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Volta Flood and Drought Management

Introduction to Disaster Risk Assessment

WORLD METEOROLOGICAL ORGANIZATION

VBA

Global Water Partnership West Africa

cima RESEARCH FOUNDATION

In collaboration with

IVM Institute for Environmental Studies

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Understanding disaster risk

Sendai Framework for Disaster Risk Reduction

- Priority 1 = Understanding disaster risk

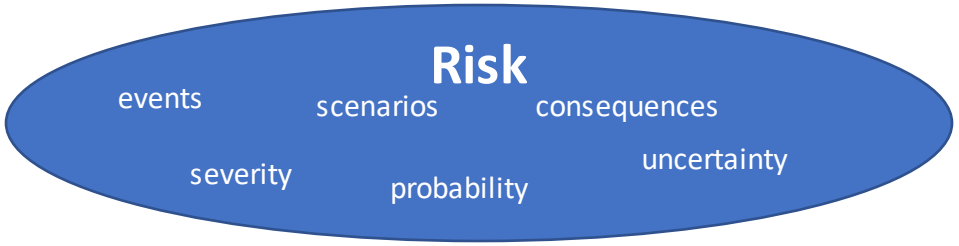
  Disaster risk management should be based on an understanding of disaster risk in all its dimensions of hazard characteristics, exposure of persons and assets, vulnerability, capacity, and the environment. Such knowledge can be used for risk assessment, prevention, mitigation, preparedness and response.

Defining disaster

*"A serious **disruption** of the functioning of a community or a society at any scale **due to hazardous events** interacting with conditions of exposure, vulnerability and capacity, **leading to one** or more of the following: human, material, economic and environmental **losses and impacts**."*
- UNISDR

What is disaster risk?

- ***probability*** *that a particular* ***adverse event*** *occurs during a stated period of time, or results from a particular challenge'. UK's Royal Society (1992)*
- *measure of the* ***probability*** *and* ***severity*** *of adverse effects (Lowrance 1976)*
- *combination of* ***probability*** *of an* ***event*** *and its consequences (ISO2002)*
- *a set of* ***scenarios****, each of which has a* ***probability*** *and a* ***consequence*** *(Kaplan and Garrick 1981; Kaplan 1991)*
- *Risk refers to* ***uncertainty*** *of outcome, of actions and* ***events*** *(UK Cabinet Office, 2002*



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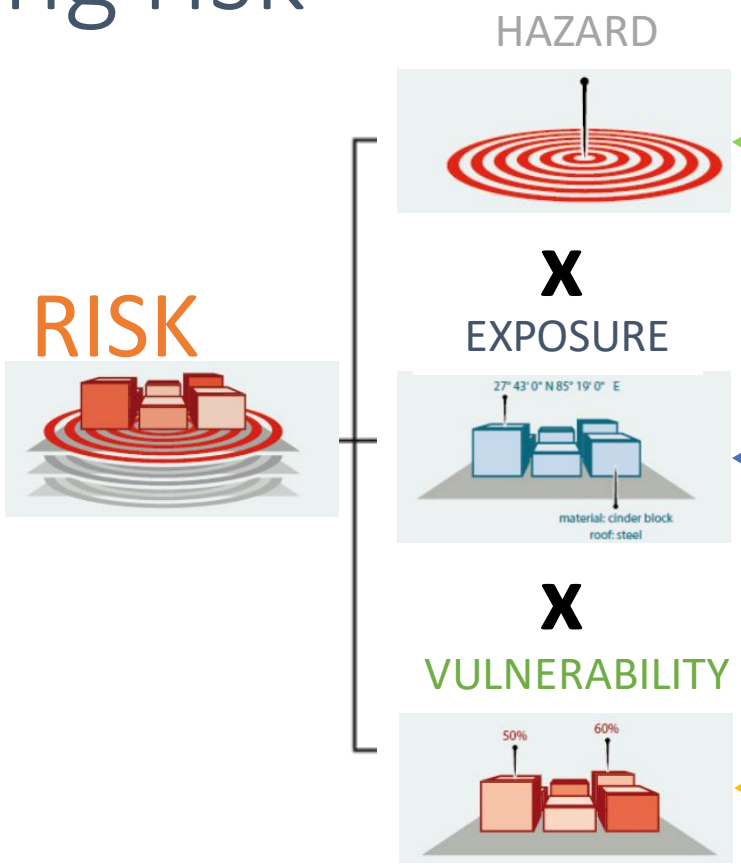
Defining risk

"The **potential loss** of life, injury, or destroyed or **damaged** assets which could occur to a system, society or a community in a **specific period of time**, determined probabilistically as a function of hazard, exposure, vulnerability and capacity. "

- UNISDR

Defining risk

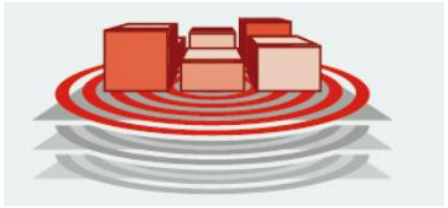


A combination of

- **Intensity and Likelihood of** hazard occurrences
- **Harmful consequences** the associated impacts that these hazards would cause if they occur

Defining risk

Risk =



HAZARD

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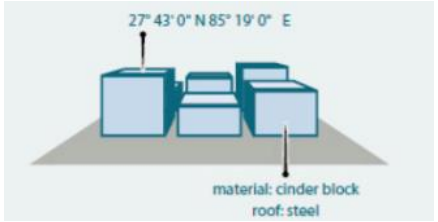
EXPOSURE



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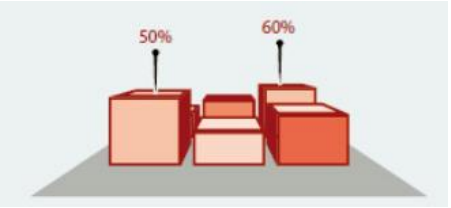
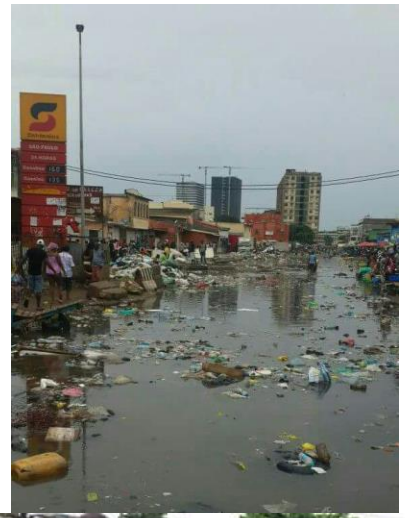
VULNERABILITY

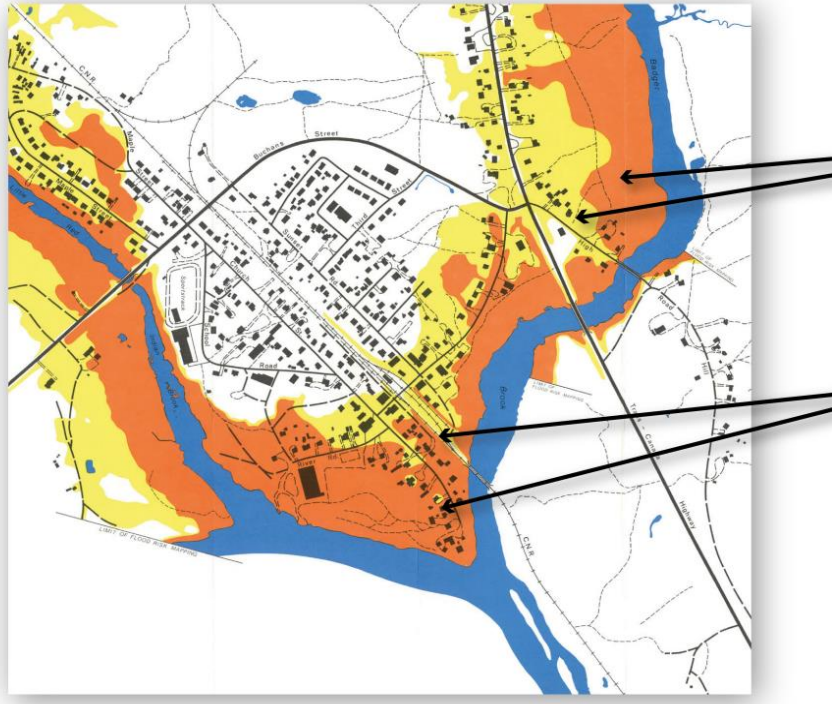


Hazard



*"A **phenomenon**, process or human activity that **may cause** loss of life, injury or other health **impacts**, property damage, loss of livelihoods and services, social and economic disruption, or environmental degradation."*

