

(6) Amnay-Patrick River Basin

The Amnay-Patrick river basin occupies about 993 km² of the province of Occidental Mindoro, located in the midwestern part of Mindoro Island.

River System

The Amnay-Patrick rivers are located in the central part of Occidental Mindoro. The combine basin area is bounded in the west by Mindoro Strait, and in the north, east and south by mountain ranges with peaks rising up to nearly 2,000 m above sea level.

The Amnay-Patrick rivers originate in the mountain range which separates Occidental Mindoro from Oriental Mindoro. After emerging from the mountainous areas, the rivers form alluvial pans and deltas which are collectively called the Sablayan plain. The rivers flow westward in a plain area for 15 km before finally draining into the Mindoro Strait.

The Amnay and Patrick rivers are the main drainageways in this basin. A smaller waterway located between the Amnay and Patrick rivers, the Pandan river, functions mainly as a local drainage channel.

River	Basin Area (km ²)	River Length (km)	Overall Slope
Amnay	586	58	1/39
Patrick	407	42	1/33

Source: Nationwide Flood Control Plan and River Dredging Program (1982)

Population

Description	Province: Occidental Mindoro					
	1960	1970	1975	1980	1990	1995
Population (thousands)	84	144	186	222	283	337
Population Density (person per sq. km)	14.3	24.5	31.6	37.8	48.1	57.3

Source: NSO

Land Uses (Occidental Mindoro Province)

Category	Area (ha)	Percentage of Area
A. Agricultural Land		
1. Cropland	72,314	12.3%
2. Pasture	86,889	14.8%
3. Fishpond Area	4,538	0.7%
B. Built-up Areas	7,986	1.4%
C. Idle Area	72,671	12.4%
D. Forest Area	343,068	58.4%
Total Land Area	587,466	100.0%

Source: Provincial Planning and Development Office, Mindoro Occidental

Main Project/Study

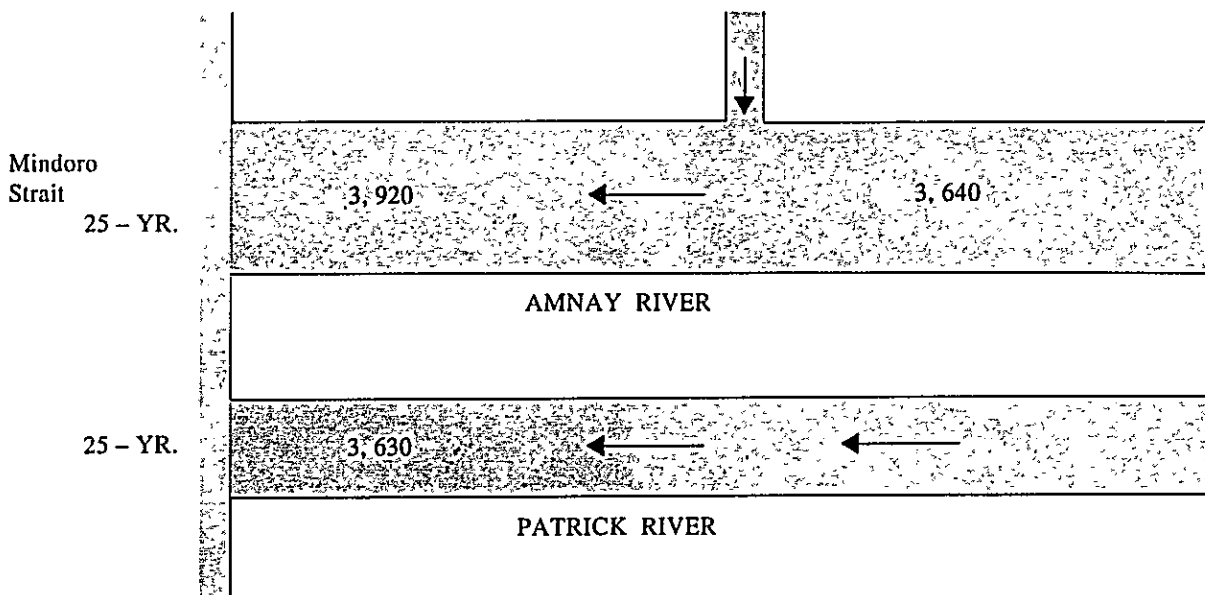
Title	Year	Agency	Status
Nationwide Flood Control Plan and River Dredging Program	1982	MPWH/OECF	MP
Feasibility Study of the Amnay Multipurpose Project	1984	MPWH	F/S

Inundation and Damages

Flooding in 1993 caused by Typhoon Gloring inflicted the most serious damage in recent years. The dead and missing, and injured were 96 and 15, respectively. The flood inundated about 804 ha of agricultural lands.

Proposed Design Discharge

PHASE FLOOD CONTROL PLAN (25-YR. FLOOD)

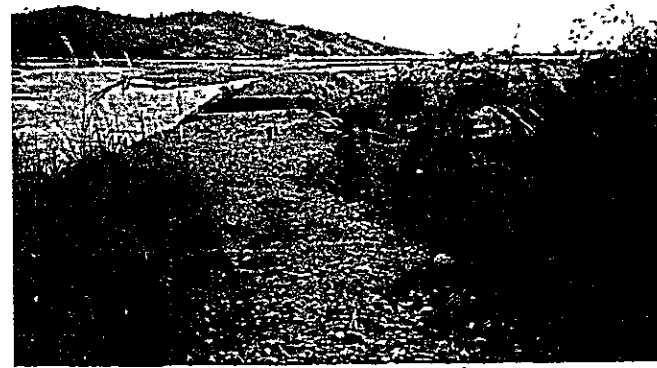


Source: Nationwide Flood Control Plan and River Dredging Program (1982)

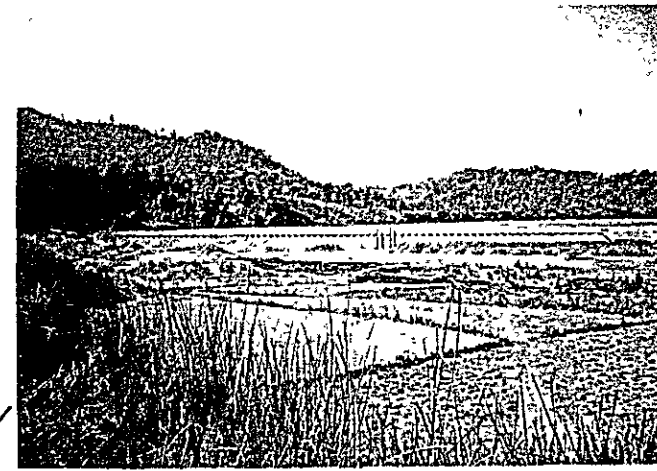
(6) Amnay-Patric River Basin



Downstream of Amnay River



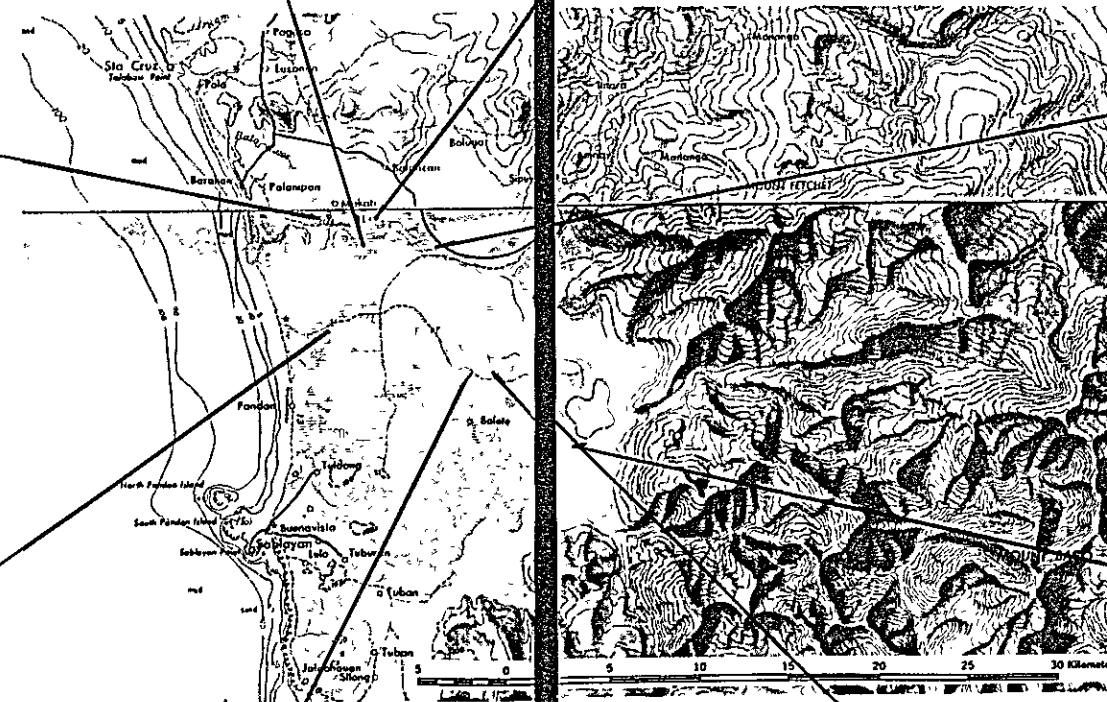
Heavily silted Portion of Amnay River



Training Dike



Upstream of Amnay River



Downstream of Patric River



On-going construction of the 60 LM. Spurdike using R.C. Sheet Piles Foundation



Upstream of Patric River



Totally damaged National Road, scoured during the typhoon Gloring along Patric River

(7) Bicol River Basin

The Bicol river basin is located in the southeastern part of Luzon Island. The basin lies mainly within the provinces of Albay and Camarines Sur and partly in a small portion of Camarines Norte province.

River System

The main channel of the Bicol river originates from the western slopes of Mayon Volcano in Camalig and flows northwest. The Sipocot-Libmanan river, the biggest tributary of the Bicol river, flows in a southeasterly from Mt. Labo and meets the main river channel at Libmanan. After joining, the river changes its flow direction to north and merges into the San Miguel Bay.

River	Basin Area (km ²)	River Length (km)	Overall Slope
Whole Bicol River	3,132	136.0	1/55
Upper reach	896	49.5	1/20
Quinali	355	22.0	1/957
Talisay	192	47.0	1/125
San Francisco	130	27.5	1/125
Nasisi	79.5	21.0	1/9
Naporong	111	39.0	1/28
Middle reach	1,493	25.0	1/25,000
Iriga	472	40.0	1/455
Pawili	222	47.0	1/27
Lower reach	3,132	55.5	1/9,233
Libmanan-Sipocot	781	82.0	1/53

Source: Nationwide Flood Control Plan and River Dredging Program (1982)

The largest of the three (3) inland lakes within the basin is Lake Bato which has an area of around 3,000 ha at a water level elevation at 6.0 m above mean sea level. During inundation, the flood waters of Lake Bato intermingles with that of the smaller Lake Baao which is located about 20 km downstream of the former. Lake Buhi lies approximately 85 m above sea level near the foot of Mt. Iriga.

