



Environmental Statement Chapter 12. Terrestrial Ecology

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12.0 Terrestrial Ecology

12.1 Introduction

- 12.1.0.1 This Chapter considers the potential impacts of the Project on terrestrial ecology including terrestrial birds (birds associated with the marine and coastal environment are discussed in Chapter 11: Coastal Birds). The Chapter describes the existing baseline conditions, sets out an impact assessment methodology, and ultimately uses this to predict and assess impacts likely to be associated with the Project. Mitigation measures designed to alleviate potential impacts are also described, in addition to proposed enhancement measures.
- 12.1.0.2 The assessment methodology follows Ecological Impact Assessment (EclA) guidance set out by the Institute of Ecology and Environmental Management (IEEM, 2006). The findings of specific field surveys supporting this Chapter are presented in the Terrestrial Ecology Technical Appendix (Volume 3).
- 12.1.0.3 This Chapter used desk study information as well as field data collected during 2012 and 2013.

12.2 Legislation, planning policy and guidance

The Wildlife and Countryside Act 1981 (as amended)

- 12.2.0.1 The Wildlife and Countryside Act 1981 (WCA 1981) is the principal legislation relating to wildlife protection in the United Kingdom (UK). In combination with other legislation, it also enacts European legislation including the Birds Directive (79/409/EEC). The Act provides a legal mechanism enabling the notification of Sites of Special Scientific Interest (SSSIs). The legislation also prohibits the killing, injuring or disturbing of certain protected species unless the action was undertaken as part of a lawful operation, could not have been reasonably avoided, or was carried out under a valid licence.

The Countryside and Rights of Way Act 2000

- 12.2.0.2 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).

Natural Environment and Rural Communities Act 2006

- 12.2.0.3 NERC 2006 places a duty upon public bodies to conserve biodiversity, stating that:
- 12.2.0.4 *Every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity.*

- 12.2.0.5 Section 40(3) expands this further to explain that *“conserving biodiversity includes, in relation to a living organism or type of habitat, restoring or enhancing a population or habitat”*.
- 12.2.0.6 The Welsh Government publishes a list of species and habitats of principal importance in Wales, to satisfy the requirements of section 42 NERC 2006. 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).

The Conservation of Habitats and Species (Amendment) Regulations 2012

- 12.2.0.7 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).
- 12.2.0.8 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).

Planning Policy Wales (Edition 5, November 2012) – Chapter 5: Conserving and Improving Natural Heritage and the Coast

- 12.2.0.9 Planning Policy Wales (PPW) provides the policy framework for local authorities in their preparation of development plans and is supplemented by topic-based Technical Advice Notes (TANs). Within PPW, the Welsh Government's objectives for the conservation and improvement of the natural heritage are the following:
- a) promote the conservation of landscape and biodiversity, in particular the conservation of native wildlife and habitats;
 - b) ensure that action in Wales contributes to meeting international responsibilities and obligations for the natural environment;
 - c) ensure that statutorily designated sites are properly protected and managed; and
 - d) safeguard protected species, and to promote the functions and benefits of soils, and in particular their function as a carbon store.

Planning Policy Wales – Technical Advice Note 5: Nature Conservation and Planning

- 12.2.0.10 Chapter 2 of Technical Advice Note 5 (TAN5) published in September 2009 sets out what are described as the 'Key Principles of Positive Planning for Nature Conservation'. Chapter 2 states that:
- 12.2.0.11 *When considering policies and proposals in local development plans and when deciding planning applications that may affect nature conservation, local planning authorities should:*

- i. *Pay particular attention to the principles of sustainable development, including respect for environmental limits, applying the precautionary principle, using scientific knowledge to aid decision making and taking account of the full range of costs and benefits in a long term perspective;*
- ii. *Contribute to the protection and improvement of the environment, so as to improve the quality of life and protect local and global ecosystems, seeking to avoid irreversible harmful effects on the natural environment;*
- iii. *Promote the conservation and enhancement of statutorily designated areas and undeveloped coast;*
- iv. *Ensure that appropriate weight is attached to designated sites of international, national and local importance;*
- v. *Protect wildlife and natural features in the wider environment, with appropriate weight attached to priority habitats and species in Biodiversity Action Plans;*
- vi. *Ensure that all material considerations are taken into account and decisions are informed by adequate information about the potential effects of development on nature conservation;*
- vii. *Ensure that the range and population of protected species is sustained; and*
- viii. *Adopt a step-wise approach to avoid harm to nature conservation, minimise unavoidable harm by mitigation measures, offset residual harm by compensation measures and look for new opportunities to enhance nature conservation; where there may be significant harmful effects local planning authorities will need to be satisfied that any reasonable alternative sites that would result in less.*

City and County of Swansea Council Unitary Development Plan

- 12.2.0.12 The City and County of Swansea Council (CCSC) UDP, adopted in November 2008, sets out the design principles and proposals to safeguard and enhance the historic and ecological landscape. The following policies were considered relevant to the Project:

Policy EV25: Sites of International Importance

- 12.2.0.13 *“Development, alone or in combination with other plans or projects, which is likely to adversely affect the integrity of a European protected site (SAC, Marine SAC, SPA and Ramsar Sites) and is not directly connected with or necessary to the management of the site, will not be permitted unless:*
- i. *There are imperative reasons of over-riding public interest, including those of a social or economic nature, which are sufficient to override the reasons for designation; and*
 - ii. *There is no alternative solution.*
- 12.2.0.14 *Where such development is permitted, planning conditions and/or obligations will be used to secure all compensatory measures necessary to ensure that the overall coherence of the European Site is protected.”*