- UNDRR



Excerpt of flood information map of the Town of Badger, Newfoundland and Labrador, Canada
(c) Newfoundland and Labrador Department of Municipal Affairs and Environment-Water Resources Management Division

Exposure

"The situation of people, infrastructure, housing, production capacities and other tangible human ***assets located in hazard-prone areas****."*

- UNDRR

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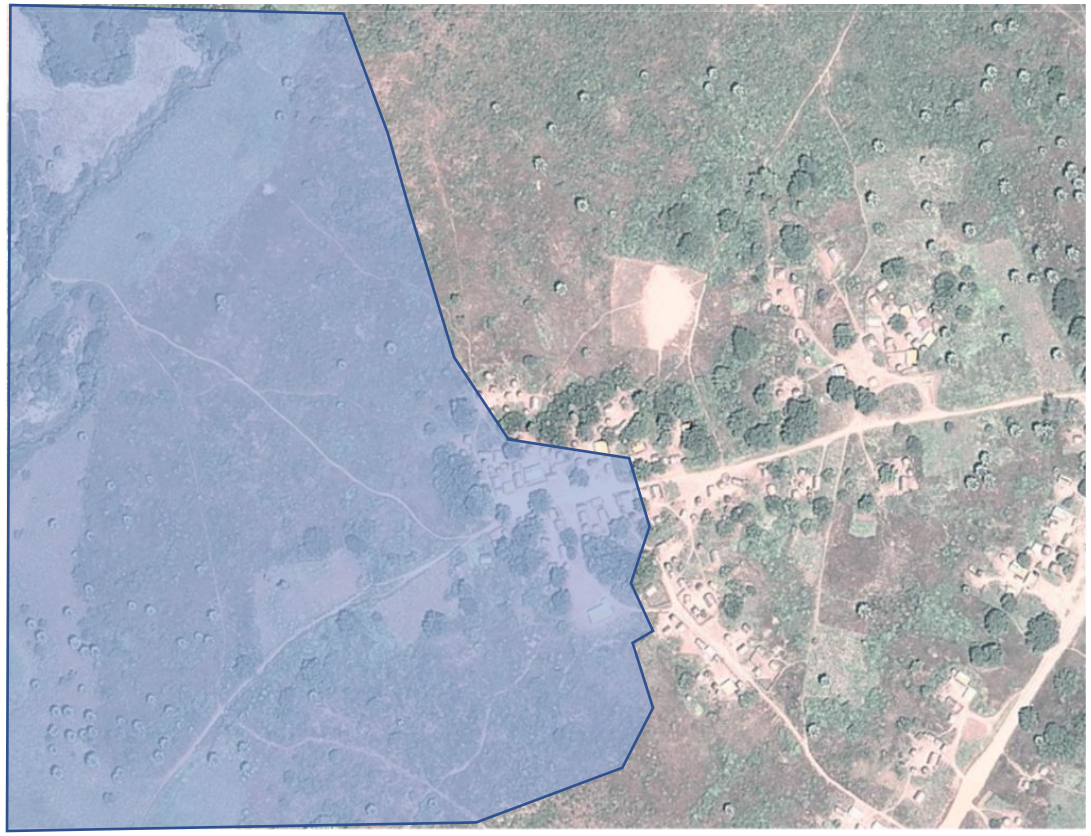
Hazard map layer 1



Hazard map layer 2

Task 1 – Hazard and Exposure

1. Discuss with your team about the different elements that could be exposed

2. List the elements

Time: 7 minutes

TEAM	Hazarp map
Blue	1
Green	1
Orange	2
yellow	2

Exposure examples

- Affected people
- Agriculture (main national crops)
- Productive asset:
  - Energy and industrial
  - Service (commercial)
- Housing
- Critical infrastrucure:
  - Health
  - Education
  - Transportation (road and railways)

Stock and Exposure

Stock: total amount/value of an asset in the study area

Exposure: part of the stock that is in hazard prone area

Stock and Exposure

Type of buildings and value (at asset level):

- Type A (red): **40$** per unit
- Type B (light-blue): **400$** per unit
- Type C (yellow): **4,000$** per unit

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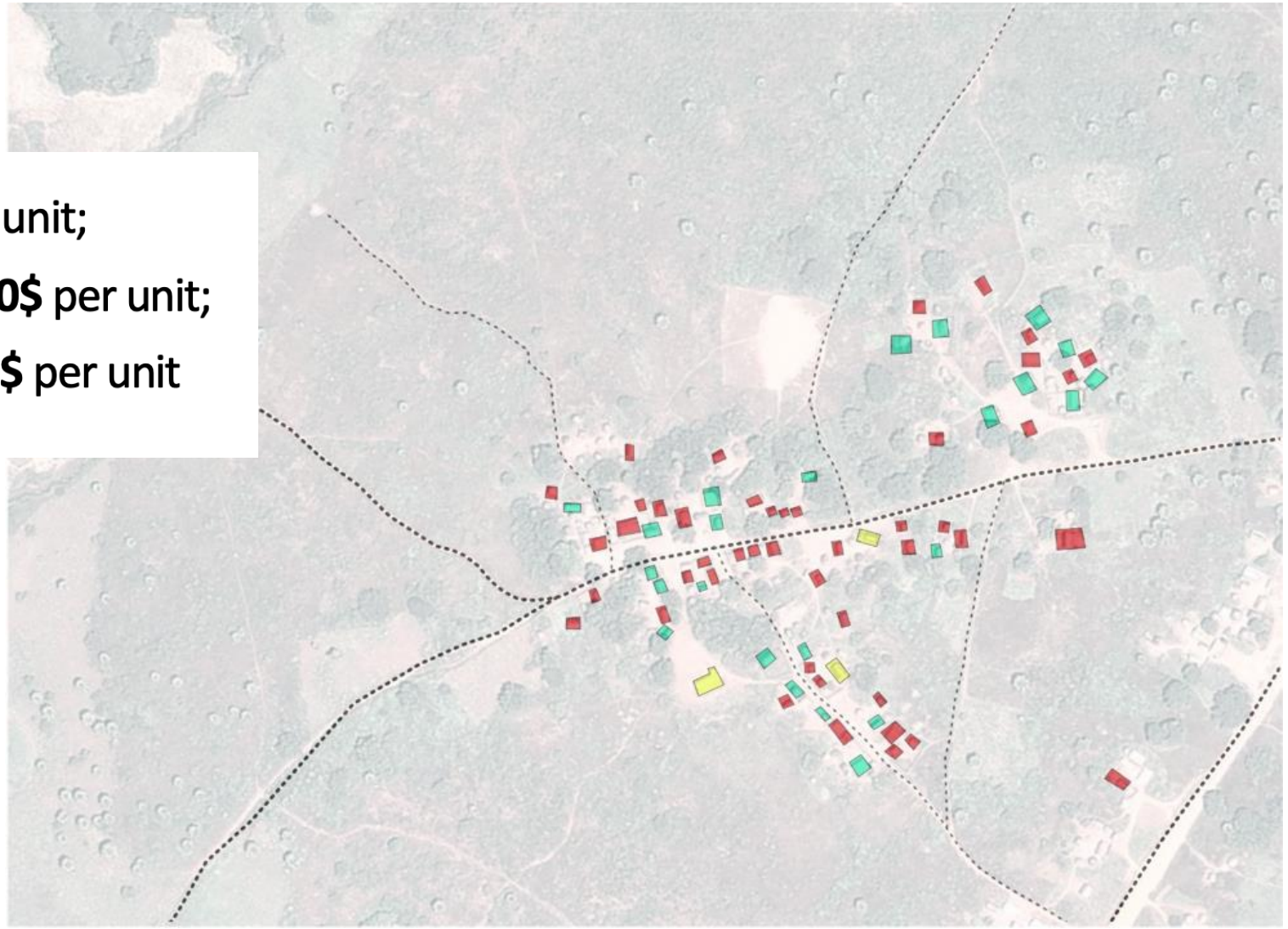
Base map

