

# **Water-Related Disasters in the Philippines: Issues and Policies**

***Based on Narrative of Two Debris Flow  
Disaster Events***

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## **Outline of Presentation**

- **Water-Related Disasters**
- **Narrative of Quezon-Aurora and Mt. Mayon Mudflow Debris Flow Disasters**
- **Discussions on Issues and Policies Based on the Two Debris Flow Disasters**
- **Conclusions**

## **Water-Related Disaster Events**

- **Rainfall-triggered or water induced landslide (debris, avalanche)**
- **Debris flows (mudflows, lahar flows)**
- **Hyperconcentrated flow (20 to 40% sediments)**
- **Floods (large water volumes and sediment-laden flows)**
- **Storm surge**
- **Tsunamis**
- **Droughts (extremely dry)**

# Debris Flow Water Hazards

- One of the major water-related hazards in the Philippines is debris flow that develops from rainfall-induced landslide, massive slope failure, or remobilization of deposited sediment materials in steep slopes or rivers.
- Under extremely wet conditions, debris flows are very disastrous and the sliding slope materials can continuously flow downslope as debris flow for significant distances.
- In the Philippines however, most engineering studies on water-related disaster mitigation assume pure flood flows (almost 100 percent water) despite being debris or even hyperconcentrated flow events thus underestimating their full disastrous effects.

## Major Debris Flow Events since 1990

- July 1991 - Mt. Pinatubo's eruption in 1991 produced several debris flow events over a span of 5 years towards the surrounding rivers.
- November 1991 - Ormoc City, Leyte with Typhoon Uring;
- November 2001 - Camiguin Island with Typhoon Nanang;
- December, 2003 - Southern Leyte landslides;
- December 2004 - Quezon-Aurora Provinces in a series of four typhoons;
- February, 2006 - Guinsaugon, Leyte landslides
- November 2006 - Mt. Mayon debris flow into Guinobatan, Albay with Typhoon Reming

The narrative of the **Quezon-Aurora Provinces** and the **Mt. Mayon in Albay Province** debris flow disaster events are given below as reference in the policy discussions.

# Quezon-Aurora and Mt. Mayon Debris Flow Events



## **Quezon-Aurora Provinces Disaster in November 2004**

- In November 29, 2004, landslide and debris flow triggered by extreme rainfall events have devastated the towns Infanta, Real and General Nakar in Quezon Province including the neighboring Dingalan town of Aurora Province.
- Rainfall recorded from 8 AM to 5 PM that day was 342 mm.
- The events leading to this debris flow and flooding disaster was built up from a prolong heavy rainfall during the period of November 14 to December 3 which can be associated to a 100-year event.



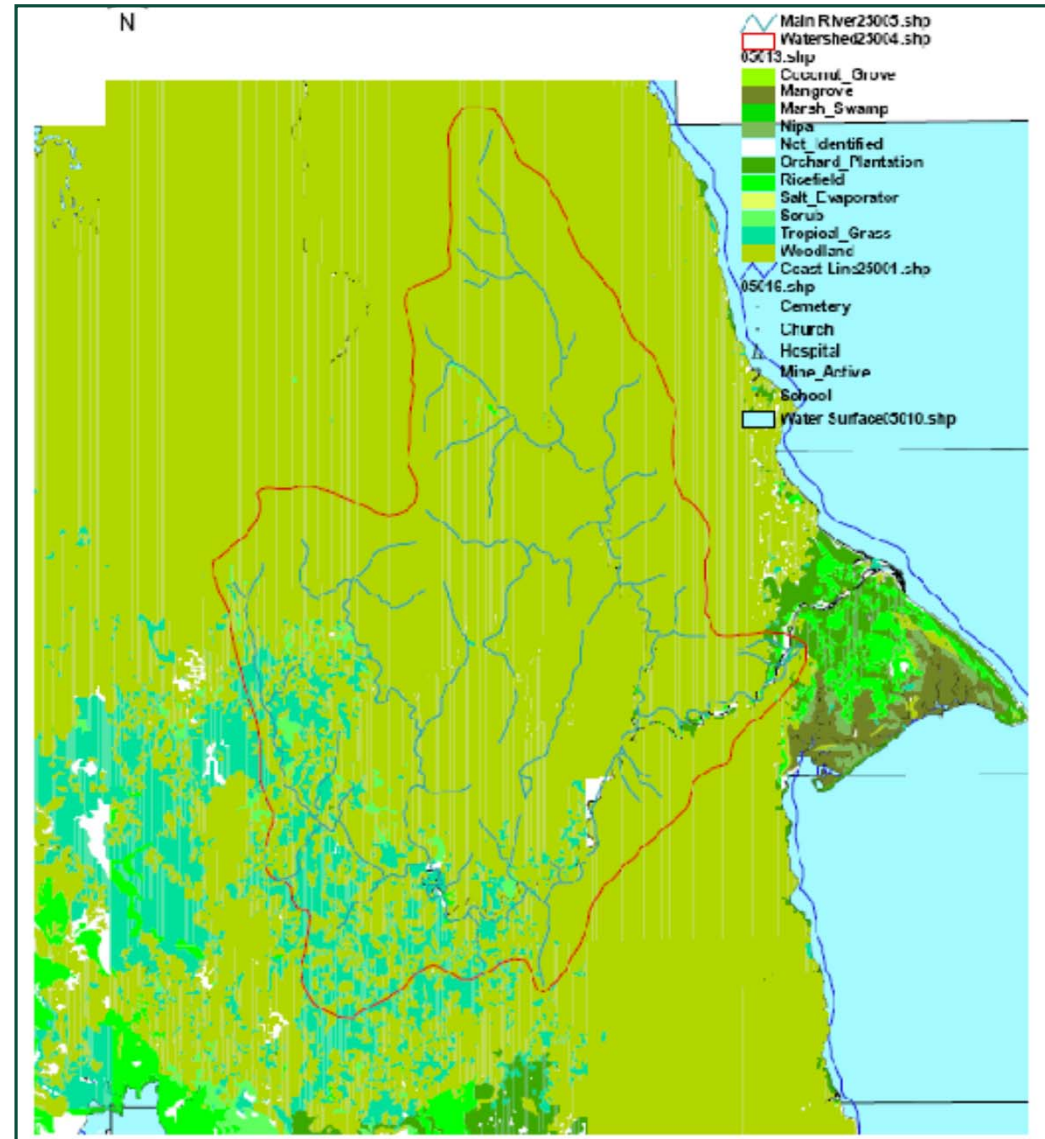
## **..Quezon-Aurora Provinces Disaster**

