THE BRISTOL PORT COMPANY

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Haven Master

Sustainable Severn – Governance and Collaboration

Bristol Port:

- Major UK Port
- Harbour Authority
- Sustainable Developer
- Decades of experience of operating in the challenging environment of the Severn Estuary

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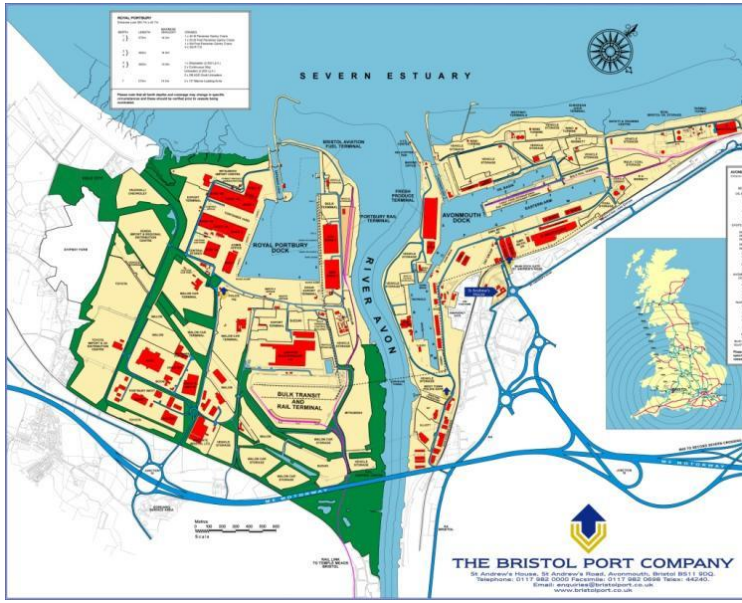