Lake	Water Surface elevation (m. MSL)	Surface Area (ha)	Storage Volume (Mil. m ³)
Bato	6.0	3,000	58
Buhi	85.0	1,900	50
Baao	5.0	2,400	25

Source: Nationwide Flood Control Plan and River Dredging Program (1982)

Population

Description	Camarines Sur			Albay		
	1980	1990	1995	1980	1990	1995
Population (thousands)	1,099	1,306	1,433	809	903	1,005
Population Density (person per sq. km)	208.7	248.0	272.1	317.0	353.8	393.7

Source: NSO

Land Uses

Category	Camarines Sur		Albay	
	Area (ha)	Percentage	Area (ha)	Percentage
A. Agriculture				
1. Cropland	326,125	61.90%	175,352	68.50%
2. Pasture	643	0.12%	34,744	13.60%
3. Fisheries	4,494	0.85%	2,544	1.00%
B. Built-up Areas	142,089	27.00%	32,337	12.60%
C. Other Land Use	53,331	10.10%	10,881	4.30%
Total	526,682	100.00%	255,860	100.00%

Source: Provincial Planning and Development Office of Camarines Sur and of Albay

Inundation and Damages

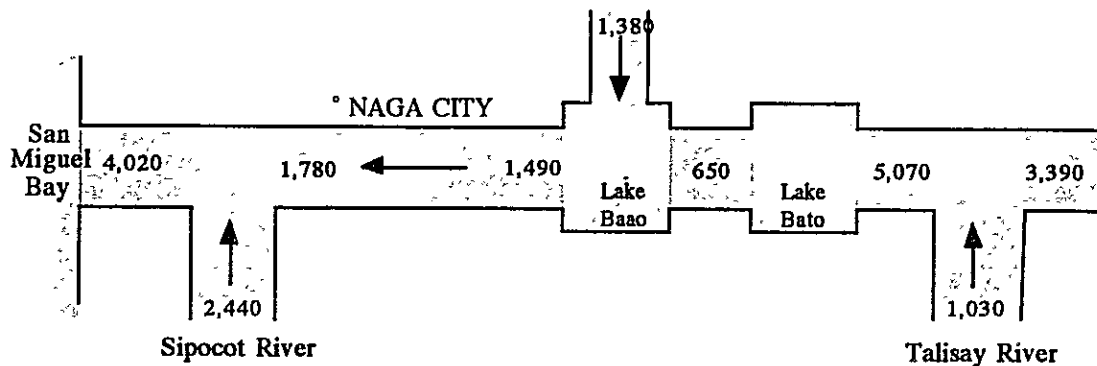
Description of Damages	Year: 1994 Typhoon: Monang	Year: 1995 Typhoon: Rosing
Casualties		
Dead/Missing	205/38	290
Injured	541	2,009
Agriculture	P 480.0 Million	
Palay/Rice		29,291 ha
Infrastructure (P)	P 190.0 Million	
Road/Bridges		P 223.6 Million
Irrigation Facility		P 10.3 Million

Source: OCD

Main Project/Study

Title	Year	Agency
Bicol River Basin Flood Control Investigation	1975	Asian Institute of Technology
Nationwide Flood Control Plan and River Dredging Program	1982	MPWH/OECF
Master Plan of Bicol River Basin Flood Control	1983	Bicol River Basin Development Project, MPWH
Bicol River Basin Flood Control and Irrigation Development Project	1990	UNDP, ADB

Proposed Design Discharge



Design Discharge is of a 50-year return period.

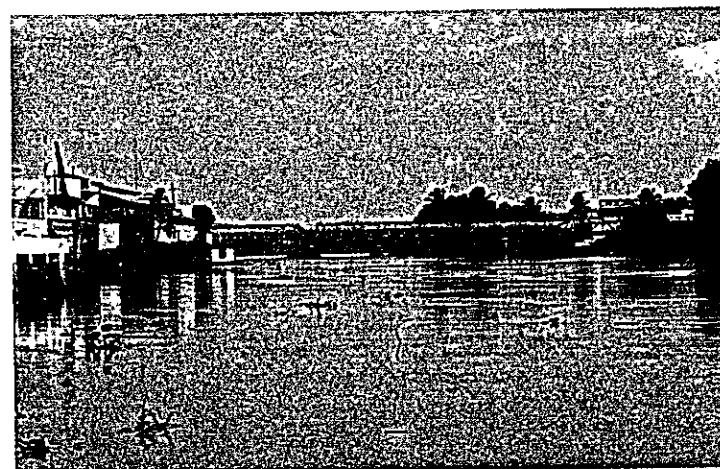
Source : Nationwide Flood Control Plan and River Dredging Program (1982)



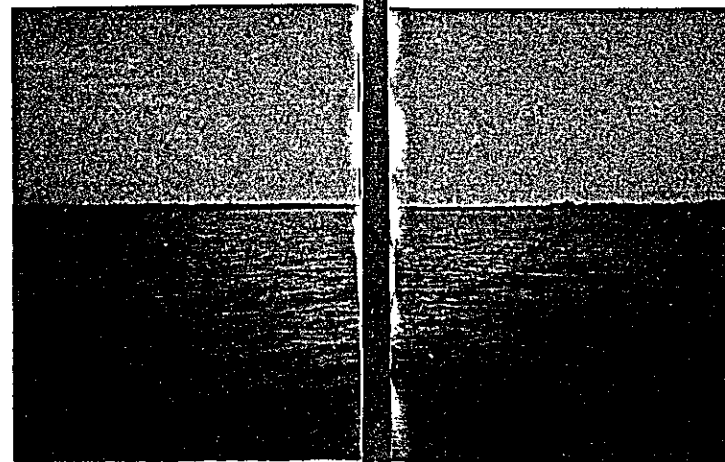
Bank Protection of Libmanan River, Camarines Sur



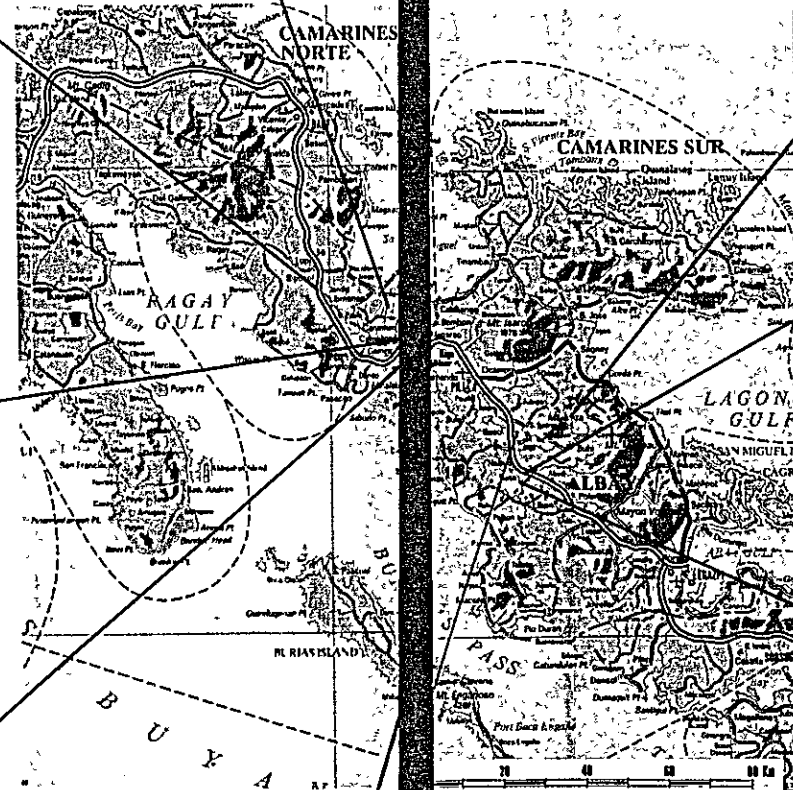
Moored Ship



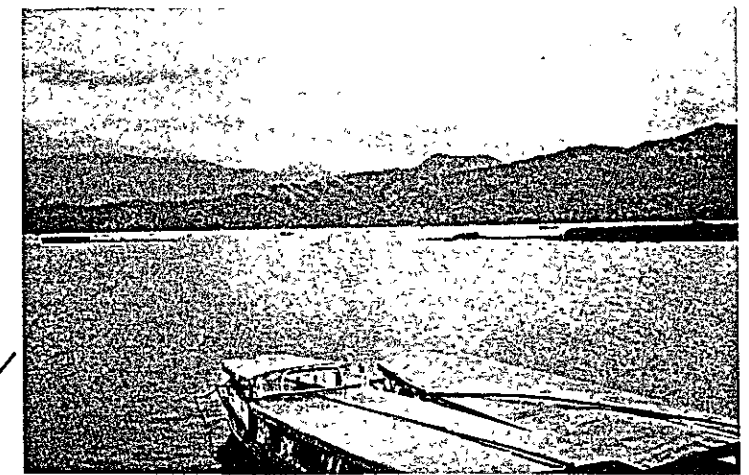
View in Naga City



River Mouth



Washed-out Nabua Damsite



Lake Buhi



Lake Bato



Bato Lakeshore damaged by Typhoon Rosing, 1995

(8) Panay River Basin

The Panay River Basin, located in the northern part of the Panay Island, lies mostly in the province of Capiz and partly in Aklan and Iloilo provinces.

River System

The Panay river originates in the Nacuron mountain range near the Capiz - Aklan boundary. The river flows in a northeasterly direction, joining the Badbaran, the Mambusao, and then the Maayon rivers. At Paslang, the Panay river is divided into two, the lower Panay and Pontevedra rivers. The lower Panay river flows in a northeasterly direction through Roxas City, and drains into Capiz Bay, while the Pontevedra river flows in an easterly direction through Pontevedra and finally drains into Tinagong Dagat Inlet. The bifurcation point of the lower Panay river is silted up and the Pontevedra river is now the main channel.

Higher mountains are located in the eastern and western edges of the basin holding a relatively flat basin in between. The average elevation of the basin is 116 m, MSL.

River	Basin Area (km ²)	River Length (km)	Overall Slope
Whole Panay River	2,068	152	1/7,600 to 1/2,700
Badbaran	350	65	1/2,600
Mambusao	499	74	1/4,100
Maayon	364	53	1/1,200

Source: Nationwide Flood Control Plan and River Dredging Program (1982)

Population

Description	Capiz			Roxas City		
	1980	1990	1995	1980	1990	1995
Population (thousands)	492	584	624	81	103	119
Population Density (person per sq. km)	186.9	221.8	237.0	795.9	1,009.8	1,163.9

Source: NSO

Land Uses (Capiz Province)

Category	Area (ha)	Percentage of Area
Total Land Area	263,317	100.0%
Alienable and Disposable Land	169,515	64.4%
Total Forest Land	93,802	35.6%
Unclassified Forest Land	86	0.0%
Total Classified Public Forest	93,716	35.6%
Established for Residence		
Established Timberland	88,566	33.6%
Fishpond	5,150	2.0%
Others		

Source: National Mapping and Resource Information Authority, DENR

Inundation and Damages

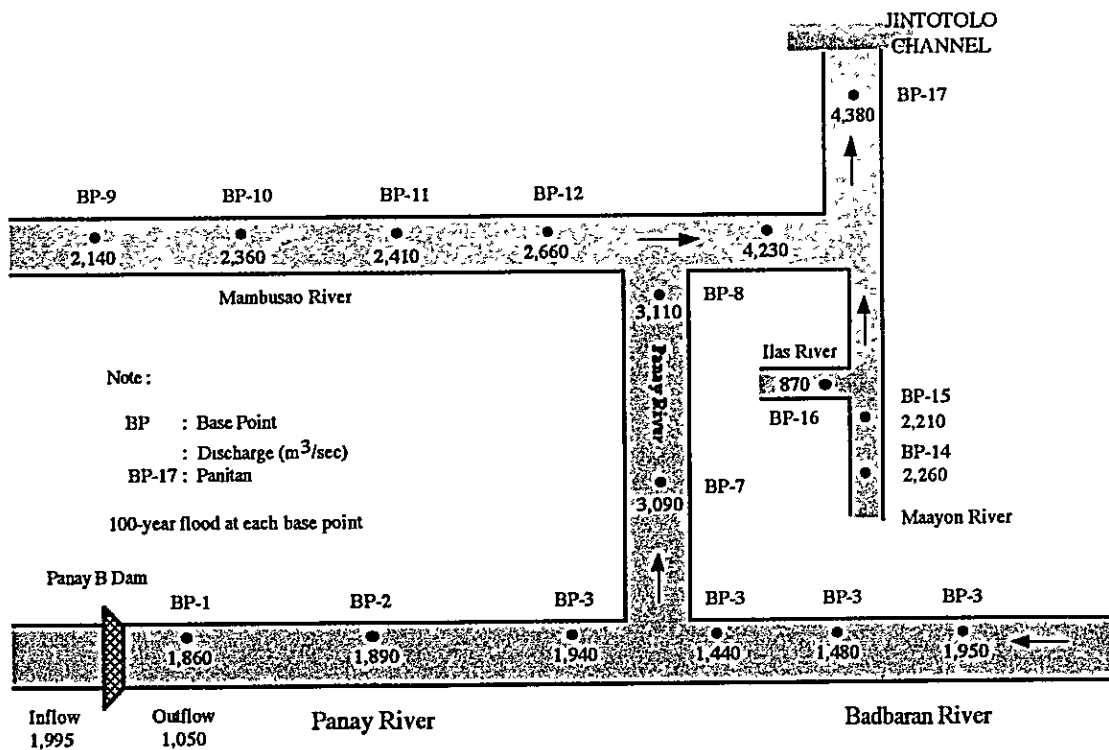
Date	Name of Typhoon	Extent of Damage
Nov. 1973	Openg	P 341 M
Nov. 1984	Undang	P 247.6 M
Nov. 13, 1990	Ruping	No record
Aug. 22, 1993	Saling	P 1,435 (thousand)
Nov. 21, 1993	Luring	P 1,678 (thousand)
Dec. 22, 1994	Garding	P 4,477 (thousand)
Sep. 30, 1995	Mameng	No record
Feb. 29, 1996	Asiang	P 15,425 (thousand)