- In the span of 20-days, there were four tropical cyclones namely: Unding, Violeta, Winnie and Yoyong that passed through these areas that unleashed intense rainfalls way above normal.**
- Flash floods swept through Infanta, Real and General Nakar in Quezon Province and residents recalled that cold, turbulent waters swelled to heights of 4 to 6 m in a span of three hours.**
- About 12,000 families were affected with 175 casualties and about 1,600 houses were destroyed and almost 4,250 houses were damaged.**



## ....Quezon-Aurora Provinces Disaster

- The town of Infanta was isolated from the rest of the country for nearly a week since the only road leading into the area was blocked by landslides.
- Figure shows Agos River watershed in Infanta, Quezon



## **.. ..Quezon-Aurora Provinces Disaster**

- **Debris flows consisting of mud and logs destroyed rice fields, homes and everything in its path.**





**Closer view of debris flow and flooding in Agos River of Infanta, Quezon Province.**



## ....Quezon-Aurora Provinces Disaster

- The coastline was also blocked by tons of logs that were removed and transported from the mountains which ended their journey along the coastline as debris flow.





**Close view of logs and debris flow in Infanta, Quezon Province.**





**Breached wall separating river and community.**

## **Questions : Aftermath of Quezon-Aurora Provinces Disaster**

- **Did upland logging caused the debris flows and floods?**
- **Was rainfall during this period very rare and unusually very heavy indeed that nothing can be done?**
- **If historically this area was prone to landslides and flooding, then the area has become vulnerable to disaster because of human settlement and housing built-up.**



## **Answers and Arguments : Quezon-Aurora Provinces Disaster**

- Logging in the area has been viewed as the cause of destruction because of the idea that deforestation leads to the loss of the sponge effect and infiltration capacity of the watershed.

If logging and deforestation caused the debris flows and floods; then, logging must stop and reforestation programs must be initiated.

- That it was extremely rare rainfall event because of the unusually prolong saturation period of around 20 days (brought by a series of four typhoons) and given the large amount of loose material swept down by the rivers, that risk of rainfall-induced landslides and debris flow became real.

But being a natural extreme event, nothing can be done about it.

## **...Answers and Arguments : Quezon-Aurora Provinces Disaster**

- **With regard to the disaster vulnerability factor, it has been noticed in the countryside that there is increased in housing and settlement areas even in the valleys, flood plains, and deltas that are considered high risk, disaster areas.**

**Thus, if historically this area was prone to landslides and flooding and yet human settlement and housing were allowed to build-up; then proper land use zoning policies must be established and strictly enforced in the area.**

## **Mt. Mayon Disaster in November 2006**

- Mt. Mayon (or Mayon volcano) is a steep-sided and an almost symmetric cone, rises 2,462 meters above the Albay Gulf and the city of Legazpi.
- It is the most active volcano in the Philippines that spews lahar or lava almost every 10 years.



