Town Hall Meeting on Individual and Family Disaster Preparedness

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Preparedness measures for impacts of tropical cyclones and flooding

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OUTLINE OF PRESENTATION

- Introduction: Understanding the hazards
- Impacts of tropical cyclones & flooding
- Preparedness measures
Introduction

- Semi-permanent cyclones & anti-cyclones
- Air streams – SW & NE monsoon
- Ocean currents
- Linear systems – ITCZ, cold front, easterly wave
- Tropical cyclones
- ENSO phenomena (El Niño & La Niña)

Climatic controls that influence Philippine climate.

- Geography & topography
Introduction

- Average annual rainfall: 2,400 mm (50% comes from Tropical Cyclones)
- Land area: 300,000 sq. km.
- The Philippines has 421 principal river basins, 18 are major river basins

Topographic map

Major river basins
1. Understanding the hazards
What is a tropical cyclone?

A tropical cyclone is classified based on its wind strength:

- **Tropical Depression (TD)** - 45 to 63 KPH
- **Tropical Storm (TS)** - 64 to 118 KPH
- **Typhoon (TY)** - greater than 118 KPH

From 1948 to 2010: 1228 tropical cyclones have crossed the Philippine Area of Responsibility (PAR).

- Wind speed ranges from 40 KPH to about 300 KPH.
- Diameter ranges from 300 to 1,000 kms.

For Manila, we experience 1 TC every year.
Hazards associated with tropical cyclones

- Strong Winds
- Tornadoes
- Storm Surges
- Flashfloods/Floods
- Landslides/Mudflows
2. Impacts of tropical cyclones & flooding
IMPACTS of Weather Phenomena in the PH

1970-2010:

Affected families – 26,978,106

Affected persons – 136,543,259

Casualties – 23,892

Cost of Damages:

Agriculture: PhP178.39 billion

Infrastructure: PhP 76.77 billion

Private properties: PhP 10.29 billion

Total cost of damages: PhP 265.5 billion

Source: Office of Civil Defense

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Source: Office of Civil Defense
2. Impacts of tropical cyclones & flooding
Map of Greater Metro Manila

Administration Areas in GMMA

River Basins, Lake Basin, and Drainage Basins in GMMA
Effective Flood Control Operation System (EFCOS) of the Pasig-Marikina- Laguna Lake Complex

Main river:
Marikina & Pasig

Tributaries:
Nangka river in San Mateo,
San Juan river
Napindan river
Effective Flood Control Operation System (EFCOS) of the Pasig-Marikina- Laguna Lake Complex

Originally, EFCOS was under DPWH but in 2003, after its expansion by JICA, it was turned over to MMDA.

Operation of EFCOS – The forecast flood in the Upper Marikina river will be the basis to operate the Rosario weir & divert flow to Laguna Lake thru the Manggahan Floodway.

PAGASA & DPWH act as monitoring agencies.

When flood in Pasig river subsides, temporary detained water from Laguna Lake will be discharged to Manila Bay thru the Napindan Channel.
Impacts of flooding due to passage of TS Ondoy (Sep 26, 2009) in Greater Metro Manila
Signatures of a Flood Disaster

Flash Flood in Metro Manila due to TS Ondoy

In 2003, Bankoff described in depth that Metro Manila’s vulnerability to flooding has evolved as a result of the degree of interplay between climate, topography, resource use, and culture over time. The flood due to TS Ondoy in Sep 2009 proved it.