Stock

- Type A (red): **40$** per unit;
- Type B (light-blue): **400$** per unit;
- Type C (yellow): **4,000$** per unit



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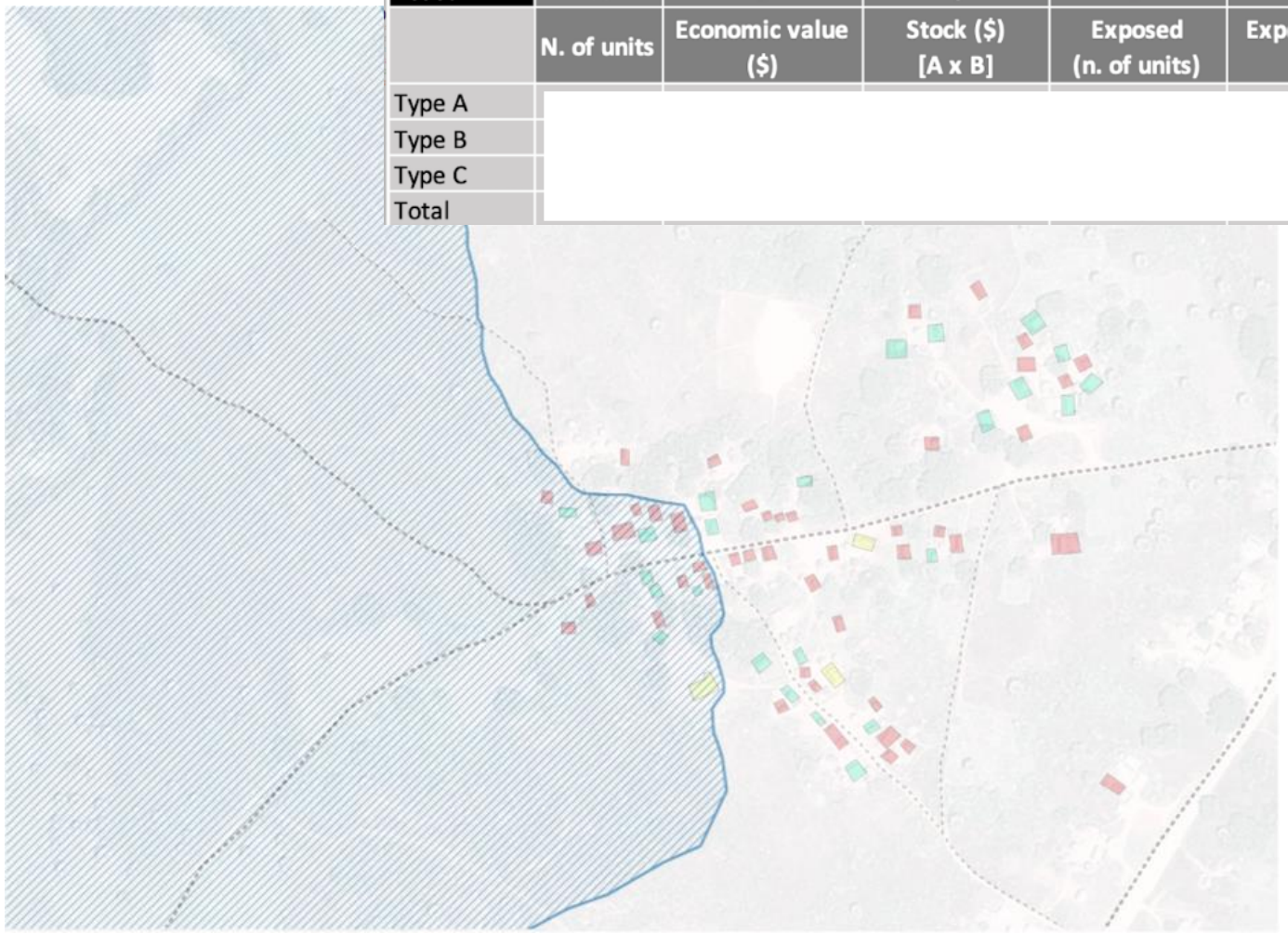
Exposure

- Type A (red): **40$** per unit;
- Type B (light-blue): **400$** per unit;
- Type C (yellow): **4,000$** per unit

Team BLUE

Asset	A	B	C	D	E
	N. of units	Economic value ($)	Stock ($) [A x B]	Exposed (n. of units)	Exposed value ($) [D x B]
Type A					
Type B					
Type C					
Total					



Task 2

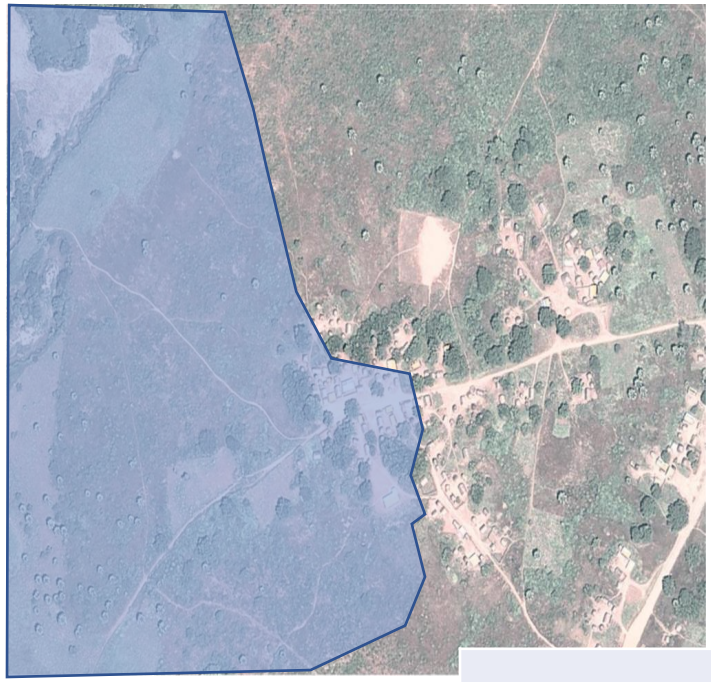
Evaluate the stock and Exposure value and complete the Table

Asset	A	B	C	D	E	F	G	H
	N. of units	**Economic value ($)**	**Stock ($) [A x B]**	**Exposed (n. of units)**	**Exposed value ($) [D x B]**	**Vulnerability index**	**Potential losses ($) [E x F]**	**Percentage of stock lost [G/C]**
Type A								
Type B								
Type C								
TOTAL								