Source: OCD, Region 6

Main Project/Study

Title	Year	Agency	Status
Nationwide Flood Control Plan and River Dredging Program	1982	MPWH/OECF	M/P
Panay River Basinwide Flood Control Study	1987	JICA	M/P

Proposed Design Discharge



Source : Panay River Basinwide Flood Control Study, 1987, JICA

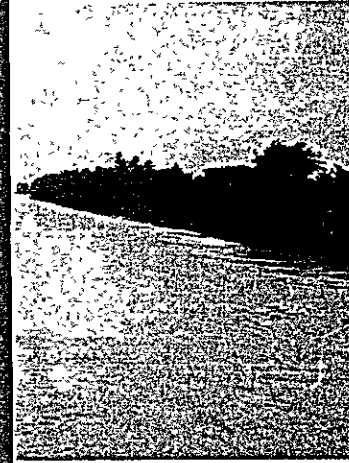
(8) Panay River Basin



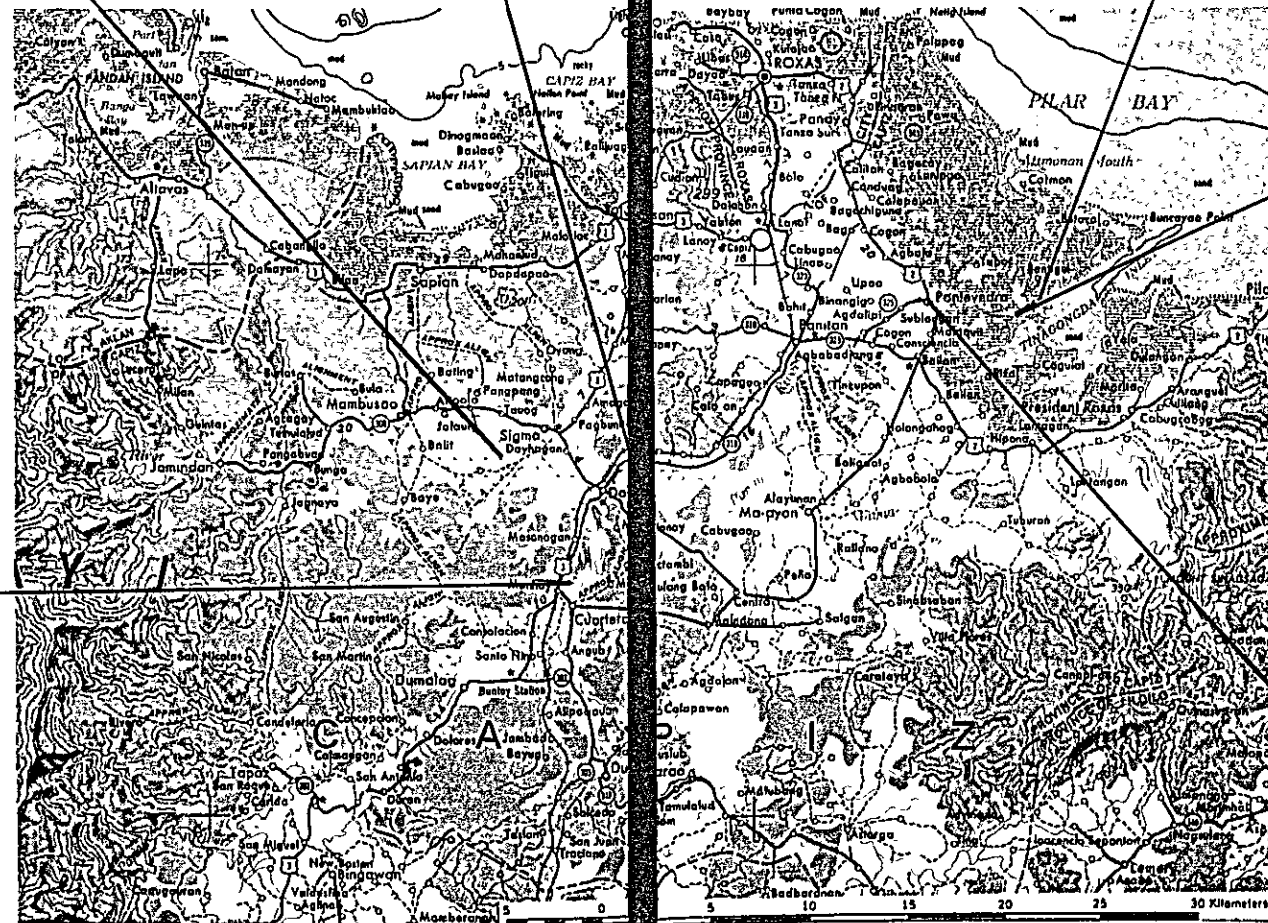
Flood Prone Area



Near Cuartero



Near Dao



Tinagongdagat Inlet



Remaining Mangrove



Near Pontevedra

(9) Jalaur River Basin

The Jalaur river basin is located in the southeastern part of Panay Island. It occupies the major part of Iloilo province and a small part of Antique and Capiz. The Northern part of the basin lies in the province of Capiz while its western part is in the mountain range called Western Cordillera.

River System

The Jalaur river, which serves as a main drainage of the basin, originates in the eastern slopes of Mt. Baloy. The river flows in the easterly direction until it joins with the Lamunan river in Passi. At this junction the river changes its flow in southerly direction and is joined by the Ulian and Suague rivers, and empties in the Iloilo Strait.

The topography of the basin is characterized by high mountains on the western side and hilly to flat plain in the rest of the basin. The average elevation of the basin is 156 m, MSL.

River	Basin Area (km ²)	River Length (km)	Overall Slope
Whole Jalaur River	1,742	123	1/5,000 to 1/1,670
Lamunan	316	51	1/1,100
Ulian	274	57	1/550
Suague	230	57	1/305

Source: Nationwide Flood Control Plan and River Dredging Program (1982)

Population

Description	Iloilo Province			
	1970	1980	1990	1995
Population (thousands)	1,168	1,434	1,765	1,876
Population Density (person per sq. km)	219.4	269.3	331.5	352.4

Source: NSO

Land Uses (Iloilo Province)

Category	Area (ha)	Percentage of Area
Total Land Area	532,397	100.0%
Alienable and Disposable Land	396,149	74.4%
Total Forest Land	136,248	25.6%
Unclassified Forest Land		
Total Classified Public Forest	136,248	25.6%
Established for Residence	41,836	7.9%
Established Timberland	85,496	16.1%
Fishpond	8,062	1.5%
Others	854	0.2%

Source: National Mapping and Resource Information Authority, DENR

Inundation and Damages

The 1990 Typhoon Ruping and the 1995 Typhoons Mameng and Pepang were the three (3) identified typhoons that caused the recent largest floods. Damages were as follows:

Description of Damages	1990 Ruping	1995 Mameng	1995 Pepang
Dead	30	10	52
Missing	5	-	7
Houses Destroyed (Totally)	42,691	183	52,032
Houses Destroyed (Partially)	97,150	1,424	18,579
Agriculture (P Mil.)	603	112	918
Infrastructure (P Mil.)	870	7	93

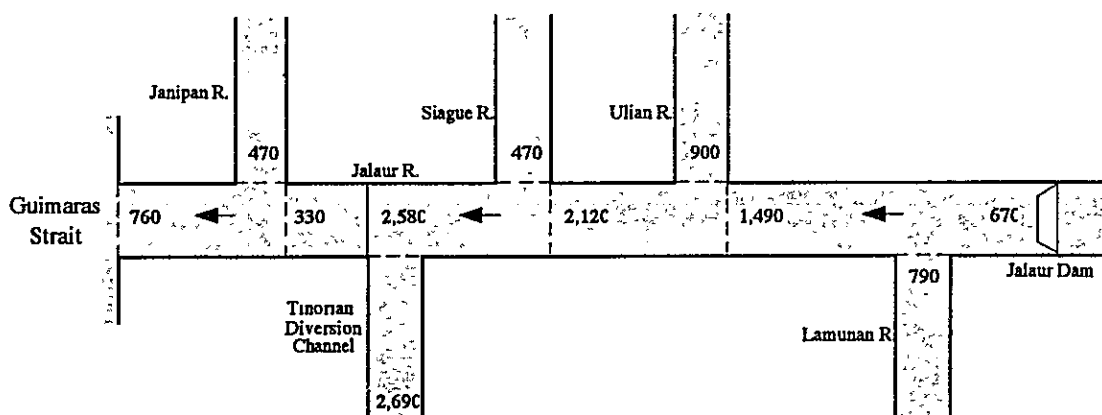
Source: OCD, Region 6

Main Project/Study

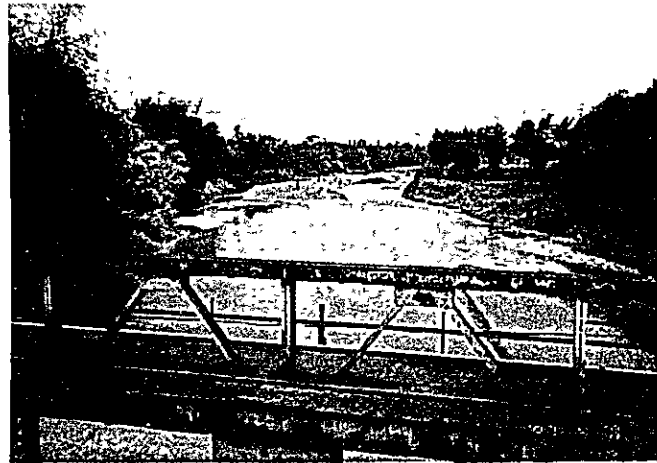
Title	Year	Agency
Nationwide Flood Control Plan and River Dredging Program	1982	MPWH/OECF
The Study on Jalaur Irrigation Systems and Rural Development Project in the Republic of the Philippines	1996	NIA/JICA

Proposed Design Discharge

FIRST PHASE FLOOD CONTROL PLAN (25 - YR. FLOOD)



Source : Nationwide Flood Control Plan and River Dredging Program (1982)



Calinog (Jagdong River)



