

# SEA LEVEL RISE, COASTAL FLOOD HAZARD AND ADAPTATION ASSESSMENT TOOLKIT FOR CITIES.

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## 1. THE FUTURE IS MORE THAN JUST SURVIVING

Successful cities need to understand and manage the uncertainty relating to sea level rise. Planning how to adapt and manage the risks will be key to ensuring a city's resilience and future well-being.

- The prospect of irreversible and significant climate change is becoming ever more real.
- Credible evidence that sea levels could rise by as much as 5m sometime between 100 and 200 years from now.
- 40% of us live close to the coast, and 5% of us – up to 300 million people – live in low-lying coastal areas.
- A substantial rise in sea levels could mean that many people have to leave their homes and place of work, or that drastic adaptation measures are needed, affecting everyone, not just coastal residents.
- The combined effects of climate change could be devastating, disrupting the established way of life for entire regions and even whole countries.
- Will our existing centres of population be able to adapt? Many cities will not be able to rely solely on engineering structures for protection. What if adaptation is not a viable reality?



House being raised to reduce flood risk, Norfolk, Virginia

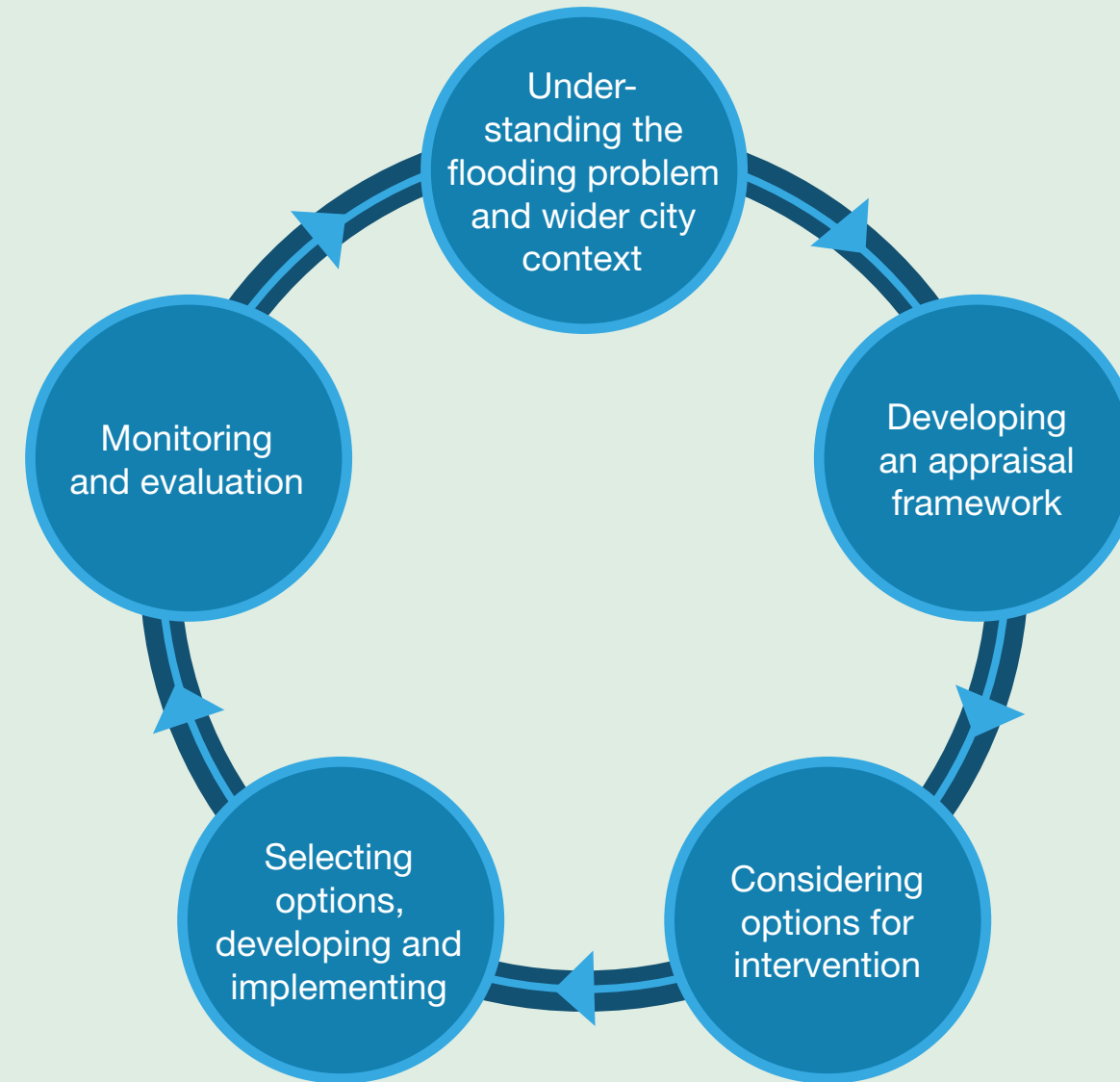


Flooding in Norfolk, Virginia, Oct 2015 © Hans Peter Plag

## 2. AIMS

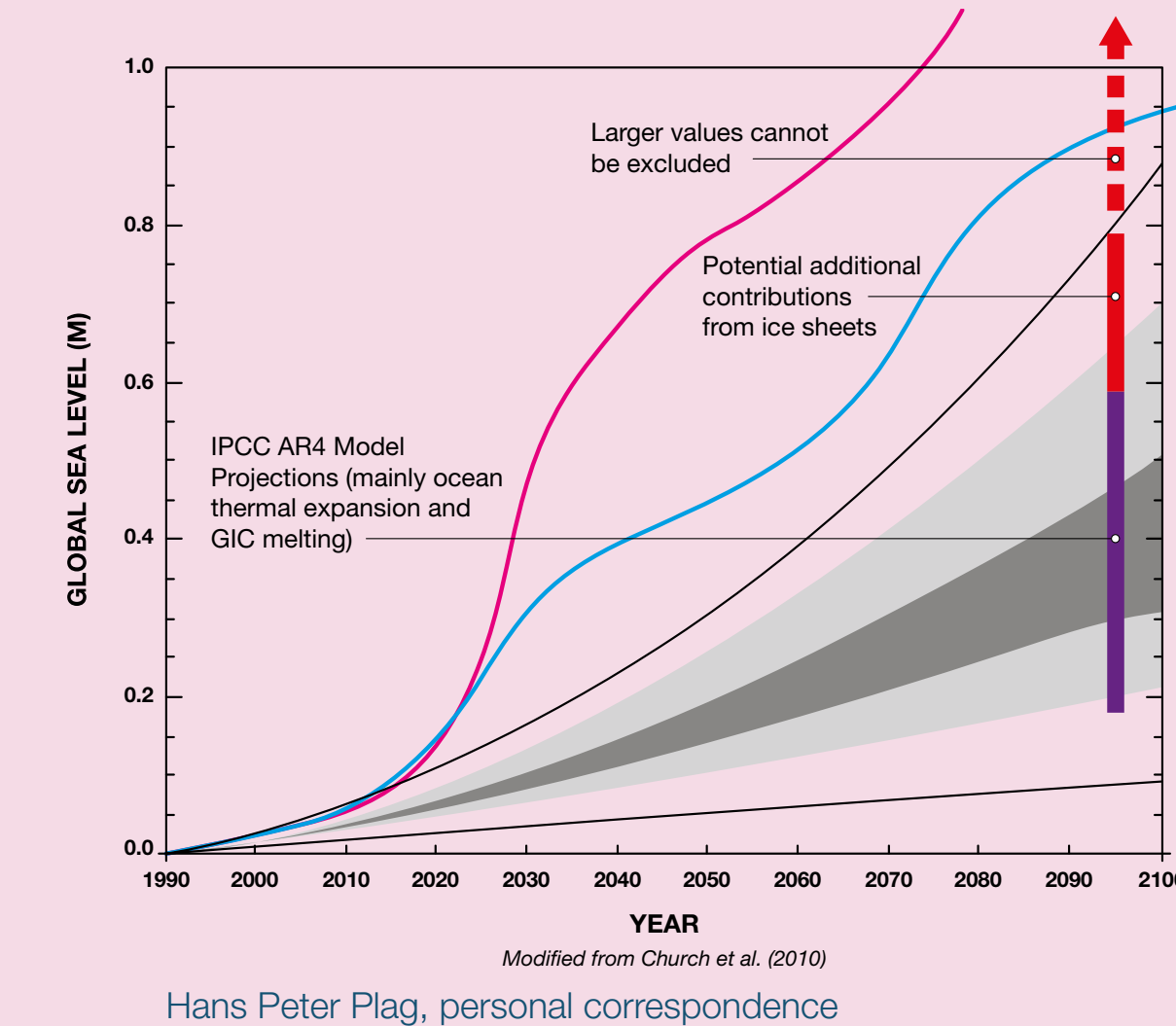
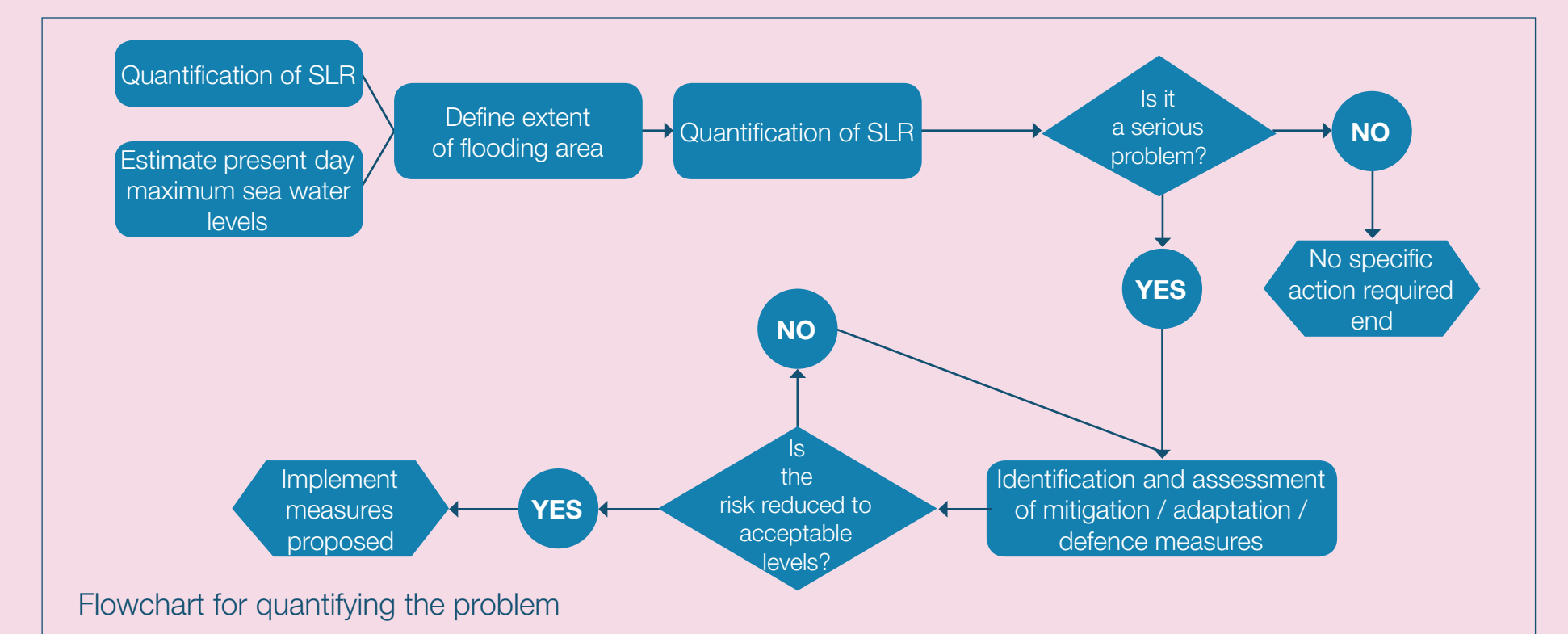
- Framework and guidance for practitioners in assessing coastal flood risk in urban areas facing rising sea levels.
- Approaches to urban adaptation in face of rising sea levels.
- Technical knowledge of sea level rise and coastal flooding.
- Economic, social, political and environmental priorities.
- Examples of good practice from case studies.
- Recommendations for cities planning for sea level rise.

