Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Environmental Statement Volume 5

Annex 6.2: Flood Risk Assessment

June 2018, Revision A

Document Reference: 6.5.6.2

Pursuant to: APFP Reg. 5(2)(a)

Vattenfall Wind Power Ltd

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Volume 5

Annex 6.2: Flood Risk Assessment

June 2018

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Date of Approval	June 2018
Revision	A

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1 Introduction

1.1 Context

1.1.1 This Flood Risk Assessment (FRA) accompanies the Environmental Statement (ES) submission by Vattenfall Wind Power Ltd (VWPL) to the Secretary of State (delegated to the Planning Inspectorate (PINS)) for the onshore elements of the proposed Thanet Extension Offshore Wind Farm (hereafter referred to as the proposed development or Thanet Extension). This report forms Annex 6.2 of the ES (Document Ref: 6.5.6.2). This FRA has been prepared based upon the final versions of the proposed development drawings provided in the Volume 3, Chapter 1: Onshore Project Description: (Document Ref: 6.3.1).

1.1.2 This assessment has been prepared in accordance with the Planning Act 2008, National Policy Statement (NPS) EN-1 (Department of Energy and Climate Change, 2011a) which sets out planning policy with regard to Nationally Significant Infrastructure Projects (NSIPs) in the energy sector, EN-3 (Department of Energy and Climate Change, 2011b) which covers renewable energy infrastructure, and EN-5 (Department of Energy and Climate Change, 2011c) which covers electricity transmission and distribution. Reference has also been made to the *National Planning Policy Framework (NPPF)* (Department for Communities and Local Government, 2012) and *Planning Practice Guidance* (Department for Communities and Local Government, 2014) where relevant for additional guidance regarding flood risk and development. Consultation with key stakeholders, including the Environment Agency, Kent County Council (KCC) (the Lead Local Flood Authority (LLFA)), Thanet District Council (TDC) and the River Stour (Kent) Internal Drainage Board (IDB) has also informed the development of this assessment

1.2 Scope of this assessment

1.2.1 This report considers the flood risks associated with the construction, operations and maintenance (O&M) and decommissioning of the onshore elements of the proposed development. Both flood risks to and flood risks from the proposed development are considered. The red outline shown in the Figures within this document is the anticipated maximum extent of land in which the proposed development, including construction works, would take place.

1.2.2 This assessment follows a source-pathway-receptor led approach to the assessment of flood risk. Sources are defined as the source of the flood risk, such as direct rainfall, watercourses, the sea, groundwater, sewers or artificial sources. The pathways define the means by which the source of flood risk can impact receptors. Examples of pathways include the floodplain of the River Stour. A specific combination of sources and pathways is referred to as a flood mechanism, such as tidal overtopping of the sea defences as a result of high tides and storm surge. Receptors comprise those persons or assets that could be vulnerable to the flood mechanisms identified.

1.2.3 The wider environmental impacts associated with the development, including hydrological impacts, are reported in Volume 3, Chapter 6: Ground Conditions, Flood Risk and Land Use (Document Ref: 6.3.6) of the ES.

1.3 Sources of information and consultation

1.3.1 A range of information and data has been gathered to support this assessment, as summarised in Table 1.1.

1.3.2 Consultation with key stakeholders regarding the scope of this assessment and acquisition of data to support this assessment has included the following activities:

- A meeting with the Environment Agency, KCC and IDB on 28th June 2017 to discuss flood risk and the water environment in general;
- Email exchanges with Environment Agency regarding climate change allowances for the proposed development and flood modelling data for the area (various date sin May and June 2017); and
- A meeting with TDC on 23rd August 2017 to discuss the tidal flood defence of the historical landfill site at Pegwell Bay Country Park.
- Email exchanges and telephone with Environment Agency conversations regarding the expected release of the updated local flood model (5th June 2007, 12th December 2017 and 5th March 2018);

1.3.3 Selected meeting minutes and email records of these consultations of relevance to this assessment are provided in Appendix A of this document.

1.3.4 In addition, representatives of Amec Foster Wheeler carried out a site visit to the proposed development area and the surrounding area on 28th June 2017. A further site visit was undertaken on 23rd August 2017 to view the outfall under the sea defence. Access to the proposed substation area was not possible during either visit and therefore the presence of an existing drainage system in this area could not be confirmed.

Table 1.1: Sources of information used in this assessment

Type	Detail/Source
Data provided by stakeholders	
Environment Agency Product 4 Flood Risk information	Flood zone map, fluvial and tidal flood model map and output data, historical flooding outlines. Environment Agency (2017) 'Product 4 Flood Risk information' supplied on 4th April 2017.
Environment Agency Light Detection and Ranging) (LiDAR) topographic data.	Open UK government data – Environment Agency 'data.gov.uk', https://environment.data.gov.uk/ds/catalogue/index.jsp#/catalogue [Accessed October 2015]. http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/
Widely available sources of data	
Environment Agency, Stour Catchment Flood Management Plan, December 2009	Environment Agency (2009)' Policy paper Stour: Catchment flood management plan', https://www.gov.uk/government/publications/stour-catchment-flood-management-plan [Accessed June 2017]
KCC, Preliminary Flood Risk Assessment, September 2011	KCC (2011) 'Preliminary flood risk assessment', http://www.kent.gov.uk/about-the-council/strategies-and-policies/environment-waste-and-planning-policies/flooding-and-drainage-policies/preliminary-flood-risk-assesment [Accessed June 2017]
KCC, Local Flood Risk Management Strategy, June 2013	KCC (2013) 'Local Flood Risk Management Strategy', http://www.kent.gov.uk/about-the-council/strategies-and-policies/environment-waste-and-planning-policies/flooding-and-drainage-policies/kent-flood-risk-management-plan [Accessed June 2017]
KCC, Drainage and Planning Policy Statement Local Flood Risk Management Strategy guidance, June 2017	KCC (2017) 'Drainage and Planning Policy Statement Local Flood Risk Management Strategy guidance', http://www.kent.gov.uk/__data/assets/pdf_file/0003/49665/Drainage-and-Planning-policy-statement.pdf [Accessed June 2017]
KCC, Thanet Stage 1 Surface Water Management Plan (SWMP), May 2013	KCC (2013) 'Thanet surface water management plan', http://www.kent.gov.uk/about-the-council/strategies-and-policies/environment-waste-and-planning-policies/flooding-and-drainage-policies/surface-water-management-plans/thanet-surface-water-management-plan [Accessed June 2017]
KCC, Kent Minerals and Waste Development Framework Strategic Flood Risk Assessment, May 2012	KCC (2012) 'Preferred Options consultation - May 2012 – all documents', https://shareweb.kent.gov.uk/Documents/Forms/AllItems.aspx?RootFolder=%2fDocuments%2fenvironment%2dand%2dplanning%2fplanning%2dand%2dland%2duse%2fPreferred%20Options%20consultation%20%2d%20May%202012&FolderCTID=0x01200019B0E8F7AFBFA541BB6297103765733A [Accessed June 2017]
KCC, Kent Minerals and Waste Local Plan 2013-30, July 2016	KCC (2016) 'Minerals and Waste Local Plan 2013 – 2030', https://www.kent.gov.uk/about-the-council/strategies-and-policies/environment-waste-and-planning-policies/planning-policies/minerals-and-waste-local-plan/minerals-and-waste-local-plan. [Accessed March 2018]
TDC, Thanet Local Plan Saved Policies and Proposals Map, 2006	TDC (2006) 'Thanet Local Plan 2006 Saved Policies', https://www.thanet.gov.uk/your-services/planning-policy/thanets-current-planning-policy/thanet-local-plan-2006/ [Accessed June 2017]
TDC, Draft Thanet Local Plan to 2031 Preferred Options, January 2015	TDC (2015) 'Local Plan', https://www.thanet.gov.uk/your-services/planning-policy/thanets-new-local-plan/what-is-the-new-local-plan/ [Accessed June 2017]
TDC, Thanet Strategic Flood Risk Assessment (SFRA), April 2009	TDC (2009), 'Strategic Flood Risk Assessment (SFRA)', http://thanet.gov.uk/your-services/planning-policy/evidence-base/strategic-flood-risk-assessment/ [Accessed June 2017]
Dover District Council (DDC) SFRA, September 2007	DDC (2007) 'Strategic Flood Risk Assessment and Appendices', https://www.dover.gov.uk/Planning/Planning-Policy-and-Regeneration/PDF/Strategic-Flood-Risk-Assessment-and-Appendices.pdf https://www.dover.gov.uk/Planning/Planning-Policy-and-

Type	Detail/Source
	Regeneration/PDF/Strategic-Flood-Risk-Assessment-and-Appendices.pdf [Accessed June 2017]
DDC, Local Development Framework Core Strategy, Adopted February 2010	DDC (2010) 'Dover District Local Development Framework Core Strategy Adopted February 2010', https://www.dover.gov.uk/Planning/Planning-Policy-and-Regeneration/PDF/Adopted-Core-Strategy.pdf [Accessed June 2017]
River Stour (Kent) IDB Policy Statement on Flood Protection and Water Level Management, June 2012	IDB (2012) 'Policy / Environmental', http://www.riverstouridb.org.uk/policy.php [Accessed June 2017]
British Geological Survey (BGS) website; Geology of Britain Viewer	BGS 'Geology of Britain Viewer' http://mapapps.bgs.ac.uk/geologyofbritain/home.html [Accessed June 2017]
National Soil Research Institute (NSRI) Soilscapes map viewer	Soil classification data Envirocheck report (2017) dated 3rd March 2017 (reference 116412988_1_1)
Environment Agency 'What's In My Backyard' website	Information on aquifers in the study location Environment Agency 'What's In Your Backyard', http://apps.environment-agency.gov.uk/wiyby/default.aspx [Accessed June 2017]
UK Government website	Flood risk map for surface water and reservoir flooding GOV.UK 'Learn more about flood risk', https://flood-warning-information.service.gov.uk/long-term-flood-risk/map [Accessed June 2017]

1.4 Structure of this report

1.4.1 This report is structured as follows:

- Section 1 provides an introduction to this assessment;
- Section 2 establishes the planning policy context for the assessment;
- Section 3 provides an overview of the proposed development site location and characteristics;
- Section 4 provides a description of the proposed development;
- Section 5 sets out the specific planning requirements for the proposed development;
- Section 6 comprises a screening assessment to consider the potential risk from all sources of flooding prevailing across the development site and the surrounding area and identifies those that require detailed assessment;
- Section 7 presents a detailed assessment of flood risks associated with the proposed development;
- Section 8 specifies flood risk management mitigation measures where appropriate, and considers residual risk;
- Section 8.4.1 presents concluding comments of the assessment; and
- Section 10 provides reference details.

2 Statutory and Policy Context

2.1 Introduction

2.1.1 The purpose of this section is to identify the key policy documents that define the scope of this assessment. The section is structured in a hierarchical order, from national policy down to local guidance.

2.2 Planning Act 2008

2.2.1 The proposed development is an NSIP, as defined by the Planning Act 2008, as it is a proposed offshore energy development with a generating capacity in excess of 100MW. As an NSIP, the project requires the grant of development consent by the making of a Development Consent Order (DCO) application under the Planning Act 2008.

2.3 National policies

Overarching NPS for Energy (EN-1)

2.3.1 The NPS set out government planning policy for NSIPs in England and Wales. The Overarching NPS for Energy (EN-1) (Department of Energy and Climate Change, 2011a) establishes national policy for energy infrastructure and has effect on the decisions by the Secretary of State for Business, Energy and Industrial Strategy on applications for energy developments that fall within the scope of the NPSs.

2.3.2 Sections of EN-1 (Department of Energy and Climate Change, 2011a) that are relevant to this assessment are as follows:

- Section 5.7, which discusses flood risk, setting out the minimum requirements of a FRA as well as information on the application of the Sequential and Exception tests; and
- Section 4.8, which discusses climate change adaptation.

2.3.3 The minimum requirements for all FRAs, irrespective of the development type, as taken from PPS25 (Department for Communities and Local Government (2006 and update in 2010), are set out in paragraph 5.7.5 of EN-1 (Department of Energy and Climate Change, 2011a). These are set out in Table 2.1 below, together with the location in which they are addressed in this assessment.

Table 2.1: EN-1 Minimum FRA requirements

EN-1 Minimum FRA Requirements		Section where provision addressed
Scope of FRA	Be proportionate to the risk and appropriate to the scale, nature and location of the project.	Section 1.2, section 5
Assessment	Consider the risk of flooding arising from the project in addition to the risk of flooding to the project.	Section 1.2, section 6, section 7
Climate change	Take the impacts of climate change into account, clearly stating the development lifetime over which the assessment has been made.	Section 4.2, section 6.4, section 7.4
Approach	Be undertaken by competent people, as early as possible in the process of preparing the proposal.	Section 1.3
Flood risk management infrastructure	Consider both the potential adverse and beneficial effects of flood risk management infrastructure, including raised defences, flow channels, flood storage areas and other artificial features, together with the consequences of their failure.	Section 6, section 7
Vulnerability and safe access	Consider the vulnerability of those using the site, including arrangements for safe access.	Section 7.1.1, section 7.3, section 8.3.1
Assessment	Consider and quantify the different types of flooding (whether from natural and human sources and including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the purpose of the decisions being made.	Section 6, section 7, section 8
Assessment	Consider the effects of a range of flooding events including extreme events on people, property, the natural and historic environment and river and coastal processes.	Section 6, section 7
Residual risks	Include the assessment of the remaining (known as ‘residual’) risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular project.	Section 8.3.1

EN-1 Minimum FRA Requirements		Section where provision addressed
Surface water runoff	Consider how the ability of water to soak into the ground may change with development, along with how the proposed layout of the project may affect drainage systems.	Section 6.4.9, section 7.1.1
Assessment	Consider if there is a need to be safe and remain operational during a worst-case flood event over the development's lifetime.	Section 7
Baseline	Be supported by appropriate data and information, including historical information on previous events.	Section 3, section 6

2.3.4 EN-1 (Department of Energy and Climate Change, 2011a) also includes a number of additional requirements that are specific to Energy Infrastructure. Those that are of potential relevance to the assessment are set out in Table 2.2, together with the location of this report in which they are addressed, or the other ES documents in which they are addressed, where appropriate.

Table 2.2: EN-1 requirements relating to flood risk, and the location in which the requirements are addressed in this report

EN-1 Requirements		Section where provision addressed
Policy	The development proposal should be in line with any relevant national and local flood risk management strategies (paragraph 5.7.9).	Section 2
Flood risk	Where necessary, the development should be appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed over the lifetime of the development (paragraph 5.7.9).	Section 7 (flood resilience and safe access), section 8.1 and section 8.2 (emergency response), section 8.3.1 (residual risk)
Operation of the site	The development should be designed to remain operational when floods occur (paragraph 5.7.24).	Section 8
Functional floodplain	The development should not result in a net loss of functional floodplain storage or impede water flows (within Flood Zone 3b) (paragraph 5.7.24).	Section 5.1.1, section 6.4, section 7.1.1
Flood warning and evacuation plan	Flood warning and evacuation plans should be in place for those areas at an identified risk of flooding. The applicant should take advice from the emergency services when producing an evacuation plan for a manned energy project as part of the FRA. Any emergency planning documents, flood warning and evacuation procedures that are required should be identified in the FRA (paragraph 5.7.25).	Section 8.1 and section 8.2 (emergency response
Climate change	The impacts of climate change should be considered when planning the location, design, build, operation and, where appropriate, decommissioning of the development (paragraph 4.8.5).	Section 4.2, section 6.4, section 7.4
Climate change	PINS should be satisfied that applicants for new energy infrastructure have taken into account the potential impacts of climate change using the latest UK Climate Projections available at the time the ES was prepared to ensure they have identified appropriate mitigation or adaptation measures (paragraph 4.8.6).	Section 4.2, section 6.4, section 7.4
Climate change	As a minimum, the applicant should consider the emissions scenario that the Independent Committee on Climate Change suggests the world is currently most closely following – and the 10%, 50% and 90% estimate ranges. These results should be considered alongside relevant research which is based on the climate change projections (paragraph 4.8.7).	Section 4.2, section 6.4, section 7.4
Climate change	Where energy infrastructure has safety critical elements, the applicant should apply the high emissions scenario (high impact, low likelihood) to those elements (paragraph 4.8.9).	Section 4.2, section 6.4, section 7.4

EN-1 Requirements		Section where provision addressed
Climate change	The applicant should demonstrate that that there are no critical features of the development which may be seriously affected by more radical changes to the climate beyond that projected in the latest set of UK climate projections (paragraph 4.8.8).	There are no critical features that would be affected by more radical change in climate.
Climate change/adaptation	Adaptations to climate change to protect against flood risk may give rise to additional impacts, such as consequential impacts on coastal change (paragraph 4.8.4).	Section 6.4
Adaptation	The potential consequential impacts of adaptation measures, including those addressing flood risk, should be considered by PINS in relation to the application as a whole (paragraph 4.8.10).	Section 7, section 8 No adaptations to climate change required.
Adaptation	Appropriate mitigation or adaptation measures to cover the estimated lifetime of the development should be identified (paragraph 4.8.6). Any adaptation measures should be based on the latest set of UK Climate Projections, the Government's latest UK Climate Change Risk Assessment, when available and in consultation with the Environment Agency (paragraph 4.8.11).	Section 7, section 8 No adaptations to climate change required.
Drainage and Sustainable Drainage Systems (SuDS)	The applicant should give priority to the use of SuDS and make provision for their adoption and maintenance (paragraphs 5.7.9 and 5.7.10).	Section 8.1, section 8.2
Drainage and SuDS	For construction work which has drainage implications, approval for the project's drainage system will form part of the DCO issued by PINS. The proposed drainage system should comply with any National Standards published by Ministers under Paragraph 5(1) of Schedule 3 to the Flood and Water Management Act 2010 (paragraph 5.7.10).	Section 8.1, section 8.2
Drainage and SuDS	Site layout and surface water drainage systems should be designed to cope with events that exceed the design capacity of the system, so that excess water can be safely stored on or conveyed from the site without any adverse impacts (paragraph 5.7.20).	Section 8.1, section 8.2
Drainage and SuDS	The volumes and peak flow rates of surface water leaving the site should be no greater than the rates prior to the proposed project, unless specific off-site arrangements are made and result in the same net effect (paragraph 5.7.21).	Section 8.1, section 8.2
Sequential Test	The PPS25 Sequential Test and sequential approach should be applied (paragraphs 5.7.9, 5.7.12 and 5.7.13).	Section 5.1
Exception Test	The PPS25 Exception Test, where necessary, should be applied (paragraphs 5.7.14 to 5.7.17).	Section 5.1.1

2.3.5 In addition to the requirements listed in Table 2.2, EN-1 (Department of Energy and Climate Change, 2011a) also details the following points:

- Exceptionally, where an increase in flood risk elsewhere cannot be avoided or wholly mitigated, PINS may grant consent if it is satisfied that the increase in present and future flood risk can be mitigated to an acceptable level and taking account of the benefits of, including the need for, nationally significant energy infrastructure (paragraph 5.7.17);
- Where adaptation measures would have adverse effects, these could be implemented should the need arise, rather than at the outset of the development (paragraph 4.8.12); and
- If any adaptation measures give rise to consequential impacts, PINS should consider the impact of the latter in relation to the application as a whole and the impacts guidance set out in Part 5 of the NPS (paragraph 4.8.10).

2.3.6 EN-1 (Department of Energy and Climate Change, 2011a) states that further guidance on flood risk can be found in PPS25. PPS25 has since been superseded by NPPF and the associated Planning Practice Guidance and consequently, where further detail for assessment of the flood risk is provided in NPPF and is of relevance to this assessment, reference has been made to NPPF.

The Sequential Test

2.3.7 The Sequential Test is set out in EN-1 (Department of Energy and Climate Change, 2011a) as follows: "Preference should be given to locating projects in Flood Zone 1 in England or Zone A in Wales. If there is no reasonably available site in Flood Zone 1 or Zone A, then projects can be located in Flood Zone 2 or Zone B. If there is no reasonably available site in Flood Zones 1 or 2 or Zones A & B, then NSIPs can be located in Flood Zone 3 or Zone C subject to the Exception Test."

2.3.8 EN-1 (Department of Energy and Climate Change, 2011a) (and NPPF) also require that a sequential approach should be applied to the layout and design when allocating land for development and land use types within development sites.

The Exception Test

2.3.9 EN-1 (Department of Energy and Climate Change, 2011a) states that "If, following application of the sequential test, it is not possible, consistent with wider sustainability objectives, for the project to be located in zones of lower probability of flooding than Flood Zone 3 or Zone C, the Exception Test can be applied. The test provides a method of managing flood risk while still allowing necessary development to occur."

2.3.10 The Planning Practice Guidance[5] for the NPPF provides further information on the circumstances under which the Exception Test should be applied.

2.3.11 EN-1 (Department of Energy and Climate Change, 2011a) states that: "for the Exception Test to be passed:

- It must be demonstrated that the project provides wider sustainability benefits to the community that outweigh flood risk;
- The project should be on developable, previously developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously developed land subject to any exceptions set out in the technology-specific NPSs; and
- A FRA must demonstrate that the project will be safe, without increasing flood risk elsewhere subject to the exception below and, where possible, will reduce flood risk overall."

2.3.12 The 'exception below' mentioned in the third part of the Exception Test is set out in paragraph 5.7.17 of EN-1 (Department of Energy and Climate Change, 2011a):

> "Exceptionally, where an increase in flood risk elsewhere cannot be avoided or wholly mitigated, the IPC (Infrastructure Planning Commission, now the PINS) may grant consent if it is satisfied that the increase in present and future flood risk can be mitigated to an acceptable level and taking account of the benefits of, including the need for, nationally significant energy infrastructure as set out in Part 3 above. In any such case the IPC should make clear how, in reaching its decision, it has weighed up the increased flood risk against the benefits of the project, taking account of the nature and degree of the risk, the future impacts on climate change, and advice provided by the Environment Agency and other relevant bodies."

NPS on Renewable Energy Infrastructure (EN 3)

2.3.13 EN-3 (Department of Energy and Climate Change, 2011b) covers nationally significant renewable energy infrastructure including offshore generating stations in excess of 100 MW, which applies to Thanet Extension.

2.3.14 Sections 2.6.37 to 2.3.39 state that any potential effects of the cable connecting the wind farm to the onshore substation and the connection to the transmission network should be assessed as part of an Environmental Impact Assessment (EIA);

2.3.15 Section 2.6.40 states that "A proposed offshore electricity cable connecting the wind farm with the onshore electricity infrastructure and any offshore electricity substations that may be required, may constitute associated development, depending on their scale and nature in relation to the offshore wind farm." The proposed development is an associated development to Thanet Extension.

2.3.16 Section 2.6.41 states that the onshore element of the grid connection (electric lines and substations) should be determined in accordance with the Electricity Networks Infrastructure NPS, EN-5 (Department of Energy and Climate Change, 2011c).

NPS for Electricity Networks Infrastructure (EN 5)

2.3.17 The technology specific NPS EN-5 (Department of Energy and Climate Change, 2011c) covers the electricity transmission and distribution network. It highlights that the new electricity generating infrastructure that the UK needs to move to a low carbon economy, while maintaining security of supply, will be heavily dependent on the availability of a fit-for-purpose and robust electricity network. That network will need to be able to support a more complex system of supply and demand and cope with generation occurring in locations of greater diversity. Section 2.4 of EN-5 (Department of Energy and Climate Change, 2011c) provides further clarification on climate change adaptation but provides no additional guidance with respect to the assessment of flood risk.

2.3.18 With respect to climate change adaptation, paragraph 2.4.1 of EN-5 (Department of Energy and Climate Change , 2011c) advises that as climate change is likely to increase risks to the resilience of electricity network infrastructure, applicants should set out to what extent the proposed development is expected to be vulnerable to extreme weather, including flooding, and, as appropriate, how it would be resilient, particularly for substations that are vital for the electricity transmission and distribution network.

National Planning Policy Framework (and associated Planning Practice Guidance)

2.3.19 The NPPF acts as guidance for local planning authorities and decision-makers, both in drawing up plans and making decisions about planning applications. This is supported by online Planning Practice Guidance.

2.3.20 Although NPPF and the associated Planning Practice Guidance are not directly applicable to NSIP developments, they do provide additional relevant guidance on a range of issues, including the definition of flood zones, development vulnerability classifications, compatibility of development types and flood zones.

2.3.21 Associated guidance on providing the appropriate allowances for the effects of climate change to be used in FRAs is provided by the Environment Agency, also on the UK Government website (Environment Agency, 2017). The climate change allowances provided are predictions of anticipated change for peak river flow by river basin district; peak rainfall intensity; sea level rise; and offshore wind speed and extreme wave height. They are based on climate change projections and different scenarios of carbon dioxide (CO_2) emissions to the atmosphere. There are different allowances for different epochs or periods of time over the next century.

2.4 Local plans and policies

2.4.1 The proposed development is located in Kent in south-east England and is wholly or partly situated within the administrative boundaries of the following local authorities:

- KCC;
- TDC; and
- DDC.

2.4.2 KCC is the Lead Local Flood Authority for the area (as defined by the Flood and Water Management Act, 2010). TDC and DDC are local planning authorities.

2.4.3 The Environment Agency is the lead statutory body with responsibility for protection of the water environment. It is also responsible for flood defence and drainage for Main Rivers (Main River is a statutory designation which is usually applied to larger watercourses) and estuarine and coastal areas.

2.4.4 The IDB is responsible for managing drainage of agricultural land with 173 km of maintained watercourses and 131 water level control structures throughout their Drainage District. The Minster Marshes, which are within the IDB District, are located relatively close to the west of the site, however, none of the proposed development area is actually located within the IDB District.

2.4.5 Local plans and policy documents that are relevant for the assessment are outlined in Table 2.3.

Table 2.3: Local plans and policies

Policy/ legislation	Key provisions
KCC, Preliminary Flood Risk Assessment, September 2011	The assessment was produced to provide a high level overview of flood risk across Kent, to identify which areas are most vulnerable, in order to deliver regulatory responsibilities required under the Flood and Water Management Act 2010. The report identified Thanet as being an area potentially at risk of local flooding.
KCC, Local Flood Risk Management Strategy, June 2013	This includes a statutory duty to develop, maintain, apply and monitor a strategy for the management of local flood risk. The local strategy has been produced by KCC through consultation with a Flood Risk Management Committee, which comprises KCC and district, borough and IDB Members and risk management authorities. The local strategy sets out the Council's approach to managing flood risk from local sources in both the short and long-term, and outlines proposals for sustainable actions that will help to manage the risk in a way that delivers the greatest benefits to the residents, businesses and environment of Kent. It also outlines how KCC will work with other lead local flood authorities to coordinate flood management within catchments that share borders. The Strategy is accompanied by an Action Plan setting out how to deliver the objectives of the local strategy in the future. The action plan is updated annually with progress on plan deliverables.
KCC, Drainage and Planning Policy Statement Local flood risk management strategy guidance, June 2017	This policy statement sets out how KCC, as Lead Local Flood Authority and statutory consultee, will review drainage strategies and surface water management provisions associated with applications for major development.