Time: 10 minutes preparation

Group results Task 2 stock and Exposure

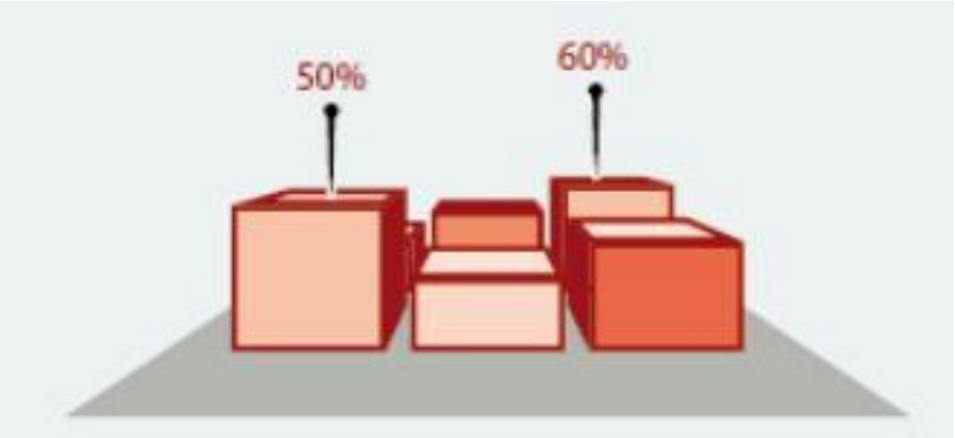
Group	Stock ($)	Exposed value ($)
Blue	23,440	6,880
Orange	23,440	14,800
Yellow	23,440	14,800
Green	23,440	6,880



Group	Stock ($)	Exposed value ($)
Blue	23,440	6,880
Orange	23,440	14,800
Yellow	23,440	14,800
Green	23,440	6,880

Vulnerability

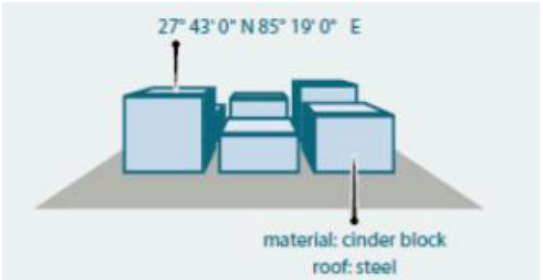
- **Potential for loss**; degree to which life, livelihood, property and other assets is put at risk by a discrete and identifiable event



Source: EU, UN, GoK (2012) PDNA 2008-2011 Drought

Direct Losses and physical damage to asset

Potential Losses = **Exposed Value** × **Vulnerability Index**



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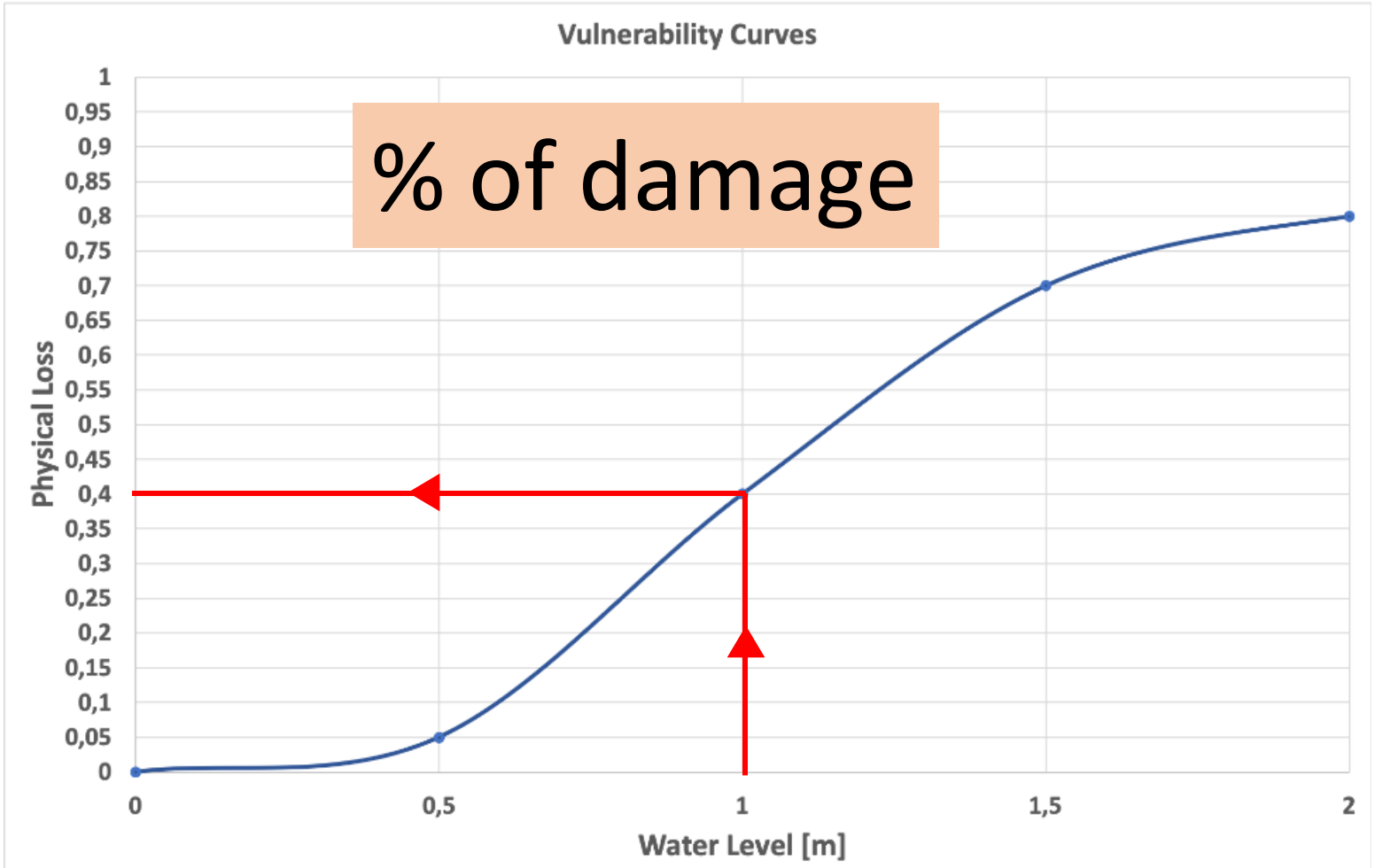
Vulnerability



