



Environmental Statement Chapter 11. Coastal Birds



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11.0 Coastal Birds

11.1 Introduction

- 11.1.0.1 This chapter of the ES examines the potential effects on the Coastal Bird assemblage of Swansea Bay as a result of the Project. It includes a summary of the current conditions/species found within the surveyed area, a valuation of the ecological features and an indication of impacts associated with the construction, operation and decommissioning of the Project. Following identification of impacts, mitigation measures for significant effects are presented and residual impacts clarified. Birds associated with the terrestrial element of the Project are covered in Chapter 12: Terrestrial Ecology. This has been discussed and agreed with Countryside Council for Wales (CCW) (now Natural Resources Wales (NRW)) on 6th December 2012.
- 11.1.0.2 The scope of the assessment is based Ecological Impact Assessment (EclA) guidance set out by the Institute of Ecology and Environmental Management (IEEM, 2006).
- 11.1.0.3 The scope of the Ecological Impact Assessment (EclA) has been developed based on:
- i. consideration of any ecological resources, in relation to coastal birds, focusing on those for which there is legal or planning policy in favour of protection or enhancement;
 - ii. data on sites of international, national and county importance within 2km of the Project boundary;
 - iii. data on notable bird species and assemblages; for example, nearby Special Protection Area (SPA) bird populations (i.e Burry Inlet SPA), legally protected, nationally rare/scare, county rare/scarse, Local (Swansea) and UK Biodiversity Action Plan, as well as species of conservation concern within 2km of the Project boundary;
 - iv. the location of the site (centred at the approximate grid reference SO 140 130) and the habitat features within areas proposed for development – these generally comprise tidal mudflats, shingle and sandbanks; and
 - v. the assessment involved desk based assessment, consultation and field surveys. The survey scope and EIA methods of assessment were initially agreed with CCW.

11.2 Legislation, planning policy and guidance

- 11.2.0.1 The main legislative considerations are those contained within the Wildlife and Countryside Act 1981, The Conservation of Habitats & Species Regulations 2010, the Countryside and Rights of Way Act 2000, and the Natural Environment and Rural Communities (NERC) Act 2006. In terms of planning policy, a number of over-arching policies are of relevance not least of which are those described within Planning Policy Wales (PPW 2012), which sets out land use planning policies of the Welsh Assembly Government.

The Wildlife and Countryside Act (1981)

- 11.2.0.2 Under Part 1 of the Wildlife and Countryside Act 1981 all birds, their nests and eggs are protected by law and it is an offence, with certain exceptions, to:



- I. intentionally kill, injure or take any wild bird;
- II. intentionally take, damage or destroy the nest of any wild bird while it is in use or being built; and
- III. intentionally take or destroy the egg of any wild bird.

The Conservation of Habitats and Species (Amendment) Regulations 2012

- 11.2.0.3 In order to promote the conservation of natural habitats and species the European Commission (EC) drafted two directives known as the Birds Directive (Council Directive 79/409/EEC on the conservation of wild birds, now 2009/147/EC) and the Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora).
- 11.2.0.4 The Conservation of Habitats and Species (Amendment) Regulations 2010 (HMSO, 2010), known commonly as the "Habitats Regulations" supersede an earlier piece of legislation, the Conservation (Natural Habitats & c.) Regulations 1994. The Habitats Regulations transpose the European directives into UK law and allow for the designation of both Special Protection Areas (SPAs) for birds and Special Areas of Conservation (SACs) for the protection of other species and habitats. These protected areas are collectively known as the Natura 2000 network of sites. Species listed under the Habitats Regulations are known as European Protected Species (EPS).

The Countryside and Rights of Way Act 2000

- 11.2.0.5 The Countryside and Rights of Way Act 2000 (CRoW 2000) primarily deals with the rights of members of the public to access the countryside. CRoW 2000 updated and strengthened the legal protection for designated sites (such as SSSIs) as well as certain species. In particular, CRoW 2000 strengthened legislation by introducing the offence of "reckless disturbance". Section 74 of CRoW 2000 placed a statutory duty on government departments to have regard to biodiversity conservation and requires the preparation and maintenance of lists of priority species and habitats. Some of the provisions set out in CRoW 2000 have been incorporated into amendments to the WCA 1981 or have been superseded by the Natural Environment and Rural Communities Act 2006 (NERC 2006).

The Natural Environment and Rural Communities (NERC) Act 2006

- 11.2.0.6 The NERC Act 2006 places a duty on all public authorities, in exercising functions, to have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity - including restoring or enhancing a population or habitat. The duty applies to all public authorities and aims to raise the profile and visibility of biodiversity, to clarify existing commitments with regard to biodiversity and make it a natural and integral part of policy and decision-making. To satisfy the requirements of section 42 of NERC Act 2006, the Welsh Government publishes a list of species and habitats of principal importance in Wales. The list forms the definitive reference point for all statutory and non-statutory bodies, including decision-makers such as local planning authorities, involved in operations or decisions that affect Welsh biodiversity (Welsh Biodiversity Partnership, 2013).



Renewable energy infrastructure National Policy Statement (EN-3, 2011)

- 11.2.0.7 EN-3 contains policy specifically relating to renewable energy infrastructure and is designed to be read in conjunction with EN-1¹. Part 2 of EN-3 contains information on assessment requirements for renewable energy infrastructure and sections specific to particular renewable energy technologies. These sections cover biomass and waste combustion, and onshore and offshore wind energy only. There is no such specific guidance for tidal range (or any other marine energy) projects. As such, the NPS is again not specifically applicable to a tidal range generating station such as the Project.
- 11.2.0.8 Paragraph 2.6.100 sets out specific considerations which apply to the effect of off-shore wind energy infrastructure proposals on birds. Although not specifically relevant to the Project, the following aspects of EN-3 have been considered:
- i. *“direct habitat loss;*
 - ii. *disturbance from construction activities such as the movement of construction/decommissioning vessels and piling;*
 - iii. *displacement during the operational phase, resulting in loss of foraging/roosting areas; and*
 - iv. *impacts on bird flight lines (i.e. barrier effect) and associated increased energy use by birds for commuting flights between roosting and foraging areas.”*
- 11.2.0.9 EN-3 identifies that the scope, effort and methods required for ornithological surveys should have been discussed with the relevant statutory advisor.

Planning Policy Wales (PPW)

- 11.2.0.10 Planning Policy Wales (2012) identifies a number key principles for the land use planning system, including:-
- I. work to achieve nature conservation objectives through a partnership between local planning authorities, CCW, the Environment Agency Wales, voluntary organisations, developers, landowners and other key stakeholders (PPW Paragraph 5.1.5);
 - II. integrate nature conservation into all planning decisions looking for development to deliver social, economic and environmental objectives together over time (PPW 5.1.3 and 5.1.4);
 - III. ensure that the UK’s international obligations for site, species and habitat protection are fully met in all planning decisions (PPW 5.3.8-10); and
 - IV. look for development to provide a net benefit for biodiversity conservation with no significant loss of habitats or populations of species, locally or nationally (PPW 5.1).

City and County of Swansea Council Unitary Development Plan (to 2011)

- 11.2.0.11 The City and County of Swansea Council (CCSC) Unitary Development Plan (UDP) was adopted on 10th November 2008. It is the most up to date Development Plan covering the administrative area of CCSC and is used in the determination of planning applications.

¹ National Policy Statement for Energy (EN-1, 2011)



The UDP sets out a range of policies and proposals relating to future development, and deals with the use and conservation of land and buildings within CCSC up to 2016.

- 11.2.0.12 Parts of the UDP are considered relevant to the Project due to the presence of protected sites/species and notable habitats both on and within close proximity to the site. The following sections are considered relevant to the Project:

Siting and Location: Policy EV2 (v)

- 11.2.0.13 New development must have regard to the physical character and topography of the site and its surroundings by undertaking, at the earliest opportunity, an assessment of species and habitats on site and, where planning permission is granted, implementing any necessary mitigation measures.

SSSIs and National Nature Reserves: Policy EV27

- 11.2.0.14 Development that significantly adversely affects the special interests of sites designated as SSSIs and NNRs will not be permitted unless the need for the development is of such significance that it outweighs the national importance of the designation. Where development is permitted, planning conditions and/or obligations will be used to protect and enhance those interests and where necessary provide effective mitigation and compensatory measures.

Swansea Local Development Plan

- 11.2.0.15 The CCSC UDP is to be replaced within the next few years by a new form of Development Plan for CCSC known as the Local Development Plan (LDP). Public consultation ran from the 23rd July 2012 to the 12th October 2012 and although exact policies details are yet to be confirmed, the following draft objectives covering 'Quality Environment' are likely to be of relevance to the Project. The LDP aims to:

- i. *promote development that avoids significant adverse environmental impacts and respects constraints; and*
- ii. *preserve or enhance the quality of the natural, cultural and historic environment.*

Neath Port Talbot County Borough Council Unitary Development Plan

- 11.2.0.16 The Neath Port Talbot County Borough Council (NPTCBC) UDP adopted in March 2008 is intended to inform decision-making on all development proposals in the county. The UDP will be replaced when the new NPTCBC LDP is adopted – this was anticipated in 2013 - but to date, no draft has been deposited. A number of policies within the UDP are considered of relevance to the Project and these are detailed below.

Policy ENV4 Proposals affecting international and national sites for nature conservation and species protected by European or UK legislation

- 11.2.0.17 A. Proposals that would adversely affect the integrity of an existing, candidate, or proposed site of European significance for nature conservation or a designated Ramsar site will not be permitted except: -
- i. *where they are directly connected with, or necessary for, the beneficial management of the site(s); and/or*



- ii. *for sites that also host a priority habitat or species, there are imperative overriding human health and public safety considerations or benefits of primary importance to the environment which justify the development, and there are no alternative solution(s); and/or*
- iii. *for sites that do not host a priority natural habitat or a priority species, there are imperative reasons of overriding public interest for the proposal.*
- ii. *Notwithstanding the above, the Council will consider the use of planning conditions or planning obligations/agreements to secure any compensatory measures necessary to retain and enhance the overall coherence of the Natura 2000 network.*

11.2.0.18 B. There is a presumption against proposals that would be likely to damage or destroy a SSSI. Proposals which would adversely affect such a nationally designated site for nature conservation will be permitted only where such proposals safeguard the nature conservation value of the national network of such sites.

11.2.0.19 C. There is a presumption against proposals that would be likely to result in disturbance to a species protected under European or UK legislation or its habitats.

Policy ENV5 – Nature Conservation

11.2.0.20 Proposals that would unacceptably damage or destroy significant local habitats and species will not be permitted. All new development should: -

- i. *retain existing features which are of particular significance in terms of nature conservation including woodland, trees, hedgerows, sand dunes, salt marshes, heathlands, moorlands, wetlands, watercourses, ponds, green lanes, protected species, geological and geomorphological features and safeguard them during construction work;*
- ii. *conserve existing habitats and features of nature conservation interest in any landscaping or planting scheme;*
- iii. *take full account of adjacent nature conservation interests, including where the site forms part of a wildlife corridor;*
- iv. *avoid the loss or damage to a habitat or species which is identified as a priority in the Neath Port Talbot Local Biodiversity Action Plan (LBAP), or for any such loss of habitat/species which can be adequately mitigated against, provide replacement habitats (features of equivalent or greater extent or contribute a financial sum specifically to fund mitigation works off site);*
- v. *take full account of opportunities to restore and enhance habitats and ecosystems including measures to eradicate invasive plant species.*

11.2.0.21 The policy framework summarised above has provided the context for the Project and the assessment of its environmental effects.



11.3 Assessment methodology

11.3.1 Introduction

- 11.3.1.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (HMSO, 1999) set out the requirement for investigation of potential environmental impacts, including ecological impacts, of certain projects.
- 11.3.1.2 The guidelines recommend the collation of existing baseline information to enable the identification of key ecological receptors. This was carried out using a combination of desk study/data search and field survey. For each receptor:
- i. the **value** of the receiving receptor (site/feature/species) is determined;
 - ii. the **magnitude** of the potential impact on the receptor is identified; and
 - iii. an overall predicted impact **significance** is given.
- 11.3.1.3 Where significant adverse effects are considered likely, measures to mitigate these effects are proposed, in order to reduce their significance. In addition, where protected species and / or valuable habitats are present but not expected to suffer any significant effects as a result of the Project, mitigation is nonetheless recommended to ensure compliance with legislation or planning policies. This approach is considered to represent best practice and provides a way of positively contributing to the overall reduction of impact on features of nature conservation value.
- 11.3.1.4 The potential impacts of the Project during construction and operation on identified ecological receptors comprise:-
- I. direct loss of habitats;
 - II. isolation and fragmentation of habitats;
 - III. changes in coastal processes;
 - IV. changes in sedimentation and tidal regime; and
 - V. increased disturbance during construction and operation (including sound and vibration).
- 11.3.1.5 In addition, to the identification of potentially sensitive ecological receptors (through baseline data, surveys and existing records), information on their legal and policy, conservation and distribution status, plus any known trends (i.e. population or migratory) are considered to measure their value.
- 11.3.1.6 This ES proceeds on the basis of the outline construction programme detailed in Chapter 4: Project Description, which anticipates construction starting in 2015 and lasting for three years. The assessments contained in this chapter are not materially sensitive to works commencing within the anticipated validity of the DCO, which is five years, or to an extension of (say) a further year-or-so.

11.3.2 Assessment criteria

- 11.3.2.1 All ecological receptors identified during the study are described (conservation status, local status, sensitivity, planning and legal protection etc.) and assigned a value based on the guidance of IEEM (2006). The criteria used for this assessment are presented below:

Table 11.1 Valuation of ecological resources

Nature Conservation Value	Examples
International	An internationally designated site or candidate site ((SPA, pSPA, SAC, cSAC, pSAC², Ramsar site, etc) or an area which the country agency has determined meets the published selection criteria for such designation, irrespective of whether or not it has yet been notified. Under the Ramsar Convention a wetland is considered internationally important if it regularly holds at least 1% of the individuals in a population of any species (or sub-species) of waterbird, or if it regularly supports 20,000 or more waterbirds (Ramsar, 2008). Regularly occurring, globally threatened species (i.e. International Union for Conservation of Nature (IUCN) Red listed) or species listed on Annex 1 of the Berne Convention. Regularly occurring populations of internationally important species that are rare or threatened in the UK or of uncertain conservation status. A regularly occurring, nationally significant population/number of any internationally important species.
National	A nationally designated site (SSSI, NNR, MNR³) or a discrete area, which the country conservation agency has determined meets the published selection criteria for national designation (e.g. SSSI selection guidelines) irrespective of whether or not it has yet been notified. A wetland regularly holding 1% or more of the estimated British population of any species (or sub-species) of waterbird. Regularly occurring populations of UKBAP species. Regular occurring populations of SSSI citation listed qualifying species.
Regional/county	Any regularly occurring significant population that is listed in a Local Red Data Book or County Local Biodiversity Action Plan (LBAP) Regularly occurring populations (<1% winter or summer) of a regionally/county important species. Regular occurring populations of Red listed species in the UK or Wales
District/Borough	Regularly occurring populations of a locally important/rare species Regularly occurring populations of Amber listed species in the UK or Wales
Parish/Local	Regular populations of species that are common and widespread. Regularly occurring populations of Green listed species in the UK or Wales

- 11.3.2.2 All resources valued at being above a given threshold of value (in this case Parish/Local is the lowest level) are considered in terms of whether any effects are likely to be ecologically significant or not. Only the ecological features that are considered to be of value at or above 'local' have been included in the ecological impact assessment. Activities associated with development are often likely to cause significant ecological effects, therefore it is necessary to identify associated changes and their implications in

² SPA (Special Protection Area), pSPA (proposed Special Protection Area), SAC (Special Area of Conservation), cSAC Candidate Special Area of Conservation), pSAC (proposed Special Area of Conservation).

³ SSSI (Site of Special Scientific Interest), NNR (National Nature Reserve), MNR (Marine Nature Reserve)



terms of whether the impact is likely to be beneficial or adverse, the magnitude (size) of the impact, extent, duration, timing, frequency, reversibility and timing for the valued resource. The predicted impact for each ecological feature has initially been assessed on the basis of a worst-case scenario. For this, the Project design outlined in Chapter 4: Project Description is assessed.

- 11.3.2.3 The term ecologically significant should not be confused with any other definitions of the term 'significant' used elsewhere in this ES. For the purposes of this assessment, an ecologically significant effect is defined as an effect (adverse or beneficial) on the integrity of a defined site or ecosystem(s) and/or the conservation status of habitats or species within a given geographical area including cumulative effects (based on IEEM 2006 guidance). In this context, integrity is defined as the: *“Coherence of a site’s ecological structure and function across its whole area that allows it to sustain the habitat, complex of habitats and/or levels of populations...”*.
- 11.3.2.4 The magnitude of the potential impact is then assessed for each receptor using the categories set out in Table 11.2 below.

Table 11.2 Assessing the magnitude of each impact on an ecological receptor

Magnitude of potential impact	Criteria
Major Negative	The change is likely to cause a permanent adverse effect on the integrity of an ecological receptor. The proposed development will have effects which would adversely impact on the integrity of a site (at regional to international level).
Moderate Negative	The proposed development will not adversely impact upon the integrity of a site, but the effect on the site is likely to be significant in terms of its ecological objectives (e.g. key attributes of a site will be altered, but not so much as to result in a change in the site’s evaluation). The proposed development will have permanent and severe impacts upon undesignated habitats of county importance. The proposed development will result in changes in the distribution of a legally protected species, but not affect its population status or conservation status but the population will become more vulnerable.
Minor Negative	Neither of the above applies, although some negative impact to a designated site or undesignated habitat of regional / county importance is evident. The proposed development will have permanent and severe impacts upon undesignated habitats of local / negligible importance. The proposed development will have an adverse effect on a legally protected species but with no significant reduction in conservation status.
Neutral	Although it is not always possible to state categorically that there will be no impact on a receptor the term neutral will be used where the level of exposure is considered to be less than the tolerance of the receptor, therefore an impact is unlikely. Or there will be no impact at all on that habitat or species/faunal group.
Positive	The change is likely to benefit the receptor in terms of its conservation status, but not so far as to achieve favourable conservation status.

- 11.3.2.5 Based on the value of the receptor and the predicted magnitude of the potential impact, the significance of an impact can then be determined according to Table 11.3. Residual impact is the significance of impact considered after mitigation measures have been taken into account.

Table 11.3 Impact significance

Nature Conservation Value	Magnitude of Potential Impact				
	Major Negative	Moderate Negative	Minor Negative	Neutral	Positive
International/ Very High	Major Adverse	Major Adverse	Moderate to Minor Adverse	No impact	Major - minor Beneficial
National/ High	Major Adverse	Major to Moderate Adverse	Minor Adverse	No impact	Major - minor Beneficial
Regional/ Medium	Moderate Adverse	Moderate – Minor Adverse	Minor Adverse	No impact	Moderate Beneficial
District/ Low	Minor Adverse	Minor Adverse	Insignificant	No impact	Minor Beneficial
Local/Negligible	Minor/ Insignificant	Insignificant	Insignificant	No impact	Insignificant

11.3.3 Desk study and consultation

- 11.3.3.1 Consultation has been carried out formally and informally in relation to coastal birds with the following organisations: Planning Inspectorate (the Inspectorate), Environment Agency Wales (EAW), CCW/NRW, CCSC, NPTCBC and Gower Ornithological Society (GOS).
- 11.3.3.2 This consultation identified the requirement for consideration of protected sites within close proximity including the Burry Inlet Special Protection Area (SPA), Carmarthen Bay SPA, Crymlyn Bog Special Area of Conservation (SAC), Blackpill Site of Special Scientific Interest (SSSI) and the Crymlyn Burrows SSSI. The responses received to the Scoping Report (Chapter 2: EIA Process and Assessment of Significance) also identified a need to consider a range of bird species including those utilising the site of the Project during the summer months including potential nesting (at Mumbles Pier on the western side of the Bay) and foraging use by Kittiwake *Rissa tridactyla*.
- 11.3.3.3 Consultation with the Inspectorate also identified the requirement to consider trans-boundary issues i.e. potential impacts on protected sites outside the UK. Given the mobile and seasonal nature of the bird assemblage utilising Swansea Bay there is potential for trans-boundary impacts. However, the lack of knowledge on the connectivity of these populations to breeding areas makes it impossible to quantify any potential impact on designated SPAs outside the UK. However, given the relatively small numbers of SPA qualifying species utilising the Bay (Section 11.5), coupled with the small area of potential habitat loss, a significant impact on any designated site outside the UK is considered extremely unlikely.
- 11.3.3.4 In order to provide an ecological context for the Project, ecological records were requested from the British Trust for Ornithology (BTO), GOS, CCSC and NPTCBC. Records were requested in relation to the Project site and coastal areas within 2km of the Project. Data requested from the BTO included both Wetland Bird Survey (WeBS) core count data for the wider Swansea Bay and Low Tide Count data for those sectors of interest.
- 11.3.3.5 Species action plans listed in the UK Biodiversity Action Plan (BAP) were also reviewed with regard to species potentially present in the Project area or in the surrounding study area. Relevant local plans within the Swansea BAP and Neath Port Talbot BAP were also consulted.



11.3.3.6 Consultation with GOS member Mark Hipkin, in December 2012, also highlighted the presence of large wintering flocks of Great Crested Grebe *Podiceps cristatus* (Approx. 300-500 birds) within the eastern areas of Swansea bay - recorded from Aberavon beach and Crymlyn Burrows.

11.3.3.7 Information from previous studies encompassing parts of the current survey area were also reviewed as part of the assessment. Available relevant studies consisted of the Scarweather Sands Offshore Wind Farm Environmental Statement (United Utilities, 2003) and the Adrenaline Sports Centre Ecological Assessment for Birds at Blackpill SSSI (Pryce & Stewart, 2008).

11.3.4 Field surveys

11.3.4.1 To inform the EclA and to supplement the more extensive longer term WeBS data. Coastal bird surveys were undertaken within a study area that extends from just east of the River Neath to Mumbles Head (Figures 11.1 and 11.2, Volume 2). Survey areas / sectors were selected to cover the whole of Blackpill SSSI and the intertidal area of Crymlyn Burrows to the west of the River Neath. The study area is divided into 23 sectors (EE001 at Mumbles in the western part of the bay and EE023 on the eastern shore of the River Neath).

11.3.4.2 The primary interest within Swansea Bay is for wintering birds. Surveys were completed on a monthly basis over the winter period 2011/12 (October-March) and 2012/13 (September – March). These winter surveys were supplemented by counts in the east of the survey area (EE013-EE023; River Tawe - River Neath) over the summer period (April-August 2013), which was agreed with NRW.

11.3.4.3 The survey methodology utilised was based on the methodologies developed by the BTO for the WeBS and consisted of both Core Count and Low Tide Count methods (Gilbert *et al*, 1998). The methodology for surveying and recording non-breeding waterfowl using the generic WeBS Core and Low Tide Count methodology was assessed as sufficient and appropriate for the purposes of assessment on the basis of professional judgment. WeBS Low Tide Counts are used to determine the spatial distribution of birds across a site and the relative importance of different areas, while WeBS Core Counts are carried out at high tide when wading birds gather into roost sites and are more easily counted. Together, these counts give accurate counts of the number of birds using a site.

11.3.4.4 The objective of the surveys was to obtain site-specific data on the numbers of, and primary areas used by, birds within the Blackpill SSSI and River Neath WeBS count areas, with particular reference to the eastern area of the Bay (Figure 11.2, Volume 2). In addition to the count data, data was also collected on bird movement around the Bay and the presence of any water birds (sea-duck, grebe, diver species etc). Survey methods were designed to gather information on the general usage and movement of birds within the Bay, in particular in relation to the Project area, on a variety of tidal cycles and weather conditions - not to record every single bird using the area.

11.3.4.5 Each survey visit aimed to provide complete coverage of the areas of interest associated with the study area for the Project. Given the scope of the area of interest, survey from vantage points was not practicable and a walked transect survey with regular point count methodology or 'look and see' methodology was adopted in its place as outlined below (Gilbert *et al* 1998).



11.3.4.6 Low Tide Counts were undertaken within a window 2 hours either side of low tide by a single surveyor in the west (Figure 11.1 River Tawe-Mumbles, Volume 2) and single surveyor in the east (Figure 11.2 River Neath-River Tawe, Volume 2). Surveyors systematically moved through the survey area (west to east or east to west) on foot and vehicle between suitable vantage points and utilised a 'look and see' methodology to record all birds utilising the foreshore and Bay area. The number, species and behaviour of all birds were then recorded on a field map. Where any water birds were recorded during field survey visits, these were marked on survey maps and assigned to adjacent Low Tide Count areas during data analysis. This was considered appropriate as the majority of records of species were recorded along the surf line or within 250m of the surf line. Where divers or grebe species are recorded further than 250m from the surf line these will be considered separately within the data and this document. Core Counts/High Tide counts were undertaken 1.5 hours either side of high tide⁴, and using the same 'look and see' methodology.

