



**Able Humber Ports Ltd
Marine Energy Park
Proposal to build a quay and associated development
on the south bank of the River Humber**

Planning Inspectorate Reference: TR030001

**Summary of Written Representations made by
The Environment Agency
Unique Reference Number: 10015552**

29 June 2012

Submitted on behalf of the
Environment Agency by:
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Summary of Environment Agency Relevant Representations

As required by the Planning Inspectorate Rule 8 letter, Annex C, Item 4, the following provides a summary of the main issues contained in the Environment Agency's Written Representations, which exceed 1500 words.

The Environment Agency has statutory duties in respect to: flood and coastal risk management, water resources, water quality, land contamination, salmon and freshwater fisheries and contributing to sustainable development.

The main concerns in relation to the Able Marine Energy Park project are as follows:

Marine Energy Park

Flood Risk

Although the risks to and from the development of the Marine Energy Park site have been assessed, this was undertaken on an early version of the quay design. We therefore require an update to this work, based on the final quay design, to ensure the findings are still valid. From the work provided so far, we can advise that the proposal will impact on overland flood flows, increasing the depth of flooding, to properties along Manby Road and Marsh Lane (one of which is a residential property known as Hazel Dene).

We also require further assurance that a satisfactory surface water management scheme will be implemented.

All works within 9m of our sea defences require our consent under the Environment Agency Anglian Region Land Drainage and Sea Defence Byelaws 1987. We will therefore require protective provisions/legal agreements to ensure our interests are protected.

Impact on Migratory Fish

We are concerned that the noise and vibration from around 26 weeks of percussive piling during the construction period has the potential to damage migratory fish populations in the Humber. We are seeking to secure conditions and requirements in the Marine Licence and DCO to mitigate these impacts, and provide compensations for residual impacts.

Hydrodynamic and Sedimentary Regime

The assessment of the proposal in respect of the impact on the hydrodynamic and sedimentary regime is not, in our opinion, adequate. There is little discussion of the impact of waves, no assessment of the impact of capital and maintenance dredging on the long-term impact on estuary processes, including indirect inter-tidal losses. The in-combination and cumulative impact assessments are also inadequate. Additional modelling in respect of the final quay design has not been undertaken; earlier modelling cannot be relied upon. We believe Able also needs to provide for a further 10ha of compensation for the long-term (100 yr) indirect loss of inter-tidal habitat, as a result of sea level rise.

Cherry Cobb Sands

The Cherry Cobb Sands (CCS) site is included in the Humber Strategy as a planned habitat creation site to compensate for the coastal squeeze losses. The Humber Estuary Coastal Habitat Management Plan (CHaMP) commits the Environment Agency to compensate for the loss of inter-tidal habitat on a 1:1 basis for coastal squeeze and temporary disturbance from Flood Risk Management Schemes. Whilst we recognise that the Strategy comes with a delivery risk, by identifying sites where we do not currently own the land, the Able project has the potential to hinder our ability to deliver habitat compensation requirements.

There is known contamination at CCS and the submitted reports identify the need for further intrusive investigation work to be undertaken. This further investigation work is not only required to provide us with an assurance that the site does not pose a risk of pollution to controlled waters, it is also necessary to provide us with confidence that the site winnings are suitable to use in the construction of the new flood defence embankment. There are also outstanding issues in respect of the final design of the new flood embankment, which requires consent under our byelaws, and we will require these works to be secured using appropriate requirements/legal agreement.

Foul Drainage requirements

We are working with Able and Anglian Water Services in respect of quantities and flows from the proposed development in order to gain greater certainty that any required Environment Permit variations can be accommodated within environment limits.

Water Framework Directive

Further WFD assessment work is required to enable us to provide advice to the Secretary of State on whether or not this proposal will cause deterioration in waterbody status.

Waste

We are satisfied that the waste chapters cover the relevant Duty of Care aspects of the development proposal from construction to operation. Able acknowledges the relevant legislation and the requirement to undertake a Site Waste Management Plan.

Environmental Permits

The proposed quay construction may require the diversion of existing E.ON and Centrica outfalls. The current outfalls are regulated by Environmental Permits issued to the operators. Diversion of the outfalls will require a variation to these permits, and therefore the agreement of the operators.



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**Detailed Written Representation by
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Unique Reference Number: 10015552**

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Environment Agency by:
Annette Hewitson, MSc, MRTPI
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1.0 Introduction

- 1.1 The Environment Agency is an executive non-departmental public body established under the Environment Act 1995. It is an adviser to Government with principal aims to protect and improve the environment, and to promote sustainable development. It plays a central role in delivering the environmental priorities of central government and the Welsh Government through its functions and roles. It is also an adviser to local decision makers in its role as a statutory consultee in respect of particular types of development, as listed in Schedule 5 of the Development Management Procedure Order 2010. For the purposes of this Development Consent Order (DCO) application, it is a statutory interested party.
- 1.2 The Environment Agency takes action to conserve and secure proper use of water resources, preserve and improve the quality of rivers, estuaries and coastal waters and groundwaters through pollution control powers and regulating discharge consents. We have regulatory powers in respect of waste management and remediation of contaminated land designated as special sites. We also encourage remediation of land contamination through the planning process.
- 1.3 The Environment Agency is the principal flood risk management operating authority. It has the power (but not a legal obligation) to manage flood risk from designated main rivers and the sea. The Environment Agency is also responsible for increasing public awareness of flood risk, flood forecasting and warning and has a general supervisory duty for flood risk management. As of 2008 the Environment Agency also has a strategic overview role for all flood and coastal erosion risk management.
- 1.4 The Environment Agency is the competent authority for England and Wales for the purposes of the Water Framework Directive, in conjunction with (as necessary) the Secretary of State (for DEFRA). Regulation 3(1) of The Water Environment (Water Framework Directive)(England and Wales) Regulations 2003 requires that the Secretary of State and the Environment Agency must exercise their relevant functions so as to secure compliance with the requirements of the Directive.
- 1.5 The Environment Agency also has statutory duties under the Environment Act 1995 (s6) to generally promote the conservation of fauna which are dependent on an aquatic environment to the extent it considers desirable and to 'maintain, improve and develop' salmon fisheries, trout fisheries, freshwater fisheries and eel fisheries in England and Wales.
- 1.6 We also issue Environmental Permits under the Environmental Permitting (England and Wales) Regulations 2010, which covers water discharge consenting, groundwater authorisations, radioactive

substances regulation authorisations and waste permitting activities.

- 1.7 On 2 April 2012 the Environment Agency made Relevant Representations to the proposal by Able Humber Ports Ltd (Able) to construct a Marine Energy Park (MEP) on the south Humber bank, together with a habitat compensation scheme on the north Humber bank. The purpose of these written representations is to expand on, and provide further detailed information on the summaries contained in our Relevant Representations.

2.0 Outstanding issues of concern

- 2.1 We still have concerns about important issues that could cause environmental harm. We are still awaiting further information from Able in respect of some of these before we can confirm that they can be resolved. However, in the majority of cases we believe these issues could be overcome by our suggested solution. Where this is the case we have recommended conditions termed “requirements” – that would incorporate those solutions into any Development Consent Order or Deemed Marine Licence granted. In those instances, inclusion of these recommended requirements will help ensure protection of the environment.
- 2.2 There are still a number of important issues relating to flood risk management that we have not yet resolved. In particular, there is still some supporting evidence required to ensure that the risks have been properly assessed for the final MEP quay design as well as an assurance that a satisfactory surface water management scheme will be implemented. Also, further assurance is required that the proposed new flood defence embankment at Cherry Cobb Sands (CCS) will be built from a suitable material and to the required standard.
- 2.3 We are also awaiting a significant amount of additional modelling in respect of the hydrodynamic and sedimentary impacts of the project on coastal processes and geomorphology from Able. We are not yet assured that the project is providing adequate compensation for climate change-related losses of inter-tidal habitat, as a result of sea level rise.
- 2.4 We are awaiting further assessment in terms of the cumulative and in-combination effects of AMEP with other projects in the area.
- 2.5 We are working with Able to agree mitigation and compensation requirements in respect of the impact of piling noise on migratory fish. We hope to reach an agreement on these issues shortly.
- 2.6 As the competent authority for the Water Framework Directive (WFD), the Environment Agency is not currently in a position to provide definitive advice on whether or not this proposal will cause deterioration

in waterbody status. This again is due to inadequate assessments, further details of which are provided below.

- 2.7 There are aspects of the development that require the co-operation of neighbouring industry. Existing Environmental Permits held by Eon, Centrica and Anglian Water Services will need to be varied for the relocation of their outfalls into the Humber, which currently exist in the vicinity of the proposed MEP quay.

3.0 Scope of Written Representations

- 3.1 These Written Representations explain the scope of our outstanding concerns and provide an update on issues that have now been resolved. Our views are supported by Statements provided by our technical experts on particular subjects, which are appended to these representations.
- 3.2 The advice we are providing is in line with that contained in the National Policy Statement for Ports (NPSP).
- 3.3 The Environment Agency reserves its right to add, amend, or delete principal issues as further information comes to light.
- 3.4 For ease of reference these representations are made following the order in the chapter headings in Able's Environmental Statement (ES) for the subjects that fall within our remit.

4.0 Environmental Statement

Chapter 4 – Description of the Development

- 4.1 The following areas of work described in Chapter 4 require either an Environmental Permit from us or require our consent under specific legislation:
- 4.2 Paragraph 4.4.6 - The construction of the quay over the existing flood defences requires consent from the Environment Agency under the Water Resources Act 1991 and under our Anglian Region Land Drainage and Sea Defence Byelaws 1987. We are currently in discussion with Able regarding this issue and will require further detailed drawings and specifications for the quay to enable us to draw up an acceptable legal agreement for these works and any necessary protective provisions in the DCO. For further explanation as to why we require this, please refer to Appendix K (Statement by Deborah Morris), paragraphs 2.2 to 2.9. If the legal agreement has not been completed at the end of the Examination, our position will be one of **objection** to the proposed development due to the potential increase in flood risk to the site and surrounding area, which may result from this development.

- 4.3 Paragraph 4.4.14 - The potential need to divert the existing outfalls/intakes to the E.ON and Centrica power stations will require a variation of the Operators' permits under the Environmental Permitting (England and Wales) Regulations 2010. We have offered to meet with Able and the Operators at their convenience to discuss these issues and we are currently waiting for these meetings to be arranged. In accordance with our Customer Charter we aim to process such permit variations within 3 months of receipt.
- 4.4 Paragraph 4.4.38 - The relocation of the proposed Killingholme Marshes Pumping Station Scheme and outfall to the north of the quay will require consent from the Environment Agency under our Anglian Region Land Drainage and Sea Defence Byelaws 1987. For further explanation as to why our consent is required, please refer to Appendix K (Statement by Deborah Morris), paragraph 2.10. Further information on the feasibility for relocating and operation/design of the proposed Pumping Station is contained Appendix K, Section 4 (Statement by Deborah Morris). The Environment Agency requires protective provisions within the DCO to ensure the integrity of its defences is secured.
- 4.5 Paragraph 4.4.60 - This paragraph states that there are two existing package treatment plants (PTPs) on site that discharge into the North East Lindsey Drainage Board's drain and that these will be retained. Although not a point on which we would raise an objection, the best environmental option, and our preference, is that these PTPs are decommissioned and all premises connect to the mains foul water drainage system (the reasons for this are explained further in paragraph 4.34-4.35 below). Chapter 13 (Drainage and Flood Risk) also mentions at paragraph 13.5.20 an existing Customs House near the quay, which will also be served by a private foul PTP with a direct discharge to the sea. If this is to be retained it will require an Environmental Permit from us for the discharge.
- 4.6 Paragraph 4.4.41 - We are currently working with Able and Anglian Water Services (AWS) to investigate if upgrades to the South Killingholme Sewage Treatment Works (STW) will be required in order to serve the proposed development. There is a possibility that AWS may need a variation to its existing Environmental Permit, and/or works to increase the STW's capacity, in order to facilitate the connection of this development.
- 4.7 Although it is not listed in the description of the project, there is a discharge pipe from the AWS Brine Storage Works that runs through the Able site. The relocation of the pipe to the north of the Able site will require a variation of AWS' Environmental Permit and where the new pipe penetrates the flood defences this will also require our consent under the previously mentioned Byelaws. Although the ultimate responsibility for obtaining the necessary Permit variation and Flood

Defence Consent lies with AWS, these will be required for the development to proceed.

- 4.8 Paragraphs 4.4.42 and 4.7.14/15 - We have discussed the possibility of Able landraising in the floodplain using clay dredged from the berthing pocket for this purpose. Able is currently considering the relevant waste management guidance in relation to this proposal.
- 4.9 Paragraph 4.10.1 - The responsibility for continued quay maintenance, including for the effects of climate change over the next one hundred years, and the improvements and maintenance of the adjacent sea defence improvements until 2035 will need to be secured in an appropriate legal agreement between Able and the Environment Agency. For further explanation as to why this is required, please refer to Appendix K (Statement by Deborah Morris), paragraph 2.5. The legal agreement will also need to secure the Environment Agency safe and appropriate access to the sea defences north and south of the new quay for continued maintenance purposes. Without this legal agreement being in place by the end of the Examination period, our position will be one of **objection** to the proposed development, due to the potential increase in flood risk to the site and surrounding area, which may result from this development.

Chapter 7 - Geology, Hydrogeology & Ground Conditions

- 4.10 The Environment Agency is responsible for protecting inland freshwaters, coastal waters, relevant territorial waters and groundwater. The definition of inland freshwaters, coastal waters and relevant territorial waters is contained in the Water Resources Act 1991, Part III, Chapter iv, s.104. "Inland freshwaters" includes all watercourses, lakes, lochs, canals, "coastal waters" includes estuaries and "relevant territorial waters" includes the sea out to 3 nautical miles. "Groundwater" is defined in Environmental Permitting Regulations 2010 as all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil. It is an offence to pollute such waters - deliberately or accidentally. In addition, an environmental permit is required from us for many discharges to inland freshwaters and coastal waters and direct discharges and discharges to groundwater via soakaways.
- 4.11 We have reviewed Chapter 7 and the appropriate supporting Annexes in relation to our duties. We are satisfied that the assessment in respect of controlled waters has been adequately undertaken. We agree with the conclusions of the Hydrogeological Risk Assessment that due to the general permeable nature of the overlying superficial deposits in the proposed piling and dredging area, their removal or penetration will not significantly affect the saline interface. The proposed area is not in a Source Protection Zone and is not considered to be within the zone of influence of groundwater abstractions. The project has identified that the tidal variation may lead to some intrusion

but that the net effect will be outflow to the channel – a significant mechanism of discharge which already exists.

- 4.12 There is currently no provision within the DCO to ensure that any unsuspected contamination, which may be encountered during the development, is adequately dealt with and will not pose a risk to controlled waters. We would request an additional requirement is included within the Schedule 11 requirements, paragraph 12, to ensure that if any unsuspected contamination is encountered during the development that it is adequately dealt with. We request the following wording:

Requirement

If, during development, contamination not previously identified is found to be present at the site then no further development (unless otherwise agreed in writing with the local planning authority) shall be carried out until the developer has submitted a remediation strategy to the local planning authority detailing how this unsuspected contamination shall be dealt with and obtained written approval from the local planning authority. The remediation strategy shall be implemented as approved.

- 4.13 The reason for seeking this requirement is to ensure any unsuspected contamination encountered during development is dealt with in an appropriate manner to ensure there will be no risk of pollution to controlled waters.
- 4.14 The dredging Strategy (Annex 7.6) will need amending following the revised modelling work currently being undertaken by Able (please see letter attached at Appendix C for details of this work) looking at the capacity available for disposal and impacts of the dredging requirements of the project on the wider Humber Estuary. We will provide further comments once we have received the additional modelling work and had time to read and review it. The Environment Agency has previously raised the question of capacity within the estuary and the implications on hydrodynamics of the estuary (please see our letter of 14 July, 2011, attached as Appendix E). Until we have received this further information and had the opportunity to properly assess it our position is one of **objection**.
- 4.15 Notwithstanding the above, we request that a requirement to ensure that the estuary is appropriately monitored to ascertain the effects of the MEP and associated development.

DML Requirement

No development shall commence until an Active Monitoring Scheme, for both the MEP and CCS sites, has been submitted to and approved in writing by the Marine Management Organisation, in consultation with the Environment Agency. The scheme shall include:

- location of active monitoring buoy(s) and depth and design of sensors;
- full details of the frequency of measurement of sediments, temperature and dissolved oxygen;
- details of trigger levels and resultant actions required if trigger levels are exceeded.

Development shall proceed fully in accordance with the approved scheme and timetable contained therein.

- 4.16 The reason for this is to ensure appropriate information is available to monitoring any adverse effects on the estuary.
- 4.17 It is likely that we will have further monitoring requirements in respect of this. However, we cannot specify these until we have received and reviewed the additional modelling and information outlined in paragraph 4.14 above.

Chapter 8 – Hydrodynamic and Sedimentary Regime

- 4.18 The assessment of the hydrodynamic and sedimentary regime, contained in Chapter 8 and the associated Annexes does not fully address all the impacts of the MEP, the compensation site and the dredge disposal sites. There is very little assessment or discussion of the impact of waves in Chapter 8. There is no adequate assessment of the impact of capital and maintenance dredging on long-term estuary processes.
- 4.19 Indirect inter-tidal losses are not adequately assessed in terms of changes resulting from long-term morphological change caused by the MEP. Able only appear to be proposing to compensate for direct losses. In Tables 11.16 and 11.17 in Chapter 11, Able set out the expected losses and gains as a consequence of the project. Annex 8.2 refers to it taking several decades for the estuary to respond to the building of the MEP and a dynamic equilibrium being reached, but no mitigation or compensation is being proposed for this impact. There is no quantification of this change in relation to natural variability.
- 4.20 Paragraph 5.3.5 of the NPSP requires applicants to undertake an assessment of the impacts of the project on coastal processes and geomorphology, taking account of the potential impact from climate change and flood and coastal defence maintenance strategies.
- 4.21 The Environment Agency has engaged independent consultants (Deltares) to review the modelling work undertaken to date and their findings are that additional compensation, to compensate for indirect long-term losses will be required. The Deltares Memo, attached in Appendix A, covers a review of the MEP project and another port

related development on the north bank of the Humber, known as Green Port Hull.

- 4.22 We are particularly concerned about this issue due to our responsibility under the European Birds and Habitats Directives and associated domestic legislation to compensate for climate change related losses of inter-tidal habitat, as a result of sea level rise. If we are unsuccessful in delivering suitable compensation (in the form of managed realignment sites) in the appropriate parts of the estuary to compensate for coastal squeeze, we will be unable to fulfil our flood risk management role. We will not be allowed to continue to build new defences and improve and maintain existing flood defences around the Humber estuary. This may ultimately result in places like Hull, Grimsby and Immingham being placed at an increased risk of flooding.
- 4.23 The identification and delivery of suitable managed realignment sites in the estuary is already extremely challenging and complex. For any development to exacerbate the rates of indirect habitat loss, no matter how small, without being required to secure suitable compensation for themselves, could seriously jeopardise our ability to meet these responsibilities as well as adding to both the cost and complexity of what needs to be delivered; a cost which would then have to be met by the public purse, not Able.
- 4.24 As a result of this review, the Environment Agency **objects** to the proposal until the developer demonstrates that they will provide a further 10ha of compensation (to account for the 100 year scenario) for the indirect loss of inter-tidal habitat. Without this compensation being secured from the developer the Environment Agency will have to provide it, at the expense of the public purse, within its own programme of compensation for coastal squeeze. Notwithstanding the financial issues, the difficulties of this situation are further explained in paragraphs 4.104 to 4.111 below and in answer to the Examining Authority's questions 67 and 68.
- 4.25 In addition to the above, there is an inadequate assessment of the in-combination and cumulative impacts within Chapter 8. We have concerns about the disposal of dredged material in association with other development projects.
- 4.26 Able has acknowledged that the assessments are inadequate in terms of the issues outlined above. They have, therefore, engaged consultants to undertake further modelling and analysis of the long-term morphological change to the north and south of the quay, changes to waves within the estuary, maintenance dredge variability, capital dredge disposal capacity and in-combination and cumulative assessment. Able intends to produce further explanatory notes and a supplement to Annex 8.1 in response to these issues. Able intends to provide us with these additional assessments during June 2012. However, we will not be able to review these and provide detailed

Written Representations on them before the submission deadline of 29 June. We alerted Able to this issue during meetings with them on 1 March and 15 March 2012 and then through written correspondence on 29 May 2012 (letter attached as Appendix C for your information). We therefore reserve the right to provide further detailed representations on these issues. In the interim we wish to **object** to the proposal on the grounds of the inadequate assessment, which currently supports the application.

Chapter 9 Water and Sediment Quality

- 4.27 The Water Framework Directive (WFD) applies to surface waters (including coastal waters out to one nautical mile) and groundwater. The Environment Agency is the competent authority for England and Wales for the purposes of the WFD, in conjunction with (as necessary) the Secretary of State (for DEFRA). Regulation 3(1) of The Water Environment (Water Framework Directive)(England and Wales) Regulations 2003 requires that the Secretary of State and the Environment Agency must exercise their relevant functions so as to secure compliance with the requirements of the Directive.
- 4.28 The WFD requires us to aim to meet good status in all water bodies. For surface waters, good status is made up of 'good ecological status (or good ecological potential where artificial or heavily modified water body) and good chemical status. Ecological status and potential are made up of a number of biological, hydromorphological and physio-chemical quality elements. Chemical status is recorded as either good or failing.
- 4.29 For a groundwater water body to be in overall good status, both quantitative and chemical status must be good. The WFD also requires prevention of deterioration in water body status including deterioration of any of the individual quality elements.
- 4.30 Paragraph 9.8.37 states that foul drainage will be discharged to an improved public sewer network. We are currently liaising with Anglian Water Services (AWS) on this issue. We have requested that Able provide AWS with information on expected flows that will need to be processed by its sewage treatment works. AWS will then provide us with information on the potential impact of these increased flows on its discharge permit.
- 4.31 Until we have this information we cannot give the Secretary of State any advice on the likelihood of any permitting amendment being acceptable. Paragraph 4.11.7 of the NPSP advises that the relevant pollution control authority needs to be satisfied that potential releases can be regulated under the pollution control framework. There is also the possibility of the need to extend the existing sewage treatment works to accommodate the increased flows. Again, this would require a variation of AWS' existing discharge permit, together with a time

delay for the extension works to be carried. Although we may be able to provide further information during the course of the examination process, if this is not forthcoming, we will need to await the submission of details currently required under the DCO, Schedule 11, Requirement 11. However, we do not think that the current wording is clear and we would request it is replaced with the following to ensure there is the necessary protection for the environment:

Requirement

No development at the Marine Energy Park site shall commence until a detailed foul water drainage strategy has been submitted to and approved in writing by the relevant local planning authority. The scheme shall be fully implemented in accordance with the approved scheme including any timetable embedded within it.

- 4.32 The reason for this is to ensure a satisfactory means of foul water drainage is implemented for the protection of the environment.
- 4.33 Please note that this requirement does not cover the issue of surface water drainage – see paragraph 4.85 below and suggested wording for the requirement to cover this issue.
- 4.34 Paragraph 9.8.37 also states that an additional package treatment plant (PTP) may be required for the small customs office (referred to as the Customs House in paragraph 13.5.20 of the Flood Risk Chapter). There is also mention of two existing PTPs on the site that discharge to the North East Lindsey Drainage Board’s drain. Non-mains drainage systems are not considered environmentally acceptable in publicly sewered areas. Where premises rely on private sewerage systems, these systems depend on proper operation and regular maintenance to function effectively. If this does not happen, the plants are prone to failure, causing pollution of land and/or watercourses, as well as potential nuisance and risk to human health.
- 4.35 Our compliance figures for England and Wales, for the five-year period of 2000-2004, show that the compliance rate for privately operated sewage treatment works regulated by a numeric discharge consent ranged from 59% to 62%. It is our opinion that PTPs can pose a high environmental risk and connection to public sewer significantly reduces the risk of pollution from a sewerage system. It is, therefore, our preferred option that PTP are not used (existing ones to be decommission) and that all premises should connect to the mains foul water system.
- 4.36 The application includes a Water Framework Directive Assessment in Annex 9.4, which covers the relevant water bodies in the area of the MEP site. At the time of writing our Relevant Representations this assessment was thought to be satisfactory. However, when the further hydrodynamic and sedimentary regime modelling is undertaken, Able will need to revise the WFD Assessment, to take account of this.

- 4.37 Since the submission of our Relevant Representations a further WFD Assessment for Cherry Cobb Sands (CCS) has been received from Able. This document does not, therefore, form part of the submitted application. Review of this document has highlighted to us the need for further overarching assessment work. We alerted Able to the need for further WFD assessment work to be undertaken during meetings (Tri-Agency (with Natural England and the MMO) meeting 16 January 2012, Tri-Agency meeting no. 5, 19 April 2012,) and then through correspondence (see letter of 29 May 2012 to Able, attached at Appendix C, for information).
- 4.38 Please see our letter to Able of 29 May 2012 attached at Appendix G for detailed comments in respect of the WFD assessments.
- 4.39 In summary, it appears from the MEP WFD assessment that the evidence presented is purely based upon our guidance ("Clearing the Waters: Marine dredging and the Water Framework Directive" April 2010) for the marine environment. It is our opinion that in the absence of specific transitional guidance (i.e. guidance covering estuaries where there is both a tidal and fluvial influence) it would be more appropriate to use a combination of both marine and fluvial guidance. Our fluvial guidance refers to the following additional considerations: critical habitat for the water body; cumulative impacts within the water body, and expert judgement.
- 4.40 It is unclear how the conclusions drawn within the assessment have been derived due to its reliance upon the ES. It would be helpful if, where the ES is relied upon to form the basis of the WFD assessment that, as a minimum, the specific section of the ES is referred to or extracts are cited. At present the assessment appears to be more of a screening exercise as it is difficult to follow the arguments presented and hence to assess the validity of them under the Directive.
- 4.41 In addition, at present there are two WFD assessments (HR Wallingford refs: DER47112 -01 (for the MEP) and TN DHM6835-01 R1 (for CCS)). Our advice would be to combine this into one WFD assessment looking at all parts of the project (reclamation, dredging, disposal, compensation site creation) in order that the different parts of the project that are interlinked are adequately assessed in terms of WFD. For example, the two assessments need to cross reference each other where there are links for specific parameter (for example benthic invertebrates) but currently do not. The current WFD assessment for CCS suggests a positive outcome with improvements to the benthic invertebrate population within the Humber Lower water body. The benthic invertebrate community will need to be monitored as part of the ecological monitoring and management plan. The WFD assessment of the remainder of the project (MEP, dredging and disposal) should acknowledge the potential benefits CCS will deliver to the benthic invertebrate element of the ecological assessment, and

consider the remainder of the impacts in this context. The evidence for this is not succinctly presented at the moment. As a minimum the two documents should cross-reference each other, but our preference would be for the points detailed in our letter of 29 May 2012 (Attached as Appendix G) to be addressed whilst producing a combined WFD assessment for the whole project.

- 4.42 In July 2011 we advised Able that the assessment also needs to ensure that the scheme will not compromise the mitigation measures 'not in place' for the Humber estuary, as detailed in our River Basin Management Plan (RBMP). As presented in the assessment the mitigation measures for this water body relate to flood protection. It is important that the impacts of this scheme will not invalidate the mitigation measures identified in the RBMP that are necessary to achieve good ecological potential. Despite the inclusion of a section within the MEP assessment on contributing to WFD improvements, the document should ideally address whether the scheme will impact on the ability to deliver the required mitigation measures. Under the WFD, there is a need not only to assess deterioration within the water body, but also a prevention of delivery of the RBMP meeting its objectives. In this case, there needs to be an assessment of the impact of delivering CCS on the flood protection mitigation measures, and more specifically its delivery of the managed realignment mitigation measures. The Humber Flood Risk Management Strategy (FRMS), our long term plan for managing flood defences along the Humber estuary into the future, had a clearly defined programme of managed realignment sites, and the impact of delivery of CCS needs to be assessed. At present we do not think that the WFD assessments sufficiently address these issues.
- 4.43 As the competent authority for WFD, the Environment Agency is not currently in a position to provide definitive advice on whether or not this proposal will cause deterioration in waterbody status, due to inadequate assessments as outlined above. Our current position is, therefore, one of **objection** to the proposal on this issue.
- 4.44 Notwithstanding the comments above, for the general protection of the water environment and to ensure compliance with the WFD, we request that the following requirements are included in the DCO:

Requirement

No development shall commence until an Environment Management plan, has been submitted to and approved by the Local Planning Authority. The plan shall include details of:

- the mitigation measure to be utilised to minimise the temporary construction-related run-off or resuspension of sediments and to maintain or improve post construction water body status;

- measures to manage plant and equipment to avoid pollution during the construction process

Development shall be carried out in accordance with the approved plan and timescales

- 4.45 The reason for this is to ensure protection of the environment and compliance with WFD.
- 4.46 As mentioned in paragraph 4.3 above, there is the potential need to divert the existing outfalls/intakes to the E.ON and Centrica power stations. This will require the co-operation of the operators who will need to apply to the Environment Agency for a variation of their existing Environmental Permits. If this issue is still outstanding and consent is granted, we request the following requirement is included in the DCO:

Requirement

No development shall commence until a scheme for the monitoring of the lines of the Centrica and E.ON intake/outfalls has been submitted to and approved in writing by the Marine Management Organisation, in consultation with the Environment Agency. The scheme shall include:

- details of monitoring proposals, including location and frequency;
- details of trigger levels and resultant actions/mitigation required if trigger levels are exceeded.

Development shall proceed fully in accordance with the approved scheme and timetable contained therein.

- 4.47 The reason for this is to ensure there are no adverse effects on the existing intake/outfalls within the vicinity of the quay.

Chapter 10 – Aquatic Ecology

- 4.48 The Environment Agency has statutory duties in relation to fisheries matters under s.6 of the Environment Act 1995, which transferred to it from predecessor organisations from the Salmon and Freshwater Fisheries Act 1975 to 'maintain, improve and develop' salmon fisheries, trout fisheries, freshwater fisheries and eel fisheries in England and Wales. This legislation affords specific protection to any salmon, trout or freshwater fish, which is either unclean (the fish is about to spawn, or has recently spawned and has not recovered from spawning) or immature; making it a criminal offence to take, kill or injure, or attempt to take kill or injure such a fish.
- 4.49 As recognised in paragraph 5.1.3 of the NPSP, noise can have an adverse impact on fish behaviour patterns.

- 4.50 The Environment Agency is concerned that the noise and vibration caused by around 26 weeks of percussive piling during the construction period has the potential to damage migratory fish populations within the Humber system. The Humber estuary acts as the sole gateway for migratory fish into the Humber system, allowing fish to travel upstream from the sea, to spawn in rivers such as the Don, Aire, Ouse, Trent, Wharfe and Derwent; the last of which has SSSI and SAC status. The success of these populations relies wholly on their ability to gain safe passage through the Humber in order for them to complete their life-cycle. As such, any activity taking place in the Humber that hinders the ability of fish to make this journey, has the potential to threaten populations throughout the river catchment.
- 4.51 In addition to the above, many fish populations, particularly Atlantic Salmon, are in a fragile, recovering state, following the almost total annihilation of the species within the Humber as a result of the poor water quality and physical barriers introduced by the industrial revolution. Recent work to address some of these issues has seen Salmon returning to upstream rivers for the first time in decades. Whilst the current number of fish within the system is not well known, a device to count the number of juvenile salmon on the River Ure was operated up until about 5 years ago, with its most recent measurements suggesting around 20,000 juveniles moving downstream. This would usually result in a yield of around 2,000 adults returning upstream to spawn. These numbers are from just one of a number of tributaries, which drain into the Humber, so are likely to represent a fraction of the overall population present within the system.
- 4.52 Able has considered the different species which might be present and likely to be affected by the predicted noise. Different species are more sensitive to sound than others. Atlantic salmon are the most sensitive of the main migratory species and more is known about the characteristics of their auditory system and their behavioural response than other species in the estuary.
- 4.53 Further evidence and expert analysis of Able's assessment is provided in a Statement attached as Appendix D from Dr Adrian Fewings.
- 4.54 We would also like to draw the Examining Authority's attention to a similar development at Dibden Bay where this issue was debated. An extract from the Inspector's Report (pages 690-695, paragraphs 36.391 to 36.417) is attached at Appendix B. In particular, we would draw your attention to the Inspector's conclusions on this issue on Page 691 paragraphs 36.399 that "*His (advice from Dr Solomon – witness for the Environment Agency) preferred solution is that the dredging (and piling) operations should be limited to the winter months, between 15 September and 15 March, when salmon are unlikely to be present in the estuary. That would effectively remove the risk of the construction process having an adverse effect on the migratory salmon*", evidence to which the Inspector attached considerable weight. His conclusions

in 36.404 are recorded as *“It seems to me that if the proposed tidal works were to coincide with the summer migration of salmon, this might well jeopardise the replenishment of the salmon stock”*.

- 4.55 The conclusion in respect of the impact of noise recorded in Able’s Environmental Statement, Chapter 10, Paragraph 10.8.6 is that *“Migratory fish of conservation interest passing through the area are unlikely significantly affected from prolonged exposure to piling works as their exposure is limited to a few hours, but it is not known if the piling operations act as an acoustic barrier to the spawning runs.”*
- 4.56 The Environment Agency relies on Dr Adrian Fewings’ expert analysis that “it is likely that some salmon will not complete their migration past the development site” and that “The proportion of salmon failing to complete their migration would depend on the environmental conditions present and the timing of the works”.
- 4.57 The Environment Agency is of the opinion that Able need to avoid, mitigate and, where necessary, compensate for the predicted effects on migratory fisheries. This position is supported by the Marine Management Organisation (MMO) and Natural England (NE), who are raising similar issues in respect of marine mammals and lamprey respectively. Paragraph 5.1.19 of the NPSP states that applicants should include appropriate mitigation measures as an integral part of the proposed development. Paragraph 5.1.20 goes on to say that where appropriate mitigation measures cannot be put in place, planning obligations should be attached to the consent.
- 4.58 The Environment Agency, together with the MMO and Natural England, has specified the requirements/mitigation measures that we would like to be secured in the Deemed Marine Licence (DML) and DCO (see letter to Able attached as Appendix H). These requirements are repeated below (please note that these conditions relate to all piling activities and some requirements are for the protection of birds). Some requirements may need to be included in the DML and DCO to ensure they can be monitored by the different regulatory authorities in connection with their particular responsibilities:

DCO Requirement and DML Condition 1

No development shall be commenced until a Piling Method Statement has been submitted to and agreed in writing by the Marine Management Organisation [substitute LPA for MMO when in Requirements schedule], following consultation with the Environment Agency and Natural England. The Piling Method Statement shall include the following measures:-

- Utilisation of pile pads;
- Utilisation of pile shrouds;
- Specification of piles to be used;
- Soft-start procedures to be followed;
- Marine mammal observation;

- Implementation of the Active Monitoring Scheme.

Development shall thereafter proceed only in strict accordance with the agreed Piling Method Statement.

- 4.59 The reason for this is to reduce the risk to sensitive mobile receptors, including Atlantic salmon, sea trout, river and sea lamprey, eel, herring, sole, plaice and marine mammals.

DML Condition 2

No development shall be commenced until an Active Monitoring Scheme has been submitted to and agreed in writing by the Marine Management Organisation, following consultation with the Environment Agency and Natural England. The Scheme shall include the following details:-

- Location of Active Monitoring Buoy(s) and depth and design of sensors;
- Full details of the frequency of measurement of temperature and dissolved oxygen in order to ascertain compliance with condition 9;
- 24 hours a day, 7 days a week monitoring of noise in order to ascertain compliance with conditions 4-7;
- Full details of when monitoring will commence and cease, which will include a 2 week period of pre and post construction monitoring in order to establish baseline conditions and the return to baseline conditions once construction activity has finished;
- A log of the number and approximate location of piling rigs which are in operation on any given day;
- Full details of how the monitored information will be accessed by or communicated to the site contractor and the Marine Management Organisation where necessary.

The Monitoring Scheme shall thereafter be implemented in accordance with the timetable approved as part of the scheme.

- 4.60 The reasons for this suggested requirement are to ensure appropriate information is available to allow noise mitigation measures to be implemented and monitored, to avoid periods when water conditions will make fish more vulnerable to disturbance and to reduce the risk to fish species including Atlantic Salmon, Sea Trout, River and Sea Lamprey, Eel, Herring, Sole and Plaice.

DCO Requirement and DML Condition 3

No percussive piling shall commence until a Cold Weather Construction Restriction Strategy for the months of February and March is agreed in writing with the Marine Management Organisation [substitute LPA for MMO when in Requirements schedule] in consultation with Natural England.

The strategy shall include the following elements/procedures:-

- a) No percussive piling (other than to finish driving any pile that is in the process of being driven at the point the cold weather restriction

comes into force) shall take place following seven consecutive days of zero or sub zero temperatures (where the temperature does not exceed 0°C for more than 6 hours in any day or any other pre-agreed formula to define short periods of thaw);

- b) Three temperature monitoring points shall be agreed within the Humber Estuary such as Immingham, Killingholme, Grimsby, or Spurn;
- c) Full details of how the monitored information will be accessed by or communicated to the site contractor and the Marine Management Organisation [substitute LPA for MMO when in Requirements schedule] where necessary.
- d) The restrictions will be reviewed as follows:
 - I. After 24 hours of above-freezing temperatures, the restrictions will be lifted on a "probationary basis", provided that the weather forecast (met office forecast location to be agreed) indicates that freezing conditions will not return within five days. If this weather forecast turned out to be wrong and freezing conditions did return, then there would have to be an immediate suspension of activity again;
 - II. After five clear days of above-freezing temperatures the restrictions will be lifted entirely and the "clock reset to zero".

The Monitoring Scheme shall thereafter be implemented in accordance with the timetable approved as part of the scheme.

- 4.61 The reason for this is to avoid an adverse effect on the interest features of the Humber Estuary SPA/Ramsar site.

During works

DML Condition 4

No percussive piling of piles shall take place between 7th April and 1st June inclusive in any one calendar year.

- 4.62 The reason for this is to reduce the risk to fish species including Atlantic Salmon, Sea Trout, River and Sea Lamprey, Eel, Herring, Sole and Place.

DML Condition 5

Percussive piling of piles shall be restricted in the following way:-

1. From 2nd June to 22nd July inclusive in any one calendar year, the maximum amount of percussive piling permitted within each four-week period shall be limited to:-

- a. 101 hours where a single rig is in operation; or
- b. A combined total of 168 hours where two or more rigs are in operation.

2. From 23rd July to 10th September inclusive in any one calendar year, the maximum amount of percussive piling permitted each week shall be limited to:-

- a. 25 hours where a single rig is in operation; or

b. A combined total of 42 hours where two or more rigs are in operation.

3. From 11th September to 31st October inclusive in any one calendar year, the maximum amount of percussive piling permitted within each four-week period shall be limited to:-

- a. 134 hours where a single rig is in operation; or
- b. A combined total of 224 hours where two or more rigs are in operation.

4. From 1st November to 6th April inclusive in consecutive calendar years, the maximum amount of percussive piling permitted within each eight-week period shall be limited to:-

- a. 336 hours where a single rig is in operation; or
- b. A combined total of 560 hours where two or more rigs are in operation.

The measurement of each work block shall begin at the start of the first percussive piling strike, roll throughout the piling day, then cease at the end of the last piling strike. Measurement will begin again at the start of the next percussive piling day, on the start of the first percussive piling strike. This process will be repeated.

- 4.63 The reason for this is to reduce the risk to fish species including Atlantic Salmon, Sea Trout, River and Sea Lamprey, Eel, Herring, Sole and Plaice.

DCO Requirement and DML Condition 6

No piling shall take place between 22.00hours on a Saturday and 06.00hours on the following Monday.

- 4.64 The reason for this is to ensure periods of quiet when no percussive piling is taking place for the benefit of fish species including Atlantic Salmon, Sea Trout, River and Sea Lamprey, Eel, Herring, Sole and Plaice.

DCO Requirement and DML Condition 7

No piling shall take place between 22.00hours and 06.00hours.

- 4.65 The reason for this is to ensure periods of quiet when no percussive piling is taking place for the benefit of fish species including Atlantic Salmon, Sea Trout, River and Sea Lamprey, Eel, Herring, Sole and Plaice.

DCO Requirement and DML Condition 8

The maximum diameter of marine piles shall be 2.1m.

- 4.66 The reason for this is that the impact assessment was undertaken on a maximum diameter of marine piles of 2.1m and a greater diameter pile would have a greater environmental impact.

DML Condition 9

No piling shall take place during periods when the data from the Active Monitoring Buoy(s) shows temperature to be above 21.5 degrees Celsius and/or dissolved oxygen to be below 5mg/l.

- 4.67 The reason for this is to reduce the risk to sensitive mobile receptors, including Atlantic salmon, sea trout, river and sea lamprey, eel, herring, sole, plaice and marine mammals.

DCO Requirement and DML Condition 10

The Licence Holder must ensure that soft-start procedures are used to ensure incremental increase in pile power over a set time period until full operational power is achieved. The soft-start duration should be a period of not less than 20 minutes. Should piling cease for a period greater than 10 minutes, then the soft start procedure must be repeated.

- 4.68 The reason for this is to allow mobile sensitive receptors, including salmon sea lamprey, river lamprey, eel, herring, sole, plaice and marine mammals, bird species to move away from the noise source, and reduce the likelihood of exposing the animal to sounds which can cause injury.
- 4.69 We are currently awaiting confirmation from Able on the acceptability of these requirements. We will then need to decide if further compensation needs to be secured for any residual risk remaining.
- 4.70 The Environment Agency previously raised with Able (in pre-application correspondence of 18 March 2011; 14 July 2011) concerns surrounding the potential impacts of dredging and disposal on suspended sediment concentrations and consequences on dissolved oxygen within the water column of the Estuary. The Humber Estuary European Marine Site Conservation Objectives are defined in Chapter 10, Table 10.8 of the AMEP application. Table 10.8 identifies that the objectives for water quality are as follows:

Dissolved Oxygen (DO)	DO should not fall below 2mg/l
	DO should not fall below 5mg/l for more than 5 consecutive days
	Following a period of DO of less than 5mg/l there should be at least 2 consecutive days where DO remains above 5mg/l
Suspended solids	Annual mean <25 mg/l

- 4.71 The dredge and disposal programme for the MEP has the potential to worsen dissolved oxygen within the estuary due to the increase in suspended sediment concentrations within the water column. As

dissolved oxygen levels within the water column are critical to certain fish species, our recommendation that the levels of increases/decreases in dissolved oxygen should be quantified in percentage terms in order to enable the assessment of impacts on species to be undertaken. This does not seem to have been done to date. We would have expected to see the evidence presented and the extent of risk to the noted fish species at risk to have been established. Any residual risk, we would have anticipated, would have been included into the potential in-combination and cumulative impacts.