## 3. PROCESS



## 4. QUANTIFYING THE PROBLEM

- What data are available?
- How soon will sea level rise be a problem?
- What is the degree of uncertainty? What is foreseeable?
- What is the nature and condition of existing flood protection measures?
- What is the risk to people, infrastructure and ecosystems?
- How resilient is the city to extreme events?

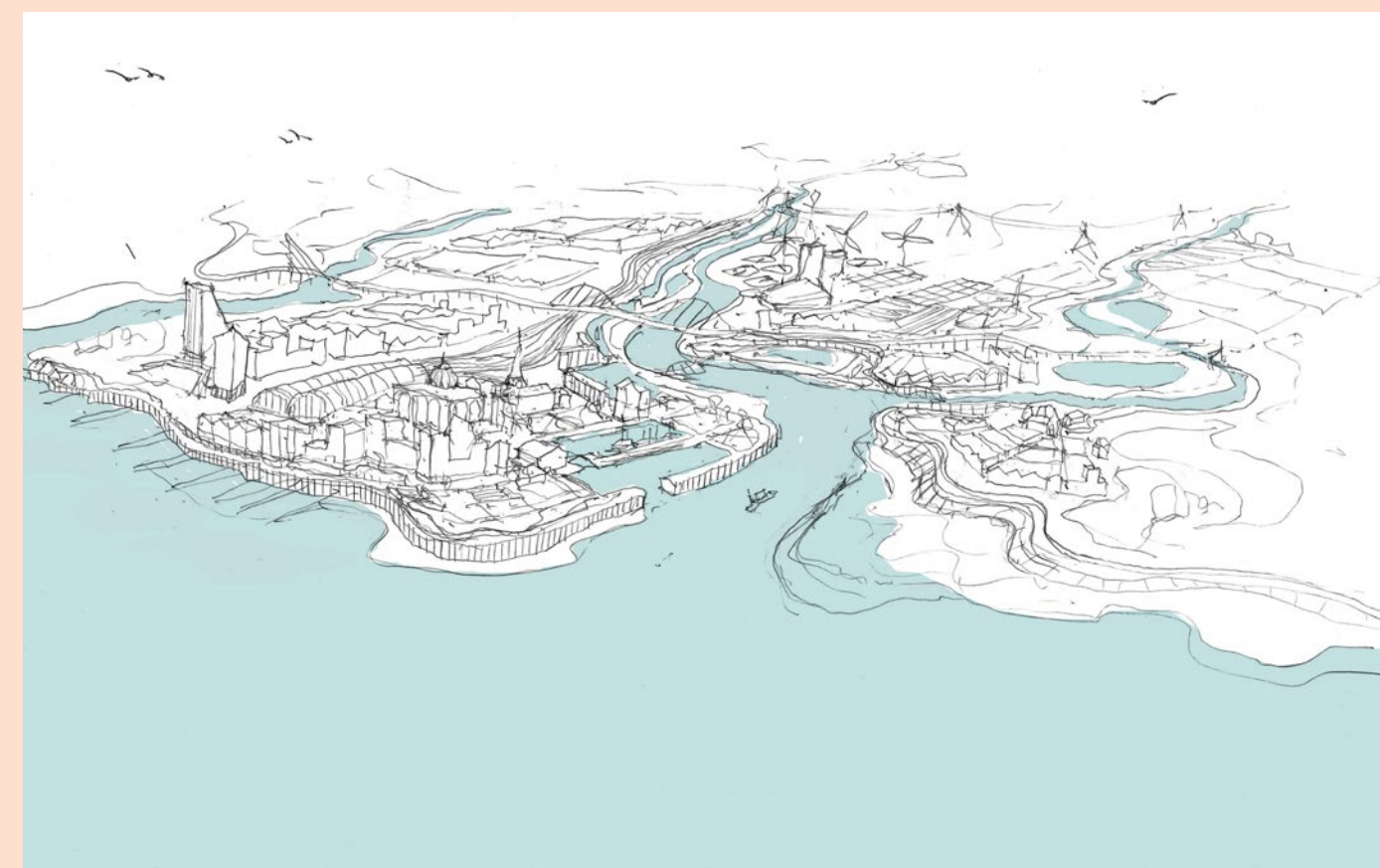


One of the "standard" projections for global sea level in the 21st century, with the uncertainty due to ice sheets added as the bold red arrow close to 2100. The blue and pink curves indicate that the uncertainty is not towards the end of the century but starts today.

