

# 4-5. Contingency Planning

## ICHARM



United Nations  
Educational, Scientific and  
Cultural Organization



• International Centre for  
• Water Hazard and Risk Management  
• under the auspices of UNESCO



Public Works Research Institute  
National Research and Development  
Agency, Japan

# Proposal of Evidence-based Contingency Planning

## (Formulation of Plan)

Step 1: Understanding current conditions

Step 2: Identifying risk

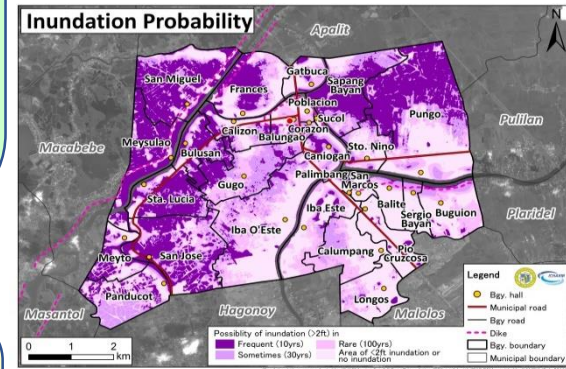
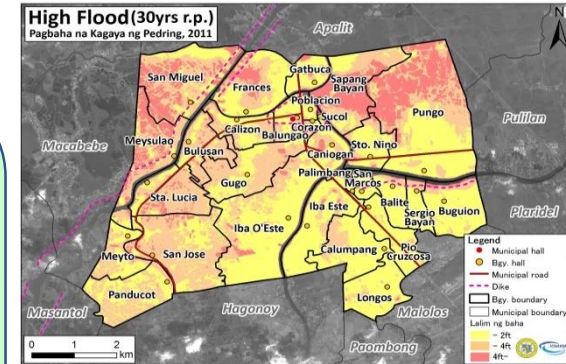
Step 3: Analyzing impact

