Climate - Greenhouse Gas Emissions and Climate Change Resilience and Adaptation (Including Flooding)

Baseline/issues: North West Plan Areas 10 11

(Please note that the figures in brackets refer to the SA scoping database. This is available on the MMO website)

The following climate impacts are predicted:

- Increase of 2.5 degrees by the 2050s and 3.6 degrees in the 2080s under the medium emissions 50 percentile estimate (Climate_180)
- Projections of mean winter precipitation change in the North West get larger over time with projected increases in average winter precipitation of +10% by the 2040s and +16% by the 2080s (Climate_201)
- Coastal infrastructure is also projected to experience increasing vulnerability due to average sea level increases by the 2080s of up to 63cm and from more frequent storm surges (Climate_180)

Sea level rise is already affecting intertidal habitats which balance delicately on the basis of tidal inundation (Climate_140)

Baseline/issues: North East Plan Areas 1 2

The following climate impacts are predicted:

- Average seasonal temperatures to increase, with a region-wide annual average daily temperature change of just under 2°C (Climate_203)
- Increased seasonality of rainfall with increases of up to around 21 per cent in winter and reductions of up to around 37 per cent in summer (Climate_203) resulting in more erratic rainfall patterns (Climate_184)
- An increase in mean sea levels of around 0.3m (Climate_203)
- Increased flooding, storm surge heights and coastal erosion (Climate_184);

The highest number of properties at risk from coastal flooding is likely to be around Yorkshire and the Humber Estuary (Climate_164)

Baseline/issues: South West Plan Areas 8 9

The following climate impacts are predicted:

- An increase of 3-5 °C in mean summer temperatures in the eastern parts of the region, though less than this in most of Devon and Cornwall (Climate_176)
- Projections of central estimates of average summer precipitation change in the South West get larger over time. Projected changes in average summer precipitation are -13% by the 2040s and -23% by the 2080s (Climate_202)
- Seasonal mean and extreme waves expected to increase (Climate_194)
- Increase in the magnitude of winter flash floods due to increased winter rainfall and reduced summer rainfall (Climate_176)

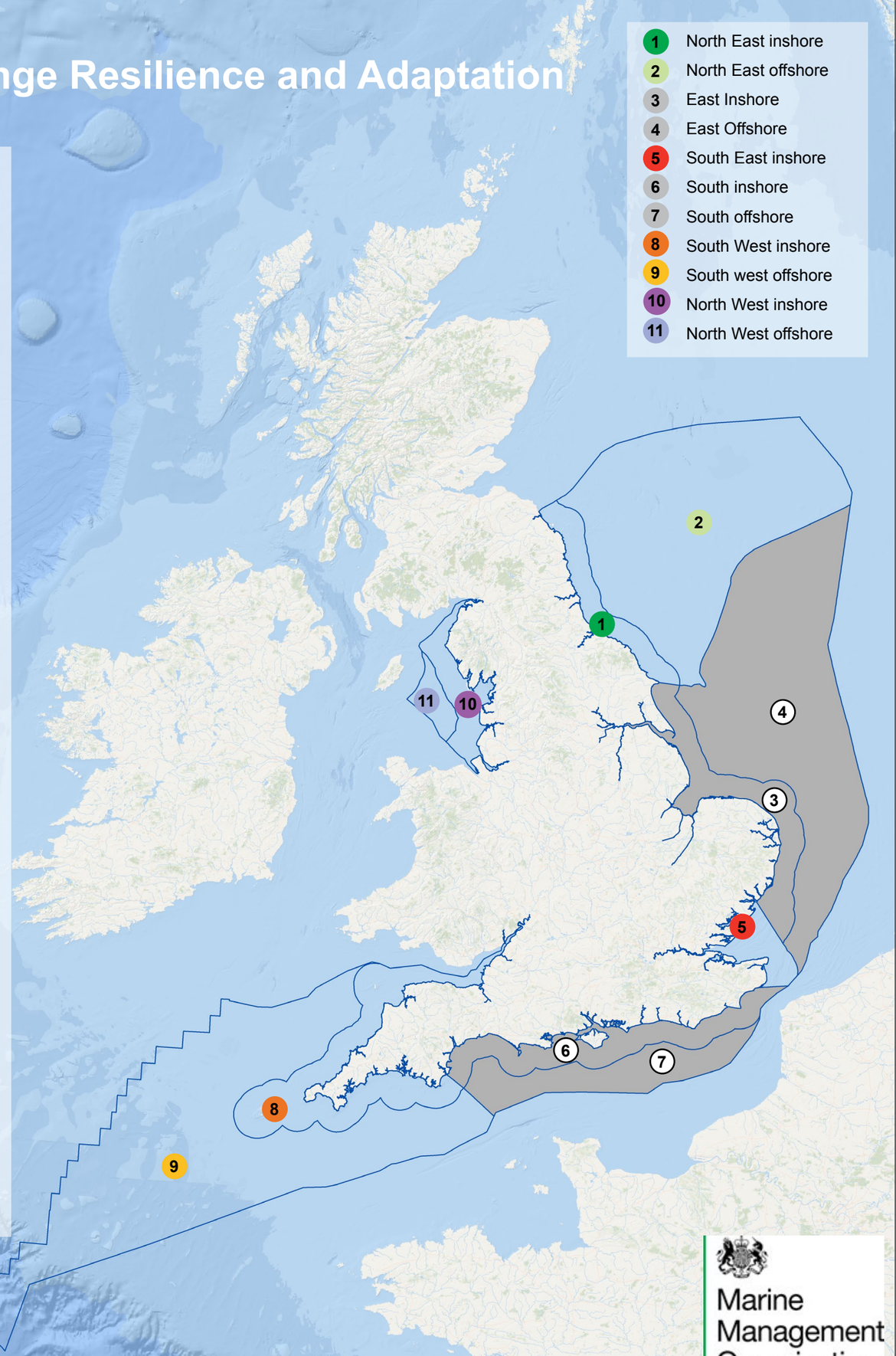
The peatlands of Bodmin, Dartmoor and Exmoor support internationally important mires and heaths provide 70% of local drinking water and lock up significant amounts of carbon (Climate_177)