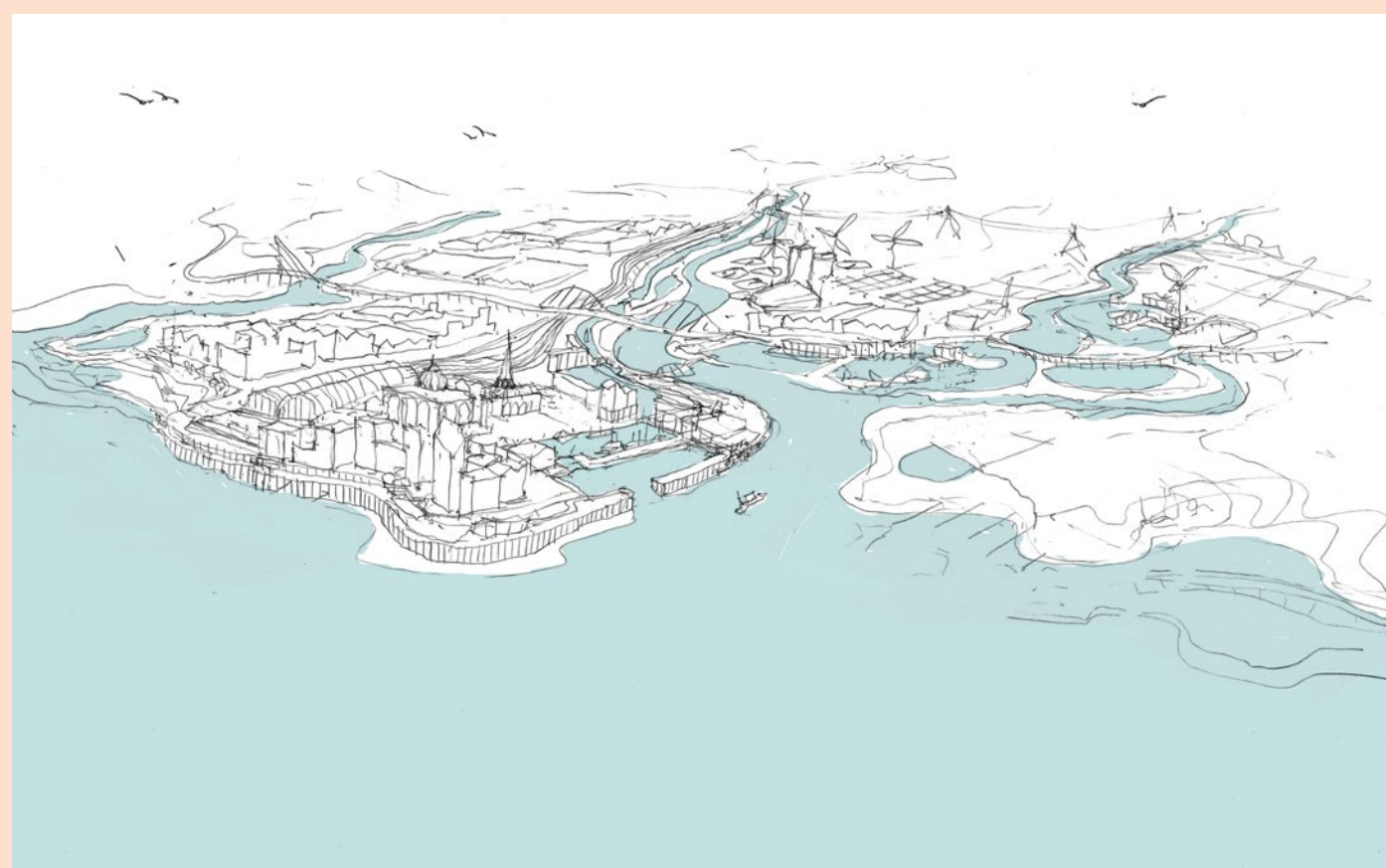
## 5. STRATEGIC APPROACHES



