

# FLOOD MANAGEMENT

by

DPWH-REGION III

# OUTLINE OF PRESENTATION

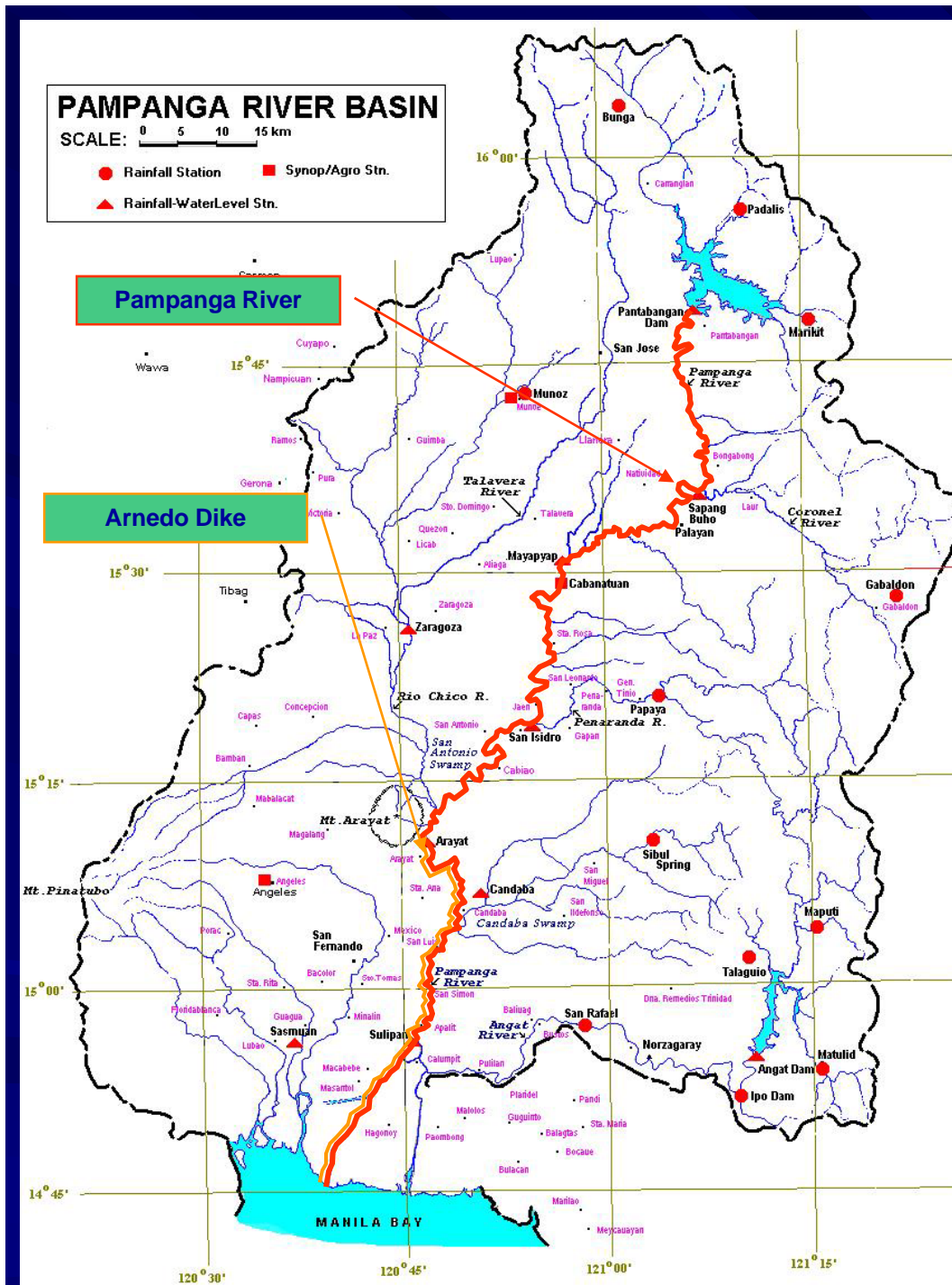
- I. BACKGROUND INFORMATION
- II. CONSEQUENCES OF FLOODS
- III. CAUSES OF FLOOD
- IV. STRATEGIES FOR MITIGATION
- V. ISSUES AND CONCERNS
- VI. PROPOSED PROJECTS

# I. BACKGROUND INFORMATION

Central Luzon is one of the most typhoon frequented regions in the Philippines with an average of 4-5 typhoons per year of the country's average typhoon of 20 per year usually occurring between the months of May to December.

- The Pampanga River Basin , the 4<sup>th</sup> ranked river basin in the Philippines, covers major portions of the provinces of Pampanga, Bulacan, Nueva Ecija and Tarlac. It originates in the Carballo mountains and it flows in a southerly direction to its mouth in Manila Bay joining its tributaries- Rio Chico-Talavera River near Mt. Arayat and Angat River in Bulacan. In the middle reaches of the Pampanga River are two (2) swamps (a) Candaba Swamp (250 sq.km.) and (b) san Antonio Swamp (120 sq.km.). It has a total drainage area of 10,503 sq.km. including that of Pasac River Basin and a river length of 260 km.

*(Source: River Maps in the Philippines, March 1997)*



# Map of Pampanga River Basin

## II. THE CONSEQUENCES OF FLOODS

- RAPID URBANIZATION and SUBURBANIZATION is impairing the retention and detention capabilities of nature.
- FLOOD PLAINS being covered into residential areas and utilized as farmlands increase the risks of flood damages.
- In urban areas, ENCROACHMENTS into the natural waterways and drainage main restrict the flow of surface run-off.

### III. CAUSES OF FLOODS

- LIMITED CARRYING CAPACITY of the river due to narrow cross-section (width and depth)

- EXTRA ORDINARY RAINFALL

*Typhoon “Dodong” registered 288mm/hr in 2 days which is 11 times the average rainfall of 27.00mm/hr in 2 days.*

- SILTATION

- INFORMAL SETTLERS AND ENCROACHMENT

- GARBAGE



# Flooding due to intense rainfall



# Encroachment of illegal fishpond

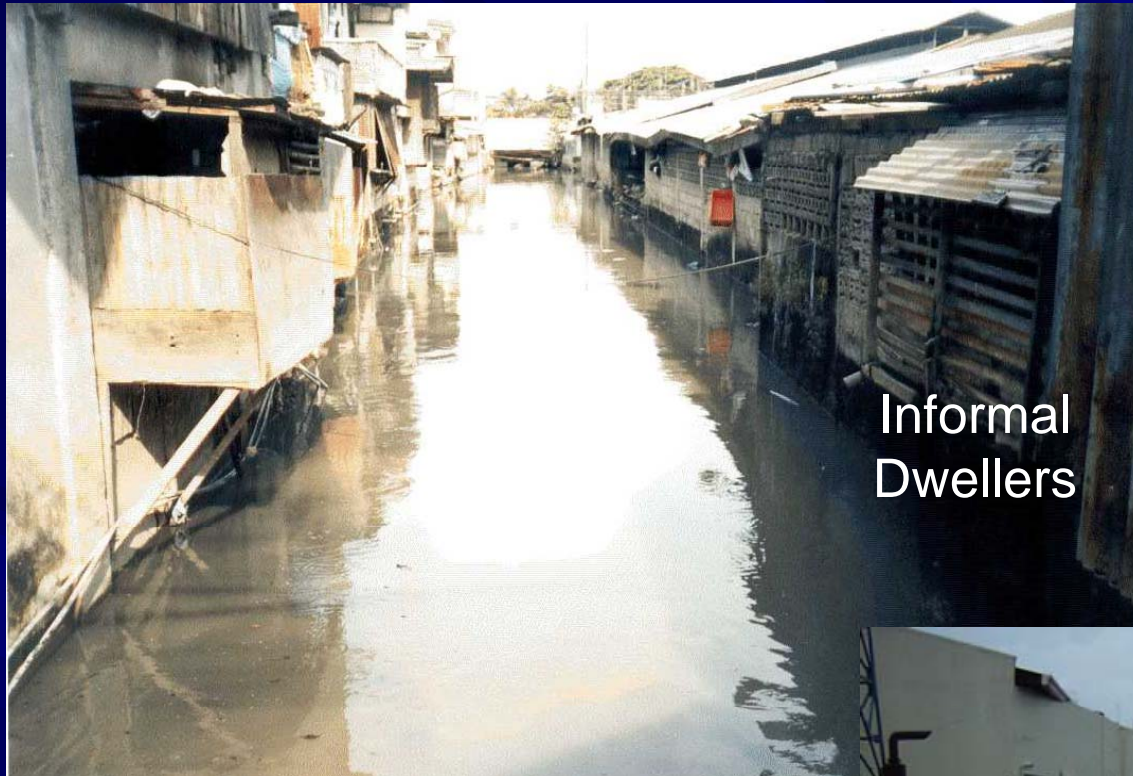


Before



After





Informal  
Dwellers

# Encroachments



Illegal Structures

# Encroachment Due to Informal Settlers





# Garbage



# IV. STRATEGIES FOR MITIGATION

## 1. Structural Mitigation Measures

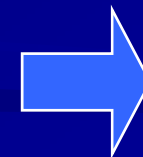
Engineering interventions such as dikes, levees, retention ponds, sedimentation basins, sabo works, channeling, revetments, floodways, pumping stations, drainage facilities, etc.



DPWH

## 2. Non-structural Mitigation Measures

Flood monitoring, information and warning system, evacuation system, hazard mapping, public awareness, land use planning, capacity building, etc.



DENR, DPWH &  
Other Govt.  
Agencies



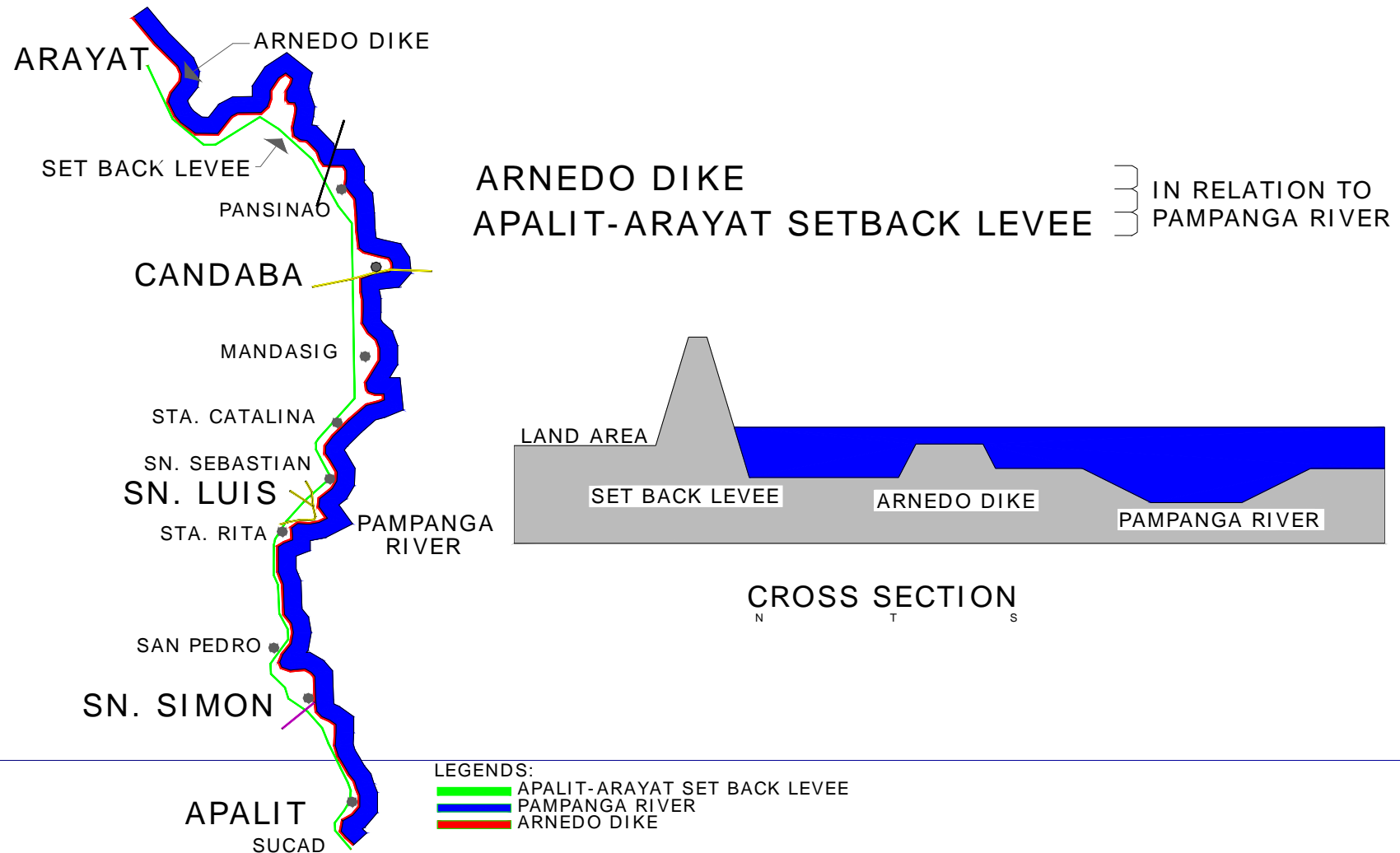
# V. ISSUES AND CONCERNS

## 1. The unstable condition of ARNEDO DIKE

- The Arnedo Dike was built in 1940 with a net length of 36 km. extending from Sulipan, Apalit to Cupang, Arayat, Pampanga. It is considered the first line of defense against overflowing of the Pampanga River.
- Very recently, the DENR-Region III thru Mines and Geosciences Bureau conducted assessment on the stability of Arnedo Dike to verify and determine the structural condition that might result to breaching in the event of heavy rainfall. Geologic hazard such as riverbank erosion was delineated and actual sounding was conducted. The primary hazard in the area is mainly related to flooding in the form of overbank flooding and riverbank erosion.

