



Tidal Lagoon Cardiff Ltd

Proposed Tidal Lagoon Development, Cardiff, South Wales

Environmental Impact Assessment Scoping Report

March 2015



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Chapter 1.0

Introduction to Scoping Report

1.0 Introduction to Scoping Report

1.1 Purpose of the document

- 1.1.0.1 This Scoping Report has been prepared by Tidal Lagoon Cardiff Ltd to assist in the process of identifying the appropriate scope for an Environmental Impact Assessment (EIA) in support of applications for consents for a proposed tidal lagoon renewable energy generation scheme near Cardiff, South Wales (Figure 1.1) (referred to as 'the Project').
- 1.1.0.2 The Project will have a generating capacity of 1800 to 2800 megawatts (MW). Consequently, the Project is a Nationally Significant Infrastructure Project (NSIP) as defined in the Planning Act 2008 (PA 2008) with a generating capacity above the threshold of 100MW, as set out in s15(3)(b) of PA 2008. On this basis, an application for development consent will be made to the Secretary of State for Energy and Climate Change (the Secretary of State), via the Planning Inspectorate. As the Project lies within Welsh waters, an application for a Marine Licence (ML) will also need to be made to the Marine Licensing Team within Natural Resources Wales (NRW). The process for granting a ML is set out by the Marine and Coastal Access Act 2009. Further consents may be required under the provisions of other legislation for certain components of the Project, such as the Town and Country Planning Act 1990. At this stage, the full suite of consents has not been identified.
- 1.1.0.3 A formal EIA will be required as part of the application for development consent and ML. An Environmental Statement (ES), documenting the findings of the EIA process, will be prepared in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (EIA Regulations) and the Marine Works (Environmental Impact Assessment) Regulations 2007 (Marine Regulations).
- 1.1.0.4 This Scoping Report is submitted to the Planning Inspectorate by Tidal Lagoon Cardiff Ltd under Regulation 8 of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009, as a request for a formal written opinion, the 'scoping opinion', on the information to be included in the ES for the Project. In preparation of this Scoping Report, the guidance within Advice Note 7: Environmental Impact Assessment: Screening and Scoping (Planning Inspectorate, 2012) has been considered. Where a different approach to that outlined in the Advice Note has been taken, this is discussed in the relevant place.

1.2 The Project

- 1.2.0.1 The Project will generate electricity using kinetic energy captured by hydro turbines from the large tidal range (the difference between high and low water) that is a distinguishing feature of the Severn Estuary. On the ebb tide, the Project will generate electricity by holding back water within the tidal lagoon to create sufficient head, in relation to the ebbing tide outside the lagoon. This water will then be released through the turbines such that this store of energy can be turned

into electric power. The electricity will be generated as water flows through bi-directional turbines, located in the turbine and sluice gate housing structures. This process will be repeated on the flood tide with water being prevented from entering the lagoon until sufficient head is created. The electricity will be exported from the Project to the National Electricity Transmission System (NETS) via a National Grid substation.

- 1.2.0.2 Figure 1.1 shows the anticipated location of the Project. The Project is proposed on the northern shore of the Severn Estuary, between Cardiff Bay and the River Usk. The area of the western landfall can be characterised by port and other industrial development close to the urban centre of Cardiff city, uses which are adjacent to the Cardiff Bay development. The area of the Eastern landfall can be characterised by low lying farmland behind a seawall defence. The impounded foreshore beyond the eastern extent of the industrial area of Cardiff can be characterised as low-lying farmland behind a seawall defence, with sporadic small settlements at irregular intervals.
- 1.2.0.3 The length of the breakwater is expected to be approximately 25km. The western breakwater landfall is expected to be approximately 2km from the entrance to Cardiff Bay. The eastern breakwater landfall will be approximately 2km from the mouth of the River Usk. At its furthest point from land, the breakwater is likely to extend 8km into the Severn Estuary. The area within the lagoon breakwater will be approximately 70km². The final location for the Project is anticipated to lie within the area shown and will also make provision for onshore working areas etc.
- 1.2.0.4 Further details of the Project are presented in Chapter 6 Project Description.

1.3 Structure of this Scoping Report

- 1.3.0.1 The objective of this report is to identify the scope of the EIA that will be undertaken to evaluate the potential effects of the project on the surrounding area. Feedback and comments on this scoping document will be sought from key consultees through the Planning Inspectorate and integrated into the EIA process.
- 1.3.0.2 Following from the submission of the Scoping Report and receipt of the scoping opinion, Tidal Lagoon Cardiff Ltd propose to engage statutory consultees and non-statutory consultees throughout the ongoing phases of the Project in relation to EIA, the Habitats Regulations Assessment and the Water Framework Directive. Chapter 2 Proposed Approach outlines the current proposed approach to this engagement.
- 1.3.0.3 The findings of the EIA will be reported successively in a Preliminary Environmental Impact Report (PEIR) and in an ES which will be provided in support of the application for development consent and other relevant applications. The results of the EIA will also be used to inform the detailed design of the Project and, where appropriate, mitigation measures will be incorporated to minimise residual effects on the environment or measures identified to enhance beneficial effects. Appropriate monitoring will be identified during the EIA process. To facilitate initial

feedback, this Scoping Report has been structured to provide an overview of the Project and describe the proposed content of the ultimate ES within the individual chapters.

1.3.0.4 Chapter 3 Structure of the Environmental Statement outlines the proposed structure of the ES, which will be produced and submitted with the application for development consent and the ML, and so far as appropriate, in support of other consents required. Further details of the proposed approach for assessing potential cumulative interrelationships and transboundary effects are provided. The Habitats Regulations Assessment and Water Framework Directive Assessments are also discussed. The wider consultation approach for the Project for both statutory and non-statutory purposes is also discussed in this chapter.

1.3.0.5 Chapters 4 – 26 detail the proposed content of the individual chapters of the ES as outlined in Table 1.1. For each environmental subject area (Chapters 8 – 25), the chapters in this Scoping Report have been structured as follows:

- Overview of the existing environment;
- The scope of potential impact to be assessed;
- Existing baseline data, consultation and need for survey; and
- Proposed assessment methodology.

Table 1.1 Overview of Scoping Report chapters detailing proposed content of ES

Chapter	Title and Overview
Chapter 3	Structure of the Environmental Statement.
Chapter 4	Introduction to the Environmental Statement. This Chapter outlines what will be discussed in the Environmental Statement Introductory Chapter submitted with the application.
Chapter 5	Background to the Project and Site Selection. This Chapter will provide an overview to the Project development up to submission of this Scoping Report.
Chapter 6	Project Description. This Chapter will provide information on the Project as a whole from construction through to operation. An overview is also given of concepts for decommissioning.
Chapter 7	Planning and Policy Context
Chapter 8	Coastal Process, Sediment Transport and Contamination
Chapter 9	Water Quality Processes
Chapter 10	Flooding and Hydrology
Chapter 11	Land Quality and Hydrogeology
Chapter 12	Intertidal and Subtidal Benthic Ecology
Chapter 13	Fish including Recreational and Commercial Fisheries
Chapter 14	Marine Mammals
Chapter 15	Coastal Birds
Chapter 16	Terrestrial Ecology
Chapter 17	Seascape and Landscape

Chapter 18	Cultural Heritage: Marine and Terrestrial
Chapter 19	Navigation and Marine Transport
Chapter 20	Marine Noise and Vibration
Chapter 21	Terrestrial Noise and Vibration
Chapter 22	Air Quality
Chapter 23	Onshore Transport
Chapter 24	Socio-economics
Chapter 25	Tourism and Recreation
Chapter 26	Mitigation, Compensation and Monitoring

1.4 The applicant and consultant team

- 1.4.0.1 The Project is being developed by Tidal Lagoon Cardiff Ltd, a special purpose vehicle (“SPV”) established by Tidal Lagoon Power Ltd (TLP) specifically for the development of the Project. The SPV will own and operate the Project upon completion.
- 1.4.0.2 TLP was established in 2012 with a vision of using the UK’s sustainable and abundant tidal resource to help move towards greater energy security, a low carbon future and lower electricity costs. It aims to help this transition while exploring regeneration, economic and recreational benefits to local communities.
- 1.4.0.3 In February 2014, its related company, Tidal Lagoon Swansea Bay plc, submitted an application for the development of a tidal lagoon generating station in Swansea Bay, south Wales, the world’s first purpose built tidal energy lagoon. Examination of the application was completed by the Examining Inspector’s in December 2014. Their recommendation is expected to be made to the Secretary of State in March 2014, who will decide whether or not to make the Order in June 2014.
- 1.4.0.4 TLP's renewable energy and infrastructure development team has both UK and international experience, supported by multiple leading consultancy firms with specialist experience in onshore and marine surveys, design, engineering and construction.
- 1.4.0.5 The specialist consultancy firms that have been involved in preparing this scoping document are listed in Table 1.2 below.

Table 1.2 Consultant team supporting the preparation of the Scoping Report (in alphabetical order)

Environmental input	
ABP Marine Environmental Research	Coastal Processes, Sediment Transport and Contamination; Navigation and Marine Transport
APEM	Intertidal and Subtidal Benthic Ecology; Fish including Commercial and Recreational Fisheries; Coastal Birds
Aquatic Environmental Research	Marine Mammals
Atkins Global	Flooding and Hydrology

Clarke Saunders Associates	Marine Noise and Vibration; Terrestrial Noise and Vibration
British Trust for Ornithology	Coastal Birds
Cotswold Archaeology	Cultural Heritage: Marine and Terrestrial
Hyder Consulting Ltd	Land Quaity and Hydrogeology; Seascape and Landscape, Air Quality, Onshore Transport, Socio-economics, Tourism and Recreation
Intertek Energy and Water	Water Quality Processes
MPEcology	Terrestrial Ecology
Turnpenny Horsfield Associates	Fish including Commercial and Recreational Fisheries

1.5 References

Planning Inspectorate (2012) Advice Note 7: Environmental Impact Assessment: Screening and Scoping

2009 No. 2263, Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (http://infrastructure.independent.gov.uk/wp-content/uploads/2009/08/uksi_20092263_en.pdf)

Marine Coastal Access Act 2009.

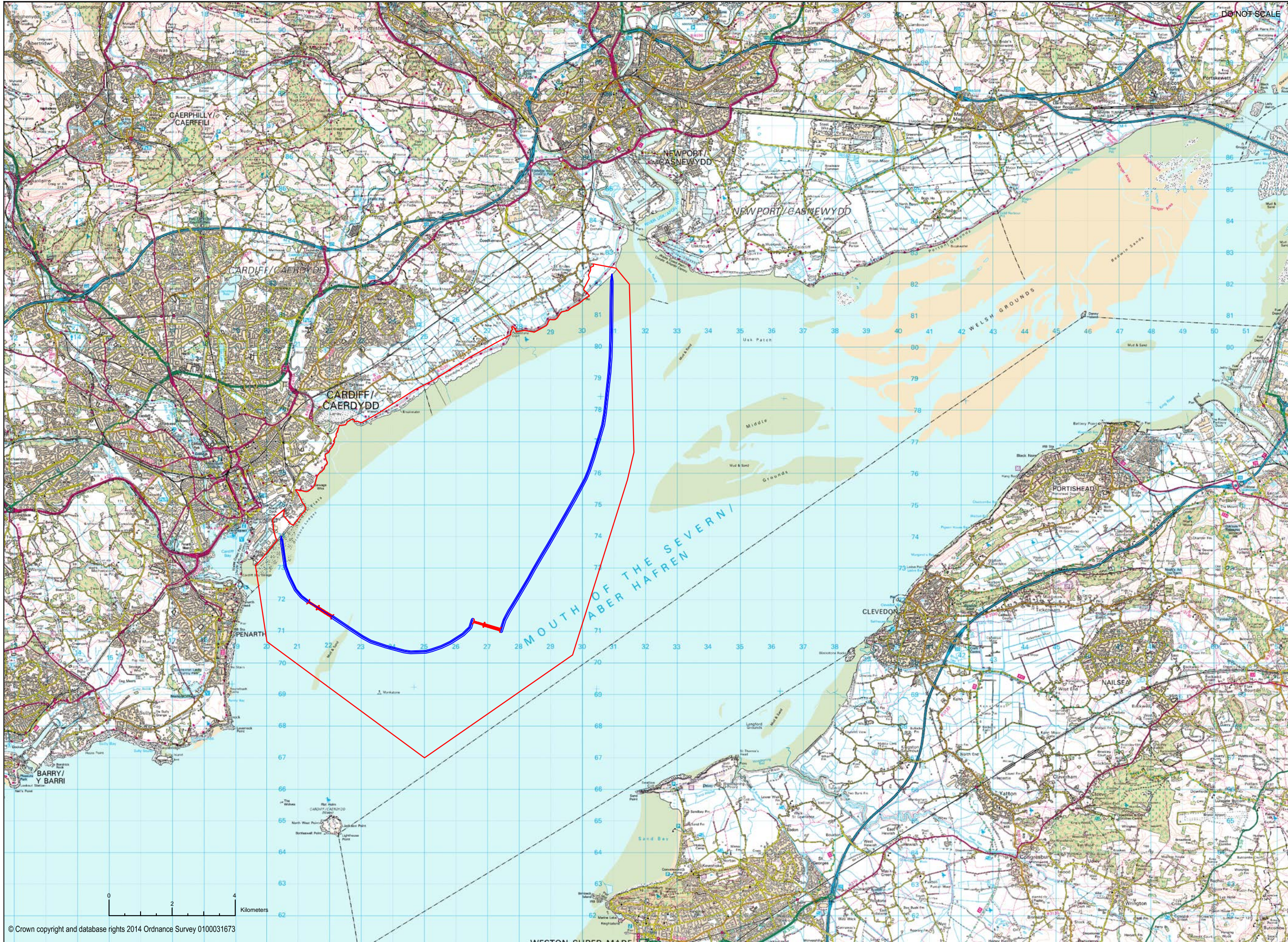
2007 No. 1518, The Marine Works (Environmental Impact Assessment) Regulations 2007 (www.legislation.gov.uk/uksi/2007/1518/contents/made)

Planning Act (2008)

Town and Country Planning Act (1990)



Figures



KEY

- REDLINE BOUNDARY
- LAGOON WALL
- ⇄ TURBINE HOUSING

Rev.	Description	By	Date	Chk'd	Auth

Purpose of Issue: **Tidal Lagoon Power**
 Pillar & Lucy House
 Merchants Road
 The Docks
 Gloucester
 GL2 5RG



Project: **TIDAL LAGOON CARDIFF**

Title: **LOCATION OF PROJECT**

Drawn	Checked	Authorised	Status
SC	MB	MB	
Date 13.02.15	Date 13.02.15	Date 13.02.15	
Drawing Number: FIGURE 1.1			Rev: D



Chapter 2.0 Proposed Approach

2.0 Proposed Approach

2.1 Proposed approach overview

- 2.1.0.1 This Chapter sets out Tidal Lagoon Cardiff Ltd's (TLC) proposed way forward for the ongoing work to undertake the Environmental Impact Assessment (EIA), the Habitats Regulation Assessment (HRA), the Water Framework Directive (WFD) assessment and the Marine Conservation Zone (MCZ) assessment for the proposed Cardiff tidal lagoon ('the Project') up to the submission of the application for a Development Consent Order (DCO) to the Planning Inspectorate.
- 2.1.0.2 This scoping report has been submitted as the first formal consultation on the proposed scope of assessment works for the EIA for the Project. It is intended that this document is a starting point for early discussions with statutory and non-statutory consultees on key aspects of the EIA namely:
- i. Suitability of baseline data;
 - ii. Further surveys/investigations/desk studies to gather additional baseline data;
 - iii. Scope of impacts to be examined; and
 - iv. Proposed assessment methodologies.
- 2.1.0.3 As the Project is likely to affect water bodies designated under the Water Framework Directive (WFD) (Directive 2000/60/EC), a WFD compliance report must also be provided to support the DCO application. The WFD compliance report must identify water bodies that may be affected and contain sufficient information to enable decision makers to assess the potential effects of the Project on the status of WFD water bodies in accordance with the WFD. A WFD screening report for the Project will be submitted to the appropriate authorities, shortly after submission of this scoping report. Where relevant, this scoping report provides details of studies that will be undertaken as part of the EIA for potential effects on WFD water bodies. The full scope of the WFD assessment will be presented in detail within the separate WFD screening report.
- 2.1.0.4 No MCZ are within the immediate vicinity of the Project, though the Project has the potential to effect MCZ further afield. Lundy MCZ is the closest designated MCZ to the Project. In addition, details of the North of Lundy candidate MCZ (cMCZ) (not proposed for designation in the second tranche) were released in January 2015. Consultation on a recommended MCZ (rMCZ) 'Bideford to Foreland Point', on the north Devon coastline, commenced in January 2015 in the second tranche of consultation for MCZ. Establishment of marine protected areas, including MCZs, is a key element of the governments' programme to protect and enhance the marine environment while supporting sustainable use of its resources. The assessment undertaken for the Project will consider any potential effects on MCZ.

- 2.1.0.5 Under Article 6 of the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the "Habitats Directive") an assessment is required where a plan or project may give rise to significant effects upon a Natura 2000 site. The Natura 2000 network comprises Special Areas of Conservation (SAC) (designated under the Habitats Directive) and Special Protection Areas (SPA), designated under Directive 2009/147/EC on the conservation of wild birds (the codified version of the earlier Council Directive 79/409/EEC as amended). The requirements of the Habitats Directive are transposed into UK law through the Conservation of Habitats and Species Regulations 2010 (as amended) the 'Habitats Regulations'.
- 2.1.0.6 Planning Inspectorate Advice Note 10 (version 5, August 2013) describes how the Habitats Regulations Assessment (HRA) process should be undertaken for Nationally Significant Infrastructure Projects (NSIPs). As the Project is likely to affect one or more ecological sites designated as being of European or international importance for nature conservation, a HRA Report must also be provided to support the DCO application. This HRA Report must identify the designated site(s) that may be affected and contain sufficient information to enable decision-makers to undertake an HRA in accordance with the Habitats Regulations.
- 2.1.0.7 Prior to the first step in the HRA, a site selection process to identify the list of European sites that will potentially affected has been drawn up, from which the final list of sites to be included for further assessment can be selected after considering the relevant information. This has been presented in two documents: first a set of 'potential impact pathway' tables and secondly, an ornithological review of Natural 2000 sites within Europe and the UK that could potentially be affected by lagoon development as detailed further below.
- 2.1.0.8 The 'potential impact pathway' tables (Appendix 2.1), presents an initial view regarding the likelihood of a potential impact pathway between the Project and marine and coastal European sites along the Welsh and English coastline. The geographical scope has been informed by initial high level coastal modelling results and previous experience gained on the Tidal Lagoon Swansea Bay project. The assessment will be developed and refined as the Project progresses to facilitate a full screening assessment and, at this stage, does not represent an assessment of impact significance. This screening assessment will be submitted to the relevant authorities at the appropriate time.
- 2.1.0.9 The second is a report entitled '*An ornithological review of UK sites within the Natura 2000 network and broad regions of Europe that could potentially be affected by the proposed Cardiff Tidal Power Lagoon and other potential lagoon proposals on the Severn Estuary*' produced by Combined Ecology (a division of BTO Services Ltd) (Appendix 2.2). This has been produced in order to inform the site selection and screening process for the HRA and considers the potential impacts on birds not just within the Severn Estuary but also further afield.

- 2.1.0.10 Where relevant, this scoping report provides details of studies that will be undertaken as part of the EIA for potential effects on designated sites. It is also proposed that an Evidence Plan process is used to ensure that any technical investigations carried out, potentially in addition to those required for the EIA process, are adequate to inform a robust HRA. The Evidence Plan process is intended to provide an audit trail for areas of agreement (and any areas of disagreement) with participating stakeholders in the evidence base for the HRA, which can inform Statements of Common Ground. The proposed Evidence Plan process for the Project is further discussed in Section 2.2 below.
- 2.1.0.11 Modelling tools that describe key estuary processes are expected to play an important part of project delivery and inform both the environmental assessment (EIA, WFD and HRA) and engineering workstreams. For the environmental assessment, primary topics where modelling tools are expected to be used to support investigations of change across the estuary include coastal processes, water quality and flood risk (coastal and fluvial). Furthermore, outputs from each of these primary topics are expected to be used to inform a range of other EIA topics, such as intertidal and subtidal benthic ecology; fish, including recreational and commercial fisheries; coastal birds; and navigation. For engineering, coastal process modelling in particular is expected to inform various stages of project design and optimisation. Hence, TLC consider that the modelling activities need to be an integrated package of work to achieve a consistent and complete understanding of the potential effects of the Project and it is intended that this is co-ordinated through a Modelling Work Plan process. The proposed Modelling Work Plan process is discussed further in Section 2.3.
- 2.1.0.12 As a separate workstream, TLC are working on an Ecosystem Enhancement Project (EEP) which aims to bring together nature conservation, flood management, climate change adaptation and socio-economic benefits throughout the Severn Estuary. This is described further in Section 2.4.
- 2.1.0.13 An outline timeline for the proposed submission of the DCO application is set out as follows:
- i. Scoping report submission by TLC March 2015;
 - ii. Scoping opinion April 2015;
 - iii. Consultation to inform options and preferred option 2015 – 2017;
 - iv. Consultation on Preliminary Environmental Information Report and other consultation documents Quarter 1 2017;
 - v. Submission of application 2017;
 - vi. Consent determination 2018; and
 - vii. Power on 2022.
- 2.1.0.14 TLC envisage engagement with statutory and non-statutory consultees, the Evidence Plan and the Modelling Work Plan will feed into this timeline. This timeline will be further expanded and discussed with stakeholders and will include the establishment of gateways where agreement for key aspects of the Project design and assessment methodologies will be sought. As outlined above, the EEP

is a separate process, but output from this will be included as appropriate within the assessment process.

2.2 The Evidence Plan Process

2.2.0.1 From September 2012, applicants of Nationally Significant Infrastructure Projects (NSIPs) located in England, or both England and Wales, have been able to agree evidence plans with relevant statutory nature conservation bodies (SNCBs) (Defra, 2012).

2.2.0.2 An evidence plan is a formal mechanism to agree upfront what information the applicant needs to supply to the competent authorities to enable them to undertake the HRA of the proposed development. As the Project lies within Wales, there is no formal mechanism in place to undertake an Evidence Plan process, however, it has been agreed in principal with Natural Resources Wales (NRW), Natural England (NE) and the Environment Agency (EA) that to follow an Evidence Plan process would be welcomed.

2.2.0.3 The Evidence Plan is a non-legally binding agreement between the applicant and the relevant SNCBs. The primary aim is to address a NSIPs potential impacts on European Sites through defining the data requirements for the HRA process specifically and not for the EIA process more generally. It is also intended to provide an audit trail for agreements and any areas of disagreement in the evidence base requirements for the HRA which can be fed into Statements of Common Ground. An outline of the proposed Evidence Plan Framework is included at Appendix 2.3 and further comment is welcome.

2.2.0.4 TLC also consider that the Evidence Plan process could be used to guide the assessment of the Project in relation to the requirements of the WFD and potentially in relation to other assessments.

2.3 The Modelling Work Plan

2.3.0.1 The scope of EIA for tidal lagoon development in the Severn Estuary requires expert assessment across a number of topic areas. These assessments are expected to be supported by a range of suitable modelling tools. The technical resources to deliver the assessment are being drawn from several different organisations that each have industry recognition in their respective areas of expertise which is also underpinned by previous extensive experience for delivering similar topic related assessments for this location. The technical resources are being drawn from:

- i. ABPmer for coastal processes;
- ii. Atkins for flood risk; and
- iii. Intertek for water quality.

2.3.0.2 Of particular note is that the coastal processes scope will provide the focal point for describing the tidal environment which in turn links to other coastal process

mechanisms which include waves and sediment transport. The same basis of establishing a description of the tidal environment then supports requirements for both flood risk and water quality modelling, noting that these requirements may also differ. For example, flood risk has a particular interest in extreme events which occur infrequently whereas water quality is likely to focus on more typical occurrences. As flood risk will address both coastal and fluvial issues, then the fluvial definition is also provided to the coastal process requirement as an upstream boundary. Hence, the modelling activities need to remain as an integrated package of work to achieve a consistent and complete understanding.

2.3.0.3 The involvement of multiple organisations in delivering the modelling requirements presents both opportunities and challenges. One of the major opportunities for the project is being able to share experiences from a wider group of experts and deliver a more robust assessment. One of the primary challenges is to ensure that the application of any modelling tools between different organisations is co-ordinated to achieve the aims of integration, efficiency and consistency across the scope of all assessments. The modelling work plan aims to facilitate this co-ordination to achieve a robust and fully integrated assessment. A benefit is that the modelling approach and the involvement of a number of organisations, is that the models and outputs are sense-checked by other team members.

2.3.0.4 The likely components of the modelling work plan comprise:

- i. A review of guidelines and standards for the application of models;
- ii. Identification of appropriate performance criteria;
- iii. Identification of modelling objectives;
- iv. Production of a Data Plan to frame the data requirements, sharing and management;
- v. Model design including use of 2D or 3D models, model extents, grid structures, boundary conditions, model optimisation and model proving (calibration and validation exercises).
- vi. Model applications;
- vii. Sharing of modelling results; and
- viii. Technical reporting.

2.3.0.5 The combination of the Modelling Work Plan and Data Plan support the requirements of an Evidence Plan as set out by Defra (2012):

- I. Evidence to be collected: *“The evidence plan should set out the evidence that needs to be collected (e.g. type of surveys, timetable of surveys, approaches to modelling and the format of providing the evidence to the relevant SNCB) to meet the agreed scope of evidence.”*

2.3.0.6 A key part of the Modelling Work Plan will be the development of gateways at which TLC proposes that there is engagement with statutory consultees. It is envisaged that these gateways will be set at key stages over the timeline of the Project, with the first gateway introducing the concept of the Modelling Work Plan and establishing appropriate follow-up gateways. As for the Evidence Plan process, it is anticipated that the Modelling Work Plan and gateways will provide an audit trail for areas of agreement (and any areas of disagreement) with participating stakeholders in the evidence base for the key studies of coastal processes, water quality and flooding, which can inform Statements of Common Ground.

2.4 Ecological Enhancement Project

2.4.0.1 The complexity of environmental challenges raised by the Project in the Severn Estuary is recognised by TLC and all relevant stakeholders. TLC are also aware of the social and economic services rooted in this estuarine environment and how these are being challenged by climate change and other factors. Therefore a programme is under way that aims to address all legislative requirements relating to assessment and consenting as a foundation but also to produce proposals that can draw together habitat, conservation and flood defence aspects to enhance the natural environment and bring economic and social benefits to host areas and the UK as a whole.

2.4.0.2 Core strands of the EEP include habitat creation for migratory and resident bird species, compliance with the WFD, flood and coastal risk management, habitat enhancement for migratory and resident fish populations and social and economic benefits, all taken in the context of both the existing status of the Severn Estuary and with a longer term climate change adaptation and resilience strategy, given the Project's design life of 120 years.

2.4.0.3 It is intended that the EEP will provide the framework for delivery of any statutorily required compensatory habitat. Where such habitats or other measures required for the Project are to be delivered, the ES and other application documents will set out the mechanisms for securing and delivery measures provided by the EEP.

2.5 References

Burton, N.H.K., Ross, K., Wright L.J. & Clark, N.A. (2015) A summary review of the survey and modelling methodologies required to inform Environmental Impact Assessment and Habitats Regulations Assessment in relation to proposed tidal power lagoons on the Severn Estuary. Combined Ecology (a division of BTO Services Ltd).

Defra, 2012. Evidence plans for Nationally Significant Infrastructure Projects. Habitats Regulations, September 2012.

Defra, 2013. Planning Inspectorate Advice Note 10 (version 5, August 2013)



Chapter 3.0 Structure of the Environmental Statement

3.0 Structure of the Environmental Statement

3.1 Overview of the Environmental Statement

3.1.0.1 The preliminary chapters of the Environmental Statement (ES) will set the scene for the Project. They will provide an overview of the Project itself including details of both the offshore and onshore components, other integral Project elements and any development which is being delivered with or to support the Project. The ES will then go on to describe the EIA process, and the Project in the context of planning and policy.

3.1.0.2 An overview will also be given of the iterative process that has been undertaken in terms of considering alternative location sites and design options. Whilst the design evolution will continue throughout the EIA process, with mitigation measures being incorporated where appropriate, a Rochdale Envelope approach (see explanation below) will be applied to the EIA process.

3.1.0.3 The main body of the ES will be prepared in stand-alone chapters to present a complete picture of assessment and effects for each individual environmental subject area. Assessments will be undertaken as appropriate for the construction, operation/maintenance and decommissioning phases of the Project.

3.1.0.4 The following Chapters will be included in the ES:

1. Introduction
2. EIA Process and Assessment of Significance
3. Site Selection and Option Appraisal
4. Project Description
5. Planning and Policy Context
6. Coastal Processes, Sediment Transport and Contamination
7. Water Quality Processes
8. Flooding and Hydrology
9. Land Quality and Hydrogeology
10. Intertidal and Subtidal Benthic Ecology
11. Fish Including Recreational and Commercial Fisheries
12. Marine Mammals
13. Coastal Birds
14. Terrestrial Ecology
15. Seascape and Landscape
16. Cultural Heritage: Marine and Terrestrial
17. Navigation and Marine Transport
18. Marine Noise and Vibration
19. Terrestrial Noise and Vibration
20. Air Quality
21. Onshore Transport
22. Socio-economics
23. Tourism and Recreation

24. Interrelationships and Transboundary effects
25. Mitigation, Compensation and Monitoring

3.1.0.5 Several documents will also be produced to support the ES and the Development Consent Order (DCO) and Marine License applications. These will include:

- i. Report Identifying any European Site which may be affected
- ii. Information to Inform an Appropriate Assessment
- iii. Water Framework Directive Assessment
- iv. Flood Consequence Assessment
- v. Construction Environmental Management Plan
- vi. Operational Environmental Management Plan
- vii. Adaptive Environmental Management Plan

3.2 Assessment process

3.2.0.1 Each assessment chapter will set out the baseline environmental conditions for the relevant subject area. The EIA will consider the impacts on the environment for the three stages of the Project which are:

- I. **Construction Phase:** covers all onshore and offshore construction and installation works associated with the Project.
- II. **Operational Phase:** this phase commences after the construction and installation phase has reached completion and covers the design lifetime of the Project which is estimated to be 120 years.
- III. **Decommissioning Phase:** considers proposals for the Project after the anticipated design lifetime of the Project. This cannot be fully assessed as the lifetime of the Project will be 120 years. An assessment will be carried out as far as is appropriate, but further assessment can be assumed to be required closer to the time of decommissioning. TLC will also have regard to emerging policy from DECC about decommissioning tidal power projects, and the appropriate stage for assessment.

3.2.0.2 The identification and assessment of environmental effects will be an iterative process and will be carried out alongside the design of the Project. Where possible, the design will be adjusted and mitigation measures embedded within it, thereby minimising by design, likely adverse effects that have been identified during the EIA process.

3.2.1 Outline structure of chapters

3.2.1.1 The general structure of each Chapter will be as follows:

- i. Overview of Chapter and relevant policy and/or legislation;
- ii. Assessment methodology, significance criteria and consultation;
- iii. Description of baseline conditions including findings of any site-specific surveys;
- iv. Detailed assessment of the effects of construction and operation, including an overview of anticipated decommissioning effects;
- v. Mitigation, enhancement measures, compensation (if required) and monitoring;
- vi. Residual effects;
- vii. Cumulative effects;
- viii. Conclusion presenting significant aspects, both positive and negative; and
- ix. References.

3.2.1.2 Appropriate study areas will be described for each specific environmental topic, to ensure that potentially significant effects are identified and assessed in accordance with relevant standards and guidance. Study areas may therefore differ for each topic, because the geographic extent of likely direct and indirect impacts in each case may differ.

3.2.2 Assessment of significance

3.2.2.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (EIA Regulations) require that the EIA considers the likely significant effects of the Project on the environment. The decision-making process to identify whether or not a Project is likely to significantly impact on the environment is central to the EIA process. The EIA Regulations do not provide a specific definition of 'significance', but the methods used to identify and assess effects should be transparent and verifiable.

Rochdale Envelope

3.2.2.2 As stated in Advice Note 9 from the Planning inspectorate (Planning Inspectorate, Advice Note 9, 2012), "*the 'Rochdale Envelope' is an acknowledged way of dealing with an application comprising EIA development where details of a project have not been resolved at the time when the application is submitted*".

3.2.2.3 The EIA process undertaken for this Project will ensure that all the realistic and likely worst case effects for potential alternate variations of the Project will be properly considered, and the findings will be clearly presented. Where "details

have not been resolved" and flexibility is allowed in the draft DCO, for instance by means of a power of deviation, this will be considered by the relevant chapter authors in the assessments.

3.2.3 Assessment of effects

3.2.3.1 To assess the effects of the Project, appropriate professional or institutional guidelines for specific environmental subject areas will be followed. Where no specific guidelines are available, a generic method for determining significance criteria levels will be employed based on guidance from the Institute for Ecology and Environmental Management Guidelines for Marine Impact Assessment (IEEM, 2010) and the Ecological Impact Assessment (EclA) guidance set out by the Institute of Ecology and Environmental Management (IEEM, 2006). The generic method is outlined briefly below and how it has been applied to the specific environmental topics will be described in the relevant chapters. In adapting these guidelines, independent specialists will employ expert interpretation and value judgements in order that the significance of any given effect can be established.

3.2.3.2 The first stage of the assessment is to identify activities resulting from the Project that are likely to cause significant impacts and to identify the features of interest (receptors) that are likely to be affected and the means by which that might occur (which are together referred to as the impact pathway). The value of the feature of interest will also be determined.

3.2.3.3 The second stage involves understanding the nature of the environmental changes to provide a benchmark against which the changes and levels of exposure (combination of magnitude and probability of occurrence) can be compared. The scale of the impacts via the impact pathways will depend upon a range of factors, including the following (in no particular order):

- i. The baseline conditions of the system;
- ii. Existing long-term trends and natural variability;
- iii. The importance of the receptor (e.g. designated habitats; protected species; internationally, nationally or locally protected features);
- iv. The sensitivity of the receptor – intolerance of a receptor to an environmental change and considering its resistance, adaptability and recoverability;
- v. Magnitude -
 - Spatial extent (small/large scale);
 - Duration (temporary/short/intermediate/long-term);
 - Timing and frequency (routine/intermittent/occasional/rare);
- vi. The margins by which set values are exceeded (e.g. water quality standards);
- vii. Probability of occurrence;

- viii. Reversibility; and
- ix. Confidence, or certainty, in the impact prediction.

3.2.3.4 Following from this, the level of impact and its significance is assessed based on the evaluation of the likelihood of a feature being vulnerable to an impact pathway. Vulnerability will depend on the sensitivity of a feature and its exposure to change. Sensitivity can be described as intolerance of a feature to an environmental change and essentially considers the response characteristic of the feature. The level of significance, which could either be beneficial or adverse, is determined from the importance of the feature and its vulnerability. The importance of a feature is based on its value and rarity such as the level of protection. The key significance levels for either beneficial or adverse impacts are described as follows:

- i. **Neutral:** No impact.
- ii. **Insignificant/Negligible:** Insignificant change not having a discernible effect.
- iii. **Minor:** Effects tending to be discernible but tolerable.
- iv. **Moderate:** Where these changes are adverse they may require mitigation.
- v. **Major:** Effects are highest in magnitude and reflect the high vulnerability and importance of a receptor (e.g. to nature conservation, noise). Where these changes are adverse they will require mitigation.