Step 4: Developing response strategies

## (Documentation and Sharing)

Step 5: Developing evidence-based contingency plans

Step 6: Sharing disaster contingency plans



# Case Study Area of the Project since April. 2014

## Pampanga River Basin:

Catchment Area: 10,434 km<sup>2</sup>

River Length: 260 km

Average annual rainfall:  
2155 mm/year

## Calumpit Municipality:

Population: 112,007

Barangay(Local community unit): 29

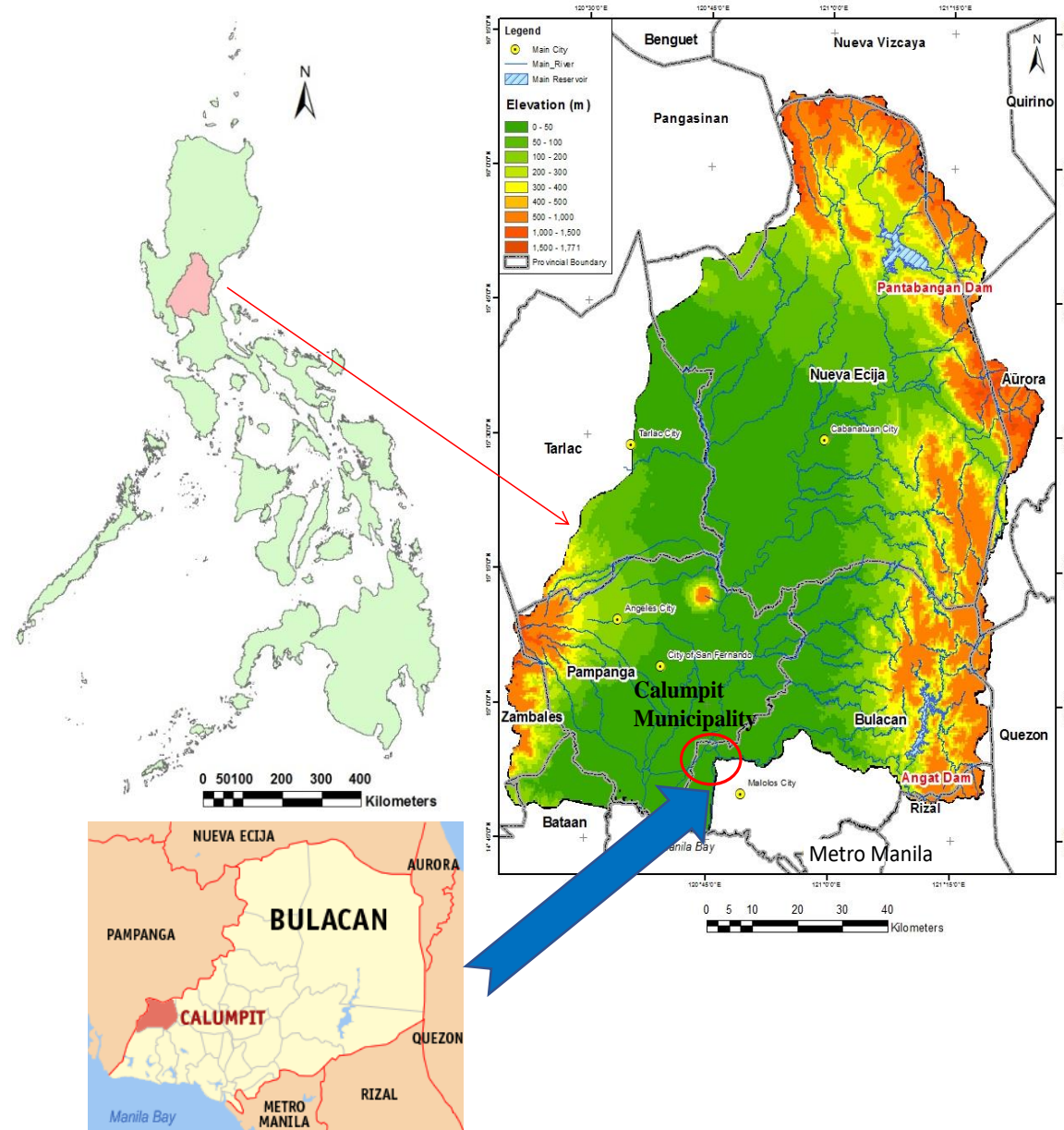
Households: 22,402

Area: 5,625 ha

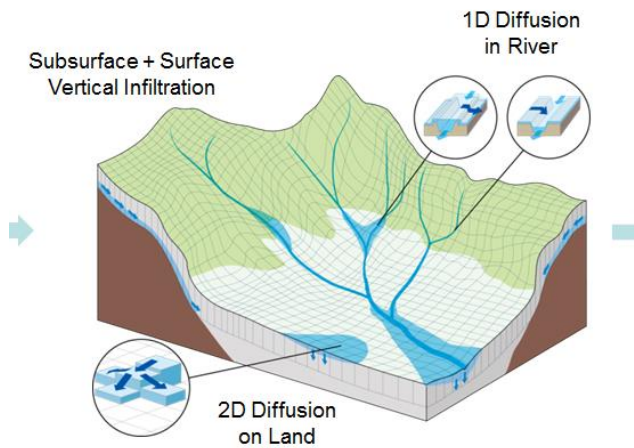
## 2011 Typhoon Pedring



Source: OCD-3/PRFFWC



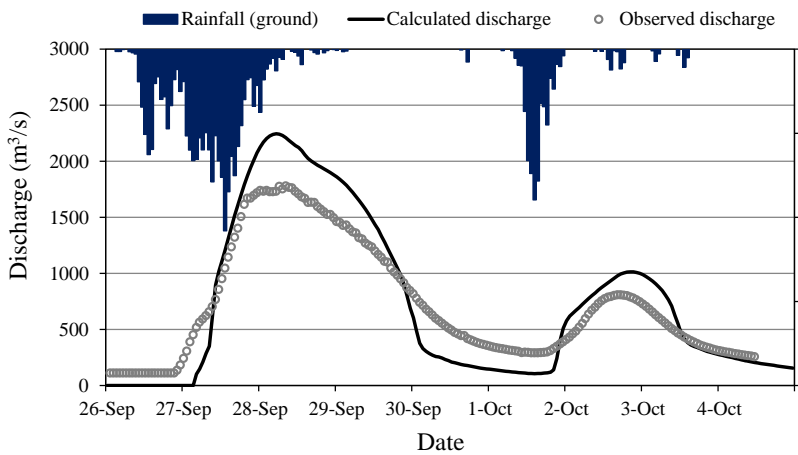
# Flood Simulation by Rainfall-Runoff-Inundation Model



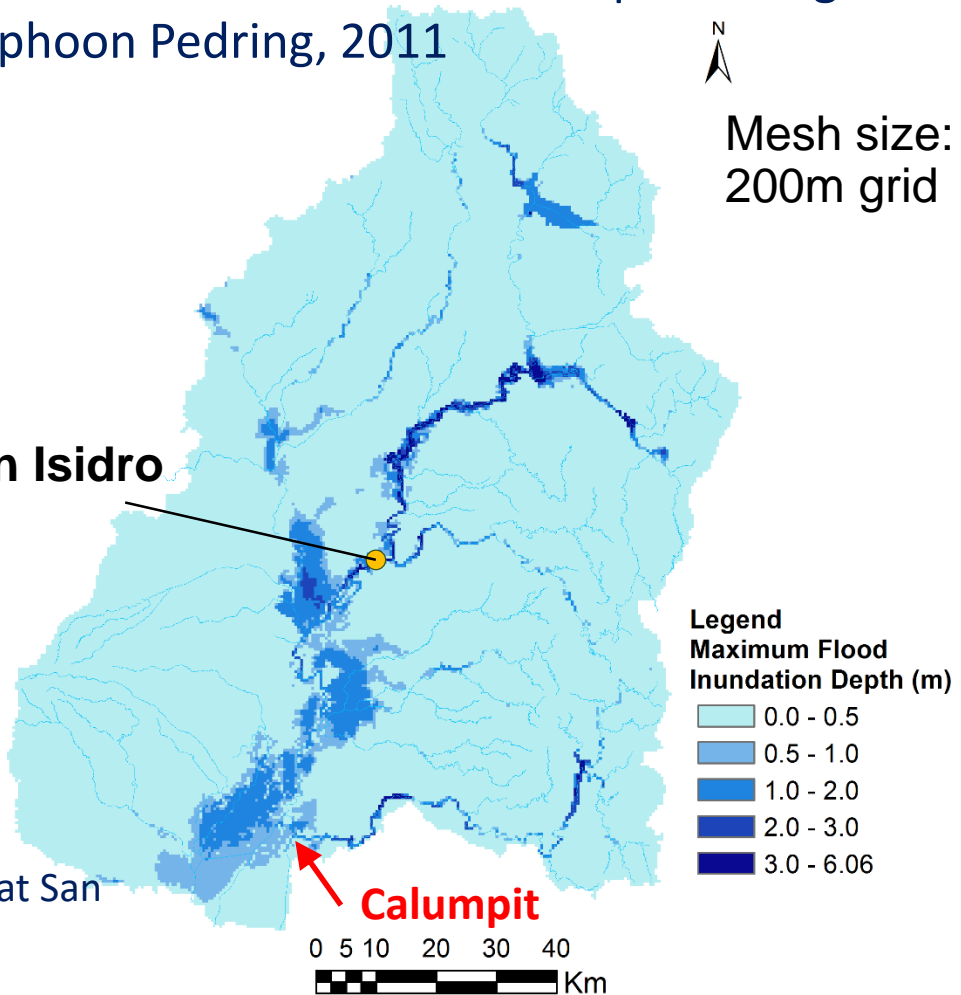
Maximum flood inundation Depth during the Typhoon Pedring, 2011