11.3.4.7 Tide times (Swansea Port) and the dates of surveys are detailed below;

21 st October 2011	Low Water 0712	High Water 1338
15 th November 2011	Low Water 1420	High Water 0823
15 th December 2011	Low Water 1459	High Water 0857
06 th January 2012	Low Water 1030	High Water 1633
20 th February 2012	Low Water 0830	High Water 1530
09 th March 2012	Low Water 1255	High Water 0655
21 st September 2012	Low Water 1629	High Water 1031
25 th October 2012	Low Water 0959	High Water 1609
26 th November 2012	Low Water 1042	High Water 1658
18 th December 2012	Low Water 1557	High Water 0947
22 nd January 2013	Low Water 0837	High Water 1500
15 th February 2013	Low Water 1514	High Water 0924
28 th March 2013	Low Water 1248	High Water 0644
26 th April 2013	Low Water 1340	High Water 0655
24 th May 2013	Low Water 1205	High Water 0545
10 th June 2013	Low Water 1340	High Water 0750
11 th July 2013	Low Water 1440	High Water 0901
23 rd August 2013	Low Water 1443	High Water 0837

11.3.4.8 In addition to the Low Tide and Core Counts, movements of birds across the survey area were also recorded on the field maps. Any birds of note/interest (defined for this assessment as those listed within the Blackpill SSSI citation or of particular conservation concern i.e. Red or Amber status (RSPB, 2009)) observed flying over the site were also recorded including height and direction of flight and location of landing. The activity of the birds using the area was also recorded and included observations on: i) where birds feed at various stages in the tidal cycle, ii) where birds do not feed, iii) where birds roost or loaf. Disturbance events and their frequency were noted as were the action of the birds disturbed.

⁴ WeBS survey methodology for Core Counts/High Tide Counts refers to completing counts within a 4 hour window around High Tide. A three hour time period around high tide was used in this assessment as this was the highest state of the tidal cycle and allowed sufficient time to cover the survey areas.



11.4 Baseline conditions

11.4.1 Desk study

- 11.4.1.1 Desk study data of both High Tide and Low Tide BTO WeBS counts are discussed in conjunction with field survey data collected as part of this study. A summary of findings is provided below and the full data set (both low and high tide data) provided in Appendix 11.1, Volume 3.
- 11.4.1.2 WeBS Low Tide data for three defined periods within the current area of interest has been utilised to inform the baseline conditions. Data for the entire survey area (EE001-EE023) was available for November 2003 to February 2004, with data for the eastern extent of the survey area (EE013-EE023) available for November 2006 and February 2007, and data for November 2007 available for sectors EE016-EE023 only. WeBS High Tide counts data was available for the entire survey area over a period from July 2006 to June 2011.
- 11.4.1.3 Data from the GOS yearly reports (Grenfell et al, 1994 to 2006) over the period 2002 to 2011 has also been collated and summarised in Appendix 11.2, Volume 3. This data, although not directly comparable with the WeBS or field survey data due to the non-standard survey methods utilised in its collection, does provide a good indication of the temporal distribution of the species recorded within the study area along with their peak counts. Discussion of this data is presented in the species accounts detailed below (paragraph 11.4.5 onwards).
- 11.4.1.4 Review of the Scarweather Sands OffShore Wind Farm Environmental Statement (United Utilities, 2003) identified Manx Shearwater *Puffinus puffinus*, Storm Petrel *Hydrobates pelagicus* and Gannet *Morus bassanus* regularly within the wider Swansea Bay area. These seabirds are qualifying species of the Skokholm and Skomer SPA and are regularly recorded in the GOS, which were all land based surveys. However, no regular desk study records of these species was identified within the survey area and no individuals were recorded during the surveys for this assessment.
- 11.4.1.5 The Adrenaline Sports Centre Ecological Assessment for Birds at Blackpill SSSI (Pryce & Stewart, 2008) study focused upon the western portion of Swansea Bay (Low Tide Count sectors EE001-EE010). This study identified western areas of the Bay as supporting regionally important (e.g. Red list in the UK and/or Wales; LBAP priority species) populations of Curlew *Numenius arquata*, Oystercatcher *Haematopus ostralegus* and Sanderling *Calidris alba*; and locally important (e.g. Amber list in the UK and/or Wales) populations of Dunlin *Calidris alpina*, Ringed Plover *Charadrius hiaticula*, Turnstone *Arenaria interpres*, Great Crested Grebe, Common Scoter *Melanitta nigra*, Kittiwake, Mediterranean Gull *Larus melanocephalus*, Black-headed Gull *Chroicocephalus ridibundus*, Common Gull *Larus canus*, Herring Gull *Larus argentatus*, Lesser Black-backed Gull *Larus fuscus* and Greater Black-backed Gull *Larus marinus*.

11.4.2 Coastal habitats

- 11.4.2.1 Chapter 12: Terrestrial Ecology and Chapter 8: Subtidal and Intertidal Benthic Ecology examine the coastal habitats within the eastern and western study areas adopted for this study in detail. This section provides a brief overview of the intertidal and subtidal habitats of relevance to this coastal birds assessment. Birds associated with the terrestrial



element of the Project are fully assessed in Chapter 12: Terrestrial Ecology and thus associated habitats are discussed only as appropriate within this chapter.

Intertidal

- 11.4.2.2 Intertidal benthic ecology within the Bay has been well studied. Data from CCW and field surveys carried out as part of the Project (see Figure 8.2 for survey areas) have been examined and discussed in detail in Chapter 8: Subtidal and Intertidal Benthic Ecology. Figures 8.4 and 8.5, Volume 2 provide a description of the habitats within and adjacent to the Project area, as well as the Bay as a whole. The figures indicate that the intertidal coastal habitat of the Swansea Bay area is predominantly sand flats, with muddy to fine sandy sediments dominating. Figure 8.6, Volume 2 provides an overview of the biotopes recorded. Analysis of the habitat mapping and biotopes recorded identifies that intertidal areas used by coastal birds within the eastern and western study areas do not differ significantly in habitat type or biotope composition. Therefore, it is considered foraging habitats of similar quality are widespread throughout the Bay.

Subtidal

- 11.4.2.3 The UKSeaMap subtidal habitat predictions provide an indication of the sediments likely to be present in the subtidal area and the species likely to be associated with them. In the vicinity of Swansea Bay, the sediments are best described as a mixture of circalittoral mud and sand within the Project area extending towards Mumbles (Figure 8.14, Volume 2) with the respective composition of each varying spatially. To the south east towards Port Talbot, the subtidal habitat is described as infralittoral sandy mud or fine mud. Subtidal benthic ecology data available from a variety of sources, together with data gathered during field surveys carried out as part of the Project, have been reviewed and presented in Chapter 8: Subtidal and Intertidal Benthic Ecology. During the field surveys and through literature review, various areas have been identified within Swansea Bay as being used by Divers and Grebes. These areas extend from Port Talbot Dock in the southeast, off Aberafan beach through to the waters off the Port of Swansea and heading out to Mumbles.

11.4.3 Designated sites

Burry Inlet Special Protection Area (SPA)

- 11.4.3.1 The Burry Inlet SPA is located over 10km north west of the Project. It is a complex of estuarine habitats considered of international importance for regularly supporting in excess of 20,000 overwintering wildfowl. The site also qualifies as it supports European significant numbers of overwintering Oystercatcher, Pintail *Anas acuta*, Knot *Calidris canutus* and Redshank *Tringa tetanus*.
- i. Oystercatcher - 13,590 individuals representing at least 1.5% of the wintering Europe & Northern/Western Africa population (5 year peak mean 1991/2 - 1995/6), JNCC, 2013;
 - ii. Pintail - 1,772 individuals representing at least 3.0% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6), JNCC, 2013);
 - iii. Knot – 4,300 individuals representing approximately 1.2% of the biogeographic population of migratory and overwintering birds (5 year peak mean 1985/86 - 1989/90), CCW, 2005; and



- iv. Redshank – 1,200 individuals representing approximately 0.8% of the biogeographic population of migratory and overwintering birds (5 year peak mean 1985/86 - 1989/90), CCW, 2005.

- 11.4.3.2 The overwintering SPA waterfowl assemblage of approximately 35,000 individual birds include Oystercatcher and Pintail as well as: Curlew, Black-tailed Godwit *Limosa limosa*, Dunlin, Grey Plover *Pluvialis squatarola*, Shoveler *Anas clypeata*, Shelduck *Tadorna tadorna*, Teal *Anas crecca*, Turnstone, Wigeon *Anas penelope* and Whimbrel *Numenius phaeopus*). The SSSI citation for Burry Inlet also notes other overwintering and passage birds.

Carmarthen Bay SPA

- 11.4.3.3 The Carmarthen Bay SPA is located over 20km north west of the Project. It is of international importance as it is used regularly by 1% or more of the biogeographic population of a regularly occurring migratory species: Common Scoter.

Crymlyn Bog Special Area of Conservation (SAC), SSSI, National Nature Reserve and Ramsar

- 11.4.3.4 Crymlyn Bog SAC is internationally important for its very wet mires, supporting the largest area of calcium-rich fen vegetation in south Wales. It also supports significant areas of wet woodland. The site is located immediately to the north of the Project (<1km). The primary reason for selection of this site as a SAC is the presence of Annex 1 habitats, although the SSSI citation for Crymlyn Bog notes sizeable breeding populations of Reed Warbler *Acrocephalus scirpaceus* and Sedge Warbler *Acrocephalus schoenobaenus* associated with the denser stands of Common Reed *Phragmites australis*. No significant effect has been assessed to habitats or species associated with Crymlyn Bog is envisaged during construction or operation of the Project and this ecological receptor is not considered further during this assessment.

Blackpill SSSI

- 11.4.3.5 The Blackpill SSSI is located 3.3km west of the Project and is of national importance due to the numbers of wintering and passage Ringed Plover and Sanderling. Species of local significance forming part of the overall SSSI bird assemblage also include Oystercatcher, Grey Plover *Pluvialis squatarola*, Bar-tailed Godwit *Limosa lapponica*, Knot and Dunlin.

Crymlyn Burrows SSSI

- 11.4.3.6 The Crymlyn Burrows SSSI is located immediately east of the Project. Crymlyn Burrows SSSI is primarily designated for the sand dune habitat, plant and invertebrate species it supports although the citation also notes “*This part of the Neath estuary is also used by part of the population of small waders overwintering in Swansea Bay*”. Field survey work undertaken to inform the current assessment (2011 – 2013) has identified a wintering wader roost (Roost 2) at the western extent of Crymlyn Burrows which is just outside the Project area (Figure 11.21, Volume 2). This roost is described further below.

11.4.4 Field survey

- 11.4.4.1 Results of the survey visits undertaken between October 2011 and August 2013 are summarised in Tables 11.4 (Low Tide Counts) and 11.5 and 11.6 (Core Counts) below, and illustrated for those species listed within the Blackpill SSSI citation in Figures 11.3-11.20 (low tide counts maps), Volume 2 with the full data set presented in Appendix 11.3, Volume 2.



11.4.4.2 Table 11.4 details the peak count of every species recorded during the Low Tide Count survey visits, including the details of the sectors where the species has been recorded on site, and the conservation / designation status of the species.

Table 11.4 Low Tide Count data summary (Winter 2011/2012 & 2012/2013 & Summer 2013)

Species	Peak Count West(Sector)	Date of peak count (west)	Peak Count East(Sector)	Date of peak count (east)	Sectors Species recorded	Designation*
Mute Swan <i>Cynus olor</i>	-	-	3 (EE015)	26/11/2012	EE015	PSoBW (A)
Shelduck <i>Tadorna tadorna</i>	5 (EE006)	18/12/2012	5 (EE020)	18/12/2012	EE004, EE006-EE008, EE018-EE020	PSoBW (A)
Mallard <i>Anas platyrhynchos</i>	-	-	2 (EE022)	20/02/2012	EE019, EE022	PSoBW (A)
Dark-bellied Brent Goose <i>Branta bernicla bernicla</i>	9 (EE009)	25/10/2012	-	-	EE009	UKBAP, S42, BCC(A)
Cormorant <i>Phalacrocorax carbo</i>	3 (EE004)(EE005)	26/11/2012	6 (EE018)	06/01/2012	EE001, EE003-EE005, EE007, EE010, EE011, EE016, EE018, EE023	PSoBW (A)
Great Northern Diver <i>Gavia immer</i>	1 (200-300m off shore EE002 and EE017)	06/01/2012	-	-	N/A	ECB Ann.I, BoC, BeC, WCA1, BCC(A), PSoBW (A)
Great Crested Grebe <i>Podiceps cristatus</i>	200 (EE009)	18/12/2012	94 (EE016)	18/12/2012	EE003, EE004, EE006-EE009, EE016-EE018.	N/A
Little Egret <i>Egretta garzetta</i>	-	-	1 (EE022)	26/11/2012	EE020, EE022	ECB, BeC, BCC(A)
Grey Heron <i>Ardea cinerea</i>	3 (EE007)	21/10/2011	-	-	EE007	N/A
Oystercatcher <i>Haematopus ostralegus</i>	375 (EE003)	15/11/2011	220 (EE016)	23/08/2013	EE001-EE011, EE015-EE018, EE020, EE023	BCC(A), PSoBW (A),
Ringed Plover <i>Charadrius hiaticula</i>	90(EE009)	26/11/2012	120 (EE016)	24/05/2013	EE005, EE006, EE008, EE009, EE010, EE016, EE017	BeC, BoC, S42, BCC(A), PSoBW (A), SSSI
Grey Plover <i>Pluvialis squatarola</i>	5 (EE009)	22/01/2013	2 (EE018)	06/01/2012 20/02/2012	EE009, EE018	BCC(A), PSoBW (R)
Knot <i>Calidris canutus</i>	32 (EE005)	20/02/2012	-	-	EE005	BCC(A), PSoBW (A),
Sanderling <i>Calidris alba</i>	250 (EE004)	15/02/2013	172 (EE017)	23/08/2013	EE002-EE007, EE009, EE010, EE016-EE018	BoC, BeC, PSoBW (A), SSSI
Common Sandpiper <i>Actitis hypoleucos</i>	-	-	1 (EE020)	26/11/2012	EE016, EE020	PSoBW (A)
Dunlin <i>Calidris alpina</i>	450 (EE004)	06/01/2012	60 (EE017)	15/12/2011	EE002-EE010, EE016, EE017, EE018, EE022, EE023.	BoC, WCA1, UKBAP, BCC(R), PSoBW (R)



Species	Peak Count West(Sector)	Date of peak count (west)	Peak Count East(Sector)	Date of peak count (east)	Sectors Species recorded	Designation*
Black-tailed Godwit <i>Limosa limosa</i>	2 (EE004)	26/11/2012	-	-	EE004	BoC, WCA1, UKBAP, BCC(R), PSoBW (A)
Bar-tailed Godwit <i>Limosa lapponica</i>	47 (EE005)	09/03/2012	-	-	EE003-EE006	S42, BCC(A), PSoBW (R)
Curlew <i>Numenius arquata</i>	17 (EE003)	25/10/2012	51 (EE019)	21/09/2012	EE001-EE011, EE015-EE020	UKBAP, S42, BCC(A), BBWC(M), PSoBW (R), NPT LBAP.
Redshank <i>Tringa totanus</i>	3 (EE001)	28/03/2013	5 (EE0015)	22/01/2013	EE001, EE003-EE005, EE007, EE010, EE013, EE018, EE019, EE022, EE023	BCC(A), BBWC(M), PSoBW (A)
Turnstone <i>Arenaria interpres</i>	50 (EE009)	22/01/2013	2 (EE015) (EE020)	15/02/2013 22/01/2013	EE001, EE003-EE005, EE008-EE011	BoC, BeC, BCC(A), PSoBW (A)
Mediterranean Gull <i>Larus melanocephalus</i>	4 (EE004)	20/02/2012	-	=	EE003 & EE004	ECB Ann.I, BoC, BeC, BCC(A)
Black-headed Gull <i>Chroicocephalus ridibundus</i>	329 (EE005)	15/02/2013	344 (EE018)	15/02/2013	EE001-EE012, EE015-EE018, EE020. EE023	PSoBW (R), S42
Common Gull <i>Larus canus</i>	68 (EE007)	15/12/2011	1100 (EE017)	22/01/2013	EE002, EE005-EE007, EE016	BCC(A), PSoBW (R)
Lesser Black-backed Gull <i>Larus fuscus</i>	23 (EE003)	09/03/2012	189 (EE015)	26/04/2013	EE001, EE002-EE011, EE016-EE019, EE023	BCC (A), PSoBW (A)
Herring Gull <i>Larus argentatus</i>	338 (EE008)	26/11/2012	678 (EE016)	22/01/2013	EE001-EE013, EE015-EE018, EE020, EE022, EE023	UKBAP, S42, BCC(R), PSoBW (R)
Great Black-backed Gull <i>Larus marinus</i>	21 (EE007)	09/03/2012	17 (EE017)	26/04/2013	EE001-EE011, EE015-EE020, EE023	BCC (A), PSoBW (R)
Kittiwake <i>Rissa tridactyla</i>	105 (mumbles pier)	26/11/2012	-	-	N/A	N/A
Lapwing <i>Vanellus vanellus</i>	-	-	1 (EE020)	22/1/2013	EE020	BCC(R), PSoBW (R)
Little Grebe <i>Tachybaptus ruficollis</i>	-	-	1 (EE020)	22/01/2013	EE020	BCC (A),
Whimbrel <i>Numenius phaeopus</i>	-	-	2 (EE019)	24/05/2013	EE019	BCC(R), ECB Ann.I, BoC, WCA1, PSoBW (A)

*- ECB Ann.I EC Birds Directive Annex I, BeC Berne Convention, BoC Bonn Convention, WCA1 Protected by listing on Schedule 1 of Wildlife and Countryside Act 1981, S42 Species of Principal Importance under the NERC Act in Wales, UKBAP UK Biodiversity Action Plan Priority Species, BCC (R) Birds Of Conservation Concern 3 (Red List), BCC (A) Birds Of Conservation Concern 3 (Amber List), BBWC (H) Breeding Birds in the Wider Countryside (High Alert), BBWC (M) Breeding Birds in the Wider Countryside (Medium Alert), NPT LBAP Neath Port Talbot Priority species, PSoBW (A) Populations status of birds in Wales (Amber), PSoBW (R) Populations status of birds in Wales (Red), SSSI Blackpill SSSI qualifying species.



11.4.4.3 Core Count data is detailed in Tables 11.5 and 11.6 below. In addition, table 11.7 presents a summary of the peak counts recorded during the field surveys, as well as those recorded by GOS or WeBs surveys. It then compares them to the 1% BTO threshold levels to provide an indication of their significance. These threshold levels have arisen from commitments made under the Ramsar Convention, in which wetlands regularly holding at least 1% of the individuals of a population are considered of International importance. The threshold levels are revised every 9 years and BTO publishes a list of both the 1% International and National levels (any wetland regularly supporting >1% of the British threshold is considered of National importance)(BTO, 2013).

Table 11.5 High Tide Count Data – Winter 2011/12 - Totals for Western and Eastern Survey Areas (Extent of Western Survey Area = Low Tide Sectors EE001-EE012 & Eastern Area = Sectors EE0013-EE023)

Region of Bay	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST
Date / Species	21/10/11		15/11/11		15/12/11		06/01/12		20/02/12		09/03/12	
Shelduck	0	0	0	0	1	0	0	0	12	2	0	2
Mallard	0	2	0	0	0	0	0	0	0	0	0	0
Teal	0	0	0	0	0	0	0	0	0	0	0	0
Dark-bellied Brent Goose	3	0	0	0	0	0	0	0	0	0	3	0
Cormorant	2	1	9	0	1	0	0	3	2	0	2	10
Great Crested Grebe	0	0	0	1	0	0	12	1	3	1	2	2
Little Egret	0	0	0	0	0	0	0	0	0	0	0	0
Oystercatcher	1354	100	2100	95	1768	35	779	89	842	80	27	38
Ringed Plover	88	0	98	0	140	0	197	0	0	0	18	0
Grey Plover	1	0	0	0	0	0	0	0	0	0	0	0
Knot	0	0	6	0	0	0	10	0	0	0	0	0
Sanderling	42	25	426	0	482	0	274	15	15	10	22	10
Dunlin	46	60	477	120	746	1	739	26	730	5	15	0
Black-tailed Godwit	0	0	0	0	0	0	0	0	1	0	0	0
Bar-tailed Godwit	10	0	21	0	20	0	12	0	0	0	25	0
Snipe		0		0		0		0		2		0
Curlew	41	0	42	0	30	0	0	3	0	0	2	0
Redshank	0	0	0	0	1	0	0	2	0	1	0	4
Turnstone	0	0	0	0	8	2	0	0	11	0	8	0
Med. Gull	0	0	0	0	0	0	2	0	0	0	0	0
Black-headed Gull	0	0	97	0	73	0	746	0	324	0	6	0
Common Gull	0	0	10	0	13	0	23	0	24	0	10	0
Lesser Black-backed Gull	0	0	11	54	0	10	40	2	6	20	3	80
Herring Gull	0	0	48	32	43	30	598	17	203	20	56	38
Great Black-backed Gull	0	0	0	2	3	0	3	0	5	0	15	2
Kittiwake	0	0	0	0	0	0	0	0	0	0	0	0



Tidal Lagoon Swansea Bay plc

Table 11.6 High Tide Count Data – Winter 2012/13 - Totals for Low Tide Sectors EE001-EE023 (plus Summer 2013 Totals for EE013-023)

Region of Bay	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	EAST	EAST	EAST
Date / Species	21/9/12	25/10/12	26/11/12	26/11/12	18/12/12	18/12/12	22/1/13	22/1/13	15/2/13	15/2/13	28/3/13	28/3/13	26/4/13	24/5/13	10/6/13	11/7/13	23/8/13		
Shelduck	0	1	2	0	0	0	0	0	0	0	4	2	2	4	10	4	6	0	1
Mallard	0	2	0	0	0	0	0	0	0	0	2	3	3	0	0	0	0	0	0
Teal	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	7	0	0
Dark-bellied Brent Goose	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cormorant	4	2	7	4	0	0	0	0	0	0	2	7	0	0	2	2	1	0	3
Great Crested Grebe	0	0	0	0	0	0	0	0	0	0	85	0	0	85	1	0	0	0	4
Little Egret	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Oystercatcher	400	316	832	132	154	460	154	300	440	607	113	350	200	3	13	0	0	122	64
Ringed Plover	0	133	0	186	0	0	0	0	0	0	0	0	0	0	0	0	0	150	1
Grey Plover	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Knot	0	0	3	0	0	0	0	0	0	0	0	4	0	0	0	1	0	0	0
Sanderling	0	230	50	32	2	0	0	14	272	179	0	0	402	20	178	0	0	53	0
Dunlin	0	44	0	5	1	0	0	21	4	469	0	0	48	3	7	30	80	11	0
Black-tailed Godwit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bar-tailed Godwit	0	4	24	1	16	0	0	10	0	20	0	11	0	13	0	0	0	0	0
Snipe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Curlew	0	72	84	2	3	0	0	0	12	5	1	0	57	0	46	10	2	0	37
Redshank	0	3	0	0	0	0	2	12	1	32	2	5	0	0	9	3	1	0	16
Turnstone	5	0	0	0	0	21	0	64	3	70	0	51	13	43	2	10	0	0	0
Med. Gull	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Black-headed Gull	142	38	181	0	1049	70	268	10	301	7	153	2	48	15	0	0	7	0	51
Common Gull	0	10	1	27	0	0	0	0	0	1	13	4	3	16	47	0	0	0	0
Lesser Black-backed Gull	116	12	2	0	1	50	0	0	0	1	0	0	0	0	4	0	2	2	7
Herring Gull	166	0	85	406	491	300	65	92	143	28	53	3	57	104	6	27	38	79	33
Great Black-backed Gull	2	2	18	6	9	5	2	0	7	0	3	0	9	2	0	0	1	0	9
Kittiwake	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 11.7 Low / Core Peak Count Summary (Winter 2011-2013 & Summer 2013)

Species	Low Tide	High Tide		GOS	WeBs	1% Threshold*	
	Peak Count (Sector)	Western Bay	Eastern Bay			International	British
Mute Swan <i>Cynus olor</i>	3 (EE015) 26/11/2012	-	-	25 Nov 2003	6 Nov 2006	320	740
Shelduck <i>Tadorna tadorna</i>	5 (EE020) 18/12/2012	12 20/02/2012	10 15/02/2013	21 Jan 2003	17 Feb 2011	3000	610
Mallard <i>Anas platyrhynchos</i>	2 (EE022) 20/02/2012	3 22/01/2013	2 21/09/2012 21/10/2012 18/12/2012	2 Jul 2008	25 Oct 2006	45000	6800
Dark-bellied Brent Goose <i>Branta bernicla bernicla</i>	9 (EE009) 25/10/2012	3 21/10/2012 09/03/2012	7 25/10/2013	28 Mar 2011	5 Dec 2006	2400	910
Cormorant <i>Phalacrocorax carbo</i>	6 (EE018) 06/01/2012	9 15/11/2011	10 09/03/2012	169 Jan 2008	12 Jun 2009	1200	350
Great Northern Diver <i>Gavia immer</i>	1 (200-300m off shore of EE002 and EE017) 06/01/2012	-	-	-	3 Mar 2007	50	25
Great Crested Grebe <i>Podiceps cristatus</i>	200 (EE009) 18/12/2012	12 06/01/2012	2 09/03/2012	486** 02/12/2013	440 Dec 2010	3500	190
Little Egret <i>Egretta garzetta</i>	1 (EE022) 26/11/2012	-	1 26/11/2012 22/01/2013	5 Nov 2008	4 Nov 2009	1300	45
Grey Heron <i>Ardea cinerea</i>	3 (EE007) 21/10/2011	-	-	9 Sep 2010	5 Nov 2007	2700	610
Oystercatcher <i>Haematopus ostralegus</i>	375 (EE003) 15/11/2011	2100 15/11/2011	881 23/08/2013	9500 Mar 2002	3850 Sep 2009	8200	3200
Ringed Plover <i>Charadrius hiaticula</i>	120 (EE016) 24/05/2013	464 26/11/2012	197 06/01/2012	560 Dec 2008	257 Sep 2010	730	340
Grey Plover <i>Pluvialis squatarola</i>	5 (EE009) 22/01/2013	3 28/03/2013	3 25/10/2012	92 Jan 2002	30 Dec 2007	2500	430
Knot <i>Calidris canutus</i>	32 (EE005) 20/02/2012	10 06/01/2012	1 28/03/2012	210 Feb 2008	50 Jan 2011	4500	3200
Sanderling <i>Calidris alba</i>	250 (EE004) 15/02/2013	482 15/12/2011	402 15/02/2013	698 Feb 2006	475 Dec 2010	1200	160
Common Sandpiper <i>Actitis hypoleucos</i>	1 (EE020) 26/11/2012	-	-	21 Jul 2007	5 Jul 2010	17500	1
Dunlin <i>Calidris alpina</i>	450 (EE004) 06/01/2012	746 15/12/2011	120 15/11/2011	2800 Feb 2011	1093 Feb 2004	13300	3500
Black-tailed Godwit <i>Limosa limosa</i>	2 (EE004) 26/11/2012	1 20/02/2012	-	150 Aug 2010	8 Oct 2008	610	430
Bar-tailed Godwit <i>Limosa lapponica</i>	47 (EE005) 09/03/2012	25 09/03/2012	4 21/09/2012	55 May 2002	17 Sep 2009	1200	380
Curlew <i>Numenius arquata</i>	51 (EE019) 21/09/2012	84 20/10/2012	118 23/08/2013	214 Feb 2002	163 Sep 2008	8400	1400
Redshank <i>Tringa totanus</i>	5 (EE0015) 22/01/2013	32 22/01/2013	16 11/07/2013	140 Jan 2005	71 Sep 2009	2400	1200
Turnstone <i>Arenaria interpres</i>	50 (EE009) 22/01/2013	70 22/01/2013	13 15/02/2013	382 Mar 2006	30 Jan 2011	1400	480



