Work Package 5.5 – Influencing institutions and/or current action plans/strategies

Dr. Robert E. Thomas

Energy and Environment Institute, University of Hull

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1 Introduction

The IMplementing MEasuREs for Sustainable Estuaries (IMMERSE) project focuses on international cooperation to address the challenges and threats faced by North Sea estuaries. To address these pressures, a three-step approach is used:

1. pressures are investigated and potential solutions, or measures, are explored;
2. measures are assessed, tested, and recommendations are provided; and
3. preparations are made to implement measures.

Not all individual measures will pass through all three steps during the lifetime of the IMMERSE project, because measure development and implementation is a long-term process, and because some partners are not legally mandated to implement measures.

The IMMERSE project consists of seven work packages:

- WP1. Project management
- WP2. Communication activities
- WP3. Measures: Defining pressures and solutions
- WP4. Measures: Assessments, tests and pilots
- WP5. Measures: Preparing for implementation
- WP6. Horizontal: Stakeholder integration
- WP7. Horizontal: Transnationality

This report is part of the different actions foreseen in Work Package 5. Measures: Preparing for implementation and presents the results of activity 5.5 - Influencing institutions and/or current action plans/strategies. The aim of this work package is to identify approaches to encourage multi-stakeholder acceptance of appropriate novel measures within the Humber 2100+ strategy.

1.1 The Humber

The Humber estuary drains one fifth of England (24,472 km^2), and provides the largest single input of freshwater to the North Sea from the English coastline. It is home to 500,000 people, 120,000 ha of agricultural land, and industries worth over £17.5bn GVA. These include the second largest chemical cluster in the UK, two of the country's six oil refineries, and five power stations. More than 25% of the UK's primary energy supply flows through the region, and its ports handle 14% of UK trade. However, the low-lying nature of the floodplains surrounding the Humber (Fig. 1) mean that the region is at severe risk of flooding during storm surges, which is expected to be exacerbated by forecast sea level rise of 0.26 – 1.45 m by 2100.

The wide, shallow, macrotidal estuary (Fig. 1.1) provides extensive wildlife habitat in its large intertidal zones and salt marshes and is thus of ecological importance for a number of habitats and species. The entire estuary and parts of the tidal river tributaries have therefore been given a number of nature conservation designations under UK, European, and international law: it is a Natura 2000 site, designated as a Special Area of Conservation (SAC), a Special Protection Area (SPA), and a Ramsar site, together forming the Humber Estuary European Marine Site.

