

North Sea current

agricultural polder drainage

Den Helder

Amstelmeer

Balgzand canal sweet discharge

Balgzand saltmarsh bay

Brackish tidal wave

Marsdiep strait

**Natural Base: hydraulic forces + tidal ecosystem**

Den Helder is an experimental habitat at the edge of Netherlands and Wadden Sea. Its urban development leverages on ecosystem services and flexibly adapts to hydro dynamics – sometimes shrinking and sometimes extensive.

Wadden Sea  
UNESCO heritage



Polder realignment  
Discharge detention

Depolder into spillway

Brackish storage  
Permeable plots

Sediment carried by tidal  
and captured with marsh,  
oyster reef

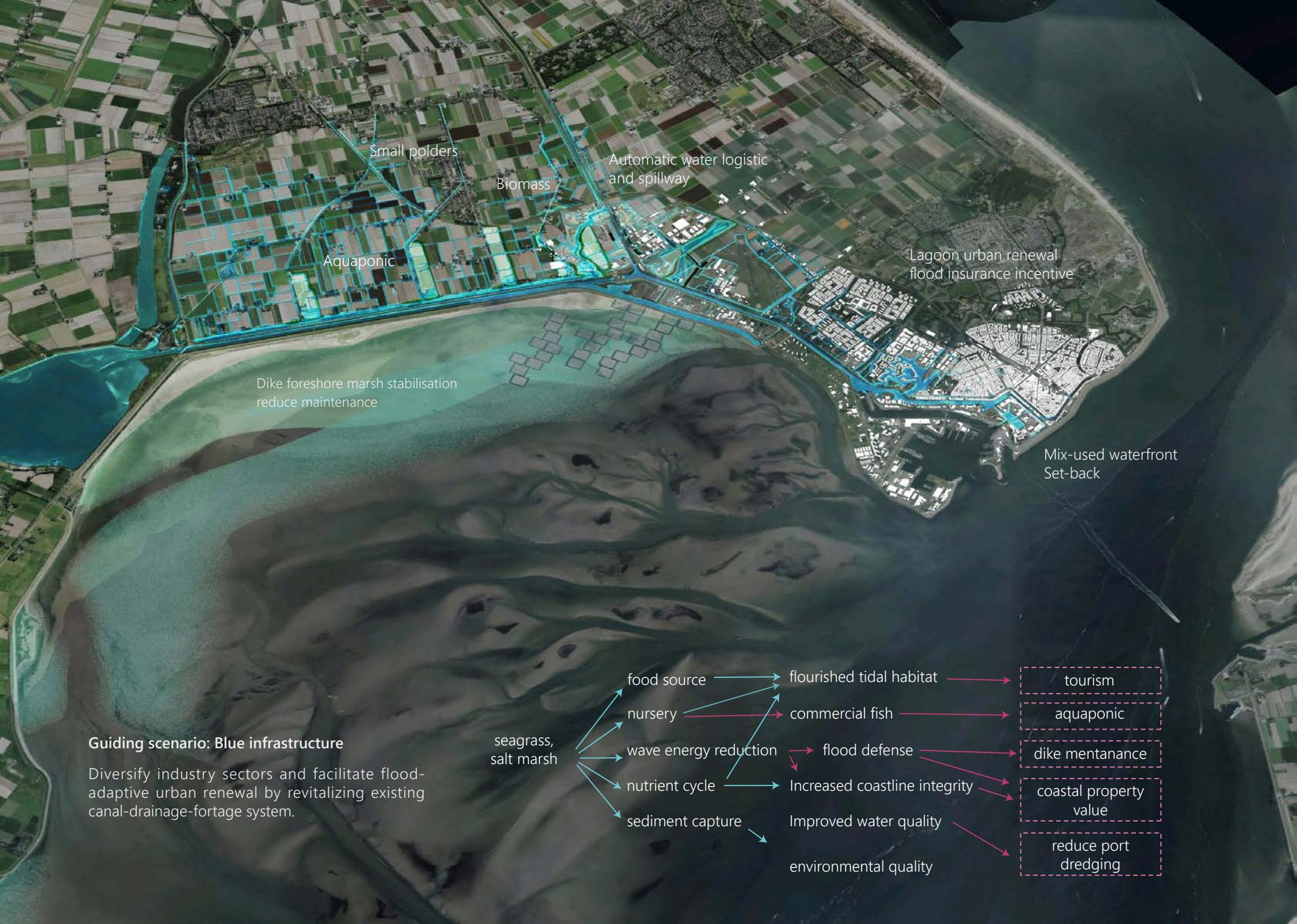
Sediments from  
discharge and de-  
polder

Dike foreshore marsh  
nourishment

Sediments from port  
dredging

**Utilizing scenario: Mud motor**

Generated by dredging and drainage, the mud motor operates as systematic management over sediments, flood, ecosystem conservation and productivity, by a sequence of marsh, de-poldered detention basins and idle permeable plots.