(Reference: DENR-MGB Report dated 08/03/06)

# ARNEDO DIKE and the APALIT-ARAYAT SETBACK LEVEE in relation to Pampanga River



**ARNEDO DIKE** was built in 1940 with a net length of 36 km. Extending from Sulipan, Apalit to Cupang, Arayat. It is considered the first line of defense against overflowing of the Pampanga River.

**ARAYAT – APALIT – MASANTOL SETBACK LEVEE** was constructed in 1973 and has a total length of 40 km. divided into 2 segments:

1. **APALIT – ARAYAT SETBACK LEVEE** – 31 km. From Sulipan, Apalit to Curang, Arayat

2. **APALIT – MASANTOL LEVEE** – 9 km. from Sulipan, Apalit to Bebe – San Esteban in Masantol

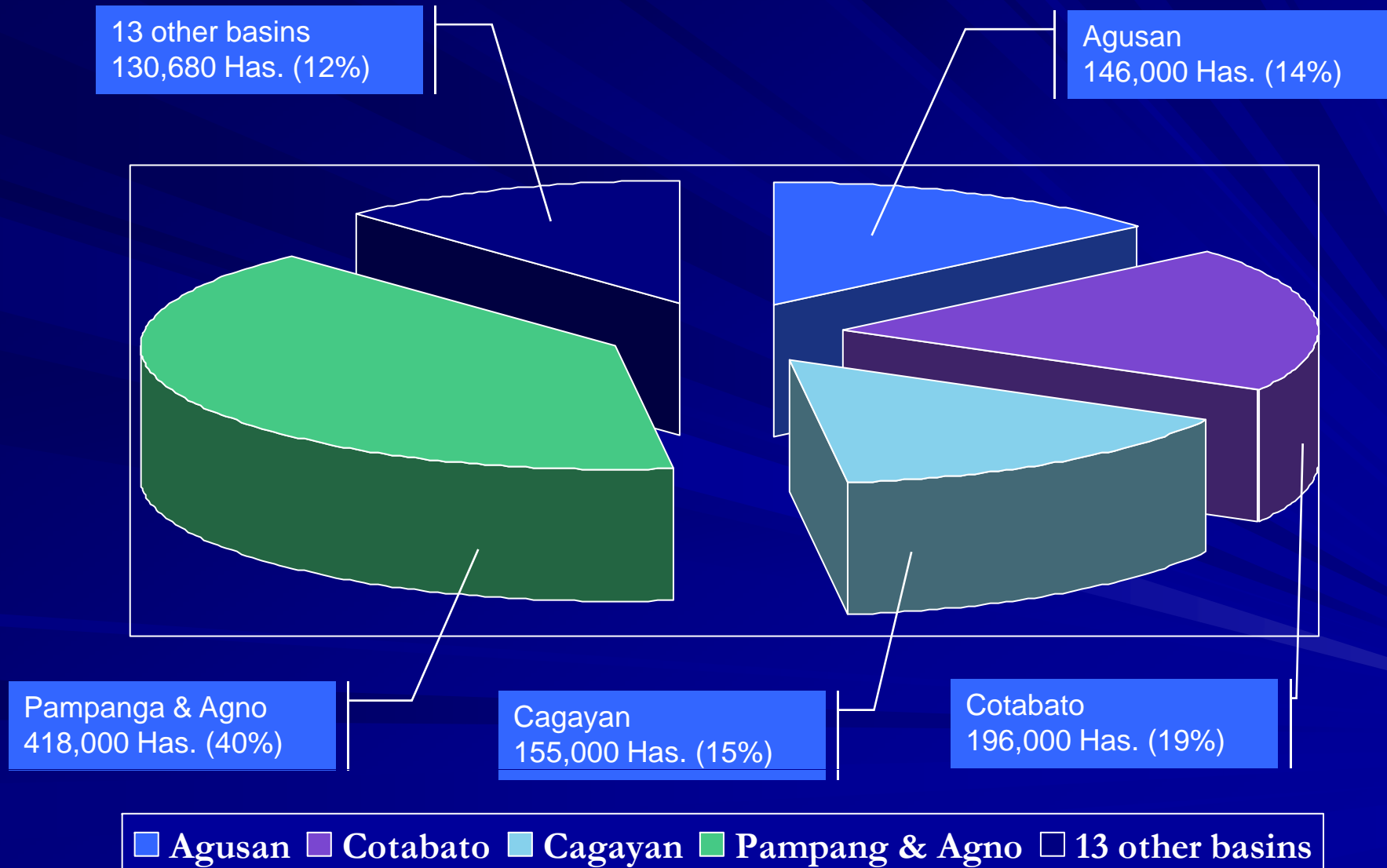
*This levee was designed to contain the bank overflow of the Pampanga River after it overtops the depressed Arnedo dike. It serves as the second line of defense against overflow – as protection against flood damaged to adjoining barangays of Candaba, San Luis, San Simon, Apalit, Macabebe, and Masantol*

# Identified critical areas/sections along Arnedo Dike

- Candaba – Pansinao, Buas, Gulap, Lanang, Pasig and Mandasig
- San Luis – Sta. Rita, Sta. Catalina, Sta. Cruz, San Sebastian and Sto. Tomas
- San Simon – San Jose and San Pedro
- Apalit – Sucad and San Vicente
  - *Those living in these areas are advice to be alert and forewarned for evacuation during flood season to seek higher grounds T the Apalit-Arayat Setback Levee) or get to the nearest barangay hall or schools identified for evacuation*



# Inundation Profile of Major River Basins



# V. ISSUES AND CONCERNS

(continuation)

## 2. Flood damage is extensive while countermeasure is limited to available funds

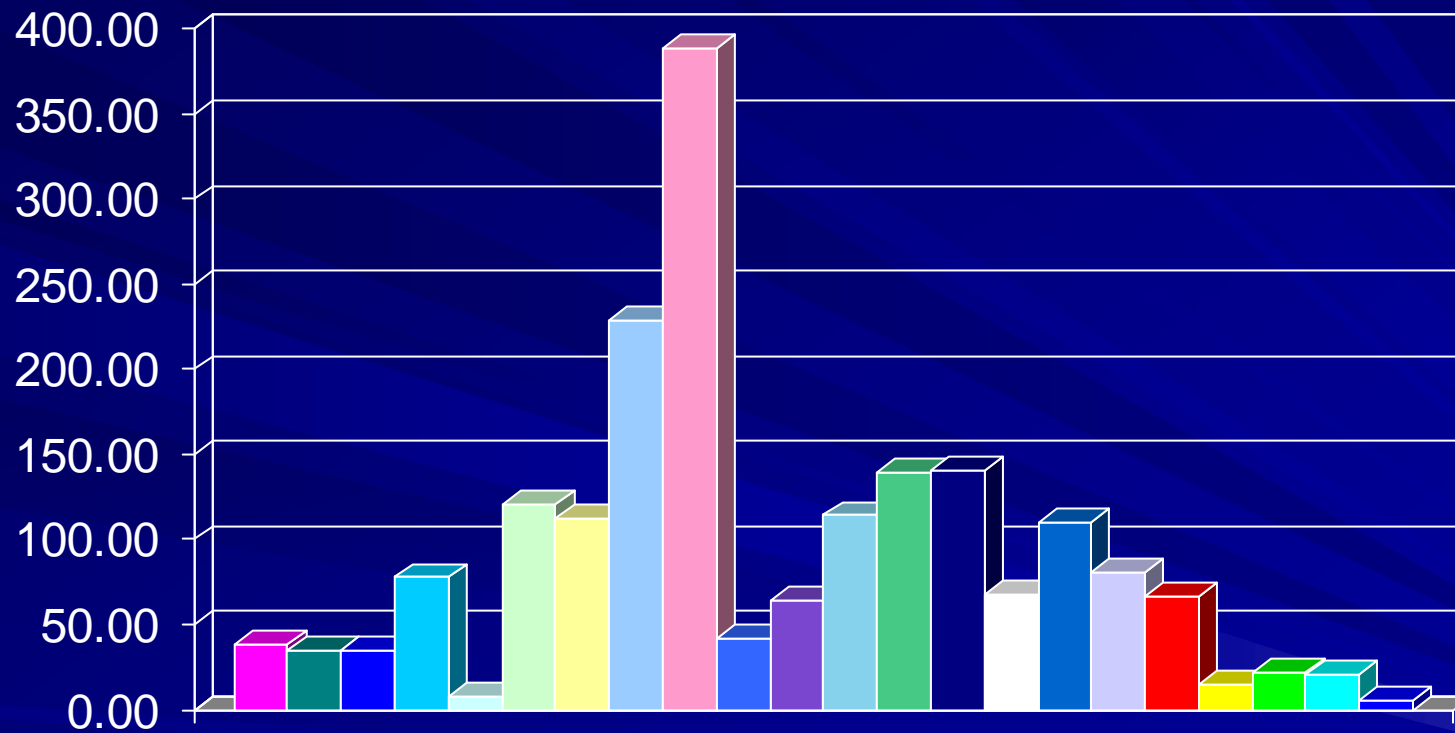
- Almost always, the funds released for the rehabilitation/ maintenance of flood control projects is very limited, hence there is less impact in arresting the damage.

Data:

- ✓ Annual regular maintenance regionwide for PRCS is only P5.0M
- ✓ Annual regular maintenance for flood control nationwide is only P500 Million

# Releases per Year

Millions



1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994  
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005

# V. ISSUES AND CONCERNS

(continuation)

## 3. Lack of Detailed /Feasibility Study of the Pampanga River Basin

- Most of the flood control projects undertaken were concentrated on the lahar stricken areas of the region.
- The Pampanga River Basin, from its upper reaches down to its lower reaches have been afflicted with bank failure due to scouring ,meandering flows triggered by intense flow during heavy rainfall coming from the mountainous sections of Aurora and Nueva Ecija and overbanking due to its limited carrying capacity and unstable bank.

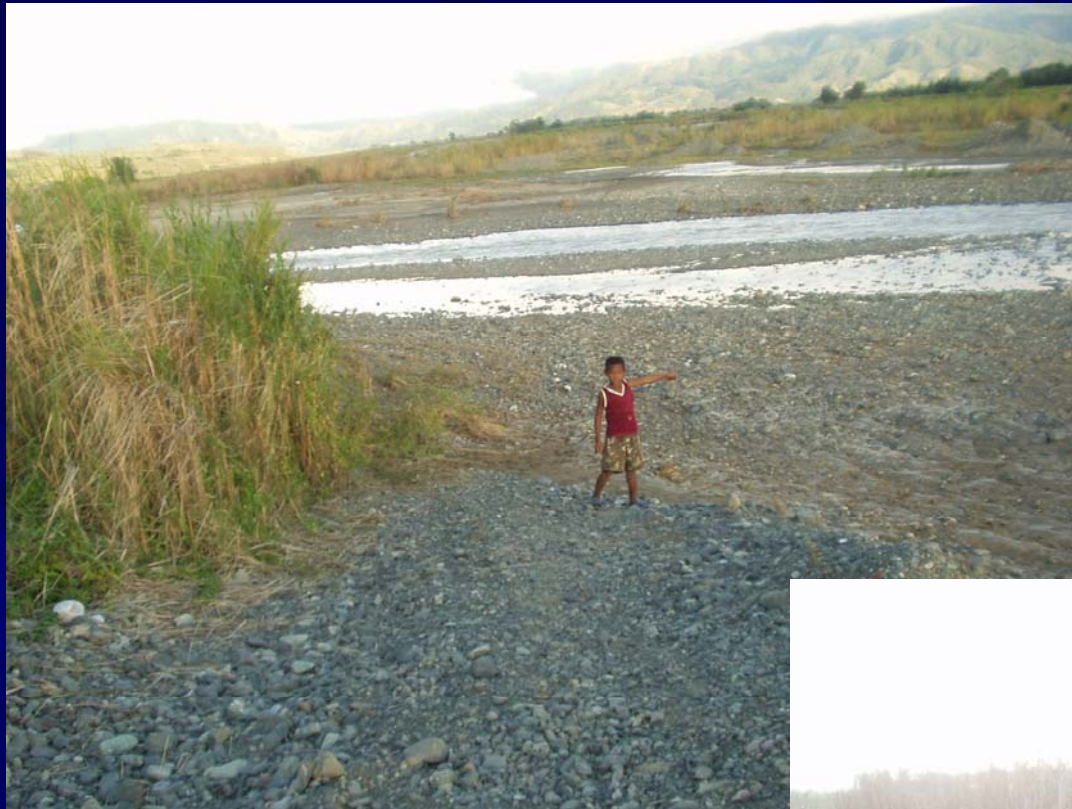


# V. ISSUES AND CONCERNS

(continuation)

## 4. Unregulated Quarrying and ground water extraction

- The upstream section of the river basin suffer bank collapse and slope failure due to disturbed watersheds, meandering of flow traced from quarrying activities near river banks and foot of dike protection and groundwater extractions.



