Royal HaskoningDHV
Enhancing Society Together

Singapore International Water Week:

Developing Flood resilience investment strategies through Global Flood Risk Tool

April 2022
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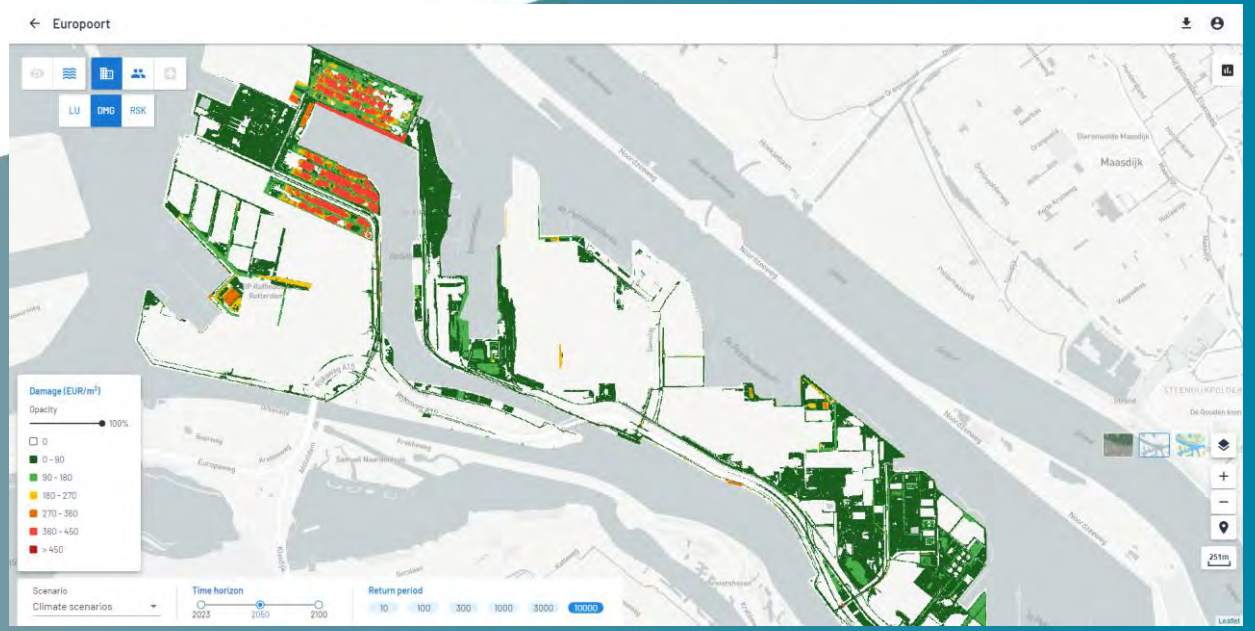
Climate Adaptation & Flood Resilience Experts RHDHV



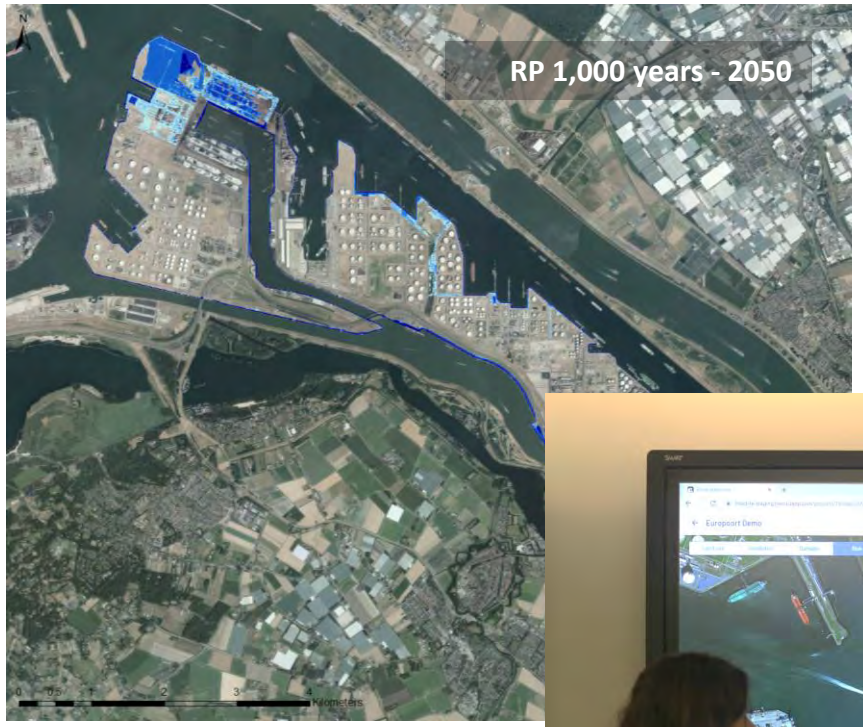
We work intensely across the world on flood risk management projects

