Discussion on flood protection measures

Nonstructural and structural flood protection measures

5th Meeting of the Youth parliament of the Sava River Basin

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Conceptual Framework

What is disaster (**flood**) risk?

$$\text{Risk} = \frac{\text{Hazard} \times \text{Vulnerability} \times \text{Exposure}}{\text{Capacity}}$$

Natural hazards

- Earthquakes
- Landslides
- **Floods**
- Droughts
- Extreme Weather Events and Climate Change
- Wildfires
- Heatwaves

Anthropogenic (human-made) hazards

Technological/Industrial Hazards

- Hazardous industrial site
- Mining sites
- Water pollution spots

Societal Hazards

- Water pollution spots
- Waste disposal site (landfills)

Engineering Hazards

Disaster Risk Reduction should be more about avoiding disasters through **risk-informed** and **climate-smart** development

Conceptual Framework

Flood risk = Hazard × Exposure × Vulnerability

- **Hazard:** Potential for harm, loss or damage. Exists where land is prone to flooding. Increases with depth of inundation, velocity of flow, and duration of inundation.

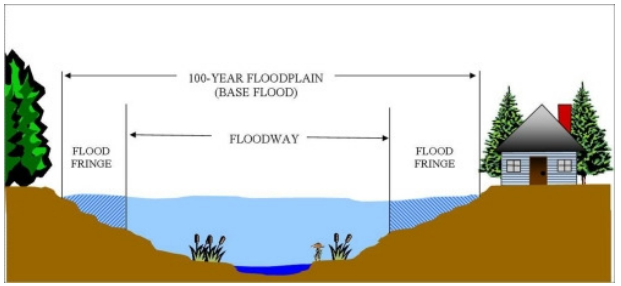
- **Exposure:** Potential for personal danger or property damage during flood.

  Flood risk exists only if there are assets that may be damaged or if people live, work, or transit through the flood hazard area.

- **Vulnerability:** Actual consequences of flood depend on how vulnerable people and assets are to danger and damage. Can be reduced if:

  (i) assets are made less susceptible to damage

  (ii) people are more aware of the flood risk, are well prepared, know what to do during a flood emergency, and have access to emergency services and post-flood support.



Conceptual Framework
Flood Risk Reduction

The Situation prior to Development

'Blind' Development

Risk-informed/ ClimateSmart Development

IN A NUTSHELL, FLOOD RISK REDUCTION FROM A HUMAN PERSPECTIVE SHOULD ENTAIL:

- consideration that natural hazards and climate change have a spatial dimension and therefore spatial analysis is crucial for identifying humans most at risk;
- moving away from the perspective of looking at disasters purely in terms of their impact on human beings and including how human action/inaction impacts on the environment, climate and disaster risk;
- recognition that the impact of a disaster depends on the kind of human development choices that are made; and
- moving away from emergency preparedness and disaster response by focusing on the prevention and mitigation of disaster risks.

Flood Risk Reduction
What can be done?

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RISK = HAZARD x EXPOSURE x VULNERABILITY

MODIFY HAZARD	MODIFY EXPOSURE	MODIFY VULNERABILITY
• Flood control dams • Detention basins • Levees or dikes • Flood diversion channels • River channel improvements • Upper watershed management	• Land use zoning • Property acquisition • Planning development controls • Building codes • Flood-proofing buildings	• Flood monitoring and warning • Flood forecasting • Emergency response plans • Community awareness • Community preparedness • Post-flood recovery & reconstruction • Flood insurance

STRUCTURAL — NON-STRUCTURAL

ENVIRONMENT — SOCIETY

Management of Vulnerability to Danger or Damage

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Measures to manage vulnerability in flood risk management are **non-structural**

- **Prior to flooding**
- **Emergency response to flooding**
- **Recovery activities after flood**