Mesh size: 200m grid



San Isidro



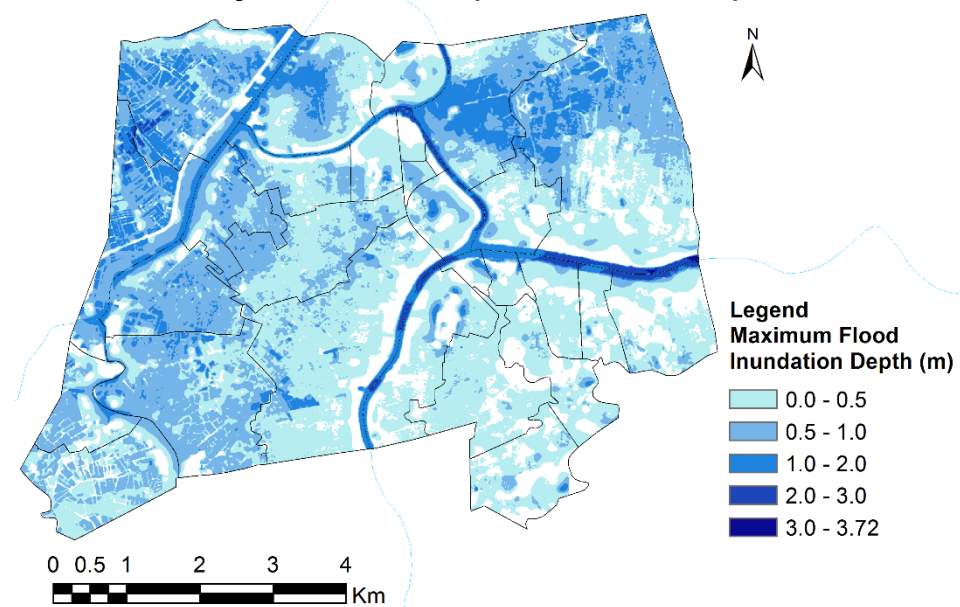
Comparison of calculated and observed discharge at San Isidro Station

Based on statistical analysis using rainfall data at 17 telemetric stations, the return period is approximately 28.3 year.

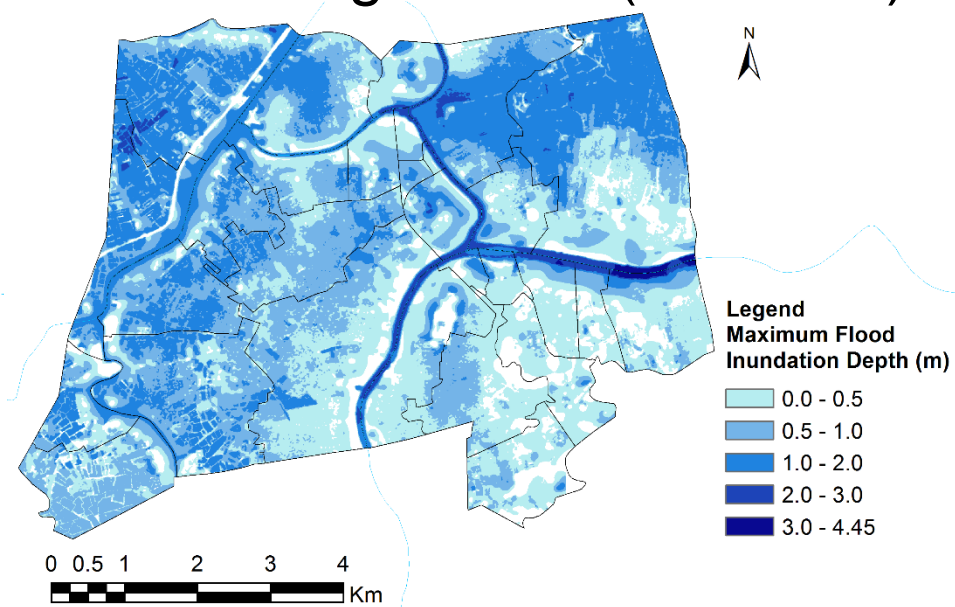


# Inundation Maps

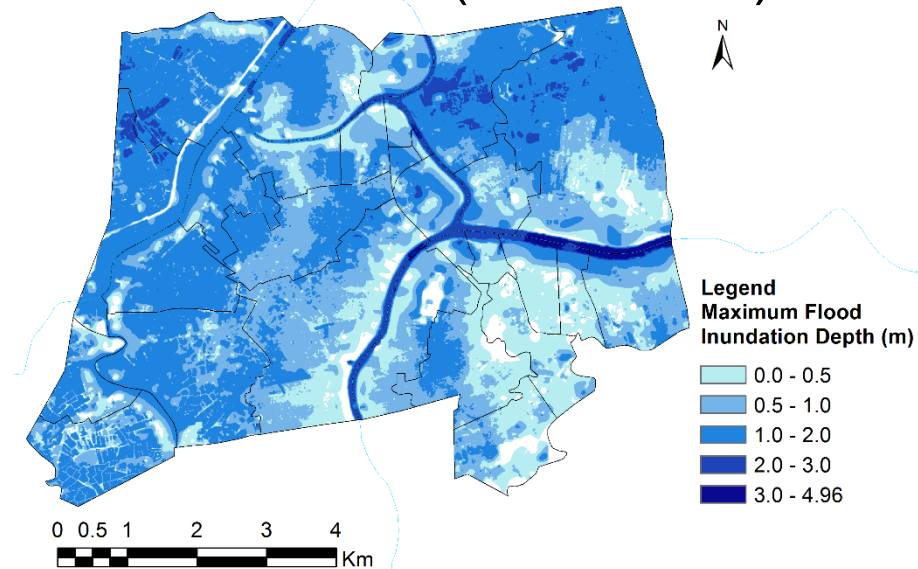
## Ordinary Flood (10 Years)