Policy EV27: SSSIs and National Nature Reserves

- 12.2.0.15 *“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.*

- 12.2.0.16 *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."*

Policy EV31: Protection of the Undeveloped Coastline

- 12.2.0.17 *"Along the undeveloped coastline development proposals for the provision of visitor and recreation facilities and services to complement existing facilities will be permitted at the coastal locations indicated below, provided that they are of a scale and design that respects sensitive nature conservation, landscape and historic environment interests: Limeslade; Bracelet Bay; Rotherslade; Langland Bay; Caswell Bay; Oxwich; Horton; Port Eynon; Llangennith; Rhossili; Penclawdd; and Loughor Foreshore.*
- 12.2.0.18 *Elsewhere along the undeveloped coast, development will not be permitted and priority is placed on protection and enhancement of the natural heritage and historic environment and improvement of existing facilities."*

CCSC Local Development Plan

- 12.2.0.19 The CCSC UDP is to be replaced within the next few years by the LDP. Public consultation on this document ran until 12 October 2012. Issues consulted on included 'The Vision – The core purpose of the Plan'; 'The Objectives – A set of objectives that elaborate upon the Vision and focus on the deliverability of the Plan' and 'Strategic Options – Various scenarios for levels of future growth and broad locations to consider for accommodating this growth'. Details of the policies are yet to be confirmed but the following draft objectives covering a 'Quality Environment' are likely to be of relevance to the Project:
- a. *promote development that avoids significant adverse environmental impacts and respects constraints; and*
 - b. *preserve or enhance the quality of the natural, cultural and historic environment.*

Neath Port Talbot County Borough Council Unitary Development Plan (UDP)

- 12.2.0.20 The Neath Port Talbot County Borough Council (NPTCBC) UDP adopted in 2008 states the objective of putting sustainability at the heart of all planning decisions and *"[i]n making these decisions a balance will be struck between the need to allow and encourage economic and social developments to improve the quality of life, and any environmental impacts which may result from such developments."*
- 12.2.0.21 The following overarching UDP policies were considered relevant to the Project in addition to NPTCBC Supplementary Planning Guidance relating to Biodiversity:

Policy 1

- 12.2.0.22 *The countryside, seascapes and landscapes of Neath Port Talbot will be enhanced where appropriate and / or protected from proposals that would have unacceptable impacts on their character and appearance.*

Policy 2

- 12.2.0.23 *Wildlife and habitats, including those within urban areas, will be enhanced where appropriate and protected from proposals that would cause unacceptable impacts. Particular emphasis will be placed on species and habitat areas that are designated as being of international or national importance.*

Policy ENV2 – Green Wedges

- 12.2.0.24 *Green Wedges are identified to protect the setting of built-up areas and prevent urban coalescence between settlements. Within these areas inappropriate development will not be permitted except in very exceptional circumstances. Apart from those forms of development which are specifically defined as appropriate, any other development which would prejudice the openness of the Green Wedge will be considered as inappropriate development and will not be permitted.*
- 12.2.0.25 NPTCBC identify a green wedge at Crymlyn Bog / Crymlyn Burrows / Llandarcy; and Margam.

Policy ENV4 – Proposals Affecting International and National Sites for Nature Conservation and Species Protected by European or UK Legislation

- 12.2.0.26 *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.*
- 12.2.0.27 *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.*
- 12.2.0.28 *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.*
- 12.2.0.29 *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

- 12.2.0.30 *Proposals that would unacceptably damage or destroy significant local habitats and species will not be permitted. All new development should:*
- a) 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;*
 - b) Conserve existing habitats and features of nature conservation interest in any landscaping or planting scheme;*

- c) *Take full account of adjacent nature conservation interests, including where the site forms part of a wildlife corridor;*
- d) *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); and*
- e) *Take full account of opportunities to restore and enhance habitats and ecosystems including measures to eradicate invasive plant species.*

NPTCBC Local Development Plan (LDP)

- 12.2.0.31 The NPTCBC UDP is to be replaced within the next few years by a new form of Development Plan known as the Local Development Plan (LDP). Public consultation on the Deposit LDP closed on the 15th October 2013. The Environment Topic Paper of the Deposit LDP sets out how National Policy and guidance would be followed by NPTCBC. The Deposit LDP also sets out specific detailed policies such as *EN6 - Important Biodiversity and Geodiversity Sites* (including sites meeting Site of Interest for Nature Conservation (SINC) criteria or supporting LBAP or Section 42 habitats or species) designed to conserve, enhance or compensate for features of biological or geological interest affected by development.

Biodiversity Action Plans

- 12.2.0.32 In 1992 at the United Nations Conference on Environment and Development in Rio de Janeiro, the UK signed up to the Convention on Biological Diversity (CBD). The CBD has three main objectives:
- i. the conservation of biological diversity;
 - ii. the sustainable use of the components of biological diversity; and
 - iii. the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.
- 12.2.0.33 The UK implemented its requirements under the CBD through the publication of a UK Biodiversity Action Plan (UKBAP). The UKBAP was a strategy which described national biological resources and set out a plan to safeguard these for future generations.
- 12.2.0.34 A species and habitats review by the UK Biodiversity Partnership in 2007 (the "2007 Review") described 1150 priority species and 65 priority habitats with an objective of ensuring the correct focus of conservation efforts. These were adopted across the UK. However, each country within the UK (Northern Ireland, Scotland, Wales and England) developed their own strategies for biodiversity and the environment. In Wales, the UKBAP priority list provided a reference point to select Welsh species and habitats of principal importance (i.e. section 42 of the NERC 2006). Habitat Action Plans (HAPs) and Species Action Plans (SAPs) set out key requirements for each.
- 12.2.0.35 A change in strategic thinking has altered the approach to the CBD objectives. Since July 2012, the 'UK Post-2010 Biodiversity Framework' succeeds the UKBAP and the 2007 Review. Devolution of responsibilities from a UK level to the regions now focuses conservation strategies within Wales firmly on the Welsh Government, with efforts ultimately enacted through the Wales Biodiversity Partnership.