Management of Exposure of People and Assets to Flood Hazard - Methods

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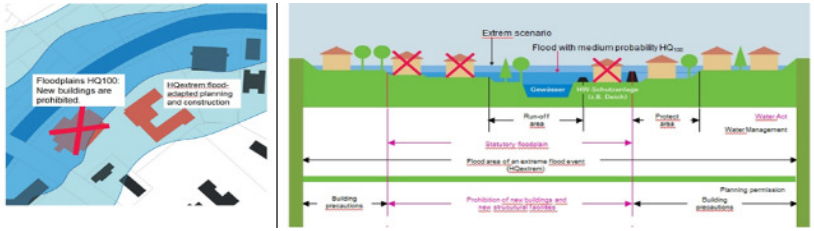
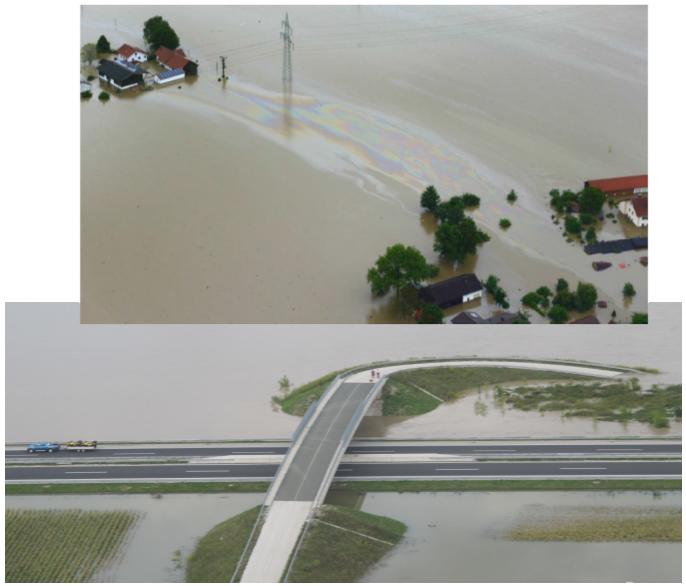
Resettlement – rarely possible



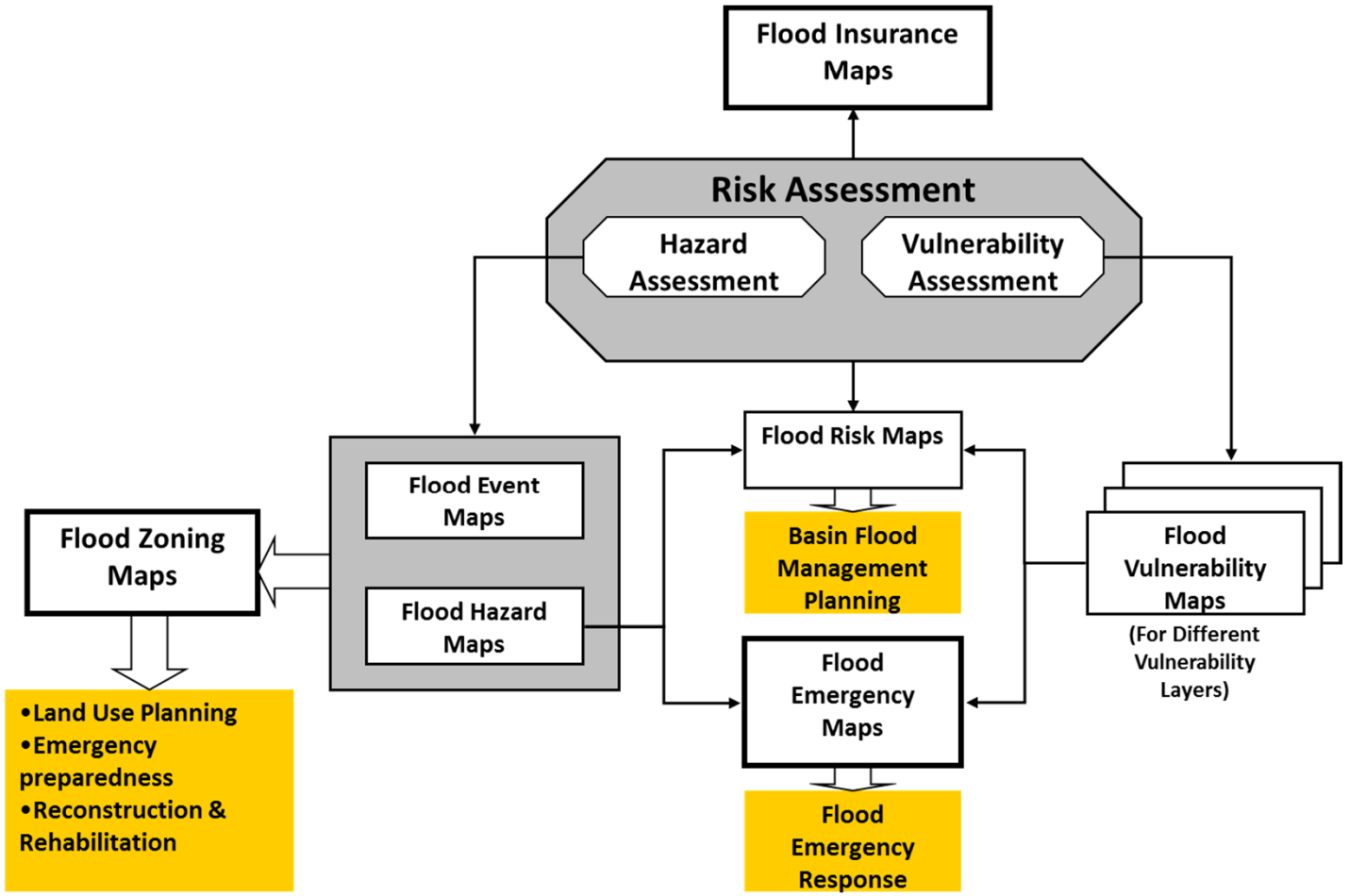
Regulation of land use - **most effective when directed at future development**