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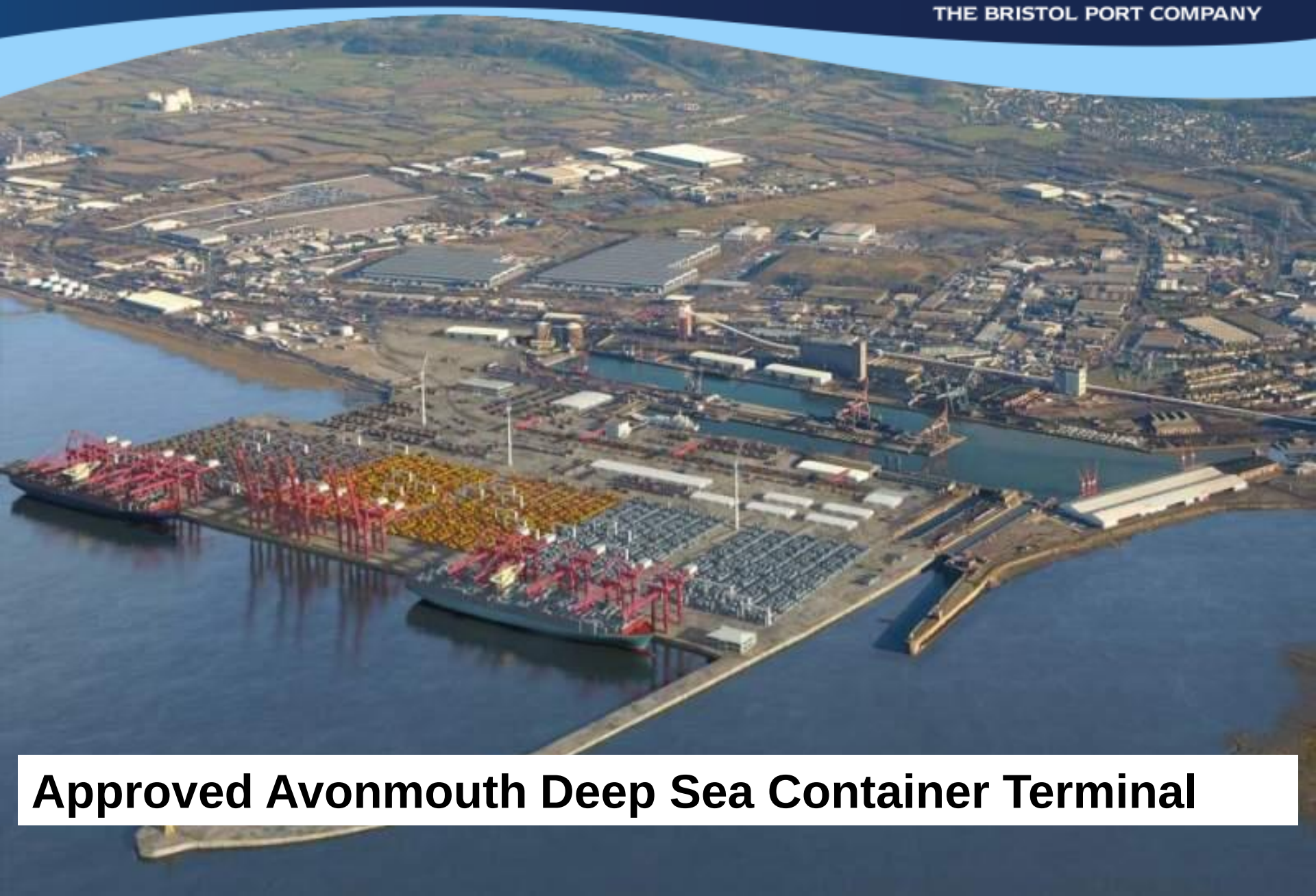
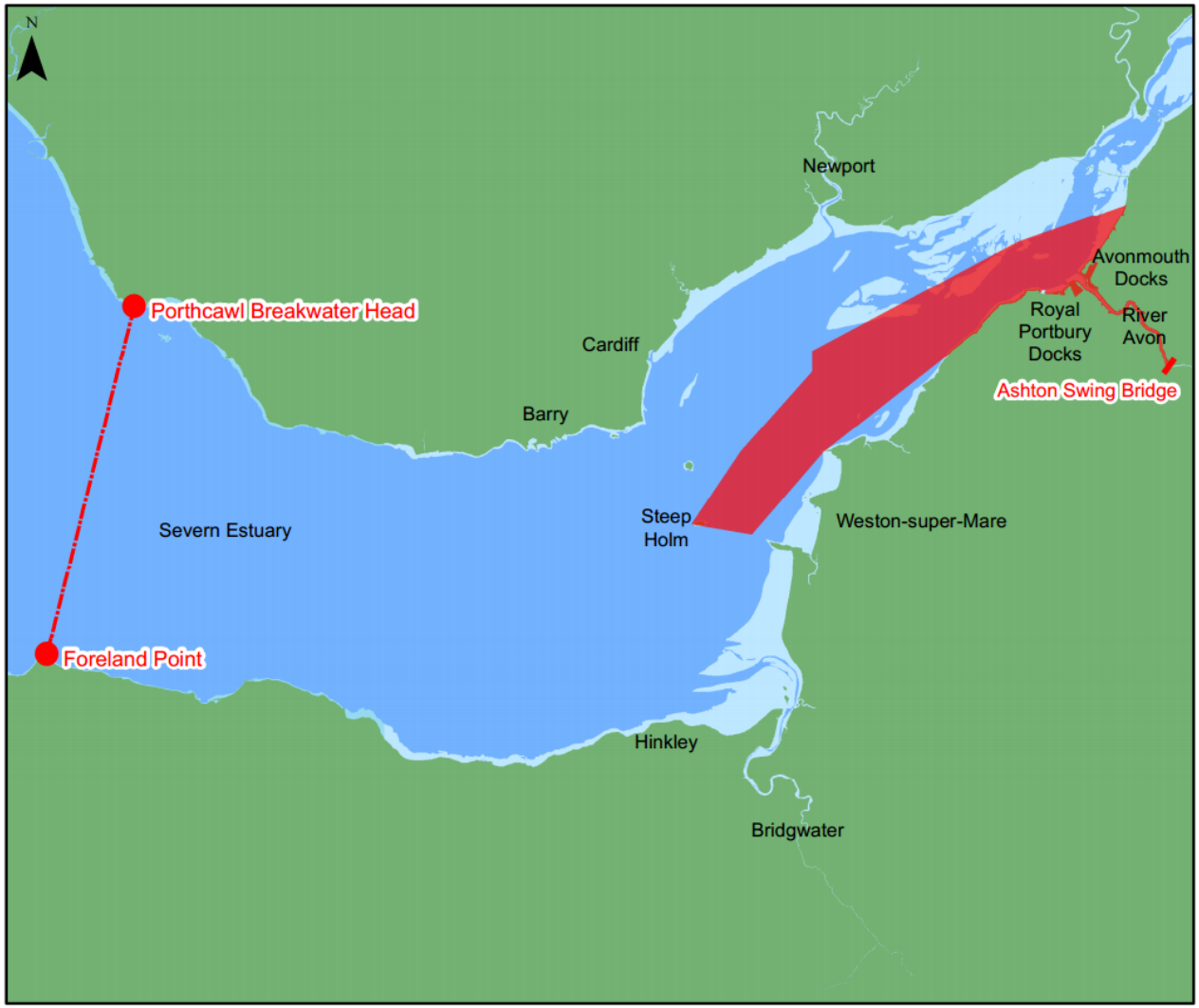
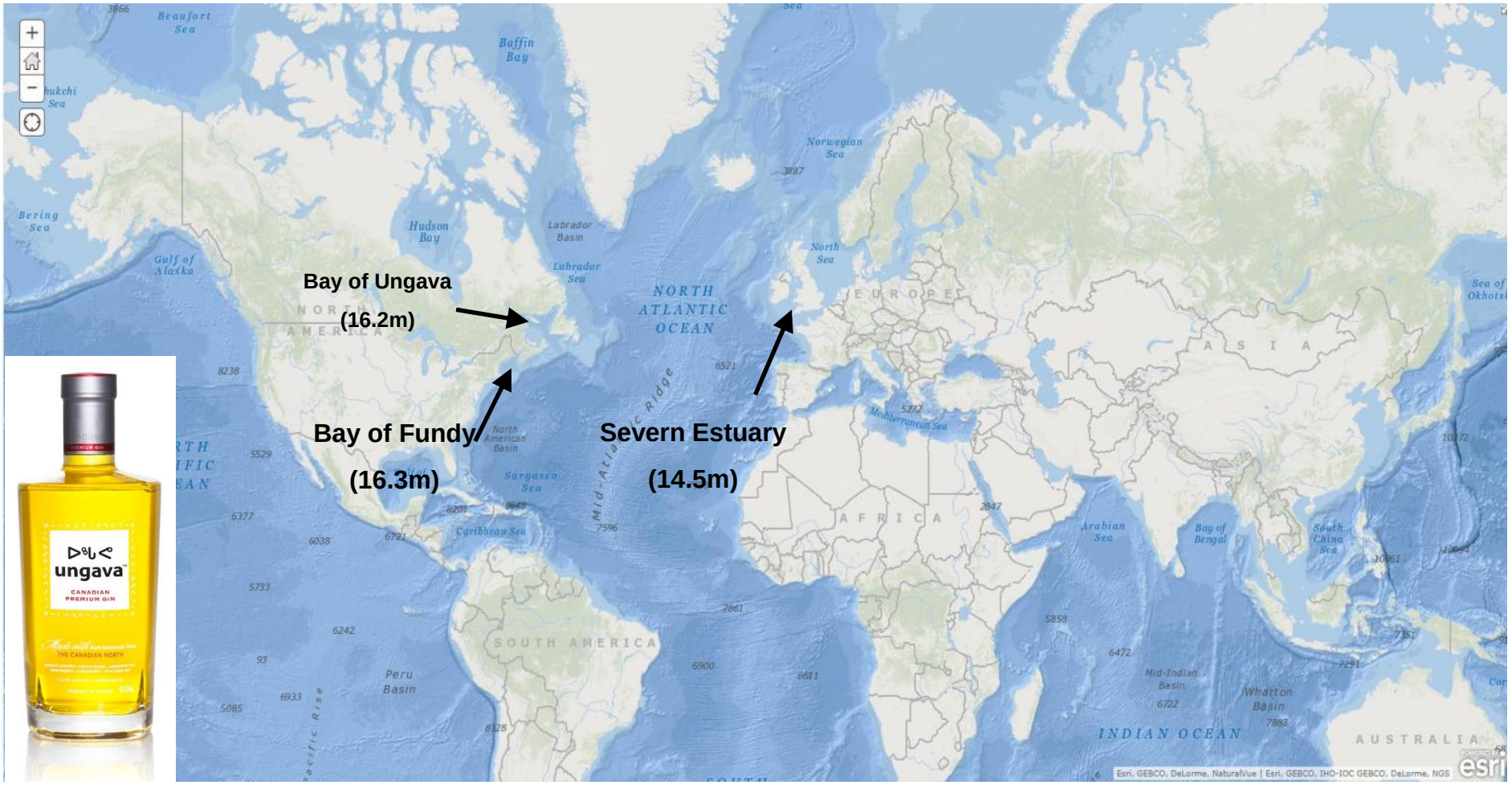