Policy/ legislation	Key provisions
KCC, Stage 1 SWMP	The SWMP was produced by JBA Consulting on behalf of KCC to investigate the local flood risks in Thanet to determine what further work may be needed. The SWMP outlines the preferred surface water management strategy for Thanet and includes consideration of flooding from sewers, drains, groundwater, and runoff from land, Ordinary Watercourses that occurs as a result of heavy rainfall. A range of recommended actions were put forward for the reduction of flood risks across the Thanet SWMP area.
TDC, Thanet Local Plan Saved Policies and Proposals Map, 2006	Saved Policy D1 – Design Principles 2l states that a new development proposal will only be permitted if it incorporates sustainable drainage systems.
TDC, Draft Thanet Local Plan to 2031 Preferred Options, January 2015	Policy SP01- National Planning Policy Framework- Presumption in favour of sustainable development - when assessing planning applications, the Council will take a positive approach towards sustainable development contained in the NPPF Policy SP30 – Climate Change – The policy requires that new development must take account of climatic effects and: • Adapt to climate change by minimising vulnerability, providing resilience to the impacts of climate change and complying with the Government's Zero Carbon Policy; • Mitigate against climate change by reducing emissions; and Policy CC01- Fluvial and Tidal Flooding - The policy states that: "The sequential test and exception test as set out in the NPPF will be applied to applications for development within identified flood risk areas. Development proposals in these areas will need a Flood Risk Assessment to be carried out by the developer." Policy CC02 – Surface Water Management – The policy states that: "New development will be expected to manage surface water resulting from the development using sustainable drainage systems (SuDS) wherever possible. Furthermore, proposals for SuDS at sites within the Groundwater Source Protection Zone, or sites near the Groundwater Source Protection Zone, must demonstrate that the methods used will not cause detriment to the quality of the groundwater." Policy CC03 – Coastal Development - The policy states that: "Proposals for new development within 40 metres of the coastline or clifftop must demonstrate to the satisfaction of the Council that it will not: 1) expose people and property to the risks of coastal erosion and flooding, or 2) accelerate coastal erosion due to increased surface water run off before planning permission can be granted."
TDC, Strategic Flood Risk Assessment, April 2009	The SFRA provides a technical, background evidence-based document intended to help inform decision making in local development planning. It provides information on a range of guidance from application of the sequential and exception tests to the implementation of SuDS. Developers and applicants should therefore consult the SFRA as a key document when preparing planning applications for new developments.
DDC, Strategic Flood Risk Assessment, September 2007	This SFRA provides a broad based assessment of flood risk to identify sites at flood risk from fluvial, coastal and other sources of flooding, to help inform spatial planning decisions. The SFRA identifies the level of detail required for site-specific Flood Risk Assessment (FRAs) in particular locations. It also provides information for the application of the Sequential Test, and to identify whether application of the Exception Test is likely to be necessary.
DDC, Local Development Framework Core Strategy, Adopted February 2010	DDC use current national and regional policies on flood risk (NRM4 and PPS25) to determine planning decisions. PPS25 has since been superseded by NPPF and its associated Planning Practice Guidance.
River Stour (Kent) IDB Policy Statement on Flood Protection and Water Level Management, June 2012	Sets out three objectives for the IDB, as follows • to encourage the provision of adequate and cost effective flood warning systems; • to encourage the provision of adequate economically, technically and environmentally sound and sustainable flood and coastal defences; and • to discourage inappropriate development in areas at risk from flooding.

3 Site Characteristics

3.1 Location

3.1.1 The proposed development area is located on the east coast of Kent in the south-east of England, at the mouth of the River Stour, and between the towns of Ramsgate and Sandwich. The location has been selected to serve the purpose of linking the offshore elements of Thanet Extension to the National Grid Energy Transmission (NGET) infrastructure currently under construction at the Richborough Energy Park.

3.1.2 The offshore elements would be located approximately 8 km offshore (at the closest point), in proximity to the operational Thanet Offshore Wind Farm (TOWF). Electricity generated would be transported to the shore by offshore export cables installed within the proposed Thanet Extension Offshore Export Cable Corridor. Thanet Extension would also require onshore infrastructure in order to connect the offshore wind farm to the electricity network. This FRA covers the onshore proposed development area only. The onshore proposed development area falls within KCC's jurisdiction, partially within the TDC and DDC areas.

3.2 Land Use

3.2.1 Current land use across the proposed development area comprises a combination of industrial, recreational, grassland and woodland as described below. General views of the area as identified during the site visit on 28th June 2017 are provided in Appendix B. The current land uses, moving from north to south along the proposed cable route is set out below.

- Pegwell Bay Country Park which is part of the Sandwich and Pegwell Bay National Nature Reserve (NNR). The park comprises grassland, woodland and ponds and is underlain by the historical Cliffsend Landfill site (landfall and cable route);
- Sandwich Bay to Hacklinge Marshes (Stonelees Unit) Site of Special Scientific Interest (SSSI), comprising neutral grassland (cable route);
- Baypoint Sports Club and associated pitches (cable route);
- British Car Auction (BCA) Technical Services car auction site (cable route);
- Richborough Port and Her Majesty's Revenue and Customs (HMRC) lorry park (substation);
- Tenant Relocation Area (replacement land for the HMRC lorry park to the south of the substation area); and
- NGET Richborough Energy Park (connection to the National Grid 400 kV transmission network).

3.2.2 Land uses in the surrounding area include the remainder of the sites listed above, as well as Pegwell Bay, the River Stour, Stonelees Golf Centre and local roads (e.g. A256).

3.3 Topography

3.3.1 The proposed development area is situated generally above that of the wider surrounding area, as shown on Figure 6.2.1. Figure 6.2.1This figure shows ground elevations obtained from LiDAR, and indicates that ground levels across the proposed development area generally range from around 3 - 4 m above Ordnance Datum (AOD) (light yellow, as shown at the NGET Richborough Energy Park), to 5.5 to 6.5 m AOD (dark orange, as shown at the Pegwell Bay Country Park). This compares to elevations generally at or below 3 m AOD in the tidal mud flats of the River Stour estuary (light blue), and at or below 1.5 m AOD in the Ash Level and Minster Marshes (blue). Areas of higher elevation land in the vicinity of the site are generally associated with historical landfills and Made Ground, where the natural ground level has been raised, such as the southern section of the 'banana land' in the south, and the Stonelees Golf Centre (both coloured red).

3.3.2 Ground elevations within the proposed development area itself range from 1.2 - 7 m AOD. Moving from north to south along the route these are detailed below:

- 3 – 4 m AOD at the saltmarsh in front of the proposed landfall site;
- 5 - 6.5 m AOD at Pegwell Bay Country Park including the proposed landfall site, with isolated areas at 6.5 - 7 m AOD;
- 4 - 6.5 m AOD at the Sandwich Bay to Hacklinge Marshes (Stonelees unit) SSSI, with elevations dropping to 4 - 5 m AOD on the western edge along the proposed cable route. The lowest points are associated with a tidal pool immediately to the south of the Pegwell Bay Country Park (2.5 - 3 m AOD), and a drain running along the western edge of Stonelees (and the southern part of the Pegwell Bay Country Park) (2 m AOD), alongside Sandwich Road;
- 4 - 6.5 m AOD at the Baypoint Sports Club and pitches;
- 5 - 6.5 m AOD at the BCA car auction site;
- 4 - 5 m AOD increasing to 5-5.5m AOD on the eastern edge at the proposed substation area in Richborough Port;
- 4 – 5 m AOD increasing to 5-5.5m AOD on the eastern edge at the Tenant Relocation Area; and
- 1.5 - 2 m AOD at NGET Richborough Energy Park.

3.4 Hydrology

3.4.1 The local hydrology is shown on Figure 6.2.2. The River Stour, which is classified as an Environment Agency Main River, is situated adjacent to the western section of the proposed development area (the Richborough Energy Park), as well as to the east of the proposed substation site (the existing HMRC lorry park) and the southern part of the cable route. The river flows in a southerly direction beyond the Energy Park, then bends around Great Stonar to turn north towards Pegwell Bay where it discharges into the North Sea. The River Stour is tidal in the vicinity of the proposed development area, as far upstream as Fordwich (National Grid Reference (NGR) TR 617996 159818).

3.4.2 The Minster Stream, which crosses the proposed cable route at approximately NGR 633546 162163, is also classified as an Environment Agency Main River. The stream generally flows in a south-easterly direction and appears to be an artificially straightened drainage channel, which discharges into the River Stour at NGR 633818 161878. Upstream of the site, the Minster Stream passes through the IDB District, and as such, flows are likely to be managed. The proposed development area passes over a culverted section of Minster Stream, just upstream of its hard-engineered outfall to the River Stour. The outfall is equipped with a penstock. Photographs of the channel upstream of the culvert and of the outfall are provided in Appendix B.

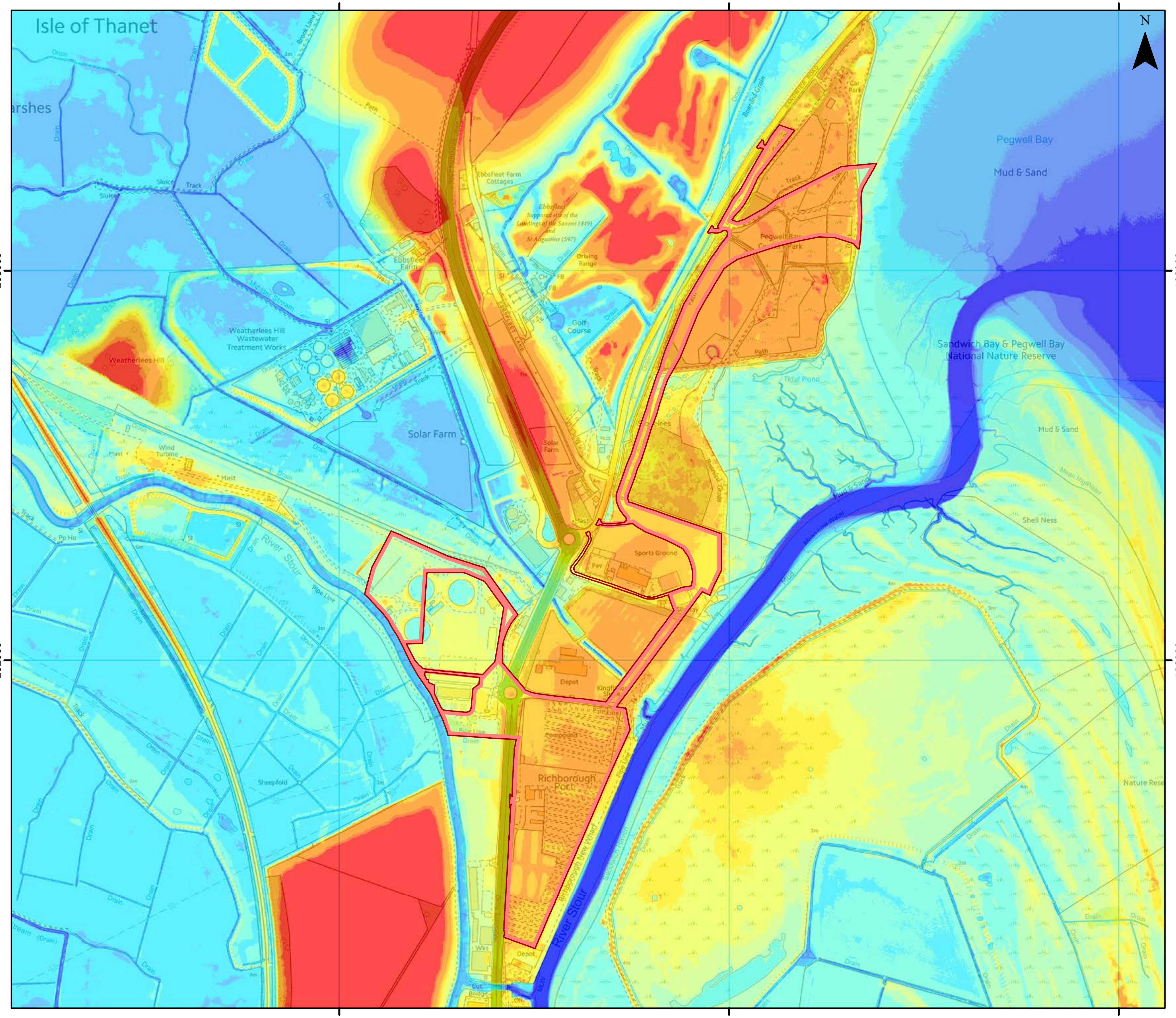
3.4.3 Another hard-engineered outfall to the River Stour was identified immediately to the south-west of the Minster Stream outfall and immediately to the east of the HMRC lorry park (the proposed substation area). The catchment/ drainage area being drained to this outfall has not been ascertained. The outfall was fitted with a flap gate and was flowing at the time of the site visit. A photograph of the outfall is provided in Appendix B.

3.4.4 The only other watercourse identified within the proposed development area is the drainage ditch running along the western edge of the Stonelees area, and between Sandwich Road and the southern part of Pegwell Bay Country Park. It was not possible to view this ditch fully for much of its length due to vegetation preventing access to the ditch edge, but the part that was observed during the June 2017 site visit was dry, which was undertaken following heavy rainfall overnight.

3.4.5 KCC advised during the consultation meeting on land quality (held on 23rd August 2017) that a small stream is culverted underneath the Cliffsend Landfill (which is itself discussed in section 3.5 below), which discharges to Pegwell Bay just to the north of the Pegwell Country Park bird hide via a tidally flapped outfall. KCC has advised that it monitors the quality of the water that discharges from this outfall, which suggests that it is draining water sourced from outside (to the west) of the landfill, however, no further information is available regarding this. A walkover survey was undertaken on 23rd August 2017 to locate the outfall, which was found by some yellow paint on the rock armour defence above the outfall. The flap is below the rock armour sea defence and was partially overgrown with the saltmarsh vegetation of Pegwell Bay. The flap was lifted completely open, meaning that ingress of tidal water into the culvert was possible. No flow was observed, nor a defined channel downstream of the outfall, other than a slight change in the saltmarsh vegetation compared to the immediate surroundings.

3.4.6 Two small ponds are shown in the Ordnance Survey mapping. One pond is located in the northern part of the Stonelees area. This area was visited by the biodiversity team between April and July 2017 as part of the Great Crested Newt study (Volume 5, Annex 5.3: Great Crested Newt Baseline Report (Document Ref: 6.5.5.10), Appendix C; Table 3.2 Screening Results). The report identifies that this waterbody is a non-permanent tidal pool, dry at the time of the surveys, with no aquatic vegetation. Another pond is shown to the west of the Baypoint Sports Club next to Ebbsfleet roundabout. This is a balancing lagoon for drainage from the A256 and Jutes Lane and is part of the East Kent Access Phase 2 transport scheme. The proposed cable route does not interact with these roads or the balancing lagoon.

3.4.7 Beyond the proposed development area, there are also a number of Ordinary Watercourses comprising interconnected man-made drains situated to the north of Sandwich Road, along the golf course between Stonelees and Cliffsend. These drainage features are within the IDB District, forming part of the Minster Marshes. Some of these watercourses are linked to small water features e.g. ponds. Water levels in the Minster Marshes to the west and north-west of Thanet Extension are managed for agricultural and nature conservation purposes by the IDB (in conjunction with the Environment Agency, which owns and operates the pumping station assets). Levels are maintained by a number of sluices and pumping stations, which serve to hydraulically isolate the freshwater ditches from the tidal River Stour and manipulate levels (primarily for the benefit of agriculture).



THANET EXTENSION OFFSHORE WIND FARM

Figure 6.2.1

LiDAR Elevations 1m DTM

Legend

Onshore Red Line Boundary

Elevation (m AOD)

- 7 - 7.5
- 6.5 - 7
- 5 - 6.5
- 4.5 - 5
- 4 - 4.5
- 3.5 - 4
- 3 - 3.5
- 2.5 - 3
- 2 - 2.5
- 1.5 - 2
- 1 - 1.5
- 0.5 - 1
- 0 - 0.5
- -2 - 0

Datum: OSGB 1936
Projection: BNG

Notes:
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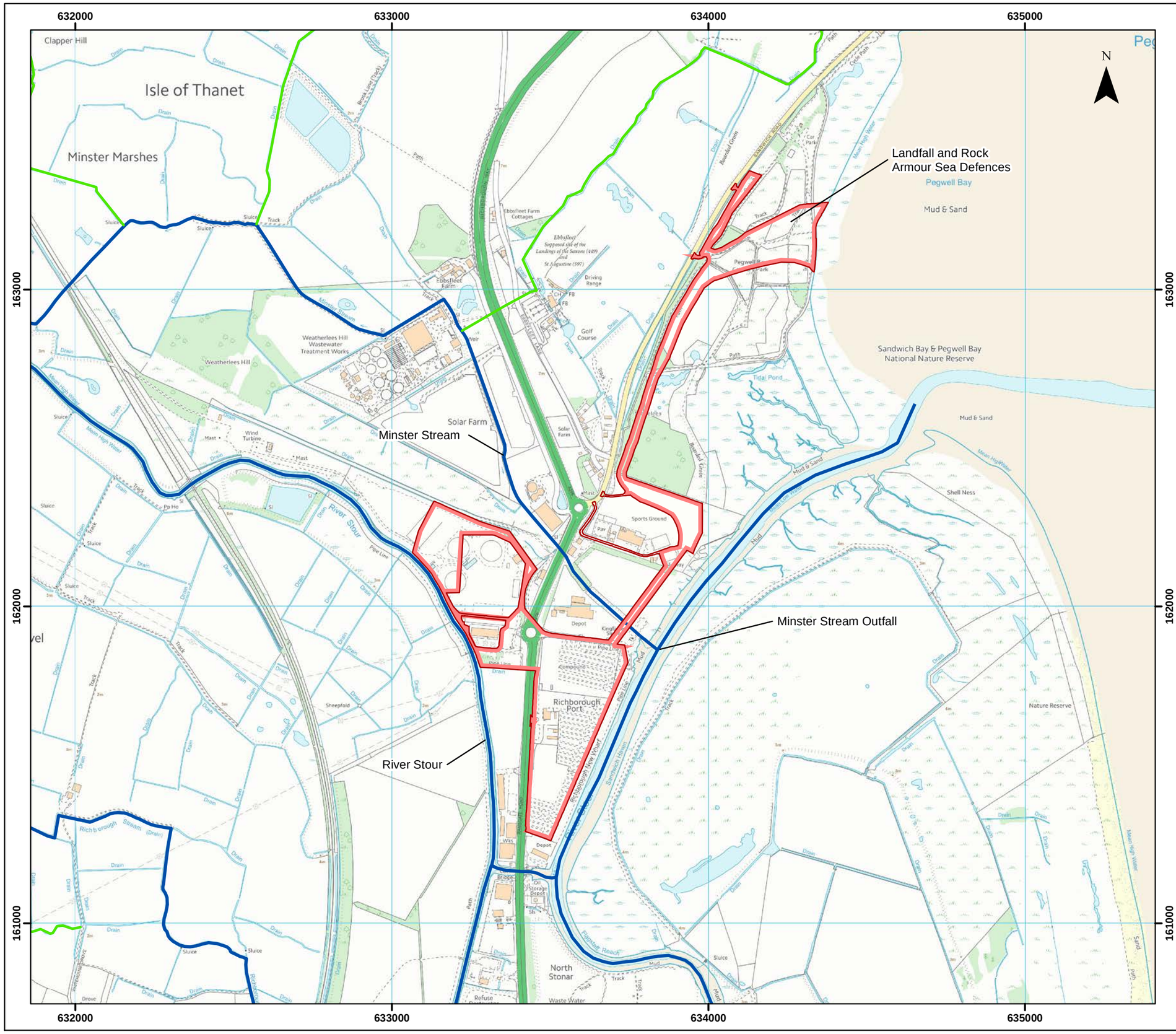
1:10,000 — 0 — 0.25 — 0.5 km

Drg No	39080-Lon158a			Figure 6.2.1
Rev	1.0	Date	03/05/2018	
By	JP	Layout	N/A	



GoBe VATTENFALL

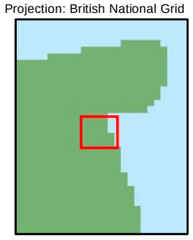
THANET EXTENSION OFFSHORE WIND FARM

Figure 6.2.2
Water Features

Legend

- Onshore Red Line Boundary
- IDB maintained watercourse
- Environment Agency main

Projection: British National Grid



Notes:
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Scale: 1:12,000 0 0.1 0.2 0.4 Km

Drg No	39080-Lon159		
Rev	1	Date	20/04/2018
By	JP	Layout	N/A

Figure 6.2.2

3.5 Geology, hydrogeology and soils

3.5.1 According to the online BGS geology mapping, the proposed development area is underlain by superficial deposits predominantly comprising Beach and Tidal Flat Deposits undifferentiated (clay, silt and sand). Other superficial deposits within the area include the Tidal Flat Deposits (clay and silt) underlying the Richborough Port, Tenant Relocation Area and National Grid Energy Centre, and the Storm Beach Deposits (sand and gravel) in the vicinity of the River Stour. Superficial deposits are absent along the corridor of the A256 Richborough Way between Ebbsfleet Roundabout and Cottington Lane. The bedrock geology in the area comprises the Thanet Formation (sand, silt and clay) overlying the Margate Chalk Member and the Seaford Chalk Formation.

3.5.2 The BGS mapping does not record the presence of 'Made Ground' at the proposed development area. However, information included in the Phase 1 Geo-environmental Desk Study (Amec Foster Wheeler Environment and Infrastructure Limited, (2018) suggests that Made Ground is present at various locations across the site, including two historical landfills, one at Pegwell Bay Country Park, and the other at the Richborough Energy Park.

3.5.3 The historical landfill underlying the Pegwell Bay Country Park is known as the Cliffsend Landfill. This landfill and other related matters were discussed at length during a meeting with KCC, TDC and the Environment Agency on 23rd August 2017. All three parties agreed to search their records for information that would be of use to Thanet Extension.

3.5.4 Information on this closed landfill has been provided by KCC, who continue to manage and monitor it (email correspondence between KCC and Amec Foster Wheeler on 10th August 2017 in relation to the Draft Phase 1 Geo-environmental Desk Study). A detailed summary of the information obtained to date is provided in the Volume 5, Annex 6.1: Phase 1 Geo-environmental Desk Study (Document Ref: 6.5.6.1), but in summary, approximately one million cubic metres of waste, including putrescible waste, was landfilled; no liner is present to prevent leachate from migrating into the underlying groundwater; and a small stream emerges centrally at the eastern boundary, from which surface water quality is monitored by KCC (this stream is thought to be culverted beneath the landfill, as discussed in section 3.4).

3.5.1 Further information on the historic Cliffsend Landfill has been sought from the Environment Agency and the Environmental Health department at TDC. Environment Agency records indicate that it was filled with household and inert waste and also non-degradable, slowly degradable, scrap metal, putrescible, hazardous and household waste. TDC advised that the last waste input was in 1972, and it has been partly capped. The rock armour (flood defence) along the eastern edge of the landfill, fronting onto Pegwell Bay, is discussed in section 3.6 below.

3.5.2 Made Ground was observed at the former Richborough Power Station (now Richborough Energy Park) and at the proposed location of the substation (Richborough Port and HMRC lorry park) during the site visit. As such, both areas are anticipated to be locally underlain by 'Made Ground' associated with its past and current uses. The Geo-environmental Desk Study reports that the landfill at the former Richborough Power Station comprises inert waste, with the last input in 1987.

3.5.3 Intrusive investigations undertaken at the former Richborough Power Station (WSP Environmental Ltd, 2007, URS Corporation Ltd, 2009a and 2009b) encountered Made Ground. This includes potentially deep deposits of Colliery Spoil material used to artificially raise levels and form a development platform at Richborough Power Station. Other areas of infilled ground are identified in the Envirocheck report (2017) included in Volume 5, Annex 6.1: Phase 1 Geo-environmental Desk Study (Document Ref: 6.5.6.1), of the ES.

3.5.4 The superficial deposits are classed as unproductive strata on-site and off-site to the west, and as a Secondary A aquifer off-site to the south-east (Environment Agency, What's in your backyard website)[1]. The Thanet Formation underlying the area is classed as a Secondary A aquifer. The underlying Chalk Formation is a Principal Aquifer.

3.5.5 The soils on and surrounding the proposed development area are classed as variably and highly permeable soils of high leaching potential (URS Corporation Ltd, 2009a). The LANDIS soils database indicates that the area is underlain by mostly well drained, loamy and clayey soils of coastal flats, with naturally high groundwater.

3.6 Flood defences

3.6.1 Generally, the proposed development area is not protected by raised defences that could fail or be breached during an extreme tidal or fluvial flood event, as shown in the Environment Agency's online Flood Map for Planning (Environment Agency, 'Flood Map for Planning' website). The absence of raised defences can also be seen in the LiDAR elevations in Figure 6.2.1, which shows no raised linear features are protecting the site. This was confirmed during the site visit.

3.6.2 A rock armour sea defence for the historical Cliffsend Landfill (discussed in section 3.5) was identified at the proposed landfall site during the site visit (Figure 6.2.2). This is not a raised defence and ground levels are higher behind the defence. The sea defence is approximately 1.5 m in height, and a photograph is provided in Appendix B. The Environment Agency has advised that a Flood Risk Activity Permit (FRAP) from itself would not be required prior to works near the sea defence as it is not an Environment Agency defence (Appendix A). The defence was discussed at length during a stakeholder meeting with TDC, KCC and the Environment Agency on 23rd August 2017. All three stakeholders agreed to investigate the history and construction details of the defence to try to resolve uncertainties regarding responsibility, as well as to help inform the landfall design options for Thanet Extension.

3.6.3 Hard defences were identified along the Richborough Port area. These are not raised defences. Hard defences were also identified along the Richborough Energy Park, some of which were slightly raised.

3.6.4 A boarded groin is identified in the Ordnance Survey mapping in the vicinity of Pegwell Bay. This refers to WWII anti-invasion defences from the 1940s, and these are discussed in detail in Volume 3, Chapter 7: Historic Environment (Document Ref: 6.3.7) of the PEIR. The boarded groin is not readily discernible at the proposed development area, but survives off-site as a shallow bank with anti-invasion concrete posts (photograph in Appendix B). To the north-west of the site, it can be identified as a low embankment in Figure 6.2.1. The boarded groin may have been removed or buried by the historical Cliffsend Landfill (Pegwell Bay Country Park). It then skirts round the seaward side of the Baypoint Sports Club likely just outside of the proposed development area. It is unclear whether it survives in the BCA car auction site or near the Minster Stream given the extents of previous disturbance, and no evidence was identified in these areas during the June 2017 site visit.

4 Development Proposal

4.1 Overview

4.1.1 The proposed development is described in detail in the Volume 3, Chapter 1: Onshore Project Description: (Document Ref: 6.3.1). A summary for the purposes of this FRA is provided in this section. Relevant proposed design drawings are included in Appendix C. This FRA has been prepared based upon the final versions of the proposed development drawings.

4.1.2 The proposed development area considered in this FRA covers the onshore elements only. The proposed development includes the following principal elements:

- Landfall, including the location and means by which the offshore cables are brought ashore and joined onto the onshore cables within two to four Transition Joint Bays (TJBs). There are three options for how the offshore cabling would be brought ashore, namely by way of horizontal directional drilling (HDD), above ground and below ground;
- Onshore (beyond landfall) cable route and its associated infrastructure, mainly by open trenching but including jointing bays and construction areas for trenchless techniques where appropriate;
- Substation, to be located within the existing HMRC lorry park at Richborough Port;
- Grid connection from the proposed substation to the NGET's existing substation at Richborough Energy Park installed by HDD under the A256 carriageway, except for the final section where the cables would be trenched (two route options for the HDD crossing are being considered);
- Other works, for example, temporary access routes to the substation construction areas and construction compounds. These elements, required for construction purposes, would only be present during the construction phase, and would be removed upon completion of the relevant element of construction works;
- The operation of the proposed development; and
- Eventual decommissioning of the onshore elements of the proposed development at the end of the operational life of the project.

4.2 Programme of development

4.2.1 Onshore construction works are anticipated to begin in September 2020 and continue for approximately 30 months subject to when the DCO is granted. Offshore construction works would occur concurrently. The indicative project programme states that the O&M phase will not commence until 2023. The operational life is expected to be around 40 years, but may be extended as the project nears decommissioning as technology and maintenance improves, Therefore, a lifetime of up to 40 years has been considered in this FRA (approximately 2060).

4.3 Landfall options (from landfall to the edge of Stoneless)

4.3.1 The landfall denotes the location and means by which the offshore cables are brought ashore and jointed to the onshore cables within TJBs. The landfall location for Thanet Extension offshore export cables is proposed to be within Pegwell Bay, Kent, just to the north-west of the River Stour.