## High Flood (30 Years)



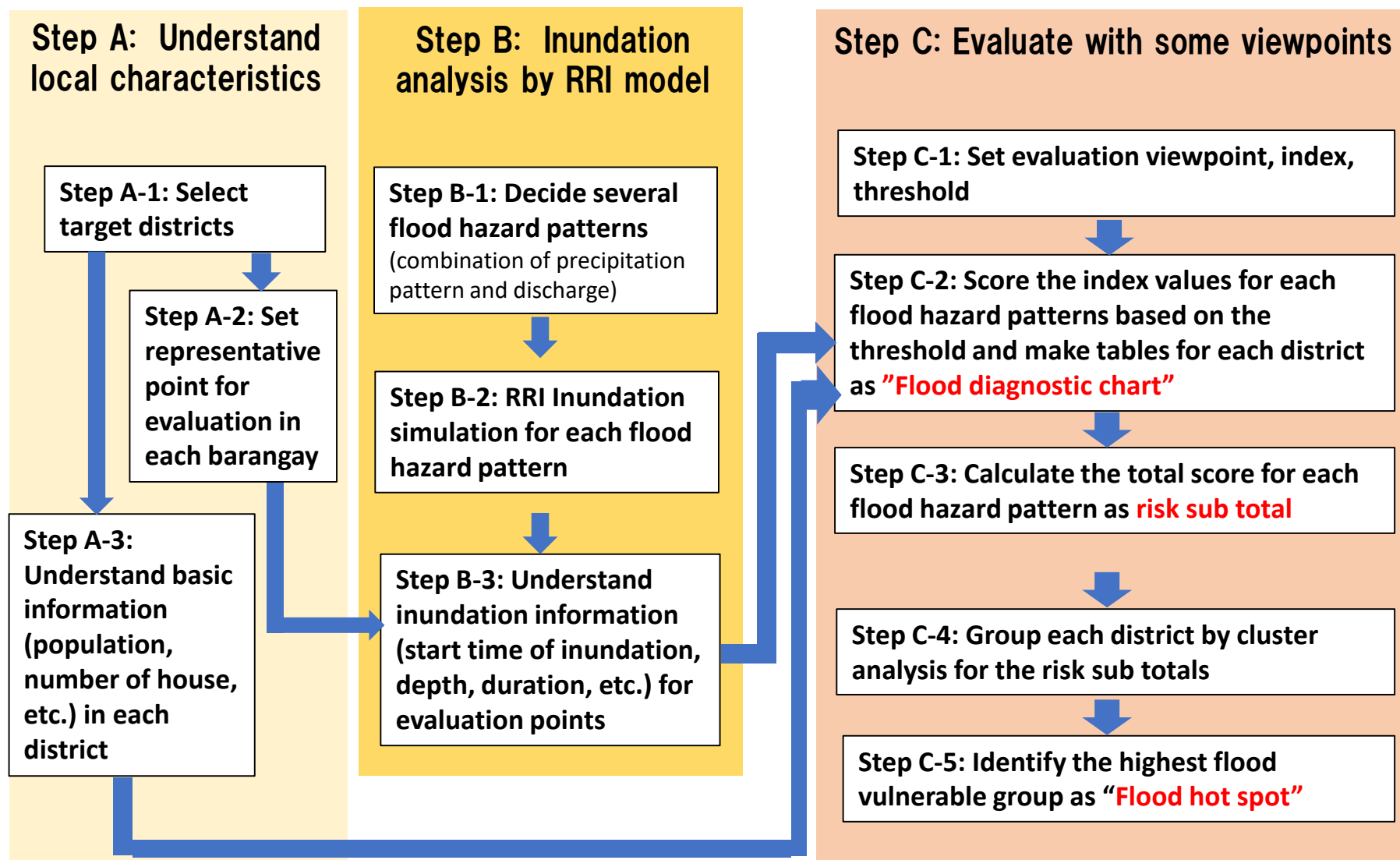
## Extreme Flood (100 Years)



*Interferometric Synthetic Aperture Radar (IfSAR) Data provided by National Mapping and Resource Information Authority (NAMRIA), Philippines, was used in the calculation (grid size/ 5m).*

# Flood Risk Diagnosis Method

A method of flood risk diagnosis developed in Aga Town in Niigata was applied to Calumpit.



# What is important viewpoint for communities?

-① How quickly they need evacuate?

-② How many days they need evacuate?

-How many vulnerable persons will be affected?

-③ How much inundation at Barangay Hall?