- Residential development (appropriate types of buildings, limitations, proper locations of public services like schools, hospitals, emergency services etc)
- Permitting of enterprises (storage of hazardous materials prohibited),
- Planning of public infrastructure (routing and/or locations of key infrastructure - electricity substations, water supply, water treatment, and sewerage facilities)

A preliminary step is **flood hazard mapping** - different zones or categories of flood hazard



Different maps ... for different users



Preparing of maps …

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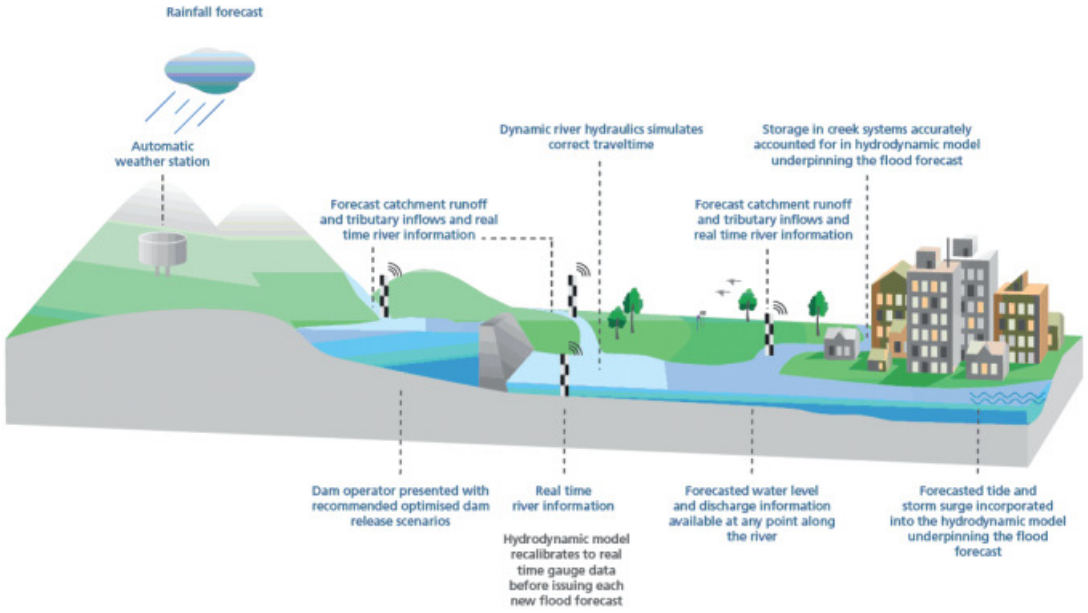