4.3.2 As mentioned earlier, three options are being considered to achieve landfall. For all three options, the TJBs are located within the Country Park up to 350 m from the existing sea wall within the 'Potential Zone for Transition Pit' area. The final versions of the proposed location, profile and plan view drawings of each landfall option are provided in Appendix C, whilst further detail, including cross sections, is provided in the ES Volume 3, Chapter 1: Onshore Project Description (Document Ref: 6.3.1). The key features of each of the three options, described in the sequence that the works would be carried out, are summarised below:

- Landfall Option 1: the TJBs would be located below ground within the Country Park 'Zone for Transition Pits' area, within an excavated area supported by a cofferdam or suitable alternative and possibly extending to the base of the Cliffsend Landfill, with the offshore cables installed by HDD. This approach requires a larger onshore temporary works compound to house the HDD rig and associated equipment compared to the other options, but does not require excavation and reinstatement of the sea wall. HDD would be undertaken from land to sea, from the base of the TJBs and possibly partly within the landfill using the methods described in ES Volume 2, Chapter 1: Onshore Project Description (Document Ref: 6.3.1), or entirely within the superficial deposits and/or solid strata beneath the landfill, thereby avoiding the landfill itself. The HDD ducts would be installed from the TJB locations out to a punch-out location at least 100 m seaward of the existing sea wall. The onshore cable would then extend from the TJBs via surface trenching in the landfill to Stonelees. This option assumes that the future SI works indicate that the TJBs, HDD and surface trench are possible and do not present an unacceptable risk of contamination release from the historic landfill, and that excessive dewatering of the landfill and underlying aquifers for the purpose of the construction of the TJBs and the surface trench is not required;

- Landfall Option 2: the TJBs would be located above ground within the Country Park 'Zone for Transition Pits' area and above the landfill. This approach requires the installation of a temporary cofferdam within the upper intertidal/saltmarsh area before extending the existing sea wall and the existing watercourse culvert into the saltmarsh and raising the land surface immediately behind. The cables would be trenched through the upper intertidal area to the seawall extension, and once the sea wall cofferdam is established the sea wall would be removed and the cable trenched up to the periphery of the Country Park before transitioning through to the above-ground TJBs. After construction of the seawall extension and the watercourse culvert extension and installation of the cables, the cofferdam would be removed. The onshore cables would then be extended from the TJBs via a surface berm above the landfill to Stonelees. This option assumes that the SI works indicate that trenching within the former landfill is unacceptable and therefore the sea wall cofferdam construction and land raise are required to mitigate the potential unacceptable risk of contamination release from the historic landfill or tidal flooding; and
- Landfall Option 3: the TJBs would be located below ground within the Country Park 'Zone for Transition Pits' area, within a cofferdam or suitable alternative in the Cliffsend Landfill. This approach requires the installation of a temporary cofferdam within the upper intertidal/saltmarsh area, but without the sea wall and watercourse culvert extension and land raise that characterises Option 2. The cables would be trenched through the upper intertidal area to the sea wall extension, and once the sea wall cofferdam is established the sea wall would be broken through and the cable trenched through to the below-ground TJBs or alternative installations. After reconstruction of the sea wall and installation of the cables the sea wall cofferdam would be removed. The onshore cable would then extend from the TJBs via surface trenching in the landfill to Stonelees. This option assumes that the SI works indicate that the sea wall cofferdam construction, TJBs and surface trench are possible and do not present an unacceptable risk of contamination from the historic landfill or result in tidal flooding, and that excessive dewatering of the landfill and underlying aquifers for the purpose of the construction of the TJBs and the surface trench is not required.

4.4 Onshore Cable Route

Overview

4.4.1 The onshore cable route consists of the High Voltage Alternating Current (HVAC) export cables (up to 220 kV), in addition to the 400 kV HVAC substation interconnecting cables and would be approximately 2.5 km in length. The onshore cable route connects the landfall to the substation location at the former Richborough Port. The substation interconnecting cable route connects the proposed onshore substation location at Richborough Port to the National Grid substation in Richborough Energy Park.

Cable installation

4.4.2 The cable installation would require predominantly open cut trenches for the cable circuits from the south-west corner of the historical Cliffsend Landfill to the substation at Richborough Park. The easement for the cable installation would also include space for an adjacent running track to deliver equipment to the installation site from mobilisation areas, and storage areas for topsoil and subsoil. Excavated soil would be stored immediately adjacent to the trench, or stored elsewhere within the Red Line Boundary (RLB) at temporary construction and laydown areas.

4.4.3 The only location outside the Country Park envisaged for trenchless installation would be under the road between the substation at Richborough Port and the National Grid connection within Richborough Energy Park. This would be a relatively short HDD of 20 – 40 m in length (two route options are currently being considered), with a reception pit of 20 x 30 m excavated on the eastward side of the road. The final section of this cable would be trenched.

Watercourse/ waterbody crossings

4.4.4 There are a few watercourses/ waterbodies for the proposed development area to cross. Permanent crossings for the cable comprise a small ditch near the sea defence/landfall, a tidal pool near Stonelees, and the Minster Stream (an Environment Agency Main River). A temporary crossing to allow access would also be required at a drainage ditch running alongside Sandwich Road.

4.4.5 Temporary damming and pumping/diversion of the worked sections would be employed at the ditches and at Minster Stream. Whilst the Minster Stream is already culverted at the point of crossing (photographs are included in Appendix B), it is currently anticipated that the culvert would need to be replaced to enable the cable to be trenched above. All works within the permitting distance of Minster Stream would be subject to the Environment Agency granting a FRAP to approve the design and the works.

Access routes/ running track

4.4.6 A running track would provide safe access for construction vehicles along the cable corridor, from mobilisation areas to cable installation sites. The running track would be up to 5 m wide and extend the full length of the cable route. It would be formed of protective matting, temporary metal road or permeable gravel aggregate, dependent on the ground conditions, vehicle requirements and any necessary protection for underground services. At drain crossings, a culvert would be installed to enable the running track to continue alongside the cable route. At the crossing over the Minster Stream, the running track would not be continuous, i.e. there would not be an additional temporary crossing to provide construction access. This location would be a 'stop end' to the construction work fronts.

4.4.7 Following construction completion, the running track would be removed and the topsoil reinstated, although rights would be retained to access the running tracks location should repairs of the cables be required through the lifetime of the project.

Temporary works area

4.4.8 To enable construction, primary mobilisation areas would be required to store equipment and provide welfare facilities. These mobilisation areas would be located adjacent to the cable route corridor, accessible from the local highways network and suitable for the delivery of cable drums and other heavy and oversized equipment. The mobilisation areas would typically be of 50 m x 100 m dimensions with specific sizing for each location based on site constraints and land boundaries.

4.4.9 Hardstanding would likely comprise of permeable gravel aggregate underlain by geotextile, or other suitable material would be employed to allow safe storage and movement of vehicles within the area.

4.4.10 Following installation of the onshore cables, the mobilisation areas and associated side accesses would be removed and the land reinstated.

4.5 Substation

4.5.1 The substation would transform the up to 22 kV wind farm export voltage to the National Grid 400 kV connection voltage. The maximum total land requirement for the substation within Richborough Port would be approximately 41,000 m^2.

4.5.2 During construction of the substation, a temporary construction compound would be established next to the substation to support the works. The compound would be formed of hardstanding with appropriate access to allow the delivery and storage of large and heavy materials and assets, such as power transformers. The compound would be approximately 20,000 m^2.

4.5.3 Works may also need to be carried out in order to provide replacement land for HMRC to the south of the proposed substation area i.e. the Tenant Relocation Area. As requested during Section 42 consultation, it is required that this replacement land be operational prior to the start of any construction works for the substation.

4.6 National Grid Energy Transmission 400 kV Richborough Energy Park substation

4.6.1 The NGET Richborough Energy Park substation would accommodate the circuit breakers which allow connection of Thanet Extension onto the existing overhead line for generation to be transmitted onto the National Grid energy system.

4.6.2 The 400 kV cables would be routed underground from the substation location within Richborough Port to and through Richborough Energy Park up to the connection location with NGET. The cables would connect to the above ground cable terminations and would be open trenched into the NGET.

4.6.3 The works required in Richborough Energy Park would be completed before construction of the proposed development. Limited works would therefore be required to connect into the National Grid at this location. The main work would be to install and bury the 400 kV cables between the substation and the National Grid connection point.

4.6.4 During construction of the NGET 400 kV Richborough Energy Park substation underground infrastructure, a temporary construction compound would be established to support the HDD works. Given the project duration, the compound may be tarmacked with some concrete hardstanding for heavier plant and equipment. The compound would be of dimensions 20 m x 30 m. The mobilisation area would be sited within the onshore substation construction compound area, with access via the existing road.

4.7 Decommissioning

4.7.1 The offshore WTG have a design life of 30 years, however, the onshore development may be extended by up to 10 years, i.e. a maximum lifetime of up to 40-years. No decision has been made regarding the final decommissioning policy, as it is recognised that industry best practice, rules and legislation change over time. However, decommissioning works would likely be undertaken in a similar fashion to construction but in reverse.

4.7.2 No decision has been made regarding the final decommissioning approach for the onshore components of Thanet Extension. However, at the end of the operational life of the project, it is likely that onshore cables would be removed from the ducts and recycled, with TJBs capped, sealed and left *in-situ*. Where it is preferable to do so, cables could be cut and left *in situ*, if it is deemed closer to the time that removing would have a greater impact than leaving *in situ*.

4.7.3 The programme for decommissioning is expected to be similar in duration to the construction phase. Any final decommissioning methodology would adhere to industry best practice, rules and regulations at the time of decommissioning. The detailed activities and methodology for decommissioning would be determined later within the project lifetime, but would be expected to include the following:

- Dismantling and removal of electrical equipment;
- Removal of cabling from site where required (or cutting and leaving *in situ*);
- Removal of any building services equipment;
- Demolition of the buildings and removal of fences; and
- Landscaping and reinstatement of the site.

5 Planning Requirements

5.1 Sequential Test

5.1.1 As defined in section 2.3, the Sequential Test is a decision-making tool designed to ensure that potential development sites at little or no risk of flooding are developed in preference to those at higher risk.

5.1.2 Thanet Extension would require onshore infrastructure in order to connect the offshore wind farm to the electricity network, comprising the landfall, onshore cables, dedicated substation, and connection to the wider National Grid electricity network at the new National Grid substation currently under construction at the Richborough Energy Park.

5.1.3 The proposed location of the onshore development has been determined following detailed options appraisal and taking into account consultees responses to the Scoping Report. A wide range of technical, environmental and socio-economic factors has been considered so that the most appropriate location could be determined (for full details see Volume 1, Chapter 4: Site Selection and Alternatives (Document Ref: 6.1.4) of the ES). A sequential approach has been taken in determining the location of the proposed development area, thus ensuring that the proposed development has been sited in the lowest flood risk areas possible. It can be seen from Figure 6.2.3 that the proposed development area avoids the River Stour and Minster Stream floodplain and the majority of the tidal floodplain. Due to the proximity to the coast, it is not possible to avoid all tidal flood risk areas, and the cable route crosses small areas of Flood Zones 2 and 3. The cable route also minimises the number of both permanent and temporary watercourses crossings. The only Main River that requires crossing is the Minster Stream, at a location in which a culvert is already present. No crossings of IDB watercourses are required.

5.1.4 The temporary working areas, substation and NGET Richborough Energy Park substation would be located in Flood Zone 1. As discussed above, the majority of the cable route would also be located in Flood Zone 1.

5.1.5 It is concluded that the Sequential Test is passed due to the following:

- The nature of the development connecting Thanet Extension to the electricity network; and
- The fact that, where possible, the proposed development and associated temporary construction infrastructure would be sited in areas of lower flood risk.

5.2 Exception Test

5.2.1 The Exception Test is described in section 2.3. This section sets out the evidence to demonstrate that the Exception Test has been passed.

Wider sustainability benefits

5.2.2 Part 1 of the Exception Test requires the proposed development to provide wider sustainability benefits to the community that outweigh flood risk. As stated in EN-1 (Department of Energy and Climate Change, 2011a)' , this would include the benefits (including need) for the infrastructure.

5.2.3 The key drivers for Thanet Extension project are reducing greenhouse gas emissions, providing energy security, and maximising economic opportunities from investment for the UK. In addition, extension projects are considered to represent a significant opportunity for cost reduction in offshore wind, an increasingly important consideration under the highly competitive UK subsidy regime and drive to deliver the best possible value to the consumer. The proposed project would have a generation capacity of up to 340 MW and produce enough energy to power approximately 230,000 homes in the UK. It is therefore concluded that the proposed development has passed Part 1 of the Exception Test.

Flood Risk

5.2.4 Part 2 of the Exception Test requires that the proposed development would be safe, without increasing flood risk elsewhere (subject to the exception below) and, where possible, would reduce flood risk overall.

5.2.5 As set out in Table 5.1 below, construction and dismantling activities and infrastructure (access routes and working areas), and the electricity infrastructure itself, are considered to be Essential Infrastructure, and thus are appropriate in Flood Zones 1 and 2, but require the Exception Test to be passed in order to be considered 'appropriate' development in Flood Zones 3a and 3b.

5.2.6 A small area of the proposed cable route and the landfall are located in Flood Zone 3, as shown on Figure 6.2.3. However, the cables and landfall are resilient to occasional flooding, would not pose a safety risk, and, as discussed further in section 7 of this annex, would not cause an increase in flood risk elsewhere. It is concluded that the location of a small section of the cables and the landfall in Flood Zone 3 is consistent with Exception Test requirements.

5.2.7 In terms of the temporary construction infrastructure, this would itself be resilient to occasional flooding. Furthermore, the construction phase infrastructure to be located in Flood Zone 3 (small area of cable route and the landfall) would only be in place for a short period owing to the limited section of the cable route passing through this area (Figure 6.2.3) and the phased nature of the construction works, whereby the works would be undertaken in stages and reinstated. At no point in time would the entire proposed construction development be present. This phased approach would also reduce the likelihood of the temporary construction structures being present at the time of a flood. With respect to flood risk elsewhere, the location-specific measures proposed later in sections 8.1 and 8.2 would ensure that the flood risk to third party receptors would not be increased. It is concluded that the placement of temporary construction phase infrastructure in Flood Zone 3 is consistent with Exception Test requirements, and that the Exception Test is passed.

Table 5.1: Application of the flood risk vulnerability and flood zone 'compatibility' matrix to the proposed development

Development type	Flood risk vulnerability classification[1]	Flood Zone(s)	Flood risk vulnerability and flood zone 'compatibility'
Construction			
Construction support areas (offices, welfare facilities, temporary laydown areas)	Less Vulnerable	1	✓
Construction activity areas (access routes and working areas)	Essential Infrastructure[2]	1 & 2	✓
		3a & 3b	Exception Test required[3]
Watercourse/ waterbody crossing points	Water compatible	1, 2, 3a and 3b	✓
Operations			
Landfall, cables, substation and NGET 400 kV Richborough Energy Park substation	Essential Infrastructure[4]	1 & 2	✓
Landfall and cables	Essential Infrastructure[4]	3a & 3b	Exception Test required[3]

Table notes:

✓ *Development is appropriate*

✗ *Development should not be permitted*

1 *Definition of flood zones is provided in* Table 6.2 *later.*

2 *The Planning Practice Guidance does not explicitly categorise the vulnerability of access routes and working areas to be used for construction purposes, therefore, given that these are for electricity transmission infrastructure it is considered that Essential Infrastructure is the most appropriate classification.*

3 *In Flood Zone 3a Essential Infrastructure should be designed and constructed to remain operational and safe in times of flood.*

In Flood Zone 3b (functional floodplain) Essential Infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- *remain operational and safe for users in times of flood;*
- *result in no net loss of floodplain storage; and*
- *not impede water flows and not increase flood risk elsewhere.*

4 *The Planning Practice Guidance does not explicitly categorise the vulnerability of electricity transmission infrastructure, however it is considered that Essential Infrastructure is the most appropriate classification.*

6 Flood Risk Screening

6.1 Screening of potential sources of flooding

6.1.1 A summary of the flood risk screening from all potential sources in and around the proposed development area is provided in Table 6.1. These are then discussed in the following sections.

Table 6.1: Summary of potential sources of flood risk to the proposed development

Flooding Source	Potential Risk	Comments
Fluvial	Low	The Environment Agency's fluvial flood modelling indicates that the proposed development area would remain at low probability of flooding (<0.1% Annual Exceedance Probability (AEP) during all AEP events modelled (defended and undefended) for its full lifetime.
Tidal	Medium	The Environment Agency's fluvial flood modelling indicates that much of the proposed development area would remain dry during the 0.5% AEP event (undefended) for its full lifetime. However, the northern part of the proposed development area may be liable to tidal flooding under present day scenarios.
Surface water	Low	Run-on: the Environment Agency's online Flood Map for Surface Water does not show any significant flood risk from surface water flooding at the proposed development area. Runoff: additional semi-permeable and impermeable areas created during the construction and O&M (permanent development, i.e. the substation) phases may result in minor increases in surface water runoff at a local scale.
Sewer	Low	It is anticipated that there are few sewer drainage networks within the proposed development area within which water levels could feasibly rise to an extent that would result in flooding of the site.
Groundwater	Low	Groundwater is likely to discharge to nearby surface waterbodies such as the River Stour and the sea, which is likely to control groundwater to similar elevations for the most part of this area. Groundwater within superficial deposits may therefore be relatively close to the surface, particularly in lower lying areas of the proposed development area. Whilst BGS Groundwater Flooding Susceptibility mapping does not show any risk of groundwater flooding at the surface, subsurface structures within the cable route area could be susceptible to groundwater flooding. Perched groundwater may be encountered in areas of Made Ground.
Reservoirs, canals and other artificial sources	Negligible	No artificial flood sources have been identified that could potentially impact the proposed development.

6.2 Flood event probability and Flood Zone definitions

6.2.1 Throughout this report, AEP terminology is used to describe the magnitude and likelihood of a flood event. AEP expresses the probability of a flood occurring in a given year. The relationship between AEP and Flood Zones are provided in Table 6.2, together with the definitions for the Flood Zones, as specified in the Planning Practice Guidance[5].

Table 6.2: Annual Probability and Flood Zone Definitions

Flood Zone	Flood Zone Definition	AEP	Annual Probability
Zone 1 – Low probability	Land having less than a 1 in 1,000 annual probability of river or sea flooding.	<0.1%	<1 in 1,000
Flood Zone 2 – Medium probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.	0.1%	1 in 1,000
Flood Zone 3a – High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.	1% (fluvial) 0.5% (tidal)	1 in 100 (fluvial) 1 in 200 (tidal)
Flood Zone 3b – Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.	5%*	1 in 20*

* The 5% AEP (or 1 in 20 annual probability) event is often used to help define Flood Zone 3b, the 'functional floodplain', but is not part of the definition.

6.3 Historical flooding

6.3.1 Records of historical flooding were provided by the Environment Agency as part of the Product 4 information (Appendix D). These indicate the extent of flooding during the February 1953, January 1978 and February 2001 flood events. The information provided indicate that the proposed development site was not flooded during these flood events.

6.4 Combined tidal and fluvial flooding

Overview

6.4.1 The Environment Agency's Flood Map covering the proposed development area is shown on Figure 6.2.3. This shows that most of the proposed development area including the substation is within an area with low probability of flooding (Flood Zone 1).

6.4.2 The landfall including the temporary sea wall cofferdam for Landfall Options 2 and 3 and central parts of the cable route and temporary working areas (Sandwich Road near Stonelees and the fields by Baypoint Sports Club) are situated within an area with high or medium probability of flooding (Flood Zones 2 or 3 respectively). The source of flood risk in this area is largely associated with fluvial and coastal tidal flooding at the estuary mouth of the River Stour.

632000 633000 634000 635000

164000 163000 162000

N

Clapper Hill
Isle of Thanet
Minster Marshes
Cottington Hill
St Augustine's Golf Course
Cliffsend Point
Pegwell Bay
Mud & Sand
Ebbsfleet Farm
Weatherlees Hill Wastewater Treatment Works
Weatherlees Hill
Solar Farm
Sandwich Bay & Pegwell Bay National Nature Reserve
Richborough Port
River Stour
Richborough Stream (Drain)

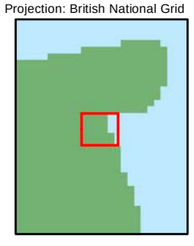
THANET EXTENSION OFFSHORE WIND FARM

Figure 6.2.3
Environment Agency Flood Map

Legend

- Onshore Red Line Boundary
- IDB maintained watercourse
- Environment Agency main river
- Flood defence
- Flood Zone 2
- Flood Zone 3
- Area benefitting from flood defences

Projection: British National Grid



Notes:
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Scale: 1:12,000 0 0.1 0.2 0.4 Km

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Rev	1	Date	19/04/2018
By	JP	Layout	N/A

Figure 6.2.3

Flood defence assets

6.4.3 Flood defences are discussed in section 3.6. The main defences for Thanet Extension are those protecting the Cliffsend Landfill site (rock armour, which is not a formal raised sea defence), the hard defences along Richborough Port, and the hard defences along the tidal River Stour adjacent to the Energy Park. Of these, only the defences along the Richborough Energy Park are raised.

6.4.4 Areas Benefiting from Defences (ABD) are indicated as hatching in the Environment Agency's Flood Map, as shown in Figure 6.2.3. These areas are protected from the 1% AEP design flood event and include areas around Sandwich and further areas of Minster Marsh and Ash Level. There are no ADB within the proposed development area.

Climate change impacts

6.4.5 Climate change may have an effect on the proposed permanent above ground development (i.e. the substation). Any potential effects during the construction phase are likely to be negligible due to the short timeframe of the temporary construction works area and access routes. Construction is likely to proceed in sections from one end of the cable route to the other with only small sections being constructed in tidal flood zones at any given time and for short timeframes.

6.4.6 The potential effects of climate change in the area were assessed as part of the Lower Stour modelling studies completed by JBA Consulting on behalf of the Environment Agency. The Environment Agency was consulted during the preparation of this FRA and has advised that the fluvial and tidal modelling covering this area is currently being updated and is likely to be released in Spring 2018. Consultation on the model release date is ongoing (emails on 12th December 2018 and 5th March 2018, and a telephone message on 15th March 2018). In the meantime, the Environment Agency has advised that the existing modelling remains the best available data and should be used to inform this assessment. Minutes of the consultation meeting held on 28th June 2017 are included in Appendix A.

6.4.7 The modelled fluvial flood extent maps assume an increase in flows of 20% to account for climate change. Although new fluvial climate change allowances have been published by the Environment Agency since the issue of the modelling, according to the updated guidance issued in February 2016[2] the climate change allowance for the permanent elements of the proposed development remains at 20%. This is on the basis of an Essential Infrastructure vulnerability classification, a lifetime of up to 2060, and a location in Flood Zone 1. This is of particular relevance for the substation site, which is located in Flood Zone 1. The application of the 20% climate change allowance for fluvial flows has been confirmed with the Environment Agency (Appendix A). The modelled fluvial flood maps included in the Product 4 data provided in Appendix D therefore remain valid under the new climate change allowance guidance. The fluvial flood modelling indicates that the proposed development area would remain at low probability of flooding (<0.1% AEP) during all AEP events modelled (defended and undefended) for its full lifetime to 2060.

6.4.8 The climate change allowances for sea level rise used in the existing Environment Agency modelling remain applicable; the latest climate change guidance did not include any changes to the sea level rise allowances compared to the previous allowances. The modelled tidal flood extent maps, taking into account various allowances for climate change for both defended and undefended scenarios, are included in the Product 4 data (Appendix D). The modelled maximum flood levels for the proposed substation site and the Tenant Relocation Area for the 0.5% AEP event in 2070 are shown on Table 6.3. These indicate that much of the proposed development area would remain dry during the 0.5% AEP event (undefended) in 2070, including the existing HMRC lorry park (proposed substation site), the Tenant Relocation Area, the BCA car auction yard and the majority of the NGET Energy Park (both defended and undefended). This timeframe extends beyond the lifetime of the proposed development to 2060, and so adequately covers the permanent proposed development, such as the substation.

[2] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

6.4.9 The modelling indicates that the northern part of the proposed development area may be liable to tidal flooding under present day scenarios. Pegwell Bay Country Park is indicated to be at risk during the 0.1% AEP present day defended event (it would remain dry during the 0.5% AEP event (both defended and undefended) and all scenarios for the undefended event). Stonelees SSSI is indicated to be at risk during events ranging from the 1.3% AEP to 0.1% AEP event during both the undefended and defended scenarios. The eastern part of the Baypoint Sports Club (the pitches) is also indicated to be at risk during events ranging from the 1.3% AEP to 0.1% AEP event (both undefended and defended). The areas at higher risk of flooding (5% AEP event) indicated along the River Stour Estuary to the east of the proposed development area are associated with the lower elevation ground indicated in light blue in Figure 6.2.1 (LiDAR elevations).

Table 6.3: Modelled Tidal Flood Levels at onshore substation and Tenant Relocation Area

Location	0.5% AEP 2070 Maximum Flood Level (m AOD)*	
	Undefended Scenario	Defended Scenario
Onshore Substation	4.8	4.8
Tenant Relocation Area	4.7	4.7

* Source: Lower Stour modelling studies completed by JBA Consulting on behalf of the Environment Agency.

6.5 Surface water flooding

Run-on

6.5.1 The Environment Agency's online Flood Map for Surface Water gives an indication of the broad areas likely to be at risk of surface water flooding i.e. areas where surface water would be expected to flow or pond. It defines areas at very low (less than 0.1% AEP), low (between 0.1% and 1% AEP), medium (between 1% and 3.3% AEP) and high (greater than 3.3% AEP) probability of surface water flooding. The mapping[3] for the proposed development area does not show any surface water flow paths running toward the site, or any areas of significant ponding with the exception of the proposed substation site, for which new drainage infrastructure could be designed to address this risk. This general lack of surface water flood risk was corroborated by observations during the June 2017 site visit. Although there had been heavy rain overnight, no areas of surface water flooding/ ponding were observed.

Runoff

6.5.2 During the construction phase, the development of temporary compounds, access routes and hardstanding at construction locations has the potential to increase the overall extent of lower permeability surfaces within the proposed development. In the absence of effective surface water management measures, this could lead to a temporary increase in peak runoff rates and a consequent increase in flood risk for downstream receptors.

6.5.3 In terms of the permanent operational development, the only aspects of the permanent infrastructure that could increase surface runoff rates would be the substation, which would cover an area of approximately 41,000 m^2. The substation would include electrical equipment and buildings which would be impermeable. It was not possible to access the substation site during the site visits, but from aerial photography the land parcel already appears to be largely covered in hardstanding. Nevertheless, vegetation is also visible in some places, so it is feasible that the proposed development could result in an increase in impermeable area at the substation site. However, with appropriate surface water management measures it would be possible to ensure there is no increase in risk associated with surface water runoff.

[3] https://flood-warning-information.service.gov.uk/long-term-flood-risk/ (accessed 08/05/17)

6.5.4 It was not possible to access the Tenant Relocation Area during the site visits. Aerial photography indicates that this area is largely covered in hardstanding which is not proposed to be replaced as part of the proposed development. No information is available on the presence or condition of a drainage system. Existing drainage systems may be used if they are found to be working adequately. If existing drainage systems are not working adequately or the area is to be re-surfaced, any new drainage system would utilise the SuDS principles.

6.5.5 It is also worth noting that the discharge location for the proposed substation site (existing HMRC lorry park) and the Tenant Relocation Area may be the flapped hard engineered outfall to the tidal River Stour estuary observed during the site visit. The control of discharge rates and volumes to tidal estuaries is not usually required on the basis that the tide itself has a far greater influence on water levels that those arising from a drainage system.

6.6 Sewer flooding

6.6.1 It is anticipated that there are few sewer drainage networks within the proposed development area. These are likely to serve the Baypoint Sports Club and BCA car auction site to south of Pegwell Bay Country Park. However, even in these areas, sewers are unlikely to constitute a significant source of flooding in their own right which can be distinguished from surface water flooding. The risk of sewer flooding in the area is likely to be low.

6.7 Groundwater flooding

6.7.1 Groundwater is likely to discharge to nearby surface waterbodies such as the River Stour and the sea, which would control groundwater to similar elevations for the most part of this area. The water table in the proposed development area is therefore likely to be generally close to the surface, and the tidal pool in the northern part of Stonelees SSSI may be in continuity with shallow groundwater.

6.7.2 Perched groundwater may be encountered in areas of Made Ground. A previous ground investigation by URS (2009)[8, 9] in the former Richborough Power Station site (now the Richborough Energy Park) found perched groundwater in the Made Ground at about 0.1 to 1.0 metres below ground level (m bgl) and the water table at about 0.7 to 3.5 m bgl. This is a lower lying part of the proposed development area.

6.7.3 The BGS Groundwater Flooding Susceptibility mapping as supplied by Envirocheck[4] shows that the proposed development area is not within an area susceptible to groundwater flooding at surface, but subsurface structures could be susceptible to groundwater flooding.