## **....Mt. Mayon Disaster**

- **Early in July 2006, Mt. Mayon has become active and has been spewing volcanic ash and lava (or lahar), leaving a layer of loose ash and rock on its surface.**
- **In November 30, 2006 when Typhoon Reming (also called Typhoon Durian) unleashed heavy rains, the surface runoff created by the rain and mixed with loose ash, developed into deadly mudslides.**
- **Typhoon Reming battered the Mt. Mayon area of Albay Province including the nearby provinces of Camarines Sur, Catanduanes and Marinduque.**

## **....Mt. Mayon Disaster**

- The area around Mt. Mayon was heavily hit as hundreds of tons of lahar and volcanic debris were swept down from the slopes of the Mayon volcano and buried entire villages in its path affecting over 1.5 million people and leaving about 600 casualties.**
- Mudflow triggered by extreme rainfall caught the residents by surprise in the absence of inadequate warning.**
- Observed winds of 230 kph blew throughout the area for nearly the whole day and the observed rainfall reached 466 mm that day.**



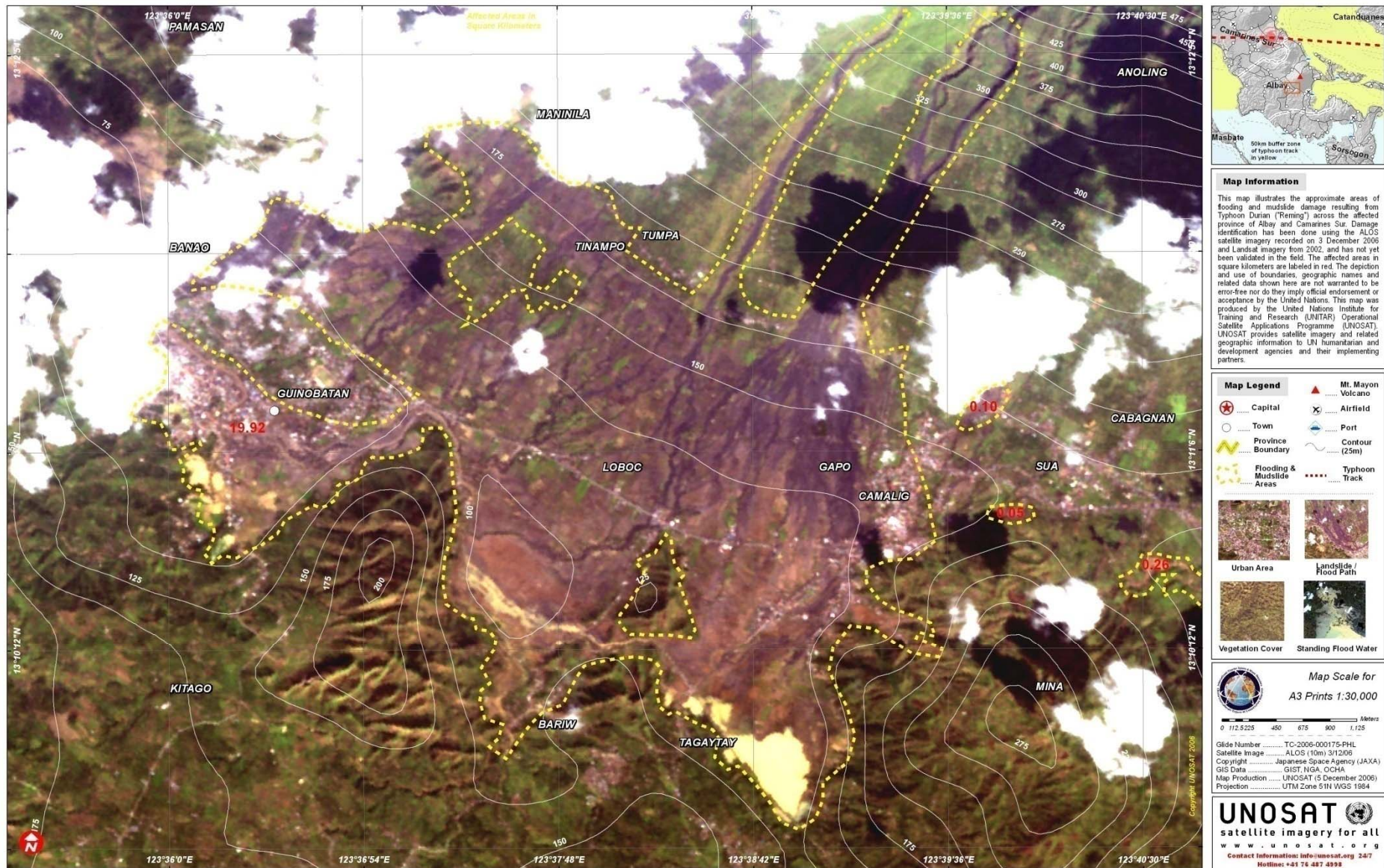
# Flooding & Mudslide Damage over Guinobatan Town, Albay Province, Philippines

Satellite Identified Damage from Typhoon Durian Using ALOS Imagery Recorded on 3 December 2006

5 December 2006

Version 1.0

Glide No: TC-2006-000175-PHL



Areas enclosed by yellow dash lines heavily hit by mudflows and floods.