Intense rainfall

Insufficient carrying capacities

High/dense population

High urbanization level

Unabated/rampant development

Deforestation

Informal settlers

Insufficient warnings
Flood depth and duration maps of GMMA due to passage of TS Ondoy in 2009

Flood Depth Map of Ondoy Flood in 2009

Flood Duration Map of Ondoy Flood in 2009
Landslide & Flood hazard Map of Metro Manila after Ondoy

Landslide and Flood Susceptibility Map of Metro Manila

Flood Prone Areas for 2- to 10-year flood cycle
Miranda, 1994: DENR-EMB/CDPWH
Flood Prone Areas for 50-100-year flood cycle
Flood Prone Areas adjacent to creeks
Metro Manila Boundary

All Rights Reserved (July 2000, modified September 2009)
Impacts of Habagat

Duration of continuous rainfall: July 16 – Aug 8 = 24 days

<table>
<thead>
<tr>
<th>Date</th>
<th>Rainfall (mm)</th>
<th>% Monthly Normal Rainfall</th>
<th>TC in PAR</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 Sep 2009</td>
<td>455.0</td>
<td>90.24%</td>
<td>TS Ondoy (Sep 24-27)</td>
<td>TS crossed C. Luzon</td>
</tr>
<tr>
<td>7 Aug 2012</td>
<td>391.4</td>
<td>77.62%</td>
<td>No TC</td>
<td>TS Haikui far N near China</td>
</tr>
<tr>
<td>7 Jun 1967</td>
<td>334.5</td>
<td>66.34%</td>
<td>No TC</td>
<td>TY Billie @ S of Japan</td>
</tr>
<tr>
<td>6 Aug 2012</td>
<td>323.4</td>
<td>64.14%</td>
<td>No TC</td>
<td>TS Haikui far N near China</td>
</tr>
<tr>
<td>8 Aug 2012</td>
<td>292.6</td>
<td>58.03%</td>
<td>No TC</td>
<td>TS Haikui over China</td>
</tr>
<tr>
<td>2 Sep 1970</td>
<td>276.5</td>
<td>54.84%</td>
<td>TS Norming (Sep 2-8)</td>
<td>TS @ NE of Luzon to Taiwan</td>
</tr>
<tr>
<td>4 Sep 2000</td>
<td>267.0</td>
<td>52.96%</td>
<td>TS Maring (Sep 2-8)</td>
<td>TS @ E-NE-W of Luzon</td>
</tr>
</tbody>
</table>

Casualties: 51, injured: 35; & missing: 6
Damages: P406.2 million
Rainfall & Thunderstorm Warning System for Metro Manila

Rainfall Warning System

Max 1-hr for TC events: 75.1 mm
Max 1-hr for Non-TC events: 97 mm
TC events: 55 (51.4%)
Non-TC events: 52 (48.6%)

Source: HMD, PAGASA

Max 1-hr for TC events: 75.1 mm
Max 1-hr for Non-TC events: 97 mm
TC events: 55 (51.4%)
Non-TC events: 52 (48.6%)

Source: HMD, PAGASA

<table>
<thead>
<tr>
<th>RAINFALL VALUES (mm)</th>
<th>MEANING</th>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall of 7.5 to 15 mm per hour is expected to fall and most likely to continue for the next 3 hours.</td>
<td>Community AWARENESS FLOODING is POSSIBLE in low lying areas and near river channels.</td>
<td>Advisory</td>
</tr>
<tr>
<td>Rainfall of more than 15 mm up to 30 mm in 1 hour was observed &amp; most likely to continue or rainfall for the past 3 hours is more than 45 mm to 65 mm.</td>
<td>Community PREPAREDNESS FLOODING is THREATENING in low lying areas and near river channels.</td>
<td>Alert</td>
</tr>
<tr>
<td>Rainfall of more than 30 mm in 1 hour was observed &amp; most likely to continue or rainfall for the past 3 hours is more than 65 mm.</td>
<td>Community RESPONSE SERIOUS FLOODING is EXPECTED Take necessary precautionary measures.</td>
<td>Emergency</td>
</tr>
</tbody>
</table>