4.72 As there are other sources of disturbance to fish within the Humber Estuary as a result of this application (i.e. piling noise as outlined above) the Environment Agency is of the opinion that there are certain periods when water conditions will make fish more vulnerable to disturbance. To reduce the risk of this, and to comply with the conservation objectives of the Humber Estuary European Marine Site, the Environment Agency propose that Active Monitoring Buoys are deployed at the points of both dredging and disposal. When the Active Monitoring Buoys shows temperature to be above 21.5 degrees Celsius AND/OR dissolved oxygen to be below 5 mg/l dredging activities (both dredge and disposal) cease until such time that the water conditions return to a favourable condition for fish (water temperature to be below 21.5 degrees Celsius and/or dissolved oxygen to be above 5mg/l).

4.73 Requirement 9 above, covers our requirement for this.

Chapter 12 – Commercial Fisheries

4.74 The Environment Agency licences activities for the operation of drift and fixed nets for salmon and sea trout in this area. We also licence eel netting activities, although not geographically specific to the Humber. There are currently no nets operating in the Humber for salmonids. Please refer to our comments above on Chapter 10, Aquatic Ecology, in respect of impacts on migratory fisheries generally.

Chapter 13 – Drainage and Flood Risk

4.75 As mentioned in paragraph 1.3 above, the Environment Agency is the principal flood risk management operating authority. We have the power (but not a legal obligation) to manage flood risk from designated main rivers and the sea. We are also responsible for increasing public awareness of flood risk, flood forecasting and warning and have a general supervisory duty for flood risk management.

4.76 Annex 13.1 includes the Flood Risk Assessment (FRA) submitted in respect of the MEP site, which has assessed the risks to and from the project based on an earlier quay (chamfer) design. The modelling methodology used is fit for purpose. Unfortunately, the FRA does not reflect the latest amended (square edged) quay design, which only

becomes apparent on reading Chapter 8 of the ES. Having raised this issue in our Relevant Representations, Able has agreed to provide an addendum to the FRA, which we expect to receive shortly. However, we will not be able to review this and provide detailed Written Representations on it within your submission deadline (please see letter to Able, dated 29 May 2012, attached for information at Appendix C). We therefore reserve the right to provide further detailed representations on flood risk. In the interim, we wish to **object** to the proposal on the grounds of the inadequate assessment, which currently supports the application.

- 4.77 At this time, we can provide the following information and comments. We can confirm that the site lies within Flood Zone 3a. We note that in Relevant Representation no. 72, made by Centrica, it is claimed that the proposal lies within Flood Zone 3b and therefore, development in this location will result in a loss of functional floodplain. We can confirm that this is not correct.
- 4.78 The construction of the quay will result in a reduction of the current standard of protection provided by the adjacent defences. This occurs at both the north and south ends of the quay, the north section being the worst affected. However, Able is proposing to mitigate for this increase to the north by improving the existing sea defence as part of the development. Able is relying on the project increasing sedimentation over time to the south of the quay to mitigate the increased flood risk. Additional modelling of the new Quay design is being undertaken and monitoring of sediment levels will need to be included within the required legal agreement (see paragraph 4.2 above for explanation of why a legal agreement is required).
- 4.79 The Environment Agency will need to review the revised modelling results for the final quay layout once they are available. We reserve the right to amend these comments following receipt of the additional modelling work.
- 4.80 The Environment Agency is concerned that the standard of protection offered by defences to the north and south of the quay should not be compromised as a result of the development. Able has agreed to monitoring sediment levels and the foreshore to the south, with a view to improving defences if/when required. Therefore, we request the following requirement is included within the DCO/DML or a legal agreement as appropriate

Requirement

No development shall commence until a scheme for the monitoring of the foreshore and sediment levels around the quay have been submitted to and agreed in writing by the Marine Management Organisation, in consultation with the Environment Agency. Annual monitoring reports shall be submitted to the MMO within 6 weeks of the anniversary of implementation up to 2033. The scheme shall include

trigger points for if/when improvements to the defences are required. The approved monitoring scheme shall be implemented and complied with at all times.

- 4.81 The reason for this is to ensure the long term effects of the quay do not increase flood risk to third parties.
- 4.82 The flood modelling has identified that the project will impact on overland flood flows and locally increases the flood depth to the surrounding area. This generally results in a 300mm increase in flood depths, depending on the breach location. Third parties could be affected, in particular the warehousing/office buildings at Manby Road, and property on Marsh Lane, such as Hazel Dene (a residential property). The following table summarises the modelled flood depths (in metres) for the present day (2014) and climate change (2115) breach scenarios. The locations are show on the map attached at Appendix F.

Location	Grid Reference	0.5% (2014)		0.5% (2115)	
		Pre-Dev	Post-Dev	Pre-Dev	Post-Dev
Ore Terminals	517516 416831	1.69	2.04	2.94	3.24
Manby Road -Office	517236 416580	-	-	1.4	1.61
Manby Road - Golf Course	517887 415858	-	-	-	0.28
Hazel Dane Property	517333 417313	1.59	1.94	2.84	3.14

- 4.83 The advice in the NPSP (Paragraph 5.2.16, 3rd bullet) is that projects should not increase flood risk elsewhere. The Secretary of State will need to take a view on whether or not this increase in flood depths to third parties is acceptable, given this conflict with the NPSP.
- 4.84 The FRA includes general principles of plot drainage within the site and details to the proposed adaptation of the North East Lindsey Drainage Board Killingholme Marshes scheme. However, further details will be required to ensure a satisfactory scheme will be implemented. Currently, the proposal requires adaptation to a small but integral part of the North East Lindsey Drainage Board Killingholme Marshes scheme and the relocation of the pumping station. The former will require the agreement of the Drainage Board and the latter will require consent from us under the Environment Agency Anglian Region Land Drainage and Sea Defence Byelaws 1987.
- 4.85 Although there is a requirement in the DCO in Schedule 11, Requirement 11, as mentioned in paragraph 4.31 above, we do not think this is clear. We, therefore, request that the following requirement (recommended by Deborah Morris – see Appendix K, paragraph 4.7) is included to ensure that a satisfactory surface water drainage scheme is agreed and implemented:

Requirement

No development shall commence until a detailed surface water drainage scheme for the site, based on sustainable drainage principles and an assessment of the hydrological and hydro geological context of the development, has been submitted to and approved in writing by the local planning authority. The scheme shall subsequently be implemented in accordance with the approved details before the development is completed.

- 4.86 The reason for this is to prevent the increased risk of flooding.
- 4.87 As mentioned in paragraph 4.4 above, we require protective provisions within the DCO in order to protect the integrity of the flood defences where the surface water outfall pipe will penetrate them to ensure there is no increase in flood risk to the surrounding area. Paragraph 5.3.14 of the NPSP states that “substantial weight should be attached to the risks of flooding”.
- 4.88 The FRA has used climate change requirements set out in Planning Policy Statement 25 ‘Development and Flood Risk’ (PPS25), which was relevant policy in force at that time, (but is now superseded by the National Planning Policy Framework (NPPF)). This was our advice to the applicant during the pre-application consultation stages. In January 2012 the NPSP was finally designated and paragraph 4.13.7 requires applicants to use the latest set of UK Climate Projections. The PPS25 levels are comparable to the high emission scenario 90% estimate from UKCP09, so by having considered this degree of change, it is our opinion that Able has covered all that is required, being conservative in its estimates. Contrary to our comment within our Relevant Representations, there is, therefore, no need for the applicant to revisit the high emissions scenario as the appropriate level at which to set any safety-critical elements of the project has already been determined.
- 4.89 Able was originally proposing to monitor the effects of climate change, and incorporate the ability to increase the height of the quay if it is found to be necessary in the future. Able has advised us that their consultants are currently considering the cost/benefits of this adaptive approach, as opposed to building in the allowances for climate change from the outset. If the adaptive approach is to be adopted, we will require an appropriate monitoring scheme, including trigger levels, to ensure works are undertaken as necessary. This is in line with the recommendation in paragraph 4.13.13-14 of the NPSP.
- 4.90 Buildings on site will be at a level where water may enter the buildings during the 1:200 year event. In order to ensure the safety of the occupants, we require safe refuge areas to be provided within all the buildings. We request that the following requirements are included within the DCO:

Requirement

The finished floor level of all buildings shall be set a minimum of 300mm above the surrounding ground level. The buildings shall incorporate flood resistant/resilient design with their construction.

- 4.91 The reason for this is to reduce the impact of flooding.

Requirement

Safe refuge areas shall be provided in all building at a minimum height of 6.84mODN as recommended in the approved Flood Risk Assessment.

- 4.92 The reason for this is to reduce the impact of flooding on the occupants of the development.

- 4.93 Paragraph 5.2.28 of the NPSP states that “Flood warning and evacuation plans should be in place for those areas at an identified risk of flooding”. The Environment Agency does not normally comment on or approve the adequacy of flood emergency response procedures accompanying development proposals, as we do not carry out these roles during a flood. Our involvement with this development during an emergency will be limited to delivering flood warnings to occupants/users covered by our flood warning network.

- 4.94 Paragraph 5.2.28 of the NPSP advises that those proposing developments should take advice from the emergency services when producing an evacuation plan for the development as part of the flood risk assessment. In all circumstances where warning and emergency response is fundamental to managing flood risk, we advise decision makers to formally consider the emergency planning and rescue implications of new development in making their decisions.

- 4.95 The Flood Risk Assessment did not include a flood warning and evacuation plan. We consider this to be an essential part of demonstrating that the residual risk of flooding can be managed in a way that does not expose occupants of the development to an unacceptable flood hazard. We, therefore, request that a requirement to undertake one is secured in the DCO and we suggest the following wording:

Requirement

Prior to the occupation of any building, a flood warning and evacuation plan shall be submitted to and approved by the Local Planning Authority. Development shall be carried out in accordance with, and fully implement, the recommendations of the plan.

- 4.96 The reason for this is to reduce the impact of flooding on the occupants of the development.

- 4.97 As the MEP development will take place within the Environment Agency Anglian Region Land Drainage and Sea Defence byelaw distance of 9 metres, our consent for the works will also be required. Within Schedule 9, Part 3, Paragraph 27 of the draft DCO, the applicant is proposing to disapply our byelaws. We, therefore, require a satisfactory legal agreement and/or protective provisions, which protect our interests in this respect. As these have not yet been agreed we **object** to the proposed development on the grounds of potential increase in flood risk to the site and surrounding area until this is in place.
- 4.98 Paragraph 13.9.2 of the ES states that “There will be no adverse cumulative impacts in combination with other adjacent developments (including the Compensation Site) during the Operational Phase”. We do not agree with this statement for the reasons outlined in paragraphs 4.133 to 4.134 below. The MEP will have, in our opinion, a long-term impact on delivery of flood risk management within the estuary. It will exacerbate the rates of indirect habitat loss and suitable compensation needs to be secured for this. Please also refer to paragraphs 4.19 to 4.24 above for further details on long-term inter-tidal habitat loss.

Chapter 23 – Waste

- 4.99 We are satisfied that the Waste Chapter covers the relevant Duty of Care aspects of the development proposal from construction to operation and satisfies the guidance in paragraph 5.5.4 of the NPSP. Able acknowledges the relevant waste management legislation and the requirement under the Site Waste Management Plans Regulations 2008 to undertake a Site Waste Management Plan.

Chapter 28 – Description of the Development (Cherry Cobb Sands)

- 4.100 With reference to paragraph 28.2.2 of the ES, the works described in respect of the design and construction of the new flood defence will need to be regulated in two ways by the Environment Agency – by legal agreement and by consent under the Yorkshire Land Drainage Byelaws 1980. The case for a legal agreement and consent is explained by Dan Normandale’s Statement of Case (Appendix L, Sections 6 and 7). We are currently in discussions with Able regarding this issue and will require further detailed drawings and specifications for the flood defence embankment to enable us to draw up an acceptable legal agreement for these works.
- 4.101 A legal agreement, made under Section 41 of the Yorkshire Water Authority Act 1986, would contain details of the sequence of works, including breaching of the existing flood defence, geotechnical and flood protection standard of works and maintenance, inspection and, going forward, remediation arrangements, responsibilities and liabilities for the new and old defences.

4.102 Consent under the Yorkshire Land Drainage Byelaws 1980 is required for all permanent and temporary works which affect the existing and new flood defences.

4.103 If the legal agreement has not been completed at the end of the Examination, our position will be one of **objection** to the proposed development.

Chapter 30 – Choice of Site

4.104 In 2004 the Environment Agency produced a Coastal Habitat Management Plan (CHaMP) (Black & Veatch Consulting Ltd, March 2004). CHaMPs provide a framework for managing sites of European importance and Ramsar sites that are located on or adjacent to dynamic coastlines.

4.105 Currently flood protection in the Humber estuary is provided by approximately 235km of defences largely comprising grassed, earth embankments or heavier rock/stone protected banks with some lengths of quay walls and sheet-piled walls, mainly in the urban areas. The defences are generally in reasonable condition, but the standard of protection is low in places where insufficient height of defence could lead to damage through overtopping, or where the condition of the defence itself results in an unacceptable risk of breaching/destabilisation through wave action.

4.106 Records show that water levels in the Humber estuary have been rising historically, relative to the land levels, at a rate of c. 2mm per year. This rate is increasing as a result of climate change and, unless action is taken, will increase flood risk in many areas to unacceptable levels. In addition to the increased risk to people, property and land uses, the rising sea levels are causing loss of inter-tidal habitats within the estuary; these habitats are prevented from migrating inland by the existing flood defences (a process known as ‘coastal squeeze’). The 2004 CHaMP assumed a rate of 6mm/year over the period 2000 – 2050. A recent review of the CHaMP revised this rate to 4mm/year (as recommended by Defra for use in flood risk planning). The review also allowed a revision of calculations of coastal squeeze habitat losses based on improved data sets.

4.107 The primary functions of the Humber Estuary CHaMP are to:

- provide a clear and agreed record of predicted habitat losses and gains, and other potential impacts on the habitats and species of European or international importance subject to shoreline change; and
- set the direction for habitat conservation measures to address net losses.

- 4.108 The Humber Estuary CHaMP commits the Environment Agency to compensate for the loss of inter-tidal habitat on the following basis (unless agreed otherwise on a site by site basis or as a result of future Strategy / CHaMP reviews):
- 1:1 replacement for coastal squeeze and temporary disturbance from Flood Risk Management schemes, and
 - 3:1 replacement for permanent loss due to flood defence works (this is the currently agreed ratio, but may be subject to alteration in the future).
- 4.109 As a result of this commitment the Cherry Cobb Sands site is identified in our Humber Strategy (our long term plan for managing flood defences along the Humber estuary into the future) as a planned habitat creation site, to compensate for these losses, identified at Keyingham. Whilst we recognise that the Strategy comes with a delivery risk, by identifying sites where we do not currently own the land, this project has the potential to hinder the Environment Agency's ability to deliver habitat compensation requirements.
- 4.110 Paragraph 5.2.9 of the NPSP says that "In determining an application for development consent, the decision-maker should be satisfied that.....the proposal is in line with any relevant national and local flood risk management strategy".
- 4.111 The Environment Agency provides further information with regard to the Humber Flood Risk Management Strategy in response to the Examining Authority's first written questions, specifically questions 67 and 68.

Chapter 31 – Geology, Hydrogeology and Ground Conditions

- 4.112 We have considered the reports submitted in respect of potential land contamination at the Cherry Cobb Sands compensation site (Annexes 31.2 to 31.4) together with Chapter 31 of the Environmental Statement. The assessments provided have identified that previous land uses may have given rise to contamination at the site. The limited intrusive investigation work undertaken within the fields in the north west area of the site has identified metal and hydrocarbon contamination of the ground, believed to be associated with an historic landfill site at this location. In addition, the assessments have identified that creeks on the site may also have been in-filled with potentially contaminated material and that there is a potential for contamination in the area of the site associated with use as a decoy site in World War II. The recommendation of the assessments is that further intrusive investigation work is required to determine the areas of potentially contaminated ground, based on the information gathered to date.

- 4.113 We concur with this recommendation. The soil sample locations should be appropriately sited in relation to current and historic areas where contamination may have arisen. Following a robust intrusive investigation the risk to controlled waters should then be determined using an updated conceptual site model for the site.
- 4.114 We have requested Able provide us with a copy of the Site Investigation (see letter to Able attached at Appendix C) report to enable us to ensure any necessary remediation is adequately carried out and that there will be no risk of pollution of controlled waters. As Able is also planning to utilise the materials on site for the formation of the new flood defence embankment, we also need to be assured that the material is fit for purpose. We have been advised that this additional information will be forwarded to us in early July, which will not provide us with sufficient time to review it and provide detailed comments. We will, therefore, provide further comments on this within later written submissions.
- 4.115 Our interim position in respect of suspected contamination is to request the following requirements are included in the DCO:

Requirement

Prior to the commencement of development approved by this planning permission (or such other date or stage in development as may be agreed in writing with the Local Planning Authority), the following components of a scheme to deal with the risks associated with contamination of the site shall each be submitted to and approved, in writing, by the local planning authority:

- 1) A preliminary risk assessment which has identified:
 - all previous uses
 - potential contaminants associated with those uses
 - a conceptual model of the site indicating sources, pathways and receptors
 - potentially unacceptable risks arising from contamination at the site.
- 2) A site investigation scheme, based on (1) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.
- 3) The results of the site investigation and detailed risk assessment referred to in (2) and, based on these, an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken.
- 4) A verification plan providing details of the data that will be collected in order to demonstrate that the works set out in the remediation strategy in (3) are complete and identifying any requirements for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action.

Any changes to these components require the express consent of the local planning authority. The scheme shall be implemented as approved.

- 4.116 The reason for this is to protect the water environment by ensuring that the site is remediated to an appropriate standard.

Requirement

Prior to development, a verification report demonstrating completion of the works set out in the approved remediation strategy and the effectiveness of the remediation shall be submitted to and approved, in writing, by the local planning authority. The report shall include results of sampling and monitoring carried out in accordance with the approved verification plan to demonstrate that the site remediation criteria have been met. It shall also include any plan (a "long-term monitoring and maintenance plan") for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action, as identified in the verification plan, and for the reporting of this to the local planning authority. The long-term monitoring and maintenance plan shall be implemented as approved.

- 4.117 The reason for this is to protect the water environment by ensuring that the site is remediated to an appropriate standard.

- 4.118 Following receipt of the Site Investigation report, it may be that parts 1) and 2) of the first requirement will have been satisfied. We will provide a further update on this in July.

Chapter 32 – Hydrodynamic and Sedimentary Regime

- 4.119 Please see comments on Chapter 8, which cross references with this Chapter, together with our comment in respect of the in-combination effects of the project.

Chapter 33 – Water and Sediment Quality

- 4.120 Technical note DHM6835-01 R1 (WFD assessment for CCS) will support Chapter 33, when it is formally submitted by Able. We have incorporated our comments on this Chapter within our comments on Chapter 9. For the purpose of assessment of the project in its totality against WFD it is more appropriate to look at the assessments in parallel.

- 4.121 Paragraphs 33.5.16 to 33.5.19 describe the site investigation works undertaken to date. Please refer to our comments on Chapter 31 above in respect of the further site investigation work required and Paragraphs 4.126 below, for the implications of site winnings being used for the construction of the new flood defence embankment.

Chapter 34- Aquatic Ecology

- 4.122 Paragraph 34.6.4 discusses the impacts of reduced dissolved oxygen on fish fauna. As discussed in paragraph 7.3 of Adrian Fewings Statement (see Appendix D), fish are more vulnerable when dissolved oxygen is reduced and water temperature is high. The breaching of the old CCS flood defence embankment will be followed by a period when suspended sediments are increased. If this occurs at a time when temperature is high and/or dissolved oxygen is reduced, fish (particularly juvenile fish) may suffer discomfort, become stressed and this may affect their progress through the estuary. The consequent delay could reduce their survival rate. We would, therefore, not want the breach to take place when water temperature is above 18 degrees Celcius. The solubility of oxygen decreases as water temperature rises, warmer water contains less dissolved oxygen for fish. Therefore, if the breach takes place when water is colder, the increase in suspended sediments, will have less impact. We will continue to work with Able on the detailed design for CCS and Able will need to be mindful of this in relation to the breach timings.
- 4.123 In paragraph 34.6.10 the potential impact of accretion rates on benthic invertebrates is discussed. High accretion rates do restrict the development of benthic communities. The potential significant benefits that may be delivered by CCS need to be reassessed following the detailed design of the site (we are currently awaiting the results of this work) so that the accretion rates can be assessed along with the total mudflat extent. Chapter 32, paragraph 32.6.22 indicated in excess of 50 ha of mudflat would be present on the site after 5 years. Our letter dated 29 May 2012, (attached at Appendix G) in respect of WFD, gives some specific advice regarding the colonisation of benthic invertebrates and this issue should be re-assessed when Able has more information about how the CCS site may develop. Also, please refer to paragraphs 4.36 to 4.44 for further discussion on WFD in impacts.

Chapter 36 – Drainage and Flood Risk

- 4.124 As outlined in our Relevant Representations, we had significant concerns about the proposed design of the compensation site's new flood defence embankment. Having reviewed the relevant Flood Risk Assessment (FRA), Chapter 36 and Annex 36.1, we were not assured that the design crest level for the new embankment would be to the required 1 in 200 year standard including climate change. However, we have now received additional information (Overtopping Design Memo, Black & Veatch, 16 December 2010 and Wave Analysis Design Memo_Rev1, Black & Veatch, 16 January 2011), which has provided us with the assurance that the new embankment will be to the required

level, i.e. 7.5mODN where the embankment will be subject to direct wave action and 7.0mODN elsewhere.

- 4.125 Different types of embankment protection are specified along the embankment length, apparently commensurate to the expected erosion forces of tidal inundation. However, we believe that greater lengths of the embankment require more robust protection than suggested. This is because the preferred breach width in the existing flood bank is likely to increase over time because the ends of the breach will not be protected from erosion. Therefore, more of the new embankment will be subjected to wave action than predicted. We note that the hydraulic model used appears to take account of existing ground levels rather than predicted ground levels following re-profiling of the site to provide embankment material. We are now aware that the detailed design of the compensation site is being considered by Black and Veatch and we expect further information in respect of this to become available during the course of the Examination. We reserve the right to provide further comments on this in due course.
- 4.126 Regarding the suitability of embankment material, we have concerns about whether winnings from within the site will be suitable (in terms of foundation settlement and performance of the material due to the dried crust which may form, thus increasing the undrained shear strength and bearing capacity) for use in the flood bank. We raised this issue with Able during the pre-application consultation stages (see letter of 14 July 2011 attached as Appendix E). We reserve judgement until the outcome of the proposed further Site Investigation (SI) work, including laboratory testing, discussed in paragraphs 4.112 to 4.114 above, becomes available.
- 4.127 The new flood defence constructed at the compensation site needs to be allowed time to settle and vegetation to establish prior to the breach of the existing defence taking place. Both the toe of the defence and the protective berm, that is potentially forming part of the final design, will be subjected to eroding forces following the breach. The risks associated with this are explained further in Daniel Normandale's Statement (see Appendix L, paragraphs 4.3-5). It is preferable for the vegetation to have established prior to exposure to any major tidal events. Natural England has agreed in principle that this delay may be acceptable in compensation terms, but until detailed design is complete and we know whether the construction works can take place in one earth works season, we do not know if a compromise can be reached.
- 4.128 The compensation site works require the Environment Agency's consent under the Yorkshire Land Drainage Byelaws 1980. We, therefore, require a satisfactory legal agreement to ensure that the defence is built to an adequate standard and is monitored and maintained appropriately. Such agreement is deemed necessary to deliver a transparent, accountable and enforceable means to ensure that the signatories discharge their responsibilities in a sustainable

manner which safeguards local communities by delivering a new flood defence of increased standard of protection and condition. Further information on the case for a legal agreement is included in Daniel Normandale's Statement (Appendix L, Section 6).

- 4.129 As no legal agreement has yet been completed, we **object** to the proposed development on the grounds of the potential increase in flood risk to people and property, which may result from the development if it is not carried out in a satisfactory manner.
- 4.130 The proposal also has the potential to increase the levels of siltation at Stone Creek, which lies 400m to the south-east of the site. Dredging of Stone Creek has in recent times been undertaken by the Environment Agency. The local Internal Drainage Board (Keyingham Level IDB) has recently taken the lead role on behalf of a number of interested drainage boards for a project to dredge the channel outside of the outfall structure, to alleviate the existing siltation issues. Able has acknowledged (in Chapter 36, paragraph 36.8.5) the potential for the development to exacerbate the issue. We would concur with the need for an agreed monitoring and maintenance plan for Stone Creek in order to identify circumstance in which work will be required. As recommended by Daniel Normandale (Appendix L, paragraph 8.3) we request that the need for this plan is secured in the DCO with the following requirement:

Requirement

No development shall commence until a scheme for the monitoring of sediment and siltation for Stone Creek has been submitted to and approved in writing by the Local Planning Authority. The scheme shall include:

- details of monitoring proposals, including location and frequency;
- details of trigger levels and resultant actions required if trigger levels are exceeded.

Development shall proceed fully in accordance with the approved scheme and timetable contained therein.

- 4.131 To ensure drainage of the surrounding land is not compromised, thereby increasing the risk of flooding to thirds parties and compliance with the WFD.

Chapter 43 – Waste

- 4.132 We are satisfied that the waste chapter covers the relevant Duty of Care aspects of the development proposal from construction to operation and satisfies the guidance in paragraph 5.5.4 of the NPSP. Able acknowledges the relevant waste management legislation and the

requirement under the Site Waste Management Plans Regulations 2008 to undertake a Site Waste Management Plan.

Chapter 44 – In-combination

- 4.133 The in-combination assessment is inadequate as presented. We recommend that a table with conclusions from all the chapters needs to be drawn together so that it is clear what impacts arise from the development in-combination and cumulatively as a result of other developments within the estuary and if, and where, these are mitigated.
- 4.134 In addition we would recommend that the assessment area is expanded to include a 10km radius around the compensation site and a 10km radius around the capital and maintenance disposal sites. At present, Grimsby and the Sunk Dredge Channel are being excluded from the assessment, but may conflict with dredging works.
- 4.135 Able has agreed to provide a Supplementary In-Combination Assessment and we are expecting to receive this in July. We will provide further detailed comments in due course.

5.0 Compulsory Purchase of Environment Agency owned land

- 4.136 The Book of Reference and accompanying Land Plans, states Able's intention to use Compulsory Purchase powers granted through the Development Consent Order to acquire land currently in our ownership. The strip of land shown on Land Plan Sheet 2, reference 02002, comprises of a ditch and bed thereof and shrubbery to the east of Rosper Road, South Killingholme, Immingham.
- 4.137 This ditch is currently used in connection with drainage to the South Killingholme Reservoir, an asset also currently in the ownership of the Environment Agency. We are in the process of transferring ownership of the Reservoir to the North East Lindsey Drainage Board. We have no objection to Able purchasing this drainage ditch from us by agreement in advance of any compulsory purchase that may be authorised by the DCO. However, any future works to it that are within the Drainage Board's byelaw distance will require their consent before being allowed to proceed.

Appendix list

Appendix A	Deltares memo
Appendix B	Extracts from Dibden Bay Inspector's Report 2003
Appendix C	EA letter to Able 29 May 2012 re outstanding information
Appendix D	Statement from Dr Adrian Fewings re impacts on migratory fish
Appendix E	EA letter to Able 14 July 2011 re hydrodynamic and sedimentary regime
Appendix F	Location of modelled depths from Able MEP flood modelling
Appendix G	EA letter to Able 29 May 2012 re Water Framework Directive assessments
Appendix H	EA letter to Able 19 June 2012 re piling mitigation requirements
Appendix I	Humber Flood Risk Management Strategy, Part 1
Appendix J	Humber Flood Risk Management Strategy, Part 2
Appendix K	Statement by Deborah Morris re MEP flood risk impacts
Appendix L	Statement by Daniel Normandale re CCS flood risk impacts

Appendix A

Deltares memo

Memo

To
Philip Winn , , The Environment Agency, Albion Mills, Great Gutter Lane,, Willerby, Hull, HU10 6DN,
UK

Date	Reference	Number of pages
3 May 2012	1203-0100	9
From	Direct line	E-mail
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Classification
confidential until further notice

Subject
Review EIA documents GPH & AMEP

1.1 Review EIA documents GPH and AMEP – Executive Summary

Two port developments, on the north (GPH) and south (AMEP) banks of the Humber Estuary (UK) are in the planning process. The environmental effects of both developments have been assessed and there is disagreement between the Environmental Statements for each as to whether the AMEP scheme will have negative effects on the estuarine system. The Environment Agency (EA) needs to ensure that developers compensate for negative effects and the indirect loss of habitat from each development. The Agency is responsible for dealing with non-scheme related indirect losses (i.e. those losses resulting coastal squeeze, 'coastal squeeze' is created when habitat migration (in response to sea-level rise) is prevented by tidal/flood defences) within the estuary, and needs to avoid having the cost of further losses being met from the public purse. Therefore Deltares have been asked to provide an independent review of both studies.

The results produced in the detailed environmental impact assessments of both developments were evaluated. It was concluded that the studies were sufficiently sound and detailed enough to adequately assess the environmental impacts of each development. The individual studies of the GPH and AMEP also considered the combined impact of both developments together. In the evaluation of the joint impacts the conclusion are appropriately cautious due to a lack of sufficiently detailed information of the other development.

The south-bank development consists of construction of a quay, dredging of the berthing areas and approach channels on the south bank and compensation (creation of land) on the north bank. Two different numerical models were applied for evaluating the effects of this development, only one of which included sediment transport. One set of model results outlining the impact on water levels and currents were presented, making it difficult to compare approaches. Nevertheless, the quality and reliability of the modelling work done is satisfactory.

The north-bank development involves the infilling of an existing dock area, there is no construction work proposed in the estuary itself. The impact assessment of the GPH development is based on a previous modelling study carried out without the inclusion of the south bank development. The dredging of material for land reclamation (for the infilling of the

dock) is not considered. Again, the modelling work carried out by the GPH team is considered to be adequate and reliable.

Model resolution plays an important role in correctly modelling the impact of the port developments. Neither study included the other development in the models used in the impact assessment. Ideally both developments should be included in the same numerical model. It is anticipated that the impact of these south and north bank developments will be limited in the long term, with sediment building up seaward of the development and erosion occurring landward of the development. Overall it is expected there will be a long-term loss of intertidal area, amounting to approximately 12 ha when adopting a precautionary approach to the assessment of the loss. This 12 ha is not evenly split between the two developments, with AMEP contributing approximately 10 ha. The GPH development is smaller and therefore results in a smaller long-term loss (of less than 1 ha) of intertidal area.

Background

Two port developments on the north and south banks of the Humber Estuary are going through the planning process. Associated British Ports (ABP) are progressing a major north bank scheme (Green Port Hull, abbreviated as GPH). Able UK is promoting a south bank scheme (Able Marine Energy Park abbreviated as AMEP). EIA studies are available for both developments, both considering the cumulative environmental effects of the combined developments. Herein disagreement exists about whether or not the south bank scheme (AMEP) will have detrimental effects on estuarine functioning and result in further indirect losses taking place. The Environment Agency (EA) is responsible for meeting coastal squeeze losses. For this reason EA commissioned Deltares to provide an independent assessment of the claims being made.

This memo reports the results of the first part of the work, which is a desk assessment of the correspondence EA has received and of the Environmental Statements. The first section below summarizes our conclusions and gives some recommendations. The subsequent sections substantiate the conclusions by first summarising the relevant findings from the assessments of the two studies, followed by a more detailed evaluation of the impacts of the developments on the estuarine processes, i.e. the hydrodynamics, sediment transports and morphology.

Conclusions and Recommendations

For both developments, GPH and AMEP, extensive and detailed studies have been carried out for making the Environmental Statements. The relevant parts of the documents reporting the studies have been assessed in a short desk study. The conclusion from this first assessment is that both studies are sound in assessing the environmental impacts for the development they consider. Each of the studies supply detailed assessments of the impacts of its own development. We did not find indications pointing at underestimated effects in the EIA studies.

As required, both studies address the combined and cumulative effects by considering the other ongoing and planned developments. For this purpose the study on GPH has considered the impacts of AMEP, and vice versa. However, both studies lack details of the other

development, apparently because of the insufficient availability of information. Therefore the evaluations of the combined and cumulative effects are precautionary, as they should.

As repeatedly stated in the EIA documents for the GPH development, the assessment of the effects of AMEP is based on results of preliminary modelling because the results of detailed modelling study were not available. The statements on the effects of AMEP are meant for a precautionary evaluation of the combined and cumulative effects in the EIA of GPH. Therefore EA is advised to interpret those statements strictly in this manner.

As follow up we recommend the EA to ask the consortium who carried out the study for AMEP to present the results of the TELEMAC model concerning the impacts of the AMEP scheme to the water levels and tidal currents. This will help to answer questions that emerged from our assessment of the EIA documents for the AMEP development (see following Section). It would also be desirable to carry out the sand transport modelling using the TELEMAC model and compare the results with those from the CMS – model. It would be ideal if both developments would be simulated with a same model with comparable resolutions of the computational grid at both sites.

AMEP documents

The following documents from the study on the AMEP development have been received from EA and assessed:

- 08 - Hydrodynamic and Sedimentary Regime.pdf
- 09 - Water and Sediment Quality.pdf
- 13.1 - Flood Risk Assessment and Drainage Strategy.pdf
- 32 - Hydrodynamic and Sedimentary Regime.pdf
- 32.1 Compensation site geomorphology.pdf
- 32.2 Hydraulic model set up report.pdf
- 32.3 Compensation site breach design report.pdf
- 32.4 Compensation site model test report.pdf
- 32.5 - Compensation site sedimentation and erosion.pdf
- 32.6 - 110ha Compensation site model test report.pdf
- 33 - Water and Sediment Quality.pdf
- 36 - Drainage and Flood Risk.pdf
- 44 - In-Combination.pdf
- 8.1 - AMEP Estuary Modelling Studies Report.pdf
- 8.2 - Geomorphological Review of the Humber.pdf
- 8.3 - Assessment of the Effects on Fine Sediments.pdf
- 8.4 - Dredging Plume Dispersion.pdf
- 9.1 - Bathymetry Hydrography Survey.pdf
- 9.4 - Water Framework Directive Assessment.pdf
- 9.5 - Anglian Water Letter.pdf
- 9.6 - Assessment of relocation EON outfall.pdf
- 92-ASS~1.PDF (draft internal document for review)
- 93-ASS~1.PDF (draft internal document for review)

Our assessment focused on those parts concerning the effects on estuarine processes, i.e impacts on the hydrodynamics, sediment transports and morphology. Relevant findings from the assessment of these documents are summarised as follows:

- Two different numerical models have been applied for evaluating the various effects of the AMEP scheme:
 - A 2DH hydrodynamic model based on CMS – Flow is used for the effect on water levels and currents and bed shear stresses. The results of this model are also used for the effect on short-term sediment transport processes and suspended sediment concentrations.
 - A 3D hydrodynamic model based on TELEMAC is set up and used in combination with DELWAQ for the effects on fine sediments.
- The results of the TELEMAC hydrodynamic model for the effects on water levels, currents and bed shear stresses are not presented. This is a pity as the results could be compared with those from the CMS model in relation to the next observation.
- The proposed development consists of: i) a quay, ii) an area of dredged depths comprising the berthing areas and approach channels, and iii) an area of compensation land exposed to the Estuary on the north bank. The hydrodynamic modelling results are from model runs without taking into account of the compensation area on the north bank (5.6 of document 8.1 AMEP Estuary Modelling Study Report). The quay has the effect that it decreases the tidal storage (volume between HW and LW) and the volume under LW, whereas the dredging increases the volume under LW. The combined effect on the volume under LW is an increase (5.8 of document 8.1 AMEP Estuary Modelling Study Report). In terms of hydrodynamics it means a decrease of the storage width and an increase of the cross-sectional area for flow. Based on the experience of earlier studies (Wang and Jeuken, 2004; Jeuken et al., 2007) initially a (small) increase of the tidal range through the estuary would be expected. However, the presented results show the opposite, a reduction in tidal range. A possible explanation is that the detailed model simulates circulations at the two (especially the north) ends which effectively decrease the local flow carrying cross-sectional area while the storage width remains the same. Another, additional explanation could be that the dredging in front of the quay is not fully implemented in the simulation. The following observation triggers this suspicion:
 - The model results show increased peak flow velocities in the majority of the dredged area. Only in a small strip directly next to the quay, a reduction in peak velocities is simulated.
 - The results of the short-term sediment transport simulations (Figure 27 in document 8.1 AMEP Estuary Modelling Study Report) point at additional sedimentation, which is remarkable given the predicted pattern of the change in flow velocity field.

GPH documents

The following documents from the study on the GPH development are received from EA and assessed:

0326_001.pdf (draft internal document for review)
 10 Water Quality, Drainage and Flood Risk FINAL.pdf
 1203-0099-m-Review EIA documents GPH & AMEP.doc (draft internal document for review)
 1203-0100-vdraft-m-Review EIA documents GPH & AMEP.doc (draft internal document for review)
 2 Need and Alternatives FINAL.pdf

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21 Cumulative and Combined Effects FINAL.pdf
 9 Coastal and Estuarine Processes FINAL.pdf
 Appendix 10C FINAL.pdf
 Appendix 9A FINAL.pdf
 Chapter 10 Figures FINAL.pdf
 Chapter 2 Figures FINAL.pdf
 Chapter 21 Figures FINAL.pdf
 Chapter 9 Figures FINAL.pdf
 Compensation. PDF (re-issued as ABPmer Report R1975 260412.pdf)
 Environment Agency Response 23.02.12.pdf
 GPH IROPI hcc draft 23 Mar 12.doc
 Green Port Hull habitat regs step guide.doc
 hcc aa 23 3 12.doc
 In combination update -ABPmer 22-3-12 (2).pdf

Our assessment focused on those parts concerning the effects on estuarine processes. Relevant findings from the assessment of these documents are summarised as follows:

- The EIA for GPH concerning coastal and estuarine processes is based on the 1D and 2DH numerical modelling of the consented Quay 2005 development. This is why no model simulation including AMEP is carried out in the study for evaluating the combined and cumulative effects. Evaluation for AMEP is based on preliminary modelling results from the AMEP-study.
- In their report "21 Cumulative and Combined Effects FINAL.pdf" they refer to the study "JBA (2011) South Humber Channel Marine Studies: Hydrodynamic, Wave and Sediment Study. Report to Yorkshire Forward". This latter study does not seem to be the same study as the one assessed in this desk study, i.e. "8.1 - AMEP Estuary Modelling Studies Report.pdf". This may explain why the effects of AMEP on the currents reported in paragraphs 21.152 and 21.153 of the GPH study "21 Cumulative and Combined Effects FINAL.pdf" are larger than those reported in the AMEP study. All the other statements saying that the effects of the AMEP development would be substantial are related to these larger effects on the currents.
- Obviously, a different set of models is used than the models used in the AMEP-study.
- Infilling of the dock and reclamation will require sediment dredged elsewhere. The dredging of the infilling material is not considered in the GPH study, probably because the dredging will take place outside the estuary, except that the dredged material from the IOTA development may be used for this purpose.
- It is proper to use the worst scenario for combined and cumulative impact as long as it is meant for evaluating the impact of the development under consideration. Presumably, this is not meant for judging the other developments, especially when no detailed information of another development is used.

Impact on estuarine processes

The results from the Geo Studies in the Humber Estuary Shoreline Realignment Project may be used as reference for evaluating the developments under consideration (See Wang and Jeuken, 2004; Jeuken et al., 2007). In that study various set backs along the shorelines of the Humber Estuary have been considered. The set backs have the effect that the size of the estuary, especially the intertidal zone, is increased. This is opposite than the effect of the

developments of GPH and AMEP. Nevertheless, the experience obtained in that study is still relevant. Both the GPH and the AMEP developments are relatively small compared with the set backs considered in that study. Therefore, the impacts of both developments, especially concerning the large-scale and long-term effects, will be limited (see the appendix for a more quantitative consideration of effects).

It is obvious that the effects of a development depend on the size of the development, the larger the size, the more serious the effects. The size of a development should be measured with the volumes of the development in the intertidal zone and in the sub-tidal zone. The AMEP development is much larger than the GPH development. However, the difference in size between the two developments seems not sufficient to explain the reported differences in the impacts on current field by the GPH-document "21 Cumulative and Combined Effects FINAL.pdf".

As a matter of fact the reclamation for a development will simply block the local current field. This means that the maximum reduction of the current by a development is simply the maximum magnitude of the current along the edges of the development. However, this is a local effect and it should be clearly distinguished from the larger scale effects in the discussion. Whether local or large scale effect is considered depends on the model used. That different models are used in the two studies is the most logical explanation of the exaggerated differences between the effects of the two developments reported by the GPH-study.

It is noted that the local effects on the current field of a development determined by a numerical model can be dependent on the resolution of the model grid. Sufficient resolution of the model grid is needed for correctly modelling the local effects on the current field. Furthermore, one of the local effects is the generation of a circulation zone behind the development, as shown in the numerical modelling study for the AMEP development. For a correct representation of this circulation zone the horizontal eddy viscosity is an important model parameter. However, the setting of this parameter is usually considered not important in 2DH flow models as usually only the large-scale effects are considered. It is noted that validation of the models concerning the local effects is not given for any of the models used in the two studies for GPH and AMEP developments respectively. It is important to use the same or at least comparable models concerning model grid resolution and parameter setting when the local effects of the developments are compared with each other.

Another issue is the disposal of the material from capital dredging. In the GPH documents it is mentioned that the large amount of the material dredged during the AMEP development will cause problems at the disposal sites, which will not have sufficient space to accommodate all the dredging material from the various developments. This issue is not considered in detail here as detailed information about the disposal sites is not available and needs to be checked by the AMEP consortium.

References

Wang Z.B. and M.C.J.L. Jeuken, 2004, Long-term morphologic modelling of the Humber Estuary with ESTMORPH, The future morphologic evolution and the impact of set backs, Report Z3451/Z3521, WL | Delft Hydraulics.