**House swept by strong winds and debris flow..**



## **Discussions : Aftermath of Mt. Mayon Disaster**

- The need to enforce proper land use planning and implement early warning systems because the areas around Mt. Mayon are always vulnerable to mudflows and floodings.
- The need for bulletins and awareness programs that no structures or houses should be constructed at the slopes of Mt. Mayon and especially along previous mudflow or debris flow channels susceptible to the same water-related hazards.
- As part of early warning system, the local government must develop protocol and procedure for information dissemination and to identify evacuation sites and relocation sites if needed.

# **Water-Related Disasters Issues and Policies**

**(Discussions according to components of disaster risk management: prevention; mitigation; preparedness; response; recovery.)**

- **Forest Cover and Mountain Slopes (Prevention/Mitigation Component)**
- **Land Use Planning and Encroachment of Disaster-Prone Area for Human Settlement (Prevention/Mitigation Component)**
- **River Alteration or Modification (Prevention/Mitigation Component)**
- **Monitoring and Prediction (Alertness/Preparedness Component)**
- **Relocation: Prevention vs. Response (Response)**
- **Social Construction of Hazard and Coping Mechanism of Filipinos (Response/Recovery Component)**

## **Forest Cover and Mountain Slopes**

### **(Prevention/Mitigation Component)**

- In the Quezon-Aurora debris flow disaster, forest denudation was argued to be one of the major causes of rainfall-triggered landslides and debris flow in the area.
- But, supposedly, the Philippines has a Forestry Code to preserve the country's forest lands including provisions for soil erosion control and slope protection.
- Also, the Water Code includes guidelines on control of waters such as floods, and the NIPAS Act to protect and manage environmentally sensitive areas or watersheds in particular.

## **.. Forest and Mountain Slopes**

- Denudation of forest lands due to illegal logging and soil erosion by undesirable slash-and-burn farming practices are identified as major causes of floods or water-related disasters and yet there are laws that cover against these practices.**
- More than 50 years ago, the Philippines forest was estimated to cover 16 million hectares which is more than 50% of the country's total area of about 30 million hectares.**
- Due to unhampered and continuous cutting of tress (legally and illegally), the forest cover was based on estimates in the 1980's was reduced to only 0.8 million hectares from the original 16 million hectares. That is 95% reduction in forest cover.**

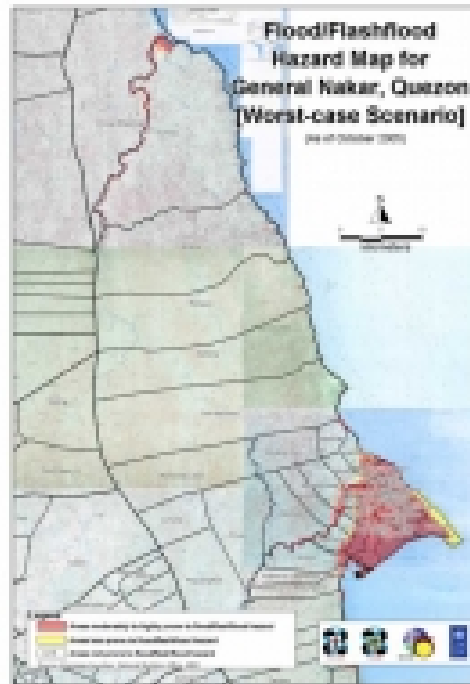
## **.. Forest and Mountain Slopes**

- With respect to the Forestry Code, watershed with 18 degrees slope should be vegetated and yet it is hard to find a watershed in the Philippines with 18 degrees slope and greater which is not at least 50% deforested and with virtually no soil and water conservation strategy in place.**
- There is of course a need to understand more specifically what role forests and reforestation plays in soil and water conservation (including soil erosion and possibly debris flow) and proper study must be made especially with limited resources in reforestation program efforts.**

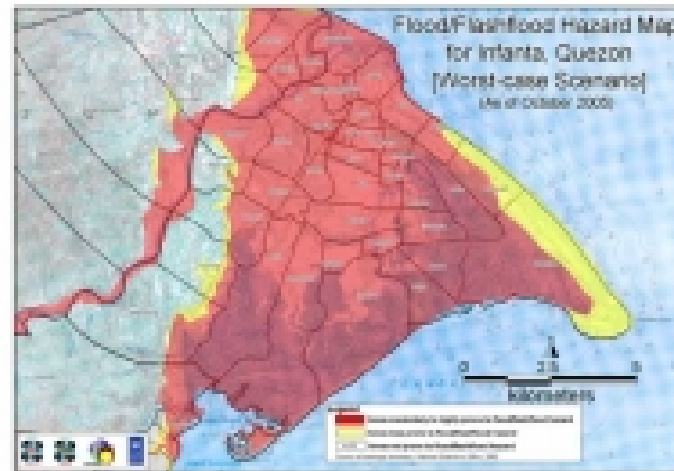
## **Land Use Planning and Encroachment of Disaster-Prone Area for Human Settlement** **(Prevention/Mitigation Component)**

- It was noted in the case of Quezon-Aurora that since the construction of roads, human settlements had extended to new areas that are vulnerable to water-related disasters. This pattern of migration and rural/urban built-up presents a great challenge to land use planning and disaster management.
- The increasing housing and settlement areas in the valleys, flood plains, and deltas throughout the Philippines are locations that run the grave risk of disaster.
- This is the case of Infanta, Quezon as well as the towns of General Nakar and Real as shown in the hazard maps below (from NDCC).