- 12.2.0.36 At a local level, habitats and species relevant to specific geographical areas are targeted through Local Biodiversity Action Plans (LBAPs). In 2005, the Swansea Biodiversity Partnership published a document 'Promoting Swansea's Natural Environment: A Local Biodiversity Strategy and Action Plan'. This document is currently under review to incorporate new species and habitats declared to be of principal importance in Wales.
- 12.2.0.37 'A Guide to the Neath Port Talbot Local Biodiversity Action Plan 2008-2012' provides a guide to focus conservation effort on a number of specific habitats and species found within the county.

12.3 Assessment methodology

12.3.1 General

- 12.3.1.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 set out the requirement for investigation of potential environmental impacts, including ecological impacts, of certain projects. The assessment methodology framework used for the Project follows that described by IEEM in the 2006 'Guidelines for Environmental Impact Assessment in the United Kingdom'.
- 12.3.1.2 The guidelines recommend the collation of existing baseline information to enable the identification of key ecological receptors. This was carried out by a combination of desk study/data search and survey. For each receptor:
- a) the **value** of the receiving receptor (site/feature/species) is determined;
 - b) the **magnitude** of the potential impact on the receptor is identified; and
 - c) an overall **predicted impact significance** is given.
- 12.3.1.3 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.
- 12.3.1.4 This ES proceeds on the basis of the outline construction programme as discussed in Chapter 4, Section 4.5.2, which anticipates construction starting in 2015 and with the main construction lasting for about 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.

12.3.2 Assessment criteria and consultation

Ecological value

- 12.3.2.1 Following the IEEM 2006 guidelines, the focus of the impact assessment is directed at activities with the potential to cause significant ecological effects on "Key Ecological Receptors" rather than attempting a detailed investigation of all potential ecological issues relating to a project.
- 12.3.2.2 The first step in the determination of significant ecological effects is the identification of any ecological receptors considered sufficiently valuable for any significant effects upon

them to be material in the decision making process. Individual plant or animal groups are valued using available information detailing rarity, status and distribution. Habitats are evaluated against existing selection criteria, for instance, those used in the designation of SSSIs (the "Ratcliffe Criteria", 1977). Ecological receptors associated with the Project have been assigned to the following geographic frames of reference:

Table 12.1 Potential value of ecological receptors (adapted from IEEM, 2006)

Level of Value	Examples
International (Very High)	- An internationally designated site or candidate site (SPA, pSPA, SAC, cSAC, pSAC¹, 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. - Internationally significant and viable areas of a habitat type listed in Annex 1 of the Habitats Directive. - Regularly occurring, globally threatened species (i.e. 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 (High)	A nationally designated site (SSSI, NNR, MNR²) 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. UKBAP habitats and species.
Regional/ County (Medium)	- Viable areas of key habitat identified in the Regional/County BAP (Biodiversity Action Plan) or smaller areas of such habitat which are essential to maintain the viability of a larger whole. - Viable areas of key habitat identified as being of Regional value. - Any regularly occurring significant population listed in a Local Red Data Book. - Significant populations of a regionally/county important species.
District Borough (Low)	- Areas of habitat identified in a sub-County (District/Borough) BAP or in the relevant Natural Area profile. - District sites that the designating authority has determined meet the published ecological selection criteria for designation, including Local Nature Reserves selected on District/Borough ecological criteria (District sites, where they exist, will often have been identified in local plans). - Sites/features that are scarce within the District/Borough or which appreciably enrich the District/Borough habitat resource.
Parish/Local (Negligible)	- Areas of habitat considered to appreciably enrich the habitat resource within the context of the Parish, e.g. species-rich hedgerows. - No site designation. - Species present are common and widespread.

N.B. Where species or habitats occur in more than one category above, the highest value is applied.

- 12.3.2.3 Only ecological receptors assigned to the District geographical frame of reference/level of value (as shown in the table above) or higher are considered Key Ecological Receptors in this ES. However, any protected species or habitats considered important under planning policies will be subject to specific mitigation measures.

¹ 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).

² SSSI (Site of Special Scientific Interest), NNR (National Nature Reserve), MNR (Marine Nature Reserve)

Impact magnitude

- 12.3.2.4 In order to assess the effects of the Project, potential impacts are identified and characterised. Knowledge of the activities likely to be associated with the Project in combination with the processes in place to avoid, reduce or mitigate potential impacts is required. The potential for enhancement is also identified.
- 12.3.2.5 If, after all of these measures are implemented, a residual impact is still considered likely, compensatory measures might need to be considered in order to offset the impact. The significance of residual impact is relevant at three separate levels:
- impact on overall biodiversity resources;
 - context in terms of planning policies; and
 - legal requirements.
- 12.3.2.6 Characterisation of the potential impacts considers the following parameters:

Table 12.2 Characterisation of impacts

Parameter	Consideration
Direction of impact	i.e. positive or negative, is the impact likely to be good or bad for the feature or species?
Magnitude	What size or amount of an impact is there (described in words, such as “complete loss”).
Extent and context	Area or numbers affected (including percentage of total resource).
Probability of occurring	Certain (>95%), probable (50-94%), unlikely (5-49%) or extremely unlikely (<5%).
Complexity	Direct, Indirect, Cumulative.
Duration	The duration over which the impact is expected to last prior to recovery or replacement of the feature.
Reversibility	Is it an irreversible (permanent) or reversible (temporary) within an appropriate ecological time - frame such as the lifespan of an affected species.
Timing and frequency	Seasonality or time of day in combination with frequency of an event (e.g. number of dog walkers passing a roost of overwintering waders).