Species	Low Tide	High Tide		GOS	WeBs	1% Threshold*	
	Peak Count (Sector)	Western Bay	Eastern Bay			International	British
Mediterranean Gull <i>Larus melanocephalus</i>	4 (EE004) 20/02/2012	2 06/01/2012	1 11/07/2013	256 Jun- Dec 2011	63 Aug 2010	770	18
Black-headed Gull <i>Chroicocephalus ridibundus</i>	344 (EE018) 15/02/2013	1049 26/11/2012	178 23/08/2013	8320 Jan 2007	4919 Nov 2006	20000	22000
Common Gull <i>Larus canus</i>	1100 (EE017) 22/01/2013	24 20/02/2012	47 28/03/2013	2361 Jan 2004	1072 Jan 2010	16400	7000
Lesser Black-backed Gull <i>Larus fuscus</i>	60 (EE023) 21/09/2012	116 21/09/2012	80 09/03/2012	328 Sep 2009	140 Aug 2008	5500	1200
Herring Gull <i>Larus argentatus</i>	678 (EE016) 22/01/2013	598 06/01/2012	406 25/10/2012	3764 Oct 2002	1066 Oct 2008	10200	7300
Great Black-backed Gull <i>Larus marinus</i>	21 (EE007) 09/03/2012	18 25/10/2012	9 23/08/2013	154 Nov 2009	122 Jun 2007	4200	760
Kittiwake <i>Rissa tridactyla</i>	105 (mumbles pier) 26/11/2012	12 21/09/2012	-	274 Aug 2009	-	20000	-
Lapwing <i>Vanellus vanellus</i>	1 (EE020) 22/1/2013	-	-	18 Feb 2004	-	20000	6200
Little Grebe <i>Tachybaptus ruficollis</i>	1 (EE020) 22/01/2013	-	-	-	-	3900	160
Whimbrel <i>Numenius phaeopus</i>	2 (EE019) 24/05/2013	-	-	584 Jun 2004	16 Apr 2009	6700	1
Snipe <i>Gallinago gallinago</i>	-	-	2 20/02/2012	29 Feb 2009	29 Feb 2009	20000	10000
Teal <i>Anas crecca</i>	-	-	12 18/12/2012	54 Dec 2010	24 Dec 2010	5000	2100

Grey cells indicate numbers exceed BTO (2013) – International & British 1% Threshold Levels⁵ / **Hipkin (2013)

11.4.4.4 Three regular roost sites were identified during the field surveys survey area and were located at:

1. Blackpill in the west (Roost 1);
2. Crymlyn Burrows beach in the east (Roost 2); and
3. at the mouth of the River Neath in the east (Roost 3).

11.4.4.5 See Table 11.8 below and Figure 11.21 (Volume 2) for details of these roost sites.

⁵ Under criterion 6 of the Ramsar Convention on Wetlands of International Importance, a wetland is considered internationally important if it regularly holds at least 1% of the individuals in a population of one species or subspecies of waterbird. A wetland in Britain is considered nationally important if it regularly holds 1% or more of the estimated British population of one species or subspecies of waterbird. <http://www.bto.org/volunteer-surveys/webs/data/species-threshold-levels>.

Table 11.8 Roost Site Summary

Roost Number	Closest WeBS Sector	Grid Reference	Description	Species recorded
1	EE007	SS 6205 9059	Blackpill, Small area of (high tide) exposed sand bank near Mill Lane	Shelduck, Dark-bellied Brent Goose, Oystercatcher, Ringed Plover, Grey Plover, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Turnstone, Med. Gull, Black-headed Gull, Common Gull, Lesser Black-backed Gull, Herring Gull, Great Black-backed Gull.
2	EE017	SS 7039 9261	Crymlyn Burrows beach	Oystercatcher, Ringed Plover, Grey Plover, Sanderling, Dunlin.
3	EE018	SS 7197 9271	Crymlyn Burrows beach eastern extent – mouth of the River Neath	Oystercatcher, Ringed Plover, Grey Plover, Sanderling, Dunlin, Bar-tailed Godwit, Curlew, Redshank, Turnstone, Black-headed Gull, Lesser Black-backed Gull, Herring Gull, Great Black-backed Gull.

11.4.4.6 Additional records taken during field survey and not assignable to WeBS low tide count sectors consisted of a single record of Great Northern Diver (Foraging 200-300m off shore of sector EE007 in January 2012) and a record of 12 Kittiwake on Mumbles pier in November 2012.

11.4.5 Overview

11.4.5.1 The long term data sets available for the study area (WeBS and GOS data) detail a similar assemblage of species to that identified through the field surveys carried out for the Project between 2011 - 2013, although a greater diversity of species and higher peak count for certain species was noted in the long term data sets. Generally with long term data sets, some variation is likely to exist as the targeted bird surveys (2011-2013) are a 'snap shot' of the birds present at that time.

11.4.5.2 Table 11.9 divides bird species identified during field surveys into groups of species with similar ecological requirements i.e. Gulls, Wading Birds and Waterfowl and Divers & Grebe species:

Table 11.9 Bird Assemblages

Waders & Waterfowl Group	Gull Group	Diver & Grebe Group
Ringed Plover Sanderling Oystercatcher Grey Plover Knot Dunlin Bar-tailed Godwit Common Sandpiper Black-tailed Godwit Curlew Redshank Snipe Turnstone Grey Heron Little Egret Whimbrel Mute Swan Shelduck Mallard Teal Dark-bellied Brent Goose Greylag Goose	Mediterranean Gull Black-headed Gull Common Gull Lesser Black-backed Gull Herring Gull Greater Black-backed Gull Kittiwake	Great Crested Grebe Red-throated Diver <i>Gavia stellata</i> Great Northern Diver Cormorant

- 11.4.5.3 The data summarised in Tables 11.4-11.7 detail the variety of bird species identified within the survey area at low tide and high tide with peak counts, their locations and date also shown. Discussion and evaluation of these species is presented in detail below on a species by species basis with those species listed within the Blackpill SSSI citation (Sanderling & Ringed Plover) discussed first, followed by those of conservation concern or conservation designation (i.e. Schedule 1 Wildlife and Countryside Act 1980; Amber or Red listed) and finally those with of no immediate conservation concern or designation. Only those species recorded during field survey work to support the current study are discussed in detail.

Ringed Plover

- 11.4.5.4 Ringed Plover are listed as a qualifying feature of the Blackpill SSSI and as species of principal importance for the purpose of conserving biodiversity under section 42 (Wales) of the NERC Act (2006)⁶. They are also listed as being of amber status within the UK and Wales (Eaton et al, 2009). WeBS core count and GOS survey record regular numbers of wintering and passage numbers of this species (Appendix 11.1 & 11.2, Volume 3) with a peak count of 257 and 560 Ringed Plover from WeBS data in September 2010 and GOS December 2008 data respectively. WeBS low tide count data for the species record a maximum count of 70 in November 2003 and peak count of 40 in sector EE004, with flocks recorded in sectors EE004-EE006, EE015, EE016 and EE017.

⁶ Only the breeding populations of Ringed Plover are listed under Section 42(Wales) of the NERC Act (2006). The passage and wintering birds that inhabit the Blackpill SSSI could contain birds from the continent.



- 11.4.5.5 The Project field surveys (2011-2013) recorded a peak count of 120 Ringed Plover during low tide counts (24/05/2013 extended summer surveys EE016), with birds noted in sectors EE005-EE010 and EE016-EE020. Ringed Plover were recorded across the survey area with a greater frequency and number recorded over the survey period in low tide sectors EE001-EE010, although regular flocks were also recorded in eastern sectors -EE016 – EE017 (Figures 11.3-11.20, Volume 2).
- 11.4.5.6 A peak count of 464 Ringed Plover was recorded in November 2012 in the eastern area of the Bay during High Tide count surveys, and a peak count of 197 was recorded in western areas. Ringed Plover were regularly recorded roosting in both the eastern and western areas of the study area, and a favoured roost site on Crymlyn Burrows beach (Roost 2) was identified. The peak High Tide count for the entire survey area combined was 464 Ringed Plover in November 2012.
- 11.4.5.7 The combination of WeBS, GOS and field survey data shows Swansea Bay supports regular wintering and likely passage populations of this species. In general, numbers in the survey area do not regularly exceed the 1% threshold value of the UK wintering population (340). However, Ringed Plover are a qualifying feature of Blackpill SSSI, and as such are recognised as an ecological feature of national ecological value.

Sanderling

- 11.4.5.8 Sanderling are listed as a qualifying feature of the Blackpill SSSI and are listed as amber status within Wales (RSPB, 2009). WeBS core count and GOS surveys record regular numbers of wintering and passage Sanderling (Appendix 11.1 & 11.2, Volume 3) with a peak count of 475 in December 2010 (WeBS) and 698 February 2006 (GOS). WeBS low tide count data from 2006/07 recorded a maximum count and peak count of 440 Sanderling in January 2007 recorded in sector EE016.
- 11.4.5.9 The Project field survey work (2011-2013) recorded a peak count of 250 Sanderling during low tide counts, with birds noted in sectors EE002-EE007, EE009, EE010 and EE016-EE018. Low tide records of Sanderling were noted from throughout the survey area with regular records from both western and eastern survey areas (Figures 11.3-11.20, Volume 2) although regular foraging counts were higher to the west of the Bay (Appendix 11.3, Volume 3).
- 11.4.5.10 High Tide counts recorded a peak count of 482 Sanderling in December 2012 in the western area of the Bay, with a peak count of 402 recorded in eastern areas. The peak High Tide count for the entire survey area combined was 482 Sanderling in December 2012. Roosting records of Sanderling were recorded from both western and eastern areas of the Bay with regular roosting records evenly distributed between Roost 2 at Crymlyn Burrows beach and Roost 1 at Blackpill.
- 11.4.5.11 The combination of WeBS, GOS and field survey data shows that Swansea Bay supports regular numbers of wintering/passage Sanderling. The peak number of Sanderling recorded in the survey area exceeds the 1% threshold value of the UK wintering population. Regular High Tide counts and occasional foraging counts exceeding this 1% threshold (160 individuals) were noted during the Project field surveys and from WeBS data. As such, the wintering and passage population of Sanderling is considered to represent an ecological feature of national ecological value.



Oystercatcher

- 11.4.5.12 Oystercatchers are listed as being of amber status within the UK (Eaton *et al*, 2009) and Wales (RSPB, 2009). WeBS Core Count and GOS surveys record regular numbers of summer (non-breeding), wintering and passage numbers of this species (Appendix 11.1 & 11.2, Volume 3) with a peak count of 3,850 Oystercatcher from WeBS data in September 2009. 9,500 individuals are recorded in March 2002 in GOS data. WeBS Low Tide Count data record a maximum count (between EE013-EE023) of 3,878 individuals in February 2007, with a peak count of 176 in sector EE023. Flocks of Oystercatchers were recorded in sectors EE001-EE010, EE015, EE016, EE017, EE018, EE022 & EE023 during WeBS Low Tide Counts.
- 11.4.5.13 During the Project field survey work (2011-2013), Oystercatcher were recorded within the majority of Low Tide Count sectors during Low Tide Counts, with a peak count of 375 birds noted in sector EE003 on the 15th of November 2011. Low tide records of Oystercatcher show a significant western bias within the survey area, with consistently greater numbers recorded over the survey period in low tide sectors EE001-EE010, although it must be noted this species was also regularly recorded in smaller numbers in the eastern survey area – EE015-EE023 (Figures 11.3-11.20, Volume 2). This western distribution bias is thought to be due to the higher quality foraging habitat present in the western Bay area.
- 11.4.5.14 High Tide counts of Oystercatcher within the western survey area (including Blackpill SSSI) had a peak count of approximately 2,100, with a range of 27-2,100 over the winter survey visits. Oystercatcher numbers at high tide within the eastern survey area were significantly lower, with a peak count of 440. As described above, Oystercatchers demonstrate a strong western bias within the Bay with the favoured high tide roost site at Blackpill significantly contributing to the bird count. However, regular roost sites also occur in the east of the survey area with numbers increasing at these sites during high spring tides and periods of increased disturbance. A particular favoured roost site exists near the mouth of the river Neath (EE0019 – Roost 3). The peak High Tide count for the entire survey area combined was 2,195 Oystercatcher in November 2011.
- 11.4.5.15 Swansea Bay supports a good wintering population of this species and the UK is an important wintering site for Oystercatcher associated with the eastern Atlantic flyway (Kirby *et al*, 2008), with a significant proportion of this wintering population utilising the UK during this period. However, field survey counts of Oystercatcher (Peak count - 2,195) do not exceed the 1% threshold value of the UK wintering population (1% value – 3,200; estimated wintering population – 32,000 (Musgrove *et al*, 2011) and although peak counts from WeBS and GOS data have exceeded this value in the past, recent counts (2007 onwards) have not regularly exceeded 3,200. As such, Swansea Bay is considered to be of regional ecological value for this species.

Grey Plover

- 11.4.5.16 Grey Plover are listed as amber status within the UK (Eaton *et al*, 2009) and red status in Wales (RSPB, 2009). WeBS Core Count and GOS surveys record irregular numbers of wintering and passage Grey Plover (Appendix 11.1 & 11.2, Volume 3) with a peak count of 30 December 2007 (WeBS) and 92 in January 2002 (GOS) respectively. WeBS Low Tide Count data for the species record a maximum count of 17 in January 2004 and peak count of 17 in sector EE018, with birds recorded in sectors EE007, EE015, EE016, EE017 and EE018.



- 11.4.5.17 Project field survey work (2011-2013) recorded a peak count of 5 Grey Plover during Low Tide Counts, with birds noted in sector EE009 and EE018 only. Low tide records of Grey Plover were generally low in number and irregular in nature. (Figures 11.3-11.20, Volume 2).
- 11.4.5.18 A peak count of 3 Grey Plover was recorded on a site visit in November 2012, in the eastern area of the Bay during High Tide count surveys, with a peak count of 3 also recorded in western areas. The peak High Tide count for the entire survey area combined was 3 Grey Plover.
- 11.4.5.19 The combination of WeBS, GOS and field survey data shows that Swansea Bay supports small, irregular numbers of wintering/passage Grey Plover only. Numbers recorded in the survey area do not exceed the 1% threshold value of the UK wintering population, and as such this ecological feature is considered to be of district ecological value only.

Knot

- 11.4.5.20 Knot are listed as amber status within the UK and Wales (Eaton et al, 2009). WeBS core count and GOS surveys record irregular, small numbers of wintering Knot (Appendix 11.1 & 11.2, Volume 3) with a peak count of 50 in January 2011 (WeBS) and 210 in February 2008 (GOS). WeBS low tide count data from 2003/04, 2006/2007 and 2007 recorded no Knot over the course of the surveys.
- 11.4.5.21 Project field survey work (2011-2013) recorded a peak count of 32 Knot during low tide counts, with birds noted in sector EE005 only. Low tide records of Knot on site were limited to a single record in the eastern survey area (Figures 11.3-11.20, Volume 2).
- 11.4.5.22 High Tide counts recorded a peak count of 10 Knot in January 2012 in the western area of the Bay, with a single bird recorded in eastern areas during March 2013. The peak High Tide count for the entire survey area combined was 10 Knot in January 2012.
- 11.4.5.23 The combination of WeBS, GOS and field survey data shows that Swansea Bay supports small, irregular numbers of wintering Knot only. Numbers recorded in the survey area do not exceed the 1% threshold value of the UK wintering population and as such this ecological feature is considered to be of district ecological value.

Dunlin

- 11.4.5.24 Dunlin are listed on the UKBAP and as red status within the UK and Wales (Eaton et al, 2009). WeBS core count data record numbers of wintering and passage Dunlin (See Appendix 11.1, Volume 3) with a peak count of 1,813 in December 2009. WeBS low tide count data from 2003/04 recorded a maximum count of 1,093 Dunlin in February 2004, with a peak count of 850 noted in sector EE002. GOS data record regular flocks of wintering Dunlin with a peak count of 2,800 in February 2011 (Appendix 11.2, Volume 3).
- 11.4.5.25 Project field survey work (2011-2013) recorded a peak count of 450 Dunlin during low tide counts with birds noted in sectors EE002-EE010, EE017, EE018, EE022 and EE023. Low tide records of Dunlin were noted throughout the survey area although regular records were largely associated with EE004-EE006 (western survey area, Figures 11.3-11.15, Volume 2).



- 11.4.5.26 High Tide counts recorded a peak count of 746 Dunlin in December 2011 in the western area of the Bay, with a peak count of 120 recorded in eastern areas in November 2011. The peak High Tide count for the entire survey area combined was 765 Dunlin in January 2012.
- 11.4.5.27 The combination of WeBS, GOS and field survey data shows that Swansea Bay supports regular wintering/passage Dunlin. The peak number of Dunlin recorded during field surveys does not exceed the 1% threshold value (3,500) and neither do counts made by GOS and WeBS. As such, the regular numbers of wintering and passage Dunlin recorded are considered to represent an ecological feature of regional ecological value.

Bar-tailed Godwit

- 11.4.5.28 Bar-tailed Godwit are listed as a species of principal importance for the purpose of conserving biodiversity under section 42 (Wales) of the NERC Act 2006 and they are also listed as amber status within the UK (Eaton et al, 2009) and red status in Wales (RSPB, 2009). WeBS core count data record regular small numbers of wintering and passage Bar-tailed Godwit (Appendix 11.1, Volume 3) with a peak count of 17 in September 2009. WeBS low tide count data from 2003/04 recorded a maximum count of 7 Bar-tailed Godwit in November 2003, with a peak count of 7 noted in sector EE017. GOS data (Appendix 11.2, Volume 3) also detail regular records of Bar-tailed Godwit with a peak count of 55 noted in May 2002.
- 11.4.5.29 Project field survey work (2011-2013) recorded a peak count of 47 Bar-tailed Godwit during low tide counts, with birds noted in sectors EE003-EE006. Low tide records of Bar-tailed Godwit were restricted to the west of the survey area (western survey area, Figures 11.3-11.15, Volume 2).
- 11.4.5.30 High Tide counts recorded a peak count of 25 Bar-tailed Godwit in March 2012 in the western area of the Bay, with a peak count of 4 recorded in eastern areas in October 2012. The peak High Tide count for the entire survey area combined was 25 Bar-tailed Godwit in March and October 2012.
- 11.4.5.31 The combination of WeBS, GOS and field survey data shows that Swansea Bay supports regular, small numbers of wintering/passage Bar-tailed Godwit. The peak number of Bar-tailed Godwit recorded in the survey area does not exceed the 1% threshold value and neither do regular counts noted during both the field survey and within WeBS data. As such, the small numbers of wintering and passage Bar-tailed Godwit recorded are considered to represent an ecological feature of district ecological value.

Mute Swan

- 11.4.5.32 Mute Swan are listed as amber status in Wales (RSPB, 2009). WeBS core count data record small, irregular numbers of Mute Swan (Appendix 11.1, Volume 3) with a peak count of 6 in November 2009. WeBS Low Tide count data from 2006/07 recorded 1 Mute Swan on February 2007 in sector EE013. A review of the available GOS data details (Appendix 11.2, Volume 3) few records of Mute Swan within the survey area although small numbers (<10) were recorded on an occasional basis with peak counts of 25 from November 2003 and December 2002.
- 11.4.5.33 Project field survey work (2011-2013) recorded a peak count of 3 Mute Swan during Low Tide counts, with birds noted in sectors EE013 and EE0015 only. High Tide counts recorded no Mute Swan over the course of survey work to date.



- 11.4.5.34 The combination of WeBS, GOS and field survey data shows that the survey area supports occasional, small numbers of Mute Swan. The peak number of Mute Swan recorded in the survey area does not exceed the 1% threshold value and neither do the counts noted in WeBS or GOS data. As such, the small numbers of Mute Swan recorded are considered to represent an ecological feature of negligible ecological value.

Shelduck

- 11.4.5.35 Shelduck are listed as amber status in Wales (RSPB, 2009). WeBS core count data record regular numbers of Shelduck (Appendix 11.1, Volume 3) with a peak count of 17 in February 2011. WeBS Low Tide count data from 2003/04 recorded a peak count of 1 Shelduck in both November and December 2003 in sectors EE006 and EE007. GOS data (Appendix 11.2, Volume 3) indicate regular records of Shelduck within the survey area with a peak count of 21 from January 2003. Review of GOS data and communication with local bird watchers also indicates that the Crymlyn Burrows area is utilised as a breeding site by this species in small numbers
- 11.4.5.36 Project field survey work (2011-2013) recorded a peak count of 5 Shelduck during Low Tide counts, with birds noted in sectors EE004, EE006-EE008 and EE018-EE020. High Tide counts recorded a peak count of 12 Shelduck in February 2012 in the western area of the Bay during High Tide count surveys with a peak count of 10 recorded in eastern areas in February 2013. The peak High Tide count for the entire survey area combined was 16 Shelduck in February 2013.
- 11.4.5.37 The combination of WeBS, GOS and field survey data shows that Swansea Bay supports regular Shelduck. Neither the peak number of Shelduck recorded nor the regular counts of this species from field survey and desk study (WeBS or GOS data) exceed the 1% threshold value of the UK wintering population. Although only small numbers of Shelduck were recorded over the winter, the eastern area of the Bay (Crymlyn Burrows) is utilised by small numbers of breeding pairs of this species. As such, it must be considered to have borough ecological value for this species.

Mallard

- 11.4.5.38 Mallard are listed as amber status in Wales (RSPB, 2009). WeBS core count data record regular small numbers of Mallard (Appendix 11.1, Volume 3) with a peak count of 25 in October 2006. WeBS Low Tide count data from 2006/07 recorded a maximum and peak count of 8 Mallard in sector EE013. GOS data (Appendix 11.2, Volume 3) show few records of Mallard associated with the current survey area (peak count of 2 was noted in July 2008) although this species is a regular resident in the wider area.
- 11.4.5.39 Project field survey work (2011-2013) recorded a peak count of 2 Mallard during Low Tide counts, with birds noted in sectors EE019 and EE022. High Tide counts recorded no Mallard in the western area of the Bay with a peak count of 3 recorded in eastern areas in January 2013.
- 11.4.5.40 The combination of WeBS, GOS and field survey data shows that Swansea Bay supports regular small numbers of Mallard. This species is noted as of amber status in Wales. The peak number Mallard recorded in the survey area does not exceed the 1% threshold value and neither do the counts noted in WeBS data. As such, the small numbers of Mallard recorded are considered to represent an ecological feature of negligible ecological value.



Teal

- 11.4.5.41 Teal are listed as amber status in the UK and Wales (Eaton et al, 2009). WeBS core count data details few records of wintering Teal within the study area, with a peak count of 24 from December 2010 (Appendix 11.1, Volume 3). WeBS Low Tide count data from 2003/04, 2006/2007 and 2007 recorded no Teal. GOS data (Appendix 11.2, Table 11.1, Volume 3) details irregular winter records of this species with a peak count of 54 individual in December 2010.
- 11.4.5.42 Project field survey work (2011-2013) recorded no Teal during Low Tide counts. High Tide counts only recorded Teal within the eastern survey area, associated with the salt marsh and marsh habitat present here, with a peak count of 12 individuals recorded in December 2012.
- 11.4.5.43 The combination of WeBS, GOS and field survey data shows that Swansea Bay supports irregular, small numbers of Teal during the winter period. The peak number Teal recorded in the survey area does not exceed the 1% threshold value (2,100) and neither do the counts noted in WeBS or GOS data. As such, the small numbers recorded are considered to represent an ecological feature of negligible ecological value.