Small polders

Biomass

Automatic water logistic and spillway

Aquaponic

Lagoon urban renewal flood insurance incentive

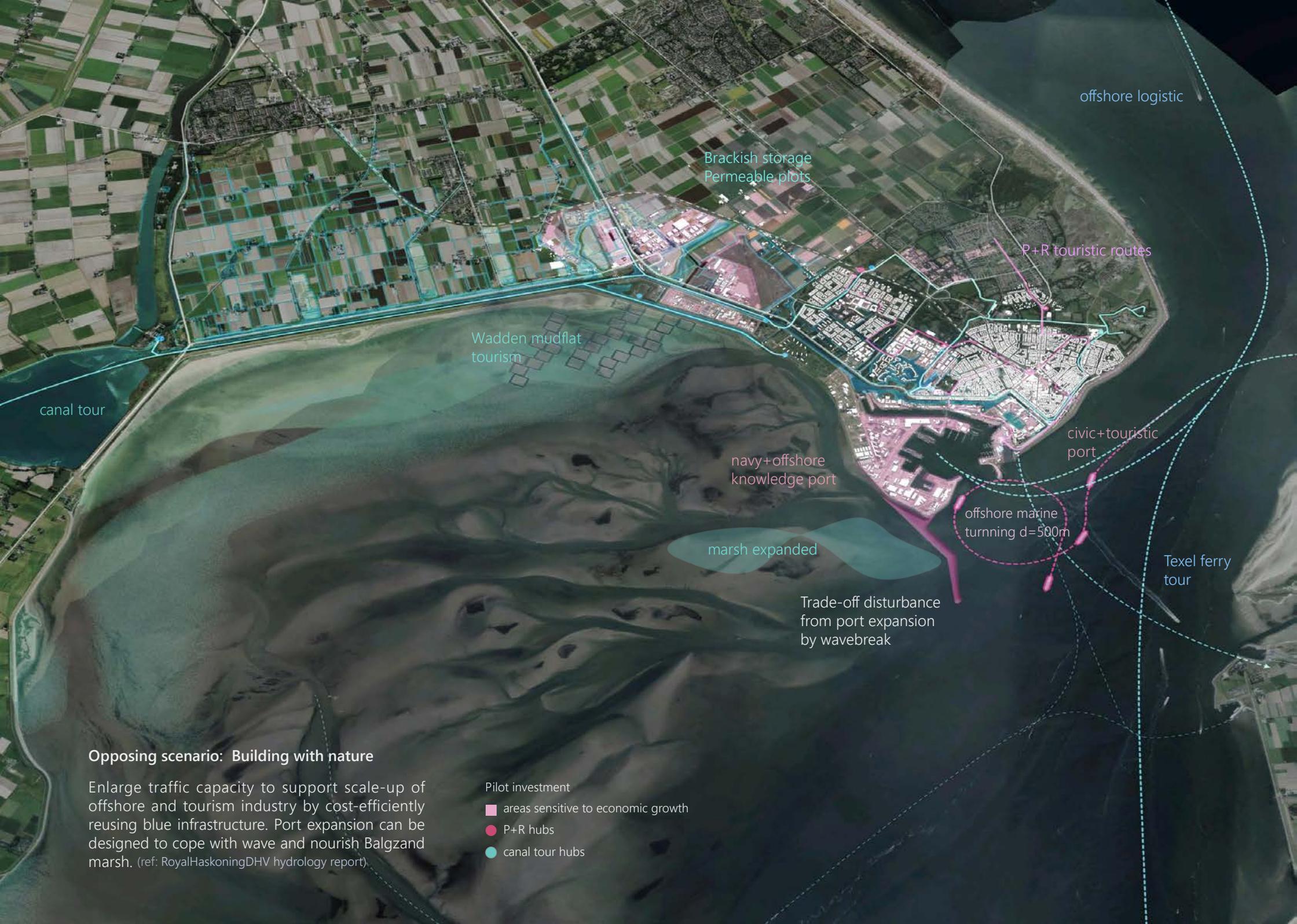
Dike foreshore marsh stabilisation reduce maintenance

Mix-used waterfront Set-back

**Guiding scenario: Blue infrastructure**

Diversify industry sectors and facilitate flood-adaptive urban renewal by revitalizing existing canal-drainage-transport system.