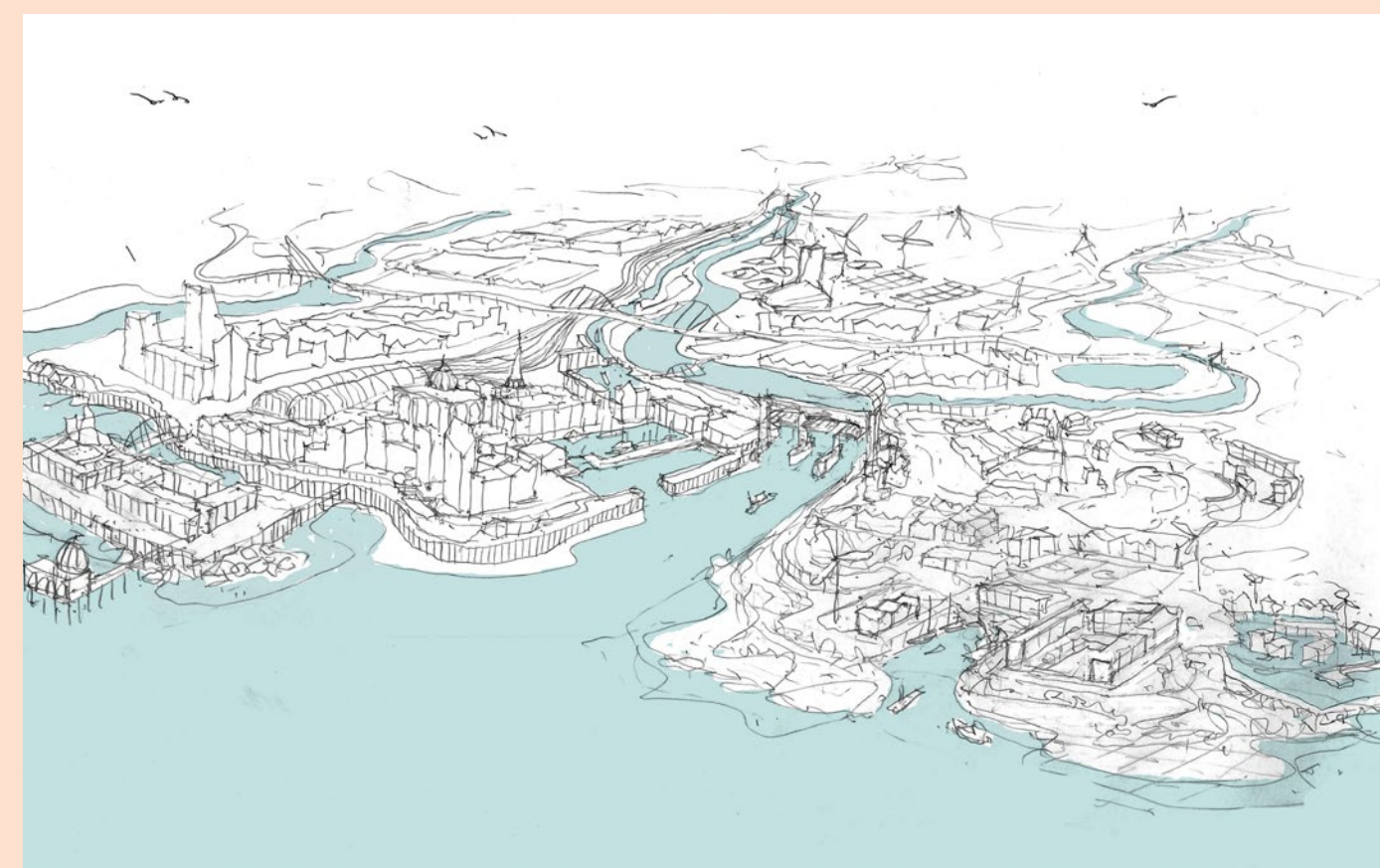
1. Defend / protect – physical defences, barriers, walls