Dark-bellied Brent Goose

- 11.4.5.44 Dark-bellied Brent Geese are listed as a priority species in the UKBAP, within section 42 of the NERC Act and they are also listed as of amber status in the UK (Eaton et al, 2009). WeBS core count data records a single record of 5 Dark-bellied Brent Geese from December 2006 (Appendix 11.1, Volume 3). WeBS Low Tide count data from 2003/04, 2006/2007 and 2007 recorded no Dark-bellied Brent Geese. GOS data (Appendix 11.2, Volume 3) detail winter records of this species with regular counts exceeding 5 individuals and a peak count of 28 from March 2011.
- 11.4.5.45 Project field survey work (2011-2013) recorded a peak count of 9 Dark-bellied Brent Geese during Low Tide counts, with birds noted in sector EE009 only. High Tide counts recorded a peak count of 3 Dark-bellied Brent Geese in the western area of the Bay in March 2012 with a peak count of 7 recorded in eastern areas in October 2012. The peak High Tide count for the entire survey area combined was 7 Dark-bellied Brent Geese in October 2012.
- 11.4.5.46 The combination of WeBS, GOS and field survey data shows that Swansea Bay supports regular small numbers of Dark-bellied Brent Geese during the winter period. The peak number of Dark-bellied Brent Geese recorded in the survey area does not exceed the 1% threshold value (910) and neither do the counts noted in WeBS or GOS data. As such, the irregular, small numbers recorded are considered to represent an ecological feature of negligible ecological value.

Cormorant

- 11.4.5.47 Cormorant are listed as of amber status in Wales (RSPB, 2009). WeBS core count data record regular, small numbers of Cormorant throughout the year with a peak record of 12 individuals from June 2009 (Appendix 11.1, Volume 3). WeBS Low Tide count data from 2003/04 recorded a maximum count of 9 individuals in January 2004, with a peak count of 4 in EE023. GOS data (Appendix 11.2, Volume 3) details regular, high numbers of cormorant with a peak count of 169 from January 2008. However, it must be noted



that a number of the GOS counts relate to evening roosting counts outside the current study area, and are unlikely to be representative of the numbers using the survey area.

- 11.4.5.48 Project field survey work (2011-2013) recorded a peak count of 6 Cormorant during Low Tide counts, with birds noted in sectors EE001, EE003-EE005, EE007, EE010, EE011, EE016, EE018 and EE023. High Tide counts recorded a peak count of 9 Cormorant in the western area of the Bay in November 2011 during High Tide count surveys, with a peak count of 10 recorded in eastern areas in March 2012. The peak High Tide count for the entire survey area combined was 12 Cormorant in October 2012.
- 11.4.5.49 The combination of WeBS, GOS and field survey data shows that Swansea Bay supports regular Cormorant numbers and significant numbers of roosting Cormorant. The peak number Cormorant recorded in the survey area does not exceed the 1% threshold value (350) and neither do the counts noted in WeBS or GOS data. As such the numbers recorded are considered to represent an ecological feature of negligible ecological value.

Great Northern Diver

- 11.4.5.50 Great Northern Diver are listed on Schedule 1 of the Wildlife and Countryside Act 1980 and are listed as amber status in Wales (RSPB, 2009). They are also listed in the EC Birds Directive Annex I, Berne Convention (Bern, 19.IX.1979) and Bonn Convention (Bonn Convention 1979). WeBS core count data show no records of this species from 2006-2011 (Appendix 11.1, Volume 3). WeBS Low Tide count data also show no records of this species. GOS data (Appendix 11.2, Volume 3) detail regular winter records of individuals and small groups of Great Northern Diver (Peak count of 3 in Jan-March 2007 and February 2006).
- 11.4.5.51 Project field survey work (2011-2013) recorded a peak count of 1 Great Northern Diver during Low Tide counts, with a single individual noted approximately 250m offshore of Low Tide sector EE002 in January 2012. High Tide counts recorded a single individual off sector EE017 in March 2013.
- 11.4.5.52 The combination of GOS and field survey data shows that Great Northern Diver are a regular winter visitor to Swansea Bay in small numbers. However, both field survey data counts and desk study records do not exceed the 1% threshold value (25) of the UK wintering population, and given the low numbers and sporadic nature of the records this is considered to represent an ecological feature of local ecological value only.

Little Egret

- 11.4.5.53 Little Egret are listed as amber status in the UK (Eaton et al, 2009) and are also listed in the EC Birds Directive, Berne Convention and Bonn Convention. WeBS core count data record regular, small numbers of Little Egret throughout the year, with a peak record of 4 individuals from November 2008 and December 2009 (Appendix 11.1, Volume 3). WeBS Low Tide count data recorded no Little Egret. GOS data (Appendix 11.2, Table 11.1, Volume 3) detail regular records of individuals and small numbers of Little Egret (Peak count of 5 in November 2005) throughout the study area, but generally associated with the small areas of salt marsh and estuary habitat present in the east.
- 11.4.5.54 Project field survey work (2011-2013) recorded a peak count of 1 Little Egret during Low Tide counts, with records of single birds in both EE020 and EE023. High Tide counts also only recorded a single Little Egret (November 2012) in the eastern survey area.



- 11.4.5.55 The combination of WeBS, GOS and field survey data shows that Little Egret are a regular occurrence in areas of salt marsh and estuary habitat around Swansea Bay in small numbers. As such, this is considered to represent an ecological feature of local ecological value. There will be a small temporary impact on estuarine /salt marsh habitats as a result of the grid connection associated with the Project if directionally drilled. This will have no significant impact on Little Egret is likely and as such this species are considered to be of negligible ecological value.

Common Sandpiper

- 11.4.5.56 Common Sandpiper are listed as amber status in Wales (RSPB, 2009). WeBS core count data record small numbers of passage Common Sandpiper with a peak record of 5 individuals from July 2010 (Appendix 11.1, Volume 3). WeBS Low Tide count data from 2003/04 recorded no Common Sandpiper. A review of GOS data (Appendix 11.2, Volume 3) indicates that Common Sandpiper are regularly recorded in the county with occasional records of likely breeding. However, few records were associated with the current survey area and those recorded largely consisted of passage birds and occasional wintering individuals (Peak count of 21 in July 2007).
- 11.4.5.57 Project field survey work (2011-2013) recorded a peak count of 1 Common Sandpiper during Low Tide counts, with a record of a single bird from EE020 in November 2012. High Tide counts recorded no Common Sandpiper.
- 11.4.5.58 The combination of WeBS, GOS and field survey data shows that Common Sandpiper are a regular passage visitor in small numbers to Swansea Bay and occasionally winter along associated estuary areas. The peak number of Common Sandpiper recorded in the survey area does exceed the 1% threshold value (1) of the UK wintering population, as do some of the counts noted in WeBS and GOS data. However, the majority of these records are from the passage period, with few irregular records from the core winter period (Nov-March). As such Swansea Bay is not considered to have significant ecological value as a wintering site for this species, and is thought to be utilised on an occasional basis. As such, is considered to represent an ecological feature of district ecological value.

Black-tailed Godwit

- 11.4.5.59 Black-tailed Godwit are listed on both the Bonn Convention and Schedule 1 of the Wildlife and Countryside 1981. They are also listed as priority species with the UKBAP, as red status in the UK (Eaton et al, 2009) and as an amber status within Wales (RSPB, 2009). WeBS core count data record irregular, small numbers of passage Black-tailed Godwit, with a peak count of 8 individuals from October 2008 (Appendix 11.1, Volume 3). WeBS Low Tide count data from 2003/04 recorded no Black-tailed Godwit. GOS data (Appendix 11.2, Volume 3) details regular records within the study area largely associated with the passage period (peak count 150 in August 2010).
- 11.4.5.60 Project field survey work (2011-2013) recorded a peak count of 2 Black-tailed Godwit during Low Tide counts, with a single record of 2 birds in EE004 in November 2012. High Tide counts recorded a single Black-tailed Godwit from the west of the survey area in March 2012.
- 11.4.5.61 The combination of WeBS, GOS and field survey data show that Black-tailed Godwit are an irregular passage visitor in small numbers to Swansea Bay. The peak number Black-tailed Godwit recorded in the survey area does not exceed the 1% threshold value (430)



of the UK wintering population. As such, this is considered to represent an ecological feature of local ecological value.

Curlew

- 11.4.5.62 Curlew are listed as a priority species on both the UKBAP, Neath Port Talbot LBAP and section 42 of the NERC Act⁷. They are also noted as of amber status in the UK (Eaton *et al*, 2009) and red within Wales (RSPB, 2009). WeBS core count data record regular numbers of wintering and passage Curlew, with a peak count of 163 individuals in September 2008. WeBS data also show a gradual decline in numbers since 2008 (Appendix 11.1, Volume 3). WeBS Low Tide count data from 2003/04 recorded a maximum count of 59 Curlew in February 2004 with a peak count of 33 in EE022. GOS data (Appendix 11.2, Volume 3) detail regular records of Curlew within the survey area from 2002-2011 (Peak count 214 in Feb 2002).
- 11.4.5.63 Project field survey work (2011-2013) recorded a peak count of 51 Curlew during Low Tide counts, with birds recorded throughout the survey area EE001-EE011 and EE015-EE020. High Tide counts recorded a peak count of 84 Curlew in the western survey area in October 2012, with a peak count of 72 in the eastern survey area in September 2012. The peak High Tide count for the entire survey area combined was 86 Curlew in March 2012.
- 11.4.5.64 The combination of WeBS, GOS and field survey data shows that Curlew are a regular winter and passage visitor to Swansea Bay. The peak number Curlew recorded in the survey area does not exceed the 1% threshold value (1,400) of the UK wintering population, and neither do the counts noted in WeBS or GOS data. As such, the numbers recorded are considered to represent an ecological feature of district ecological value.

Redshank

- 11.4.5.65 Redshank are listed as amber status in the UK and Wales (Eaton *et al*, 2009). WeBS core count data record regular numbers of wintering and passage Redshank with a peak count of 71 individuals from October 2008 and August 2009 (Appendix 11.1, Volume 3). WeBS Low Tide count data from 2003/04 recorded a maximum count of 24 Redshank in November 2003 with a peak count of 20 from EE002. GOS data (Appendix 11.2, Volume 3) also details regular wintering and passage Redshank within the study area with a peak count of 140 in January 2005.
- 11.4.5.66 Project field survey work (2011-2013) recorded a peak count of 5 Redshank during Low Tide counts, with small numbers and individual birds recorded throughout the survey area (EE001, EE003-EE005, EE007, EE010, EE013, EE015 EE018, EE019, EE022 and EE023). High Tide counts recorded a peak count of 32 Redshank from the western survey area in January 2013, with a peak count of 9 from the eastern survey area in March 2013. The peak High Tide count for the entire survey area combined was 34 in January 2013.
- 11.4.5.67 The combination of WeBS, GOS and field survey data show that Redshank are a regular winter and passage visitor to Swansea Bay. The peak number of Redshank recorded in the survey area does not exceed the 1% threshold value (1,200) of the UK wintering

⁷ Referring to breeding populations of Curlew.



population and neither do the counts noted in WeBS or GOS data. As such, given the low numbers recorded this is considered to be of local ecological value only.

Turnstone

- 11.4.5.68 Turnstone are listed on both the Bern Convention and Bonn Convention and as amber status within both the UK and Wales (Eaton et al, 2009). WeBS core count data record regular small numbers of wintering and passage Turnstone with a peak count of 30 individuals from November 2007 and January 2011 (Appendix 11.1, Volume 3). WeBS Low Tide count data from 2003/04 recorded a maximum count of 23 Turnstone in November 2003 with a peak count of 23 from EE002. GOS data details (Appendix 11.2, Volume 3) regular records of passage and wintering Turnstone (peak count 382 in March 2006) with records of smaller numbers during the summer (non-breeding) also noted.
- 11.4.5.69 Project field survey work (2011-2013) recorded a peak count of 50 Turnstone during Low Tide counts, with birds recorded within the western survey area only (EE001, EE003-EE005, EE008-EE011). High Tide counts recorded a peak count of 70 Turnstone from the western survey area in January 2013, with a peak count of 13 from the eastern survey area in February 2013. The peak High Tide count for the entire survey area combined was 70 in January 2013.
- 11.4.5.70 The combination of WeBS, GOS and field survey data show that Turnstone are a regular winter and passage visitor to Swansea Bay. The peak number Turnstone recorded in the survey area does not exceed the 1% threshold value (480) of the UK wintering population and neither do the counts noted in WeBS or GOS data. As such, given the low numbers recorded this ecological feature is considered to be of local ecological value.

Mediterranean Gull

- 11.4.5.71 Mediterranean Gull is listed on the EC Birds Directive Annex I (EC, 2009), Berne Convention, Bonn Convention and as amber status within the UK (Eaton et al, 2009). WeBS core count data record regular numbers of wintering and passage Mediterranean Gull, with a peak count of 63 individuals from August 2010 (Appendix 11.1, Volume 3). Data for gulls and terns was not presented in WeBS Low Tide count data, since counting was optional and thus the statistics are unreliable.
- 11.4.5.72 Project field survey work (2011-2013) recorded a peak count of 4 Mediterranean Gull during Low Tide counts with small numbers recorded in EE003 & EE004. High Tide counts recorded a peak count of 2 Mediterranean Gull from the western survey area in January 2012 with a single record from the eastern survey area in July 2013.
- 11.4.5.73 The combination of WeBS and field survey data show that Mediterranean Gull are a regular winter and passage visitor to Swansea Bay. The peak number Mediterranean Gull recorded in the survey area does not exceed the 1% threshold value of the UK wintering population, although some counts noted in WeBS data do. As such, the numbers recorded are considered to represent an ecological feature of district ecological value.



Black-headed Gull

- 11.4.5.74 Black-headed Gull is a BAP species on the section 42 list for Wales⁸, and listed as red status within Wales (RSPB, 2009) and amber status in the UK (Eaton et al, 2009). WeBS core count and GOS surveys record regular numbers of summer (non-breeding), wintering and passage Black-headed Gull, with a peak count of 4,919 and 8,320 individuals from WeBS November 2006 and GOS January 2007 (Appendix 11.1 & 11.2, Volume 3).
- 11.4.5.75 During Project field survey work (2011-2013), Black-headed Gull were recorded within the majority of Low Tide count sectors, with a peak count of 344 birds noted in sector EE018 on the 15th February 2013. Low Tide records of Black-headed Gull show a significant western bias within the survey area, with consistently greater numbers recorded over the survey period in sectors EE001-EE011. This species was also regularly recorded in eastern survey area – EE014-EE023 (Figures 11.3-11.20, Volume 2). This western distribution is thought to be due to the higher quality foraging habitat that the western Bay area provides.
- 11.4.5.76 High Tide counts recorded a peak count of 1,049 Black-headed Gull in November 2012 within the western survey area, with a peak count of 70 in the eastern survey area (Nov. 2012). The peak High Tide count for the entire survey area combined was 1,119 in November 2012.
- 11.4.5.77 The combination of WeBS, GOS and field survey data shows that Black-headed Gull are resident throughout the year in Swansea Bay with influxes of wintering and passage birds increasing their numbers. The peak number of Black-headed Gull recorded in the survey area does not exceed the 1% threshold value (22,000) of the UK wintering population. As such, given the relatively low numbers, this is considered to represent an ecological feature of local ecological value only.

Common Gull

- 11.4.5.78 Common Gull is listed as red status within Wales (RSPB, 2009) and amber status in the UK (Eaton et al, 2009). WeBS core count and GOS surveys record regular numbers of wintering and passage Common Gull with a peak count of individuals 1,072 and 2,361 from WeBS January 2010 and GOS January 2004 respectively (Appendix 11.1 & 11.2, Volume 3).
- 11.4.5.79 During Project field survey work (2011-2013), Common Gull were recorded within sectors EE002, EE005, EE006, EE007, EE009, EE010, EE011 and EE016 during Low Tide counts with a peak count of 1,100 birds noted in sector EE017 on the 22nd January 2013. Low Tide records of Common Gull show no bias within the survey area, with numbers recorded over the survey period in Low Tide sectors EE002-EE011 and sectors EE016-EE017 (Figures 11.3-11.20, Volume 2).
- 11.4.5.80 High Tide counts recorded a peak count of 24 Common Gull in February 2012 within the western survey area, with a peak count of 47 in the eastern survey area (March 2013). The peak High Tide count for the entire survey area combined was 63 in March 2013. The numbers of this species recorded during current field survey work were significantly lower than those recorded during WeBS and GOS surveys. The reason for this is unclear although the species does appear to be declining within the Bay area (Appendix 11.1,

⁸ Referring to breeding population of Black-headed Gull



Volume 3). However, the fields survey only provide a 'snap shot' of the birds species present at that time and some variation is likely to exist between these results and the long term data.

- 11.4.5.81 The combination of WeBS, GOS and field survey data shows that Common Gull are a regular winter and passage visitor to Swansea Bay in significant numbers. The peak number of Common Gull recorded in the survey area does not exceed the 1% threshold value (7,000) of the UK wintering population and neither do counts from desk study data (WeBS and GOS peak counts). As such the given the relatively low numbers, this is considered to represent an ecological feature of local ecological value only.

Lesser Black-backed Gull

- 11.4.5.82 Lesser Black-backed Gull is listed as amber status within the Wales and UK (Eaton et al, 2009). WeBS core count and GOS surveys record regular numbers of resident birds (breeding colonies present with 50km), with smaller numbers of wintering and passage Lesser Black-backed Gull (peak count of 140 individuals from (WeBS) September 2009 and 328 (GOS) August 2008 (Appendix 11.1 & 11.2, Volume 3)).
- 11.4.5.83 During Project field survey work (2011-2013), Lesser Black-backed Gull were recorded within the majority of sectors (apart from EE012, EE013, EE014, EE015, EE020 and EE022) during Low Tide counts, with a peak count of 60 birds noted in sector EE023 on the 21st of September 2012. Low Tide records of Lesser Black-backed Gull show a mostly even distribution of numbers over the survey area, with the exception of the central sectors EE012, EE013, EE014 and EE015 located adjacent to Swansea Docks.
- 11.4.5.84 High Tide counts recorded a peak count of 116 Lesser Black-backed Gull in September 2012 within the western survey area, with a peak count of 80 in the eastern survey area (March 2012). The peak High Tide count for the entire survey area combined was 128 in September 2012.
- 11.4.5.85 The combination of WeBS, GOS and field survey data shows that Lesser Black-backed Gull are resident birds (that breed nearby) with fewer winter and passage visitors recorded in Swansea Bay. The peak number of Lesser Black-backed Gull recorded in the survey area does not exceed the 1% threshold value (1,200) of the UK wintering population. As such the relatively low numbers recorded are considered to represent an ecological feature of local ecological value.

Herring Gull

- 11.4.5.86 Herring Gull are listed as a priority species on both the UKBAP and section 42 of the NERC Act⁹. They are also noted as of red status in the UK and Wales (Eaton et al, 2009). WeBS core count and GOS surveys record regular numbers of resident and wintering Herring Gull with a peak count of 1,066 individuals from (WeBS) October 2008 and 3,764 (GOS) October 2002 (Appendix 11.1 & 11.2, Volume 3).
- 11.4.5.87 During Project field survey work (2011-2013), Herring Gull were recorded within the majority of sectors (apart from EE014) during Low Tide counts, with a peak count of 678 birds noted in sector EE016 in January 2013. Low Tide records of Herring Gull show a mostly even distribution of numbers over the survey area with the exception of the central sectors EE012, EE013 and EE014.

⁹ Referring to the breeding population of Herring Gull.



- 11.4.5.88 High Tide counts recorded a peak count of 598 Herring Gull in January 2012 within the western survey area, with a peak count of 406 in the eastern survey area (October 2012). The peak High Tide count for the entire survey area combined was 791 in November 2012.
- 11.4.5.89 The combination of WeBS, GOS and field survey data shows that Herring Gull are resident and winter visitors in Swansea Bay. The peak number of Herring Gull recorded in the survey area does not exceed the 1% threshold value (7,300) of the UK wintering population and neither do desk study records for the study area (WeBS and/or GOS data). As such, the relatively low numbers recorded are considered to represent an ecological feature of district ecological value.

Greater Black-backed Gull

- 11.4.5.90 Greater Black-backed Gull is listed as red status within Wales (RSPB, 2009) and amber status in the UK (Eaton et al, 2009). WeBS core count and GOS surveys record regular numbers of resident birds (breeding colonies present with 50km) with fewer wintering and passage Greater Black-backed Gull (peak count of 122 from (WeBS) June 2007 and 154 individuals (GOS) November 2009 (Appendix 11.1 & 11.2, Volume 3)).
- 11.4.5.91 During Project field survey work (2011-2013), Greater Black-backed Gull were recorded within the majority of sectors (apart from EE012, EE013, EE014 and EE022) during Low Tide counts, with a peak count of 21 birds noted in sector EE007 (contains a freshwater stream outflow) on the 9th of March 2012. Low Tide records of Greater Black-backed Gull show a mostly even distribution of numbers over the survey area, with the exception of the central sectors EE012, EE013, EE014 and EE015.
- 11.4.5.92 High Tide counts recorded a peak count of 18 Greater Black-backed Gull in October 2012 within the western survey area, with a peak count of 6 in the eastern survey area (October 2012). The peak High Tide count for the entire survey area combined was 24 in October 2012.
- 11.4.5.93 The combination of WeBS, GOS and field survey data shows that Greater Black-backed Gulls are resident (non-breeding) birds in Swansea Bay. The peak number of Greater Black-backed Gull recorded in the survey area does not exceed the 1% threshold value (760) of the UK wintering population and neither do desk study records. As such, the numbers recorded are considered to represent an ecological feature of local ecological value only.

Kittiwake

- 11.4.5.94 Kittiwake is listed as amber status within the UK (Eaton et al, 2009). GOS surveys record regular numbers of summer birds visiting Swansea Bay and breeding on Mumbles Pier with a peak count of 274 individuals from GOS August 2009 (Appendix 11.2, Volume 3). Data for gulls and terns was not presented in WeBS Low Tide count data, since counting was optional and thus the statistics are unreliable.
- 11.4.5.95 The Project field survey effort was conducted in the winter months which falls outside the Kittiwakes breeding season, and as such Kittiwakes were only recorded on the 21/09/2012 and 28/03/2013 (during Low Tide surveys) on the artificial nesting ledges of the Mumbles Lifeboat House (offshore from EE001) with a total of 12 individuals recorded in 2012 and 105 in 2013. No Kittiwake were recorded during high tide survey visits or during the extended summer month surveys in the eastern section.



- 11.4.5.96 It is evident from the field survey records that the Kittiwake is a feature of negligible ecological value, only utilising the western extent of the Bay as a breeding site and preferring a pelagic foraging strategy. Kittiwakes leave the Bay during the winter months and adopt a predominantly pelagic lifestyle.

Snipe

- 11.4.5.97 Snipe are listed as amber status within the UK and Wales (Eaton et al, 2009). WeBS core count data record regular, small numbers of wintering and passage Snipe with a peak count of 29 individuals from February 2009 (Appendix 11.1, Volume 3). WeBS Low Tide count data from 2003/04, 2006-2007 and 2007 recorded no Snipe. GOS data (Appendix 11.2, Volume 3) details few records of Snipe within the survey area with only three separate records within the current study area associated with areas of salt marsh in the east of the survey area (peak count of 29 in February 2009).
- 11.4.5.98 Project field survey work (2011-2013) recorded Snipe on a single occasion during high tide surveys in the eastern survey area, associated with salt marsh and marsh habitats present there, with a peak count of two individuals recorded in February 2012. Given the cryptic nature of this species, it is likely this species has been under recorded in the eastern survey area given the suitable habitat available within the salt marsh and marsh habitats. However, given the limited areas of suitable habitat available within the survey area, this likely under recording is not considered significant.
- 11.4.5.99 The peak number of Snipe recorded in the survey area does not exceed the 1% threshold value of the UK wintering population (10,000) and neither do desk study records. As such the study area is considered to be of negligible ecological value to wintering Snipe.

Grey Heron

- 11.4.5.100 Grey Heron are listed as green status within the UK and Wales and are not currently thought to be of conservation concern (Eaton et al, 2009). WeBS core count data record regular small numbers of Grey Heron with a peak count of 5 individuals in January and November 2007 (Appendix 11.1, Volume 3). WeBS Low Tide count data from 2003/04 recorded a peak count of two in November 2003 (EE022) and no Grey Heron were recorded in WeBS Low Tide counts in 2006-2007 and 2007. Review of GOS data (Appendix 11.2, Volume 3) identified a total of three records of Heron within the study area, associated with Blackpill and the Crymlyn/Baglan area of the eastern survey area, a peak count of 9 individuals was noted in September 2010.
- 11.4.5.101 Project field survey work (2011-2013) recorded a peak count of 3 Grey Heron (EE007) on the 21st October 2011 during Low Tide counts, with Grey Heron only encountered in sector EE007 during Low Tide surveys. High Tide counts recorded no Grey Heron over the course of the survey visits.
- 11.4.5.102 The combination of WeBS, GOS and field survey data shows that Grey Heron are resident (non-breeding) birds in Swansea Bay with small numbers recorded throughout the year. The peak number of Grey Heron recorded in the survey area does not exceed the 1% threshold value (610) of the UK wintering population. As such, given the numbers recorded coupled with their common and widespread status in the UK and Wales, the study area is considered to be negligible ecological value for Grey Heron.