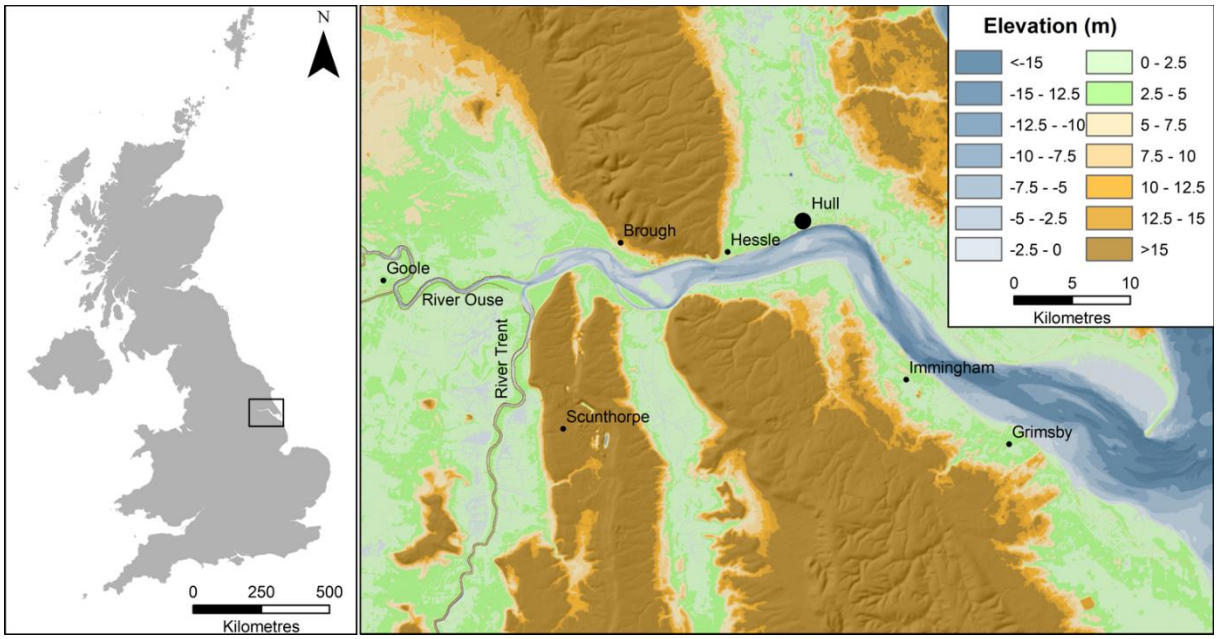


Figure 1.1 Map of the Humber estuary, indicating the position of the Humber within the UK (inset) and the bathymetric and topographic characteristics of the estuary and surrounding region. Note the extensive areas of land with elevation <2.5m above mean sea level.

Flood risk management in the Humber needs to be designed and implemented to provide cost effective, longer-term resilience to flooding without compromising ecosystems and causing damage to natural habitats along the estuary. A satisfactory solution requires co-development with estuary stakeholders. The University of Hull (UoH) has engaged with the Environment Agency, 12 local authorities and key stakeholders including Associated British Ports (ABP), Natural England

and Internal Drainage Boards- to develop the Humber 2100+ flood risk strategy that aims to simultaneously address tidal flood risk while reinforcing the long-term ambition for a prosperous Humber, which is a safe and sustainable place to live, work and visit.

1.2 Historical context

The need for a strategic approach to coastal planning and management was first recognised at UK Government level in the House of Commons Environment Select Committee Report "Coastal Zone Protection and Planning" (1992). To ensure the sustainable use of estuaries, English Nature (1993) stressed the need for integrated estuary management plans that would be guided and implemented by estuary management groups. In particular, to ensure that plans reflected local needs and that any proposed actions received widespread support, English Nature (1993, p.11) regarded as essential that all stakeholders who use and manage an estuary should be included in discussions. Roe (2000) notes that plans were not intended to be statutory documents, but were meant to influence local government through coordinating, supporting and informing existing estuarine planning and management structures. Nevertheless, a criticism of the existing 2008 Humber strategy is that it did not incorporate collaborative decision-making and instead was derived almost in isolation by the Environment Agency. As a result, local authorities did not obtain a sense of ownership and the strategy did not receive buy-in. In addition, past approaches have been driven and informed by discrete needs or challenges, whether considering specific spatial locations in isolation or related to specific pieces of legislation.

2 A new approach: Humber 2100+

Since reducing flood risk around the Humber is a whole-estuary issue that cannot be compartmentalised or limited to places where current funding rules favour, the Humber 2100+ strategy aims to adopt a systems approach. A "systems approach" is an estuary-wide approach to integrated management based on the understanding of individual components such as hydro-morphology, physico-chemistry, and ecology, their interactions and how they, and the system, respond to change. This approach, developed during the TIDE Project Toolbox (https://www.tide-toolbox.eu/), comprises an iterative feedback loop incorporating: Functioning, developing understanding of the estuary and its processes; Governance, understanding and agreeing drivers/governance; and Measures, implementing planned measures and monitoring (Figure 1). Development of the systems approach will be informed by large-scale data collection, assimilation and modelling; fundamentally, it is a data- and evidence-driven approach. By embedding the systems approach within the Humber 2100+ strategy, it is hoped that long-term flood risk management activities in the estuary will align to a more holistic way of managing the natural environment. The advantage of heavy reliance upon evidence is the avoidance of geopolitical bias.

In order to embed a systems approach within the Humber 2100+ strategy, it is necessary to:

- Develop understanding of the estuary environment;
- Review legal and policy obligations against most up to date information;
- Re-assess the current environmental programme of measures;

- Set revised targets and obligations for the current Humber flood risk management strategy;
- Record and agree these changes;
- Use this assessment to inform development of systems approach measures; and
- Engage with key stakeholders and experts.