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3 May 2012

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M.C.J.L. Jeuken, Z.B. Wang and D. Keiller, 2007, Impact of setbacks on the estuarine morphology, In Dohmen-Jansen, C.M. and S.J.M.H. Hulscher (eds.), River, Coastal and Estuarine Morphodynamics, RCEM2007, Taylor & Francis, 2008, London, pp1125-1134.

Appendix - Effects on intertidal area

Basically, a realignment development (reclamation or setback) in an estuary may affect the intertidal area in three ways (Jeuken et al., 2007): (1) its direct effect, (2) change due to change of tidal range, (3) morphological change due to sedimentation and erosion. Effect (1) is local at the realignment site and it is a sudden change in time, i.e. takes place immediately after the realignment and can be considered to remain constant in time. Effect (2) is in principle through the whole estuary and it takes place immediately after the realignment and will change in time due to effect (3). Effect (3) is a gradual change in time and can in principle occur through the whole estuary. A realignment development causes thus an initial change (effects 1 & 2) as well as a change in time (effects 2 & 3) for the intertidal area. The change in time causes a long-term effect, which can be a gain or a loss of intertidal area depending on the type as well as the location of the development.

The AMEP development consists of a reclamation on the south bank of the estuary and a setback as compensation on the north bank, both in the mid – estuary zone. The reclamation has a size of 45 Ha of which 31.5 Ha in the intertidal zone and 13.5 Ha in the subtidal zone. The setback has a size of about 100 Ha, at an elevation of about ODN + 2.5 m which is around the MHW. Effect (1) for the intertidal area is thus $-31.5 + 100 = + 68.5$ Ha. Additionally, there is a direct functional loss¹ of 6 ha (in sector E), resulting in a total direct loss of inter-tidal area of 37.5 ha. The initial compensation ratio for the intertidal area is $100:37.5 = 2.7$. The compensation ratio for the entire reclamation is $100:45 = 2.2$.

The combined effect of the reclamation and the compensation site on the tidal prism is a decrease, even for spring tide. MHWs = 3.4 m and MLWS = - 3 m, so the increase of tidal prism due to the compensation site is about $(100 \text{ Ha} * 0.9 \text{ m})$ 0.9 million m³. The sub-tidal part of the reclamation causes a decrease of the tidal prism of $6.4 \text{ m} * 13.5 \text{ Ha} = 0.9$ million m³. The intertidal part of the reclamation will also cause about 1 million m³ ($31.5 \text{ Ha} * 0.5 * 6.4 \text{ m}$) decrease of the tidal prism during spring tide. During neap tide the compensation site will not be flooded. Therefore the combined effect on the tidal prism is always a decrease. The dredging causes an increase of the sub-tidal water volume of the estuary which is larger than the decrease resulting from the reclamation, causing an increase of the tidal range. Therefore, the initial part of effect (2) is an extra (small) gain in intertidal area because of the expected increase of the tidal range.

For the long-term morphological development it is expected that sedimentation will take place seaward of the development and erosion landward of the development. For the evaluation of this part of the effect reference is made to the development of Sunk Island setback (because of comparable location along the estuary) reported by Jeuken et al. (2007). The trend of the development will be opposite, i.e. a long-term loss due to the AMEP development instead of the long-term gain reported in Jeuken et al. (2007) for the Sunk Island setback case. The long-term gain for the Sunk Island setback case is about 5% of the size of the development after 50 years. If this relative number is applied to the AMEP case it will mean a loss of intertidal area of about 3 Ha ($68.5 * 0.05$) after 50 years and an equally large gain of sub-tidal area (i.e. intertidal area changed into subtidal area). For the change after 100 years the loss is estimated to be

¹ It is assumed, that functional loss implies a loss in e.g. ecological value without affecting the intertidal character of Sector E.

about 5 Ha (the rate of change decreases in time, although no more reference to the earlier study can be made). To deal with uncertainties we may take a factor 2 for the lower and the upper limits of the changes, resulting in 2 to 7 Ha loss after 50 years and 3 to 10 Ha after 100 years.

For the worst scenario after 100 years we take the upper limit of the long-term loss and ignore the initial part of effect (2), the remaining total gain of intertidal area will be about 58 Ha, i.e. 10 Ha has changed into sub-tidal area. The compensation ratio for the intertidal area is then about 1.8 (58:31.5). Taking the functional loss of 6 Ha into account as well, the compensation ratio for the intertidal area is 1.6 (58:37.5). The compensation-ratio for the entire reclamation will stay the same (i.e. 2.2) as intertidal losses will result in sub-tidal gains.

The GPH development will influence the estuary by reclamation of 7.5 Ha, 4.5 Ha in the intertidal zone and 3 Ha in the sub-tidal zone. This concerns a very small development, and it is a consented development. The long-term development will cause a similar relative loss as discussed above. For the worst case scenario this will be about 0.6 Ha ($\approx 10 \cdot 4.5 / 68.5$) after 100 years. This is calculated with the same rule as in the AMEP case. Note that the 4.5 Ha initial change is a loss instead of gain in the AMEP case. Motivation that the long-term effect will be a loss is that the reclamation will cause a small increase of the tidal range in the estuary. The long-term increase in tidal range will be associated with increasing current velocities and erosion. During this erosion process intertidal area will be transformed into subtidal area. Thus the estimated loss of about 0.6 ha of intertidal area implies an equal gain for the sub-tidal zone.

Appendix B

Extracts from Dibden Bay Inspector's Report 2003

Appendix B
Extracts from the Inspector's Report for the Dibden Bay Inquiry

Dibden Bay Inquiry - Inspector's Report

Front Cover

Report to the First Secretary of State and the Secretary of State for Transport

by Michael Hurley BA DipTP MRTPI

an Inspector appointed by the Secretaries of State

The Planning
Inspectorate
Temple Quay House
2 The Square
Temple Quay
Bristol BS1 6PN
☎ GTN 1371 8000

22 Sept 2003

HARBOURS ACT 1964

TRANSPORT AND WORKS ACT 1992

TOWN AND COUNTRY PLANNING ACT 1990

ACQUISITION OF LAND ACT 1981

APPLICATIONS FOR ORDERS, PLANNING PERMISSIONS

AND AN EXCHANGE LAND CERTIFICATE

by

ASSOCIATED BRITISH PORTS

in connection with

THE PROPOSED DIBDEN TERMINAL

Land in

NEW FOREST DISTRICT

Salmon and Sea Trout

- 36.391 Commercial fishing for salmon and sea trout is prohibited in the vicinity of Dibden Bay, so as to ensure the safe passage of these migratory fish and promote their conservation [6.70]. The fish start life in the Test and Itchen, but mature to adulthood at sea. They return to their native rivers to spawn. As a result, the salmon stock of each river is genetically distinct and would be irreplaceable if lost [6.79].
- 36.392 The salmon stocks of the Test and Itchen are of high recreational and conservation value. There are important rod fisheries on each river. Salmon are listed as species of interest in the citations for both the Test and Itchen SSSIs. They are also specified as an interest feature of the River Itchen cSAC [6.71].
- 36.393 However, the numbers of fish in each of these rivers is now at a historically low level. For instance, in 1975 the adult salmon run in the Test numbered about 4,000 fish. The corresponding figure for 1997 was 361 [6.72]. Over the past 10 years, egg deposition in each river has been at about 40% of the level needed to maintain the salmon stock [6.77]. The two rivers have been restocked with smolts, without which the local salmon population might by now be extinct.
- 36.394 I note that there is no evidence that conditions in the estuary have contributed to the present parlous state of the salmon stocks. The decline of the salmon may well have had more to do with factors such as the condition of the spawning grounds and over-fishing at sea [3.909]. The presence of a major seaport on Southampton Water appears not to have had a significant effect on salmon numbers in the past [3.912]. However, this does not mean that salmon would be immune from adverse effects as a result of future changes in the character of Southampton Water consequent upon the Dibden Terminal development.

Water Quality

- 36.395 There is little doubt that the concentration of suspended sediment in parts of Southampton Water could be increased as a result of the proposed dredging and recharge works, with a consequent reduction in the availability of dissolved oxygen [3.922 and 6.93]. These effects could pose a significant risk to migrating salmon.
- 36.396 At present, the average ambient concentration of dissolved oxygen at depths below 5m in Southampton Water ranges from 6.9mg/l in July to 10.1mg/l in January [6.59]. Witnesses for both ABP and the Environment Agency accept Nixon's proposition that concentrations of dissolved oxygen in excess of 8mg/l will have no adverse effect on marine life. As the concentration falls below this level, there is an increasing risk of adverse effects. If the concentration falls within the range 4mg/l to 8mg/l, Nixon characterises the risk as being low [6.58; 3.929].
- 36.397 The "stop" threshold for dissolved oxygen proposed by ABP in their draft agreement with the Environment Agency is 60% of the saturation level.

This approximates to an absolute value of about 4.5mg/l in summer. The threshold refers to the concentration of dissolved oxygen at one of a number of monitoring stations that would be arranged in a "box" around the dredging site and stationed alongside the recharge. The monitoring stations would be 1m above the seabed. Typically there is a reduction of at least 1mg/l of dissolved oxygen between the surface and bed of Southampton Water [3.930]. A dissolved oxygen concentration of 4.5mg/l at the monitoring station would imply a 95%ile value for the adjacent reach of the estuary (excluding the monitoring "box") of 5.5mg/l. At that level, the risk of there being an adverse effect on migratory fish would be about 7% [3.931]. On the other hand, if conditions within the monitoring "box" are taken into account, the risk of an adverse effect on marine life could exceed 20% [6.63].

36.398 The Environment Agency seek a "stop" threshold for dissolved oxygen of 60% of the saturation level or 5mg/l, whichever is the higher. During the summer, when there are likely to be significant numbers of salmon in the estuary, their preferred "caution" threshold would be 1.5mg/l above the "stop" threshold. At other times, the "caution" threshold proposed by ABP would be acceptable to them [**Error! Reference source not found.**]. The draft agreement includes a provision whereby the more stringent thresholds preferred by the Environment Agency would become effective if the Secretary of State so determines.

36.399 Nevertheless, the evidence of the Environment Agency's witness, Dr Solomon, is that adherence even to these more stringent water quality thresholds would not be sufficient entirely to eradicate the risk to the salmon stock [6.93]. His preferred solution is that the dredging (and piling) operations should be limited to the winter months, between 15 September and 15 March, when salmon are unlikely to be present in the estuary. That would effectively remove the risk of the construction process having an adverse effect on the migratory salmon [6.94]. I accept ABP's evidence that this would add substantially to the cost of the Dibden Terminal project and the duration of construction [3.936]. However, Dr Solomon was the only expert on salmon who appeared at the Inquiry. I attach considerable weight to his evidence.

36.400 The monitoring "box" would measure about 500m by 500m [3.926]. The level of dissolved oxygen within the "box", close to the dredger, might be appreciably lower than the level of dissolved oxygen at the monitoring stations. A concentration of dissolved oxygen of 4.4mg/l implies a 23% risk of an adverse effect on marine life [6.62]. If the concentration of dissolved oxygen falls between 2mg/l and 4mg/l, Nixon characterises this as giving rise to a medium risk of an adverse effect on marine life. Concentrations of less than 2mg/l pose a high risk of an adverse effect on marine life [6.58].

36.401 The term "adverse effect" does not imply fatality; it may merely indicate that a fish would take avoiding action [3.931]. However, if an adult salmon is delayed in returning to its home river by as little as a week, its prospects of surviving to spawn are known to be reduced [6.82]. The evidence is that a fish approaching an area of poor water quality might well react by swimming back in the direction from which it came. An adult fish would swim back towards the sea. If the fish were repeatedly frustrated in its attempts to

reach its native river in this way, it might eventually return to sea to die without having spawned [6.90]. That would clearly have an adverse effect on the replenishment of the salmon stock.

36.402 I have noted the case described by Westerberg, in which salmon swam past some working dredgers in the Gulf of Bothnia [3.921]. However, the material being dredged in that case was gravel, and Westerberg himself has confirmed the absence of sediment plumes [6.92]. In my view his observations are of limited value in predicting the likely behaviour of salmon approaching plumes of suspended sediment resulting from the proposed tidal works in Southampton Water.

36.403 ABP refer to the fact that there would be frequent periods when dredging would cease, providing windows of opportunity in which salmon could swim past the dredging site [3.922]. However, there is no reason to think that fish will time their arrival so as to be able to take advantage of these opportunities. ABP also refer to the availability of a corridor of relatively clean water on the eastern side of the estuary, through which the salmon could pass at all times [3.924]. However, there is no behavioural evidence to suggest that a fish confronted with an area of poor water quality would seek out the corridor of cleaner water.

36.404 It seems to me that if the proposed tidal works were to coincide with the summer migration of salmon, this might well jeopardise the replenishment of the salmon stock. The proposed works would continue over a number of years. The effect of the disturbance might be cumulative.

Integrity of the Itchen cSAC

36.405 In the circumstances, I do not consider that it could be ascertained that ABP's proposals would not adversely affect the integrity of the River Itchen cSAC. It seems to me that the greatest risk to the Itchen salmon would be caused by the recharge, which the fish would have to pass when travelling to and from their home river. I have already commented on the potential limits to the effectiveness of the proposed "stop" and "caution" thresholds in controlling the movement of sediment from the recharge into the water column (see para 36.387 above).

36.406 I do not consider that it would be practicable to confine the recharge operations to the winter months as suggested by Dr Solomon. ABP propose that these operations should be suspended during the winter, when the Hythe to Cadland foreshore is most intensively used by migratory birds [3.110]. That would have obvious ornithological advantages. I conclude that it may be impossible to eradicate the potential adverse effects of the Dibden Terminal project on the Itchen salmon if the recharge is to remain part of the project. I consider the nature conservation value of the recharge further at paragraph 36.446 et seq below.

36.407 The adverse effect of the proposed dredging operations on the Itchen salmon would be less acute than the potential effect of the recharge. The dredging would take place mainly in the River Test, and its effects would be

more susceptible to control by activation of the proposed "caution" and "stop" thresholds. The Secretary of State may consider that the dredging would not have a significant adverse effect on the Itchen salmon (or the River Itchen cSAC) particularly if the more stringent thresholds for dissolved oxygen sought by the Environment Agency were to be applied, and/or other mitigation measures were to be taken.

36.408 The Environment Agency have suggested a range of mitigation measures which would help reduce mortality during the freshwater phase of the salmon's life cycle [6.97-6.100]. These include Habitat Enhancement and Restoration Programmes and an Assisted Spawning Programme. Together they would cost about £1.75 million (to cover both the Test and the Itchen). However, ABP have not agreed to fund the programmes in question and cannot be required to do so.

36.409 Alternatively, it would be possible to ascertain that the integrity of the Itchen cSAC would not be adversely affected by dredging at Dibden, if the dredging were to be prohibited during the summer months when salmon migrate through Southampton Water. ABP argue that such a restriction would add up to £70 million to the cost of the Dibden Terminal project [3.936].

Channel Narrowing, Artificial Lighting and Noise

36.410 I do not consider that the Itchen salmon would be significantly affected by the narrowing and deepening of the channel in front of the Dibden Terminal; or by the Terminal lighting. Normally the Itchen salmon would not enter the River Test [3.956].

36.411 It has been argued that salmon might be affected by the noise generated by dredgers and by the increased number of big ships that would use Southampton Water once the Dibden Terminal was operational. However, Westerberg's observations suggest that salmon are not greatly bothered by the noise of working dredgers [3.941]. Even with the Terminal operational, there would still be long gaps between the movements of big ships in Southampton Water. On balance, I am not convinced that the increased disturbance from these noise sources would be significant.

36.412 The Itchen salmon could be adversely affected by construction noise from the Terminal site. There is evidence that fish may take avoiding action when up to 2km away from a working pile driver [6.88]. ABP propose that the impact of piling noise on salmon would be mitigated by the use of a "bubble curtain" or some similar device. A "bubble curtain" would have the effect of reducing the radius of the zone within which fish would take avoiding action to between 200 and 500 metres of the pile driver [3.945]. On this basis, I consider that the use of a "bubble curtain" would effectively protect the Itchen salmon from the adverse effects of piling noise. Provision for the use of a "bubble curtain" is contained in Schedule 4 of the filled-up HRO, which deals with measures for the protection of the Environment Agency. There was no dispute about the content of this proposed modification to the HRO. Accordingly, I

recommend that, if the HRO is made, it should be modified by the revision of Article 30 and the addition of Schedule 4, as shown in the filled-up Order.

Compensatory Measures

36.413 If the Secretary of State's appropriate assessment of the effect of the proposed development on the River Itchen cSAC is negative, he would have to secure that any necessary compensatory measures would be taken in accordance with Regulation 53 before the project could proceed. I find it difficult to envisage the form of such compensatory measures. If the adverse effects of the proposed development were to lead to the extinction of the Itchen salmon, the overall coherence of Natura 2000 could not be protected. In any event, no specific compensatory measures are proposed by ABP.

The Test Salmon

36.414 English Nature consider that the Test salmon should be afforded the same degree of protection as the Itchen salmon as a matter of policy [7.123]. I disagree. I recognise that the Test salmon are similar to the Itchen salmon insofar as they are genetically unique and face the threat of extinction. However, the Test has not been proposed as a SAC. The protective regime set out in the Habitats Regulations applies to nature conservation features of recognised international importance. It is extremely demanding and, in my view, should not be applied more generally by analogy.

36.415 Nevertheless, the potential damage that the proposed development would do to the Test salmon is a material consideration that should be weighed in the balance. In my view, the Test salmon would be at greater risk than the Itchen salmon. Like the Itchen salmon they would have to swim past the Hythe to Cadland recharge when migrating to or from the sea. But they would also have to swim past the dredging and piling sites at Dibden. Even with the attenuation provided by the "bubble curtain", the piling noise could delay the passage of migratory salmon travelling to and from the upper reaches of the Test.

36.416 The Test salmon would face other environmental changes. The channel in front of the Dibden Terminal would be narrower than it is now; and would be bounded by quays on either side. There would be no shallow water for some distance north of the mouth of Dibden Creek [6.85]. The lighting installation could also have an effect on migrating salmon [6.95]. The evidence that these factors would have a significant adverse impact on the salmon stock is not clear cut. Nevertheless it seems to me that the threat to the Test salmon could be significant. This adds weight to the arguments against the proposed development.

36.417 In view of the vulnerability of the salmon stock, I prefer the more stringent "caution" and "stop" thresholds proposed by the Environment Agency [6.54]. I recognise ABP's charge that these thresholds do not derive from any scientific study. But it seems to me that the higher the standard of water quality, the less would be the threat to the salmon stock. I recognise that the

higher thresholds may delay the dredging programme and add £17 million or more to the cost of the development [3.934]. However, there is no evidence that these factors would be fatal to the project. Accordingly, **I recommend that, if the HRO is made, the Secretary of State should determine that the more stringent "caution" and "stop" thresholds for dissolved oxygen will apply, as set out in paragraphs 3.1(a) and (d) of the draft agreement between ABP and the Environment Agency (CD/ABP/95J, Tab 3).**

Appendix C

**EA letter to Able 29 May 2012 re outstanding
information**

Mr Richard Cram
Able UK Ltd
Able House (Billingham Reach Industrial
Estate) Haverton Hill Road
Billingham
Cleveland
TS23 1PX

Our ref: AN/2012/113982/01-L03
Your ref: IPC-Pro-11
Date: 29 May 2012

Dear Richard

Able Humber Ports Ltd, Development Consent Application for a Marine Energy Park at Killingholme Marshes, North Lincolnshire

I write with reference to the recent Pre-Examination meeting in respect of your project and the detailed Written Representations that we are required to provide to the Planning Inspectorate on the 29 June 2012.

I am in receipt of your draft timetable for providing additional reports and explanatory notes, which is reproduced below:

<u>Report Title</u>	<u>Provider</u>	<u>Date Due to Able</u>	<u>Formally Issued</u>
Badger Bait-Marking Survey	P. Lewns	22/05/2012	29/05/2012
EX. NOTE: Sensitive Months for Birds Using Intertidal	ERM	24/05/2012	31/05/2012
EX. NOTE: Maintenance Dredge Variability	HRW	25/05/2012	01/06/2012
HR Wallingford Long-Term Morphological Change to N of Quay	HRW	25/05/2012	01/06/2012
HR Wallingford Long-Term Morphological Change to S of Quay	HRW	25/05/2012	01/06/2012
EX. NOTE: Bats	ERM	29/05/2012	05/06/2012
GCN Licence Application	AE	29/05/2012	05/06/2012
EX. NOTE: Operational Buffer	Able	29/05/2012	05/06/2012
EX. NOTE: Site Habitat Loss Tabulation	Able	29/05/2012	05/06/2012
Description of Works within DML	Able	01/06/2012	08/06/2012
EX. NOTE: Quantum of Habitat Compensation	Able	01/06/2012	08/06/2012
Supplement to Annex 8.1	JBA	08/06/2012	15/06/2012
EX. NOTE: Impacts of Construction on NKHP	ERM	12/06/2012	19/06/2012
EX. NOTE: Pumping Station	ERM	12/06/2012	19/06/2012
Additional Landscape Masterplan	ERM	15/06/2012	22/06/2012

Corrigenda to Flood Risk Assessment	JBA	15/06/2012	22/06/2012
EX. NOTE: Beneficial Use of Dredge Arisings	Able	15/06/2012	22/06/2012
EX. NOTE: Dredging/Disposal on Aquatic Ecology & Sub-Tidal Losses	ERM	15/06/2012	22/06/2012
EX. NOTE: Further assessment of Breeding Bird Survey	Able	15/06/2012	22/06/2012
EX. NOTE: Re-use of In-Situ Material at CCS	Able	15/06/2012	22/06/2012
Supplementary In-Combination Assessment	ERM/JBA	15/06/2012	22/06/2012
Biotope Report	Able	Received	
EX. NOTE: Mitigation for Compensation	Able	Received	
EX. NOTE: N Bank Flood Defence Crest Height	B&V	Received	

In addition to the information you have listed, we would like to point out that we will also require the following:

- a further Water Framework Directive Assessment update to reflect the findings of the additional hydrodynamic and sedimentary work listed above;
- findings of the Site Investigation for Cherry Cobb Sands;
- Black and Veatch detailed design work for Cherry Cobb Sands, including the new flood defence and treatment of existing defence (as discussed at our meeting on 9 May 2012);
- further detailed design work for the Marine Energy Park quay/flood defences (as discussed at our meeting on 9 May 2012);
- HRW sediment modelling for the pumping station outfall (information you already hold and agreed to send to us at our meeting on 9 May 2012).

Unfortunately, due to the volume of additional work still outstanding we will not be able to provide detailed Written Representations to the Planning Inspectorate covering all of our issues within the required deadline. Consequently, our detailed comments on the contents of these reports and the issues they relate to will have to be provided within the second round of Written Representations towards the end of July 2012.

However, we would like to assure you of our continued commitment to working with you towards resolving these outstanding matters.

Should you require any additional information, or wish to discuss these matters further, please do not hesitate to contact me on the number below.

Yours sincerely

Annette Hewitson
Principal Planning Officer

Direct dial 01522 785896
Direct fax 01522 785040
Direct e-mail annette.hewitson@environment-agency.gov.uk

Appendix D

**Statement from Dr Adrian Fewings re impacts on
migratory fish**



**Able Humber Ports Ltd
Marine Energy Park
Proposal to build a quay and associated development
on the south bank of the River Humber**

Planning Inspectorate Reference: TR030001

**Statement by
Dr Adrian Fewings BSc (Hons), MSc, PhD**

**On behalf of
The Environment Agency
Unique Reference Number: 10015552**

29 June 2012

1.0 Qualifications and Experience

- 1.1 I am Dr Graham Adrian Fewings and I am employed by the Environment Agency ('EA') as a Senior Monitoring Officer in the Solent and South Downs Area of the EA's South East Region. This statement is given in support of the Environment Agency's written representations in this Examination.
- 1.2 I am a fisheries scientist and I have worked for the EA and its predecessor, the National Rivers Authority since 1989 in a specialist capacity, primarily working with salmon. Prior to this I worked for North West Water running and developing automatic salmon counters.
- 1.3 I hold an honours degree in Applied Biological sciences, Masters degrees in Underwater Technology and Fisheries Biology and Management and a doctorate in Oceanography. I have spent six years tagging and tracking salmon in the south of England and observing salmon behaviour. I have also operated several automatic fish counters and taken part in salmon juvenile trapping operations for over twenty years. I was a member of the team representing the EA at the Dibden Bay Development inquiry in Southampton between 2001 and 2002, an element of which involved the potential effects of piling. Since that involvement I have become familiar with the issue of how piling impacts on fisheries and have advised on a number of piling developments for the EA¹.

2.0 Introduction

- 2.1 The proposed Able development involves constructing a new quay wall on the south side of the Humber estuary near Immingham. The quay construction will involve the driving of tubular steel piles into the ground over the entire length of 1075m (From AMEP EIA chapter 4 - 4.4.5). The quay is proposed to be a solid berth structure for 1 075 m of its length with a front wall that comprises a combination of large diameter tubular steel piles alternating with steel sheet piles. This arrangement is commonly referred to as a combi-pile wall.
- 2.2 Typically, such piles need to be driven into the ground so that only a third of their length is above the ground. In this case the piles may be driven of the order of 50m into the ground. The piles themselves are tubular, approximately 1.8 - 2.1m in diameter and separated by sheet piles (sheets of steel pressed into a corrugated shape). To drive the tubular piles into the ground considerable force is required, which is normally achieved by a large weight being driven or dropped onto the top of the pile. Not all of the energy imparted by the driving mass is converted into downward motion of the pile. Some of the energy emerges as acoustic noise energy, some in air, some into the ground and some into the water through which the piles are driven. Humans are generally protected from injury within a modest range of such developments through personal protective equipment and at greater range by timing controls to avoid sleep disturbance. Where the developments are near

¹ Piling/acoustic disturbance developments on which I have advised include, Marchwood Power Station (Southampton), Navitus Bay Offshore Wind Farm (Dorset Coast), Gosport Ferry Terminal (Portsmouth), Lymington Ferry Terminal (Lymington), Lymington Flood Alleviation Scheme (Lymington), Red Funnel Terminal (Southampton), South Wales Gas Pipeline (South Wales), Southampton Berth extension (Southampton), Green Port Hull Development (Hull), Hull Riverside Bulk Terminal (Hull)

existing buildings the low frequency noise that travels through the ground can cause disturbance to foundations and affect the structural integrity of the building.

- 2.3 Fish can be disturbed by noise and vibration in a similar way to humans or birds. The main difference is that noise travels much more efficiently through water and the estuary bed and can therefore exert its effects over considerable distances. Since sound can travel through the ground more efficiently than through water and then radiate into the water, it is even possible for underwater noise to increase, in some cases, at some range from the source.
- 2.4 Migratory fish, such as Atlantic salmon, that pass from river to sea and vice versa are entirely dependent on free passage through the estuary to complete their lifecycle. If this lifecycle is interrupted, the populations of migratory fish species will be detrimentally affected. This is particularly relevant in an estuary location such as the Humber Estuary where any impact will affect the entire river basin.
- 2.5 Since each salmon must pass through the estuary at least twice² to complete their life-cycle the estuary is a highly important location for the protection of salmon populations.
- 2.6 In many cases these estuaries are already hazardous places for migratory fish with lower water quality than the rivers upstream or the marine environment. It is also common for significant proportions of salmon to fail completing their passage through the estuary due to existing stressors. These stressors include disturbance by vessels, adverse water quality, predation and fishing operations as well as delays in entry to freshwater due to low river flows and or high water temperatures. Disturbance or injury in the estuary due to construction activities have the potential to add to these existing stressors.
- 2.7 It is logical to expect that in estimating the degree of risk to migrating salmon the noise populations some key factors would need to be considered. These include how much underwater noise would be discharged when the proposed piles were driven into the ground, how level changes with distance from the source of the noise and the sensitivity of the species of interest to this noise.

3.0 Predicting Source Noise

- 3.1 Source noise levels are predicted using a combination of acoustic modelling and real data from measurements taken at other similar projects. Source noise level is largely dependent on the size and type of the pile in question, the nature of the ground material (the latter will dictate how hard the pile has to be driven). In general, the larger the diameter of the pile, the noisier it will be when forced into the ground by impact. This relationship is not a straight line relationship, so a small increase in pile diameter can be associated with a large increase in the level of underwater noise produced.
- 3.2 Measurements taken from projects in the USA, Europe and the UK provide a range of underwater noise levels observed by impact driving different pile sizes. This not only allows us to estimate the mean source noise level for the pile size proposed at any specific project, but also allows us to estimate the

² Some salmon may pass through the estuary even more times if they are repeat spawners

prediction interval associated with it – in other words the variation in this noise estimate likely to be experienced when making a prediction at a new site. This estimation allows calculation of the source noise level in a precautionary way – both the best estimate of the source noise level and the noise level that is only expected to be exceeded 10% of the time. If the mean estimate were used then roughly half of the time the noise level would be under-estimated. Using the 10 percentile exceedance estimate we would expect to under-estimate the noise level only one time in ten, I therefore consider this a more precautionary approach.

4.0 Estimating Noise Propagation

- 4.1 Once the source noise level is predicted, how this noise propagates within the environment must then be considered. If this can be understood, we can estimate the noise level at almost any distance from the source of noise.
- 4.2 It is widely accepted that noise levels decline in a non-linear manner with increasing range. So noise levels tend to reduce quickly initially, but then much more slowly after that. This means there tends to be a relatively small zone where noise levels are so high that fish might experience physical injury but a much larger zone where behavioural responses can be expected.
- 4.3 It is possible to account for other site-specific factors such as tidal state and the topography of the river/sea bed using other proprietary models not presently available to the EA.

5.0 Predicting the Significance of the Disturbance

- 5.1 Different species of fish are better at hearing than others. We have focused on Atlantic salmon (*Salmo salar* L.) at this location because they have better hearing than many estuarine species. More is known about the characteristics of their hearing, their behavioural responses and their economic value than other species in the estuary. As a result, we have used Atlantic salmon as a substitute for the other species present. If we are successful in protecting Atlantic salmon, we should automatically protect the majority of other species present. If we are unsuccessful in protecting salmon, the impact on other migratory species such as eel, lamprey and sea trout must also be considered as they may also be affected. European eel and Lamprey have additional protections in this environment but what is known about their hearing suggests that it is poorer than that of salmon.
- 5.2 The effects of noise energy on fish vary depending on a number of factors. The noise energy from piling can be so intense that fish are killed directly. Some descriptions of this impact are available from existing studies but the range of this effect appears to be limited to a short range from piling works with pile diameters that are suggested for the Able Marine Energy Park project. At lower noise intensity fish hearing can be permanently or temporarily damaged leading to a reduced “fitness” for the environment and increased mortality risk. As range from the noise source increases further the noise intensity falls more slowly leading to a large distance over which accumulated hearing damage can occur. This feature is well known in humans and has led to significant controls on the intensity and duration to which workers are allowed to be exposed. A measure of this combination of sound intensity and exposure has been developed for underwater fauna and is used as a guideline by the National Fisheries Agency in the USA. It is

appropriate to piling operations as once piling starts it is often continuous as the pile is impacted at approximately one second intervals.

- 5.3 Fish behavioural impacts can occur over even greater distances than those that cause accumulated injury. Observations of commercial catches near piling operations in the North Sea have showed reduced catches to a range of over 20km. These involved fish with comparatively good hearing but demonstrates that effects can extend over considerable distances.
- 5.4 Fish disturbance data exists from monitoring at power station intakes where acoustic fish deterrents have been used to divert fish away from danger. The data tells us how successful different noise levels (above the hearing threshold of the relevant species) are at diverting fish away from their normal course³. Acoustic means have also been developed to divert salmon as they migrate in river, generally to guide fish away from harm⁴. Given that we can estimate the noise level at any point across the Humber estuary, we can therefore estimate the overall proportion of fish likely to be disturbed or diverted. This can be done daily or annually, taking into account factors such as periods of working, the length of the construction period and the distribution of fish presence in the estuary throughout the year. The EA provided a means to estimate such disturbance to Able so that alternate piling schedules could be considered alongside the potential risk to salmon.
- 5.5 A significant uncertainty is that we do not know what proportion of 'diverted' fish will be disturbed to the extent that they will be prevented from spawning or continuing their migration. This is impossible to accurately predict so a professional judgement must be made about the likely significance of the impact, taking into account the vulnerability of any population and the degree of protection afforded to it by relevant environmental legislation.
- 5.6 Our estimates of noise source level and transmission loss for the types of piling proposed by Able suggest that direct injury, including hearing damage⁵, could occur at ranges of the order of 60-70m from the source with accumulated injury possible at ranges of approximately 1.5km. Able suggest that the range to auditory injury is of the order of 20m using criteria proposed by Subacoustech Environmental.
- 5.7 Using behaviourally relevant noise measures Able suggests that almost all individuals would show a strong reaction at ranges up to about 490m (about 11% of the estuary width). If noise propagates across the estuary as indicated by Able UK's acoustic consultants then the zone of significant behavioural response would extend over approximately 63% of the width of the estuary⁶.

³ This approach proposed by Able's acoustic consultants is not universally accepted but is the closest we can come to estimating behavioural risk at present. The method has been employed by several national developers to consider the underwater noise risk from many developments. It is described in Subacoustech Report No. 534R1231 "A validation of the dB_{HT} as a measure of the behavioural and auditory effects of underwater noise J.R. Nedwell, A.W.H. Turnpenny, J. Lovell, S.J. Parvin, R. Workman, J.A.L. Spinks & D. Howell 24 October 2007"

⁴ WELTON, J. S. , BEAUMONT, W. R. C. and CLARKE, R. T. (2002), The efficacy of air, sound and acoustic bubble screens in deflecting Atlantic salmon, *Salmo salar* L., smolts in the River Frome, UK. *Fisheries Management and Ecology*, 9: 11–18

⁵ Single strike injury using American (National Oceanic and Atmospheric Administration) criteria [assumes up to 2.1m diameter tubular steel piles]

⁶ Using a 2.1m diameter pile at high water and a behavioural threshold of 75dB_{HT salmon}

Such estimates should be considered mean estimates and therefore it is reasonable to expect that they would be underestimates approximately half of the time. Able behavioural noise level at range estimates also indicate that noise levels would not fall to below that causing a behavioural response in a majority of individuals⁷ even on the far side of the estuary.

- 5.8 These estimates assume the operation of only one piling rig whereas Able intend to use up to three rigs concurrently. Downtime between actually striking piles may be significant but since multiple rigs will be used without any activity linkage and a wide zone of influence expected from the works, it may, in practice, be unlikely that migrating fish could exploit the “gaps” between piling activity during the working day as Able’s estimate of maximum migration speed is 0.5-0.9km/hr⁸ and the significant behavioural response range is ~2-3km⁹. As a result the main “quiet” period from piling would be overnight.

6.0 Significance of Salmon in the Humber Basin

- 6.1 Few salmon are presently caught and reported in the rivers discharging to the Humber Estuary. This is thought to be due, in part, to the lack of fishermen fishing for salmon in these recovering rivers. It is unlikely for anglers fishing without a salmon licence to report their salmon catch.
- 6.2 The operation of a single salmon smolt trap (for juvenile seaward-migrating salmon) on the River Ure (approx. 158 Km upstream of the development location) suggested smolt populations of the order of 20,000 fish about 5 years ago¹⁰. This might be expected to yield about 2,000 returning salmon to the River Ure. It is uncertain what contribution other rivers may be making to the returning stock of the Humber Basin and therefore the size of the Humber basin salmon stock may be considerably more than this estimate. I understand that the River Trent is at least one other river considered “recovering” with several others scheduled to have salmon and sea trout catchment summaries compiled over the next few years.

7.0 Mitigation Options

- 7.1 Timing restrictions on percussive (impact) piling during sensitive periods are thought to be an effective way of reducing the potential risk. We consider a very sensitive period to be the 8 week period from around mid-April to mid-June when juvenile salmon (smolts) will be travelling downstream. Salmon are thought to be particularly vulnerable at this stage in their life cycle as they are small (~150mm long) and a suitable prey size for many estuarine predators. Injury or delay in this environment could increase the mortality for this group of fish. As they make the transition from freshwater to saltwater they are under particular physiological stress. Additional water quality stress from dredging operations and or disturbance by piling operations are likely to add to the losses at this stage. Salmon and other species will be present at other times of the year, but we consider this 8-week period to be the most sensitive as the entire reproductive potential (salmonid) of the river basin passes through the estuary in relatively few weeks. Avoiding this period

⁷ A behavioural threshold of 50dB_{HT salmon}

⁸ AMEP ES Chapter 10, section 10.6.5

⁹ MEP Annex 10.3

¹⁰ Consecutive trapping years suggest an increasing output of salmon from the R Ure

therefore achieves a substantial reduction in risk for the number of days excluded from piling operations.

- 7.2 Another key period persists over the summer months as adult salmon arrive from the sea and pass through the estuary. In particular, the months of July through to the end of September account for approximately 43% of salmon movement through the estuary based on nearby trap catches. The Able proposal effectively involves piling intensively over all of these key migration months for adult salmon. Even delays in the commencement of piling for several weeks would substantially reduce the risk of impacts. Able has indicated that the anticipated piling programme would take approximately 26 weeks. By scheduling the construction for commencement on the 1st September and operating until the 6th of April, just over 4% of the salmon migrations would be at risk of exposure, reducing to 2% if works commenced on 12th September. This would provide 29 and 26 weeks of low risk piling works respectively for the two commencement dates.
- 7.3 When salmon are disturbed they are prone to swim at speed in an attempt to avoid the perceived danger. In order to “sprint” away the animal can build up an oxygen debt in its tissues that can take some time or even be impossible to repay in waters with low dissolved oxygen. These fish may then become easy prey or just die from this physiological stress. Water has less ability to dissolve oxygen as the temperature rises and salmon have a greater requirement for oxygen at higher water temperatures¹¹. Where other pollution is present, such as ammonia from foul water discharges, the effect on oxygen demand combined with high water temperature further adds to the stress on salmon. These factors combine to increase stress on salmon as they pass through estuaries in the summer months to the point where many do not succeed in entering freshwater¹². I am aware that other schemes¹³ have proposed real-time monitoring water quality parameters to limit operations during periods of adverse water quality. The way that this works is that work stops when the water quality falls below certain thresholds measured at agreed locations and does not re-commence until the water quality improves.
- 7.4 Salmon are considered to be more at risk of failing to complete their life-cycle following several radio-tracking studies in Wales and the South West of England¹⁴. These studies found that in some cases more than half of the adult salmon tagged failed to enter freshwater when freshwater flow or water temperature conditions in the estuary were unfavourable. Additional stressors whilst passing through the estuary such as noise disturbance are likely to exacerbate the situation. It is likely that such factors will combine with any existing stressors to reduce the rate of river entry.

¹¹ Alabaster, J. S., Gough, P. J. and Brooker, W. J. (1991), The environmental requirements of Atlantic salmon, *Salmo salar* L., during their passage through the Thames Estuary, 1982–1989. *Journal of Fish Biology*, 38: 741–762.

¹² Solomon, D. J. and Sambrook, H. T. (2004), Effects of hot dry summers on the loss of Atlantic salmon, *Salmo salar*, from estuaries in South West England. *Fisheries Management and Ecology*, 11: 353–363.

¹³ Southampton main channel dredge (ABP), Green Port Hull (ABP), Tamar ?

¹⁴ Solomon D.J., Sambrook H.T. & Broad K.J. (1999) Salmon Migration and River Flow – Results of Tracking Radio-tagged Salmon in Six Rivers in South West England. R&D Publication 4, Bristol: Environment Agency, 110 pp. , Clarke D.R.K., Evans D.M., Ellery D.S. & Purvis W.K. (1994) Migration of Atlantic Salmon (*SALMO SALAR* L.) in the River Tywi Estuary during 1988, 1989 and 1990. Regional Environmental Appraisal Unit, Welsh Region, National Rivers Authority, Cardiff, Report RT/WQ/RCEU/94/7, 64 pp.

- 7.5 Soft-start piling should give fish an opportunity to vacate the noisy area before sound levels increase to damaging levels. However, it is not known how effective fish are at detecting the direction of the source noise (detecting the source of low frequency noise could be difficult as sound arrives both from the free water path and the estuary bed) or how able they are to react effectively to avert any risk.
- 7.6 Pile pads / shrouds have been used elsewhere to reduce source noise levels above ground for the benefit of people and birds. When used to reduce underwater noise they have had some limited success although the pads have a short working life and are understood to slow the piling process.
- 7.7 Bubble curtains are an option that has been tried in a number of locations, however, in order for them to be effective they must successfully create a continuous curtain of bubbles from bed to surface that is metres thick. The EA has been advised by Able that achieving this in the Humber estuary, where 6 knot currents are common and the tidal range is around 7.5 metres, will be extremely difficult and therefore has not been proposed by them. Whilst incorporating such techniques may reduce source noise levels to some degree, they will also slow operations such that the overall construction period may be longer.

8.0 Compensation Options

- 8.1 It is often suggested by developers that salmon stocks should be monitored to establish the magnitude of impact before compensation should be required. In this case monitoring was suggested by Able to establish an impact. This approach, while appearing logical on the face of it, has practical limitations. Salmon populations naturally fluctuate from year to year, often halving or doubling from one year to the next. With such substantial natural variability it is statistically difficult to detect impacts of lesser magnitude without many years of data. Therefore impacts of ten or twenty percent would not be noticeable in the natural variability of salmon population size.
- 8.2 If it is considered that the proportion of fish disturbed, after mitigation measures have been accounted for, is unacceptable, it may be necessary to compensate for the possible impacts. Common measures include contributing to the construction of an up-stream fish pass, or deliver relevant habitat improvements, such that those fish that do successfully navigate past the construction site, are more likely to successfully spawn as a result and contribute to the salmon population. Such measures would not assist all of the rivers entering the Humber estuary but supporting the main recovering rivers would provide a local source of stray salmon to re-colonise other tributaries.
- 8.3 Projects to address water quality issues, for example, may also be viable options. There may be existing salmon restoration schemes that could provide a cost effective means of compensation although salmon stocking schemes are not thought to be a reliable means of compensating for potential losses.
- 8.4 Other schemes thought to carry a risk to salmon populations have employed compensation measures to protect against environmental damage, examples

include the Second Tyne Tunnel scheme and the Cardiff Bay Barrage¹⁵ and Green Port Hull¹⁶.

- 8.5 The degree or quantum of compensation should be proportionate to the risk, the sensitivity and to the value of the salmon populations now recovering in the Humber Basin.