3.2.3.5 Impacts that are 'moderate' or 'major' are regarded as being significant for the purposes of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 and the Marine Works (Environmental Impact Assessment) Regulations 2007.

3.2.4 Mitigation measures, residual impacts and monitoring

3.2.4.1 Mitigation is an iterative process of avoiding, reducing, ameliorating or compensating for significant potential effects upon receptors, and the wider environment, resulting from the Project during the EIA process. This process has the status of a hierarchy, with avoidance being most preferred and compensating being least preferred.

3.2.4.2 The development of the design of the Project will run in parallel with the EIA. As a result, the design will aim to avoid key areas (by changes to layout or location) or by including features that will minimise effects on specific receptors. These measures can be referred to as being "embedded" within the design.

3.2.4.3 Additional mitigation measures will be developed during the EIA process once potential effects on key environmental receptors are identified. Details of these mitigation measures will be discussed within each topic Chapter and summarised in the Chapter entitled Mitigation, Monitoring and Compensation (see Chapter 26 of this Scoping Report).

3.2.4.4 Within each environmental Chapter, significant effects that remain after mitigation measures will be identified - i.e. these are the residual effects of the Project. The residual effects will be considered and weighed by the Examining Authority and the Secretary of State as part of the decision-making process of the application for DCO, ML and any other required supporting consents. Therefore, assessment of the significance of the residual effects after mitigation is a key outcome of the EIA process.

3.2.4.5 To confirm the findings of the EIA process, a monitoring programme will be proposed and will be implemented during the pre-construction, construction, operational and decommissioning phases of the Project.

3.2.5 Cumulative/in-combination effects

3.2.5.1 In accordance with Schedule 4, Part 1 of the EIA Regulations, 'cumulative/in-combination effects' have been considered for the Project. By convention, "in-combination" effects are generally considered to result from the interaction of different types of effect of the Project itself. The term "cumulative" is usually applied to the interaction between the effects of different projects/developments.

3.2.5.2 The cumulative/in-combination assessment needs to take account of the total effects of all pressures acting upon all relevant receptors in seeking to assess the overall cumulative/in-combination significance. Consideration will be given to activities and plans or projects that exist, that are approved but uncompleted, or the applications for which are under consideration, where spatial/physical overlaps of the impacts are likely to occur. Additionally, consideration will be given to any other activities and plans or projects, including any impacts that do not directly overlap spatially, but may indirectly result in a cumulative/in-combination impact. The cumulative and in-combination effects that the Project may have on the existing and reasonably foreseeable environment will be considered in the appropriate technical chapters.

3.2.5.3 Guidance will be sought from the Local Authorities, Natural Resources Wales (NRW), Natural England (NE), the Marine Management Organisation (MMO) and the Environment Agency (EA) on the projects that may require assessment in terms of cumulative effects. These are likely to include port development, coastal defence works, marine dredging, nearby terrestrial development, major road developments, and other onshore and offshore renewable energy projects. Table 3.1 provides a list of projects, as defined in February 2015 that appear likely to require consideration for the cumulative assessment.

Table 3.1 Potential Projects for Cumulative Assessment

Project	Stage	Description
Tidal Lagoon Swansea Bay	Development Consent decision stage	A proposed tidal lagoon in the vicinity of the Bristol Channel, which may share receptors linked to far field effects.
The West Somerset Tidal Lagoon	Pre-application stage for Development Consent	A proposed tidal lagoon in relatively close proximity in the Severn Estuary. Environmental receptors may be shared in the dynamic environment of the estuary.
Hinkley Point C New Nuclear Power Station	Development Consent granted	A nuclear energy generating station. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Oldbury New Nuclear Power Station	Pre-application stage for Development Consent	A nuclear energy generating station. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Hinkley Point C Connection	Development Consent examination stage	A grid connection. The scheme will be a linear scheme with an impact on the landscape near the estuary.
M4 corridor around Newport	Pre-application consultation	The proposed relief road would be constructed inland of the impounded foreshore. The scheme will be a linear scheme with an impact on the landscape.
Seabank 3 CCGT	Pre-application stage for Development Consent	A gas fired energy generation proposed near the mouth of the River Avon. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Avon Power Station	Pre-application stage for Development Consent	A gas fired energy generation proposed near the mouth of the River Avon. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.

BBC Headquarters Cardiff	Planning applications have been submitted to the Local Authority and commencement of construction is due for 2018.	Relocation of BBC Wales Headquarters to be a major project in Cardiff City Centre. Construction impacts may be shared in terms of impacts on the local highway network as Tidal Lagoon Cardiff and this scheme would be constructed concurrently.
Tidal Energy Ltd Deltastream Installation, Ramsey Sound, Pembrokeshire.	Consent secured. Installation was due to be carried out in 2014.	An array of tidal stream devices. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Tidal Energy Ltd, Deltastream Demonstration Array, St David's Head, Pembrokeshire.	An EIA has not yet been completed; however construction is planned to commence in 2017 following the decommissioning of the Ramsey Sound installation.	An array of tidal stream devices. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Bristol Port Deep Sea Container Terminal (DSCT) at Avonmouth Dock	Consent secured	The Bristol Port Company is planning to build a £600m Deep Sea Container Terminal (DSCT) at Avonmouth Dock. The DSCT will handle large container vessels and next-generation ultra large container ships with a draught of up to 16 m and a capacity in excess of 150,000 DWT
Tabb's Gout and Portland Grounds Sea Defence Improvements	Construction anticipated Summer 2015	Raising of sea defences on the Severn Estuary coastline between ST248787 and ST254790 and ST438848 and ST453857 respectively, in line with the 'Hold the Line' policies for the second Severn Estuary Shoreline Management Plan (SMP2) and the draft Severn Estuary Flood Risk Management Strategy

3.2.6 Interrelationships

3.2.6.1 In order to assess the environmental effects of the Project as a whole, interrelationships between aspects of the Project on receptors will be considered, as required under Schedule 4 of the EIA Regulations. The interrelationships between specialist topics will be examined as appropriate within each of the Chapters, with mitigation measures recommended and residual effects identified. An overview of the interrelationships examined within each of the individual chapters will be presented within an ES chapter entitled 'Interrelationships and Transboundary Effects'.

3.2.7 Transboundary effects

3.2.7.1 Under Regulation 24 of the EIA Regulations, an assessment of transboundary effects should be carried out if a development, which is subject to an EIA application in England, Wales or Scotland, is likely to have significant effects on the environment in another European Economic Area (EEA) State or another EEA State likely to be significantly affected by such development requests an assessment. At this stage, only limited project and environmental information is available and it is not considered feasible to prepare a Screening Matrix for likely significant effects on the environment of another EEA State as advised within Advice Note 7: Environmental Impact Assessment: Screening and Scoping (Planning Inspectorate, 2012). As transboundary effects cannot be ruled out at this stage a screening assessment will be undertaken as the Project progresses and the findings presented within an ES chapter entitled 'Interrelationships and Transboundary Effects'.

3.3 Habitats Regulations Assessment

3.3.0.1 Under Article 6 of the EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the "Habitats Directive"), an assessment is required where a plan or project may give rise to significant effects upon a Natura 2000 site (otherwise referred to as a European site). The Natura 2000 network comprises Special Areas of Conservation (SAC) (designated under the Habitats Directive) and Special Protection Areas (SPA), designated under Directive 2009/147/EC on the conservation of wild birds (the codified version of the earlier Council Directive 79/409/EEC as amended).

3.3.0.2 The requirements of the Habitats Directive are transposed into UK law through the Conservation of Habitats and Species Regulations 2010 (as amended). In addition, it is a matter of UK Government policy (ODPM Circular 06/2005) that sites designated under the 1971 Ramsar Convention for their internationally important wetlands ("Ramsar sites") are also considered in this process, along with potential SPAs ("pSPAs"), or (in England) candidate SACs ("cSACs").

3.3.0.3 Paragraph 3, Article 6 of the Habitats Directive states that:

"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implications for the site and subject to paragraph 4 (see below), the competent national authority shall agree to the plan or project only having ascertained that it would not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public".

3.3.0.4 Under Regulation 61 of the Habitats Regulations an appropriate assessment is required for a plan or project, which either alone, or in combination with other plans or projects, is likely to have a significant effect on a European site and is not directly connected with or necessary for the management of the site.

3.3.0.5 In this case, competent authorities in respect of the Project are considered to include the Secretary of State for Energy and Climate Change in relation to the application for development consent. For the application for a Marine Licence, the competent authority is expected to comprise the Welsh Government acting through its executive agency, Natural Resources Wales (NRW).

3.3.0.6 As the Project is located within European sites, it is appropriate for the potential for effects on such sites to be considered. A stand-alone report to inform the appropriate assessment will be prepared as part of the HRA process and accompany the application for development consent. It is expected that the HRA process will be facilitated by the Evidence Plan process as outlined in Chapter 2 Proposed Approach. This will comply with Regulation 5(2)(g) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009.

3.4 Water Framework Directive

3.4.0.1 The WFD (Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy) was implemented in the UK by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. The fundamental principle of the Directive is to protect water resources and to promote sustainable water use. The WFD was put in place to:

- i. Enhance the status, and prevent further deterioration of, aquatic ecosystems and associated wetlands which depend on the aquatic ecosystems;
- ii. Promote the sustainable use of water;
- iii. Reduce pollution of water, especially by 'priority' and 'priority hazardous' substances; and

iv. Ensure progressive reduction of groundwater pollution¹.

- 3.4.0.2 The WFD creates a mechanism through which each signatory has to aim to bring its water resources to an accepted biological and chemical standard (good ecological/chemical status for natural water bodies; and good ecological potential/good chemical status for artificial/heavily modified water bodies) by 2015; this is based on a series of parameters (quality elements) dependent on the type of water body considered (i.e. rivers; lakes; transitional waters and coastal waters) and its hydromorphological designation (i.e. natural; artificial or heavily modified). In cases where good status/potential cannot be achieved by 2015 a provision is given under Article 4.4 of the WFD extending the deadline to 2021 or 2027. The date has been extended to 2027 in respect of a large number of water bodies. Within Wales the competent authority, as of 2013, for delivering the Directive is NRW (preceded by the Environment Agency (EA)). In England, the EA is the competent Authority.
- 3.4.0.3 The WFD has important implications for planning works that may affect relevant water bodies. It has the effect of controlling such development such that it does not cause deterioration in water body status, or preventing it achieving an improved status under the Directive. Ideally, such development should improve the status of the affected water bodies.
- 3.4.0.4 The WFD (Articles 4.7 and 4.8) provides that, in the event of a project resulting in an adverse impact on a water body which could cause a deterioration in its WFD status, or could prevent actions which are required to raise the WFD status of the water body, then the project must be assessed and justified in the context of the actions proposed to mitigate the adverse impact on the status of the water body. The WFD does allow derogations from its requirements to prevent deterioration in status or to restore water bodies to Good Ecological (or Good Potential) status if the Development meets certain socio-economic and environmental criteria.
- 3.4.0.5 As outlined in Chapter 2 Proposed Approach, a WFD screening assessment will be submitted to the relevant authorities shortly after this scoping report. Following from this a WFD assessment will be undertaken and a stand-alone report will be prepared to accompany the application for development consent and Marine Licence.

3.5 Marine Conservation Zone Assessment

- 3.5.0.1 As outlined in Chapter 2 Proposed Approach, the potential effects of the Project on Marine Conservation Zones will be assessed as part of the EIA process and reported within the ES.

¹ <http://ec.europa.eu/environment/water/water-framework/>

3.6 Consultation

- 3.6.0.1 Before an application for a development consent is submitted, wide consultation with key stakeholders, the local community and interest groups is required. An objective of the PA 2008 is for an application for development consent should have been consulted upon prior to submission. Opportunities to change the parameters of a scheme or its assessment are limited once an application has been made. Consultation prior to submission should help to shape the scheme and application, in order to aid an efficient examination and ensure that material changes to an application are avoided.
- 3.6.0.2 The PA 2008 requires that the following parties be consulted with, and that the consultation responses be taken into account, prior to the submission of an application for development consent:
- i. Section 42 of the PA 2008 requires that consultation is carried out with those 'prescribed bodies' set out in the Infrastructure Planning (Applications, Prescribed Forms and Procedures) Regulations 2009; each local authority defined by Section 43 of the PA 2008 ; and people with an interest in the land as set out in s44 of the PA 2008.
 - ii. Section 47 of the PA 2008 requires the applicant to agree a statement, with the relevant local authority, setting out how it proposes to consult with people living in the vicinity of the development. The applicant must then consult the public in accordance with the proposals set out in this statement.
- 3.6.0.3 Identification of potential stakeholders has been commenced and will be continued as part of the Project's pre-application programme. The consultation programme will be designed to ensure consultation informs the design and assessment iterations. TLC intend to carry out consultation in a manner which fulfils and exceeds the requirements of the PA 2008.
- 3.6.0.4 Broadly, the stages of the consultation to be carried out will be:
- Consultation on the options and preferred option, in order to inform the Project that will be applied for; and
 - Consultation on the proposals for the Project in greater detail, accompanied by a Preliminary Environmental Information Report which will be in the form of a draft Environmental Statement, and other application documents, in order for consultation to inform the final application under the PA 2008.
- 3.6.0.5 Prior to the submission of this scoping report, TLC has undertaken engagement with a wide range of stakeholders, including over 130 individuals and organisations. Engagement with all prospective stakeholders will continue until the commencement of the pre-application rounds of consultation.

- 3.6.0.6 In particular, on the 6 November 2014, a meeting was held with the environmental bodies (Natural England, Environment Agency, Marine Management Organisation, and Natural Resources Wales (invited but could not attend)) to discuss the proposed survey methodologies for certain environmental topics for the Project (namely, marine mammals, fish, ornithology and benthic ecology). Similar engagement has been carried out with the heritage bodies (CADW, English Heritage, Glamorgan Gwent Archaeological Trust and the Royal Commission on the Ancient and Historical Monuments of Wales) to discuss the approach to assessment, prior to the submission of the Scoping Report.
- 3.6.0.7 The stakeholders who have been engaged with and, at this time, may hold a significant interest in the development of the Project include, but are far from limited to:
- i. City of Cardiff Council
 - ii. Newport City Council
 - iii. Natural Resources Wales
 - iv. Marine Management Organisation
 - v. CADW
 - vi. Glamorgan Gwent Archaeological Trust
 - vii. Royal Commission on the Ancient and Historical Monuments of Wales
 - viii. Environment Agency
 - ix. English Heritage
 - x. Natural England
 - xi. Associated British Ports
 - xii. Bristol Ports
 - xiii. The Crown Estate
 - xiv. RSPB
 - xv. Wildfowl and Wetlands Trust
 - xvi. Local cruising and sailing groups
 - xvii. Local angling clubs
 - xviii. Local environmental groups
 - xix. Local residents
- 3.6.0.8 It is considered that the engagement carried out has fulfilled the intention of the advice contained in Advice Note 7, which states that “*applicants may wish to undertake their own informal consultation with the prescribed consultation bodies, or others, to inform the information provided with the scoping request*” (page 6).



Chapter 4.0

Introduction to Environmental Statement

4.0 Introduction to the Environmental Statement

4.1 Overview

- 4.1.0.1 This Chapter will set out the purpose of the Environmental Statement (ES) and will give a general description of the site and the Project. An overview will be provided of the technology, any development that will support or otherwise be delivered along with the integral Project elements, the site and any current activities within the vicinity, and any additional facilities and amenities associated with the development.
- 4.1.0.2 The development described will include what is described in the Planning Act 2008 (PA2008) as “associated development”. In Wales, associated development for a tidal lagoon generation station cannot be included in a development consent at present. However, the EIA for the Project will assess all such proposals, so that the Project as a whole can be understood, as well as all relevant interactions between the elements, however consented or secured.
- 4.1.0.3 The consenting regime, outlined in Chapter 1 of this Scoping Report, for the Project will be clarified. This Chapter will then outline the need for the Project in line with local, national and international policies, and its ability to contribute to renewable energy targets. It will also explain the requirement for an ES under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (the ‘EIA Regulations’) and the Marine Works (Environmental Impact Assessment) Regulations 2007. An overview of the relevance of the Planning Inspectorate Advice Note 9: Use of the ‘Rochdale Envelope’ (2012) (the Note) which provides guidance on the degree of flexibility that is considered appropriate in relation to an application for a NSIP under PA 2008 will be provided. The chapter will then provide an overview of the structure of the ES and any supporting documents.
- 4.1.0.4 A section will be dedicated to describing Tidal Lagoon Cardiff as the applicant, and the team that are supporting the Project.

4.2 References

The Planning Inspectorate (April 2012) Advice Note Nine: Use of the ‘Rochdale Envelope’

Legislation

Infrastructure Planning (Environmental Impact Assessment) Regulations 2009

Marine Coastal Access Act 2009.

Marine Works (Environmental Impact Assessment) Regulations 2007

Planning Act (2008)

Town and Country Planning Act (1990)



Chapter 5.0

Background to the Project and Site Selection

5.0 Background to the Project and Site Selection

5.1 Overview

- 5.1.0.1 This Chapter of the ES will detail the background to the Project detailing why the option of a tidal lagoon has been chosen compared to other energy generating facilities. The Chapter will then provide details of the process undertaken to position the Project at its chosen location between Cardiff and Newport. Finally, the design iterations that have been considered as part of the development of the final layout that will be submitted will be discussed. This will include the reasons for any changes in relation to economic viability, engineering or environmental factors.
- 5.1.0.2 This Chapter of the Scoping Report provides an overview of the above aspects using the current available data and preliminary feasibility studies. An application for the world's first tidal lagoon generating station in Swansea Bay was submitted to the Planning Inspectorate in February 2014, and the site selection and preliminary design of the Cardiff Lagoon described briefly below, has benefitted from the experience and extensive studies undertaken to demonstrate the technology's viability.

5.2 Tidal Lagoons

- 5.2.0.1 For a tidal lagoon site to provide an economic source of renewable energy, it needs to have a large volume of water subject to a high dynamic tidal range and be sited in relatively shallow waters to minimise breakwater construction cost.
- 5.2.0.2 The tidal range of a particular location is dependent, in part, on its position relative to the equator, but more on other physical factors in the area e.g. topography, water depth, shoreline configuration, size of the ocean basin etc. The highest tidal range in the world can be found in the Bay of Fundy in Nova Scotia (>11m), and this is closely followed by the Bristol Channel, UK (>9m).
- 5.2.0.3 Figure 5.1 below illustrates the areas around England and Wales where particularly high tidal ranges are found (coloured yellow/orange). This, combined with the fact that the time of high tide varies around the coast of the UK, gives the potential to produce base load electricity, around the clock, from a reliable, renewable resource.

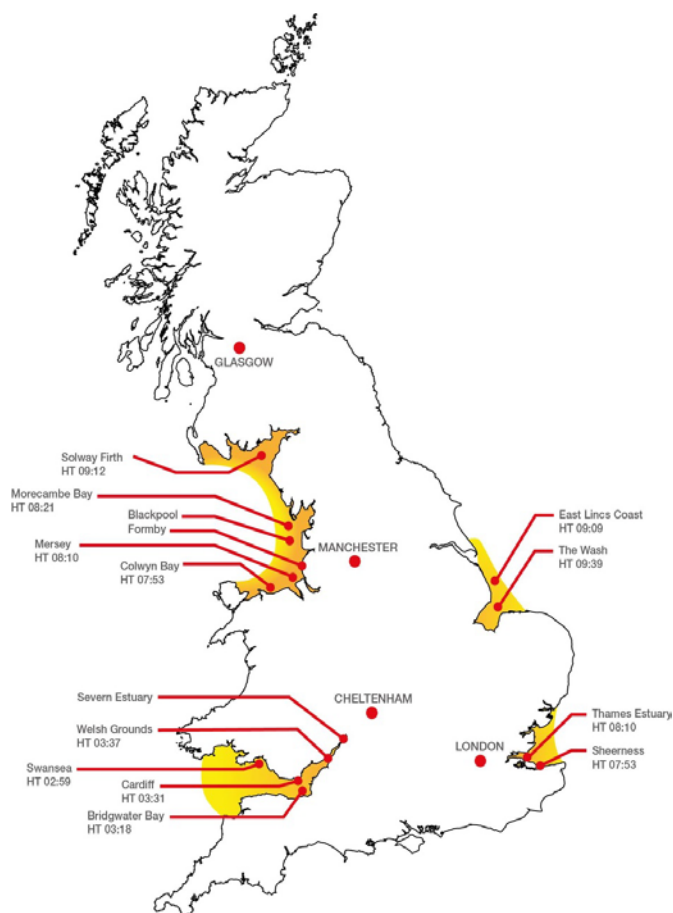


Figure 5.1 Tidal range areas potentially suitable for tidal lagoon projects

5.3 Positioning and preliminary design of Cardiff lagoon

5.3.0.1 The Severn Estuary has been identified as a potential location for renewable energy schemes. This was recently recognised in the Department of Energy and Climate Change (DECC) Severn Tidal Power Feasibility Study which involved an extensive two year study of potential renewable energy generating schemes within the Estuary. This report identified that *“The Severn’s enormous tidal range could provide up to 5% of our current electricity generation from an indigenous renewable source, and bring new employment opportunity both locally and nationally”* (DECC, 2010a). The outcome of the 2010 report was that the Government considered that other options, such as the expansion of wind energy, carbon capture and storage and nuclear power without public subsidy, represented a better deal for taxpayers and consumers at the time of the study. However, it was recognised that factors which would determine the feasibility of Severn tidal power could change over time:

- i. *“if predicted future costs of alternative technologies are expected to become comparable with Severn costs, either due to increasing costs of those technologies or reducing public costs of a Severn scheme;*

- ii. *if technologies playing a key role in meeting 2050 targets are not expected to be deployed as required e.g. increases in costs, effectiveness in reducing emissions is not as great as anticipated, long lead times into building;*
- iii. *if the level of unpredictable intermittent renewables required to meet goals cannot be sustained by the grid and more predictable, though still intermittent, energy is needed;*
- iv. *if a larger and quicker contribution to decarbonising UK electricity supplies is needed than is currently expected; and*
- v. *if the UK ambition for renewable energy or an indigenous power supply increases” (DECC, 2010).*

5.3.0.2 The areas of shallow seabed immediately in front of Cardiff have long been identified as ideal locations for lagoons going back to work by E.M Wilson for the Central Energy Generating Board in the 1970s and more recently in the 2008 Department of Energy and Climate Change (DECC) report by Parsons Brinckerhoff ‘Analysis of the Options for Tidal Power Development in the Severn’ (Figure 5.2). The area considered for the Project was previously referred to as “L3c Peterstone Flats”.

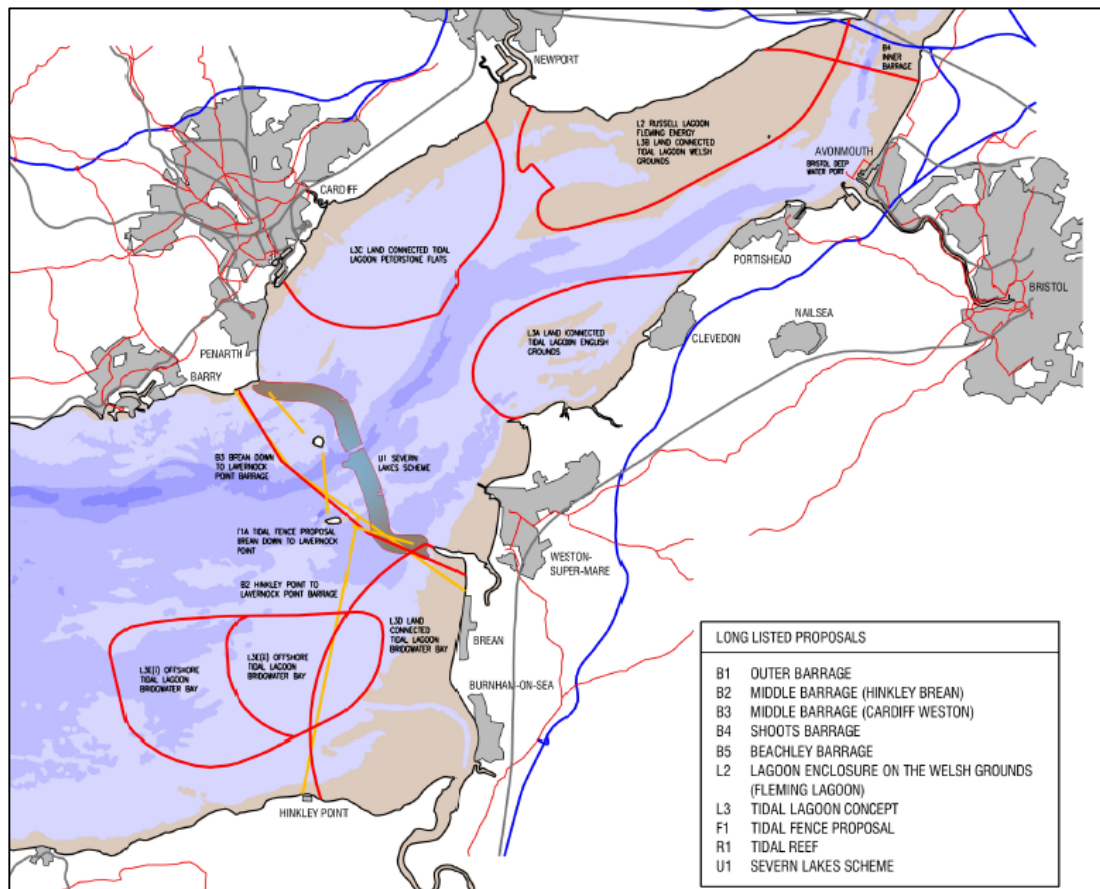


Figure 5.2 DECC Analysis of the Options for Tidal Power Development in the Severn (Parsons Brinckerhoff, 2008)

- 5.3.0.3 The proposed layout of the Project is very similar to the L3c Peterstone Flats layout identified in Figure 5.2. The L3c Peterstone Flats layout (See Figure 5.3 below) was excluded from the shortlist of schemes taken through to the Severn Tidal Power Feasibility Study (2010a) because the levelised costs were higher than the land connected L3d Bridgwater Bay Lagoon and the energy yields were lower (DECC, 2010b). L3d Bridgwater Bay Lagoon was considered to be the better candidate for further study.

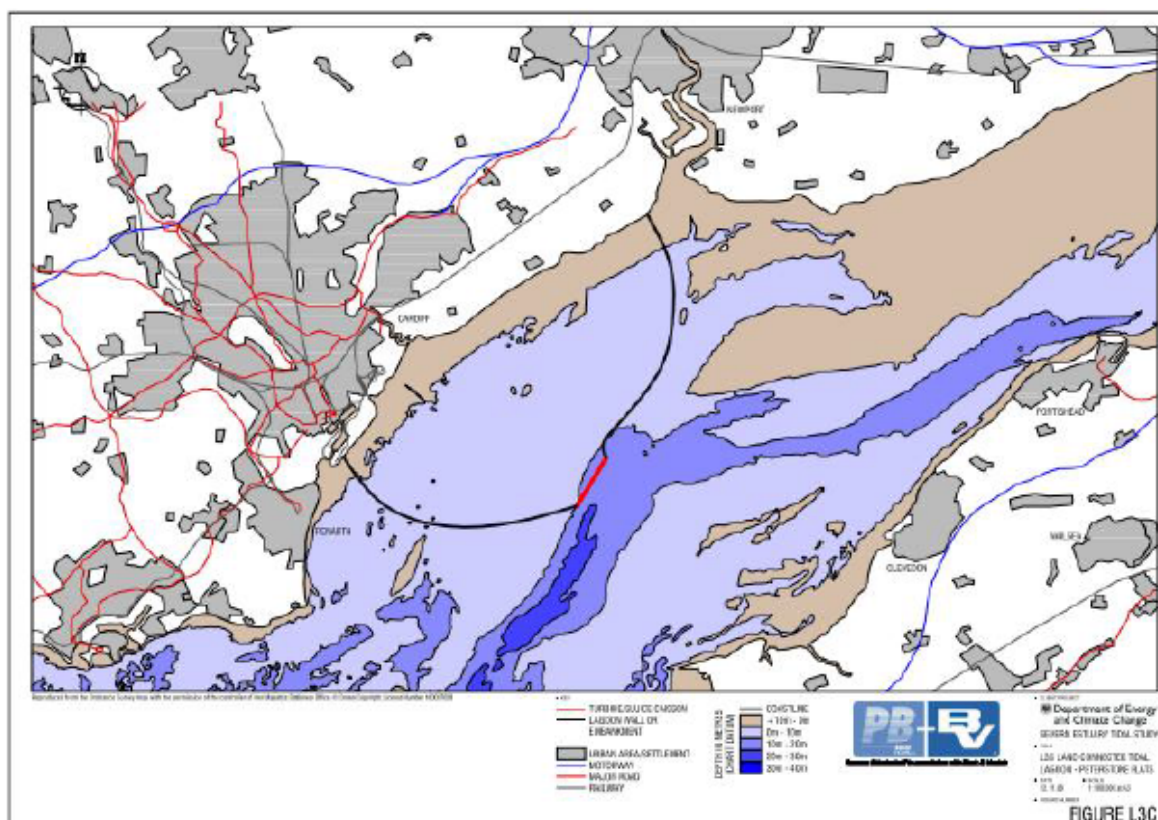


Figure 5.3 L3c Peterstone Flats Lagoon (from IOAR), DECC 2010b

- 5.3.0.4 The DECC Options Definition Report (DECC, 2010b) noted that the L3c Peterstone Flats Lagoon could probably be configured to discharge to areas of the Estuary where the topography would not lead to the energy losses experienced at the Welsh Grounds lagoon. It also noted that the shape of the L3c Peterstone lagoon was more similar to Bridgwater Bay than Welsh Grounds. L3c Peterstone was therefore considered more likely to behave in a similar way to the Bridgwater Bay lagoon and likely to be more optimal as an ebb/flood scheme than an ebb only scheme. The report also acknowledged that the L3c Peterstone lagoon would be likely to benefit from optimisation of the powerhouse location. Following the application of Phase 2 findings, the DECC Options Definition Report (DECC 2010b) confirmed that the costs for the L3c Peterstone Flats Lagoon exceeded £200 per MWh and therefore concluded that there was no case for adding this lagoon option back in to the shortlisted schemes.

5.3.0.5 Having carried out initial design development to optimise the layout and turbine house locations (two/three separate turbine house locations proposed compared to the single turbine house originally considered) and carried out energy modelling based on ebb/flood operation, construction of a tidal lagoon at Cardiff is now considered technically and economically viable. The key factors that have influenced siting the Project between Cardiff and Newport are discussed below. It should however, be noted that the siting and layout are based on available data and further site specific surveys and investigations are being undertaken, including for EIA, which may result in amendments to the layout and arrangement/number of turbine houses in order to maximise energy generation, whilst minimising, as far as is practicable, any potential effects identified as the development of the Project progresses.

Tidal range

5.3.0.6 Tidal range is a key factor for tidal lagoon technology. The Severn Estuary has the highest tidal range in the UK and the second highest in the world. The siting of the Project in Cardiff offers the opportunity to harness this tidal range to produce a significant and consistent generation of base load, clean energy.

Beach profile and depth of water

5.3.0.7 A shallow shelving seabed slope is essential in terms of breakwater construction as the wall height, width of the base of the breakwater and the overall volume of material required is related to the depth of water. If the angle of the breakwater and hence reflection co-efficient is to be maintained, as the water levels increase the overall height of the breakwater increases which in turn affects the width of base. This in turn affects the volume of material required, to a point at which the depth of water would make it uneconomical to build.

5.3.0.8 If the seabed fluctuates in depth or drops off in depth significantly this would cause significant engineering challenges in terms of breakwater design or would require significant subtidal advanced seabed works (cut and fill) prior to breakwater construction. The breakwater has been positioned to closely follow the natural bathymetry along the -2m to -4m (Chart Datum) contour.

5.3.0.9 Turbines need to be positioned in deep water, such that there is adequate head of water for generation at all states of the tide. Dredging may be required to obtain the required depth, but ideally natural areas of deep water can be used.

Landfalls

5.3.0.10 Preliminary energy and cost modelling has previously shown that large offshore lagoon designs are not commercially viable, as the ratio of breakwater length to enclosed area is too low. Consequently, tidal lagoons with land attachments are the preferred option and are essential for producing the amount of power that will be generated by the Project. Suitable landfall locations are therefore a key consideration.

- 5.3.0.11 The use of a western landfall point within Associated British Ports Cardiff Port is seen as an opportunity, as the site is within an existing industrial port which provides significant benefits in terms of: assisting with transport logistics (i.e. supporting delivery of materials by sea); opportunities for supporting facilities during construction and operation; and access to a good local and wider transport infrastructure. The final location of the landfall point within Cardiff Port will be confirmed following further site specific surveys and assessments and ongoing discussions with relevant stakeholders to minimise effects on existing businesses and port operations.
- 5.3.0.12 The eastern landfall avoids urban areas and is positioned to the west of the River Usk to avoid enclosing the river. The River Usk is designated as a Special Area for Conservation for migratory fish (see Chapter 13 Fish, including Commercial and Recreational Fisheries) and is important for navigation (see Chapter 19 Navigation and Marine Transport). It was thus considered appropriate not to enclose this river within the boundary of the lagoon. It is noted that other watercourses enclosed within the lagoon, such as the Rhymney River and reen systems have the potential to support migratory fish. However, on initial review and with the use of variable speed turbines which reduce the likely impacts on migratory fish, it was considered feasible to encompass these watercourses within the lagoon footprint. Further studies will be undertaken as set out in Chapter 13 Fish, including Recreational and Commercial Fisheries, to examine potential effects on these watercourses.

Grid connection

- 5.3.0.13 Feasibility studies and discussions with National Grid are ongoing to identify an appropriate grid connection point.

Preliminary design considerations

- 5.3.0.14 The preliminary design presented within this Scoping Report and discussed further in Chapter 6 Project Description, has been based on consideration of the above factors and an initial review of engineering, economic and environmental factors.
- 5.3.0.15 It is advantageous, in terms of optimising energy output, to even out the distribution of flows into and out of the lagoon wherever possible. This would also reduce potential effects on navigation. As noted above, the single turbine/slucice gate housing structure has therefore been split into two distinct blocks and located to take advantage of the natural tidal flows during filling and emptying the lagoon. Further studies are currently being carried out to examine the need for an additional sluice gate/turbine housing, particularly in relation to potential effects on water quality within the impounded lagoon.

5.4 Summary

- 5.4.0.1 The location of the Project at Cardiff therefore provides favourable seabed conditions to enable delivery of a viable tidal range scheme, with a shoreline that offers an opportunity to produce a large amount of energy that will significantly contribute to UK renewable energy targets. Optimisation of the preliminary design is currently ongoing in order to maximise energy generation, whilst minimising as far as practicable, environmental effects.
- 5.4.0.2 The ES chapter will further discuss the background to the Project, site selection and detail the outcome of the ongoing design iteration process.