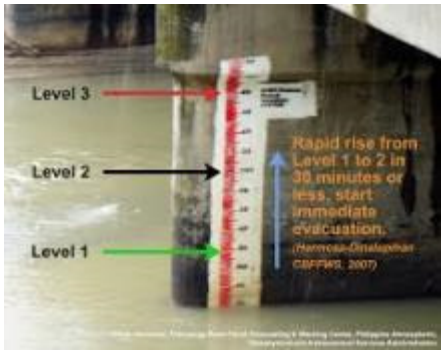

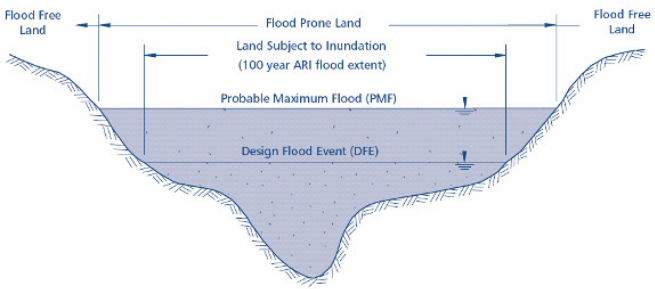

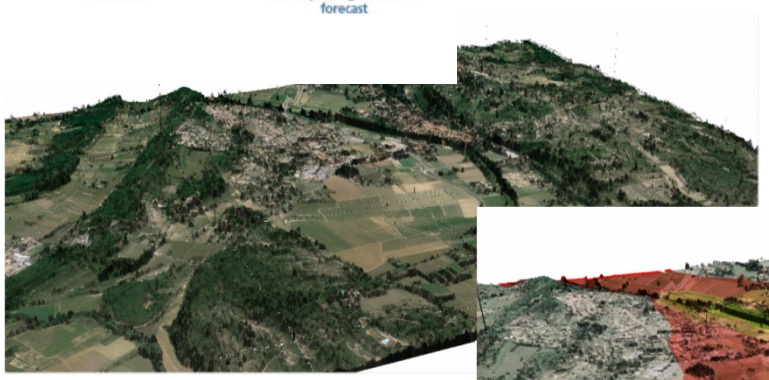

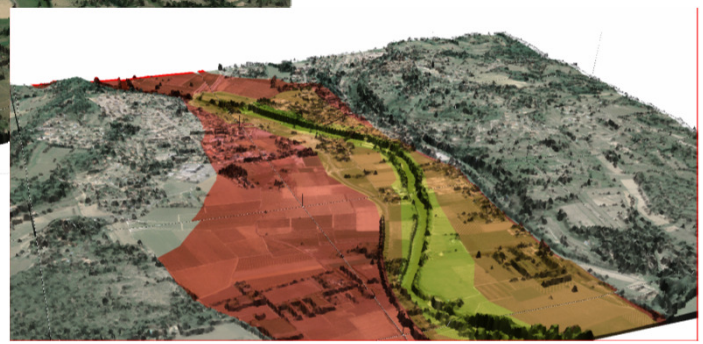

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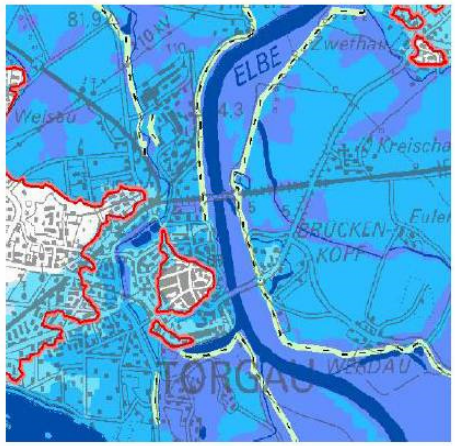
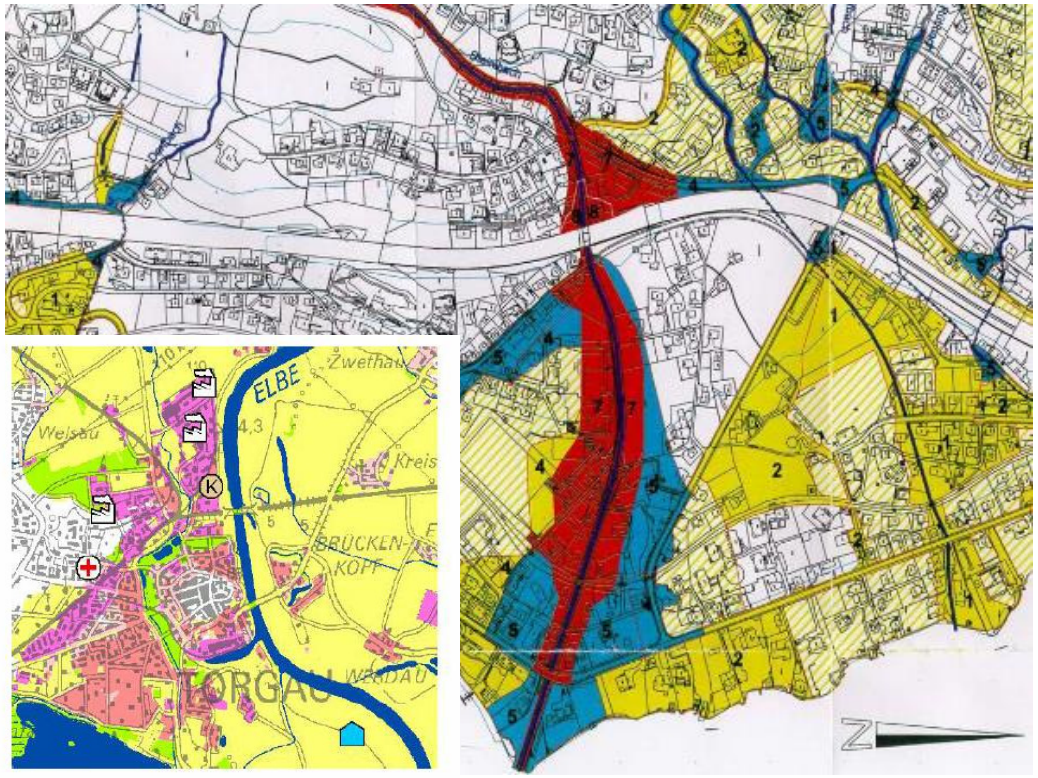


Hazard maps showing different flooding depth



Vulnerability map showing average damage per unit area and sensible objects

Management of Flood Hazard

Flood hazard is natural component of flood risk
Worsening in CC conditions

Structural flood control works **modify** flood hazard

- **flood control reservoirs** and **flood detention basins**
- **flood dikes (levees)**
- **river channel training**
- **flood diversion channels**