Flood with water level of 1 m damages the building for about 40% of its value

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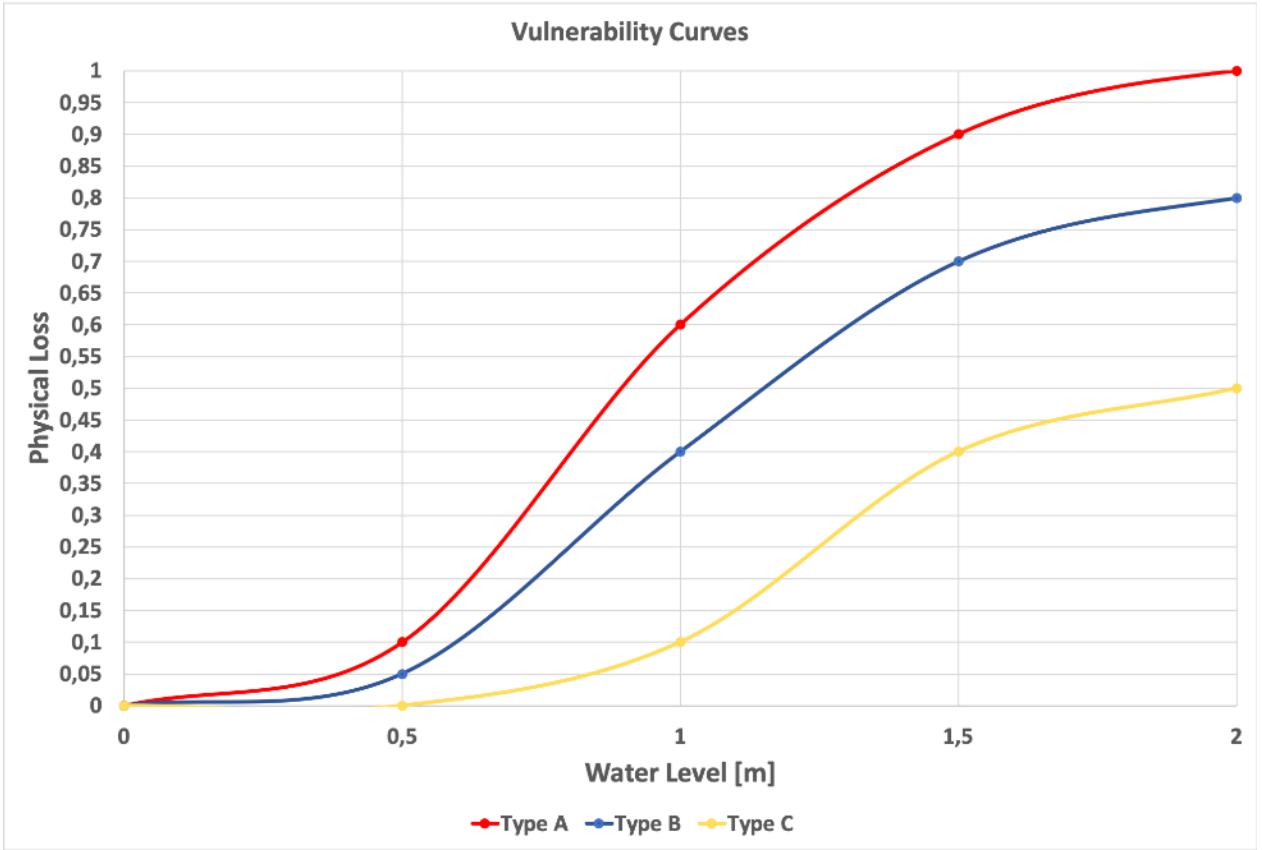
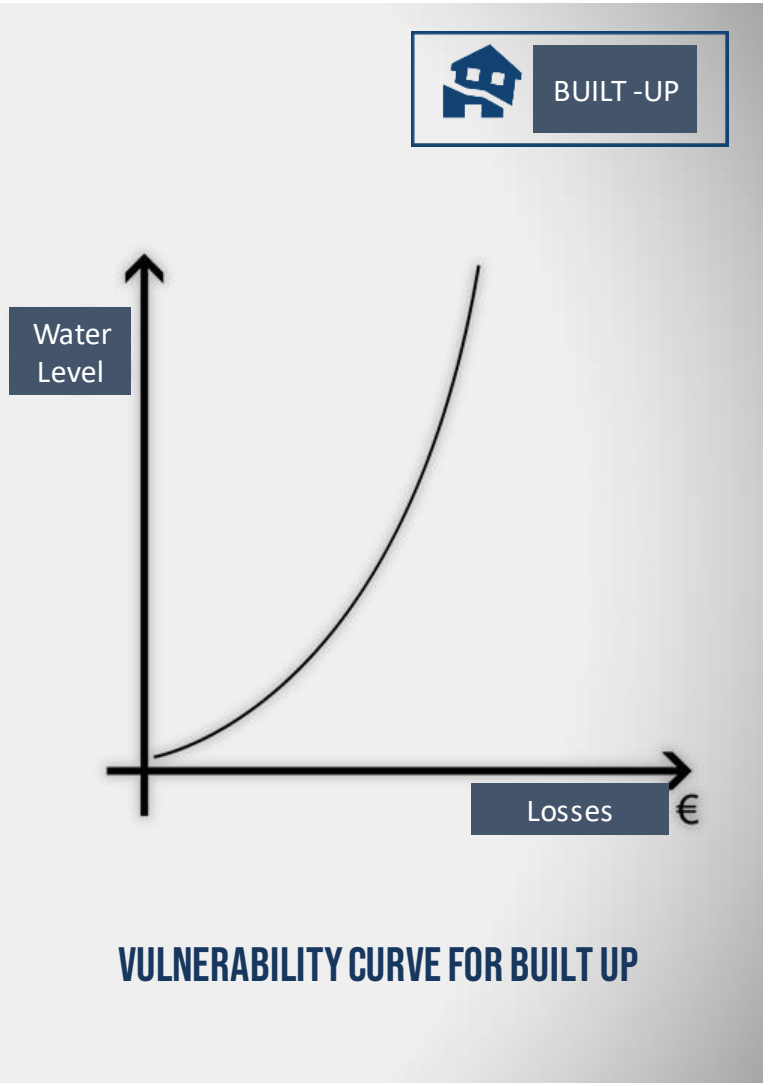
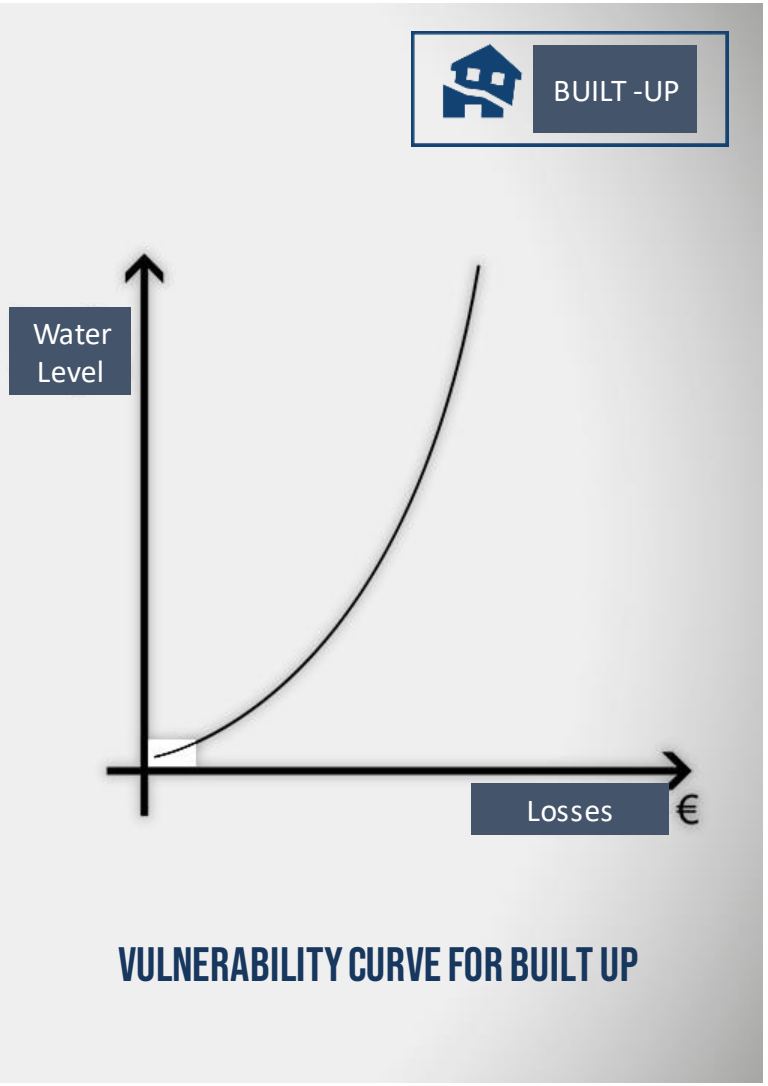
Vulnerability