- 12.3.2.7 The magnitude of the potential impact is then assessed for each receptor using the categories set out in Table 12.3 below.

Table 12.3 Assessing the magnitude of each impact on an ecological receptor

Impact description	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 affect on a legally protected species but with no significant reduction in conservation status.

Impact description	Criteria
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.

12.3.3 Significance criteria

- 12.3.3.1 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 12.4. Residual impact is the significance of impact considered after mitigation measures have been taken into account.

Table 12.4 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

12.3.4 Consultation

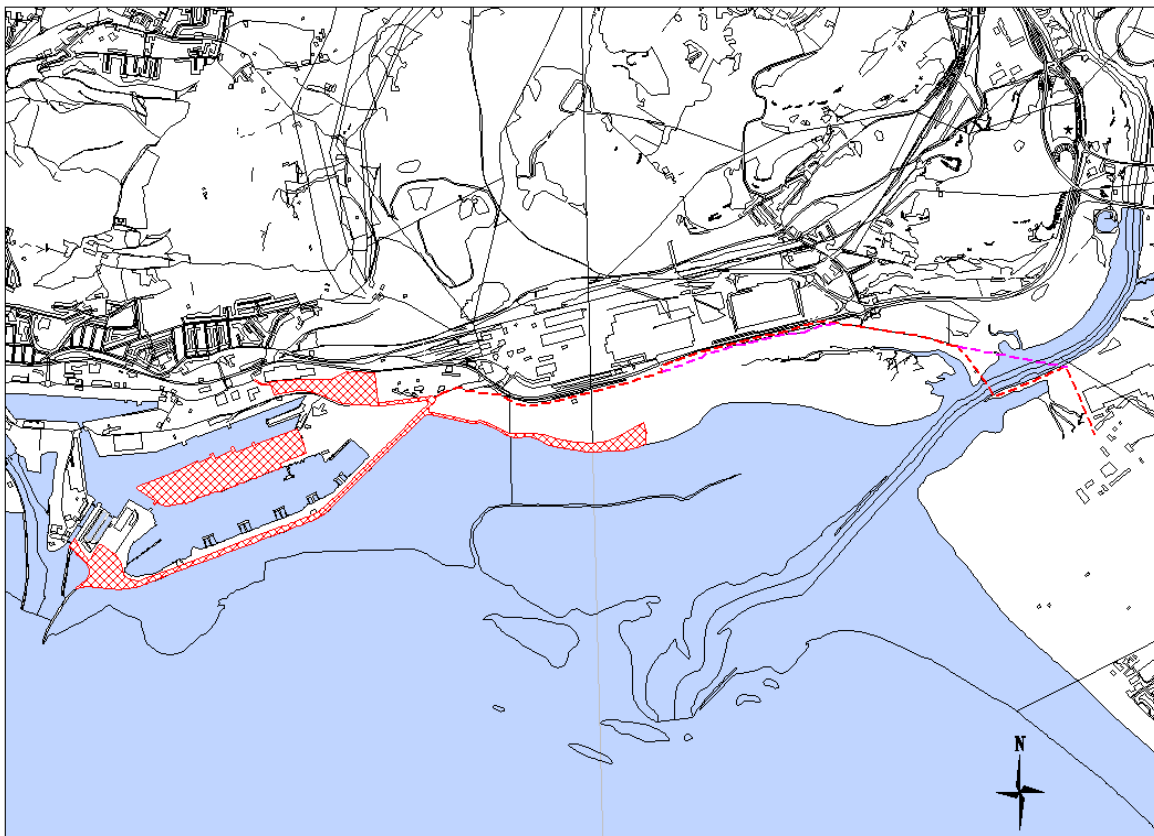
- 12.3.4.1 A process of consultation, including the production of a scoping report detailing comments from consultees (refer to Chapter 2, EIA Process and Assessment of Significance), was undertaken by TLSB in 2012 to facilitate the identification and valuation of potential ecological receptors associated with the Project.

12.3.5 Desk study

- 12.3.5.1 A formal data search for existing ecological information was commissioned from the South East Wales Biodiversity Records Centre (SEWBReC) in November 2012. A search area within 2.5km of the Project was requested for protected or otherwise notable species and a 5km search area for designated sites. Appendix 12.1, Volume 3 identifies the search area (based on the DCO/redline project boundary) and presents the mapped results of the data search. The location of designated sites at greater distances was identified from Geographical Information System (GIS) resources available via the website of the Countryside Council for Wales (now Natural Resources Wales). Records within 2km of the Project, specifically related to birds, were requested from the British Trust for Ornithology (BTO), Gower Ornithological Society, CCSC and NPTCBC.
- 12.3.5.2 The internet was also used to search for publicly available information relating to the search area, including resources held by the Joint Nature Conservation Committee.
- 12.3.5.3 Formal and informal meetings were held with Environment Agency Wales and the Countryside Council for Wales, CCSC, NPTCBC, Swansea University, and Mr B Stewart

(Botanical Society of the British Isles vice-county recorder and former Glamorgan Moth and Butterfly recorder).