Watershed management – control of sediment and runoff

- **Erosion control measures**
- **Torrent control measures**

Structural measures

Mountainous area

Runoff control

Sediment control

River corridor

Regulating flow

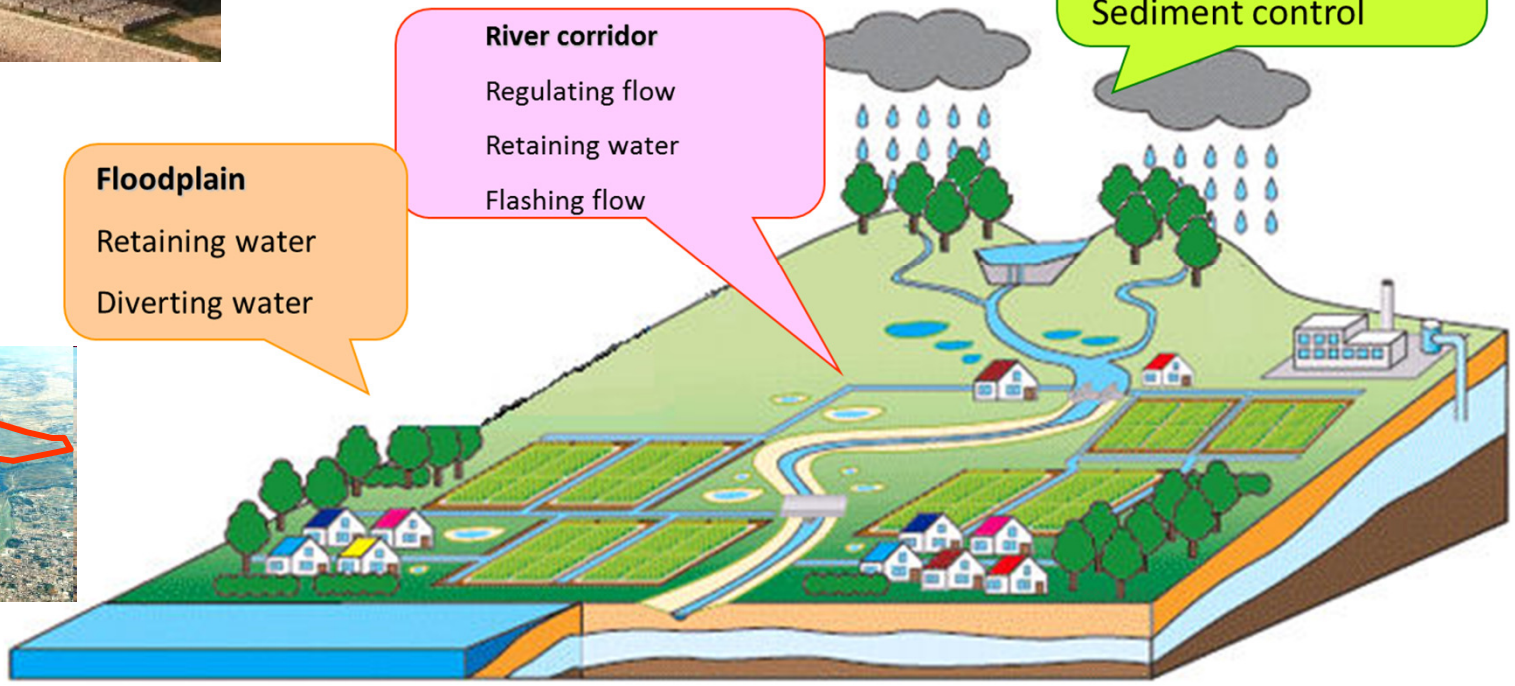
Retaining water

Flashing flow

Floodplain

Retaining water

Diverting water



NWRM

Natural Water Retention Measures

NWRM are **multi-functional measures** that aim to protect and manage water resources and address water-related challenges by restoring or maintaining ecosystems as well as natural features and characteristics of water bodies using natural means and processes

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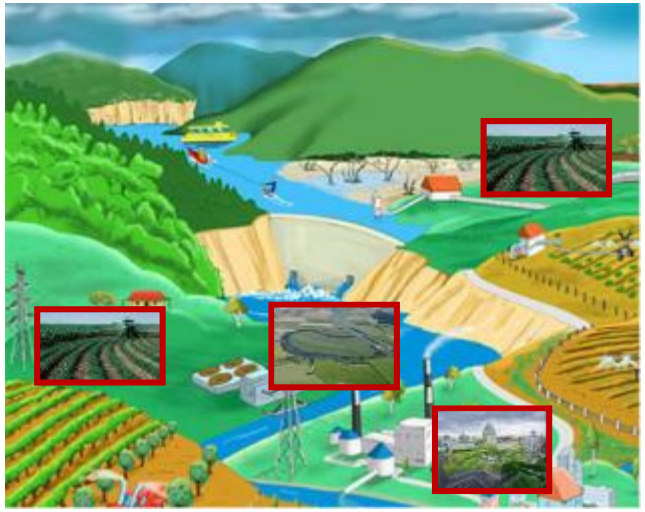
Natural water retention measures are considered "win-win" solutions improves ecological status of water bodies AND helps to prevent and mitigate flood events



