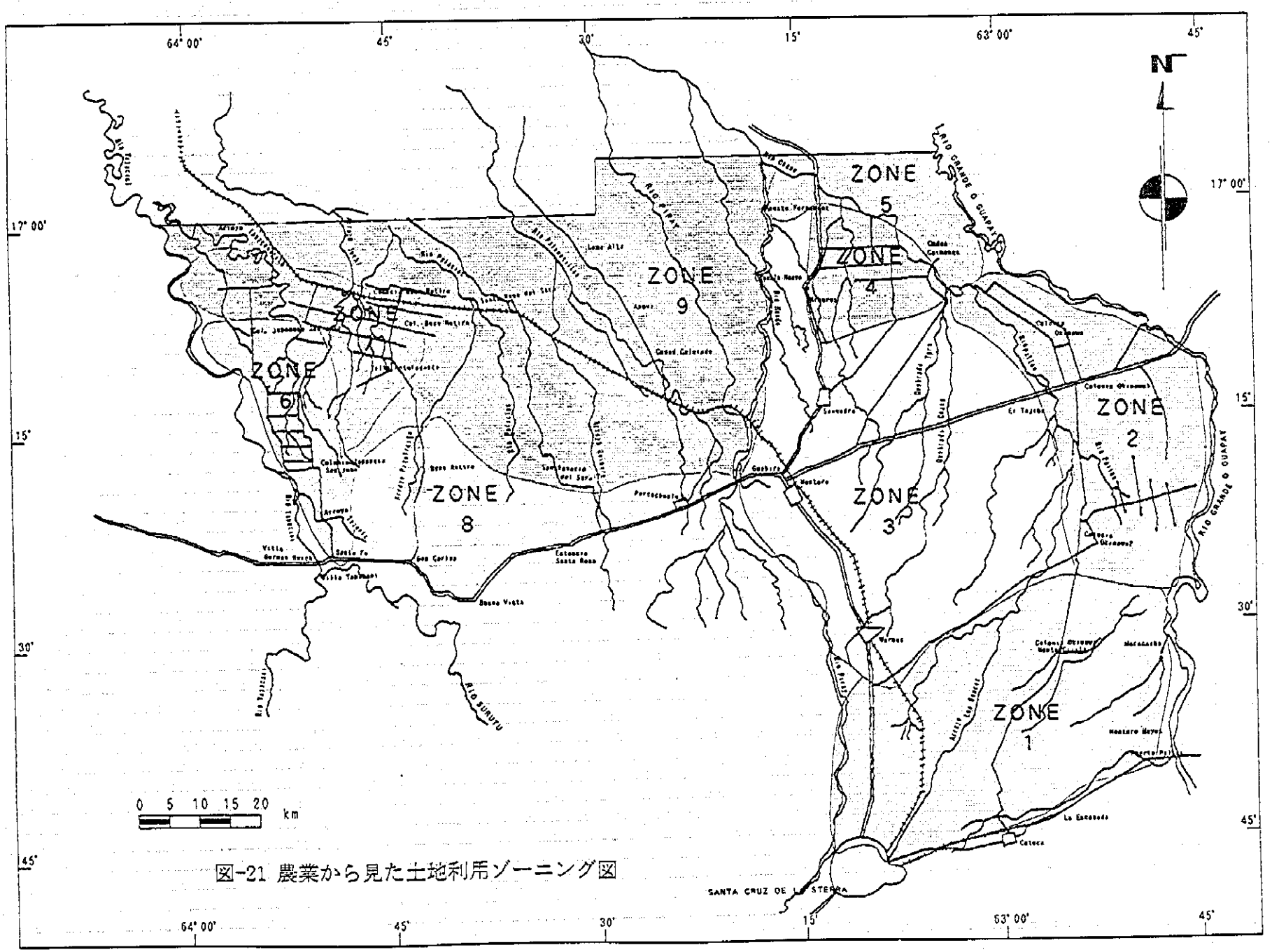


図-21 農業から見た土地利用ゾーニング図

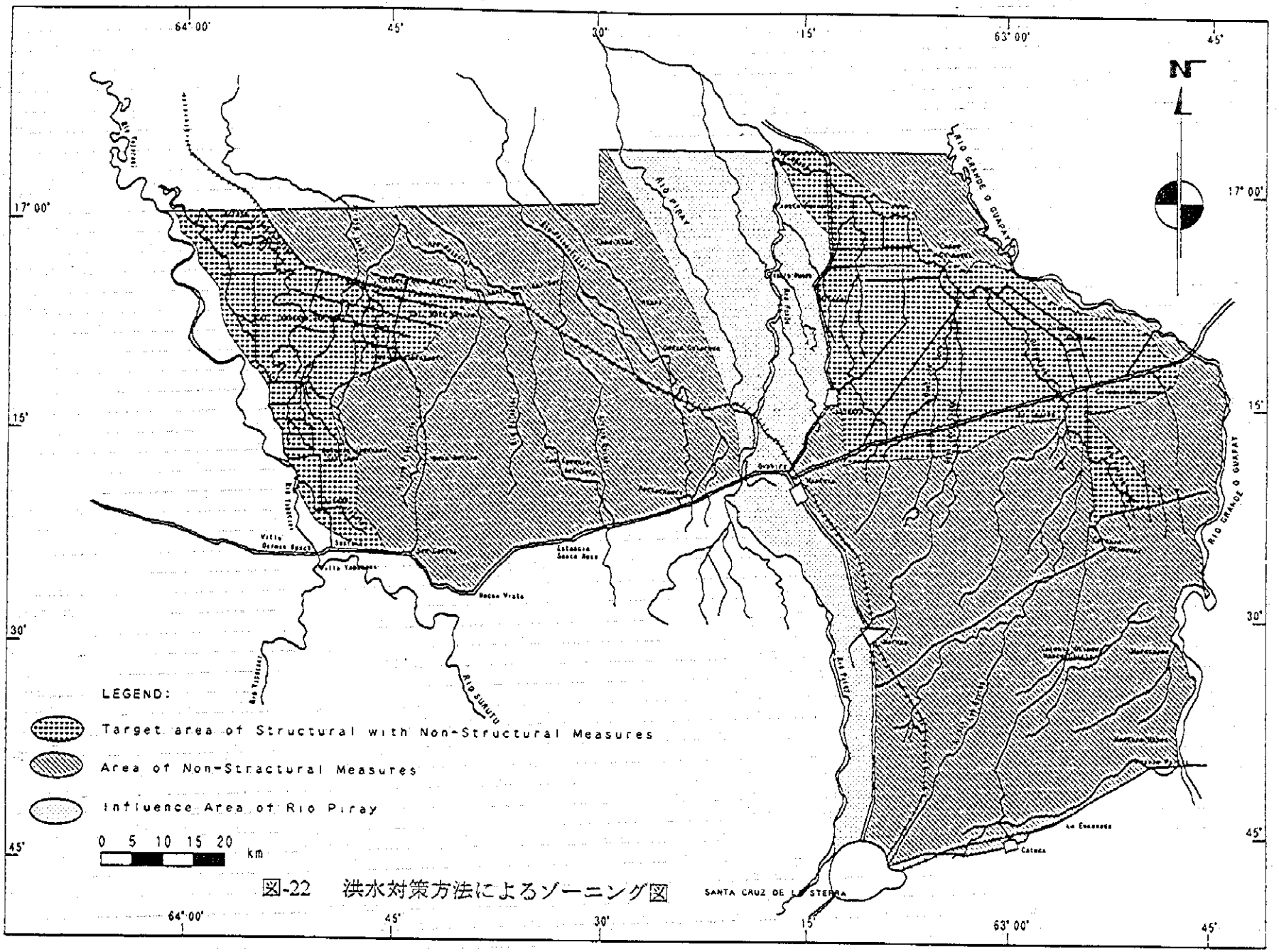


