Flood and erosion risk and decision making in the coastal zone in conditions of climate change

Andrzej Cieślak
Maritime Office in Gdynia
cieslak@umgdy.gov.pl

Future Pressures on Coastal Zones

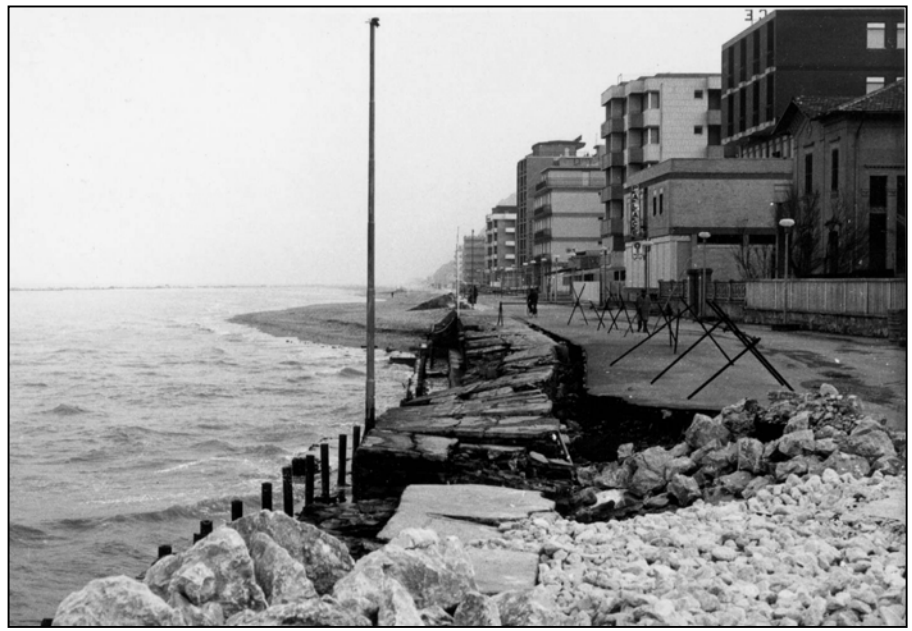
- Overtopping of coastal defences due to sea level rise
- Loss of fronting deposits
- Increased wave forces
- Increased „storminess”
- Change in longshore drift patterns ?
- Increased groundwater levels
- Increased instability of cliffs, alleviated by reduced toe support
- Storm surge / fluvial flooding interaction
- Potential for flash flooding