9.0 Conclusion

- 9.1 On the basis of the scheme proposed by Able, which could involve piling over the majority of the summer months (from June 1st for 26 weeks), I consider that it is likely that some salmon will not complete their migration past the development site. It is difficult to be more specific than this as studies to estimate the level of this risk are not available. Able's own estimates consider that over 10% of the estuary width will be exposed to a strong behavioural response in almost all individuals. The proportion of the estuary for which a significant behavioural reaction will be expected in most individuals extends to more than half of the width of the estuary. The proportion of salmon failing to complete their migration would depend on the environmental conditions present and the timing of the works. Since stocks of salmon in the tributaries of the Humber are recovering they should be considered sensitive to additional impact.
- 9.2 Given the uncertainty of the magnitude of impact due to the potential for multiple schemes to be operating concurrently, the lack of relevant scientific investigations of salmon migratory behaviour in relation to piling works and the sensitivity of the Humber Basin salmon stocks I recommend a precautionary approach in applying the EA's duties. If satisfactory mitigation measures cannot be agreed then proportionate compensation measures should be sought.

¹⁵ The Second Tyne Tunnel scheme included compensation works ~£1-2m (fish pass, habitat works and fish monitoring), the Cardiff Bay Barrage scheme included a significant on-going stocking programme including the operation of a hatchery site, monitoring of returns of hatchery fish and a significant water quality monitoring and control programme and a fish pass.

¹⁶ Green Port Hull development involves a set of measures (including a fish pass and a contribution to a local Rivers Trust for river rehabilitation works) that are agreed by all parties

Appendix E

**EA letter to Able 14 July 2011 re hydrodynamic and
sedimentary regime**



Mr Richard Cram
Able UK Ltd
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Haverton Hill Road
Billingham
Cleveland
TS23 1PX

Our ref: AN/2010/110109/07-L03
Your ref: RC.JD.AMEP.A.L11/0021
Date: 14 July 2011

Dear Mr Cram

**Marine Energy Park: Consultation on Draft Environmental Statement
Able Humber Port, Killingholme, South Humber Bank**

Thank you for sending the draft Environmental Statement (ES), which was received on 30 June 2010.

At our meeting on 11 July 2011 you advised us that Chapter 8 is currently being revised and therefore the following comments are based on the information reviewed to date. We reserve the right to change our position in relation to any further information received/reviewed and the formal application.

Volume 1 – Marine Energy Park
Chapter 4 - Description of the Development

As mentioned in our previous letters, the Environment Agency requires confirmation that Anglian Water Services (AWS) can provide sufficient capacity in the sewerage network and treatment facilities to serve the proposal. We will need to be satisfied that the development can be adequately accommodated and will not lead to a deterioration in water quality in either the Killingholme Drain or the Humber. We are aware that you will provide a copy of your correspondence with AWS to address this issues.

Paragraph 4.4.68, in respect of water supply, states that Anglian Water will reinforce their existing infrastructure to provide the peak demand and we will also require confirmation from them that this is possible.

Chapter 7 - Geology, Hydrogeology and Ground Conditions

7.6.17 Before any dredging works are undertaken there will need to be confirmation that a suitable site has been secured for the deposition of the glacial clay materials. If you have already secured a suitable site, details of this should be included in the ES.

7.1 Geoenvironmental Assessment (ES) 27-04-11

Table 5.1: Conceptual Site Model refers to Major Aquifer and should be amended to refer to the Principal Aquifer.

Our previous comments regarding consistency in conceptual drawings still apply. There are significant differences in the way in which superficial and chalk bedrock is depicted, e.g. drawing KI - 99002 (flat chalk surface), Figure 7.1, 7.5 and 7.6 and AME - 09000. The revision dates on the drawings e.g. KI 99002 and AME 09000 have not changed suggesting previous comments have not been considered. Some of the information contained within the dredging strategy and 7.4 Ground Engineering Interpretive Rpt (BH) Jan 2011.pdf for example could be used to improve the conceptual presentation of the site.

7.4 Ground Engineering Interpretive Rpt (BH) Jan 2011.pdf

1.2 Indicates that one of the objectives was to determine ground conditions (ground profile, ground water levels). However, we cannot find any further reference to groundwater in this report. Groundwater is anticipated to be at or near artesian conditions. This information should be taken into consideration, both from a disturbance point of view and also a pollution prevention point of view.

7.5 Hydrogeological, Piling and Dredging Risk Assessment

Following a review of this document, we have identified an issue with the interpretation of abstraction boreholes associated with the Associated British Ports (ABP) site south-east of the proposed development site. There are three boreholes described in the ESI report as being private water supplies not abstracting greater than 20m³ / day. This is not the case, there are actually four boreholes covered by an abstraction licence held by ABP which allows up to 1,400,000 m³ / year. This is not something that has changed in the report when compared with previous drafts and we apologise for not highlighting this in previous reviews. This omission may be derived from a Customer Contact (CCN/2011/25664) request which asked for abstractions within 3 km of a customer supplied grid reference (we cannot locate the grid reference for this request but assume it is the same as the grid reference in CCN Request 26583). This grid reference appears to be located just outside the western boundary of the proposed site. The nearest ABP borehole is 3.1 km from this grid reference, just outside the specified search area. However, the boreholes at ABP are 1.8 Km from the southern boundary of the proposed development quay. Therefore they should be included in the assessment.

A new request for information should be made to us (via email to: Custanno.Lincoln2.AN@environment-agency.gov.uk) for information within 3km radius of the proposed site boundary (as opposed to a point outside the site boundary). There will be a charge of £60 (including VAT) for providing this information, and we will start gathering this so that it can be sent to you by return of receiving your request. ESI will then have to reassess their conclusions in light of this new information as it is considered possible that the size of this abstraction is sufficient to be affected by the proposed development works.

Specifically, the summary in 2.5.4.1 Groundwater abstractions – public & private and subsequent conclusions based upon this.

7.6 Dredging Strategy (Able) April 2011.pdf

2.1.1 There appears to be an error in the distance to Grimsby quoted. We believe this should read 13.5km rather than 3.5km.

Chapter 8 - Hydrodynamic & Sedimentary Regime

Annex 8.1 AMEP Estuary Modelling Report (JBA) May 2011

5.76 mentions that there will be a 40cm increase in wave height in 2029. Could you please advise how this is to be addressed.

Table 18 mentions that the Humber Work Boats may experience erosion in the inter-tidal area. Further information is requested in respect of the size of this impact and whether there are proposals to mitigate for this. This will need to be quantified to enable us to remove it from our inter-tidal losses calculations.

This document does not include any discussion of mitigation. This should be included as we will need to assess whether any compensation proposals are acceptable.

Annex 8.2 Review of the Geomorphological Dynamics of the Humber Estuary

Figure 5 – the first map in Figure 5 shows more erosion, but the text specifies accretion. Could you please provide an explanation of this or amend if there is an error.

2.5 Could you please explain how the changes in intertidal area have been calculated or provide references if this has been taken from the work of others.

2.7 Could you please clarify if the mean sea level rises quoted are from literature or if they have been calculated from gauge data?

Chapter 10 Aquatic Ecology

Chapter 10 acknowledges the presence and importance of migratory fish species in the Humber Estuary and concludes that no significant impact on them is assumed. Table 10.10 includes relevant species and notes sensitivity to noise. However, the migration periods for salmon do not appear accurate. The text states migration for adults as August-October and March-June for smolt. We are aware from data available that the migration period for adult salmon is more likely between June to October/November.

We are pleased to see that impacts to fish from dredging and quay construction are identified and the consideration of impacts for salmon and other diadromous fish are discussed in paragraphs 10.6.32 to 10.6.58. These are generally good but only assumes that if hearing damage occurs then hearing will return, except that predation and fitness may be impaired. Also, it is not considered that the disturbance may have the consequence of salmon failing to spawn. The ranges given for accumulation of damage are 1.3km, behavioural effect not given. We believe these issues have a greater impact than your assessment recognises.

A single strike damage range of 55m is suggested. This is suggested as worst case (2.4m pile) although details of the source level and transmission loss methodology are not given in order to establish suitability of the assumptions.

10.6.50 - Given the maximum swimming speeds quoted, not average, the time for salmon to swim through a potentially damaging zone often exceeds an hour if fish swim directly through the zone. Since the development could be in construction for two years this represents a significant risk to the disturbance of salmon in their transits through the Humber estuary

10.6.55 discusses the changes in dissolved oxygen (DO) as a result of dredging or dredge disposal. The level of increases/reductions should be quantified in percentage terms, in order to enable an assessment of impacts on species.

In summary, many of the potential effects have been noted but dismissed. The evidence presented suggests that further work is required to establish the extent of risk to the noted fish species at risk. No mitigations are proposed or discussed. We would suggest that there are significant residual risks related to the potential impacts of construction noise on the passage of migratory fish past this site during the construction phase and further consideration of this issue is necessary.

Chapter 13 – Drainage and Flood Risk

Annex 13.1 Flood Risk Assessment and Drainage Strategy (JBA)

The Flood Risk Assessment (FRA) has described the flood risk to the site but no modelling data has been supplied to support the conclusion or recommendations. The Final FRA must include this information in accordance with the technical requirements outlined in our letter of 4 July 2011.

In addition to this further clarification is also requested on the following:

Further detail is required on the possible effects of the increased flood levels to the surrounding residential properties. Whilst it is acknowledged that there is already a significant depth of flooding, will the additional flood water cause flooding to 1st floor or safe refuge accommodation of the existing residential dwellings? Does the increased flood level increase the hazard locally resulting in restriction for evacuation?

Further discussions are required to confirm if the two stage approach in the design of the quay, to compensate for sea level rise through climate change, is acceptable. These will be held through the Flood Defence Consent (FDC) process therefore it is premature to include such a conclusion in the FRA. The principle requirements for a FDC must be agreed together with any legal agreements prior to formal submission of your application to the Infrastructure Planning Commission (IPC). We wish to avoid the need to have to request amendments to the scheme which are not covered in the IPC application.

Given the identified level of flood risk to the site and the acceptance of flood waters entering the site, the Flood Warning and Evacuation Plan (FWEP) needs to be agreed before a formal application to the IPC is submitted. The FWEP will form a significant evidence base to demonstrate the development is 'safe'. The principle authority to approve such plans will be North Lincolnshire Council, and including a letter of confirmation from them that the plan is suitable should be included in the FRA.

A suitable surface water strategy has been put forward. However, if the Killingholme Marsh Scheme does not come forward or is not in place prior to the proposed development taking place, there needs to be an assurance that an alternative

scheme is available. It is recommended that a second option is discussed in the FRA which does not rely on third parties and can be implemented within the constraints of the Marine Energy Park site. Whilst this scheme would not be the preferred option it will provide a robust application to the IPC.

Chapter 16 - Noise

As a general comment, we have found it difficult to review this chapter as many of the linked references are not working.

We are pleased to see the identification of spawning grounds, marine mammals and migrating lamprey in the Humber Estuary as sensitive ecological receptors in paragraph 16.3.9. However, the proposed use of shrouds and soft starts as mitigation are mainly for terrestrial noise mitigation and the effectiveness of soft starts for fish are not known, especially for migratory salmonids.

The locations of point sources suggest works on the foreshore and set back into the site are considered. It would be expected that the largest noise sources would be from the estuary works but there is little information on the pile diameter, only a maximum pile energy (500Kj) quoted. Again, this is only a consideration of airborne noise and not waterborne noise.

We note that the hours of construction for marine works are not time restricted (Table 16.4). The site construction limitations give some opportunity for de-rating but there is little information on time of tide or day when fish pass; some seasonal data is available for scheduling but the scheme is of long duration (2 years). We are therefore concerned that, although there is recognition of potential aquatic receptors, there is no specific attempt to address the potential issues.

Chapter 17 – Air Quality

We note that paragraph 17.6.11 highlights the potential for combustion gases arising from the operation of supply chain facilities at the site, in particular foundries and casting. These facilities may require a permit from us if they meet the thresholds defined in Schedule 1, Part 2, Chapter 2 of the Environmental Permitting Regulations 2010. A copy of the thresholds is attached at Appendix A below for your information.

If the facilities being developed fall within the definitions of this chapter of the regulations but do not meet the thresholds stated in Appendix A the local council would have the responsibility for regulation.

Chapter 23 - Waste

We are satisfied that this chapter covers the relevant Duty of Care aspects of the development proposal from construction to operation. It also acknowledges the requirement to undertake a Site Waste Management Plan.

Volume 2 - Compensation Site

Chapter 31 Geology, Hydrogeology & Ground Conditions

Within our letter of 3 June 2011, we requested a copy of the additional Site Investigation in respect of the suspected landfilling. At our meeting of 11 July 2011 you advised us that it is not your intention to carry out any further Site Investigation works before submission of your application. Richard Morgan (Groundwater & Contaminated Land Officer) advised of the potential risks with this, i.e. commercial risks associated with un-quantified contamination and the remediation costs. However, you expressed a preference that this issue is dealt with through appropriate conditions and we are agreeable to this.

Annex 31.3 Site Investigation Interpretative Report

We strongly recommend that a trial embankment, as discussed in sections 5.4 and 9.2 of Annex 31.3, is constructed in the first instance. We believe this is the most appropriate and robust solution to fully address the uncertainties about foundation settlement and the suitability and performance of won material from site, as highlighted in Annex 31.3.

We have a particular concern in respect of the statements made in sections 5.1 and 9.2 of Annex 31.3 about the dried 'crust' that the warped soils have formed, thus increasing its undrained shear strength and bearing capacity, for use as the embankment foundation. However, given the identified risk of seepage, as detailed in para. 9.2 (c), we would like clarity on whether this could lead to the rehydration of the soils and a subsequent critical loss of shear strength and bearing capacity.

There is no discussion of maintenance responsibility once the realigned defence is constructed and operating. This issue needs to be addressed, with a clear indication of where responsibility will lie. The Environment Agency does not currently maintain the existing defences in this location, the current landowner, Crown Estates, are responsible for maintenance. Subsequently, the Environment Agency will not be responsible for maintaining the new defence. You will need to reach agreement with Crown Estates on this issue.

We agree that the effects of this scheme on the sediment regime at the Stone Creek outfall should be monitored over at least 5 years. We will expect to reach formal agreement on this undertaking, and also a committed provision to carry out remedial works, if a direct detrimental effect is proven. It is worthy of note that, at the comparable sites of Chowder Ness and Welwick, a 10-year monitoring programme was put in place to understand the many different environmental impacts of these schemes.

There is inconsistency in the discussion of the proposed dimensions of the new defence. Section 4.5 of Annex 31.1 suggests an embankment slope of 1:5 (1V:5H) whereas in Section 5.6 of Annex 31.3, a gradient of 1:3 was specified in the 'model assumptions'. Given the uncertainties about the suitability of site-won foundation and fill material, we would suggest that the shallower slope of 1:5 is preferable.

There are similar inconsistencies over crest elevation exists, figures quoted ranging from 6.50 to 7.50 metres AOD. Could you please supply clarification on this.

In Section 4.5, Annex 31.1, a suggestion is made that the old defence could be breached before vegetation has established on the new defence embankment, if a protective berm is constructed at the bank toe. However, this berm will be itself subjected to eroding forces following the breach, unless, like the remainder of the embankment, time is allowed for vegetation to establish or the berm is protected with the interlocking concrete blocks, detailed in paragraph 28.3.13, of Annex 28, for employment on areas exposed to direct wave attack.

At the nearby, recently completed alignment scheme at Welwick, a year was waited for vegetation to establish on bank before breaching the existing defence. We would advise that a comparable period is appropriate at Cherry Cobb Sands, especially, if, as advised, a trial embankment is constructed first beforehand.

In terms of determining the extent of interlocking concrete blocks employed, we note that comparative schemes at Welwick and Chowder Ness are protected in their entirety by such measures. We would suggest, unless demonstrated otherwise, that a similar extent of concrete protection is used at Cherry Cobb Sands.

There is no discussion on the fate of the material from the 250m breach. At Welwick this material was used to fill temporary borrow pits used to construct a new defence. We request further explanation on this matter is included in the ES.

Further information is required in respect of the protection to the ends (limit) of the breach width, or will it be increased through time by erosive action? We require a clear indication of the preferred course of action and associated anticipated impacts. For example, if the breach were to expand naturally, the embankment material that is dislodged could add to the sediment load of Cherry Cobb Sands Creek and subsequently Stone Creek.

Chapter 32 - Hydrodynamic & Sedimentary Regime

2.2.4 Do you have any modelling to provide confidence that a change in dynamics resultant from the breaching of Cherry Cobb Sands will not affect the remainder of the creek and the impacts will be to the localised dynamic downstream portion of the creek?

Chapter 36 – Drainage & Flood Risk

36.9.1 highlights that the Compensation Site may impact drainage through Stone Creek through a short term reduction in the duration of low tide and an increase in its level, which could potentially limit the flows through Stone Creek during high flows. Details are requested on how you intend to mitigate for this residual risk.

Annex 36.1 Compensation Site FRA draft final

We are satisfied that the amended draft Flood Risk Assessment, dated June 2011, has addressed the inaccuracies in the original FRA. However, we would like to take this opportunity to remind you that prior written Consent will be required from the Environment Agency, under the Water Resources Act and the Yorkshire Land Drainage Byelaws 1980, for all temporary and permanent works affecting flood embankments and watercourses.

We would also like to reiterate the point made in our letter of 18 March 2011 that the Cherry Cobb Sands site is identified within the Humber Flood Risk Management Strategy as a planned habitat creation site, to enable the Environment Agency to meet Habitats Directive requirements. The loss of this site will have implications on our ability to deliver the Strategy.

Water Framework Directive Assessment

At our meeting on 11 July, I briefly explained the difficulties we are encountering in respect of assessing the Water Framework Directive document. Unfortunately, our national colleagues have not yet been able to provide me with feedback on your submission yet. I will, therefore, have to forward their comments to you under separate cover when they are received. Please accept my sincere apologies for the delay in respect of this.

Habitats Regulations Assessment

We note that you require comments in respect of this report at our meeting scheduled for 18 July 2011 and I would advise you that these are currently being discussed with Natural England.

Should you require any additional information, or wish to discuss these matters further, please do not hesitate to contact me on the number below.

Yours sincerely

Annette Hewitson
Principal Planning Officer

Direct dial 01522 785896

Direct fax 01522 785040

Direct e-mail annette.hewitson@environment-agency.gov.uk

**Extract from the Environmental Permitting Regulations 2010
Schedule 1, Part 2, Chapter 2**

Under Section 2.1 - Ferrous Metals

This is defined as an alloy of which iron is the largest constituent, or equal to the largest constituent, by weight, whether or not that alloy also has a non-ferrous metal content greater than any percentage specified in Section 2.2

- (a) Roasting or sintering metal ore, including sulphide ore, or any mixture of iron ore with or without other materials.
- (b) Producing, melting or refining iron or steel or any ferrous alloy, including continuous casting except where the only furnaces used are—
 - (i) electric arc furnaces with a designed holding capacity of less than 7 tonnes, or
 - (ii) cupola, crucible, reverberatory, rotary, induction, vacuum, electro-slag or resistance furnaces.
- (c) Processing ferrous metals and their alloys by using hot-rolling mills with a production capacity of more than 20 tonnes of crude steel per hour.
- (d) Loading, unloading or otherwise handling or storing more than 500,000 tonnes in total in any 12-month period of iron ore, except in the course of mining operations, or burnt pyrites.

Under section 2.2 - Non-ferrous metals

This is defined as an alloy which is not a ferrous alloy, as defined in Section 2.1.

- (a) Unless falling within Part A(2) of this Section, producing non-ferrous metals from ore, concentrates or secondary raw materials by metallurgical, chemical or electrolytic activities.
- (b) Melting, including making alloys, of non-ferrous metals, including recovered products (such as refining or foundry casting) where—
 - (i) the plant has a melting capacity of more than 4 tonnes per day for lead or cadmium or 20 tonnes per day for all other metals; and
 - (ii) any furnace (other than a vacuum furnace), bath or other holding vessel used in the plant for the melting has a design holding capacity of 5 or more tonnes.
- (c) Except where the activity is related to an activity described in Part A(2)(a), or Part B(a),
- (d) or (e) of this Section, refining any non-ferrous metal or alloy, other than the electrolytic refining of copper.
- (d) Producing, melting or recovering by chemical means or by the use of heat, lead or any lead alloy, if—
 - (i) the activity may result in the release into the air of lead; and
 - (ii) in the case of lead alloy, the percentage by weight of lead in the alloy in molten form is more than 23 per cent if the alloy contains copper and 2 per cent in other cases.
- (e) Recovering any gallium, indium, palladium, tellurium or thallium if the activity may result in their release into the air.
- (f) Producing, melting or recovering (whether by chemical means or by electrolysis or by the use of heat) cadmium or mercury or any alloy containing more than 0.05 per cent by weight of either of those metals or both in aggregate.
- (g) Mining zinc- or tin-bearing ores where the activity may result in the release into water of cadmium or any compound of cadmium in a concentration which is greater than the background concentration.

(h) Manufacturing or repairing involving the use of beryllium or selenium or an alloy containing one or both of those metals, if the activity may result in the release into the air of any substance in paragraph 6(3) of Part 1 of this Schedule; but an activity does not fall within this paragraph by reason of it involving an alloy that contains beryllium if that alloy in molten form contains less than 0.1 per cent by weight of beryllium and the activity falls within Part B(a) or (d) of this Section.

(i) Pelletising, calcining, roasting or sintering any non-ferrous metal ore or any mixture of such ore and other materials.

Under section 2.3 - Surface Treating Metals and Plastic Materials

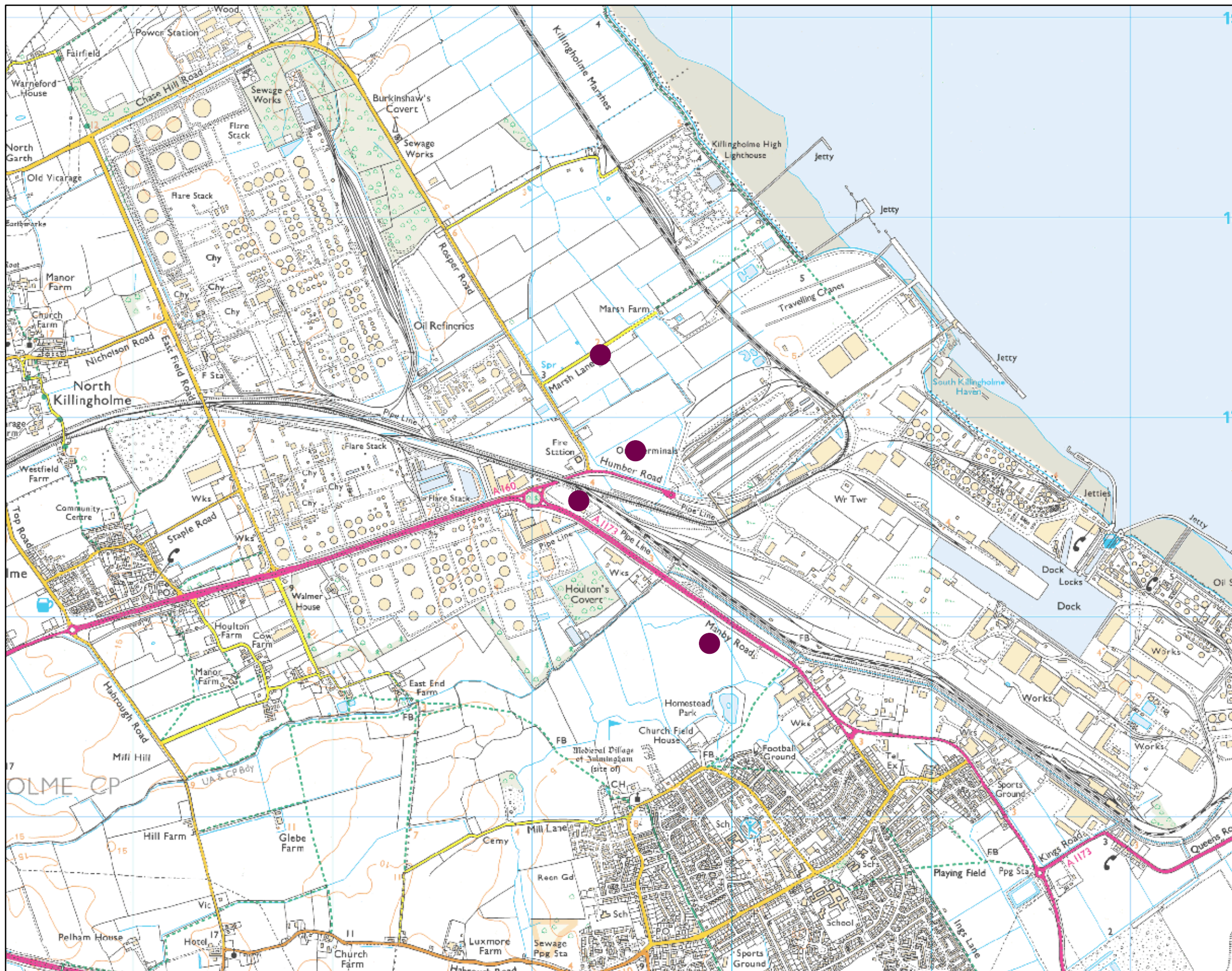
(a) Unless falling within Part A(2) of this Section, surface treating metals and plastic materials using an electrolytic or chemical process where the aggregated volume of the treatment vats is more than 30m³.

Appendix F

Location of modelled depths from Able MEP flood modelling

Map 1. Location of Modelled Depths from ABLE Modelling

Map centred on ABLE proposed development site - created June 2012



Scale 1:20,000



● Modelled Depth Locations

Created by the Flood Risk Mapping & Data Management Team, Lincoln

Appendix G

**EA letter to Able 29 May 2012 re Water Framework
Directive assessments**

Mr Richard Cram
Able UK Ltd
Able House (Billingham Reach Industrial
Estate) Haverton Hill Road
Billingham
Cleveland
TS23 1PX

Our ref: AN/2012/113982/01-L05
Your ref: IPC-Pro-11
Date: 29 May 2012

Dear Richard

**Water Framework Directive Assessments
Marine Energy Park, Killingholme Marshes, North Lincolnshire**

We have now reviewed the Water Framework Directive (WFD) Assessment for the Marine Energy Park (MEP) Habitat Compensation Scheme at Cherry Cobb Sands.

At the same time we have also revisited the original MEP WFD Assessment and the specific areas of the Environmental Statement (ES), which you directed us to within your signposting report in relation to our previous WFD related comments.

Habitat Compensation Scheme WFD Assessment (ref: TN DHM6835-01 R1)

We have the following comments to make in respect of this document:

3.2 Zinc measure. The reason behind the likely improvement in this element without any noticeable published measures is due to the closure of the point source causing the problem. The predicted improvement is based on the source being removed, rather than a 1st cycle measure.

3.4.1 page 6 – The first paragraph states that 0.1% of the saltmarsh will be lost as a result of the proposal. This appears incorrect as the loss of 2ha from 627ha is 0.3%. This part of the WFD assessment cannot be signed off as acceptable to the Environment Agency until Natural England confirm the Habitats Regulation Assessment (HRA) is acceptable.

Page 6 Benthic invertebrates. The evidence from Managed Realignment sites on the Humber to date is that the benthic invertebrate population is one of the later species to colonise the created sites. In the short-term (1-5 years) they would not contribute significantly to the benthic invertebrate population of the Lower Humber

water body. In the medium-term they would make a contribution, but as the site undergoes succession from mudflat to saltmarsh the benthic invertebrate population would again become a paucity in species and density within the site. In his presentation on 16 May 2012, David Keiller said that his modelling shows the creation of only 43 ha of intertidal mudflat after 5 years (whereas the target for sustainable intertidal mudflat at the ratio of 2:1 is 76 ha) and that this is likely to be significantly less over 10 years. David Keiller's interpretation of the modelling results gave a clear indication that the compensation of intertidal mudflat after 10 years is likely to be less than a ratio of 1:1. The WFD assessment will need amending in the light of this.

Page 6 Benthic Invertebrate fauna, the second paragraph states that there will be a net improvement in the status of this currently low scoring biological element. We would request that more detail on the timing for the net improvement to take place is provided. It is our opinion that it is unlikely to show any improvement in the first WFD monitoring cycle post breach, and possibly not in the second monitoring cycle either.

Page 7 end of first paragraph – the risk in a reduction in status may depend upon when the breach in the compensation site takes place in relation to the reclamation of the intertidal area at AMEP. This is not currently reflected in the assessment, but if the reclamation takes place ahead of the breach, this statement does not necessarily hold true. We would request that this point is addressed.

Page 7 Conclusion – As above, we will not be able to sign the WFD assessment off as acceptable until we have confirmation of HRA acceptance.

Page 8 3.4.3 Specific Pollutants and Priority Substances – We note the need for additional ground samples to confirm CEFAS Action Level 1 and to include pesticides and fertilisers and we look forward to receiving these in due course.

Page 8 Conclusion – we note the interim conclusion drawn and we are likely to request that an updated WFD assessment is secured through a condition in the DCO if this is not received before determination.

Page 9 – It would be helpful if you could provide further clarity in respect of the figures provided in the report. The site area is quoted as being 115 hectares, and the target at Cherry Cobb Sands is to create 79 hectares of sustainable mudflat, whilst removing 2 hectares of saltmarsh in its construction. It is not clear from the report what portion of the 115 hectares will be mudflat and what proportion will be saltmarsh.

Page 10 4.1. We have sent a map to HR Wallingford showing the nitrate vulnerable zones. They may need to update this section following receipt of the map.

Page 16 Paragraph 1 "The ES does confirm that advice will be sought from the EA on the measures required to maintain or improve the status of the soke dyke." We would expect to see the required measures within the Ecological Management and Maintenance Plan.

Page 16 Section 5 Conclusion – we concur with the conclusion that the following two bullet points are critical to the validity of the assessment:

- The acceptability of the HRA;

- Confirmation of a lack of contamination from the secondary ground assessment.

We can therefore confirm that we will not be able to give our full approval of either WFD assessment until the above points have been addressed.

AMEP WFD Assessment (Ref: DER47112-01), including responses to issues included in the Signposting Report provided on 30 January 2012

It appears from the AMEP WFD assessment that the evidence presented is purely based upon guidance for the marine environment. It would seem that in the absence of specific Transitional guidance it would be more appropriate to use a combination of both marine and fluvial guidance. Our fluvial guidance refers to the following additional considerations: critical habitat for the water body; cumulative impacts within the water body, and expert judgement. The application of a trigger is not a reason to ignore expert judgement within the assessment. From the above Technical Note it is unclear how conclusion has been derived as the assessment relies upon the ES. It would be helpful for the regulators if, where the ES is relied upon to form the basis of the WFD Assessment that as a minimum the specific section of the ES is referred to or extracts are cited. At present the assessment appears to be more of a screening exercise as it is difficult to follow the arguments presented and hence to assess the validity of them under the Directive.

In addition, at present there are two WFD assessments. Our advice would be to compile this into one WFD assessment looking at all parts of the project (reclamation, dredging, disposal, compensation site creation) in order that the different parts of the project that are interlinked are adequately assessed in terms of WFD. For example Benthic Invertebrates in both assessments (DER47112-01 and TN DHM6835-01 R1) need to cross-reference each other, but at present do not. If the benthic invertebrate improvement suggested in TN DHM6835-01 R1 is realised, it should have been assessed in terms of the impact of the remainder of the project on the benthic invertebrate community. The evidence for this is not succinctly presented at present. As a minimum the two documents should cross-reference each other, but our preference would be for the points below to be addressed whilst combining a WFD assessment for the total project.

Biological Elements

Benthic invertebrates-

We have concern with regard to the impact on the biological elements. The lowest scoring biological element for the Humber Lower water body is for benthic invertebrates. The only other classification for the biological elements in this water body is for fish, which is currently at Good status. The Benthic Invertebrate Classification for the Humber Lower is Moderate but it is borderline reaching Good status. It is likely that the classification should actually be elevated to Good status as of this year. However, this element will be just inside the Good status boundary with Moderate status. This means with any improvements in sediment quality over the next four years that the biological element could comfortably be in the Good status classification for the benthic invertebrate element. Activities that work against this aim work against the ability to maintain and reach Good status. Our monitoring frequency is yearly and we currently define a non-temporary effect as an impact lasting greater than a year.

By achieving Good status for benthic inverts, the overall monitored biological

elements will be reaching Good status. It could be viewed that any major impacts to the benthic invertebrate communities could be considered as detrimental to achieving and maintaining good status for that element and must therefore be considered carefully. With this information in mind, we would request that further consideration be given to the effects of benthic invertebrates for the water body in the WFD deterioration assessment paper - for example, highlighting areas of impact and impact assessment in the background of a water body that is on a status boundary for that element. Much of this may well be borrowed from the Environmental Statement; however it must be put in the context of the Water Framework Directive.

At present the explanation enclosed within Technical Note DER4712-01 is insufficient for the Environment Agency to accept the argument presented. Table 4.a (Disposal) indicates an impact on benthic invertebrates is unlikely, but in Table 4.b (Disposal) is scoped into the ES. There is no further evidence of the full WFD Assessment we would expect for this activity in the documents present. It appears the argument being made is that the impact on this can be screened out. The evidence to substantiate this view point is not presented. In addition Technical Note TN DHM6835-01-R1 indicates that the creation of a compensation site will ensure there is no impact on benthic invertebrates and that this risk is being mitigated. The sub-tidal element of the impact from AMEP is being compensated at a ratio of 1:1. The impact on benthic invertebrates from both non-erodible and erodible deposition is likely to extend to 18 months (based on Appendix 2 in Annex 7.6). The compensation site will not commence construction until either the DCO is granted or planning permission is sought by an alternative means. The compensation site is not going to have a rich benthic invertebrate community in the early years (years 1-5 as a minimum). This means that there is a potential impact on benthic invertebrates that would span a period from the onset of marine works in the short-term. As we stated in our letter of 25 July 2011, our monitoring frequency is yearly and we currently define a non-temporary effect as an impact lasting greater than a year.

We expect to see a detailed assessment of the impact of the entire project (reclamation, dredging, and the compensation site) on benthic invertebrates within the Lower Humber water body, explaining the reasoning behind the argument presented. It is our understanding that there are potential impacts on benthic invertebrates in the short and longer-term (as the effectiveness of the compensation site reduces), with a potential improvement in the medium term as the colonisation of the compensation site takes place.

Other Aquatic Flora (e.g. Saltmarsh and seaweed)

At present it is not possible to understand the argument made with regard to this biological element within the WFD assessment. The assessment is summarised in the table, but with no evidence presented, and no reference to where in the ES this can be found. It is difficult, at present, to link the argument between the mitigation presented within TN DHM6835-01 R1 and DER4712-01. This needs to be improved.

Fish

At present it is not possible to understand the argument made with regard to this biological element within the WFD assessment. The assessment is summarised in the table, but with no evidence presented, and no reference to where in the ES this can be found.

Hydromorphological elements supporting biological elements

Morphological Conditions

Depth Variation

No screening or assessment of this appears to have taken place. Evidence needs to be presented as to how the disposal of both erodible and non-erodible material will affect the depth variation as a consequence of the development. There are numerous dredge specific mitigation measures within the Humber Lower water body. How are these being applied to this development? How will the footprint of the reclamation affect the depth variation in the Humber Lower water body as a consequence of changes in flow dynamics?

Bed

No screening or assessment of this appears to have taken place. Evidence needs to be presented as to how the disposal erodible and non-erodible material will affect the bed of the estuary as a consequence of the development. There are numerous dredge specific mitigation measures within the Humber Lower water body. How are these being applied to this development? How will the footprint of the reclamation affect the bed of the estuary in the Humber Lower water body as a consequence of the development?

Intertidal Zone Structure

Screening has been undertaken for this element, but concluded that the likelihood of a non-temporary effect is unlikely. At present it is not possible to understand the argument made with regard to this hydromorphological supporting biological element within the WFD assessment. The assessment is summarised in the table, but with no evidence presented, and no reference to where in the ES this can be found. It is difficult at present to link the argument between the mitigation presented within TN DHM6835-01 R1 and DER4712-01. This needs to be improved.

Tidal Regime

Wave exposure

Reference is made within the ES of the potential impact on tidal regime within Annex 8.1 specifically at the AMEP site. Is not clear within the ES of the impact on the wider estuary, and specifically the Humber Lower water body. From Tables 4.a and 4.b within the assessment it is not possible to understand the evidence being presented to conclude that it is unlikely for a non-temporary effect. If the tidal regime is permanently affected, we would expect to see the argument presented within the assessment as to why this is not significant at the water body level.

Water Dependent Features

We agree that this can be based on the outcome of the HRA, but you need to consider the Humber Lower water body in this assessment, and whether there is anything unique to the Humber Lower water body. It is worth noting that the Humber Lower water body does not coincide with the Outer part of the estuary as far as the Habitat Regulations are considered, but overlaps with the Humber Middle part of the estuary. The loss of mudflat in the Humber Lower water body does need to be considered in terms of the biological quality elements.

Not affect delivery of mitigation measures as outlined in the Humber Lower water body in Annex B.

As indicated in our response on 25 July 2011, the assessment also needs to ensure that the scheme will not compromise the mitigation measures 'not in place' for the Humber estuary. Even though, as HR Wallingford point out, the mitigation measures

for this water body relate to flood protection, it is important that the impacts of this scheme will not invalidate the mitigation measures we need to put in place to achieve good ecological potential. Despite the inclusion of a section on contributing to WFD improvements, the document should ideally address whether the scheme will impact on the ability to deliver the required measures. At present we do not think that the Technical Notes sufficiently addresses the points raised above.

If your consultants would like to discuss the technical aspects of this response with us, they are advised to contact Sue Manson from our Humber Strategy Team, on 01709 312925.

Should you require any additional information, or wish to discuss these matters further, please do not hesitate to contact me on the number below.

Yours sincerely

Annette Hewitson
Principal Planning Officer

Direct dial 01522 785896

Direct fax 01522 785040

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Appendix H

EA letter to Able 19 June 2012 re piling mitigation requirements

Mr Peter Stephenson
Able Uk Ltd
Able House
Billingham Reach Industrial Estate
Haverton Hill Road
Billingham
Cleveland
TS23 1PX

Our ref: AN/2012/113982/01-L06
Your ref: IPC-Pro-11
Date: 19 June 2012

Dear Peter

**Marine Energy Park, Killingholme Marshes, North Lincolnshire
Piling Mitigation & Compensation proposal**

Thank you for your letter dated 11 May 2012 in respect of salmon disturbance. I have shared the letter with our Defra partners (the Marine Management Organisation (MMO) and Natural England (NE)) and now provide our joint response to your mitigation proposals.

General Mitigation

The general construction proposals outlined in your letter are welcomed. We would like to inform you of the following detailed requirements, which we will seek to secure in respect of your general proposals:

Soft Start

We will be requiring that the soft-start procedure for percussive piling recommended by the Joint Nature Conservation Committee (JNCC), for a period of not less than 20 minutes is implemented. Should piling cease for a period of greater than 10 minutes, then the soft-start procedure must be repeated. This is required to allow commercial and migratory fisheries, such as herring, sole, plaice, salmon and lamprey, together with marine mammals to move away from the noise source and reduce the likelihood of exposing them to sounds which can cause injury. If you believe that the 20 minute requirement should be reduced, we will be please to review any evidence that you have to substantiate this.

Noise Shrouds

We note that the use of piling shrouds is only possible up to the piling gate. This technique is primarily for the protection of birds and only provides partial mitigation. However, I can confirm that this is acceptable to NE, providing full mitigation is

implemented as soon as the pile gate is removed.

Pile Pads

The use of pile pads is welcomed.

Monitoring of water temperature/dissolved oxygen

Your proposal to cease impact piling if water temperature in the estuary exceeds 21.5°C is welcomed. The Environment Agency will also require cessation of impact piling if dissolved oxygen drops below 5mg/l. Active monitoring will be necessary to ensure compliance with this requirement.

Piling restrictions

We are satisfied that the piling restrictions proposed will provide some mitigation for the species of concern, in particular the complete cessation of piling between 7 April and 1 June for the protection of migratory salmon, elvers and river lamprey. We agree that the piling period should commence at the start of percussive piling, roll throughout (which includes any quiet periods when piles may be being placed) and cease at the end of the piling day. This is required as the expected time periods for the setting up/placing of piles, i.e. 30 minutes, is not considered an adequate period of quiet for fish to swim through the zone of potential impact before piling recommences.

Compensation proposal

We can confirm that enhancing the development of the Cherry Cobb Sands compensation site for juvenile fish is welcomed. We have evidence of similar schemes at Alkborough and Chowderness working well. We will require this work to be secured through the appropriate mechanism, together with a scheme to monitor its effectiveness. As previously discussed, it would be helpful if you could provide a monetary value for this work.

Development Consent Order and Deemed Marine Licence requirements

In order to provide clarity on this issue, we provide below a schedule of requirements and conditions that we are proposing:

We recommend that a definition of “percussive piling” is included in the Interpretation section of the deemed marine licence as follows:

“percussive piling” means the driving of piles by percussive means but does not include the handling, placing and vibro-driving of piles.

We recommend that a definition of “marine piles” is included in the Interpretation section of the deemed marine licence as follows:

“marine piles” being defined as a pile that will be in the marine area.

Prior to works commencing:

DCO and DML Condition 1

No development shall be commenced until a Piling Method Statement has been submitted to and agreed in writing by the Marine Management Organisation [substitute LPA for MMO when in Requirements schedule], following consultation with the Environment Agency and Natural England. The Piling Method Statement shall include the following measures:-

- Utilisation of pile pads;
- Utilisation of pile shrouds;
- Specification of piles to be used;

- Soft-start procedures to be followed;
- Marine mammal observation;
- Implementation of the Active Monitoring Scheme.

Development shall thereafter proceed only in strict accordance with the agreed Piling Method Statement.

Reason: To reduce the risk to sensitive mobile receptors, including Atlantic salmon, sea trout, river and sea lamprey, eel, herring, sole, plaice and marine mammals.

DML Condition 2

No development shall be commenced until an Active Monitoring Scheme has been submitted to and agreed in writing by the Marine Management Organisation, following consultation with the Environment Agency and Natural England. The Scheme shall include the following details:-

- Location of Active Monitoring Buoy(s) and depth and design of sensors;
- Full details of the frequency of measurement of temperature and dissolved oxygen in order to ascertain compliance with condition 9;
- 24 hours a day, 7 days a week monitoring of noise in order to ascertain compliance with conditions 4-7;
- Full details of when monitoring will commence and cease, which will include a 2 week period of pre and post construction monitoring in order to establish baseline conditions and the return to baseline conditions once construction activity has finished;
- A log of the number and approximate location of piling rigs which are in operation on any given day;
- Full details of how the monitored information will be accessed by or communicated to the site contractor and the Marine Management Organisation where necessary.