図-22　洪水対策方法によるゾーニング図

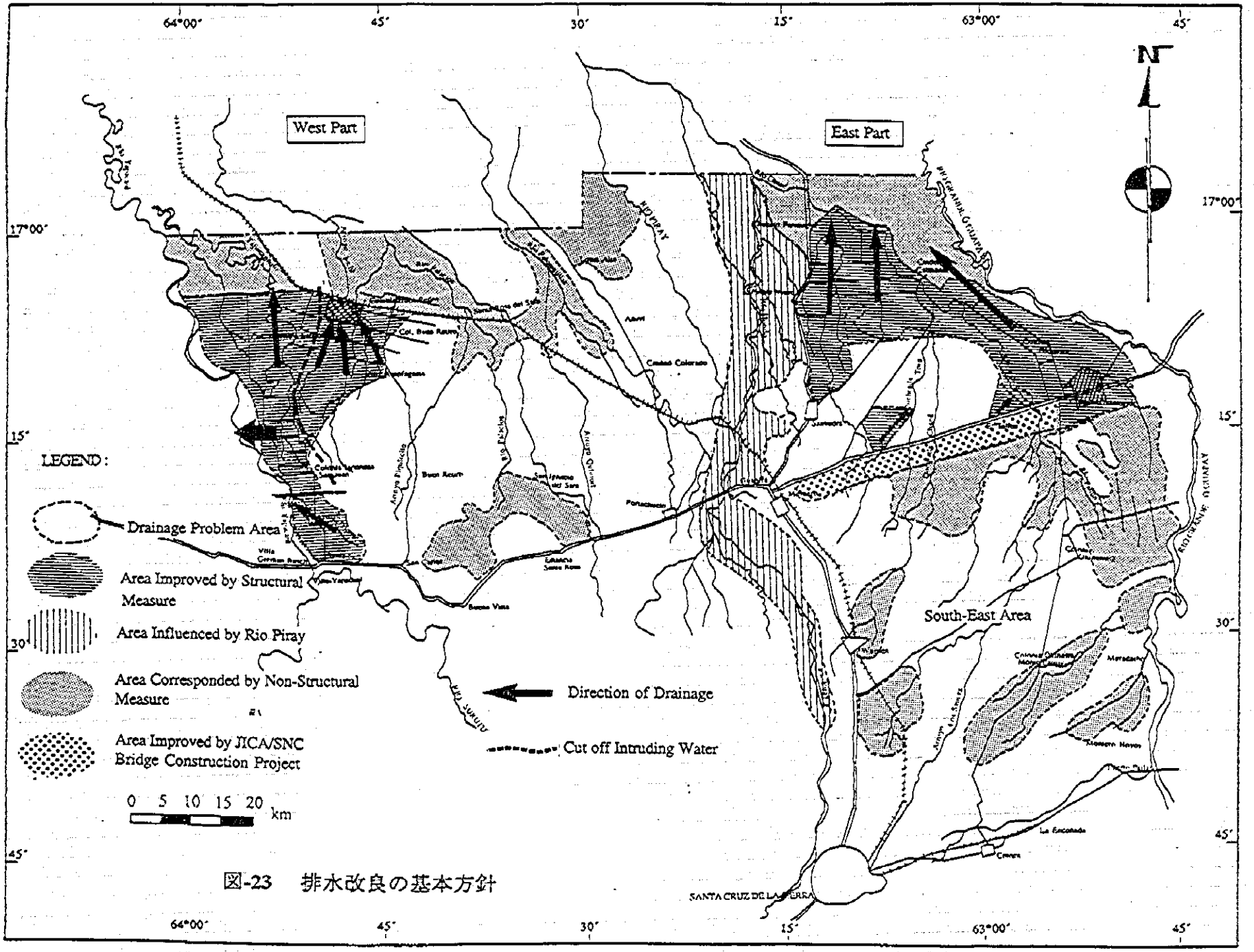


図-23　排水改良の基本方針