These tasks are being undertaken through a three-step process (Figure 2):

1. **Building understanding and acceptance of the magnitude and consequence of tidal flood risk both now and in the future, and how to communicate it;**
   Initial model outcomes, when presented to local authorities, were met with scepticism. As a result, the Environment Agency has made significant efforts to develop trust, understanding and acceptance of evidence. To achieve this, it established an Officers Group composed of representatives from all members of the partnership and tasked them with collaborating to prepare datasets to feed into new modelling, undertaken by highly respected independent consultants, of present-day compound flood hazard (i.e., joint probability simulations of river and tidal flood risk to explicitly capture interactions). All datasets and raw modelling results are shared in near real time with all partners through an interactive web-based portal. After data and modelling results have been gathered for the present day situation, the outcomes will be assessed by the Officers, Project Board and Programme Board. If results are not accepted, scope will be refined and further evidence will be gathered until the baseline can be fully endorsed. During this process, the scope for remaining (i.e., future climate change and sea-level rise scenarios) will be established and refined and the modelling exercise conducted. At the end of that exercise, once again outcomes will be assessed by the Officers, Project Board and Programme Board. If results are not accepted, scope will be refined and further evidence will be gathered until the future projections can be fully endorsed.

   An important element of Step 1 is identifying and implementing a communications strategy to distil key messages (e.g., tidal flood risk is already a reality and will only increase over time; we continue to invest now and we're already planning for the future, working in partnership across the Humber; and we're going to need a new approach if we are going to continue to manage risk in the face of climate change, which will mean we all need to think differently, be bold, and adapt to change) in an effective and attractive way. This includes infographics and animations to explain the dynamics of the tides and tidal rivers, current flood management activities around the Humber, the level of investment in flood defences to date, an ESRI StoryMap, a new Citizen Space, and a context setting graphic that brings all of the key messages together, contains links to the other public engagement products, and can be used on social media, printed off as a leaflet, used as a poster, etc... In addition, the Environment Agency has established an Elected Members Forum (EMF) composed of elected representatives from each of the local authorities and a Liaison Forum (LF) composed of stakeholders with responsibilities for communicating activities

with the wider public. At the end of Step 1, outputs will be published and public-facing messaging will be reviewed and revised if appropriate.

2. **Agree a range of strategic approaches that will be used to manage tidal flood risk, accepting that the current approaches won't be enough;**
   Initial 2D hydrodynamic modelling (see Skinner et al., 2022) identified a range of opportunities and constraints:

   - Large-scale flood storage inland from the Humber Bridge can lower water levels in the estuary and reduce flood risk into the tidal rivers;
   - Large-scale flood storage downstream of the Humber Bridge has a limited effect over the next 25 years but this does change in the future;
   - Apart from in the outer south estuary, defence raising could increase tidal flood risk inland, with increased water levels increasing with distance inland and with relative sea level rise;
   - Tide-locking influences flood risk inland and this is expected to worsen.

   In order to address these, possible interventions include on-the-ground measures such as building embankments and walls, storage areas and habitat creation, but also warning systems and changes to land use planning policy.

   Three broad strategies were proposed in 2020 to address 21st century Humber flood risk management:

   Managing the Tide using a combination of improved flood defences, existing and additional flood storage, and occasional planned flooding of land. Changes to land use in some areas would also be required to manage the impact of rising sea levels and high tides.

   Adapting to the Tide by continuing to improve or maintain defences in some areas and changing land use in others to allow defences to be deliberately altered or moved back in some locations over time.

   Keeping Out the Tide by constructing a tidal surge barrier. Defences on the seaward side of the barrier would need to be improved and there would be continued maintenance of defences inland of the barrier.

   All three strategies will require additional approaches to improve resilience to occasional flooding.

   Step 2 will also involve analysis of the cost and feasibility of the different strategic approaches (e.g. see Thomas and Harrison, 2023). These approaches will be assessed, modified and potentially adopted by the partnership through an agreed acceptance route, a mixture of local authority cabinets, scrutiny committees and delegations.

3. **Define what actions are needed, where and when, and how they will flex and adapt over time.**
   The third step of the development process essentially outlines the requirements for implementation. Specifically, it will consider the practicalities of implementing change within a partnership. This will include consideration of future investment programmes at national and regional level, the continued incorporation of evidence (which will remain under review), and continued engagement with members of the partnership through the Officers, Project Board, Programme Board, Elected Members Forum, Liaison Forum, and with wider stakeholders (e.g., ward members, parishes, strategic stakeholders). This step also incorporates two periods of pre-public consultation engagement and public consultation.

It is emphasised that partnership working is embedded within each step, through technical collaboration to gather baseline datasets in Step 1, collaborative working to develop, assess and agree strategic approaches in Step 2 and collaborative working to identify and apply for funding, incorporate evidence and implement suggested changes. Furthermore, messaging and public engagement products will be under continual review as additional evidence and opinions are inputted. In addition, feedback loops following input from Officers, fora, boards, community members and stakeholders are incorporated within each step and between steps to ensure the incorporation of views and buy-in from all partners and as many stakeholders as possible.