The Monitoring Scheme shall thereafter be implemented in accordance with the timetable approved as part of the scheme.

Reason: To ensure appropriate information is available to allow noise mitigation measures to be implemented and monitored. To avoid periods when water conditions will make fish more vulnerable to disturbance. To reduce the risk to fish species including Atlantic Salmon, Sea Trout, River and Sea Lamprey, Eel, Herring, Sole and Plaice.

DCO and DML Condition 3

No percussive piling shall commence until a Cold Weather Construction Restriction Strategy for the months of February and March is agreed in writing with the Marine Management Organisation [substitute LPA for MMO when in Requirements schedule] in consultation with Natural England.

The strategy shall include the following elements/procedures:-

- a) No percussive piling (other than to finish driving any pile that is in the process of being driven at the point the cold weather restriction comes into force) shall take place following seven consecutive days of zero or sub zero temperatures (where the temperature does not exceed 0°C for more than 6 hours in any day or any other pre-agreed formula to define short periods of thaw);
- b) Three temperature monitoring points shall be agreed within the Humber Estuary such as Immingham, Killingholme, Grimsby, or Spurn;

- c) Full details of how the monitored information will be accessed by or communicated to the site contractor and the Marine Management Organisation [substitute LPA for MMO when in Requirements schedule] where necessary.
- d) The restrictions will be reviewed as follows:
- I. After 24 hours of above-freezing temperatures, the restrictions will be lifted on a "probationary basis", provided that the weather forecast (met office forecast location to be agreed) indicates that freezing conditions will not return within five days. If this weather forecast turned out to be wrong and freezing conditions did return, then there would have to be an immediate suspension of activity again;
 - II. After five clear days of above-freezing temperatures the restrictions will be lifted entirely and the "clock reset to zero".

The Monitoring Scheme shall thereafter be implemented in accordance with the timetable approved as part of the scheme.

Reason: To avoid an adverse effect on the interest features of the Humber Estuary SPA/Ramsar site.

During works

DML Condition 4

No percussive piling of piles shall take place between 7th April and 1st June inclusive in any one calendar year.

Reason: To reduce the risk to fish species including Atlantic Salmon, Sea Trout, River and Sea Lamprey, Eel, Herring, Sole and Plaice.

DML Condition 5

Percussive piling of piles shall be restricted in the following way:-

1. From 2nd June to 22nd July inclusive in any one calendar year, the maximum amount of percussive piling permitted within each four-week period shall be limited to:-
 - a. 101 hours where a single rig is in operation; or
 - b. A combined total of 168 hours where two or more rigs are in operation.
2. From 23rd July to 10th September inclusive in any one calendar year, the maximum amount of percussive piling permitted each week shall be limited to:-
 - a. 25 hours where a single rig is in operation; or
 - b. A combined total of 42 hours where two or more rigs are in operation.
3. From 11th September to 31st October inclusive in any one calendar year, the maximum amount of percussive piling permitted within each four-week period shall be limited to:-
 - a. 134 hours where a single rig is in operation; or
 - b. A combined total of 224 hours where two or more rigs are in operation.
4. From 1st November to 6th April inclusive in consecutive calendar years, the maximum amount of percussive piling permitted within each eight-week period shall be limited to:-
 - a. 336 hours where a single rig is in operation; or
 - b. A combined total of 560 hours where two or more rigs are in operation.

The measurement of each work block shall begin at the start of the first percussive piling strike, roll throughout the piling day, then cease at the end of the last piling strike. Measurement will begin again at the start of the next percussive piling day, on the start of the first percussive piling strike. This process will be repeated.

Reason: To reduce the risk to fish species including Atlantic Salmon, Sea Trout, River and Sea Lamprey, Eel, Herring, Sole and Plaice.

DCO and DML Condition 6

No piling shall take place between 22.00hours on a Saturday and 06.00hours on the following Monday.

Reason: To ensure periods of quiet when no percussive piling is taking place for the benefit of fish species including Atlantic Salmon, Sea Trout, River and Sea Lamprey, Eel, Herring, Sole and Plaice.

DCO and DML Condition 7

No piling shall take place between 22.00hours and 06.00hours.

Reason: To ensure periods of quiet when no percussive piling is taking place for the benefit of fish species including Atlantic Salmon, Sea Trout, River and Sea Lamprey, Eel, Herring, Sole and Plaice.

DCO and DML Condition 8

The maximum diameter of marine piles shall be 2.1m.

Reason: The impact assessment was undertaken on a maximum diameter of marine piles of 2.1m and a greater diameter pile would have a greater environmental impact.

DML Condition 9

No piling shall take place during periods when the data from the Active Monitoring Buoy(s) shows temperature to be above 21.5 degrees Celsius and/or dissolved oxygen to be below 5mg/l.

Reason: To reduce the risk to sensitive mobile receptors, including Atlantic salmon, sea trout, river and sea lamprey, eel, herring, sole, plaice and marine mammals.

DCO and DML Condition 10

The Licence Holder must ensure that soft-start procedures are used to ensure incremental increase in pile power over a set time period until full operational power is achieved. The soft-start duration should be a period of not less than 20 minutes. Should piling cease for a period greater than 10 minutes, then the soft start procedure must be repeated.

Reason: To allow mobile sensitive receptors, including salmon sea lamprey, river lamprey, eel, herring, sole, plaice and marine mammals, bird species to move away from the noise source, and reduce the likelihood of exposing the animal to sounds which can cause injury.

In order to progress with our detailed Written Representations and the joint Statement of Common Ground, it would be helpful if you could confirm your agreement to the imposition of these requirements and conditions. We will then be able to give further consideration to any residual risk remaining, following

implementation of these mitigation measures, and whether or not further compensatory works will be necessary.

Should you require any additional information, or wish to discuss these matters further, please do not hesitate to contact me on the number below.

Yours sincerely

Ben Thornely
Area Planning & Corporate Services Manager

Direct dial 01536 385137

Direct fax 01536 411354

Direct e-mail ben.thornely@environment-agency.gov.uk

Appendix I

Humber Flood Risk Management Strategy, Part 1

Would you like to find out more about us,
or about your environment?

Then call us on

08708 506 506 (Mon-Fri 8-6)

email

enquiries@environment-agency.gov.uk

or visit our website

www.environment-agency.gov.uk

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floodline **0845 988 1188**



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planning for the rising tides

The Humber Flood Risk
Management Strategy

March 2008



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Aims and objectives

Overall aims

To manage the risk of flooding around the Humber Estuary in ways that are sustainable for the people who live there, the economy and the environment, taking into account:

- natural estuary processes; and
- future changes in the environment (built or natural), sea levels or the climate.

To ensure that all proposals are:

- technically feasible;
- economically viable;
- environmentally appropriate; and socially beneficial.

Within these overall aims the strategy seeks to achieve the following objectives:

Detailed objectives	Subsidiary objectives
To maintain and, where possible, enhance public safety, health and security	To protect people and their property from the adverse effects (physical and psychological) of flooding
To respond to natural processes and to avoid contamination and erosion	To minimise adverse effects on wider estuarine processes
	To prevent ‘contaminated sites’ having an adverse effect on the estuary
To protect and, where appropriate, provide opportunities for economic development and employment (including protection of existing land uses where appropriate)	To protect areas of employment from the adverse effects of flooding
	To provide, where appropriate, a secure environment for economic activity and development
	To minimise adverse effects on high quality agricultural land
To protect existing transport infrastructure (land and sea)	To minimise adverse effects on navigation (e.g. on channels, deepwater docks and beacons etc)
	To minimise adverse impacts on road and rail infrastructure
To protect and, where appropriate, enhance flora and fauna (biodiversity)	To minimise adverse effects on European Site(s) and ensure direct losses are compensated
	To address the adverse effects of ‘coastal squeeze’ on European Site(s)
	To support and, where appropriate, enhance biodiversity, including the delivery of national and local Biological Action Plan (BAP) targets
To protect the historic environment	To minimise adverse effects on undiscovered or buried archaeology
	To protect designated archaeological and historic features within the floodplain
To protect and, where appropriate, enhance landscape, amenity and recreational features	To protect and, where appropriate, enhance the characteristics and local distinctiveness of all landscapes
	To protect and promote, where appropriate, regional and local recreational and amenity features

Foreword

This strategy sets out the Environment Agency's vision for managing the risk of flooding from the Humber Estuary as the climate changes and sea levels rise.

Nearly 400,000 people living near the estuary are at risk, as are key industries, businesses, agriculture and the jobs they provide. Our Humber Strategy shows how we aim to limit the impact on people, property and industry in ways that won't damage the area's landscape character or its historical or wildlife importance. This will help safeguard the growth and prosperity of the Humber's communities and its economy, which are vitally important both to the Yorkshire and Humber and the East Midlands Regions, and to the country as a whole.

Overall, our Humber Strategy will ensure that more than 99 per cent of the people living round the estuary will continue to have a good standard of protection from tidal flooding. To achieve this, we will start a major programme of flood defence improvements this year. There will be losers as well as winners, however, since we will not be able to raise all the estuary's defences in line with sea levels, particularly where they protect only a few people or businesses. In due course any defences not raised are likely to fail and the land behind them to flood. This document identifies where these defences are and how long they're likely to last, so the people affected will have as much warning as possible about the consequences. It also describes what they can do to limit the impacts and what help will be available to them.

Flooding in the area doesn't only come from the estuary, as we know from the impact of the very heavy rain in June and July 2007 and again in January 2008. We can't stop all floods from happening and the water has to go somewhere, so we need to look closely at how we manage them when they do and how to help people take preventative action. We're working with the local authorities, the emergency services and the government to review what happened during the recent floods and will adjust our Humber Strategy in the light of any changes and lessons learned.

It has taken 10 years to develop our Humber Strategy and get it approved by the government. Doing so has involved much hard work from many people, not only the Environment Agency's staff and consultants but also those who have given their time to think and talk about the issues it raises. Our thanks to you all, and in particular to the members of the Steering Group (listed on page 55), who have met regularly since the work started and have been unstinting in their support and guidance.

Jeremy Walker

Chairman, Yorkshire Regional Flood Defence Committee

Robert Caudwell

Chairman, Anglian (Northern) Regional Flood Defence Committee

Tim Farr

Chairman, Severn-Trent Regional Flood Defence Committee

Alkborough flood storage site



Introduction

On the night of 31st January 1953, the most damaging storm surge on record in the North Sea struck, leading to the loss of 300 lives, damaging 24,000 homes and flooding almost 100,000 hectares of land between Yorkshire and the Thames Estuary.

After 1953 the defences along the East Coast were improved and if the same event happened now the flooding wouldn't be as extensive, but would be tremendously damaging. Looking to the future, our climate is changing, causing sea levels to rise and severe storms to happen more often, and our defences are ageing. If they are not improved, they will become less and less effective and in due course they will fail. Furthermore, more of the land behind them has been developed, so more homes and more industry will be affected if it is flooded.

Currently about 90,000 hectares of land around the Humber is at risk of being flooded by a storm surge in the North Sea. This area, shown on the map opposite, contains the homes of about 400,000 people. Most of them are in cities such as Hull and Grimsby, or in smaller towns or villages, and the area also contains major industries, including power stations, refineries and the country's largest port complex, handling 80 million tonnes of cargo each year. Most of the remaining land, over 85 per cent of the total, is farmed and consequently has relatively few people living on it. The whole area has an important history and heritage while the importance of the estuary's wildlife and habitats has led to its designation under the Birds and Habitats Directives, which provides them with legal safeguards under the Conservation (Natural Habitats etc) Regulations 1994, otherwise known as the Habitats Regulations.

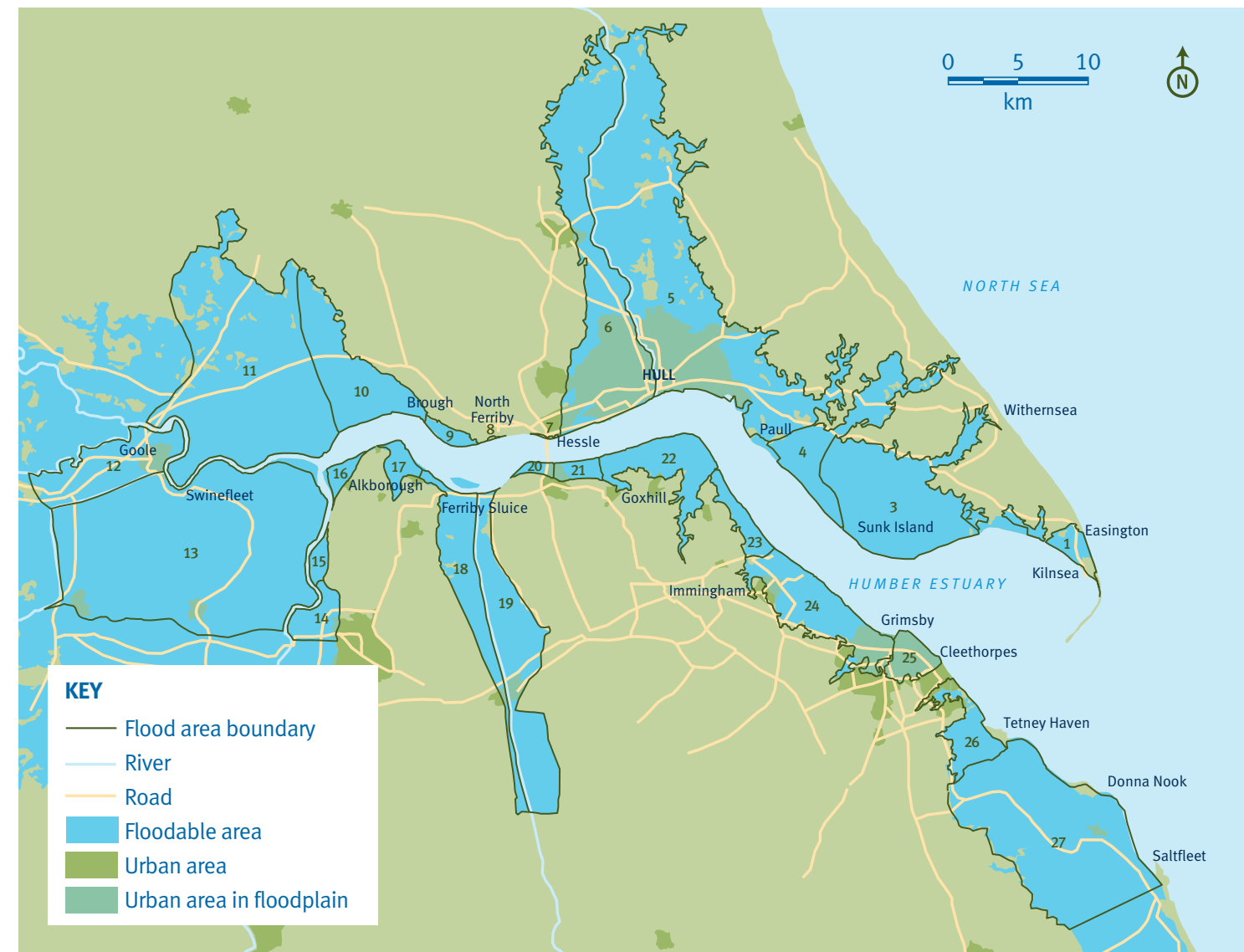
In 1997 we began developing a long-term strategy for managing flood risk around the Humber Estuary and the lower reaches of its main tributaries, the Ouse and the Trent. We published a consultation draft of our

proposals for the next 100 years in August 2005 and received approval for the first 25 years from the Department for Environment, Food and Rural Affairs (Defra) in March 2007. This document sets out the strategy that has resulted. It covers flooding from the estuary and the lower reaches of the Ouse and the Trent only; separate strategies are being developed for flooding from other sources. The first section gives a brief outline of how it was developed and is followed by a summary of the comments we received on the consultation draft and of recent developments in government policy, in particular its 'Making Space for Water' initiative, which is aimed at 'managing the risk from flooding and coastal erosion by employing an integrated portfolio of approaches which reflect both national and local priorities'. These are taken into account in the general description of our Humber Strategy and the summary of what will happen now it has been adopted, given in the third and fourth sections respectively. They are followed by more detailed descriptions of what will happen in different areas beside the estuary.

Although we have based our strategy on the best information we currently have, circumstances can change and better information may become available in the future. We will therefore review it regularly, generally every five years, and will carry out a detailed assessment before taking final decisions about any part of the estuary or its defences. During all reviews and detailed assessments we will consult widely.

If you would like any more information please contact us using the details inside the back cover.

The floodplain of the Humber Estuary



Section 1

How we developed the strategy

Strategy objectives

Our objectives for the Humber Strategy are set out on page 3. They are based on the objectives in our Humber Estuary Shoreline Management Plan (HESMP), published in September 2000, revised to take into account the government's developing policy on managing flood risk.

Drawing up the strategy

The first step in drawing up the strategy was to define the problem; finding out about the people and property at risk in the area; about the defences protecting them; about the way the estuary behaves and how this influences the flooding that can occur; and about the natural and historic environment this flooding might affect. With this information we drew up our overall approach and set it out in the HESMP. We then looked at the implications in more detail, and in particular established what we must do to comply with the Habitats Regulations. This allowed us to draw up a programme of the work needed to maintain the defences for the next 100 years and to look in more detail at the works planned for the first 15 years. From this we produced the consultation draft for the full strategy.

We submitted our proposals to Defra in May 2006 and in March 2007 received approval in principle for the first 25 years at an estimated cost of just under £323 million. The approval drew attention to the changes in government policy that had occurred since the draft strategy was published, in particular through the 'Making Space for Water' programme and the publication of Planning Policy Statement (PPS) 25 'Development and Flood Risk', both of which had been strongly influenced by Foresight 'Future Flooding' report produced in April 2004. These changes are described in the next section and have been taken into account in the current Humber Strategy.

The main studies carried out as the strategy was developed are outlined on page 53 and a full list of reports is given on page 54.

Keeping people informed

Consultation has played an important part in the strategy's development. As well as the consultation draft of the strategy itself, we published two consultation documents while the HESMP was being prepared, and two information documents about the managed realignment of existing defences. We circulated six newsletters before the strategy consultation document was produced and have distributed a further three since then. We have also held meetings throughout the project, either with individual stakeholders or open to the public. At every stage we have invited people to tell us about their concerns and have taken these into account as the strategy has developed.

We established a Steering Group when we began to develop the strategy and this has played a fundamental role ever since. It contains representatives from the key stakeholder organisations listed on page 55 and meets about three times a year to review progress and discuss the issues raised. We have also received advice from the Liaison Panel, a small group of people from outside the Environment Agency chosen for their knowledge of the area and understanding of local issues.



Flood defence at Brough

Section 2

What's happened since the consultation draft

The public's reaction

In August 2005 we issued over 3000 copies of the consultation draft and subsequently held drop-in sessions around the estuary, for members of the public to come and talk about the strategy and the effect it could have on them. The main points raised and how we are addressing them are summarised in the table below.

Points raised	Response
Concern about the coastal defences near Kilnsea.	See page 11.
Too much emphasis placed on 'green' issues, in particular managed realignment. Concern that the strategy is more about protecting birds rather than people.	The strategy includes managed realignment because this is the most cost-effective way of creating the new habitat needed to comply with the Habitats Regulations. If this wasn't included the strategy would not have been approved and none of the work it covers would go ahead.
Standards of protection will fall in some areas, blighting the people who live there and making flood insurance more difficult to obtain. There is no compensation for this.	As explained later in the document, the national flood defence budget is limited, so we can only maintain or improve defences where there is a good business case for doing so. The defences we can't improve will deteriorate and in due course fail, unless others are willing to take on the responsibility of managing them and can obtain the appropriate approvals. Property owners will get no compensation in these circumstances but we will advise them about what they can do to minimise the impacts (see page 20). The availability of flood insurance will depend on individual circumstances, including the resilience of the property at risk.
The role of Environmental Stewardship and related schemes is not properly set out.	The effects of rising sea levels are likely to be felt most in sparsely populated areas, as these are the areas where we may not be able to improve the defences. Many of the people living there are farmers, who may have not only their homes but also their livelihoods at risk if they can't continue working their land as before. Environmental Stewardship and similar schemes can help cushion the change from one type of agriculture to another (see page 21).
Lack of public awareness either about the strategy or about the drop-in sessions and other public meetings.	We will be placing more emphasis on contacts with parish councils and individual households, particularly in the areas likely to be most affected by our proposals. We will use the approaches tried out in our Coastal Futures research project (see page 11).
National policy needs to change from managing flood defences to managing flood risk. Important to work with planners (at regional and local levels) and developers.	This is happening through the government's 'Making Space for Water' initiative, discussed later in this section. We're now working more closely with both regional and local authority planners than before, as discussed in Section 3.

The public's reaction (continued)

Points raised	Response
Need to consider potential as well as current land use (particularly near Immingham), economic importance of ports.	We understand how important the Humber, its ports (with their deepwater access) and the land nearby are, both regionally and nationally. We will work closely with planners and others to make the best use of these assets while following the principle that the developer should pay for any new or improved defences needed for a development to go ahead.
Important to consider impact on health	We are reviewing how the costs of flooding should be calculated and which ones to include when we assess whether a flood defence scheme is worthwhile. The impact on health is one of the issues being addressed.
Doubts that sea levels are rising, concerns about the future of Spurn	The tidal record confirms that sea levels are rising and the latest research confirms that the rate of rise will increase significantly in the future. We too are concerned about the future of Spurn and the pilot and lifeboat facilities there, so we have commissioned, with others, a study to look at the risks and implications.
Importance of maintenance (of defences and drainage arrangements)	We agree it is vitally important that defences and drainage arrangements are properly maintained, provided the resulting benefits due to the reduced flood risk are greater than the cost. We describe in Section 3 how we will do this.
Links with other strategic initiatives	Again, we agree this is very important and describe in Section 3 what we will do about it.
Limited reference to historic environment, sports, recreation	We will look in more detail at these and other site-specific environmental issues through the Environmental Assessment procedures we will follow as normal when developing proposals for specific defences.
Need for Appropriate Assessment	We are preparing an Appropriate Assessment for the Humber Strategy and will produce supplementary assessments for individual schemes as we seek approval for them.

What we have done since 2005

Since we published the consultation draft we have:

- realigned the coastal defence at Kilnsea using funds partly raised by the local residents, as described in the adjacent panel;
- completed repairs to the defences at Saltmarshes, Goole and north of Keadby as set out in the consultation draft;
- realigned the defences at Alkborough to provide flood storage and create 170 hectares of new intertidal habitat, which we expect will allow us to comply with the Habitats Regulations in this part of the estuary for many years, with reedbed and other BAP habitat on the remainder of the site;
- developed our plans for the defence works we said we would carry out in the five years after the strategy had been approved, in particular at Brough; Halton Marshes and Stallingborough near Immingham; Swinefleet; and Donna Nook, where we are planning a managed realignment scheme to create new intertidal habitat to help us comply with the Habitats Regulations in the outer estuary;
- set up the Coastal Futures Humber Community Project with the RSPB, a scheme to support communities experiencing coastal change along the north bank of the estuary (further information can be obtained from the project website at www.coastalfutures.org.uk);
- followed up the issues raised by coastal erosion at Easington, where the coastal lagoons in front of the defences are being threatened, and are looking at the long-term flood risk issues in the area at the same time; and
- reviewed our storm tide forecasting arrangements and installed new flood warning sirens at Grimsby.



Improving the defences at Kilnsea

The consultation draft drew attention to the erosion taking place at Kilnsea (marked on the map on page 23), which was threatening to wash away the coastal defences protecting the village.

While preparing the consultation draft we had carried out a high-level appraisal, which suggested that we would not be able to spend money from the national flood and coastal defence budget on realigning the defences there. When we looked in more detail, however, we concluded that we could carry out the work provided a significant part of the funding was raised by others, since even though no money would be available from the national budget we could make up the balance using money raised locally by the Yorkshire Regional Flood Defence Committee.

The residents formed the Kilnsea and Spurn Flood Defence Group to raise the funds needed and the grants they obtained, together with a contribution from East Riding of Yorkshire Council for infrastructure protection, allowed us to go ahead and complete the work in time for the 2006/07 winter storms. The Group has taken on the responsibility for managing the new defence, which will protect the village for a further 30 years or so.

We have also been developing the strategy itself. In particular we have divided the large management units considered in the consultation document into smaller flood areas, where any flooding that occurs can generally be prevented from spreading to neighbouring areas, so we can assess the issues in more detail. These are shown on the map on page 13 and are listed in the accompanying table together with the references used in the consultation draft.

Although there have been some big storms since the consultation document was published, there has been no serious flooding from the estuary. The extensive flooding in June and July 2007 was caused by extremely heavy rainfall running off land already saturated by earlier rain, and was not affected by conditions in the estuary. We are working with the local authorities, the emergency authorities and the government to review what happened and will adjust the Humber Strategy in the light of any changes to our role as a result. In particular, we are looking at how we can integrate it with the strategy being developed for the River Hull, something Defra mentioned specifically when giving their approval.

Local and regional initiatives

The Yorkshire and Humber Regional Assembly has published its Regional Spatial Strategy, a core component of which is that development should be located so as to secure urban and rural renaissance and to minimise both the need to travel and the development of greenfield sites. It highlights the importance of the Humber ports and the associated industry to the region while recognising our strategy and the need to take flood risk into account when planning future developments. Yorkshire Forward, the Regional Development Agency responsible for promoting economic development in the region, has an extensive programme of urban and rural regeneration and also regards the estuary as a vitally important economic asset.

Regeneration and development proposals have been produced or are being prepared for Hull, Grimsby, the South Humber Bank (near Immingham), Goole and Scunthorpe. The four local authorities around the estuary are all preparing or have produced Strategic Flood Risk Assessments to help them plan development in their areas. We are taking a stronger role in assessing proposals and recommending rejection for those that don't take flood risk into account properly.



Grey seal pup at Donna Nook

Flood area boundaries

Flood area ref.	Flood area name	Ref. used in consult. doc.
1	Kilnsea and Easington	1/1
2	Skeffling	1/2
3	Sunk Island	1/3
4	Stone Creek to Paull Holme	1/4
5	Hull East	2/1
6	Hull West	2/2
7	Hessle	2/3
8	North Ferriby	2/4
9	Brough	3/1
10	Brough Haven to Weighton Lock	3/2
11	Faxfleet to Saltmarshe	4a/1
12	Goole	4b/1
13	Goole Fields and Crowle	4c&d/1
14	Gunness to Flixborough	4e/1
15	Flixborough Grange	4e/2
16	Alkborough Flats	4e/3
17	Whitton to Winteringham	5/1
18	Winteringham Ings	5/2
19	South Ferriby	5/3
20	Barton Cliff to Barton Haven	6/1
21	Barton Haven to Barrow Haven	6/2
22	Barrow Haven to East Halton Skitter	6/3
23	Halton and Killingholme Marshes	7/1
24	Immingham to R Freshney	7/2
25	East Grimsby	7/3
26	Cleethorpes and Humberston	8/1
27	Tetney to Saltfleet Haven	8/2



National guidance and government policy

In October 2006 the government issued new guidance on the likely effects of climate change, taking into account the latest output from the UK Climate Impacts Programme (UKCIP). This was incorporated in the Planning Policy Statement (PPS) 25, Development and Flood Risk, which was published in December 2006 to replace PPG 25 (published in 2001). PPS 25 confirms our role as the lead authority with regard to flood risk and flood defences, a role that is further strengthened by the government's 'Making Space for Water' initiative. We are now responsible for putting into practice the policies emerging from this initiative and have been working closely with Defra to determine what changes are needed to do this.

These changes will affect how we manage our defences in the future. In the past we have generally carried out routine maintenance (such as grass-cutting and minor repairs) each year and, when a defence's condition or standard is no longer acceptable, undertaken an improvement scheme. Each scheme has gone through a rigorous assessment process, comparing whole life costs and benefits, to determine whether it's worthwhile. Schemes passing this test have been funded through the national flood and coastal defence budget. Although this process will remain much the same as before, the policy changes will affect the way schemes are funded, how they are delivered and what happens if the costs of continuing to maintain a defence are greater than the potential benefits. The changes are summarised below while their effect on the strategy is discussed in the next section.

Changes in national guidance and policy

(a) New guidance on climate change

The rate of sea level rise is now expected to be slower over the next 20 years than assumed before, but to get much faster after that. The implications are that in 50 years from now sea levels will be about 350 mm (slightly more than one foot) higher than they are now while in 100 years they will be more than one metre (over three feet) higher. New figures are also given for increases in peak rainfall intensity and river flow, and for extreme offshore wind speed and wave heights. The estimates are continually being reviewed as our understanding of climate change improves and the guidance will be updated regularly to reflect this. Further information can be obtained from Defra's website at www.defra.gov.uk/environ/fcd

(b) PPS 25, Development and flood risk

PPS 25 aims to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding and to direct any development away from areas at highest risk. Where, exceptionally, new development is necessary in such areas PPS 25 aims to make it safe without increasing flood risk elsewhere and, where possible, reducing flood risk overall. It emphasises that flood risk assessments should be carried out at all levels of the planning process, sets out the minimum requirements for them and confirms the Environment Agency's role as a statutory consultation body for all issues concerning flood risk and its management, including all applications for development in flood risk areas. Further information can be obtained from the Communities and Local Government website at www.communities.gov.uk/planningandbuilding/planning

(c) Affordability and spending priorities

The national flood and coastal defence budget (the amount of money the government provides for spending on the country's defences each year) is not enough to keep all our defences in good order. In view of this we now rank all the proposed defence schemes across the country on the basis of their value for money, the number of houses they protect and their impact on the environment, and direct the budget we have towards the ones at the top of the list as they have the highest priority. Any scheme falling below the point where the budget runs out won't be funded that year although it will remain on the list and be re-considered next time. If it has a very low priority, however, the chances are against it ever getting near the top so the work may never be carried out. Further information can be obtained by following the links under 'Grant Aid' on Defra's website at www.defra.gov.uk/environ/fcd

(d) National policy on withdrawing maintenance

Our national policy on managing uneconomic defences is described in 'Information for Owners and Occupiers of Land Adjacent to Sea Defences in England'. We will withdraw maintenance from a defence if the whole life cost of continuing to maintain it is greater than the value of the property it protects (i.e. it is an uneconomic defence), and there are no other reasons for carrying on. We will give property owners reasonable notice of our intentions, generally between six months and two years but possibly longer in special circumstances, and will continue routine maintenance during the notice period. We will not repair the defence if it is damaged, for example during a storm. No financial compensation will be payable as a result of our decision to withdraw but we will do our best to make

Changes in national guidance and policy (continued)

sure all those affected are aware of the implications and what they can do in the circumstances. This could range from taking over and maintaining the defences themselves to making their property more flood-resilient, so it is easier to recover from a flood. Further information can be obtained by searching for 'sea defences' on our website at www.environment-agency.gov.uk/

(e) Contributions from developers and major beneficiaries

PPS 25 makes it clear that all developers should take flood risk into account when making their decisions and, in particular, should expect to pay the full cost of any new works needed to protect their development. Other proposals, which could

involve seeking contributions that reflect the protection that developers and major beneficiaries receive from existing defences, are also being considered and policy guidance is being prepared.

(f) Delivery arrangements

We are keen to work with the government and others to explore different ways of delivering flood risk management that could lead to savings in time and money. In particular we will examine whether the private sector can be involved through public-private partnerships or similar private finance initiatives (known collectively as PPP/PFI arrangements), as have been used for other large infrastructure projects such as roads and hospitals.



Section 3

The Humber Strategy

Overall approach

We have adapted our overall approach to managing flood risk around the Humber to take the changes described earlier into account. A summary of our Humber Strategy is given below and is followed by more information about its main features.

1	<p>We will manage flood risk round the estuary to protect people and property by:</p> <ul style="list-style-type: none"> – continuing to maintain existing defences where this is sustainable; – identifying potentially unsuitable development in the floodplain; – providing targeted and timely flood warnings.
2	<p>We will withdraw maintenance from defences that are uneconomic but will examine other ways of protecting people and property where this happens, including:</p> <ul style="list-style-type: none"> – building secondary lines of defence; – advising people on how to prepare for flooding.
3	<p>We will move defences where doing so will:</p> <ul style="list-style-type: none"> – provide flood storage to help manage water levels during serious floods and so benefit others; – allow us to stop maintaining defences that are uneconomic; – replace inter-tidal habitat lost because of the strategy.

Much of the August 2005 consultation draft was concerned with managing the estuary’s flood defences. While this remains a key part of our strategy, the overall aim is to manage flood risk within the floodplain. Accordingly we will also help prevent unsuitable development in the floodplain, taking on the role set out for us in PPS25, and help limit the amount of damage caused when a flood does occur, by issuing warnings and advising people on how to prepare for it.

Managing the defences

The strategy sets the direction for managing the estuary’s defences but does not make the final decision about specific defence lengths. We will continue to maintain the estuary’s defences where this is sustainable, taking technical, economic, environmental and social issues into account, and will start a major programme of improvements this year. We will look at potentially more efficient ways of doing this, such as through a PPP/PFI arrangement. Where these are not suitable we will continue with our current practice of assessing a full range of options and the likelihood of getting funds from the national budget when a defence needs to be improved. If at any time we cannot get the funds to improve a defence that could fail very soon, we will stop maintaining it. The areas most likely to be affected as a result are shown on the map on page 23. More details about our approach to managing the defences are given at the end of this section.

Links with the planning system

We are building links with planners at both regional and local levels, to make sure that flood risk is taken fully into account as their plans are drawn up. We have contributed to the recently published Regional Spatial and Economic Strategies for Yorkshire and the Humber and will work with Yorkshire Forward on any initiatives that may affect the estuary. We are also liaising with local planning authorities about the Local Development Frameworks and the supporting Strategic Flood Risk Assessments they are required to produce.

Controlling development on the floodplain

We are working with the local planning authorities to make sure that applications for development in the floodplain take flood risk issues into account, as required by PPS 25, and are accompanied by a Flood Risk Assessment demonstrating this and identifying any measures proposed to deal with the problem. We will provide advice to those proposing developments and undertaking assessments and, where appropriate, will review the applications when submitted. While doing this we will pay particular attention to proposals in areas where we may withdraw maintenance from the defences in the future or that have already been identified as suitable for creating the new inter-tidal habitat we will need to comply with the Habitats Regulations. Further

information can be obtained by following the links to ‘Policy’ and ‘Planning’ on our website at www.environment-agency.gov.uk/aboutus

Responding to emergencies

We will continue to work closely with the emergency services during and after an extreme event, so we can bring our knowledge of the area to help manage flood flows, dispose of flood water and clear up afterwards. We have reviewed the flood warning arrangements around the estuary and will work on making them consistent and updating them as forecasting capabilities improve. We can give detailed advice about how to make buildings and their contents more resistant to flooding and more resilient in coping with flood incidents, and we are supporting government research into providing grants for doing this. Further information is given at the end of this section.

Planning where the water goes

An important aspect of managing flood risk is directing floodwaters when and where they occur so as to minimise the damage that occurs. We will not be able to raise the estuary’s defences enough to prevent all flooding in the future, so we will look carefully at where they are likely to be overtopped first and where the water will go when this happens. When we improve the defences we will do it so that if any overtopping does occur, it will be where we can manage it most easily. We will look at the implications of this flooding, identifying the property and infrastructure most at risk, reviewing our flood warning arrangements and discussing the need for additional controls on development with the local planning authorities.

Providing flood storage

If any defences in the areas 10 to 17 shown on the map on page 23 are overtopped during an extreme event, the water stored on the floodplain will result in lower river levels. When we assess options for raising defences upstream of the Humber Bridge we will take this effect into account. We will also look in more detail at the two sites we previously identified as possible flood storage schemes, also shown on the map, to determine whether we can make a good case for building them.

Complying with the Habitats Regulations

We will meet our obligations under the Habitats Regulations by creating new inter-tidal habitat to replace the losses caused by the strategy, as set out in our Coastal Habitat Management Plan. We will do this by acquiring land where we can move the defences back when new habitat is needed in that part of the estuary.

We have already identified some sites for this purpose, shown on the map on page 23 and listed in the table below with an indication of the dates they are likely to be built. These dates are based on our current predictions of the losses that will occur and assume that no other defences fail or are re-aligned. If they do, either because we stop maintaining them or for any other reason, we will adjust the predictions taking into account any impact on the area of suitable inter-tidal habitat in the estuary. We are very willing to consider other sites as well, and any landowner who might be interested in making their land available should get in contact with us using the details given inside the back cover.

Site for creating new inter-tidal habitat	Likely completion date*
Paul Holme Strays	Completed in 2003
Alkborough	Completed in 2006
Donna Nook	2010
Skeffling	Between 2010 and 2020
Welwick	After 2020
Keyingham	After 2030
Goxhill	Medium to long term

* Actual completion dates will depend on actual habitat losses

Supporting the environment

We will continue to monitor the environmental and social impacts of our strategy and to prepare all the assessments necessary to get the planning and other approvals needed to carry out our proposals. We will work to conserve and enhance both the natural environment, including the habitats behind the defences as well as those in front of them, and the historic environment (known and still buried). We will take account of the impact our work will have on the landscape and its character and will look for opportunities to improve the area’s amenity and recreational facilities, including access to the coast.

Paying for the work

Initially we expect the bulk of the funding that will be needed to come from the national flood and coastal defence budget. We know this is limited, however, and will become increasingly difficult to obtain as the effects of climate change cause the demand from other parts of the country to increase. We will therefore look for funding from other sources and in particular will seek contributions to new defence works from major beneficiaries and developers, liaising with local and regional planners as appropriate.

Links with other strategies

We will continue to keep in touch with the strategies and other plans, including Catchment Flood Management Plans, being developed for the rivers discharging into the Humber; the Ouse, Don, Aire, Trent, Ancholme, Freshney and the Hull. We will work particularly closely with the River Hull team as the flood risk in much of Hull City is strongly affected by a combination of events in the river and the estuary. We will also work closely with those responsible for land drainage to ensure that the impacts of changing sea levels and sedimentation patterns in the estuary are taken into account. In addition, we will work closely with the team reviewing the Humber Estuary Coastal Authorities Group (HECAG) Shoreline Management Plan (SMP) covering the coastline between Flamborough Head and Gibraltar Point including the outer estuary. The conclusions arrived at within the Humber Strategy may also be adopted within the SMP in the area where the strategies overlap (see map on page 23). This team will review our decisions for these frontages to confirm they are appropriate in the broader coastal context.

Reviewing progress

We inspect the defences regularly and draw up our annual maintenance plans on the basis of these inspections. We will continue to do this and will also continue to monitor the estuary, recording in particular the area of inter-tidal habitat to show we are complying with the Habitats Regulations and the data needed to confirm our understanding of how the estuary behaves. The results will be used when we

review our strategy, which will be at intervals of about five years. We are currently producing a 'State of the Estuary' report, which will describe its condition and the changes that are taking place, and will produce another one in time for the next review. Every 15 years or so we will carry out a detailed review of the scientific studies that underpin our strategy, making full use of any improvements in estuary and flood modelling and forecasting techniques as well as any new data.

Preparing for what's coming

We are the competent authority for implementing the Water Framework Directive in England and Wales, which requires all inland and coastal waters within the European Community to reach 'good status' by 2015. We will also be involved in implementing the Floods Directive, which is likely to come into effect within the next two years. The government's policy on flooding and flood risk management will develop as 'Making Space for Water' is put in place. We will follow all these initiatives to make sure our strategy takes them fully into account. Further information can be obtained by following the links at the following websites:

Water Framework Directive
www.environment-agency.gov.uk/subjects/waterquality

Floods Directive
www.defra.gov.uk/enviro/fcd/eufldir

Paull Holme Strays



Talking to others

We want to strengthen the links between our strategy and the community. We have a number of advisory groups with external representatives to review different aspects of our work and make sure our Humber Strategy continues to serve the needs of the country and the community. The key ones are listed on page 55 and further information about them can be obtained from the contact details given inside the back cover of this document. We will continue to keep in close contact with the local authorities around the estuary (East Riding of Yorkshire Council, Kingston upon Hull City Council, North Lincolnshire Council (North East), East Lindsey District Council) and, following the example of our Coastal Futures research project, will

also aim to work more closely with the Town and Parish Councils and to make direct contact with people who might be unfavourably affected by our strategy. These will include, for example, people living where we are planning to work on the defences, where we would like to create new inter-tidal habitat or where we may stop maintaining the defences. Some of the issues that might affect these people are summarised at the end of this section.

We are also keen to work with any others who think our Humber Strategy might affect them. In particular we would encourage any developers who are proposing to build in places where there might be a risk of flooding from the estuary, or from any other source, to get in touch with us as early as they can. Our contact details are given inside the back cover.

Our approach to managing the defences

(a) General

We will continue carrying out routine maintenance to all the defences around the estuary for which we are responsible and where it is economically worthwhile. We will improve the defences as set out in the strategy programme subject to the review arrangements described below and the availability of funding from the national flood and coastal defence budget. We will review the standard and condition of defences for which we are not responsible and if they are below the required standard will seek to get them improved.

(b) Improving defences

Before we improve any defences we will carry out a detailed assessment of the case for doing so, considering a wide range of options and taking technical, social, environmental and economic issues into account. If this confirms that funding is likely to be available we will carry on to design the works, obtain the appropriate approvals and build them when the funding comes through. If it is not, we are likely to withdraw maintenance in the future so will start the withdrawal process described below.

(c) Withdrawing maintenance

We have looked at all the flood areas and identified those where, on the basis of the information currently available, we think we could have difficulty funding improvement work. If so, the risk of these defences failing will increase and, when it gets very high, we will generally stop maintaining them. At the appropriate stage we will write to all property owners in these flood areas, advising them about when we are likely to do this and the possible consequences. We will issue formal notice of our intentions to withdraw maintenance in accordance with our national policy for uneconomic sea defences,

although we will aim to provide up to five years notice where we can rather than between six months and two years as it states. Before giving notice we will assess the case for building secondary defences or cross-banks to protect part of the area and talk to property owners about what they can do to help themselves. Information about some of the options is given on the next page.

(d) Maintaining third party defences

We will tell everyone who owns or maintains a defence that their property is part of the protection system. We will check the condition of these defences to confirm they are safe and provide a suitable standard of protection. If they are not adequate, we will tell the owners and, if possible, agree what improvements they will make. If this is not possible we will take whatever steps we think are needed to make the risk of flooding acceptable and may take action to recover the costs.