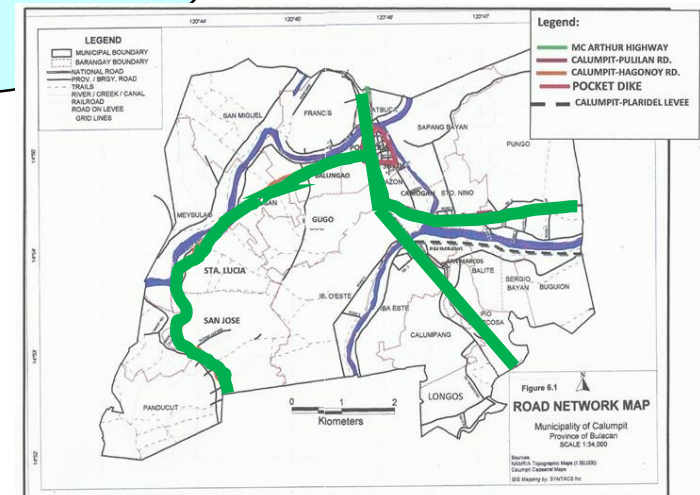
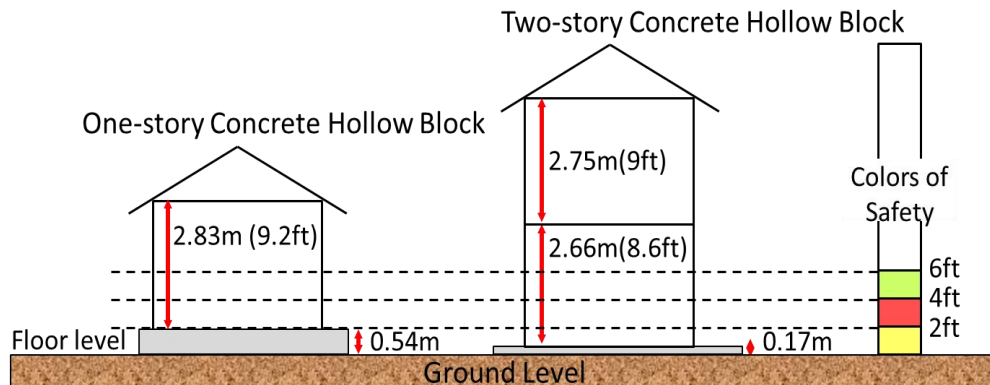
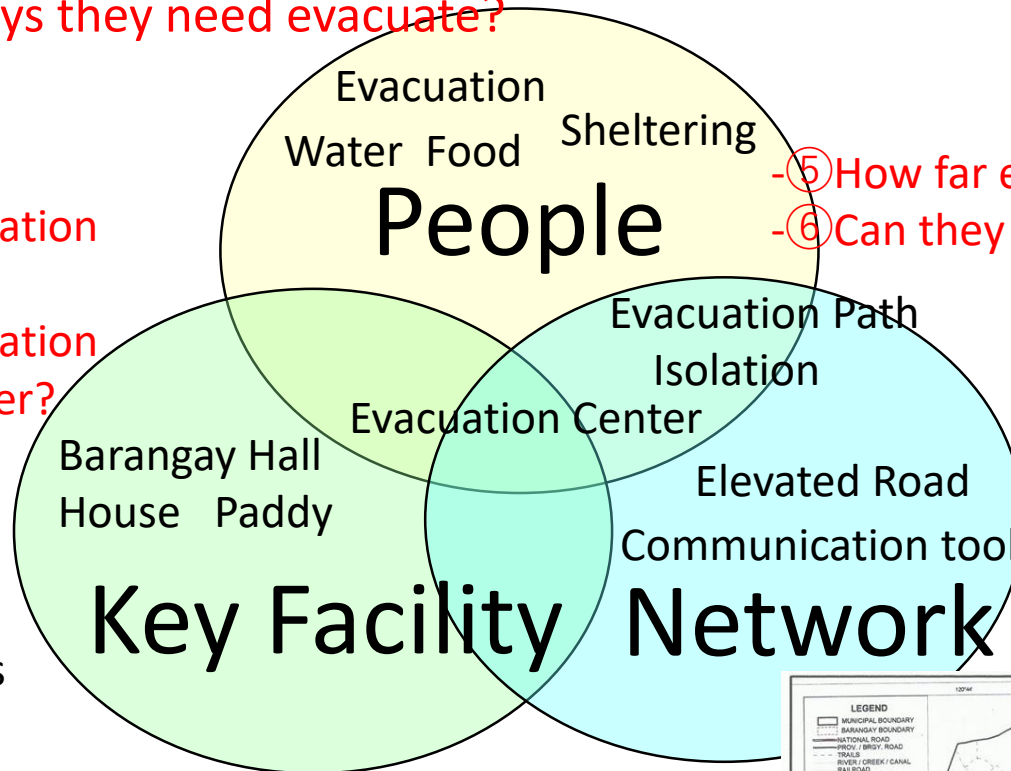
-④ How much inundation Evacuation Center?

-⑤ How far evacuation center is?

-⑥ Can they access to elevated road?

-How many people will be isolated?

-How much wastes will be generated?