Traces of quarry/extractions  
near foot of the dike with the  
child pointing to the access  
ramp

Screen left out in the  
channel indicative that there  
is quarrying activity.



# V. ISSUES AND CONCERNS

(continuation)

## 5. Unregulated Land Use / Zoning

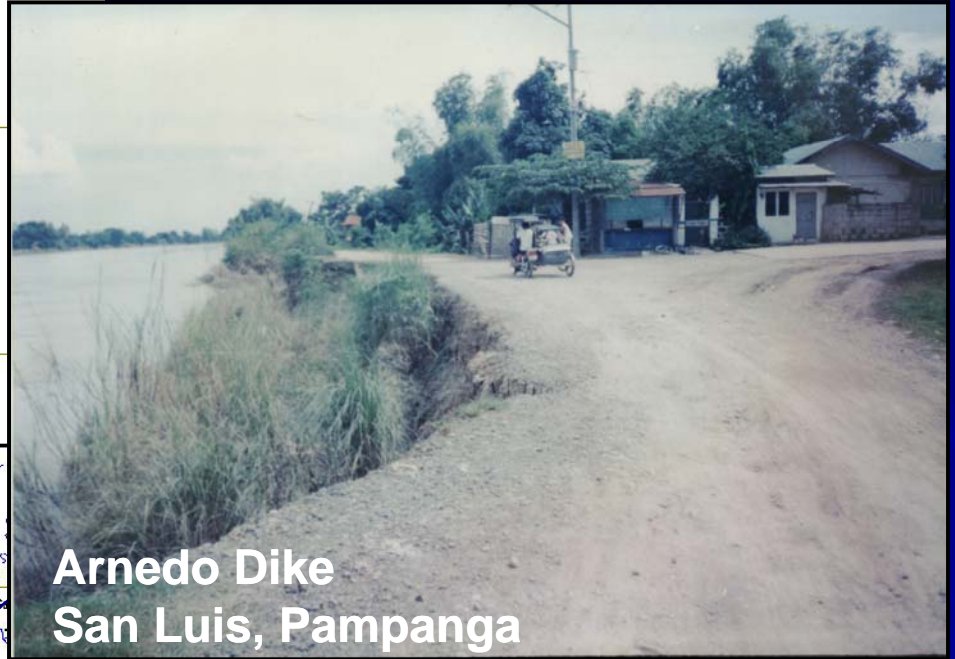
- Land conversion had been rapidly moving such that wetlands are converted to subdivisions.
- Waterways becoming constricted due to urbanization

## 6. Disturbed watershed/protected areas (illegal logging)

## 7. Climatic changes /global warming

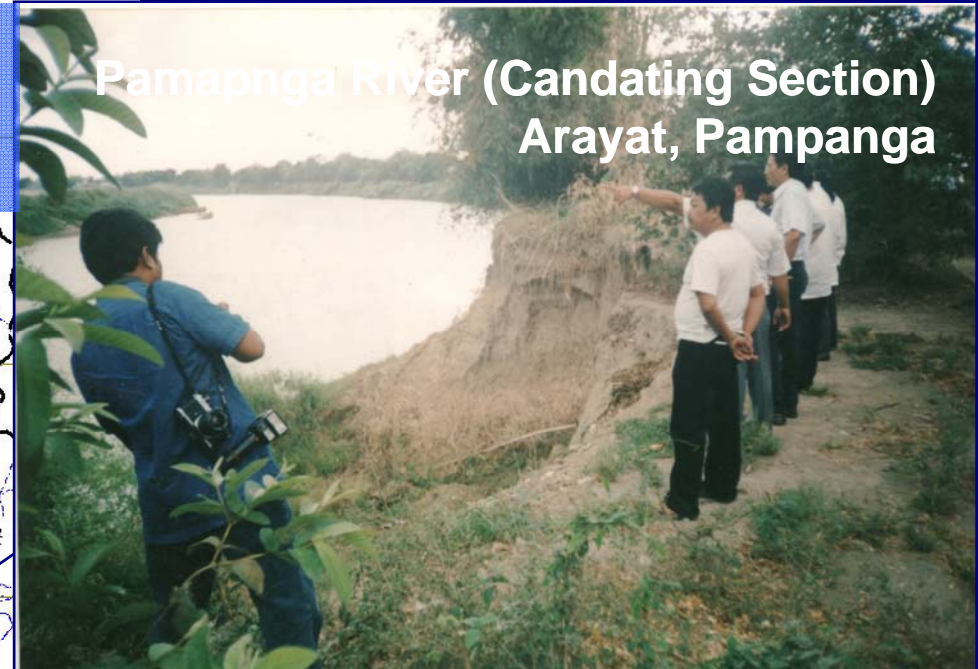
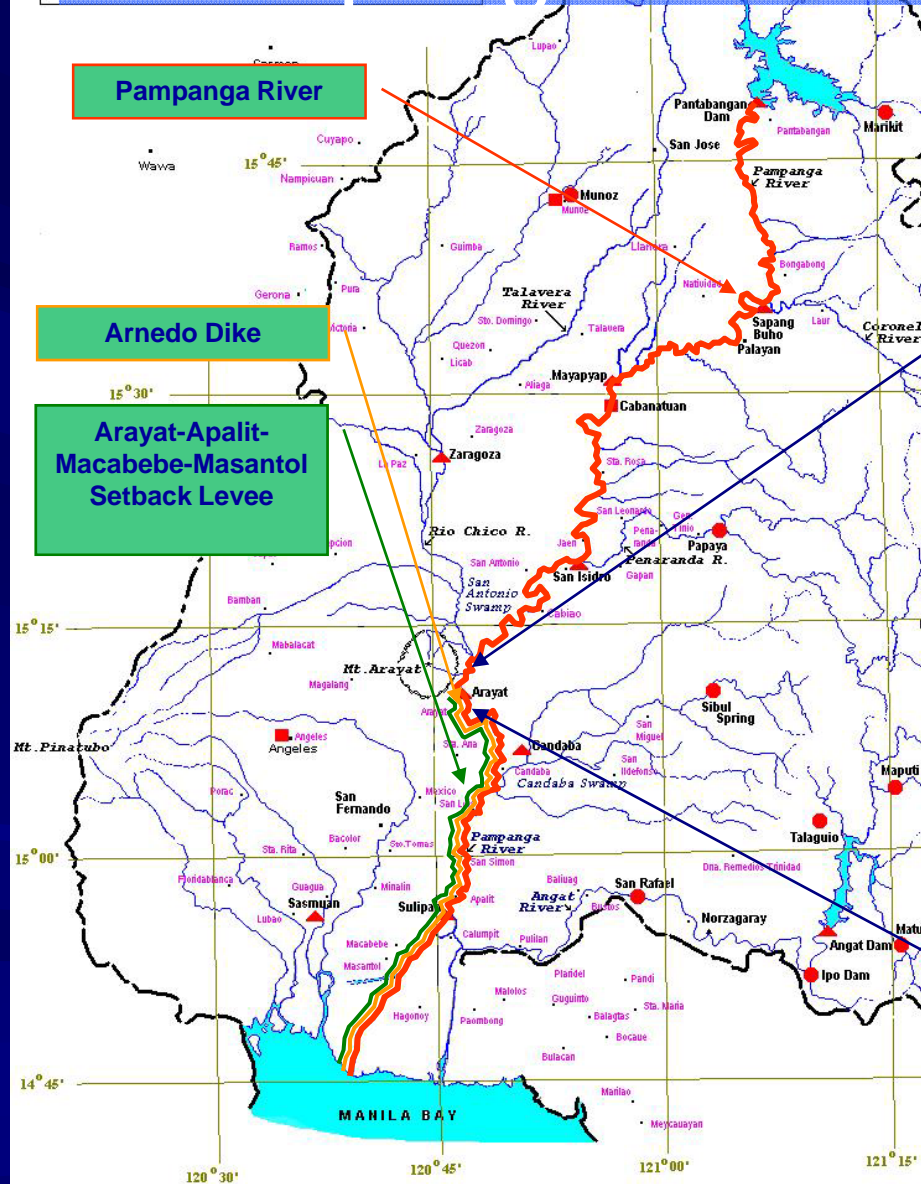