Approved Avonmouth Deep Sea Container Terminal

Statutory Harbour Authority

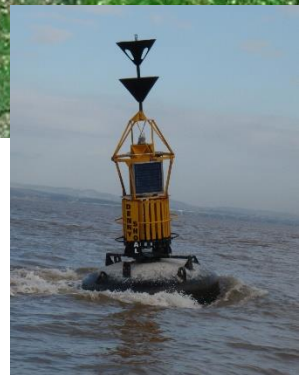


Where are the Highest Tides?



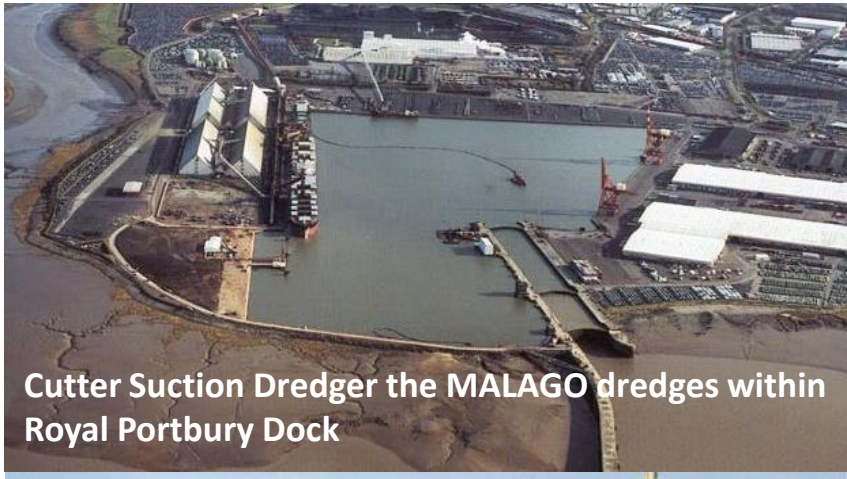
The Severn Estuary - a challenging environment

- Third highest tidal range in the world (over 14.5m)
- Strong tidal currents (4m/s or 8 knots at the Shoots/Severn Bridges).
- Highly mobile sandbank features
- Huge suspended sediments loads (estimated over 30 million tonnes in the Estuary on a Spring tide)
- These muds settle on to the seabed on Neap tides
- Over large areas of the Estuary average suspended sediment levels are >1,000 mg/l, while locally average bed levels can exceed 15,000mg/l

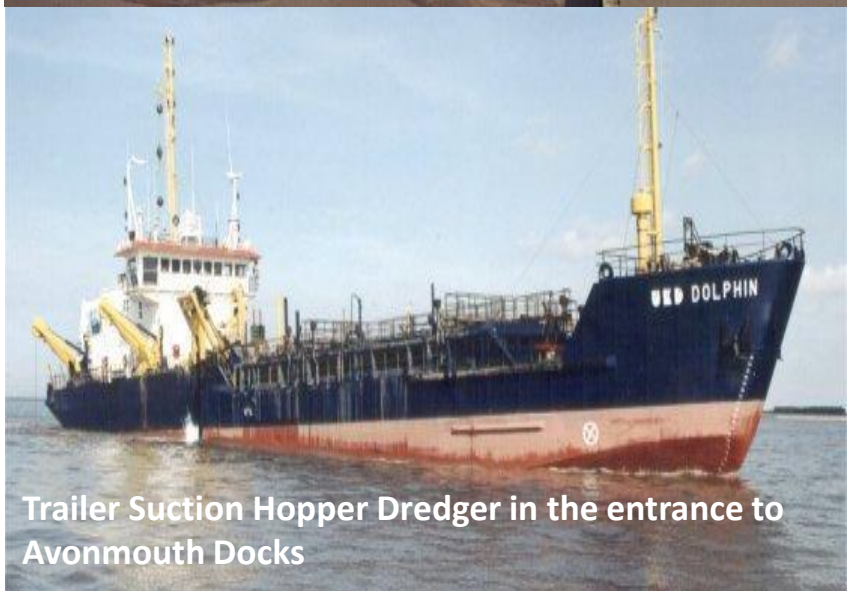


Marine Operations - Maintenance Dredging

- Dredging is a statutory duty required to provide safe navigable depths for commercial shipping
- High suspended sediment levels in the Estuary means that the Docks and their entrances require regular maintenance dredging
- Dredging has taken place here for over a century
- Dredging is highly localised to the docks and their immediate entrances (around 1km^2)
- The main navigation channel in the estuary is not dredged (it's naturally scoured by tides)