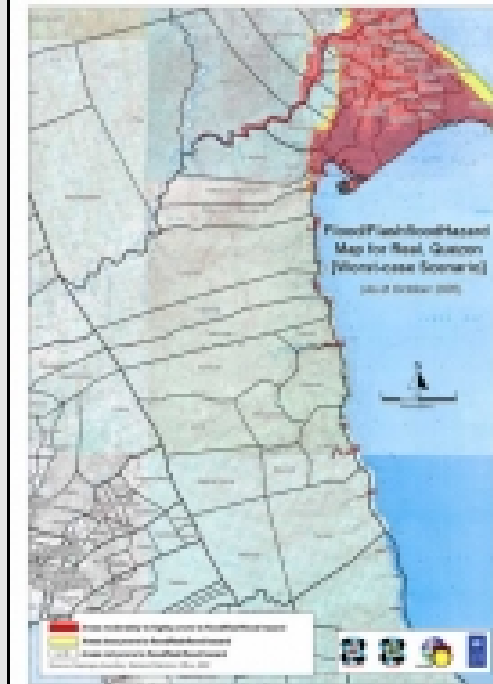
## Severe Flood Hazard Maps of General Nakar, Infanta and Real, Quezon from National Disaster Coordination Council (from NDCC website)



**General Nakar, Quezon**  
([noynics](#))  
[Severe Flood Hazard Maps](#)  
Comments: 0  
☐ [Lightbox](#)



**Infanta, Quezon** ([noynics](#))  
[Severe Flood Hazard Maps](#)  
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**Real, Quezon** ([noynics](#))  
[Severe Flood Hazard Maps](#)  
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**\* Entire area of Infanta, Quezon is susceptible to severe flood hazard and thus not livable.**

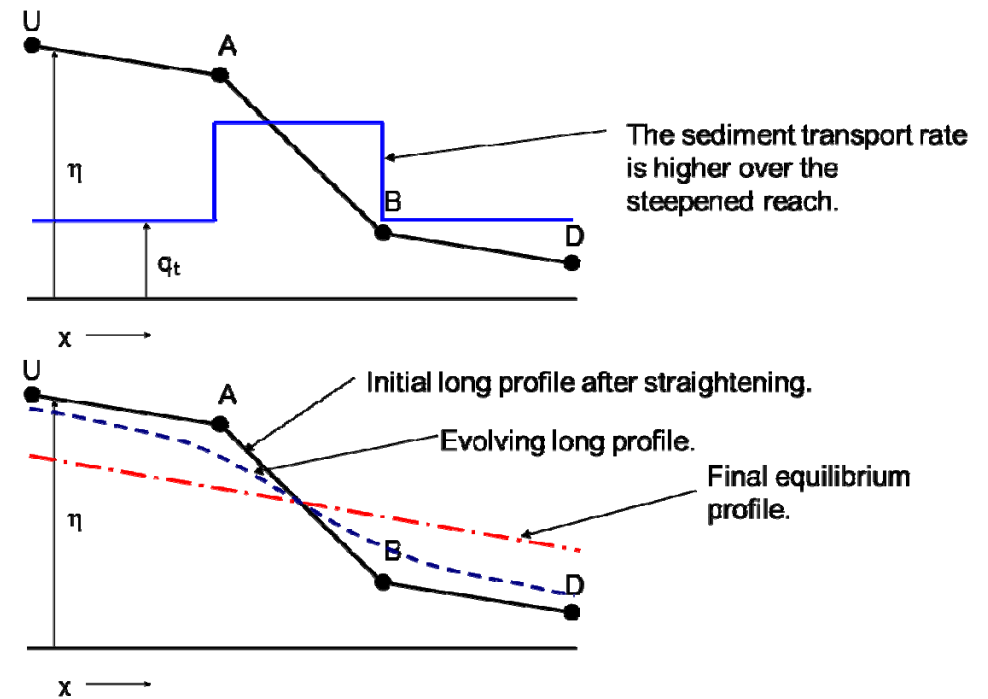
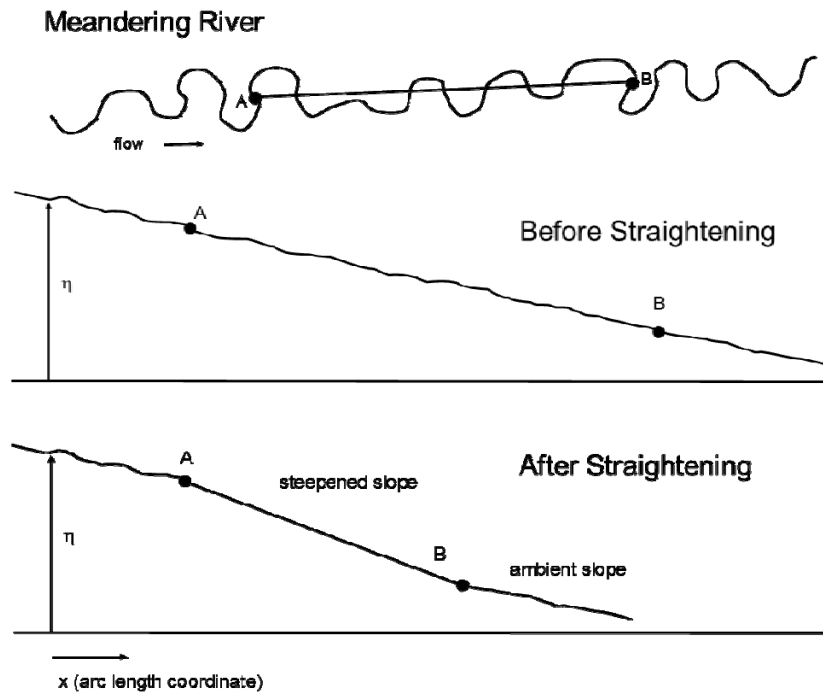