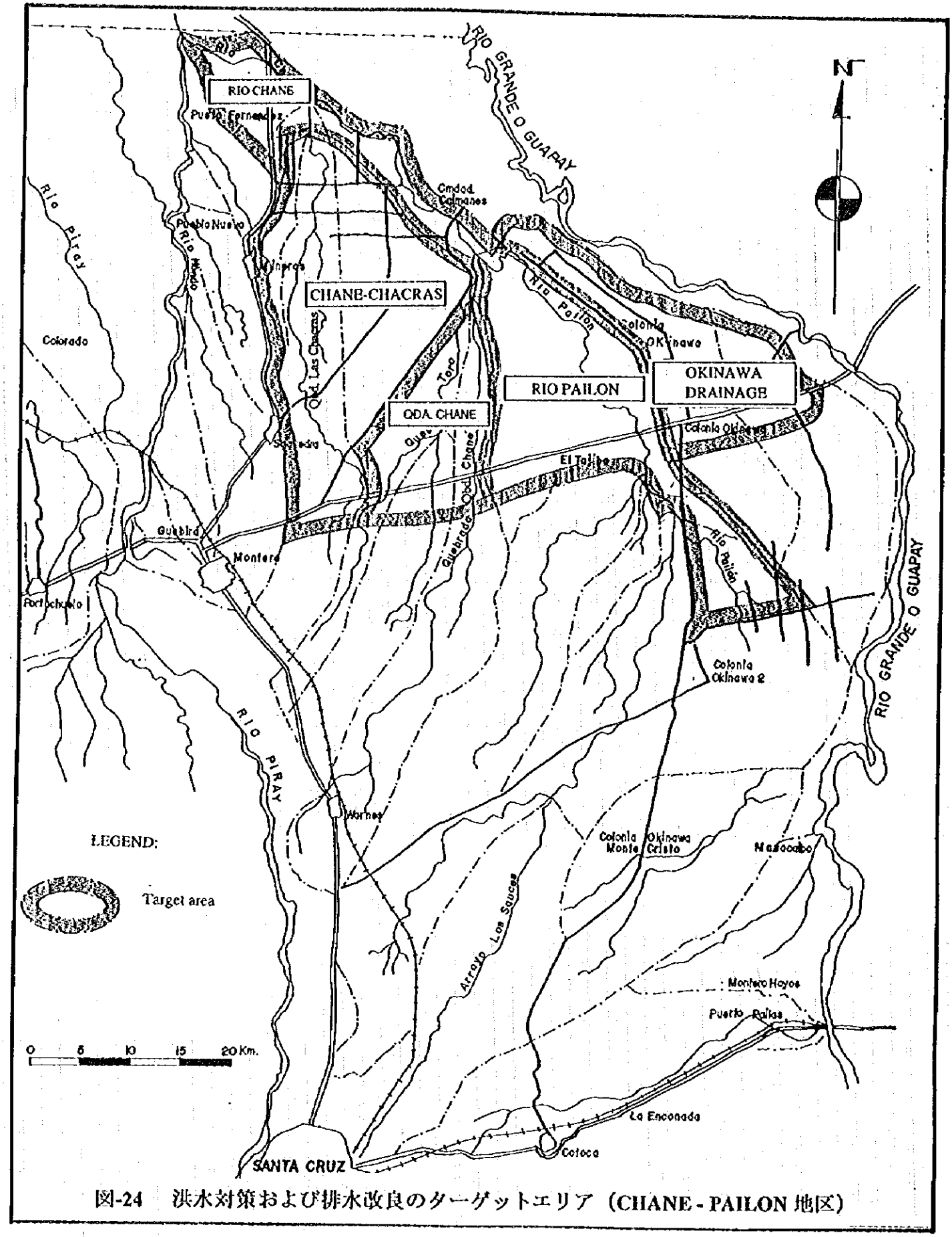


図-24　洪水対策および排水改良のターゲットエリア（CHANE - PAILON 地区）