6.7.4 This suggests that although some groundwater would be likely to be encountered during excavations, for most of the cable route groundwater is unlikely to be found in significant quantities, and is not considered to be a significant potential flood risk. The exception would be the deep TJB in the landfill created to enable HDD works during the construction phase for Landfall Option 1. Groundwater flood risk is considered further in the assessment section below.

6.8 Reservoirs, canals and other artificial sources

6.8.1 No artificial flood sources, such as impounding reservoirs in the catchments upstream of the proposed development, have been identified that could potentially present a flood risk.

6.9 Summary

6.9.1 The Environment Agency's flood model indicates that the majority of the proposed development area is at low risk of tidal flooding over the O&M period (proposed maximum lifetime is to approximately 2060) taking climate change into account, but that some of the cable route, including the landfall location and temporary sea wall cofferdam for Landfall Options 2 and 3, is at risk under the present day scenarios. This tidal risk is addressed in the Section 7.

6.9.2 The screening assessment indicates that the proposed development area is at a low risk of flooding from fluvial, sewer and groundwater sources. The risk associated with surface water run-off would be addressed through adequate drainage design, as discussed further in Section 7.

[4] Landmark Information Group (2017). Envirocheck Information Report, June 2017.

7 Assessment of Flood Risk

7.1 Introduction to the assessment

7.1.1 Having outlined in broad terms the principal potential flood risks prevailing in and around the proposed development area in section 6 of this document, the current section assesses specific flood risk both to and from the development i.e. the risk to receptors associated with the proposed development and the potential for flood risks to third-party receptors to be increased as a consequence of the proposed development. Appropriate mitigation measures are specified to address the identified risks.

7.2 Risks during construction

7.2.1 During the construction phase there is the potential for the following:

- increased flood risk due to temporary sea defence works (Landfall Options 2 and 3);
- loss of floodplain storage;
- changes to watercourse flow conveyance;
- surface water flood risk;
- groundwater flood risk; and
- risk to construction workers (site access).

Increased flood risk due to temporary sea defence works

7.2.2 Landfall Option 1 does not interact with the sea defence as the cables would be installed underneath it, and therefore there would be no change regarding flood risk to the landfill. However, Landfall Options 2 and 3 involve temporary removal/break-through of the existing sea defence at the edge of the historical landfill underlying Pegwell Bay Country Park, and therefore present the potential for sea water to reach the landfill through the temporarily weakened sea defences. A temporary sea wall cofferdam would therefore be installed to act as a barrier to tidal flooding and to contain any contamination from the landfill. If the cofferdam is not of sufficient height flood water could reach the exposed landfill. This could present a risk to the site workers and contamination risk to the SSSI. Mitigation relating to the crest height of the cofferdam to address this risk is provided in section 8.1. The cofferdam would reduce the risk of flooding of the landfill during the works, but a residual risk would remain from potential overtopping of the cofferdam.

Loss of floodplain storage

7.2.3 In a fluvial floodplain, the development of raised structures in the floodplain (such as temporary stockpiles during construction works for the cable route) would lead to a loss of floodplain storage and thus an increase in water levels elsewhere. However, according to the Environment Agency's fluvial modelling, the site would remain dry during the design 1% AEP event including the appropriate allowance for climate change. As such, the development is not located within a fluvial floodplain, and hence the Environment Agency has confirmed (minutes of the consultation meeting on the 28th June 2017 included in Appendix A) that it has no concerns regarding loss of floodplain storage associated with the proposed development.

7.2.4 Loss of floodplain storage is not a concern when the risk is from tidal sources, particularly when facing the open coast or estuary, as is the case at Stonelees and the Baypoint Sports Club pitches, on the basis that the volume of water associated with the sea far exceeds any effect of raised structures on the loss of any floodplain volume.

7.2.5 The Environment Agency has suggested that the contractor may wish to consider avoiding creating stockpiles of topsoil in areas at highest tidal flood risk, in order to minimise the risk of the stockpiles being washed away during extreme high tide events. The stockpiles could instead be located nearby in Flood Zone 1. However, Kent Wildlife Trust (KWT) has previously indicated that it would be preferable for soil stockpiles to be located adjacent to the area of excavation to minimise environmental impacts, such as the spread of any invasive species (if these are present) and to return soil to the place of excavation. It is currently proposed that stockpiling occurs next to the area of excavation wherever possible.

Changes to watercourse flow conveyance

7.2.6 Permanent watercourse crossings for the cable and temporary watercourse crossings that are required for construction would have the potential to adversely affect flow conveyance within the affected watercourses and therefore to influence flood depths.

7.2.7 As stated in section 4, the only watercourses/ waterbodies in the proposed development area include a small ditch on the landward side of the sea defence/ landfall (the crossing for which would be associated with the landfall works), a ditch alongside Sandwich Road (a temporary crossing for access), a tidal pool in Stonelees (often dry) and the Minster Stream (an Environment Agency Main River). The detailed design of all the watercourse crossings would be subject to approval from the appropriate consenting authority prior to the commencement of construction works, namely the Environment Agency for Main Rivers (such as Minster Stream), and the KCC for all other Ordinary Watercourses, such as the two drainage ditches (the proposed development area is entirely outside of the IDB District). However, it was agreed with the stakeholders during the 28th June 2017 meeting (Appendix A) that any problems related to watercourse crossings should be resolvable.

7.2.8 Provided detailed consideration is given to watercourse crossing design and the implementation of mitigation measures to minimise impacts on watercourses during construction, it is therefore concluded that the proposed development would be delivered without causing any increase flood risk through impacts on watercourse conveyance.

Surface water flood risk

7.2.9 The Environment Agency's surface water flood mapping indicates a general low risk of surface water flooding at the proposed development area. Surface water flood risk to construction workers is minor and deemed to be of lower significance than the combined flood risk arising from fluvial and tidal sources. Therefore, provided generic mitigation measures to address drainage and flood risk requirements are implemented to address the risks set out below, no further location-specific mitigation to address surface water flood risks would be required.

7.2.10 The development of temporary access tracks and areas of hardstanding (required to progress construction works) could however, in the absence of appropriate mitigation, result in a reduction in permeability in the proposed development area. Such a reduction in permeability could result in an increase in surface water run-off and thus an increase in risk elsewhere. Therefore, measures to allow infiltration of incident rainfall would be required, as set out in section 8.1 below.

7.2.11 As discussed in section 6.7 of this document, groundwater is likely to be shallow and dewatering of excavations may be required. In order to ensure such works do not result in an increase in flood risk downstream, water from excavations would preferably be discharged to ground and allowed to infiltrate. Where this is not possible, and direct discharge to a watercourse is necessary, this could conceivably increase downstream water levels and flows. Dewatering would therefore be suspended if there are any fluvial flood alerts or warnings in place downstream. Such events would coincide with heavy rainfall, during which works may cease in any case.

7.2.12 No surface water flow pathways have been identified along the route as part of this study to date. If identified at the construction phase, raised features such as the overground cable route and/ or temporary soil stockpiles could feasibly cause surface water to pond on the uphill side. In such instances, cross drainage/ under-drainage would be installed to allow surface water to pass underneath. Alternatively, gaps in temporary soil stockpiles could be provided.

Groundwater flood risk

7.2.13 It is likely that shallow groundwater would be encountered during excavations. Some of these excavations, particularly for underground TJB's may need to be dewatered to facilitate the construction works. There is a potential risk to construction personnel and equipment working in excavations below water table level. Cofferdams or suitable alternatives would be deployed for the deepest excavations, such as the landfill TJBs, to restrict groundwater inflows, and prevent overland flows from entering the excavations from the surface. Provided such measures are employed, as already incorporated into the construction proposals to enable the works to be undertaken, and the necessary processes are followed to secure the necessary permits to work (including health and safety risk assessments in the excavations), the risk to workers in the excavations would be low.

Risk to construction workers (site access)

7.2.14 Some of the construction site associated with the onshore cable and landfall is located in tidal Flood Zones 2 and 3. In addition, a number of the access routes by which the site would be reached from the wider area are also located in Flood Zones 2 and 3. Therefore, it is feasible that construction workers, even when working in an area that is itself at low risk of flooding, could be exposed to a high tidal flood risk as a result of access/ egress routes being flooded. To minimise the risk to operatives in the event of a flood, an Emergency Flood Response Plan would be prepared covering all construction activities and the response required in the event that a tidal flood is considered likely. It might be prudent to also cover fluvial flood risk given the proximity of the site to the River Stour, but the current Environment Agency flood modelling does not indicate that this is necessary. Provided an appropriate Emergency Flood Response Plan is prepared and adhered to, as set out in section 8.1 below, the residual risk to construction workers would be low.

7.3 Risks during operation

Risk to infrastructure (cable route)

7.3.1 Localised flooding of the cable infrastructure may occur at times. Flooding mechanisms could be from groundwater ingress (i.e. the underground cable being below groundwater levels), or from occasional tidal flooding at cable sections passing through the floodplain. Given the electrical nature of the development, potential risks would be both to the infrastructure itself, as well as the public and maintenance workers in the vicinity of the compromised electrical equipment. The cable infrastructure, including all TJBs, and both underground and overground sections, would be designed to be resilient to flooding. Provided the design incorporates such resilience, the risk to the infrastructure, public and maintenance workers would be low. This would be considered further in the detail design stage.

Risk to infrastructure (substation)

7.3.2 As discussed in section 6.4, the proposed substation would be located in an area that would remain dry during both the 1% AEP fluvial event and the 0.5% AEP tidal event, for the duration of its lifetime i.e. including the relevance allowances for climate change. A drainage strategy for the substation site would be prepared to ensure that surface water is adequately managed on-site without increasing risk elsewhere. On this basis, the flood risk to the substation infrastructure itself is considered to be low, requiring no further mitigation.

7.3.3 Detailed design of the substation, including drainage, would be undertaken once the DCO is secured. A suitable drainage system would be provided. The applicant has confidence that this will be possible within the development land parcel identified, particularly given the likely opportunity to discharge to the tidal River Stour, for which attenuation (usually the greatest land-take element) would only be required to address tidal locking. As such, it has not been deemed necessary to prepare a Drainage Strategy to accompany the DCO application. The preparation of a Surface Water and Drainage Management Plan for the permanent development (including the sub-station) would be covered by a DCO Requirement (Document Ref: 3.1), which itself would reference the need for the Plan to be prepared in accordance with the drainage principles set out in the Technical Note in Appendix E of this FRA. The intention of this Technical Note is to provide confidence to KCC, as the LLFA, that suitable drainage measures would be provided at the permanent developments in due course. New drainage infrastructure at the Tenant Relocation Area would also be subject to the principles set out in Appendix E.

Risk to operatives (site access)

7.3.4 There are a number of circumstances where site maintenance visits would be required. For instance, annual inspection of the link boxes/ test pits would be necessary, and access to the cable easement would occasionally be required to carry out emergency repairs. Whilst the substation would not be staffed, access would be required periodically (typically one visit per week) for routine maintenance activities.

7.3.5 Personnel could be at risk of flooding in areas where a fluvial/ tidal flooding has been identified. These areas are small and include the area near Stonelees and the Baypoint Sports Club. Furthermore, during an extreme tidal flood event, although the main A256 road to the north of the proposed development would remain dry, a number of access routes to and from the substation could be flooded and should be avoided. An Emergency Flood Response Plan would therefore be incorporated into inspection procedures to mitigate these risks. Provided an appropriate Emergency Flood Response Plan is prepared and adhered to, as set out in section 8.2 below, the residual risk to maintenance workers would be low.

7.4 Risks during decommissioning

7.4.1 Risks during decommissioning would be similar to those encountered during construction. However, if climate change occurs as projected, the flood hazard baseline would be altered compared to that which would apply during construction. Current allowances for climate change indicate that tidal flood risk, both extents and depths, would be increased, as a result of potential sea level rise. It is worth noting that the climate change horizon considered in the tidal assessment was to the year 2070, which is 10 years beyond the anticipated maximum lifetime of approximately 2060, thus potentially covering the period during which decommissioning would take place.

7.4.2 Decommissioning works would require comprehensive re-assessment at the time based on best available information, and under prevailing planning regime at the time prior to commencement of works. The higher level of risk such as this could be addressed through more stringent mitigation, such as an even more precautionary emergency flood plan. Decommissioning is covered by Requirement in the DCO (Document Ref: 3.1).

8 Flood Risk Management

8.1 Construction phase

8.1.1 As discussed in section 7 of this document, the majority of the potential flood risks identified would occur during the construction phase. Measures to manage flood risks for this phase are set out in Table 8.1 and would be dealt with in the Construction Environmental Management Plan (CEMP), which will be secured through a requirement in the DCO (Document Ref: 3.1) and are captured as part of the Code of Construction Practice (CoCP).

Table 8.1: Proposed flood risk management measures (construction phase)

Ref no.	Development element	Flood risk management measure	Reason
1	All works	No works within 3 m of any watercourse (other than for watercourse crossings). Any works within 8 m of an Ordinary Watercourse would be subject to consent from KCC (or the IDB if within the IDB District, which none of the proposed development currently is). Any works within 8 m of a non-tidal Main River (e.g. Minster Stream) or 16 m for a tidal Main River (e.g. River Stour) would be subject to provision of a FRAP from the Environment Agency.	To minimise the risk of any impacts to watercourses, including impacting flood flow conveyance.
2	Raised structures across surface water flow pathways (if any are identified)	Cross drainage should be provided as necessary at topographic low points.	To avoid disrupting flow paths and retain natural surface water flow routes.
3	Access routes and working areas	Stone access routes and working areas to be constructed of permeable aggregate material.	To retain the existing infiltration characteristics and runoff rate.
4	Access routes and working areas	Runoff from access routes and working areas to be allowed to infiltrate wherever possible. No formal (piped or open channel) systems to be constructed, but infiltration trenches to be used to promote infiltration of locally displaced runoff where required (not where Made Ground is present, such as in Pegwell Bay Country Park).	To retain the existing runoff rate.
5	Access routes and working areas	All access route and working area construction material to be removed at the end of construction, reinstated with material from the soil stockpiles (to a level slightly above natural ground level to allow for settlement) and reseeded or replanted.	To return the temporary access routes and working areas to a natural condition, in terms of their rainfall infiltration and runoff generation characteristics.
6	Working areas	Dewatering of excavations outwith the landfill would be pumped via settling tanks or ponds to remove sediment, before being preferentially discharged to adjacent vegetated intertidal land (of low ecological value), away from watercourses. Where this is not possible, and direction discharge to a watercourse is necessary, dewatering would be suspended if a flood alert or flood warning is in place downstream.	To prevent any increase in flood risk downstream.
7	Topsoil stockpiles	No stockpiles within 8 m of Ordinary Watercourses, within 8 m of a non-tidal Main River, and within 16 m of a tidal Main River.	To minimise any impacts on flood flow conveyance, and to maintain access for watercourse maintenance.

Ref no.	Development element	Flood risk management measure	Reason
8	Topsoil stockpiles	Stockpile gaps would be located at topographic low points to preserve existing flow paths. Where stockpiles are placed on both sides of the access routes (to allow for cross drainage) the gaps should coincide.	To maintain existing surface water flow paths.
9	Topsoil stockpiles	Stockpiles to be seeded to encourage stabilisation, where required for long term storage.	To prevent sedimentation of watercourses. To prevent loss of topsoil in a major flood event, thereby reducing the availability of material for reinstatement.
10	Construction compounds	Compounds would be surfaced with material with similar permeability to the existing ground cover (with the exception of fuel storage areas and similar, where pollution containment in the event of a spillage is the priority).	To retain predevelopment runoff rates in previously undeveloped areas.
11	Construction compounds	Preparation of a pre-construction drainage strategy, utilising SuDS principles for new areas of hardstanding and run-off limited to pre-development rates. SuDS measures may include attenuation storage, and infiltration trenches/soakaways. This would be secured through a DCO Requirement (Document Ref: 3.1).	To retain predevelopment runoff rates in previously undeveloped areas, and water quality control.
12	Watercourse crossings – temporary (access) crossings	Where culverts are used, these would be appropriately sized to maintain existing flow conveyance.	Maintain existing conveyance capacity.
13	Watercourse crossings – temporary (access) crossings	No multiple pipes for culverts (culverts should have a single pipe/opening of an appropriate size for the watercourse cross section).	Maintain existing conveyance capacity and minimise the risk of blockage.
14	Watercourse crossings – temporary (access) crossings	Circular culverts to have concrete bedding.	To prevent settling of the culvert and resultant loss of flow capacity
15	Watercourse crossings – temporary (access) crossings (and any other works within permitting distance)	A FRAP from the Environment Agency would be required for any works within 8 m of the Minster Stream. Consent would be required from KCC for Ordinary Watercourse crossings. These permits and consents would determine the eventual form of any temporary crossing, thus ensuring that only suitable crossings are provided.	To minimise the loss of channel capacity (and to prevent in channel or bankside disturbance where there are ecological requirements to do so).
16	Cofferdam	The crest height of the sea wall cofferdam would be no less than the present day 1 in 200 year undefended flood level of 3.64 m AOD. The provision of a freeboard allowance (of up to 600 mm) on top of the undefended flood level would be considered by the contractor at the time of the construction works. This would be subject to an appropriate health and safety risk assessment to consider whether the increase in the crest of the cofferdam would itself result in an increase in risk (perhaps from other hazards, such as reduced ability to evacuate easily) to construction workers within the cofferdam.	Prevention of tidal flooding and consequent contamination of the SSSI by landfill leachate.

Ref no.	Development element	Flood risk management measure	Reason
17	All onshore construction works	Preparation of Emergency Flood Response Plan for the construction phase, including safe access and escape routes where required, and also covering fluvial flood risk due to the proximity of the River Stour. The Preparation of an Emergency Flood Response Plan would be covered by a DCO Requirement.	For the safety of construction workers who may be working within the floodplain, or may need to cross it to access/ egress the part of the proposed development areas they are working in.
18	Landfall Option 2	If the existing watercourse culvert underneath the landfill is uncovered during landfall construction works, and damaged in any way, this would be 'made good' to ensure the continued function of the culvert is not compromised.	To prevent water from backing up on the upstream side of the culverted watercourse.

8.2 Permanent/ operational phase

8.2.1 Measures to manage flood risks from the operational development (i.e. the cable infrastructure, proposed substation, and Tenant Relocation Area) are detailed in Table 8.2. The finished floor levels and the flood resilience of the water sensitive equipment of the onshore substation would be in excess of the design flood levels including allowances for climate change and freeboard. This would be covered by a DCO Requirement.

Table 8.2: Proposed flood risk management measures (permanent/ operational phase)

Ref no.	Development element	Flood risk management measure	Reason
19	Watercourse/ waterbody crossings – permanent cable crossings	For any permanent crossings (for the cable) over existing watercourses, the relevant flood management agencies (Environment Agency and KCC) would be consulted on the principles of their design. For the proposed replacement culvert over the Minster Stream, for example, the suitability of the method would be advised at detailed design stage, and subject to FRAP consent from the Environment Agency.	To prevent impact on flow conveyance of the affected watercourses and therefore to influence flood depths.
20	Onshore cable route	The cable infrastructure, including all jointing bays, and both underground and overground sections, would be designed to be resilient to flooding.	To prevent damage to the cables and safety risks

Ref no.	Development element	Flood risk management measure	Reason
21	Onshore Substation	A Surface Water and Drainage Management Plan would be prepared for the substation area as DCO Requirement 20 (Document Ref: 3.1). This would be prepared in accordance with the Drainage Principles set out in the Technical Note included in Appendix E. The key principles from the Technical Note are set out below: • a SuDS approach for new drainage systems; • SuDS measures would include interception (no discharge from the site for the first 5 mm of rainfall); • treatment of runoff flows prior to discharge; and • depending on the discharge point, attenuation storage prior to discharge (not required if discharging to the tidal River Stour). Consideration of tide locking would be necessary.	To retain pre-development runoff rates in previously undeveloped areas (and water quality control).
22	Tenant Relocation Area	Existing drainage systems would be used if they are found to be working adequately (following a CCTV survey). If existing drainage systems are not working adequately or the area is to be re-surfaced, any new drainage system would be prepared in accordance with the Drainage Principles set out in the Technical Note included in Appendix E, as secured by the DCO (Document Ref: 3.1). The key principles from the Technical Note are as set out for the substation.	To retain predevelopment runoff rates in previously undeveloped areas, and water quality control.
23	Areas requiring access via the floodplain	Emergency Flood Response Plan for the O&M phase, including safe access and escape routes where required. The Preparation of an Emergency Flood Response Plan would be covered by a DCO Requirement.	For the safety of workers who may be working within the floodplain, or may need to cross it to access/ egress the part of the proposed development areas they are working in.
24	Finished floor levels of onshore substation	Finished floor levels of onshore substation should be no less than 5.1 m AOD, to include a 300 mm freeboard allowance above the 0.5% AEP plus climate change (2070) flood level.	Flood protection of the onshore substation.
25	Flood resilience of onshore substation	The water sensitive equipment of the onshore substation should be flood resilient to a level of 5.4 m AOD, to provide a 600 mm freeboard above the 0.5% AEP plus climate change (2070) flood level.	Flood protection of the water sensitive equipment of the onshore substation

8.3 Maintenance/ refurbishment works and decommissioning

8.3.1 Some of the measures included in Table 8.1 could be required for infrequent refurbishment activities during the O&M phase of the proposed development and for eventual decommissioning, such as the inclusion of an Emergency Flood Response Plan within the method statements for maintenance/ refurbishment works. However, specific flood risk mitigation requirements for these phases would need to be specified when the details of such works are known. Furthermore, specification of future mitigation measures would need to take account of the changes in the flood hazard baseline relating to climate change, land use change and the planning and regulatory requirements prevailing at the time.

8.4 Residual risk

8.4.1 Residual risk is that which remains after the flood risk management measures set out above have been taken into account. Site operatives undertaking works in the small sections of the cable route within the floodplain (or accessing/ egressing other areas of the site via the floodplain) and during the construction and removal of the sea wall cofferdam (Landfall Options 2 and 3) would be at residual risk in the event of flood.

8.4.2 As stated in paragraph 5.7.25 of EN-1 (Department of Energy and Climate Change, 2011a) , receipt of and response to warnings of floods is an essential element in the management of the residual risk of flooding. The Emergency Flood Response Plan would address this residual risk, and therefore upon implementation of the flood risk management measures set out above, the residual risk to all potential receptors is considered to be low. The implementation of the Emergency Flood Response Plan would ensure that the risk to them is as low as it reasonably practicable, and appropriate for their vulnerability (Essential Infrastructure). Such an approach is considered to be proportionate to the risk and appropriate to the scale, nature and location of the proposed development.

9 Conclusions

9.1.1 This FRA accompanies the ES submission for the onshore elements of Thanet Extension. The proposed development falls within the administrative boundaries of KCC, TDC and DDC in the south-east of England.

9.1.2 This assessment has been carried out in accordance with National Policy Statements EN-1 (Department of Energy and Climate Change, 2011a), which sets out planning policy with regard to NSIPs in the energy sector in general, EN-3 (Department of Energy and Climate Change, 2011b) which sets out the requirements for renewable energy infrastructure, and EN-5 (Department of Energy and Climate Change, 2011c), which relates specifically to electricity networks infrastructure. Reference has also been made to the NPPF and the associated Planning Practice Guidance for additional guidance regarding flood risk and development, as appropriate. This assessment has also been informed through consultation with key stakeholders, including the Environment Agency, IDB, KCC (the Lead Local Flood Authority) and TDC, who may be the stakeholder responsible for the tidal flood defence of the historical landfill site at Pegwell Bay Country Park (this matter is as yet unresolved between TDC, KCC and the Environment Agency).

9.1.3 The proposed location of the onshore development has been determined following an options appraisal and taking into account consultees responses to the Scoping Report. A sequential approach has been taken in siting the proposed development, with a route mainly located in Flood Zone 1 selected. Alternative route options were considered at the scoping stage, however these passed through greater areas of flood risk than the northern route options selected. The proposed development area avoids the River Stour and Minster Stream floodplain and the majority of the tidal floodplain. However, due to the proximity to the coast to this route, it is not practical to avoid all tidal flood risk areas, and the cable route would cross small areas of Flood Zones 2 and 3. The temporary working areas, substation and NGET Richborough Energy Park substation would be located in Flood Zone 1. On the basis that the route with the least possible risk of flooding has been selected, where practicable, it is concluded that the Sequential Test is passed.

9.1.4 In accordance with the guidance in the NPPF, the development proposals are appropriate for the flood zone classification of the site, and where necessary the Exception Test has been passed.

9.1.5 A preliminary assessment of flooding during construction and operation of the proposed development indicates that the development area is at a low risk of flooding from fluvial, sewer and groundwater sources. It is anticipated that the risk associated with surface water runoff could be addressed through adequate drainage design. The Environment Agency's flood model indicates that the majority of the proposed development area is at low risk of tidal flooding over the operations and maintenance period (proposed lifetime is to approximately 2060) taking climate change into account, but that some of the cable route, including the landfall location, is at risk under the present day scenarios (Flood Zones 2 and 3). To reduce the risk to the landfall location during the construction works, a temporary sea wall cofferdam would be installed to act as a barrier to tidal flooding and to contain any contamination from the landfill.

9.1.6 Suitable flood risk management measures have been identified to address the risks identified. Any permanent infrastructure located in flood risk areas would be appropriately flood resilient and resistant, including safe access and escape routes where required, and the residual risks would be safely managed over the lifetime of the development. A drainage strategy for the construction phase would be prepared, utilising SuDS principles for new elements of the drainage system.

9.1.7 The works required and associated flood risks during eventual decommissioning would be similar to the construction phase, subject to any climate change impacts. It has been concluded that more stringent mitigation could be implemented to address the risks associated with such future works, to be identified through an appropriate assessment to be undertaken at the time. It is not anticipated that there would be any insurmountable flood risk obstacles to decommissioning that could not be overcome.

9.1.8 The proposed development, with the flood risk management measures described above in place, would not be subject to an unacceptable level of flood risk, nor would it increase flood risk elsewhere.

9.1.9 In conclusion, this assessment demonstrates that the requirements of EN-1 (Department of Energy and Climate Change, 2011a), EN-3 (Department of Energy and Climate Change, 2011b) and EN-5 (Department of Energy and Climate Change, 2011c) and the NPPF and its associated Planning Practice Guidance with respect to flood risk can be met for the proposed development, and the flood risk management measures identified could be secured through the DCO Requirements (Document Ref: 3.1) if approved.

10 References and Glossary

10.1.1 This report has used the following references:

- Amec Foster Wheeler Environment and Infrastructure Limited, (2018), 'Thanet Extension Offshore Wind Farm, Phase 1 Geo-environmental Desk Study', March 2018 (Volume 5, Annex 6.1: Phase 1 Geo-environmental Desk Study (Document Ref: 6.5.6.1), of the ES).
- Department for Communities and Local Government (2012). 'National Planning Policy Framework'. http://planningguidance.planningportal.gov.uk/ [Accessed: July 2017].
- Department for Communities and Local Government. (2006 and update in 2010). 'Planning Policy Statement 25: Development and Flood Risk (PPS25)' 'http://webarchive.nationalarchives.gov.uk/20100407164532/http://www.communities.gov.uk/planningandbuilding/planning/planningpolicyguidance/planningpolicystatements/planningpolicystatements/pps25/ [Accessed July 2017] (PPS25 has since been superseded by NPPF and its associated Planning Practice Guidance).
- Department for Communities and Local Government (2014). 'Planning Practice Guidance – Flood Risk and Coastal Change'. https://www.gov.uk/guidance/flood-risk-and-coastal-change [Accessed: July 2017].
- Department of Energy and Climate Change (DECC) (2011a), 'Overarching National Policy Statement for Energy (EN-1)' https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf [Accessed: July 2017].
- Department of Energy and Climate Change (DECC) (2011b), 'Overarching National Policy Statement for Renewable Energy Infrastructure (EN-3)' https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47856/1940-nps-renewable-energy-en3.pdf [Accessed: July 2017].
- Department of Energy and Climate Change (DECC) (2011c). 'National Policy Statement for Electricity Networks Infrastructure (EN-5)'. http://www.nemo-link.com/pdf/cpo/The_National_Policy_Statement_for_Electricity_Networks_Infrastructure_(EN-5).pdf [Accessed: July 2017].
- Envirocheck report (2017) dated 3rd March 2017 (reference 116412988_1_1).
- Environment Agency 'Long term flood risk mapping website' https://flood-warning-information.service.gov.uk/long-term-flood-risk/ [Accessed May 2017].
- Environment Agency, (2017). 'Flood Map for Planning website' (https://flood-map-for-planning.service.gov.uk/summary/633603/161807) [Accessed: July 2017].
- Environment Agency 'What's in your backyard' http://maps.environment-agency.gov.uk/wiyby/wiybyController?value=thanet&lang=_e&ep=map&topic=groundwater&layerGroups=default&scale=9&textonly=off&submit.x=0&submit.y=0#x=638118&y=162429&lg=&scale=7 [Accessed: July 2017].
- Environment Agency (2017). 'Flood risk assessments: climate change allowances'. https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances. [Accessed: July 2017].
- Landmark Information Group (2017). 'Envirocheck Information Report, June 2017'.
- URS Corporation Ltd, (2009a), 'Detailed Quantitative Risk Assessment'
- URS Corporation Ltd, (2009b), 'Geoenvironmental Interpretative Report'
- WSP Environmental Ltd, (2007), 'Thanet Offshore Substation (Richborough) Ground Investigation Report'.