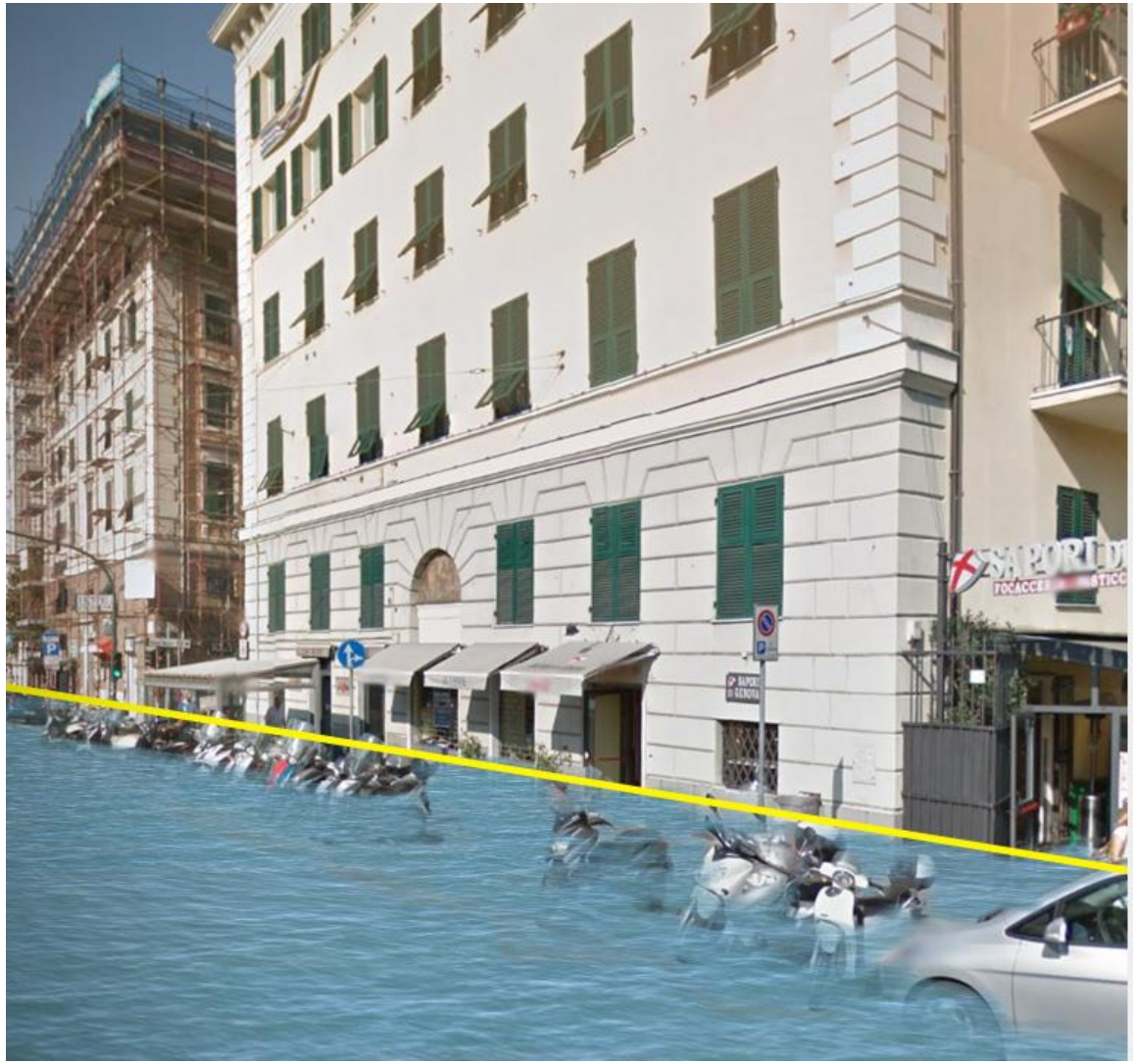


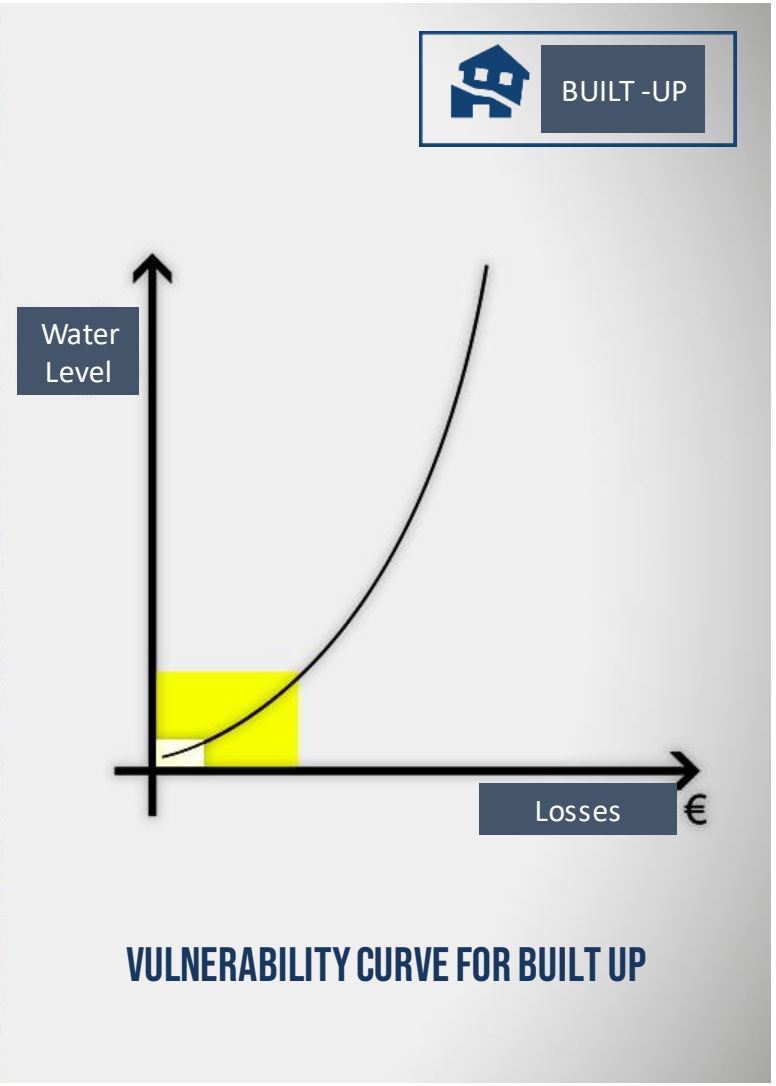


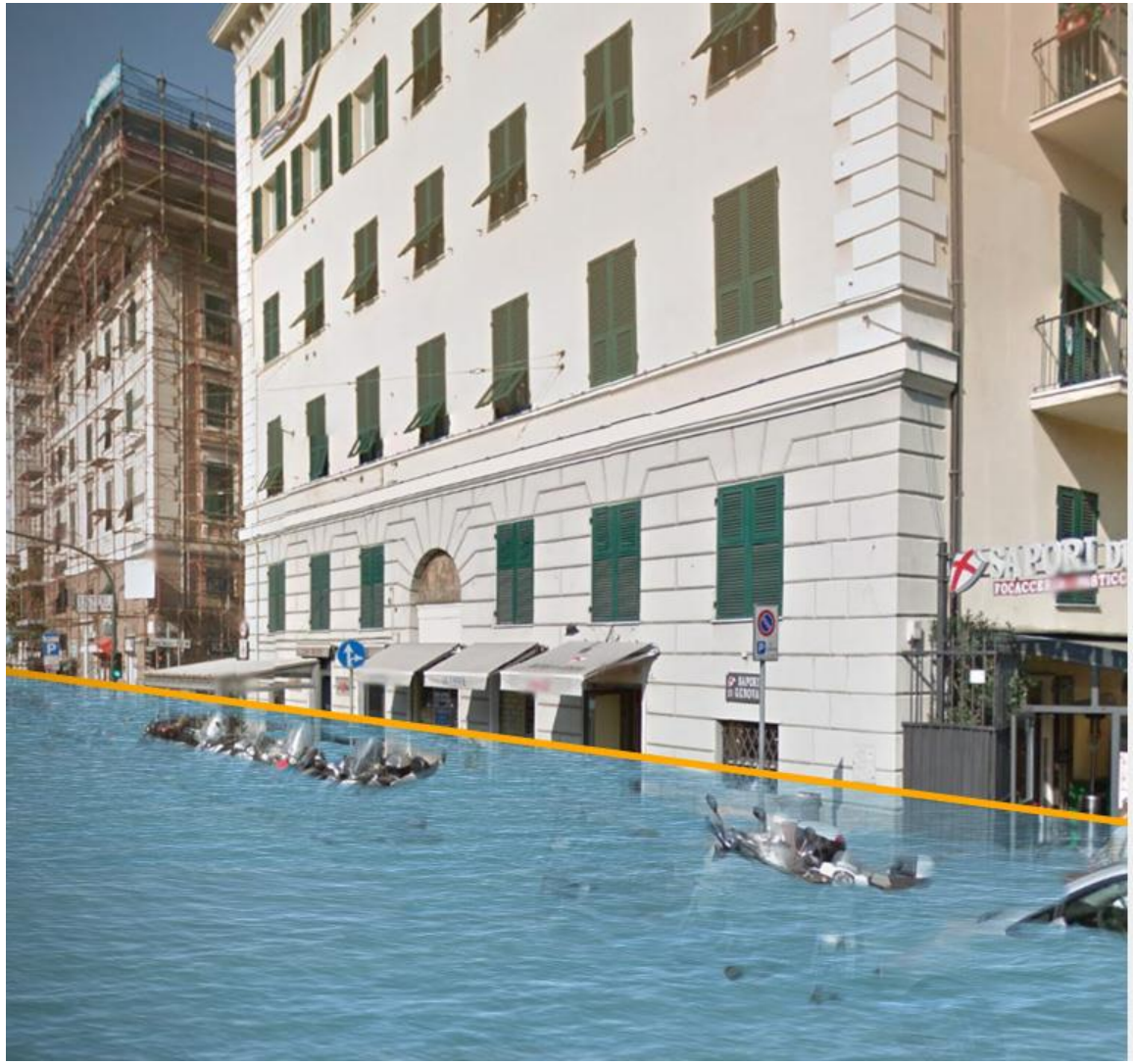
VULNERABILITY CURVE FOR BUILT UP

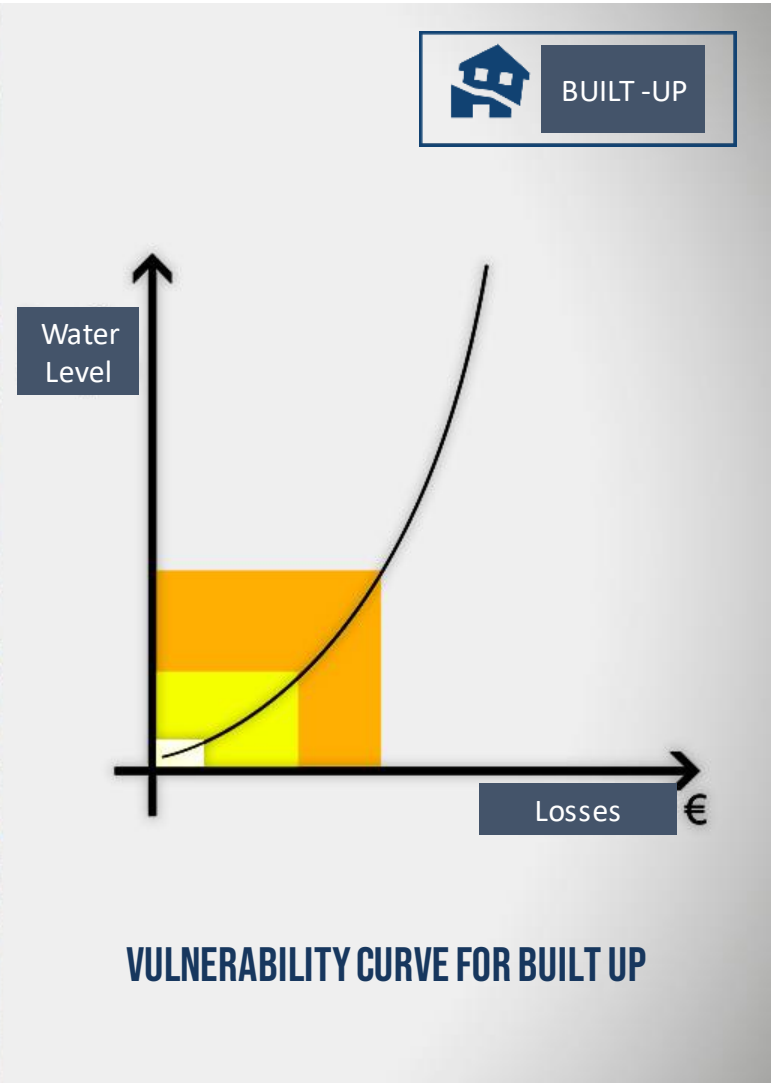


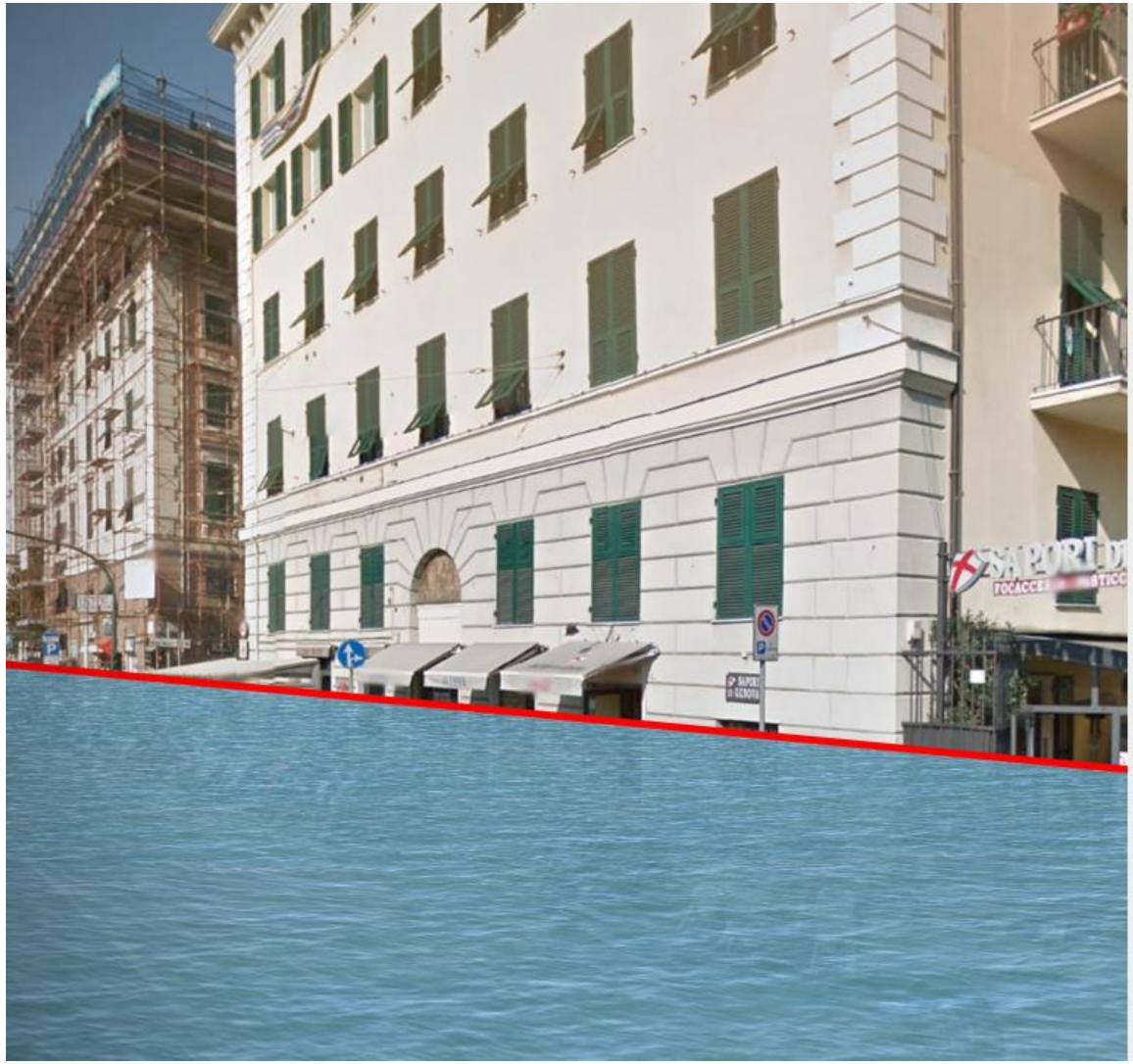
VULNERABILITY CURVE FOR BUILT UP

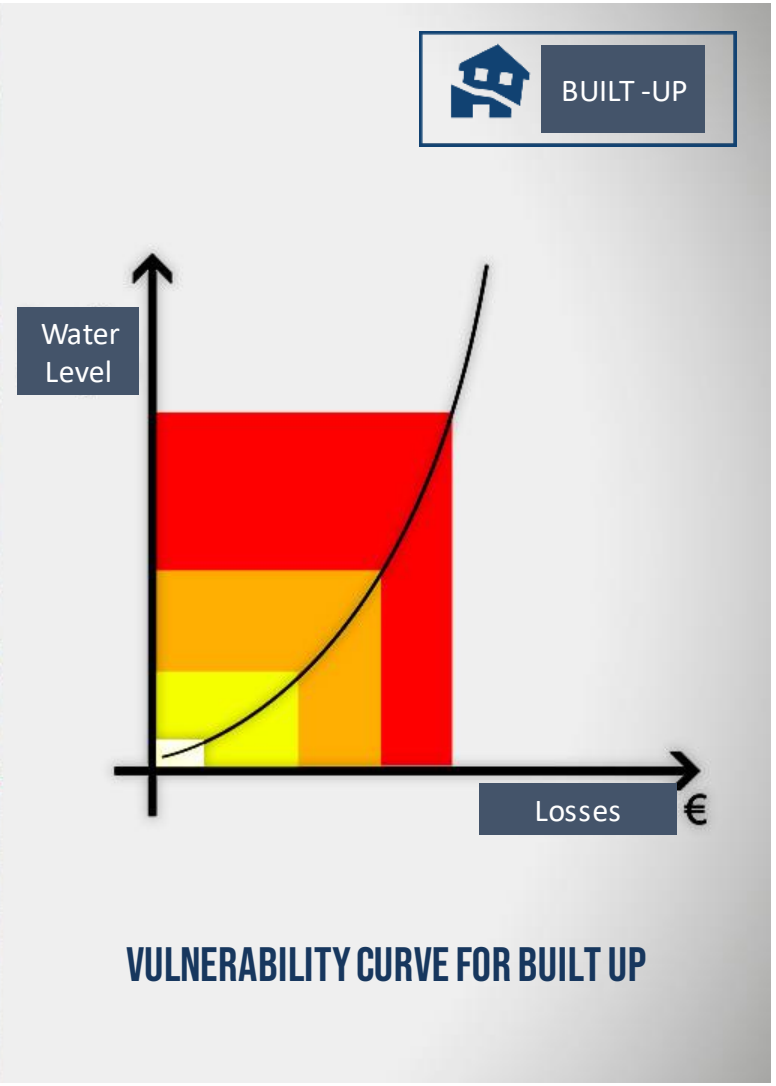



BUILT -UP
Water Level
Losses
€
VULNERABILITY CURVE FOR BUILT UP




BUILT -UP
Water Level
Losses
€
VULNERABILITY CURVE FOR BUILT UP




BUILT -UP
Water Level
Losses
€
VULNERABILITY CURVE FOR BUILT UP

Tasks 3: evaluate potential losses

1. Estimated the Vulnerability Index to each building type.
2. Compute the potential loss [Column G] for Type A, B, C and total.
3. Present the results obtained

Asset	A	B	C	D	E	F	G	H
	N. of units	**Economic value ($)**	**Stock ($) [A x B]**	**Exposed (n. of units)**	**Exposed value ($) [D x B]**	**Vulnerability index**	**Potential losses ($) [E x F]**	**Percentage of stock lost [G/C]**
Type A								
Type B								
Type C								
TOTAL								

TEAM	Hazarp map	Water level [m]