Great Crested Grebe

- 11.4.5.103 Great Crested Grebe are listed as green status within the UK and Wales and are not currently thought to be of conservation concern (Eaton et al, 2009). WeBS core count data record regular numbers of wintering Great Crested Grebe with a peak count of 440 individuals in December 2010 (Appendix 11.1, Volume 3). WeBS Low Tide count data from 2003/04 recorded a peak count of 10 in December 2003 (EE004) whilst no Great Crested Grebe were recorded in WeBS Low Tide counts in 2006-2007 and 2007 (Appendix 11.1, Volume 3). A review of GOS data (Appendix 11.2, Volume 3) for the study area details regular records of Great Crested Grebe with a peak count of 327 Great Crested Grebe in December 2008.
- 11.4.5.104 Project field survey work (2011-2013) recorded a peak count of 200 Great Crested Grebe during Low Tide counts (EE009) in December 2012. High Tide counts recorded a peak count of 12 in the western survey area in January 2012 and 85 in the eastern survey area in December 2012. The peak High Tide count for the entire survey area combined was 85 in December 2012.
- 11.4.5.105 The combination of WeBS, GOS and field survey data shows that Great Crested Grebe regularly winter within Swansea Bay with numbers peaking in January/December. The peak number of Great Crested Grebe recorded in Swansea Bay area during field surveys in 2012 (200) exceeds the 1% threshold value (190) of the UK wintering population, although regular counts were highly variable with few exceeding the threshold value (Hipkin 2013). However, desk study data (both WeBS and GOS) also detail regular records of this species above the threshold value and as such Swansea bay is considered to be of national ecological value to Great Crested Grebe.

Red-throated Diver

- 11.4.5.106 Red-throated Diver are listed as Amber status within the UK and Wales (Eaton et al, 2009), listed in Annex I of the EC Birds Directive and are also listed on Schedule 1 of the Wildlife and Countryside Act 1981. WeBS core count data record irregular, low numbers of wintering Red-throated Diver with a peak count of 7 individuals in January 2010 (Appendix 11.1, Volume 3). WeBS Low Tide count data from 2003/04 recorded no Red-throated Diver (Appendix 11.1, Volume 3). A review of GOS data (Appendix 11.2, Volume 3) for the study area details regular records of Red-throated Diver with a peak count of 36 in January 2011.
- 11.4.5.107 No records of Red-throated Diver were recorded during either high tide or low tide Project field surveys (2011-2013). However, records from desk study data do indicate the occurrence of this species in low numbers within the study area, although numbers recorded do not exceed the 1% threshold value (170) of the UK wintering population. As such, the presence of small numbers of Red-throated Diver within the Bay is considered to represent an ecological feature of local ecological value.

Whimbrel

- 11.4.5.108 Whimbrel are listed as red status in the UK (Eaton et al, 2009) and amber status in Wales (RSPB, 2009), and are also listed on Schedule 1 of the Wildlife and Countryside Act 1981. WeBS core count data record small numbers of passage Whimbrel with a peak record of 16 individuals from April 2009 (Appendix 11.1, Volume 3). WeBS Low Tide count data from 2003/04 recorded no Whimbrel. A review of GOS data (Appendix 11.2, Volume 3) indicates that Whimbrel are regularly recorded in the county. However,



records largely consisted of passage birds, occasionally occurring in large numbers (Peak count of 584 between 15th April and 6th June 2004).

- 11.4.5.109 Project field survey work (2011-2013) recorded a peak count of two Whimbrel during Low Tide counts with a record of a two birds from EE019 in May 2013. High Tide Core Counts recorded 3 Whimbrel during the May 2013 survey.
- 11.4.5.110 The combination of GOS and field survey data shows that Whimbrel are a regular passage visitor in varying numbers to Swansea Bay. The peak number of Whimbrel recorded in the survey area does exceed the 1% threshold value (1) of the UK wintering population, as do some of the counts noted in WeBS and GOS data. However, the majority of these records are from the passage period, with few irregular records from the core winter period (Nov-March). In addition, where 1% of the national population is less than 50 birds, then 50 is normally used as a minimum qualifying threshold for evaluation of national or international importance (BTO, 2013). As such, Swansea Bay is not considered to have significant ecological value as a wintering site for this species. It is considered to be utilised on an occasional basis only and thus to represent a site of district ecological value for this species.

Greylag Goose

- 11.4.5.111 Greylag *Anser anser* are listed as of amber status in the UK (Eaton et al, 2009). There are little or no WeBS/GOS records of wintering Greylag within the study area.
- 11.4.5.112 Project field survey work (2011-2013) recorded no Greylag during Low Tide counts. High Tide counts only recorded Greylag within the eastern survey area, associated with the salt marsh and marsh habitat present here, with a peak count of 3 individuals recorded in May 2013.
- 11.4.5.113 The combination of WeBS, GOS and field survey data shows that Swansea Bay supports very few, irregular numbers of Greylag during the winter period. The peak number of Greylag recorded in the survey area does not exceed the 1% threshold value (1,400) and neither do the counts noted in WeBS or GOS data. Such small, irregular recorded numbers are considered to represent an ecological feature of negligible ecological value.

Other Bird species

- 11.4.5.114 In addition to the species described and discussed above, a number of species were recorded on an occasional or single basis within WeBS data. These included Common Tern *Sterna hirundo*, Little Tern *Sternula albifrons*, Common Scoter, Wigeon, Velvet Scoter *Melanitta fusca*, Curlew Sandpiper *Calidris ferruginea*, Lapwing, Jack Snipe *Lymnocyrtus minimus*, and Canada Goose *Branta canadensis*. Given the lack of records of these species in the WeBS desk study data, and their absence from the field survey data, these species have been excluded from the current assessment. It is considered that the study area does not form a core part of their range and thus is extremely unlikely to support a regular population of any of these species.

Summary

- 11.4.5.115 As can be seen in Figures 11.3-11.15, Volume 2, the western area of site (Mumbles – River Tawe) supports a greater diversity and number of birds, whilst the eastern area (River Tawe – River Neath) supports a smaller number and lower diversity of species. As



such, the western and eastern areas of the Bay have been assessed as having different relative ecological values to the Bay's bird assemblage as a whole. The western areas of the Bay are considered to be of national ecological value, whilst eastern areas are considered to be of regional ecological value.

- 11.4.5.116 A summary of the features and their value is shown in Table 11.10 below. This table also includes an assessment of the ecological value of the bird assemblage supported/recorded within the study area further broken down into those groups of species with similar ecological requirements i.e. Gulls, Wading birds & Waterfowl, Divers & Grebe species. These groups have been formed to allow the impact assessment to identify impacts on an ecological requirement basis. To ensure no feature is undervalued, each of these assemblages is valued at the highest constituent species valuation.

Table 11.10 Summary of designated sites and ecological species/feature valuation

Species/Feature	Valuation
Designated Sites	
Burry Inlet SPA	International
Carmarthen Bay SPA	International
Crymlyn Bog SAC	International
Blackpill SSSI	National
Crymlyn Burrows SSSI	National
Overall Study Area	
Western bird species assemblage	National
Eastern bird species assemblage	Regional
Bird Assemblages	
Gull Species Assemblage	District
Wading & Waterfowl Bird Assemblage	National (based on highest feature valuation)
Divers & Grebe	National (based on highest feature valuation)
Species	
Ringed Plover*	National
Sanderling*	National
Oystercatcher*	Regional
Grey Plover*	District
Knot*	District
Dunlin*	Regional
Bar-tailed Godwit*	District
Mute Swan	Negligible
Shelduck	Borough (Breeding habitat – Crymlyn Burrows) Negligible wintering habitat
Mallard	Negligible
Teal	Negligible
Dark-bellied Brent Goose	Negligible
Cormorant	Negligible
Great Northern Diver	Local
Little Egret	Negligible
Common Sandpiper	District
Black-tailed Godwit	Local
Curlew	District



Redshank	Local
Snipe	Negligible
Turnstone	Local
Mediterranean Gull	District
Black-headed Gull	Local
Common Gull	Local
Lesser Black-backed Gull	Local
Herring Gull	District
Greater Black-backed Gull	Local
Kittiwake	Negligible
Grey Heron	Negligible
Great Crested Grebe	National
Red-throated Diver	Local
Whimbrel	District
Greylag Goose	Negligible

*- Blackpill SSSI citation listed species

11.5 Assessment of impacts during construction, operational and decommissioning phases

11.5.1 Introduction

11.5.1.1 The following section provides an assessment of the overall effect of the Project on the ecological receptors discussed above and presented in Table 11.10. It assesses the potential adverse effects that may arise from construction, operation and decommissioning of the Project, without mitigation. It also identifies any associated beneficial environmental effects which may result during operation. The information presented in this section is in the absence of any mitigation or compensation measures – i.e. a ‘worst case scenario’. However, proposals embedded in the Project relevant for coastal birds, described in Chapter 4: Project Description have been assessed within this section. Further mitigation measures are described in Section 11.6. To assess the effects on the coastal bird species that may arise from construction, operation and decommissioning of the Project, the ecological requirements of the different bird species need to be considered throughout each stage of the development. The ecological needs of the coastal bird receptors can be categorised into four broad behavioral traits:

- i. roosting;
- ii. foraging;
- iii. loafing (general state of immobility that involves a heterogeneous set of behaviours such as sleeping, sitting, standing, resting, preening, and defecating that occur outside the breeding territory); and
- iv. movement.

11.5.1.2 These broad traits have been utilised within the assessment, where appropriate, to characterise the potential impacts of the Project on the coastal bird receptors identified. However, the Project is considered extremely unlikely to have any significant impact on bird movements, given the relatively low profile of the Lagoon seawalls and its high visibility coupled with its location - effectively a continuation of the existing port infrastructure. As such, no impacts associated with bird movements have been considered in the sections below.



11.5.1.3 The remaining traits (roosting, foraging and loafing) have been considered for each ecological species assemblage (i.e. groups of species with similar ecological requirements) namely Gulls, Wading Birds & Waterfowl and Divers & Grebes as detailed in Table 11.10. These groups with similar requirements have been formed to allow the impact assessment to identify impacts on an ecological requirement basis. As stated previously, each of the assemblages has been valued at the highest constituent species valuation for each stage of the Project (i.e. construction and operational). For example, impacts on Gulls have been assessed based on the valuation of District as set out in Table 11.10, with valuations of National used for Wading Birds & Waterfowl and Divers & Grebes. However, where a significant impact on a species within the assemblage has been identified, but significant impacts are considered unlikely for the remaining species within the ecological requirement assemblage, this has been detailed separately.

11.5.2 Construction phase

11.5.2.1 Details of the construction programme can be found in Chapter 4: Project Description. In summary, the main construction of the Project will occur in sequence over approximately 39 months with the main dredging/construction works associated with the Lagoon seawalls being programmed, where possible, for between April and October of each year. The standard dredging season is generally April to October to minimise down time and to take advantage of potentially better weather conditions. Outside this period the offshore dredging marine plant will be stood down until the following season. However, if in year 1 for instance works are not complete on the seawall and cofferdam there may be a requirement to extend the construction period to complete this work such that the works are secure to withstand winter conditions. This works would be essential but restricted in extent. Construction of the Lagoon seawall will commence in the west, moving offshore to the turbine/slucice gate housing area. Within the first season, the existing Port eastern breakwater will be removed and the first section of the eastern arm (to approximately 2.3km offshore) will also be constructed. The following season, the eastern arm will be extended further offshore whilst works at the turbine/slucice gate structure continue. In the final season, the temporary cofferdam will be removed and the Lagoon seawall will be completed. Electricity generation is expected to start in 2018. Given the size of the Project, the potential main activity from construction will be focused on different sections of the Project at different times.

11.5.2.2 In terms of temporary effects, the following are considered likely to occur as a result of the construction stage of the Project and an assessment of impact of these has been undertaken for the receptors presented in Table 11.10:

- i. change in disturbance levels from increased presence of people, vehicles and vessels;
- ii. changes in artificial lighting;
- iii. changes in sound and vibration from sheet piling, dredging, excavation and construction;
- iv. changes in water turbidity from sheet piling and dredging;
- v. excavation of Inlet channels/scour protection; and
- vi. laying of infrastructure and loss of habitat.



Project Area and Swansea Bay

- 11.5.2.3 Due to the proximity of the Project, construction impacts will have a direct effect on WeBS sectors EE015-EE018. There is also the potential for wide ranging indirect impacts in the Bay through disturbance (people, traffic, noise) and changes to the water turbidity and sediment regime. However, given the focused nature of the construction phase of the Project in eastern areas of the Bay, both disturbance and direct habitat loss impacts will be primarily restricted to the eastern survey area, namely low tide sectors EE014-EE018, with direct habitat loss restricted to the Lagoon footprint.
- 11.5.2.4 Both intertidal and subtidal habitats exist within the footprint of the Lagoon. Existing intertidal habitat within the footprint of the Lagoon is dominated by sandflats (186 ha) and a relatively large Sabellaria reef (approximately 63 ha). Sabellaria are noted for their ability to form biogenic reefs; which serve to attract a variety of invertebrates and fish (Gubbay, 2007). Similar reefs have also been found west of the River Tawe, so it can be seen that they are not exclusive to the area within the bounds of the Lagoon. It should be noted that the introduced Lagoon seawall could offer a habitat to future Sabellaria populations, as it will provide a stable substrate on which tube-worm populations could develop (see Chapter 8: Subtidal and Intertidal Benthic Ecology). Other intertidal habitats present include mixed substrate with barnacles and periwinkles. Subtidal habitat enclosed by the Lagoon forms approximately 19% of the total available substrate within the Bay. Subtidal habitat within the Lagoon is fairly homogenous and consists of infralittoral coarse sediment, primarily populated by polychaetes, crustaceans and bivalves (see Chapter 8: Subtidal and Intertidal Benthic Ecology).
- 11.5.2.5 It is likely that the increased disturbance associated with construction of the Lagoon seawalls will temporarily impact those bird species utilising sectors EE014-EE018 and displace some birds from the Lagoon area. The level of this impact will be species dependent and is likely to be greater within the wader assemblage. It has been demonstrated through academic research that increased disturbance can impact wintering waders and wildfowl through a reduced intake rate of feeding and through increased flushing (a bird or flock of birds that has been frightened from cover), resulting in energetic costs and stress (Liley, D. *et al*, 2010). A study undertaken at Cardiff bay (Burton, Rehfish, & Clark, 2002) identified displacement of wading bird species from suitable foraging habitat due to construction activity associated with a tidal barrage development. This study concluded that construction work disturbance significantly reduced the densities of five species - Teal, Oystercatcher, Dunlin, Curlew and Redshank - on adjacent intertidal mudflats. Construction work also reduced the feeding activity of Oystercatcher, Dunlin and Redshank on these mudflats.
- 11.5.2.6 The effects of disturbance activities on waterbird species has been the subject of much academic study, with research often focused on measuring the behavioural responses shown by individuals to different disturbance stimuli. This research has also provided information on the distances at which different species take flight from a disturbance activity (escape distance or flight initiation distance). Such information, particularly in relation to disturbance distances, is considered relevant to the current assessment and has been used to help identify the likely extent of disturbance impact associated with the construction (and operational) stages of the Project.
- 11.5.2.7 Laursen *et al* (2005) details escape distances for a number of western palearctic bird species due to human disturbance activities. These distances for species recorded

during the current study are summarised in Table 11.11. Escape distances within Laursen *et al* (2005) were collected from survey work undertaken in spring and autumn in the Danish Wadden Sea using a standardised disturbance event (walking person) and as such are unlikely to be representative of disturbance distances resulting from construction activities. This study collected no data on Great Crested Grebe and there is limited research on escape distances and disturbance impacts on Great Crested Grebe. However, variation in behavioural reaction to human disturbance has been suggested to be an adaptive response to increasing recreational activity in Great Crested Grebe (Keller 1989). Keller (1989) suggests escape distances due to recreational disturbance of 30-100m during the breeding season. As Great Crested Grebe do not breed within the study area and are only present in large loafing and foraging flocks during the winter period (during their post breeding moult), this data is not of direct relevance but is considered likely to offer an indication of potential disturbance distances.

Table 11.11 Waterbird escape distance (ED) detailed in Laursen *et al* (2005)

Species	Mean ED	Min - Max ED
Brent Goose	319m	130-1000m
Teal	197m	80-450m
Mallard	236m	60-400m
Shelduck	225m	55-700m
Oystercatcher	119m	20-400m
Grey Plover	132m	42-400m
Ringed Plover	42m	18-100m
Curlew	298m	58-650m
Bar Tailed Godwit	156m	40-450m
Redshank	137m	40-450m
Dunlin	70m	15-450m
Common Gull	120m	70-350m
Black-headed Gull	116m	50-450m

11.5.2.8 These values provide a useful indication of species tolerance to disturbance and thus are considered relevant to the consideration of disturbance impacts in the following sections. In light of these values, it is considered highly unlikely that disturbance impacts associated with construction and operation of the scheme will extend beyond 500m from the Lagoon seawall boundaries. It is also worth noting that all regularly recorded foraging species in sectors EE015-EE018 were also recorded foraging within close proximity to the existing eastern breakwater of Swansea docks (within 200m) and as such any displacement impact is considered likely to be temporary in nature (period of construction only).

11.5.2.9 A study and review of wildfowl sensitivity to construction by Cutts *et al* (2009) details disturbance associated with construction activities including piling. It concludes that wildfowl generally become habituated to steady noise from construction between 55dB and 85dB, with behavioural response (heads up and flight) occurring when there is large difference between the ambient noise and the maximum recorded noise associated with a construction activity i.e. piling. Generally, activities over 85dB elicited a behavioural response, although it was observed that any birds displaced by the activity (foraging and loafing) would generally move a small distance (200m) away before resuming their normal behaviour. These observations were made with migratory birds which were not habituated to the construction activities, so displacement distances could well be less.

Designated Sites

Burry Inlet SPA

- 11.5.2.10 The Burry Inlet SPA will not be directly affected by the Project. However, due to its geographical proximity, the potential exists for movement of coastal birds between the Project area and the SPA. Relatively low numbers of SPA species were recorded foraging and roosting within the Project study area, and even lower numbers were recorded within the Project area. Of the SPA species, the numbers of Oystercatcher were considered the most significant. As a result, the potential for likely significant effects on the features of Burry Inlet SPA has been taken forward for further assessment in the Report to Inform Appropriate Assessment (Habitats Regulations Assessment (HRA) Report) submitted as part of the DCO Application (TLSB, 2014) and the main findings are summarised below.
- 11.5.2.11 Peak numbers of Oystercatcher were recorded in the western part of Swansea Bay on 15 November 2011, when 375 individual birds were recorded at low tide and 2,100 at high tide (Table 11.7). This figure accounts for 15.4% of the peak mean population numbers (1991/2-1995/6) associated with the SPA (JNCC, 2013). The peak count for the eastern Bay was made on 23 August 2013, when 881 Oystercatcher were recorded at high tide (Table 11.7) (outside the core overwintering period of November to January). Peak numbers of Oystercatcher within the Project area were also recorded during the late summer (220 on 23 August 2013). WeBs and GOS data include peak counts higher than those recorded during the field surveys (for instance a peak count of 3,850 individuals in September 2009, WeBS data – see Table 11.7).
- 11.5.2.12 Peak numbers of overwintering Dunlin and Curlew (also individually qualifying species of the Burry Inlet SPA) recorded during surveys accounted for 11.9% and 9.6% of the SPA population respectively.
- 11.5.2.13 It is evident that significant numbers of Oystercatcher, Dunlin and Curlew use Swansea Bay. However, in this case, the distance of the Project from the SPA (approximately 13km) means that only a very small proportion of the birds using Swansea Bay are also likely to be using the habitats of the Burry Inlet SPA on a regular basis, and therefore the habitats can be defined as 'functionally linked'. Notwithstanding this, some exchange of the overwintering migratory population must take place between other sites in South Wales and beyond. However, regular movement of birds between Swansea Bay and the Burry Inlet SPA is difficult to confirm without detailed studies, and so it is assumed on a precautionary basis.
- 11.5.2.14 Ringing studies at sites such as Morecombe Bay (Marsh, Roberts & Skelcher, 2012) have shown that Oystercatchers can exhibit a high degree of fidelity to overwintering sites and that high tide roosts are often located in proximity to favoured foraging areas. Studies in Swansea Bay have observed Oystercatchers roosting at Blackpill and following the tide down the shoreline as it receded before dispersing more widely within the bay and along the coast during low tide (Evans & Clark, 1993). In the UK, shellfish including Cockles *Cerastoderma edule*, Mussels *Mytilus edulis* and to a lesser degree Baltic Clam *Macoma balthica* form key prey species for Oystercatcher (Rehfish et al, 1993).
- 11.5.2.15 Destruction of habitat, or disturbance of birds within Swansea Bay, would ultimately reduce carrying capacity and could have indirect implications for the birds supported by the Burry Inlet SPA. However, key roosting and foraging areas (particularly Blackpill and the western part of the Bay) are distant from the Project construction areas (>3km).



Disturbance of any SPA species also associated with the Blackpill overwintering bird assemblage is therefore considered highly unlikely.

- 11.5.2.16 The planned scheduling of Lagoon seawall construction activity will principally be outside the core overwintering period (November to February). However, any extension of construction works into the core over-wintering period would be extremely limited due to adverse weather conditions not being appropriate for offshore construction works. This means that the majority of disturbance impacts on any overwintering species using the eastern habitats of Swansea Bay will be avoided. The effects of temporary disturbance due to intermittent construction activity on birds on the eastern side of the Bay was assessed in the HRA Report as being insignificant due to the small numbers of SPA species recorded in the area and the temporary nature of any potential disturbance.
- 11.5.2.17 Results of the coastal process modelling and the planned timing of construction works to be principally outside the core overwintering period, was used to demonstrate that there would be no significant effect on the achievement of the conservation objective in relation to the distribution or abundance of suitable prey for any SPA species that also use Swansea Bay, throughout construction (see separate HRA Report, TLSB, 2014).
- 11.5.2.18 No significant effect has been identified for any of the bird features associated with Burry Inlet SPA/Ramsar, which may also use the habitats of Swansea Bay. The potential for an effect on the integrity of the SPA/Ramsar is considered insignificant. Thus it is considered that there is an effect of neutral magnitude on this receptor of International importance resulting in **No impact**.

Carmarthen Bay SPA

- 11.5.2.19 The Carmarthen Bay SPA (20km distant from the Project) will not be directly affected by the Project. No Common Scoter were recorded within the study area during the field surveys (2011-2013) and desk study records suggest only low numbers of Common Scoter occasionally use Swansea Bay (less than 1% of the peak mean associated Carmarthen Bay SPA (CCW,2005). The potential for a significant impact on the integrity of the SPA is considered extremely unlikely and thus it is considered that there is an effect of neutral magnitude on this receptor of International value, resulting in **No impact**. Carmarthen Bay SPA is not considered further for the operational or decommissioning phases of the Project.

Blackpill SSSI

- 11.5.2.20 The physical distance between the Blackpill SSSI and the Project (3.3km) is such that no direct impacts will occur during the construction phase. However, the Project does have the potential for indirect impacts on the bird species that use Blackpill SSSI, through direct loss of habitat (both roosting and foraging) as well as temporary displacement due to disturbance within the footprint of the Project. Specifically this loss of habitat and displacement of birds through disturbance (restricted to low tide sectors EE014-EE018), will result in a net loss of available habitat for the Bay and SSSI bird assemblages. Given that roosting and foraging sites within the Project area form part of the intertidal habitat resource of the wider Bay, this loss could adversely impact SSSI species through increased competition for resources. However, this loss (quantified as 42.75ha loss of intertidal habitat under the Lagoon seawalls (20.25ha) and temporary rock storage compound (22.25ha)) represents only 1.76% of the available intertidal



habitat of similar composition within Swansea Bay coastal water body (2,424ha). As such, the potential effect on available foraging habitat within Swansea Bay is insignificant. Conversely, the Lagoon seawalls and temporary cofferdam will provide 39.90ha of alternate intertidal habitat although it will differ in composition to those lost underneath the structure.

- 11.5.2.21 The following paragraphs describes changes in habitats as a result of construction of the Project and its effect on coastal processes. The Project will be constructed over a period of approximately 39 months and the effects will change as the Project progresses over this time. This assessment is based on the completed seawalls, but the turbines and sluice gates are not operational. Operation of the turbines and sluice gates is considered in Section 11.5.3.
- 11.5.2.22 The coastal processes assessment (Chapter 6: Coastal Processes, Sediment Transport and Contamination) identifies that there will be a general slight reduction in mean flow speeds over the western part of the bay as a result of the constriction of the bay between Mumbles headland and the outer extent of the lagoon wall. Reflection of SW waves off of the outer lagoon wall result in a small predicted increase in significant wave height to the southern part of the SSSI (behind Mumbles), along with an associated small reduction in wave period.
- 11.5.2.23 The assessment of potential changes to mud transport shows no predicted increased deposition of mud material within the Blackpill SSSI, with any changes predicted to occur in the subtidal part of the bay. This potential small increase in sedimentation is not predicted to affect the intertidal feeding areas favoured and utilised by the Sanderling and Ringed Plover populations.
- 11.5.2.24 The potential intermittent transport of sand material from the eastern part of the bay to the western part of the bay (including the Blackpill SSSI) will be blocked by the lagoon, leaving direct transport from offshore during SW and SE storms as the primary source of sand to the western part of the bay. Analysis of the Swansea and Carmarthen Bay Coastal Engineering Group annual beach profiles for this region (see Chapter 6: Coastal Processes) shows an initial reduction in beach and intertidal levels between 1998 and 2005, but a more stable elevation between 2005 and 2013. A slight general seaward movement of the Highest Astronomical Tide and Mean High Water Springs indicates a general trend for slight accretion since 2005. As a result of this, and the reduction in intermittent sand transport, it is considered that this slight accretion is likely to reduce following construction of the lagoon, leading to a more stable profile in the future. This will not affect the foraging areas of the intertidal areas, nor the ability of the birds to roost.
- 11.5.2.25 The magnitude of this habitat modification to the SSSI is assessed as Minor negative magnitude equating to a **Minor adverse** impact on this receptor of National importance.

Crymlyn Burrows SSSI

- 11.5.2.26 Crymlyn Burrows SSSI was notified for its sand dune and saltmarsh habitat in addition to supporting a range of uncommon plants, strandline invertebrates and providing habitat used by part of the wading bird assemblage of Swansea Bay.