(e) Repairing failed defences

The advisory letters about withdrawing maintenance from a flood area will set out what we will do if the defences deteriorate or fail earlier than expected. If this happens when we have not already sent a letter, we will carry out temporary repairs to make the defence safe, review the case for making permanent repairs and confirm that funding is likely to be available. If it is, we will carry on to design and build the work as quickly as we can. If it is not, we will issue formal notice of our intention to withdraw, setting out a timetable and describing the process we will go through. This will include looking at the possibility of building secondary defences or cross-banks to protect part of the area and talking to property owners about how they can help themselves.

Information for property owners

The key issues affecting the owners of property in the estuary floodplain and the main ways they can manage flood risk are reviewed below. The information is particularly relevant where we may withdraw from maintaining the defences in the future.

(a) Risk of flooding

All the areas shown in the map on page 13 are at risk of being flooded. The frequency and depth of flooding at a property depends on its level and location; the severity of the event; whether the area has any flood defences; and, if so, on their condition, standard and future management. Both the frequency and the depth of flooding will increase in the future as sea levels rise. More information about each area can be obtained from the descriptions following the next section or by contacting us using the details given inside the back cover.

(b) Flood warning arrangements

We fund a national Storm Tide Warning System that uses information from the Meteorological Office to predict when a combination of high tides and storm surges might cause tidal flood conditions around the UK coastline. The results are fed into our Floodline Warnings Direct service, which is free to join and is available to everyone living in a flood risk area. It can be accessed by calling 0845 9881188 or if a warning is in place for your area, you can arrange to have flood warnings telephoned to you automatically. More information can be obtained from our website at www.environment-agency.gov.uk/subjects/flood/floodwarning

(c) Availability of flood insurance

Insurance companies look at the risk of flooding at the property being insured rather than at the standard of protection provided by the defences. They also consider the amount of damage likely to be caused if a flood does occur, so will take into account any flood resistance or resilience measures that have been installed. Property owners will therefore need to find out from their insurance company whether a new policy for their property is likely to be issued or an existing one renewed. The insurance industry has, however, agreed with the government to continue to renew existing policies where flood defences providing at least a 1.3 per cent standard of protection (one in 75 years) or better are in place or planned to be built within the next five years. Further information can be obtained by following the links on the Defra website at www.defra.gov.uk/enviro/fcd

(d) Developing or selling property

The Local Planning Authority is responsible for approving any applications to develop a property, although we advise each authority about the flood risk associated with an application. In doing this we will take into account the nature of the proposed development, the standard and condition of the defences and how we expect to manage them in the future. Inevitably the value of any property will be affected by the risk of it being flooded.

(e) Standard of defence

The standard of a defence indicates the severity of the event it will protect against, so a defence with a 20 per cent standard will protect against all events with a 20 per cent chance or more of happening each year (i.e. likely to occur once or more every five years on average). If a more severe event occurs the structure will be overtopped and is likely to fail, flooding the area behind. A defence's standard will fall as sea levels rise unless it is raised or other improvements are carried out.

(f) Consequences of withdrawing maintenance

If a defence is not improved the likelihood of it failing will increase with time and will accelerate once maintenance is withdrawn. If anyone else wishes to carry on maintaining it we will not object provided they comply with the Habitats Regulations and obtain all the other approvals necessary. If this doesn't happen and the defence fails, the risk of any property in the area behind it being flooded will increase significantly and may make it difficult to continue living there. Installing flood resistance or resilience measures might delay the need to leave some properties but will not be suitable for all cases. The areas that may be affected in this way are shown in the map on page 23.

(g) Flood resistance and flood resilience measures

Flood resistance measures are aimed at preventing water getting into a property and include such things as flood boards (installed in doorways or to close off airbricks), plastic skirts surrounding a property, permanent earth bunds and free-standing flood barriers. Their suitability depends on a wide range of factors, such as ground level and emergency access, and so needs to be assessed for each property individually. Flood resilience measures do not prevent water from entering a property but limit the damage caused when it does. They include such things as having solid tiled floors rather than carpets at ground level, raising electrical sockets and circuits above flood level, using water-proof rather than conventional plaster, plans for

Information for property owners (continued)

moving furniture and similar items upstairs. Again, their suitability needs to be assessed for each property individually. Further information can be obtained by following the link to 'Prepare for flooding' on our website at www.environment-agency.gov.uk/subjects/flood

(h) Changing land use

If the flood risk increases it may no longer be possible to continue the current land use. Environmental Stewardship and similar schemes

can help cushion the change from one type of agriculture to another. Further information can be obtained by following the link to 'Grants and funding' on Natural England's website at www.naturalengland.org.uk/planning/. We may be interested in buying land that can be used to create the new inter-tidal habitat we will need to comply with the Habitats Directive. Further information can be obtained by contacting us using the details inside the back cover.



Flood defences at Goole

Section 4

What happens next?

Summary of programme and issues

Some important features of each flood area covered by the strategy are listed in the table overleaf together with an indication of when we expect its defences will need to be improved. The table also identifies the areas where:

- there may be habitat creation or flood storage opportunities;
- some of the defences are managed by others;
- it may be difficult to obtain funding to improve the defences;
- we may stop maintaining the defences in the future.

Further information about individual flood areas is given in the next section.

Work in the next five years

Over the next five years we are planning to improve the defences at four sites around the estuary, review the need for improvements at a further site, create about 140 hectares of new inter-tidal habitat and sustain an internationally important conservation site, as detailed in the table below. We have already begun contacting the people who will be affected by three of these schemes (at Brough, Swinefleet and Donna Nook) and will contact those affected by the others in due course.

Flood Area	Location	Work planned
1	The Lagoons, Easington	Re-create features and habitats being lost due to coastal erosion.
5	Paull Village	Review risk of waves overtopping sea wall and flooding adjacent properties, carrying out improvements if necessary.
9	Brough (BAe Works)	Improve standard of protection to houses in Brough and to BAe works; withdraw from uneconomic defences.
13	Swinefleet	Improve standard of protection to houses in Swinefleet; prevent erosion from undermining defences.
23	Halton Marshes	Prevent erosion from undermining defences; withdraw from uneconomic defences.
24	Stallingborough	Prevent erosion and channel movements from undermining defences.
27	Donna Nook	Create about 140 ha of new inter-tidal habitat; build new defences behind the area.

Work in later years

We will soon begin preparing for the works that we expect will be needed in 10 to 15 years, in particular at Hull, Grimsby and near Immingham where the risks are high, some of the defences are managed by third parties and there are major development issues. We will work closely with those who manage the defences to make sure the improvements needed are carried out and with the local and regional authorities to confirm that all development plans take flood risk into account.

Creating new inter-tidal habitat

We have already started acquiring the land we will need to develop our proposed habitat creation site at Skeffling and are in discussion about the land we will need for the site at Welwick. We will continue this process and are interested in any land that might be suitable for creating inter-tidal habitat in the areas where we will need it (marked in green on the table on page 25), or that could be exchanged for land that is suitable. Any landowner who might be interested in making their land available should contact us using the details inside the back cover.

Habitat creation, flood storage and potential withdrawal of maintenance



Opportunities for flood storage

We are beginning to look at the opportunities for managing flooding in Flood Area 13, which lies between the Trent and the Ouse, and in due course will do the same for areas 10 to 17. We will look at the potential gains to be made from leaving some lengths of defence lower than others so that they would overtop first, and then managing the flooding that would result. In doing this we will take into account any reduction in damage elsewhere because of the lower river levels (caused by losing the floodwater from the river). We will also review the potential benefits of the proposed flood storage schemes at Sandhall and Flixborough Grange and assess whether they are economically worthwhile. Once we have examined these opportunities and considered how any proposals might be implemented we will contact the people who may be affected by our findings.

Withdrawing maintenance

We have looked at whether we might have difficulty funding the improvements needed to make it worthwhile continuing to maintain the defences where there are only a small number of houses at risk and few other assets. We will write to the property owners in the flood areas marked in pink on the map above and listed in the table overleaf, advising them that they might be affected. The way we will manage this process is described on page 19. At this stage we expect that very few, if any, properties are likely to be affected in the next 10 years, about 800 in the following 10 years and a further 1000 subsequently, although we anticipate being able to protect a significant proportion of them by building secondary defences.

Management Proposals

Key

Habitat creation opportunities (managed realignment)

No suitable land or not needed in this area (unmarked)

Possible if land available ✓

Site already included in Strategy programme ✓

Flood storage opportunities

No suitable land or not needed in this area (unmarked)

Possibly suitable ✓

Probably suitable (includes existing proposals) ✓

Responsibility for managing defences

All defences managed by Environment Agency

Some defences managed by others

Most defences managed by others

All defences managed by others

Other economic assets in flood cell

Limited value (e.g. agricultural land only)

Important value (e.g. major infrastructure etc)

Primary value (e.g. key industrial facilities etc)

Case for improving defences

Probably not difficult to make

Possibly difficult to make

Probably difficult to make

Withdrawal warnings (EA defences only)

Environment Agency will not issue warnings None

Warnings may be issued in more than 20 years > 20

Warnings may be issued in 10 to 20 years 10-20

Warnings may be issued in less than 10 years < 10

N.B. Uncertainty about rate of sea level rise means timings are approximate

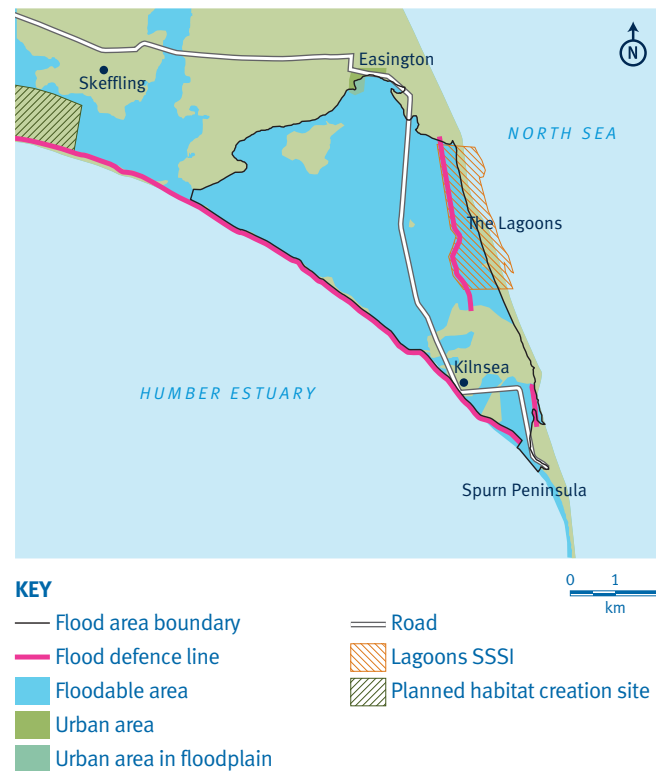
Notes: *No EA defences, so no withdrawal warning. #Further study may show building secondary defences to protect some groups of properties is economically worthwhile. †Although all the defences will continue to be maintained, some of them are likely to be raised earlier and to a higher standard than others.

Flood cell	Name	Area (ha)	Length of defences (km)	Estimated residual life (years)	Works needed in years			Habitat creation	Flood storage	Currently managed by	Residential properties (No)	Other economic assets	Case for improving defences	Withdrawal warnings may be issued	Number of properties affected
					1-5	5-15	15-25								
1a	Kilnsea (Spurn Road)	97	2.0 (coast)	10-20						9		•••	10-20 yrs	9	
1b	Kilnsea (Kilnsea Village)	17	5.3 (estuary)	< 10						14		•••	None*	14	
1c	Kilnsea (Easington)	567		10-20	✓		✓	✓		53		•••	10-20 yrs#	53	
2	Skeffling	411	4.8	10-20		✓		✓✓		10		•••	10-20 yrs#	10	
3	Sunk Island	6,812	11.8	10-20		✓	✓	✓✓		668		••	10-20 yrs#	668	
4	Stone Creek to Paull Holme	3,300	11.5	10-20				✓✓		195		••	None*	195	
5a	Hull East (Paull Village)	2,613	13.2	< 10	✓					5,728	■	•	None		
5b	Hull East (Victoria Dock Village)	12,355		10-20		✓				51,356	■	•	None		
6	Hull West	9,471	8.4	10-20		✓				79,974	■	•	None		
7	Hessle	35	2.4	< 5	✓					24		•••	None*	24	
8	North Ferriby	32	3.2	> 20			✓			28		••	> 20 yrs#	28	
9a	Brough (East)	389	6.1	< 10	✓					0		•••	< 10 yrs	0	
9b	Brough (West)			< 10	✓					483	■	•	None		
10	Brough Haven to Weighton Lock	4,259	6.5	< 10			✓		✓	697	■	•	None		
11a	Saltmarshe (Blacktoft to Yokefleet)	14,143	24.4	10-20		✓			✓	2,821	■	•†	None		
11b	Saltmarshe (Sandhall)			> 20		✓	✓		✓		■	•	None		
12	Goole	3,380	8.6	> 20						9,960	■	•	None		
13a	Goole Fields (Swinefleet)			< 10	✓				✓			•†	None		
13b	Goole Fields (Swinefleet to Reedness)	19,626	28.7	10-20		✓			✓	10,654		•†	None		
13c	Crowle (Amcotts to Keadby)			> 20			✓		✓			•	None		
14	Gunness to Flixborough	1,070	5.9	10-20		✓			✓	2,649	■	•	None		
15	Flixborough Grange	365	6.3	> 20					✓	7		•••	> 20 yrs#	7	
16	Alkborough Flats	427	6.4	> 20				✓	✓	Scheme completed in 2006		•	None		
17	Whitton to Winteringham	636	4.6	10-20			✓		✓	59		•••	10-20 yrs#	59	
18	Winteringham Ings	4,760	4.5	< 10		✓	✓			536	■	•	None		
19	South Ferriby	6,170	3.2	> 20			✓			1,107	■	•	None		
20a	Barton Cliff to Barton Haven (West)	206	2.9	> 20						10		••	> 20 yrs#	10	
20b	Barton Cliff to Barton Haven (East)									429		•	None		
21	Barton Haven to Barrow Haven	442	3.3	> 20			✓			958	■	•	None		
22	Barrow Haven to East Halton Skitter	2,551	10.5	> 20			✓	✓✓		634		••	> 20 yrs#	634	
23a	Halton Marshes	876	7.3	< 10	✓	✓	✓			0		•••	< 10 yrs	0	
23b	Killingholme Marshes			< 10		✓	✓			26	■	•	None		
24	Immingham to River Freshney	3,613	12.6	< 10	✓	✓	✓			11,687	■	•	None		
25	East Grimsby	802	3.9	10-20		✓				18,909	■	•	None		
26	Cleethorpes and Humberston	1,669	9.2	> 20			✓			2,243	■	•	None		
27	Tetney to Saltfleet Haven	13,138	17.4	> 20	✓	✓	✓	✓✓		2,928	■	•	None		

Section 5 Proposals for each flood area

Flood area 1 – Easington and Kilnsea

Key information	
Size of flood area	681 ha
Number of properties in floodplain	76
Area of agricultural land	597 ha
Length of defences (a) sea	2.0 km
(b) estuary	5.3 km
Current standard of protection	Varies, minimum 20% (1 in 5)
Remaining life of defence	Varies, generally 10 to 40 years
Defences managed by	Environment Agency, apart from new sea defences at Kilnsea which are managed by the villagers



About 25 of the properties at risk are in Kilnsea but most of the rest are in Easington, at the edge of the floodplain. The area is used almost entirely for agriculture but contains important wildlife habitats, particularly at Spurn and The Lagoons. The habitats at The Lagoons are threatened by erosion, which is causing the coastline to retreat by two to three metres each year on average. Spurn Peninsula is a Heritage Coast site and the estuary's main pilotage and lifeboat facilities are at Spurn Head.

Existing flood defences

The area is protected by two sets of defences, beside the estuary and the sea. The sea defences are threatened by the retreating coastline; those protecting Kilnsea have recently been replaced and are expected to last for between 20 and 30 years before the retreating coastline reaches them, while those protecting Easington are expected to last for between 30 and 40 years. The estuary defences are expected to need minor repairs every few years and major improvement in about 20 years.

Proposed management approach

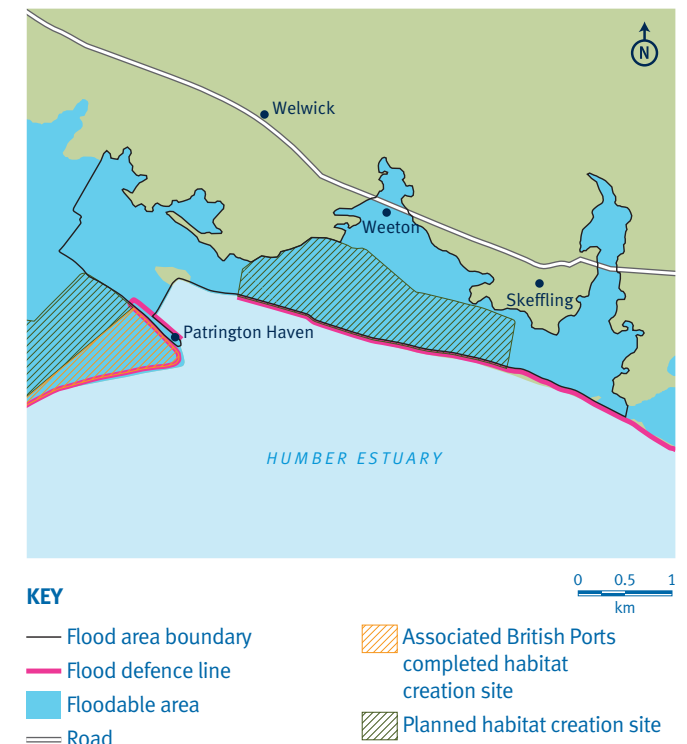
At present we are continuing to maintain the defences and are looking at how to provide replacement habitat

for The Lagoons. In the future we will not maintain the new flood defence embankment built near to the sea at Kilnsea. We are continuing to maintain the other defences. Uncertainty about the rate at which sea levels will rise and the defences deteriorate means we cannot say exactly when this might happen but currently we expect it to be in between 10 and 20 years. We will re-assess the situation each time we review the strategy and tell all property owners in the area about the outcome.

Although we may not be able to carry on maintaining the defences, others may wish to. Provided they can comply with the Habitats Regulations and obtain the approvals needed, we will provide all the advice and information we can to help them. If not, we will look at building a secondary bank to protect properties in Easington. Without further study we cannot confirm this will be possible or say exactly where the bank might be located. The owners of any property not protected may wish to consider other options, which in some cases might include flood-proofing individual houses. Again we will provide all the advice and information we can.

Flood area 2 – Skeffling

Key information	
Size of flood area	411 ha
Number of properties in floodplain	10
Area of agricultural land	403 ha
Length of defences	4.8 km
Current standard of protection	Varies, generally about 5% (1 in 20) but 50% (1 in 2) locally
Remaining life of defence	Varies, generally 10 to 20 years
Defences managed by	Environment Agency



Most of the properties at risk are in Weeton (at the edge of the floodplain), there are none in Skeffling itself. The area contains farms and high-grade agricultural land and is drained to the estuary, either by gravity or by being pumped. A large part of the area has been identified as suitable for creating the new inter-tidal habitat we will need to replace the losses caused by our flood defence improvements and sea level rise. We have already bought some of the land and plan to buy more so we can develop the site between 2010 and 2020.

Existing flood defences

The defences are generally in good condition. They are expected to need minor repairs every few years and major improvement in about 20 years.

Proposed management approach

At present we are continuing to maintain the existing defences. However, in the future the relatively small number of properties at risk means that we could find it difficult to justify spending public money on the existing defences and so may have to withdraw from them. Uncertainty about the rate at which sea levels will rise and the defences deteriorate means we cannot say exactly when this might happen but currently expect it to be in between 10 and 20 years. We will re-assess the situation each time we review the strategy and tell all property owners in the area about the outcome.

Withdrawing from the existing defences will not affect properties behind the habitat creation site, as this will include new defences to protect them. The defences either side of the site will not be improved, however, so once we withdraw they will deteriorate and in due course fail. Although we may not be able to carry on maintaining the existing defences, others may wish to. Provided they comply with the Habitats Regulations and can obtain the approvals needed, we will provide all the advice and information we can to help them. The owners of any property not protected may wish to consider other options, which in some cases could include flood-proofing individual houses. Again we will provide all the advice and information we can.

Flood area 3 – Sunk Island (Winestead Drain to Stone Creek)

Key information	
Size of flood area	6812 ha
Number of properties in floodplain	668
Area of agricultural land	6733 ha
Length of defences	11.8 km
Current standard of protection	Varies, generally about 10% (1 in 10) or better but 50% (1 in 2) locally
Remaining life of defence	Varies, generally 10 to 20 years
Defences managed by	Mostly Crown Estate but also Associated British Ports, Environment Agency



Most of the properties are at the edge of the floodplain, in the villages of Keyingham, Ottringham, Pattrington or Pattrington Haven. It contains scattered farms and high-grade agricultural land. The land is drained to the estuary by a system of ditches leading either to the Winestead Drain (which is pumped) or to Keyingham Drain (which flows by gravity). Although this and the neighbouring area of Stone Creek to Paull Holme Strays (Flood Area 4) are separated by Keyingham Drain, flooding in one can affect the other. Therefore the two areas should be considered together.

Associated British Ports has created a new inter-tidal habitat at a site near Welwick to compensate for losses due to their development at Immingham. We have identified land behind this site for creating the inter-tidal habitat we will need to replace the losses caused by our flood defence improvements and sea level rise. We plan to develop it after 2020.

Existing flood defences

Some work is needed to protect the defences against erosion and this will probably need to be repeated every few years. Major improvements are likely to be needed in 20 to 30 years.

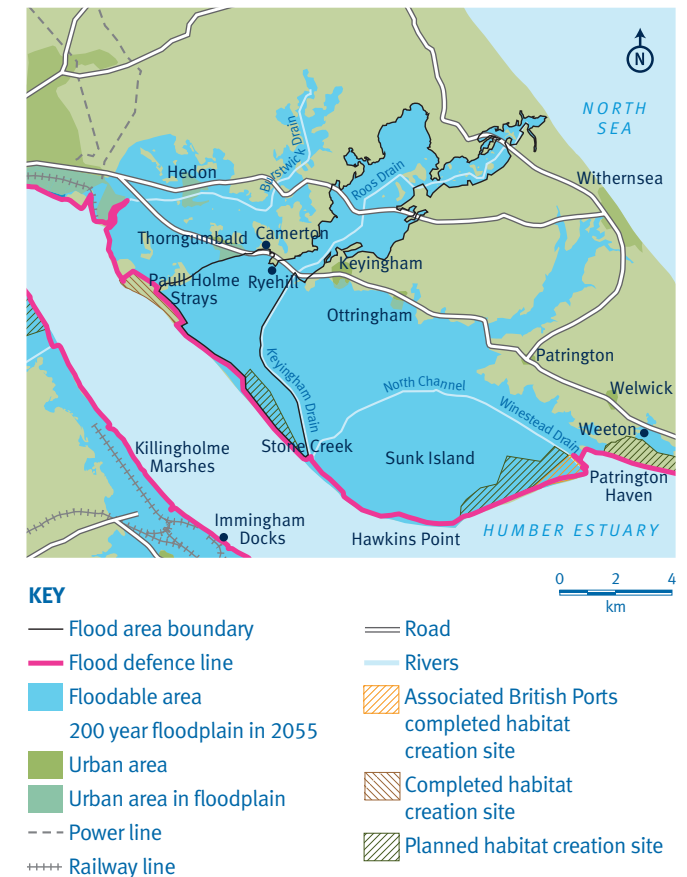
Proposed management approach

Currently, the banks in this part of the estuary are mostly owned by the Crown. It will become increasingly expensive to maintain the existing defences in the future as sea levels rise and at some point the owners may decide it is not worthwhile carrying on. We think this is unlikely to be within the next 20 years.

If maintenance is withdrawn from the existing defences, we will look at building secondary banks to protect the villages at the edge of the floodplain. Without further study we cannot confirm this is possible or say exactly where the banks might be located. The owners of any property not protected may wish to consider other options, which in some cases might include flood-proofing individual houses. We will provide all the advice and information we can to help.

Flood area 4 – Stone Creek to Paull Holme Strays

Key information	
Size of flood area	3300 ha
Number of properties in floodplain	195
Area of agricultural land	3268 ha
Length of defences	11.5 km
Current standard of protection	About 12.5% (1 in 80) or better
Remaining life of defence	Varies, generally 10 to 20 years
Defences managed by	Environment Agency responsible for defences at Paull Holme Strays, other defences managed by Crown Estate



Most of the properties at risk are at the edge of the floodplain, in the villages of Ryehill or Camerton (Thorngumbald, the village next door, is in Flood Area 5). It contains scattered farms and high-grade agricultural land. The land is drained to the estuary by a system of ditches leading to Keyingham Drain. Although this and the neighbouring area of Sunk Island (Flood Area 3) are separated by Keyingham drain, flooding in one can affect the other. Therefore the two areas should be considered together.

In 2004 we completed a scheme at Paull Holme Strays that created new inter-tidal habitat to replace the losses due to flood defence improvements and sea level rise. We have identified another site near Keyingham as suitable for creating additional habitat but are unlikely to develop it until after 2030.

Existing flood defences

The defences are generally in good condition. Major improvements are likely to be needed in 40 years or so.

Proposed management approach

We have looked at the costs and benefits of continuing to maintain the existing defences in the future and concluded that this will become increasingly expensive as sea levels rise. In the long term those responsible may decide it is not worthwhile carrying

on. Uncertainty about the rate at which sea levels will rise and the defences deteriorate means we cannot say when this might happen, although we think it is unlikely to be within the next 20 years. We will re-assess the situation when we review the strategy and keep in touch with those responsible for the defences.

If maintenance is withdrawn from the existing defences, we will look at building secondary banks to protect the villages at the edge of the floodplain. Without further study we cannot confirm this will be possible or say exactly where the banks might be located. The owners of any property not protected may wish to consider other options, which in some cases might include flood-proofing individual houses. We will provide all the advice and information we can to help.

Flood area 5 – Hull East (including Paull Village)

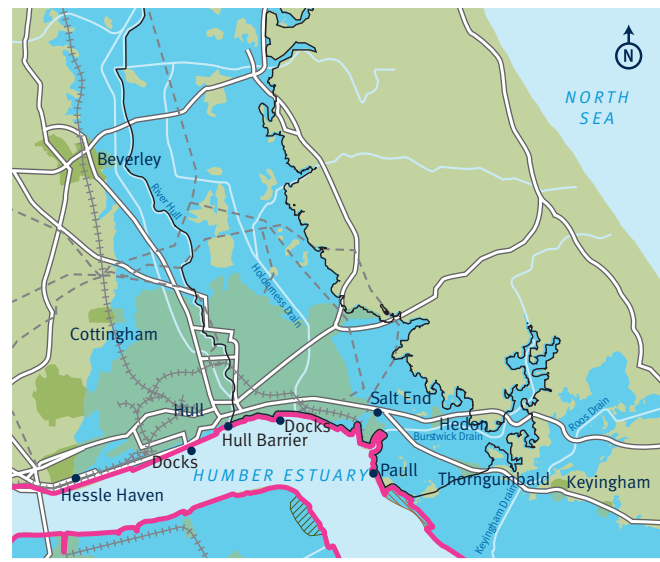
Key information	
Size of flood area	14,968 ha
Number of properties in floodplain	57,084
Area of agricultural land	9,328 ha
Length of defences	13.2 km
Current standard of protection	Hull, 0.5% (1 in 200) or better. Paull, 1% (1 in 100)
Remaining life of defence	10 to 20 years
Defences managed by	Mixed; Hull City Council, Associated British Ports and Environment Agency

Most of the properties at risk are in Hull, although there is a significant number in the smaller communities east of the city including Hedon, Burstwick, Thorngumbald and Paull. The area also contains major industrial and commercial facilities, including petro-chemical and port-related developments. Surface water is drained by a combination of sewers (mostly managed by Yorkshire Water) and open channels, all of which flow or are pumped to the estuary. An independent review of these arrangements has been carried out following the extensive flooding in June 2007. Hull City Council has prepared a Strategic Flood Risk Assessment to inform their planning decisions and the future development of the city.

Existing flood defences

The estuary defences are in good condition. We are reviewing the standard provided at the Victoria Dock development and may improve the defences there in the next 10 years if necessary. We are also looking at the Paull defences, in particular how to manage the large volumes of spray from waves that can occur during severe storms.

The city of Hull is also at risk of flooding from the River Hull and from surface water overwhelming the drainage system. We are developing a separate strategy for the River Hull defences that takes into account the crucial role of the Hull Barrier and are working closely with the other relevant authorities to develop effective approaches for dealing with the complex flooding issues in the city.



KEY	
— Flood area boundary	++++ Railway line
— Flood defence line	— Road
■ Floodable area	— River
■ Urban area	▨ Completed habitat creation site
■ Urban area in floodplain	▨ Planned habitat creation site
- - - Power line	

Proposed management approach

We will continue to protect this area and will work with the local and regional authorities, property owners and developers to make sure flood risk is taken into account at all stages of the planning process. The defences will need to be improved as sea levels rise. This will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.

Flood area 6 – Hull West (Hull Barrier to Hesse Haven)

Key information	
Size of flood area	9,471 ha
Number of properties in floodplain	79,974
Area of agricultural land	5,191 ha
Length of defences	8.4 km
Current standard of protection	Generally 0.5% (1 in 200) but locally 5% (1 in 20)
Remaining life of defence	Generally 10 to 20 years, locally 5 years
Defences managed by	Mixed; Hull City Council, Associated British Ports and Environment Agency

The properties at risk are in Hull and further inland (e.g. at Beverley). The area also contains major infrastructure, industrial and commercial facilities. Surface water is drained by a combination of sewers (mostly managed by Yorkshire Water) and open channels, all of which flow or are pumped to the estuary. An independent review of these arrangements has been carried out following the extensive flooding in June 2007. Hull City Council has prepared a Strategic Flood Risk Assessment to inform their planning decisions and the future development of the city.

Existing flood defences

The estuary defences are generally in good condition and provide a good standard of protection, except from the Hull Barrier to Victoria Pier and from Albert Dock to St Andrews Quay, where the standard needs to be improved.

The area is also at risk of flooding from the River Hull and from surface water that overwhelms the drainage system. We are developing a separate strategy for the River Hull defences that takes into account the crucial role of the Hull Barrier and are working closely with the other relevant authorities to develop effective approaches for dealing with the complex flooding issues in the city.



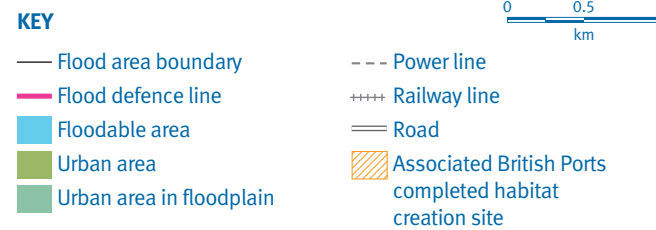
KEY	
— Flood area boundary	- - - Power line
— Flood defence line	— Railway line
■ Floodable area	— Road
■ Urban area	— River
■ Urban area in floodplain	▨ Completed habitat creation site
	▨ Planned habitat creation site

Proposed management approach

We will continue to protect this area and will work with the local and regional authorities, property owners and developers to make sure flood risk is taken into account at all stages of the planning process. The improvements needed to the defences will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.

Flood area 7 – Hesse Frontage (Hesse Haven To Hesse Country Park Hotel)

Key information	
Size of flood area	35 ha
Number of properties in floodplain	24
Area of agricultural land	8 ha
Length of defences	7.4 km
Current standard of protection	Varies, locally 20% (1 in 5) or less
Remaining life of defence	Varies, locally 5 years
Defences managed by	East Riding of Yorkshire and others



Clive Sullivan Way separates this small area from the main part of Hesse and Hull (which is included in Flood Area 6). As well as residential properties, it contains recreational areas and some commercial and industrial premises. Surface water is drained by a combination of sewers (mostly managed by Yorkshire Water) and open channels, all of which flow or are pumped to the estuary.

Existing flood defences

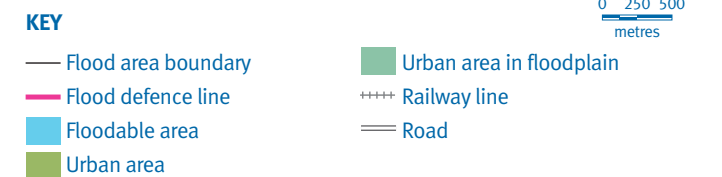
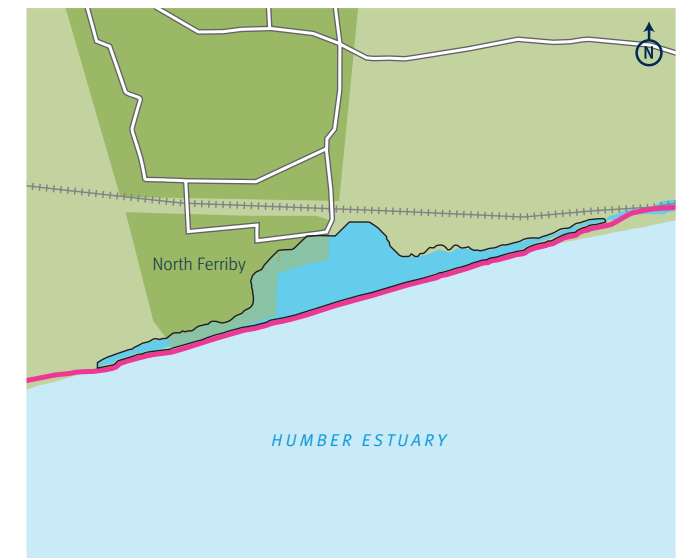
The defences are generally in a poor condition and provide a low standard of protection. The shoreline is being worn away by tides and waves in places, which in time will threaten some of the defences.

Proposed management approach

We expect that continuing to maintain these defences in the future will become increasingly expensive as sea levels rise. In the long term those responsible may decide it is not worthwhile carrying on. Other ways of managing the flood risk may need to be considered. We will review the situation regularly and keep in touch with those responsible for the defences.

Flood area 8 – North Ferriby

Key information	
Size of flood area	32 ha
Number of properties in floodplain	28
Area of agricultural land	8 ha
Length of defences	3.2 km
Current standard of protection	Generally 1% (1 in 100) or better, locally 20% (1 in 5)
Remaining life of defence	10 to 20 years
Defences managed by	Environment Agency



The area is mainly residential, although there is some farmland and a old landfill site at the eastern end. The edge of this site is being eroded by tides and waves, which could release contaminants into the estuary. Part of the main railway to Hull is on the edge of the area but is above the level of flood risk.

Existing flood defences

There are two lines of flood defences protecting this area both of which are in reasonable condition and provide a good standard of protection.

Proposed management approach

At present we are continuing to maintain the defence along the edge of the estuary. As sea levels rise we may find it difficult to justify spending public money doing this, in which case we may have to withdraw. Before doing so we will consider other options for protecting the area. Uncertainty about the rate at which sea levels will rise and the defences deteriorate means we cannot say when this might happen, although we think it is unlikely to be within the next 20 years. We will re-assess the situation each time we review the strategy and tell all property owners in the area about the outcome.

We are reviewing the risk of allowing the erosion of the landfill site to continue. Any work needed as a result will be separate from the flood defence strategy.

Appendix J

Humber Flood Risk Management Strategy, Part 2

Flood area 9 – Brough

Key information	
Size of flood area	389 ha
Number of properties in floodplain	483
Area of agricultural land	148 ha
Length of defences	6.1 km
Current standard of protection	Varies, western end (new defences) 0.5% (1 in 200), eastern end 2.5% (1 in 40)
Remaining life of defence	Varies, western end 20 years or more, eastern end 10 to 20 years
Defences managed by	Environment Agency

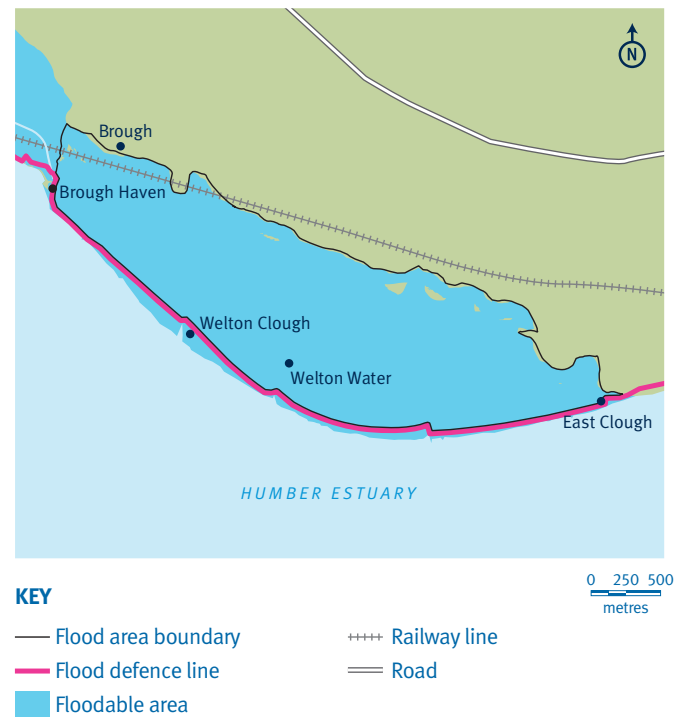
Most of the properties are residential and are located in Brough, at the western end of the area, which also contains an important factory and airfield owned by BAe. The eastern end contains old gravel/clay extraction pits, which are now used for recreation (fishing, sailing) or nature conservation and a landfill site. Although not a flood defence issue, the landfill site is being eroded by waves and tides, which could release contaminants into the estuary.

Existing flood defences

The defences at the western end have been improved within the last 10 years and as a result are in good condition and provide a good standard of protection. Work is needed to improve the condition of the remaining defences and the standard they provide.

Proposed management approach

We will continue to protect Brough and the BAe factory and will improve the standard they receive by building a new defence from the end of the recently completed one across the airfield to high ground behind Welton Water. We cannot justify spending public money on maintaining the defences at the eastern end of the area, as they protect very few properties. After giving due notice we will withdraw from these defences. Although we may not be able to carry on maintaining the existing defences, others may be able to obtain the approvals



needed to do so while complying with the Habitats Regulations. If anyone does we will provide all the advice and information we can to help them.

We are reviewing the risk of allowing the erosion of the landfill site to continue. Any work needed as a result will be separate from the flood defence strategy.

Flood area 10 – Brough Haven to Weighton Lock

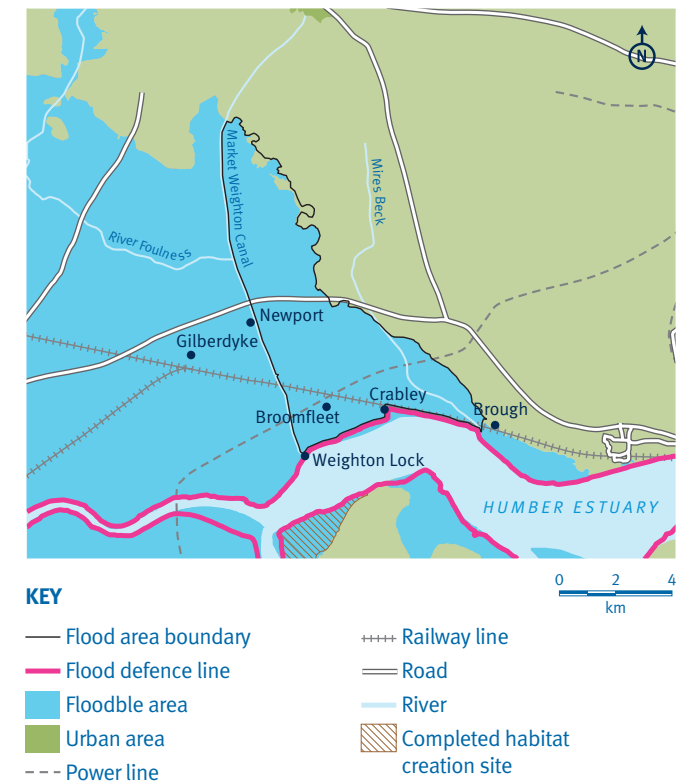
Key information	
Size of flood area	4259 ha
Number of properties in floodplain	697
Area of agricultural land	4208 ha
Length of defences	6.5 km
Current standard of protection	Varies, eastern end (new defences) 0.5% (1 in 200), western end 10% (1 in 10) locally
Remaining life of defence	Varies, eastern end 20 years or more, western end 10 to 20 years
Defences managed by	Environment Agency, Associated British Ports and others

The properties are scattered throughout the area, which is largely devoted to farming but also contains key infrastructure including road and rail links to Hull and high-voltage power lines. The land is drained by a system of ditches flowing either to the estuary by gravity or to the Market Weighton Canal, which itself flows into the estuary by gravity through Weighton Lock.

Existing flood defences

The defences between Brough Haven and Crabley Farm have been improved within the last 10 years and as a result are in good condition and provide a good standard of protection.

The remaining defences are owned by others and are in fair to poor condition and are narrow and difficult to maintain. They are likely to need improvement in the next 15 to 20 years.



Proposed management approach

We will continue to inspect all the defences and to maintain and improve the ones for which we are responsible as necessary. We will also keep in touch with those responsible for the other defences, telling them about any maintenance or improvements needed.

We are considering the possibility of keeping some lengths of the defences lower than others, so that we will know which areas will be flooded during a major event and can take steps to minimise the damage. We will look carefully at all the implications of this approach, taking into account the benefits of the lower river levels that will result from any overtopping that occurs or from the flood storage schemes that have been identified in the Humber and Ouse strategies. Before deciding whether or not to adopt the approach we will discuss the issues it raises with all those who might be affected.