offshore logistic

Brackish storage  
Permeable plots

P+R touristic routes

Wadden mudflat  
tourism

canal tour

civic+touristic  
port

navy+offshore  
knowledge port

offshore marine  
turning d=500m

marsh expanded

Texel ferry  
tour

Trade-off disturbance  
from port expansion  
by wavebreak

### Opposing scenario: Building with nature

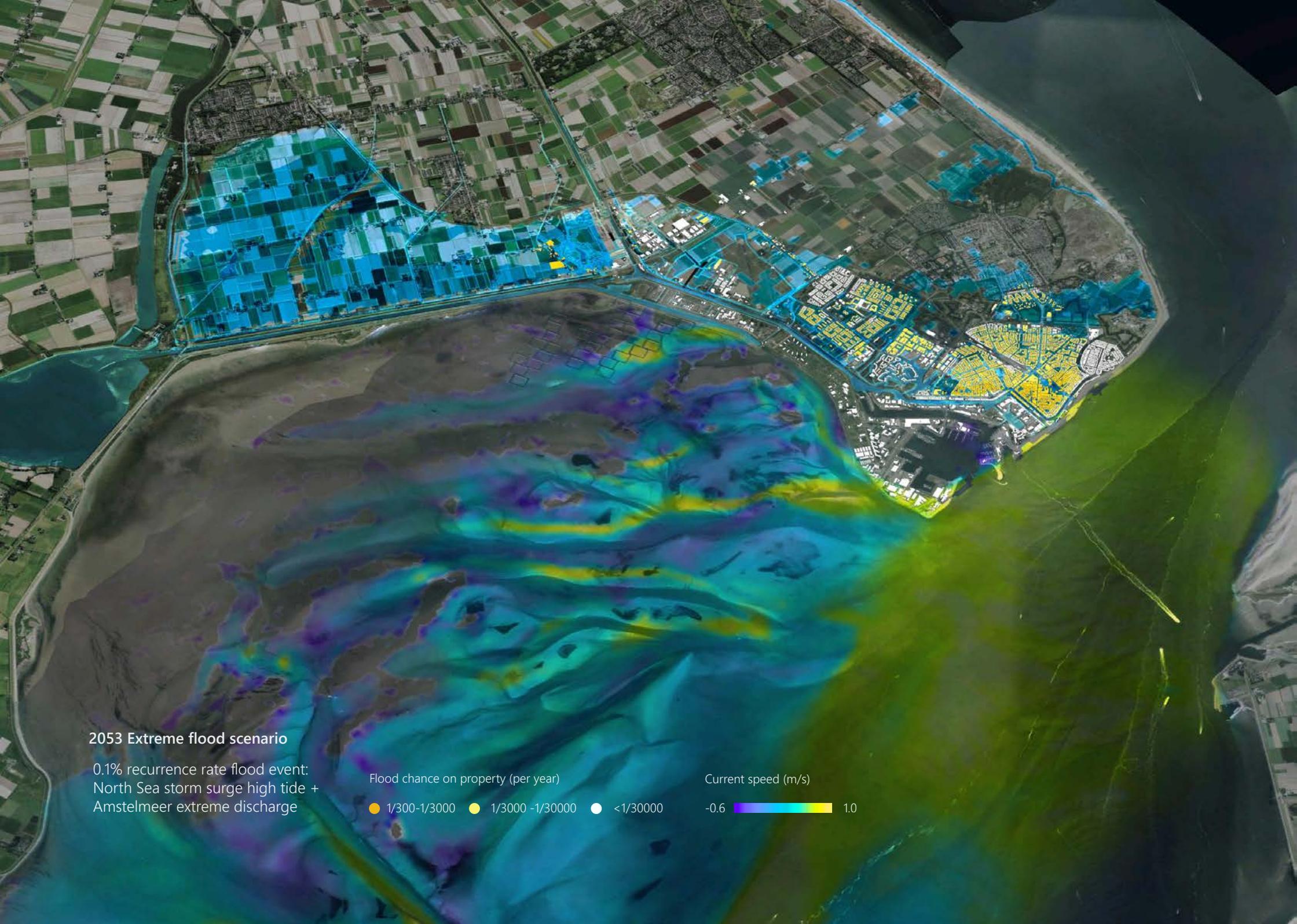
Enlarge traffic capacity to support scale-up of offshore and tourism industry by cost-efficiently reusing blue infrastructure. Port expansion can be designed to cope with wave and nourish Balgzand marsh. (ref: RoyalHaskoningDHV hydrology report)