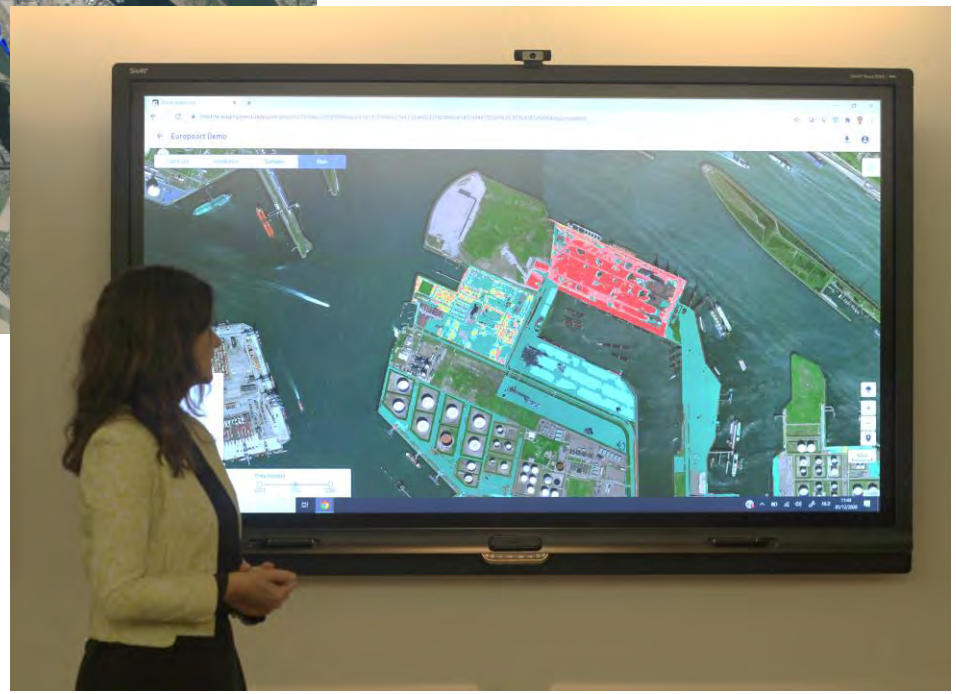





Global Flood Risk Tool – Comprehensive Risk mapping & planning tool

- **Risk mapping & Adaptative Planning:** Planning tool to formulate climate resilience strategies
- **Online service:** Flood Risk calculations through cloud-based computing platform based on 5-steps approach
- **Fast calculations:** inundation and damage calculations within a minute instead of hours (5m resolution) by making use of advanced GIS technologies
- **Visually attractive:** User interface is interactive, visually attractive and understandable for non-experts to stimulate stakeholder dialogue during real-life sessions.
- **Decision-making:** GFRT to be used for scenario modelling to support and enable decision-making on business cases for different climate scenarios





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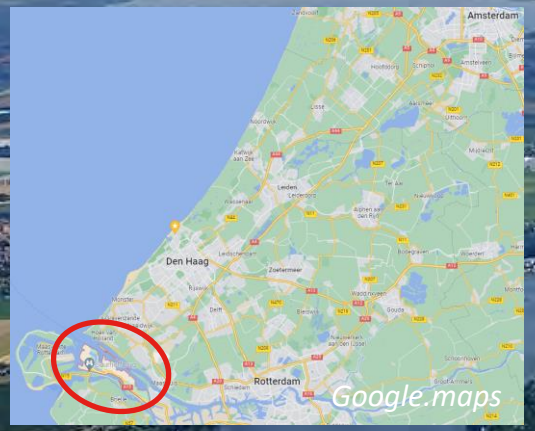
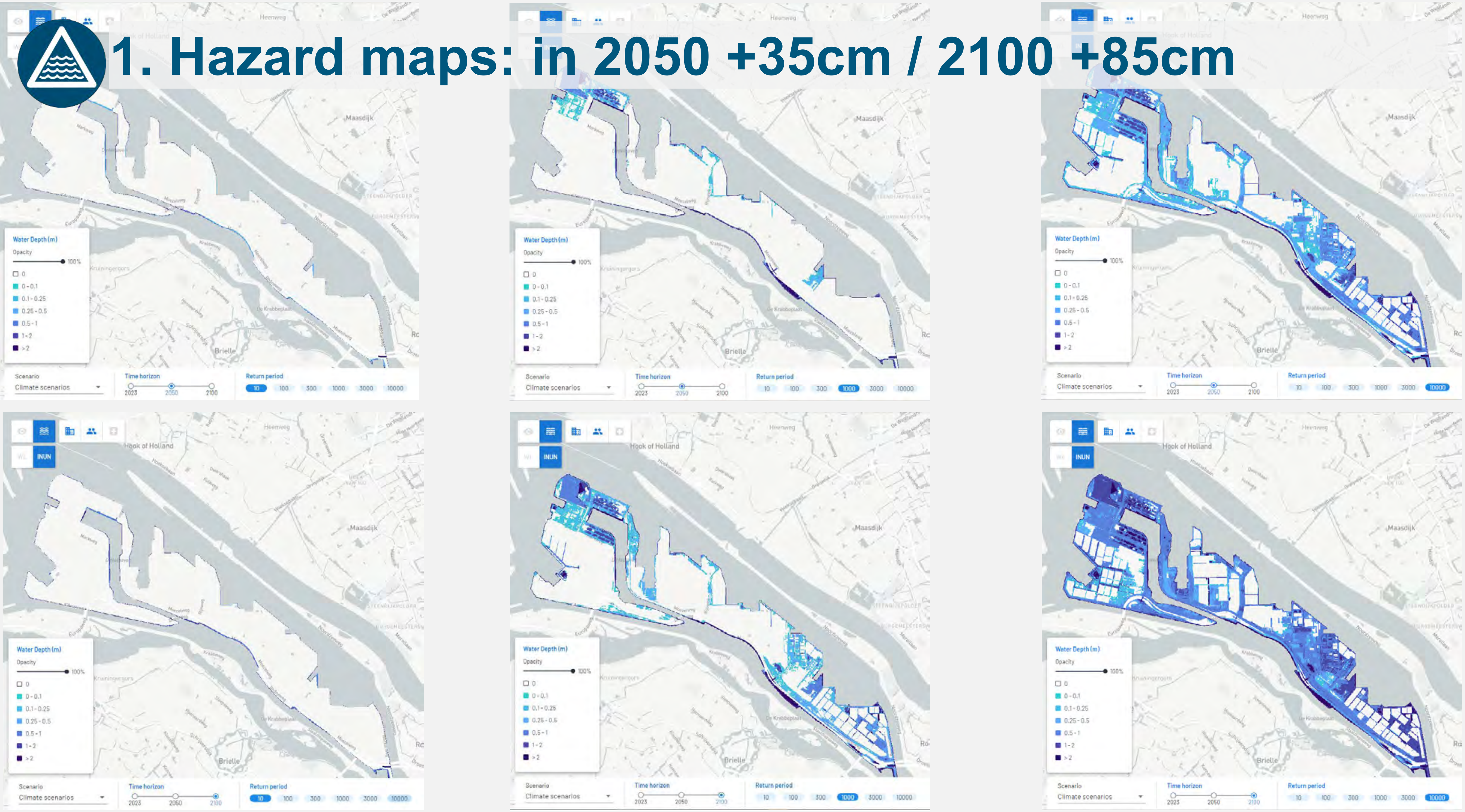
5-steps approach