Cutter Suction Dredger the MALAGO dredges within Royal Portbury Dock



Trailer Suction Hopper Dredger in the entrance to Avonmouth Docks

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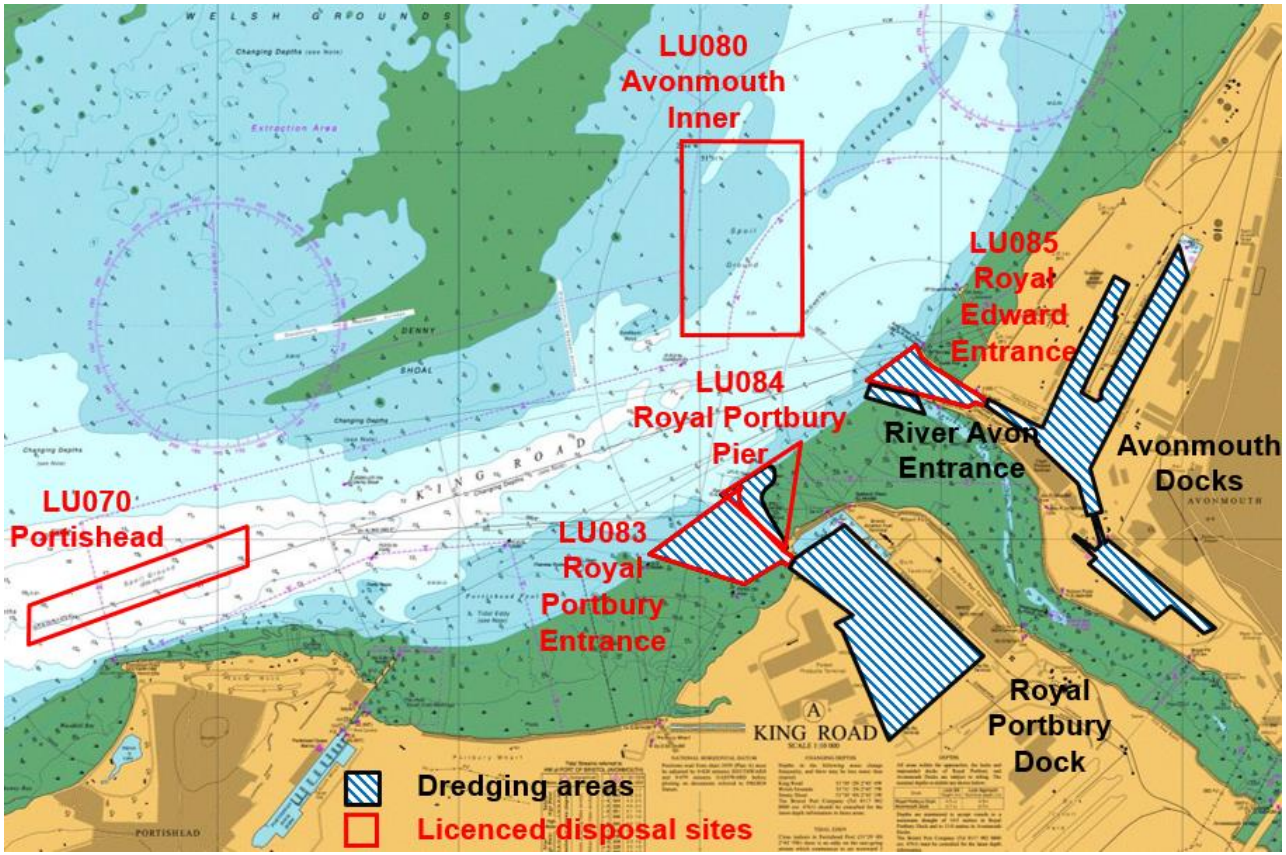
Managing mud on a grand scale!

Muds are deposited in Portbury Entrance at a rate of around 0.1m/week



Muds are deposited in Avonmouth Entrance at a rate of around 0.1m/month

Around 1.5 million m^3 of muds are dredged from the dock entrances each year and placed at nearby licenced disposal sites

Around 4 million m^3 of muds per year are dredged from within the Docks and discharged via pipelines into the estuary

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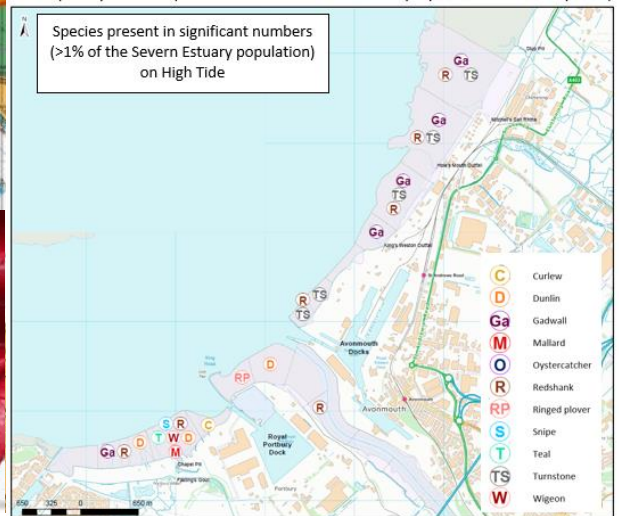
We monitor our harbour area to manage our marine operations, to support effective decision making, to minimise impacts and to improve our understanding of the estuary



Main picture: Multibeam bathymetry of King Road
Insert top: Fish surveys
Insert bottom left: *Sabellaria* worm tube on cobble from benthic survey
Insert bottom right: Surveys of overwintering birds