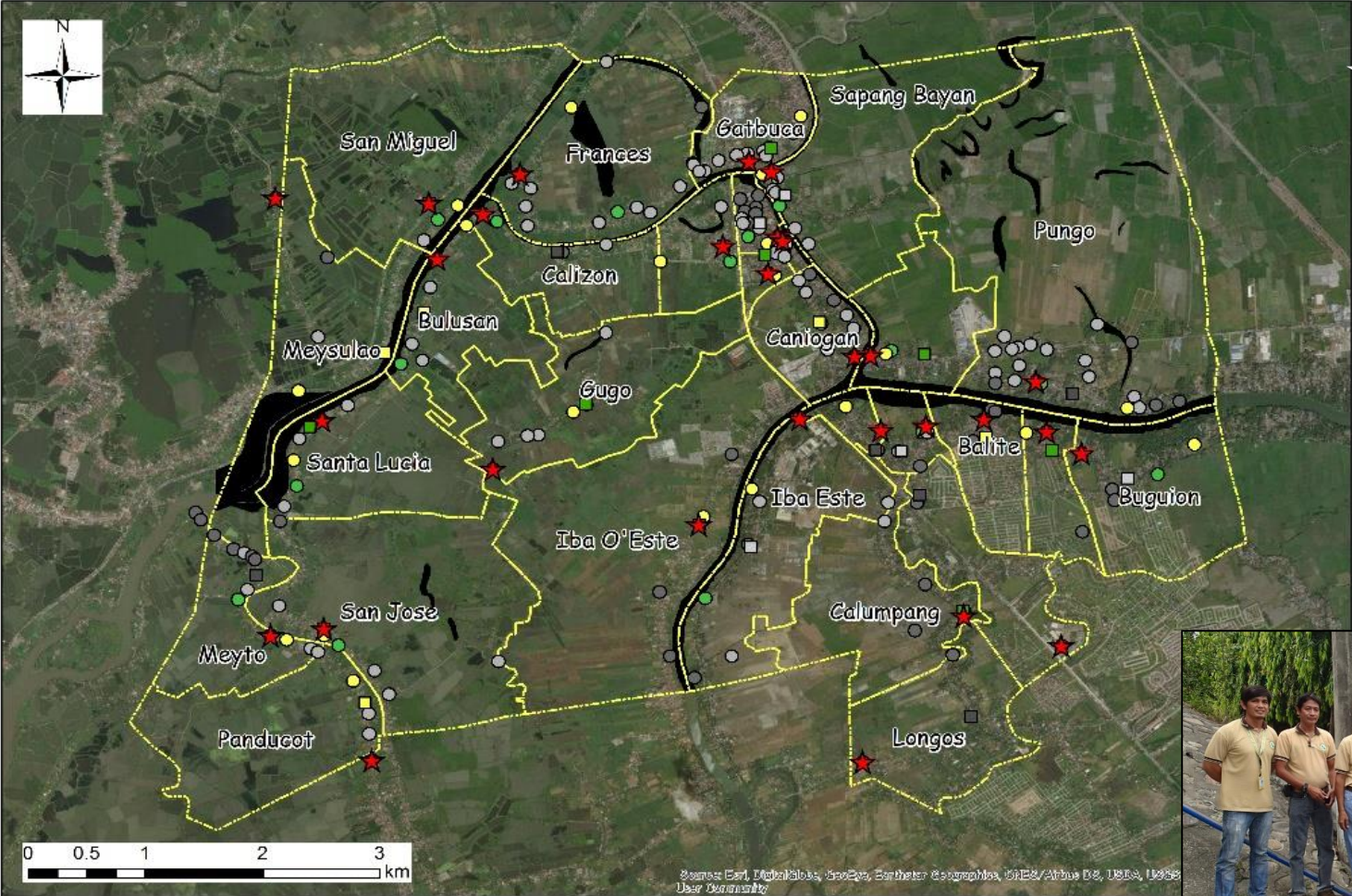
# Step C-1: Set evaluation viewpoint, index, threshold

Viewpoint	Index	Threshold																					
Lead time to start evacuation	Duration of the inundation rising from 0.1m to the first floor level at representative points	<table border="1"> <thead> <tr> <th></th> <th>1story</th> <th>2story</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>-3hr</td> <td>-1hr</td> </tr> <tr> <td>B</td> <td>-6hr</td> <td>-3hr</td> </tr> <tr> <td>C</td> <td>-12hr</td> <td>-6hr</td> </tr> <tr> <td>D</td> <td>-24hr</td> <td>-12hr</td> </tr> <tr> <td>E</td> <td>-48hr</td> <td>-24hr</td> </tr> <tr> <td>F</td> <td>No Flood</td> <td>24hr~</td> </tr> </tbody> </table>		1story	2story	A	-3hr	-1hr	B	-6hr	-3hr	C	-12hr	-6hr	D	-24hr	-12hr	E	-48hr	-24hr	F	No Flood	24hr~
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Duration of evacuation	Duration of the inundation remaining over the first floor level at representative points	<table border="1"> <tbody> <tr> <td>A</td> <td>7days-</td> </tr> <tr> <td>B</td> <td>-7days</td> </tr> <tr> <td>C</td> <td>-3days</td> </tr> <tr> <td>D</td> <td>-1day</td> </tr> <tr> <td>E</td> <td>-0.5day</td> </tr> <tr> <td>F</td> <td>No Flood</td> </tr> </tbody> </table>	A	7days-	B	-7days	C	-3days	D	-1day	E	-0.5day	F	No Flood									
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Maximum Inundation depth	Maximum inundation depth at representative points and Bgy. hall	<table border="1"> <tbody> <tr> <td>A</td> <td>9ft(2.74m)-</td> </tr> <tr> <td>B</td> <td>-9ft(2.74m)</td> </tr> <tr> <td>C</td> <td>-6ft(1.83m)</td> </tr> <tr> <td>D</td> <td>-4ft(1.22m)</td> </tr> <tr> <td>E</td> <td>-2ft(0.61m)</td> </tr> <tr> <td>F</td> <td>No Flood</td> </tr> </tbody> </table>	A	9ft(2.74m)-	B	-9ft(2.74m)	C	-6ft(1.83m)	D	-4ft(1.22m)	E	-2ft(0.61m)	F	No Flood									
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Inundation depth at evacuation centers	Maximum inundation depth at evacuation centers																						
Interruption of transportation between barangay halls and municipal elevated roads	Maximum inundation depth between Bgy. Hall and elevated roads																						
Distance to nearby evacuation centers	Distance from to Barangay hall to nearby evacuation centers	<table border="1"> <tbody> <tr> <td>A</td> <td>2000m-</td> </tr> <tr> <td>B</td> <td>-2000m</td> </tr> <tr> <td>C</td> <td>-1000m</td> </tr> <tr> <td>D</td> <td>-500m</td> </tr> <tr> <td>E</td> <td>-250m</td> </tr> <tr> <td>F</td> <td>-20m</td> </tr> </tbody> </table>	A	2000m-	B	-2000m	C	-1000m	D	-500m	E	-250m	F	-20m									
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# Step A-2: Set representative point for evaluation in each Bgy.