Port of Rotterdam

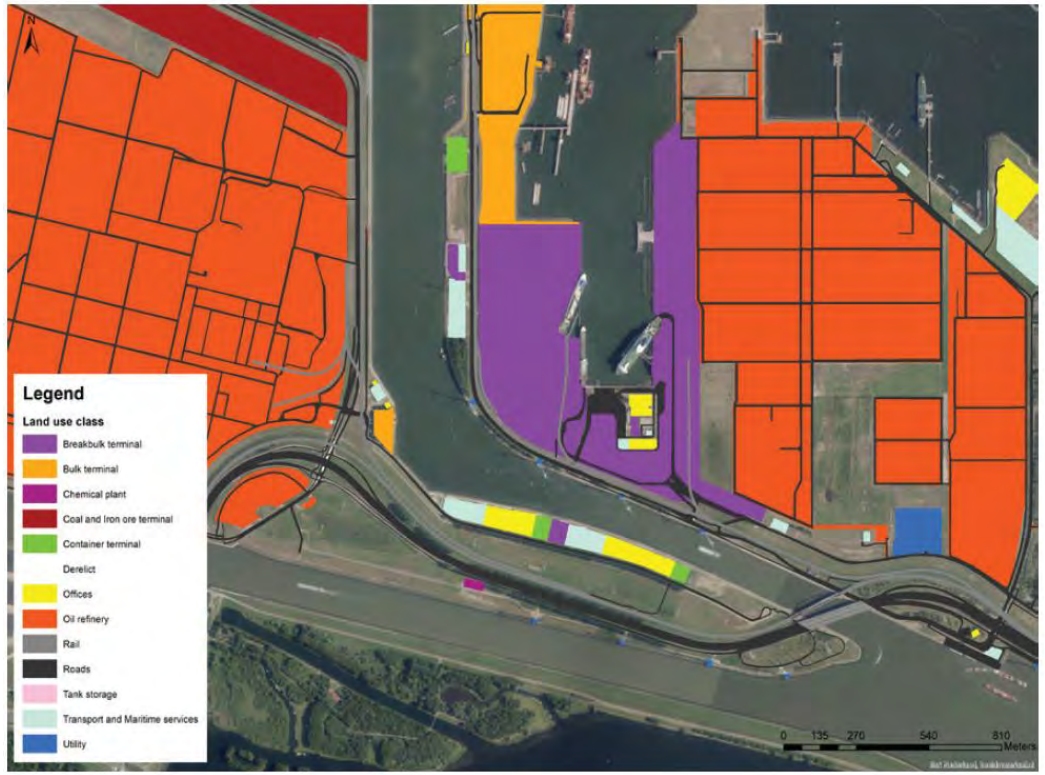
1. Hazard maps: in 2050 +35cm / 2100 +85cm