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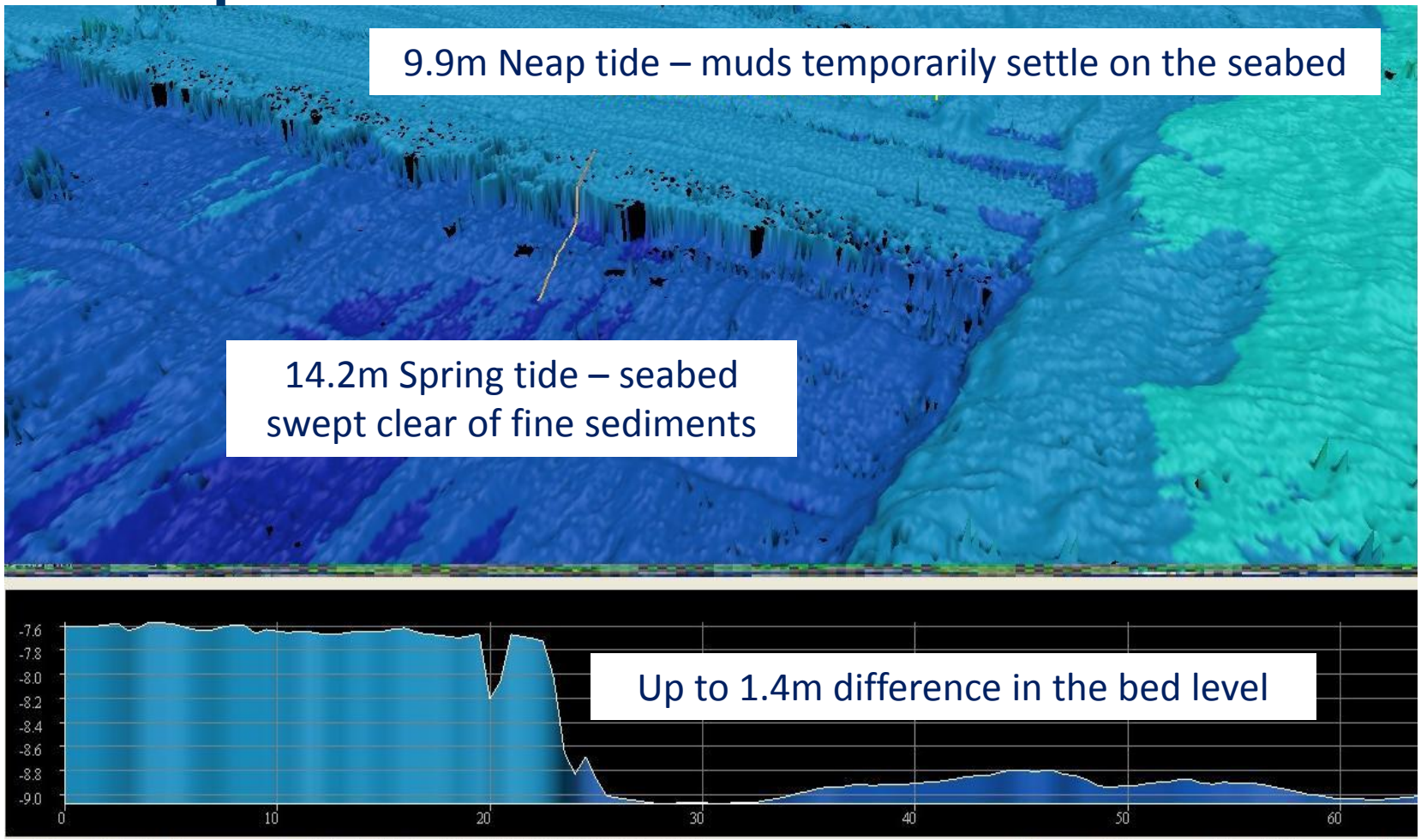
Natural variation over a tidal cycle
Deep-water channel off Portishead Point



9.9m Neap tide

14.2m Spring tide

Surveys in the deep-water channel off Portishead Point (Note: Spring survey undertaken 2 days after a disposal campaign)

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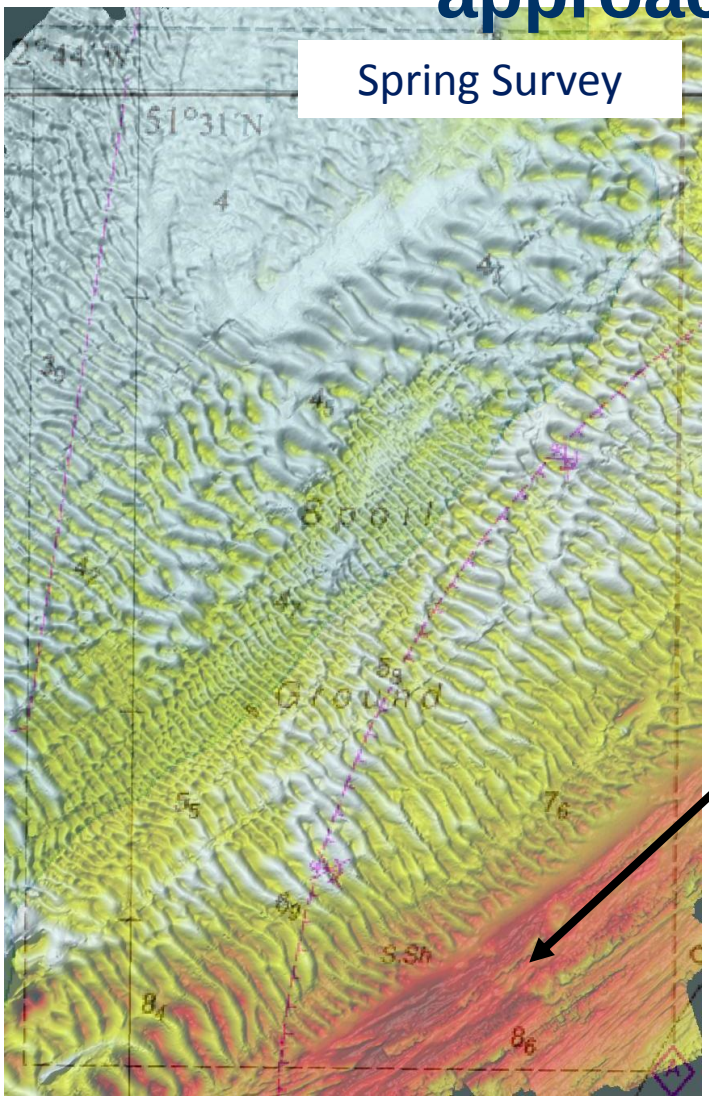
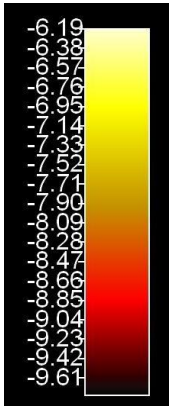
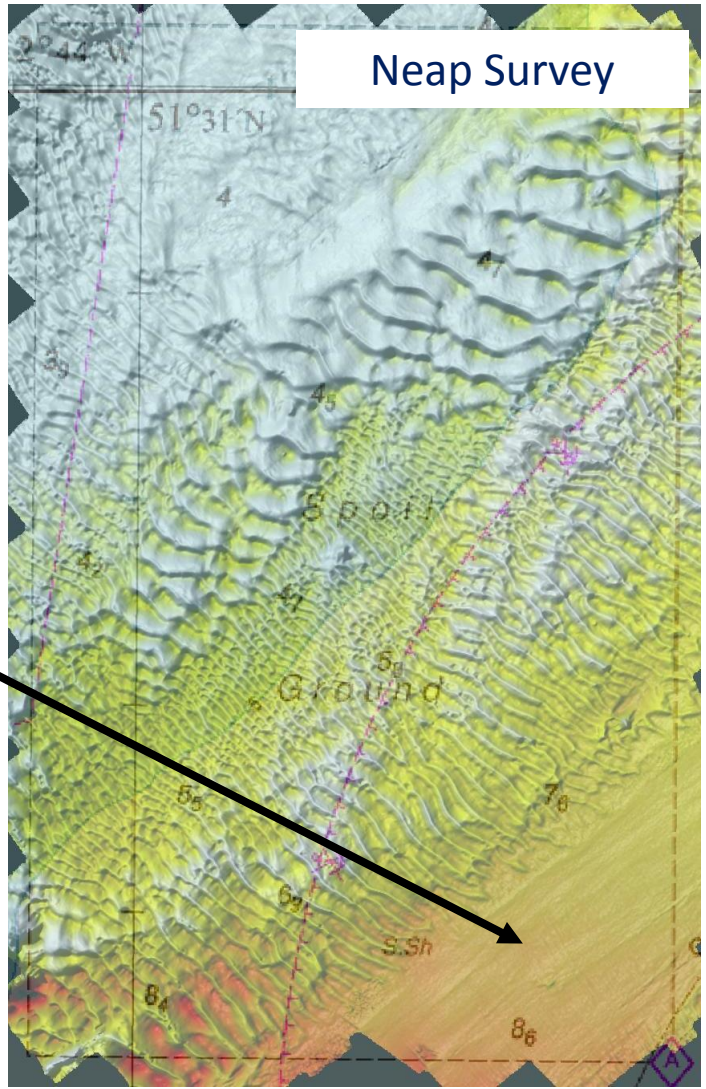
Natural variation over a tidal cycle near the approaches to Avonmouth