5.5 References

DECC (2010a) Severn Tidal Power Feasibility Study: Conclusions and Summary Report

DECC (2010b) Strategic Environmental Assessment of Proposals for Tidal Power Development in the Severn Estuary, Options Definition Report, Version 3, Volume 1

Parsons Brinckerhoff (2008) for DECC, Analysis of Options for Tidal Power Development in the Severn Estuary



Chapter 6.0 Project Description

6.0 Project Description

6.1 Overview

- 6.1.0.1 The Project is a nationally significant energy generating station, which is expected to have a generating capacity of 1800-2800MW. It is proposed to be located on and near the northern shore of the Severn Estuary, with landfall of the lagoon breakwater walls at Cardiff Docks in the west and near to the mouth of the River Usk in the east (on the west bank of the River).
- 6.1.0.2 The Project spans the southern edges of the Wentlooge Levels, an area of agricultural land reclaimed from the sea, together with low-lying estuarine alluvial wetland and intertidal mudflats. The breakwater walls encompass an area of approximately 70km² of the seabed and foreshore.
- 6.1.0.3 The total length of the breakwater is expected to be approximately 25km. The western landfall will be positioned to the south of the Queen Alexandra Dock, within Cardiff Docks, and will extend in a curve southwards into the Severn Estuary. At its furthest point from land, the breakwater is likely to extend 8km offshore. The lagoon will have around 60-90 turbines and 20-30 sluice gates which will be situated in 2-3 turbine and sluice gate housing structures. The final arrangement and positioning/number of these structures will be developed during the EIA process thereby optimising energy generation whilst minimising potential environmental effects, such as water quality, fisheries and sedimentation. An indicative layout is provided in Figure 6.1.
- 6.1.0.4 As can be seen in Figure 6.1, the two turbine and sluice gate housing structures are located on the western section of the breakwater, one approximately 2km from the western landfall, and the other a further 5km offshore. These are positioned to take advantage of the natural and predicted tidal flows within the Severn Estuary during filling and emptying of the lagoon. From the second turbine sluice gate structure, the breakwater continues northeast up the estuary before heading north towards the shore. The eastern landfall attaches in the Wentlooge area of Newport, approximately 2km to the southwest of the River Usk. This area is comprised primarily of reclaimed agricultural land, as well as areas of tidal marsh.
- 6.1.0.5 The footprint of the proposed lagoon encompasses the mouth of the River Rhymney. The footprint also encompasses existing outfalls owned and operated by Dŵr Cymru - Welsh Water and others.

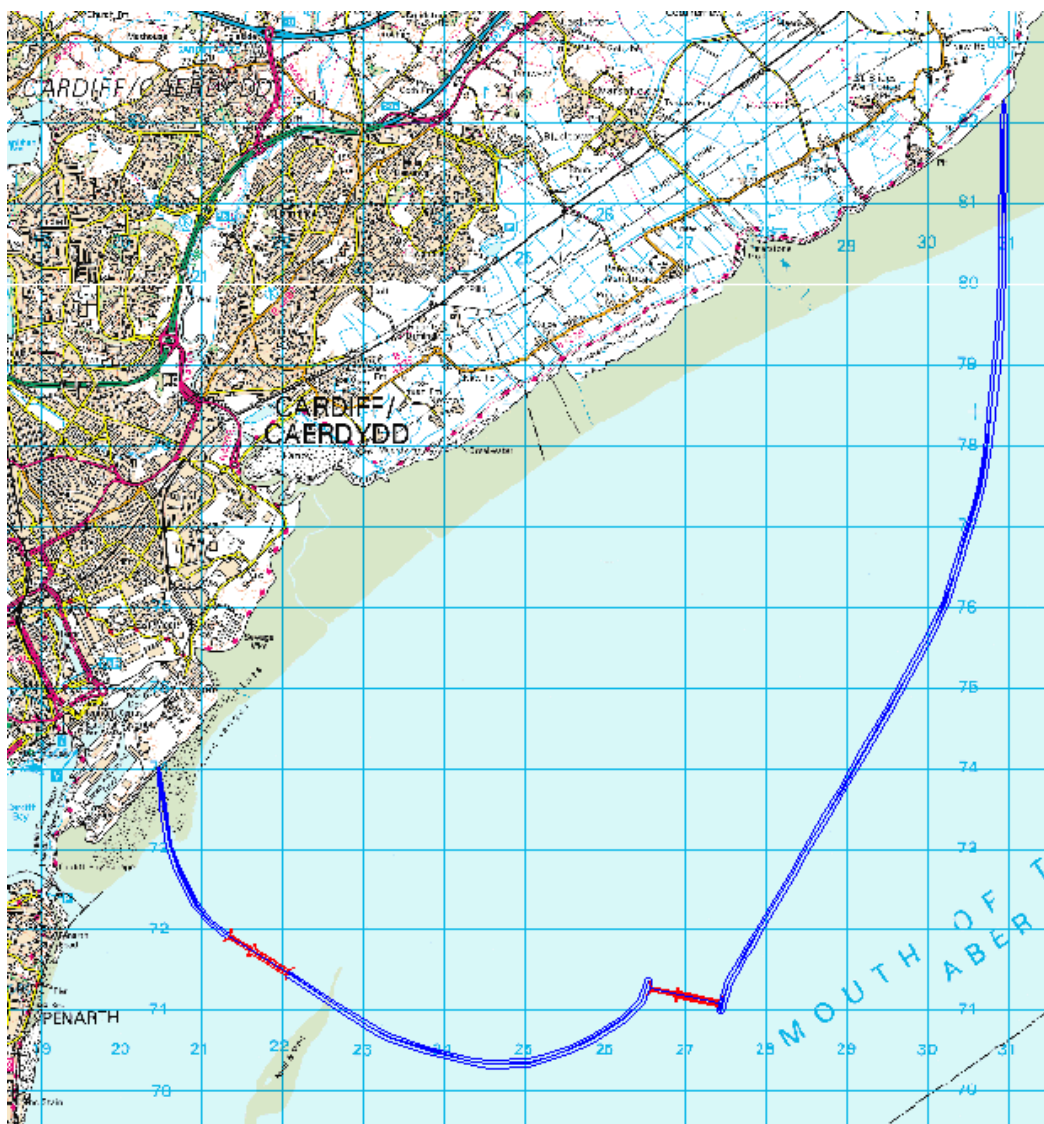


Figure 6.1 Location and layout of the Project

- 6.1.0.6 On the ebb tide, the Project will generate electricity by holding back water within the tidal lagoon to create sufficient head, in relation to the ebbing tide outside the lagoon. This water will then be released through the turbines such that this store of energy can be turned into electric power. The electricity will be generated as water flows through bi-directional turbines, located in the turbine and sluice gate housing structures. This process will be repeated on the flood tide with water being prevented from entering the lagoon until sufficient head is created.
- 6.1.0.7 The electricity generated will be fed into the National Electricity Transmission System (NETS). Options for grid connections will be developed in conjunction with National Grid.
- 6.1.0.8 The Project requires the following elements to generate electricity, which include:
- i. breakwater;

- ii. concrete turbine and/or sluice gate housings;
- iii. turbines and sluice gates located within the housings;
- iv. operations and maintenance access upon the structures;
- v. cable works within the breakwater and connection to an appropriate substation; and
- vi. structures located upon the turbine/sluice gate housing.

6.1.0.9 The Project will comprise the key on and offshore elements that are identified below:

6.1.0.10 **Offshore works:** The offshore works during the construction and operation phases comprise the following: turbines and sluice gates, their housing structures, gantry cranes and other facilities, such as generators and switchgear; temporary cofferdams or caissons to facilitate the construction of the turbine and sluice gate housing structures; temporary rock storage areas; breakwater and associated dredging works; access road on the breakwater including lighting structures and shelters; operation and maintenance (O&M) facilities, emergency facilities; navigation facilities including locks and lighting.

6.1.0.11 **Onshore works:** Provision of construction support sites including access routes for construction traffic, land creation works, lay-down areas and temporary rock stockpile areas.

6.2 Project elements

Breakwater

6.2.0.1 The breakwater will form the impounding structure for the lagoon, each section of the breakwater acting to hold the water behind/upstream of the turbine/sluice gate houses, with the purpose of creating a difference in water level between the lagoon and the sea outside.

6.2.0.2 It is anticipated that the breakwater will be constructed as a conventional rock-armoured, sand filled and quarry run, gravity structure. The sediment/quarry run core will be held in position, with layers of rock and rock armour placed on the outside of the structure for protection; the thickness and quantity of the rock armour layers will vary depending on breakwater location/exposure. The option of using concrete caissons for the deeper sections, protected by rock armour, will also be evaluated. Where possible, selected appropriate dredged material (sand and gravel) from within the footprint of the lagoon will be used to fill the core of the breakwater. Sediment analysis will be undertaken and processed for the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) suite of determinants by a CEFAS accredited laboratory to determine suitability.

- 6.2.0.3 The angle of the rock armour that forms the slope of breakwater gives stability to the structure and also reduces reflection of waves. The reflection coefficient of the lagoon breakwater will be subject to further design iteration.
- 6.2.0.4 As mentioned previously, the breakwater is expected to be approximately 25km from landfall to landfall. It is expected that it will be a maximum of 17m above Chart Datum (CD) in height. The breakwater will be a maximum of 120m in width at the base (at the deepest sections).
- 6.2.0.5 The provision of locks within the breakwater is being considered for inclusion in further design iterations to minimise impact on maritime users of the impounded area.
- 6.2.0.6 A typical section through a breakwater is shown in Figure 6.2 at the end of this Chapter.
- 6.2.0.7 The source for the external rock armour, and balance of core fill material, for the lagoon breakwater has not yet been finalised, although a number of options are currently being considered. The approximate volumes required for the breakwater, based on initial calculations on the current design iteration, are:
- Approximately 10 million m³ sandy material for the core of the breakwater;
 - Approximately 5.5 million m³ of quarry run for the outer core of the breakwater; and
 - Approximately 2.5 million m³ of rock armour for the inner and outer layers of the armoured outer section of the breakwater.
- 6.2.0.8 For the purposes of the EIA it will be assumed that the rock and fill material will be sourced from existing operational sites or sources, and that any potential effects and required mitigation (e.g. noise, dust, ecology etc.) resulting from winning those materials would be addressed under the permits relating to those sites.
- 6.2.0.9 Rock and fill material for the lagoon is likely to be brought directly to site by sea. However, other materials may also be brought in by road and/or rail. Whichever transport option is identified, the potential effects will be addressed within the appropriate chapters of the EIA. If at all practical, the sandy material for the core of the breakwater will be dredged from within the footprint of the lagoon area.
- 6.2.0.10 The breakwater will be constructed on two fronts: land based equipment will be used where the water depth does not allow access for marine based equipment, and marine based equipment for the remainder. The landward connection of the breakwater will facilitate the transport of construction materials, and the movement of construction workers, to and from the offshore site for other aspects of construction.

- 6.2.0.11 Both the land and marine based construction will follow conventional breakwater construction methods. These can be described as advancing a berm of core fill, protected with a geotextile or rock filter layer to prevent wash-out of the finer material, followed by the placement of rock armour protection.
- 6.2.0.12 The land based equipment is likely to consist of bulldozers, rock/sand dump trucks and excavators. The marine based equipment is likely to be a combination of supply barges, hopper barges, dredgers, excavators and cranes supported by tugs.

Turbine and sluice gate housing structures

- 6.2.0.13 The turbine and/or sluice gate housing structures are large, reinforced concrete structures comprising individual turbine and sluice gate housings. It is expected that there will be 2 separate turbine and/or sluice gate housing structures (however this will be subject to confirmation during design development and with the findings from environmental topic studies). At this stage of the design, initial modelling has demonstrated that the most efficient configuration of the turbine houses is likely to be in locations along the western breakwater, approximately 2km from the western landfall attachment, and 5km further along the breakwater (see Figure 6.1).
- 6.2.0.14 The turbine and sluice gate housing structures are expected to be up to 800m in length and 75m wide. The height of the concrete structure is likely to be up to 20m above Chart Datum (CD) at its highest point. Maintenance structures, such as cranes, will be located on top of the housing and these are likely to be up to 30m above CD. The purpose of the turbine and sluice gate housing structures is to house the turbines and sluice gates which form the energy generating station, and through which all tidal energy generation will occur.
- 6.2.0.15 Cross sections through a typical turbine and sluice structure are shown in Figures 6.3 and 6.4 at the end of this chapter.
- 6.2.0.16 A scour protection mattress will be constructed at seabed level, which will extend on either side of the housing structures. A potential design for a scour protection mattress could comprise a double layer of geotextile fabric placed in position and filled with a concrete/grout mixture.
- 6.2.0.17 In order to function efficiently, the turbines and sluice gates have to be submerged at all states of the tide. To achieve this, the seabed will be gradually deepened, on either side of the turbine and sluice gate structure, to create a gently-sloping bowl across the base where it meets the scour protection mattress. The angle of the slope will ensure that it remains stable and will minimise scour and erosion.
- 6.2.0.18 To protect the turbine and sluice gate structures, both during construction and operation, and to ensure a more visible demarcation, some form of safety zone will be provided. This may consist of a number of dolphin piles, or a visual separation

barrier such as floating boom, which will be appropriately painted and lit. This will be discussed and agreed with the Maritime and Coastguard Agency (MCA) and Trinity House, the national lighthouse authority.

- 6.2.0.19 Consideration will be given to two possible methods of constructing the concrete housing structures: in-situ construction or off-site pre-fabricated (caisson type) structures. The pre-fabricated structures will be either in part or whole.
- 6.2.0.20 Depending on the foundation requirements, piling may be required in the form of driven or bored piles. Any ship berthing and mooring facilities for construction and/or operation, either inside or outside the lagoon, will most likely be piled steel structures.
- 6.2.0.21 The in-situ construction methodology will require a de-watered temporary cofferdam constructed from either a rubble breakwater, steel sheetpiles, caissons, or a combination thereof. Once the cofferdam is de-watered the construction will follow conventional concrete construction methods typical for these types of structures.
- 6.2.0.22 Typically, the base of the temporary cofferdam will be at a depth of about 16m below the low sea water level thereby requiring a substantial cofferdam structure to ensure safety during all phases of the construction. Construction within the cofferdam will be isolated from the weather risks associated with a marine based operations and will allow construction to be carried out throughout the year.
- 6.2.0.23 The intention will be for the cofferdams to be linked to the shore with a completed portion of the breakwater to facilitate access of personnel and construction equipment.
- 6.2.0.24 As an alternative construction methodology, pre-fabricated caissons would be considered for some or all of the concrete structures.
- 6.2.0.25 This would involve the concrete structures being constructed in part or whole off-site in either a commercial dry-dock or bespoke facility. Although the actual sizes of the caisson may vary, and will only be finalised during the detailed engineering phase, the installation methodology will be similar irrespective of final caisson sizes.
- 6.2.0.26 If caissons were to be used, they would be built as a “box-type” structures that will be able to float when launched into the sea. The caisson would either be constructed complete before launching, or to a point where they can be launched and the remaining construction completed while they are floating. A third option that may be considered would be to install a part caisson and complete the construction in-situ.

- 6.2.0.27 For all of the above options the caissons would be launched into the sea, towed to site by a suitable tug and placed on a prepared stone foundation bed by ballasting the caisson with sea water. Once the caisson is in a stable condition the scour mats and other supporting works would be completed.
- 6.2.0.28 The foundation for the caissons will be prepared by dredging the seabed to the required depth and installing a stone foundation bed. The stone foundation bed would take the form of a crushed rock bed that would be installed to the correct level to receive the caissons.
- 6.2.0.29 The pre-fabricated caisson option would require marine based construction activities and would include dredging, underwater placement of a stone foundation bed (involving tugs, jack-up barges and stone supply barges) and caisson towing (involving tugs).
- 6.2.0.30 Temporary onshore construction compounds will be required for either of the above construction methods. These are likely to be located at the most appropriate places near both the western and eastern land falls as required.

Turbines and sluice gates

Turbines

- 6.2.0.31 The purpose of the turbines is to capture energy from tidal flows for the generation of electricity. There will be up to approximately 60-90 turbines. The turbines are expected to be variable speed, bi-directional bulb turbines, able to generate power with water flow entering the lagoon on the flood tide and leaving the lagoon on the ebb tide.
- 6.2.0.32 A bulb turbine derives its name from the shape of the upstream bulb-shaped watertight casing (although in this case the turbines are bi-directional with the bulb facing into the lagoon, as most efficiency is gained from the ebb tide. A variable speed bulb turbine uses power electronics to control the rotational speed of the turbine at the optimum efficiency point for a particular head of water and flow. Therefore, the output frequency from the generator is variable and it uses power conversion electronics to convert the frequency of the power output to 50Hz to match the frequency of the NETS.
- 6.2.0.33 The exact required diameter of the turbines is yet to be determined, but they are expected to be approximately 7-8.00m.
- 6.2.0.34 Variable speed turbines have the ability to be used in a pumping mode. As such, this could be utilised at the end of each tidal cycle to equalise the water levels inside and outside the lagoon as far as possible before the turn of the tide. The ability to pump at the end of a tide increases the total volume of water that can pass through the

turbine on each tidal cycle. This practice will also reduce the loss of intertidal area within the footprint of the lagoon.

- 6.2.0.35 It is not proposed to install physical screens on the turbine structure for a number of reasons. In terms of potential damage, smaller debris/objects are not a risk to the size of turbines proposed, as the openings in between the turbine blades and between the wicket gate blades are large. In addition, due to the anticipated flow velocities through the turbines it would be difficult for such objects to cause a blockage. In terms of large objects, like trees, these could in principle cause damage or blockage to the turbines. However, large objects such as these are rarely found in the sea and if present, they would be most likely to remain on the surface of the water, rather than be pulled down in to the water column towards the intake. Notwithstanding this, emergency stop procedures will be in place to address any risk of debris/turbine collision (striking of a moving object against a fixed object) occur.
- 6.2.0.36 In terms of risks to navigation and human safety arising from the turbines, the safety zone enacted should reduce to an acceptable level any chance of vessel collision or human interaction with the turbines.

Sluice gates

- 6.2.0.37 It is expected that there will be approximately 20-30 sluice gates located across the turbine housing structures. The clear opening of each sluice gate at the narrowest part is expected to be approximately up to 14m wide and 15m high. The sluice gates are an additional mechanism (as well as the turbines) to control the water entering and leaving the lagoon. The sluice gates will be opened and lowered by mechanical means and controlled remotely from the control centre. The gates remain closed until towards the end of each cycle when they are then opened to allow the water levels in and outside the lagoon to level out and so create additional hydraulic head for the next tidal cycle.

Installation

- 6.2.0.38 The installation of the turbines and sluice gates, and associated electrical installation, would follow the construction of the turbine and sluice gate house.
- 6.2.0.39 The turbines will either be assembled at the site, or be delivered from an assembly site elsewhere. If the turbines were to be assembled at the site it would require the establishment of a temporary turbine assembly facility. This facility would either be close to the Cardiff site or in the temporary cofferdam. If turbines were to be assembled in Cardiff, it is likely they would be transported to the turbine housings by heavy lift trailer.

- 6.2.0.40 Turbines assembled elsewhere would be delivered to site by either a transport barge or heavy-lift vessel. On arrival at site the turbines would be offloaded onto heavy lift trailers and transported to the turbine housing structure for installation.
- 6.2.0.41 The possibility of installing the turbines in the turbine house caisson structures whilst they are being constructed would also be considered.

Other project elements

Access

- 6.2.0.42 It is anticipated that access will be required to the landfalls of the breakwater for construction, operations and maintenance. However, it is anticipated that the majority of materials required for construction will be transported by sea. The extent of any works that may be required to the local network is to be confirmed.

Grid connection

- 6.2.0.43 The capacity of the export cable for connection to the NETS will be 400 kV. Several opportunities for grid connections exist in the local area. Options for connecting the lagoon will be developed in conjunction with National Grid.

Compensation

- 6.2.0.44 At this early stage, any consideration of compensatory measures must be taken in the context of the HRA being in its early stages, and so the extent of any compensatory requirement has not yet been quantified. However, in line with the precautionary approach, it is considered appropriate to consider this eventual requirement in the context of the Project, as compensation measures must be secured before consent for a proposal is given. It is intended that the Ecological Enhancement Project (EEP) (Chapter 2) will provide the framework for delivery of any statutorily required compensatory habitat. Compensation is discussed further in Chapter 26 Mitigation, Monitoring and Compensation.

6.3 Construction period

- 6.3.0.1 The construction of the Project will commence following the grant of development consent, Marine Licence, other consents as required (see Chapter 7), and discharge of any relevant requirements or conditions prior to construction. Once construction commences it is anticipated the tidal lagoon will take 4-5 years to construct with the first power output predicted to be in 2022.

6.4 Operation and Maintenance

- 6.4.0.1 The Project is intended to have an operational life of 120 years. Notwithstanding continued maintenance, the turbines have a design life of 50 years. After this time

it is expected that they would be replaced. It is also expected that other elements of the Project (such as the breakwater) will be capable of being assessed at this time to ensure their suitability for continued operation up to the full intended design life.

- 6.4.0.2 Operational and maintenance facilities will be included in the Project either within the turbine housing, on-land or both. As part of the operation of the lagoon, maintenance dredging will be required in order to maintain the amount of water which is capable of being held in the footprint of the Project, and to avoid other effects of siltation on the operation of the generating station.

6.5 Decommissioning

- 6.5.0.1 An outline decommissioning scheme will be prepared as part of a DCO application in line with the requirements of the Energy Act 2004, the Decommissioning of offshore renewable energy installations under the Energy Act 2004 (DECC, 2011) and the DECC (2015) Addendum to decommissioning of offshore renewable energy installations under the Energy Act 2004 Guidance notes for industry: Tidal Lagoons¹. The DECC (2015) guidance notes state:

The scope of any decommissioning programme will depend on the specific circumstances of each installation, having regard to the principles and standards set out in the Offshore Renewables Decommissioning Guidance. By way of example the scope could include: decommissioning in the event of developer / operator insolvency or complete removal. As the removal of tidal lagoons may impact on the local environment the scope should also consider on-going maintenance of some or all of the structure at the end of the installation's operational life.

- 6.5.0.2 It is considered that wholesale decommissioning is not appropriate for the Project. It is expected that decommissioning of the Project will involve the retention of breakwater, and the removal of the turbines, metals and plastics relating to the energy generating installation. This is in order to preserve the established biodiversity at the time when operation ceases, and the potential continuation of a public amenity. The tide will flow freely around the remaining structures.

¹https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/399561/addendum_to_guidance_on_decommissioning_of_orei_under_the_Energy.pdf



Figures

100
10
0
Millimetres

DO NOT SCALE

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION

1. EXPOSED LOCATION, WEATHER RISK, TIDAL WORKING
2. NAVIGATION RISK/VESSEL COLLISION

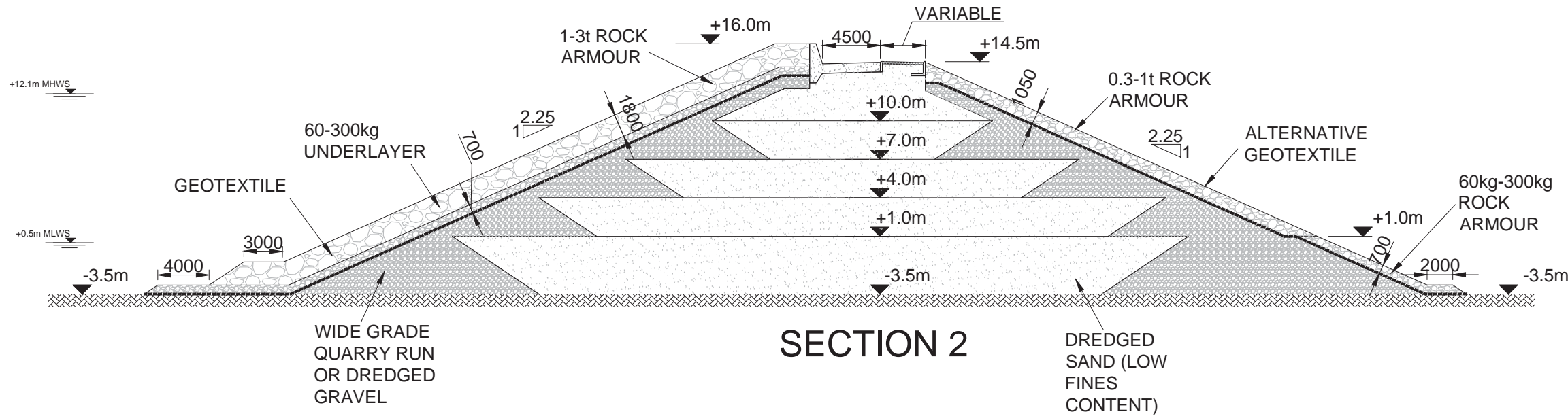
MAINTENANCE/CLEANING

DECOMMISSIONING/DEMOLITION

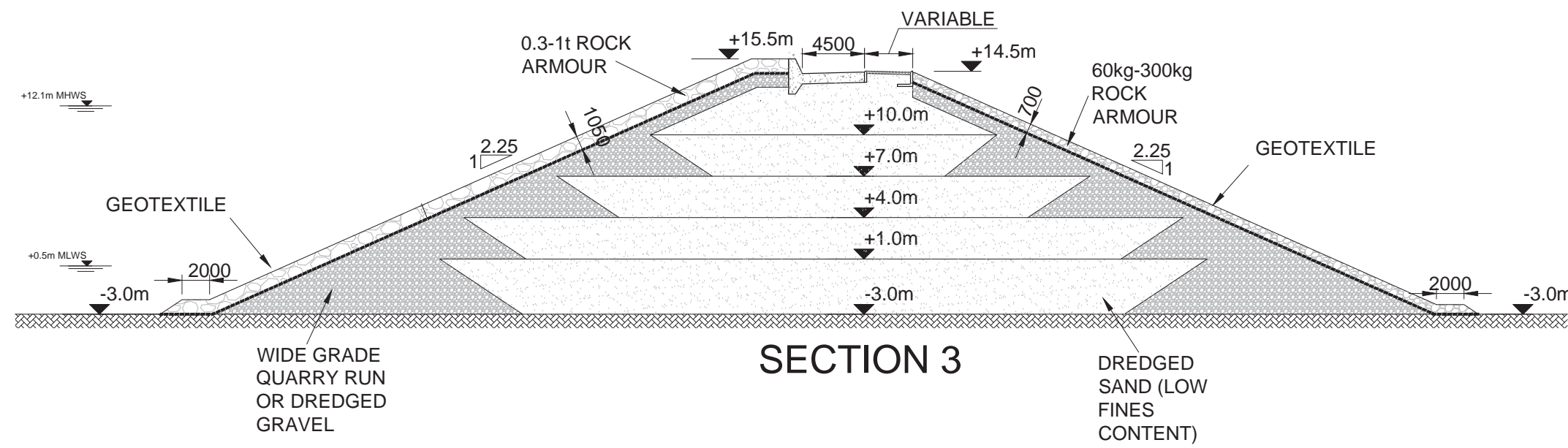
It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE
2. ALL LEVELS ARE IN METERS TO CHART DATUM (CD).



SECTION 2



SECTION 3

Rev.	Date	Description	By	Chk'd	App'd
A	27/02/2015	INITIAL ISSUE	JDE	IDR	

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Client
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Project Title
TIDAL LAGOON CARDIFF

Drawing Title
**FIGURE 6.2 (INDICATIVE ONLY)
 PERMANENT BREAKWATER
 BUND WALL SECTIONS**

Scale	Designed	Drawn	Checked	Authorised
1:200	JDE	JDE	IDR	
Original Size	Date	Date	Date	Date
A1	26/01/15	26/01/15	26/01/15	
Drawing Number	Revision			
TLC-ATK-00-XX-DR-C-0002	A			

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Millimetres

DO NOT SCALE

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION

MAINTENANCE/CLEANING

DECOMMISSIONING/DEMOLITION

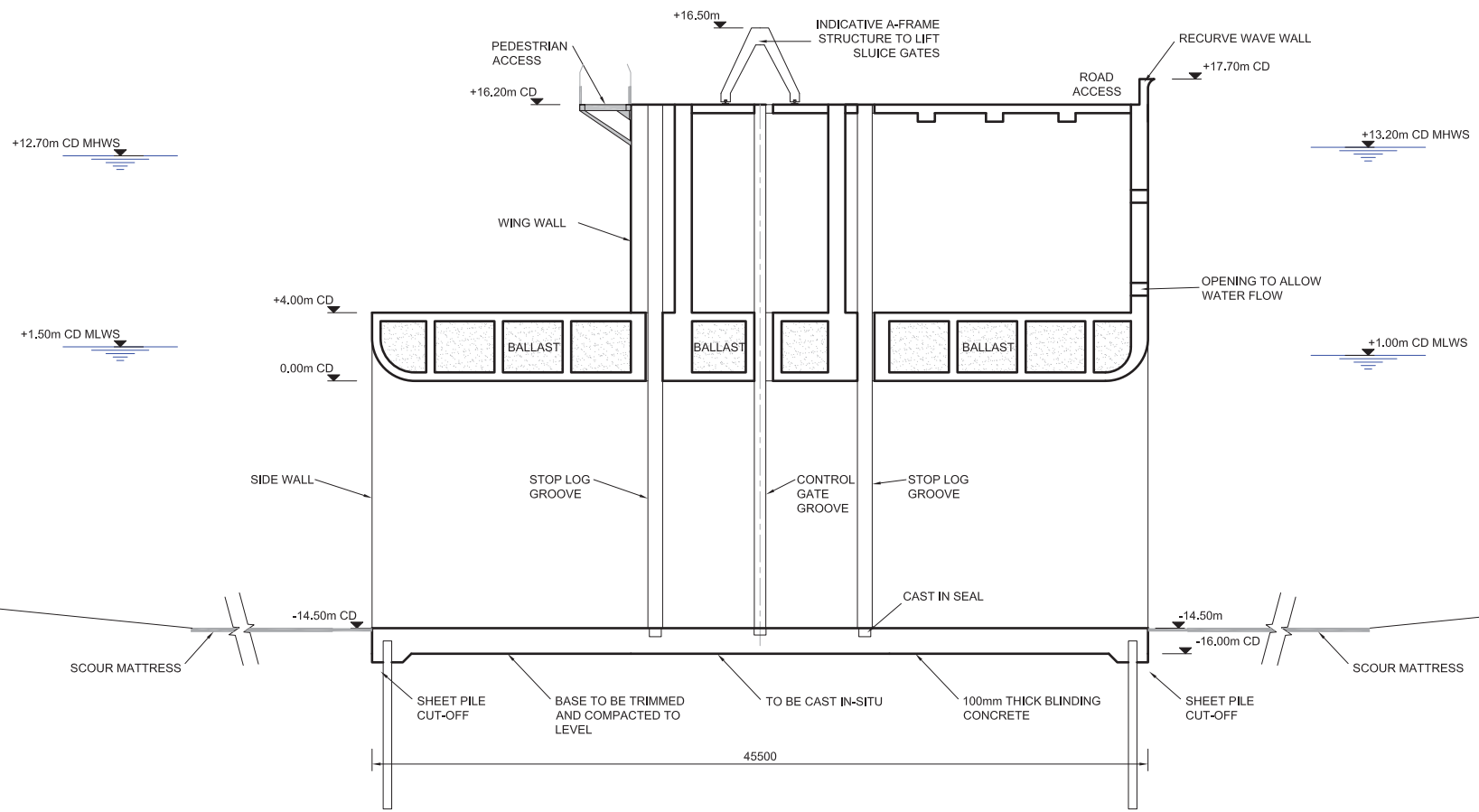
It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

NOTES:

- 1. ALL DIMENSIONS ARE IN MILLIMETRES (mm) UNLESS OTHERWISE STATED.
- 2. ALL LEVELS IN METRES TO CHART DATUM (CD).
- 3. DESIGN NOT OPTIMIZED FOR PROPORTION OF STRUCTURAL CONCRETE AND MASS CONCRETE

BASIN

SEA



SECTION A-A
Scale 1:200

Rev.	Date	By	Description	Chk'd	App'd
A	23/01/15	JDE	ISSUE FOR COMMENT		

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**FIGURE 6.4 (INDICATIVE ONLY)
SLUICE GATE HOUSE
PRELIMINARY GENERAL SECTION**

Scale	Designed	Drawn	Checked	Authorised
1:200	JDE	JDE		
Original Size	Date	Date	Date	Date
A1	04/02/15	21/01/15		

Drawing Number: **TLC-ATK-00-XX-DR-C-0004**

Revision: **A**



Chapter 7.0

Planning and Policy Context

7.0 Planning and Policy Context

7.1 Consenting framework

7.1.0.1 The Project is intended to have an offshore installed capacity in excess of 100MW and therefore qualifies as a Nationally Significant Infrastructure Project (NSIP) under section 15(3) of the Planning Act (PA) 2008, which must be authorised by the grant of development consent under section 31 of the PA 2008. The Project will also require consents from the relevant Local Authorities under the Town and Country Planning Act (TCPA) 1990.

7.1.0.2 As the Project is in Welsh waters, an application for a Marine Licence (ML) will also be sought from Natural Resources Wales (NRW) on behalf of the Welsh Government (WG). The ML must be sought in relation to the construction of an offshore generating station and for the carrying out of dredging for capital works. See the table below for consideration of potentially relevant consenting routes.

Table 7.1 Elements of the Project and indicative consenting routes.

Element	DCO	ML	TCPA 1990
Breakwater	X	X	
Turbine house concrete works	X	X	
Operations and maintenance access upon the breakwater	X		
Operations and maintenance facilities	X		
Cable works within the breakwater	X		
Other associated grid connection works that do not form an NSIP			X
Compensatory habitat			X
Other associated facilities (such as visitor facilities)			X
Access (works to highways associated with the Project)			X

7.2 Planning policy

7.2.0.1 The following policy documents set out criteria relevant for determining a consent and will be considered where relevant in the ES. There are broader policies that are relevant and important considerations, but these do not set out relevant information for EIA. The following policies inform the scope of matters which need to be addressed through EIA and are not an exhaustive list of policies which may be considered important and relevant matters for determining the application.

Overarching National Policy Statement for Energy (EN-1)

7.2.0.2 As a Nationally Significant Energy Project (NSIP), NPS EN-1 will be applicable to the consideration of the Project. Section 3.3 sets out the need for new nationally

significant energy generating projects. Part 4 (assessment principles) will be considered where relevant in the assessment.

National Policy Statement for Renewable Energy (EN-3)

- 7.2.0.3 This sets out the national policy considerations for renewable energy projects, including that the need for renewable energy projects is established. The assessment principles that relate to coastal and marine developments will be considered where relevant in the assessment.

National Policy Statement for Electricity Networks (EN-5)

- 7.2.0.4 This policy statement sets out policy in relation to electricity networks. The majority of the statement concerns overhead lines that are subject to an application for a development consent order. The policy provides principles for the assessment for overhead electricity infrastructure which would be taken into account should this form part of the assessed Project.