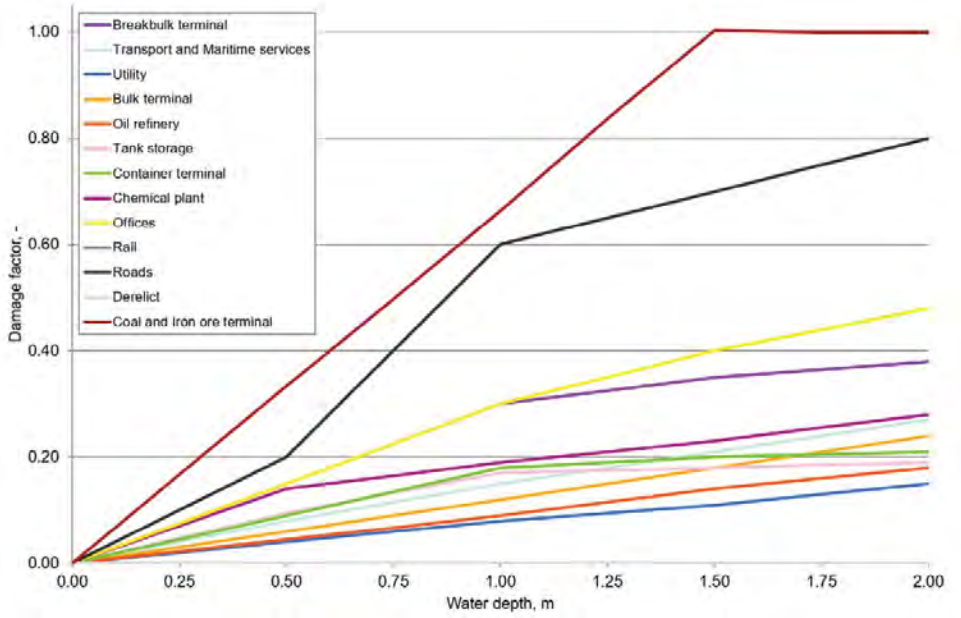


2. Exposure and Vulnerability input parameters

- **Land use map, Land values and damage curves (obtained from literature and stakeholder consultations)**

Sector	Value
Bulk terminals	€ 443
Container terminals	€ 696
Distriparks	€ 886
Public utilities	€ 1583
Goods transshipment	€ 886
Transport industry	€ 633
Other industry	€ 633