Pilot investment

■ areas sensitive to economic growth

● P+R hubs

● canal tour hubs



### 2053 Extreme flood scenario

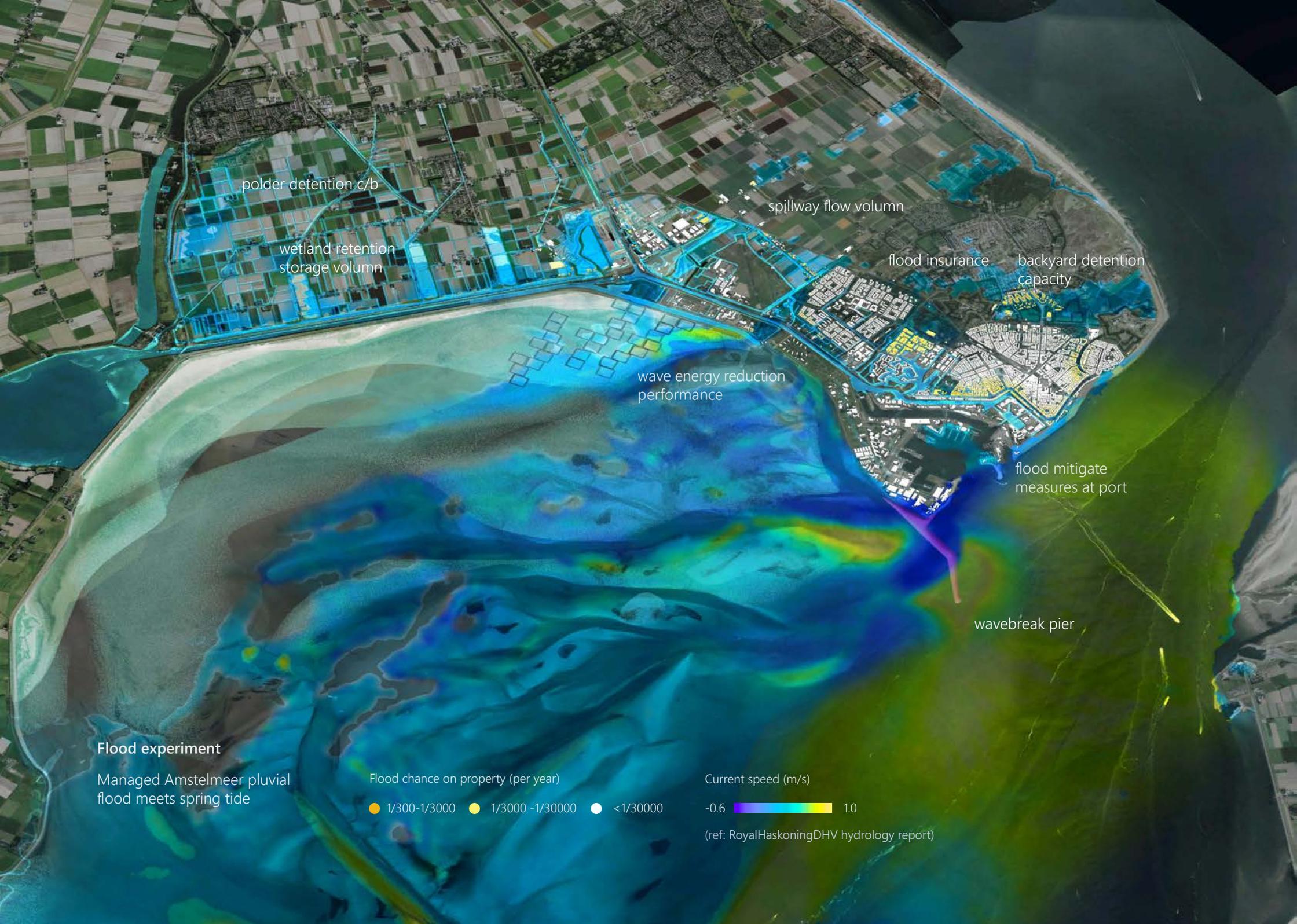
0.1% recurrence rate flood event:  
North Sea storm surge high tide +  
Amstelmeer extreme discharge

Flood chance on property (per year)

● 1/300-1/3000	● 1/3000 -1/30000	● <1/30000
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Current speed (m/s)

-0.6  1.0



polder detention c/b

wetland retention  
storage volumn

spillway flow volumn

flood insurance

backyard detention  
capacity

wave energy reduction  
performance

flood mitigate  
measures at port

wavebreak pier

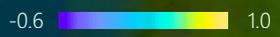
**Flood experiment**

Managed Amstelmeer pluvial  
flood meets spring tide

Flood chance on property (per year)

- 1/300-1/3000
- 1/3000 -1/30000
- <1/30000

Current speed (m/s)



(ref: RoyalHaskoningDHV hydrology report)