- 12.3.5.4 The direct impacts of the Project were investigated within a more targeted study area centred on Swansea Docks and its immediate environs but also including a linear corridor for the electrical grid connection works to Baglan Bay substation. The study area was defined by the footprint of the Onshore Works in addition to the temporary areas required during construction. Further information on the footprint of the Project is set out in Chapter 4: Project Description. It is accepted that the Project has the potential to impact other nearby sites indirectly, which are associated with Swansea Bay, including Crymlyn Burrows SSSI. Existing survey information, particularly the vegetation surveys of Dargie (1989) and Jones (1989), have been reviewed. In addition, field visits aimed at characterising the current coastal habitat resources of Swansea Bay were carried out during spring and summer of 2013. Figure 12.1 presents the study area (cross-hatched in red with electrical grid connection options, red indicating route along southern verge of Fabian Way (preferred) and pink indicating route through SSSI (alternative shown as a dotted lines) associated with direct impacts of the Project:



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Figure 12.1 Terrestrial ecology study area (construction)

12.3.6 Phase 1 habitat survey

- 12.3.6.1 An extended phase 1 habitat survey of the terrestrial elements of the Project was begun during site visits between 27 November 2012 and 9 January 2013. The results of the initial survey were updated following repeated visits to the site through the spring and summer of 2013. JNCC 2010 habitat survey techniques were used, with habitats and other features of ecological interest being mapped and described using target notes. Particular note was taken of protected and/or notable species (as well as the potential for them to occur) during site visits following the Institute of Environmental Assessment

Guidelines (IEA, 1995). The results of the survey are presented in Appendix 12.2, Volume 3.

12.3.7 Botanical survey

12.3.7.1 The assessment of plant communities found within the study area has built upon information gathered during the phase 1 habitat survey. The initial phase 1 survey methodology entailed a walk-over of the study area, whilst recording plant species and noting areas of higher value habitat. Further investigation of plant communities has been undertaken by specifically sampling stands of vegetation (using 2m x 2m quadrats) and where possible, assigning these to defined communities of the National Vegetation Classification (Rodwell, 2000). Vegetation sampling was undertaken between June and August 2013. The location of quadrats and data collected are presented in Appendix 12.3, Volume 3.

12.3.8 Bat survey

12.3.8.1 The open and exposed character of coastal habitats present within the study area did not appear to favour bats although existing records provided some evidence of bat foraging activity. Following good practice guidelines of the Bat Conservation Trust (Hundt, 2012), three surveys of two to three hours duration were undertaken along a defined transect route between spring and autumn. A single surveyor (accompanied for reasons of health and safety) carried out each survey armed with a Pettersson D240x time expansion detector and Edirol R-09HR digital MP3 sound recorder. In addition, an automated bat detector (Anabat SD1 frequency division detector) was deployed for a minimum of four consecutive nights to coincide with each visit.

12.3.8.2 Survey visits were undertaken on 16 May 2013, 5 July 2013 and 3 September 2013, the results of which are provided in the description of Baseline Conditions below. Bat survey results are presented in Appendix 12.4, Volume 3.

12.3.9 Breeding / over-wintering bird survey

12.3.9.1 The breeding bird survey followed a methodology utilising a combination of defined transects routes supplemented by mapping of birds seen or heard using Common Bird Census (CBC) codes of the British Trust for Ornithology (BTO) (Marchant, 1983). Three survey visits during the bird breeding season (March-July/August) were undertaken. The initial visit was delayed until late April due to unseasonably cold weather in March and early April 2013. A second visit was undertaken in late May and a third visit in late June 2013.

12.3.9.2 The visits were undertaken in suitable weather conditions, between the hours of 6am and 8 - 9am, when birds are most active. The surveyor noted the singing or calling of birds, repeated territorial calls, territorial aggression, displaying, adults carrying food or nesting material, juvenile birds and family groups, on a field map using standard BTO codes.

12.3.9.3 The findings of the surveys are described further in the description of Baseline Conditions, as well as Appendix 12.5, Volume 3.

12.3.10 Otter survey

12.3.10.1 Otters are wide-ranging animals and the existence of local recorded sightings from the River Neath, River Tawe and Tennant Canal, was considered to increase the likelihood that Otters visited habitat associated with Swansea Docks and its immediate coastline. A

survey targeting specific areas within the wider study area which were considered to provide potential cover for Otters at locations was undertaken. The survey concentrated on areas considered to be more likely to be subject to disturbance during construction and operation of the Project.

- 12.3.10.2 The survey effort was concentrated along the seawall and at the south-western end of the Queens Dock during a site visit undertaken on 11 April 2013. A search for spraint, footprints, or feeding signs was carried out. In addition, a location at the western end of Queens Dock provided an opportunity to deploy a trail camera within an area considered suitable for Otters and deployment was carried out between 11 and 19 April 2013. Sprainting sites identified during the April visit were checked for continued signs of activity in July 2013 and a second trail camera deployment was carried out between 3 and 13 September 2013. Appendix 12.6, Volume 3 presents a map of findings.

12.3.11 Reptile survey

- 12.3.11.1 Existing records and surveys associated with the Swansea University Bay Campus (SUBC) (Atkins, 2012) identified the presence of reptiles at the northern and eastern end of Swansea docks. Survey effort for reptiles focused on grassland habitat to the south and west of Queens Dock where an absence of records existed.
- 12.3.11.2 A series of artificial refugia (or 'tins') were deployed at potentially suitable reptile basking sites. The tins consisted of 50 x 50cm squares of heavy-duty roofing felt.
- 12.3.11.3 The surveys followed guidelines outlined in the Herpetofauna Workers Manual (Gent & Gibson, 1998). A series of 11 visits was carried out between April and September 2013, at times of day and during weather conditions considered likely to favour detection of basking animals (intermittent sunshine in early morning or late afternoon with ambient temperature between 10 and 17°C). Each visit involved checking beneath refugia, as well as visual searches for any reptiles basking in the open.
- 12.3.11.4 The findings of surveys are described further in Baseline Conditions below, as well as in Appendix 12.7, Volume 3.