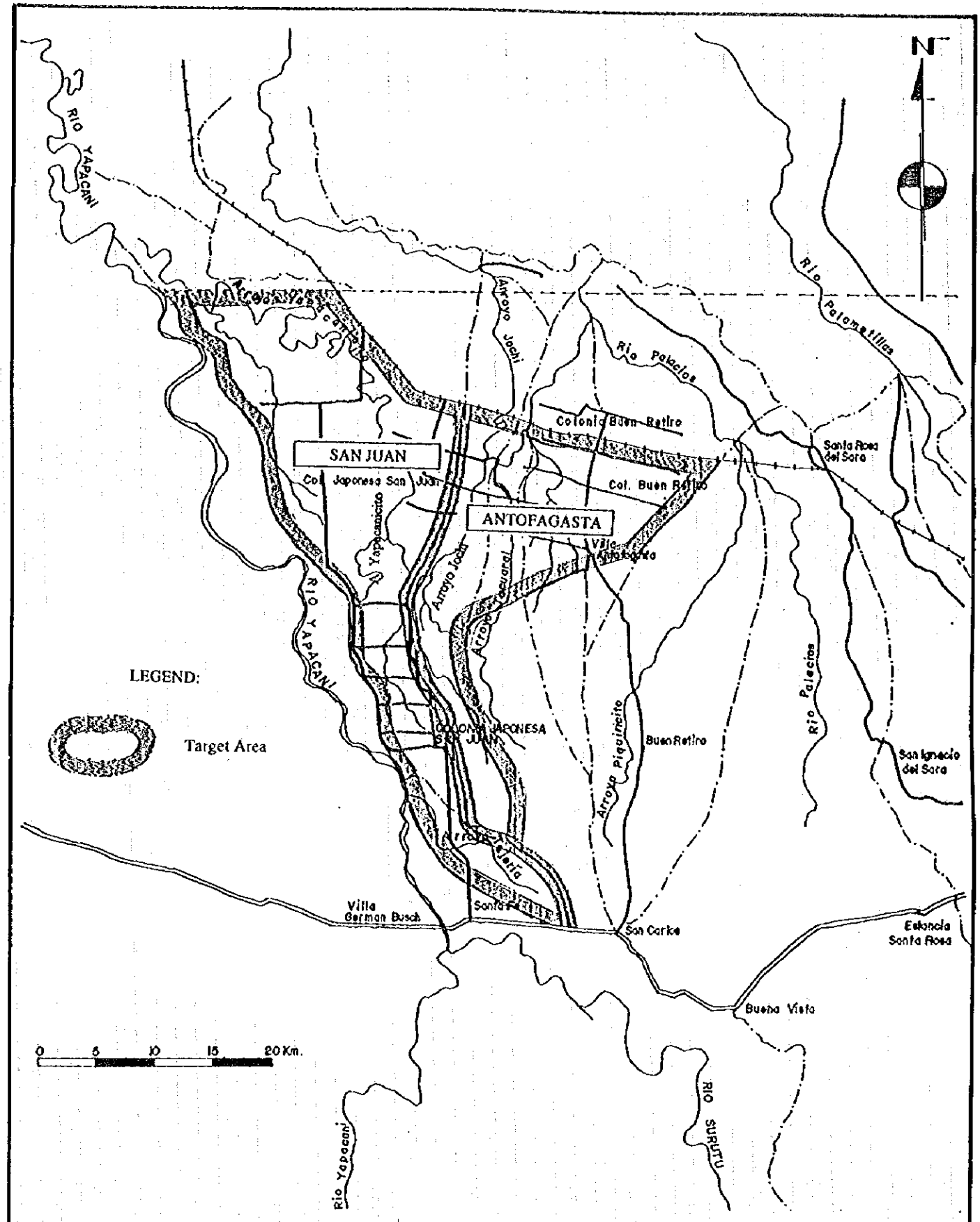


図-25　洪水対策および排水改良のターゲットエリア（SAN JUAN - ANTOFAGASTA 地区）