Baseline/issues: South East Plan Areas 5

The following climate impacts are predicted (Climate_182):

- Estimates of winter temperature change are projected to be generally between 2 and 3ºC across most of the country, with slightly larger changes in the South East. In summer some parts of the south are projected to be over 4ºC with the largest increase in numbers of hot days in the south east (Climate_200)
- Extreme high water from rising sea levels combined with storm surge and large waves could lead to a higher risk of a breach in low-lying areas of the coast and reorganisation of coastal ecosystems. This risk is particularly apparent in East and South England (Climate_182)
- The greatest increases in risk of river and tidal flooding affecting high-quality agricultural land occur in the South and East (Climate_182)
- Rising sea levels and storms will also put pressure on coastal flood defences (Climate_181)
- Coastal groundwater systems are vulnerable due to predicted increase in sea level (Climate_139)

Fifteen per cent of the city's surface area lies on the floodplains of London's rivers. The Thames Barrier will continue to provide flood protection to London through most of this century with some modification (Climate_147).



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Summary of the legislative / policy context

The Marine Policy Statement sets a number of high level marine objectives which enable the UK's move towards a low carbon economy in order to mitigate the causes of climate change and ocean acidification and adapt to their effects. This includes recognition that the marine environment plays an important role in mitigating climate change and makes it clear that the use of the marine environment should be spatially planned where appropriate and based on an ecosystems approach which takes account of climate change (Climate_5)

Shoreline Management Plans (SMPs) in the UK provide a large scale assessment of the risks associated with coastal processes that result in both flooding and erosion and presents a policy framework to reduce these risks. SMPs will be reviewed later in the SA process as will Catchment Flood Management Plans, if relevant at the assessment stage. There may also be other specific strategies in place in some areas (for example, the Humber Strategy) and these will also be reviewed if appropriate (Climate_204)

Various legislative and policy requirements are in place to reduce greenhouse gas emissions from all sectors. Key examples are as follows:

- UK Climate Change Act 2008 commits the government to reduce greenhouse gas emissions by 34% in 2020 and at least 80% by 2050 (compared to 1990 levels) (Climate_1)
- The UK has a legally binding target to produce 15% of its energy needs from renewable sources by 2020, required under the Renewable Energy Directive (2009) (Climate_2)
- The Committee on Climate Change recommends that international shipping emissions are included in the UK's 2050 target to reduce emissions by 80% on 1990 levels. However, other mechanisms, for example, via the International Maritime Organisation (IMO) could play a role in reducing relative emissions via technical and operational measures (such as efficiency improvements) (Climate_3)
- The UK Low Carbon Transition Plan (2009) details how targets for UK GHG reductions will be achieved. Around half the emissions reductions are expected to come from the power and heavy industry sectors with more modest contributions (about one third in total) being made by transport, homes and communities (Climate_7)

In addition the consideration of greenhouse gas emissions is also evident in UK legislation through:

- The 2008 Planning Act and 2011 Localism Act, supported by the National Planning Policy Framework (NPPF). This requires local planning authorities to develop policies and adopt proactive strategies to mitigate and adapt to a changing climate, taking full account of flood risk, coastal change and water supply and demand considerations (Climate_169)

Key cross cutting baseline / issues across all plan areas

The impacts of climate change are already being observed, and impacts are predicted to continue (Climate_115)

- Average UK temperatures have risen since the mid 20th century, as have average sea level and sea surface temperatures around the UK coast. There has been an approximate 14 cm rise in mean sea-level since the beginning of the 20th century, which has significantly increased (as much as doubled) the risk of flooding at many locations around the coast (Climate_121)
- The UK is likely to experience hotter, drier summers and warmer, wetter winters (Climate_127)
- For the UK's marine environment, the impacts of climate change include relative sea level rise, increased seawater temperatures, ocean acidification and changes in ocean circulation (Climate_127)
- If carbon emissions continue unchecked, surface ocean pH will decrease to between 7.6 and 7.8 by the year 2100 (Climate_118)
- Emissions from ships are estimated to be approximately 3 per cent of global CO2 emissions, projected to rise to approximately 15 to 30 per cent by 2050 due to expected increase in global trade. UK shipping emissions are estimated between 0.8 and 5 per cent of global shipping emissions (Climate_110)

Management and adaptation to these impacts should be a priority for terrestrial planning on the coast (Climate_6) for example protecting and restoring marine habitats, using natural means of flood defence using ecosystem-based approaches and ensuring that that inappropriate types of development are not permitted in those areas most vulnerable to coastal change (Climate_132)

- In the absence of adaptation or mitigation (which may become prohibitively expensive) some beaches will narrow and habitats such as dune systems (Climate_129), mudflat and saltmarsh (Climate_193) may be lost
- In particular it is important to note that climate impacts have wider environmental and social implications, and are derived from both inundation processes, and anthropogenic action including coastal defence and other coastal infrastructure (such as cable and pipe landfall, new port infrastructure) and sea-level change (Climate_134)

Council led Strategic Flood Risk Assessments (SFRAs) may be important sources of information / modelling at the assessment stage. Examples discussed by consultees include Avonmouth Severnside SFRA model and the Bristol City Council Central Area Flood Risk Assessment (Climate_192)

The likely evolution of the environment over the plan duration

- The realignment of some coastal infrastructure and housing may be expected (Climate_131). Around 700 properties could be lost to coastal erosion over the next 20 years (Climate_171)
- Future effects of climate change are also likely to include increased storm intensity, increased rainfall, increase in seawater temperature and acidity leading to ecological impacts. This could have practical implications for licensing and exploration. The rate of coastal erosion is likely to increase as sea levels rise (Climate_114)
- Climate change could lead to deeper water in near shore areas, which would in turn cause an increase in wave energy reaching the coast. Impacts of coastal erosion on buildings and infrastructure located along the coast are therefore likely to increase (Climate_116)
- Over the next 20 years, there will be a need to reduce greenhouse gas emissions in order to meet UK climate legislation. It is envisaged that further development of renewable energy generation including offshore wind farms and wave and tidal energy generation, could contribute to this reduction. There are also a number of important ports within these marine plan areas and marine planning can make a contribution to climate change mitigation and adaptation in line with United Kingdom national policies and recent International Maritime Organization measures (Climate_3)

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Potential interactions with other topics

There are particularly clear links identified with biodiversity, ecosystem services, economy, ports and shipping, renewable energy and communities. A number of examples are listed below; however please see other report cards for topic specific impacts:

- Renewable energy offers the potential for mitigating greenhouse gas emissions from energy production. It could also provide opportunity for socio-economic benefits including employment, energy security and export business (Climate_159)
- Rising air temperature and sea temperatures and associated sea level rise could have implications for the majority of marine ecology receptors identified within the biodiversity report cards. For instance, the loss of intertidal habitat through coastal squeeze and the effect on foraging bird species (Climate_126). The loss of intertidal habitat and impacts on benthic species is covered in the Benthic and Intertidal Ecology report card.
- Ocean acidification, through the uptake of CO2 from the atmosphere, is predicted to have negative impacts on calcifying organisms, including numerous plankton taxa, molluscs and echinoderms, which will resonate at higher trophic levels (Climate_135)
- Marine aggregates are required for the maintenance of coastal defences required for climate change adaptation. Marine aggregates can present reduced impacts on local communities compared to the extraction of land-won aggregates, including skilled, stable employment and the generation of income through the construction industry supply chain. Potential adverse impacts could include changes to the hydrodynamic regime that may alter coastal processes; loss of seabed habitat and heritage assets; impacts on fisheries and secondary impacts to marine life and habitat associated with sediment plumes; disturbance of fish spawning, migration routes, nursery and overwintering areas; overspills from dredging vessels and impacts on geodiversity.

Potential transboundary issues

- Climate change is a global issue and therefore transboundary in nature. Climate change has the potential to exacerbate erosion and flooding issues on a national scale and as such, climate change resilience and adaptation techniques set out in shoreline management plans should take account of transboundary impacts in other plan areas.
- Sea surface temperature has risen approximately 0.7 degrees Celsius per decade and air temperature approximately 0.6°C per decade in the period 1984 to 2008 tending to be largest in the south and east of England and smallest in Scotland (Climate_117)
- Coastal groundwater systems are also vulnerable due to predicted increase in sea level - implications for coastal flooding are particularly evident in the Southern North Sea (Climate_139)

Key data gaps

There are a number of key data gaps mainly relating to current knowledge gaps and uncertainties in climate change predictions and impact:

- Knowledge of the impacts of ocean acidification on marine species is limited (Climate_161)
- Coastal responses to changes in sea level, extreme storms and waves are complex and localised (Climate_160) – Shoreline Management Plans (SMPs) in the UK provide a large scale assessment of the risks associated with coastal processes that result in both flooding and erosion and presents a policy framework to reduce these risks. SMPs will be reviewed later in the SA process as will Catchment Flood Management Plans, if relevant at the assessment stage. There may also be other specific strategies in place in some areas (for example, the Humber Strategy) and these will also be reviewed if appropriate (Climate_204)
- Regional variability of sea-level changes are poorly addressed at the current resolution of Global Climate Models used for climate projections (Climate_144)
- An increased frequency in storms and storm surges (including an increase in wave height) which can be directly attributed to climate change, remains unproven in the most recent probabilistic projections for the UK (Climate_119)
- A lack of long-term records from deep-sea habitats means that there is no baseline against which to assess climate change impacts (Climate_165)
- Sea surface warming is the most evident in Region II (North Sea) of the OSPAR Convention, however there is no data recorded for the immediate east coast of England, or the English Channel (Climate_123)
- Improved knowledge of how regional patterns in rainfall and winds will change over the next century is needed to understand potential changes to stratification in shelf seas (Climate_162)
- Due to the timescales of the project the 2016 Draft River Basin Management Plans (RBMPs) have been reviewed as the final RBMPs were published very shortly before the publication of the SA scoping report. It would be useful to review the final RBMPs before the SA assessment stage begins (Climate_157)
- The Environment Agency have updated climate change allowances (these are predictions of anticipated change for: peak river flow by river basin district; peak rainfall intensity; sea level rise; offshore wind speed and extreme wave height). This updated guidance was published shortly before the publication of the SA scoping report and it may be useful to review the climate change allowances for the river basin districts within each plan area before the SA assessment stage begins (Climate_156)
- Climate Ready has produced regional summaries of the UK climate change risk assessment and it would be beneficial to review before the assessment stage of the SA begins (Climate_172)

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