2. Accommodate / embrace – resilience, zoning, planning regulations



3. Retreat – set-back, realignment, buy-out



4. Advance – reclamation, floating communities

## 6. CHOOSING, IMPLEMENTING & MONITORING

- What is the policy context within which decisions can be made?
- What are the 'no regrets' measures?
- Who has the authority and funding to make adaptation decisions?
- Is there a long-term sustainable option?
- Can the city control development in areas at risk from sea level rise, or use financial incentives to direct the location of development?
- Is sufficient funding available?
- Are there creative solutions that balance short-term financial interests with long term risk reduction measures?
- What role could insurance play?
- Is land available for relocation if needed?
- Is the preferred strategy politically acceptable?
- What is the residual risk? How can this be managed?
- Can the city live with some flooding?



## 7. CASE STUDY: NORFOLK, VIRGINIA, USA

- 2nd largest population centre in United States at risk from sea level rise (85% of the population at risk).
- SLR 0.7m - 1.6m by 2100.
- 17 municipal governments and 16 federal agencies.
- Select as a national 'Whole of Government' pilot - Focus on bi-partisan, regional and whole of government planning – towards a common goal (with different levels of government, the military, the private sector, and academia).
- Working groups: infrastructure, legal, planning, economic impacts, public health, community engagement.
- Sea Level Rise Advisory Committee makes recommendations for local governments, advocates for state and federal support.
- Implementing a range of activities such as structural flood defence works, wetland restoration, improving flood mapping, increasing the number of certified floodplain managers, improving documentation of properties in Special Flood Hazard Areas (1:100 flood risk), creating a warning and response system, improving public outreach programs, raising roads, investigating the option of purchasing properties at risk of flooding, and requiring new construction to meet heightened standards.

Flood extent in Norfolk, Virginia from Hurricane Isabel (2003) assuming 1m sea level rise



## 8. LESSONS FROM CASE STUDIES

- Barriers to adaptation: governance, politics, costs of adaptation responses, reactive responses.
- Incentives needed for risk reduction at community and property levels.
- Link adaptation strategy and insurance with land use planning and building codes.
- Collaborative regional planning is critical.
- Start with low regret measures, easy wins: a small visible project that can be delivered in the time frame of politicians.
- Plan now to finance future adaptation measures.
- Extreme events can act as policy windows: have a plan ready to go.