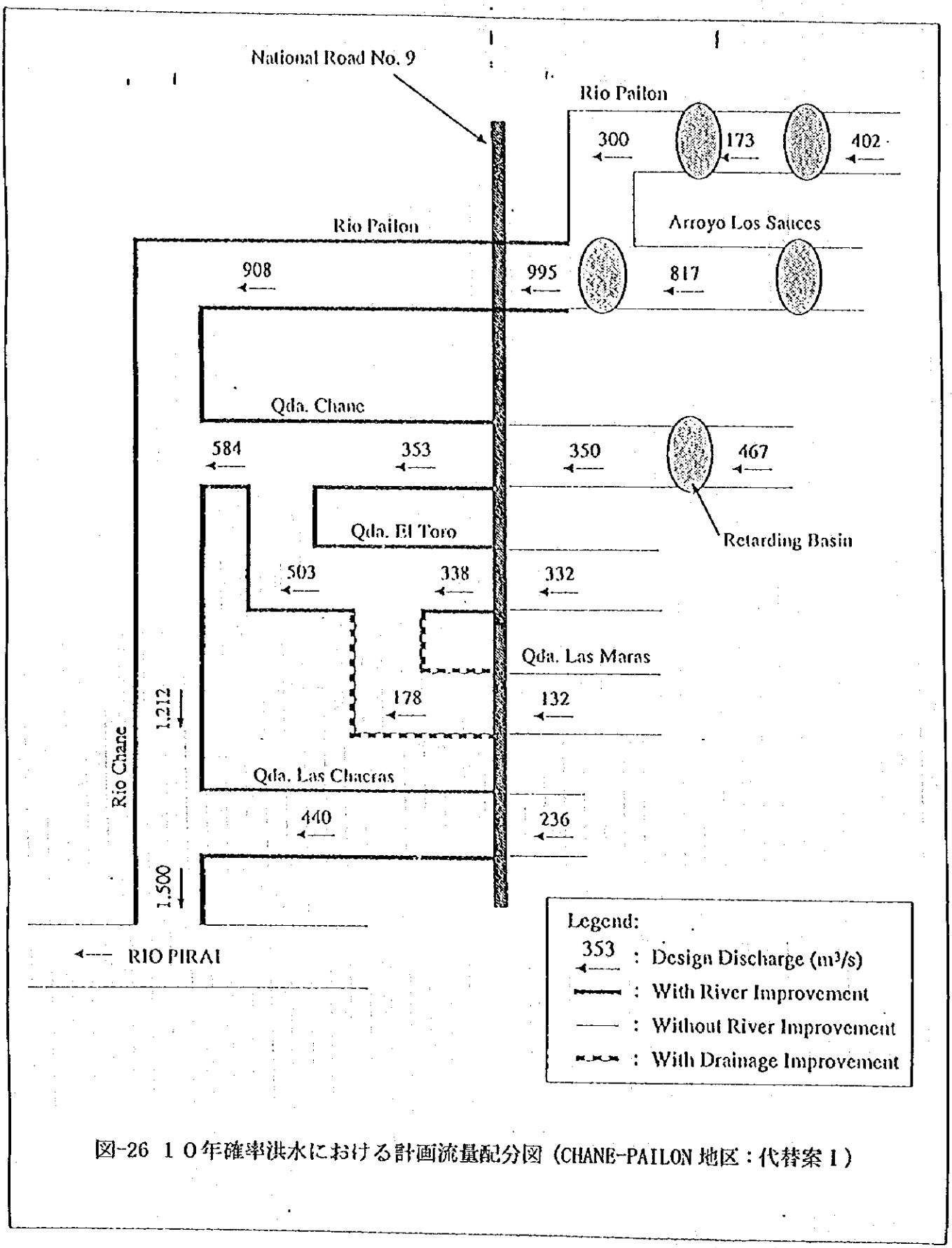


図-26 １０年確率洪水における計画流量配分図（CHANE-PAILON 地区：代替案１）