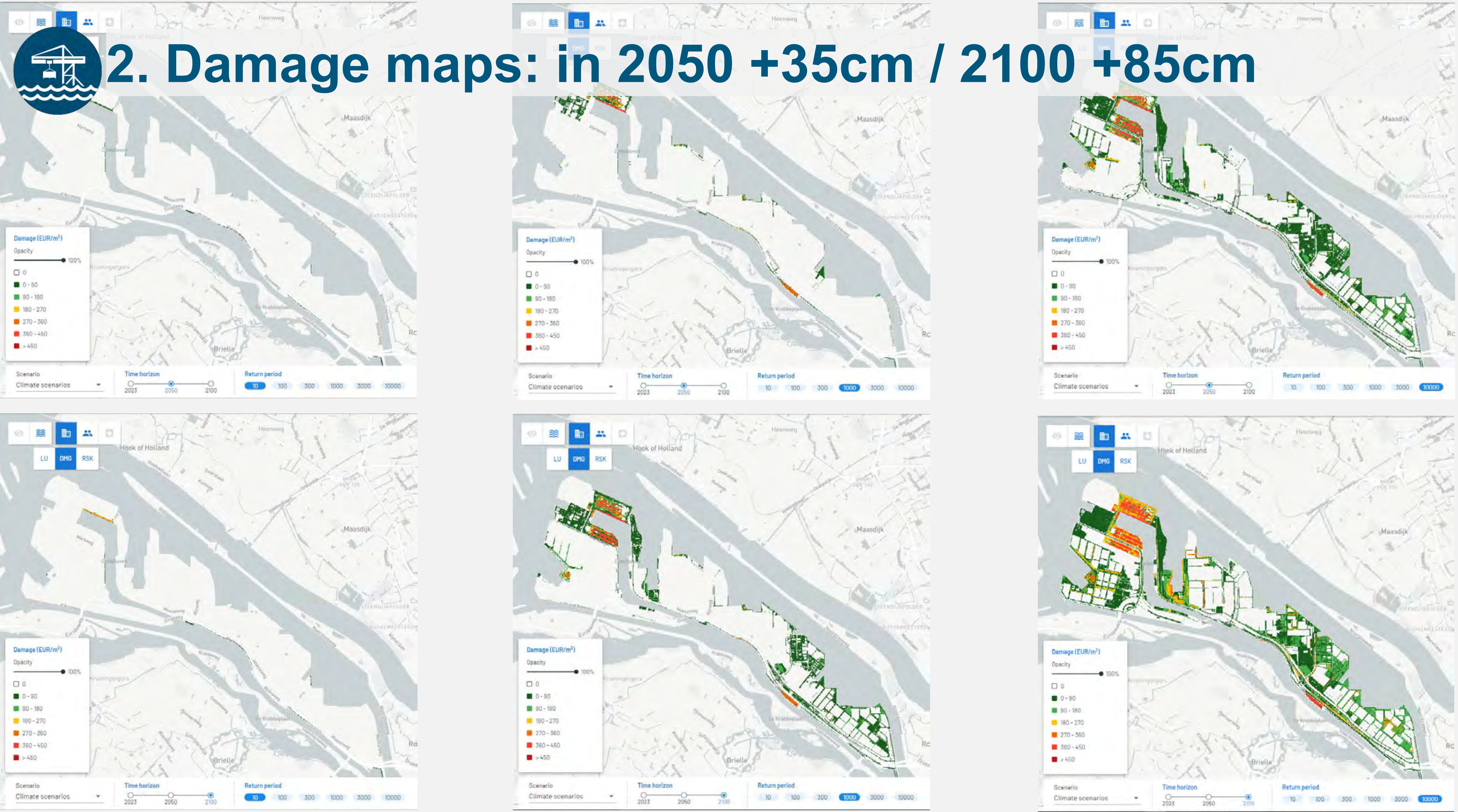




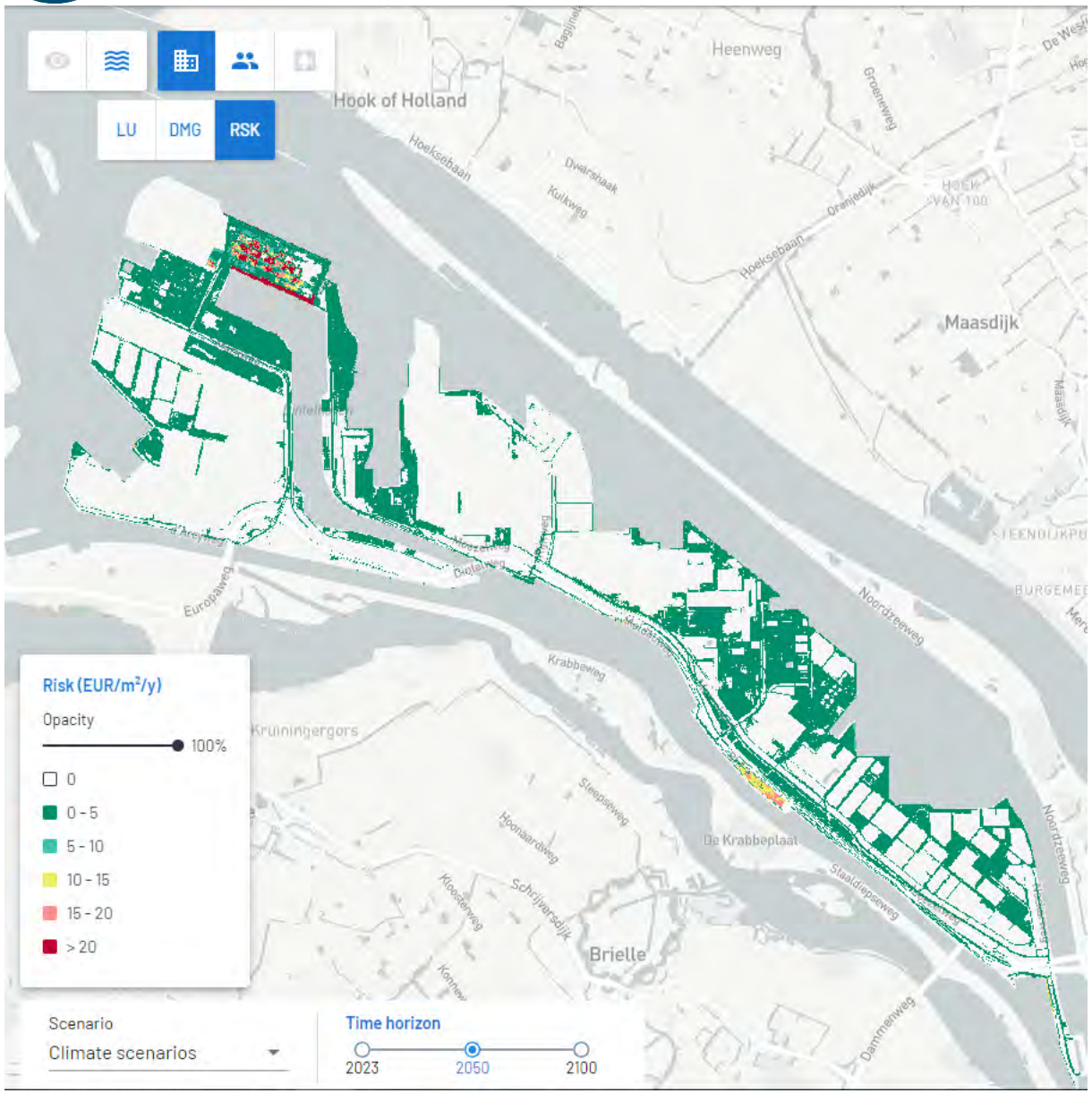
Sources:

* JCR, 2017. Global flood depth-damage functions: Methodology and the database with guidelines, Huizinga, De Moel and Wojciech: https://publications.jrc.ec.europa.eu/repository/handle/JRC105688
* Tebodin, 1998. Schade bij inundatie. By Rijkswaterstaat

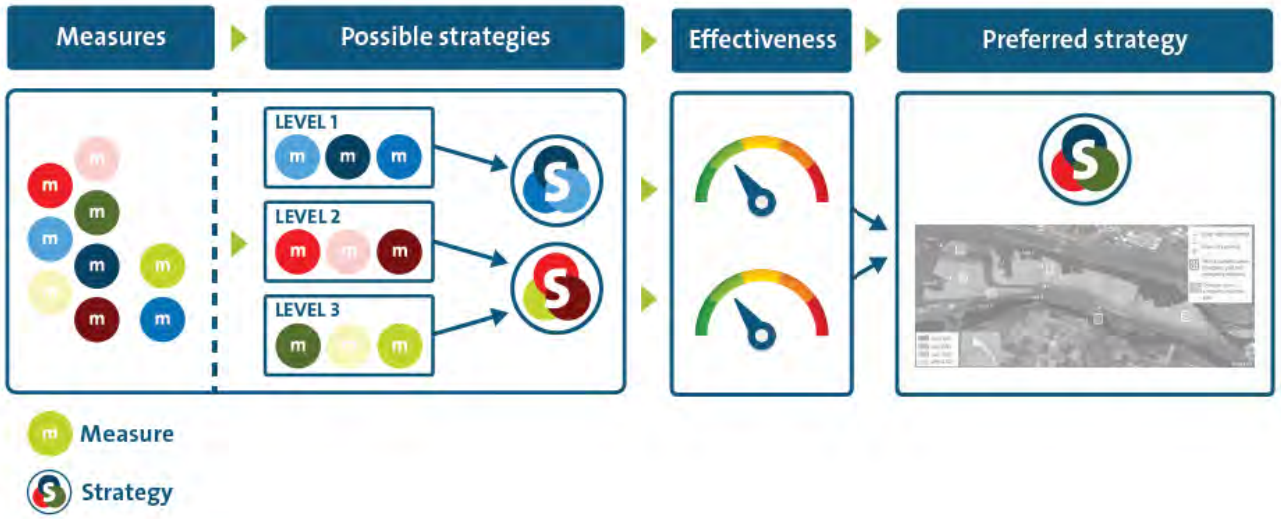
2. Damage maps: in 2050 +35cm / 2100 +85cm