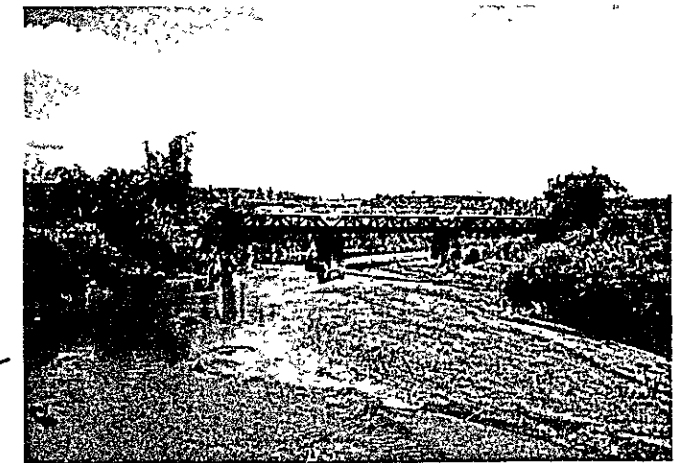
Calinog (Jagdong River)



Magapa River (Tributary of Suague River)



Passi



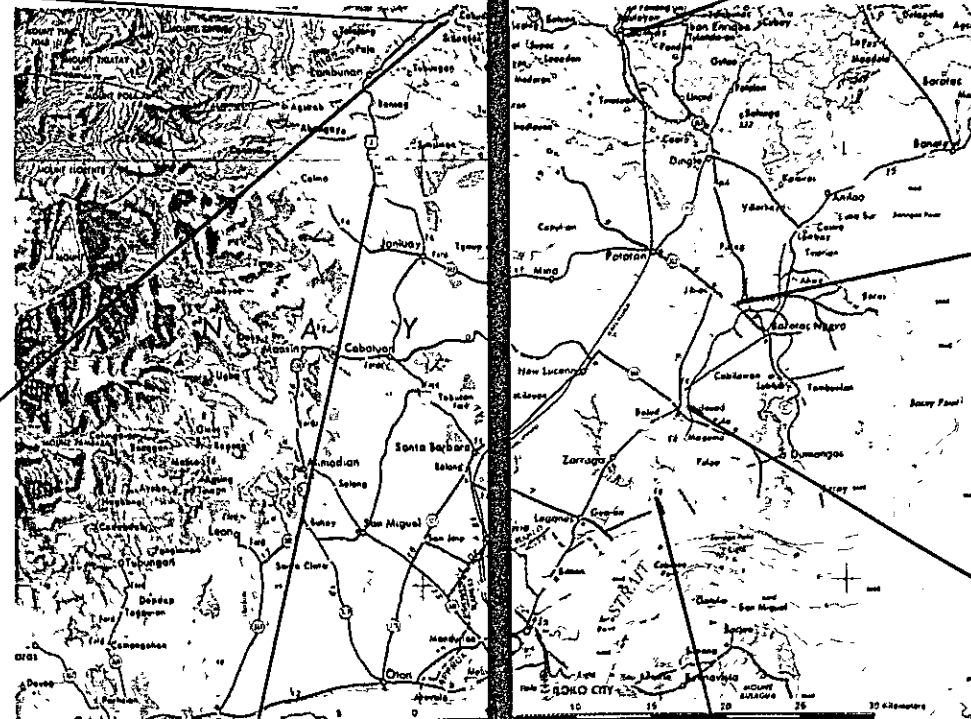
Dueñas (Jagdong River)



Tabucan



Near Balabag



Near River Mouth

(10) Ilog-Hilabangan River Basin

The Ilog river basin, having an area of about 2,104 km², is located in the southwestern portion of Negros Island. It occupies a large portion of Negros Occidental province and a small portion of Negros Oriental province.

River System

The Ilog river is the principal drainageway of the basin. Its headwater originates in the northwestern tip of the basin and flows in a southeasterly direction until it reverses its course to a general northwesterly direction and finally discharge into the Panay Gulf with two (2) distributaries, the Bungol diversion channel and the lower Ilog river. At about 25 km from the mouth, the Ilog river is joined by the Hilabangan river, a main tributary which originates in the eastern tip of the basin.

The Ilog river is formed by numerous streams and creeks. The river system is composed of two (2) main rivers, namely: Ilog and Hilabangan rivers. Alluvial deposits blanket the area at the vicinity of the mouth of the Ilog river system. The terrain of the surrounding areas of the river system is an irregularly shaped depression characterized by alluviated flatlands and gently sloping hills. The hilly portion located at the southeastern part is made up of beds of young and old sedimentaries associated with some volcanic rocks.

River	Basin Area (km ²)	River Length (km)	Overall Slope
Whole Ilog	2,104	124	1/248
Hilabangan	488	54	1/50

Source: Nationwide Flood Control Plan and River Dredging Program (1982)

Population

Description	Province : Negros Occidental				
	1960	1970	1980	1990	2005
Population (thousands)	1,332	1,504	1,930	2,257	2,434
Population Density (person per sq. km)	168.1	189.7	243.5	284.8	307.1

Source: NSO

Land Uses (Negros Oriental Province)

Category	Area (ha)	Percentage of Area
Total Land Area	540,227	100.0%
Alienable and Disposable Land	258,841	47.9%
Total Forest Land	281,386	52.1%
Unclassified Forest Land	63,091	11.7%
Total Classified Public Forest	218,295	40.4%
Established for Residence	8,570	1.6%
Established Timberland	207,718	38.5%
Fishpond	101	0.0%
Others	1,906	0.4%

Source: National Mapping and Resource Information Authority, DENR

Inundation and Damages

The 1984 Typhoon Nitang was identified as the typhoon that caused the largest floods in the past.

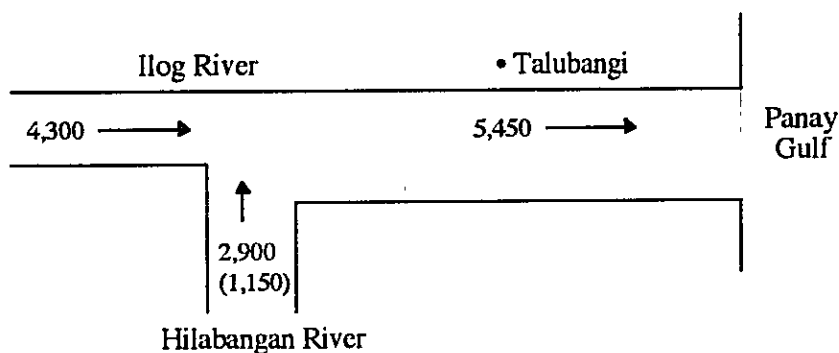
Description of Damages	1984 Typhoon Nitang	1990 Typhoon Ruping	1990 Typhoon Rosing	1995 Typhoon Pepang
Dead/Missing	140	2		201
Injured	4			267
Affected	227,408	41,019	4,067	98,781
Houses/Bldgs	9,001			
Totally Destroyed		1,147	505	46,861
Partially Destroyed		4,618	23	111,500
Agricultural Prod'tn.	P 417 Mil.			
Infrastructure	P 71 Mil.			

Source: OCD, Region 6

Main Project/Study

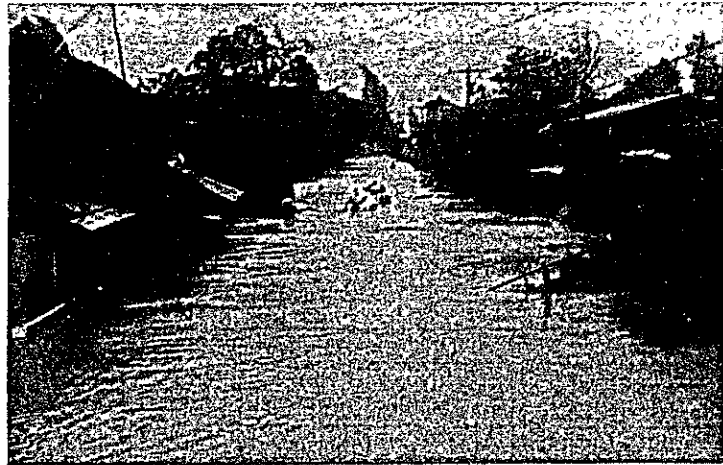
Title	Year	Agency	Status
Nationwide Flood Control Plan and River Dredging Program	1982	MPWH / OECF	M/P
Study on Ilog-Hilabangan River Basin Flood Control Project	1991	JICA	M/P
F/S of Hilabangan, Binalbagan and Pacuan-Hinoba-an Hydro Power Project in Negros Island	1996- (On-going)	NPC, KFW	F/S

Proposed Design Discharge



Source : Study on Ilog-Hilabangan River Basin Flood Control Project, 1991, JICA

(10) Ilog-Hilabangan River Basin



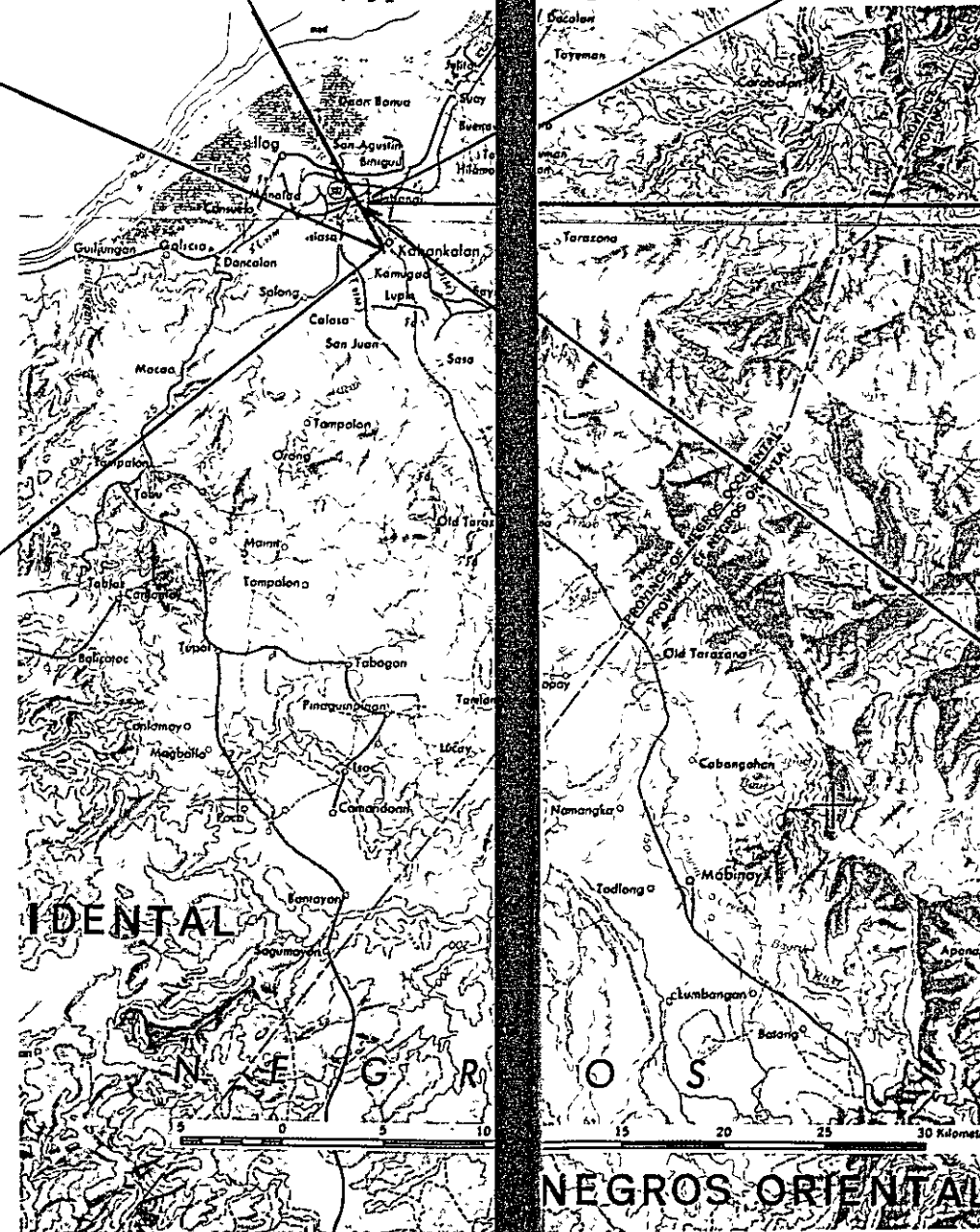
Flooded Kabankalan Proper
(Typhoon Ruping 1990)



Damaged Ilog-Hilabangan River
Control Project



Flooded Kabankalan Proper
(Typhoon Ruping 1990)



Damaged Ilog-Hilabangan
River Control Project



On-going Rehabilitation Project



View from Talubangi Bridge

(11) Tagoloan River Basin

The Tagoloan river basin has an area of about 1,778 km², which is located within the provinces of Misamis Oriental and Bukidnon in Northern Mindanao.