Coastal Erosion –Blackgang, Isle of Wight

Winter storm, December 1990

**Bonchurch,
Isle of Wight**

Meeting the Challenge of Coastal Risk Management



Pesaro Beach, Regione Marche, Italy before and after a violent coastal storm

POLAND

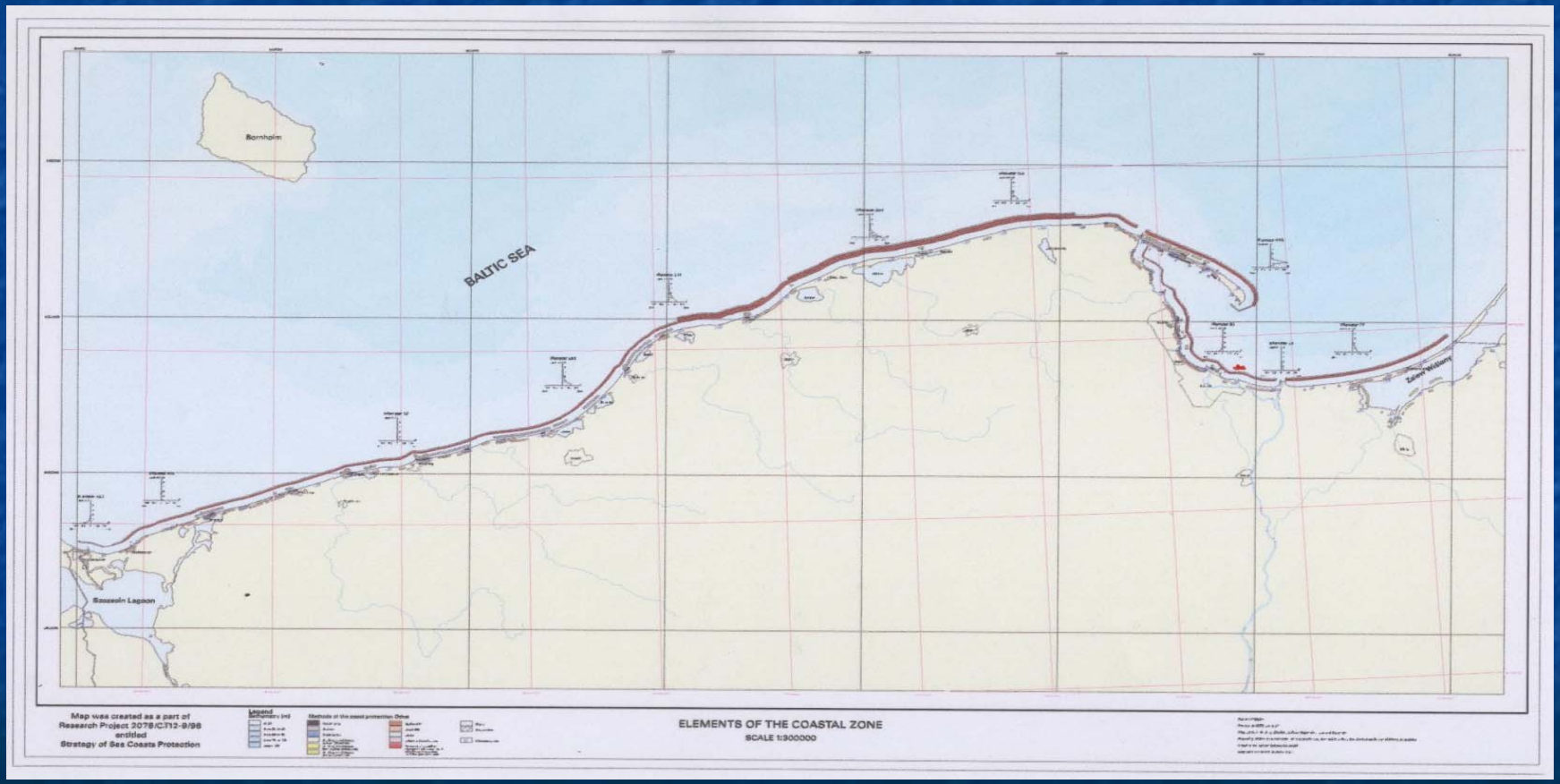
- **Long term strategy of coastal protection (50 years with view to 2100)**