- Surveys within a week of each other
- Sand waves (white) are much the same
- 2m of mud deposited in the deep-water area





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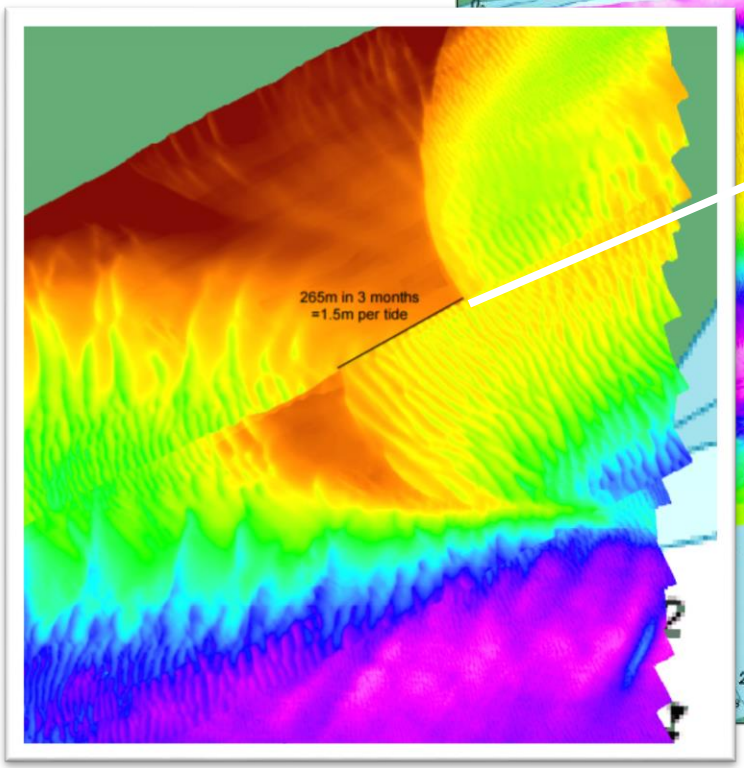
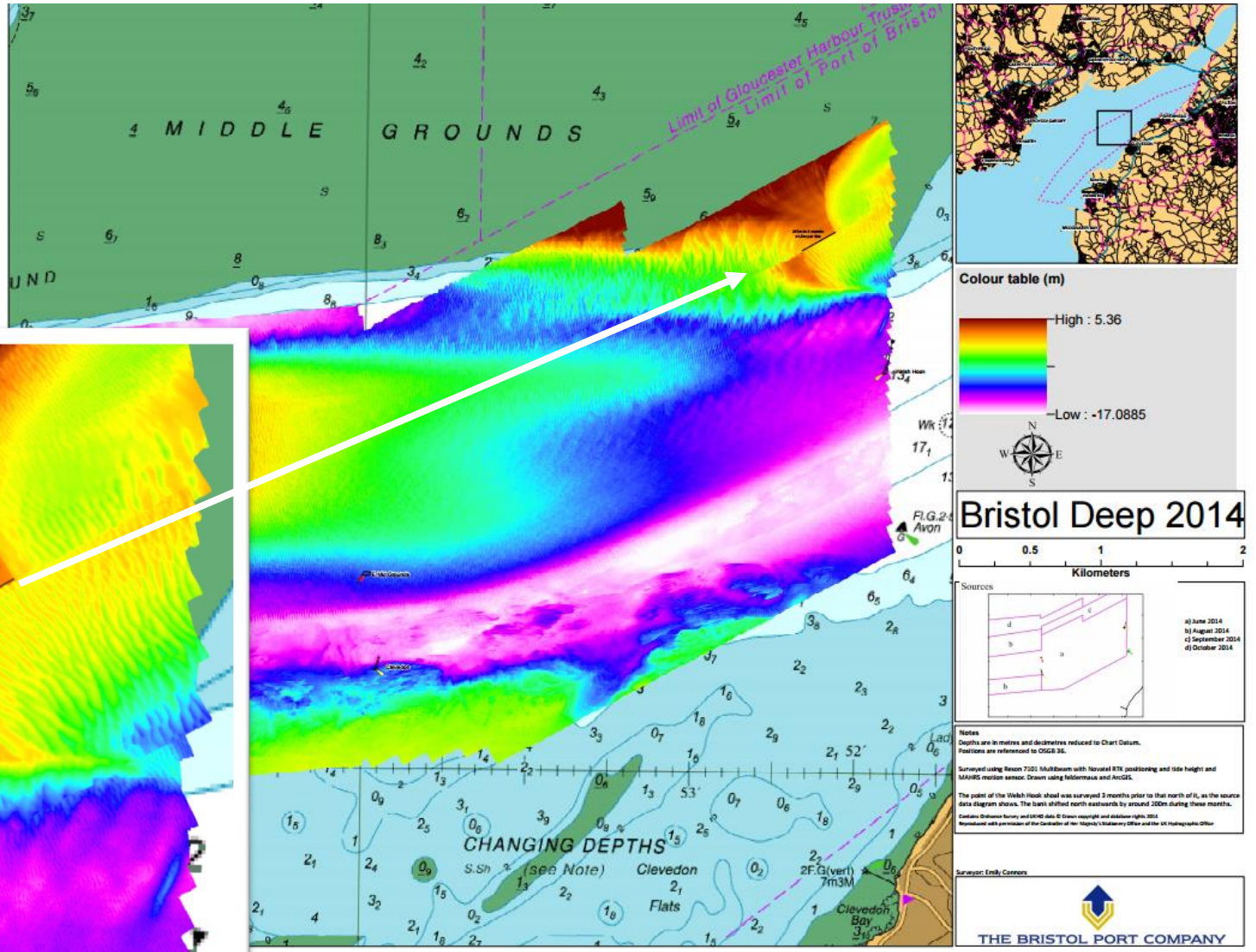
Migrating sandbanks