12.3.12 Invertebrate survey

- 12.3.12.1 The invertebrate survey focused on investigating habitat associated with the estate of the Port of Swansea ("Docks Estate") largely comprising brown-field land supporting areas of hard-standing as well as grassland habitat and small areas of scrub. This area has not been accessible to members of the public and lacked existing invertebrate records. Two-intensive moth-trapping visits were undertaken in July and early August 2013. Incidental invertebrate records were also taken during botany and reptile survey visits.
- 12.3.12.2 Towards the eastern end of the Project area, invertebrate surveys undertaken for the SUBC (URS, 2010) as well as other surveys targeted at strandline species (Bolchover, 2009) provide records for disturbed ground and sand dune habitat associated with Crymlyn Burrows SSSI. Further investigation of the strandline invertebrate assemblage at Crymlyn Burrows was carried out during a survey undertaken on 30 August 2013. The findings of surveys are described further in Baseline Conditions below, as well as in Appendix 12.8, Volume 3.

12.3.13 Wind flows

- 12.3.13.1 To investigate the potential effects of the lagoon structure on wind flows across Swansea Bay and the resultant impacts on the Crymlyn SSSI, a Computational Fluid Dynamics (CFD) study was carried out. Details of the methodology and findings are presented in Appendix 12.9, Volume 3.
- 12.3.13.2 In summary, a computational model was set up to cover a region 6km in diameter and includes the SUBC building (phase 1 of which is under construction), eastern section of the lagoon wall, the Crymlyn Burrows SSSI site and the surrounding terrain. The model considered the elevation of the ground and large structures on the ground level in 3 dimensions and included representations of the presence of smaller features, such as vegetation and minor undulations, by making use of a surface roughness factor. The baseline model scenario was based on conditions with winds blowing from the south west as this is representative of the prevalent wind direction in the region. A sample wind speed of 8 m/s was applied at a height of 10m and constitutes a velocity (wind speed and direction) profile applied as the upstream boundary condition of the model. Steady-state CFD simulations were then carried out to predict the effects of the lagoon seawall and SUBC buildings on the movement of sands entrained from the beach by comparing the simulation results of the wind conditions across the site for two situations: scenario 1, a baseline with no SUBC buildings or lagoon wall; and scenario 2, a which included the completed SUBC buildings and the lagoon wall. The resulting wind profiles for both cases were then compared at different locations, at ground level, 1m above ground level, and select vertical planes, using contours of velocity magnitude. The difference in the calculated velocities between both cases (scenario 1 and 2) was then used to assess the impact of the structures on the wind flow across the localised area and across the SSSI dune system.
- 12.3.13.3 It is acknowledged that the model was limited in scope in that it only examined prevalent wind direction rather than a full range of wind speeds and directions. However, the objective of the model was to investigate the potential for impact using a 'worst-case' scenario (i.e. wind direction / strength most likely to show an affect) rather than to provide a full assessment under all weather conditions.

12.4 Baseline conditions

12.4.1 Site overview

- 12.4.1.1 The Project is located so that its offshore works will lie within Swansea Bay on the northern fringes of the Bristol Channel, whilst its onshore elements are primarily adjacent to the Bay or in very close proximity to it. The Bay supports an open, sandy shoreline that has been partly modified by industry and urban development. This is most evident at Swansea, where artificial seawalls enclose the port and docks. Further modification is present at Port Talbot and, in particular, artificial walls there create a harbour servicing the Tata Steel Works at Margam. The rocky shoreline of Mumbles Head, at the south-eastern end of the Gower Peninsula, defines the western extent of the Bay.
- 12.4.1.2 The Project is located between the mouths of the Rivers Tawe and Neath. The stretch of coastline enclosed by the Project begins at the western seawall landfall and comprises the existing port breakwater/seawall and the rock armouring that protects the docks. There is a small section of sand dune habitat towards the eastern seawall landfall where the rock armour diminishes. In the wider landscape, habitat to the west of the Project

and the River Tawe comprises intertidal mud and sands of the main Swansea Bay. Landward habitat to the west of the River Tawe is constrained by the presence of roads, paths, coastal protection walls and embankments, although a narrow and intermittent band of dune is also present.

- 12.4.1.3 Intertidal sands to the east of the Project grade into coastal sand dunes and saltmarsh habitat at Crymlyn Burrows. The River Neath bisects this habitat before it continues along the south-eastern fringes of the Bay at Baglan Burrows. The complex of open dune supports large populations of sand dune specific plant species. The mosaic of dune and saltmarsh habitat is considered of high conservation value and represents one of the last major areas of undeveloped coastline in Swansea Bay.
- 12.4.1.4 Modified coastline including a narrow fringe of dunes is also present at Aberafan and Margam, which eventually grades into an extensive dune system at Kenfig.