Appendix A: Record of consultations

Minutes

Date: 28 June 2017

Meeting at: Environment Agency, Rivers House, Sturry Road, Canterbury, Kent, CT2 0AA

Subject / purpose:

Consultation meeting covering Flood Risk Assessment (FRA) and Water Environment Assessment (including potential sources of contamination to controlled waters) supporting the Environmental Impact Assessment for the onshore elements of the Thanet Extension Offshore Wind Farm, South East Kent

Attendees:

Jennifer Wilson (JeW) – Environment Agency (Planning, Sustainable Places)
Meriel Mortimer (MM) – Environment Agency (Flood)
Pete Dowling (PD) – River Stour IDB (Engineer to the Board)
Joseph Williamson (JoW) – Kent Council (Flood and Drainage)
Oliver Gardner (OG) – Amec Foster Wheeler (EIA Co-ordinator, on-shore route)
Richard Cartlidge (RC) – Amec Foster Wheeler (Flood and Drainage)
Ana Braid (AB) – Amec Foster Wheeler (Flood and Water Environment)
Vanessa Dahmoun (VD) – Amec Foster Wheeler (Contaminated Land)

Apologies:
None

Minutes: **Action by:**

1 **Project overview**

OG provided a project update based upon the outcome of the Project meeting held the day before. OG provided the meeting with an overview of the onshore proposals, including a description of each element of the latest red line boundary. It was noted that the latest route doesn't pass through any of the IDB District. OG advised that construction works would be scheduled to commence in 2020.

Open cut through mud flats (offshore). Landfall location requires crossing a rock armour sea defence (either under, through or over). Transition pit at 'landfall', comprising a permanent concrete box. 2 x pairs; 4x offshore cables to 4x onshore cables. Cable would be above ground through the country park to avoid excavation of the landfill. Above ground approach is to create a concrete slab at the ground surface. The cables run through concrete trough(s) on top,

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covered in earth (crushed chalk to recreate a chalk grassland effect) to create one bund. The final bund would be approximately 5m wide and 2m high. This is similar to the approach adopted by the Nemo Link project through the country park. Elsewhere, (outside of landfill) the approach will generally be cut & fill, comprising a trench, lined with concrete trough(s) through which the cables will run. The remainder of the trench to be backfilled with arisings. Cut and fill through the Sports Club (& pitches) and the car auction site. The route then crosses an EA main river (Minster Stream), which is culverted where the route is currently proposed.

New location for the substation site is located adjacent to Richborough Port, in an area currently used by the Department for Transport for the impoundment of vehicles. The main construction compound would be located adjacent to the substation site, to the south. The final part of the route would be to connect the sub-station site to the National Grid infrastructure in the Energy Park. Only one cable would be required from the substation to the NG connection. HDD under the road and then trench through energy park, probably within the internal access road.

Temporary access roads for construction would be located alongside the cable route.

2 **Landfall/Sea Defence**

It was acknowledged that the landfall at the sea defence will need to be carefully managed, but MM advised that the rock armour sea defence at the landfall is not an EA defence at this location (transition pit). This defence is the responsibility of Thanet District Council (TDC). The contact is Mike Humber. MM advised that Andy Crates (Coastal Engineer for EA) has had involvement and would be interested in discussions regarding this defence (Andy is on leave for two weeks). MM advised that Flood Risk Activity Permit (FRAP) from the EA would not be necessary (it is not their defence), but that a permit from TDC may be required.

MM to provide a plan showing where the TDC and EA flood defences begin and end, if known (change over likely to be at the edge of landfill site).

The phasing of works at the flood defence was raised. JeW asked whether the existing defence could be left in place. RC suggested that a new defence could be constructed on the seaward side of the existing defence and the transition pit then located between the two defences. OG pointed out that this would allow maintenance at the transition pit without interrupting the sea defence or any excavation of the landfill. OG to discuss with engineers.

OG to raise with engineers

RC queried the exact extent of the EA sea defences (and by association where the TDC begins and ends). MM advised that the flood defence at the landfill is TDCs and at the car auction site it is the EA's, but that the exact location where these begin and end would need to be confirmed subsequently.

3 **Landfill**

OG asked JeW whether the EA had any historic information on the landfill, such as whether it has an engineered cap and the type of

JeW to find out, if possible. Action Completed email

waste. JeW stated that may be colleagues at EA with some knowledge. — 10/07/17 to VD, OG Jennifer Stothert

4 **Drainage on landfill**

JoW advised that KCC would not be concerned with impact of the final raised bund on infiltration – rainfall currently infiltrates into the landfill and the proposed bund would not significantly impact this. JoW advised that cross drains could be provided under the concrete slab if any areas were identified where surface water might pond behind the raised bund, but this was not anticipated to be a great concern.

5 **Flood Zone 3 (tidal) at SSSI**

OG advised that the cables would be buried through the SSSI. Also, buried as soon as they enter Flood Zone 3 (which coincides with the southern end of the landfill). JeW & MM advised that it would not be necessary to move temporary stockpiles from Flood Zone 3 (high probability) to Flood Zone 1 (low probability) because it is a tidal flood risk here. However, JeW & MM suggested that Vattenfall could consider avoiding the creation of temporary stockpiles in FZ3 here on the basis that they could be washed away during tidal events – they could be moved to nearby FZ1. RC noted that the current EA tidal flood model indicates that flood depths of up to 0.9m deep could be experienced at this location during the modelled 1 in 200 year event.

6 **FRAPs & Consents**

MM advised that a FRAP might be needed for temporary stockpiling in the Flood Zone or within 16m of main river.

JoW advised that KCC do not have any land drainage Byelaws so consent would only be required for works within the channel (between bank tops) for those watercourses not covered by the EA (Main Rivers) or the IDB (within the IDB District), both of whom have Byelaws/permitting distances from channels.

7 **Minster Stream**

MM advised that a FRAP would be required for the Minster Stream crossing. A FRAP would also be required for any ground investigation at Minster Stream too.

Post meeting note: MM, please confirm that the 8m permitting distance applies to Minster Stream (on the basis that it is flapped so non-tidal). — MM to respond to post meeting note.

PD advised that the Minster Stream culvert is likely to be relatively deep below ground level at the proposed crossing location. PD raised a question to MM as to whether a Requirement would be required in the DCO to cover future maintenance of culvert (which may be more complicated/expensive if there is additional infrastructure to avoid. JeW advised that, yes, the best mechanism for this would be through a Requirement in the DCO. OG — OG to notify project team of

acknowledged and agreed to raise this matter with the wider project team. potential additional DCO requirement

8 **Compounds**

RC queried the location of construction compounds with respect to Flood Zones. MM advised that the EA would unlikely be concerned about temporary compounds located in FZ2. OG advised that construction would likely commence in 2020.

9 **Substation**

OG advised that the footprint of the final substation would unlikely occupy the whole of the DfT land parcel discussed.

Fluvial flood risk

RC pointed out that the EA Product 4 flood risk information indicates that that the sub-station plot would remain dry during all fluvial events (defended and undefended) for the previously agreed climate change allowance (20% increase in peak flows, on the basis of Essential Infrastructure vulnerability classification, and location in Flood Zone 1, with a lifetime of up to 2060. MM acknowledged and accepted both points (climate change and no fluvial risk).

MM advised that where the development is located outside of the fluvial floodplain (all of it) there would be no concerns with respect to loss of floodplain storage and therefore ground raising would be acceptable.

MM advised that the EA would not be concerned about any temporary raised structures in Energy Park (FZ1 and not in fluvial floodplain).

Tidal Flood Risk

RC pointed out that the EA Product 4 flood risk information indicates that that the sub-station plot would be dry during the 0.5% AEP tidal event in 2070 (both defended and undefended), but would be 'wet' by 2115. OG advised that the lifetime of the development is intended to be 25 years, which may be extended to a maximum of 50 years as has been the case for some other recently consented wind farm developments. MM advised that the EA would not object to the DCO application on the grounds of tidal flood risk on the basis of these 2070 flood levels.

RC queried the new EA model. MM advised that this is still anticipated fairly soon (August or September hopefully), but that, if anything, flood levels are expected to be lower than the current model. In the meantime the existing model is the best available data and should be used.

Surface water flood risk

JoW advised that with respect to surface water drainage at the substation (i.e. the permanent development), measures to address water quality would be required.

JoW advised that KCC would be expecting no discharge from the site for the first 5mm of rainfall – this would need to be intercepted. This could be provided by use of block paving/gravel. If block paving/gravel is not preferred, KCC would expect a swale/pond would be needed.

JoW advised that existing discharge from the proposed sub-station site is likely direct to the (tidal) River Stour. Consideration of tide locking would be necessary.

10 **Potential sources of contamination to controlled waters**

Energy Park – CSEC

JeW advised that any breaking of ground at the road and the Energy Park (and also at the Sports Club (& pitches), the car auction site) will need a Desk Study and a site intrusive investigation (SI)

VD advised that aPhase 1 Desk Study has been prepared and is to be updated. Potential contamination sources have been identified, including the landfills, a closed pollution incident at the Sports Club and past uses of power station at Energy Park.

Risk to maintenance workers and controlled waters have been identified;

VD asked whether any investigation, monitoring data and any details about the landfill's cap were available for the landfills.

JeW to find out, if possible
Completed see above

VD advised that Ground Gas monitoring and water sampling would be carried out as part of the SI, which would also comprise soil testing and waste classification testing.

JeW advised that Claire definition of waste code of practice will have to be followed. JeW advised that the EA would like to be consulted on the scope of the SI.

VD advised that there is a former oil pipeline (with its part within the Energy Park believed to having been decommissioned) present along the northern and eastern boundary of the Substation site.

OG and VD to look for information.

OG advised that the cable would cross this. The pipeline is a above ground, and may need a couple of meters removed to enable crossing.

JeW asked if AFW can get hold of reports to confirm that the pipeline has been decommissioned. If it has, JeW advised that it may be fine to do so, but that she will need to check with her colleagues in the contamination team.

Substation site

JeW advised that with respect to ground contamination issues, the sub-station should be treated as you would any other potentially contaminated site.

11 **Closing**

OG: This is likely route. Still confidential until the 11 July 2017 meeting in London at GoBe's offices.

JoW: April Newing has left KCC. Sean Leake to send invite to JoW. JoW will circulate to KCC representatives as appropriate.

OG to notify Project Team as necessary of KCC

Minutes

Date: 23 August 2017 10.30 to 12.30 **Meeting at:** Vattenfall Wind Power Limited, Ramsgate, Kent

Subject / purpose:

39080 - TEOWF – Pegwell Bay Landfall Options Review

Attendees:

Jennifer Wilson (JW) – Environment Agency
Morgan Sproates (MS) – Thanet District Council (TDC)
Luke Glover (LG) – TDC
Nick Gill (NG) – Kent County Council (KCC)
Charlotte Beck (CB) – KCC
Rebecca Frier (RF) – KCC

Damian Martin (DM) – Vattenfall
Oliver Gardner (OG) – Amec Foster Wheeler (AFW)
Richard Cartlidge (RC) – AFW
Vanessa Dahmoun (VD) – AFW
Matt Logan (ML) – AFW

Apologies:

Sean Leake - GoBe Consultants

Minutes: **Action by:**

1 Introductions were made and OG thanked all for attendance. OG explained that the main purpose of the meeting was to review the proposals for the Thanet Extension Offshore Windfarm (Thanet Extension) export cables making landfall at the Pegwell Bay Country Park. AFW would also provide a brief summary of the results from the Phase 1 Geo-environmental Desk Study.

2 OG and DM gave an overview of the Thanet Extension project and of the programme.

DM confirmed that current programme is for Section 42/47 consultations to take place during October 2017, submission of DCO application in March 2018, and DCO examination from July to December 2018.

3 VD shared draft copies of the Phase 1 Geo-environmental Desk Study and gave a summary of the methodology and key findings.

There was a discussion on the identified sources of contamination across the study area.

VD led a discussion on the Pegwell Bay Landfill (previously named Cliffsend Landfall), which is now the Pegwell Bay Country Park. Information on the history of the landfill had been obtained from an Envirocheck data search, with additional information provided by KCC and TDC. It was acknowledged that there was not much information available about the construction methodology for the landfill, NG stated that KCC have reviewed the old micro-fiche records but there was little historic information on the construction of the landfill available.

CB stated that the main concern for KCC is the lack of detailed knowledge of the landfill construction techniques, for example whether or not the landfill was lined, whether or not there is any shuttering along the edge of the landfill, the depth of the landfill.

CB also stated that there is a culverted surface watercourse/drain that runs beneath the landfill. The entrance is not known (assumed to be along the western edge of the country park adjacent to the road), but the exit at the eastern edge of the landfill close to the bird hide is marked and sampled by KCC (known as PB-S2). The outfall is beneath the rock armour (marked with yellow paint on the rocks) and has a tidal flap. DM noted that this location is likely to be close to the proposed location of the cable landfall. A 2016 water sampling report, including plans showing the surface water sampling locations and boreholes, has been provided to AFW by KCC. Another surface water drain runs around the southeastern edge of the landfill which is also regularly sampled (known as PB-S1). PB-S1 is collected from a small tributary of the River Stour.

The results from samples suggest that PB-S2 is predominately influence by the landfill and the leachates that it produces. Sample PB-S1 is partly effected by tidal water, a limited influence by the landfill has been recorded at PB-S1.

DM asked if the borehole logs from the 2016 water sampling are available.

AFW will review the report and identify the surface water outfall in relation to the development proposals.

4 DM gave an overview of the project and the proposals for the onshore export cable for the Thanet Extension project.

The offshore export cable will follow the route of the existing Thanet Offshore Wind Farm cable to make landfall at a location in the centre of the Pegwell Bay Country Park. There are offshore constraints, e.g. the Nemo Link Cable, the Ramsgate Harbour channel, which need to be avoided. Offshore the worst case will require four offshore export cables, these will need to transition to onshore cables within a transition pit.

From the transition pit the cable will run above ground through the country park using a similar technique to the Nemo Link project, first inland to where the Nemo Link cable runs, then parallel to the Nemo

Link to the south. The proposed sub-station is within the former Richborough Port, the connection to the National Grid Electricity Transmission Network is within the Richborough Energy Park.

There is an access to the cable corridor through the country park car park to the north, the existing Nemo Link working compound within the country park will be reused during construction.

CB asked if the project could make landfall adjacent to the Nemo Link project and then follow the same route running alongside the Nemo Link cable.

MS asked if any landfall options that could avoid a landfall within the country park were explored,

DM stated that the options of landfall adjacent to the Nemo Link project and further north were looked at, but there is not enough space due to constraints including the existing Thanet Offshore Wind Farm export cable, the Cliffs End petrol station, the former Ramsgate Hoverport and ecological constraints.

There are currently three options for the landfall and location of the transition pit which are being assessed for the Preliminary Environment Information (PEI) report:

1. Transition pit constructed within the intertidal area;
2. Transition pit on the top of the Pegwell Bay Country Park, close to the existing footpath;
3. Transition pit further inland within the Pegwell Bay Country Park.

All three options will require the construction of new rock armour defences to create an area in front of the landfill for the cables to be buried in order to rise onto the top of the country park; this will avoid the need for any excavation within the former landfill. This will require some land take from the salt marsh, which is a SSSI. JW said a concern for the EA would be the loss of the salt marsh habitat, and that the EA would want to see more detailed design in order to determine the potential impact on the saltmarsh. DM stated that engineering solution would look to reduce the land take within the salt marsh as much as possible.

CB asked if the existing rock armour defences will be left in place. DM stated the construction technique has not been set, and could either leave the existing rock armour defences in place, or remove them depending on the status of the sea defences and landfill and any potential effects.

JW stated recommended keeping the existing sea defences in place as this was likely to have the least impact on the historic landfill. MS of TDC agreed to this position.

Option 3 would require the ‘off shore’ cables to run on-land from the landfall to the transition joint bay. As these are larger the land take

and above ground construction within the country park would be larger.

RF asked how close to the Nemo Link project the cables will run. DM stated that discussions are taking place to agree the separation distance, however there would need to be a gap for thermal protection.

RF stated that KCC would be concerned if any excavation was undertaken within the country park (no holes in the side of the landfill). KCC would also need to have continued access around the country park on the existing footpaths and access tracks.

5 There was a discussion on the ownership and construction of the existing sea defences around the Pegwell Bay County Park.

JW stated that these are not Environment Agency sea defences.

LG/NG will determine whether it is TDC or KCC who are responsible for the sea defences.

KCC/TDC are not sure when the sea defences were constructed. LG will look into the TDC records for any information on the age of the sea defences.

NG stated that the landfill was formerly operated by TDC but would have been transferred to KCC following the 1974 Local Government Act. NG has some memory that there was steel shuttering around the edge of the landfill adjacent to the sea defences, but cannot be sure.

CB suggested consultation with the Pegwell Bay Country Park group should be undertaken.

6 AOB

MS asked if there was any potential for a build-up of landfill gasses within the cable ducts and inspection pits that cross the landfill. The transition pits in the design, particularly in Option 1, are at a lower point than the cable ducts are they cross the landfill. Therefore, if there were any pathway for the ingress of landfill gases into the sealed concrete cable ducts (broken seal, etc…) there is the potential for pooling/concentration of denser gases in the inspection pits (ie. CO2 – asphyxiant).

DM stated that the ducts would be sealed plastic pipes within a sealed concrete box, therefore it would not be possible for gas to enter the ducts. OG also stated that the construction works and operational procedures for any maintenance works would include standard HSE protocols, such as a Confined Spaces Procedure, to mitigate any risks. MS even with above controls given the very rapid effects of entering a space with high levels of potential asphyxiants, consideration of passive ventilation of the inspection pits (or other mitigation) as part of the design may be desirable.

Currently no GI/SI is planned pre-construction but DM stated that is would be undertaken during the construction phase, but ML asked if any was undertaken in the country park would KCC support. CB

stated that KCC would like to see details of any planned works for review and approval. JW confirmed there would be no need for a FRAP for any works adjacent to the country park sea defences as the defences do not belong to the EA, however the EA would like to see any proposals before work commences as there may be an impact on the saltmarsh. LG stated TDC should also be consulted but have no formal consenting/approval process.

CB asked if there will be a preferred option for the landfall when the DCO is submitted. DM confirmed that it was the intention to present one landfall option in the DCO application.

Braid, Ana

From: [redacted]@environment-agency.gov.uk>
Sent: 05 June 2017 11:14
To: [redacted]
Cc: [redacted]
Subject: RE: Flood information request for Thanet Extension Site

[redacted]

Sorry for the delay.

Details of flood risk and recorded events will be provided through the Product 4 process. Your email has been forwarded to [redacted]@environment-agency.gov.uk . You should hear from them in due course.

We agree that 20% climate change allowance is correct, providing the site is in Flood Zone 1. The new East Kent model should be available during the summer but until then the fluvial and tidal Lower Stour Model is the best available and we would be happy for the Flood Risk Assessment to be completed using this data.

If you have any further queries, please do not hesitate to contact me.

Kind Regards,

[redacted]
Planning Specialist
Sustainable Places – Kent and South London

[redacted]environment-agency.gov.uk
[redacted]

From: [redacted]@amecfw.com]
Sent: 05 May 2017 11:04
To: [redacted]@environment-agency.gov.uk>
Cc: [redacted]@amecfw.com>; [redacted]@amecfw.com>; [redacted]@gobeconsultants.com>; [redacted]@amecfw.com>; [redacted]@amecfw.com>
Subject: Flood information request for Thanet Extension Site

Dear [redacted]

We are undertaking a flood risk assessment (FRA) supporting the Environmental Impact Assessment for the onshore elements of the Thanet Extension Offshore Wind Farm, southeast Kent. The onshore area of interest covers two potential onshore cable routes options from landfall at Pegwell Bay or Sandwich Bay to Richborough substation site (please see map attached). Most of the cable route options lie within the Environment Agency Flood Zones 2 and 3 whilst the substation area of interest lies within Flood Zone 1.

We should be grateful if you could provide any supplementary information regarding flood risk which would be required to be included in the FRA including incidents of local historical flooding or surface water flood risk issues.

Climate change allowance has been calculated in accordance with the latest Environment Agency Guidance (https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances) as described in the table below. Please confirm the use of a climate change allowance of 20%.

Parameter	Value	Justification
Flood risk vulnerability classification	Essential infrastructure	Substation area of interest is classified as *Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.*
Lifetime	40 years (to 2060)	Design
Environment Agency flood zone	Flood Zone 1	Consultation of Environment Agency on-line flood zone maps
Climate change allowance	20%	From *Table 1 - peak river flow allowances by river basin district (use 1961 to 1990 baseline)* and the following parameters: - South east river basin district - Central allowance* - Total potential change anticipated for the '2050s' (2040 to 2069)

Note *According to the Environment Agency Guidance *Central allowance is appropriate for essential infrastructure in Flood Zone 1*.

We propose to use the results of the fluvial and tidal Lower Stour Model to assess flood risk at the site. We understand that the Environment Agency are currently updating the Lower Stour tidal model for the East Kent coast from Ramsgate to Dover which is likely to be completed by Summer 2017. In the absence of the updated tidal model and allowing for a potential delay in the model update we propose to use the existing model on the basis that it is currently the best available data.

Please ring me on the number below if you have any queries.

Kind regards

[redacted]

[redacted]

Senior Environmental Consultant, Environment & Infrastructure Europe, Amec Foster Wheeler
Canon Court, Abbey Lawn, Abbey Foregate, Shrewsbury SY2 5DE, UK

[redacted]

[redacted]@amecfw.com amecfw.com

Please note my normal working hours are Monday & Tuesday (9:00 -17:30) and Wednesday to Friday (9:00 – 15:00)

invoices, project communications and similar factual, non-commercial electronic communications.

Please click http://amecfw.com/email-disclaimer for notices and company information in relation to emails originating in the UK, Italy or France.

Braid, Ana

Subject: FW: 39080 - TEOWF Thanet Extension - Meeting Request for Ground Conditions - Contamination and Flood Risk

From: [redacted]@environment-agency.gov.uk]
Sent: 20 July 2017 11:14
To: [redacted]@amecfw.com>; [redacted]@amecfw.com>; [redacted]@THANET.GOV.UK>; [redacted]@THANET.GOV.UK>; [redacted]@THANET.GOV.UK>
Cc: [redacted]@amecfw.com>; [redacted]@amecfw.com>; [redacted]@amecfw.com>
Subject: RE: 39080 - TEOWF Thanet Extension - Meeting Request for Ground Conditions - Contamination and Flood Risk

[redacted]

Thank you for the clarification on what is to be discussed in relation the Flood Risk matters. I have contacted Andy Crates and he has confirmed the defences are a matter for Thanet DC as they belong to them.

We would be interested in seeing the any proposed designs for the works as they impact the landfill.

I understand from your email that Vanessa is proposing to discuss contaminated land issues with Thanet DC. As previously stated unfortunately my colleague Jonathan Atkinson is on leave. I am free to attend but obviously I have a general overview of contaminated land issues, so I would have to go back to Jonathan with any specifics.

Kind Regards,

[redacted]
Planning Specialist
Sustainable Places – Kent and South London

From: [redacted]@amecfw.com]
Sent: 19 July 2017 10:12
To: [redacted]@environment-agency.gov.uk>; [redacted]@amecfw.com>; [redacted]@THANET.GOV.UK>; [redacted]@THANET.GOV.UK>; [redacted]@THANET.GOV.UK>; [redacted]@amecfw.com>; [redacted]@amecfw.com>; [redacted]@amecfw.com>
Subject: RE: 39080 - TEOWF Thanet Extension - Meeting Request for Ground Conditions - Contamination and Flood Risk

[redacted]

To summarise our chat just now (for the benefit of everyone on this thread), in terms of flood risk, I was only envisaging that we need to cover the Thanet landfill flood defence at the Country Park. We covered other flood risk matters sufficiently at our previous meeting in Canterbury. On the basis that this is not an EA flood defence, I wasn't envisaging Meriel wanting/needing to attend. However, I thought Meriel mentioned that Andy Crates (EA Coastal Defence Engineer) might be interested in attending and commenting?

However, if the EA are not interested in commenting on this defence (and any works here) on the basis that it is a Thanet DC asset, please let us know. We need to record the EA's position on this matter. We could cover the EA's

position in the minutes of the meeting, but if we need Andy to attend/consider in advance of the meeting in order to get to that position, then we need his consideration now.

You mentioned whether we could send any designs for the works at the flood defence in advance. I'll need to check whether anything is available yet, it might not be.

Vanessa has advised that she will be covering more than just the Thanet flood defence at the upcoming meeting – this is her first opportunity to discuss contaminated land issues with Thanet DC.

Regards

[redacted]

From: [redacted]@environment-agency.gov.uk]
Sent: 19 July 2017 09:16
To: [redacted]@amecfw.com>; [redacted]@THANET.GOV.UK>; [redacted]@THANET.GOV.UK>; [redacted]@THANET.GOV.UK> [redacted]amecfw.com>; [redacted]@amecfw.com>; [redacted]@amecfw.com>; [redacted]@amecfw.com>
Subject: RE: 39080 - TEOWF Thanet Extension - Meeting Request for Ground Conditions - Contamination and Flood Risk

[redacted]

I'm afraid the only day I'm free out of those dates is 23rd.

My colleague Jonathan Atkinson (Groundwater and Contaminated Land technical Specialist) is on leave that week and Meriel Mortimer (Flood Coastal is away on leave this week so I'm not sure of her movements that week.

Sorry not very helpful.

[redacted]

From: [redacted]@amecfw.com]
Sent: 18 July 2017 16:10
To: [redacted]@THANET.GOV.UK>; [redacted]@THANET.GOV.UK>; [redacted]@THANET.GOV.UK>; [redacted]@environment-agency.gov.uk> [redacted]@amecfw.com>; [redacted]@amecfw.com>; [redacted]@amecfw.com> [redacted]@amecfw.com>
Subject: RE: 39080 - TEOWF Thanet Extension - Meeting Request for Ground Conditions - Contamination and Flood Risk

Good afternoon,

Would either 21, 22 or 23 August be convenient?
Jennifer, Morgan would you know the name of the relevant person with Kent County Council to be invited to the meeting?

Kind regards,

From: [redacted]@THANET.GOV.UK]
Sent: 12 July 2017 09:19
To: [redacted]@THANET.GOV.UK>; [redacted]@amecfw.com>; [redacted]@THANET.GOV.UK>
Subject: Re: 39080 - TEOWF Thanet Extension - Meeting Request for Ground Conditions - Contamination and Flood Risk

Hi [redacted]

I'm on leave 1st two weeks in August so we may have to wait until 15th August. Could you suggest some dates for that week.

Kind Regards

[redacted]

Sent from Samsung Mobile

-------- Original message --------
From: [redacted]
Date:11/07/2017 16:57 (GMT+00:00)
To: [redacted]
Subject: RE: 39080 - TEOWF Thanet Extension - Meeting Request for Ground Conditions - Contamination and Flood Risk

[redacted]

Thank you for your e-mail. Would recommend EA are present as I understand they have previously requested mitigation measures with regard to cable landfall.

Fairly tied up over the next couple of weeks, but at the moment can do 31st – 3rd August or after 15th August.