3. Risk Maps: in 2050 +35cm / 2100 +85cm



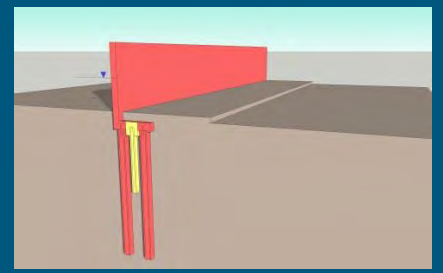
4. Flood Measures



Based on the hazard, damage and risk & vulnerability assessment we will provide you with appropriate measures based on the multi-level safety approach to reduce the impact of hazards and to reduce the risks.

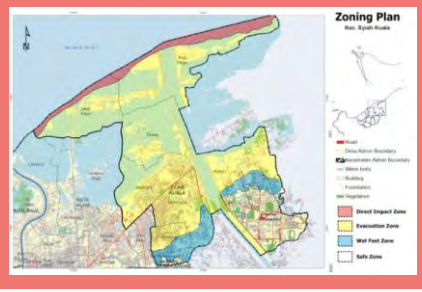
- **Level 1:** preventive structural measures dikes, spillways, culvert, sluices (grey) mangroves, wetlands, foreshores, nourishments, increasing conveyance by dredging and river widening (green) and storage areas, side channels and dike in dune system (hybrid).
- **Level 2:** adaptive and non-structural measures raising terrains or floors, dry/wet proofing (adaptive), land use planning, relocation/ managed retreat, operation and maintenance protocols, monitoring, building codes and laws and regulations (non-structural).
- **Level 3:** emergency response measures early warning response systems, emergency response and crisis management plans (controlled shutdown, stock removal), evacuation routes and storm shelters and temporary dikes.

Level 1



Level 2

FloodAngel



Level 3


Floodcontrolinternational.com

5. Business case

a) Determine required Protection level (2050):
   - Net present value (NPV) and Benefit-cost ratio (BCR) on rough options.

b) Define adaptive pathways for selected measures and Test effectiveness for 100 years ahead:
   - Net present value (NPV) and Benefit-cost ratio (BCR) on strategic options.

c) Score through MCA (qualitative):
   - technical (e.g. adaptive to climate change, effectiveness, does it require relocation, does it have stakeholder support, replicable and scalable);
   - economic/planning aspects (e.g. urgency, consistent with policy and plans, does it stimulate the economy);
   - socio-economic (e.g. protect people affected, reduce risk on losing lives);
   - environmental impacts (e.g. disturbance or destroys habitats).

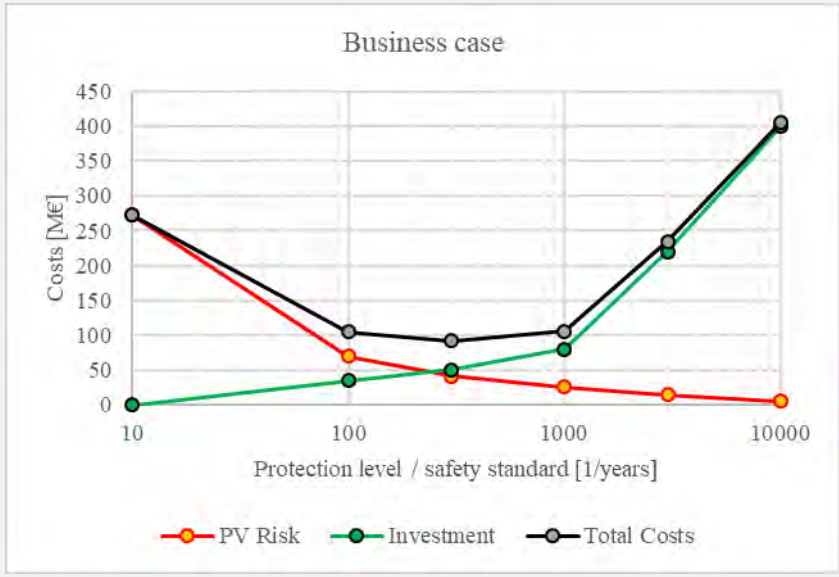
d) Select preferred strategy.