River System

The Tagoloan river basin covers a portion of the province of Misamis Oriental on the north and a part of the province of Bukidnon on the south.

The terrain and climate have made the basin ideal for cattle raising and corn and pineapple production. The unique landscape of the basin consists of plateaus of varying heights separated by deep canyons and valleys.

Tagoloan River provides the main drainageway for the basin. Its headwaters are located on the slopes of the Katanglad Mountains. It traverses the basin in a generally northwesterly direction until it discharges into the Macajalar Bay. The average annual runoff is 4,350 million cubic meters.

The various tributaries along this river are Malitbog, Siloo, Mangima, Amusig and Culaman rivers. The various creeks are Diklom, Mungon, Talibnon, Mamala, Dalirig, Abablawan Guibeau and Mapolo creeks.

River	Basin Area (km ²)	River Length (km)	Overall Slope
Whole Tagoloan	1,778	106	1/75
Pugaan	64	25	1/36
Malitbog	135	31	1/11
Siloo	142	47	1/14
Amusig	227	53	1/13
Ipaon	89	27	1/20
Atugan	518	61	1/11
Calamuan	153	61	1/12
Manolo Fortich	151	78	1/17

Source: Nationwide Flood Control Plan and River Dredging Program (1982)

Population

Description	Misamis Oriental			Bukidnon			Cagayan de Oro City		
	1980	1990	1995	1980	1990	1995	1980	1990	1995
Population (thousands)	690	865	1,016	632	844	940	227	340	428
Population Density (person per sq. km)	193.3	242.3	284.6	76.2	101.8	113.3	550.7	823.6	1,037.6

Source: NSO

Land Uses

Category	Misamis Oriental		Bukidnon	
	Area (ha)	Percentage	Area (ha)	Percentage
Total Land Area	357,003	100.0%	829,378	100.0%
Alienable and Disposable Land	174,959	49.0%	335,995	40.5%
Total Forest Land	182,044	51.0%	493,383	59.5%
Unclassified Forest Land	-	-	42,943	5.2%
Total Classified Public Forest	182,044	51.0%	450,440	54.3%
Established for Residence	7,836	2.2%	50,636	6.1%
Established Timberland	174,148	48.8%	391,052	47.2%
Fishpond	-	-	-	-
Others	60	0.0%	8,752	1.1%

Source: National Mapping and Resource Information Authority, DENR

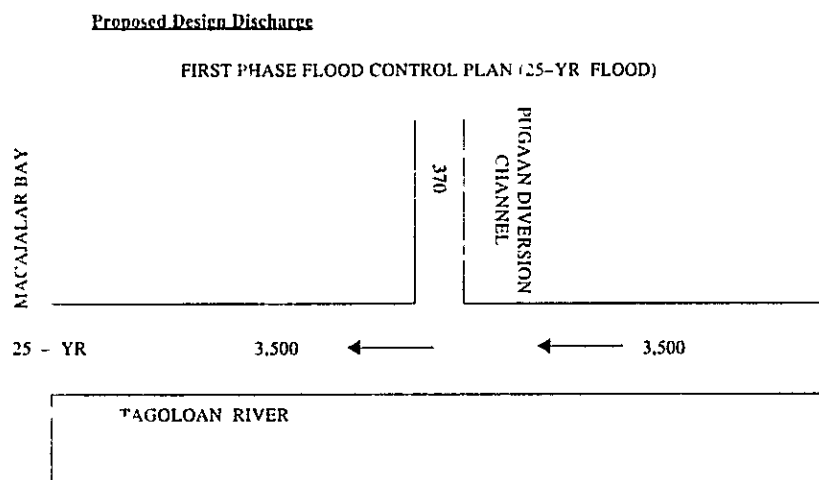
Main Project/Study

Title	Year	Agency	Status
Nationwide Flood Control Plan and River Dredging Program	1982	MPWH/OECF	M/P

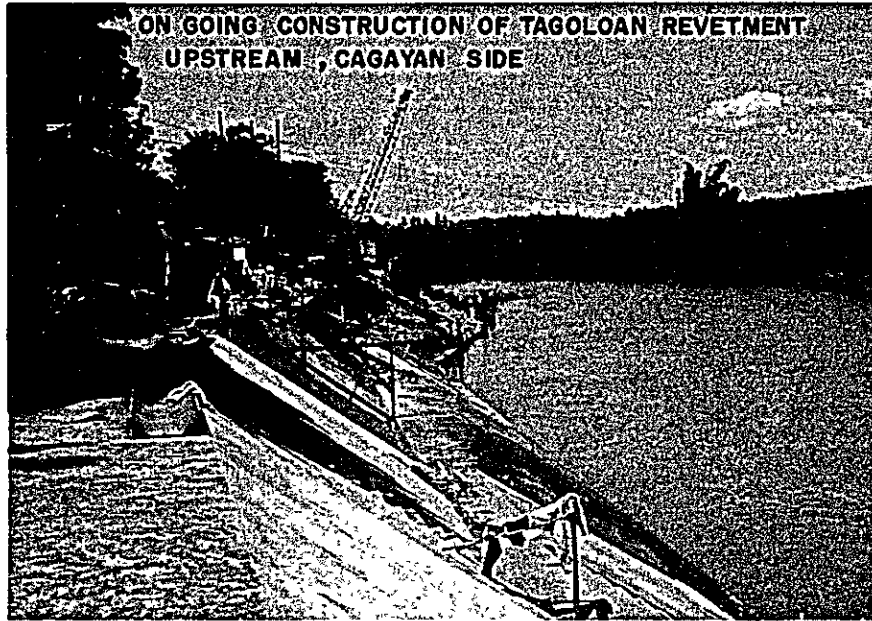
Inundation and Damages

Description of Damages	Year: 1995 Typhoon Trining	Year: 1995 Flash Flood	Year: 1995 Typhoon Pepang
Dead/Missing	-	20	1
Injured	-	8	-
Affected	278	852	784
Houses/Bldgs			
Totally Destroyed	29	-	7
Partially Destroyed	19	-	75
Agriculture (P Mil.)	2,025	182	356

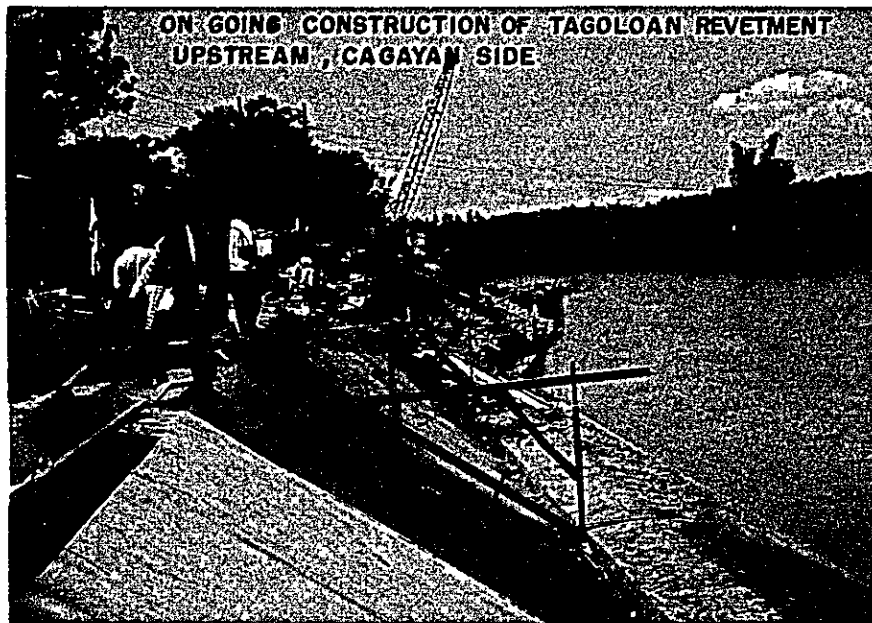
Source: OCD



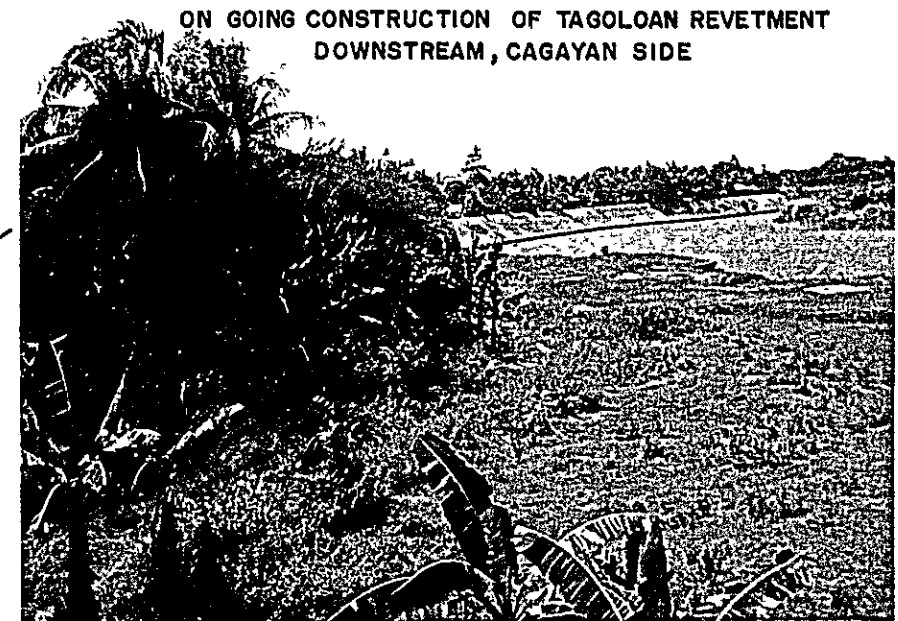
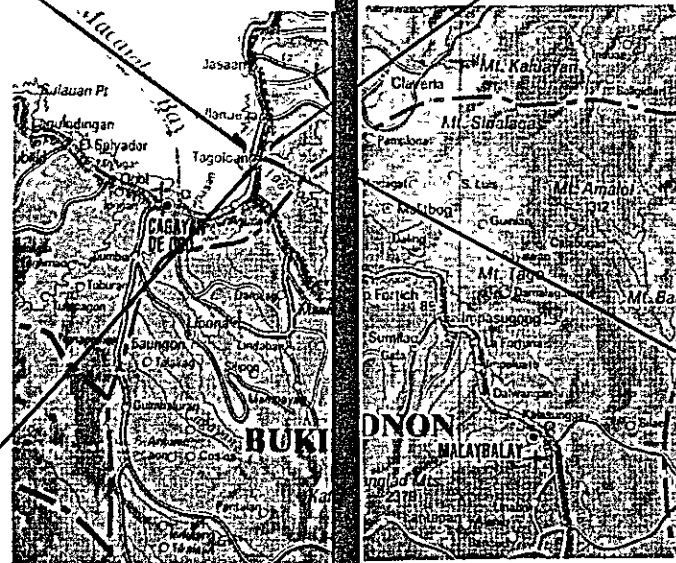
Source: Nationwide Flood Control Plan and River Dredging Program (1982)



On-going Construction of Tagoloan
Revetment, upstream, Cagayan Side



On-going Construction of
Tagoloan Revetment,
upstream, Cagayan Side



On-going Construction of
Tagoloan Revetment,
downstream, Cagayan Side



On-going Construction of Tagoloan
Revetment, upstream, Cagayan Side

(12) Agusan River Basin

The Agusan river basin, the third largest in the Philippines, is located in the eastern part of the Mindanao Island. The basin lies mainly within the provinces of Agusan del Norte, Agusan del Sur and Davao del Norte, and occupies small portions of Surigao del Sur, Bukidnon and Misamis Oriental.