## **River Alteration or Modification**

### **(Prevention/Mitigation Component)**

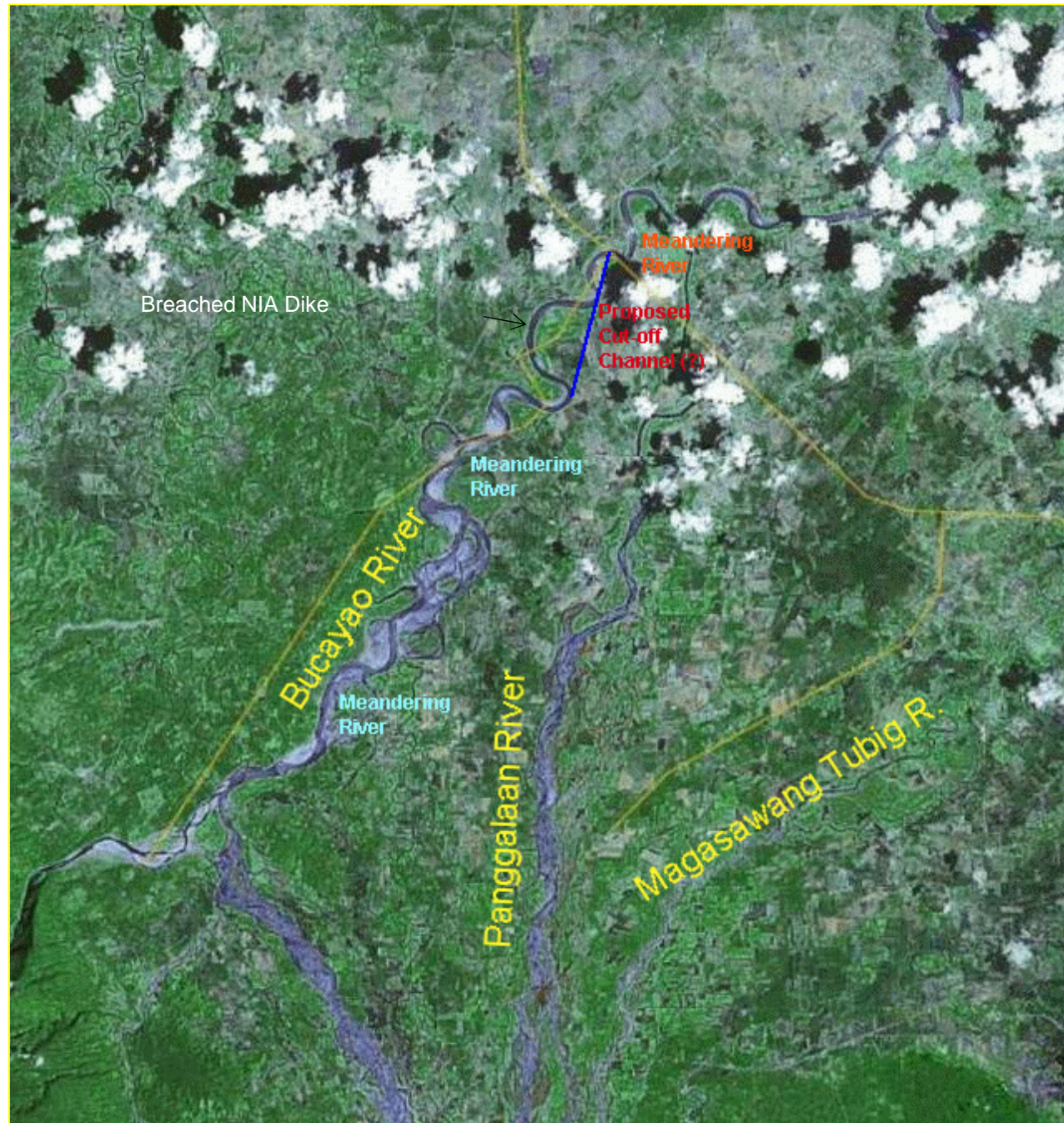
- It is oftentimes costly and dangerous to try to control or modify the flow of a river.
- Sometimes, it results in tragic losses of lives and properties to live or built-up in floodplains or debris flow/mudflow paths.
- Illustrated next is on river straightening problem in a meandering river.