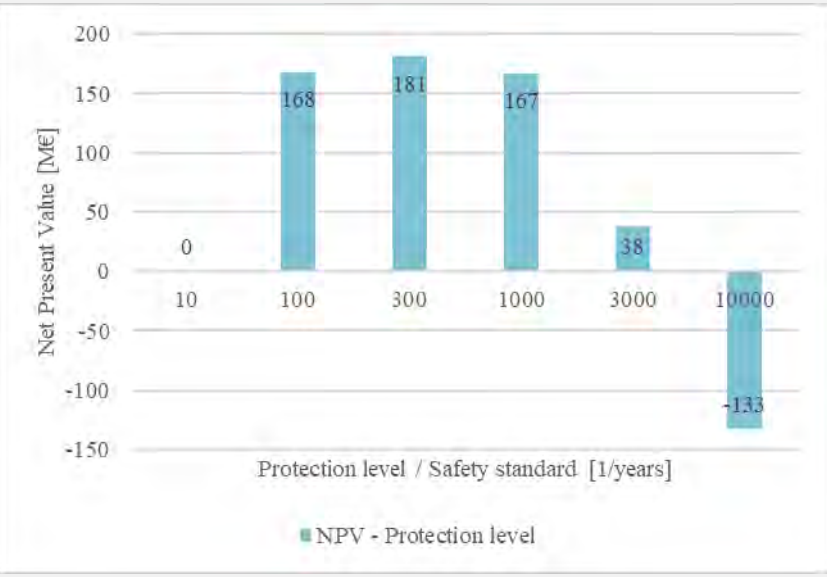
5a. Determine required Protection level (2050)

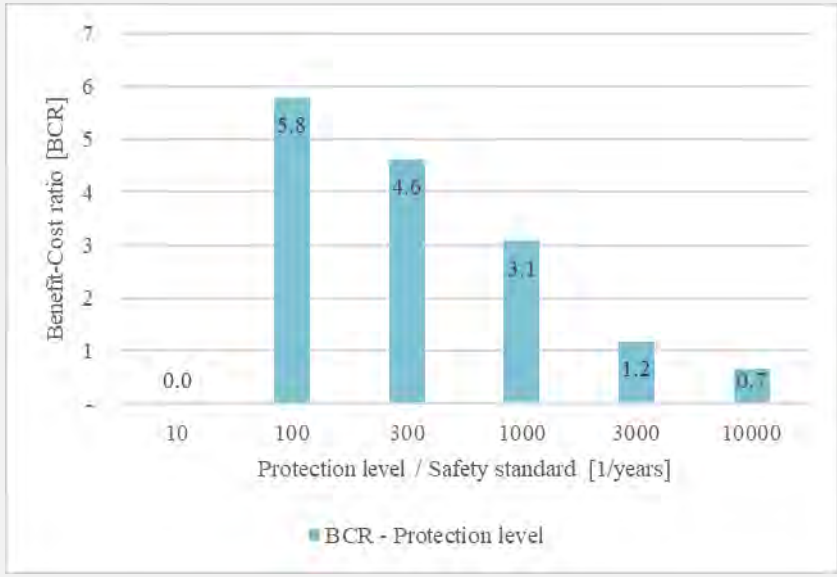
Estimate investments per protection level and calculate present value risk.
Total costs = PV Risk + investment

Find maximum Net Present Value
NPV = Total Costs – Benefits
Benefit = Averted risk