Thunderstorm Warning System

<table>
<thead>
<tr>
<th>WARNING</th>
<th>MEANING</th>
<th>DISSEMINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information</td>
<td>Thunderstorm is less likely to develop in the Metro Manila area</td>
<td>This will be disseminated thru website</td>
</tr>
<tr>
<td>Watch</td>
<td>Thunderstorm formation is likely within the next twelve (12) hours. This is more general than a warning.</td>
<td>This will be disseminated thru SMS, Twitter, website and fax</td>
</tr>
<tr>
<td>Warning</td>
<td>Thunderstorm is threatening a specific area(s) within the next 2 hours. Updates will be issued as frequent as necessary</td>
<td>This will be disseminated thru SMS, Twitter, website and fax</td>
</tr>
</tbody>
</table>

Innovations in PAGASA’s Warning Services

2. Thunderstorm Warning System

Innovations in PAGASA’s Warning Services

2. Thunderstorm Warning System
Integrated Flood Warning System for Metro Manila

Integrated Network & Warning System

- EFCOS (JICA) - MMDA
- KOICA - PAGASA
- CIDA - PAGASA

Facilities:
- Rainfall stations (10 KOICA; 6 EFCOS; 22 CIDA)
- Water level stations (10 KOICA; 1 CIDA; -- EFCOS)
- Automatic Weather Station (AWS): 4 – KOICA
- Warning Stations (20 along Pasig-Marikina – KOICA; 4 along Manggahan Floodway – EFCOS)

Real-time access of Radar data, AWS, Rainfall & Water Level Data & Rainfall Forecasts

Launching: 06 Jul 2012 in Marikina City
EWS for flood – carried out on a river basin approach.

Threshold for Flood Warnings:

### 1. Rainfall intensities

<table>
<thead>
<tr>
<th>Rainfall Values</th>
<th>Meaning</th>
<th>Flood Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall observation of 5 to 9 mm per hour</td>
<td>Awareness</td>
<td>READY</td>
</tr>
<tr>
<td>Rainfall observation 10 to 19 mm/hour</td>
<td>Preparedness</td>
<td>GET SET</td>
</tr>
<tr>
<td>Rainfall observation of 20 mm/hour or more</td>
<td>Response</td>
<td>GO</td>
</tr>
</tbody>
</table>

### 2. Assessment Water Levels

<table>
<thead>
<tr>
<th>Station Name</th>
<th>Gauge Datum</th>
<th>Assessment Levels</th>
<th>Actual Water Level (m)</th>
<th>Meaning</th>
<th>Flood Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Burgos</td>
<td>25.00</td>
<td>Alert 22.40, Alarm 23.00, Critical 23.60</td>
<td>22.40 m</td>
<td>Awareness</td>
<td>READY</td>
</tr>
<tr>
<td>2. San Mateo</td>
<td>27.41</td>
<td>Alert 16.50, Alarm 17.50, Critical 18.50</td>
<td>23.00 m</td>
<td>Preparedness</td>
<td>GET SET</td>
</tr>
<tr>
<td>3. Mindanao</td>
<td>28.00</td>
<td>Alert 28.00, Alarm 29.00, Critical 30.00</td>
<td>23.60 m</td>
<td>Response</td>
<td>GO</td>
</tr>
<tr>
<td>4. Tumana</td>
<td>27.73</td>
<td>Alert 16.00, Alarm 17.00, Critical 18.00</td>
<td>22.40 m</td>
<td>Awareness</td>
<td>READY</td>
</tr>
<tr>
<td>5. Sto. Niño</td>
<td>24.73</td>
<td>Alert 15.00, Alarm 16.00, Critical 17.00</td>
<td>23.00 m</td>
<td>Preparedness</td>
<td>GET SET</td>
</tr>
<tr>
<td>6. Marcos Highway</td>
<td>22.60</td>
<td>Alert 13.50, Alarm 14.50, Critical 15.50</td>
<td>23.60 m</td>
<td>Response</td>
<td>GO</td>
</tr>
<tr>
<td>8. Rosario J.S.</td>
<td>12.50</td>
<td>Alert 12.50, Alarm 13.20, Critical 13.80</td>
<td>23.00 m</td>
<td>Preparedness</td>
<td>GET SET</td>
</tr>
<tr>
<td>9. Napindan I</td>
<td>12.00</td>
<td>Alert 10.90, Alarm 11.90, Critical 12.90</td>
<td>23.60 m</td>
<td>Response</td>
<td>GO</td>
</tr>
<tr>
<td>10. Napindan II</td>
<td>15.56</td>
<td>Alert 10.90, Alarm 11.90, Critical 12.90</td>
<td>22.40 m</td>
<td>Awareness</td>
<td>READY</td>
</tr>
</tbody>
</table>