Many thanks & regards,

[redacted]
Environmental Protection Manager
Thanet District Council

From: [redacted]@amecfw.com]
Sent: 10 July 2017 14:36
To: [redacted]
Cc: [redacted]
Subject: 39080 - TEOWF Thanet Extension - Meeting Request for Ground Conditions - Contamination and Flood Risk

[redacted]

As part of the ground conditions -contamination and flood risk assessments for the Thanet Extension Offshore Wind Farm project, we would like to set up a meeting with you to discuss the results of the Phase 1 desk-top study, the proposed scope of the flood risk assessment and any further surveys.
We have also started discussions with Kent County Council and the Environment Agency and would like to invite them to attend the meeting.
We can hold the meeting at Vattenfall's office in Ramsgate (CT11 9LG) or at another location if preferred.

Please could you indicate your availability for the coming weeks?

Many thanks.

Kind regards,
[redacted]

Appendix B: Site visit photographs

Photo 1: General view of Pegwell Country Park (NGR TR3433563145) (June 2017)

Photo 2: Rock armour sea defence for the historical Cliffsend landfill at Pegwell Country Park (NGR TR3433563145) (June 2017)

Photo 3: Baypoint club leisure centre and associated sports pitches (NGR TR3390462215) (June 2017)

Photo 4: BCA Technical Services car auction site NGR) (June 2017)

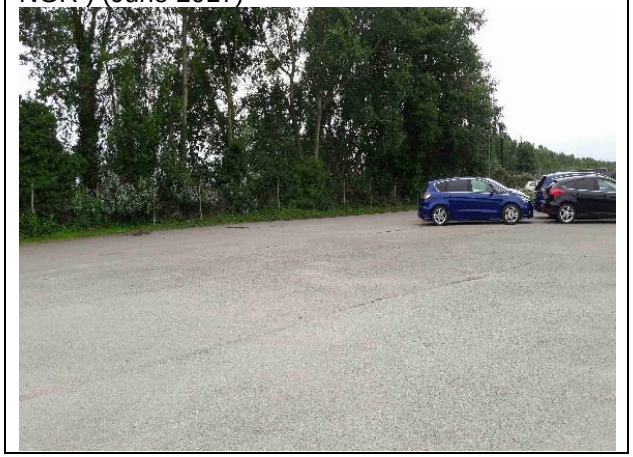


Photo 5: View of proposed substation location (no access possible) (NGR TR3366461892) (June 2017)

Photo 6: Hard defence on southern boundary of National Grid Energy Transmission Richborough Energy Park (NGR TR3314962077) (June 2017)

Photo 7: Minster Stream upstream of its outfall to the River Stour (NGR TR3372761971) (June 2017)

Photo 8: Minster Stream outfall to the River Stour with penstock (NGR TR3378861904) (June 2017)

Photo 9: Additional flapped outfall to the River Stour (NGR TR3377461882) (June 2017)

Photo 10: Nemo link onshore overground cable construction in Pegwell Country Park (NGR TR3431063382) (June 2017)

Photo 11: General view of Boarded Groin (shallow bank with WWII anti-invasion concrete posts) (June 2017)

Photo 12: Nemo link onshore overground cable construction in Pegwell Country Park now covered with chalk restoration (August 2017)

Photo 13: Location of the tidally flapped outfall (bottom left, covered by grass) for the small stream culverted thought to pass underneath the Cliffsend landfill, which discharges to Pegwell Bay just to the north of the Pegwell Country Park bird hide (black box in the background) (August 2017).

Photo 14: The location of the tidally flapped outfall is between the two rocks of the sea defence marked with yellow paint (August 2017).

Photo 15: Close up photograph of the tidally flapped outfall (wedged open at the time of this photo) in the grass below the rock armor sea defence for the Cliffsend landfill (August 2017).

Appendix C: Selected drawings from Project Design Chapter (Draft Final)

Figure C1: Onshore Cable Route (Landfall Option 1)

633800 634000 634200 634400 634600

163400 163200 163000 162800

N

St Augustine's

Sandwich Road

The Viking Coast Trail

Thanet Coastal Path

Sandwich & Pegwell Bay

GoBe VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

Figure 1.2

Onshore Cable Route: Landfall Option 1 (Indicative locations).

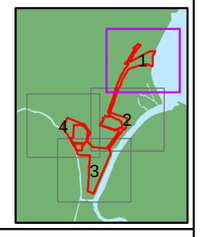
Legend

- Onshore Red Line Boundary
- Offshore Red Line Boundary

Onshore Infrastructure (Indicative locations)

- Construction and laydown area
- Possible access
- HDD exit pits
- Landfall Area 350 m from seawall
- Temporary work area for HDD
- Transition pit cofferdam extent
- Cable corridor
- Transition Pit -12 x 22 m

Datum: OSGB 1936
Projection: BNG



1:3,500 0 0.09 0.18 km

Drg No	Fig1.2_OnRLBOp1			**Figure 1.2**
Rev	0.1	Date	25/05/2018	
By	RM	Layout	N/A	

Figure C2: Plan View of Landfall Option 1

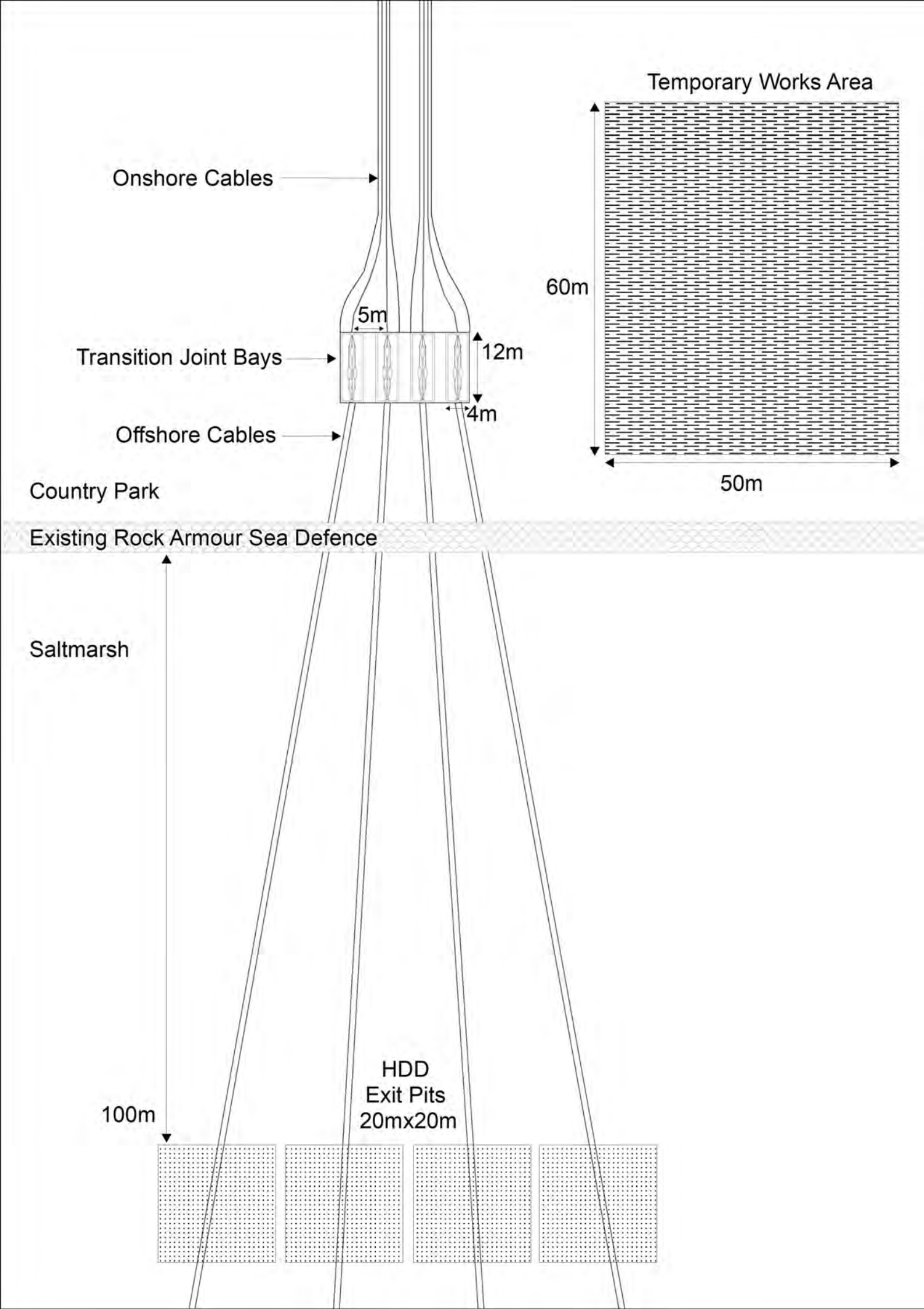

Temporary Works Area
Onshore Cables
60m
5m
Transition Joint Bays
12m
4m
Offshore Cables
50m
Country Park
Existing Rock Armour Sea Defence
Saltmarsh
HDD
Exit Pits
20mx20m
100m

Figure C3: Profile View of Landfall Option 1

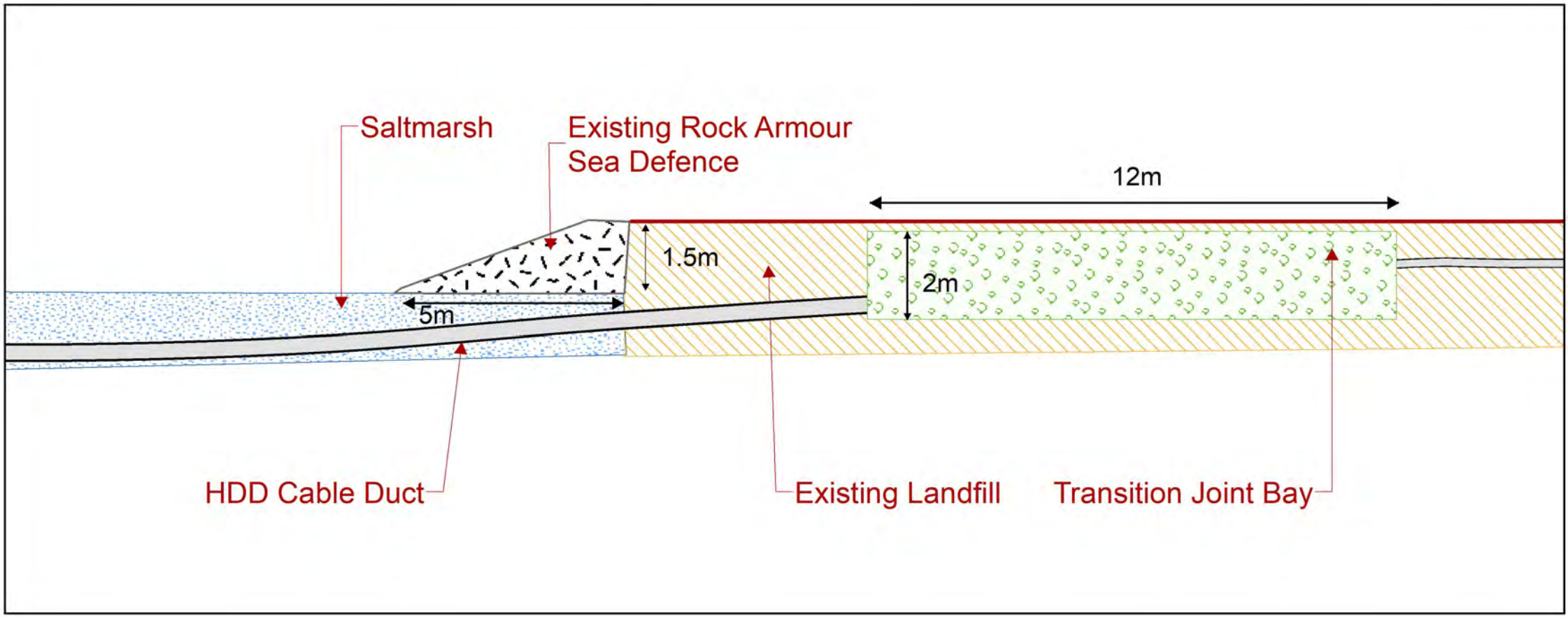

Saltmarsh
Existing Rock Armour
Sea Defence
12m
1.5m
2m
5m
HDD Cable Duct
Existing Landfill
Transition Joint Bay

Figure C4: Onshore Cable Route (Landfall Option 2)

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THANET EXTENSION OFFSHORE WIND FARM

Figure 1.3

Onshore Cable Route: Landfall Option 2 (1 of 4)

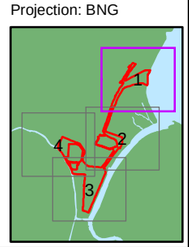
Legend

- Onshore Red Line Boundary
- Offshore Red Line Boundary

Onshore Infrastructure (Indicative

- Construction and laydown area
- Possible access
- Rock armour replacement area
- Temporary works area trenching
- Sea defence extension possible area
- Sea defence extension possible cofferdam extent
- Landfall Area 350 m from seawall
- KWT Crossing 5 x 54 m
- Cable corridor
- Subsea Cable Installation Area - 19
- Transition Pit Area -12 x 46
- Transition Pit -12 x 22 m

Datum: OSGB 1936
Projection: BNG



1:3,500 0 0.09 0.18 km

Drg No	Fig1.3_OnRLBOp2			**Figure 1.3**
Rev	0.1	Date	25/05/2018	
By	RM	Layout	N/A	

Figure C5: Plan View of Landfall Option 2

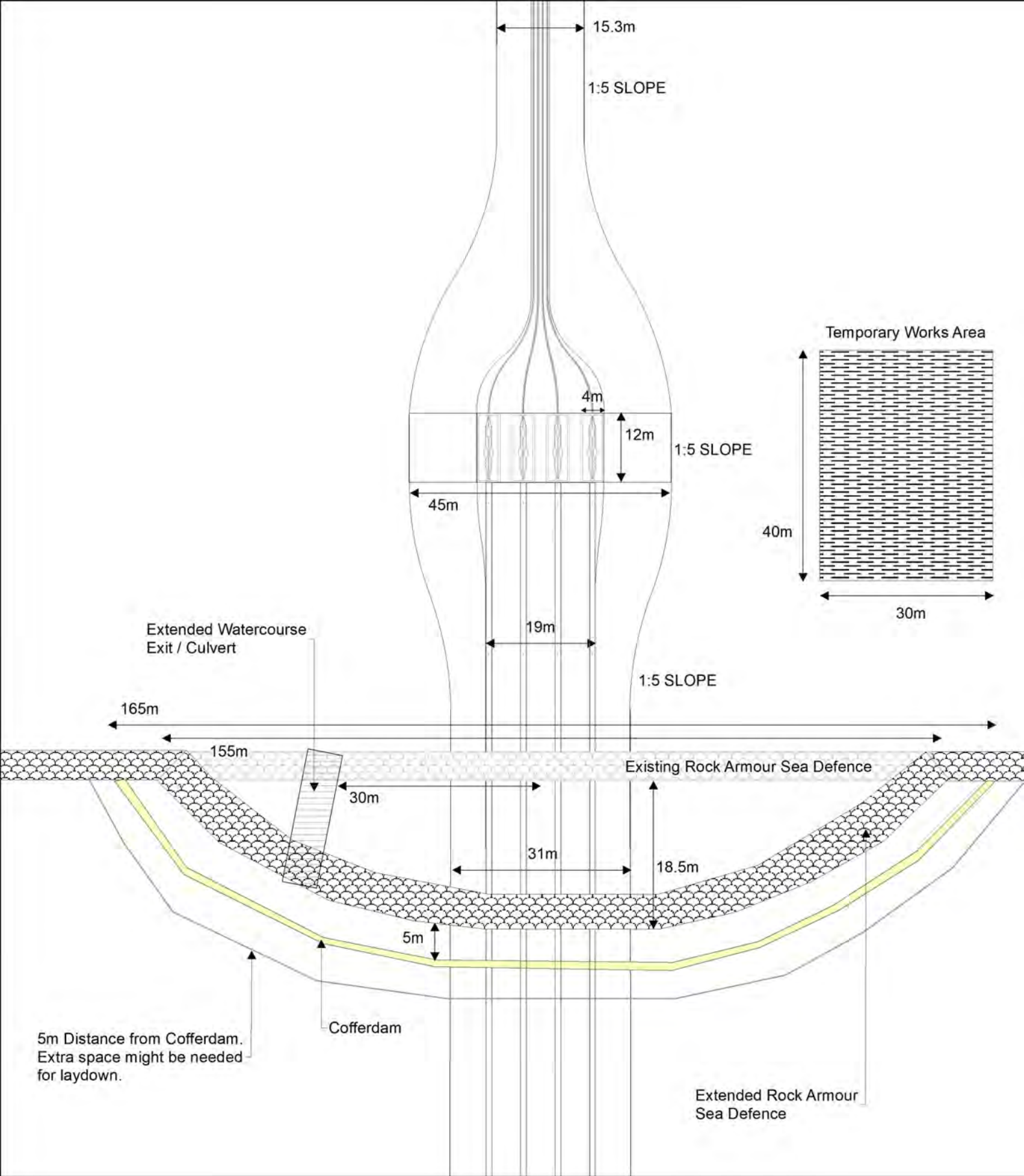

15.3m
1:5 SLOPE
Temporary Works Area
4m
12m
1:5 SLOPE
45m
40m
30m
Extended Watercourse
Exit / Culvert
19m
1:5 SLOPE
165m
155m
Existing Rock Armour Sea Defence
30m
31m
18.5m
5m
Cofferdam
5m Distance from Cofferdam.
Extra space might be needed
for laydown.
Extended Rock Armour
Sea Defence

Figure C6: Profile View of Landfall Option 2

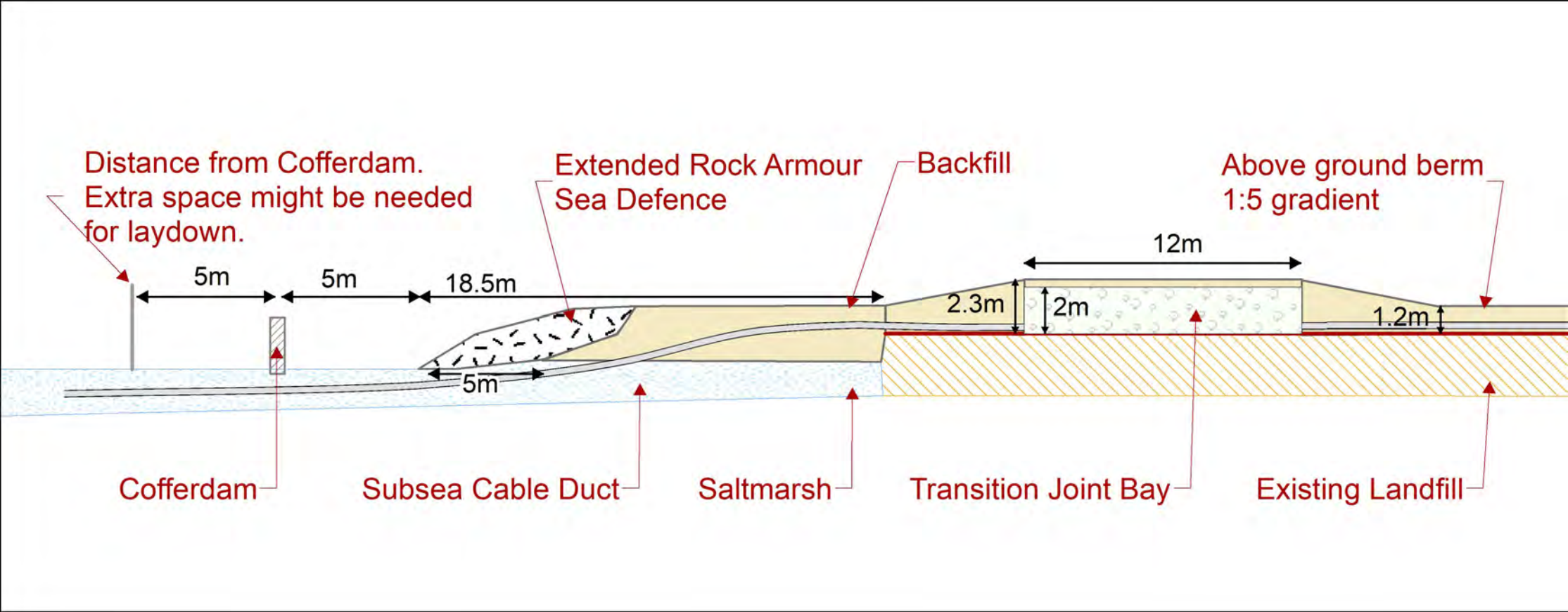

Distance from Cofferdam.
Extra space might be needed
for laydown.
Extended Rock Armour
Sea Defence
Backfill
Above ground berm
1:5 gradient
5m
5m
18.5m
12m
2.3m
2m
1.2m
5m
Cofferdam
Subsea Cable Duct
Saltmarsh
Transition Joint Bay
Existing Landfill

Figure C7: Onshore Cable Route (Landfall Option 3)

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THANET EXTENSION OFFSHORE WIND FARM

Figure 1.4

Onshore Cable Route: Landfall Option 3 (1 of 4)

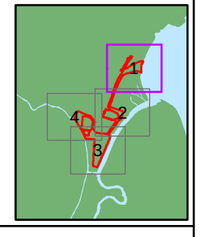
Legend

- Onshore Red Line Boundary
- Offshore Red Line Boundary

Onshore Infrastructure (Indicative

- Construction and laydown area
- Possible access
- Temporary works area trenching
- Sea defence extension possible area
- Sea defence extension possible cofferdam extent
- Landfall Area 350 m from seawall
- Transition pit cofferdam extent
- Cable corridor
- Subsea Cable Installation Area - 19
- Transition Pit -12 x 22 m

Datum: OSGB 1936
Projection: BNG



1:3,500 0 0.09 0.18 km

Drg No	Fig1.4_OnRLBOp3			**Figure 1.4**
Rev	0.1	Date	25/05/2018	
By	RM	Layout	N/A	

Figure C8: Plan View of Landfall Option 3

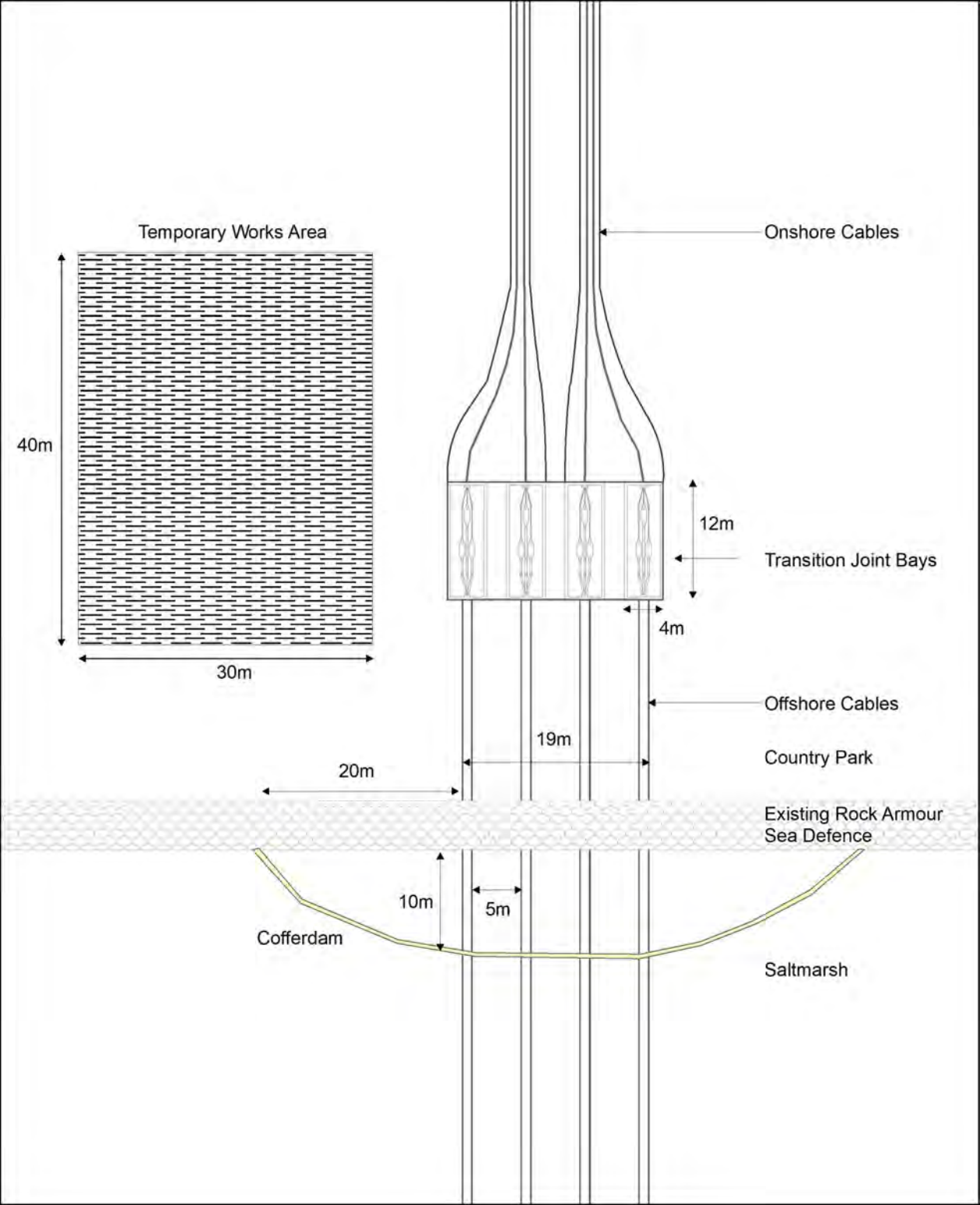

Temporary Works Area
40m
30m
Onshore Cables
12m
Transition Joint Bays
4m
Offshore Cables
19m
Country Park
20m
Existing Rock Armour
Sea Defence
10m
5m
Cofferdam
Saltmarsh

Figure C9: Profile View of Landfall Option 3

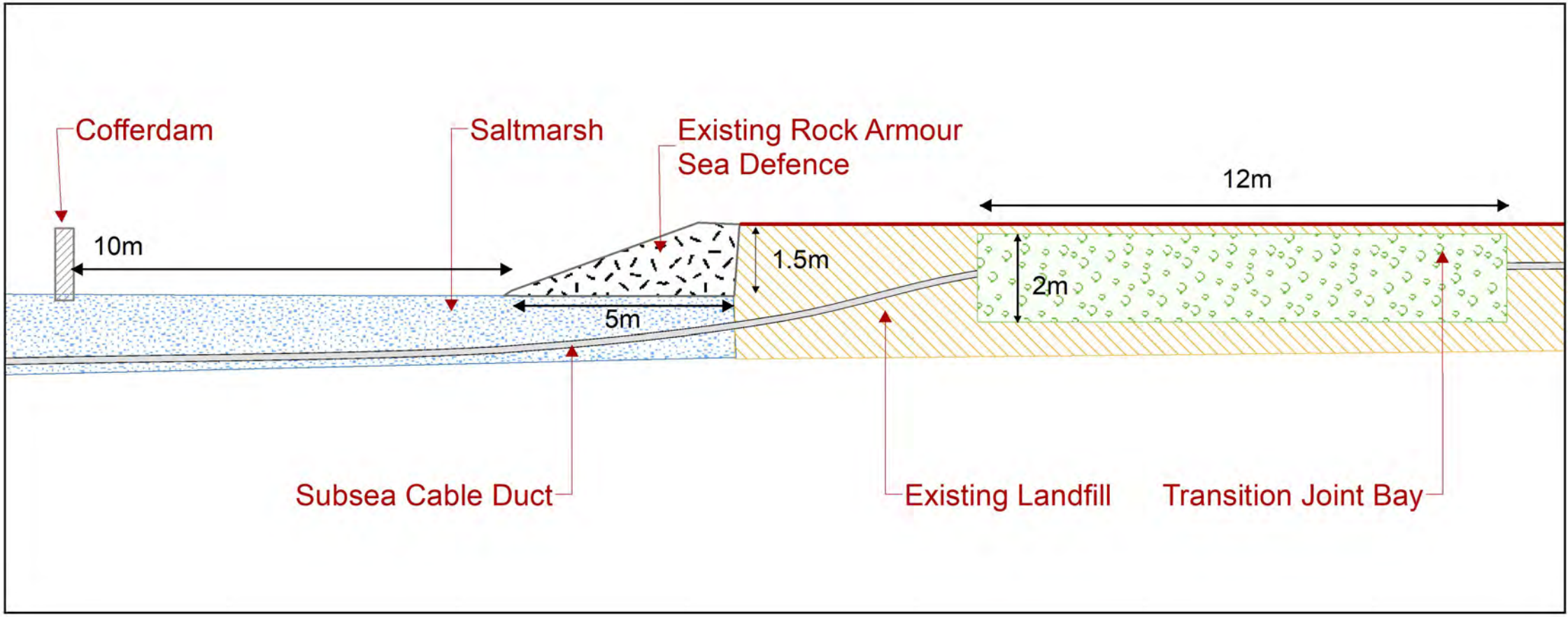

Cofferdam
Saltmarsh
Existing Rock Armour
Sea Defence
12m
10m
1.5m
2m
5m
Subsea Cable Duct
Existing Landfill
Transition Joint Bay

Figure C10: Onshore Cable Route (Stonelees Nature Reserve and Baypoint Sports Club)

633600 633800 634000 634200 634400

162600 162400 162200 162000

N

Ebbsfleet Lane
Stonelees Bungalow
Stonelees House
Stonelees Farm Bungalow
Sandwich Road
The Viking Coast Trail
Stonelees Nature Reserve
Richborough Way
Jutes Lane
G dant
Ramsgate Road
A256
Sandwich & Pegwell Bay NNR
Cliffsend
River Stour
BayPoint
Texaco
Depot
Minster Stream (Drain)
Worth

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THANET EXTENSION OFFSHORE WIND FARM

Figure 1.5

Onshore Cable Route: Landfall Option 1 (2 of 4).