Flood area 11 – Weighton Lock to Boothferry Bridge

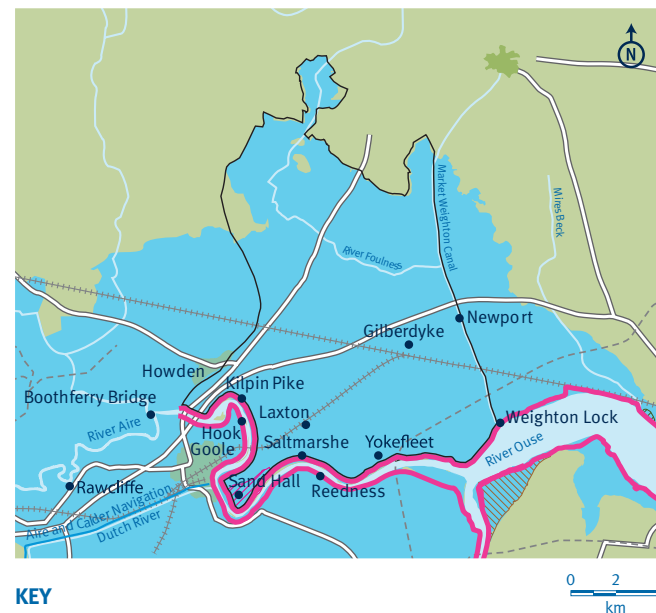
Key information	
Size of flood area	14,143 ha
Number of properties in floodplain	2821
Area of agricultural land	14,074 ha
Length of defences	24.4 km
Current standard of protection	Varies, generally 5% (1 in 20) or better but locally 20% (1 in 5)
Remaining life of defence	Varies, generally 10 to 20 years
Defences managed by	Environment Agency, Associated British Ports Ltd and others

This area contains several villages together with many scattered residential properties and farmsteads. It also contains a large area of high-grade agricultural land together with key infrastructure including road and rail links to Hull and high-voltage power lines. The land is drained by ditches that flow either to the River Ouse by gravity or to the Market Weighton Canal (directly or through the River Foulness), which itself flows to the estuary by gravity through Weighton Lock.

Existing flood defences

The defences are generally in reasonable condition and provide an appropriate standard of protection. The banks of the River Ouse are being eroded in a number of places and there is concern about the stability of the defences at some points. Two lengths have been identified as needing to be improved within the next 15 years; between Blacktoft and Yokefleet; and at Sand Hall. The latter has also been identified as a possible flood storage scheme, although this needs further study.

The area is also at risk of flooding from high flows in the River Derwent and the River Ouse. We are preparing separate strategies or management plans for these rivers.



Proposed management approach

We will continue to inspect all the defences and to maintain and improve the ones for which we are responsible as necessary. We will also keep in touch with those responsible for the other defences, telling them about any maintenance or repairs needed.

We are considering the possibility of keeping some lengths of the defences lower than others, so that we will know which areas will be flooded during a major event and can take steps to minimise the damage. We will look carefully at all the implications of this approach, taking into account the benefits of the lower river levels that will result from any overtopping that occurs or from the flood storage schemes that have been identified in the Humber and Ouse strategies. Before deciding whether or not to adopt the approach we will discuss the issues it raises with all those who might be affected.

Flood area 12 – Goole

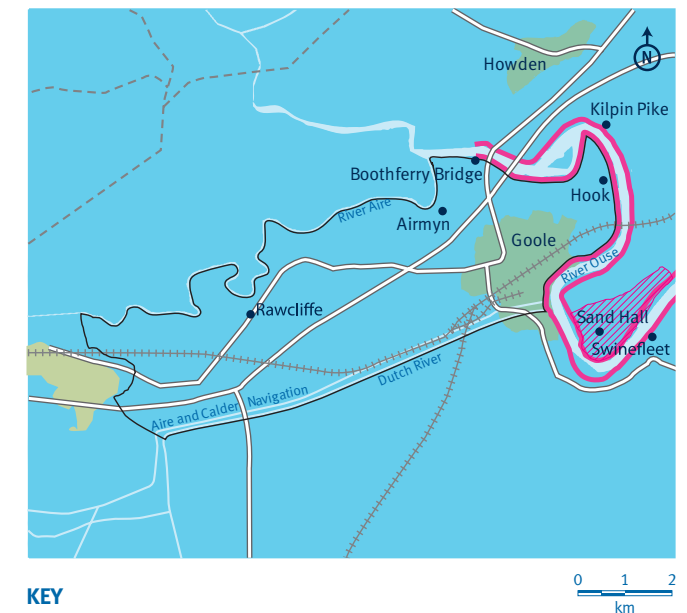
Key information	
Size of flood area	3380 ha
Number of properties in floodplain	9960
Area of agricultural land	2855 ha
Length of defences	8.6 km
Current standard of protection	0.5% (1 in 200) or better
Remaining life of defence	20 years or more
Defences managed by	Environment Agency

All the properties in Goole, which is very low-lying, are at risk of flooding. There is also a significant number of properties in smaller communities nearby including Hook, Airmyn and Rawcliffe. The area contains important industrial, commercial and port-related facilities together with key infrastructure (including major road and rail links) and high-grade agricultural land.

Existing flood defences

The defences are generally in good condition and provide a good standard of protection. However, in places the banks of the River Ouse are being eroded by the river and showing signs of instability, for example at Hook Road.

Parts of the area are also at risk of flooding from high flows in the rivers Ouse, Aire and Don. We are preparing separate strategies for these rivers.

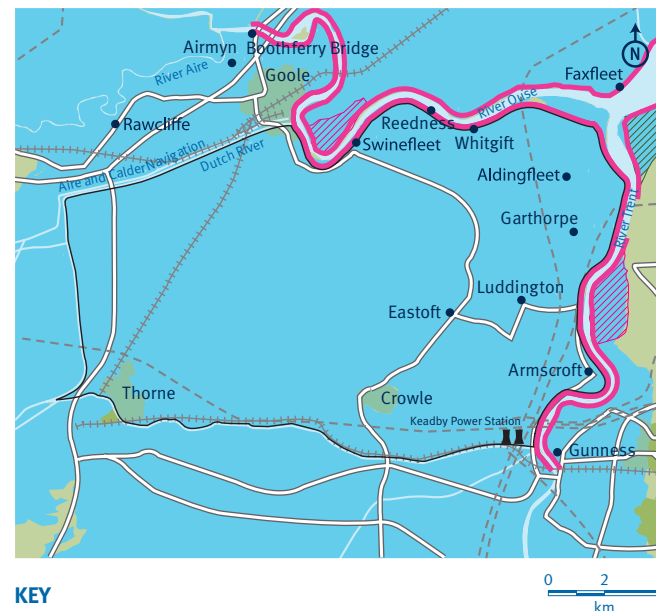


Proposed management approach

We will continue to maintain and improve this area's existing defences, carrying out further investigations as necessary. We will also work with the local and regional authorities, property owners and developers to make sure flood risk is taken into account at all stages of the planning process. The defences will need to be improved as sea levels rise. This will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.

Flood area 13 – Goole Fields and Crowle

Key information	
Size of flood area	19,626 ha
Number of properties in floodplain	10,654
Area of agricultural land	19,787 ha
Length of defences	28.7 km
Current standard of protection	Varies, 3.3% (1 in 30) to 0.5% (1 in 200) or better
Remaining life of defence	Generally 10 to 20 years, 5 years locally
Defences managed by	Environment Agency, Associated British Ports Ltd and others



Many of the properties at risk, such as those in Thorne and Crowle, are some distance from the flood defences. There are also significant numbers of properties in small communities close to them including Swinefleet, Reedness, Garthorpe, Amcotts and Keadby. The area is largely used for agriculture and contains scattered farms as well as a rail link, power station, high-voltage power lines and the internationally important Humberhead Peatlands. The land is drained by several systems of ditches and pumping stations flowing either to the River Ouse or the Trent. The future management of the system leading to Keadby Pumping Station (draining a part of this area as well as an extensive area further south) is being reviewed.

Existing flood defences

The defences are generally in reasonable condition and their height provides an adequate standard of protection. However, the riverbanks are being worn away in places and there are concerns about the stability of the defences at some points. We have recently improved the defences near Amcotts and are planning to do so at Swinefleet within the next five years and at Reedness within the next 15.

The area is also at risk of flooding from high flows in the rivers Ouse, Don and Trent. We are preparing separate strategies for these rivers that will link with this strategy.

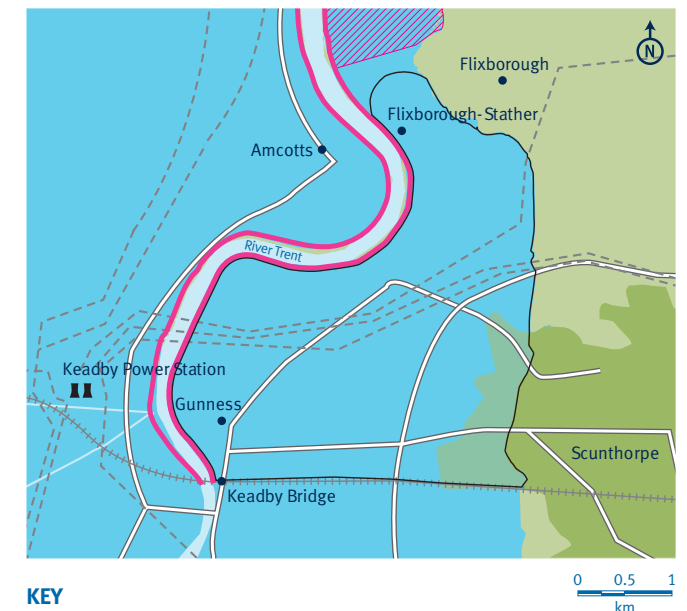
Proposed management approach

We will continue to inspect all the defences and to maintain and improve the ones for which we are responsible as necessary. We will also keep in touch with those responsible for the other defences, telling them about any maintenance or repairs needed.

We are considering the possibility of keeping some lengths of the defences lower than others, so that we will know which areas will be flooded during a major event and can take steps to minimise the damage. We will look carefully at all the implications of this approach, taking into account the benefits of the lower river levels that will result from any overtopping that occurs or from the flood storage schemes that have been identified in the Humber and Ouse strategies. Before deciding whether or not to adopt the approach we will discuss the issues it raises with all those who might be affected.

Flood area 14 – Guinness to Flixborough

Key information	
Size of flood area	1070 ha
Number of properties in floodplain	2649
Area of agricultural land	934 ha
Length of defences	59 km
Current standard of protection	Varies, 1% (1 in 100) to 0.5% (1 in 200)
Remaining life of defence	Varies, generally more than 20 years but locally 10 to 20 years
Defences managed by	Environment Agency and others



Most of the residential properties at risk are in Scunthorpe or Guinness but there are industrial and commercial developments at Flixborough Stather and Grove Wharf. The remainder of the area is largely used for agriculture but includes road and rail links and high-voltage power lines. The land is drained by a system of ditches that flow into the River Trent. North Lincolnshire Council is examining development opportunities in the area through its Lincolnshire Lakes project.

Existing flood defences

In places the defences are formed by quays, elsewhere they are earth banks. They are generally in good condition and provide a good standard of protection, although in places there is some concern about erosion and stability. We will look into the stability of the defences between Grove Wharf and Neap House within the next five years, carrying out any improvements necessary. Defences between Neap House and Flixborough will be improved within the next 15 years.

The area is also at risk of flooding from high flows in the River Trent. We have produced a separate strategy for the tidal reaches of this river that will link with this strategy.

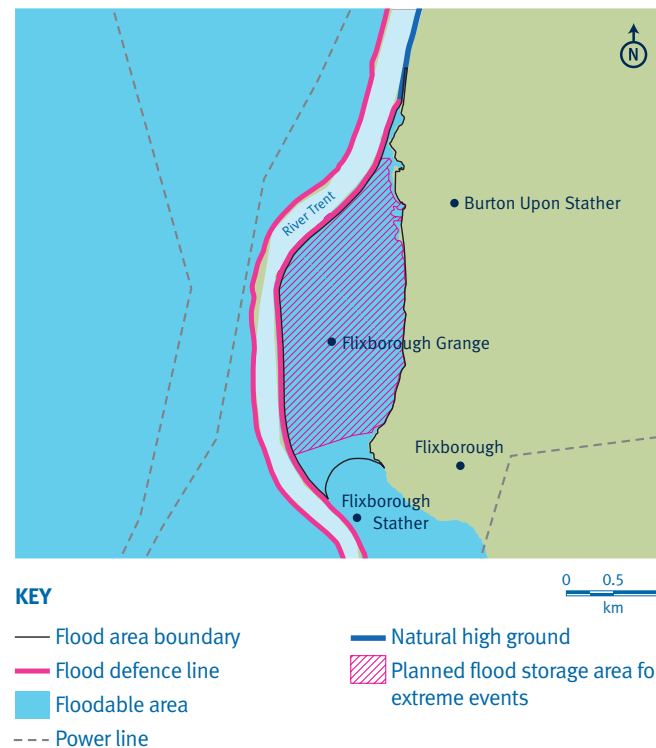
Proposed management approach

We will continue to maintain and improve our defences in this area as necessary and will keep in touch with those responsible for the other defences about any work needed. We will also work with the local and regional authorities, property owners and developers to make sure flood risk is taken into account at all stages of the planning process.

The defences will need to be improved as sea levels rise. This will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new work needed to protect their development.

Flood area 15 – Flixborough Grange

Key information	
Size of flood area	365 ha
Number of properties in floodplain	7
Area of agricultural land	355 ha
Length of defences	6.3 km
Current standard of protection	0.5% (1 in 200) or more
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency



All but one of the properties at risk are in Burton upon Stather, where there is also a wharf. The other one is set in high-grade agricultural land that drains to the River Trent by gravity.

Existing flood defences

The defences are in good condition and provide a good standard of protection. They are not expected to need major improvement for at least 20 years. The area has been identified as a possible flood storage scheme, although this needs further study.

Proposed management approach

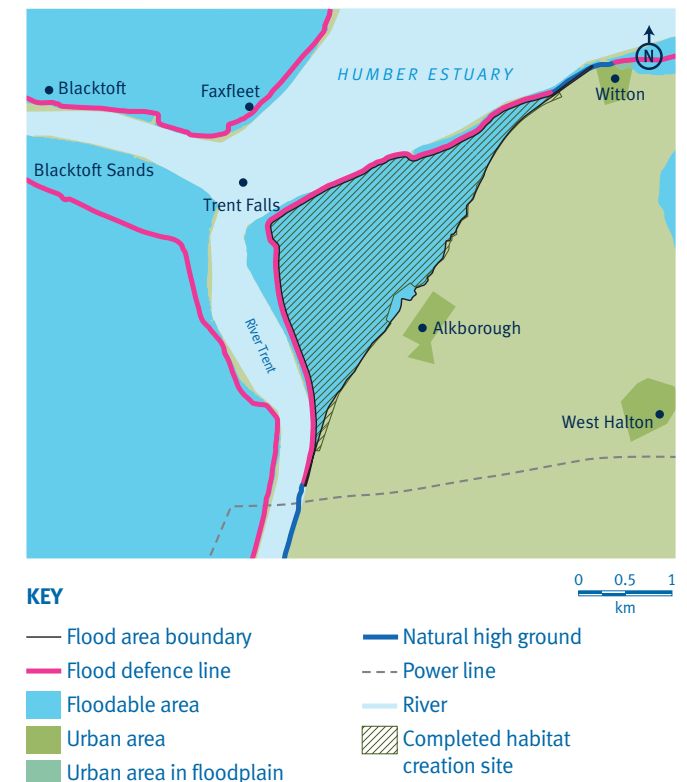
At present we are continuing to maintain the defences but the relatively small number of properties at risk means that in future we could find it difficult to justify spending public money doing this. The area could be used for flood storage, which would lower water levels, if further study shows this to be worthwhile. If not, we may withdraw. Uncertainty about the rate at which sea levels will rise and the defences deteriorate means we cannot say exactly when this might happen, but currently we expect it to be in more than 20 year's time. We will re-assess the situation each time we review the strategy and tell all property owners in the area about the outcome.

Although we may not be able to carry on maintaining the existing defences, others may wish to. Provided they comply with the Habitats Regulations and can obtain the approvals needed, we will provide all the

advice and information we can to help them. If not, we will look at building secondary banks to protect properties in Burton upon Stather. Without further study we cannot confirm this will be possible or say exactly where the banks might be located. The owners of any property not protected may wish to consider other options, which in some cases might include flood-proofing individual houses. Again, we will provide all the advice and information we can.

Flood area 16 – Alkborough

Key information	
Size of flood area	427 ha
Number of properties in floodplain	0
Area of agricultural land	408 ha
Length of defences	6.4 km
Current standard of protection	Varies (partly inter-tidal)
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency



The recently completed scheme at Alkborough covers the whole 427 ha of the flood cell. The land is now managed for nature conservation and provides about 170 ha of inter-tidal habitat to replace the losses caused by our flood defence works and sea level rise. The remainder of the area will provide grazing marsh and reedbed habitats.

Existing flood defences

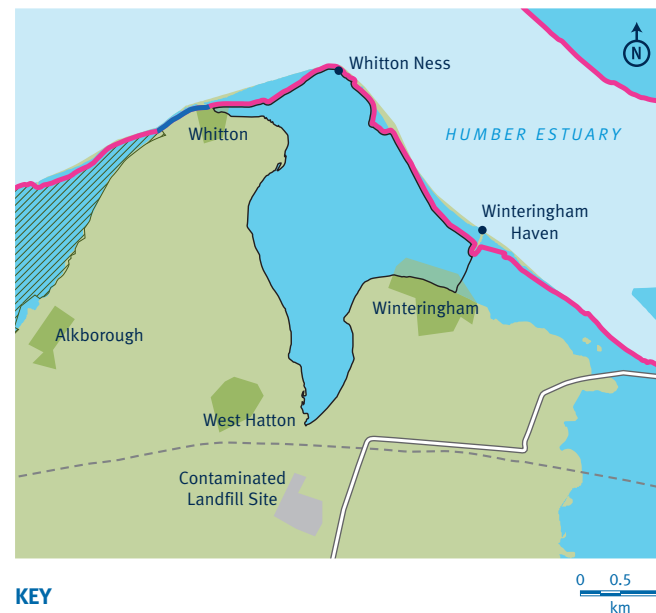
The defences have been modified and new structures built so that just under half the area will flood on most high tides while the remainder will be available to store water during extreme events. As a result water levels in the Trent and the Ouse during these events are likely to be up to 150 mm lower than they would be without the changes. The defences are in good condition and are expected to last for at least 30 years before any major improvements are needed.

Proposed management approach

We will maintain the existing defences and the new structures so the scheme continues to provide flood defence benefits by lowering water levels during extreme events. We will also work with our partners, Natural England, North Lincolnshire Council and Associated British Ports, to make sure our joint objectives for the area are achieved.

Flood area 17 – Whitton to Winteringham

Key information	
Size of flood area	636 ha
Number of properties in floodplain	59
Area of agricultural land	635 ha
Length of defences	4.6 km
Current standard of protection	1% (1 in 100 years on average)
Remaining life of defence	Varies, generally more than 25 years, except at Whitton Ness
Defences managed by	Environment Agency



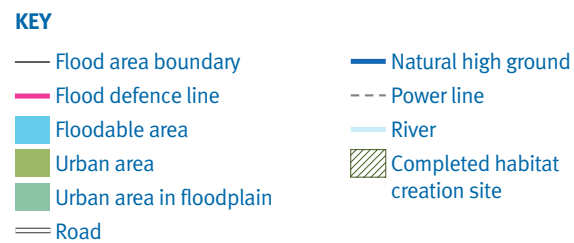
Most of the properties at risk are in Whitton and Winteringham, at the edge of the floodplain. The rest of the area is high-grade agricultural land containing scattered farms and a high-voltage power line. The land is drained through a system of channels to an outfall at Winteringham Haven.

Existing flood defences

The defences are generally in good condition except at Whitton Ness where there is a risk that they could be eroded. If this is prevented from happening and regular maintenance continues the defences are expected to last for more than 25 years.

Proposed management approach

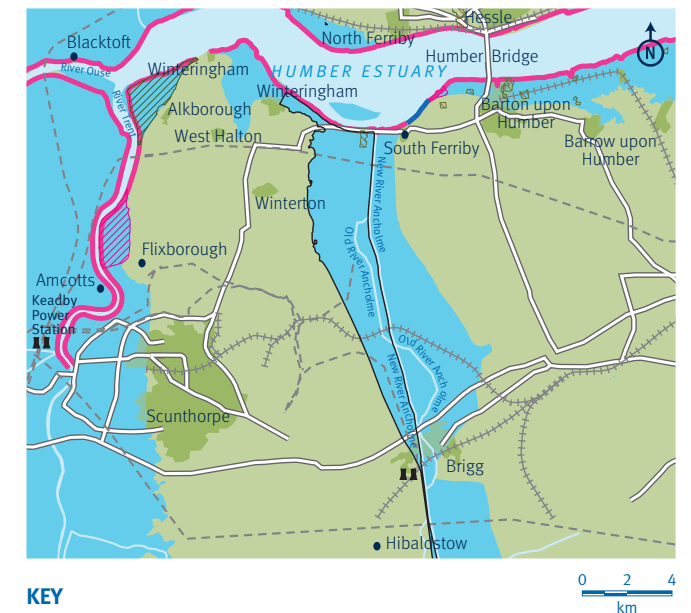
At present we are continuing to maintain the defences. In the future, however, the relatively small number of properties at risk means that we could find it difficult to justify spending public money on the defences and so may have to withdraw. Uncertainty about the rate at which sea levels will rise and the defences deteriorate means we cannot say exactly when this might happen but currently expect it to be in between 10 and 20 years, possibly more. We will re-assess the situation each time we review the strategy and tell all property owners in the area about the outcome.



Although we may not be able to carry on maintaining the existing defences, others may wish to. Provided they comply with the Habitats Regulations and can obtain the approvals needed, we will provide all the advice and information we can to help them. If not, we will look at building short secondary banks to protect properties in Whitton and Winteringham. Without further study we cannot confirm this will be possible or say exactly where the bank might be located. The owners of any property not protected may wish to consider other options, which in some cases might include flood-proofing individual houses. Again we will provide all the advice and information we can.

Flood area 18 – Winteringham Ings

Key information	
Size of flood area	4,760 ha
Number of properties in floodplain	536
Area of agricultural land	4,745 ha
Length of defences	4.5 km
Current standard of protection	Varies, 20% (1 in 5) to 1% (1 in 100)
Remaining life of defence	10 years or less
Defences managed by	Environment Agency



The area extends along the Ancholme Valley past Brigg, which contains a significant number of the properties at risk. The remainder are scattered along the valley, which is largely devoted to agriculture but also contains a cement works together with key infrastructure including major road and rail links and high-voltage power lines. Although this and the neighbouring area of South Ferriby (Flood Area 19) are separated by the River Ancholme, flooding in one can affect the other. Therefore the two areas should be considered together.

Existing flood defences

Very strong tidal currents flow along the channel between the shore and Read's Island and there is a serious threat they will wash away the existing defences and the A1077 behind them. We've strengthened and repaired the defences at various times over the last 10 years and more repairs are likely to be needed within the next 10, both to manage the erosion threat and improve the standard of protection.

The area is also at risk of flooding from high flows in the River Ancholme, for which a separate strategy was initiated some years ago, but which is currently stalled. We are keen to progress that plan alongside the Humber Strategy if the opportunity arises.

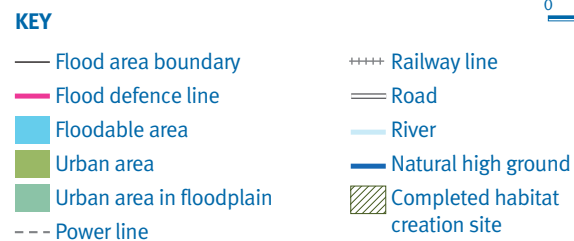
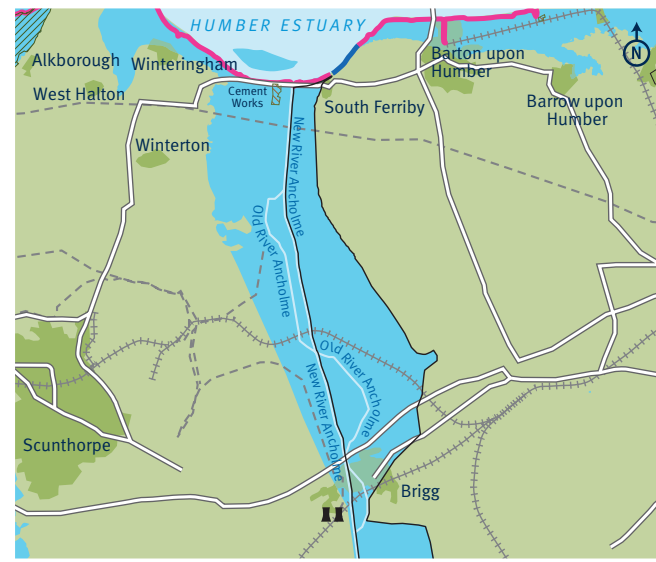


Proposed management approach

We will continue to maintain and improve the estuary defences protecting this area. This may involve moving them back from the shore in places and we will work with North Lincolnshire Council to make sure the effects on the A1077 are taken into account. The work will be expensive so we will seek to supplement public funds with contributions from major beneficiaries.

Flood area 19 – South Ferriby

Key information	
Size of flood area	6,170 ha
Number of properties in floodplain	1,107
Area of agricultural land	6,075 ha
Length of defences	3.2 km
Current standard of protection	Varies, 10% (1 in 10) to 0.5% (1 in 200)
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency



The area extends along the Ancholme Valley past Brigg, which contains a significant number of the properties. The remainder are scattered along the valley, which is largely devoted to agriculture but also contains key infrastructure including major road and rail links and high-voltage power lines. Although this and the neighbouring area Winterringham Ings (Flood Area 18) are separated by the River Ancholme, flooding in one can affect the other. Therefore the two areas should be considered together.

Existing flood defences

The existing defences are in good condition but are expected to need major improvement in about 20 years time.

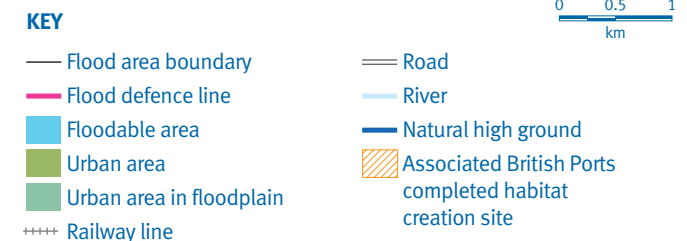
The area is also at risk of flooding from high flows in the River Ancholme, for which a separate strategy was initiated some years ago, but which is currently stalled. We are keen to progress that plan alongside the Humber Strategy if the opportunity arises.

Proposed management approach

We will continue to maintain and improve the estuary defences protecting this area as necessary.

Flood area 20 – Barton Cliff to Barton Haven

Key information	
Size of flood area	206 ha
Number of properties in floodplain	439
Area of agricultural land	196 ha
Length of defences	2.9 km
Current standard of protection	Varies, 5% (1 in 20) to 2% (1 in 50)
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency, Associated British Ports



Most of the properties at risk are in Barton-upon-Humber. The rest of the area contains several disused clay pits, which are internationally important for their fresh-water habitats. There are also some scattered properties and farmland. The area is drained to the estuary by gravity.

Associated British Ports has created new inter-tidal habitat at a site near Chowder Ness to compensate for losses due to port development at Immingham.

Existing flood defences

The estuary defences are in good condition and are not expected to need major improvement for more than 20 years. The defences along Barton Haven have been improved within the last five years.

Proposed management approach

At present we are continuing to maintain all the existing defences. There are very few properties at the western end of the area. This means that in the future we could find it difficult to justify spending public money on maintaining the defences protecting them, rather than building a secondary shorter defence near the Humber Bridge that only protects Barton-upon-Humber. Without further study we cannot confirm this would be the best option or say exactly where the new defence might be located. If a new defence is built, we would withdraw from the defences further west. Uncertainty about the rate at which sea levels will rise and the defences deteriorate means we cannot say exactly when this might happen, although currently, we expect it will not

be for 20 years or more. We will re-assess the situation each time we review the strategy and tell all property owners in the area about the outcome.

Although we may be unable to carry on maintaining the existing defences, others may wish to. Provided they comply with the Habitats Regulations and can obtain the approvals needed, we will provide all the advice and information we can to help them. The owners of any property not protected may wish to consider other options, which in some cases might include flood-proofing individual houses. Again we will provide all the advice and information we can.

Flood area 21 – Barton Haven to Barrow Haven

Key information	
Size of flood area	442 ha
Number of properties in floodplain	958
Area of agricultural land	362 ha
Length of defences	3.3 km
Current standard of protection	Varies, 5% (1 in 20) to 1% (1 in 100)
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency



Most of the properties at risk are in Barton-upon-Humber with a few near Barrow Haven. The rest of the area contains several disused clay pits (important for their fresh-water habitats), a rail link and farmland.

Existing flood defences

The existing defences are in good condition but are expected to need major improvement in about 20 years. The defences along Barton Haven have been improved within the last five years.

Proposed management approach

We will continue to maintain existing defences protecting this area and improve them as sea levels rise. This will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.

Flood area 22 – Barrow Haven to East Halton Skitter

Key information	
Size of flood area	2551 ha
Number of properties in floodplain	634
Area of agricultural land	2542 ha
Length of defences	10.5 km
Current standard of protection	Varies, 10% (1 in 10) to 0.5% (1 in 200)
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency



Most of the properties at risk are in Barrow upon Humber and New Holland, at the western end of the site, or near the edge of the floodplain at Goxhill. There is a wharf with industrial and commercial developments and a rail line at New Holland. The rest of the area contains high-grade agricultural land with scattered farms. The land is drained to the estuary by gravity.

We have identified a suitable site for creating new intertidal habitat north of East Halton Skitter at Goxhill. This habitat is needed to replace the losses caused by flood defence improvements and sea level rise. However, the site's development depends on whether the defences continue to be maintained and is unlikely to be until after 2040.

Existing flood defences

The existing defences are good condition and are expected to need major improvement in 20 to 30 years.

Proposed management approach

At present we are continuing to maintain the defences. There is a possibility, however, that we could protect most of the properties at risk in Goxhill, Barrow upon Humber and New Holland by building a secondary line of new defences. If so, we will find it difficult to justify spending public money on maintaining the existing defences to protect the rest of the area. Without further study we cannot confirm secondary defences would be the best option or say exactly where they would be located. Uncertainty about the rate at which sea levels

will rise and the defences deteriorate means we cannot say exactly when this might happen, although currently we expect it will not be for 20 years or more. We will re-assess the situation each time we review the strategy and tell all property owners in the area about the outcome.

Although we may not be able to carry on maintaining the existing defences, others may wish to. Provided they comply with the Habitats Regulations and can obtain the approvals needed, we will provide all the advice and information we can to help them. The owners of any property not protected may wish to consider other options, which in some cases might include flood-proofing individual houses. Again we will provide all the advice and information we can.

Flood area 23 – Halton and Killingholme Marshes

Key information	
Size of flood area	876 ha
Number of properties in floodplain	26
Area of agricultural land	871 ha
Length of defences	7.3 km
Current standard of protection	Varies, 2% to 0.67% (1 in 50 to 1 in 150)
Remaining life of defence	Varies, 5 to 15 years
Defences managed by	Environment Agency, Associated British Ports



The areas of Halton and Killingholme Marshes lie within the proposed South Humber Bank development site which has been allocated for estuary related industry or commercial activities. Most of the properties at risk fall into this category, including wharf facilities and a major petro-chemical plant. There is also a significant area of high-grade agricultural land. The local authorities have prepared a Strategic Flood Risk Assessment to inform their planning decisions and the future development of the area. The land drainage is designed to cater for these developments and releases surface water into the estuary through a combination of pumped systems and gravity.

Existing flood defences

The foreshore is being worn away, which is weakening the defences along the whole frontage, particularly at Halton Marshes. If they are not repaired these defences are likely to fail within the next five years.

We are currently planning to improve the standard of protection in 10 to 20 years, although the timing will depend on the rate of sea level rise.

Proposed management approach

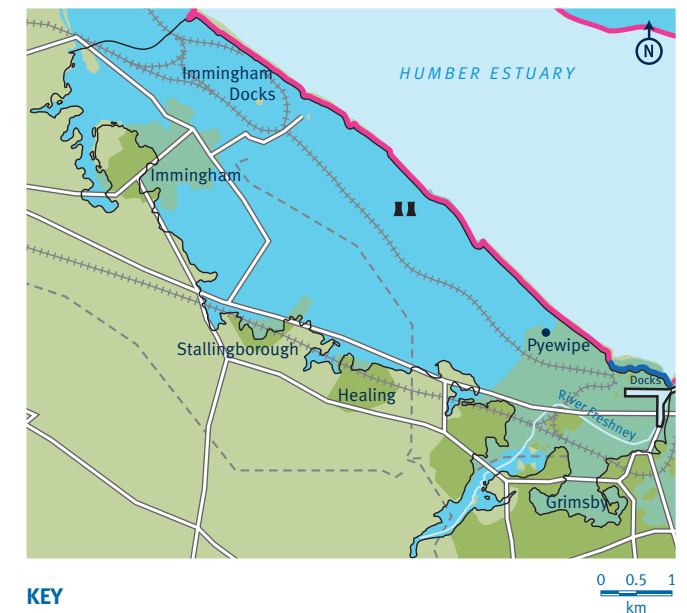
We will continue to protect most of this area and will work with the local and regional authorities, property owners and developers to make sure flood risk is taken into account at all stages of the planning process. We will also work with the local planning authorities to

avoid any permanent buildings being located immediately behind the defences.

We will improve the defences that protect existing development but plan to stop maintaining those that protect currently undeveloped areas. The work will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.

Flood area 24 – Immingham to River Freshney

Key information	
Size of flood area	3613 ha
Number of properties in floodplain	11687
Area of agricultural land	2233 ha
Length of defences	12.6 km
Current standard of protection	Varies, 1% to 0.5% (1 in 100 to 1 in 200)
Remaining life of defence	Varies, 10 to 20 years generally, 5 years locally
Defences managed by	Environment Agency, Associated British Ports



Most of the residential properties at risk are in Immingham and West Grimsby, although there are some in Stallingborough and Healing. A large part of the area lies within the proposed South Humber Bank development site and has been allocated for estuary related activities. It already contains major industrial and commercial facilities, including wharves, storage areas, petro-chemical and power plants. The area also contains important road and rail links and high-voltage power lines, while most undeveloped land is used for agriculture. The local authorities have prepared a Strategic Flood Risk Assessment to inform their planning decisions and the future development of the area. The land drainage is designed to cater for the level of development and releases surface water into the estuary through a combination of pumped systems and gravity.

Existing flood defences

The existing defences generally provide a good standard of protection. However, the foreshore is being eroded which is weakening the defences along much of the frontage. We are planning to improve a length of the defences near Immingham within the next five years and to carry out further improvements later.

Proposed management approach

We will continue to protect this area and will work with the local and regional authorities, property owners and developers to make sure flood risk is taken into account at all stages of the planning process. We will

also work with the local planning authorities to avoid any permanent buildings being located immediately behind the defences. We will have to work on the defences to deal with erosion and maintain a good standard as sea levels rise. This will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.

Flood area 25 – East Grimsby

Key information	
Size of flood area	802 ha
Number of properties in floodplain	18909
Area of agricultural land	0 ha
Length of defences	3.9km
Current standard of protection	Varies, 20% to 0.5% (1 in 5 to 1 in 200) or better
Remaining life of defence	Varies, 10 to 20 years generally, less than 5 years locally
Defences managed by	Associated British Ports, North East Lincolnshire Council, Environment Agency

The area at risk covers the docks at Grimsby as well as a large part of the town. In addition to residential properties it contains important industrial and commercial developments, including cold storage and associated facilities, together with key road and rail links. The local authorities have prepared a Strategic Flood Risk Assessment to inform their planning decisions and the future development of the area. Surface water is drained by a combination of sewers (mostly managed by Anglian Water) and open channels, all of which flow or are pumped to the estuary.

Existing flood defences

North East Lincolnshire Council manage the defences at the eastern end of the flood area, which are in good condition and provide a good standard of protection. Most of the remaining defences are along the dock frontage and are managed by Associated British Ports. Their condition varies, with a significant proportion being in poor condition. The standard of protection they provide also varies. If flooding does occur it is likely to be initially in the dock area rather than in the town. Nevertheless, major improvements are needed within the next 10 years.



Proposed management approach

We will work with those who manage the defences, particularly Associated British Ports, to make sure properties in Grimsby receive an appropriate standard of protection, with defences being maintained and improved as necessary. We will also work with the local and regional authorities, property owners and developers to make sure flood risk is taken into account at all stages of the planning process. Maintaining and improving the defences will be expensive so we will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.

Flood area 26 – Cleethorpes and Humberston

Key information	
Size of flood area	1669 ha
Number of properties in floodplain	2243
Area of agricultural land	1234 ha
Length of defences	9.2 km
Current standard of protection	Varies, Cleethorpes 0.5% (1 in 200) or better, Humberston Fitties 20% (1 in 5)
Remaining life of defence	More than 20 years
Defences managed by	North East Lincolnshire Council, Environment Agency

Most of the properties at risk are in Cleethorpes and Humberston with some at Tetney. Humberston Fitties contains a considerable number of seasonally occupied chalets and a large caravan site. Between Humberston and Tetney there is a large area of high-grade agricultural land. Surface water is drained by a combination of sewers (mostly managed by Anglian Water) in the built-up areas and open channels elsewhere, all of which flow or are pumped into the estuary.

Existing flood defences

North East Lincolnshire Council manage most of the defences protecting Cleethorpes and Humberston. These are generally in good condition and provide a good standard of protection, except at Humberston Fitties, where they consist of reinforced sand dunes with significant low spots. We manage a second line of defences behind them, which protects the caravan site. Most of the chalets are in front of these defences, and so, are at serious risk of being flooded if waves wash over the sand dunes. Our defences continue along the shoreline to protect the agricultural land beyond them.



Proposed management approach

We will continue to inspect all the defences and to maintain and improve the ones for which we are responsible as necessary. We will also work with North East Lincolnshire Council to make sure the flood risk in Cleethorpes and Humberston remains acceptable, paying particular attention to the situation at Humberston Fitties.

Flood area 27 – Tetney to Saltfleet Haven

Key information	
Size of flood area	13,138 ha
Number of properties in floodplain	2,928
Area of agricultural land	11,540 ha
Length of defences	17.4 km
Current standard of protection	Varies, 10% (1 in 10) to 0.5% (1 in 200) or better
Remaining life of defence	More than 20 years
Defences managed by	Environment Agency

The properties at risk are scattered across the area, many in villages such as North Cotes, Marsh Chapel, Grainthorp, Conisholme, North Somercotes and Saltfleet. There is also a large number of isolated residential properties and farms. Most of the land is used for agriculture and is drained through a system of channels and ditches, some of which are pumped and some flow by gravity.

We have identified a site near Donna Nook as suitable for creating new inter-tidal habitat. This will replace the losses due to flood defence improvements and sea level rise. We are planning to develop it within the next five years.

Existing flood defences

The defences consist of a combination of earth banks and sand dunes. They are generally in good condition but some of the dunes appear to be deteriorating as the beaches in front of them change. At present we do not expect major improvements will be needed for the next 20 years but this will be reviewed.

The area is also at risk of flooding from high flows in the Louth Canal. We are preparing a separate management plan for this watercourse.



Proposed management approach

At present we expect to continue maintaining the existing defences and improving them as necessary, though this will depend on the availability of government funding and on whether the sand dunes continue to deteriorate and the rate at which this happens. We will keep this under review.

Studies undertaken

Producing the HESMP (1997-2000)

Land use: identifying the assets lying within the floodplain and so benefiting from the protection provided by the defences.

Flood defences: consolidating and reviewing data about the defences to determine their condition and the standard of protection they provide.

Historic and current estuary behaviour: examining the estuary's geology and historic development as well as the processes taking place there now.

Environmental baseline: collecting environmental data (natural and historic) about the estuary and floodplain and identifying the constraints on managing the defences.

Producing the strategy consultation draft (2001-2005)

(a) Studies covering the whole estuary

Future estuary behaviour: examining the effect of sea level rise on the sediment balance and inter-tidal habitat in the estuary (and on the adjacent coast-line) and assessing the impact of possible management options, including managed realignment.

Coastal Habitat Management Plan (CHaMP): drawing up a CHaMP to determine how the integrity of the SPA/SAC can be maintained while continuing to manage the estuary's defences.

Potential managed realignment sites: identifying sites where the defences could be re-aligned, costing the work needed and starting to discuss the implications with landowners and tenants.

Standard of protection: identifying and costing the work needed over the next 50 years to provide a high or low standard of protection to each of the 12 management units (subsequently subdivided into flood areas) around the estuary.

Strategic Environmental Assessment (SEA): undertaking an SEA to assess the impact of the work and determine which option is to be preferred in each unit on environmental grounds.

Economic appraisal: comparing the costs and benefits of each option to determine which is to be preferred in each unit on economic grounds.

Long-term programme of work: selecting the preferred option for each unit taking all issues into account and drawing up a prioritised programme of the work needed over the next 50 years (including managed realignment as necessary).

Sustainability Appraisal: assessing the sustainability of the overall strategy using a methodology developed by the Yorkshire and Humber Regional Assembly.

Strategic Environmental Assessment (SEA): undertaking an SEA to assess the impact of the strategy as a whole to complement the earlier study of the individual options.

(b) Studies covering work at individual sites or in specific parts of the estuary

Work in first 15 years: reviewing the work in the first 15 years of the programme to identify key issues (including the possibility of realigning the defences), re-assessing their priority and so confirming the work to be included in a package covering the first five years.

Approval process: establishing the approach to be followed when applying for outline approval of a package of flood defence work affected by the Habitats Regulations.

Work in first five years: developing the designs and assessing the impacts (technical, environmental, economic and social) of the work in the first five-year package sufficiently to allow outline approval to be obtained.

Monitoring and maintenance: reviewing the monitoring and maintenance work needed to manage the defences in the future (including erosion protection to prevent them being undermined).

Benefits of flood storage: determining the reduction in risk and saving in cost that will result from the provision of flood storage upstream of the Humber Bridge in the future.

'Shadow' Appropriate Assessment: assessing the impact of the work included in the package as required by the Habitats Regulations and drawing the individual assessments together to provide a 'shadow' assessment of the whole package.