Expected inundation height at the locations of Barangay hall and all the colors of safety due to the flood simulation assuming the 2011 Typhoon Pedring was compared. Then, the location with the highest inundation was selected as the representative point for Barangay.



★ Representative point for evaluation in each Barangay

Photo of "Colors of safety"

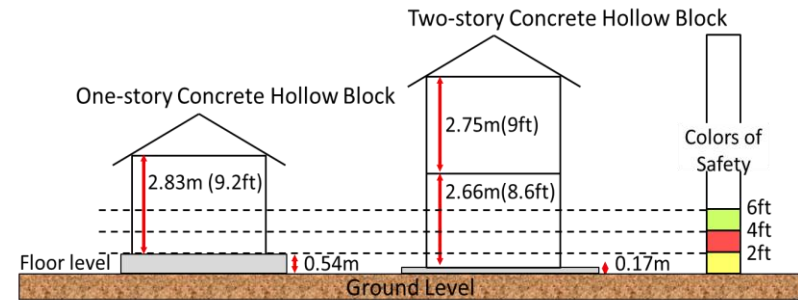




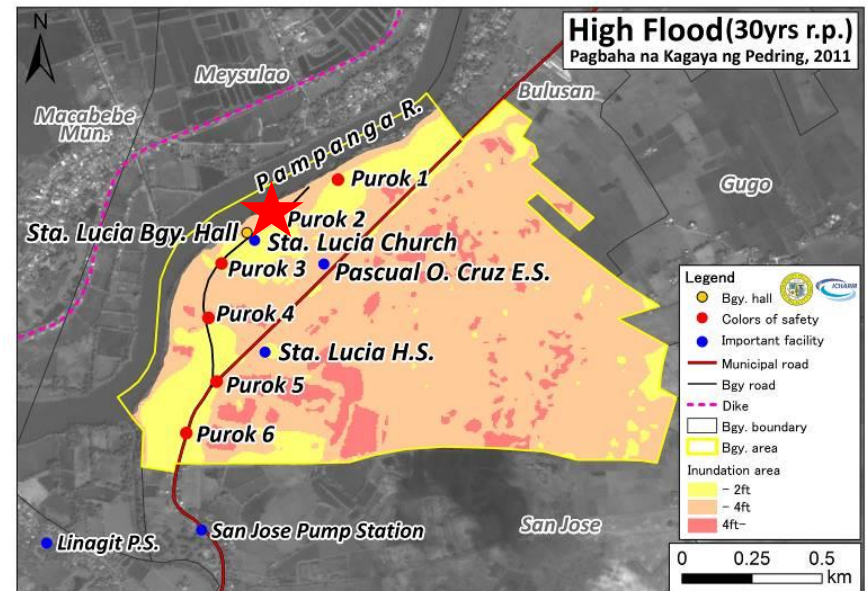
# Step C-2: Make tables for each district as "Flood diagnostic chart"

		100yrs	50yrs	30yrs	10yrs
① Lead time to start evacuation	1story	B	B	B	C
	2story	A	A	A	A
② Duration of evacuation	1story	A	B	B	C
	2story	A	A	B	B
③-1 Inundation depth at representative point		C	C	C	D
③-2 Inundation depth at Barangay Hall		D	D	D	E
④ Inundation depth at evacuation centers		AA	AA	AA	AA
⑤ Distance to nearby evacuation centers		A	A	A	A
⑥ Interruption of transportation		B	C	C	C

## Example of Barangay Santa Lucia along Pampanga River



Google Earth Street View with inundation visualization at the road in front of Bgy. Hall (High Flood Case)



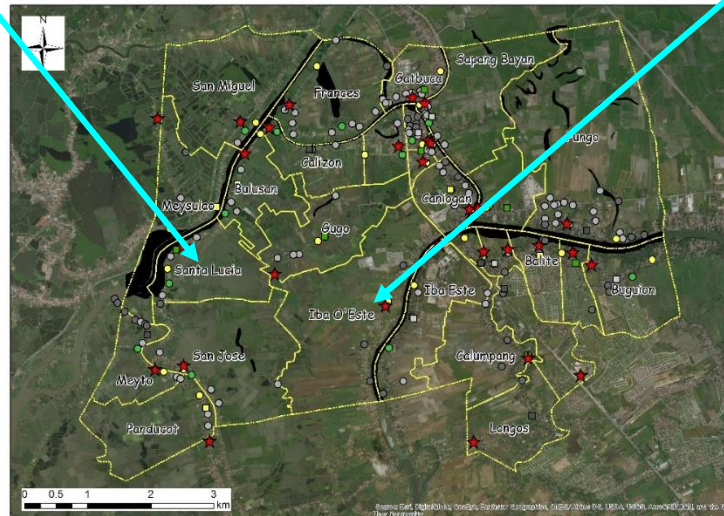
# Step C-2: Make tables for each district as "Flood diagnostic chart"

## Example of Barangay Santa Lucia

		100yrs	50yrs	30yrs	10yrs
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	2story	A	A	A	A
② Duration of evacuation	1story	A	B	B	C
	2story	A	A	B	B
③-1 Inundation depth at representative point		C	C	C	D
③-2 Inundation depth at Barangay Hall		D	D	D	E
④ Inundation depth at evacuation centers		AA	AA	AA	AA
⑤ Distance to nearby evacuation centers		A	A	A	A
⑥ Interruption of transportation		B	C	C	C