Blue	1	0.5
Green	1	1
Orange	2	1
yellow	2	1.5

Time: 10 minutes preparation + 5 minutes presentation

Group results Task 3 Potential Losses

Asset	C	E	G	H
	Stock ($)	Exposed value ($)	Potential losses ($) [E x F]	Percentage of stock lost [G/C]
Blue	23,440	6,880	1,032	2,7%
Orange	23,440	14,800	3,760	16%
Yellow	23,440	14,800	8,200	34%
Green	23,440	6,880	1,648	7.03%

Team BLUE

Asset	A	B	C	D	E	F	G	H
	N. of units	Economic value ($)	Stock ($) [A x B]	Exposed (n. of units)	Exposed value ($) [D x B]	Vulnerability index	Potential losses ($) [E x F]	Percentage of stock lost [G / C]
Type A	46	40	1840	12	480	0.1	48	3%
Type B	24	400	9600	6	2400	0.05	120	1%
Type C	3	4000	12000	1	4000	0	0	0%
Total	73	-	23440	19	6880	-	168	1%

Team GREEN

GAR	A	B	C	D	E	F	G	H
	N. of units	Economic value ($)	Stock ($) [A x B]	Exposed (n. of units)	Exposed value ($) [D x B]	Vulnerability index	Potential losses ($) [E x F]	Percentage of stock lost [G / C]
Type A	46	40	1840	12	480	0.6	288	16%
Type B	24	400	9600	6	2400	0.4	960	10%
Type C	3	4000	12000	1	4000	0.1	400	3%