- 11.5.2.27 The coastal fringe of the SSSI will not be directly affected by the Project (although the cable and grid connection may affect habitat near its boundary with Fabian Way). Field surveys identified a roost (Roost 2 - Figure 11.21, Volume 2) fronting Crymlyn Burrows and used by wading birds including Oystercatcher, Sanderling, Ringed Plover and Grey Plover at a location immediately to the east of the proposed eastern landfall of the Lagoon seawall. The roost will not be directly affected by construction of the Project but continued use by birds may be discouraged due to the proximity of the new structure (within 500m). Disturbance during construction is, to a great extent, mitigated by seasonal timing of offshore works which predominantly avoids the overwintering period.
- 11.5.2.28 It is considered likely that birds using the roost will move along the beach to a location slightly further away from the new structure, or will make use of other roost sites including one at the eastern end of Crymlyn Burrows, near the mouth of the River Neath (Roost 3, Table 11.8).
- 11.5.2.29 In terms of birds, the Project is not considered likely to impact the integrity of the SSSI and an effect of neutral magnitude to this receptor of National significance is envisaged, resulting in **No impact**. However, further consideration of the coastal bird assemblage (particularly in relation to individual species of birds) is given below.

Coastal Bird Species (Ecological Receptors)

Gull Assemblage

Roosting, Loafing and Foraging

- 11.5.2.30 The Project will affect areas of intertidal habitat within sectors EE014-EE018 through direct habitat loss beneath the Lagoon seawalls, disturbance of the eastern breakwater (on which all gull species have been recorded foraging, loafing and roosting during field surveys between 2011-2013), and increased disturbance associated with construction activities and personnel. These activities will exclude birds from the Lagoon seawall footprint and potentially from habitat within 500m of active construction zones.
- 11.5.2.31 Roosting, loafing and foraging behaviour by some gull species (Herring Gull, Black-headed Gull, Greater Black-backed Gull and Common Gull) was regularly recorded in eastern areas, with a peak count of 406 Herring Gull and 1,100 Common Gull recorded on single occasions during low tide field surveys (Table 11.4). However, in general, a more diverse and numerous gull assemblage was recorded within western areas of the Bay (Appendix 11.1 and 11.2, Volume 3). No gull species count recorded in the study area exceeded 1% of the UK wintering population.
- 11.5.2.32 As construction work in the various areas of the Project is completed, and, as the Project nears completion as a whole, the disturbance levels will reduce both inside the Lagoon and in proximity to the Lagoon seawalls. A reduction in construction activity will increase the availability of existing and new habitat (i.e. Lagoon seawalls) for use by gull species. Given the relatively low numbers of gulls recorded, known tolerance of this group to human disturbance and availability of alternative roosting and foraging habitat (in Swansea Bay and the central Lagoon), a temporary minor negative magnitude of effect is considered likely. An effect of minor negative magnitude on a receptor of District value equates to an **Insignificant** impact during the construction phase.



Wading & Waterfowl Bird Assemblage

Loafing & Roosting

- 11.5.2.33 The wading bird interest is largely concentrated in the western part of Swansea Bay (Figures 11.3-11.15, Volume 2 and Appendix 11.3, Volume 3) with the largest and most diverse high tide roost located at Blackpill (Roost 1). This roost is distant from proposed construction activities (<3km) and is therefore unlikely to be directly or indirectly affected by the Project.
- 11.5.2.34 As discussed above, the displacement of wading bird species from a site (Roost 2) at the western end of Crymlyn Burrows SSSI (Figure 11.21 Volume 2) may occur through proximity of the new structure (within 500m). An increased level of disturbance is to some extent mitigated by the scheduling of offshore construction activity predominantly outside the core overwintering period.
- 11.5.2.35 Roost 2 supports a range of wading bird species (Ringed Plover, Sanderling, Oystercatcher and Dunlin) and, in particular, notable numbers of Ringed Plover and Sanderling were recorded during surveys (occasional observations of Sanderling and a single observation of Ringed Plover in excess of the 1% UK winter population threshold values of 160 and 340 individuals, respectively).
- 11.5.2.36 Ringed Plover and Sanderling are both relatively tolerant of disturbance. The mean escape distances described by Laursen *et al* (2005), at which a stimuli resulted in a flushing or flight response in wading birds, states a distance of 42m for Ringed Plover, 70m for Dunlin and 119m for Oystercatcher. A Californian study into the effects of human activity on foraging Sanderling found an average minimum approach distance of 14m (Thomas, Kvitek & Bretz, 2003).
- 11.5.2.37 Scheduling of Lagoon seawall construction outside the core overwintering bird period will mitigate much of the potential for disturbance. However, the potential for intermittent construction activity to disturb wading birds at roost will remain. Any such disturbance will be temporary in character.
- 11.5.2.38 The alignment of the eastern landfall of the Lagoon close to Roost 2 also raises the possibility that displacement of roosting birds could occur. Displacement of birds will either be minor, such as roost relocation slightly further along the beach to the east, or major displacement will occur, and birds may utilise an alternative roost site such as Roost 3 near the mouth of the River Neath. The significance of such displacement is considered to be greatest for Sanderling and Ringed Plover due to the numbers of individual birds using the roost whilst the significance for Oystercatcher (peak count of 100 individuals) and Dunlin (peak count of 70 individuals) is considered lower.
- 11.5.2.39 The potential impact of construction on roosting waders largely relates to potential impacts to Roost 2 at the western end of Crymlyn Burrows. The Project will not directly impact Roost 2 but may lead to disturbance and displacement of birds. The magnitude of effect on the receptor of National value (due to the presence of Sanderling and Ringed Plover) is considered to be minor negative, equating to a **Minor adverse** impact.

Foraging

- 11.5.2.40 The majority of foraging bird species and the greatest numbers of individual birds were recorded in the west of the bay (Figures 11.3-11.15, Volume 2 and Appendix 11.1 and 2,



Volume 3). As identified previously, the Project will result in the loss of some intertidal foraging habitat in sectors EE015-EE017 (and small areas of EE018) both beneath the Lagoon seawalls (20.5ha loss) and through temporary construction disturbance causing displacement (within 500m of the Lagoon seawalls). These areas are utilised by a small number of foraging Oystercatcher, Turnstone, Curlew, Redshank, Dunlin, Sanderling and Ringed Plover, with a single record of Grey Plover.

- 11.5.2.41 Seasonal timing of offshore construction where possible (April – October) will ensure areas of intertidal habitat remain available for use by waders. Additionally, foraging habitat will remain within the Lagoon as well as in proximity to it. Potential disturbance of foraging birds within 500m of construction works may lead to temporary displacement but as works progress onto the next active construction zone, displacement will shift and foraging habitat will be available for exploitation.
- 11.5.2.42 It is also worth noting that it is anticipated that the construction activity associated with the intertidal Lagoon seawalls will mainly be undertaken either side of high water to allow sufficient depth for dredger access and Geotube® laying. Rock armour placement is anticipated to be mainly from the sea as well, although some land based works may be undertaken. During boat working times, the intertidal feeding areas will be mostly or completely covered, meaning that the potential effect on foraging wading bird species is reduced.
- 11.5.2.43 Seasonal timing that avoids the core overwintering period and Lagoon seawall works that require water depth will, to a great extent, reduce potential disturbance impacts on foraging birds. Only small numbers of Grey Plover, Turnstone, Curlew, Redshank, Oystercatcher and Dunlin were recorded during the field surveys, and thus it is considered that sectors EE015-EE017 (and western extent of EE018) are unlikely to be of principal importance to these species.
- 11.5.2.44 Given the seasonal timing, limited loss of potential foraging habitat and temporary nature of displacement, a minor negative magnitude of effect on Grey Plover, Turnstone, Curlew and Redshank (receptors of local/district value) is considered an **insignificant** impact, whilst a minor negative magnitude of effect on Sanderling, Oystercatcher and Dunlin (receptors of national/regional value) equates to a **minor adverse** impact.

Divers & Grebe

Foraging/loafing

- 11.5.2.45 Terrestrial roost sites, with the exception of Cormorants, are not a requirement of most Divers & Grebes, which tend to raft on areas of open water. In general, few records of Great Northern and Red-throated divers exist for the study area (existing data or field observations), and so it is considered that the Project will have a negligible effect on these species. However, regular records of Great Crested Grebe were noted from both eastern and western study areas, with occasional flocks exceeding 90-100 birds noted and a single record of 200 off Blackpill. Significant flocks were also noted from GOS desk study records equating to >1% of the UK Wintering Population (peak counts of 440 individuals in December 2010 and 425 in December 2009). Correspondence with GOS member Mark Hipkin highlighted that the waters off Aberavon beach and Crymlyn Burrows are key for the local Great Crested Grebe population (M.Hipkin, *pers.comm.* 7th December 2012). Recent observations have again identified large numbers of grebe using Swansea Bay, with a count on the 2nd December 2013 noting a total of 486 Great



Crested Grebe comprising sightings of 55 individuals from Blackpill, 403 from Crymlyn Burrows and 28 from Aberavon Beach (Hipkin, 2013).

- 11.5.2.46 The diet of the Great Crested Grebe consists predominantly of large fish as well as insects, crustaceans (e.g. crayfish, shrimps) and molluscs, and occasionally adult and larval amphibians (del Hoyo et al. 1992). As outlined in Chapter 9: Fish, including Recreational and Commercial Fisheries, the pelagic fish community within the Swansea Bay is characterised by an abundance of Herring (*Clupea harengus*) and Sprat (*Sprattus sprattus*), whilst Sandeel *Ammodytes* spp. are amongst the most common benthopelagic fish. The artificial reef created by the construction of the Lagoon seawall is expected to provide further habitats suitable for increased ecological biodiversity, including fish populations. Leonhard et al. (2011) have shown that the introduction of hard substrates to homogenous sand banks associated with renewable energy developments can result in a net gain for marine fish biodiversity. Artificial reef structures support varied macrobenthic communities which in turn make the 'reef' more attractive to fish (Boaventura et al., 2006), increasing both density and biomass of local fish populations (Santos & Monteiro, 1997). As such, the seawalls can be expected to provide an additional source of prey species for Divers and Grebe. This is discussed further in the operational assessment below.
- 11.5.2.47 The construction of the Project will result in a loss of intertidal and subtidal habitat in sectors EE015-EE018. The disturbance and minor loss of subtidal habitat during construction is likely to displace Great Crested Grebe from the immediate area, and thereby result in a net loss of available foraging and loafing habitat - at least in the short term. As discussed previously, the offshore dredging and Lagoon seawall construction works will be predominantly undertaken outside the main overwintering period. Since species appear to peak in numbers in December/January, the overall loss is considered likely to have a negligible effect on Great Crested Grebe. This is particularly so given the species' relative tolerance to human disturbance (escape distances of 30-100m of Keller (1989)), the availability of alternative suitable habitat in the wider area, the seasonal timing of main works and the irregular occurrence of the species in the areas affected (EE015-EE018). However, for a short period during the construction phase, there may be a temporary adverse effect on Great Crested Grebe considered to be of minor negative magnitude equating to a **minor adverse** impact on the Divers and Grebe receptor of National importance.

11.5.3 Operational Phase

- 11.5.3.1 During operation, seawater entering or exiting the Lagoon is delayed for approximately 2.5 hours in order to create the operational head. Once sufficient head has been reached, water is allowed to flow into or out of the Lagoon through the turbines to generate electricity. Towards the end of a generation sequence, in order to maximise head on the following tide, the sluice gates will be opened. This will empty or fill the Lagoon so that the water levels inside and outside the Lagoon are equalised as much as possible prior to low or high tide level. Doing this ensures that the Lagoon water level is at a minimum (maximise foreshore/intertidal exposure) or maximum height before the sea starts to rise or fall; thereby maximising electricity generation. This generation sequence will happen on both the flood and ebb tide, 4 times a day in total.
- 11.5.3.2 An assessment of the potential pre-mitigation effects of the Lagoon during the operation stage has been undertaken in this section. For the operational assessment the following potential effects have been identified:



- i. small loss of intertidal habitat within the lagoon caused by retention of seawater based on assumption of fixed speed turbine installation (62ha);
- ii. delay in ebb/flood timings within the Lagoon compared to outside the Lagoon;
- iii. change in disturbance levels from increased presence of people and vehicles;
- iv. changes in sedimentation in the Lagoon intertidal zone;
- v. modification of coastal processes in adjacent habitats – potential sediment changes both subtidal and intertidal affecting feeding areas; and potential effects of water level changes on intertidal areas;
- vi. changes in prey species within the Lagoon footprint; and
- vii. changes in artificial lighting.

- 11.5.3.3 Operation of the Project will affect areas of the eastern study area (WeBS sectors EE015-EE017) through changes in the tidal regime: namely offsetting of the intertidal window required to generate head for electricity production. In addition with fixed speed turbines there will be a worst case loss of 62ha of intertidal area (resulting in a 62ha gain in subtidal area) within the Lagoon, as a result of the rate at which water is able to be sluiced from the Lagoon at the end of the generation cycle. It should be noted that if variable speed turbines were used, this impact could be eliminated through pumping at the end of the generation cycle thereby equalising the waters inside and outside the Lagoon. For the purposes of this assessment, fixed speed turbines have been assessed since this represents a worst case. Should variable speed turbines be selected for the Project, it can be assumed that impacts will be less.
- 11.5.3.4 As identified previously, the intertidal habitats that will be lost (Lagoon seawalls and changes as a result of water levels) comprise fine sand sediment, sandy mud, mixed substrate with barnacles and periwinkles, and the BAP habitats *Sabellaria alveolata* reef and hydroid rockpools. Within the context of the Bay as a whole, this change in water levels in the Lagoon equates to a worst case scenario of 2.56% intertidal habitat loss (62ha of 2,424ha total). As noted previously, habitats of similar composition to those in the Lagoon are found elsewhere across the Bay and within Blackpill SSSI.
- 11.5.3.5 A study undertaken of Redshank before and after Cardiff Bay was flooded (as part of the barrage project) concluded that a 44% increase in mortality was identified in adult birds that were displaced from the site, as a result of their lost foraging habitat (Burton et al, 2006). However, there cannot be direct comparison between the Cardiff Bay Barrage and the Lagoon Project because of the extent of the habitat losses, alternative available habitat study species.
- 11.5.3.6 Both erosion and accretion of mud (and some sands) is predicted to occur within the Lagoon (see Coastal Processes Chapter 6 and Figure 6.50, Volume 2). Sandier conditions are considered favourable intertidal habitat for use by foraging Ringed Plover and Sanderling, whilst the increased mud deposition will favour such species as Oystercatcher.
- 11.5.3.7 Predicted changes to mud deposition within the lagoon during the operation phase, shows the upper intertidal region within the lagoon is likely to be less accretionary for muds, when compared to the baseline scenario. The middle intertidal shows no significant change to the baseline case, whilst the lower intertidal regions show a potential for increased mud deposition during the operation phase. Across the subtidal,



regions that are influenced by the increased flow speeds through the turbines are considered likely to scour under the flood generation phase, until an equilibrium condition is reached (likely as a result of the more dense, less erodible, sub-bottom material), at which point further scouring is considered unlikely.

- 11.5.3.8 In addition, as with the wider bay region, it is noted here that the system will reach an equilibrium condition whereby the increased deposition will result in shallower depths, such that the flows over the bed will be increased to the point that further deposition will be less likely. Additionally, calmer periods (which have less potential to mobilise sediment from the bed) and larger storm events (which have the potential to increase erosion), have been shown to result in lower levels of deposition, and over a reduced spatial extent.
- 11.5.3.9 Flow speeds in areas of sedimentation are insufficient to remobilise the sediments completely. As a result of this lack of remobilisation and the level of sedimentation within the Lagoon, it is anticipated that the Lagoon will require long-term maintenance dredging in order to maintain a cost-effective tidal exchange volume (with respect to power generation). Based on the results of the modelling, increases in sedimentation (above baseline levels) are estimated to cover approximately one-third of the Lagoon during operation of the turbines. Although there will be areas within the Lagoon where maintenance dredging is avoided (e.g. safety zone around the outfall), as a worst case it has been assumed that this maintenance dredging takes place uniformly across this area. It is anticipated that maintenance dredging within the Lagoon will not need to start until 10 to 15 years after the completion of construction and then be performed approximately every two years. However, the need to do so will be monitored. Based on this monitoring a dredging strategy will be developed and a licence for disposal will be discussed and agreed with the Marine Licensing Team.
- 11.5.3.10 The maintenance dredging will change the quality of the habitat under the footprint of any dredging through the periodic disturbance of intertidal and/or subtidal habitat. Dredged material will mainly be muds deposited as described above, with some sands. The populations of benthic organisms which inhabit these areas can be adversely effected by frequent dredging, affecting the fish that prey upon them and ultimately the Divers and Grebes that rely on the fish. This potentially has the effect of restricting the available foraging habitat within the lagoon available to these birds.
- 11.5.3.11 In relation to the potential effects of dredging on prey species for Divers and Grebes, sprat which are ubiquitous throughout the Bristol Channel are pelagic spawners, their eggs and larvae drifting inshore to their nursery grounds. Thus sprat do not rely on the substrates within the Bay for recruitment, unlike herring. Herring spawning media will be positioned around the seawalls as part of the Project and will be unaffected by the maintenance dredging. Flatfish (e.g. plaice) are the most likely to be affected by the dredging, on the premise that they will feed on polychaetes, especially the young. The initial ten to fifteen year period prior to maintenance dredging commencing, will allow re-colonisation of the Lagoon, and within certain areas of the Lagoon, sediments will be unaffected by the dredging regime. The baseline fish surveys (Chapter 9: Fish, including Recreational and Commercial Fisheries) indicated higher numbers of flatfish on Swansea and Port Talbot beaches and it is considered that there is alternative suitable habitat within the Bay. Chapters 9 (Fish) and 8 (Intertidal and Subtidal Benthic Ecology) identify that the Lagoon walls are expected to increase ecological and thus, fish biodiversity within the Bay. Jensen (2002) identified that typically, renewable energy structures



increase habitat heterogeneity and production. As such, although maintenance dredging will occur within the Lagoon, the expected increase in fish biodiversity, the presence of alternative habitat for prey fish species, and the areas of habitat unaffected by dredging within the Lagoon, will result in continued foraging opportunities for Divers and Grebe within and around the Lagoon.

- 11.5.3.12 There will be changes in habitat extents as a result of the construction and operation of the Project. In relation to intertidal habitat, there will be a loss of 20.50ha of intertidal areas during the construction phase (under the footprint of the seawalls and turbine house), a 62ha loss through retention of seawater within the lagoon (worst case use of fixed speed turbines, see Chapter 4: Project Description) and 2.88ha loss due to water level modification in the wider Bay. This results in overall worst case loss of 3.52% of the total intertidal habitat within Swansea Bay (85.38ha of 2,424ha). There will however, be a gain in intertidal habitat as a result of the construction of the seawalls and turbine/sluice gate housing of 38.7 ha, although it is recognised that the habitat type is different to that which is lost.
- 11.5.3.13 The coastal modelling results no predicted increased deposition of mud material within the Blackpill SSSI which is utilised by the majority of the coastal bird species (including Sanderling and Ringed Plover), with any changes predicted to occur in the subtidal part of the bay.
- 11.5.3.14 Due to the proposed use of the lagoon once operational, there is likely to be ongoing disturbance and displacement of bird species near lagoon walls and in areas of the lagoon identified for specific activities (i.e. mariculture, openwater swimming and boating). In particular, recreational activities within the lagoon have the potential to repeatedly displace or disturb birds at roost or loafing. To counter these potentially adverse effects, activities will be centred within specific areas (designated for boating, mariculture etc), and a defined quiet zone will be created towards the north-eastern end of the lagoon to specifically accommodate birds (Chapter 4: Project Description).
- 11.5.3.15 Although the recreational activities within the lagoon may lead to intermittent disturbance of birds, some degree of habituation would be expected. In addition, the potential for disturbance of foraging or roosting birds would also be related to time of day and state of the tide. For instance, the likelihood of boating activity disturbing foraging birds during low tides which coincide with early mornings is likely to be low.
- 11.5.3.16 The operational lagoon will provide an extensive length of artificial rocky shoreline, an area of sheltered water, intertidal habitat offering extended foraging potential for wading birds, as well as a habitat creation area designed to support saltmarsh (Chapter 4: Project Description).

Designated sites

Burry Inlet SPA

- 11.5.3.17 No direct impact to Burry Inlet SPA will occur during the operational phase of the Project. Potential indirect effects could occur through increased competition for resources leading to a reduction in carrying capacity of the habitat and a corresponding decrease in health and survival of birds, particularly any impact to the overwintering Oystercatcher population.



- 11.5.3.1 The potential for a significant impact to Burry Inlet is intrinsically linked to the overwintering bird assemblage associated with Blackpill SSSI and wider Swansea Bay. This is discussed above (construction impacts) and potential operational impacts, particularly relating to Blackpill SSSI are detailed below. As identified in Section 11.5.2, the potential for likely significant effects on the features of Burry Inlet SPA has been taken forward for further assessment in the Report to Inform Appropriate Assessment (Habitats Regulations Assessment (HRA) Report) submitted as part of the DCO Application.
- 11.5.3.2 This used the results of the coastal process modelling and the timing of dredging outside the core overwintering period to demonstrate that there would be no significant effect on the achievement of the conservation objective in relation to the distribution or abundance of suitable prey for any SPA species that also use Swansea Bay, throughout operation. . Thus it is considered that there is a neutral magnitude on this receptor of International importance resulting in **No impact**.

Blackpill SSSI

- 11.5.3.3 Blackpill SSSI is distant from the Project (>3km) and will not be directly affected during its operation phase. However, an indirect impact from the operation of the Project, on the western extent of Swansea Bay, is slight changes in water levels. Coastal processes modelling within Chapter 6 (Coastal Processes) predicts that there will be a maximum reduction in the Mean High Water Spring tidal level of approximately 0.01 to 0.02 m within the western side of the bay, specifically adjacent to Swansea and in the lee of the Mumbles (Figure 6.42, Volume 2). More noticeably, however, are predicted changes to Mean Low Water Springs outside of the Lagoon, where increases of up to 0.04m are observed largely across the subtidal region of the western bay (see Figure 6.43, Volume 2) and an increase of approximately 0.01m along the edge of the intertidal. It is estimated that these changes to water levels outside of the Lagoon will equate to a loss of 2.88 ha of intertidal within the western part of the bay, although there will be an equivalent gain in subtidal. This 2.88ha loss equates to 0.12% of the available intertidal habitat within Swansea Bay (2.88ha of 2,424ha). This small change in water level is considered unlikely to impact bird feeding areas within Swansea Bay and Blackpill SSSI (worst case assumption of the 2.88ha being totally within Blackpill SSSI, equates to a loss of intertidal habitat of less than 0.62% (2.88ha of 467.4ha)). However, as shown in Figures 6.42 and 6.43, the predicted changes to High Water and Low Water levels are predominantly constrained to the parts of the bay outside of the Blackpill SSSI.
- 11.5.3.4 The results from the Coastal Processes modelling (Chapter 6) have concluded that a significant indirect effect upon the intertidal areas of Blackpill SSSI, through changes in currents, wave action or sedimentation resulting from the operation of the Project is unlikely. A moderate/minor adverse impact was predicted as a result of the potential reduction in intermittent sand supply at Blackpill on the upper reaches of the beach but this will not affect the foraging or roosting habitats within the SSSI. The predicted changes to High Water and Low Water levels are predominantly constrained to the parts of the bay outside of the Blackpill SSSI, so this worst case resultant loss of habitat is not considered likely to affect the integrity of the SSSI. Thus it is considered that there will not be a significant effect on foraging areas of the wintering bird assemblage and the effect of the operational phase of the Project is considered to be of a neutral magnitude (**No impact**) on this receptor of National value.



Crymlyn Burrows SSSI

- 11.5.3.5 Computational fluid dynamic and coastal process modelling indicate that sand is likely to accrete along the outside the eastern lagoon wall as well as to continue to do so along the western frontage of Crymlyn Burrows. In terms of birds, the deposition of sand at these locations has the potential to create more remote roost sites, which may favour birds such as Sanderling. In addition, the provision of an artificial high tide roost (eg island) within a quiet zone at the north-eastern end of the lagoon to accommodate birds (particularly Ringed Plover, Sanderling, Oystercatcher and Dunlin) associated with Roost 2. Overall, the low potential for displacement and disturbance, the magnitude of the operation phase of the Project on birds is considered to be neutral (**No impact**).

Gull Assemblage

Roosting & Loafing

- 11.5.3.6 Due to the general tolerance of these species to human disturbance coupled with the lower levels of disturbance likely to be associated with the operational phase of the Project, the lagoon infrastructure will almost certainly be utilised by gulls. In particular, areas of the seawall and associated rock armour have the potential to provide suitable low disturbance and predator free high tide roosting habitat replacing former habitat associated with the eastern (docks) breakwater. The sheltered open water enclosed within the lagoon may also be used for loafing.
- 11.5.3.7 Ledges designed to provide nesting features for Kittiwake are proposed on the leeward side of the turbine and sluice gate housing. These enhancement proposals may further benefit the gull assemblage (but will specifically benefit Kittiwake).
- 11.5.3.8 The operation of the Project is considered to have a neutral magnitude of effect on the roosting/loafing gull assemblage equating to **No impact** on species of District value. A **minor beneficial** effect would be expected through the provision of ledges for Kittiwake and potential roosting habitat on the lagoon seawalls.