# Critical Areas along Pampanga River



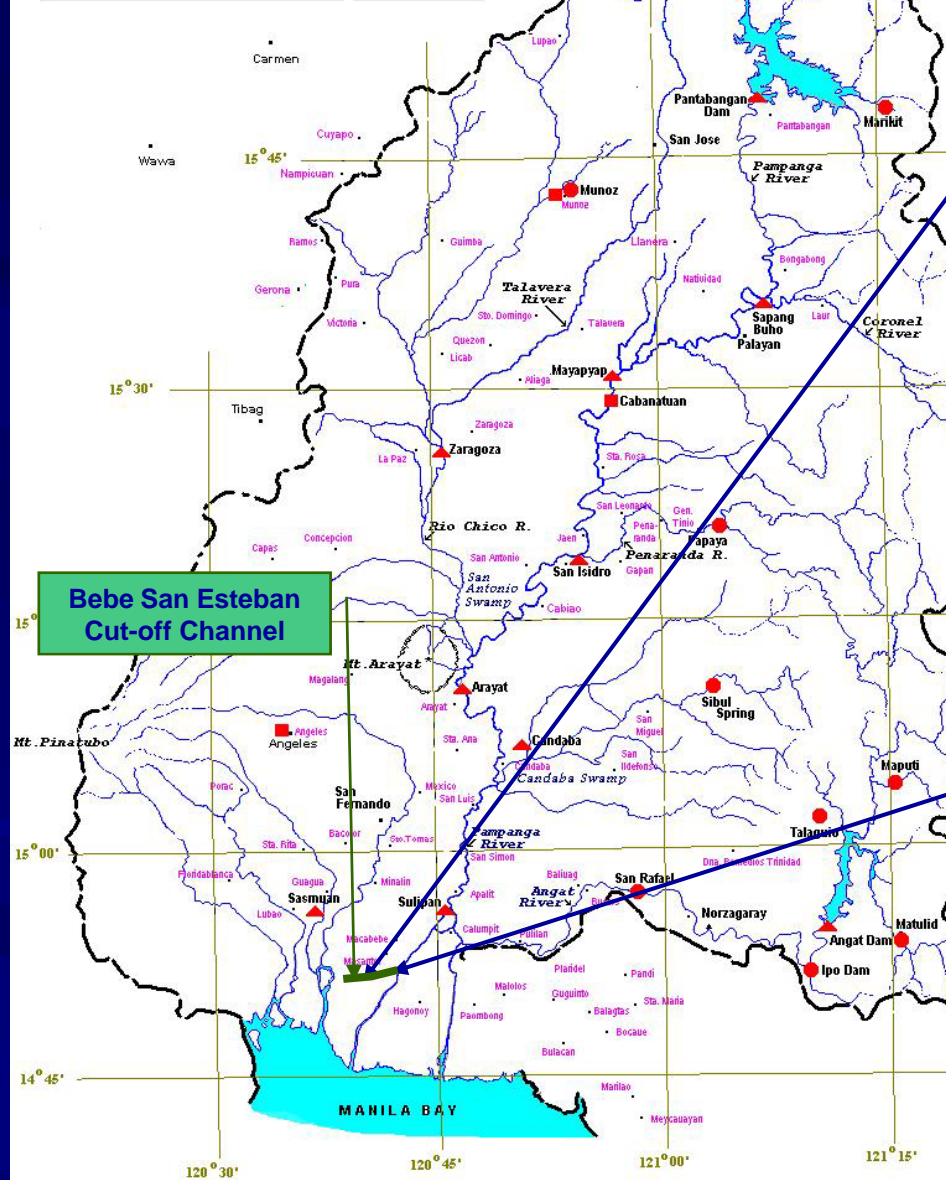


# Critical Areas along Pampanga River





# Critical Areas along Pampanga River



# Allied Rivers and tributaries of Pampanga River

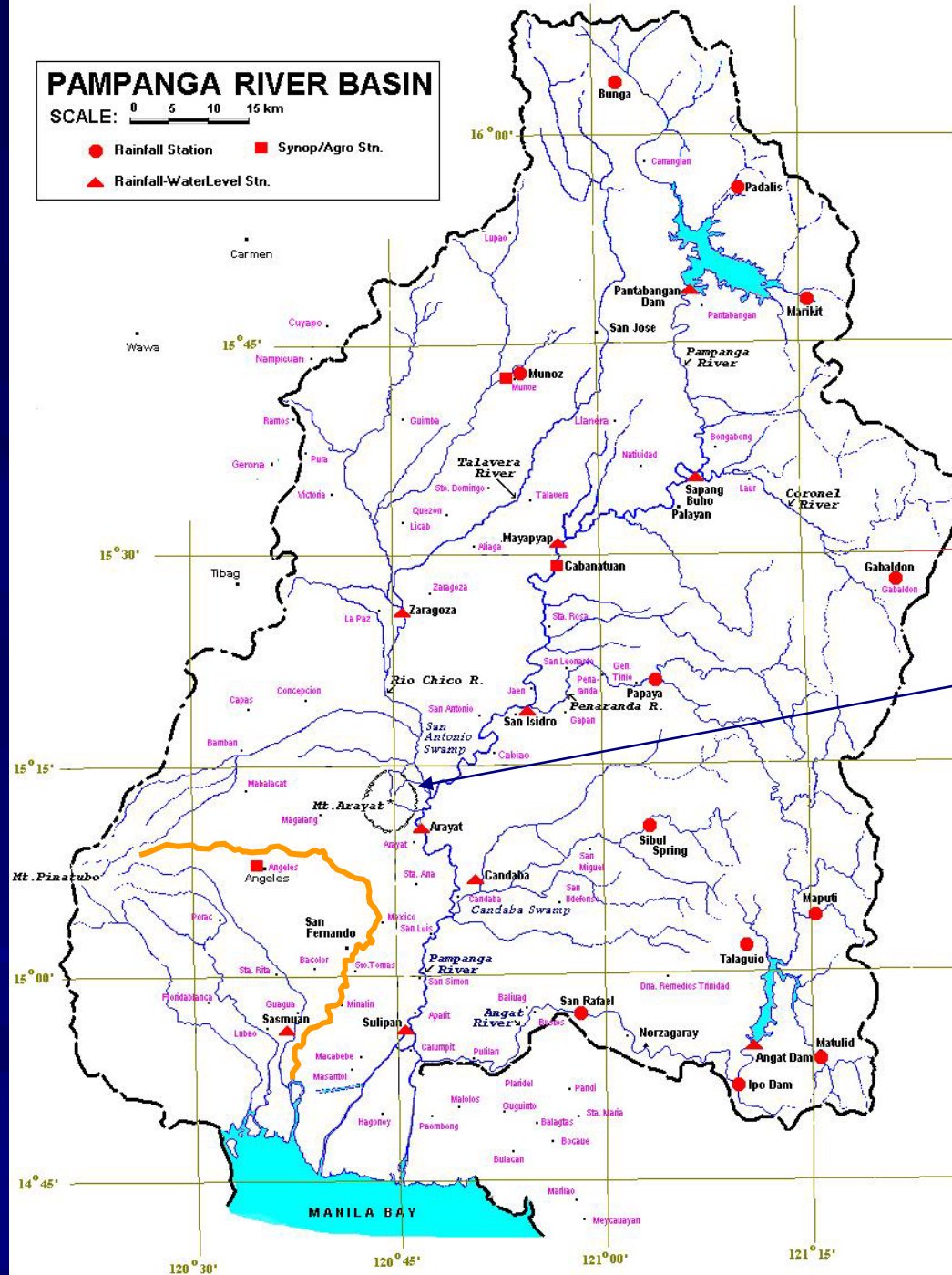
- Taug-Sapang Bato-Abacan Rivers (Angeles-Mexico)
- Quitangil Rive and Sapang Balen ( Mabalacat and Magalang)
- San Miguel –Maasim River (Sn Miguel, Bulacan and Candaba, Pampanga)
- Digmala River, Bongabon, Nueva Ecija
- Bato Ferry and Laur River, Nueva Ecija
- Penaranda River, Nueva Ecija
- Mambangnan River, San Leonardo, Nueva Ecija
- Talavera-Hinukay River, Nueva Ecija
- Sacobia-Bamban-Parua, Tarlav
- Rio-Chico River, Tarlac and Nueva Ecija
- Cabu River, Nueva Ecija
- Cabiao-San Isidro-Gapan Levee
- San Mateo Cut-Off Channel, Arayat, Pampanga
- Calumpit-Hagonoy River, Bulacan
- Labangan Cut-Off Channel, Bulacan
- Minalin-Francis River, Macabebe and Minalin, Pampanga



# PAMPANGA RIVER BASIN

SCALE: 0 5 10 15 km

- Rainfall Station
- Synop/Agro Stn.
- ▲ Rainfall-WaterLevel Stn.