Technical reports

Producing the HESMP (1997 – 2000)	
Joint Probability Analysis of Large Waves and High Water Levels	Environmental Baseline Study
Geomorphological Studies	Historic Environment Baseline Study
Urgent Works Review	Humber Estuary Shoreline Management Plan (SMP)
Producing the strategy consultation draft (2001 – 2005)	
(a) Studies covering the whole estuary	(b) Studies covering work at individual sites or in specific parts of the estuary
HESMP Phase 2 Geomorphology Studies	Key Issues Assessments (of work in first 15 years)
Coastal Habitats Management Plan (CHaMP)	Detailed Appraisals (of work in first five years)
Engineering Studies Report	Water Level Modelling Report
Economic Assessment Report	Technical Report
Strategic Environmental Assessment (of the Long-Term Programme)	‘Shadow’ Appropriate Assessment
Sustainability Appraisal	Sustainability Appraisal
Strategic Environmental Assessment (of the strategy)	Strategic Environmental Assessment (of the strategy)
Getting the strategy approved (2005 – 2007)	
Project Appraisal Report for the Strategy	Project Appraisal Report for the Works in the First 5 Years

Consultation and information documents

General consultation documents	
A Strategy for Flood Defence (April 1999)	Humber Flood Risk Management Strategy, Consultation Document (August 2005)
Options Consultation Document (November 1999)	
Information documents	
Managed Realignment: Information for Landowners and Tenants (June 2002)	Newsletters ‘TidesNews’ #1 (July 2001) to #6 (March 2005)
Update on Managed Realignment (July 2003)	Newsletters ‘Humber tides news’ #1 (August 2007) to #3 (January 2008)

Advisory groups

Advisory groups	
Humber Joint Committee: consists of the Chairman and another representative from each of the three Regional Flood Defence Committees with responsibilities on the Humber. Meets about three times a year to agree programme and funding arrangements and act as a co-ordinating link to the three parent committees.	Technical Group: contains representatives from key organisations involved in estuary and estuary process studies. Will meet about once a year to review current behaviour (including effects of sea level rise) and to advise on technical developments and opportunities for co-operation with others.
Steering Group: contains representatives from the key stakeholders listed on the next page. Meets about three times a year to review progress in all aspects of strategy and discuss issues raised.	CHaMP Review Group: drawn from organisations with conservation interests. Will meet about twice a year to review programme for creating new habitat and advise on managing sites where habitat has been created.
Liaison Panel: small group of people chosen for knowledge of the area and understanding of local issues. Meets about three times a year to discuss strategy and provide advice.	

Organisations on the steering group

Organisations invited to Steering Group meetings	
Environment Agency Anglian Region Midlands Region North East Region	Non-government bodies Associated British Ports Ltd British Association for Shooting and Conservation Country Landowners and Business Association Humber Estuary Management Strategy Humber Industry Nature Conservation Association Humberside Internal Drainage Boards Lincolnshire Wildlife Trust National Farmers Union Royal Society for the Protection of Birds The Crown Estate Yorkshire Wildlife Trust
Local authorities East Lindsey District Council East Riding of Yorkshire Council Kingston upon Hull City Council Lincolnshire County Council North Lincolnshire Council North East Lincolnshire Council	
Government and regional bodies Department for Environment, Food and Rural Affairs English Heritage Government Office for Yorkshire and Humber (Rural Affairs) Natural England Yorkshire Forward	

Glossary

Affordability

The ability to pay for the repairs or improvements needed if a flood defence is to continue performing satisfactorily.

Assessment process

The process of defining objectives, examining options and weighing up the costs, benefits, risks and uncertainties of an action before a decision is made to proceed or not.

Asset

Any item in the floodplain with a value that can be assessed.

Beneficiary

In this document, an individual or organisation that benefits from the presence of flood defences.

Biodiversity

The variety of life; the different plants, animals and micro-organisms, their genes and the ecosystems of which they are a part.

Birds Directive

An EC Directive that provides a framework for the conservation and management of wild birds in Europe. Covers the classification of Special Protection Areas (SPAs).

Blight

Adverse impact on property and land value or the ability to use it to its full extent brought about as a consequence of future plans.

Business case

A comparison of the costs, benefits, risks and uncertainties associated with a decision.

Catchment Flood Management Plan (CFMP)

A plan prepared by the Environment Agency with other key decision-makers within a river catchment to identify and agree sustainable flood risk management policies.

Climate change

Radiation passes through the Earth's atmosphere and warms its surface before being reflected back into space. Some gases, including carbon dioxide and methane, trap some of the heat from radiation in the atmosphere. Human activity has increased the concentration of these gases dramatically, trapping more heat, causing global temperatures to rise and the climate to change. Sea level rise (q.v.) is a particular consequence of these changes.

Coastal Habitat Management Plan (CHaMP)

A plan for managing a length of coastline to conserve and promote the habitats and wildlife it supports and to ensure compliance with the Habitats and Birds Directives (q.v.).

Coastal defence

A structure, such as a groyne, length of piling or rock armour, intended to stop the coast from being eroded (worn away) by the sea.

Coastal squeeze

A process whereby the area between high and low tide decreases as sea levels rise because the low water line moves towards the land while the high water line is fixed by the presence of flood or coastal defences (or high ground).

Competent authority

The organisation responsible for implementing policy.

Contribution

A payment made by an organisation or individual benefiting from flood defences, covering all or part of the costs of providing, maintaining or improving them.

Department for Environment, Food and Rural Affairs (Defra)

The UK government department responsible for flood defence policy, the environment and animal welfare and regulation of the food industry.

EC Directive

Legislation issued by the European Union that is binding on Member States in terms of the results to be achieved, but that leaves choice as to methods.

Economically worthwhile

Describing the result of an assessment process (q.v.) in which the benefits of the action assessed, in monetary terms, are greater than the costs.

Environmental Stewardship

A scheme administered by Natural England which provides funding to farmers and other land managers who deliver effective environmental management on their land.

Erosion

The wearing away of material, in this document it generally refers to the wearing away of land by waves and currents in a river, estuary or the sea.

Estuary processes

The movement and interaction of water, sediment and other materials (chemical or biological) in an estuary due to the action of waves, freshwater flows, tides, wind and other disturbing forces.

Financial compensation

Monetary payments to offset damages or losses.

Flood area

An area bounded by high ground or raised structures that will contain any flooding that occurs there (i.e. prevent it from extending outside the area).

Flood defence

A wall, embankment or similar structure intended to exclude floodwater from the land behind it. The term includes any other items integral to its function such as sluices, weirs, barriers, locks, outfall culverts or pumping stations.

Flood defence standard (see also Standard of protection)

The protection provided by a flood defence, generally expressed in terms of the average return frequency (e.g. once in 50 years, or 2 per cent per year) of a flood event that would cause it to be overtopped.

Flood proofing (see also Flood resistance measures)

Actions taken to prevent floodwater from entering an area or a building.

Flood resilience measures

Measures to minimise the damage caused to a building if flooding occurs.

Flood resistance measures

Measures to limit the volume of floodwater entering an area or a building, or to keep water levels inside from rising too far.

Flood risk

The risk of an area or building being flooded, generally expressed in terms of the average return frequency (e.g. once in 50 years, or 2 per cent per year) of an event that would cause this.

Flood storage

Allowing floodwater to flow out of a river or estuary onto the adjacent floodplain and storing it there until river/estuary levels have fallen; a flood storage scheme is an area separated from the rest of the floodplain and designed to optimise the flow of floodwater into and out of it.

Floodplain

Land next to a river, estuary or the coast over which water flows in times of flood, or would flow if there were no flood defences.

Habitat

The natural home of an animal or plant.

Habitat creation site

An area designed to allow new habitat to develop within its boundaries. In the context of the Humber Strategy it generally involves the conversion of farmland to inter-tidal habitats (q.v.).

Habitats Directive

An EC Directive that provides for the maintenance of biodiversity in Europe by maintaining or restoring natural habitats and wild species. Covers the classification of Special Areas of Conservation (SACs).

Habitats Regulations

The Conservation (Natural Habitats &c.) Regulations (1994), the legislation enacting the EC Habitats and Birds Directives in the United Kingdom.

Improvement (to a flood defence)

A scheme to improve the condition of or the standard provided by a flood defence, often (but not always) increasing its height so it can withstand rising sea levels.

Inter-tidal habitat

Habitats that occur naturally between the low and high tide lines on land that is open to the sea or estuary; including saltmarsh, sandflats and mudflats.

Managed realignment

Moving flood defences back from their existing position, either to reduce the cost of maintaining them in the future, or to provide an area that can be used for flood storage, or to create new inter-tidal habitats.

Management unit

An area of the floodplain considered as a unit while developing the Humber Strategy.

National flood and coastal defence budget

The money allocated by the government each year for maintaining and improving the country's flood defences.

Overtop

Water flowing over the top of a defence, either because the water level in the river or estuary has risen above it or because the water level is high enough for large waves to wash over it.

Routine maintenance

Inspections and other activities (such as grass-cutting, vermin control and minor repairs) that are carried out regularly to limit the deterioration of a defence.

Sea level rise

Sea levels have been rising since the end of the last Ice Age but the rate is predicted to increase rapidly due to climate change caused by man's activities. The main direct causes of the increase are the melting of glaciers and ice packs and the expansion of seawater as its temperature rises.

Secondary defence

A relatively short defence, generally built behind an existing longer defence to provide extra protection to part of the floodplain.

Shoreline Management Plan (SMP)

A document that brings together information about issues such as flooding, erosion, coastal processes and human and environmental needs for a particular stretch of coastline. The preparation of SMPs is a national initiative for the future planning of the coastline.

Special Area of Conservation (see also Habitats Directive)

An internationally important site where conservation measures are applied for the maintenance or restoration of the habitats and/or species for which the site is designated.

Special Protection Area (see also Birds Directive)

An internationally important area classified for rare and vulnerable birds (listed in Annex I to the Birds Directive) and for regularly occurring migratory species.

Stakeholder

An organisation or individual affected by or interested in the Humber Strategy.

Standard of protection (see also Flood defence standard)

The protection provided by a flood defence, generally expressed in terms of the average return frequency (e.g. once in 50 years, or 2 per cent per year).

Strategic Flood Risk Assessment (SFRA)

A strategic analysis of flood risk prepared by a local planning authority or other decision-maker and providing information about areas that flood, sources of flooding, the influence of climate change and other relevant issues. Forms the basis for preparing policies for flood risk management in these areas.

Storm surge

The temporary rise in sea level caused by the low pressure and strong winds associated with a severe storm. During an extreme surge sea levels near the Humber can be raised up to two metres above the expected tide level.

Sustainable

'Meeting the needs of the present generation without compromising the ability of future generations to meet their own needs' 1985 Brundtland Commission. Balances economic development, social development, and environmental protection.

Tidal flooding

Flooding from the sea (and so influenced by tidal conditions) rather than from a river.

Uneconomic defence

A defence for which the whole life cost of keeping it functioning satisfactorily over a given period will be greater than economic benefits that will result.

Water Framework Directive

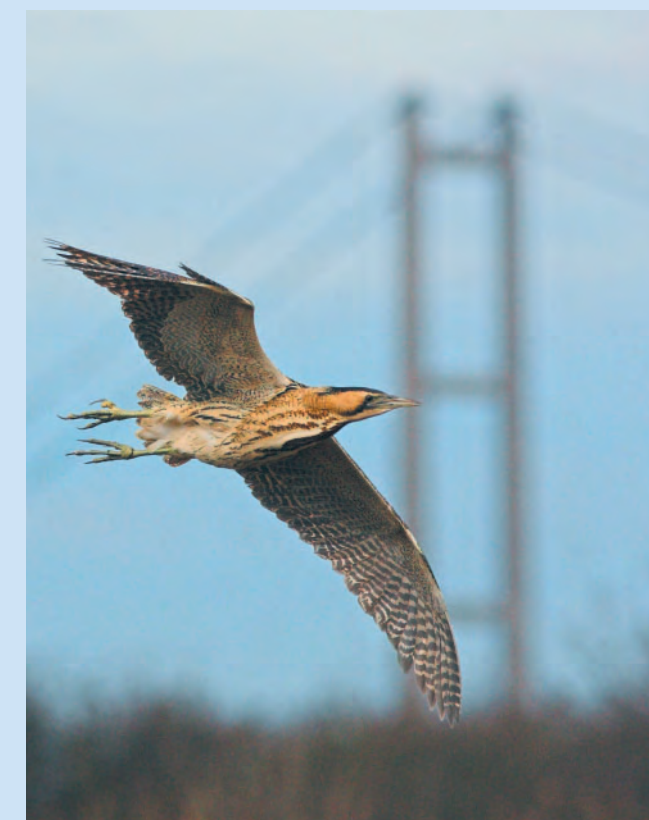
An EC Directive that aims to establish a framework for the protection of rivers and lakes, estuaries, coastal waters and groundwater.

Whole life cost

The overall cost of keeping something functioning satisfactorily for a given period, including both routine maintenance and more significant periodic repairs and improvements.

Withdrawing maintenance

The decision to stop carrying out any further work of any nature (including routine maintenance, repairs or improvements) to a defence.



Bittern

Abbreviations



- ABP** – Associated British Ports
- BAe** – BAe Systems plc
- CFMP** – Catchment Flood Management Plan
- CHaMP** – Coastal Habitat Management Plan
- Defra** – Department for Environment, Food and Rural Affairs
- HECAG** – Humber Estuary Coastal Authorities Group
- HESMP** – Humber Estuary Shoreline Management Plan

- PPP/PFI** – Public-private partnership/private finance initiative
- PPS 25** – Planning Policy Statement 25: Development and Flood Risk
- SEA** – Strategic Environmental Assessment
- SFRA** – Strategic Flood Risk Assessment
- SMP** – Shoreline Management Plan
- UKCIP** – UK Climate Impacts Programme

Contact details

This document summarises the Humber Flood Risk Management Strategy and is supported by the reports listed on page 54. If you would like any further information about the strategy or about the estuary's flood defences, please visit our website, www.environment-agency.gov.uk/humberstrategy, or contact the Humber Strategies Manager, Philip Winn, by post, telephone or e-mail to the address given below:

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www.environment-agency.gov.uk/humberstrategy

Planning for the rising tides

The Humber Flood Risk Management Strategy

Appendix K

Statement by Deborah Morris re MEP flood risk impacts



**Able Humber Ports Ltd
Marine Energy Park
Proposal to build a quay and associated development
on the south bank of the River Humber**

Planning Inspectorate Reference: TR030001

**Statement by
Deborah Morris, BSc (Hons), Civil Engineering**

**On behalf of
The Environment Agency
Unique Reference Number: 10015552**

29 June 2012

1.0 Introduction

- 1.1 This evidence is given by Deborah Morris. I am employed by the Environment Agency as the Coastal Partnerships and Strategic Overview Advisor. I hold a 1st Class Honours Degree in Civil Engineering from Nottingham Trent University and I have been employed by the Environment Agency since November 1997. During this time I have developed my career as a flood risk engineer considering flood risk with regards to proposed development and works which affect our Main Rivers and Sea Defences. I have undertaken a continuous programme of training and professional development in various specialist subjects ranging from hydrology to town and country planning.
- 1.2 My work involves reviewing flood risk assessments (FRAs) submitted in support of planning applications covering most of Lincolnshire including development on the East Coast from the Humber to the Wash, encompassing the area of Immingham. When commenting on planning applications, the Partnerships and Strategic Overview teams of the Environment Agency aim to ensure that flood risk is not increased, and where possible, is reduced and to ensure that development is 'safe'.
- 1.3 This written statement addresses the technical aspects of flood risk in relation to the proposed Able Marine Energy Park (AMEP) and in particular the consideration of Paragraph 5.2.16. bullet point 3 of the National Policy Statement for Ports (NPSP) Exception Test. In my assessment I have considered the AMEP supporting FRA against the minimum requirements for FRAs detailed in Paragraph 5.2.5 of the NPSP.

2.0 Flood Defences

- 2.1 The current flood defences are constructed from a concrete recurve defence wall with bitumen grouted stone revetment. The identified

current range of standards of protection for the length of defences at the AMEP site is considered to be between a 2% to 0.67% chance of occurring in any one year (1 in 50 year return period to 1 in 150 year return period). When considering the lifetime of the quay development (100 years) the chance of the 2% flood occurring in any one year is 87% and there is 49% chance of occurrence for 0.67% flood. This means that it is likely the defences will be overtopped over the lifetime of the development and the need for future improvements. The Environment Agency has given the defences a condition standard rating of 3 which is defined as 'Fair – where defects have been identified that could reduce performance of the asset'. The flood defences have a predicted residual life of 20 years however this is difficult to assess so it maybe longer or shorter depending on how they continue to deteriorate. Over the lifetime of the proposed development, works on the defences will be required for both improvements and maintenance.

- 2.2 The defence line is identified as Flood Area 23 – Halton and Killingholme Marshes within The Humber Flood Risk Management Strategy dated March 2008 (attached as Appendix J to the Environment Agency's Written Representations – Page 48). The proposed management policy for this cell is to continue to protect existing development whilst planning to stop maintaining defences which protect currently undeveloped areas. The flood defence protecting this flood cell is 7.3Km in length and protects 876 Ha of land, which includes 871 Ha currently in agricultural use and 26 residential properties.
- 2.3 The proposed quay will be constructed on the seaward side of the defence and access to it will be provided by ground raising over the existing defences. The current height of the existing defence is 6.20m ODN. Able Humber Ports Limited ('Able') proposes to raise the ground level to 6.38m ODN. The quay will have a platform level of 6.10m rising landwards to the 6.38mODN level at a 1 in 100 slope. This means significant wave action will occur over the front edge of the quay, which will be intercepted by drainage channels.

- 2.4 It is proposed to raise the quay by 200mm to take into account climate change. This final level will see the quay front set at 6.30m ODN and the raised land behind set at 6.58m ODN.
- 2.5 In order to ensure that the standard of protection afforded by the quay does not deteriorate over the lifetime of the development (100 years) continued maintenance will be required. To ensure this occurs a legal agreement between Able and the Environment Agency must be in place. If the standard of protection falls at the site, parts of flood cell 23 will be at increased risk of inundation. As illustrated in the breach hazard mapping within Appendix I of Able's supporting FRA (Environmental Statement, Annex 13.1) large areas of the flood cell will be affected by flood water. From the modelling outputs it can be seen that various flood depths are predicted, in some areas this will reach over 2.0m in depth. Please refer to section 3.0 for further analysis on the site and surrounding area.
- 2.6 Due to the proposed construction of the quay, wave reflection off the quay will impact on the defences both to the north and south. The increased wave height indicated in the FRA is based on the original quay design, which has been subsequently amended. We are currently waiting for modelling results of the amended design but the original assessment concluded there would be a negative impact, lowering existing defence standard of protection. Looking to 2033 which is the approximate lifetime of the current Humber Strategy for the defence the proposed quay would result in greater volumes of flood water overtopping the defences. The predicted 100mm increase south of the quay would see an increase of 37% and the 400mm increase to the north would see 188% increase (Values taken from Table 14 of Appendix H Quay Design).
- 2.7 To mitigate the impacts of increased wave height Able propose to improve the defences along the affected area and amend the quay

design to reduce its impact on wave reflection action. They also expect the increased sedimentation south of the quay to mitigate the impacts of the wave reflection. To ensure the defence standard is not compromised we will require adequate monitoring of sedimentation accretion and erosion and a contingency plan to improve the defences if the sedimentation accumulation does not occur. This approach must be secured in the Development Consent Order or a legal agreement to ensure that flood risk is not increased.

- 2.8 To overcome Environment Agency's objection to the application the final report will need to be completed to allow us to assess the impacts of the quay and reach an agreement on the design and maintenance to improve the sea defences. Until such time there remains an outstanding concern on the increase in flood risk created by the proposal.
- 2.9 Environment Agency officers must be able to gain access along the sea defences at all times. Once the works are completed this will exclude the quay, which will then be maintained and inspected by Able. Access to the north of the quay will be along the same route currently used with access gained from North Killingholme Haven as shown in Appendix 1 Dwg No. AME – 01151 Rev B. However, a turning facility will need to be provided adjacent to the proposed quay. Access to the south of the quay will require suitable right of entry through the site from Rosper Road. These access requirements must be agreed within a legal agreement to ensure the Environment Agency can undertake its permitted duties of inspection, improvement and emergency response in order to manage flood risk.
- 2.10 As part of the proposed surface water scheme a new pumping station needs to be commissioned, operated and maintained. This requires an outfall through the sea defences south of the quay and works within 9 metres of the defences. Currently design proposals within the application are generic with no specific detail. In order to protect the integrity of the sea defences the Environment Agency require suitably worded

protective provisions within the Order and Able must accept a legal obligation to design, operate and maintain the pumping station if it is not to be adopted by the North East Lindsey Drainage Board. Such provisions either within the DCO or in a legal agreement must be in place prior to formal permission being granted. Consideration is also required around supporting legislation such as Eels (England and Wales) Regulations 2009 which may influence the design and construction of the pumping station and its outfall.

2.11 In conclusion, the proposed scheme impacts on the Flood Defences at and around the site. Thorough consideration and agreement of the issues outlined above is essential in order to protect surrounding land, property and occupants within the flood plain. Whilst the final detail is not sufficient and we are still awaiting additional requested information to formalise a final response and recommendation, the general principle of development is acceptable providing some safe guards are in place. These principally amount to ensuring a Section 30 Anglian Water Authority Act 1977 legal agreement is completed, the requirement for Able to apply for flood defence consent is protected and suitable requirements are imposed on the DCO. The Environment Agency will continue to work with Able on the application with the aim of ensuring that flood risk to the local area is not compromised and the impacts of climate change are considered and mitigated.

3.0 Flood Risk

3.1 The submitted flood risk assessment looks at many aspects of the development and its impacts. In order to achieve this JBA, the consultants advising Able on flood risk issues have taken the Environment Agency Coastal Hazard Mapping model and amended it to reflect the proposed quay and land raising. The results of the breach modelling is included in Annex I of the flood risk assessment submitted by Able (Annex 13.1, Flood Risk Assessment and Drainage Strategy, JBA Consulting August 2011), .

- 3.2 The submitted modelling methodology is acceptable to the Environment Agency and has considered two breach locations plus residual (overtopping) risk. One breach is located north of the quay and the second south of the quay. From the results in Table 2 of the Technical Note dated 4/8/11 in Appendix I of the Flood Risk Assessment it can be seen that the southern breach records the greatest flood depths on the site at 5.60m ODN taking into account climate change up to 2114.
- 3.3 The inclusion of the quay and associated land raising has been modelled and evidences a resultant increase the flood depths by approximately 300mm at the residential property Hazel Dene (from the southern breach). This increases the predicted 2114 breach flood depth at the dwelling from 2.84m to 3.14m. When considering the residual Overtopping run the flood depths are lowered to 2.70m for the same storm event. The impacts of the increase in flood depths and the safety of the occupants is beyond the scope of the Environment Agency and the Examining Authority will need to determine if this increase is either significant or acceptable and make its recommendation to the Secretary of State. The project results in an increase in flood depth, which appears contrary to Paragraph 5.2.16, 3rd bullet point, of the National Policy Statement for Ports. However, Paragraph 5.2.19 highlights that the decision-maker may still grant consent, if it satisfied that the increase in flood risk can be mitigated to an acceptable level, taking account of the benefits of the port infrastructure.
- 3.4 The breach modelling (Able's flood risk assessment, Appendix I, section 3.2) has also identified an increase of up to 500mm to industrial buildings located on the western side of Rosper Road, at the junction of Marsh Lane.
- 3.5 The breach modelling has demonstrated no noticeable increase in flood flow velocities outside of the site development area to third parties. This

indicates that the rate of onset of flooding remains largely unchanged following the proposed development.

- 3.6 The breach modelling demonstrates the development site itself suffers significant flooding which rapidly occurs, the site has also historically flooded during the 1953 floods due to overtopping of the defences. Flood waters from the southern breach reach 1m in depth within 15 minutes and spread across the whole site in 1.5 hours. This rapid inundation will need to be considered when evaluating a Flood Warning and Evacuation Plan (FWEP) for the site as outlined in section 4 of the flood risk assessment. The FWEP will be an essential element in the management of the residual risk, and the decision maker should consider the acceptability of this in accordance with Paragraph 5.2.28 of the National Policy Statement for Ports.
- 3.7 Section 3.7 of the flood risk assessment proposes 'safe' refuge areas in mezzanine floors within the buildings. These will be set at 6.84m ODN above the predicted modelled flood depths on the site for the design flood.
- 3.8 The flood risk assessment recommends the incorporation of flood resistant construction measures. These will have to consider the predicted depth of flooding to ensure the buildings are recoverable after a flood.
- 3.9 In conclusion the site suffers significant rapid and deep flooding which needs to be mitigated. The Flood Warning and Evacuation Plan will need to be assessed by the relevant Emergency Planning Authority, North Lincolnshire Council, to ensure that it addresses the safety of the occupants of the Marine Energy Park. This will need to consider the rapid onset and the fact that occupants will be trapped in the safe refuge areas above the predicted flood depths. The use of flood resilient construction will allow the fabric of the building to be recoverable after the flood. We would recommend the Examining Authority considers the

impact of the development on third parties and if the predicted increase in flood depths are either significant or acceptable and make recommendations to the Secretary of State on this issue.

4.0 Surface Water

- 4.1 The current proposal is for the inland plots surface water to discharge into the North East Lindsey Drainage Board Killingholme Marshes scheme together with alterations proposed to the scheme to address the impacts of the Quay and Marine Energy Park. This involves relocating the existing gravity outfall, proposed pumped outfall and pumping station.
- 4.2 The surface water from the quay will be on a separate system and discharge directly to the Estuary.
- 4.3 The proposed North East Lindsey Drainage Board Killingholme Marshes scheme is designed for the 1% (100 year) flood with an adaptive approach to climate change. This ensures that the increased volumes of surface water runoff are taken into account over the lifetime of the proposed development.
- 4.4 A study undertaken by JBA regarding the Pumping Station Feasibility has been submitted to support the application. This highlighted four options and concluded that Option D to relocate the pumping station south of the quay is the most appropriate. The study identified that for this option the current quay layout may require some amendment and further consideration on land ownership as it is understood that two developers share ownership of the field adjacent to Station Road behind the River Humber bank.
- 4.5 We would recommend that the Examining Authority takes into account the comments of North East Lindsey Drainage Board regarding the proposed surface water scheme. We are aware that they have had

extensive meetings and discussions with Able to try and move the Killingholme Marshes scheme forward and they are best suited to provide a comprehensive update and synopsis of the impacts of the proposed development on the scheme.

4.6 No calculations have been made or submitted to determine the size and recommended operation of the proposed pumping station. These will need to be incorporated in the final design to ensure that surface water does not cause a flood risk to the site and third parties.

4.7 In conclusion to guarantee the final drainage design incorporates the requirements of Killingholme Marshes scheme, ensures that plot drainage is adequate and there is no negative impact to the site and on third parties, a suitably worded surface water requirement is needed. I would recommend the following requirement wording:

Requirement

No development shall commence until a detailed surface water drainage scheme for the site, based on sustainable drainage principles and an assessment of the hydrological and hydro geological context of the development, has been submitted to and approved in writing by the local planning authority. The scheme shall subsequently be implemented in accordance with the approved details before the development is completed.

Reason: To prevent the increased risk of flooding.

5.0 Case for Legal Agreement

5.1 To provide the Environment Agency with confidence and powers to ensure flood risk is not increased by interference, damage, or reduction in standard of flood protection due to the proposed development a Legal Agreement with Able is required.

- 5.2 A legal agreement will allow the Environment Agency to limit the level of detail required within the proposed application and support/complement our recommended requirements to the Examining Authority.
- 5.3 The legal agreement will support the application, ensure that flood risk is adequately mitigated, reduce the burden on the public purse for maintaining a section of defences at the quay and to ensure the effects on surrounding defences are mitigated in line with the Humber Flood Risk Management Strategy.
- 5.4 If a legal agreement is not concluded between the Environment Agency and Able would result in the Environment Agency objecting to the proposed development. To overcome our objection we would require further detailed information on the issues covered by the legal agreement and issue flood defence consents for the proposed works.

6.0 Outstanding Information

- 6.1 We are still awaiting the amended report on wave reflection following the alteration in the Quay design. This information is required to make a final assessment on the impact of the quay on the defences and the amount of sedimentation likely to occur around the site. The results of the report will provide detail for the legal agreement and recommendation of requirements for the Development Consent Order.
- 6.2 We are still awaiting confirmation that a suitable amended approach for the Killingholme Marshes Scheme has been agreed with North East Lindsey Drainage Board and Able.

7.0 Conclusion

- 7.1 In summary, there are still issues relating to flood risk management, which need to be resolved. On receipt of the outstanding information from Able, outlined above, and subject to satisfactory legal safeguards

being in place, I anticipate that our current objections can be overcome.

Appendix 1 – Plan showing Environment Agency Access



Appendix L

Statement by Daniel Normandale re CCS flood risk impacts

**Able Humber Ports Ltd
Marine Energy Park
Proposal to build a quay and associated development
on the south bank of the River Humber**

Planning Inspectorate Reference: TR030001

**Statement by
Daniel Normandale BSc, MCIWEM, C.WEM, CEnv**

**On behalf of
The Environment Agency
Unique Reference Number: 10015552**

29 June 2012

1.0 Introduction

- 1.1 I am Daniel Normandale, a Partnerships & Strategic Overview Advisor for East Yorkshire, within the Flood and Coastal Erosion Risk Management function of the Environment Agency's Yorkshire & North-East region. I have 11 years experience of assessing flood risk matters affecting the Humber Estuary, a role I attained after gaining a HND qualification in Civil Engineering, as well as previous experience as a DEFRA marine regulator for the Humber. I am a Chartered Member of the Chartered Institute of Water and Environmental Management (CIWEM) and a Chartered Environmentalist with the Society for the Environment.

2.0 Current Defences and Flood Risk

- 2.1 The Cherry Cobb Sands area on the North bank of the Humber put forward by Able as compensatory habitat is currently defended from tidal inundation by a raised turf-faced earth flood bank, situated parallel to the Humber estuary. This defence is maintained by the current landowner, Crown Estates. The flood bank is part of a defence line which protects 'Flood Area 4 – Stone Creek to Paull Holme Strays' page 29, in the Environment Agency's Humber Flood Risk Management Strategy – March 2008' (*Attached as Appendix I to the Environment Agency's Written Representations*). This flood area contains scattered farms and high-grade agricultural land. 195 properties and 3268 hectares of agricultural land are listed within a floodable area of 3300 hectares. The villages of Ryehill and Camerton lie on the outer edge of the floodable area, were the defences to be removed or to fail. Using hazard maps from East Riding of Yorkshire's Strategic Flood Risk Assessment Level 1 (January 2010) the submitted Flood Risk Assessment (Chapter 36; Annex 36.1) for Cherry Cobb Sands identifies 19 properties at risk if the flood defence fails.
- 2.2 The 'South Holderness Study' (Arup 2011), commissioned by the Environment Agency, states that the Cherry Cobb Sands defence currently provides protection up to the equivalent of a 1 in 200 year magnitude flood event, the probability of this which equates to a 0.5% probability in any year (Annual Exceedance Probability - AEP). Due to the anticipated impacts of climate change, leading to rising sea levels, the Standard of Protection will deteriorate to between 1 in 100 to 1 in 75 years (1-1.3% AEP) by 2060 and to between 1 in 25 to 1 in 10 years (4 -10% AEP) by 2110. A condition assessment report by Arup in 2009 (Strategy development: Phase 2a Sunk Island Asset Inspection – Exception Report on Asset Condition. Flood cells 3 and 4) described the bank as overgrown and uneven, requiring attention and closer investigation and graded its visual inspection condition as Grade 4, 'poor' (graded as per the Environment Agency's Condition Assessment

Manual), the description of which is “Defects that would significantly reduce the performance of the asset. Further investigation needed”.

- 2.3 The Environment Agency’s ‘Humber Flood Risk Management Strategy, Summary Document – March 2008’ states that Flood Area 4, amongst others, is unlikely to attract government funding for future improvement work, due to its sparse population. The residual lifetime of existing defences is estimated to be between 10 and 20 years. The costs of replacing the 2 kilometre length in question can be estimated from an analogous scheme, recently completed at Brough, some 30 km upstream from Cherry Cobb Sands. Here, a new earth flood bank and sheet piled wall, of a combined length of 2 km cost approximately £5.8m, protecting approximately 8000 properties in Brough. This was, predominantly paid for from the public purse but funding was also provided from local private concerns.

3.0 Proposed New Flood Defence

- 3.1 The Able proposals at Cherry Cobb would result in approximately 3.2 km of new flood defence grass and erosion protection-faced earth embankment constructed to the landward side of the existing defence. At its maximum extent, the new defence will be 750 metres away from the old defence. At its two northern and southern extremities, the new defence will be constructed to tie in at right angles to the existing defences (see Figure 28-1 – Compensation Site layout – Chapter 28 Description of the Development (Cherry Cobb Sands)). The crest height of the new defence will be set in excess of the existing defence. Effectively, the standard of defence for the area will be increased to in excess of 1 in 200 years plus allowances for 100 years of projected climate change sea level rises. Where the new embankment will be subject to direct wave action, the crest level will be 7.50 metres AOD and 7.00 m AOD elsewhere. The old defence will be deliberately breached along a 250 metre stretch as denoted in Figure 28-1, to allow cyclical tidal inundation of the land between the two sets of defences.

4.0 Risks associated with New Flood Defence

- 4.1 The scheme clearly represents a significant benefit in terms of an increased standard of protection to land affected. Additionally, the new embankment will begin its life in considerably better condition than the existing deteriorating structure. However, there are associated risks going forward.
- 4.2 The new defence, by virtue of its initial inland location, is in closer proximity to nearby dwellings. The FRA (Chapter 36 and Annex 36.1) acknowledges that using the hazard mapping methodology from East Riding of Yorkshire Council’s Strategic Flood Risk Assessment (after DEFRA/EA’s report - FD2320 Flood Risk Assessment for New Development) the residual risk to some of these properties will

increase. This residual risk would arise from a structural failure of the new defence.

- 4.3 Additionally, if further sections of the old defence breach or collapse naturally, in an uncontrolled manner then areas of the new flood defence which do not benefit from erosion protection will be exposed to direct wave action, increasing erosion risk and potential future overtopping given the crest level will be 0.5 metres lower along lengths originally intended to be beyond direct wave action.
- 4.4 The suitability of material used to build the embankment could also present a risk. It is proposed to utilise winnings from excavations within the realignment site as bank material. In Annex 31.3, AMEP Site Investigation Interpretative Report, doubts are expressed by the report writers of the suitability of site-won material. More Site Investigation work has been scheduled by Able to address these uncertainties and we await the results.
- 4.5 We support the report's recommendation that a trial embankment is constructed so any issues can be identified before actual bank construction. An alternative way forward has since been presented by Able, involving a time lapse between bank construction and breach of the old bank, to allow a sufficient period of settlement and establishment of vegetation so any structural issues are identified and so erosion potential is minimised. Agreement would be required with both the Environment Agency and Natural England for such a solution to be realised.

5.0 Managing these Risks

- 5.1 To reduce this risk, it is paramount to ensure that the new flood bank's structural integrity is maintained through time. To achieve this typically requires frequent and scheduled monitoring, inspection, routine maintenance (e.g. grass cutting; vermin control) and a commitment to deliver necessary repairs, remediation and even improvement.
- 5.2 The Environment Agency carries out such activities on flood banks for which it is responsible, having the resources, responsibilities and accountabilities to do so. However, the Environment Agency has no such responsibilities at Cherry Cobb Sands, save for routine visual condition inspections that are carried out on all defences.
- 5.3 Responsibility will remain with the landowner for the existing defence and extend to the new defence during construction and completion, which if the scheme proceeds, will be Able. Clearly, they are not a Flood Risk Management public body like the Environment Agency, with the pre-requisite resources, expertise and transparent, embedded responsibilities and accountabilities in law.

6.0 Legal Obligation to maintain New Flood Defence

- 6.1 In the Environment Agency's opinion it is essential that Able is legally obliged to ensure the new flood defences to the Cherry Cobb Sands site are properly maintained to an appropriate standard and continue to be fit for purpose for the protection of local communities and agricultural holdings.
- 6.2 Without an enforceable legal agreement, there is a risk that the defences will not be properly maintained, falling into disrepair. Such a deterioration in condition could increase the likelihood of flooding and lead to the Environment Agency having to take over responsibility. This would strain existing resources and publicly-funded budgets..
- 6.3 A legal agreement, between the Environment Agency and Able, (which would be made under Section 41 of the Yorkshire Water Authority Act 1986), could contain details of the sequence of works, including timing of the existing flood defence breaching, geotechnical and flood protection standard of works and maintenance, inspection and, going forward, remediation arrangements, responsibilities and liabilities for the new and old defences.
- 6.4 We are currently in discussions with Able regarding many of the above aspects and have asked for further technical details in some cases. We hope to reach agreement with Able on the legal obligations they need to accept in relation to the new flood defences for the important reasons set out above, which is acceptable to both parties. If this cannot be concluded before the examination closes leaving us still uncertain about key aspects of deliverability our position will remain that of objecting to the proposed development.

7.0 Requirements for Land Drainage Byelaw consent

- 7.1 Consent under the Environment Agency's Yorkshire Land Drainage Byelaws 1980 is required for all permanent and temporary works which affect the existing and new flood defences.

8.0 Monitoring of siltation levels in Stone Creek

- 8.1 The creation of the managed realignment site also has the potential to increase siltation levels in Stone Creek, some 400 metres south-east of the site. Able has acknowledged the potential for the development to exacerbate siltation (Chapter 36, para 36.8.5; Chapter 32) more certainly in the first few years. Paragraph 2.2.18 of the FRA, Annex 36.1 makes reference to the implementation of an agreed monitoring and maintenance plan to determine any impacts caused on Stone Creek and identify what triggers would lead to mitigation being required.

8.2 We agree that a monitoring and maintenance plan is needed. Siltation is already an existing issue on Stone Creek, constituting a major constraint on the effective drainage of land from four watercourses which outfall into the Humber immediately south of the compensation site. Currently, the Environment Agency and local Internal Drainage Board are working together to fund and carry out dredging works. However, any increased siltation from the compensation site during construction or operation will reduce the effectiveness of the dredging programme. It is unreasonable to expect additional public funds be made available to mitigate for effects directly attributable to the compensation site.

8.3 Consequently, we request the following requirement be included in the DCO:

Condition

No development shall commence until a scheme for the monitoring of sediment and siltation for Stone Creek has been submitted to and approved in writing by the Environment Agency and Local Planning Authority. The scheme shall include:

- Details of monitoring proposals, including location and frequency;
- Details of trigger levels and resultant actions required if trigger levels are exceeded.

Development shall proceed fully in accordance with the approved scheme and timetable therein.

Reason: To ensure drainage of the surrounding land is not compromised thereby increasing the risk of flooding to third parties and compliance with the Water Framework Directive.

29 June 2012



**Able Humber Ports Ltd
Marine Energy Park
Proposal to build a quay and associated development
on the south bank of the River Humber**

Planning Inspectorate Reference: TR030001

**Summary of Relevant Representations made by
The Environment Agency
Unique Reference Number: 10015552**

29 June 2012

Submitted on behalf of the
Environment Agency by:
Annette Hewitson, MSc, MRTPI
Principal Planning Officer
Waterside House
Waterside North
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LN2 5HA

Summary of Environment Agency Relevant Representations

As required by the Planning Inspectorate Rule 8 letter, Annex C, Item 4, the following provides a summary of the main issues contained in the Environment Agency's Relevant Representations, which exceeded 1500 words.

The Environment Agency has statutory duties in respect to: flood and coastal risk management, water resources, water quality, land contamination, salmon and freshwater fisheries and contributing to sustainable development.

The main concerns in relation to the Able Marine Energy Park project are as follows:

Marine Energy Park

Flood Risk

Although the risks to and from the development of the Marine Energy Park site have been assessed, this was undertaken on an early version of the quay design. We therefore require an update to this work, based on the final quay design, to ensure the findings are still valid. From the work provided so far, we can advise that the proposal will impact on overland flood flows, increasing the depth of flooding, to properties along Manby Road and Marsh Lane (one of which is a residential property known as Hazel Dene).

We also require further assurance that a satisfactory surface water management scheme will be implemented.

All works within 9m of our sea defences require our consent under the Environment Agency Anglian Region Land Drainage and Sea Defence Byelaws 1987. We will therefore require protective provisions/legal agreements to ensure our interests are protected.

Impact on Migratory Fish

We are concerned that the noise and vibration from around 26 weeks of percussive piling during the construction period has the potential to damage migratory fish populations in the Humber. We are seeking to secure conditions and requirements in the Marine Licence and DCO to mitigate these impacts, and provide compensations for residual impacts.

Hydrodynamic and Sedimentary Regime

The assessment of the proposal in respect of the impact on the hydrodynamic and sedimentary regime is not, in our opinion, adequate. There is little discussion of the impact of waves, no assessment of the impact of capital and maintenance dredging on the long-term impact on estuary processes, including indirect inter-tidal losses. The in-combination and cumulative impact assessments are also inadequate. Additional modelling in respect of the final quay design has not been undertaken; earlier modelling cannot be relied upon.

Cherry Cobb Sands

The Cherry Cobb Sands (CCS) site is included in the Humber Strategy as a planned habitat creation site to compensate for the coastal squeeze losses. The Humber Estuary Coastal Habitat Management Plan (CHaMP) commits the Environment Agency to compensate for the loss of inter-tidal habitat on a 1:1 basis for coastal squeeze and temporary disturbance from Flood Risk Management Schemes. Whilst we recognise that the Strategy comes with a delivery risk, by identifying sites where we do not currently own the land, the Able project has the potential to hinder our ability to deliver habitat compensation requirements.

There is known contamination at CCS and the submitted reports identify the need for further intrusive investigation work to be undertaken. This further investigation work is not only required to provide us with an assurance that the site does not pose a risk of pollution to controlled waters, it is also necessary to provide us with confidence that the site winnings are suitable to use in the construction of the new flood defence embankment. There are also outstanding issues in respect of the final design of the new flood embankment, which requires consent under our byelaws, and we will require these works to be secured using appropriate requirements/legal agreement.

Foul Drainage requirements

We are working with Able and Anglian Water Services in respect of quantities and flows from the proposed development in order to gain greater certainty that any required Environment Permit variations can be accommodated within environment limits.

Water Framework Directive

Further WFD assessment work is required to enable us to provide advice to the Secretary of State on whether or not this proposal will cause deterioration in waterbody status.

Waste

We are satisfied that the waste chapters cover the relevant Duty of Care aspects of the development proposal from construction to operation. Able acknowledges the relevant legislation and the requirement to undertake a Site Waste Management Plan.

Environmental Permits

The proposed quay construction may require the diversion of existing E.ON and Centrica outfalls. The current outfalls are regulated by Environmental Permits issued to the operators. Diversion of the outfalls will require a variation to these permits, and therefore the agreement of the operators.