# River Straightening Problem



## Calapan, Mindoro Flood of December 2005

Due to a series of typhoons (December 7, 14 and 21, 2005), the meandering Bucayao River swelled and swung leftward to breach the NIA dike causing floodwaters to flow downslope to Calapan, Mindoro Oriental.



## **Monitoring and Prediction**

### **(Alertness/Preparedness Component)**

- There are available technologies for predicting water-related hazards such as flash floods as well as rainfall-triggered landslides and debris flow.
- An important requirement in prediction of these hazards being a water-related hazard is rainfall forecasting.
- Rainfall prediction is the job of the PAGASA (weather agency) but unfortunately PAGASA does not provide short-term rainfall forecasts which can be used for flash floods or rainfall-triggered debris flow prediction.

## **... Monitoring and Prediction**

- **The MGB (Mining and Geosciences Bureau) of DENR is responsible for rainfall-triggered landslides or debris flow.**
- **In contrast to PHIVOLCS is responsible for seismic-triggered landslides.**
- **These are two separate agencies and sometimes they have to deal with both a rainfall- and seismic triggered landslide such as the case with the Guinsaugon, Leyte disaster.**
- **In any case, both MGB and PHIVOLCS do not perform short-term prediction but rather only long-term landslide studies.**



## **Relocation: Prevention vs. Response**

### **(Response/Recovery Component)**

- Proper relocation of people either as prevention or response to a water-related disaster must be addressed properly.
- Primarily, poor people who live along floodplains or riverbanks in makeshift houses cannot be immediately relocated (in response to floods) and permanently relocated (as prevention), so that effort at this must be gradual and strategic.
- There are still a lot people today who live in the in floodplains, riverbanks or even around flood control structures wondering if the next flood will come in their lifetime. Thus, proper attention and action should be given to secure the relocation of these people and including disaster awareness and education programs.

## **Social Construction of Hazard and Coping Mechanism of Filipinos**

### **(Response/Recovery Component)**

In the paper by Greg Bankoff, “In the Eye of the Storm: The Social Construction of the Forces of Nature and the Climatic and Seismic Construction of God in the Philippines”, he mentioned that:

A number of Filipinos believed that the forces of nature are at the service of divine command and that the disasters caused by natural hazards are expression of vengeful deity. In this case then,

“Disasters, then, are not simply geophysical or meteorological events but are psychological matters as well. In some societies, natural hazards occur with such historical frequency that the constant threat of them has been integrated into the schema of both daily life and attitude to form what can be called ‘cultures of disaster’.”