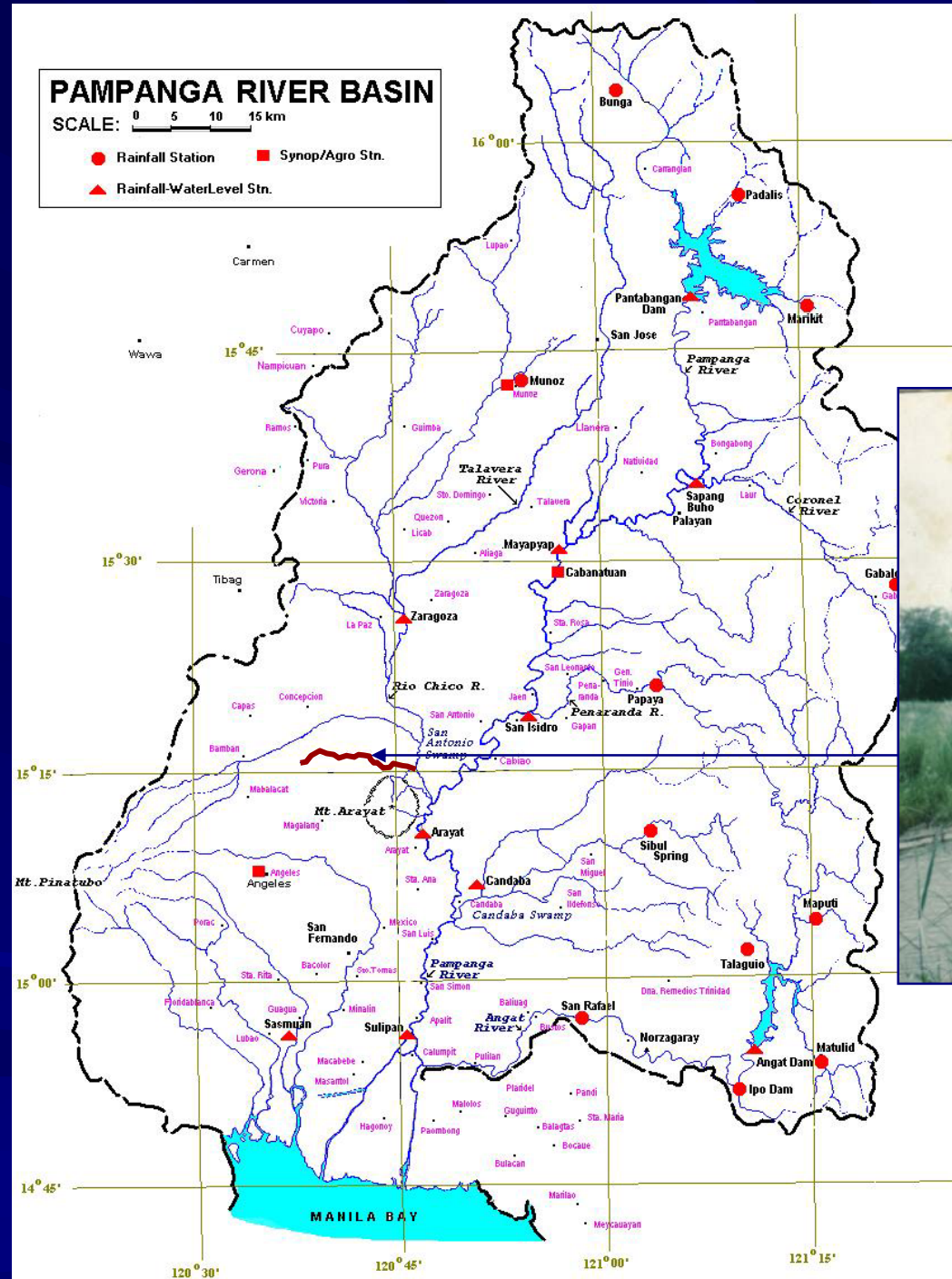
# Allied Projects



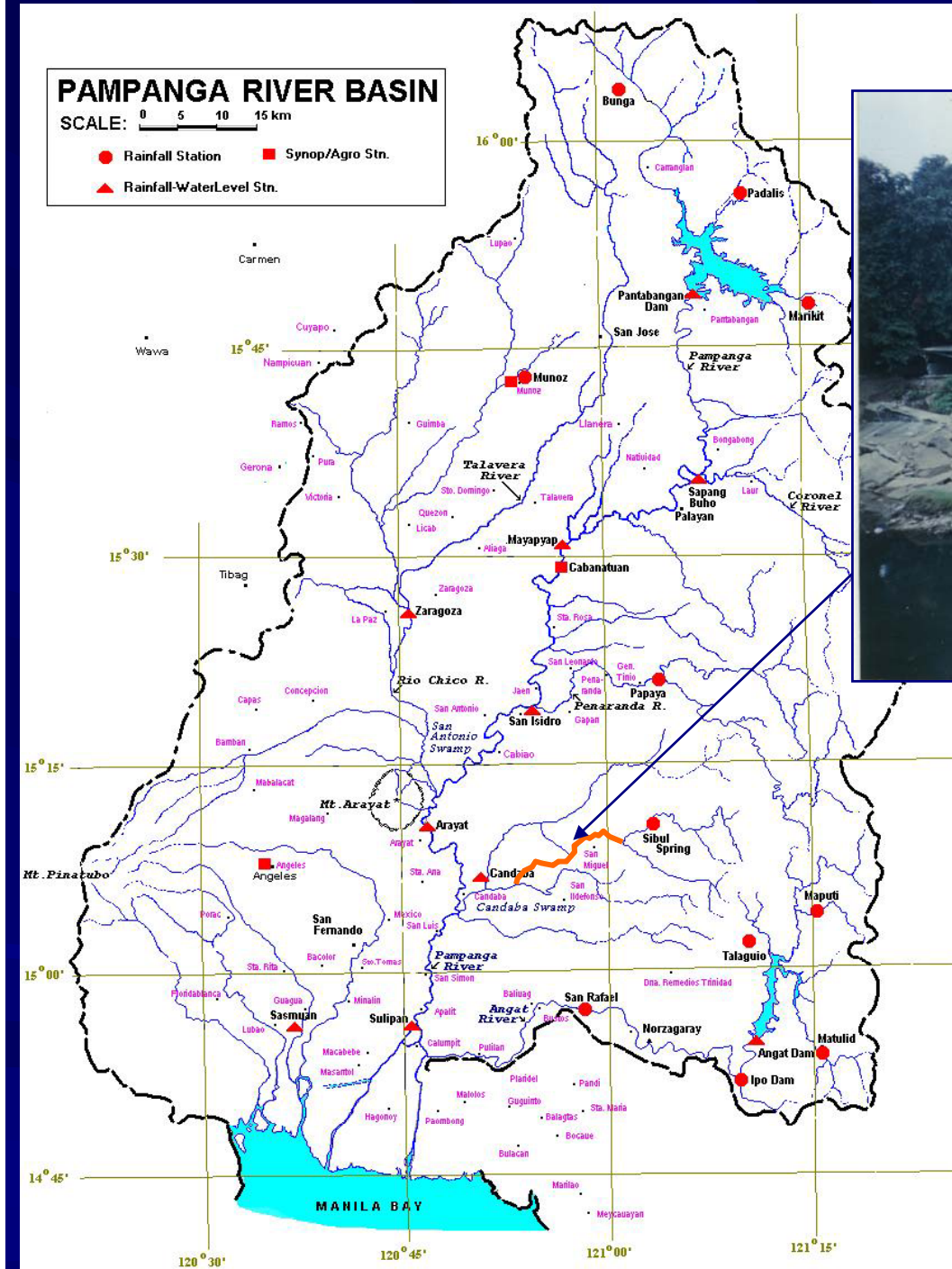
Aba  
Angeles City, Pampanga



# Allied Projects



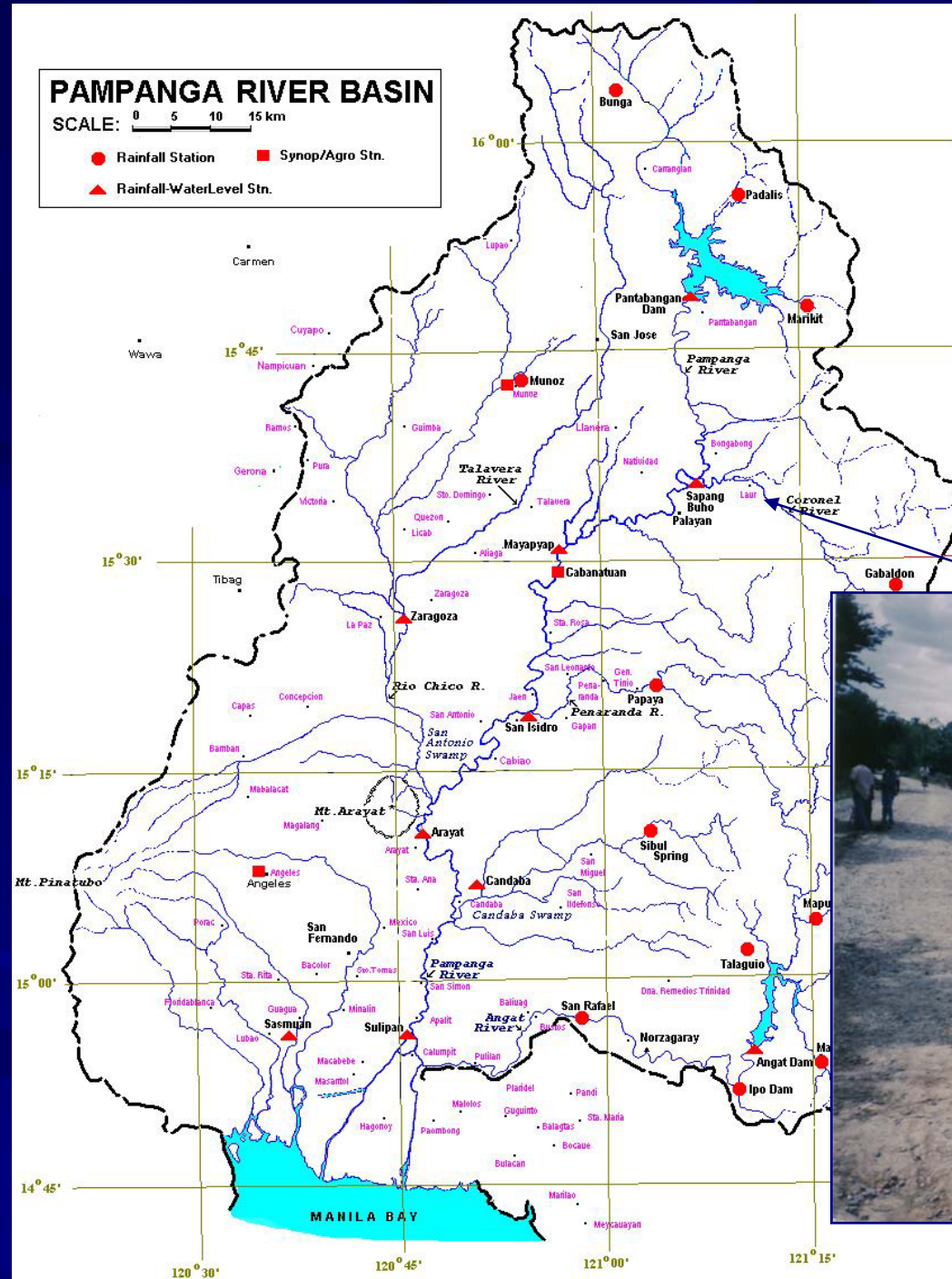
Quitangil River  
Mabalacat-Magalang, Pampanga



# Allied Projects

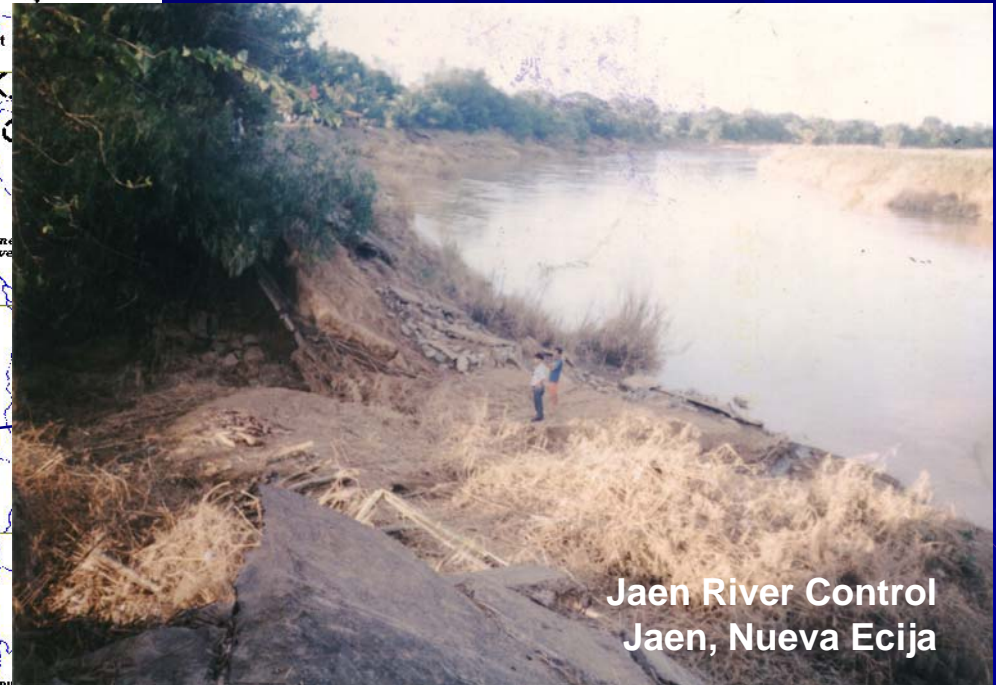
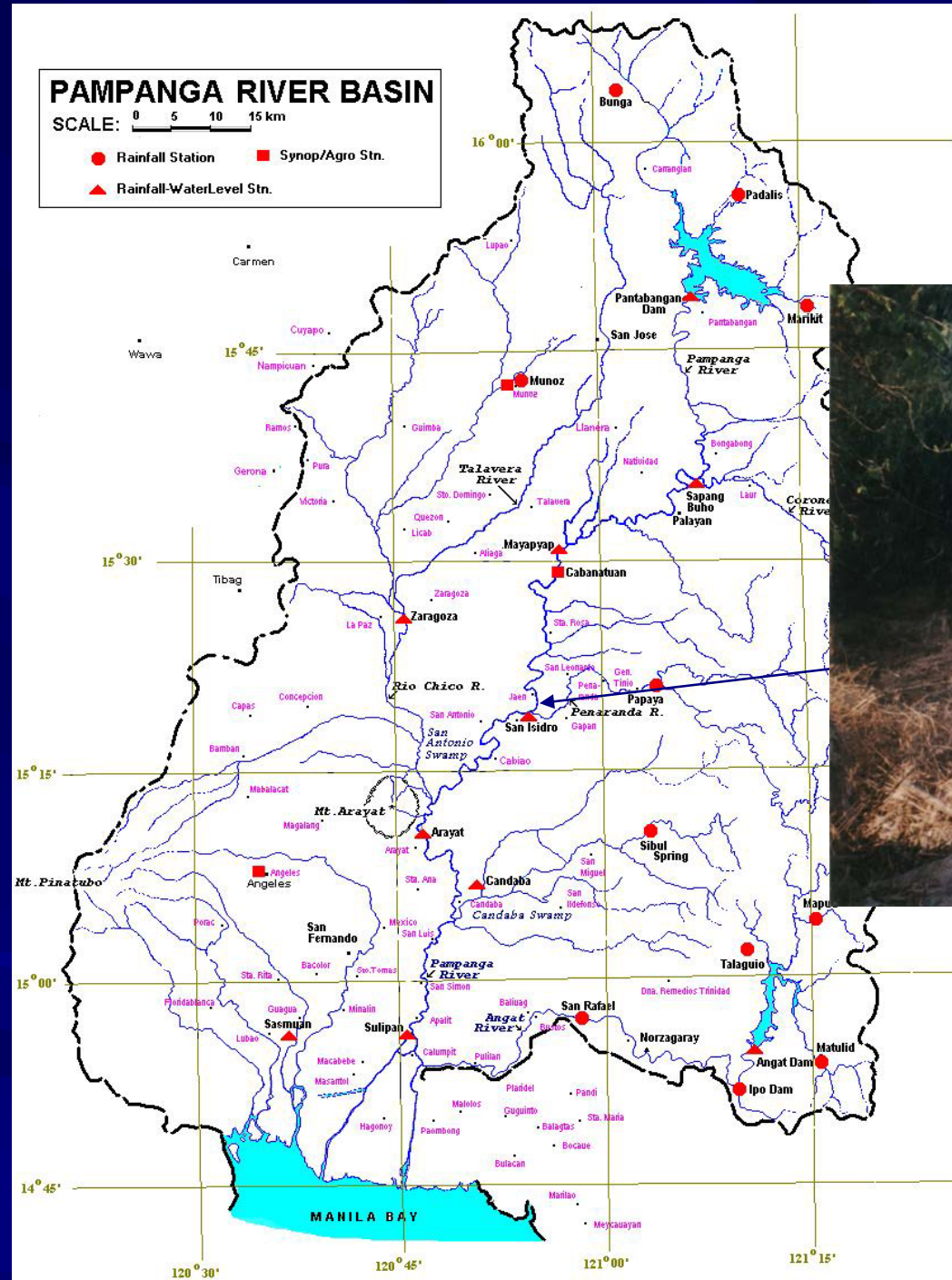