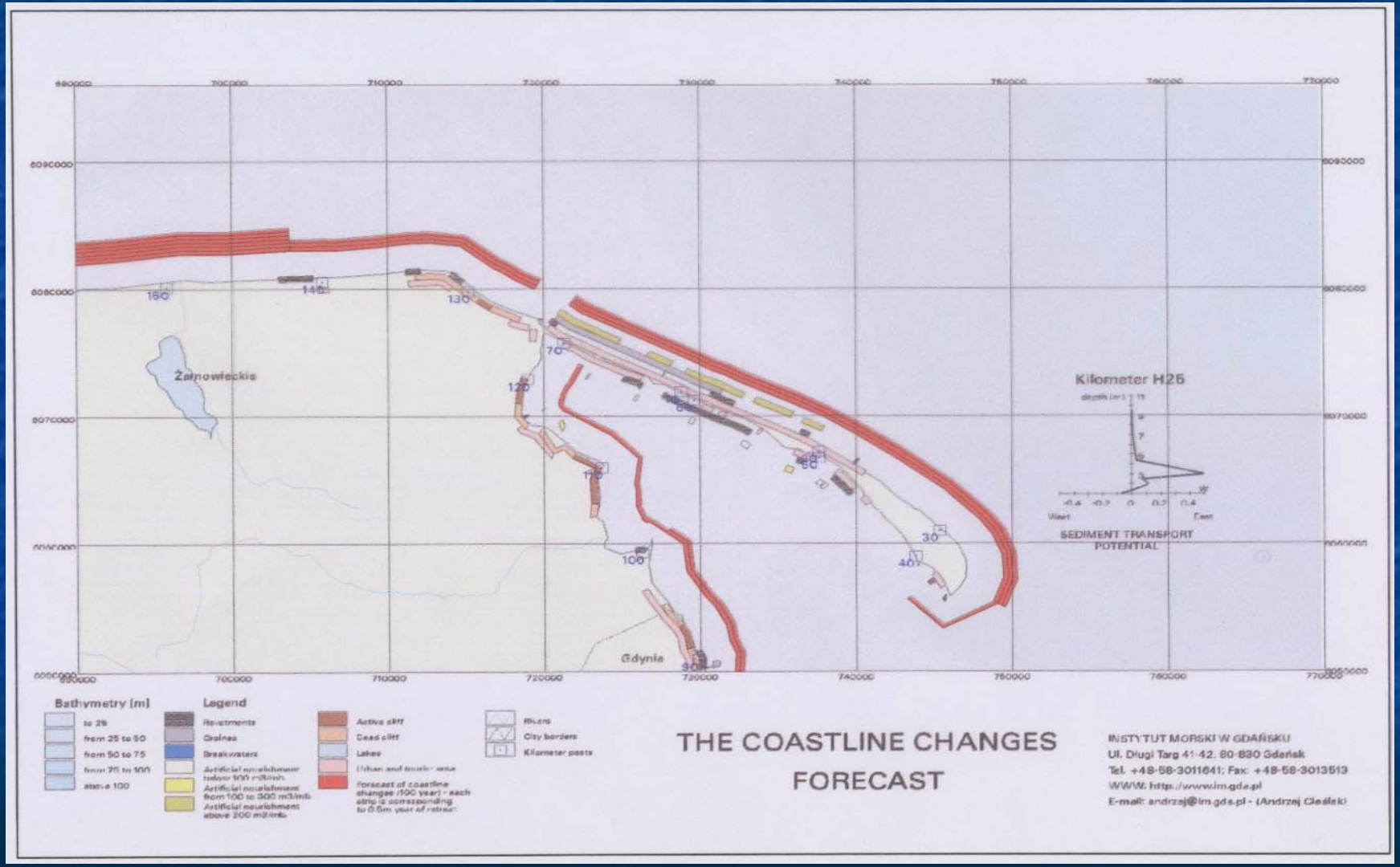
<u>Basic assumptions</u>

3 sea level rise scenarios:	**optimistic**	**30cm/100years**
	most probable	**60cm/years**
	pessimistic	**100cm/100 years**

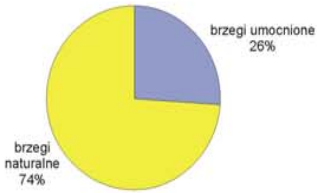
Increased storminess (by 5 – 10%)

More wind from the W to N sector

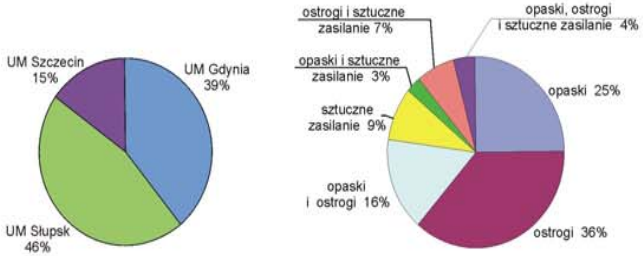

Bornholm
BALTIC SEA
Szczecin Lagoon
Zalew Wiślany
Map was created as a part of
Research Project 2078/C.T12-9/98
entitled
Strategy of Sea Coasts Protection
Legend
ELEMENTS OF THE COASTAL ZONE
SCALE 1:300000


Żarnowieckie
Gdynia
Kilometer H25
SEDIMENT TRANSPORT POTENTIAL
West
East
Bathymetry [m]
to 25
from 25 to 50
from 50 to 75
from 75 to 100
above 100
Legend
Revetments
Groines
Breakwaters
Artificial nourishment below 100 m3/mb
Artificial nourishment from 100 to 200 m3/mb
Artificial nourishment above 200 m3/mb
Active cliff
Dead cliff
Lakes
Urban and tourist area
Forecast of coastline changes (100 year) - each strip is corresponding to 0.5m year of retreat
Rivers
City borders
Kilometer posts
THE COASTLINE CHANGES FORECAST
INSTYTUT MORSKI W GDAŃSKU
Ul. Długi Targ 41-42, 80-830 Gdańsk
Tel. +48-58-3011641; Fax: +48-58-3013513
WWW: http://www.im.gda.pl
E-mail: andrzej@im.gda.pl - (Andrzej Cieślik)