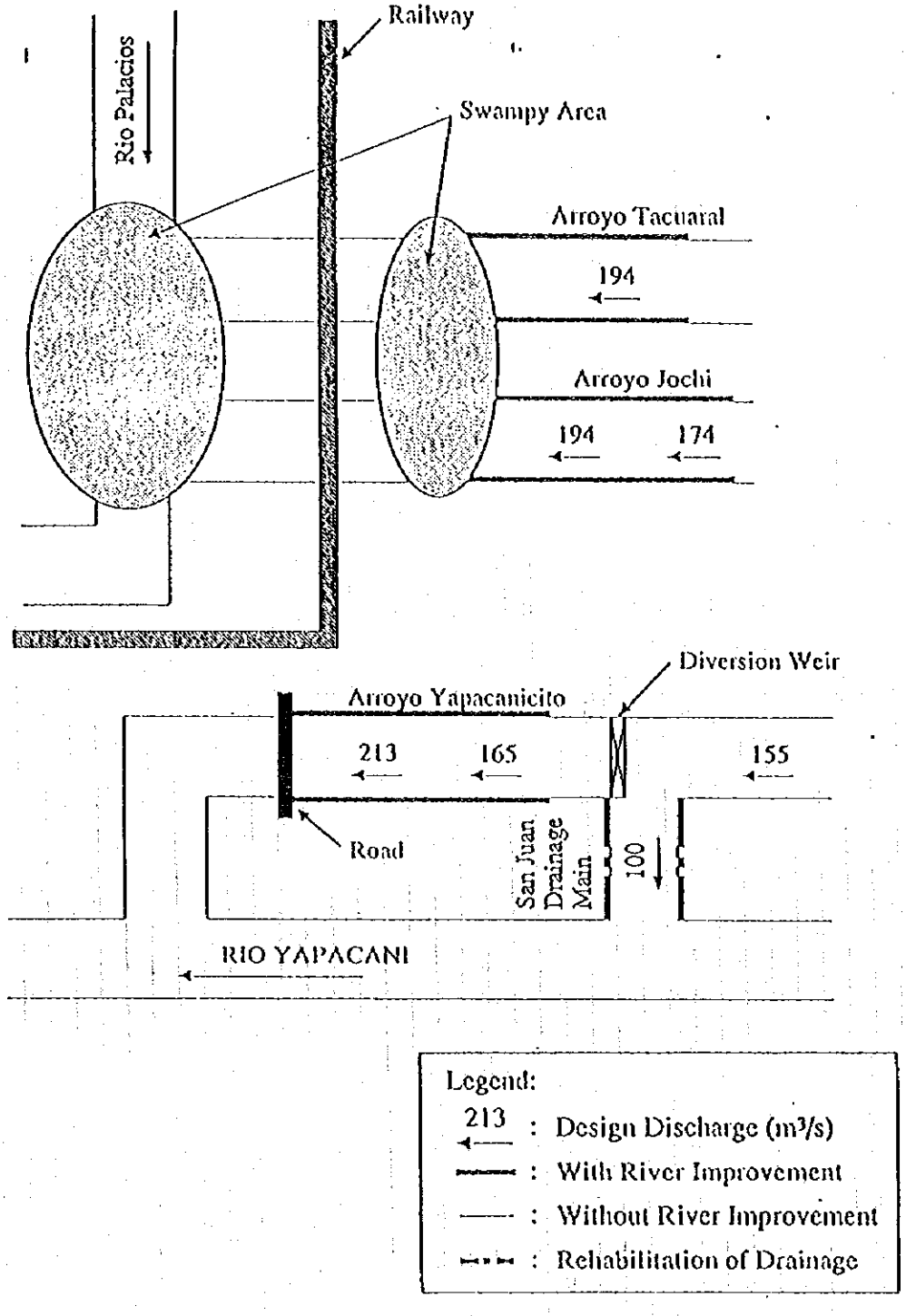


図-27 １０年確率洪水における計画流量配分図
(SAN JUAN - ANTOFAGASTA 地区：代替案Ｉ)