Note:
Values are arbitrary and will be modified when sufficient data becomes available.
3. Preparedness measures
Typical tropical cyclone damage

1
Rice in flowering stage may suffer significant damage.
Some nipa and cogon houses may be partially unroofed.
Sea travel of small sea crafts and fishing boats is risky.

2
Moderate damage to agriculture; Rice and corn adversely affected; Few large trees uprooted; Large number of nipa and cogon house partially or totally unroofed; Travel by land, sea and air is dangerous.

3
Heavy damage to agriculture; Some large trees uprooted; Majority of nipa and cogon houses unroofed or destroyed, considerable damage to structures of light to medium construction; Moderate to heavy disruption of electrical power and communication services; Travel by land, sea and air is dangerous.

4
Widespread damage to infrastructure and agriculture.
3. Preparedness measures

Public Storm Warning Signal Number 1

A tropical cyclone may threaten or affect the locality.

Winds of not more than 60 KPH may be expected in at least 36 hours.

Potential Impacts

- Twigs and branches of small trees may be broken.
- Some banana plants may tilt or land flat on the ground.
- Rice in flowering stage may suffer significant damage.
- Some houses of very light materials (nipa and cogon) houses may be partially unroofed.
- Very light or no damage at all may be sustained by exposed communities.

What to do?

- Listen to your radio for more information about the weather disturbance.
- Check the capacity of the house to withstand strong winds and strengthen the house if necessary.
- Prepare flashlights, batteries, matches, kerosene lamps or candles and charcoal in anticipation of power failure.
- Listen to the latest PAGASA’s Severe Weather Bulletin issued by every 6 hours. In the meantime, business may be carried out as usual except when flood occurs.
- Disaster preparedness plan is activated to alert status.
3. Preparedness measures

Public Storm Warning Signal Number 2

A moderate tropical cyclone may affect the locality.

Winds of not more than 61 to 100 KPH may be expected in at least 24 hours.

Potential Impacts

- Some coconut trees may be tilted with few others broken.
- Few big trees may be uprooted.
- Many banana plants may be downed.
- Rice and corn may be adversely affected.
- Large number of nipa and cogon houses may be partially or totally unroofed.
- Some old galvanized iron roofing may be peeled off.
- Light to moderate damage to the exposed communities.

What to do?

- Special attention should be given to the latest position, the direction and speed of movement as it may intensify and move towards the locality.
- The general public, especially people traveling by sea and air are cautioned to avoid unnecessary risks.
- Secure properties before the signal are upgraded.
- Board up windows or put storm shutters in place and securely fastened.
- Stay at home.
- Disaster preparedness agencies must alert their communities.
### Public Storm Warning Signal Number 3

A strong tropical will affect the locality.

Winds of 101 to 180 KPH may be expected in at least 18 hours.

### Potential Impacts

- Many coconut trees may be broken or destroyed.
- Almost all banana plants may be downed and a large number of trees may be uprooted.
- Majority of nipa and cogon houses maybe unroofed or destroyed and considerable damage to structures of light to medium construction.
- Widespread disruption of electrical power and communication services.
- Moderate to heavy damage maybe experienced in the industrial sectors.