Figure 1 – A visual representation of the systems approach developed in the TIDE project, as incorporated within the Humber 2100+ strategy development process. Note the iterative feedback loop between the "Functioning", "Governance" and "Measures" stages (from Environment Agency, 2020).

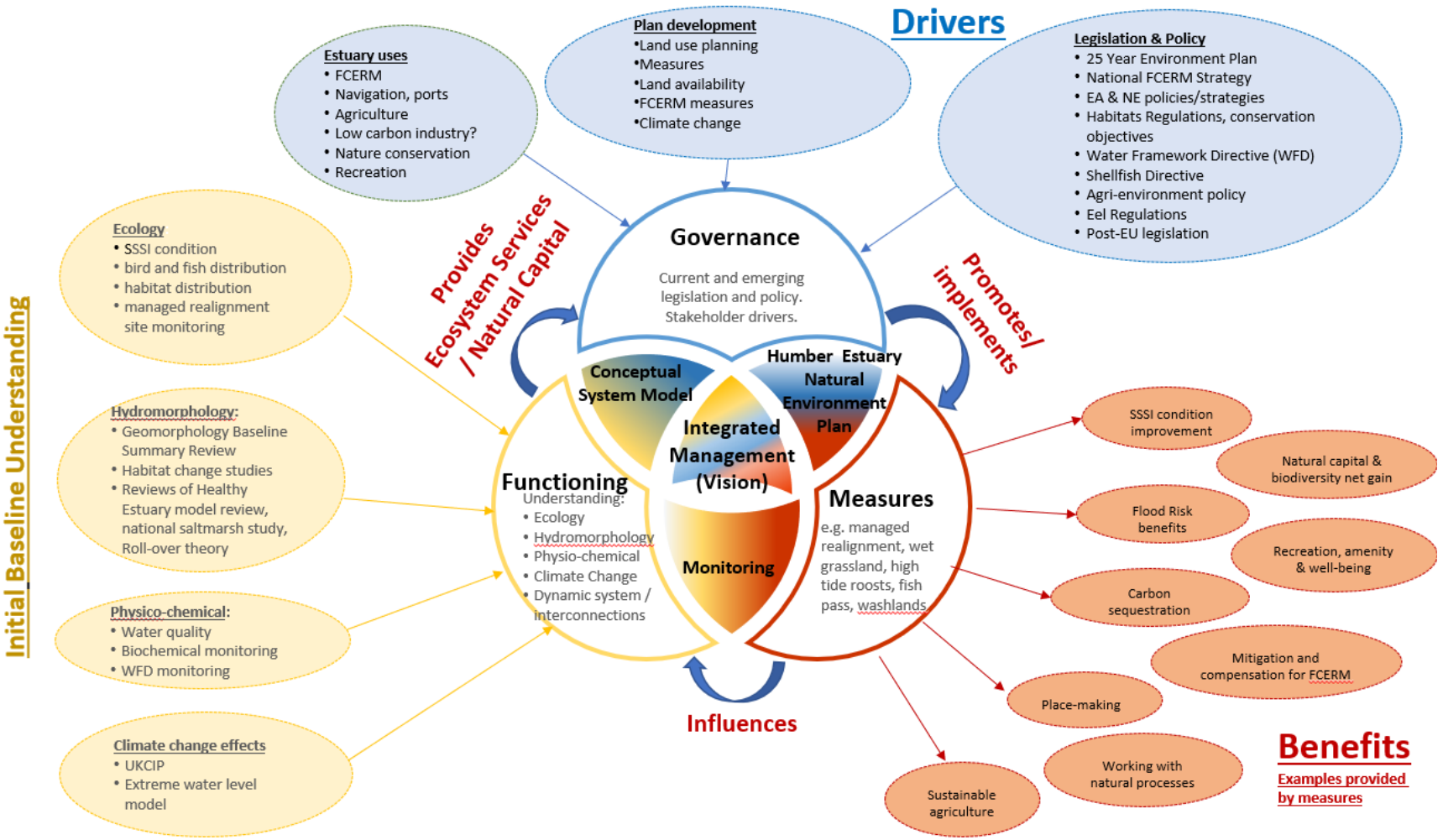
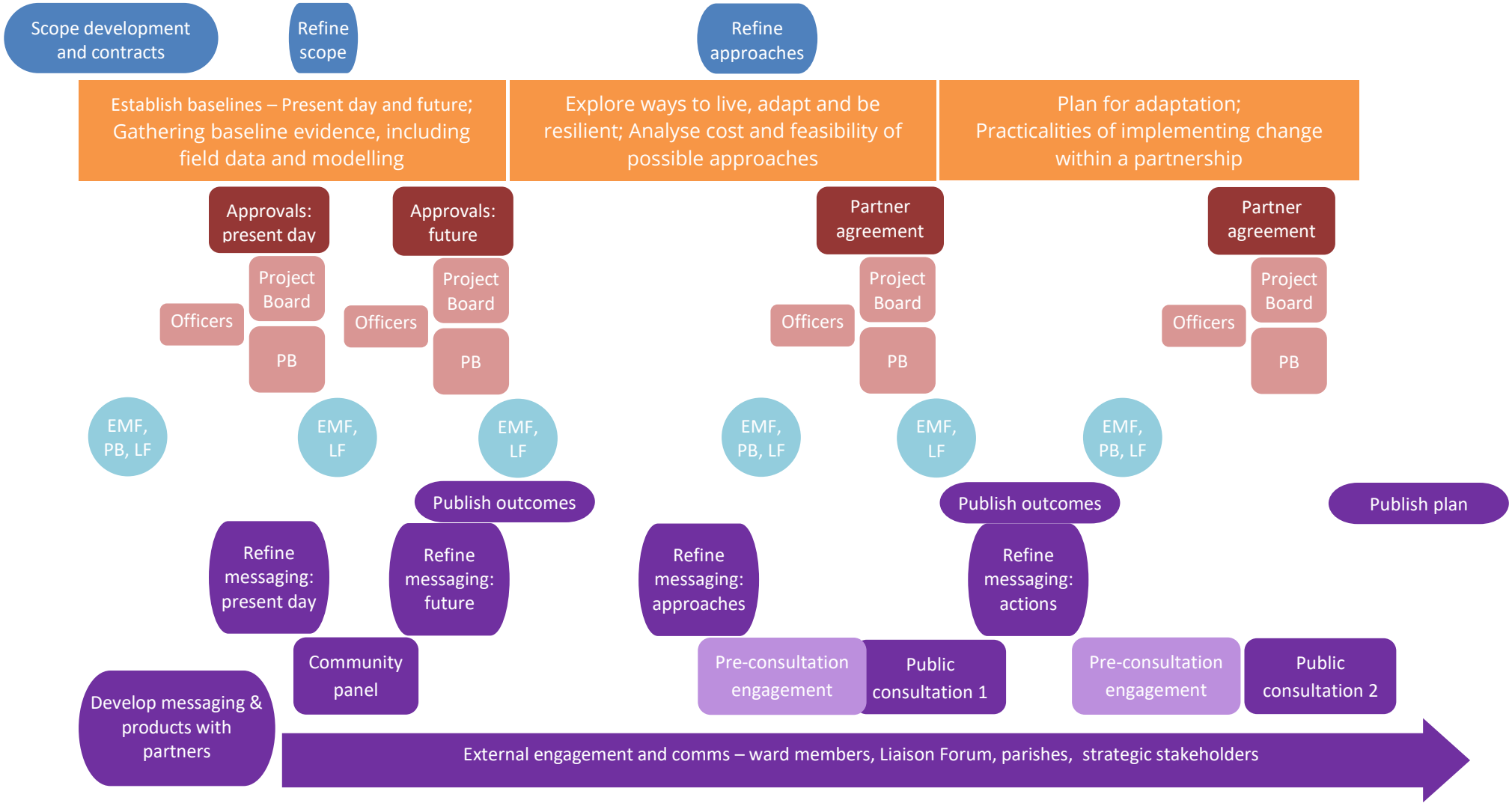


Figure 2 – Signposts of the anticipated development process of the Humber 2100+ strategy. The diagram proceeds from left to right, approximately in order, but note that the relative distances are not representative of timescales. EMF = Elected Members Forum, LF = Liaison Forum, PB = Programme Board

Step 1: Data & Modelling technical collaboration to understand present day and future risk	**Step 2:** Agree strategic approaches to manage tidal flood risk, accepting that the current approaches won't be enough	**Step 3:** Define what actions are needed, where and when, and how they will flex and adapt over time



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