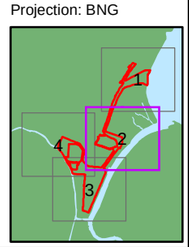
Legend

- Onshore Red Line Boundary

Onshore Infrastructure (Indicative

- Construction and laydown
- Possible access
- Substation landscape
- Temporary works area
- Cable corridor
- Onshore Substation Area

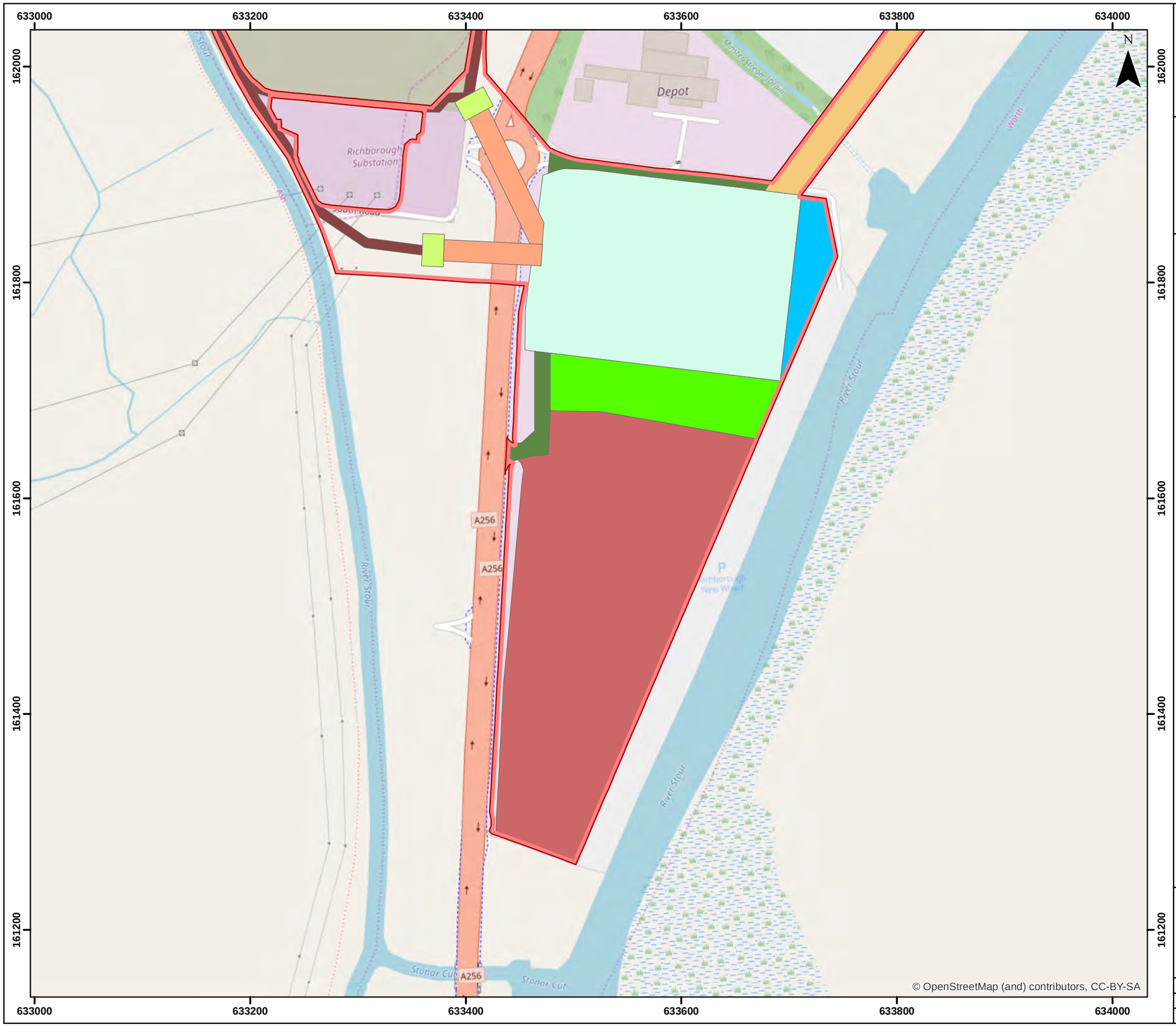
Datum: OSGB 1936
Projection: BNG



1:3,500 0 0.09 0.18 km

Drg No	Fig1.5_OnRLB2			**Figure 1.5**
Rev	0.1	Date	25/05/2018	
By	RM	Layout	N/A	

Figure C11: Onshore Cable Route (Substation and Tenant Relocation Area)



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THANET EXTENSION OFFSHORE WIND FARM

Figure 1.6

Onshore Cable Route: Landfall Option 1 (3 of 4).

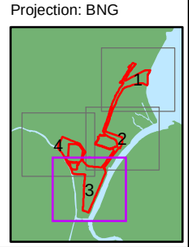
Legend

- Onshore Red Line Boundary

Onshore Infrastructure (Indicative locations)

- Construction and laydown area
- Possible access
- Substation landscape area
- Tenant relocation area
- Cable corridor
- HDD crossing of A256 - 20 m
- Reception pit for HDD 30 m x 20 m
- Cable route
- Onshore Substation Area

Datum: OSGB 1936
Projection: BNG



1:3,500 0 0.09 0.18 km

Drg No	Fig1.6_OnRLB3			**Figure 1.6**
Rev	0.1	Date	25/05/2018	
By	RM	Layout	N/A	

Figure C12: Onshore Cable Route (NGET Richborough Energy Park)

632600 632800 633000 633200 633400

162600 162400 162200 162000 161800

N

Ebbsfleet Solar Farm

Minster Stream (Drain)

A256

Richborough Way

Jutes Lane

River Stour

Richborough Energy Park

Ramsgate Road

Texaco

Richborough Substation

Kent Coast Line

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THANET EXTENSION OFFSHORE WIND FARM

Figure 1.7

Onshore Cable Route: Landfall Option 1 (4 of 4)

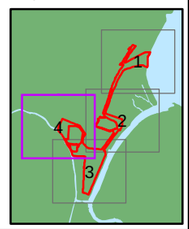
Legend

- Onshore Red Line Boundary

Onshore Infrastructure (Indicative locations)

- Possible access
- HDD crossing of A256 - 20 m
- Reception pit for HDD 30 m x 20 m
- Cable route
- Onshore Substation Area

Datum: OSGB 1936
Projection: BNG



1:3,500 0 0.09 0.18 km

Drg No	Fig1.7_OnRLB4		
Rev	0.1	Date	25/05/2018
By	RM	Layout	N/A

Figure 1.7

Appendix D: Environment Agency Product 4 Information

Product 4 (Detailed Flood Risk) for: Thanet Extension Offshore Wind Farm, East Kent
Requested by: Ana Braid
Reference: KSL 41339 LB
Date: 3 April 2017

Contents

The information provided is based on the best data available as of the date of this letter.

You may feel it is appropriate to contact our office at regular intervals, to check whether any amendments/ improvements have been made to the data for this location. Should you contact us again, after a period of time, please quote the above reference in order to help us deal with your query.

Please refer to the Open Government Licence which explains the permitted use of this information.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Flood Map Confirmation

The Flood Map:

Our Flood Map shows the natural floodplain for areas at risk from fluvial and tidal flooding. The floodplain is specifically mapped ignoring the presence and effects of flood defences. Although flood defences reduce the risk of flooding they cannot completely remove that risk as they may be overtopped or breached during a flood event.

The Flood Map describes flood risk using Annual Exceedance Probability (AEP) - the probability of a flood of a particular magnitude, or greater, occurring in any given year. The Flood Map indicates areas with a 1% AEP of flooding from rivers (0.5% in tidal areas) (Flood Zone 3), and up to a 0.1% AEP of flooding from both rivers and the sea (Flood Zone 2), in any given year. The flood map also shows the location of flood defences and the areas that benefit from them.

The Flood Map is intended to act as a guide to indicate the potential risk of flooding. When producing it we use the best data available to us at the time of completion, taking into account historic flooding and local knowledge. The Flood Map is updated on a quarterly basis to account for any amendments required. These amendments are then displayed on the internet at www.gov.uk/prepare-for-a-flood.

At this Site:

The Flood Map shows that parts of this site lie within the outline of the 1% / 0.5% (Flood Zone 3) chance of flooding from rivers and the sea in any given year.

Enclosed is an extract of our Flood Map which shows this information for your area.

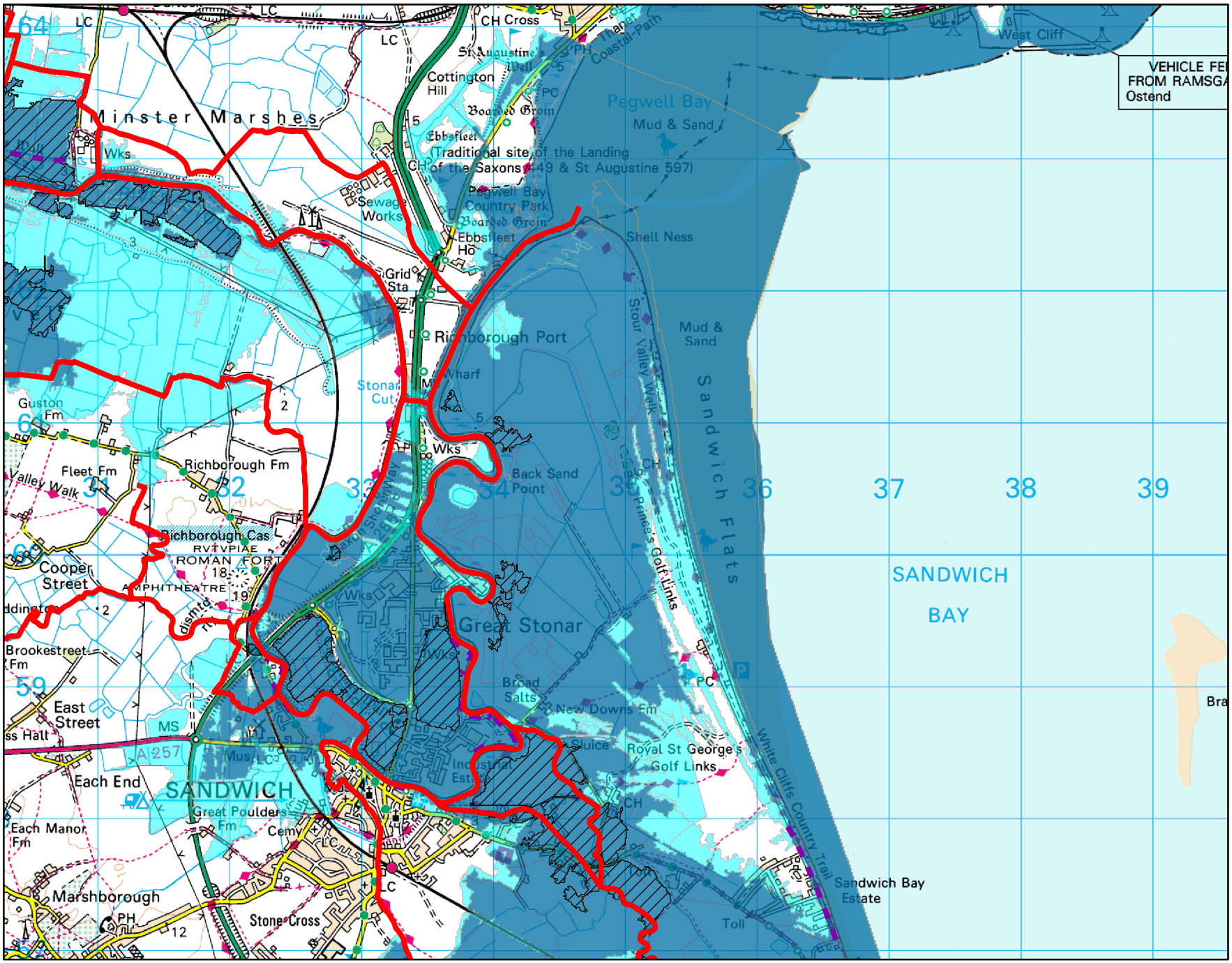
Method of production

The Flood Map at this location has been derived using detailed tidal and fluvial modelling of the Lower Stour, completed by JBA Consulting in 2010, updated in 2012. Parts of the flood map in this area have been derived using national generalised modelling (using JFLOW modelling techniques), completed in 2004.

Whilst this is the best available data at this time, please be aware that a new tidal modelling study covering this area is currently being undertaken. The outputs from this new study will be used to inform our Flood Map. You may wish to contact us at a later date to ascertain whether flood risk has changed in this area, and if we have any new information for you.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Flood Map centred on Thanet Extension Offshore Wind Farm, East Kent.
Created 3 April 2017 [Ref: KSL 41339 LB].



Environment Agency

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Scale 1:40,000

Legend

- Main River
- Flood Defences
- Flood Storage Area
- Areas Benefiting From Flood Defence
- 1% AEP Fluvial 0.5% AEP Tidal
- 0.1% AEP of Flooding

Annual Exceedance Probability (AEP). The probability of a flood of a particular magnitude, or greater, occuring in any given year.

0 1,000 2,000
Meters

Contact us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506. Email:enquiries@environment-agency.gov.uk

Model Output Data

You have requested flood levels and depths for various return periods at this location.

2D

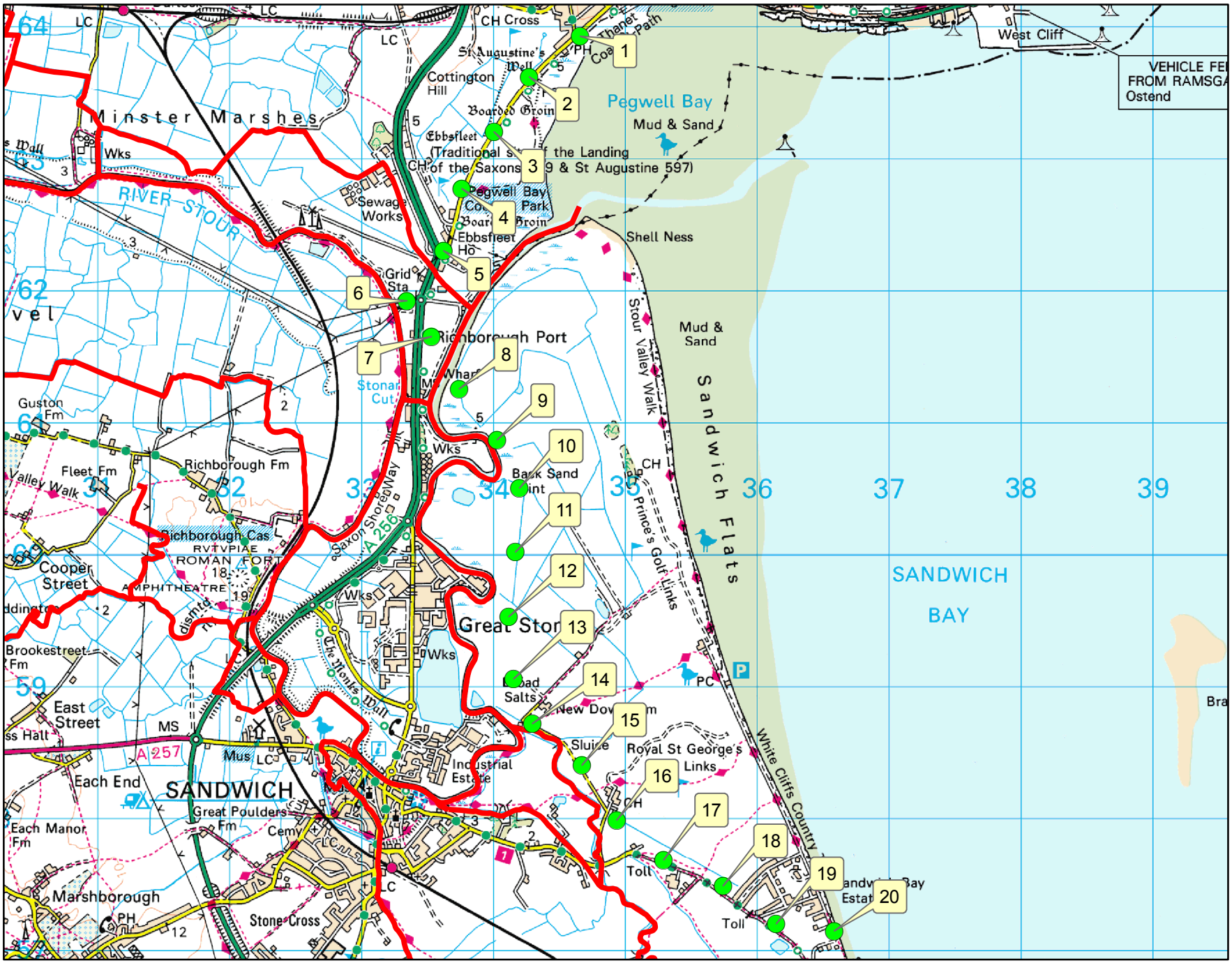
A 2D TuFLOW model has been used to represent the floodplain as a grid. The flood water levels have been calculated for each grid cell. The modelled flood levels presented here are for the closest most appropriate model grid cells. Any additional information you may need to know about the modelling from which they are derived and/or any specific use or health warnings for their use are set out below.

A map showing the location of the points from which the data is taken is enclosed. Please refer to the Open Government Licence which explains the permitted use of this information.

Please note we can only provide predicted flood levels from the Lower Stour model; we cannot provide flood depths.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Data points map centred on Thanet Extension Offshore Wind Farm, East Kent.
Created 3 April 2017 [Ref: KSL 41339 LB].



Environment Agency

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Scale 1:40,000

Legend

- Data Points
- Main River

0 1,000 2,000
Meters

Contact us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506. Email:enquiries@environment-agency.gov.uk

Fluvial Flood Levels

Table 1: Modelled fluvial flood levels for various Annual Exceedance Probability (AEP) events, shown in metres above Ordnance Datum (mAOD)

Point ID	National Grid Reference		Modelled Fluvial Flood Levels for Annual Exceedance Probability (AEP) events shown (metres AOD)											
			Undefended				Defended							
	Easting	Northing	5%	1%	1% + CC	0.1%	50%	20%	5%	2%	1.3%	1%	1% + CC	0.1%
1	634659	163927	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	634273	163619	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	634007	163202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	633763	162772	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	633624	162301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	633347	161923	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	633532	161651	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	633743	161257	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	634029	160871	2.55	2.55	2.55	2.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	634197	160503	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	634170	160019	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	634118	159528	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	634156	159057	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	634297	158719	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	634672	158405	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	634938	157988	1.94	1.95	1.95	1.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	635293	157685	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	635742	157488	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	636145	157202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	636586	157148	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Data taken from fluvial modelling of the Lower Stour, completed by JBA Consulting in 2010.

Climate change (CC) data represents modelled levels with a 20% increase in river flows.

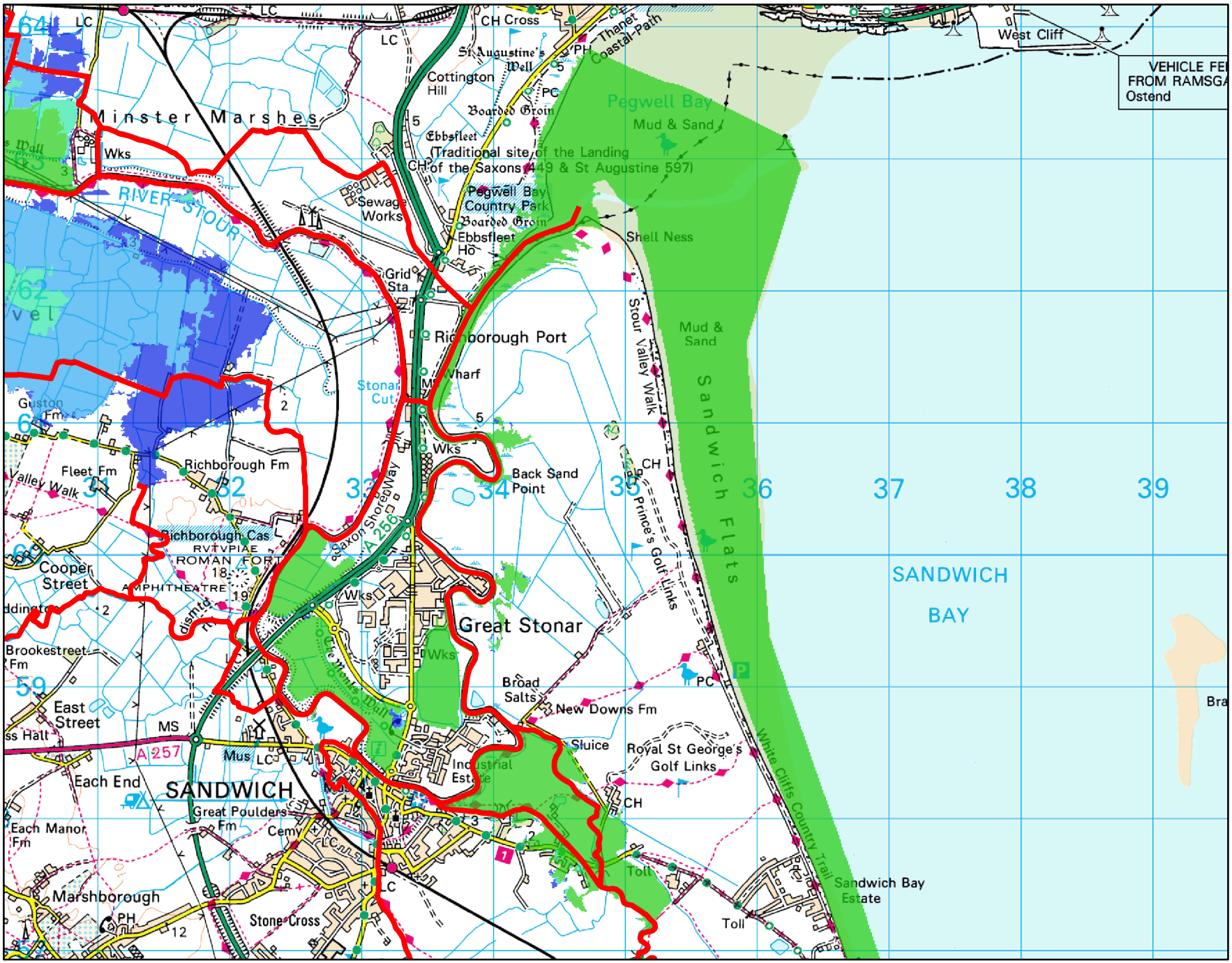
Values of 0.00 indicate locations at which the selected points lie outside of a particular modelled flood extent.

There are no health warnings or additional information for these levels, or the model from which they were produced.

It should also be noted that climate change allowances have changed since 2004. On 19/02/2016 new allowances for climate change were published on gov.uk. The fluvial climate factors are now more complex and are based on a regional river basin district. You can view the new allowances at 'Flood risk assessments: climate change allowances'. The data provided in this product does not incorporate the new allowances. We will incorporate the new allowances into future modelling studies.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Fluvial undefended flood extents map centred on Thanet Extension Offshore Wind Farm, East Kent.
Created 3 April 2017 [Ref: KSL 41339 LB].



Environment Agency

N
W E
S

Scale 1:40,000

Legend

- Main River

Fluvial Undefended Flood Extents

Lower Stour Model

- 5% AEP
- 1% AEP
- 1% AEP + CC
- 0.1% AEP

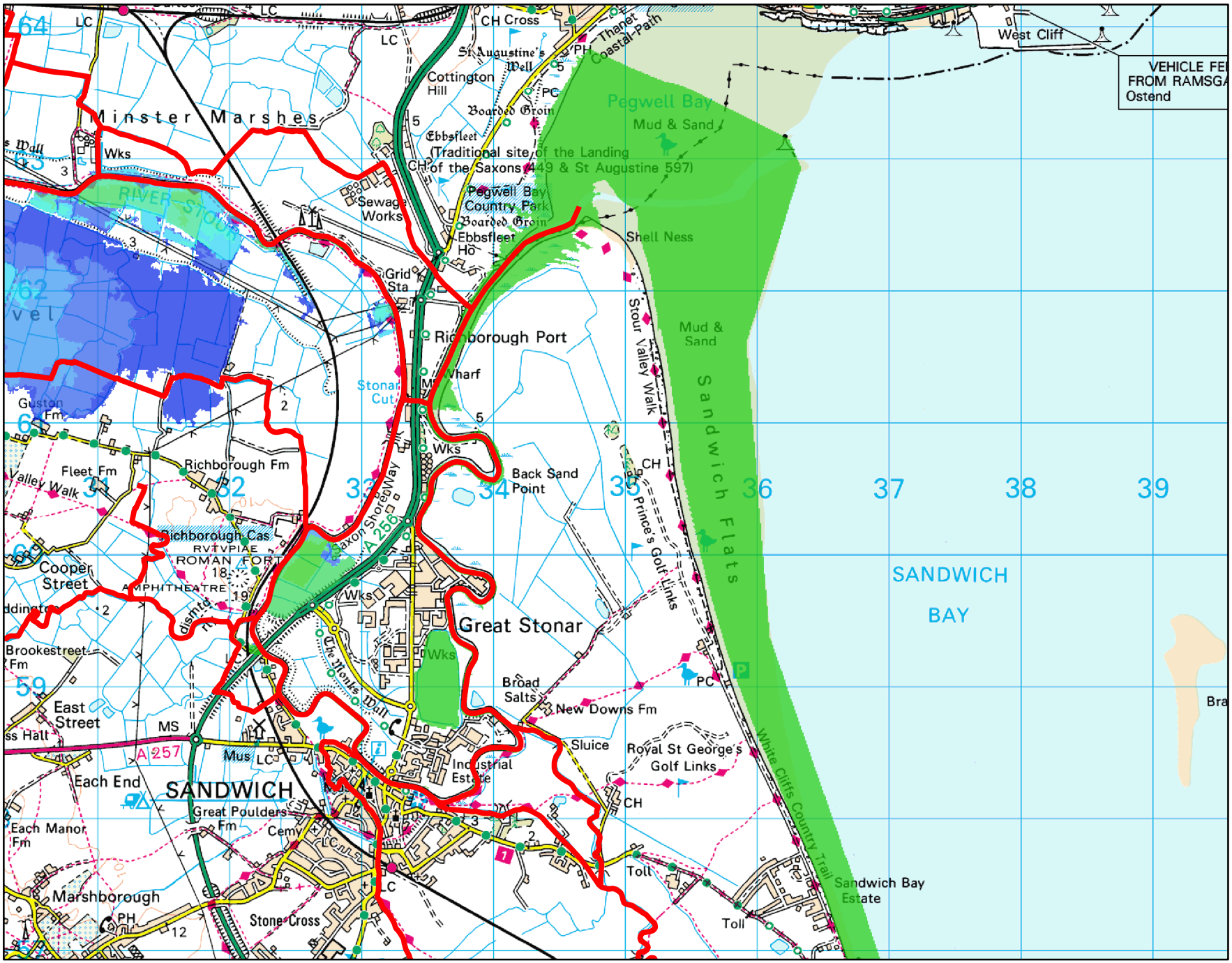
Climate Change (CC) extent based on an increase of 20% in river flows.