National Policy Statement (NPS) for Ports

- 7.2.0.5 NPS for Ports contains the decision-making framework for nationally significant port developments. The policy also provides a framework for the assessment of nationally significant port developments. It will be considered where relevant to analogous aspects of a tidal lagoon development. The policy will also be taken into account in relation to nearby existing ports.

Addendum to decommissioning of offshore renewable energy installations under the Energy Act 2004: guidance notes for industry (2015)

- 7.2.0.6 In this addendum to the existing guidance¹, it was decided by the Government that tidal lagoons attached to land should be subject to the requirements of the Energy Act 2004, in that offshore renewable energy schemes should submit a decommissioning scheme to be agreed by the Secretary of State. The assessment will take into account the principles of decommissioning contained in this and **Decommissioning of offshore renewable energy installations under the Energy Act 2004**. A decommissioning scheme will be submitted to the Secretary of State at the appropriate time.

UK Marine Policy Statement (marine plans)

- 7.2.0.7 The UK Marine Policy Statement (MPS) was published in March 2011. The statement establishes frameworks for preparing Marine Plans and decision-making for proposals affecting the marine environment. It aims to ensure that activity within the marine environment contributes to the aim of sustainable development.

¹ Decommissioning of offshore renewable energy installations under the Energy Act 2004 (DECC, July 2011)

7.2.0.8 This policy statement will be taken into account in lieu of the Welsh National Marine Plan, which is currently under consultation.

Planning Policy Wales

7.2.0.9 Planning Policy Wales Edition 7 (PPW) was published in July 2014 with the purpose of setting out the WG's land use planning policy. The policies contained within PPW provides a steer to local planning authorities in the production of their Local Development Plans (LDP) and informs development management decisions. This is especially in the absence of designated Local Plans. PPW is supported by a series of Technical Advice Notes (TAN's) (see below).

7.2.0.10 The policy commits the WG to optimising renewable and low carbon energy generation. Planning authorities are directed to facilitate the development of all renewable technologies in a sustainable manner. The policy states that local authorities should take into account the following aspects when considering renewable energy technologies:

- i. the wider social, environmental and economic benefits;
- ii. impacts on natural heritage, the coast and the historic environment;
- iii. minimisation of impacts on local communities;
- iv. avoidance, mitigation and compensation of identified adverse impacts;
- v. impacts of climate change on the Project and whether measures to adapt to climate change will have any further effects;
- vi. grid connection issues; and
- vii. effects on the transportation network.

7.2.0.11 These matters will be considered in the assessment.

7.2.0.12 PPW identifies the relevance of impacts on natural heritage and the coast for renewable energy development². It states that the planning and design of a project can minimise the potential for conflict and create new opportunities sustainable development³. To meet biodiversity objectives, approaches to development should be taken into consideration which: create opportunities to enhance biodiversity; prevent biodiversity losses; or compensate for losses where damage is unavoidable⁴. TAN5 (see below) advises on these matters and they will be considered in the assessment.

7.2.0.13 PPW recognises the value of landscapes which have been designated on an international, national and local scales and states that appropriate weight should

² PPW Edition 7, Section 5

³ PPW Edition 7, paragraph 5.1.3

⁴ PPW edition 7, paragraph 5.4.5

be afforded to these. Landscape value and designations will be taken into account in the assessment⁵.

7.2.0.14 PPW establishes the importance of the coast for the conservation of the natural and historic environment and the economic potential for it to be used in a sustainable manner. The coastal location of a development should be demonstrated to be essential⁶, and should be resilient to the effects of climate change over its lifetime. There should also be consideration of risks from climate change on adjacent and surrounding places as a result of coastal development⁷. These matters will be taken into account in the assessment.

7.2.0.15 PPW sets out flooding as a material consideration in all developments, including climate change. Flooding as a hazard involves the assessment of the risk and consequence of flooding⁸. TAN 15 advises how this assessment should be carried out.

TAN 5: Nature Conservation and planning

7.2.0.16 This TAN document provides advice about how the land use system should contribute to protecting and enhancing biodiversity and geological conservation. It provides advice on the key principles which may be taken into account in the assessment, including: ensuring the UK's international and national obligations are met; the provision of net benefits for biodiversity; and reducing the effects of climate change through the reduction of emissions.

TAN 8: Planning for Renewable Energy

7.2.0.17 The purpose of TAN8 is to provide technical planning guidance on the delivery of renewable energy projects in order to help achieve WG targets. With regard to tidal range, paragraph 11.1 of Annex C briefly discusses the potentially "significant" impacts of a barrage scheme, along with the large capital cost, and acknowledges that tidal lagoons exist as an alternative. The principles of the advice regarding the consideration of renewable energy projects will be taken into account in the assessment where relevant.

TAN 14: Coastal planning

7.2.0.18 TAN14 sets out the issues for consideration by local authorities in relation to development in the coastal zone. The key issues relating to coastal planning are defined by this advice as: likely effects on physical and biological process along the coast; potential effects on mineral, water and conservation resources; and potential visual impact from both land and sea. The policy also sets the need for

⁵ PPW Edition 7, paragraph 5.3.2

⁶ PPW Edition 7, paragraph 5.8.2

⁷ PPW Edition 7, paragraph 5.8.3

⁸ PPW Edition 7, section 13.2

local authorities and other agencies to provide Shoreline Management Plans, which are discussed below.

TAN 15: Development and flood risk

- 7.2.0.19 TAN 15 provides guidance in relation to development and flood risk, which is intended for use by Local Planning Authorities. It provides a precautionary framework from which risks associated with river, coastal and surface water flooding can be assessed. An assessment of this nature will be submitted with any applications necessary.

Interim Marine Aggregates Dredging Policy

- 7.2.0.20 The Interim Marine Aggregates Dredging Policy (IMADP) is a policy that is used to form the basis for decisions regarding aggregate dredging. It seeks to ensure sustainable, objective and transparent decision-making to meet society's needs for aggregates dredged from the Bristol Channel, Severn Estuary and River Severn.
- 7.2.0.21 This policy is referred to in the **Sand and gravel supply for South East Wales – position statement**, which states the value of aggregates and the need for extraction to be carried out in a way that minimises environmental and amenity impacts.

Minerals Technical Advice Note 1: Aggregates (MTAN1)

- 7.2.0.22 This refers to the **Interim Marine Aggregates Dredging Policy** in its advice on marine aggregates. MTAN1 gives general advice about the consideration of the protection of areas of importance, including: SPA, SAC, Ramsar and Natura 2000 sites; European protected species; and the historic environment amongst other things. This general advice will be taken into account in the assessment.

Shoreline Management Plans

- 7.2.0.23 Shoreline Management Plans (SMPs) are high level policy documents that form an important part of the WGs strategy for managing risks due to flooding and coastal erosion. The Severn Estuary Shoreline Management Plan SMP2 (Anchor Head to Lavernock Point) is the relevant plan that will be taken into account in the assessment.

National Strategy for Flood and Coastal Erosion Risk Management in Wales

- 7.2.0.24 The national strategy sets four overarching objectives for the management of flood and coastal erosion risk in Wales. It informs the SEFRMS (see below) and other policies for the management of flood and coastal erosion. It will be taken into account in the assessment where relevant.

Severn Estuary Flood Risk Management Strategy (SEFRMS)

- 7.2.0.25 The SEFRMS aims to assess flood risk and how it could be managed over the next 100 years, taking into account climate change and deterioration of the existing flood defences.
- 7.2.0.26 The SEFRMS covers the northern coastline from Lavernock Point near Cardiff to Gloucester, and back down the southern coastline to Hinkley Point in Somerset. Flood risk in the estuary is primarily from the tide but in the more constrained channel of the upper estuary there is also a flooding risk from high flows in the River Severn.

Catchment Flood Management Plans (CFMP's)

- 7.2.0.27 CFMP's assess inland flood risk throughout England and Wales. The documents identify flood risk management policies to assist decision makers in the catchment area. The areas of relevance include:
- i. Eastern Valleys CFMP
 - ii. Taff and Ely CFMP
 - iii. Wye and Usk CFMP

Cardiff Local Development Plan

- 7.2.0.28 At this time, there is no relevant plan for Cardiff which would inform what should be included in the assessment. The emerging plan, Deposit Local Development Plan (LDP) is currently in examination, with a recommendation of whether or not to adopt the plan, due by October 2015.

Newport Local Development Plan

- 7.2.0.29 The Newport City Council Local Development Plan was adopted in January 2015. The Plan sets objectives to fulfil the vision of the plan. These, and the strategic and general policies of the plan, will be taken into account in the assessment.

7.3 References

City of Cardiff Council (2014) Deposit Local Development Plan (LDP)

Department of Energy and Climate Change (DECC) (2011) Overarching National Policy Statement for Energy (EN-1)

Department of Energy and Climate Change (DECC) (2011) National Policy Statement for Renewable Energy (EN-3)

Department of Energy and Climate Change (DECC) (2011) National Policy Statement for Electricity Networks (EN-5)

Department of Energy and Climate Change (DECC) (2015) Addendum to decommissioning of offshore renewable energy installations under the Energy Act 2004: guidance notes for industry

Department for Transport (2012) National Policy Statement for Ports

Environment Agency / Environment Agency Wales (2009) Catchment Flood Management Plans (CFMP's)

Natural Resources Wales / Environment Agency (2011) Draft Severn Estuary Flood Risk Management Strategy (SEFRMS)

Newport City Council (2015) Local Development Plan

Severn Estuary Coastal Group (2015) Severn Estuary Shoreline Management Plan SMP2 (Anchor Head to Lavernock Point)

UK Government (2011) UK Marine Policy Statement (marine plans)

Welsh Government (1998) TAN 14: Coastal planning

Welsh Government (2002) Sand and gravel supply for South East Wales – position statement

Welsh Government (2004) Minerals Technical Advice Note 1: Aggregates

Welsh Government (2004) Interim Marine Aggregates Dredging Policy

Welsh Government (2004) TAN 15: Development and flood risk

Welsh Government (2005) TAN 8: Planning for Renewable Energy

Welsh Government (2009) TAN 5: Nature Conservation and planning

Welsh Government (2011) National Strategy for Flood and Coastal Erosion Risk Management in Wales

Welsh Government (2014) Planning Policy Wales 7th Edition



Appendix 2.1

HRA Selection of European Sites (Pre-screening)



Appendix 2.1 HRA Selection of European Sites (Pre-screening)

Introduction

This Appendix presents the findings of an initial site selection process for European sites that are to be considered in the Habitats Regulations Assessment (HRA) process (pre-screening). These 'potential impact pathway' tables are intended to initially examine the potential cause-effect relationships between the Project and the sites and do not represent an assessment of impact significance. Further comment on the site selection process is welcomed and this pre-screening stage will form the basis for the Evidence Plan process. Figure 1 illustrates the location of the sites in relation to the Project. Appendix 2.2 presents a high level site selection process for those SPAs that may be affected by displacement of birds from the Severn Estuary Special Protection Area (SPA) and Ramsar site.

The Habitats Regulations Assessment process

Under Article 6 of the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the "Habitats Directive") an assessment is required where a plan or project may give rise to significant effects upon a Natura 2000 site. The Natura 2000 network comprises Special Areas of Conservation (SAC) (designated under the Habitats Directive) and Special Protection Areas (SPA), designated under Directive 2009/147/EC on the conservation of wild birds (the codified version of the earlier Council Directive 79/409/EEC as amended).

The requirements of the Habitats Directive are transposed into UK law through the Conservation of Habitats and Species Regulations (2010) as amended, the 'Habitats Regulations'. In addition, it is a matter of UK Government policy (ODPM Circular 06/2005) that sites designated under the 1971 Ramsar Convention for their internationally important wetlands ("Ramsar sites") are also considered in this process, along with potential SPAs ("pSPAs"), or (in England) candidate SACs ("cSACs").

As the assessment requirements of the Habitats Directive have been applied since its inception, it has become generally accepted that the HRA process comprises four stages (European Commission, 2002):

Stage One: Screening – the process which identifies the potential for likely impacts upon a Natura 2000 site of a project or plan, either alone or in combination with other projects or plans, and considers whether these impacts are likely to be significant.

Stage Two: Appropriate assessment – the consideration of the impact on the integrity of the Natura 2000 site of the project or plan, either alone or in combination with other projects or plans, in respect of the site's structure and



function and its conservation objectives. Additionally, where adverse impacts are identified, an assessment of the potential mitigation of those impacts is undertaken. The assessment of the effect on integrity of the site is undertaken including the effect of such mitigation.

Stage Three: Assessment of alternative solutions – the process which examines alternative ways of achieving the objectives of the project or plan that might avoid adverse impacts on the integrity of the Natura 2000 site.

Stage Four: Assessment where no alternative solutions exist and where adverse impacts remain - following the identification of imperative reasons of overriding public interest ("IROPI"), if it is deemed that the project or plan should be allowed to proceed, compensatory measures are identified and their effectiveness ascertained.

Nationally Significant Infrastructure Projects (NSIPs) and HRA

The Planning Inspectorate Advice Note 10 (version 5, August 2013) describes how the process outlined above should be undertaken for Nationally Significant Infrastructure Projects (NSIPs).

This guidance recommends early consultation and an iterative approach towards the assessment in order to ensure that a robust assessment is carried out and as few outstanding issues as possible are taken into the examination process.

Attention is also drawn in the guidance to the Evidence Plan process in England as a method of complying with the requirements of the Habitats Regulations.

The Evidence Plan

An evidence plan is a formal mechanism to agree upfront what information the applicant needs to supply to the competent authorities to enable them to undertake the HRA of the proposed development. As the Project lies within Wales, there is no formal mechanism in place to undertake an Evidence Plan process, however, it has been agreed in principal with Natural Resources Wales (NRW), Natural England (NE) and the Environment Agency (EA) that to follow an Evidence Plan process would be welcomed.

Selection of European Sites potentially affected

Site selection is the first stage of screening for likely significant effects. In effect, this aspect establishes a list of European sites that will enable an appropriate 'short-list' of sites potentially affected to be drawn up, from which the final list of sites to be included in the assessment can be selected after considering the relevant information (Tyldesley and Chapman, 2013). At this stage, only limited project and environmental information is available upon which to form a preliminary view on site selection. However, drawing from previous experience



gained through the Swansea Bay Tidal Lagoon proposal and initial high level coastal modelling results, a series of 'potential impact pathway' tables are presented in this document.

These tables provide an initial view regarding the likelihood of a potential impact pathway between the Project and marine and coastal European sites along the Welsh and English coastline during construction (Table 1) and operation (Table 2) (i.e. the potential for an impact pathway to occur is unlikely, possible or probable). An explanation of the likely impact pathway is identified for each receptor below each of the tables. The assessment will be developed and refined as the Project progresses through the Evidence Plan process to facilitate a full screening assessment and, at this stage, does not represent an assessment of impact significance. Further comment on these tables and the site selection is welcomed.

Table 1 Pre-screening selection of sites and features and consideration of potential impact pathways for the Project – construction

No impact pathway identified
Potential impact pathway unlikely
Potential impact pathway possible
Potential impact pathway probable

N.B. no consideration has been given at this stage to measures designed to reduce or avoid the potential impact likelihood.

Site and Feature	Alteration of coastal processes / sediment transport	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects
Severn Estuary SAC							
Estuaries	1	13	16	20			
Mudflats and sandflats not covered by water at low tide	1	13	16	20			
Atlantic salt meadows	1	13	16	20			
Sandbanks which are slightly covered by sea water the whole time	1	13	16	20			
Reefs (sabellaria, etc)	1	13	16	20			
Sea lamprey	3	14	17	21	23	25	27
River lamprey	3	14	17	21	23	25	27
Twaite shad	3	14	17	21	23	25	27
Severn Estuary SPA							
Bewick's swan	7	7	7	7	7	7	
White-fronted goose	7	7	7	7	7	7	
Ringed plover	8	15	18	22	24	26	

Site and Feature	Alteration of coastal processes / sediment transport	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects
Curlew	8	15	18	22	24	26	
Dunlin	8	15	18	22	24	26	
Pintail	8	15	18	22	24	26	
Redshank	8	15	18	22	24	26	
Shelduck	8	15	18	22	24	26	
Gadwall	8	15	18	22	24	26	
Assemblage	8	15	18	22	24	26	
Severn Estuary Ramsar							
Sandbanks which are slightly covered by sea water the whole time	1	13	16	20			
Estuaries	1	13	16	20			
Mudflats and sandflats not covered by water at low tide	1	13	16	20			
Atlantic salt meadows	1	13	16	20			
Atlantic salmon	3	14	17	21	23	25	27
Sea trout	3	14	17	21	23	25	27
Sea lamprey	3	14	17	21	23	25	27
River lamprey	3	14	17	21	23	25	27
Allis shad	3	14	17	21	23	25	27
Twaite shad	3	14	17	21	23	25	27
European eel	3	14	17	21	23	25	27

Site and Feature	Alteration of coastal processes / sediment transport	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects
Bird assemblage	8	15	18	22	24	26	
Carmarthen Bay and Estuaries SAC							
Sandbanks which are slightly covered by sea water the whole time	2						
Estuaries	2						
Mudflats and sandflats not covered by water at low tide	2						
Large shallow inlets and bays	2						
Salicornia and other annuals colonising mud and sand	2						
Atlantic salt meadows	2						
Twaite shad	4						
Sea lamprey	4						
River lamprey	4						
Allis shad	4						
Otter	no impact pathways identified						
Burry Inlet SPA							
Oystercatcher	9		19				
Pintail	9		19				
Shoveler	9		19				
Teal	9		19				
Wigeon	9		19				

Site and Feature	Alteration of coastal processes / sediment transport	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects
Dunlin	9		19				
Knot	9		19				
Curlew	9		19				
Grey plover	9		19				
Shelduck	9		19				
Redshank	9		19				
Bird assemblage	9		19				
Burry Inlet Ramsar							
Redshank	9		19				
Pintail	9		19				
Oystercatcher	9		19				
Knot	9		19				
Bird assemblage	9		19				
Carmarthen Bay SPA							
Common scoter	no impact pathways identified						
Castlemartin Coast SPA							
Chough	no impact pathways identified						
Pembrokeshire Marine SAC							
Estuaries	2						
Large shallow inlets and bays	2						
Reefs (sabellaria, etc)	2						

Site and Feature	Alteration of coastal processes / sediment transport	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects
Sandbanks which are slightly covered by sea water the whole time	2						
Mudflats and sandflats not covered by water at low tide	2						
Atlantic salt meadows	2						
Submerged or partially submerged sea caves	2						
Grey seal	11	11	11	11	11	11	11
Shore dock	no impact pathways identified						
Sea lamprey	4						
River lamprey	4						
Allis shad	4						
Twaite shad	4						
Otter	no impact pathways identified						
Lundy SAC							
Reefs (sabellaria, etc)	2						
Sandbanks which are slightly covered by sea water the whole time	2						
Submerged or partially submerged sea caves	2						
Grey seal	11	11	11	11	11	11	11



Site and Feature	Alteration of coastal processes / sediment transport	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects
Cardigan Bay SAC							
Reefs	no impact pathways identified						
Sandbanks which are slightly covered by sea water the whole time							
Submerged or partially submerged sea caves							
Bottlenose dolphin	no impact pathways identified						
Sea lamprey							
River lamprey							
Grey seal	11	11	11	11	11	11	11
Pen Llyn a'r Sarnau SAC							
Sandbanks which are slightly covered by sea water the whole time	no impact pathways identified						
Mudflats and sandflats not covered by water at low tide							
Estuaries							
Coastal lagoons							
Large shallow inlets and bays							
Reefs							
Salicornia and other annuals colonising mud and sand							

Site and Feature	Alteration of coastal processes / sediment transport	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects
Atlantic salt meadows							
Submerged or partially submerged sea caves							
Bottlenose dolphin	no impact pathways identified						
Grey seal	11	11	11	11	11	11	11
Otter	no impact pathways identified						
River Usk SAC							
Watercourses of plain to montane levels	no impact pathways identified						
Sea lamprey	5	14	17	21	23	25	27
River lamprey	5	14	17	21	23	25	27
Twaite shad	5	14	17	21	23	25	27
Atlantic salmon	5	14	17	21	23	25	27
Allis shad	5	14	17	21	23	25	27
Bullhead	6	6	6	6	6	6	6
Brook lamprey	6	6	6	6	6	6	6
Otter	12	12	12	12	12	12	12
River Wye SAC							
Watercourses of plain to montane levels	no impact pathways identified						
Transition mires and quaking bogs	no impact pathways identified						

Site and Feature	Alteration of coastal processes / sediment transport	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects
Sea lamprey	5	14	17	21	23	25	27
River lamprey	5	14	17	21	23	25	27
Twaite shad	5	14	17	21	23	25	27
Atlantic salmon	5	14	17	21	23	25	27
Allis shad	5	14	17	21	23	25	27
Bullhead	6	6	6	6	6	6	6
Brook lamprey	6	6	6	6	6	6	6
Otter	no impact pathways identified						
Afon Tywi SAC							
Twaite shad	4						
Sea lamprey	4						
River lamprey	4						
Allis shad	4						
Bullhead	no impact pathways identified						
Brook lamprey	no impact pathways identified						
Otter	no impact pathways identified						
Somerset Levels and Moors SPA							
Teal	10		19				
Bewick's swan	7		7				
Golden plover	10		19				
Lapwing	7		7				
Bird assemblage	10		19				
Somerset Levels and Moors Ramsar							

Site and Feature	Alteration of coastal processes / sediment transport	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects
Teal	10		19				
Bewick's swan	7		7				
Lapwing	7		7				
Bird assemblage	10		19				
Invertebrate assemblage	no impact pathways identified						
Walmore Common SPA							
Bewick's swan	7		7				
Walmore Common Ramsar							
Bewick's swan	7		7				
Kenfig SAC							
Grey dunes	2						
Dunes with Salix repens	2						
Humid dune slacks	2						
Hard oligo-mesotrophic waters	2						
Atlantic salt meadows	2						
Petalwort	2						
Fen orchid	2						
Cleddau Rivers SAC							
Watercourses of plain to montane levels	no impact pathways identified						
Active raised bogs							



Site and Feature	Alteration of coastal processes / sediment transport	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects
Alluvial forests							
Sea lamprey	4						
River lamprey	4						
Brook lamprey	no impact pathways identified						
Bullhead							
Otter							
Braunton Burrows SAC							
Mudflats and sandflats not covered by water at low tide	2						
Grey dunes	2						
Dunes with Salix repens	2						
White dunes	2						
Humid dune slacks	2						
Petalwort	2						
Limestone Coast of South and West Wales							
Vegetated sea cliffs of the Atlantic and Baltic coasts	no impact pathways identified						
Grey dunes							
European dry heaths							
Semi-natural dry grasslands and scrubland							
Caves not open to the public							



Site and Feature	Alteration of coastal processes / sediment transport	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects
Submerged or partially submerged sea caves							
Greater horseshoe bat							
Petalwort							
Fen orchid							
Dunraven							
Shore dock	no impact pathways identified						

- 1: The Project is located within the Severn Estuary SAC and Ramsar site therefore potential effects of interruptions or alteration of coastal hydrodynamics and sediment transport on habitats are probable.
- 2: The potential in-combination impacts of alteration of coastal hydrodynamics and sediment transport when the Project is considered with other potential lagoon projects will be assessed. At this stage it is anticipated that in-combination effects may provide a potential impact pathway with far-field European sites.
- 3: The Project is located within the Severn Estuary SAC and Ramsar site therefore potential effects of interruptions or alteration of coastal hydrodynamics and sediment transport on associated fish features are probable.
- 4: At this stage it is anticipated that only in-combination effects on coastal hydrodynamics with other possible future lagoons (i.e. Swansea or West Somerset lagoon) may provide a potential impact pathway on the fish features of far-field European sites.
- 5: The Project is located downstream of the River Usk and River Wye, therefore any alterations in coastal hydrodynamics and sediment transport has the potential to impact upon these migratory fish.
- 6: Bullhead and brook lamprey are non-migratory species, therefore an impact pathway between the Project and these features of the River Usk and River Wye is considered unlikely.
- 7: Bewick's swan, white-fronted goose and lapwing are not generally associated with the marine environment, therefore it is considered unlikely that any potential impact pathway on these birds is possible.



- 8: The Project is located within the Severn Estuary SPA and Ramsar site therefore potential effects of interruptions or alteration of coastal hydrodynamics and sediment transport on habitats associated with the bird features are probable.
- 9: At this stage it is anticipated that only in-combination effects on coastal hydrodynamics with other future lagoons may provide a potential impact pathway on the bird features of far-field European sites.
- 10: The Somerset Levels and Moors is an inland site and therefore there is no impact pathway between alterations in coastal processes in the Severn Estuary and this site.
- 11: Grey seal are very rarely recorded in the Severn Estuary and there are no known haul out sites in the Severn Estuary. This makes a potential impact pathway between the Project and the grey seal populations of far-field European sites unlikely.
- 12: Potential impact pathways exist between otters associated with the River Usk and the Project, given its proximity to the River Usk and the wide range of otter territories.
- 13: Decreases in water quality as a result of dredging and other construction activities during construction could impact the habitats of the Severn Estuary SAC and Ramsar site.
- 14: Impacts of a decrease in water quality during construction could affect the passage of migratory fish both within the Severn Estuary SAC and Ramsar site and to European sites upstream.
- 15: The Project is located within the Severn Estuary SPA and Ramsar site therefore potential adverse impacts on water quality during construction could affect prey availability and therefore these bird features.
- 16: A potential impact pathway exists between habitat loss, degradation and fragmentation during construction and the habitat features of the Severn Estuary SAC and Ramsar site.
- 17: A potential impact pathway exists between habitat loss, degradation and fragmentation and migratory fish associated with the Severn Estuary SAC and Ramsar site, River Usk SAC and River Wye SAC.
- 18: The Project is located within the Severn Estuary SPA and Ramsar site therefore a direct potential impact pathway exists between habitat loss, degradation and fragmentation and the bird features associated with this site.
- 19: Habitat loss, degradation and fragmentation at the Project site may indirectly affect birds associated with these far-field European sites as birds may be displaced to these sites, increasing competition for prey and affecting the condition and health of the birds.
- 20: Pollution events as a result of the Project could adversely affect the invertebrate or plant assemblages supported by the habitats of the Severn Estuary SAC and Ramsar site.
- 21: A potential impact pathway is probable between pollution events and migratory fish associated with the Severn Estuary SAC and Ramsar site, River Usk SAC and River Wye SAC.
- 22: Pollution events as a result of the Project could adversely affect the invertebrate food supply of the birds or directly affect birds using the habitats of the Severn Estuary SPA and Ramsar site (e.g. through oiling of plumage).
- 23: The Project is located within the Severn Estuary SAC and Ramsar site and downstream from the River Usk SAC and River Wye SAC, therefore an impact pathway between noise and vibration disturbance and migratory fish is probable.



22: The Project is located within the Severn Estuary SPA and Ramsar site therefore a direct potential impact pathway exists between noise disturbance during construction and the bird features associated with this site.

25: Visual disturbance due to construction lighting means that an impact pathway is possible to the migratory fish features of the Severn Estuary SAC and Ramsar site, River Usk SAC and River Wye SAC.

26: The Project is located within the Severn Estuary SPA and Ramsar site therefore a direct potential impact pathway exists between visual disturbance during construction and the bird features associated with this site.

27: The Project is located within the Severn Estuary SAC and Ramsar site and downstream from the River Usk SAC and River Wye SAC, therefore an impact pathway between the construction of the Project creating a barrier and migratory fish is probable.

Table 2 Pre-screening selection of sites and features and consideration of potential impact pathways for Cardiff Lagoon – operation

No impact pathway identified
Potential impact pathway unlikely
Potential impact pathway possible
Potential impact pathway probable

N.B. no consideration has been given at this stage to measures designed to reduce or avoid the potential impact likelihood.

Site and Feature	Alteration of coastal processes / sediment transport	Water level effects	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects	Entrainment in turbines/slucice gates	Electro-magnetic effects
Severn Estuary SAC										
Estuaries	1	13	17	20						
Mudflats and sandflats not covered by water at low tide	1	13	17	20	24					
Atlantic salt meadows	1	13	17	20	24					
Sandbanks which are slightly covered by sea water the whole time	1	13	17	20	24					
Reefs (sabellaria, etc)	1	13	17	20	24					
Sea lamprey	3		18	21	25	27	29	31	30	33
River lamprey	3		18	21	25	27	29	31	30	33
Twaite shad	3		18	21	25	27	29	31	30	33
Severn Estuary SPA										
Bewick's swan	7	7	7	7	7	7	7			
White-fronted goose	7	7	7	7	7	7	7			
Ringed plover	8	15	19	22	26	28	30			

Tidal Lagoon Cardiff Ltd

Site and Feature	Alteration of coastal processes / sediment transport	Water level effects	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects	Entrainment in turbines/slucice gates	Electro-magnetic effects
Curlew	8	15	19	22	26	28	30			
Dunlin	8	15	19	22	26	28	30			
Pintail	8	15	19	22	26	28	30			
Redshank	8	15	19	22	26	28	30			
Shelduck	8	15	19	22	26	28	30			
Gadwall	8	15	19	22	26	28	30			
Assemblage	8	15	19	22	26	28	30			
Severn Estuary Ramsar										
Sandbanks which are slightly covered by sea water the whole time	1	13	17	20	24					
Estuaries	1	13	17	20	24					
Mudflats and sandflats not covered by water at low tide	1	13	17	20	24					
Atlantic salt meadows	1	13	17	20	24					
Atlantic salmon	3		18	21	25	27	29	31	32	33
Sea trout	3		18	21	25	27	29	31	32	33
Sea lamprey	3		18	21	25	27	29	31	32	33
River lamprey	3		18	21	25	27	29	31	32	33
Allis shad	3		18	21	25	27	29	31	32	33
Twaite shad	3		18	21	25	27	29	31	32	33
European eel	3		18	21	25	27	29	31	32	33
Bird assemblage	8	15	19	22	26	28	30			



Site and Feature	Alteration of coastal processes / sediment transport	Water level effects	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects	Entrainment in turbines/slucice gates	Electro-magnetic effects
Carmarthen Bay and Estuaries SAC										
Sandbanks which are slightly covered by sea water the whole time	2	14								
Estuaries	2	14								
Mudflats and sandflats not covered by water at low tide	2	14								
Large shallow inlets and bays	2	14								
Salicornia and other annuals colonising mud and sand	2	14								
Atlantic salt meadows	2	14								
Twaite shad	4									
Sea lamprey	4									
River lamprey	4									
Allis shad	4									
Otter	no impact pathways identified									
Burry Inlet SPA										
Oystercatcher	9	16		23						
Pintail	9	16		23						
Shoveler	9	16		23						
Teal	9	16		23						
Wigeon	9	16		23						



Site and Feature	Alteration of coastal processes / sediment transport	Water level effects	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects	Entrainment in turbines/slucice gates	Electro-magnetic effects
Dunlin	9	16		23						
Knot	9	16		23						
Curlew	9	16		23						
Grey plover	9	16		23						
Shelduck	9	16		23						
Redshank	9	16		23						
Bird assemblage	9	16		23						
Burry Inlet Ramsar										
Redshank	9	16		23						
Pintail	9	16		23						
Oystercatcher	9	16		23						
Knot	9	16		23						
Bird assemblage	9	16		23						
Carmarthen Bay SPA										
Common scoter	no impact pathways identified									
Castlemartin Coast SPA										
Chough	no impact pathways identified									
Pembrokeshire Marine SAC										
Estuaries	2	14								
Large shallow inlets and bays	2	14								
Reefs (sabellaria, etc)	2	14								



Site and Feature	Alteration of coastal processes / sediment transport	Water level effects	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects	Entrainment in turbines/slucice gates	Electro-magnetic effects
Sandbanks which are slightly covered by sea water the whole time	2	14								
Mudflats and sandflats not covered by water at low tide	2	14								
Atlantic salt meadows	2	14								
Submerged or partially submerged sea caves	2	14								
Grey seal	11		11	11	11	11	11	11	11	11
Sea lamprey	4									
River lamprey	4									
Allis shad	4									
Twaite shad	4									
Otter	no impact pathways identified									
Shore dock	no impact pathways identified									
Lundy SAC										
Reefs (sabellaria, etc)	2	14								
Sandbanks which are slightly covered by sea water the whole time	2	14								
Submerged or partially submerged sea caves	2	14								
Grey seal	11		11	11	11	11	11	11	11	11



Site and Feature	Alteration of coastal processes / sediment transport	Water level effects	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects	Entrainment in turbines/slucice gates	Electro-magnetic effects
Cardigan Bay SAC										
Reefs	no impact pathways identified									
Sandbanks which are slightly covered by sea water the whole time										
Submerged or partially submerged sea caves										
Bottlenose dolphin	no impact pathways identified									
Sea lamprey										
River lamprey										
Grey seal	11		11	11	11	11	11	11	11	11
Pen Llyn a'r Sarnau SAC										
Sandbanks which are slightly covered by sea water the whole time	no impact pathways identified									
Mudflats and sandflats not covered by water at low tide										
Estuaries										
Coastal lagoons										
Large shallow inlets and bays										
Reefs										



Site and Feature	Alteration of coastal processes / sediment transport	Water level effects	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects	Entrainment in turbines/slucice gates	Electro-magnetic effects
Salicornia and other annuals colonising mud and sand										
Atlantic salt meadows										
Submerged or partially submerged sea caves										
Grey seal	11		11	11	11	11	11	11	11	11
Harbour porpoise	no impact pathways identified									
Otter	no impact pathways identified									
River Usk SAC										
Watercourses of plain to montane levels	no impact pathways identified									
Sea lamprey	5		18	21	25	27	29	31	32	33
River lamprey	5		18	21	25	27	29	31	32	33
Twaite shad	5		18	21	25	27	29	31	32	33
Atlantic salmon	5		18	21	25	27	29	31	32	33
Allis shad	5		18	21	25	27	29	31	32	33
Bullhead	6		6	6	6	6	6	6	6	6
Brook lamprey	6		6	6	6	6	6	6	6	6
Otter	12		12	12	12	12	12	12		
River Wye SAC										
Watercourses of plain to montane levels	no impact pathways identified									



Site and Feature	Alteration of coastal processes / sediment transport	Water level effects	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects	Entrainment in turbines/slucice gates	Electro-magnetic effects
Transition mires and quaking bogs	no impact pathways identified									
Sea lamprey	5		18	21	25	27	29	31	32	33
River lamprey	5		18	21	25	27	29	31	32	33
Twaite shad	5		18	21	25	27	29	31	32	33
Atlantic salmon	5		18	21	25	27	29	31	32	33
Allis shad	5		18	21	25	27	29	31	32	33
Bullhead	6		6	6	6	6	6	6	6	6
Brook lamprey	6		6	6	6	6	6	6	6	6
Otter	no impact pathways identified									
Afon Tywi SAC										
Twaite shad	4									
Allis shad	4									
Sea lamprey	4									
River lamprey	4									
Brook lamprey	no impact pathways identified									
Bullhead	no impact pathways identified									
Otter	no impact pathways identified									
Somerset Levels and Moors SPA										
Teal	10			23						
Bewick's swan	7			7						
Golden plover	10			23						