River System

The Agusan river has a catchment area of around 11,700 km² and a total length of around 350 km along the main river.

The upper Agusan river, which stretches from the river origin to the upstream end of Bunawan marsh, has an alluvial pan at the foot of the mountainous area and the skirts of its pan consists of a plain area. The river course appears to have changed frequently in the past. On the topographic maps of scale 1/50,000 the river course is shown at the east side of this pan, while on the 1/250,000 topographic map the river course at present is the latter one, the former tributary of the Agusan river called the Manat river.

The middle Agusan river starts from the upstream end of Bunawan marsh and meanders downstream around 150 km to Amparo which is located 20 km upstream from the mouth. The middle Agusan is characterized by the presence of a large swamp, the Bunawan marsh, which has an area of more than 1,000 sq. km. A number of large tributaries including Ihaosan, Umayam, Adgaoan, Simulao, Gibong, Ojot and Wawa, discharge into this particular reach.

The lower Agusan river stretches from the rivermouth to 20 km upstream. Butuan City, which is the largest city in the basin and the principal commercial center of Agusan del Norte, is located in this area. The area is frequently inundated by the flood discharge of the Agusan river. In spite of these floodings, rainfed paddy fields are widely cultivated.

River	Basin Area (km ²)	River Length (km)	Overall Slope
Whole Agusan River	11,700	350	1/330
Principal Reaches			
Lower Agusan River	520	21	1/4,000
Middle Agusan River	9,610	158	1/16,800
Upper Agusan River	1,570	171	1/1,900
Major Tributaries			
Manat River	420	27	1/20
Ihaosan River	760	83	1/140
Umayam River	700	102	1/90
Simulao River	920	111	1/70
Adgaoan River	1,100	123	1/80
Gibong River	950	115	1/90
Ojot River	960	68	1/40
Wawa River	770	81	1/60

Source: Nationwide Flood Control Plan and River Dredging Program (1982)

Population

Description	Agusan del Norte			Agusan del Sur		
	1980	1990	1995	1980	1990	1995
Population (thousands)	365	465	514	265	421	515
Population Density (person per sq. km)	141.1	179.5	198.4	29.6	47.0	57.4

Source: NSO

Land Uses

Category	Agusan del Norte		Agusan del Sur	
	Area (ha)	Percentage	Area (ha)	Percentage
A. Agriculture				
1. Cropland	76,560	25.43%	88,684	9.89%
2. Pasture	57,592	19.13%		
3. Fisheries	10,084	3.35%	1,350	0.15%
B. Forest	150,811	50.10%	573,792	64.00%
C. Built-up Areas	1,831	0.61%		
D. Other Land Use	4,151	1.38%	232,724	25.96%
Total	301,029	100.00%	896,550	100.00%

Source: Provincial Planning and Development Office of Agusan del Norte & of Agusan del Sur

Inundation and Damages

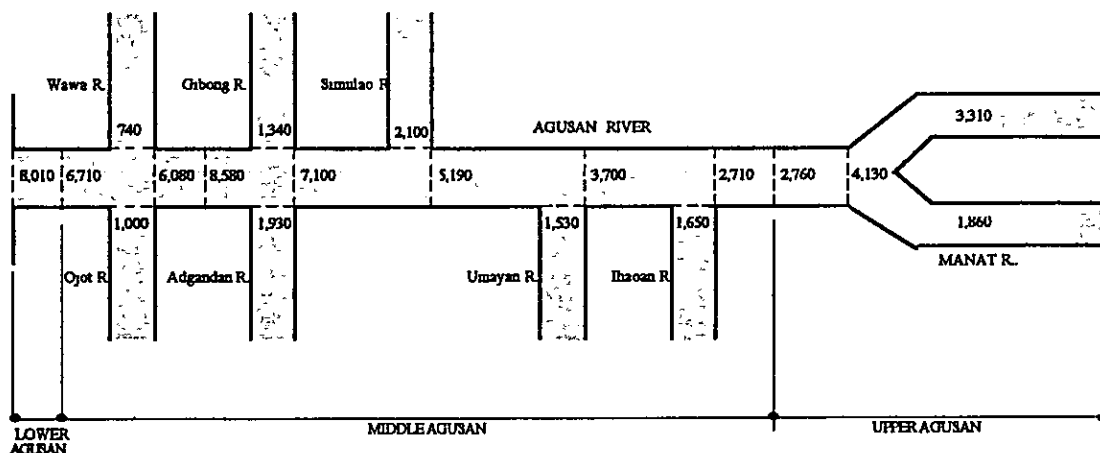
The 1962 flood was the highest magnitude in previous years, during which an area of 12,500 ha out of the total lower Agusan catchment area of 18,000 ha was inundated for 30 days causing damages estimated at ₱ 86 M at 1981 prices. Observations indicate that during time of large floods, water rises fast and reaches a peak in around one week and stays at that level for about one month before it gradually recedes in about three weeks time. Recently, the 1993 flood caused by Typhoon Puring claimed 27 lives and recorded a total damage of ₱ 266 M.

Main Project/Study

Title	Year	Agency	Status
Nationwide Flood Control Plan and River Dredging Program	1982	MPWH/OECF	M/P
Master Planning and Detailed Design for Flood Control and Drainage of the Upper Agusan Dev't. Project	1984	MPWH	M/P
Cotabato-Agusan River Basin Development Project	1980	MPW	M/P, F/S
Lower Agusan Development Project	1983	MPWH/OECF	D/D
Lower Agusan Development Project	1989 -	DPWH/OECF	Construction On-going

Proposed Design Discharge

FIRST PHASE FLOOD CONTROL PLAN (LOWER AGUSAN : 100 - YR. FLOOD, MIDDLE AND UPPER : 25 - YR. FLOOD)

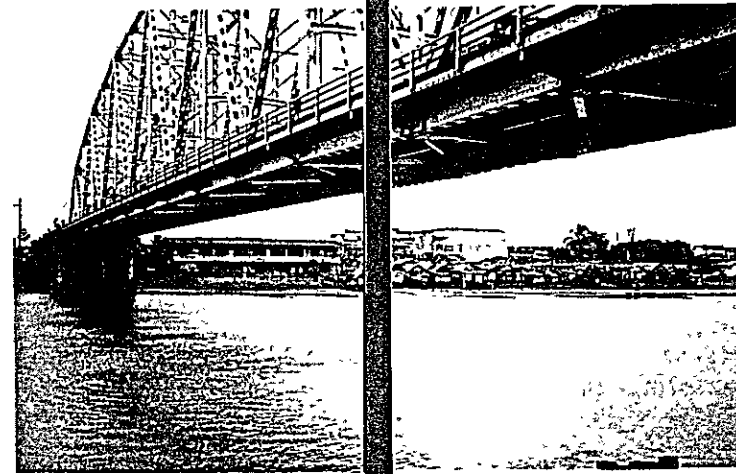


Source : Nationwide Flood Control Plan and River Dredging Program (1982)

(12) Agusan River Basin



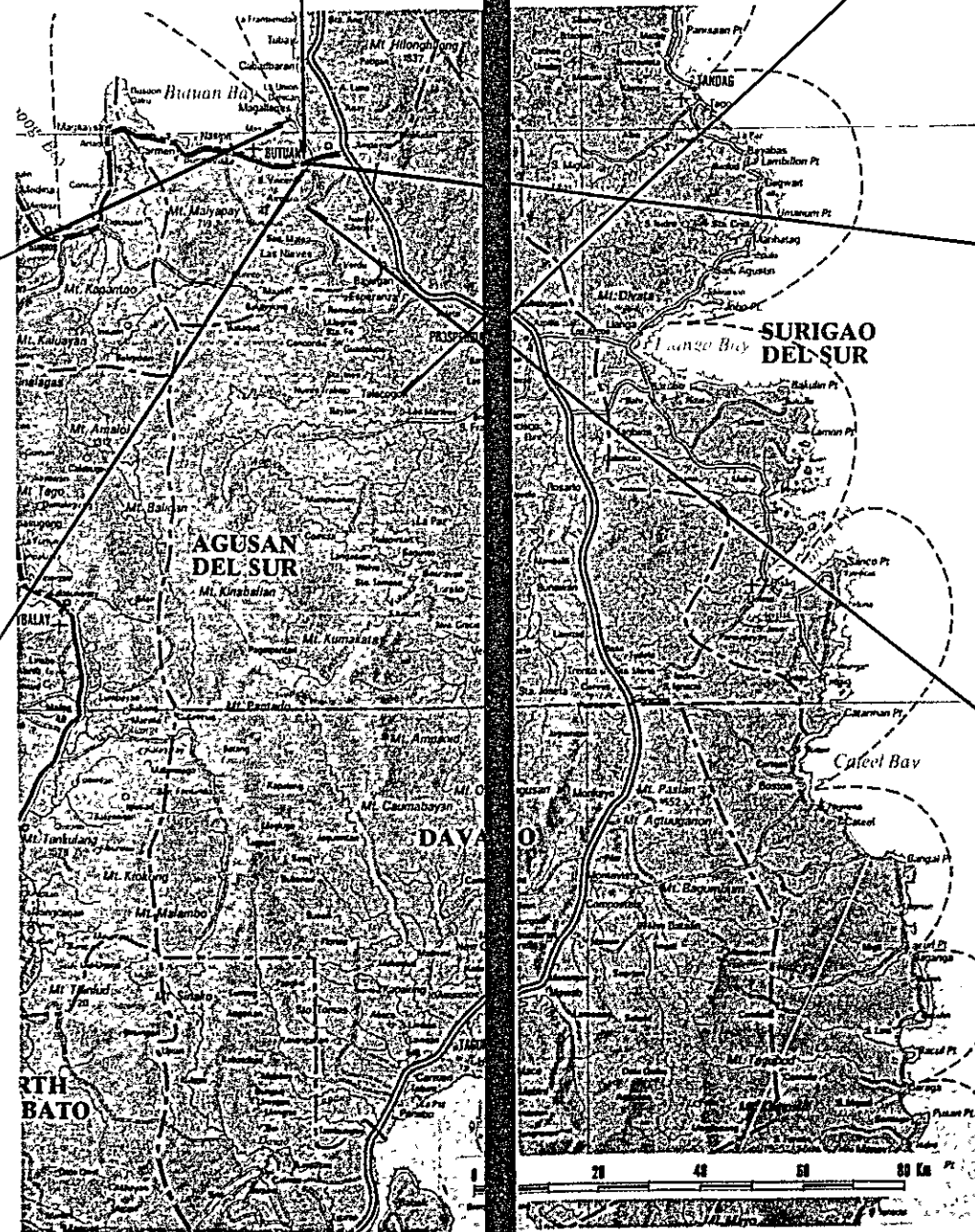
River/Basin Model of Lower Agusan Development Project (under Construction)



Magsaysay Bridge



Middle Reach of Agusan River, Taken at Talacogon, Agusan Del Sur



On-going Floodwall Site



Estuary of Agusan River



Dike Embankment near Bit-OS



Villa Kananga Open Canal on-going deepening and widening

(13) Cotabato River Basin

The Cotabato river basin ranks second to the Cagayan river basin in terms of watershed area. Situated in Central Mindanao it occupies major portions of the provinces of Maguindanao, Sultan-Kudarat, South Cotabato, North Cotabato and Bukidnon, and small portions of the provinces of Lanao del Sur, Agusan del Norte and Davao del Norte.