- Floodplains
- Sustainable land use practices
- Dike relocation
- Space for Rivers

Cost-benefit and decision making

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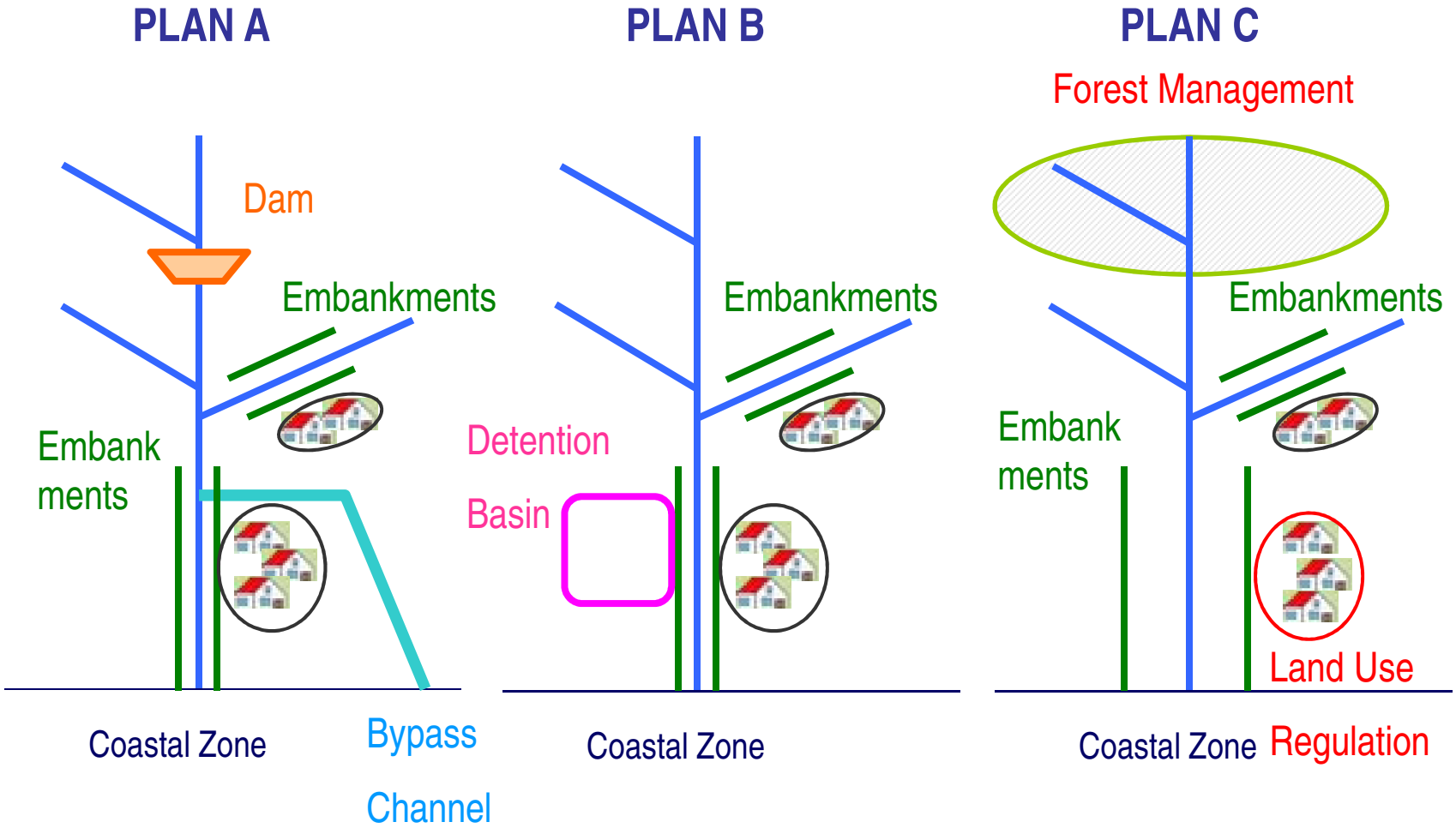

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