Total	73	-	23440	19	6880	-	1648	7%

Team ORANGE

Asset	A	B	C	D	E	F	G	H
	N. of units	Economic value ($)	Stock ($) [A x B]	Exposed (n. of units)	Exposed value ($) [D x B]	Vulnerability index	Potential losses ($) [E x F]	Percentage of stock lost [G / C]
Type A	46	40	1840	30	1200	0.6	720	39%
Type B	24	400	9600	14	5600	0.4	2240	23%
Type C	3	4000	12000	2	8000	0.1	800	7%
Total	73	-	23440	46	14800	-	3760	16%

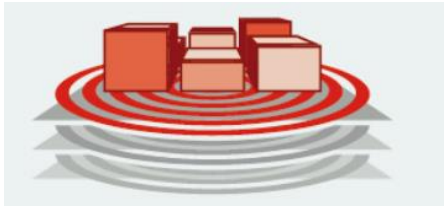
Team YELLOW

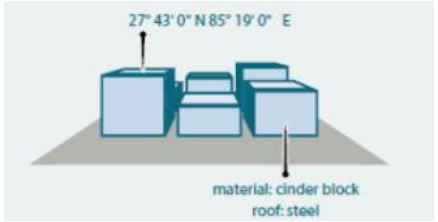
GAR	A	B	C	D	E	F	G	H
	N. of units	Economic value ($)	Stock ($) [A x B]	Exposed (n. of units)	Exposed value ($) [D x B]	Vulnerability index	Potential losses ($) [E x F]	Percentage of stock lost [G / C]
Type A	46	40	1840	30	1200	0.9	1080	59%
Type B	24	400	9600	14	5600	0.7	3920	41%
Type C	3	4000	12000	2	8000	0.4	3200	27%
Total	73	-	23440	46	14800	-	8200	35%

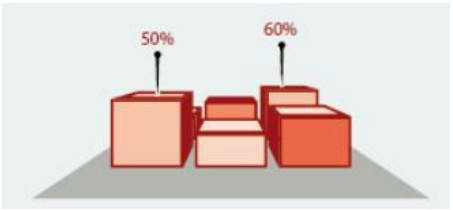
Risk Components and Risk Reduction

HAZARD **EXPOSURE** **VULNERABILITY**

Risk =







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