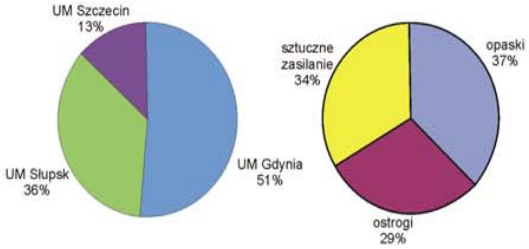
Długość brzegów morskich - 499,4 km



Długość brzegów morskich umocnionych - 131,4 km



Koszty umocnień brzegów morskich - 630,4 mln zł (ceny z 1998 r.)



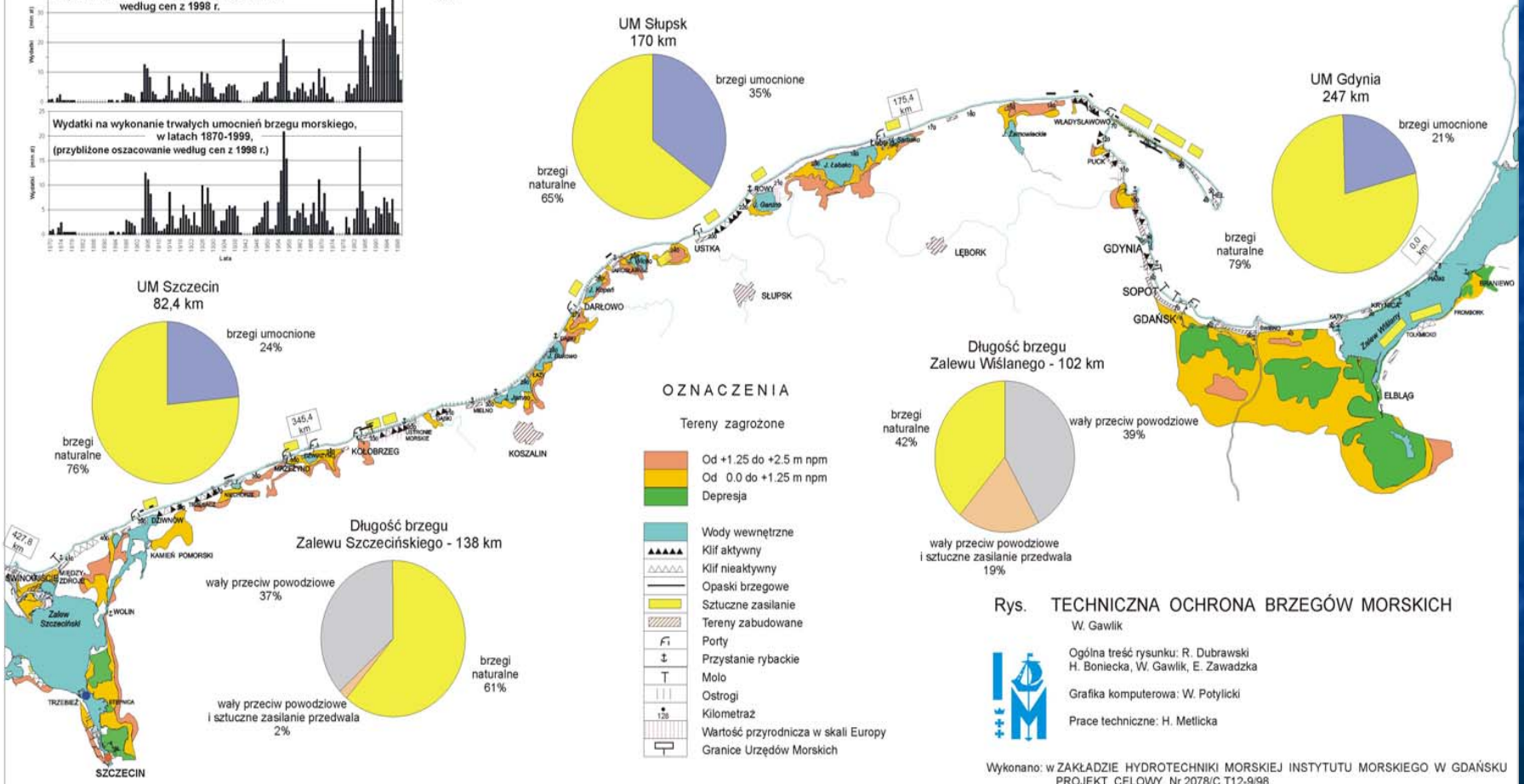
UM Słupsk
170 km

UM Gdynia
247 km

UM Szczecin
82,4 km

Długość brzegu
Zalewu Wiślanego - 102 km

Długość brzegu
Zalewu Szczecińskiego - 138 km


175,4 km
WŁADYSŁAWOWO
PUCK
USTKA
ROWY
DARŁOWO
SŁUPSK
LĘBORK
GDYNIA
SOPOT
GDAŃSK
KRYNICA
FRAUENBURG
FRAUENBURG
FRAUENBURG

Basic results of assessment

- Possible flooding (to 2.5 m above MSL) 2200 sq.km, in that
  over 20% is of unique natural values at European and national scale
  over 7% is intensely urbanised & industrialised
- Increased groundwater level in low lying areas to +1.25 m above MSL
- Eroded (loss of land) at least 120 sq.km
- Additional risk: increased significant landslides on coastal cliffs due to deep cracking of soil during extended dry periods and deep penetration of water
- About 300 thous. people in direct risk area
- Additional ca. 1.7 mln. people indirectly involved (jobs!)

Main decisions

- Maintenance of coastline 2000 along selected stretches (ca. 30% of the coast), controlled retreat along the rest of the coast
- Control development in the coastal belt to avoid:
  - coastal squeeze
  - uncontrolled development in flood/erosion/ landslide-prone areas
- Improve construction practices to take into account possible sea level rise and flooding
- Activities in coastal waters cannot decrease coastal safety

Legal instruments

- Coastal Belt consisting of

  Technical Belt (10m to 1km wide) „ area of land/sea interaction, designated [primarily] for maintaining a proper level of safety and state of environment”,

  Protective Belt (100m to 2km wide) „area in which human activity may influence the state of the technical belt”.

- Maritime administration responsible of management of sea area, coastal protection and introducing „sea issues” into spatial plans and designes of structures.

Legal instruments contd.