Foraging

- 11.5.3.9 Gulls are opportunistic feeders able to exploit a range of habitats. The displaced tidal cycle within the lagoon (providing extended low water feeding habitat) and the availability of artificial lighting may increase foraging opportunities. The presence of visitors may also provide further foraging opportunities for gulls through direct or indirect feeding (food littering) by members of the public. In addition, the increased ecological biodiversity resulting from the creation of the artificial reef (lagoon seawalls) may provide further foraging opportunities.
- 11.5.3.10 The operational phase of the Project is not considered likely to affect the gull assemblage significantly and so a neutral magnitude of effect is envisaged equating to **no impact** on this receptor of District value. A **minor beneficial** effect would be expected through the provision of low level artificial lighting facilitating night time foraging and increased ecological biodiversity as a result of the creation of the artificial reef (lagoon seawalls).



Wading Bird & Waterfowl Assemblage

Roosting & Loafing

- 11.5.3.11 Disturbance to Roost 2 (beachfront at western end of Crymlyn Burrows) from operational activities is expected to be lower than during the construction phase. Additionally, alternative roost sites are available nearby (Roost 3 near the mouth of the River Neath) and at Blackpill SSSI.
- 11.5.3.12 Computational fluid dynamic and coastal process modelling indicate that sand is likely to accrete along the outside the eastern lagoon wall, as well as to continue to do so along the western frontage of Crymlyn Burrows. In terms of birds, the deposition of sand at these locations has the potential to create more remote roost sites which may favour birds such as Sanderling. In addition, sections of the lagoon wall, rock armour and enclosed beach may become attractive for roosting at high tide which may increase roost availability.
- 11.5.3.13 A high tide roost (eg island) is also being considered for the north-eastern part of the lagoon. The feature would remain exposed at high tide and therefore provide a further alternative high tide roost.
- 11.5.3.14 Visitors to the lagoon wall may disturb roosting birds if they venture onto the beach, although the relatively close escape distances for Sanderling, Ringed Plover, Dunlin and Oystercatcher described by Laursen *et al* (2005) and Thomas, Kvitek & Bretz (2003), suggest some tolerance to disturbance. The provision of visitor amenities at the western end of the lagoon as well as access routes directing visitors to managed locations should further offset the potential for impact by separating people and birds.
- 11.5.3.15 The magnitude of effect of the operational scheme on the wading bird and waterfowl assemblage of National value is therefore considered to be neutral (**No impact**). A **minor beneficial** effect would be expected through the provision of a high tide roost (eg island) within the lagoon.

Foraging

- 11.5.3.16 The loss of 82.5ha (20.5ha beneath lagoon walls and 62ha through seawater retention if fixed speed turbines are used¹⁰) of intertidal foraging areas will occur when the turbines become operational. There will be a gain in intertidal habitat of 38.7ha associated with the seawalls. In addition, it is likely that during operation, the Project will provide some benefit to foraging birds due to the tidal lag which will provide exposed intertidal habitat within the lagoon while intertidal habitat elsewhere in the bay is covered by the incoming tide. On the flood tide, when areas of intertidal habitat become covered outside the Lagoon, the offset tide means that low water habitat inside the lagoon will remain available for exploitation by foraging birds for a further 2.5 hours. The availability of foraging habitat outside the tidal windows will allow some birds to forage for longer periods and in theory this has the potential to enhance survival rates by enabling increased food intake particularly during severe weather conditions. It is possible that low level artificial lighting associated with the Project will illuminate areas of intertidal foraging habitat at night and further increase available foraging time for a

¹⁰ The use of variable speed turbines is being examined (see Chapter 4: Project Description). Intertidal and subtidal effects on water levels within the lagoon would be negligible with variable speed turbines and pumping at the end of the tidal cycle.



range of birds. Sanderling and Dunlin are examples of wading bird species that have been shown to benefit from the artificial illumination of intertidal habitats during the night and winter months (Rehfishch et al. 1993).

- 11.5.3.17 As identified previously, there will be areas of mud, and to a lesser extent sand deposited within the footprint of the Lagoon once the turbines and sluice gates are operational. Sandier habitat is favoured by foraging Sanderling and Ringed Plover. Whilst any increase mud deposition within the Lagoon, will favour such foraging bird species such as Oystercatchers.
- 11.5.3.18 Once operational, the presence of the Lagoon walls could potentially create a barrier effect restricting movement of birds to and from foraging areas within and outside the lagoon. There is limited available literature on this topic. However, Ringed Plover were noted from inland areas of Swansea Port during the terrestrial breeding bird survey (Chapter 12: Terrestrial Ecology), providing evidence that some wading species will navigate over the existing sea defences and port wall. As such it is likely that both Sanderling and Ringed Plover (and the wading bird species assemblage) will continue to use large areas of the Lagoon for foraging at low tide during the operation phase. Regular incidental sightings of Oystercatcher and Curlew feeding on recreational land along either side of Mumbles Road (during field surveys at high tide) indicate that certain coastal bird species regularly traverse existing infrastructure, and would not see the lagoon wall as a barrier, continuing to utilise its internal habitats.
- 11.5.3.19 Disturbance caused by activities associated with the operation of the lagoon (e.g. recreation, O&M etc.) are likely to result in less disturbance to foraging than the construction activities.
- 11.5.3.20 The provision of a saltmarsh habitat creation area would also provide additional feeding opportunities for certain bird species such as Little Egret and Redshank.
- 11.5.3.21 Overall, the operation of the Project is considered unlikely to impact the wading bird and waterfowl assemblage significantly. A neutral magnitude of effect is envisaged, equating to **no impact** on this receptor of National value. A **minor beneficial** effect would be expected through the provision of artificial lighting facilitating night time foraging, saltmarsh habitat and the intertidal lag created by operation of the turbines, although the saltmarsh habitat will only favour some bird species (not including the qualifying species associated with Blackpill SSSI).

Divers & Grebe

Foraging/Loafing

- 11.5.3.22 Once operational, the Project will result in direct loss of subtidal habitat under the footprint of the tidal Lagoon walls and turbine/sluice gate structure (approximately 68.48ha). However this will be offset by the gain in subtidal habitat within the Lagoon (86.15ha) if fixed speed turbines are used. There will also be a 2.88ha gain in subtidal environment over the wider Swansea Bay. Overall this would result in a subtidal habitat gain of 20.55 ha throughout Swansea Bay, and a gain of 17.67ha within the Lagoon. As discussed previously if variable speed turbines were used then the intertidal loss and subtidal gain within the Lagoon footprint would not occur (62ha). This would result in a loss of subtidal habitat from the Lagoon footprint of 44.32ha and 41.45ha within the context of the wider Bay (gain of 2.88 ha as a result of the change in habitat from intertidal to subtidal as a result in changes to water levels in the wider bay).



- 11.5.3.23 Once operational, the Lagoon will be used for recreational activities (sailing, rowing, open water swimming) and mariculture but these will be focused in specific areas (Chapter 4: Project Description). Within these areas, Grebes and Divers may be displaced due to disturbance, but the extent of this disturbance will depend on the exact timings and nature of the activities at any given time. Outside these recreational areas, the lagoon will provide sheltered areas of open water habitat for foraging and loafing.
- 11.5.3.24 A minor negative magnitude is envisaged for potential disturbance, equating to **minor adverse** impact on this receptor of National value.
- 11.5.3.25 As discussed above the lagoon seawalls will create an artificial reef (24.15 ha subtidal gain) which is likely to result in an increased aggregation of fish species amongst these submerged rocks (Richard et al, 2009) (further discussed in Chapter 8: Intertidal and Subtidal Benthic Ecology and Chapter 9: Fish, including Recreational and Commercial Fisheries). The resultant increase in fish species around the lagoon seawall structure is likely to provide a foraging resource for pursuit diving species of this assemblage and thereby result in a beneficial effect. However, there is likely to be a reduction of certain fish species within the lagoon offsetting the artificial reef effect. Herring, which have been identified as spawning within the Lagoon footprint, will be actively deterred from entering the lagoon in order to reduce mortality rates due to turbine shear stress (pressure from water turbulence). This will be achieved through the use of acoustic deterrents and provision of alternative spawning media on the outside the Lagoon wall (Chapter 9: Fish including Recreational and Commercial Fisheries). During their spawning periods, herring constitute a large proportion of the Great Crested Grebe diet, and the absence of Herring from the Lagoon will potentially reduce its attractiveness to Grebes leading to localised displacement. Mitigation is proposed to counter this in the form of lagoon seawall design to encourage Herring to spawn on the Lagoon walls, thus retaining this food resource in the area.
- 11.5.3.26 The proposed dredging programme (required within the lagoon to maintain water depth) has the potential to affect benthic communities, ultimately effecting fish populations and availability of prey species for Divers and Grebes. The programme is not anticipated to start until 10 to 15 years after the completion of construction and then be performed approximately every two years. As identified previously, the dredged material will mainly comprise muds i.e. areas of low benthic diversity, with some sands. There are alternative areas for foraging outside the Lagoon and this, together with areas of undisturbed habitat which will remain within the Lagoon and the increased ecological biodiversity associated with the seawalls, will maintain the food chain for the Divers and Grebe.
- 11.5.3.27 A minor negative magnitude is envisaged on the availability of prey species, equating to **minor adverse** impact on this receptor of National value.
- 11.5.3.28 A potential collision risk exists for birds diving near the operational turbines. Evidence suggests that Grebes and Divers typically dive to depths <10m although greater depths are possible by diving bird species identified in the survey area (McCluskie *et al.* 2012). The centre of the turbines will be positioned at 7.5m below Chart Datum which is within the dive profile of the diving bird species identified.



- 11.5.3.29 Of these, Great Northern and Red Throated Divers adopt a 'peering' technique whilst foraging, searching for their prey from the surface of the water and as such are able to identify potential collision risks (McCluskie et al. 2012).
- 11.5.3.30 In contrast, both Great Crested Grebe and Cormorant are pursuit hunters, chasing their prey beneath the surface of the water and occasionally cooperatively foraging. This behaviour potentially increases their risk of collision with the turbines especially in turbid water. However, Great Crested Grebes, the only diving species to be recorded in significant numbers during field surveys (200 individual birds), generally have a shallow dive profile reducing turbine collision risk (McCluskie *et al.* 2012). Cormorants are less visually acute in comparison to the other species and potentially more susceptible to underwater collision with turbines. However, although capable of greater dive depths the average Cormorant dive is <5m (Ropert-Coudert *et al.* 2005). Additionally, only small numbers were recorded in the survey area (peak count of 10 individual birds recorded during a High Tide count) and as such the potential for collision is low.
- 11.5.3.31 The magnitude of effect on the Divers and Grebe bird assemblage for the potential for collision with turbines is considered to be minor negative, equating to a **minor adverse** impact on this receptor of National value.

11.5.4 Decommissioning

- 11.5.4.1 In terms of decommissioning, two options currently being considered. The options vary in terms of physical intervention. The decommissioning options are:
- i. at the end of the working life of the facility, the turbines and sluice gates could be removed, and the tide allowed to flow through the resultant gaps in the structure; and
 - ii. it is equally likely that at the nominal end of the working life of this facility, the technology relating to power generation by tidal lagoons will have further developed, and the Project will have been progressively updated so that the Project could be kept in use as a generating station, and would not require decommissioning.
- 11.5.4.2 The effects of decommissioning would therefore be different for each of the options. If the Project's operation life is extended through ongoing updates, then the impacts would be the same as those identified for the operational phase, subject to any improvements due to increased understanding and technological advances. It is anticipated that the works to maintain, replace or remove the turbines and sluice gates would be undertaken from the turbine/sluice gate structure using the overhead gantry cranes. As such the potential impacts are considered to be negligible to the coastal bird receptors compared to those identified for the construction phase.
- 11.5.4.3 The removal of the turbines and sluice gates would result in the water exchange within Swansea Bay being largely reinstated. There will still be a change to the flow and sedimentary regimes but to a lesser degree than during the operational phase. It is probable that sedimentation will settle inside the Lagoon if it is not removed by dredging. In the long-term, this would result in seabed levels increasing and extensive intertidal mudflat and saltmarsh are likely to occur. In time, it is likely that decommissioning would result in a change in habitat within the Lagoon to that of



mudflat/saltmarsh providing breeding sites for certain wading birds and winter feeding areas for certain waders and wildfowl.

- 11.5.4.4 Thus actual decommissioning as currently proposed is likely to result in change to the physical environment that will develop during the operation of the Lagoon for energy generation. Whilst this is likely to be a significant change to the environment, in 120 years' time such changes (to the future baseline environment) may be seen as beneficial and not adverse.

11.6 Mitigation and Monitoring

11.6.1 Mitigation

- 11.6.1.1 In identifying the type and extent of mitigation required for the construction and operation phases of the Project, consideration was given to the scale of the development and the impact on the Coastal Bird features and designations. The impact assessment presented in Section 11.5 was on the basis that no mitigation has been implemented. However, iterative design modifications have been undertaken during the scheme design which mitigate some of the impacts identified at early stages of the Project:

Roosting sites

- i. Sections of the seawall to be subject to restricted access (no public access) in order to minimise disturbance at potential roost sites;
- ii. Artificial beaches may provide additional roost site opportunities.

Foraging

- I. The Lagoon wall is expected to form an artificial reef attracting fish and increasing foraging potential for fish eating birds;
- II. Herring spawning media on the outer Lagoon wall will safeguard fish stocks and continue to provide a food source for Grebes within the area;
- III. Artificial lighting may extend intertidal foraging periods, particularly in the winter (although lighting will be not be designed to create light spill because of other sensitive receptors including bats);
- IV. Recreational, O&M and mariculture uses within the lagoon will be defined in order to separate users and ensure an undisturbed area at the north-eastern end of the Lagoon supports open water / intertidal habitat available for use by birds.

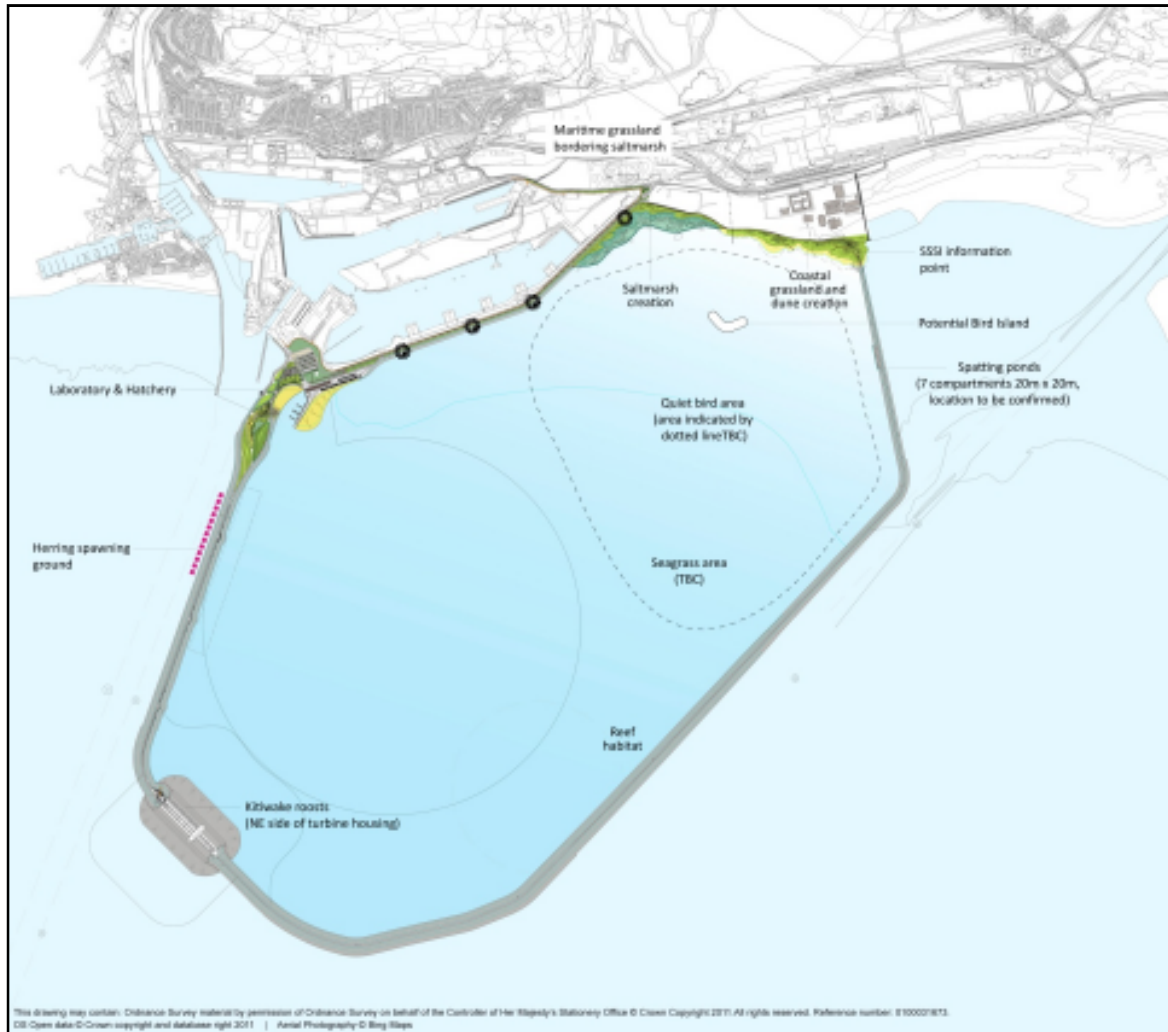


Figure 11.22 Masterplan showing ecological mitigation

11.6.1.2 Mitigation measures specific to the construction and operational phases of the Project are set out below:

Construction:

- i. Timing of Lagoon wall construction between April and October is designed to avoid overwintering birds (October to March). If works are unavoidable outside the summer period, then such works will be kept to a minimum;
- ii. Construction works to be phased around the Lagoon footprint to minimise the size of the potential disturbance zone;
- iii. Removal of existing structures (e.g. eastern breakwater/seawall) outside bird breeding season, where possible, or areas to be checked for nests prior to demolition.
- iv. Environmental liaison officer to be employed during the construction phase charged with overseeing environmental aspects which would include aspects such as minimising access to sensitive areas (e.g. roost site 2, Crymlyn Burrows SSSI).



Operation:

- I. A high tide roost eg island within the quiet zone at the north-eastern end of the lagoon. Factors to be considered include being located >300m from lagoon walls to ensure a clear field of vision for birds whilst roosting. The artificial roost would be designed for use by species associated with Blackpill SSSI species including Sanderling and Ringed Plover. A similar artificial high tide roost island was created for the Cardiff Bay Barrage and used by Dunlin, Redshank and Curlew has been documented as becoming a favoured roosting location on spring tides (Toomer & Clark, 1992 and Rehfish et al. 1993).
- II. Warden to be employed to work with statutory and non-statutory organisations to manage environmental aspects of Project including the potential effects on Crymlyn Burrows SSSI.

Project Enhancement Measures

11.6.1.3 The Project has incorporated enhancement measures plan (Figure 11.22) to encourage biodiversity within habitats associated with the lagoon. The following measures do not mitigate for loss of intertidal and subtidal habitat, but do benefit some of the coastal bird species that were recorded within the survey areas:

- i. Provision of kittiwake ledges for roosting on north east facing wall of turbine house away from down lighting. This species was considered to be of negligible ecological value within the survey area but will benefit from the additional breeding locations within the Bay;
- ii. Provision of saltmarsh habitat does not mitigate for loss of intertidal habitat but does provide additional habitat for some coastal bird species including Little Egret and Redshank (Negligible and Local ecological value respectively);
- iii. Use of concepts such as bioreefs in the eastern intertidal area of lagoon will encourage general levels of biodiversity including prey species of some coastal bird species.

11.6.2 Monitoring

11.6.2.1 During construction of the Project a programme of adaptive monitoring will be conducted to assess the impact of the Project upon the ecological features within the Lagoon footprint and Bay. The monitoring will evaluate the effectiveness of phased working (April to October) and use of the other areas of lagoon by birds during construction.

11.6.2.2 Adaptive monitoring will continue during the operational phase of the lagoon assessing the impact of the Project upon ecological features within the Lagoon and Bay. The continued monitoring will evaluate utilisation of the lagoon by coastal bird species, the effectiveness of the high tide roost (eg island) in addition to the take up of Kittiwake ledges on the turbine housing. The results of these surveys will be reviewed and mitigation measures will be adapted if necessary. The operational surveys will be conducted post-construction in years 1, 3, 5 and 10, in order to evaluate population trends including long lived species such as Oystercatcher.

11.6.2.3 It should be noted that BTO and WeBS survey data do not currently cover the Project area sufficiently, and the low tide data is not conducted with the frequency required for



detailed monitoring, to establish population patterns and trends. Notwithstanding this, routine monitoring is regularly undertaken within the Bay as a whole as part of the long term WeBS data collection as well as by local groups. Data from these surveys will be collated to provide further understanding of the effects of the Project within the Bay as a whole.

- 11.6.2.4 Monitoring proposals for both the construction and the operational phases of the Project are described further in Appendix 23.1 Adaptive Environmental Monitoring Plan.

11.7 Residual Effects

- 11.7.0.1 For ease of reference, Table 11.12 below summarises the potential impacts of the Project on each of the evaluated ecological receptors both with, and in the absence of mitigation. Where impacts remain these are described by the residual impact section.

Table 11.12 Summary of potential impacts together with outline mitigation measures

Ecological Receptor	Potential Impact		Characterisation & Significance	Description of Mitigation Measures	Residual Impact
	Description				
Burry Inlet SPA	<i>Construction</i> Potential displacement and disturbance to SPA bird species within Swansea Bay Potential for increased competition for resources through disturbance and small net loss of habitat utilised by SPA bird species with Swansea Bay.		HRA concluded that there will be no significant effect on species associated with the Burry Inlet SPA that may also use Swansea Bay (TLSB, 2014). Neutral magnitude effect on a receptor of International value equating to No impact .	None required, however the mitigation proposed to reduce the impacts on Blackpill SSSI and Crymlyn Burrows SSSI will also benefit SPA species.	No impact.
	<i>Operation</i> Potential for increased competition for resources through disturbance and small net loss of habitat utilised by SPA bird species with Swansea Bay.		HRA concluded that there will be no significant effect on species associated with the Burry Inlet SPA that may also use Swansea Bay (TLSB, 2014). Neutral magnitude effect on a receptor of International value equating to No impact .	None required.	No impact.
Carmarthen Bay SPA	<i>Construction</i> Habitat associated with Swansea Bay is irregularly used by low numbers of Common Scoter.		Neutral magnitude effect on a receptor of International value equating to No impact .	None required.	No impact.
	<i>Operation</i> None identified.		None identified.	None required.	No impact.

Tidal Lagoon Swansea Bay plc

Ecological Receptor	Potential Impact		Description of Mitigation Measures	Residual impact
	Description	Characterisation & Significance		
Blackpill SSSI	<i>Construction</i> Temporary disturbance resulting in increased competition for resources through net loss of habitat utilised by SSSI bird species within the footprint of the project. No predicted increased deposition of mud material within the Blackpill SSSI, with any changes predicted to occur in the subtidal part of the bay.	Minor negative magnitude effect on a receptor of National value equating to a Minor adverse impact .	An artificial high tide roost (eg island) within a quiet zone at the north-eastern end of the lagoon to accommodate birds. Design of lagoon seawalls to enhance ecological biodiversity including the use of concepts such as bioreefs and bioblocks.	No impact.
	<i>Operation</i> Small long-term net deficit of sand input to the western part of Swansea Bay. Small change in water levels predominantly constrained to outside the SSSI.	Neutral magnitude effect on a receptor (bird assemblage) of National value equating to No impact .	Beach nourishment activities if required following findings of beach profile monitoring undertaken during construction and operational phases of the Project.	No impact.
Crymlyn Burrows SSSI	<i>Construction</i> Construction disturbance and potential displacement of roosting birds including Nationally significant numbers of Sanderling from Roost 2 (avoided by seasonal construction).	Neutral magnitude effect on a receptor of National value equating to No impact .	Scheduling of construction works to avoid the core overwintering period largely avoids impact to the roosting bird assemblage at Crymlyn.	No impact.
	<i>Operation</i> Sand accretion fronting Crymlyn Burrows and to the outside the eastern lagoon wall.	Neutral magnitude effect on a receptor of National value equating to No impact .	An artificial high tide roost (eg island) within a quiet zone at the north-eastern end of the lagoon to accommodate birds (particularly Ringed Plover, Sanderling, Oystercatcher and Dunlin) associated with Roost 2.	No impact.

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Ecological Receptor	Potential Impact		Characterisation & Significance	Description of Mitigation Measures	Residual impact
	Description				
Gull Assemblage	<i>Construction</i> Loss of intertidal habitat beneath lagoon walls (20.5ha) reducing roosting, loafing and foraging habitat.		Temporary minor negative magnitude effect on a receptor of District value equating to an Insignificant impact	Seasonal timing and phasing of lagoon wall construction. Phased completion of seawalls providing potential roost sites and increased ecological biodiversity resulting in increased potential foraging opportunities.	No impact
	Increased disturbance to roost sites and foraging areas through construction activity (zone of up to 500m from construction works).				
	<i>Operation</i> New lagoon walls and sheltered open water provide roosting, loafing and foraging opportunities.		Neutral magnitude effect on a receptor of District value equating to No impact . Minor beneficial effect would be expected in terms of i) roost sites through provision of ledges for Kittiwake and high tide roost sites on lagoon seawalls; and ii) foraging opportunities due to the increased ecological biodiversity associated with the artificial reef.	Provision of Kittiwake ledges on turbine housing. An artificial high tide roost (eg island) within a quiet zone at the north-eastern end of the lagoon to accommodate birds. Restriction to access along quiet parts of the lagoon wall to minimise disturbance of intertidal foraging / roosting habitat adjacent to the Project. Provision of disturbance free areas within internal lagoon areas. Design of lagoon walls to encourage ecological biodiversity including the use of concepts such as bioreefs and bioblocks creating increased foraging opportunities and also potential roost sites.	Minor beneficial impact.
	Visitors including recreational users increase levels of disturbance.		Neutral magnitude effect on a receptor of District value equating to No impact .	Provision of quiet areas within internal lagoon areas and along lagoon wall areas at high tide.	No impact
	Artificial lighting facilitating night time foraging.		Positive effect on a receptor of District value equating to Minor beneficial impact .	None identified.	Minor beneficial impact.