### What to do?

- Keep your radio on and listen to the latest news about typhoon.
- Everybody is advised to stay indoors.
- People are advised to stay in strong buildings.
- Evacuate from low-lying areas.
- Stay away from coastal areas and riverbanks.
- Watch out for the passage of the “Eye Wall” and the “Eye” of the typhoon.
- Disaster preparedness and response agencies are in action with appropriate response to actual emergency.
3. Preparedness measures

<table>
<thead>
<tr>
<th>Public Storm Warning</th>
<th>Potential Impacts</th>
<th>What to do?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Number 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A very strong tropical cyclone will affect the locality.</td>
<td>• Coconut plantations may suffer extensive damage.</td>
<td>• The situation is potentially very destructive to the community.</td>
</tr>
<tr>
<td>Very strong winds of more than 180 KPH may be expected in at least 12 hours.</td>
<td>• Many large trees may be uprooted.</td>
<td>• Stay in safe houses or evacuation centers !!!</td>
</tr>
<tr>
<td></td>
<td>• Most residential and institutional buildings of mixed construction material may be severely damaged.</td>
<td>• All travels and outdoor activities should be cancelled.</td>
</tr>
<tr>
<td></td>
<td>• Electrical power distribution and communication services may be severely disrupted.</td>
<td>• Generally, damage to affected communities can be very heavy.</td>
</tr>
<tr>
<td></td>
<td>• Damage to affected communities can be very heavy.</td>
<td>• The National Disaster Risk Reduction Office and other disaster response organizations are now fully responding to emergencies and in full readiness to immediately respond to possible calamity.</td>
</tr>
</tbody>
</table>
BEFORE THE FLOOD:
• Find out how often your location is likely to be flooded.
• Know the flood warning system in your community and be sure your family knows it.
• Keep informed of daily weather condition.
• Designate an evacuation area for the family and livestock.
• Assign family members instructions and responsibilities according to an evacuation plan.
• Keep a stock of food which requires little cooking and refrigeration; electric power may be interrupted.
• Keep a transistorized radio and flashlight with spare batteries, emergency cooking equipment, candies, matches and first aid kit handy in case of emergency.
• Store supplies and other household effects above expected flood water level. Securely anchor weak dwellings and items.

WHEN WARNED OF FLOOD:

• Watch for rapidly rising flood waters.
• Listen to your radio for emergency instructions.
• If you find it necessary to evacuate, move to a safe area before access is cut off by flood waters.
• Store drinking water in containers, water service may be interrupted.
• Move household belongings to upper levels.
• Get livestock to higher grounds.
• Turn off electricity at the main switch in the building before evacuating and also lock your house.

DURING THE FLOOD:

- Avoid areas subject to sudden flooding.
- Do not attempt to cross rivers of flowing streams where water is above the knee.
- Beware of water-covered roads and bridges.
- Avoid unnecessary exposure to the elements.
- Do not go swimming or boating in swollen rivers.
- Eat only well-cooked food. Protect leftovers against contamination.
- Drink clean or preferably boiled water ONLY.
AFTER THE FLOOD:

- Re-enter the dwellings with caution using flashlights, not lanterns or torches.
- Flammables may be inside. Be alert for fire hazards like broken wires.
- Do not eat food and drink water until they have been checked for flood water contamination.
- Report broken utility lines (electricity, water, gas and telephone) to appropriate agencies authorities.
- Do not turn on the main switch or use appliances and other equipment until they have been checked by a competent electrician.
- Consult health authorities for immunization requirements.
- Do not go in disaster areas. Your presence might hamper rescue and other emergency operations.

http://noah.dost.gov.ph/

NOAH Screenshots

Coverage of Subic & Tagaytay Doppler Radars

% Chance of Rain

Extent of a 10-year return period flood in Marikina

Extent of a 25-year return period flood in Marikina

Extent of a 50-year return period flood in Marikina

Real-time Stream gage data
Thank you for your attention.

The source of man's unhappiness is his ignorance of Nature.

- Paul Henry Thiry d'Holbach