Site and Feature	Alteration of coastal processes / sediment transport	Water level effects	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects	Entrainment in turbines/slucice gates	Electro-magnetic effects
Lapwing	7			7						
Bird assemblage	10			23						
Somerset Levels and Moors Ramsar										
Teal	10			23						
Bewick's swan	7			7						
Lapwing	7			7						
Bird assemblage	10			23						
Invertebrates	no impact pathways identified									
Walmore Common										
Bewick's swan	7			7						
Walmore Common										
Bewick's swan	7			7						
Kenfig SAC										
Grey dunes	2	14								
Dunes with Salix repens	2	14								
Humid dune slacks	2	14								
Hard oligo-mesotrophic waters	2	14								
Atlantic salt meadows	2	14								
Petalwort	2	14								
Fen orchid	2	14								
Cleddau Rivers SAC										



Site and Feature	Alteration of coastal processes / sediment transport	Water level effects	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects	Entrainment in turbines/slucice gates	Electro-magnetic effects
Watercourses of plain to montane levels	no impact pathways identified									
Active raised bogs										
Alluvial forests										
Otter	no impact pathways identified									
Sea lamprey	4									
River lamprey	4									
Brook lamprey	no impact pathways identified									
Bullhead										
Braunton Burrows SAC										
Mudflats and sandflats not covered by water at low tide	2	14								
Grey dunes	2	14								
Dunes with Salix repens	2	14								
White dunes	2	14								
Humid dune slacks	2	14								
Petalwort	2	14								
Limestone Coast of South and West Wales										
Vegetated sea cliffs of the Atlantic and Baltic coasts	no impact pathways identified									
Grey dunes										
European dry heaths										



Site and Feature	Alteration of coastal processes / sediment transport	Water level effects	Water quality effects	Habitat loss, degradation, fragmentation	Toxic contamination (pollution events)	Noise and vibration disturbance	Visual disturbance	Barrier effects	Entrainment in turbines/sluice gates	Electro-magnetic effects
Semi-natural dry grasslands and scrubland										
Caves not open to the public										
Submerged or partially submerged sea caves										
Greater horseshoe bat										
Petalwort										
Fen orchid										
Dunraven										
Shore dock	no impact pathways identified									

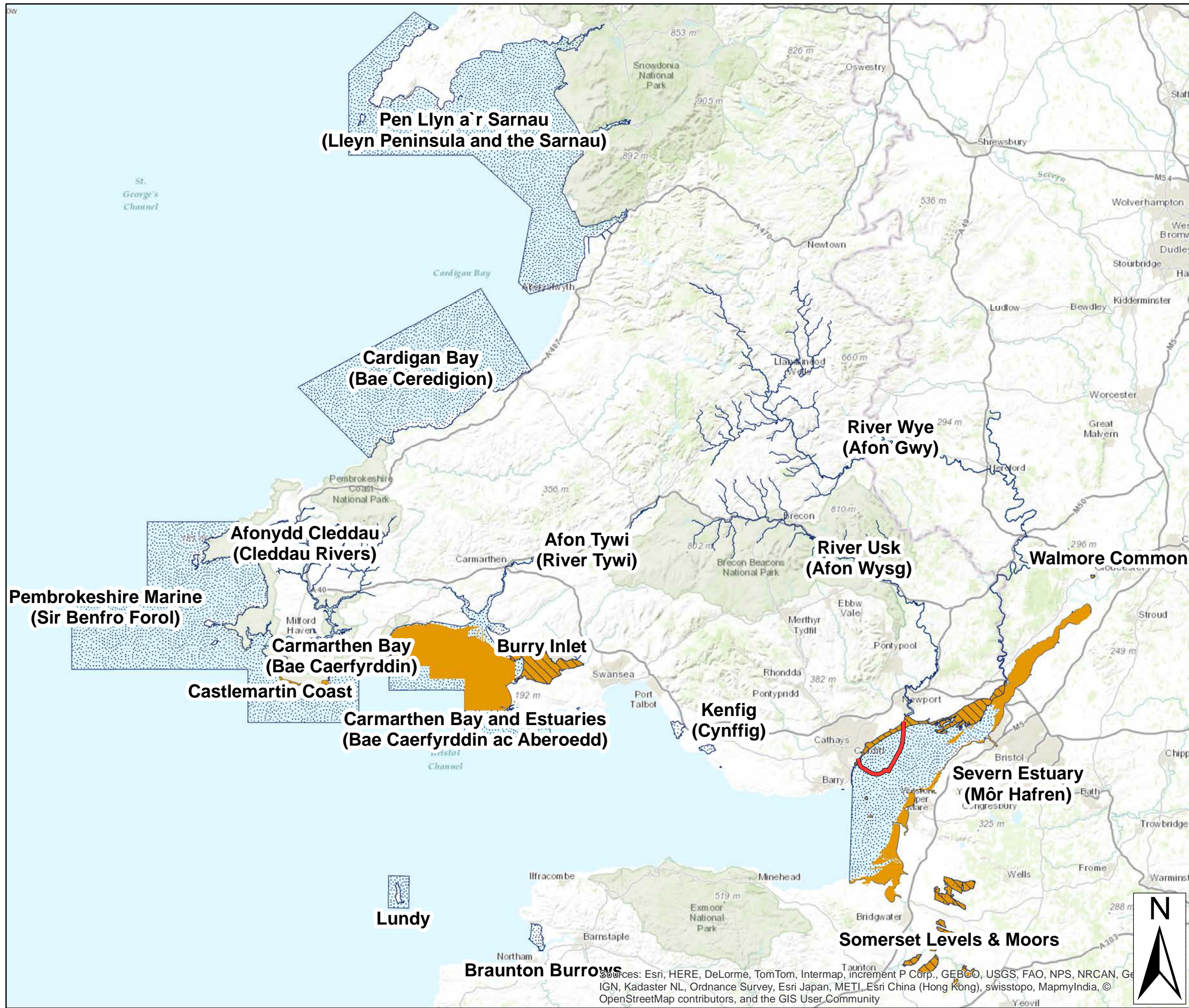
- 1: The Project is located within the Severn Estuary SAC and Ramsar site therefore potential effects of interruptions or alteration of coastal hydrodynamics and sediment transport during operation on habitats are probable.
- 2: The potential in-combination impacts of alteration of coastal hydrodynamics and sediment transport when the Project is considered with other potential lagoon projects will be assessed. At this stage it is anticipated that in-combination effects may provide a potential impact pathway with far-field European sites.
- 3: The Project is located within the Severn Estuary SAC and Ramsar site therefore potential effects of interruptions or alteration of coastal hydrodynamics and sediment transport on associated fish features are probable.
- 4: At this stage it is anticipated that only in-combination effects on coastal hydrodynamics with other possible future lagoons (i.e. Swansea or West Somerset lagoon) may provide a potential impact pathway on the fish features of far-field European sites.
- 5: The Project is located downstream of the River Usk SAC and River Wye SAC, therefore any alterations in coastal hydrodynamics and sediment transport has the potential to impact upon these migratory fish.



- 6: Bullhead and brook lamprey are non-migratory species, therefore an impact pathway between the Project and these features of the River Usk SAC and River Wye SAC is considered unlikely.
- 7: Bewick's swan, white-fronted goose and lapwing are not generally associated with the marine environment, therefore it is considered unlikely that any potential impact pathway on these birds is possible.
- 8: The Project is located within the Severn Estuary SPA and Ramsar site therefore potential effects of interruptions or alteration of coastal hydrodynamics and sediment transport on habitats associated with the bird features are probable.
- 9: At this stage it is anticipated that only in-combination effects on coastal hydrodynamics with other future lagoons may provide a potential impact pathway on the bird features of far-field European sites.
- 10: The Somerset Levels and Moors is an inland site and therefore there is no impact pathway between alterations in coastal processes in the Severn Estuary and this site.
- 11: Grey seal are very rarely recorded in the Severn Estuary and there are no known haul out sites in the Severn Estuary. This makes a potential impact pathway between the Project and the grey seal populations of far-field European sites unlikely.
- 12: Potential impact pathways exist between otters associated with the River Usk SAC and the Project, given its proximity to the River Usk and the wide range of otter territories.
- 13: The Project is located within the Severn Estuary SAC and Ramsar site therefore potential effects on water levels during operation on habitats are probable.
- 14: At this stage it is anticipated that only in-combination effects with other future lagoons may affect water levels and provide a potential impact pathway on the habitat features of far-field European sites.
- 15: The Project is located within the Severn Estuary SPA and Ramsar site therefore potential effects on water levels during operation could affect habitat and prey availability and therefore these bird features.
- 16: At this stage it is anticipated that only in-combination effects with other future lagoons may affect water levels and provide a potential impact pathway on the bird features of far-field European sites.
- 17: The Project is located within the Severn Estuary SPA and Ramsar site therefore potential impacts on water quality during operation could affect the habitat features of the Severn Estuary SAC and Ramsar site.
- 18: A potential impact pathway is probable between a decline in water quality and migratory fish during operation associated with the Severn Estuary SAC and Ramsar site, River Usk SAC and River Wye SAC.
- 19: The Project is located within the Severn Estuary SPA and Ramsar site therefore potential impacts on water quality during operation could affect prey availability and therefore the bird features.
- 20: A potential impact pathway exists between habitat degradation and fragmentation during operation and the habitat features of the Severn Estuary SAC and Ramsar site.
- 21: A potential impact pathway exists between habitat loss, degradation and fragmentation and migratory fish associated with the Severn Estuary SAC and Ramsar site, River Usk SAC and River Wye SAC.

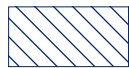




- 22: The Project is located within the Severn Estuary SPA and Ramsar site therefore a direct potential impact pathway exists between habitat loss, degradation and fragmentation and the bird features associated with this site.
- 23: Habitat loss, degradation and fragmentation at the Project site may indirectly affect birds associated with these far-field European sites as birds may be displaced to these sites, increasing competition for prey and affecting the condition and health of the birds.
- 24: Pollution events within the Project footprint during operation could adversely affect the invertebrate or plant assemblages supported by the habitats of the Severn Estuary SAC and Ramsar site.
- 25: A potential impact pathway is probable between pollution events and migratory fish associated with the Severn Estuary SAC and Ramsar site, River Usk SAC and River Wye SAC.
- 26: Pollution events as a result of the Project could adversely affect the invertebrate food supply of the birds or directly affect birds using the habitats of the Severn Estuary SPA and Ramsar site (e.g. through oiling of plumage).
- 27: The Project is located within the Severn Estuary SAC and Ramsar site and downstream from the River Usk SAC and River Wye SAC, therefore an impact pathway between noise and vibration disturbance through turbine operation and migratory fish is probable.
- 28: The Project is located within the Severn Estuary SPA and Ramsar site therefore a direct potential impact pathway exists between noise and vibration disturbance during operation (e.g. recreational use, maintenance vehicles) and the bird features associated with this site.
- 29: Lighting during operation is unlikely, however, should any lighting be proposed an impact pathway is possible to the migratory fish features of the Severn Estuary SAC and Ramsar site, River Usk SAC and River Wye SAC.
- 30: The Project is located within the Severn Estuary SPA and Ramsar site therefore a direct potential impact pathway exists between visual disturbance during operation and the bird features associated with this site.
- 31: The Project is located within the Severn Estuary SAC and Ramsar site and downstream from the River Usk SAC and River Wye SAC, therefore an impact pathway as the presence of the lagoon walls creates a barrier to migratory fish is probable.
- 32: The Project is located within the Severn Estuary SAC and Ramsar site and downstream from the River Usk SAC and River Wye SAC, therefore an impact pathway is probable between entrainment in turbines and migratory fish features of these sites.
- 33: Depending on the route of the grid connection, an impact pathway with the migratory fish features of the Severn Estuary SAC and Ramsar site, River Usk SAC and the River Wye SAC is possible.



— Lagoon Wall

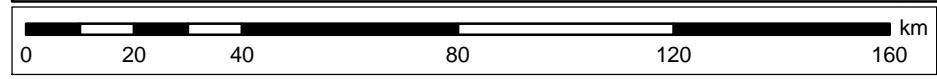
Designated Sites

-  RAMSAR
-  SPA
-  SAC

European Sites considered at site selection stage

Figure 1

Date FEB 2015	Drawn By SC
Project No. CARDIFF LAGOON	Issue 1



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Scale @ A3 1:1,400,000

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Appendix 2.2

An ornithological review of UK sites within the Natura 2000 network and broad regions of Europe that could potentially be affected by the proposed Cardiff Tidal Power Lagoon and other potential lagoon proposals on the Severn Estuary



**Combined
Ecology**

Safeguarding global
biodiversity by supporting
sustainable development

Research report No: TLPL05/25.2.2015

An ornithological review of UK sites within the Natura 2000 network and broad regions of Europe that could potentially be affected by the proposed Cardiff Tidal Power Lagoon and other potential lagoon proposals on the Severn Estuary

Report of work carried out by Combined Ecology (a division of BTO Services Ltd) on behalf of Tidal Lagoon Power Ltd

Authors: Niall H.K. Burton and Nigel A. Clark

January 2015



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Executive summary

1. In order to inform the screening process being undertaken for the Habitats Regulations Assessment (HRA) required in relation to the proposed Cardiff Tidal Power Lagoon and other potential lagoon proposals on the Severn Estuary, it is necessary to consider whether these developments might have the potential to impact birds not just within the area of the Severn Estuary Special Protection Area (SPA) and Ramsar site, but also further afield.
2. This report provides for a review of UK sites within the Natura 2000 network and broad regions of Europe that could potentially be affected by the proposed Cardiff Tidal Power Lagoon and other potential lagoon proposals on the Severn Estuary, either through displacement or through their use by migratory species from the Severn Estuary. All waterbird species which occur on the Severn Estuary, and are features of the Severn Estuary SPA, Severn Estuary Ramsar Site, or one of the component SSSIs (Table 3.1), or are listed as a UK Biodiversity Action Plan (BAP) species, Section 41 BAP Species of Principal Importance in England, Section 42 Species of Principal Importance in Wales, Amber or Red Listed Birds of Conservation Concern (BoCC) in the UK (Eaton *et al.* 2009) or Wales (Welsh Ornithological Society *et al.* 2009), or IUCN Red list species (Table 3.2), are considered as potential receptors.
3. It is assumed that displacement effects would only occur on far-field sites if there are significant negative effects on waterbirds within the area of the Severn Estuary itself. It is also assumed that displacement is most likely to affect features of adjacent sites; however, effects on sites further afield cannot be discounted. The magnitude of displacement effects is assumed to be negatively related to the degree of site-fidelity shown by each species. In this review, site fidelity has been assessed using the 'Wetland Bird Survey (WeBS) Alerts Biological Filter' (Maclean & Austin 2008). Results of this evaluation, and thus the likelihood that species might be displaced to particular sites that also support these species, are provided in Table 3.3.
4. Features of other sites in the Natura 2000 network could also be affected, should measures to prevent or reduce any significant adverse effects on the environment or compensation for loss or reductions in the numbers of a SPA feature not be fully possible, as the waterbirds that use the Severn Estuary also pass through many other sites on their migrations to and from breeding grounds. For each species, sites are categorised into:
 - i. Those most likely to be affected;
 - ii. Those that potentially might be affected;



- iii. Other sites unlikely to be affected or likely to be only negligibly affected.

To provide context, for each species, information is provided on the size of breeding / non-breeding populations on the Severn Estuary, breeding / non-breeding populations in Great Britain and the overall 'biogeographic' (international) populations that birds on the Severn Estuary may be part of. SPAs and Ramsar Sites most likely to be affected or which potentially might be affected are listed in Tables 3.4 and 3.5 respectively.



1. Introduction

In order to inform the screening process being undertaken for the Habitats Regulations Assessment (HRA) required in relation to the proposed Cardiff Tidal Power Lagoon and other potential lagoon proposals on the Severn Estuary, it is necessary to consider whether these developments might have the potential to impact birds not just within the area of the Severn Estuary Special Protection Area (SPA) and Ramsar site, but also further afield.

Potentially significant issues for waterbirds relating to the construction of a tidal power lagoon or barrage within an estuary were assessed as part of the Severn Tidal Power Strategic Environmental Assessment (SEA) (Burton *et al.* 2010a) and summarised by Burton *et al.* (2010b). These include: disturbance, loss of and changes to intertidal habitat, changes to saltmarsh, changes to fish populations, changes to freshwater wetlands, far-field changes in water levels, displacement effects, and through-knock on effects on other sites in the Natura 2000 network used by migratory species.

Large tidal power schemes have the potential to affect both adjacent freshwater wetlands, through changes in the water table, as well as sites further afield through changes in tidal levels (Burrows *et al.* 2009). Predictions of the magnitude and spatial extent of such changes are needed to be able to determine the potential for such effects to impact the waterbird features of other protected sites.

The immediate loss of intertidal habitat would displace birds and cause them to redistribute either within the estuary or to neighbouring sites. This in turn might affect the birds at those sites through competition and density-dependent mortality. Common Redshank *Tringa totanus* displaced following the construction of an amenity barrage at Cardiff Bay, South Wales, for example, had a lower survival rate after they moved (Burton *et al.* 2006). The magnitude of displacement effects – and thus the likelihood of effects on adjacent sites – can be assumed to be negatively related to the degree of site-fidelity shown by each species.

Features of other sites in the Natura 2000 network could also be affected, should measures to prevent or reduce any significant adverse effects on the environment or compensation for loss or reductions in the numbers of a SPA feature not be fully possible, as the waterbirds that use the Severn Estuary also pass through many other sites on their migrations to and from breeding grounds.

Here, we provide a review of UK sites within the Natura 2000 network and broad regions of Europe that could potentially be affected by the proposed Cardiff Tidal Power Lagoon and other



potential lagoon proposals on the Severn Estuary, either through displacement or through their use by migratory species from the Severn Estuary.



2. Methods

2.1 Evaluating UK SPAs that might be affected by the proposed Cardiff Tidal Power Lagoon and other potential lagoon proposals through displacement of birds from the Severn Estuary

It is assumed that displacement effects would only occur on far-field sites if there are significant negative effects on waterbirds within the area of the Severn Estuary itself. It is also assumed that displacement is most likely to affect features of adjacent sites; however, effects on sites further afield cannot be discounted. The magnitude of displacement effects is assumed to be negatively related to the degree of site-fidelity shown by each species.

Although the likelihoods of significant negative effects on waterbirds within the area of the Severn Estuary in relation to the proposed Cardiff Tidal Power Lagoon and other potential lagoon proposals on the Severn Estuary have yet to be evaluated, the potential for different species to be displaced – and thus the sites which could be affected – can be evaluated by considering their site-fidelity. Our review thus draws on previous work for the Severn Tidal Power SEA Waterbirds Topic Paper (Burton *et al.* 2010a) and an assessment of the issues surrounding potential habitat creation mitigation / compensation measures (Wright *et al.* 2010) to summarise the site-fidelity shown by species features of the Severn Estuary SPA and Ramsar site and other potential receptor species and thus the likelihood that these species might be displaced to particular sites that also support these species.

2.2 Evaluating UK SPAs and broad regions of Europe that might support species from the Severn Estuary on their migrations to and from breeding grounds and thus that might also be affected by the proposed Cardiff Tidal Power Lagoon and other potential lagoon proposals on the estuary

Features of other sites in the Natura 2000 network could also be affected, should measures to prevent or reduce any significant adverse effects on the environment or compensation for loss or reductions in the numbers of a SPA feature not be fully possible, as the waterbirds that use the Severn Estuary also pass through many other sites on their migrations to and from breeding grounds.

Our review draws on and updates previous work for the Severn Tidal Power SEA Waterbirds Topic Paper (Burton *et al.* 2010a) that provided a review of sites within the UK that could thus be affected, as well as broad regions of Europe where Natura 2000 sites could additionally be affected.



For this assessment, broad migration patterns of key receptor species were assessed using published information, e.g. the British Trust for Ornithology (BTO) Migration Atlas (Wernham *et al.* 2002) and BTO 'Migration Mapping Tool' (Atkinson *et al.* 2007). Further information on migratory routes was collected from Clark (1989), which used information gathered from ringing recoveries to describe the movements of waders to and from the Severn Estuary, other relevant literature and broad summaries provided in Stroud *et al.* (2001) and Delaney *et al.* (2009).

We update this work to draw on a recent review and delimitation of the migratory routes of species features of UK SPAs (and other Annex 1 species) undertaken to help inform assessments of the risk of offshore wind farm development to these species (Wright *et al.* 2012¹).

Species interest features of SPAs are taken from the JNCC UK SPA Data Excel spreadsheet² and the Natura 2000 Data Forms for the SPAs submitted to the European Commission³. The list is limited to those species specified in section 3.2 of the Natura 2000 Data Forms and excludes those solely specified as part of an assemblage. (Note, differences exist between this list and the species interest features listed in the 2001 SPA Review (Stroud *et al.* 2001) because in many cases the latter data have not yet been submitted to the EU as part of an amended Natura 2000 Data Form. It should also be noted that the SPA Review is currently being updated.)

For each species, sites are categorised into:

- i. Those most likely to be affected (highlighted BOLD in species accounts);
- ii. Those that potentially might be affected (highlighted BOLD in species accounts);
- iii. Other sites unlikely to be affected or likely to be only negligibly affected.

To provide context, for each species, information is provided on the size of breeding / non-breeding populations on the Severn Estuary, breeding / non-breeding populations in Great Britain and the overall 'biogeographic' (international) populations that birds on the Severn Estuary may be part of. For the Severn Estuary, non-breeding population sizes are provided by standard five-year mean of peak figures taken from the latest Wetland Bird Survey (WeBS) annual report for 2012/13 (data from 2008/09-2012/13; Austin *et al.* 2014) and also from the Natura 2000 Data Form for the Severn Estuary SPA (data from 1991/92-1995/96) and Information Sheet for the Severn Estuary Ramsar site (data from 1998/99-2002/03). For gulls,

¹ Report and GIS shapefiles of migratory zones available at: <http://www.bto.org/science/wetland-and-marine/soss/projects>

² <http://jncc.defra.gov.uk/page-1409>, updated 1 Sep 2014, accessed 8 Jan 2015

³ <http://jncc.defra.gov.uk/page-1400>



breeding population estimates for the Severn Estuary, based on data from the last national seabird census, Seabird 2000 (data from 1998-2002: Mitchell *et al.* 2004), are also provided on the Ramsar Information Sheet. Great Britain population estimates are taken from Musgrove *et al.* (2013) and biogeographic population estimates from Wetlands International (2015).

The populations of species supported on the Severn Estuary SPA and, indeed, across the UK SPA network as a whole, have changed over time (Cook *et al.* 2013). This is apparent in the differences between the population sizes provided in the Natura 2000 Data Forms for the Severn Estuary SPA, the Information Sheet for the Severn Estuary Ramsar Site and Austin *et al.* (2014), which are based on data from WeBS for 1991/92-1995/96, 1998/99-2002/03 and 2008/09-2012/13 respectively. These changes may reflect both site-level and broader scale factors including, for example, climate change.

Examining WeBS data, Austin and Rehfisch (2005) found that the distributions of eight out of nine common species of waders overwintering on UK estuaries had changed in association with recent climate change. For seven of these species – Eurasian Oystercatcher *Haematopus ostralegus*, Grey Plover *Pluvialis squatarola*, Ringed Plover *Charadrius hiaticula*, Bar-tailed Godwit *Limosa lapponica*, Red Knot *Calidris canutus*, Sanderling *Calidris alba* and Dunlin *Calidris alpina* – the proportion of the population wintering in the south-west was lower in warmer winters. Similarly, looking at data from across north-west Europe from the International Waterbird Census (which WeBS feeds into), Maclean *et al.* (2008) found that the wintering distributions of seven species of wader had undergone substantial shifts, those of Eurasian Oystercatcher, Grey Plover, Bar-tailed Godwit, Red Knot and Dunlin in a north-easterly direction. The implications of climate change for the populations of both non-breeding and breeding birds across the UK SPA network have been examined by the recent ‘CHAINSPAN’ project (Pearce-Higgins *et al.* 2011, Johnston *et al.* 2013). Spatial climate-abundance models were able to predict 56% of the variation in recent 30-year population trends. Using these models, future climate change resulting in 4.4 °C global warming by 2080 was projected to cause declines of at least 25% for more than half of the internationally important populations considered. Nonetheless, most UK SPAs were projected to retain species in sufficient abundances to maintain their legal status, and generally sites that are important now were projected to be important in the future. Conservation objectives at the site level focus on maintaining both the populations of the qualifying species and the habitats used by them⁴. Hence, the CHAINSPAN project also considered the changes in the management of UK SPAs which might be required to enable the network to support the Annex I and migratory species predicted to occur in the UK as the climate changes.

⁴ E.g. <http://www.severnestuary.net/asera/docs/Regulation%2033%20Advice.pdf>



3. Results

All waterbird species which occur on the Severn Estuary, and are features of the Severn Estuary SPA², Severn Estuary Ramsar Site³, or one of the component SSSIs (Table 3.1), or are listed as a UK Biodiversity Action Plan (BAP) species⁵, Section 41 BAP Species of Principal Importance in England⁶, Section 42 Species of Principal Importance in Wales⁷, Amber or Red Listed Birds of Conservation Concern (BoCC) in the UK (Eaton *et al.* 2009) or Wales (Welsh Ornithological Society *et al.* 2009), or IUCN Red list species⁸ (Table 3.2), are considered as potential receptors. Previous work for the Severn Tidal Power SEA Waterbirds Topic Paper (Burton *et al.* 2010a) to identify potential receptors has been updated to account for recent revisions of these listings.

3.1 Evaluating UK SPAs that might be affected by the proposed Cardiff Tidal Power Lagoon and other potential lagoon proposals through displacement of birds from the Severn Estuary

In this review, following the Severn Tidal Power SEA Waterbirds Topic Paper (Burton *et al.* 2010a) and an assessment of the issues surrounding potential habitat creation mitigation / compensation measures (Wright *et al.* 2010), site fidelity has been assessed using the 'WeBS Alerts Biological Filter' (Maclean & Austin 2008). This scoring system is used to assess the natural fluctuations in species' numbers within and between winters, and is calculated using a combination of measures of population size fluctuation, longevity, between-winter movements of birds and within-winter movements of birds. The score assigned reflects the typical behaviour of each species at a UK level. Species with the lowest scores are those that tend to have fluctuating population sizes, are short-lived and are highly mobile (i.e. large between- and within-winter movements). Conversely species with the highest scores are those that tend to have relatively stable populations, are long-lived and are site faithful (i.e. small between- and within-winter movements). Species with scores of five or below are classified as typically exhibiting low site-fidelity, those with scores of 6-8 as typically exhibiting high site-fidelity.

Results of this evaluation of site-fidelity, and thus the likelihood that species might be displaced to particular sites that also support these species, are provided in Table 3.3.

⁵ <http://jncc.defra.gov.uk/page-5163>

⁶ <http://webarchive.nationalarchives.gov.uk/20140605090108/http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/habsandspeciesimportance.aspx>

⁷ <http://www.biodiversitywales.org.uk/49/en-GB/Section-42-Lists>

⁸ <http://www.iucnredlist.org/>



3.2 Evaluating UK SPAs and broad regions of Europe that might support species from the Severn Estuary on their migrations to and from breeding grounds and thus that might also be affected by the proposed Cardiff Tidal Power Lagoon and other potential lagoon proposals on the estuary

Features of other sites in the Natura 2000 network could also be affected, should measures to prevent or reduce any significant adverse effects on the environment or compensation for loss or reductions in the numbers of a SPA feature not be fully possible, as the waterbirds that use the Severn Estuary also pass through many other sites on their migrations to and from breeding grounds.

Species interest features of SPAs are taken from the JNCC UK SPA Data Excel spreadsheet⁹ and the Natura 2000 Data Forms for the SPAs submitted to the European Commission¹⁰. The list is limited to those species specified in section 3.2 of the Natura 2000 Data Forms and excludes those solely specified as part of an assemblage. (Note, differences exist between this list and the species interest features listed in the 2001 SPA Review (Stroud *et al.* 2001) because in many cases the latter data have not yet been submitted to the EU as part of an amended Natura 2000 Data Form. It should also be noted that the SPA Review is currently being updated.)

For each species, sites are categorised into:

- i. Those most likely to be affected;
- ii. Those that potentially might be affected;
- iii. Other sites unlikely to be affected or likely to be only negligibly affected.

SPAs and Ramsar Sites most likely to be affected or which potentially might be affected are listed in Tables 3.4 and 3.5 respectively.

⁹ <http://jncc.defra.gov.uk/page-1409>, updated 1 Sep 2014, accessed 8 Jan 2015

¹⁰ <http://jncc.defra.gov.uk/page-1400>



3.2.1 Species summaries

Mute Swan *Cygnus olor*

Population	Size
Severn Estuary	366 individuals (non-breeding, 2008/09-2012/13)
Great Britain	6,000 (breeding pairs) 74,000 individuals (non-breeding)
International	31,700 individuals (Great Britain)

Mute Swans are a mainly sedentary species with ringing data suggesting few movements of more than 14 km from natal sites.

Given this, effects would probably be negligible at all SPAs in the UK where the species is a feature: Abberton Reservoir, Hornsea Mere, Ouse Washes, Rutland Water and Stour & Orwell Estuaries.

Bewick's Swan *Cygnus columbianus*

Population	Size
Severn Estuary	263 individuals (non-breeding, 2008/09-2012/13) 280 individuals (SPA, non-breeding, 1991/92-1995/96) 229 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	7,000 individuals (non-breeding)
International	21,500 individuals (W Siberia & NE Europe/NW Europe)

Bewick's Swans are long distance migrants which congregate in large numbers at a relatively small number of sites during the winter and are highly site-faithful to these sites. The birds that winter in the UK originate from the Arctic coast of Russia and migrate through Karelia, the Gulf of Finland and the Baltic Sea to the UK. Large numbers of British wintering Bewick's Swans stopover in the Pechora delta of Estonia and then use the Ouse Washes SPA as a staging area before dispersing to sites in the UK. Given their migration route, birds that winter in the southwest may use more sites in the UK than those that winter elsewhere in the country.

As birds use relatively few sites in large numbers, effects on Bewick's Swans on the Severn Estuary could affect the biogeographic population as a whole and a number of other sites in the Natura 2000 network. Neighbouring sites such as the **Somerset Levels & Moors and Walmore Common SPAs, and the Ouse Washes SPA** are the most likely sites to be affected in the UK.



However, birds using the Severn Estuary SPA might also pass through other sites in eastern and south-east England and thus there may potentially also be effects on: the **Arun Valley, Avon Valley, Breydon Water, Broadland, Dungeness to Pett Level, Lower Derwent Valley, Medway Estuary & Marshes, Nene Washes SPAs and The Wash.**

Effects would probably be negligible on other SPAs in the UK where the species is also a feature: Lough Neagh & Lough Beg, Martin Mere and the Ribble & Alt Estuaries.

European White fronted Goose *Anser albifrons albifrons*

Population	Size
Severn Estuary	461 individuals (non-breeding, 2008/09-2012/13) 2,664 individuals (SPA, non-breeding, 1991/92-1995/96) 2,076 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	13,000 individuals (non-breeding)
International	1,200,000 individuals (NW Siberia & NE Europe/NW Europe)

The European White-fronted Geese that winter in the UK originate from the Russian Arctic and migrate along the Baltic Coast, using staging areas in Southern Sweden and Eastern Germany before moving into the UK, where numbers peak in January.

European White-fronted Geese using the Severn Estuary SPA may potentially pass through the **Minsmere-Walberswick and Stodmarsh SPAs.**

Common Shelduck *Tadorna tadorna*

Population	Size
Severn Estuary	4,076 individuals (non-breeding, 2008/09-2012/13) 3,330 individuals (SPA, non-breeding, 1991/92-1995/96) 3,223 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	15,000 pairs (breeding) 61,000 individuals (non-breeding)
International	300,000 (NW Europe)

The Common Shelduck occurs in the UK both as a breeding species and in the non-breeding seasons. A small number of birds from continental Europe migrate to winter in the south of the UK. However, a large proportion of the UK breeding population also migrates to moult in the



Helgoland Bight area of the Wadden Sea from the end of August to mid-September before then moving back into the UK to winter. Moulting flocks also occur within the Severn at Bridgwater Bay and on The Wash and the Firth of Forth (Owen *et al.* 1986), although the latter at least mostly comprises local birds (Pienkowski & Evans 1979).

Effects on Common Shelduck on the Severn Estuary are thus perhaps most likely to also affect **The Wash SPA** and perhaps the neighbouring **Burry Inlet SPA**.

Other SPAs in eastern and southeast England where the species is also a non-breeding interest feature could also potentially be affected because of movements to and from the Wadden Sea: **Chichester & Langstone Harbours, Hamford Water, Humber Estuary, Lindisfarne, Medway Estuary & Marshes, Poole Harbour, Stour & Orwell Estuaries and Teesmouth & Cleveland Coast**.

Effects would probably be negligible on other SPAs in the UK where the species is also a feature: Firth of Forth, Firth of Tay & Eden Estuary, Mersey Estuary, Morecambe Bay, Ribble & Alt Estuaries, The Dee Estuary and the Upper Solway Flats & Marshes.

Eurasian Wigeon *Anas penelope*

Population	Size
Severn Estuary	7,837 individuals (non-breeding, 2008/09-2012/13) 4,658 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	300-500 pairs (breeding) 440,000 individuals (non-breeding)
International	1,500,000 (W Siberia & NE Europe/NW Europe)

The Eurasian Wigeon is a long distance migrant, with around 1,250,000 individuals wintering in northwest Europe each year. One SPA in the UK includes breeding populations of Eurasian Wigeon as an interest feature: the **South Tayside Goose Roosts SPA**, although numbers at this site are small in comparison to the biogeographic population. Birds that winter in the UK predominantly originate from Iceland, Scandinavia and Russia.

Effects on Eurasian Wigeon on the Severn Estuary are most likely to also affect the neighbouring **Burry Inlet SPA**.

Given the wide geographic origins of overwintering birds and mobility of the species in response to changing conditions, effects on Eurasian Wigeon on the Severn Estuary might potentially be observed on the **South Tayside Goose Roosts SPA** and all other SPAs in the UK for which the



species is a non-breeding interest feature: **Abberton Reservoir, Broadland, Chichester & Langstone Harbours, Dornoch Firth & Loch Fleet, Firth of Forth, Humber Estuary, Lindisfarne, Lower Derwent Valley, Martin Mere, Medway Estuary & Marshes, Mersey Estuary, Nene Washes, North Norfolk Coast, Ouse Washes, Ribble & Alt Estuaries, Rutland Water, Stodmarsh, Stour & Orwell Estuaries, The Dee Estuary, The Wash and Upper Nene Valley Gravel Pits.**

Gadwall *Anas strepera*

Population	Size
Severn Estuary	207 individuals (non-breeding, 2008/09-2012/13) 282 individuals (SPA, non-breeding, 1991/92-1995/96) 241 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	670-1,710 pairs (breeding) 25,000 individuals (non-breeding)
International	60,000 (NW Europe)

The Gadwall breeds in increasing numbers in the UK and is also a winter visitor from C Europe, Fennoscandia and Russia. As a breeding bird, the species is an interest feature of the Minsmere-Walberswick, Nene Washes, Ouse Washes and Stodmarsh SPAs, although numbers here are small in comparison to the biogeographic population. Only a small proportion of the British breeding population remains in the country through the winter. Ringing recoveries suggest that many of the Gadwall that winter in the UK stop at IJsselmeer in the Netherlands during the autumn to moult.