# Allied Projects



**Laur River Control**  
**Laur, Nueva Ecija**

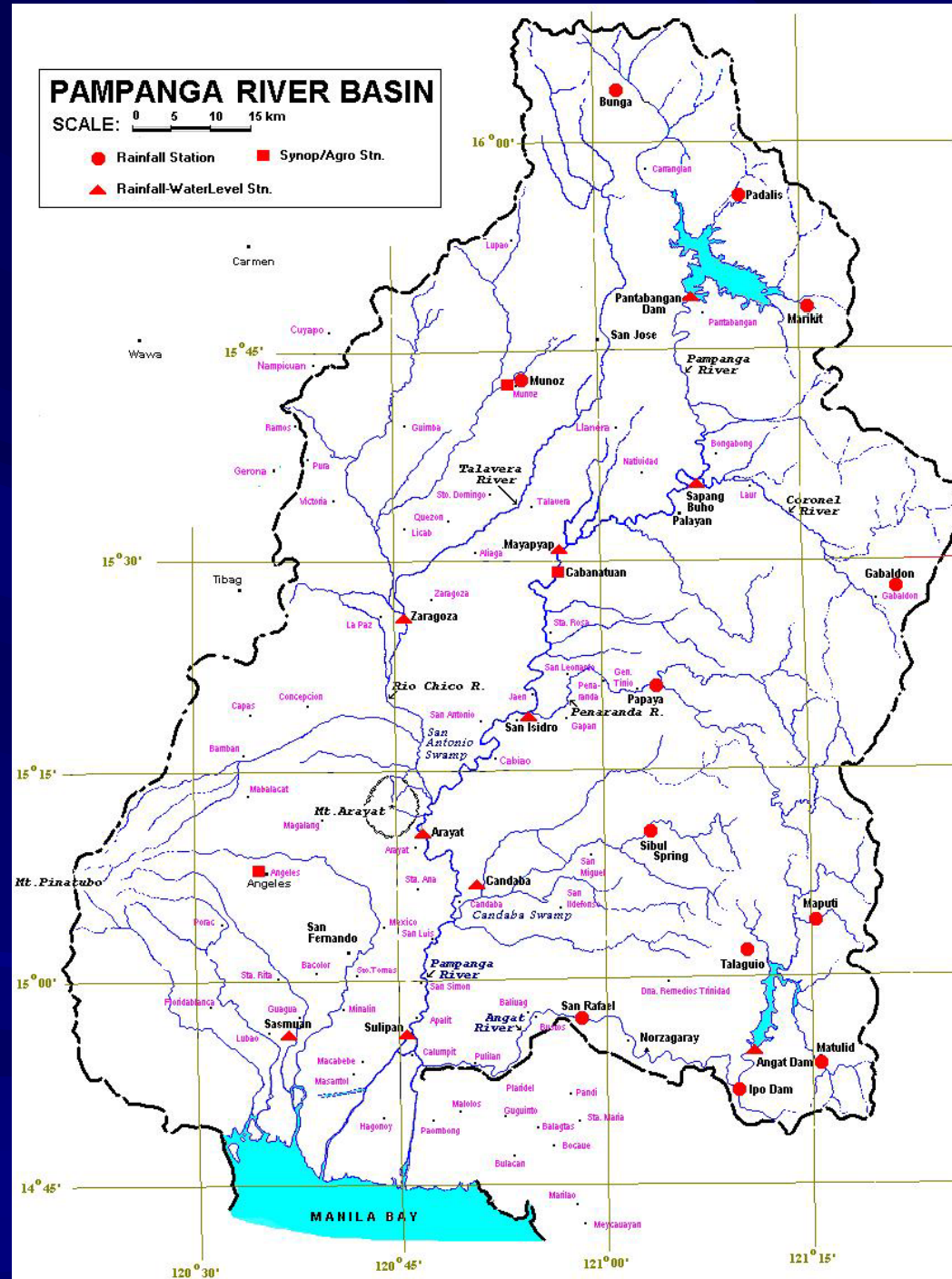
# Allied Projects



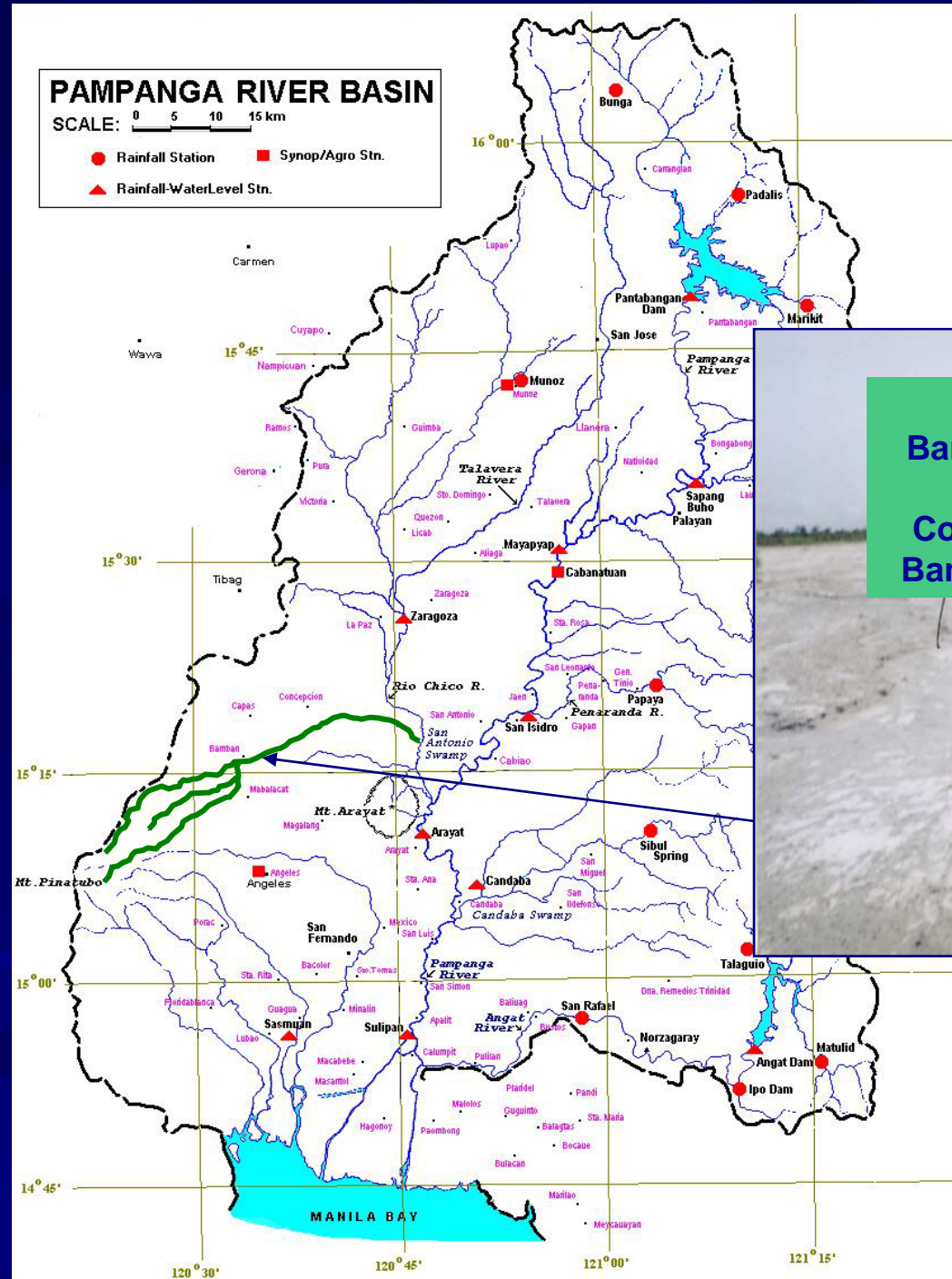
Jaen River Control  
Jaen, Nueva Ecija



# Allied Projects



# Allied Projects

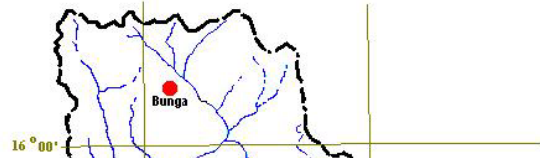


Sacobia-  
Bamban-Parua  
River  
Concepcion &  
Bamban, Tarlac

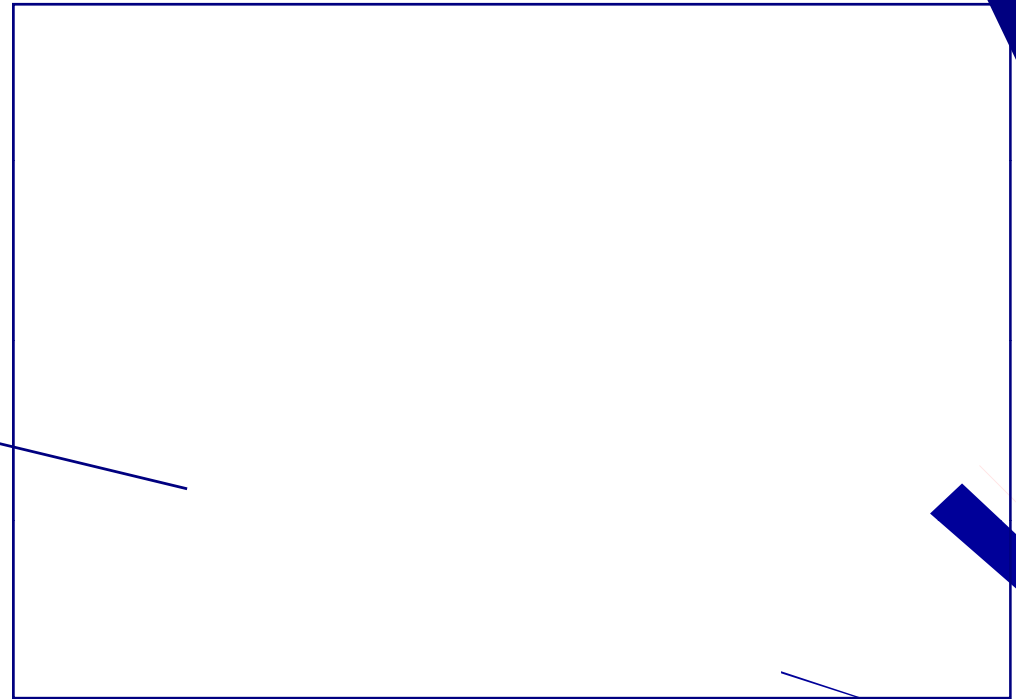
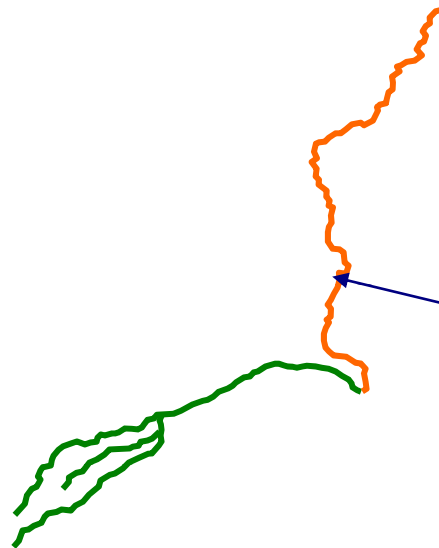


## PAMPANGA RIVER BASIN

SCALE: 0 5 10 15 km



# Allied Projects



# Major Flood Control Projects Completed

- A. Pampanga Delta Dev't Project, Phase I  
Sulipan, Apalit to Masantol, Pamp.
- B. Pinatubo Hazard Urgent Mitigation Projects  
(PHUMP)
  - Phase I - Bamban-Sacobia-Parua River Basin
  - Phase II – Pasig-Potrero River Basin and Pasac  
Delta



# Pampanga Delta Development Project (PDDP) Flood Control Component

## PDDP I

**Project Cost :** P 2.9 Billion

**Time Table :** 1993 – 2002

### Main Feature

- Dredging : 12,205,000 cum
- Embankment
  - Total length 15.4 km
  - Total Volume 1,898,000 cum
- Resettlement Area
  - 2,535 lots for 70 ha

### Completed Portion (94%)

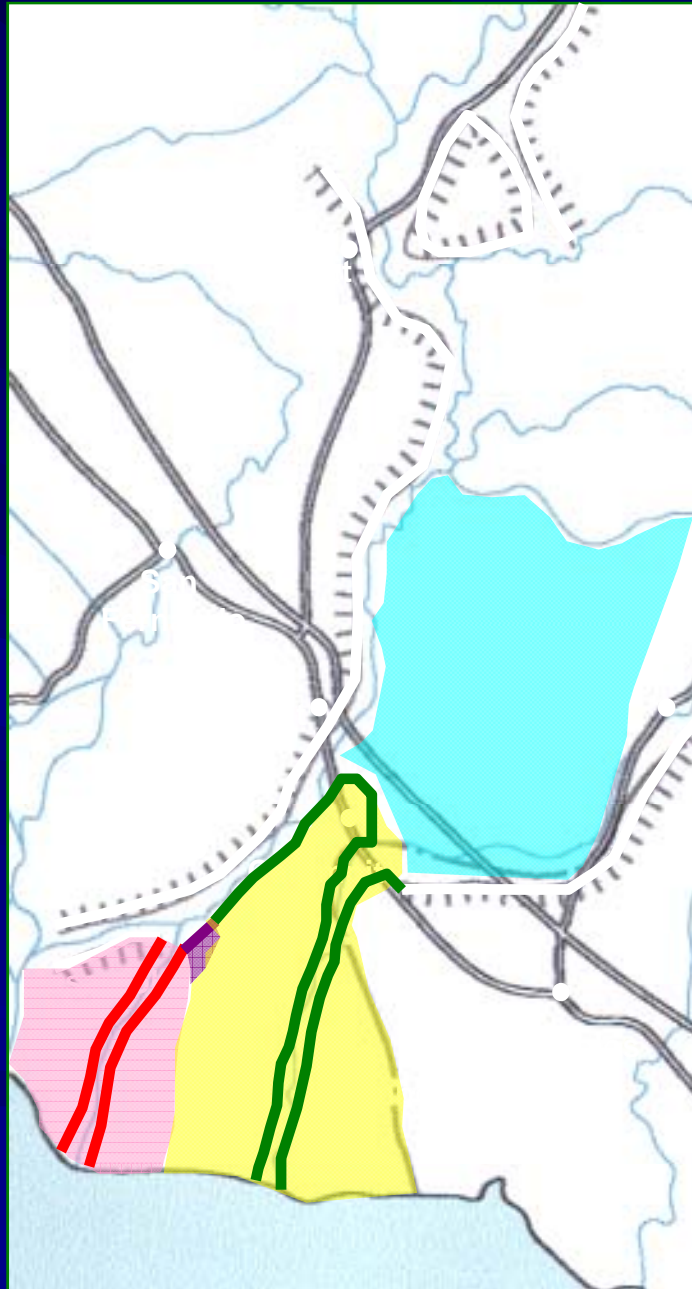
Length 13.90 km  
Beneficial Area 100 km<sup>2</sup>  
Population 71,000

### Deleted Portion (6%)

Length 1.5 km  
Beneficial Area 6 km<sup>2</sup>  
Population 7,121

### Reason for Deletion

Strong opposition by the local people of Barangay Candelaria Macabebe Pampanga up to Barangay Meyto Calumpit Bulacan covering 1.5 km up to the end of the project



## PDDP II

**Project Cost :** P 8.8 Billion

### Main Feature

- Dredging : 13,313,752 cum
- Embankment 3,831,504 cum
- Resettlement Area 198 ha
- Affected Families 6,700
- Affected Lots 1,221ha