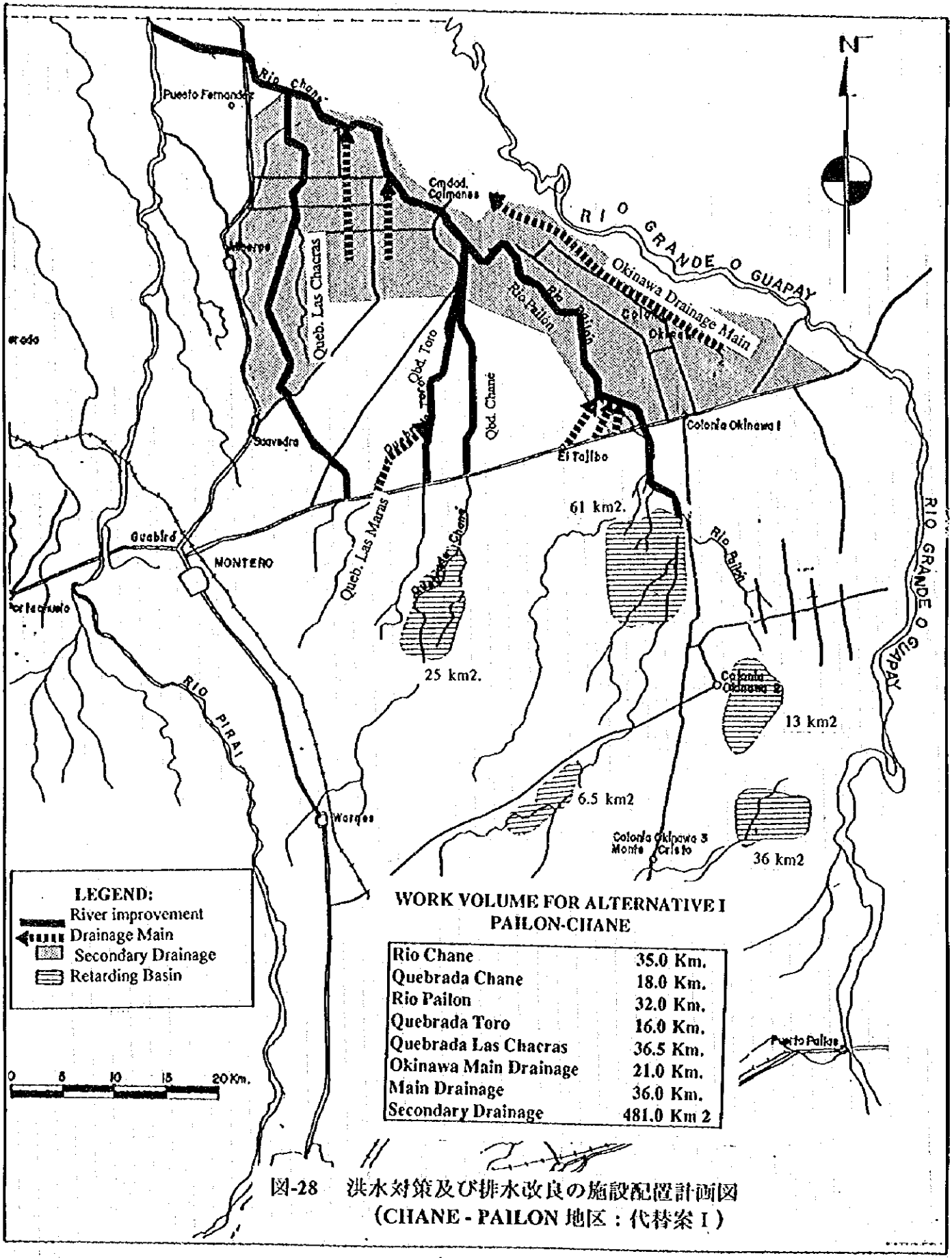


図-28　洪水対策及び排水改良の施設配置計画図
（CHANE - PAILON 地区：代替案 I）