SPAs in eastern and southeast England where the species is also a non-breeding interest feature could potentially be affected because of the species' migration route: **Abberton Reservoir, Avon Valley, Broadland, Hornsea Mere, Lee Valley, Minsmere-Walberswick, Nene Washes, Ouse Washes, Rutland Water, South West London Waterbodies, Stodmarsh, Stour & Orwell Estuaries, The Swale, The Wash and Upper Nene Valley Gravel Pits.**

Effects would probably be negligible on the other SPA in the UK where the species is also a feature: Loch Leven.



Common Teal *Anas crecca*

Population	Size
Severn Estuary	5,302 individuals (non-breeding, 2008/09-2012/13) 4,456 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	1,500-2,600 pairs (breeding) 210,000 individuals (non-breeding)
International	500,000 (NW Europe)

Small numbers of Common Teal breed in the UK and as a breeding bird, the species is an interest feature of the Minsmere-Walberswick SPA. However, the majority of those that winter in the UK or pass through en route to wintering grounds in southern Europe are long distance migrants that breed in Iceland, Fennoscandia and Russia. Most of the Icelandic population winters in the UK. Cold spells can result in movements of birds from the UK to France, Iberia, the Netherlands and Denmark, but in general, birds remain on wintering grounds throughout the winter.

Effects on Common Teal on the Severn Estuary are most likely to also affect the neighbouring **Somerset Levels & Moors and Burry Inlet SPAs.**

However, given the wide geographic origins of overwintering birds, effects on Common Teal on the Severn Estuary might potentially be observed on both the **Minsmere-Walberswick SPA** and all other SPAs in the UK for which the species is a non-breeding interest feature: **Abberton Reservoir, Chichester & Langstone Harbours, Hamford Water, Humber Estuary, Loch Leven, Loch of Strathbeg, Lower Derwent Valley, Medway Estuary & Marshes, Mersey Estuary, Nene Washes, Ouse Washes, Ribble & Alt Estuaries, Rutland Water, Solent & Southampton Water, Teesmouth & Cleveland Coast, The Dee Estuary, The Swale and Upper Solway Flats & Marshes.**



Mallard *Anas platyrhynchos*

Population	Size
Severn Estuary	3,089 individuals (non-breeding, 2008/09-2012/13)
Great Britain	59,000-142,000 pairs (breeding) 680,000 individuals (non-breeding)
International	4,500,000 (NW Europe)

Breeding populations of Mallard in the UK are largely sedentary, with most dispersing no more than 22 km following breeding. In the winter populations are supplemented by long distance migrants from Fennoscandia, Russia, Poland, Denmark, Germany, The Netherlands, Belgium, France and Iceland. It is estimated that up to three quarters of birds in Britain during the winter are migrants. Given the origin of these wintering birds, effects on Mallard on the Severn Estuary might potentially be observed on four other SPAs in eastern and southeast England for which the Mallard is a non-breeding interest feature: the **Humber Estuary, Medway Estuary & Marshes, Stodmarsh and Upper Nene Valley Gravel Pits**. However, given the size of the population on the Severn Estuary relative to the national non-breeding population, the proportion of birds using other UK sites on passage that might originate from the Severn Estuary is likely to be small.

Effects would probably be negligible on the other SPA in the UK where the species is also a feature: Firth of Forth.

Northern Pintail *Anas acuta*

Population	Size
Severn Estuary	508 individuals (non-breeding, 2008/09-2012/13) 756 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	9-33 pairs (breeding) 29,000 individuals (non-breeding)
International	60,000 (NW Europe)

Very small numbers of Northern Pintail breed in the UK and are probable resident throughout the year. Most of the large numbers of Northern Pintail that winter in the UK, or pass through en route to wintering grounds further south through Europe and into western Africa, come from breeding grounds in Fennoscandia and Russia, although birds that breed in Iceland also winter in the UK.



Effects on Northern Pintail on the Severn Estuary are most likely to also affect the neighbouring **Burry Inlet SPA**.

However, given the wide geographic origins of overwintering birds, effects on Northern Pintail on the Severn Estuary might potentially be observed on all other SPAs in the UK for which the Northern Pintail is a non-breeding interest feature: **Chichester & Langstone Harbours, Duddon Estuary, Martin Mere, Medway Estuary & Marshes, Mersey Estuary, Morecambe Bay, Nene Washes, Ouse Washes, Ribble & Alt Estuaries, Stour & Orwell Estuaries, The Dee Estuary, The Wash and the Upper Solway Flats & Marshes**.

Northern Shoveler *Anas clypeata*

Population	Size
Severn Estuary	491 individuals (non-breeding, 2008/09-2012/13) 297 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	310-1,010 pairs (breeding) 18,000 individuals (non-breeding)
International	40,000 (NW & C Europe)

The only SPAs in the UK for which breeding Northern Shoveler is an interest feature are: Lower Derwent Valley, Minsmere-Walberswick, Nene Washes and Ouse Washes. Most British breeding birds winter in France, Spain and North Africa, so the likelihood that effects on the Severn would affect the breeding birds on these sites is negligible.

Wintering Northern Shoveler in the UK have widespread origins, coming from France, the Netherlands, through eastern Europe into the Baltic regions and Russia. Low temperatures can lead to movements from Britain to the Iberian Peninsula.

Effects on Northern Shoveler on the Severn Estuary are most likely to also affect the neighbouring **Burry Inlet and Chew Valley Lake**.

Other SPAs in eastern and southeast England could also potentially be affected because of the species' migration route: **Abberton Reservoir, Broadland, Chichester & Langstone Harbours, Dungeness to Pett Level, Lee Valley, Medway Estuary & Marshes, Minsmere-Walberswick, Nene Washes, Ouse Washes, Rutland Water, South West London Water Bodies, Stodmarsh, Teesmouth & Cleveland Coast and Upper Nene Valley Gravel Pits**.

Effects would probably be negligible on the one other SPA in the UK where the species is also a feature: Loch Leven and Upper Solway Flats & Marshes.



Common Pochard *Aythya ferina*

Population	Size
Severn Estuary	569 individuals (non-breeding, 2008/09-2012/13) 1,118 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	330-610 pairs (breeding) 38,000 individuals (non-breeding)
International	300,000 (NE Europe, NW Europe)

The relatively small numbers of Common Pochard that breed in the UK tend to remain in the country over winter. During the winter the population is supplemented by birds from the Baltic region and C Europe. Common Pochard show low winter site fidelity and harsh weather typically leads to a movement towards coastal and maritime sites. In particularly harsh weather conditions, birds from the Netherlands also move into the UK and birds from parts of the UK move into Northern France.

SPAs in eastern and southeast England where the species is also a non-breeding interest feature could potentially be affected because of the species' migration route: **Abberton Reservoir, Humber Estuary, Medway Estuary & Marshes, Ouse Washes, Stodmarsh and Upper Nene Valley Gravel Pits.**

Effects would probably be negligible on other SPAs in the UK where the species is also a feature: Loch Leven and Lough Neagh & Lough Beg.

Tufted Duck *Aythya fuligula*

Population	Size
Severn Estuary	793 individuals (non-breeding, 2008/09-2012/13)
Great Britain	16,000-18,000 pairs (breeding) 110,000 individuals (non-breeding)
International	1,200,000 (NW Europe)

British and Irish breeding Tufted Duck are typically resident throughout the year, making only short movements to and from wintering grounds. During the winter, larger numbers of birds arrive from breeding grounds stretching from Iceland, through northwest Europe Finland and northwest Russia, many passing through IJsselmeer in the Netherlands. The species is very



mobile during the winter and, during periods of cold weather, may move from the south east of England to the southwest and Ireland.

Given the wide geographic origins of overwintering birds, effects on Tufted Duck on the Severn Estuary might potentially be observed on all SPAs in the UK for which the Tufted Duck is a non-breeding interest feature: **Abberton Reservoir, Loch Leven, Lough Neagh & Lough Beg, Ouse Washes, Rutland Water, Stodmarsh and Upper Nene Valley Gravel Pits**. However, given the size of the population on the Severn Estuary relative to the national non-breeding population, the proportion of birds using other UK sites on passage that might originate from the Severn Estuary is likely to be small.

Great Cormorant *Phalacrocorax carbo*

Population	Size
Severn Estuary	99 individuals (non-breeding, 2008/09-2012/13)
Great Britain	8,355 (breeding pairs) 35,000 individuals (non-breeding)
International	120,000 individuals (<i>carbo</i> , NW Europe)

The Great Cormorant is a breeding feature species of six SPAs: Abberton Reservoir, Calf of Eday, East Caithness Cliffs, the Forth Islands, Sheep Island and Puffin Island. Ringing evidence suggests that birds from coastal colonies tend to remain close to their breeding sites during the winter whilst inland birds move an average of 150 km from their breeding sites. Ringing evidence suggests Scottish birds move towards the southwest of England during winter and birds from other regions pass through on their way to sites further south. The likelihood that effects on the Severn would affect the Great Cormorants on any of these sites is thus probably negligible aside from perhaps birds from **Puffin Island**.

Great Cormorant are relatively site faithful to their wintering grounds, and thus effects on the species on the Severn Estuary are unlikely to affect any other sites in the UK for which the Great Cormorant is a non-breeding interest feature: Firth of Forth, Firth of Tay & Eden Estuary, Loch Leven, Medway Estuary & Marshes, Mersey Narrows & North Wirral Foreshore, Ouse Washes, Ribble & Alt Estuaries, Stour & Orwell Estuaries, Teesmouth & Cleveland Coast and Upper Nene Valley Gravel Pits.



Little Egret *Egretta garzetta*

Population	Size
Severn Estuary	103 individuals (non-breeding, 2008/09-2012/13) 17 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	4,500 individuals (non-breeding)
International	125,000-143,000 individuals (W Europe, NW Africa)

The Little Egret has only recently colonised the UK, and was regarded as a rare vagrant as recently as 1989. The species typically migrates in a southerly or south-westerly direction after breeding, and thus effects on the Little Egret on the Severn Estuary could potentially affect the one site in the UK for which the Little Egret is a non-breeding interest feature: **the Tamar Estuaries Complex**.

Water Rail *Rallus aquaticus*

Population	Size
Severn Estuary	35 individuals (non-breeding, 2008/09-2012/13) 11 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	1,100 territories (breeding)
International	100,000-1,000,000 (<i>aquaticus</i> , Europe & North Africa)

The UK Water Rail population is largely resident. In winter, ringing evidence suggests it may be supplemented by birds arriving from central Germany and France.

The Water Rail is a non-breeding interest feature of only one UK SPA: **Stodmarsh**. Given the geographic origins of overwintering and passage birds, effects on Water Rail on the Severn Estuary might also affect birds at this site.



Pied Avocet *Recurvirostra avosetta*

Population	Size
Severn Estuary	130 individuals (non-breeding, 2008/09-2012/13)
Great Britain	1,500 pairs (breeding) 7,500 individuals (non-breeding)
International	73,000 (W Europe & NW Africa)

Relatively small numbers of Pied Avocets either winter or breed on the Severn Estuary.

The Pied Avocet is a breeding feature of six SPAs in the UK, all on the east coast of England: the **Alde-Ore Estuary, Foulness, Humber Estuary, Medway Estuary & Marshes, Minsmere-Walberswick, North Norfolk Coast and Stour & Orwell Estuaries**. After the breeding season Pied Avocets move to adjacent estuaries and form moulting flocks, before moving to wintering sites predominantly around southern English coasts and also abroad.

Effects on Pied Avocets wintering on the Severn Estuary might potentially affect all the above sites, whereas effects on Pied Avocets breeding on the Severn might potentially affect the three southwestern SPAs for which the species is a non-breeding feature: **the Exe Estuary, Poole Harbour and the Tamar Estuaries Complex**.

Effects would probably be negligible on other SPAs in the UK where the species is also a non-breeding feature: the Alde-Ore Estuary, Breydon Water, Deben Estuary, Foulness, Hamford Water, Humber Estuary, Medway Estuary & Marshes, North Norfolk Coast and Thames Estuary & Marshes.

Eurasian Oystercatcher *Haematopus ostralegus*

Population	Size
Severn Estuary	898 individuals (non-breeding, 2008/09-2012/13)
Great Britain	110,000 pairs (breeding) 320,000 individuals (non-breeding)
International	820,000 (<i>ostralegus</i> , Europe/S & W Europe & NW Africa)

The Eurasian Oystercatcher is a breeding feature of one SPA in Scotland: the **Tiree Wetlands & Coast**. Most breeding birds remaining in the UK over winter, although many move down the west coast of the UK, and thus effects on the species on the Severn Estuary could potentially affect this site. However, given the size of the non-breeding population on the Severn Estuary



relative to the national breeding population, the proportion of birds on UK sites important for their breeding populations that might originate from the Severn Estuary is likely to be small.

The UK wintering population also includes breeding birds from the Netherlands, Denmark, Scandinavia, Iceland and the Faroes.

Effects on Eurasian Oystercatcher on the Severn Estuary are most likely to also affect the neighbouring **Burry Inlet SPA**.

However, given the wide geographic origins of overwintering birds, effects on the Eurasian Oystercatcher on the Severn Estuary might potentially be observed on all other SPAs in the UK for which the species is a non-breeding interest feature: **Exe Estuary, Firth of Forth, Firth of Tay & Eden Estuary, Foulness, Humber Estuary, Lavan Sands, Medway Estuary & Marshes, Mersey Narrows & North Wirral Foreshore, Montrose Basin, Morecambe Bay, Ribble & Alt Estuaries, The Dee Estuary, The Swale, The Wash and the Upper Solway Flats & Marshes**. However, given the size of the population on the Severn Estuary relative to the national non-breeding population, the proportion of birds using other UK sites on passage that might originate from the Severn Estuary is likely to be small.

European Golden Plover *Pluvialis apricaria*

Population	Size
Severn Estuary	2,467 individuals (non-breeding, 2008/09-2012/13)
Great Britain	38,000-59,000 pairs (breeding) 400,000 individuals (non-breeding)
International	140,000-210,000 (<i>apricaria</i> , Britain, Ireland, Denmark, Germany & Baltic) 930,000 (<i>altifrons</i> , Iceland & Faroes/E Atlantic coast) 500,000-1,000,000 (<i>altifrons</i> , N Europe/W Europe & NW Africa)

The European Golden Plover is a breeding feature of eight SPAs: **Caithness and Sutherland Peatlands, Lewis Peatlands, Muirkirk and North Lowther Uplands, North Pennine Moors, North York Moors, Peak District Moors, South Pennine Moors, and Pettigoe Plateau** in Northern Ireland. Ringing recoveries indicate that some remain in the UK but many UK birds move to Iberia, North Africa and the Low Countries for the winter, potentially passing through the Severn Estuary en route. Effects on the species on the Severn Estuary could thus potentially affect all of these sites.

Effects on European Golden Plover on the Severn Estuary are most likely to also affect the neighbouring **Somerset Levels & Moors SPA**.



Birds that remain in the UK over winter are joined by birds from Iceland, Scandinavia and western Siberia. Given the wide geographic origins of overwintering and passage birds and potential for cold weather movements, effects on European Golden Plover on the Severn Estuary might potentially be observed on all other SPAs in the UK for which the species is a non-breeding interest feature: **Breydon Water, Firth of Forth, Humber Estuary, Lindisfarne, Lower Derwent Valley, Mersey Estuary, Outer Ards, Ribble & Alt Estuaries, Stour & Orwell Estuaries, Thanet Coast and Sandwich Bay, Upper Nene Valley Gravel Pits and the Upper Solway Flats & Marshes**. However, given the size of the population on the Severn Estuary relative to the national non-breeding population, the proportion of birds using other UK sites on passage that might originate from the Severn Estuary is likely to be small.

Grey Plover *Pluvialis squatarola*

Population	Size
Severn Estuary	370 individuals (non-breeding, 2008/09-2012/13)
Great Britain	43,000 individuals (non-breeding)
International	250,000 (<i>squatarola</i> , W Siberia & Canada/W Europe & W Africa)

The Grey Plover that winter in the UK mostly belong to Russian breeding population and are almost entirely confined to the coast, where they exhibit strong winter site fidelity. Birds also pass through the UK en route to wintering grounds as far south as Ghana, although very few of these pass through the Severn.

Effects on Grey Plover on the Severn Estuary are most likely to also affect the neighbouring **Burry Inlet SPA**.

SPAs in eastern and southeast England where the species is also a non-breeding interest feature could potentially be affected because of the species' migration route: **Benfleet & Southend Marshes, Blackwater Estuary, Chichester & Langstone Harbours, Dengie, Exe Estuary, Foulness, Gibraltar Point, Hamford Water, Humber Estuary, Lindisfarne, Medway Estuary & Marshes, Stour & Orwell Estuaries, Thames Estuary & Marshes, The Swale and The Wash**.

Effects would probably be negligible on other SPAs in the UK where the species is also a feature: the Firth of Forth, Firth of Tay & Eden Estuary, Mersey Estuary, Mersey Narrows & North Wirral Foreshore, Morecambe Bay, Ribble & Alt Estuaries, The Dee Estuary and the Upper Solway Flats & Marshes.



Northern Lapwing *Vanellus vanellus*

Population	Size
Severn Estuary	10,471 individuals (non-breeding, 2008/09-2012/13)
Great Britain	130,000 pairs (breeding) 620,000 individuals (non-breeding)
International	5,500,000-9,500,000 (Europe, W Asia/Europe, N Africa & SW Asia)

Northern Lapwing breed throughout the UK and across Eurasia. Many UK breeders stay within the country to winter, birds from the northwest typically moving to the southwest or Ireland, although those from the south typically move to France or the Iberian Peninsula. Those wintering in the UK are also joined by birds from northern and C Europe, particularly during periods of cold weather.

Effects on Northern Lapwing on the Severn Estuary are most likely to affect the neighbouring **Somerset Levels & Moors SPA**.

SPAs in northwest or southeast England where the species is also a non-breeding interest feature could potentially be affected because of the species' migration route: **Breydon Water, Mersey Estuary, Ribble & Alt Estuaries, Stodmarsh, Stour & Orwell Estuaries and Upper Nene Valley Gravel Pits**.

Effects would probably be negligible on other SPAs in the UK where the species is also a feature: Firth of Forth and Humber Estuary.

Common Ringed Plover *Charadrius hiaticula*

Population	Size
Severn Estuary	1,335 individuals (non-breeding, 2008/09-2012/13) 740 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	5,300 (5,100-5,500) pairs (breeding) 34,000 individuals (non-breeding)
International	73,000 (<i>hiaticula</i> , Northern Europe/Europe & North Africa)

The Common Ringed Plover is a breeding feature of six SPAs: the **North Uist Machair & Islands, South Uist Machair & Islands and Tiree Wetlands & Coast** in Scotland and the **Blackwater Estuary, Colne Estuary and Foulness** in eastern England. Many British birds remain in the country to winter, although the movements of these breeding birds away from their breeding



sites is poorly understood. Effects on Ringed Plover on the Severn Estuary could thus potentially all of these birds from all of these sites.

The Ringed Plovers that breed in the UK belong to European population of the nominate *hiaticula* subspecies. Birds from Baffin Island, Greenland, Iceland and Svalbard (sometimes considered as a separate subspecies *psammodrma*) may pass through the UK en route to more southerly wintering grounds in France, Iberia and West Africa.

Given the wide geographic origins of overwintering and passage birds, effects on Ringed Plover on the Severn Estuary might potentially be observed on all other SPAs in the UK for which the species is a non-breeding interest feature: **Benfleet & Southend Marshes, Blackwater Estuary, Chichester & Langstone Harbours, Firth of Forth, Hamford Water, Humber Estuary, Lindisfarne, Medway Estuary & Marshes, Mersey Estuary, Morecambe Bay, North Uist Machair & Islands, Outer Ards, Ribble & Alt Estuaries, Solent & Southampton Water, South Uist Machair & Islands, Stour & Orwell Estuaries, Thames Estuary & Marshes, The Swale and Tiree Wetlands & Coast.**

Whimbrel *Numenius phaeopus*

Population	Size
Severn Estuary	241 individuals (non-breeding, 2008/09-2012/13) 333 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	400-500 pairs (breeding) 30 individuals (non-breeding)
International	600,000-750,000 (<i>islandicus</i> , Iceland, Faroes & Scotland/W Africa) 190,000-340,000 (<i>phaeopus</i> , N Europe/W Africa)

The Whimbrel is a breeding interest feature of the Fetlar SPA in Shetland, at the southern edge of the species breeding distribution. However, most of those seen in the UK occur on passage and originate from breeding populations in Iceland, the Faroes, Fennoscandia and northwest Russia.

Effects could potentially be observed on the **Fetlar SPA** and, given the wide geographic origins of overwintering birds, the other SPAs where the species is a non-breeding interest feature: **Humber Estuary and Ribble & Alt Estuaries.**



Eurasian Curlew *Numenius arquata*

Population	Size
Severn Estuary	3,631 individuals (non-breeding, 2008/09-2012/13) 2,021 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	66,000 pairs (breeding) 140,000 individuals (non-breeding)
International	700,000-1,000,000 (<i>arquata</i> , Europe/Europe, N & W Africa)

The Eurasian Curlew is a breeding feature of one UK SPA, the **Peak District Moors**. At the end of the breeding season, many British breeding Eurasian Curlew move to the west and southwest coasts of Britain and Ireland, or on to France and Iberia. The winter population is supplemented by the arrival birds from continental Europe, Scandinavia and the Baltic region.

Effects on Eurasian Curlew on the Severn Estuary are most likely to also affect the neighbouring **Burry Inlet SPA**.

SPAs in south and east England where the species is also a non-breeding interest feature could also potentially be affected because of the origins of wintering birds: **Chichester & Langstone Harbours, Humber Estuary, Medway Estuary & Marshes, Stour & Orwell Estuaries, The Swale and The Wash**.

Effects would probably be negligible on other SPAs where the species is also a non-breeding feature: Firth of Forth, Lavan Sands, Mersey Estuary, Morecambe Bay, Ribble & Alt Estuaries, The Dee Estuary and the Upper Solway Flats & Marshes.

Black-Tailed Godwit *Limosa limosa*

Population	Size
Severn Estuary	616 individuals (non-breeding, 2008/09-2012/13)
Great Britain	7-9 pairs (<i>islandica</i> , breeding) 54-57 pairs (<i>limosa</i> , breeding) 43,000 individuals (<i>limosa</i> , non-breeding)
International	160,000-180,000 (<i>limosa</i> , W Europe/NW & West Africa) 50,000-75,000 (<i>islandica</i> , Iceland/W Europe)

The Black-tailed Godwit is a breeding feature of two UK SPAs: the Nene Washes and the Ouse Washes. Birds show a high degree of philopatry to these sites. Adults which breed in the UK



show a tendency to winter in Sub-Saharan Africa, but there is no evidence that birds from these sites pass through the Severn Estuary on their way to these wintering grounds.

Wintering birds belong to the Icelandic (*islandica*) breeding population. Effects on Black-tailed Godwits on the Severn Estuary might potentially affect other SPAs to the south or north where the species is a non-breeding interest feature: **Exe Estuary, Firth of Tay & Eden Estuary, Mersey Estuary, Poole Harbour, Portsmouth Harbour, Ribble & Alt Estuaries, Solent & Southampton Water and The Dee Estuary.**

Effects would probably be negligible on other SPAs where the species is also a non-breeding feature: Blackwater Estuary, Hamford Water, Humber Estuary, Medway Estuary & Marshes, Stour & Orwell Estuaries, Thames Estuary & Marshes and The Wash.

Bar-Tailed Godwit *Limosa lapponica*

Population	Size
Severn Estuary	68 individuals (non-breeding, 2008/09-2012/13)
Great Britain	38,000 individuals (non-breeding)
International	120,000 (<i>lapponica</i> , N Europe/W Europe)

The British wintering population of Bar-tailed Godwit originates from the Fennoscandian and Western Russian breeding population. At the end of the breeding season many birds move into the Wadden Sea to moult before moving into their wintering grounds in Britain, or as far south as the West African Coasts around Mauritania and Guinea Bissau.

Effects on Bar-tailed Godwit on the Severn Estuary might potentially affect SPAs in eastern and southeast England: **Chichester & Langstone Harbours, Foulness, Gibraltar Point, Humber Estuary, Lindisfarne, and The Wash.** However, given the size of the population on the Severn Estuary relative to the national non-breeding population, the proportion of birds using other UK sites on passage that might originate from the Severn Estuary is likely to be small.

Effects would probably be negligible on other SPAs where the species is also a non-breeding feature: Cromarty Firth, Dornoch Firth & Loch Fleet, Firth of Forth, Firth of Tay & Eden Estuary, Inner Moray Firth, Lough Foyle, Mersey Narrows & North Wirral Foreshore, Morecambe Bay, Ribble & Alt Estuaries, The Dee Estuary and the Upper Solway Flats & Marshes.



Ruddy Turnstone *Arenaria interpres*

Population	Size
Severn Estuary	381 individuals (non-breeding, 2008/09-2012/13)
Great Britain	48,000 individuals (non-breeding)
International	100,000-200,000 (<i>interpres</i> , NE Canada & Greenland/W Europe & NW Africa) 45,000-120,000 (<i>interpres</i> , N Europe/W Africa)

The Ruddy Turnstone is a long-distance, winter migrant to the UK. Most of the birds occurring in the UK over winter are from the population in Canada and Greenland, and use Iceland as a migratory stopover site, although there are also a small number of Fennoscandian birds. Ruddy Turnstone from Fennoscandia and Siberia also occur during passage.

Given the wide geographic origins of overwintering and passage birds, effects on Ruddy Turnstone on the Severn Estuary might potentially be observed on all SPAs in the UK for which the species is a non-breeding interest feature: **Chichester & Langstone Harbours, East Sanday Coast, Firth of Forth, Humber Estuary, Medway Estuary & Marshes, Morecambe Bay, North Uist Machair & Islands, Northumbria Coast, Outer Ards, Stour & Orwell Estuaries, Thanet Coast & Sandwich Bay, The Wash, Tiree Wetlands & Coast and Upper Solway Flats & Marshes.** However, given the size of the population on the Severn Estuary relative to the national non-breeding population, the proportion of birds using other UK sites on passage that might originate from the Severn Estuary is likely to be small.

Red Knot *Calidris canutus*

Population	Size
Severn Estuary	2,634 individuals (non-breeding, 2008/09-2012/13)
Great Britain	320,000 individuals (non-breeding)
International	450,000 (<i>islandica</i> , NE Canada & Greenland/W Europe)

Red Knot wintering in the UK are from the *islandica* subspecies and originate from northern Greenland and Arctic Canada. Following the breeding season, Red Knot move to moulting sites in Britain and notably the Wadden Sea, before dispersing to wintering grounds. Birds then use staging grounds in Norway and Iceland en route back to breeding sites. Birds from the nominate *canutus* subspecies also pass through east coast estuaries of the UK en route between breeding grounds on the Russian Taimyr Peninsula and west Africa.



Effects on Red Knot on the Severn Estuary are most likely to also affect the neighbouring **Burry Inlet SPA**.

However, given the wide geographic origins of overwintering birds, effects on Knot on the Severn Estuary might potentially be observed on all other SPAs in the UK for which the species is a non-breeding interest feature: **Benfleet & Southend Marshes, Dengie, Duddon Estuary, Firth of Forth, Foulness, Humber Estuary, Medway Estuary & Marshes, Mersey Narrows & North Wirral Foreshore, Montrose Basin, Morecambe Bay, North Norfolk Coast, Ribble & Alt Estuaries, Stour & Orwell Estuaries, Strangford Lough, Teesmouth & Cleveland Coast, Thames Estuary & Marshes, The Dee Estuary, The Wash and Upper Solway Flats & Marshes**. However, given the size of the population on the Severn Estuary relative to the national non-breeding population, the proportion of birds using other UK sites on passage that might originate from the Severn Estuary is likely to be small.

Ruff *Calidris pugnax*

Population	Size
Severn Estuary	17 individuals (non-breeding, 2008/09-2012/13) 12 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	0-11 pairs (breeding) 800 individuals (non-breeding)
International	1,000,000-1,500,000 (N Europe & W Siberia/W Africa)

The Ruff is a rare breeding feature of one UK SPA – the Ribble and Alt Estuaries. There is very little known about the movements of these birds, although it might be hypothesised that effects on the species on the Severn Estuary could potentially affect this site.

The majority of Ruff breed in Fennoscandia and Russia and may pass through the UK during passage en route to their main wintering grounds in Senegal and Mali. A small number of birds remain in the UK over winter, and may be supplemented by birds from elsewhere in western Europe during cold weather.

Effects on Ruff on the Severn Estuary might potentially affect all sites for which the species is also a non-breeding feature: **Alde-Ore Estuary, Breydon Water, Broadland, Humber Estuary, Lower Derwent Valley, Ouse Washes and Pagham Harbour**.



Sanderling *Calidris alba*

Population	Size
Severn Estuary	336 individuals (non-breeding, 2008/09-2012/13)
Great Britain	16,000 individuals (non-breeding)
International	120,000 (E Atlantic Europe, W & S Africa)

The Sanderling is a long-distance, winter migrant to the UK. Birds from both Greenland and Siberia occur in the UK in autumn. Most of the birds occurring in the UK over winter are thought to be from the Siberian population, although birds from the Greenland population may also occur.

Given the wide geographic origins of overwintering and passage birds, effects on Sanderling on the Severn Estuary might potentially be observed on all SPAs in the UK for which the species is a non-breeding interest feature: **Chichester & Langstone Harbours, Firth of Tay and Eden Estuary, Gibraltar Point, Humber Estuary, Lindisfarne, Mersey Narrows & North Wirral Foreshore, Ribble & Alt Estuaries, South Uist Machair & Lochs, Teesmouth & Cleveland Coast and The Wash and Upper Solway Flats & Marshes.**

Dunlin *Calidris alpina*

Population	Size
Severn Estuary	26,412 individuals (non-breeding, 2008/09-2012/13) 44,624 individuals (SPA, non-breeding, 1991/92-1995/96) 25,082 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	8,600-10,600 pairs (breeding) 350,000 individuals (non-breeding)
International	1,330,000 (<i>alpina</i> , NE Europe & NW Siberia/W Europe & NW Africa) 23,000-26,000 (<i>schinzii</i> , Britain & Ireland/SW Europe & NW Africa) 940,000-960,000 (<i>schinzii</i> , Iceland & Greenland/NW and West Africa) 3,300-4,100 (<i>schinzii</i> , Baltic/SW Europe & NW Africa) 21,000-45,000 (<i>arctica</i> , NE Greenland/West Africa)

The Dunlin is a breeding feature of six UK SPAs: **Caithness and Sutherland Peatlands, Fetlar, Lewis Peatlands, North Uist Machair & Islands, South Uist Machair & Islands and Tiree Wetlands & Coast.** These birds are from the subspecies *schinzii*, the main populations of which are from Iceland and southeast Greenland and which primarily winters in West Africa (Mauritania) as does the *arctica* subspecies breeding in NE Greenland. Many of these birds pass



through west coast estuaries (including the Severn) in spring en route between the wintering grounds and breeding areas. Effects on the autumn and spring populations of this species on the Severn Estuary could thus potentially affect all of these sites.

The nominate *alpina* from northern Fennoscandia and western Siberia forms the bulk of the British winter population. During the spring, many *alpina* Dunlin congregate on The Wash and the Wadden Sea before departing for their breeding grounds. In autumn, Dunlin wintering on the Severn moult on The Wash and the Wadden Sea before they arrive on the Severn (Clark 1983).

Effects on Dunlin on the Severn Estuary are most likely to also affect the neighbouring **Burry Inlet SPA**.

Given the wide geographic origins of overwintering and passage birds, effects on Dunlin on the Severn Estuary might potentially be observed on all SPAs in the UK for which the species is a non-breeding interest feature: **Benfleet & Southend Marshes, Blackwater Estuary, Chichester & Langstone Harbours, Exe Estuary, Firth of Forth, Firth of Tay & Eden Estuary, Humber Estuary, Lindisfarne, Medway Estuary & Marshes, Mersey Estuary, Mersey Narrows & North Wirral Foreshore, Morecambe Bay, Portsmouth Harbour, Ribble & Alt Estuaries, Stour & Orwell Estuaries, Thames Estuary & Marshes, The Dee Estuary, The Swale, The Wash and the Upper Solway Flats & Marshes SPAs.**

Spotted Redshank *Tringa erythropus*

Population	Size
Severn Estuary	10 individuals (non-breeding, 2008/09-2012/13) 10 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	98 individuals (non-breeding)
International	60,000-120,000 (N Europe/S Europe, N & W Africa)

Spotted Redshank predominantly occur in the UK during the winter and passage periods. Ringing records link British birds to France, Morocco, Italy, Malta and Denmark. The Spotted Redshank is not a feature of any SPA site in the UK, although the species is a non-breeding feature of some Ramsar Sites.



Common Greenshank *Tringa nebularia*

Population	Size
Severn Estuary	17 individuals (non-breeding, 2008/09-2012/13) 26 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	1,100 (700-1,500) pairs (breeding) 610 individuals (non-breeding)
International	190,000-270,000 (N Europe/SW Europe, NW & W Africa)

The Common Greenshank is a breeding feature of one Scottish SPA: the **Lewis Peatlands**. However, most of those seen in the UK occur on passage and originate from breeding populations in Fennoscandia and Russia. Small numbers of birds winter in the UK and Ireland, although the majority pass further south to winter in Africa. Effects on the species on the Severn Estuary could thus potentially affect this site

Effects would probably be negligible on other SPAs where the species is a non-breeding feature: Humber Estuary and Medway Estuary & Marshes.

Common Redshank *Tringa totanus*

Population	Size
Severn Estuary	3,067 individuals (non-breeding, 2008/09-2012/13) 2,330 individuals (SPA, non-breeding, 1991/92-1995/96) 2,616 individuals (Ramsar, non-breeding, 1998/99-2002/03)
Great Britain	24,000 pairs (breeding) 120,000 individuals (non-breeding)
International	95,000-135,000 (<i>britannica</i> Britain & Ireland/Britain, Ireland & France) 150,000-400,000 (<i>robusta</i> Iceland & Faeroes/W Europe) 200,000-300,000 (<i>totanus</i> N Europe)

The Common Redshank is a breeding feature of one UK SPA: **Tiree Wetlands & Coast**. Many of the UK breeding population (subspecies *britannica*) remain in the country over winter, although birds from southern England move further south into the Low Countries, France and Iberia. In the winter, UK breeders are joined by birds of the *robusta* subspecies from Iceland, and a small number of *totanus* birds from continental Europe.