Protected Area 142 km<sup>2</sup>

Population 161,000

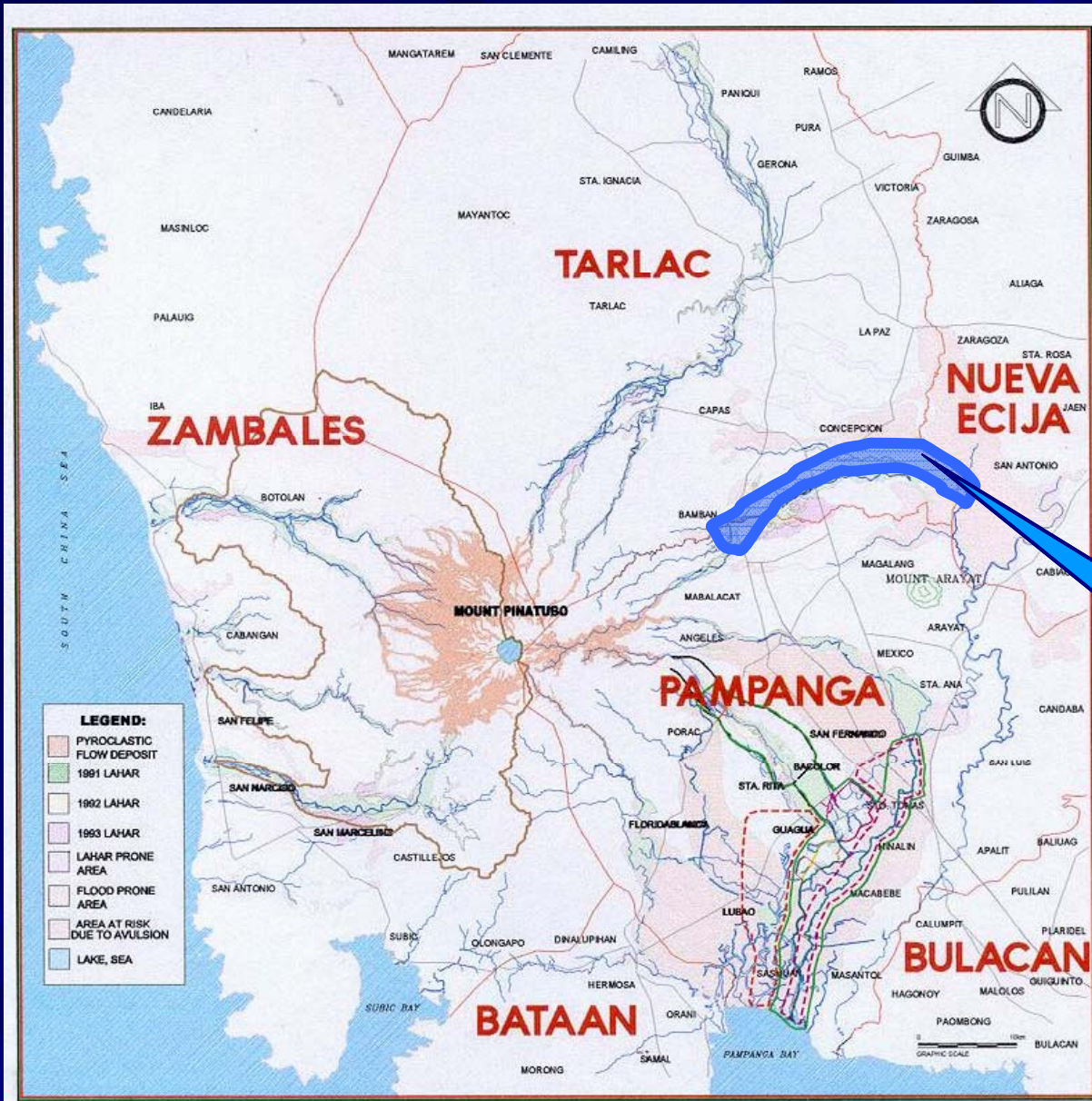
Flood Mitigated Area 113 km<sup>2</sup>

Population 57,000

### Reason as to why PDDP II was cancelled

The local government units, local people and NGOs in Bulacan and Pampanga are strongly against the implementation of PDDP II because of social issues of the Project

# PHUMP Phase I

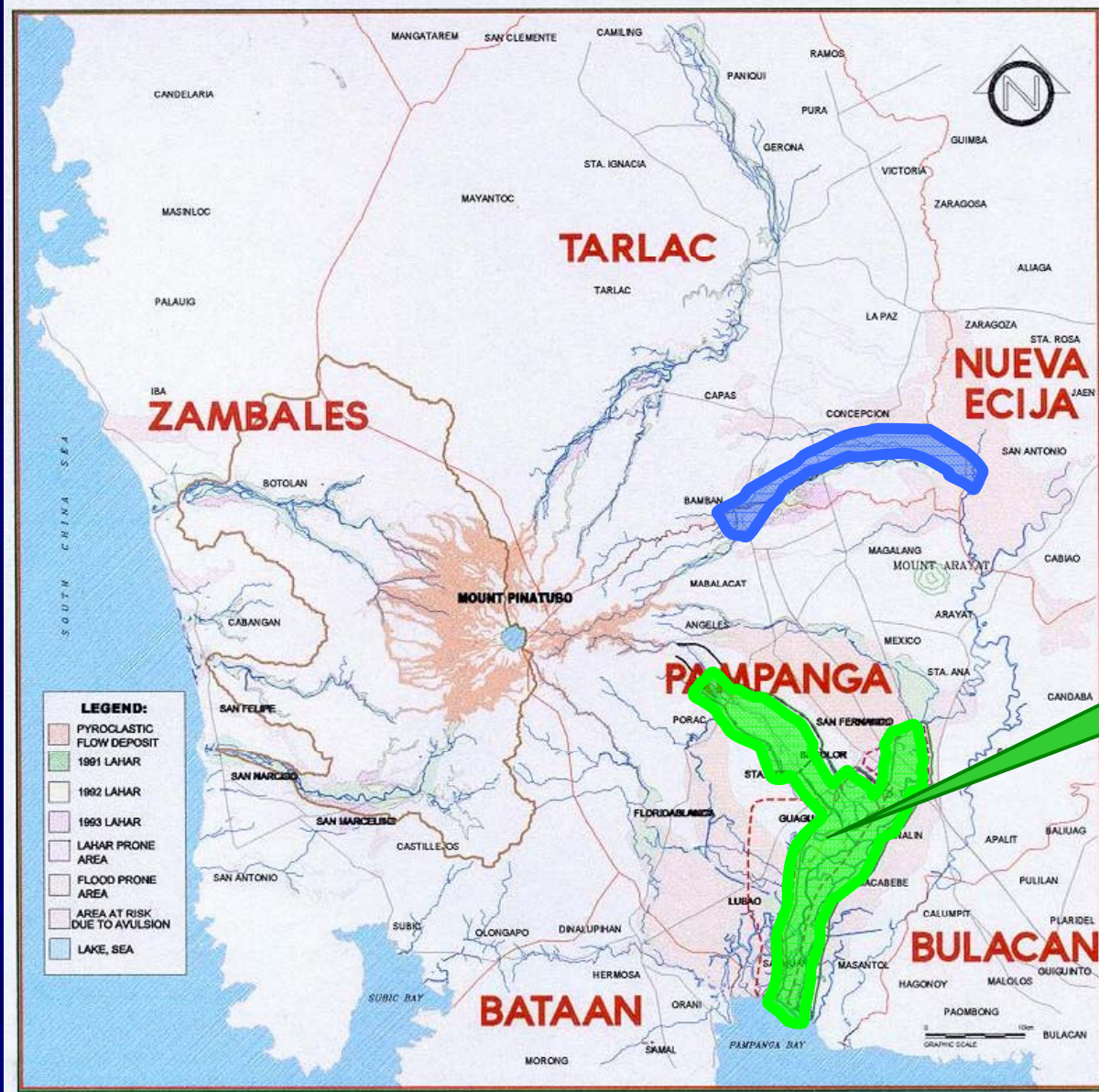


CONSTRUCTION  
COMPLETED

LOCATION MAP



# PHUMP Phase II



COMPLETED

LOCATION MAP



# Proposed Projects

## ■ LONG TERM

1. Full feasibility study of Pampanga River Basin
2. Rehabilitation/Improvement of Rio Chico River Control

## ■ MEDIUM TERM

1. PHUMP Phase III
2. Dredging of Porac Gumain River- Lower Dalan Bapor under the Korean assisted Project

## ■ SHORT TERM

1. Continuous desilting and dredging of waterways using land based equipment and government dredgers in coordination with concerned LGU's.
2. Emergency bank protection on identified critical areas
3. Maintenance of completed PHUMP projects under Phase 1 and Phase 2

# **Status of PHUMP Phase III and WIDENING OF GSO ROAD AND MERGENCY DREDGING PROJECT**

## **(Korean Assisted Project)**

### **■ PHUMP PHASE III (under the 27<sup>th</sup> Yen Loan Package, JBIC)-Flood Control Works in the Pasac Delta including Porac-Gumain River**

- Project Cost: P 4.13Billion
- Status : Approved by the NEDA-Technical Board and ICC-CC
- Schedule of Implementation: 5-yr implementation starting 2006 from engineering design to construction completion

### **PROPOSED WIDENING OF GSO ROAD AND MERGENCY DREDGING OF PORAC-GUMAIN RIVER from its confluence with Upper Dalan Bapor**

- Project Cost: P 1.56686 Billion
- Status : Parcellary Survey was conducted/Awaiting approval of plans by LMB-DENRi/Detailed Design being conducted
- Schedule of Implementation: 2008-2011 (48 months)