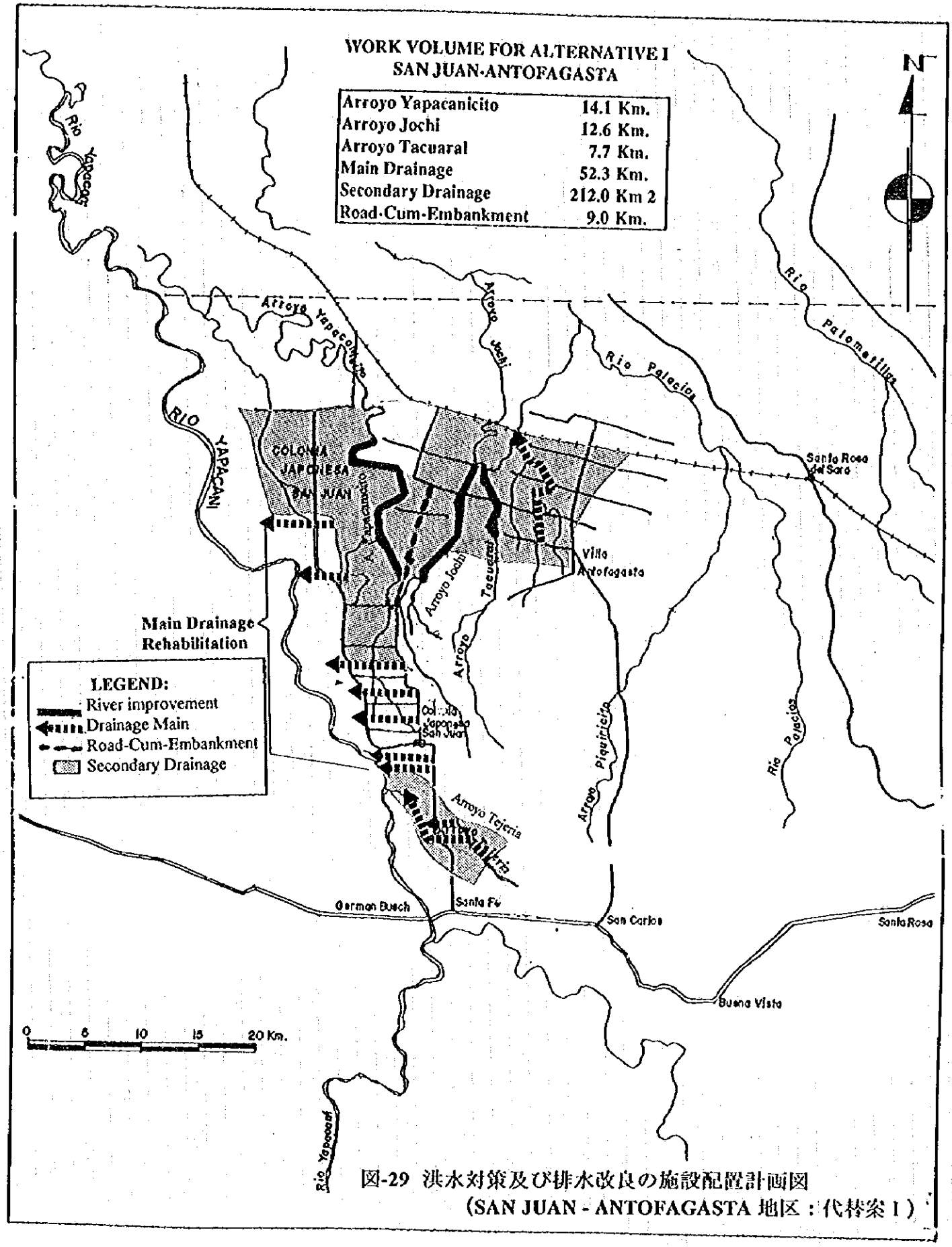


図-29 洪水対策及び排水改良の施設配置計画図
(SAN JUAN - ANTOFAGASTA 地区：代替案 I)