Birds wintering at Cardiff Bay on the Severn Estuary were estimated to be predominantly of the *britannica* subspecies, although with a small proportion of the *robusta* subspecies; breeding



season recoveries came from throughout northern and western Britain including the Uists and Tiree (Burton *et al.* 2002). Effects on the species on the Severn Estuary may thus potentially affect breeding birds on the **Tiree Wetlands & Coast SPA**.

Effects on Common Redshank on the Severn Estuary are most likely to also affect the neighbouring **Burry Inlet SPA**.

Effects might also potentially affect other sites to the south or north where the species is a non-breeding interest feature: **Belfast Lough, Chichester & Langstone Harbours, Duddon Estuary, Firth of Forth, Firth of Tay & Eden Estuary, Humber Estuary, Inner Clyde Estuary, Inner Moray Firth, Lindisfarne, Mersey Estuary, Mersey Narrows & North Wirral Foreshore, Montrose Basin, Moray & Nairn Coast, Morecambe Bay, Ribble & Alt Estuaries, Strangford Lough, Teesmouth & Cleveland Coast, The Dee Estuary and Upper Solway Flats & Marshes**.

Effects would probably be negligible on other SPAs where the species is also a non-breeding feature: the Alde-Ore Estuary, Colne Estuary, Foulness, Hamford Water, Medway Estuary & Marshes, Stour & Orwell Estuaries, Thames Estuary & Marshes, The Swale and The Wash.

Common Snipe *Gallinago gallinago*

Population	Size
Severn Estuary	143 individuals (non-breeding, 2008/09-2012/13)
Great Britain	76,000 pairs (breeding) 1,000,000 individuals (non-breeding)
International	2,500,000 (<i>gallinago</i> , Europe/S & W Europe & NW Africa)

Snipe breeding in the southern UK typically migrate to France and Iberia during the winter, with some travelling as far as North Africa. The remaining winter population is supplemented by up to one million birds that arrive from Fennoscandia, Germany, Iceland, the Baltic States, Russia and the Czech Republic. There is some evidence of movements in response to cold weather.

The Snipe is a non-breeding interest feature of only one UK SPA: **Stodmarsh**. Given the wide geographic origins of overwintering and passage birds, effects on Snipe on the Severn Estuary might also affect birds at this site. However, given the size of the population on the Severn Estuary relative to the national non-breeding population, the proportion of birds using other UK sites on passage that might originate from the Severn Estuary is likely to be small.



Black Headed Gull *Chroicocephalus ridibundus*

Population	Size
Severn Estuary	8,814 individuals (non-breeding, 2008/09-2012/13)
Great Britain	130,000 pairs (breeding) 2,200,000 (2,100,000-2,200,000) individuals (non-breeding)
International	3,700,000-4,800,000 (W Europe/W Europe, W Mediterranean, W Africa)

The Black-headed Gull is a breeding interest feature of one UK SPA: **the Ribble & Alt Estuaries**. Most of the birds which breed in the UK and Ireland also winter here, although some, particularly from the southwest, migrate to France and Iberia. Breeding birds from the north and east of the UK tend to move migrate to the southwest. Effects on the species on the Severn Estuary could thus potentially affect the above site.

Ringling recoveries also indicate that considerable numbers of Black-headed Gulls may move into the UK to winter from Fennoscandia, the Baltic Sea and the continent. No SPAs in the UK currently include non-breeding Black-headed Gull as a feature.

Common Gull *Larus canus*

Population	Size
Severn Estuary	693 individuals (non-breeding, 2008/09-2012/13)
Great Britain	48,000 pairs (breeding) 700,000 (670,000-720,000) individuals (non-breeding)
International	1,200,000-2,250,000 (<i>canus</i> , NW & C Europe/Atlantic coast & Mediterranean)

The Common Gull is a breeding interest feature of one UK SPA: the **Tips of Corsemaul & Tom Mor** in Scotland. During the winter, the Scottish birds move southwest into Ireland and England, whilst Irish birds may move east into western England. Effects on the species on the Severn Estuary could thus potentially affect the above site.

These birds are joined by wintering Common Gulls originating from Norway, Sweden, Finland, Denmark, the Baltic States and western Russia. No SPAs in the UK currently include non-breeding Common Gull as a feature.



Lesser Black Backed Gull *Larus fuscus*

Population	Size
Severn Estuary	560 individuals (non-breeding, 2008/09-2012/13) 4,167 AONs (Ramsar, breeding, 1998-2002)
Great Britain	110,000 pairs (breeding) 120,000 (120,000-130,000) individuals (non-breeding)
International	530,000-570,000 (<i>graellsii</i> , W Europe/Mediterranean & W Africa)

The Lesser Black-backed Gull is a breeding interest feature of six UK SPAs: **Ailsa Craig, Alde-Ore Estuary, Bowland Fells, Forth Islands, Isles of Scilly and Ribble & Alt Estuaries**. Birds tend to move south and west in the winter, with some UK breeding birds wintering in Iberia and North Africa. Effects on the species (during winter) on the Severn Estuary could thus potentially affect all of the above sites. However, given the size of the non-breeding population on the Severn Estuary relative to the national breeding population, the proportion of birds on UK sites important for their breeding populations that might originate from the Severn Estuary is likely to be small.

During the autumn and winter, the UK population of Lesser Black-backed Gull is swollen by the arrival of birds from Iceland, the Faroes and Continental Europe. Lesser Black-backed Gulls can travel up to 100 km in search of food each day, and often travel long distances to sheltered estuaries during periods of poor weather. No SPAs in the UK currently include non-breeding Lesser Black-backed Gull as a feature.

Herring Gull *Larus argentatus*

Population	Size
Severn Estuary	1,406 individuals (non-breeding, 2008/09-2012/13) 1,540 AONs (Ramsar, breeding, 1998-2002)
Great Britain	130,000 pairs (breeding) 730,000 (700,000-760,000) individuals (non-breeding)
International	1,300,000 - 3,100,000 (<i>argentatus</i> , N & NW Europe) 990,000-1,050,000 (<i>argenteus</i> , Iceland & Western Europe)

The Herring Gull is a breeding interest feature of eight UK SPAs: **Ailsa Craig, Buchan Ness to Collieston Coast, Canna and Sanday, East Caithness Cliffs, Forth Islands, Fowlsheugh, St Abb's Head to Fast Castle and Troup, Pennan & Lion's Heads**. Breeding Herring Gulls in the UK (subspecies *argenteus*) tend to move south and west in the winter. Effects on the species (during winter) on the Severn Estuary could thus potentially affect all the above sites. However,



given the size of the non-breeding population on the Severn Estuary relative to the national breeding population, the proportion of birds on UK sites important for their breeding populations that might originate from the Severn Estuary is likely to be small.

During the autumn and winter, the UK population of Herring Gull is swollen by the arrival of birds from the Low Countries, Fennoscandia and western Russia. No SPAs in the UK currently include non-breeding Herring Gull as a feature.



4. Acknowledgements

Our thanks go to all those volunteers who have helped with the WeBS counts of the Severn Estuary and other sites. WeBS is a partnership between the British Trust for Ornithology (BTO), the Royal Society for the Protection of Birds (RSPB) and the Joint Nature Conservation Committee (JNCC) – the last on behalf of the Countryside Council for Wales (CCW), Natural England (NE), Scottish Natural Heritage (SNH) and the Northern Ireland Environment Agency (NIEA) – in association with the Wildfowl and Wetlands Trust (WWT). Our thanks also to Maria Knight for help in formatting the report.



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Table 3.1 Feature waterbird or seabird species of the Severn Estuary SPA, Severn Estuary Ramsar Site and component SSSIs.

Site	Severn Estuary	Severn Estuary	Severn Estuary	Severn Estuary	Bridgwater Bay ⁴	Flat Holm ⁴	Severn Estuary ⁴	Sully Island ⁴	Upper Severn Estuary ⁴
Designation	SPA ¹	SPA ²	SPA ³	Ramsar	SSSI	SSSI	SSSI	SSSI	SSSI
Bewick's Swan	✓	✓	✓	✓					✓
European White-fronted Goose	✓	✓	✓	✓					✓
Common Shelduck	✓	✓	✓	✓	+		✓		
Eurasian Wigeon	✓		✓	✓	+				✓
Gadwall	✓	✓	✓	✓					✓
Common Teal	✓		✓	✓	+		✓ ⁵		
Mallard			✓						
Northern Pintail	✓		✓	✓			✓ ⁵		
Northern Shoveler			✓	✓			✓ ⁵		✓
Common Pochard	✓		✓	✓			✓ ⁵		✓
Tufted Duck	✓		✓						
Little Egret				✓					
Water Rail				✓					
European Golden Plover							✓		
Grey Plover	✓		✓		✓		✓	✓ ⁶	
Northern Lapwing			✓						
Common Ringed Plover	✓		✓	✓	✓		✓	✓ ⁶	
Whimbrel	✓		✓	✓	✓				

Site	Severn Estuary	Severn Estuary	Severn Estuary	Severn Estuary	Bridgwater Bay ⁴	Flat Holm ⁴	Severn Estuary ⁴	Sully Island ⁴	Upper Severn Estuary ⁴
Designation	SPA ¹	SPA ²	SPA ³	Ramsar	SSSI	SSSI	SSSI	SSSI	SSSI
Eurasian Curlew	✓		✓	✓	✓		✓		
Black-tailed Godwit					✓		✓ ⁵		
Ruff				✓					
Dunlin	✓	✓	✓	✓	✓		✓	✓ ⁶	
Spotted Redshank	✓			✓					
Common Greenshank				✓					
Common Redshank	✓	✓	✓	✓	✓		✓	✓ ⁶	
Lesser Black-backed Gull				✓		✓			
Herring Gull				✓					
Waterbird assemblage	✓	✓	✓	✓					

¹ Listed under the SPA's original citation in 1995.

² Listed on the Natura 2000 Standard Data Form for the SPA updated in 1999.

³ Listed in the SPA Review (Stroud *et al.* 2001).

⁴ Component SSSIs of the Severn Estuary SPA (the Penarth Coast and Steep Holm SSSIs which are also components are not notified for their bird interest).

⁵ Features that are not notified but qualify following a recent CCW review.

⁶ Features that are notified but failing following a recent CCW review.



Table 3.2 Waterbird or seabird species that regularly occur within the main study area and are listed as UK Biodiversity Action Plan (BAP) species, Section 41 BAP Species of Principal Importance in England, Section 42 BAP Species of Principal Importance in Wales, Amber- or Red-listed Birds of Conservation Concern (BoCC) or IUCN Red list species.

Receptor	UKBAP	Section 41 BAP England	Section 42 BAP Wales	BoCC	BoCC Wales ²	IUCN Red List
Mute Swan ¹				Amber	Amber	
Bewick's Swan ¹	✓	✓	✓	Amber	Amber	
European White-fronted Goose ¹	✓	✓	✓	Amber	Red ³	
Common Shelduck				Amber	Amber	
Eurasian Wigeon ¹				Amber	Amber	
Gadwall ¹				Amber	Amber	
Common Teal ¹				Amber	Amber	
Mallard ¹					Amber	
Northern Pintail ¹				Amber	Amber	
Northern Shoveler ¹				Amber	Amber	
Common Pochard ¹				Amber	Red	
Tufted Duck ¹					Amber	
Great Cormorant				Amber	Amber	
Little Egret ¹				Amber		
Water Rail ¹				Amber		
Pied Avocet				Amber	Amber	
Eurasian Oystercatcher				Amber	Amber	
European Golden Plover ¹			✓		Red	
Grey Plover				Amber	Red	



Receptor	UKBAP	Section 41 BAP England	Section 42 BAP Wales	BoCC	BoCC Wales ²	IUCN Red List
Northern Lapwing ¹	✓	✓	✓	Amber	Red	
Common Ringed Plover			✓	Amber	Amber	
Whimbrel ¹				Amber	Amber	
Eurasian Curlew ¹	✓	✓	✓	Amber	Red	Near Threatened
Black-tailed Godwit	✓	✓		Red	Amber	Near Threatened
Bar-tailed Godwit			✓	Amber	Red	
Ruddy Turnstone				Amber	Amber	
Red Knot				Amber	Amber	
Ruff				Amber	Amber	
Sanderling					Amber	
Dunlin ¹				Amber	Red	
Spotted Redshank				Amber	Amber	
Common Redshank ¹				Amber	Amber	
Common Snipe ¹				Amber	Amber	
Black-headed Gull			✓	Amber	Red	
Common Gull				Amber	Red	
Lesser Black-backed Gull				Amber	Amber	
Herring Gull	✓	✓	✓	Amber	Red	

¹ Species regularly occurs both on the Severn Estuary and in the study area floodplain.

² See Welsh Ornithological Society *et al.* (2009).

³ White-fronted Goose is a Red-list species in Welsh Ornithological Society *et al.* (2009), although the main subspecies that occurs in Wales is the Greenland White-fronted Goose *Anser albifrons flavirostris* which is largely restricted to the Dyfi Estuary.





Table 3.3 Site-fidelity of potential receptor species on the Severn Estuary.

Receptor ¹	Site-fidelity ²
Mute Swan	Low ³
Bewick's Swan	Low
European White-fronted Goose	High
Common Shelduck	Low
Eurasian Wigeon	Low
Gadwall	Low
Eurasian Teal	Low
Mallard	Low
Northern Pintail	Low
Northern Shoveler	Low
Common Pochard	Low
Tufted Duck	Low
Great Cormorant	High
Little Egret	Low ³
Water Rail	High ³
Pied Avocet	High
European Oystercatcher	High
European Golden Plover	High
Grey Plover	High
Northern Lapwing	High
Common Ringed Plover	High
Whimbrel	High ³
Eurasian Curlew	High
Black-tailed Godwit	High
Bar-tailed Godwit	High
Ruddy Turnstone	High
Red Knot	Low
Ruff	High ³
Dunlin	High
Spotted Redshank	High ³
Common Greenshank	High ³
Common Redshank	High



Receptor ¹	Site-fidelity ²
Common Snipe	High ³
Black-headed Gull	Low ³
Common Gull	Low ³
Lesser Black-backed Gull	Low ³
Herring Gull	Low ³

¹ All waterbird species which occur on the Severn Estuary, and are features of the Severn Estuary SPA, Severn Estuary Ramsar Site, or one of the component SSSIs (Table 3.1), or are listed as a UK Biodiversity Action Plan (BAP) species, Section 41 BAP Species of Principal Importance in England, Section 42 Species of Principal Importance in Wales, Amber or Red Listed Birds of Conservation Concern (BoCC) in the UK (Eaton *et al.* 2009) or Wales (Welsh Ornithological Society *et al.* 2009), or IUCN Red list species (Table 3.2), are considered as potential receptors.

² Based on the 'WeBS Alerts Biological Filter' (Maclean & Austin 2008) in which a scoring system is used to assess the natural fluctuations in species' numbers between winters. Species with scores of five or below (for which a filter would be applied to 'High Alerts' in this system) are classified as typically exhibiting low site-fidelity, those with scores of 6-8 as typically exhibiting high site-fidelity.

³ Qualitative assessment.



Table 3.4 SPAs most likely to be affected or which potentially might be affected, should measures to prevent or reduce any significant adverse effects on the environment or compensation for loss or reductions in the numbers of a Severn Estuary SPA feature not be fully possible.

Special Protection Area
Abberton Reservoir
Ailsa Craig
Alde-Ore Estuary
Arun Valley
Avon Valley
Belfast Lough
Benfleet and Southend Marshes
Blackwater Estuary
Bowland Fells
Breydon Water
Broadland
Buchan Ness to Collieston Coast
Burry Inlet
Caithness and Sutherland Peatlands
Canna and Sanday
Chichester and Langstone Harbours
Chew Valley Lake
Colne Estuary
Dengie
Dornoch Firth and Loch Fleet
Duddon Estuary
Dungeness to Pett Level
East Caithness Cliffs
East Sanday Coast
Exe Estuary
Fetlar
Firth of Forth
Forth Islands
Firth of Tay and Eden Estuary
Foulness
Fowlsheugh
Gibraltar Point



Special Protection Area

Hamford Water

Hornsea Mere

Humber Estuary

Inner Clyde Estuary

Inner Moray Firth

Isles of Scilly

Lee Valley

Lewis Peatlands

Lindisfarne

Loch Leven

Loch of Strathbeg

Lough Neagh and Lough Beg

Lower Derwent Valley

Martin Mere

Medway Estuary & Marshes

Mersey Estuary

Mersey Narrows and North Wirral Foreshore

Minsmere-Walberswick

Montrose Basin

Moray and Nairn Coast

Morecambe Bay

Muirkirk and North Lowther Uplands

Nene Washes

North Norfolk Coast

North Pennine Moors

North Uist Machair and Islands

North York Moors

Northumbria Coast

Ouse Washes

Outer Ards

Pagham Harbour

Peak District Moors

Pettigoe Plateau (NI)

Poole Harbour

Ribble and Alt Estuaries

Rutland Water

Solent and Southampton Water



Special Protection Area

Somerset Levels and Moors

South Pennine Moors

South Tayside Goose Roosts

South Uist Machair and Islands

South West London Waterbodies

St Abb's Head to Fast Castle

Stodmarsh

Stour and Orwell Estuaries

Strangford Lough

Tamar Estuaries Complex

Teesmouth and Cleveland Coast

Thames Estuary and Marshes

Thanet Coast and Sandwich Bay

The Dee Estuary

The Swale

The Wash

Tips of Corsemaul and Tom Mor

Sléibhteán agus Cladach Thiriodh (Tiree Wetlands and Coast)

Traeth Lafan / Lavan Sands

Troup, Pennan and Lion's Heads

Upper Nene Valley Gravel Pits

Upper Solway Flats and Marshes

Walmore Common

Ynys Seiriol / Puffin Island



Table 3.5 Ramsar Sites most likely to be affected or which potentially might be affected, should measures to prevent or reduce any significant adverse effects on the environment or compensation for loss or reductions in the numbers of a Severn Estuary SPA feature not be fully possible.

Ramsar Site
Abberton Reservoir
Alde-Ore Estuary
Arun Valley
Avon Valley
Belfast Lough
Benfleet and Southend Marshes
Blackwater Estuary
Breydon Water
Broadland
Burry Inlet
Caithness and Sutherland Peatlands
Chichester and Langstone Harbours
Colne Estuary
Dengie
Dornoch Firth and Loch Fleet
Duddon Estuary
East Sanday Coast
Exe Estuary
Firth of Forth
Firth of Tay and Eden Estuary
Foulness
Gibraltar Point
Hamford Water
Humber Estuary
Inner Clyde Estuary
Inner Moray Firth
Isles of Scilly
Lee Valley
Lewis Peatlands
Lindisfarne
Loch Leven
Loch of Strathbeg



Ramsar Site

Lough Neagh and Lough Beg

Lower Derwent Valley

Martin Mere

Medway Estuary & Marshes

Mersey Estuary

Minsmere-Walberswick

Montrose Basin

Moray and Nairn Coast

Morecambe Bay

Nene Washes

North Norfolk Coast

North Uist Machair and Islands

Northumbria Coast

Ouse Washes

Outer Ards

Pagham Harbour

Pettigoe Plateau (NI)

Poole Harbour

Portsmouth Harbour

Ribble and Alt Estuaries

Rutland Water

Solent and Southampton Water

Somerset Levels and Moors

South Uist Machair and Islands

South West London Waterbodies

Stodmarsh

Stour and Orwell Estuaries

Strangford Lough

Teesmouth and Cleveland Coast

Thames Estuary and Marshes

Thanet Coast and Sandwich Bay

The Dee Estuary

The Swale

The Wash

Sléibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast)

Upper Solway Flats and Marshes

Walmore Common







Appendix 2.3

Draft Evidence Plan Framework

Appendix 2.3 Draft Evidence Plan Framework

1.1 Introduction

- 1.1.0.1 This Evidence Plan Framework is based on a document produced for Sizewell C Nuclear Power Station by Royal HaskoningDHV for NNB GenCo in February 2014. It also draws on Defra guidance regarding Evidence Plans for Nationally Significant Infrastructure Projects (NSIPs) (Defra, 2012). The aim of this document is to present a Framework that can form the basis for discussion during the first steps of the iterative Evidence Plan process. It sets out the proposed approach by Tidal Lagoon Cardiff Ltd (TLC) to developing and preparing the Evidence Plan for the proposed Tidal Lagoon Cardiff (the 'Project'). For the purposes of this document, the description of the Project can be found in Chapter 6 of the Scoping Report and will be added to as the Project develops.
- 1.1.0.2 From September 2012, applicants of NSIPs located in England, or both England and Wales, have been able to agree Evidence Plans with relevant statutory nature conservation bodies (SNCBs) (Defra, 2012).
- 1.1.0.3 An Evidence Plan is a voluntary mechanism which aims to agree in advance the evidence that an applicant needs to supply to the competent authorities to enable them to undertake Habitats Regulations Assessment (HRA) of the proposed development. As the Project lies within Wales, there is no formal mechanism in place to undertake an Evidence Plan process, however, it has been agreed in principle with Natural Resources Wales (NRW), Natural England (NE) and the Environment Agency (EA) that to follow an Evidence Plan process would be welcomed.
- 1.1.0.4 The key objective of the Evidence Plan process is to help reduce the risk to the Project as a result of the precautionary approach that needs to be applied to the HRA. It aims to:
- Provide greater clarity to all parties on the scope and detail of evidence the Applicant should collect;
 - Focus the evidence requirements so that they are proportionate to the Project's potential impacts in order to inform decision making; and
 - Help address and agree issues earlier on in the pre-application process so that robust, streamlined decisions can be taken.
- 1.1.0.5 TLC also consider that, in this case, the Evidence Plan process could be used to guide the assessment of the Project in relation to the requirements of the Water Framework Directive (WFD) and potentially, a Marine Conservation Zone (MCZ) assessment if required.
- 1.1.0.6 The Evidence Plan does not replace or duplicate existing statutory requirements such as pre-application consultation and is a technical process. It is intended to provide an audit trail for agreements and any areas of disagreement in the

evidence base requirements for the HRA, WFD and MCZ which can be fed into Statements of Common Ground.

- 1.1.0.7 The primary aim of the Evidence Plan is to address the Project's potential impacts through defining the data requirements for the HRA, WFD and MCZ process specifically and not for the EIA process more generally.

1.2 The Evidence Plan Process

Introduction

- 1.2.0.1 This section describes the proposed process to be followed to prepare and agree the Evidence Plan for the Project, including the organisations and groups involved and their proposed roles and responsibilities, anticipated working arrangements and the principles of the assessment approach. The focus of this framework document is on the inception period for the Evidence Plan in order to establish its overall approach and requirements.

Steering Group

- 1.2.0.2 Inception and development of the Evidence Plan and monitoring of its progress will be undertaken by a Steering Group. It is suggested that the Evidence Plan Steering Group for the Project consists of the following organisations:

- i. TLC will chair the group and lead the drafting of the Evidence Plan and associated technical documents, and their maintenance thereafter;
- ii. Natural Resources Wales (Advisory) will be the lead SNCB for discussion and agreement of the Evidence Plan;
- iii. Natural England will provide advice and input into the Evidence Plan;
- iv. Environment Agency will provide advice and input into the Evidence Plan where necessary;
- v. The Planning Inspectorate will be approached to ascertain what role (if any) they wish to play as the examining authority for the development consent application; and
- vi. The MMO will also be approached to ascertain if they want to become involved in the process – their participation would be appropriate in the case of potential effects on MCZs.

- 1.2.0.3 The role of the Steering Group will be:

- i. to oversee and discuss progress of the Evidence Plan process for the Project;
- ii. to consider the list of organisations invited to participate in the process;

- iii. to consider thresholds for areas such as likely significant effect (LSE) screening and assessment of effects on integrity;
- iv. to discuss any issues that emerge during the Evidence Plan and wider HRA, WFD and MCZ process and use reasonable endeavours to agree a way forward;
- v. to monitor progress against the schedule for the collection of evidence;
- vi. to consider the recommendations of Expert Topic Groups; and
- vii. to capture any learning from the process and suggest areas where improvements to the Evidence Plan process could be made.

1.2.0.4 It is proposed that the Steering Group will have its inception meeting at the start of the Evidence Plan process (March 2015) in order to agree the organisations and individuals involved, their proposed roles and responsibilities and the anticipated working arrangements. Formulation of the Evidence Plan will then take place over the following few months.

Evidence Plan Working Group

1.2.0.5 The Sizewell C Evidence Plan included the formation of a Working Group to prepare the Evidence Plan. This comprised the members of the Steering Group, the local Councils, the local Wildlife Trust and the Royal Society for the Protection of Birds. This group met monthly over four months to discuss and agree the Evidence Plan for Sizewell C. A similar arrangement may be employed for the Project and will be discussed at the inception meeting.

Expert Topic Groups

1.2.0.6 Following agreement of the Evidence Plan, the form, attendance and frequency of meetings is proposed to be issue-driven (with the details to be discussed and agreed by the Steering Group) in the form of Expert Topic Groups. These groups will be made up of a small number of technical experts from relevant organisations specific to individual environmental topics and will be chaired by TLC.

1.2.0.7 It is proposed that these Expert Topic Groups have the following functions:

- i. to consider detailed evidence requirements in the context of the Evidence Plan;
- ii. to consider the relevance, appropriateness and sufficiency of evidence for the specific assessment requirement under consideration (including both site specific and contextual data);
- iii. where appropriate, to agree the survey methods and data analysis; and

- iv. to consider methods for assessment(s) and assumptions (including interpretation of impact and levels of significance).
- 1.2.0.8 The process will be iterative and each topic group will work towards key ‘gateways’ for example, agreement on survey methodologies, agreement on interpretation of survey findings. Each group will document areas of agreement and disagreement throughout the process.
- 1.2.0.9 Expert Topic Groups have yet to be determined, however, the following groups are currently proposed:
- i. Intertidal and subtidal habitats;
 - ii. Coastal processes;
 - iii. Benthic ecology;
 - iv. Water quality;
 - v. Coastal birds;
 - vi. Fish;
 - vii. WFD;
 - viii. HRA.
- 1.2.0.10 Consideration will also be given to the possibility of forming a marine mammals topic group and an approach to incorporate discussions for MCZ.
- 1.2.0.11 It is considered that the topic groups above cover the potential effects on the following features as designated under the relevant European legislation:
- i. Special Areas of Conservation (SACs and candidate SACs (cSACs) if appropriate) (as listed on Annex I of the Habitats Directive);
 - ii. SAC designated species populations (as listed on Annex II of the Habitats Directive);
 - iii. Special Protection Areas (SPAs), potential SPAs (pSPAs) if appropriate and Ramsar sites, including rare and vulnerable birds (as listed on Annex I of the Birds Directive), regularly occurring migratory species and species forming designated assemblages;
 - iv. habitats and species populations of Ramsar sites not covered under SPA and SAC designations;
 - v. supporting species and habitats in those cases where there are potential impacts upon designated features through indirect effects (e.g. prey species; and

vi. waterbodies designated under the WFD (Directive 2000/60/EC).

1.2.0.12 Consideration of MCZ would be under the requirements of National policy.

1.3 Screening of European Sites for Likely Significant Effects

1.3.0.1 The Evidence Plan will include an agreed position with relevant stakeholders on areas of likely significant effect (LSE) pertaining to European sites, based on the most up-to-date information. It is considered that this will take the form of a series of LSE scoping tables that will be informed by ongoing studies to help the understanding of potential cause-effect pathways in some key areas.

Site selection

1.3.0.2 Site selection is the first stage of this pre-screening basis. To this end, and in order to provide a basis for discussion for the Steering Group, Appendices 2.1 and 2.2 have been provided as part of this Scoping Report. Appendix 2.1 presents the findings of an initial site selection process for European sites that are to be considered in the HRA process. These 'potential impact pathway' tables are intended to initially examine the potential cause-effect relationships between the Project and the sites and do not represent an assessment of impact significance. Appendix 2.2 presents a high-level site selection process for those SPAs that may be affected by displacement of birds from the Severn Estuary SPA, Ramsar.

Screening for Likely Significant Effects

1.3.0.3 Once the site selection process is agreed, the LSE scoping tables will provide a framework for further more detailed discussions with technical experts on evidence requirements. The assessment will be developed and refined as the Project progresses to facilitate the full shadow Screening and Information to Support a Habitats Regulations (shadow appropriate assessment).

1.4 WFD Screening

1.4.0.1 A WFD screening report for the Project will be submitted to the appropriate authorities, shortly after submission of the Scoping Report. This can then form the basis of discussion for the WFD Expert Topic Group. The full scope of the WFD assessment will be presented in detail within the separate WFD screening report.

1.5 MCZ Screening

1.5.0.1 The requirements for screening for potential effects on MCZ will be determined as a result of further assessment and discussions with statutory authorities.



1.6 Programme

1.6.0.1 Indicative key dates for the Evidence Plan are proposed as follows:

- i. March 2015: Inception Meeting of the Steering Group to agree roles and responsibilities;
- ii. April/May 2015: TLC to further refine the Evidence Plan Framework document for discussion and development of site selection criteria based on information available for presentation at the Workshop proposed for May 2015;
- iii. May 2015: Workshop to discuss European site selection and LSE scoping assessment and also to confirm survey methodologies proposed within the Scoping Report (potential to combine with workshop noted above);
- iv. June 2015: Workshop with the Evidence Plan Working Group to provide a project update and to discuss and agree the Evidence Plan Framework;
- v. June/July 2015: Preparation of draft Evidence Plan;
- vi. July 2015: Second workshop with the Steering Group and other key stakeholders to agree Evidence Plan and discuss proposals for its roll out. The Evidence Plan remains live throughout the assessment process; and
- vii. August 2015: Final Evidence Plan and LSE screening assessment defined (please note that this does not include the preparation of a formal shadow Screening Report).

1.6.0.2 Please note that the production of a final Evidence Plan is currently longer than the 3 month period specified in Defra guidance (2012). It is also acknowledged that the Scoping Report document already sets out proposed survey methodologies (following initial consultation with statutory nature conservation bodies). The process of consultation will therefore run alongside the preparation of the Evidence Plan and will feed into it where appropriate.

1.7 Roles and Responsibilities

1.7.0.1 The roles and responsibilities for the Steering Group as set out below are based on Defra guidance (2012) and the Evidence Plan Framework for Sizewell C (RHDV, 2014).

1.7.0.2 Representatives of the Steering Group (or any Expert topic Groups) should have the authority to ensure that any agreed position within the Evidence Plan process is an agreed corporate position, and not the advice of the officer only, and be in a position to provide advice to the Applicant (TLC) on evidence requirements.

Applicant

- i. Draft and maintain the Evidence Plan on an on-going basis until it is considered complete by the Steering Group;

- ii. Collect, analyse, review and share evidence with other Evidence Plan participants at appropriate intervals;
- iii. Updates the relevant SNCB(s), the Planning Inspectorate and other consenting bodies of modifications to the Project;
- iv. Meet with the SNCB and other relevant parties, to discuss progress and, if necessary, agree any changes to evidence requirements;
- v. Work with the SNCB to resolve as many issues as possible at the pre-application stage and set out the issues agreed, or not agreed, in Statements of Common Ground, using the Evidence Plan as a mechanism to do this; and
- vi. Finalise the Evidence Plan and use it to inform the shadow HRA and the WFD compliance report (and if applicable, an MCZ assessment) for the development consent and Marine Licence applications.

Natural Resources Wales (NRW)

- i. Advise on which European sites and features need to be considered in the Evidence Plan (including the status of any potential changes to designated features);
- ii. Advise on which WFD waterbodies (and MCZ sites) need to be considered in the Evidence Plan;
- iii. Advise on the conservation objectives and conservation status of relevant sites;
- iv. Discuss and agree an initial Evidence Plan with the Applicant, ensuring that evidence requirements are proportionate to the potential impacts of the Project, taking account of the precautionary principle and having regard to cost and programme;
- v. Assess and review evidence provided by the Applicant at agreed regular reviews, giving written feedback on progress to agreed timescales. In this context, NRW and Natural England may need to have further discussions in order to make best use of their expertise and avoid the duplication of functions. NRW (MLT) role as competent authority for the Marine Licence is also acknowledged here;
- vi. Identify and provide to the Applicant any relevant public domain information (e.g. conservation objectives, monitoring reports, site condition assessment data; grey literature) they have access to in order to inform the Evidence Plan / assessment;
- vii. Ensure consistency of approach to advice between this Project and other NSIPs; and
- viii. Work with the Applicant to resolve as many issues as possible during the pre-application period, to agreed timescales, including through the

Statement(s) of Common Ground. Consultation and timescales/deadlines should be agreed with Expert Topic Groups or the Steering Group.

Natural England and Environment Agency

- i. Advise on which European sites and features need to be considered in the Evidence Plan (including the status of any potential changes to designated features);
- ii. Advise on which WFD waterbodies (and MCZ sites) need to be considered in the Evidence Plan;
- iii. Advise on the conservation objectives and conservation status of relevant sites;
- iv. Assess and evaluate evidence provided by the Applicant at agreed regular reviews, giving feedback on progress;
- v. Identify and provide to the Applicant any relevant public domain information (e.g. conservation objectives, monitoring reports, site condition assessment data; grey literature) they have access to in order to inform the Evidence Plan / assessment;
- vi. Ensure consistency of approach to advice between this Project and other NSIPs; and
- vii. Work with the Applicant to resolve as many issues as possible during the pre-application period, to agreed timescales, including through the Statement(s) of Common Ground. Consultation and timescales/deadlines should be agreed with Expert Topic Groups or the Steering Group.

Marine Management Organisation

- i. Advise on which MCZ sites need to be considered, if any, and the process for their inclusion as part of the Evidence Plan.

Working arrangements

1.7.0.3 The following general principles will apply:

- i. any documents prepared for a meeting should be available within agreed deadlines and two weeks prior to the meeting;
- ii. documents, guidance and/or advice given should be clear and comprehensive;
- iii. agreed deadlines for comment should be met, unless adequate notice is given;
- iv. in order to optimise meeting efficiency, adequate preparation and full participation is expected of all involved;

- v. in order to understand the process requirements and effort, all participants should log the time spent on the Evidence Plan process;
- vi. where costs may be incurred, the Applicant is to be provided with cost estimates for approval before they are incurred (at intervals to be agreed); and
- vii. key points of contact should be established for all participants in order to provide a clear communication route.

1.8 Principles of the Assessment Approach

1.8.0.1 The Evidence Plan Framework needs to set out high-level general principles across all topics. Proposals for these topics are set out below (based on RHDV, 2014).

Site characterisation data

1.8.0.2 The Applicant is required to provide “information as may reasonably be required for the purposes of the assessment”. Data must ultimately be sufficient to enable an assessment of likely significant effects to be undertaken and effects on site integrity to be defined. However, it must also be proportionate in the context of both the likely significance of the effect under consideration and the point in the process. To this end TLC intends to adopt a risk based approach to the assessment that characterises the nature of the evidence requirements for issues of substance. Best endeavours will be used both with respect to site specific data and other information required in order to characterise an area/species population.

1.8.0.3 If more data for a particular topic is requested by the Steering Group, beyond that agreed within the Evidence Plan, consideration must be given to any cost and/or time considerations and the overall benefit to the assessment (i.e. would extra data significantly change an assessment outcome?). It should be noted that additional data may be necessary to develop a baseline for compliance monitoring post-consent, but this is separate from the data requirements for HRA and WFD assessment, i.e. to characterise the environment.