12.4.2 Statutory designated sites

- 12.4.2.1 A number of statutory designated sites are located within 5km of the Project. Please note that a Habitat Regulations Assessment (HRA) separate to the ES has been undertaken for European protected sites potentially impacted by the Project. Appendix 12.1, Volume 3 provides maps, 12.10 citations and Table 12.5 below identifies the sites identified during the desk study:

Table 12.5 Statutory designated sites located within 5km of the Project

Site	Designation
Special Areas of Conservation (SAC)	SACs are European protected sites designated under the Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora). Article 3 requires the establishment of a European network of important high-quality conservation sites contributing to the conservation of 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended).
Crymlyn Bog / Cors Crymlyn SAC	A site designated for its transition mires and quaking bogs as well as calcareous fen vegetation. The site supports a number of rare or notable plant species including Slender Cotton-grass (<i>Eriophorum gracile</i>) and Great Fen Sedge (<i>Cladium mariscus</i>) as well as a rich invertebrate fauna.
Ramsar	Ramsar sites are wetlands of international importance designated under the Convention on Wetlands (Ramsar, 1971).
Crymlyn Bog Ramsar Site	Designated as one of the largest floodplain valley mires in Wales and one of the most important in the United Kingdom.
Sites of Special Scientific Interest (SSSI)	SSSIs form one of the main building blocks of site-based nature and geological conservation legislation. Sites are notified where they support some of the best representative samples of habitat or species assemblages, geology or geomorphology, within a given geographical area.
Crymlyn Bog SSSI	Crymlyn Bog is notable for its wet woodland and fen communities including a diverse assemblage of invertebrates. It is the most extensive area of lowland fen in South Wales supporting a substantial population of the nationally rare Slender Cotton-grass and a population of the nationally scarce Hornet Robberfly (<i>Asilus crabroniformis</i>).
Pant-y-Sais SSSI	A lowland fen situated within a narrow valley and former course of the River Neath. The site supports a range of fen communities including developing carr woodland. Pant-y-Sais Fens SSSI is encompassed within the boundaries of Crymlyn Bog SAC.
Crymlyn Burrows SSSI	Notified as one of the last sections of Swansea Bay largely unmodified by industrial development. The site supports sand dune ridges interspersed by tongues of saltmarsh. Rare or notable plants species recorded from the site include Field Wormwood (<i>Artemisia campestris ssp maritima</i>), Dutch Rush (<i>Equisetum hyemale</i>), Dittander (<i>Lepidium latifolium</i>), Rock Hutchinsia (<i>Hornungia petraea</i>), Round-leaved Wintergreen (<i>Pyrola rotundifolia</i>), Variegated Horsetail (<i>Equisetum variegatum</i>),

Site	Designation
	Rock Sea-lavender (<i>Limonium binervosum</i>), Sea Stock (<i>Matthiola sinuata</i>) and Fen Orchid (<i>Liparis loeselii</i>). The site also supports separate dune invertebrate assemblages and independently qualifying invertebrate species feature - a rare strandline beetle <i>Eurynebria complanata</i> .
Blackpill SSSI	Notified for its importance as an over-wintering and passage site for waders, particularly Ringed Plover (<i>Charadrius hiaticula</i>) and Sanderling (<i>Caladris alba</i>) supporting <1% of both British and Western European populations and making the Bay of international importance. The site is considered of local importance for Oystercatcher (<i>Haematopus ostralegus</i>), Grey Plover (<i>Pluvialis squatarola</i>), Bar-tailed Godwit (<i>Limosa lapponica</i>), Knot (<i>Calidris canutus</i>) and Dunlin (<i>Calidris alpina</i>).
National Nature Reserves (NNR)	The first NNRs emerged in the early post-war years alongside National Parks, initially to protect sensitive features as well as to provide 'outdoor laboratories' for research. NNRs represent a selection of some of the finest SSSIs and it this underlying designation that provides legal protection.
Crymlyn Bog and Pant-Y-Sais NNR	The fen and wet woodland communities associated with Crymlyn Bog and Pant-Y-Sais are managed by the Countryside Council for Wales.

12.4.2.2 Four further SSSIs notified for their geological interest were identified: Earlswood Road Cutting and Ferryboat Inn Quarries SSSI; Langland Bay (Rotherslade) SSSI; Oystermouth Old Quarry SSSI; and Bracelet Bay SSSI. None of these sites would be affected by the Project and, being geological in nature, they are not considered further during the assessment of effects on ecological receptors.

12.4.2.3 The next nearest coastal sites with a geomorphological connection with the Severn Estuary / Bristol Channel include: Kenfig SAC, SSSI, NNR and LNR (a sand dune site approximately 10km to the south-east); and, Oxwich Bay SSSI and NNR (a sand dune site approximately 14km to the west). The results of coastal processes and wave modelling of sediment transport within and around Swansea Bay indicate that potential effects are localised (Chapter 6, Coastal Process) and as such these sites are not likely to be impacted by the Project.

12.4.3 Non-statutory designated sites

12.4.3.1 Non-statutory designated sites within 1km of the Project include Pant-y-Sais Local Nature Reserve (LNR), Red Jacket Fen Wildlife Trust Reserve (WTR) near Jersey Marine and Baglan (woodland) WTR north of the M4 at Baglan (The Wildlife Trusts, 2013). Appendix 12.1, Volume 3 identifies the location of these sites.

12.4.3.2 Pant-y-Sais LNR, although a non-statutory designated site, is encompassed within the boundaries of Crymlyn Bog SAC.

12.4.3.3 Red Jacket Fen Wildlife Trust Reserve is a small area (3.5ha) of lowland fen, open water and wet woodland located immediately to the east of Pant-y-Sais. The site supports Water Vole (*Arvicola amphibius*) and Fen Raft Spider (*Dolomedes plantarius*) as well as providing breeding habitat for Cetti's Warbler (*Cettia cetti*), Reed Bunting (*Emberiza schoenichus*), Reed Warbler (*Acrocephalus scirpaceus*) and Sedge Warbler (*Acrocephalus schoenobaenus*).