Seek for BCR > 1
BCR = Benefits / Total Costs
Benefit = Averted risk

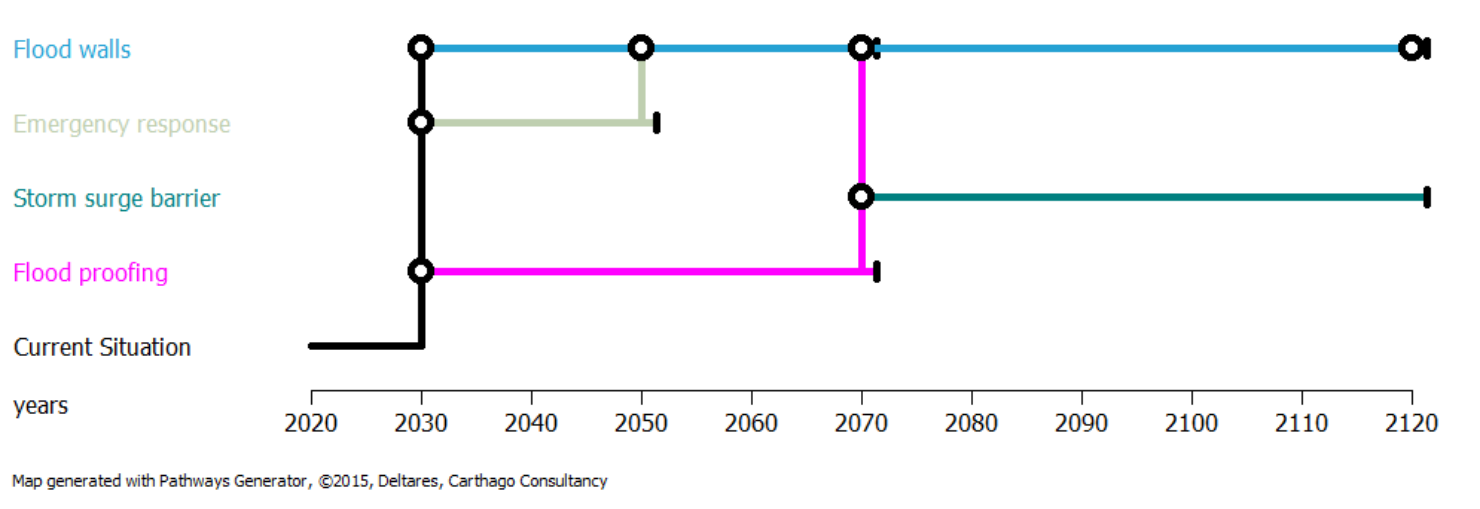


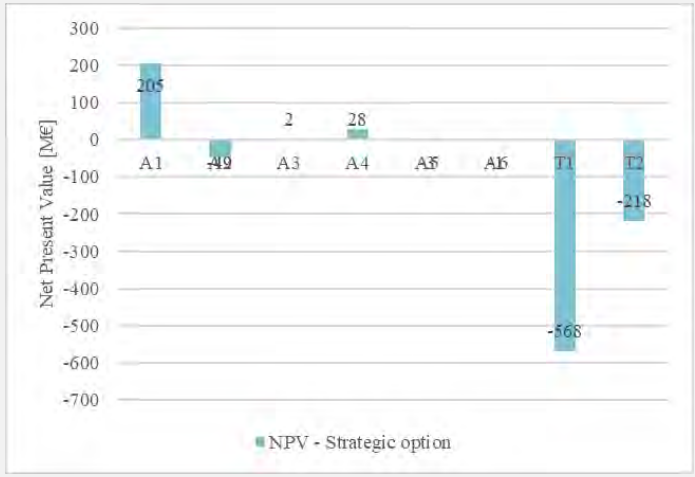


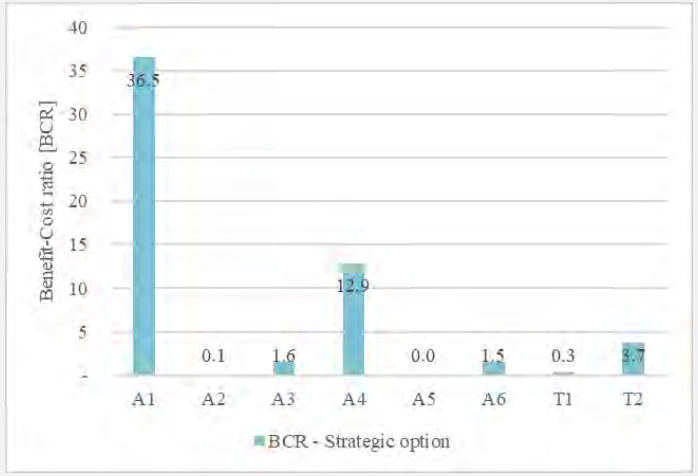


5b. Define Adaptive pathway and test effectiveness

(Haasnoot, 2013)







Haasnoot M., Kwakkel J. H., Walker W. E., and ter Maat J. (2013). Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world. Glob. Environ. Chang., vol. 23, no. 2, pp. 485–498

5. Preferred strategy (until 2070)

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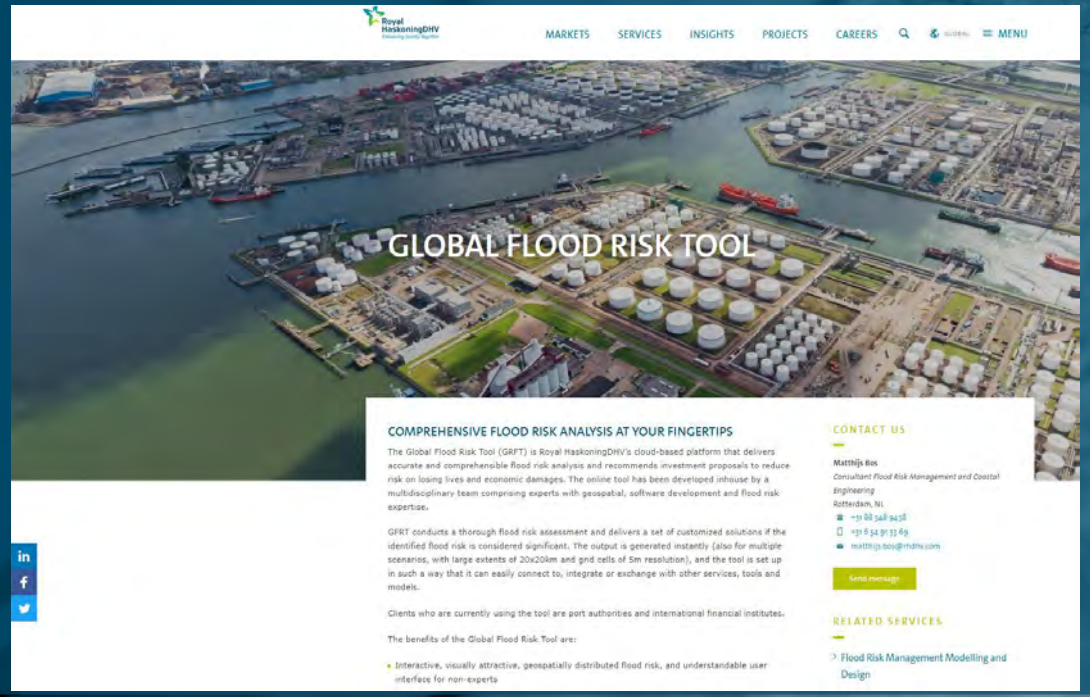
Thank you!

Webpage: More info on Global Flood Risk Tool

Blog: Providing protection and security through our Global Flood Risk Tool

Client reference: Flood Risk Management at Port of Rotterdam



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