River System

The Pulangi river of Reach I is fed by three (3) major rivers, the Muleta, Kabacan, and Maridagao rivers, and by minor tributaries among which are the Manupali, Maapag, Kulaman and Maramag rivers. The two (2) large rivers, the Malitubog and Maladugao in turn, drain into Maridagao river. The courses of the M'lang and Malasila rivers are somewhat undefined as they reach the Liguasan marsh. Waters from these streams presumably disperse into the swamp or join the Buluan river before spilling into the Cotabato river.

The Buluan river, which traverses the Liguasan marsh as it flows to the Cotabato river, is fed by the Alip and Marbel rivers. A noteworthy hydrological feature in this river system is the Buluan Lake, the largest of the few fresh water lakes in the basin.

With exception of the Pulangi river, the Allah river is the largest as well as one of the most important river system in the Cotabato river basin. Quite a number of streams contribute to the flow of the Allah river, among them are the Maganoy, Cabilanan, Banga, and Sipaka. Lake Sebu, a priority site for a hydropower project is located near the southern tip of this river basin.

An important feature of the Cotabato river flood plain, particularly in the point of view of flood control, is the presence of the Libungan and Liguasan marshes. These two (2) large swamps, together with some minor marshes, have a combined area of some 74,000 ha, about 55,000 ha of which are reported to be perennially waterlogged.

The Libungan and Simuay rivers add to the flows of the Cotabato river at its lowermost reach. Although these rivers are small compared to the other major tributaries, they are equal in significance or are more important than some river systems in terms of potentials for development. Within the lower reach is Cotabato City, the only city in the basin and considered the most progressive urban center thereat.

River	Basin Area (km ²)	River Length (km)	Overall Slope
Whole Cotabato	20,260	373	1/280
Muleta	1,185	72	1/30
Kabacan	1,104	64	1/70
Maridagao	2,012	104	1/90
M'Lang/Malasila	1,287	108	1/200
Buluan	2,731	110	1/100
Allah	2,504	120	1/125
Libungan	992	65	1/40
Simuay	492	58	1/250

Source: Nationwide Flood Control Plan and River Dredging Program (1982)

Population

Description	Maguindanao		Sultan Kudarat		South Cotabato		Cotabato	
	1980	1995	1980	1995	1980	1995	1980	1995
Population (thousands)	453	662	304	522	770	948	565	863
Population Density (person per sq. km)	93.0	135.9	64.4	110.7	103.2	126.9	86.0	131.4

Source: NSO

Land Uses

Category	Maguindanao		Sultan Kudarat		South Cotabato		North Cotabato	
	Area (ha)	Percentage	Area (ha)	Percentage	Area (ha)	Percentage	Area (ha)	Percentage
Total Land Area	504,760	100.0%	471,480	100.0%	746,876	100.0%	656,590	100.0%
Alienable and Disposable Land	306,622	60.7%	238,383	50.6%	342,191	45.8%	149,972	22.8%
Total Forest Land	198,138	39.3%	233,097	49.4%	404,685	54.2%	506,618	77.2%
Unclassified Forest Land	3,525	0.7%	45,806	9.7%	101,273	13.6%	3,825	0.6%
Total Classified Public Forest	194,613	38.6%	187,291	39.7%	303,412	40.6%	502,793	76.6%
Established for Residence	12,515	2.5%	40,106	8.5%	33,188	4.4%	55,852	8.5%
Established Timberland	152,050	30.1%	146,727	31.1%	259,549	34.8%	345,600	52.6%
Fishpond		0.0%	458	0.0%	428	0.1%	0	0.0%
Others	30,048	6.0%		0.0%	10,247	1.4%	101,341	15.4%

Source: National Mapping and Resource Information Authority, DENR

Inundation and Damages

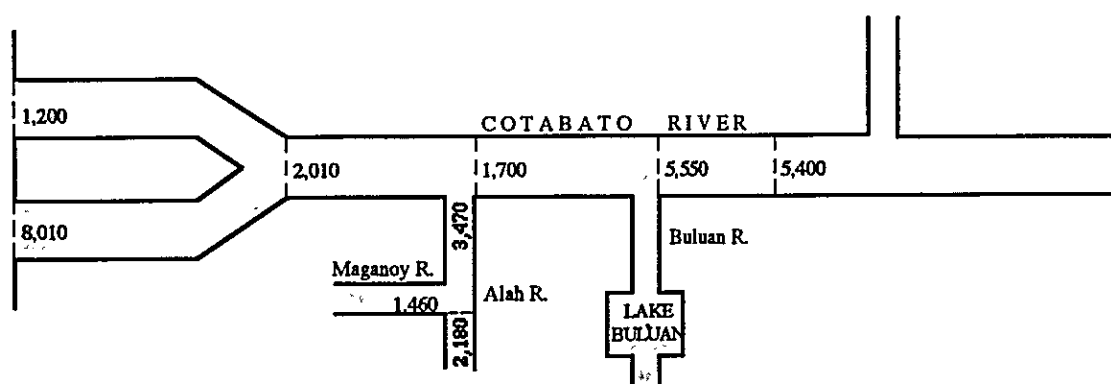
Major floods had occurred in 1955, 1958 and 1960. Recently the 1995 Mt. Parker flashflood affected 182 barangays in 34 municipalities causing extensive damages to 831 houses, and to crops and infrastructures estimated at P 935.7 M.

Main Project/Study

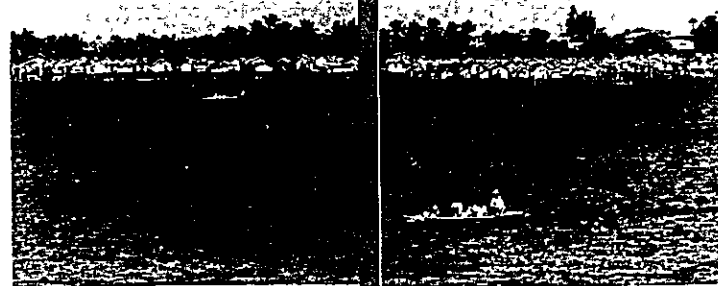
Title	Year	Agency	Status
A Report on the Cotabato River Basin	1966	USAID	Inventory
Cotabato-Agusan River Basin Dev't. Project	1980	MPW	M/P, F/S
Nationwide Flood Control Plan and River Dredging Program	1982	MPWH	M/P

Proposed Design Discharge

FIRST PHASE FLOOD CONTROL PLAN (25 - YR. FLOOD)



Source : Nationwide Flood Control Plan and River Dredging Program (1982)



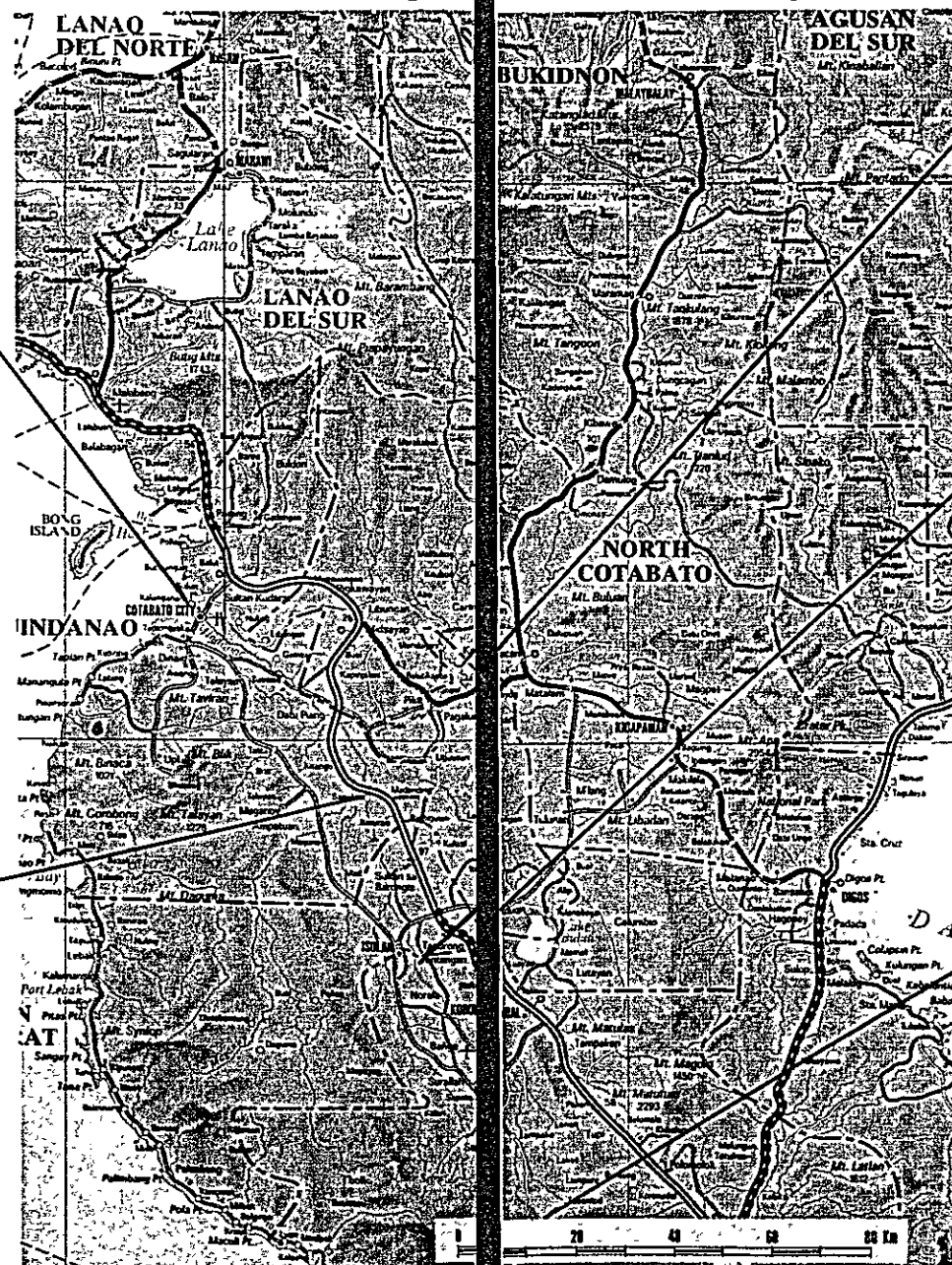
Downstream of the Cotabato River about 4 km upstream from the estuary



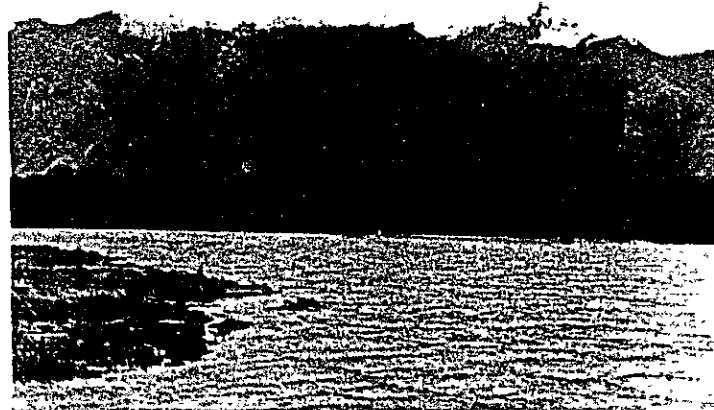
Meandering Course Pulangi River



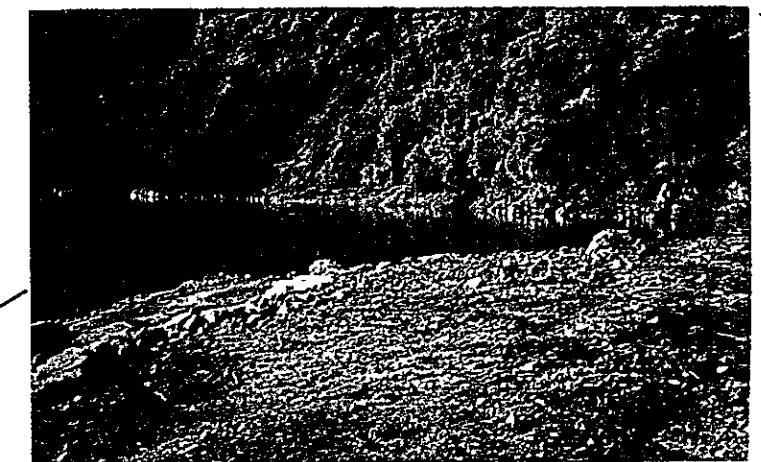
Rio Grande Cut-off Channel near Cotabato City



Flood as Allah River



Upstream of the Allah River from National Highway Bridge near Maganoy



Maughan Lake, after blasting on September 6, 1995

II.2 Urban Centers

(1) Iloilo City

Iloilo City is located in the eastern part of Panay Island. It has two (2) related rivers, namely, Iloilo River and Jaro River.