## Pinatubo Hazard Urgent Mitigation Project Phase 3

### CP-1

EXCAVATION/  
DREDGING OF  
PORAC-  
GUMAIN RIVER

### CP-3

DIVERSION  
WITH/WITHOUT  
DIKE

### CP-2

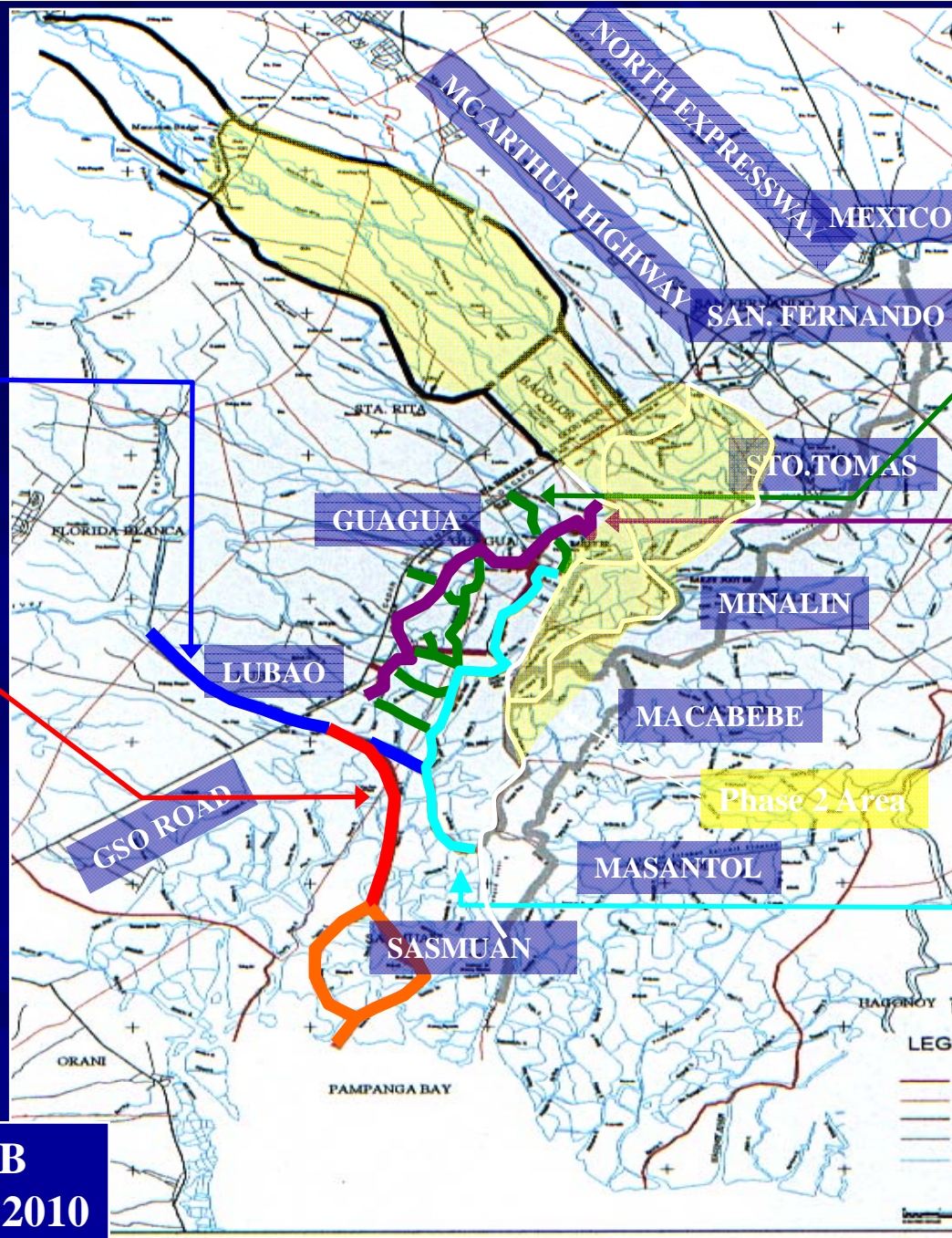
EXCAVATION/  
DREDGING OF  
LOCAL DRAINAGE  
CHANNEL

### CP-4

RAISING ROADS/  
BRIDGES

### CP-5

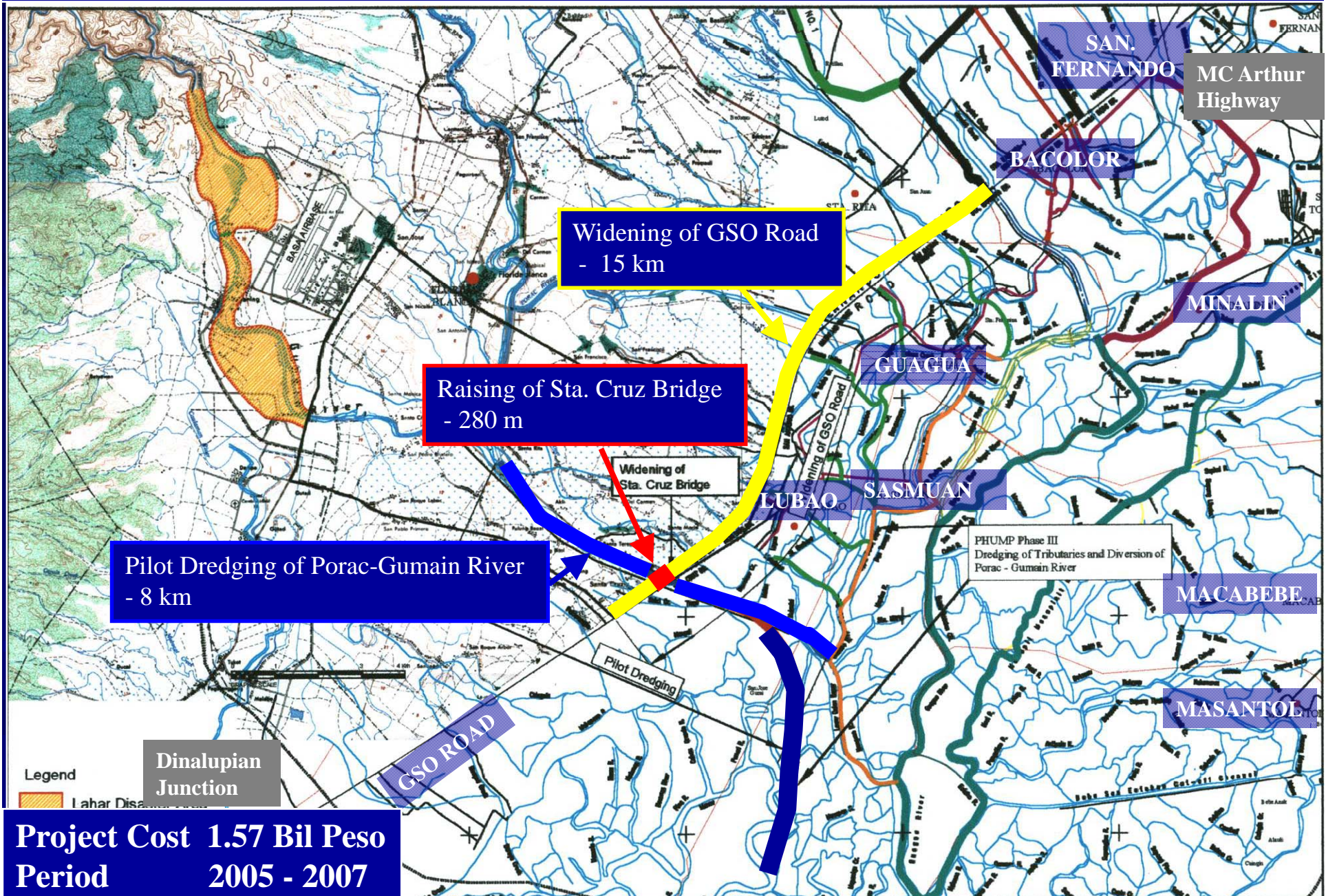
EXCAVATION/  
DREDGING OF  
MAJOR RIVERS



Project Cost P 4.13 B  
Period 2005 - 2010

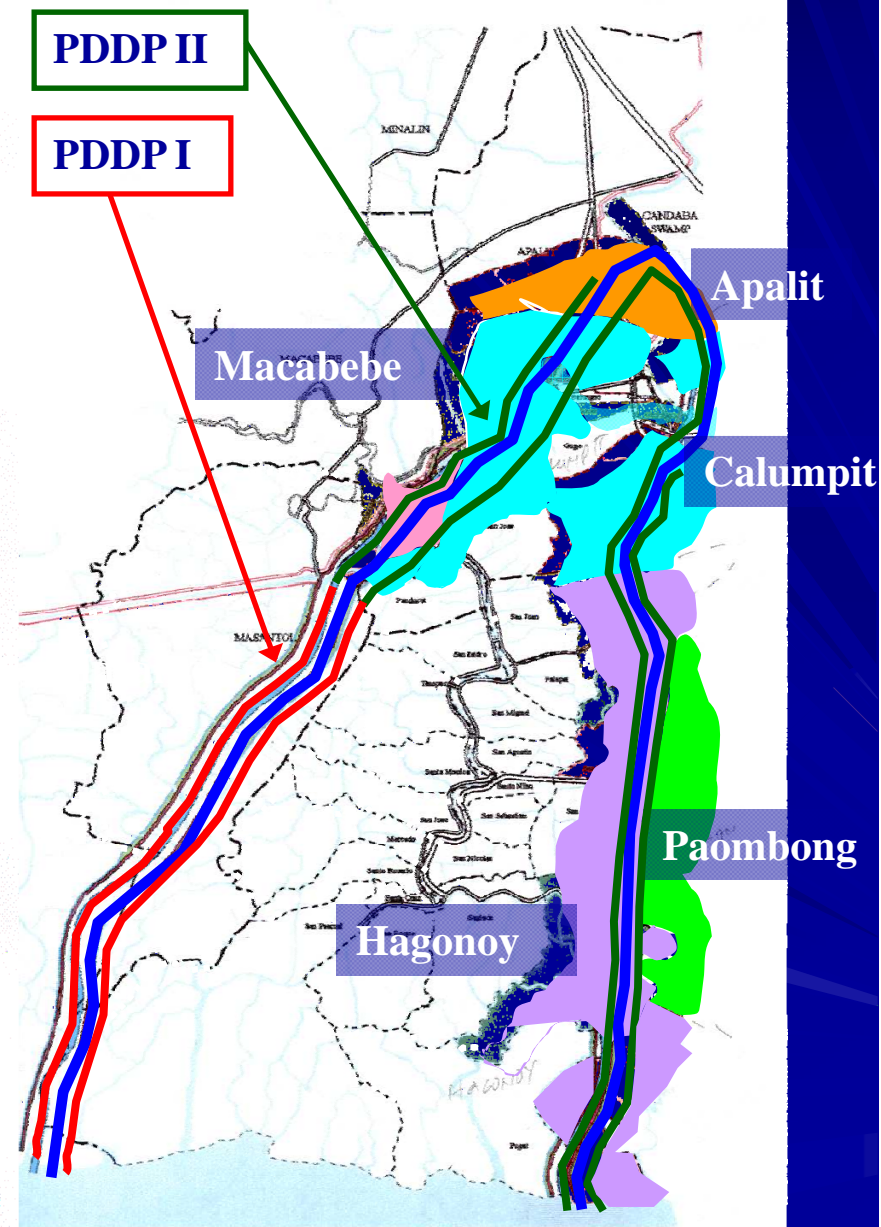


# WIDENING OF GAPAN-SAN FERNANDO-OLONGAPO (GSO) ROAD INCLUDING STA. CRUZ BRIDGE AND EMERGENCY PILOT DREDGING PROJECT

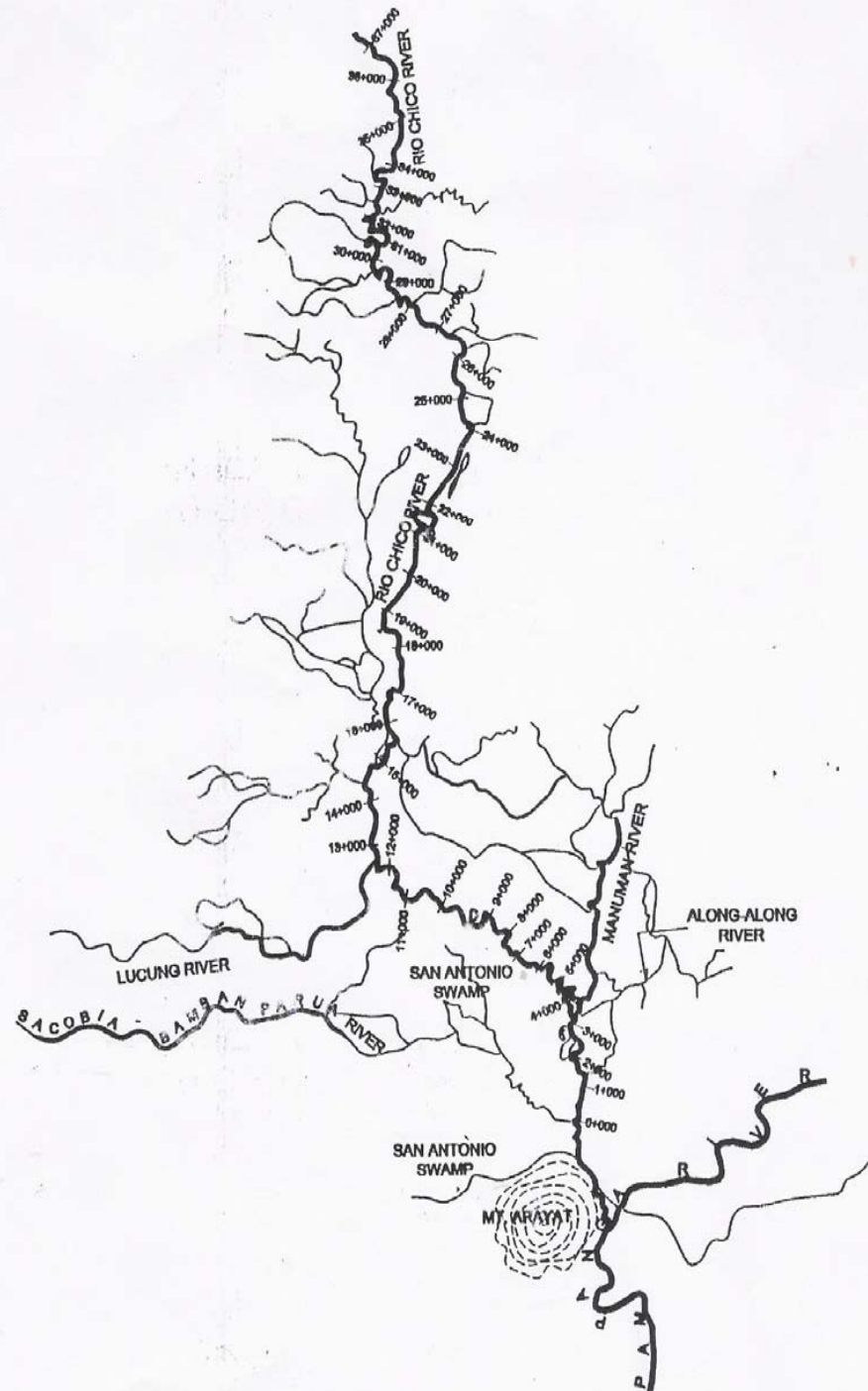




PROVINCE	MUNICIPALITY	BARANGAY
PAMPANGA	Macabebe	Candelaria
		Batasan
		San Vicente
	Sub-Total	3
	Apalit	Capalangan
		Sulipan
	Sub-Total	2
BULACAN	Calumpit	Meyto
		San Jose
		Meysulao
		San Miguel
		Sta. Lucia
		Bulusan
		Calizon
		Frances
		Sapang Bayan
		Sta. Niño
		Ganiogan
		Iba Oeste
		Iba Este
	Sub-Total	13
	Hagonoy	Iba
		Iba Ibayo
		Carillo
		Abulalas
		San Pedro
		San Pablo
		Sta. Elena
		Tigbaguin
		Pugad
	Sub-Total	9
	Paombong	Capitangan
		San Roque
		San Isidro
	Sub-Total	3
TOTAL		30



# Flood Mitigation Project Proposal along Rio Chico River Control





# Policies and Strategies

- One of the major components of the Medium-Term Development Plan (MTPDP) is the Infrastructure Development Program of DPWH.
- The recurrent serious effect of natural disasters particularly flood towards our national economy, emphasizes the need for the implementation of flood mitigation measures and practical approach towards proper river management programs

# Strategic Objectives

- Coordinate the development of flood projects with the implementation of irrigation and water resources development projects;
- Study and formulate guidelines leading to sustainable development/land use in sediment-related disaster areas; and
- Implement comprehensive measures consisting of structural construction, warning/evacuation, livelihood programs in coordination with other concerned government units and LGU's
  - *These are the objectives arrived at in the 1<sup>st</sup> Water Resource Summit in Central Luzon held in Clarkfield, Pampanga on July 29-30, 2005*

**End of Presentation**  
**Thank You!**