- The “Welsh Hook” has migrated 265m in 3 months
- (Around 1.5m per tide)





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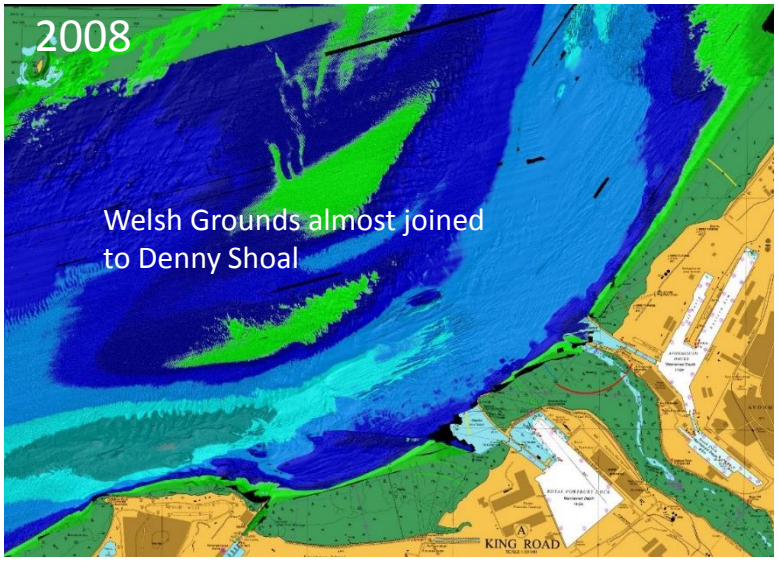
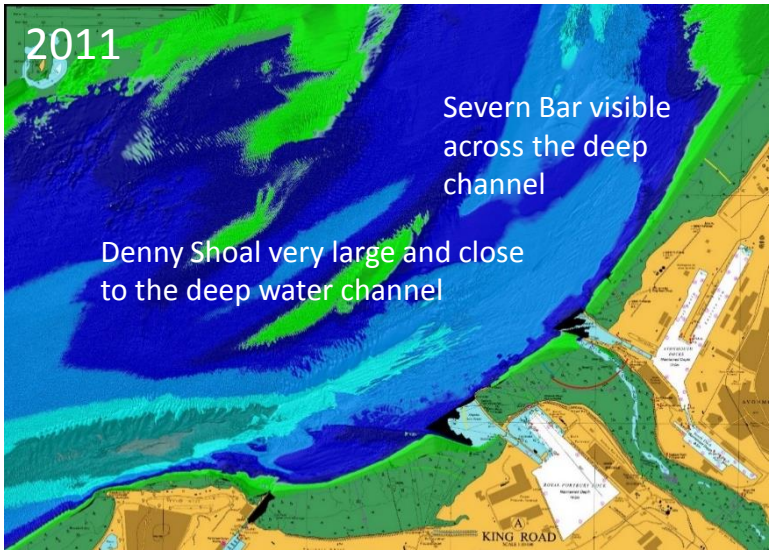
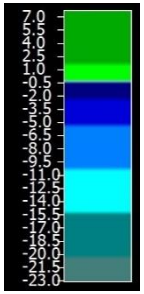
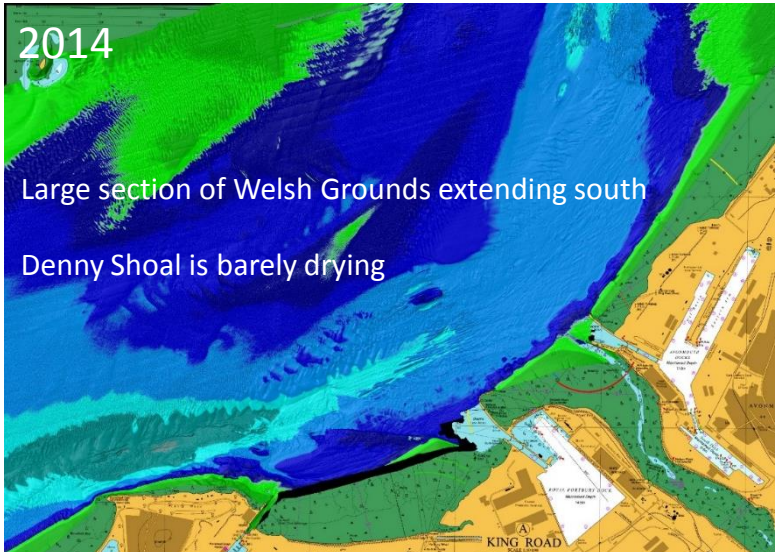
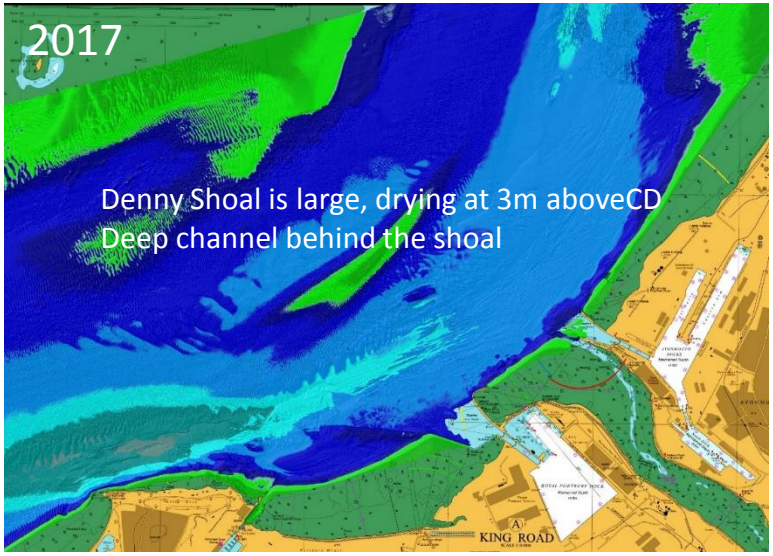
Longer-term changes - Denny Shoal and Severn Bar