Annual Exceedance Probability (AEP). The probability of a flood of a particular magnitude, or greater, occuring in any given year.

0 1,000 2,000
Meters

Contact us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506. Email:enquiries@environment-agency.gov.uk

Fluvial defended flood extents map centred on Thanet Extension Offshore Wind Farm, East Kent.
Created 3 April 2017 [Ref: KSL 41339 LB].



Environment Agency

N
W E
S

Scale 1:40,000

Legend

- Main River

Fluvial Defended Flood Extents

Lower Stour Model

- 50% AEP
- 20% AEP
- 5% AEP
- 2% AEP
- 1.3% AEP
- 1% AEP
- 1% AEP + CC
- 0.1% AEP

Climate Change (CC) extent based on an increase of 20% in river flows.

Annual Exceedance Probability (AEP). The probability of a flood of a particular magnitude, or greater, occuring in any given year.

0 1,000 2,000
Meters

Contact us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506. Email:enquiries@environment-agency.gov.uk

Tidal Flood Levels

Table 2: Modelled tidal flood levels for various Annual Exceedance Probability (AEP) events, shown in metres above Ordnance Datum (mAOD)

Point ID	National Grid Reference		Modelled Tidal Flood Levels for Annual Exceedance Probability (AEP) events shown (metres AOD)										
			Undefended					Defended					
	Easting	Northing	5%	0.5%	0.1%	0.5% + CC (2070)	0.5% + CC (2115)	5%	1.3%	0.5%	0.1%	0.5% + CC (2070)	0.5% + CC (2115)
1	634659	163927	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	634273	163619	0.00	0.00	3.82	3.81	5.44	0.00	0.00	0.00	3.71	3.70	5.39
3	634007	163202	0.00	0.00	0.00	0.00	5.43	0.00	0.00	0.00	0.00	0.00	5.39
4	633763	162772	0.00	3.64	4.29	4.29	5.43	0.00	0.00	0.00	3.98	3.97	5.39
5	633624	162301	0.00	0.00	0.00	0.00	3.97	0.00	0.00	0.00	0.00	0.00	4.06
6	633347	161923	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	633532	161651	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	633743	161257	3.68	4.14	4.64	4.64	5.25	0.00	0.00	0.00	4.17	4.17	5.22
9	634029	160871	3.50	3.99	4.50	4.49	5.07	2.51	3.18	3.45	4.17	4.17	5.11
10	634197	160503	3.40	3.87	4.37	4.35	4.93	0.00	2.88	3.20	4.15	4.15	4.87
11	634170	160019	3.20	3.64	4.08	4.06	4.62	0.00	2.83	3.16	4.15	4.15	4.63
12	634118	159528	3.00	3.43	3.86	3.89	4.44	0.00	2.80	3.15	4.14	4.15	4.46
13	634156	159057	2.95	3.33	3.77	3.82	4.36	0.00	2.80	3.15	4.14	4.14	4.42
14	634297	158719	0.00	3.15	3.58	3.64	4.25	0.00	0.00	2.99	4.05	4.05	4.39
15	634672	158405	2.59	2.94	3.31	3.38	3.93	0.00	0.00	0.00	2.83	2.83	3.18
16	634938	157988	2.02	2.56	2.91	2.96	3.62	0.00	0.00	0.00	2.59	2.59	2.73
17	635293	157685	0.00	2.85	3.02	3.02	3.50	0.00	0.00	0.00	0.00	0.00	0.00
18	635742	157488	0.00	2.98	3.44	3.43	4.04	0.00	0.00	0.00	0.00	0.00	0.00
19	636145	157202	3.17	3.79	4.23	4.23	4.84	0.00	0.00	0.00	0.00	0.00	0.00
20	636586	157148	3.94	4.54	5.04	5.03	5.64	0.00	0.00	0.00	5.04	5.04	5.67

Data taken from tidal modelling of the Lower Stour, completed by JBA Consulting in 2010, updated in 2012.

Climate change (CC) data represents modelled levels with an adjustment for future sea-level rise based on the years shown.

Values of 0.00 indicate locations at which the selected points lie outside of a particular modelled flood extent.

There are no health warnings or additional information for these levels, or the model from which they were produced.

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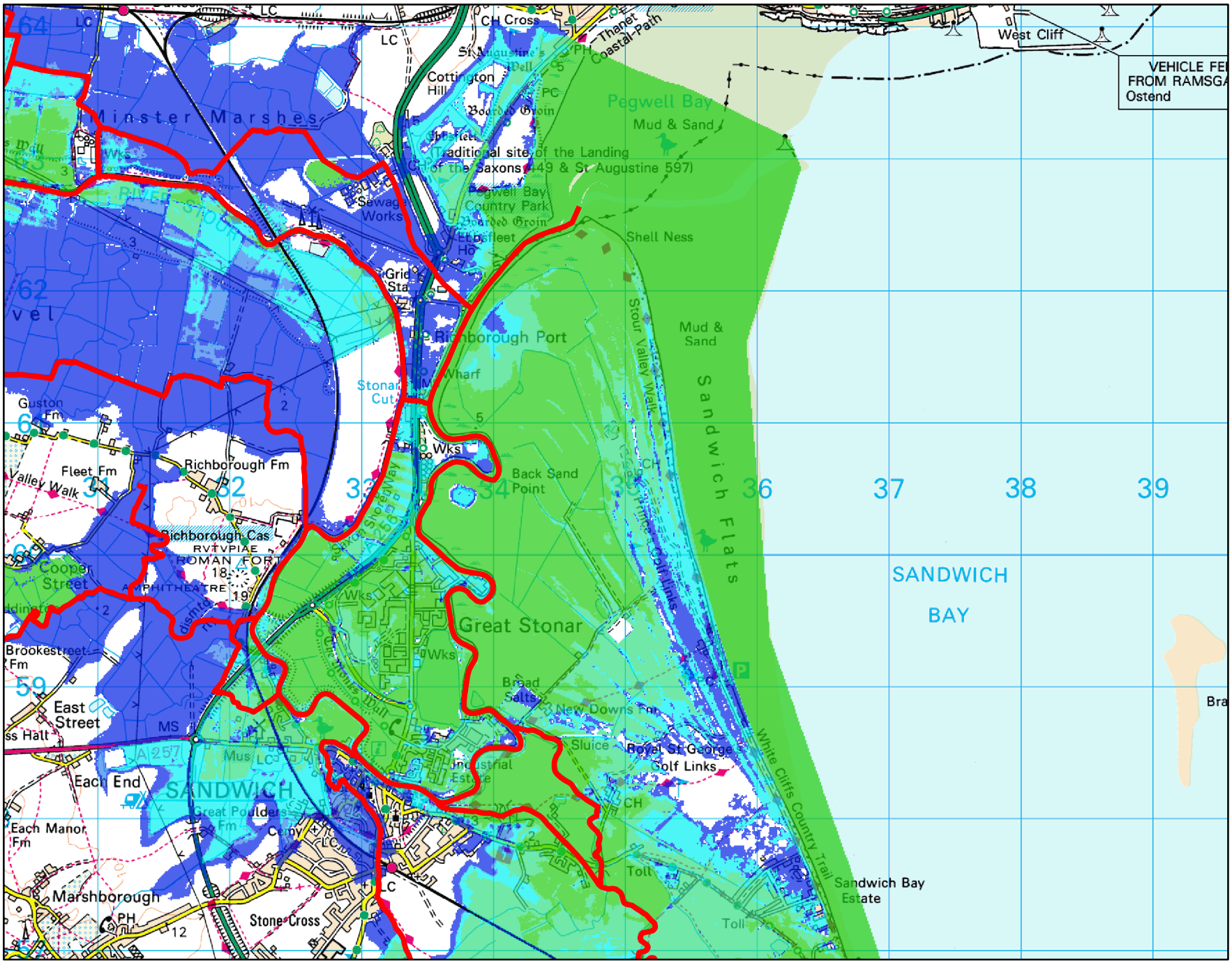
Tidal undefended flood extents map centred on Thanet Extension Offshore Wind Farm, East Kent.
Created 3 April 2017 [Ref: KSL 41339 LB].



Environment Agency

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Scale 1:40,000

Legend

- Main River

Tidal Undefended Flood Extents

Lower Stour Model

- 5% AEP
- 0.5% AEP
- 0.1% AEP
- 0.5% AEP + CC (2070)
- 0.5% AEP + CC (2115)

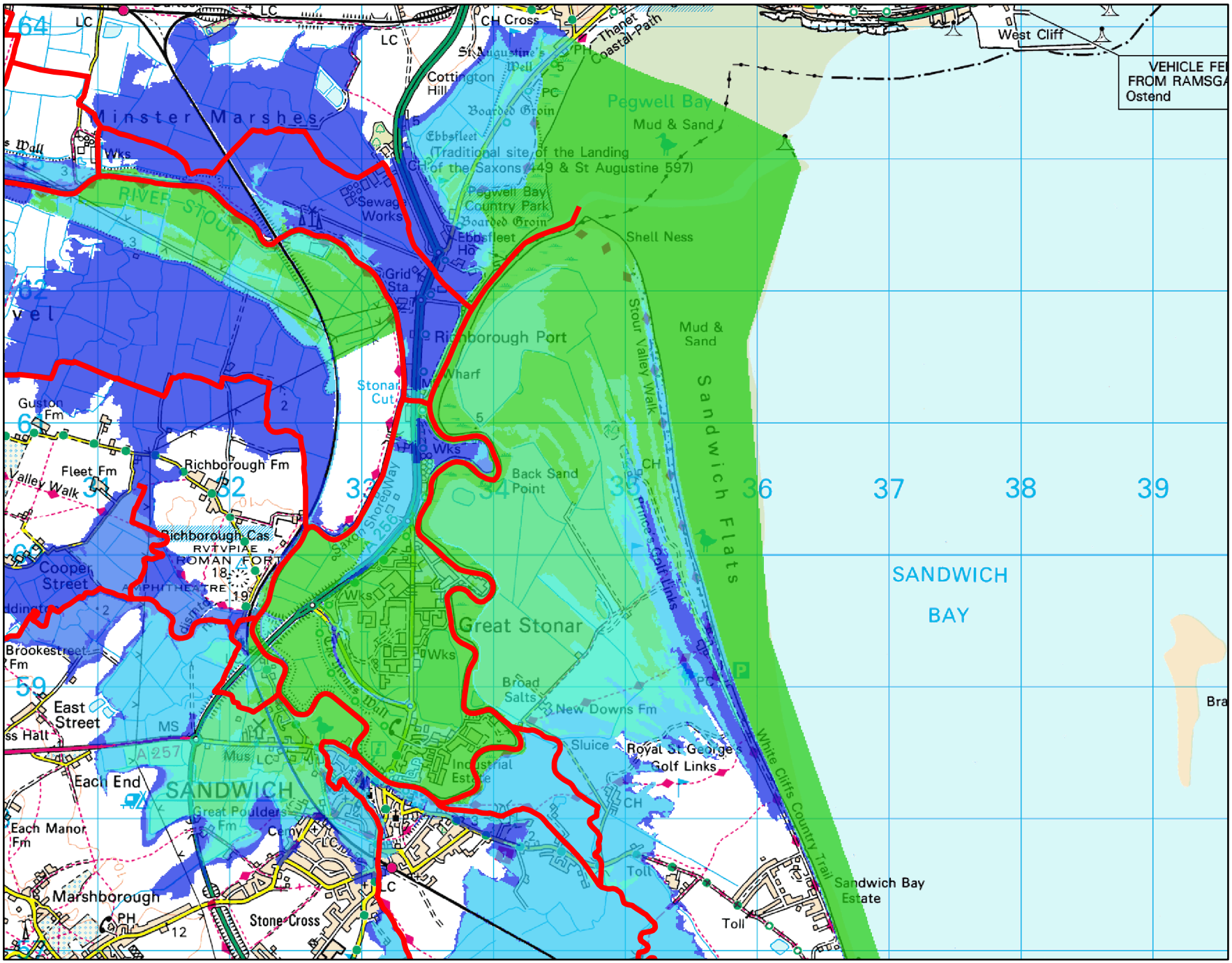
Climate Change (CC): Modelled flood extent with an allowance for climate change, for the year specified.

Annual Exceedance Probability (AEP). The probability of a flood of a particular magnitude, or greater, occuring in any given year.

0 1,000 2,000
Meters

Contact us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506. Email:enquiries@environment-agency.gov.uk

Tidal defended flood extents map centred on Thanet Extension Offshore Wind Farm, East Kent.
Created 3 April 2017 [Ref: KSL 41339 LB].



Environment Agency

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Scale 1:40,000

Legend

- Main River

Tidal Defended Flood Extents

Lower Stour Model

- 5% AEP
- 1.3% AEP
- 0.5% AEP
- 0.1% AEP
- 0.5% AEP + CC (2070)
- 0.5% AEP + CC (2115)

Climate Change (CC): Modelled flood extent with an allowance for climate change, for the year specified.

Annual Exceedance Probability (AEP). The probability of a flood of a particular magnitude, or greater, occuring in any given year.

0 1,000 2,000
Meters

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Defence Details

Sandwich
The Sandwich Town Tidal Defence Scheme consists of 16 sections of defence around the River Stour. The scheme includes a new tidal flood storage area outside of the town at Broadsalts, 14km of flood walls and embankments of varying heights (between 0.5m and 1.2m in town) on both banks of the River Stour, and a 1m high flood wall at Sandwich Quay. Combined, the scheme provides a 1 in 200 year standard of protection.

Shell Ness to Sandwich Bay Estate
This reach is characterised by a sandy beach backed by an extensive dune system. The ground levels of the dune system provide protection from flooding for the land behind the dunes.

Sandwich Bay Estate
Sandwich Bay Estate is protected by a shingle beach backed by a concrete revetment.

Sandwich Bay Estate to Sandown Castle
North of Sandown Castle the frontage consists of beaches backed by a colliery shale embankment and a narrow dune system.

Areas Benefiting from Flood Defences (ABDs)

Small parts of this site are within an area benefiting from flood defences, as shown on the enclosed extract of our Flood Map. Areas benefiting from flood defences are defined as those areas which benefit from formal flood defences specifically in the event of flooding from rivers with a 1% (1 in 100) chance in any given year, or flooding from the sea with a 0.5% (1 in 200) chance in any given year.

If the defences were not there, these areas would be flooded. An area of land may benefit from the presence of a flood defence even if the defence has overtopped, if the presence of the defence means that the flood water does not extend as far as it would if the defence were not there.

Please note: We are currently undertaking a coastal flood risk modelling project for the East Kent coast from Ramsgate to Dover. Following the completion of this project our ‘Flood map for planning purposes’ and ‘Risk of flooding from rivers and sea’ maps are programmed to be updated with any changes in the area, including defence locations and ABDs.

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Historic Flood Data

We hold records of historic flood events from rivers and the sea. Information on the floods that may have affected the area local to your site are provided below and in the enclosed map (if relevant).

Flood Event Data

Dates of historic flood events in this area: February 1953, January 1978, February 2001

Please note that our records are not comprehensive. We would therefore advise that you make further enquiries locally with specific reference to flooding at this location. You should consider contacting the relevant Local Planning Authority and/or water/sewerage undertaker for the area.

We map flooding to land, not individual properties. Our historic flood event record outlines are an indication of the geographical extent of an observed flood event. Our historic flood event outlines do not give any indication of flood levels for individual properties. They also do not imply that any property within the outline has flooded internally.

Please be aware that flooding can come from different sources. Examples of these are:

- from rivers or the sea;
- surface water (i.e. rainwater flowing over or accumulating on the ground before it is able to enter rivers or the drainage system);
- overflowing or backing up of sewer or drainage systems which have been overwhelmed,
- groundwater rising up from underground aquifers

Currently the Environment Agency can only supply flood risk data relating to the chance of flooding from rivers or the sea. However you should be aware that in recent years, there has been an increase in flood damage caused by surface water flooding or drainage systems that have been overwhelmed.

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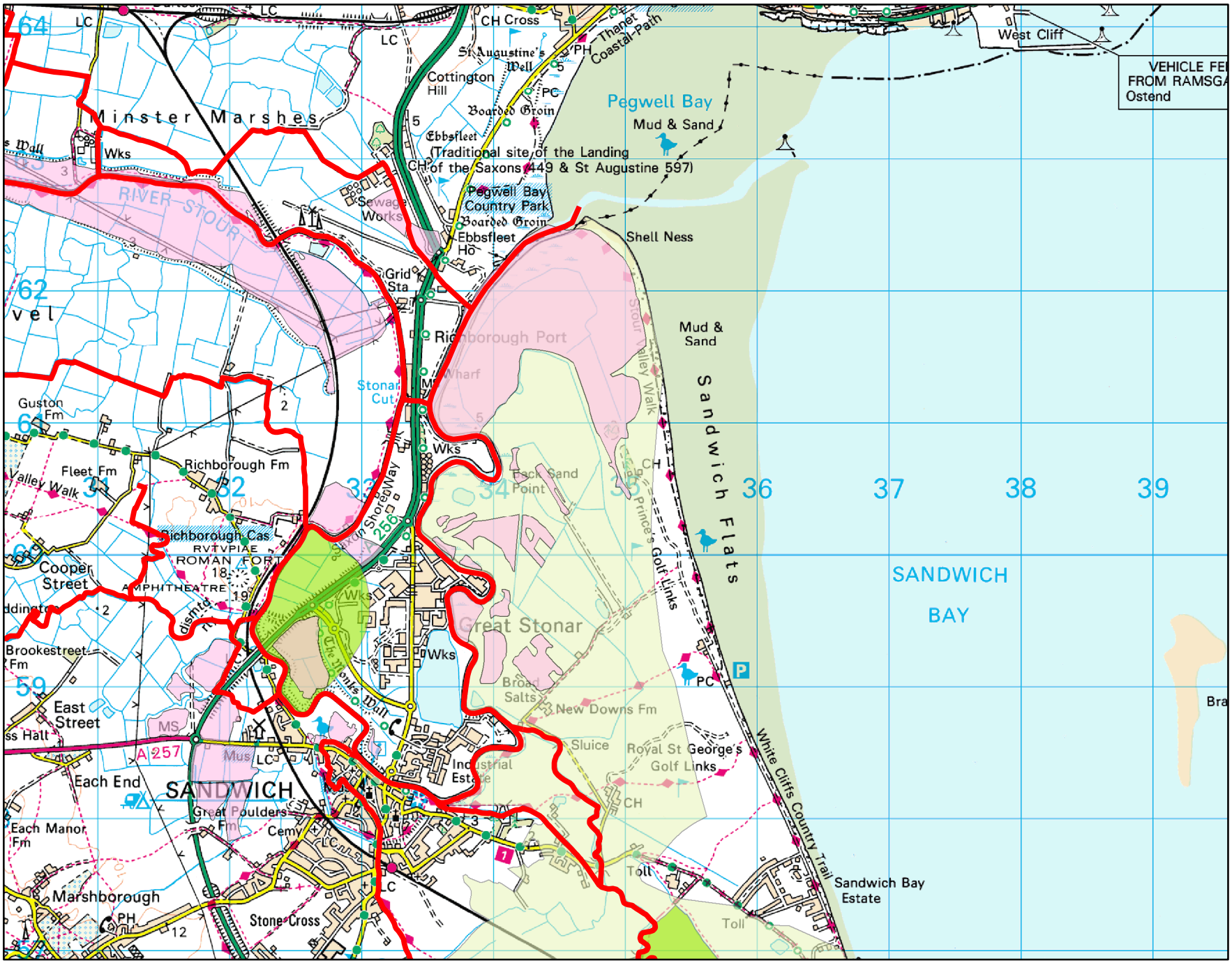
Historic flood extents map centred on Thanet Extension Offshore Wind Farm, East Kent.
Created 3 April 2017 [Ref: KSL 41339 LB].



Environment Agency

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Scale 1:40,000

Legend

- Main River
- Feb 2001
- Jan 1978
- Feb 1953

0 1,000 2,000
Meters

Contact us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506. Email:enquiries@environment-agency.gov.uk

Additional Information

Use of Environment Agency Information for Flood Risk / Flood Consequence Assessments

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In **England**, you should refer to the Environment Agency's Flood Risk Standing Advice, the technical guidance to the National Planning Policy Framework and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

https://www.gov.uk/government/publications/flood-risk-standing-advice-for-local-planning-authorities-frsa
http://planningguidance.planningportal.gov.uk/

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk / Consequence Assessment (FRA / FCA) where one is required, but does not constitute such an assessment on its own.

2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. The information produced by the local planning authority referred to above may assist here.

3. Where a planning application requires a FRA / FCA and this is not submitted or deficient, the Environment Agency may well raise an objection.

4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.

Please refer to the Open Government Licence which explains the permitted use of this information.

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Updated climate change requirements for flood risk assessments

On 19/02/2016 the 'Flood risk assessments: climate change allowances' were published on gov.uk. You can view the new allowances at 'Flood risk assessments: climate change allowances'. This replaces the previous guidance Climate Change Allowances for Planners.

The data provided in this product does not include the new allowances. You will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding. The fluvial climate change factors are now more complex reflecting the fact that the latest information shows that a single uplift percentage across England cannot be justified.

The Environment Agency will incorporate the new allowances into future modelling studies.

It remains the applicant's responsibility to demonstrate through their proposals and flood risk assessments that new development will be safe in flood risk terms for its lifetime.

Surface Water

We have provided two national Surface Water maps, under our Strategic Overview for flooding, to your Lead Local Flood Authority, who are responsible for local flood risk (i.e. surface runoff, ground water and ordinary watercourse), which alongside their existing local information will help them in determining what best represents surface water flood risk in your area.

Your Lead Local Flood Authority have reviewed these and determined what it believes best represents surface water flood risk. You should therefore contact this authority so they can provide you with the most up to date information about surface water flood risk in your area.

You may also wish to consider contacting the appropriate relevant Local Planning Authority and/or water/sewerage undertaker for the area. They may be able to provide some knowledge on the risk of flooding from other sources. We are working with these organisations to improve knowledge and understanding of surface water flooding.

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Appendix E: Drainage Design Principles Technical Note

Thanet Extension Offshore Wind Farm: Drainage Design Principles

1. Introduction

This technical note forms an Appendix to the Flood Risk Assessment (FRA) that accompanies the Development Consent Order (DCO) submission by Vattenfall Wind Power Ltd (VWPL) to the Secretary of State (delegated to the Planning Inspectorate (PINS)) for the onshore elements of the proposed Thanet Extension Offshore Wind Farm (hereafter referred to as the proposed development or Thanet Extension).

The note sets out the drainage design principles for the onshore permanent development, principally for consideration by Kent County Council (KCC) as the Lead Local Flood Authority (LLFA) and its role as Statutory Consultee for drainage for major planning applications. The principal element of the development for which drainage infrastructure would be required is the new substation. Detailed design of the substation, including drainage, would be undertaken once Development Consent is secured. A suitable drainage system will be provided within the development land parcel identified, and as such it has not been deemed necessary to prepare a Surface Water and Drainage Management Plan to accompany the DCO application. The intention of this technical note is to provide confidence to KCC as the LLFA that suitable drainage measures would be provided for the aspects of the proposed developed described above in due course.

Drainage for temporary works during the construction phase would be dealt with in Construction Environmental Management Plan (CEMP) which will be secured through the DCO (Document Ref: 3.1) and delivered in accordance with the Code of Construction Practice (CoCP).

2. Drainage Design Principles

2.1 Overarching Approach

A Surface Water and Drainage Management Plan would be prepared for the new onshore substation as a DCO Requirement (Document Ref: 3.1).

Any new drainage systems would be designed in accordance with the guidance provided in the SuDS Manual (CIRIA C753, 2015). This general approach would be supplemented by advice provided by KCC, such as that provided during the consultation meeting held on 28th June 2017 (minutes provided in Appendix A of the FRA). Key advice is summarised below:

- The impact on infiltration of any final raised bund (for the cable across the Pegwell Bay Country Park/ Cliffsend Landfill) is not of a significant concern – rainfall currently infiltrates into the landfill and the proposed bund would not significantly impact this.
- Cross drains could be provided under the concrete slab (of any cable bund across the Country Park/ Cliffsend Landfill) if any areas are identified where surface water might pond behind the raised bund, but this is also not anticipated to be a great concern.
- The key area of interest for KCC regarding surface water drainage would relate to the permanent development, i.e. the substation and the Tenant Relocation Area:

- Interception of runoff flows such that there would be no discharge off-site for the first 5 mm of rainfall;
- Measures to address water quality would be required;
- Existing discharge from the proposed substation site and the Tenant Relocation Area is likely to be direct to the (tidal) River Stour. It is understood that attenuation would not be required prior to discharge to this tidal watercourse at this location. Consideration of tide locking would be necessary. Attenuation storage may be necessary if discharge to non-tidal waterbodies is proposed.

Where existing development exists, and would be re-used 'as is' (as may be possible for the Tenant Relocation Area), the existing drainage system may also be suitable for re-use 'as is'. This would be assessed through an appropriate survey of the system (e.g. CCTV survey), and in liaison with KCC. Where redevelopment is necessary, such that the existing drainage system would be removed, a new drainage system would be provided, designed in accordance with the principles set out in this note.

Where suitable, point source infiltration (such as soakaways) could be considered for the permanent development. However, where discharge to a tidal water body is possible (subject to suitable treatment), the benefits of infiltration may be minimal. Any decision on the potential suitability of infiltration would be informed by suitable site investigations (SIs) as necessary to establish existing ground characteristics, including infiltration rates, existing ground contamination and depth to groundwater.

2.2 Permanent Development

Onshore Cable route

No permanent drainage infrastructure would be needed for the onshore cable route. The cables would either be buried beneath existing ground cover (to be restored to pre-development characteristics following construction of the underground cable) or, for Landfall Option 2, i.e. the above-ground landfall option, would be within a raised chalk-covered bund through the Pegwell Bay Country Park, into which rainfall would be able to infiltrate. Cross drainage beneath the raised chalk bund may be provided where the bund crosses overland flow paths.

Substation

A Surface Water and Drainage Management Plan would be prepared for the substation area and secured through a DCO requirement (discussed further below). The plan would utilise the SuDS principles set out by KCC and summarised in Section 2.1, including interception for the first 5 mm of rainfall, appropriate treatment before discharge, and attenuation if not discharging to a tidal waterbody (subject to consideration of the storage necessary to address tidal locking considerations).

Foul drainage is not a matter to be addressed in this surface water drainage technical note. The specific approach would be determined during post-DCO detailed design, with consideration for the availability of a mains connection and the number of visiting hours for site attendees during operation and maintenance (O&M).

Tenant Relocation Area

The proposals are for the use of the Tenant Relocation area 'as is'. No groundworks are proposed. Existing drainage systems may be used if they are found to be working adequately. This would be assessed by CCTV survey. Interceptors may be added if necessary. If existing drainage systems are not working adequately or the area is to be re-surfaced, any new drainage system would utilise the SuDS principles set out above for the substation area.

2.3 DCO Requirement

The preparation of a Surface Water and Drainage Management Plan for the substation is secured by requirement in the draft DCO (document ref: 3.1) which itself would reference the need for the Surface Water

and Drainage Management Plan to be prepared in accordance with the drainage principles set out in this technical note. The purpose of the Requirement is to provide confidence to KCC, as the LLFA (who the Local Planning Authority will presumably consult as the statutory consultee for drainage), that suitable drainage measures would be provided at the development in due course.

2.4 References

CIRIA (2015), *The SuDS Manual C753* (London: CIRIA).

Author	Reviewer
Ana Braid	Richard Cartlidge