Data analysis and impact assessment

1.8.0.4 As part of the Evidence Plan discussions will be required to agree inter alia the following:

- i. the definition of terminology and approach (such as magnitude, sensitivity, uncertainty);
- ii. study areas (spatial and temporal);
- iii. reference populations (HRA);
- iv. identification of WFD waterbodies under Articles 4.7 and 4.8 of the Directive;
- v. methodologies, analysis techniques and statistical analysis tools to be used;

- vi. apportionment of impacts from receptors to designated sites (HRA);
- vii. classification of effects of the Project on status of waterbodies or actions required to raise the status of a waterbody (WFD); and
- viii. consideration of the effects of the Project on MCZ conservation objectives (MCZ).

1.8.0.5 In addition, effort will be made throughout the Evidence Plan process to agree:

HRA:

- i. Thresholds for screening (in/out) with respect to European sites and designated features;
- ii. Where appropriate, thresholds for likely significant effect, as well as 'adverse effect on site integrity';

WFD:

- iii. Thresholds for screening (in/out) with respect to WFD waterbodies;
- iv. Where appropriate, thresholds for identifying deterioration of WFD status or the effects of the Project that could prevent actions which are required to raise the WFD status of a waterbody;

MCZ:

- v. Thresholds for screening (in/out) with respect to MCZ sites; and
- vi. Where appropriate, thresholds for identifying effects on MCZ conservation objectives.

1.8.0.6 In order to create a clear audit trail that can be referred to in the Statements of Common Ground, survey and assessment methodologies will be shared and discussed for each topic.

Principles for in-combination assessment

1.8.0.7 In terms of assessing the effect of the Project in-combination with other plans or projects, consideration will be given to the following: activities and plans or projects that exist, that are approved but uncompleted, or the applications for which are under consideration, where spatial/physical overlaps of the impacts are likely to occur.

1.8.0.8 Additionally, consideration will be given to any other activities and plans or projects, including any impacts that do not directly overlap spatially, but may indirectly result in any in-combination impact.

1.8.0.9 Chapter 3 of the Scoping Report lists potential cumulative developments, but the final list will be defined following further consultation with statutory authorities.

1.8.0.10 For an assessment to be meaningful it has to be based on evidence. Future plans or projects for which sufficient information is not available on which to base a

reliable assessment, which are unlikely to be submitted or receive consent until after the proposed development has been completed, cannot reasonably be assessed as part of an in-combination assessment.

Approach to mitigation

- 1.8.0.11 Mitigation will be embedded into the design of the Project as far as is possible. Where significant adverse impacts are identified, TLC will apply the mitigation hierarchy of: avoid – reduce – mitigate – compensate – enhance.
- 1.8.0.12 It is important that for mitigation to be effective the expectation of what can be achieved reflects the timeline for actual construction and operation and is sufficiently flexible to allow for changes in understanding over time. To further define the mitigation and monitoring proposals an Adaptive Environmental Management Plan (AEMP) will be prepared as the Evidence Plan progresses (see Chapter 26 of the Scoping Report).
- 1.8.0.13 The AEMP will be updated as the Project progresses through consultation and in light of the data emerging from any surveys and monitoring undertaken. This is seen as an essential part of the process to validate the findings of the extensive studies that have been and are currently being undertaken to determine the potential effects of this type of renewable energy development. This accords with Policy set out on page 18 of the EC Guidance Note ‘The implementation of the Birds and Habitats Directives in estuaries and coastal zones with particular attention to port development and dredging’ (2011) that:
- “Where uncertainties or lack of knowledge on physical, morphological or biological processes still exist, these should be minimized as far as possible by additional research; where uncertainty remains adaptive monitoring programmes should be foreseen. New evidence and scientific information should be fed back into the management plan and where necessary lead to an appropriate adaptation of the management measures and monitoring schemes.”*
- 1.8.0.14 These principles also accord with the HRA process as the objective is to reduce uncertainty over impacts to an acceptable level.

1.9 References

Department for Environment, Food and Rural Affairs (DEFRA) (September 2014) Habitats Regulations Evidence Plans for Nationally Significant Infrastructure Projects

Royal HaskoningDHV, February 2014. Sizewell C – HRA Evidence Plan Framework

Royal HaskoningDHV, October 2014. Sizewell C – HRA Evidence Plan Volume 1



Abbreviations

Abbreviations

3D	Three Dimensional
AA	Appropriate Assessment
ABP	Associated British Ports
AEMP	Adaptive Environmental Management Plan
AEP	Annual Exceedance Probability
AIMS	Asset Information Management System
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AONB	Area of Outstanding Natural Beauty
AQS	Air Quality Strategy
AQMA	Air Quality Management Area
BAP	Biodiversity Action Plan
BGS	British Geological Survey
BMAPA	British Marine Aggregate Producers Association
BoCC	Birds of Conservation Concern
BRES	Business Register and Employment Survey
BSBI	Botanical Society of the British Isles
BTO	British Trust for Ornithology
BWD	Bathing Water Directive
CBC	Common Bird Census
CCO	Channel Coastal Observatory
CD	Chart Datum
Cebr	Centre for Economics and Business Research
CEFAS	Centre for Environment, Fisheries & Aquaculture Science
CEMP	Construction Environmental Management Plan
CFMP	Catchment Flood Management Plan
CIS	Celtic and Irish Seas
COLREGS	International Regulations for Preventing Collisions at Sea
CPUE	Catch rates per unit effort
CRTN	Calculation of Road Traffic Noise
CSM	Conceptual Site Model
CTD	Conductivity-temperature-depth
CWLIBD	Caldicot and Wentlooge Levels Internal Drainage Board
DAIN	Dissolved available inorganic nitrogen
DASSH	Data Archive for Seabed Species and Habitats
DAIP	Dissolved Available Inorganic Phosphorus
DCO	Development Consent Order
DCWW	Dŵr Cymru Welsh Water
DECC	Department of Energy and Climate Change
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
DSCT	Deep Sea Container Terminal
DWCT	Deep Water Containment Terminal
DWT	Deadweight Tonnage
EA	Environment Agency
EC	European Commission
Ecia	Ecological Impact assessment
EEA	European Economic Area
EEP	Ecosystem Enhancement Project

EHA	English Heritage Archives
EIA	Environmental Impact Assessment
EMF	Electro-Magnetic Field
EMS	European Marine Site
EPUK	Environment Protection United Kingdom
ES	Environmental Statement
EWL	Extreme Water Levels
EU	European Union
FCA	Flood Consequence Assessment
FCERM	Flood and Coastal Erosion Risk Management
FOCI	Features of Conservation Importance
FRM	Flood Risk Management
GGAT	Glamorgan Gwent Archaeological Trust
GIS	Geographical Information System
GMMP	Gower Marine Mammal Project
GOMMMS	Guidance on the Methodology for Multi-Modal Studies
HAM	Habitat Association Modelling
HDV	Heavy Duty Vehicle
HLER	High Level Evidence Requirements
HSE	Health and Safety Executive
IALA	International Association for Marine Aids to Navigation and Lighthouse Authorities
IAMMWG	Inter-Agency Marine Mammal Working
IAQM	Institute for Air Quality Management
IBD	Internal Drainage Boards
IBM	Individual Based Modelling
IEEM	Institute of Ecology and Environmental Management
IEMA	Institute of Environmental Management and Assessment
IMADP	Interim Marine Aggregates Dredging Policy
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
JPA	Joint Probability Analysis
LAQM	Local Air Quality Management
LBAP	Local Biodiversity Action Plan
LDP	Local Development Plan
LiDAR	Light Detection and Ranging
LNR	Local Nature Reserve
LOA	Length Overall
MAIB	Marine Accident Investigation Branch
mAOD	Metres above Ordnance Datum
MCA	Maritime and Coastguard Agency
MCZ	Marine Conservation Zone
MESH	Marine European Seabed Habitats
MGN	Marine Guidance Note
MHW	Mean High Water
MHWS	Mean High Water Springs
ML	Marine Licence
MLW	Mean Low Water
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring

MMO	Marine Management Organisation
MPS	Marine Policy Statement
MW	Mega Watt
NASCO	North Atlantic Salmon Conservation Organisation
NATA	New Approach to Transport Appraisal
NERC	Natural Environment and Rural Communities Act
NETS	National Electricity Transmission System
NGO	Non-Government Organisation
NO	Nitrogen Oxide
NPL	National Physical Laboratory
NPS	National Policy Statement
NRA	Navigational Risk Assessment
NRW	Natural Resources Wales
NSIP	Nationally Significant Infrastructure Project
NNR	National Nature Reserve
NVC	National Vegetation Classification
ONS	Office for National Statistics
OREI	Offshore Renewable Energy Installations
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PM	Particle Matter
PMSC	Port Marine Safety Code
PPW	Planning Policy Wales
PROW	Public Right Of Way
PSA	Particle Size Analysis
RBD	River Basin District
RBMP	River Basin Management Plan
rBWD	revised Bathing Water Directive
RCAHMW	Royal Commission for Ancient and Historic Monuments in Wales
RCZAS	Rapid Coastal Zone Assessment Surveys
rMCZ	Recommended Marine Conservation Zone
RNLI	Royal National Lifeboat Institution
RSER	Receptor-Specific Evidence Requirements
RSPB	Royal Society Protection of Birds
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAFFA	The Salmon and Freshwater Fisheries Act 1975
SAR	Search and Rescue
SARA	Severn Area Rescue Association
SEA	Strategic Environmental Assessment
SEFRMS	Severn Estuary Flood Risk Management Strategy
SEL	Sound Exposure Level
SELRC	Severn Estuary Levels Research Committee
SEWBRcC	South East Wales Biodiversity Records Centre
SI	Statutory Instruments
SLA	Special Landscape Area
SME	Small and Medium-sized Enterprise
SMP	Shoreline Management Plan
SNCB	Statutory Nature Conservation Bodies
SPA	Special Protection Area
SPL	Sound Pressure Level

SPV	Special Purpose Vehicle
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
STP	Severn Tidal Power
STCW	Standards of Training, Certification and Watchkeeping
TAN	Technical Advice Note
TL	Transmission Loss
TLC	Tidal Lagoon Cardiff Ltd's
TraC	Transitional and Coastal Water
TTTC	Through The Tidal Cycle
TTWA	Travel to Work Area
UAV	Unmanned Aerial Vehicle
UKBAP	UK Biodiversity Action Plan
UKHO	United Kingdom Hydrographic Office
VER	Valued Ecological Receptors
WeBS	Wetlands Bird Survey
WFD	Water Framework Directive
WG	Welsh Government
WHO	World Health Organisation
WWBIC	West Wales Biodiversity Information Centre
WWF	Worldwide Fund for Nature
WWT	Wildfowl and Wetlands Trust
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility



Glossary

Glossary

A	
Above Ordnance Datum (AOD)	Height in metres relative to the average sea level at Newlyn, Cornwall.
Acoustic Fish Deterrents (AFDs)	Sound emitting devices which are used to discourage fish entrainment.
Acoustic Wave and Current Profiler (AWAC)	An instrument that measures the current velocities and wave height in moving water.
Admiralty Chart	Admiralty Charts are supplied by the United Kingdom Hydrographic Office and are nautical charts that identify information such as the coastline, land and underwater contour lines, seabed depth and composition, hazards, prominent features and anything that may assist with navigation on the water.
Air-borne noise	This refers to noise which is fundamentally transmitted by way of the air and can be attenuated by the use of barriers and walls placed physically between the noise and receiver.
Ambient sound	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.
Anthropogenic	Actions, consequences or material originating from Human activities.
Area of Outstanding Natural Beauty	Area designated by the Natural Resources Wales where the primary purpose is the conservation and enhancement of natural beauty including flora, fauna, geology and landscape.
Artificial Reef	An artificial reef is a man-made, underwater structure, typically built for the purpose of promoting marine life. Artificial reefs are designed to provide hard surfaces to which algae and invertebrates (like barnacles, corals, and oysters) attach, which in turn provides intricate structure and food for assemblages of fish.
Assessment	A general term for description, analysis and evaluation.
Audible range	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
Automated Identification System (AIS)	Short range coastal tracking system.
B	
Background noise	Background noise is the term used to describe the noise measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period.
Barrier effects	An impact resulting from blockage by a structure or barrier.
Baseline	The existing environmental conditions against which any future changes can be measured or predicted and assessed.
Bathing Waters	Fresh or sea water in which bathing is either explicitly authorised or is not prohibited and is traditionally practiced by large numbers of bathers.

Bathymetry	Measurement of ocean or lake depth and the study of floor topography.
Bedload transport	Particles (usually coarser material such as sands and gravels) that move, roll or bounce along the seabed as they are transported by currents, waves or a combination of both.
Bedrock	The unweathered rock below the soil and drift cover.
Benthic	Area of the water column that concerns the sea bed or adjacent to the sea bed.
Bioaccumulation	The increase in concentration of a substance in an organism over time.
Biodiversity	The variation of life forms, including plants, animals and microorganisms, the genes that they contain, and the biotypes and ecosystems that they form.
Biodiversity Action Plan	A conservation programme deriving from the 1992 Convention on Biological Diversity. It describes biological resources, prioritising certain species and habitats and setting out plans and targets for their conservation. The UK BAP provides a national framework for a series of Local BAPs, usually compiled and managed by local authorities. In Wales there is also a BAP managed by the Welsh Assembly Government.
Biotopes	An area of the same environmental conditions that supports a specific collection of species.
Breakwater	A structure constructed on coasts as part of coastal defence or to protect an anchorage from the effects of both weather and longshore drift.
Bund	A bund is an outer wall designed to retain the contents of an inner tank.
Bulb turbine	A type of hydro turbine in which the entire generator is mounted inside the water passageway as an integral unit with the turbine. These installations can offer significant reductions in the size of the powerhouse.
C	
Cadw	The Welsh Government's historic environment service, whose primary role is to conserve and protect the historic environment and to promote distinctive regeneration and sustainable development within Wales.
Centre for Environment, Fisheries and Aquaculture Science (CEFAS)	An agency of DEFRA and an international aquatic science research and consultancy centre.
Cetaceans	A group of marine mammals including dolphins, porpoises and whales.
Chart Datum	Approximately the level of the lowest astronomical tide excluding meteorological effects.

Clupeid species	Clupeids (herrings, shads, and sardines) are mostly marine forage fish, although a few species are found in freshwater. No species has scales on the head, and some are entirely scaleless. Clupeids spawn huge numbers of eggs near the surface of the water. After hatching, the larvae live among the plankton until they develop a swim bladder and transform into adults. They typically feed on plankton and are preyed upon by larger fish, seabirds and marine mammals. Clupeids compensate for their small size by forming schools which can become immense shoals.
Coastal squeeze	Term used to describe a situation where the coastal margin is squeezed between the fixed landward boundary (artificial or otherwise) and the rising sea level.
Coast Protection Act (CPA) 1949	An amendment to the law regarding the protection of the coast of Great Britain against erosion and encroachment by the sea; section 34 is concerned with the restriction and removal of works detrimental to navigation.
Consented Development	A development that has been granted planning permission, although has not yet been constructed.
Consultee	Any body specified in the relevant EIA regulations which the competent authority must consult in respect of the EIA, and which also has a duty to provide a scoping opinion and information.
Cofferdam	A temporary structure built around a site to allow the removal of water and to permit free access to the area within. It may take various forms such as an earth embankment, a single row of steel or timber sheet piling, or a double row of sheet piling with the space between filled with impermeable material.
Commissioning	The process of assuring that all systems and components of a building or industrial plant are designed, installed, tested, operated, and maintained according to the operational requirements of the owner or final client.
Computational fluid dynamic (CFD) analysis	CFD simulate fluid (either liquid or gas) passing through or around an object and heat transfer. The analysis can be very complex – for example in one calculation it could incorporate heat transfer, mixing, and unsteady and compressible flows.
Concrete Batching Plant	A device that combines various ingredients to form concrete. Some of these inputs include sand, water, aggregate (rocks, gravel, etc.), fly ash, potash, and cement.
Crown Estate	The Crown Estate belongs to the reigning monarch ‘in right of The Crown’, that is, it is inherent with the accession to the throne. Apart from owning extensive areas of land it owns about 55% of the foreshore around the UK coastline and the seabed to 12 nautical miles offshore.
Cumulative effects	The combined effect of more than one development on the environment.

Cutter Suction Dredger	A cutter-suction dredger (CSD) is a vessel that sucks sediment from the sea bed through a long tube, like some vacuum cleaners but on a larger scale. The suction tube has a cutting mechanism at the suction inlet, which loosens the bed material and transports it to the suction mouth. The dredged material is usually sucked up by a wear-resistant centrifugal pump and discharged either through a pipe line or to a barge.																		
D																			
dB re 1µPa	Decibels (dB) relative to a reference pressure of water of one micro Pascal (1µPa).																		
dB(ht) species metric	References the sound level to the hearing threshold of an individual fish.																		
Decibel	<p>The level of noise is measured objectively using a Sound Level Meter. This instrument has been specifically developed to mimic the operation of the human ear. The human ear responds to minute pressure variations in the air. These pressure variations can be likened to the ripples on the surface of water but of course cannot be seen. The pressure variations in the air cause the eardrum to vibrate and this is heard as sound in the brain. The stronger the pressure variations, the louder the sound is heard.</p> <p>The range of pressure variations associated with everyday living may span over a range of a million to one. On the top range may be the sound of a jet engine and on the bottom of the range may be the sound of a pin dropping.</p> <p>Instead of expressing pressure in units ranging from a million to one, it is found convenient to condense this range to a scale 0 to 120 and give it the units of decibels. The following are examples of the decibel readings of every day sounds;</p> <table data-bbox="662 1265 1316 1579"> <tr> <td>Four engine jet aircraft at 100m</td> <td>120 dB</td> </tr> <tr> <td>Riveting of steel plate at 10m</td> <td>105 dB</td> </tr> <tr> <td>Pneumatic drill at 10m</td> <td>90 dB</td> </tr> <tr> <td>Circular wood saw at 10m</td> <td>80 dB</td> </tr> <tr> <td>Heavy road traffic at 10m</td> <td>75 dB</td> </tr> <tr> <td>Telephone bell at 10m</td> <td>65 dB</td> </tr> <tr> <td>Male speech, average at 10m</td> <td>50 dB</td> </tr> <tr> <td>Whisper at 10m</td> <td>25 dB</td> </tr> <tr> <td>Threshold of hearing, 1000 Hz</td> <td>0 dB</td> </tr> </table>	Four engine jet aircraft at 100m	120 dB	Riveting of steel plate at 10m	105 dB	Pneumatic drill at 10m	90 dB	Circular wood saw at 10m	80 dB	Heavy road traffic at 10m	75 dB	Telephone bell at 10m	65 dB	Male speech, average at 10m	50 dB	Whisper at 10m	25 dB	Threshold of hearing, 1000 Hz	0 dB
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Demersal Fish	Fish that live and feed on or near the bottom of seas or lakes (the demersal zone). Demersal fish species encompasses crustaceans (shrimps, langoustines, lobster and crabs), cephalopods (octopus, squid, calamari) as well as miscellaneous fish belonging to the benthic or benthic-pelagic species and living in shallow water or on the sea bed.																		
Department of Energy and Climate Change (DECC)	A government body which works to ensure the UK has secure, clean and affordable energy supplies and promotes action to mitigate climate change.																		
Designated site	An area listed under a Convention, Law, European Directive, or UK Statutory Instrument specifically for the protection of the resource, for instance for nature conservation purposes.																		

Dewatering	Construction dewatering, unwatering, or water control are common terms used to describe removal or draining groundwater or surface water from a riverbed, construction site, caisson, or mine shaft, by pumping or evaporation.
Development Consent Order (DCO)	Applicants promoting nationally significant infrastructure Projects in the fields of energy, transport, water and waste will apply for a DCO rather than for planning permission. A DCO, when issued, combines the grant of planning permission with a range of other consents that in other circumstances have to be applied separately, such as listed building consent.
Diadromous Fish	Migratory fish that travel between salt water and fresh water.
Digital Terrain Model	Digital relief map that represents the bare ground topography of the earth's surface.
Direct Impacts	An impact that is directly attributable to the proposed development.
Dredged Channel	An artificially maintained sea lane extending from an inland water body into the marginal sea to accommodate vessel traffic through coastal shallows.
E	
Ebb Tide	The period between high tide and the next low tide in which the sea is falling.
Ebb tide generation	The Lagoon is filled through the sluices until high tide. Then the sluice gates are closed. The turbine gates are kept close until the sea level falls to create sufficient head across the barrage, and then opened so that the turbines generate until the head is again low.
Effluent	Effluent is a liquid waste product (whether treated or untreated) discharged from an industrial process or human activity into the environment.
Electrosensitive	Sensitivity to electrical current.
Electromagnetic Interference	Interference to or from an electromagnetic source.
Enhancement	Restoration, reconstruction or creation of an element to make an improvement
Entrainment	The process of entrapment of fish, fish larvae and zooplankton in the turbines of the Project.
Environmental Impact	A change, brought about in the existing environment, which results in an effect, adverse, beneficial, or both.
Environmental Impact Assessment	In this context, the process by which information about the environmental effects of a project is evaluated and mitigation measures are identified.
Eutrophication	Eutrophication is the movement of a water body's trophic status in the direction of more plant biomass, by the addition of artificial or natural substances, such as nitrates and phosphates, through fertilizers or sewage, to an aquatic system. In other terms it is the 'bloom' or increase in phytoplankton in a water body. Negative environmental effects include hypoxia, the oxygen depletion in water.
Existing development	A development that has been constructed following planning consent and is fully operational.

F	
Flood Tide	The period between low tide and the next high tide in which the sea is rising.
Flood Tide Generation	The Lagoon is filled through turbines, which generate at tide flood. This is generally much less efficient than ebb generation, because the volume contained in the upper half of the Lagoon (which is where the ebb generation operates) is greater than the volume of the lower half (filled first during flood generation). Therefore the available level difference – important for the turbine power produced – between the Lagoon side and the sea side of the seawall, reduces more quickly than it would in ebb generation.
Foreshore	The land along the edge of a body of water.
G	
Generator	An arrangement of magnets spinning inside a coil of wire to produce electricity.
Geographic(al) Information System (GIS)	A system which captures, stores, analyses, manages, and displays spatially referenced data for solving complex planning and management problems.
Geomorphological	The geological structure of an area
Grid	A nationwide network of high voltage transmission lines.
Ground Investigation (GI)	A complete examination, investigation, and testing of surface and subsurface soil and conditions. The report resulting from the investigation is used in design of the structure.
Groundwater	Water occupying openings, cavities and spaces in rocks.
GPS	A navigational system supported by a large number of low orbit satellites.
H	
Habitat fragmentation	Alteration of a habitat resulting in spatial separation of habitat units from a previous state of greater continuity.
Habitats Directive	A European Union directive adopted in 1992. It is one of the EU's two directives in relation to wildlife and nature conservation, the other being the Birds Directive.
Haul-out	Behaviour of seals, coming to rest on land. Also the terrestrial site that hauled-out seals occupy.
Head	The vertical change in elevation between two bodies of liquid.
Heritage Coast	Designated by Natural Resources Wales and managed by the local authority, they are stretches of outstanding, unspoilt coastline.
Hertz	Empirical measurement of frequency.
Hydraulic Modelling	The use of mathematical or physical techniques to simulate water systems and make Projections relating to water levels, flows and velocity.
Hydrology	The study of water on the surface of the earth, including rainfall, rivers, streams and embraces the concept of the hydrological cycle.
Hydrogeology	The study of the geological factors relating to the Earth's water.
Hydromorphology	The physical characteristics of the shape, boundaries and content of a water body.
I	

ICES statistical rectangles	ICES statistical rectangles are the smallest spatial unit used for the collation of regional fisheries statistics by the European community and member states.
Indirect Effects	Impacts on the environment, which are not a direct result of the development but are often produced away from it or as a result of a complex pathway. Sometimes referred to as secondary impacts
Individual-Based Modelling (IBM) models	Individual-based models are a widely used ecology tool which allow scientists to explore the mechanisms through which population and ecosystem ecology arises from how individuals interact with each other and their environment.
Infralittoral	Always submerged, below the low-tide within the euphotic zone. Rocky seabed dominated by algae, and variable water column temperature.
International Council for the Exploration of the Sea (ICES)	A multidisciplinary scientific forum for the exchange of information and ideas on all aspect of marine sciences pertaining to the North Atlantic, Baltic Sea and North Sea. Its principle functions are to: (i) promote, encourage, develop, and coordinate marine research; (ii) publish and otherwise disseminate results of research; and (iii) provide non-biased, non-political scientific advice to member nation governments and international regulatory commissions.
International Union for Conservation of Nature (IUCN) red list	A compilation of species and their conservation status.
Intertidal Area	The area of the shore that lies between the average high tide mark and the average low tide mark.
Invertebrate	An animal lacking a backbone and internal skeleton.
J	
Jack-Up Barge	A jack-up barge is specialised barge that consists of a buoyant hull fitted with a number of movable legs, capable of raising its hull over the surface of sea. The buoyant hull enables transportation of the unit and all attached machinery to a desired location. Once on location the hull is raised to the required elevation above the sea surface on its legs supported by the sea bed.
Joint Nature Conservation Committee (JNCC)	A statutory advisor to UK government on international nature conservation.
K	
L	

L₁₀ & L₉₀	<p>If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L₁₀ is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L₉₀ is the average minimum level and is often used to describe the background noise.</p> <p>It is common practice to use the L₁₀ index to describe traffic noise, as being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic noise.</p>
L_{eq} :	<p>The concept of L_{eq} (equivalent continuous sound level) has up to recently been primarily used in assessing noise in industry but seems now to be finding use in defining many other types of noise, such as aircraft noise, environmental noise and construction noise.</p> <p>L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc).</p> <p>The use of digital technology in sound level meters now makes the measurement of L_{eq} very straightforward.</p> <p>Because L_{eq} is effectively a summation of a number of noise events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute noise limit.</p>
L_{max} :	<p>L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.</p>
Lagoon	<p>A body of water separated from a larger body of water by a barrier</p>
LANDMAP	<p>A GIS (Geographical Information System) based landscape resource where landscape characteristics, qualities and influences on the landscape are recorded and evaluated into a nationally consistent data set.</p>
Landscapes of Outstanding/Special Interest of Historic Interest	<p>Register of landscapes of outstanding or special historic interest, compiled by Cadw/ICOMOS and which are considered to be the best examples of different types of historic landscapes. Used to inform decision makers and landscape managers, to help ensure that the historic character of the landscape is sustained, and that where change is contemplated, it is well-informed</p>

Landscape Value	The relative value that is attached to different landscapes. In a policy context the usual basis for recognising certain highly valued landscapes is through the application of a local or national landscape designation. Yet a landscape may be valued by different communities for many different reasons without any formal designation, recognising, for example, perceptual aspects such as scenic beauty, tranquillity or wilderness; special cultural associations; the influence and presence of other conservation interests; or the existence of a consensus about importance, either nationally or locally.
Listed Building	A building which has been identified by the Secretary of State for the Environment as being of special architectural or historic interest and is entered on the list of such buildings.
Local Biodiversity Action Plan (LBAP)	A BAP (see previously) which has been developed by a local authority.
Local Nature Reserve	Area designated by the Countryside Council for Wales for being of particular importance to nature conservation and where public understanding of nature conservation issues is encouraged.
Local Seascape Unit	A section of the coastline divided into areas of broadly similar pattern based on coastline features, including estuaries, inlets, harbour walls etc; composition of the seabed, water depth and wave patterns.
M	
Made Ground	Soil deemed to be man-made or not natural
Magnitude	A combination of the scale, extent and duration of effect.
Mariculture	The cultivation of marine organisms in their natural environments, usually for commercial purposes.
Marine Management Organisation (MMO)	A non-departmental public body established and given powers under the Marine and Coastal Access Act 2009 to make a significant contribution to sustainable development in the marine area and to promote the UK government's vision for clean, healthy, safe, productive and biologically diverse ocean and seas.
Metocean	Data relating to meteorology and oceanography.
Mitigation	Measures, including any process, activity or design to avoid, reduce, remedy or compensate for adverse effects.
N	
Natal Rivers	Stream or river in which an anadromous fish was spawned
Natural Environment and Rural Communities (NERC) Act 2006	NERC provides that any public body or statutory undertaker in England and Wales must consider impacts to biodiversity when determining planning applications.
Natural Resources Wales	Principal adviser to the Welsh Government on the environment, enabling the sustainable development of Wales' natural resources for the benefit of people, the economy and wildlife.
Nautical mile	1 nautical mile = 1.85200km or 1.15077945 miles
Non-Technical Summary	A brief report summarising the principle sections of a document eg the Environmental Statement, in non-technical language.
O	
P	

Particle Size Analysis (PSA)	A laboratory technique which determines the size range, and/or the average, or mean size of the particles in a powder or liquid sample.
Pelagic Fish	Live near the surface or in the water column of coastal, ocean and lake waters, but not on the bottom of the sea or the lake such as tuna and sardines.
Permanent threshold shift (PTS)	The irreversible hearing loss that results from exposure to intense impulse or continuous sound.
Phase 1 Habitat Survey	A standardised system for classifying and mapping wildlife habitats in all parts of Great Britain.
Photomontage	The superimposition of an image onto a photograph for the purpose of creating a representation of potential changes to any view.
Planning Policy Guidance	Provide statements of Government policy on nationally important land use and other planning matters, supported where appropriate by a locational framework.
Proposed Development	A development for which a planning application has been submitted, though any decision is still pending.
Protected Species	Species with special protection under the terms of the Wildlife and Countryside Act 1981 and the Wildlife and Countryside (Amendments) Act 1985.
Public Right of Way	A route where the public has a right to walk, and in some cases ride horses, bicycles, motorcycles or drive motor vehicles, which will be designated either as a footpath, a bridleway, a road used as a public path (RUPP) or a byway.
Q	
R	
Ramsar Site	Wetlands of international importance, designated under the Ramsar Convention. Wetlands are defined as areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six metres. Ramsar sites may also incorporate riparian (banks of a stream, river, pond or watercourse) and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands.
Receptor	A component of the natural or man-made environment that is affected by an impact, including people.
Registered Park & Garden of Special Historic Interest	Register of parks and gardens, compiled by Cadw/ICOMOS, which are thought to be of national importance. Used to aid the informed conservation of historic parks and gardens by owners, local planning authorities, developers, statutory bodies and all concerned with them. Sites on the Register are graded I, II* and II.
Residual Impacts	Impacts predicted as a consequence of the development assuming implementation of proposed mitigation measures.
Re-suspension	Dispersion of particles back into water, as when wave action or re-dredging stir up sediments that have fallen out of suspension and settled.

Rock armour	Rock or other material used to armor shorelines, streambeds, bridge abutments, pilings and other shoreline structures against scour, water or ice erosion.
Runners	The part of a turbine , consisting of curved vanes, blades, or buckets on a wheel or hub, that is turned by the pressure of high velocity water, thereby transforming falling water energy into rotating mechanical energy.
S	
Scoping	The process of identifying the likely significant effects of a development in the environment.
Scour (marine)	Sea-floor erosion caused by strong tidal currents, resulting in removal of inshore sediments and formation of deep
Screening Opinion	A written statement of the opinion of the relevant planning authority as to whether development requires an EIA.
Sensitivity	A term applied to specific receptors, combining judgements of the susceptibility of the receptor to the specific type of change or development proposed and the value related to that receptor .
Sheet Pile Wall	Sheet pile walls are made out of steel, vinyl or wood planks which are driven into the ground. A proportion of the wall will be above ground and a proportion below ground.
Shutters (Concrete)	Wood or purpose made steel in planks used as a temporary structure to contain setting concrete
Site of Importance for Nature Conservation (SINC)	An area of land designated by a local authority because it supports nature conservation of significance in a county context. Designation criteria and policy context may vary between different local authority areas but they are usually linked with planning policies relating to nature conservation.
Sound Exposure Level (SEL)	The sum of acoustic energy over a given measurement period or the total noise energy produced from a single noise event.
Sound Pressure Level (SPL):	Sound level is usually defined in terms of SPL. SPL is the ratio of the absolute sound pressure and a reference value (usually the threshold of hearing, or the lowest intensity sound that can be heard by an organism). It is measure in decibels (dB).
Spawning Substrate	The surfaces on which fish prefer to deposit their eggs.
Special Area of Conservation	Land protected under Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora. Data supplied has a status of 'Candidate'.
Special Protection Area	Land classified under Directive 79/409 on the Conservation of Wild Birds. Data supplied has a status of 'Classified'.
Special Site of Scientific Interest (SSSI)	An area of land or water notified by the Nature Conservancy Council or its successor agencies under the Wildlife and Countryside Act 1981 as being special in nature (can include geological) conservation importance.
Spring Tide	The tides of increased range occurring near the times of full moon and new moon. The gravitational forces of the moon and the sun act to reinforce each other. Since the combined tidal force is increased the high tides are higher and the low tides are lower than average.

Storm overflow	A weir, orifice or other device for permitting the discharge from a combined sewer of the flow in excess of that which the sewer is designed to carry.
Substrate	The surface or material on which an organism lives – rock, sand, mud, pilings, shells etc.
Subtidal	Depths greater than the intertidal zone. Where the intertidal zone is the area of seabed between high water mark and low water mark which is exposed each day as the tide rises and falls (also known as the littoral zone).
Suspended Sediment (SS)	Fine particles that remain in suspension in water for a considerable period of time without contact with the bottom. Such material remains in suspension due to the upward component of turbulence and currents and/or by suspension.
T	
Tidal flushing	The systematic replacement of water in a bay or estuary as a result of tidal flow.
Trained Entrance	A trained entrance often consists of rock walls that force the water into a deeper more stable channel
Transect	A method of surveying an area by sampling along linear routes through it (as was used for the bat and bird surveys in this study).
Transformer	An electromagnetic device for reducing or increasing the voltage of an alternating current.
Turbidity	Can be defined as the weight of particulate matter per unit volume of sea water and is a measure of water clarity.
Turbine	A rotary engine that converts the energy of a moving stream of water, steam or gas into mechanical energy.
U	
Unexploded Ordnance (UXO)	Unexploded ordnance (or UXOs/UXBs,UO) are explosive weapons (bombs, bullets, shells, grenades, land mines, naval mines, etc.) that did not explode when they were employed and still pose a risk of detonation, potentially many decades after they were used or discarded.
V	
Valued Ecological Receptors (VER)	Species and habitats that are indicative of the ecological quality of the Assessment Site and which could be adversely affected by the proposed development.
W	
Watching Brief	Undertaken during construction, whereby a qualified archaeologist is present to examine any uncovered remains or artefacts.
Water column	The entire depth of a water body, from its surface to the bottom.
Water Framework Directive (WFD)	An EU directive for the protection and improvement of the quality of surface freshwater (including lakes, streams and rivers), groundwater and any dependent ecosystems, estuaries and coastal waters out to 1 mile from low water.
Wicket Gates	Wicket gates are adjustable elements that control flow through the turbine.
X	
Y	
Z	



Zone of Theoretical Visibility	Area within which a proposed development may be seen and have an influence or effect on visual amenity.
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