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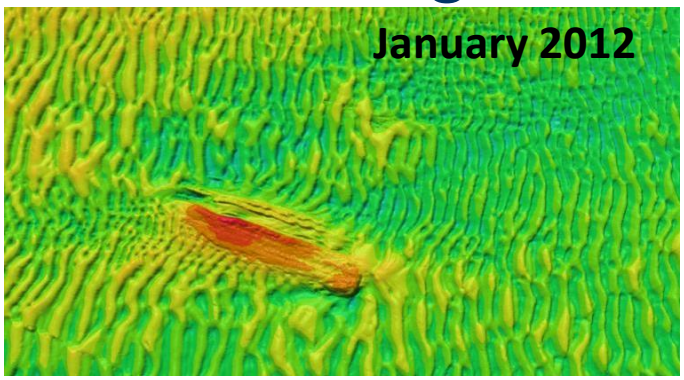
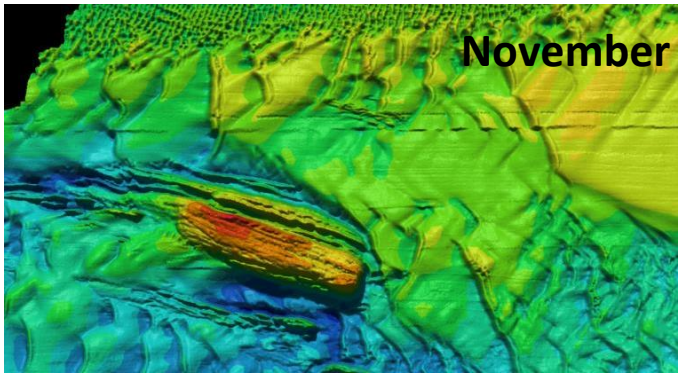
Longer-term changes – Cockburn Rock

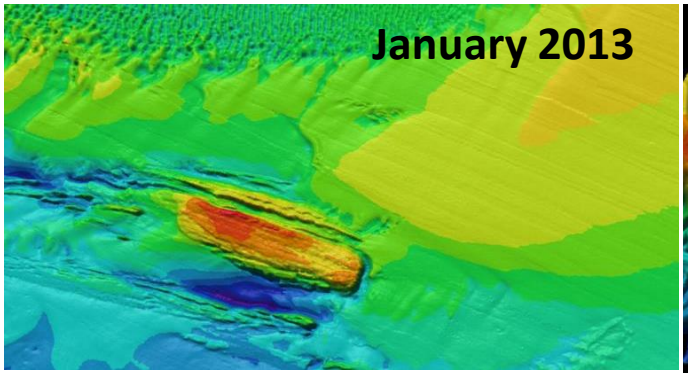
Each survey has vast differences, even the January surveys each year

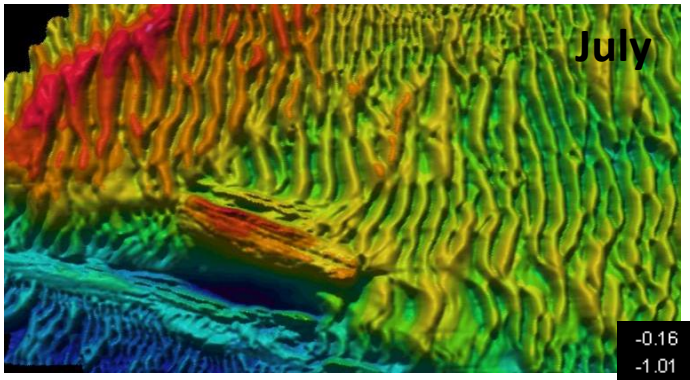
-2012 small sand waves
-2013 large area of freshly deposited flat sand
-2014 two large scours either side of rock

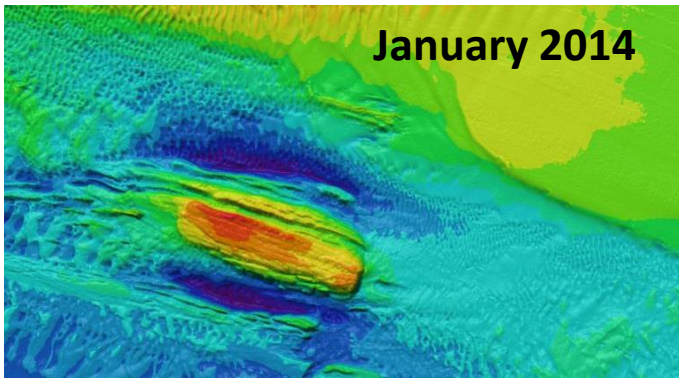
-July 2013 large sand waves shallower than surveyed before (pink)

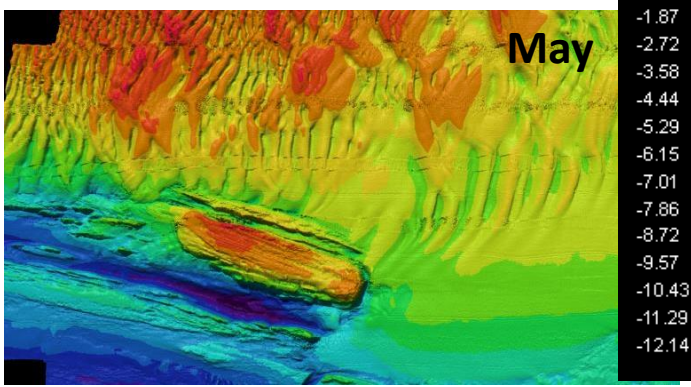












Summary

Challenges:

- Large scale natural changes
- Monitoring and evidence
- Uncertainty and risk
- Difficulty in predicting changes or trends/modelling
- Unintended consequences
- Sedimentation and dredging
- Abrasion of marine structures