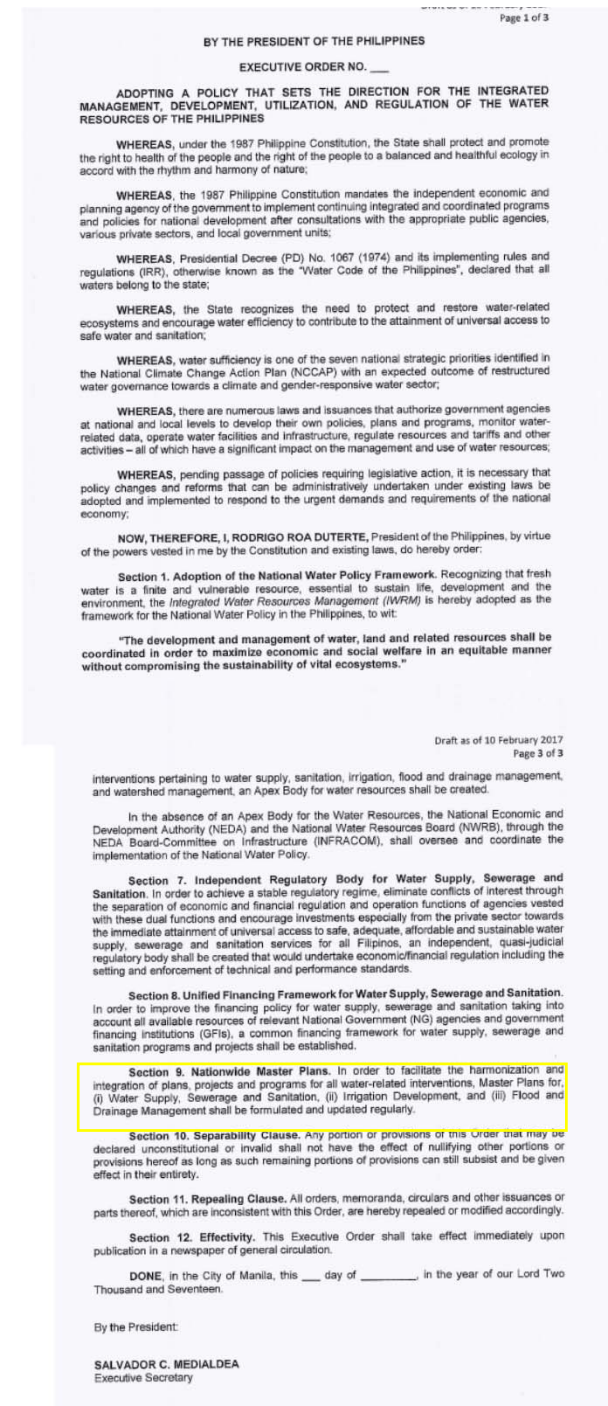
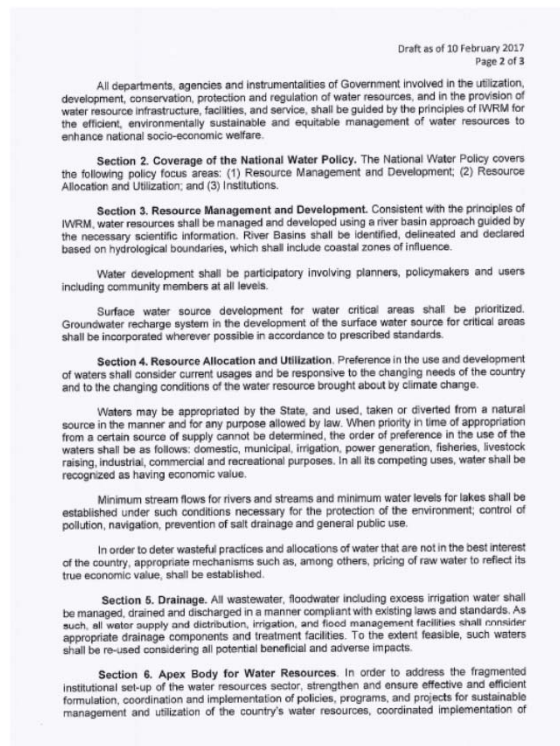
**Major Public Works (DPWH) Flood Control Projects in the Philippines**  
**(Inadequate design flood level of protection and investment?)**

<b>Name of River or Area</b>	<b>Return Period</b>	<b>Design Discharge m<sup>3</sup>/sec</b>	<b>Catchment area Km<sup>2</sup></b>	<b>Specific Discharge: q (m<sup>3</sup>/sec)/ Km<sup>2</sup></b>
Laoag	1/25	11,200	1,332.1	8.41
Agno	1/10	6,410	5,910	1.08
Pampanga delta flood way	1/20	3,800 – 4,300		
KAMANAVA	1/30: river 1/10: drainage	450	18.5	
<b>Pasig-Marikina</b>	<b>1/30</b>	<b>2,900</b>	<b>500 (Sto.Nino)</b>	<b>5.8</b>
<b>Mangahan Flood way</b>	<b>1/30</b>	<b>2,400</b>		
Iloilo	1/20: rivers (1/50) 1/5: drainage	1,000 (1,400)	412	2.4 (3.4)
Agusan	1/25	8,010	10,621	0.754
Ormoc	1/50	610	25.2	24.21

**(Source: DPWH, October 2009)**



# Draft Executive Order (E.O.) for the Adoption of National Water Policy of the Philippines (February 2017)



## Conclusions

Based on this two major water-related disasters, we reiterate the arguments put forward and to learn how to prepare in similar, future events.

### Case of Quezon-Aurora Provinces Disaster

- If logging and deforestation caused the debris flows and floods; then, logging must stop and reforestation programs must be initiated.
- If it was caused by rainfall which was indeed rare and unusually heavy, then it is a natural extreme event that nothing can be done about it.
- If historically this area was prone to landslides and flooding and that due to human settlement and housing built-up, disaster happened; then proper land use zoning policies must be established and enforced in the area.

## **..Conclusions**

### **Case of Mt. Mayon Disaster**

- This Mt. Mayon area has always been vulnerable to mudflows and floodings so it is matter of reiterating and seriously implementing the following:
  - Proper land use planning and observance of proper buffer zones.
  - Need for early warning systems.
  - Awareness and alertness by education and drills to evacuate people.

***Final Slide. Thank you!***