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Ecological Receptor	Potential Impact		Description of Mitigation Measures	Residual impact
	Description	Characterisation & Significance		
Wading & Waterfowl Bird Assemblage	Tidal offset within lagoon resulting in increased foraging opportunities.	Positive effect on a receptor of District value equating to Minor beneficial impact .	None identified.	Minor beneficial impact.
	<i>Construction</i> Displacement of wading bird species from roost site due to construction of eastern seawall within 500m of roost site 2.	Minor negative magnitude effect on a receptor of National value (due to the presence of Sanderling) equating to Minor Adverse impact .	Seasonal timing of construction works to avoid the key wintering period.	No impact
	Disturbance of foraging / roosting by construction activity resulting in displacement from or near active zones.	Minor negative effect on receptors of Local/District and National/ Regional value equating to No impact on former and Minor Adverse on latter.	Seasonal timing and phasing of lagoon wall construction.	No impact
	<i>Operation</i> Visitors including recreational users increase levels of disturbance.	Neutral magnitude effect on a receptor of National value equating to No impact .	An artificial high tide roost (eg island) within a quiet zone at the north-eastern end of the lagoon to accommodate birds (particularly Ringed Plover, Sanderling, Oystercatcher and Dunlin) associated with Roost 2. Restriction to access along parts of the lagoon wall to minimise disturbance of intertidal foraging / roosting habitat adjacent to the Project.	No impact.
	Loss of intertidal habitat (62ha) through operation of fixed speed turbines countered by habitat creation features and tidal offset.	Neutral magnitude effect on a receptor of National value equating to No impact .	Design of lagoon walls to encourage ecological biodiversity including the use of concepts such as bioreefs and bioblocks. A saltmarsh area will be created providing potential foraging habitat for some wading bird species.	No impact.
	Artificial lighting facilitating night time foraging.	Positive effect on a receptor of National value equating to Minor beneficial impact .	None identified.	Minor beneficial impact.

Tidal Lagoon Swansea Bay plc

Ecological Receptor	Potential Impact		Characterisation & Significance	Description of Mitigation Measures	Residual impact
	Description				
Divers & Grebe Bird Assemblage	<i>Construction</i> Habitat loss beneath lagoon walls will reduce available habitat for both foraging and loafing.		Minor negative magnitude effect to a receptor of National value (Great Crested Grebes) equating to a Minor adverse impact.	Seasonal timing and phasing of lagoon wall construction. (Insignificant impact on Great Northern and Red-throated divers).	No impact
	Disturbance through construction activity resulting in reduced availability of habitat through displacement from or near active zones.				
	<i>Operation</i> Artificial reef effect of lagoon wall will encourage fish in proximity to the structure. Loss of Herring spawning grounds under the footprint of the Project mitigated by provision of spawning media on parts of lagoon wall maintaining food resources for Great Crested Grebes. Dredging operations can potentially affect the food chain which the birds rely on.		Minor negative magnitude effect on a receptor of National value equating to Minor adverse impact .	Provision of spawning media for Herring (prey species). Lagoon seawalls increasing ecological biodiversity and thus potential availability of fish and other prey species. Acoustic fish deterrents on turbines to minimise potential impacts on herring prey species entering lagoon through turbines. Areas within the lagoon to be left undisturbed by the maintenance dredging programme where possible to maintain biodiversity and prey species for Divers and Grebes.	No impact.
	Potential collision effects with turbines		Minor negative magnitude effect on a receptor of National value equating to Minor adverse impact .	Acoustic deterrents near turbines deterring fish and thus prey species in the immediate vicinity of the turbines.	No impact.
	Minor disturbance of birds foraging or loafing within the operational lagoon.		Minor negative magnitude effect on a receptor of National value equating to Minor adverse impact .	Zonation within lagoon to create a quiet zone to specifically accommodate birds.	No impact.



11.8 Cumulative and in-combination Effects

11.8.0.1 Table 11.13 below considers projects for which a cumulative and in-combination effect has the potential to impact coastal bird assemblages:

Table 11.13 Preliminary screening of cumulative and in-combination projects

Project and location	Current Status	Screening
Swansea University Bay Campus, adjacent to Crymlyn Burrows	Construction Feb 2013 – Sept 2015	Adjacent to Project, potential cumulative effect – further assessment.
St Modwens land development - east of Swansea Docks, to west of Neath estuary.	Remediation of land, and potential future developments – no details available	No cumulative effect anticipated.
Mumbles pier, foreshore and coastal strip redevelopment	Due to be completed by the end of 2013	Temporary increased construction activity disturbance – non-concurrent with current proposal - no cumulative effect anticipated
Construction of new RNLI Lifeboat Station, Mumbles	Expected completion 2014	Work complete. No cumulative effect anticipated.
SA1 development, Swansea	Development currently taking place, completion date unknown	No cumulative effect anticipated.
Construction of the southern access road to Coed Darcy Urban Village, crossing nearby Crymlyn Bog	Yet to commence	No cumulative effect anticipated.
Swansea Boulevard project – work between Princess way and The Strand, and the River Tawe bridges and The Strand.	Phase to be complete Nov 2013. Phase 2 starts 2014.	No cumulative effect anticipated.
Wind turbine – on Welsh water site on Fabian Way	Application – Unsuccessful 25/10/2013	Not considered.
Five wind turbines – at Mynydd Marchywel between Rhos and Cilfrew Neath	Submitted Jan 2012. Consultation finished Jan 2013. Still in planning.	Distant no cumulative effect anticipated.
Sixteen wind turbines – at Mynydd Y Gwair, Swansea	Approved – unknown construction timetable	Distant no cumulative effect anticipated.
Five wind turbines – on land at Mynydd Brombil Farm, Margam Port Talbot	Submitted June 2012, still in planning. Consultation finishes April 2013	Distant no cumulative effect anticipated.
Atlantic Array Wind Farm – off North Devon Coast approx 35km distant	DCO application submitted but withdrawn in November 2013.	Not considered.
Seventy six turbine Pen y Cymoedd windfarm near Neath.	Planning approved – construction 2014	Distant no cumulative effect anticipated.
Llynfi Afan Renewable Energy Park -15 turbine windfarm – on land 500m southwest of Cynnonville Port Talbot	Planning permission refused. Application was allowed on appeal on 27/08/2013	Distant no cumulative effect anticipated.
Mynydd y Betws- Fifteen turbine windfarm located on land to the east of Ammanford in Carmarthenshire	Granted planning consent 2009. Started operating April 2013.	Distant no cumulative effect anticipated.
Mynydd y Gwrhyd - windfarm in the Upper Amman and Swansea valleys	Approved on appeal 07/05/2009	Distant no cumulative effect anticipated.



Project and location	Current Status	Screening
Swansea Port single wind turbine	Operational	No cumulative effect anticipated.
Newlands Farm, single wind turbine-Margam	Application submitted January 2013	Distant no cumulative effect anticipated.
Kenfig Industrial Estate single wind turbine	Application submitted. Expected decision by Feb 2014.	Distant no cumulative effect anticipated.
Port Talbot Harbour redevelopment	Potential future activities/development. Status unknown.	No information currently available and therefore cumulative assessment cannot be undertaken at this stage.
Upgrading of the existing coastal defence of Aberavon West Promenade, Sandfields, Port Talbot	Completed August 2013	Potentially increased disturbance in bay – displacement of foraging waders (Sanderling) further assessment may be required.
Porthcawl regeneration scheme includes Porthcawl Marina project and 19th century lighthouse restoration.	Approved by BCBC – timescale unknown.	Distant no cumulative effect anticipated.
Tata Steel works- Internal power generation enhancement for Port Talbot steel works- installation of two new boilers and two new turbines housed in new power station building.	Application expected to be submitted 2014.	No cumulative effect anticipated.
Underground coal gasification under Swansea Bay	License potentially to be extended.	No further information available. - cumulative assessment cannot be undertaken at this stage.
Underground coal gasification under Llanelli	Conditional Licence issued	Work distant and not anticipated in the foreseeable future. No cumulative impact anticipated.
Navigational dredging along the Swansea (Tawe), Neath and Port Talbot Channels.	On-going	On-going - no cumulative effect anticipated.
Dredging at Monkstone cruising and sailing club and Swansea Marina	On-going maintenance as required	On-going - no cumulative effect anticipated.
Mumbles Oyster project: Plan to put 10,000 oysters on seabed off the village of Oystermouth	Permission granted September 2013.	Distant no cumulative effect anticipated.
Severn Barrage	Not within foreseeable future	Not considered. See note in Chapter 2.
Swansea Barrage	Operational	On-going – no cumulative effect anticipated.
Cardiff Barrage	Operational	On-going – no cumulative effect anticipated.
Baglan Power station	Operational	On-going – no cumulative effect anticipated.
Prenergy Biomass Power Station, Port Talbot- 350MW wood chip fuelled thermal generating station	Granted condition approval by BERR on the 20 November 2007. While large scale construction has not been begun, a lawful start of development has occurred and as such the planning permission remains extant.	No cumulative effect anticipated.



Project and location	Current Status	Screening
Abernedd Power station was granted conditional approval by DECC on the 23 Feb 2011 for construction of a 870MW gas fired combined cycle gas turbine power plant.	No lawful start has yet been made to this development	No cumulative effect anticipated.
Nobel Banks aggregate extraction site	Ongoing	On-going – no cumulative effect anticipated.
The Swansea Bay (Thomas Shellfish Limited) Mussel Fishery Order	Ongoing	On-going – no cumulative effect anticipated.
Ro Ro Ferry – Swansea Port	Currently not operational	Ferry not anticipated to recommence in the foreseeable future. No cumulative assessment undertaken.
Rhiannon Offshore Windfarm	Pre-application stage.	Project approx 240km distant – no cumulative impact anticipated.
Burbo Bank Offshore Windfarm extension	Existing and extension sought 2013.	Project approx 215km distant – no cumulative impact anticipated.
Tidal Energy Ltd Deltastream Installation Ramsey Sound	Consent secured. Installation 2014.	Project approx 100km distant – no cumulative impact anticipated.
Seagen Skerries Tidal Stream Array	Consent secured. Installation 2014.	Project approx. 200km distant – no cumulative impact anticipated.
Tidal Stream Energy Demonstration Array St David's Head, Pembrokeshire	Construction is planned to commence in 2017	Distant no cumulative effect anticipated.

- 11.8.0.2 Swansea University Bay Campus (SUBC) which is currently under construction (expected Feb 2013 – Sept 2015) has the potential to result in an impact on the coastal bird assemblages utilising intertidal habitat at Crymlyn Burrows through increased disturbance. As discussed above, the Project has the potential to affect Roost 2, primarily during construction. An environmental liaison officer will be employed during the construction phase of the Project to ensure disturbance resulting from construction activities are minimised.
- 11.8.0.3 Disturbance during operation is expected to be reduced compared to construction. However, increased visitor pressure due to student access from the SUBC to the eastern end of Crymlyn burrows, in addition to Lagoon visitors, has the potential to increase disturbance of Roosts 2 (fronting Crymlyn Burrows) and to a lesser extent Roost 3 (near the mouth of the River Neath). Although Roost 3 is distant from the SUBC, and already affected by users of the foreshore, increased recreational disturbance was highlighted by the Countryside Council of Wales (now Natural Resources Wales). The cumulative effects of the Project and the SUBC could potentially result in an adverse impact on the Wader Assemblage through the disturbance/loss of Roost 2 and increased recreational disturbance at Roost 3. However, the presence of an artificial beach at the north-eastern corner of the lagoon could form a focal point for students potentially reducing disturbance of the adjacent SSSI.
- 11.8.0.4 As part of the Project, a warden will be employed during the operational phase to manage the environmental aspects of the Project which will assist in reducing the potential effects of the operation of the Project on coastal birds. The Warden will be



based at the laboratory in the Western Landfall Building and will also liaise with local ecological groups, adjacent landowners and Statutory Nature Conservation Bodies.

- 11.8.0.5 In addition, SUBC is subject to a number of planning conditions and obligations enforceable by NRW and NPTCBC in relation to management, monitoring and mitigation for Crymlyn Burrows SSSI and Whiteford Point (Baglan Burrows). In the event that the Project is given the go-ahead, cooperation and organisation of any additional resources that to be delivered by the Project in relation to these commitments will be co-ordinated by TLSB.

11.9 Conclusion

- 11.9.0.1 The combination of desk study and field surveys has identified that valued ecological features exist within and in the vicinity of the Project. Ecological receptors (i.e. designated sites and coastal bird species) were assigned a value at a geographical scale ranging from 'International' (Burry Inlet SPA) to 'Negligible' (Kittiwake, Little Egret etc.). The potential impact of the Project on these features has been assessed on designated sites and then on groups of species with similar ecological requirements i.e. Gulls, Wading Birds and Waterfowl and Divers & Grebe species.
- 11.9.0.2 The nearest designated sites to the Project are Crymlyn Burrows SSSI immediately to the east and Blackpill SSSI located 3.3km to the west.
- 11.9.0.3 Crymlyn Burrows is primarily notified for its sand dune and saltmarsh habitat, although its citation states that the Neath Estuary is also used by part of the population of small waders overwintering in Swansea Bay. Although Crymlyn Burrows SSSI will not be directly affected by the Project, landfall of the eastern Lagoon seawall will be located close to a high tide roost used by Sanderling and Ringed Plover.
- 11.9.0.4 Blackpill SSSI is specifically notified for its nationally significant numbers of wintering Ringed Plover and Sanderling. A secondary feature of Blackpill SSSI is the presence of wintering Oystercatchers. This species is also a qualifying feature of Burry Inlet SPA and disturbance of individuals from Blackpill has the potential to indirectly impact Burry Inlet SPA by increasing the demand for resources. However, the distance of key roosting and foraging areas from works (particularly Blackpill SSSI), fidelity of Oystercatchers to wintering sites and continued availability of significant areas of local foraging habitat is considered likely to minimise displacement of Oystercatchers. The findings from the HRA concluded that there will be no significant effect on Burry Inlet SPA.
- 11.9.0.5 The Project will result in the loss off intertidal and enclosure of subtidal habitat which is utilised by a variety of coastal bird species, including those associated with designated sites, for foraging, roosting and loafing. In particular, construction works are likely to result in some displacement of coastal bird species using habitat within or adjacent to the project footprint. During operation recreational activities also have the potential to disturb birds using the Lagoon.
- 11.9.0.6 Mitigation measures to offset potential adverse effects during construction to species associated with designated sites include seasonal scheduling of works outside the key overwintering period (October-March) and phasing of construction activities within zones to localise impacts ensuring alternative habitat for roosting, foraging and loafing is available within the lagoon and nearby Bay. An environmental liaison officer will be



employed during the construction phase to ensure disturbance to the high tide roost is minimised.

- 11.9.0.7 During operation, mitigation will include provision of a delineated 'quiet zone' for birds within the Lagoon, use of concepts such as bioreefs and provision of spawning media for fish. The Lagoon seawalls and an artificial high tide roost (eg island) will provide additional roosting opportunities and the creation of the artificial reef will increase ecological biodiversity and thus foraging opportunities to certain species. Operation of the Project may also provide further opportunities for foraging by introducing a tidal lag and the provision of artificial lighting which may provide additional access to intertidal habitats within the Lagoon environment.
- 11.9.0.8 Alternative foraging and roosting habitat is available within the Bay and as such it is considered that the construction and operation of the Project will have no significant adverse effect on intertidal bird feeding areas or roosts. An environmental warden will also be employed during the operation phase to work with statutory and non-statutory organisations to ensure potential effects of the Project are minimised. No significant residual adverse impact on Blackpill SSSI or Crymlyn Burrows SSSI is expected.
- 11.9.0.9 Of the bird assemblages associated with the study area, perhaps the group least likely to be impacted by the Project is the Gull Assemblage. Gulls are generally an adaptable and opportunistic and likely to exploit new features and resources created by the Project. Habitat creation measures including the construction of Kittiwake ledges on the turbine housing may also benefit this receptor.
- 11.9.0.10 For the Wading Bird and Waterfowl Assemblage, one of the key impacts will be potential displacement from an existing high tide roost near the eastern landfall (Roost 2) as well as a net loss of intertidal foraging habitat within the enclosed Lagoon. The provision of an alternative roost, availability of foraging habitat locally and provision of measures to avoid disturbance is considered likely to minimise the potential for any significant impact. Additionally, Sanderling and Ringed Plover appear to be relatively tolerant of disturbance.
- 11.9.0.11 The presence of Divers and Grebes within the bay, particularly Great Crested Grebes, appears to be associated with shelter but probably also coincides with the availability of prey species. The bay will continue to offer shelter following completion of the Project and measures to ensure fish are not adversely affected include design of the Lagoon walls to provide fish spawning opportunities as well as acting as an artificial reef.
- 11.9.0.12 It is considered that the proposed mitigation measures will minimise the effect of habitat loss and disturbance incurred as a result of the Project, in addition to providing resources ensuring continued use of the site by coastal bird species. In the long term, as birds become habituated to the presence of the structure and as new habitats develop a residual impact of the Project on coastal birds is not considered likely.

11.10 References

Boaventura, D. et al., 2006. Macrobenthic colonization of artificial reefs on the southern coast of Portugal (Ancao, Algarve). *Hydrobiologia*, 555, pp.335–343.



- Burton, N.H.K., Rehfish, M.M. & Clark, N.A. 2002b. Impacts of disturbance from construction work on the densities and feeding behaviour of waterbirds using the intertidal mudflats of Cardiff Bay, UK. *Environ. Manage.* 30: 865–871.
- Burton, N.H.K., Rehfish, M.M. , Clark, N.A. 2006 & Stephen, G.D. Impacts of sudden winter habitat loss on the body condition and survival of redshank *Tringa totanus*. *Journal of Applied Ecology*. Volume 43, Issue 3, pages 464-473, June 2006.
- BTO (2013). Species Threshold Levels – 2010/11. British Trust for Ornithology <http://www.bto.org/volunteer-surveys/webs/data/species-threshold-levels>
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 19.IX.1979)
- Countryside Council for Wales (2005) Carmarthen Bay and Estuaries European Marine Site. Draft Interim Advice.
- Davidson, I.C., Crook, A.C. & Barnes, D.K.A. (2004). Quantifying spatial patterns of intertidal biodiversity: Is movement important? *Marine Ecology*: 25 (1), 15-34
- Department of Energy and Climate Change (DECC) (July 2011), National Policy Statement for Renewable Energy Infrastructure (EN-3)
- Department of Energy and Climate Change (July 2011), Overarching National Policy Statement for Energy (EN-1)
- del Hoyo, J.; Elliot, A.; Sargatal, J. 1992. *Handbook of the Birds of the World, vol. 1: Ostrich to Ducks*. Lynx Edicions, Barcelona, Spain. Cited from: <http://www.birdlife.org/datazone/speciesfactsheet.php?id=3639>
- Eaton, M.A., Brown, A.F., Noble, D.G., Musgrove, A.J., Hearn, R., Aebischer, N.J., Gibbons, D.W., Evans, A. and Gregory, R.D. (2009). Birds of Conservation Concern 3: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man. *British Birds* 102.
- EC Directive 2009/147/EC on the conservation of wild birds.
- Evans, J. & Clark, N.A. (1993). BTO Research Report No.107: Disturbance studies on Swansea Bay and the Burry Inlet in relation to bird populations. British Trust for Ornithology.
- Gubbay, S., 2007. *Defining and managing Sabellaria spinulosa reefs: Report of an inter-agency workshop 1-2 May, 2007*, JNCC report No. 405: Peterborough
- Hipkin, M (2013). Swansea Bay and Baglan Bay – Posted 4th December 2013. Glamorgan Rarities Committee. http://grcforum.blogspot.co.uk/2013_12_01_archive.html
- HMSO (1981). Wildlife and Countryside Act 1981 (<http://www.legislation.gov.uk>)
- HMSO (1994). The Conservation (Natural Habitats &c.) Regulations 1994 (<http://www.legislation.gov.uk>)
- HMSO (1999). Town and Country Planning (Environmental Impact Assessment) Regulations 1999 (<http://www.legislation.gov.uk>)



- HMSO (2000). Countryside and Rights of Way Act 2000 (<http://www.legislation.gov.uk>)
- HMSO (2006). Natural Environmental and Rural Communities Act 2006 (<http://www.legislation.gov.uk>)
- HMSO (2010). The Conservation of habitats and Species Regulations 2010 (<http://www.legislation.gov.uk>)
- IEEM (2006). Guidelines for Ecological Impact Assessment in the United Kingdom. Chartered Institute for Ecology and Environmental Management.
- Jackson, A.C., & McIlvenny, J. (2011). Coastal squeeze on rocky shores in northern Scotland and some possible ecological impacts. *J. Exp. Mar. Biol. Ecol.* 2011, doi:10.1016/j.jembe.2011.02.012
- Jensen, A., 2002. Artificial reefs of Europe: perspective and future. *ICES Journal of Marine Science*, 59, pp.S3–S13
- JNCC (2013). Burry Inlet SPA Description. Joint Nature Conservation Committee. <http://jncc.defra.gov.uk/default.aspx?page=2065>
- Keller, V. (1989). Variations in the response of great crested grebes *Podiceps cristatus* to human disturbance - a sign of adaptation?. *Biological Conservation* 49, 31-45.
- Kirby, J. S., Stattersfield, A. J., Butchart, S. H. M., Evans, M. I., Grimmett, R. F. A., Jones, V. R., O'Sullivan, J., Tucker, G. M. and Newton, I. (2008) Key conservation issues for migratory land- and waterbird species on the world's major flyways. *Bird Conserv. Int.* 18: S74–S90.
- Laursen, K., Kahlert, J. & Frikke, J. 2005. Factors affecting escape distance of staging waterbirds. *Wildlife Biology* 11:13-19
- Leonhard, S.B., Stenberg, C. & Støttrup, J., 2011. Effect of the Horns Rev 1 Offshore Wind Farm on Fish Communities Follow-up Seven Years after Construction, National Institute of Aquatic Resources:DTU Aqua report No 246-2011.
- Liley D., Lake, S., Underhill, Day, J., Sharp, J., White, J. Hoskin, R. & Cruickshanks, K. (2010). Welsh Seasonality Habitat Vulnerability Review. Footprint Ecology / CCW
- Lourenc, P.M., Silvaa, A., Santosa, C.D, Mirandaa, A.C., Granadeiroc, J.P. & Palmeirima, J.M. 2008. The energetic importance of night foraging for waders wintering in a temperate estuary *acta oecologica* 34. 1 2 2 – 1 2 9.
- Marsh, P., Roberts, J., & Skelcher, G. (2012). Morecambe Bay Wader Roost Study. A Review for RSPB, NE and the Morecambe Bay Study Group.
- McCluskie, A.E., Langston R.H.W. & Wilkinson N.I. 2012. Birds and Wave & Tidal Stream Energy: An Ecological Review RSPB. Research Report No. 42
- Musgrove, A.J., Austin, G.E., Hearn, R.D, Holt, C.A., Stroud, D.A. & Wotton, S.R. 2011. Overwinter population estimates of British waterbirds. *British Birds*, 104, pp 364-397.



Ramsar (2008). Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance of the Convention on Wetlands (Ramsar, Iran, 1971) - Third edition, as adopted by Resolution VII.11 (COP7, 1999) and amended by Resolutions VII.13 (1999), VIII.11 and VIII.33 (COP8, 2002), IX.1 Annexes A and B (COP9, 2005), and X.20 (COP10, 2008). Convention on Wetlands (www.ramsar.org)

Rehfishch, M.M., Langston, R.H.W., Clark, N.A & Forrest, C. (1993). A Guide to the Provision of Refuges for Roosting Waders. BTO Research Report No. 120.

Richard I, Martin JA, Stuart B, Annette C, Broderick W, James G, David JH, Cheryl M, Emma S, Stephen CV, Matthew JW and Brendan JG (2009) Marine renewable energy: potential benefits to biodiversity? An urgent call for research. The Journal of Applied Ecology. British Ecological Society.

Robert-Coudert, J., Grémillet, D., Kato, A. (2005). Diving angle of great cormorants. National Institute of Polar Research. 18, 54–59, 2005.

RSPB (2009). The Population Status of Birds in Wales. Published by the Royal Society for the Protection of Birds on behalf of the Welsh Ornithological Society, British Trust for Ornithology, Welsh Assembly Government, Countryside Council for Wales, Wildfowl and Wetlands Trust, and RSPB Cymru.

Santos, M.N. & Monteiro, C.C., 1997. The Olhao artificial reef system (south Portugal): fish assemblages and fishin yield. Fisheries Research, 30, pp.33–41.

TLSB (2014) Habitat Regulations Assessment: Report to Inform Appropriate Assessment

The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979)

Thomas, K., Kvitek, R.G., & Bretz, C. (2003). Effects of human activity on the foraging behaviour of sanderlings *Calidris alba*. Biological Conservation: 109 (2003) 67-71.

Toomer, D.K. & Clark, N.A. (1992). The Roosting Behaviour of Waders and Wildfowl in Cardiff Bay. The British Trust for Ornithology. April 1992.

Wales Biodiversity Partnership (2013). Section 42 Priority Species. (<http://www.biodiversitywales.org.uk/en-GB/Latest-News>).