River System

Iloilo river is sandwiched between the sandbar and alluvial plain formed by its tributaries. It flows 10 km along the coastal line from west to east, with a catchment area of 93.1 km² and a gentle gradient of 1/4,000.

Three (3) tributaries flowing into the Iloilo river run almost in parallel from north to south. These are the Mandurriao River (Pandan Creek), Carahauan Brook and Corosan Brook with catchment areas of 9.9 km², 27.5 km² and 39.7 km², respectively, and with channel length from 5 to 6 km each.

Jaro River, which is located at the northern part of Iloilo City, has a catchment area of 412 km² and stretches about 20 km from the river mouth to the confluence of two major rivers; namely, Jaro-Tigum River, the main stream with a length of about 55 km and a catchment area of 200.2 km²; and Aganan River, the largest tributary with a length of 40 km and a catchment area of 198.8 km².

Tigum River originates in Mt. Llorente (EL. 1,344 m) and flows southwest toward Sta. Barbara through Maasim where the mountain area turns into plain area. At Sta. Barbara, the river, now named Jaro River, heads southward to the confluence with Aganan River gathering small tributaries. The river course of Tigum at the stretch between Maasim and Sta. Barbara shapes the wide flood plain with small water channels called braided rivers.

Aganan River flows southeast to south in the mountain area. After passing the plain area, the river turns east and meets Jaro River at Pavia.

Jaro River, after joining the Aganan River, flows south with meandering. Although quite steep upstream with a riverbed gradient of 1/1,500, Jaro river slopes gently downstream at 1/4,500 and flows out into the Iloilo Strait.

River	Basin Area (sq.km)	River Length (km)	Overall Slope
Iloilo River	93.1	11.3	1/5,000
Mandurriao	9.9	9.6	1/300
Jaro River	412.1		1/500
Tigum	213.3	56.3	1/40
Aganan	198.8	65.9	1/50

Source: Study on Flood Control for Rivers in the Selected Urban Centers (JICA, Feb. 1995)

Population

Description	Iloilo City			
	1970	1980	1990	1995
Population (thousands)	210	245	310	335
Population Density (person per sq. km)	3,745.3	4,371.9	5,526.9	5,973.9

Source: NSO

Land Uses (Iloilo City)

Category	Area (ha)	Percentage (%)
A. Agriculture	2,887.0	51.6
1. Cropland	1,853.5	33.1
2. Upland Field	256.8	4.6
3. Fishpond, Saltbed	776.7	13.9
B. Park Open Space, etc.	76.1	1.4
C. Not-Identified	237.9	4.2
D. Built-up Areas	2,399.0	42.8
Total	5,600.0	100.0

Source: JICA Study (Feb., 1995)

Inundation and Damages

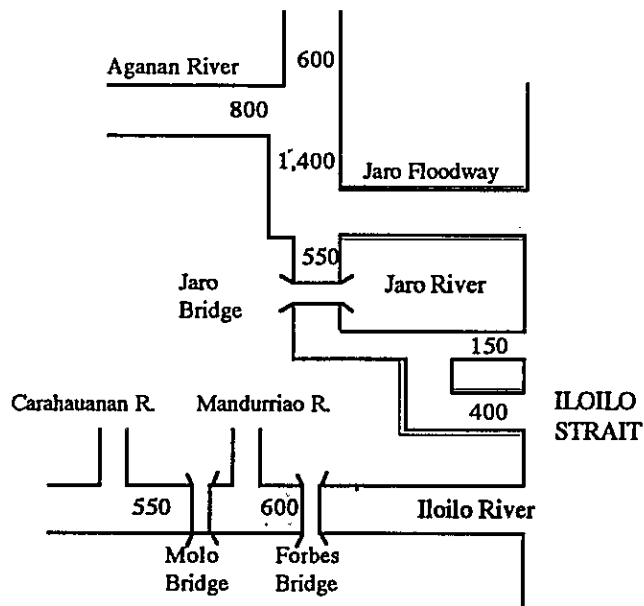
Iloilo City suffered from widespread flooding on July 29 to August 1, 1994 caused by the unusual heavy monsoon rains. Massive rainfall (319 mm/day) was recorded at the Iloilo Airport on July 29, 1994. Due to the heavy rain, the flood overflowed Aganan and Tigum rivers. About 80% of Iloilo City was submerged for two days/nights, especially in low-lying areas, and infrastructures were destroyed and human activities disrupted. A total of 25,000 families at Jaro District in Iloilo City and Oton in Iloilo Province were adversely affected. Total damage was estimated at 75 million Pesos.

Main Project/Study

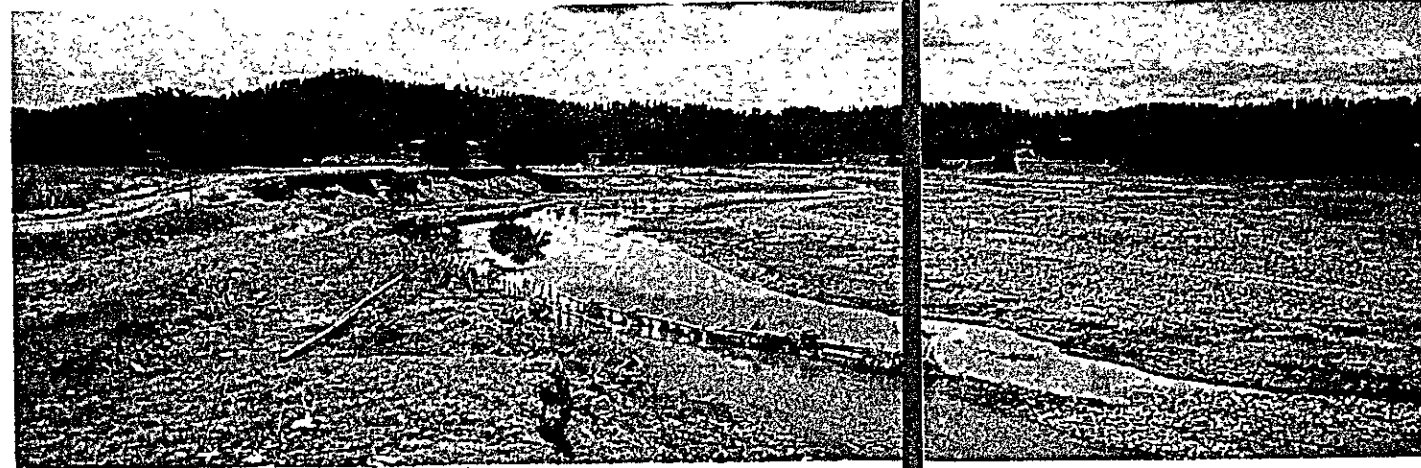
Title	Year	Agency	Status
Study on the Flood Control for Rivers in the Selected Urban Centers	1995	JICA	M/P, F/S

Proposed Design Discharge

50-year Return Period



Source : Study on the Flood Control for Rivers in the Selected Urban Centers, 1995, JICA



Upstream View of Tigum River



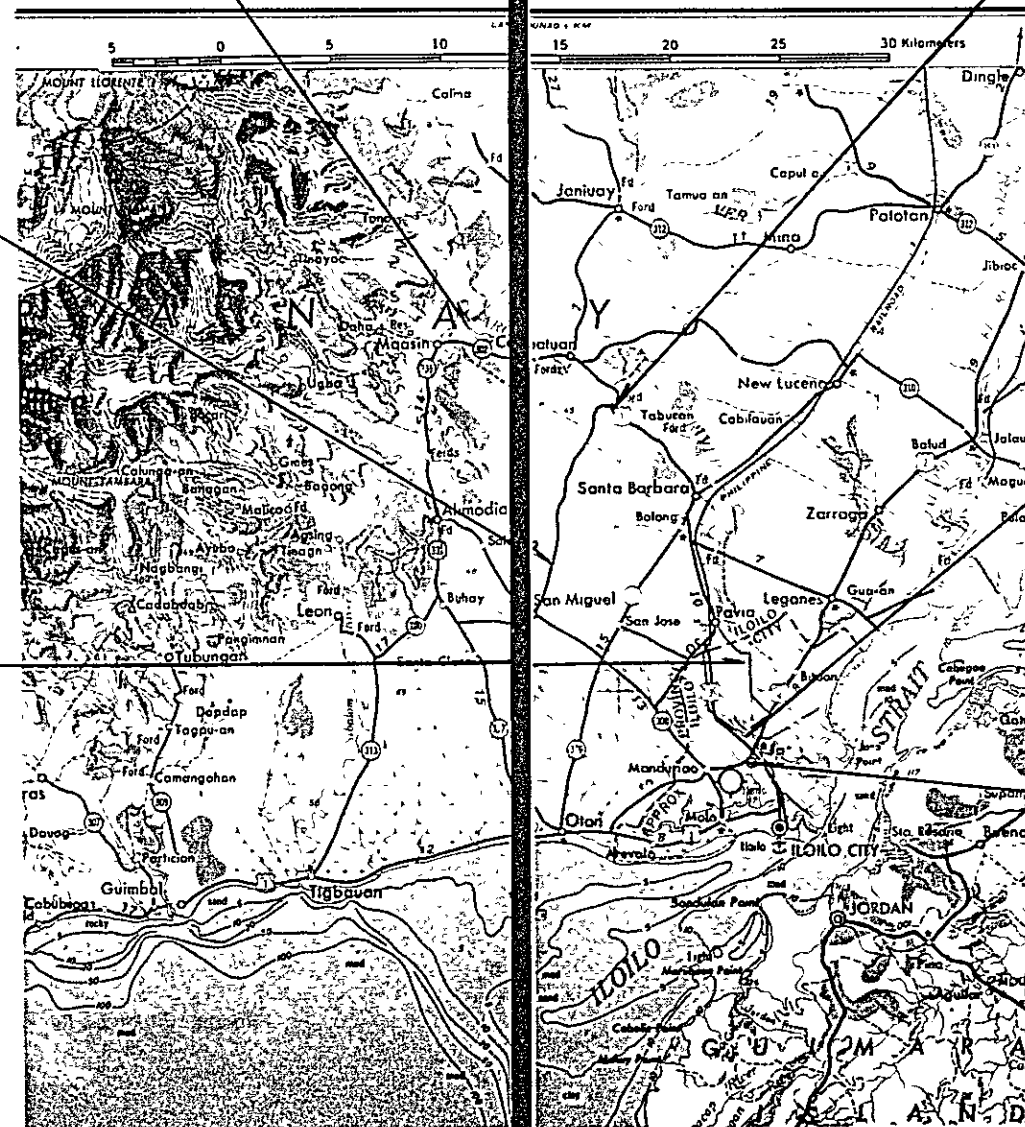
Bridge along Tigum River



Bridge along Aganan River



ILOILO CITY



Jaro Diversion Bridge



Confluence of Jaro and Aganan River



Water Level Gauge located at Jaro Bridge