## Example of Barangay Iba O' Este

		100yrs	50yrs	30yrs	10yrs
① Lead time to start evacuation	1story	E	E	E	E
	2story	C	E	E	E
② Duration of evacuation	1story	E	E	E	E
	2story	D	E	E	E
③-1 Inundation depth at representative point		D	D	D	D
③-2 Inundation depth at Barangay Hall		E	E	E	E
④ Inundation depth at evacuation centers		D	D	D	E
⑤ Distance to nearby evacuation centers		C	C	C	C
⑥ Interruption of transportation		D	D	D	D

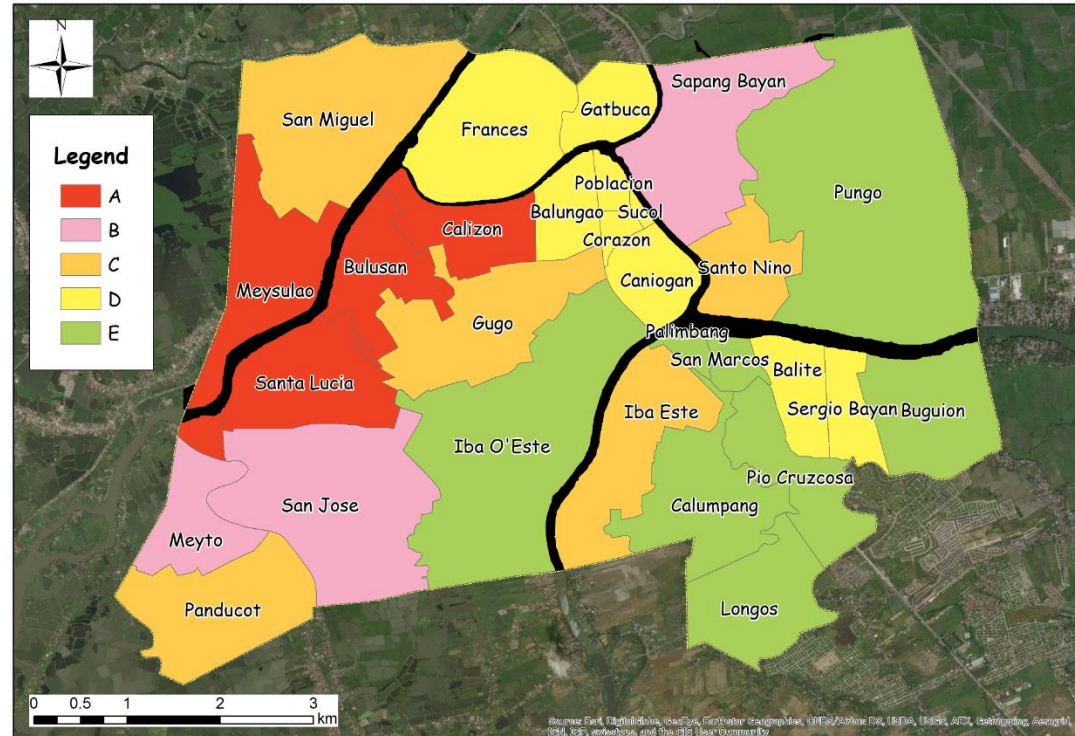


# Step C-3: Calculate total score, Step C-5: Identify **flood hot spot**

Total Score (A:5, B:4, C:3, D:2, E:1)

ID	Location	Sub-total					Total				
		100yr	50yr	30yr	10yr						
01	Sapang Bayan	A	32	A	31	B	29	C	24	B	116
02	Gatbuca	B	25	C	24	C	23	D	16	D	88
03	Frances	B	28	C	24	C	23	C	20	D	95
04	Meysulao	A	31	A	32	A	30	B	28	A	121
05	San Miguel	B	29	B	28	B	25	C	20	C	102
06	Sto. Nino	B	29	B	29	B	27	C	24	C	109
07	Calizon	A	34	A	31	B	29	B	28	A	122
08	Caniogan	B	27	C	23	C	20	D	17	D	87
09	Bulusan	A	33	A	33	A	31	A	30	A	127
10	Sta. Lucia	A	34	A	31	A	31	B	27	A	123
11	Meyto	A	31	B	29	B	28	B	27	B	115
12	Panducot	B	29	B	27	B	25	C	21	C	102
13	San Jose	A	32	B	28	B	28	B	26	B	114
14	Gugo	A	30	B	28	C	23	C	20	C	101
15	Pungo	C	20	D	18	D	18	E	12	E	68
16	Iba O'Este	D	17	E	14	E	14	E	14	E	59
17	Iba Este	B	29	B	29	B	26	C	24	C	108
18	Corazon	B	26	B	25	C	24	D	18	D	93
19	Poblacion	B	26	B	25	C	24	C	20	D	95
20	Balungao	B	26	B	25	C	24	D	17	D	92
21	Sucol	B	27	B	26	B	25	C	21	D	99
22	Balite	B	26	C	24	C	24	D	16	D	90
23	Sergio Bayan	B	26	B	26	C	23	D	16	D	91
24	Buguion	B	27	C	23	C	20	E	12	E	82
25	Palimbang	B	25	C	23	D	18	E	13	E	79
26	Pio Cruzcosa	D	17	E	13	E	11	E	11	E	52
27	San Marcos	C	24	C	22	C	23	D	15	E	84
28	Calumpang	D	15	E	11	E	11	E	10	E	47
29	Longos	B	26	C	22	D	18	E	12	E	78

Identification of Flood Hot Spot  
(Area with rank A)





# What is important viewpoint for communities?

-① How quickly they need evacuate?

-② How many days they need evacuate?

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