- Coastal Belt defined by law as area of direct risk of flooding. All activities require an administrative decision releasing from prohibitions (quite strict) in force in such areas. Decision issued by maritime administration.
- All local spatial management plans, spatial studies, etc. including the Coastal Belt must be agreed upon with the maritime administration.
- All construction permits, changes of use of land, water use permits must be agreed upon with the maritime administration

Main things introduced into plans and designs by the Maritime Administration

Spatial plans

- Level of safety of hinterland provided by the coastal protection system;
- Setback lines (related to: coastal protection systems, landslide risk on cliffs);
- Boundaries of safe investment (on cliffs);
- Marking of areas of direct risk of flooding;
- Statements on level of storm surge flooding and groundwater rise;
- Space for drainage systems;

Plans cont.

- Where possible, location of new development outside risk areas;
- Restrictions on uses significantly increasing environmental risk in case of flooding;
- Minimum height of embankments;
- Highest level of rain and melt water cleaning;
- Special requirements concerning crossing of land/sea interface by cables, pipelines
- Special requirements on location and use of jetties, piers, etc. And related land infrastructure.

Release decisions

- Ground floor level (typically not less than 2.5 m msl, but changes slightly depending on location);
- Additional measures to protect against flooding by storm surges and groundwater;
- Details of location of project/investment

Construction permits

- Height of coastal protection systems / flood defences;
- Height of embankments, hydrotechnic structures and reserve bearing strength for increasing height in future;
- Height of ground floor;
- Special solutions to protect buildings, storage areas, etc. against flooding in case of flood protection system's breakdown and against high groundwater level;
- Protection of rainwater drainage systems against flooding during storm surges.

Thank you