12.4.3.4 Baglan WTR is a woodland site on steep slopes on the north-eastern fringes of Baglan.

12.4.3.5 NPTCBC have also designated the grassland verge alongside Fabian Way as a Conservation Verge. The grassland is managed as a hay-meadow and supports diverse flora consisting of at least 90 species of flowering plant. During the early summer

months Oxeye Daisy (*Leucanthemum vulgare*) is a particularly conspicuous feature (NPTCBC, 2002).

- 12.4.3.6 In addition, CCSC have designated dune habitat at the fringes of Swansea Bay (Spontex Dunes), west of the Tawe, as a SINC (D.Hill *pers.comm.*).

12.4.4 Protected, rare or notable floral species

- 12.4.4.1 The desk study and consultation identified the following protected or otherwise notable plant species in proximity to the Project:
- i. Fen Orchid (*Liparis loeselii* var *ovata*) – a European Protected Species (EPS) formerly recorded from the dune slacks of Crymlyn Burrows SSSI. The sand dunes of the South Wales coast support 90% of the British population although surveys in the mid-1990s found extant populations at only four sites (JNCC, 2013b), of which Kenfig SAC is the closest site to the Project;
 - ii. Field Wormwood (*Artemisia campestris* ssp *maritima*) perhaps better described as Dune Wormwood (*Artemisia crithmifolia*) – protected under Schedule 8 WCA 1981 and listed under section 42 NERC 2006, the only extant South Wales population of this species grows in dune habitat near the northern edge of Crymlyn Burrows SSSI, where one plant remains;
 - iii. Prickly Sandwort (*Salsola kali* ssp *kali*) – a coastal species of sandy or shingle strandlines listed under section 42 NERC 2006. The species has a widespread distribution within the upper shore of Swansea Bay;
 - iv. Sea Stock (*Matthiola sinuata*) - a coastal species of sandy or shingle strandlines listed under section 42 NERC 2006. The species has a restricted UK distribution with the Gower and Swansea Bay population forming a significant national population resource. The species also has cultural significance having been first described at Briton Ferry by the naturalist John Lightfoot whilst touring Wales with Joseph Banks in 1773 (Bowden, 1989). Surveys identified three core population centres within Swansea Bay including sites at Baglan Burrows, Aberafan Sands and on the Swansea seafront near the University;
 - v. Basil Thyme (*Clinopodium acinos*), Yellow Bartsia (*Parentucellia viscosa*) and Common Cudweed (*Filago vulgaris*) – species associated with open, dry, calcareous and often disturbed habitats only recorded from a handful of sites in South Wales. The Glamorgan Rare Plants Register records both Common Cudweed and Yellow Bartsia as having been recorded from less than ten sites since the 1970s and although common on the cliffs of South Gower, Basil Thyme is rare elsewhere (BSBI, 2012). All of these species have been recorded in open habitats associated with Crymlyn Burrows SSSI and brown-field sites at Baglan (C.Hipkin *pers.comm.*). Surveys identified the continued presence of these species at locations to the east of the River Neath. Basil Thyme is a section 42 species NERC 2006 and Yellow Bartsia is a NPT BAP species;
 - vi. Sharp Rush (*Juncus acutus*) – a species associated with upper parts of saltmarshes and brackish dune slacks. Sharp Rush is a NPT BAP species, present within the docks, Crymlyn Burrows and Baglan Bay;
 - vii. Rock Sea-lavender (*Limonium binervosum* agg.) – a species of rocky shorelines and a NPT BAP species found within Swansea Docks and the wider area;
 - viii. Deptford Pink (*Dianthus armeria*) – Fully protected under Schedule 8 WCA 1981, this species has been recorded in the Baglan Energy Park;

- ix. Common Wintergreen (*Pyrola minor*) – a rhizomatous mycorrhizal evergreen herb associated with damp woodland as well as late-successional sand dune habitat. The species is a NPT BAP species and has been found in birch-willow scrub at Jersey Marine;
- x. Slender Cottongrass (*Eriophorum gracile*) - Fully protected under Schedule 8 WCA 1981, in Wales this species is only found in Crymlyn Bog SAC and fens of the Lleyn Peninsula; and
- xi. Autumn Lady's-tresses (*Spiranthes spiralis*) – a species of unimproved well-grazed grassland on dry calcareous soils and listed on the Glamorgan Rare Plants Register at less than ten sites since the 1970s. The species grows in a lawn beside the ABP offices within the western end of the docks (B.Stewart *pers.comm.*).

12.4.4.2 Naturalised non-native plants species are often associated with docks and ports. Examples of such plants with a very limited distribution in the UK include Oak-leaved Goosefoot (*Chenopodium glaucum*) and Argentine Dock (*Rumex frutescens*) which were both found during surveys at locations to the south-west of Queens Dock.

12.4.4.3 In addition, plants listed as invasive species under Schedule 9 WCA 1981 were recorded during field visits. Japanese Rose (*Rosa rugosa*), Japanese Knotweed (*Fallopia japonica*), Himalayan Balsam (*Impatiens glandulifera*) and Montbretia (*Crocasmia x crocosmiiflora*) were all found growing in the vicinity of Queens Dock. Japanese Knotweed, Japanese Rose and Entire-leaved Cotoneaster (*Cotoneaster integrifolius*) were also identified within Crymlyn Burrows SSSI.

12.4.5 Protected, rare or otherwise notable faunal species

Amphibians

12.4.5.1 The nearest known record for Great Crested Newts (*Triturus cristatus*), a species protected by law, is a casual record from the St Thomas area of Swansea. The closest known breeding colony is at Llandarcy approximately 2.5km north of the Project.

12.4.5.2 Widely occurring species including Palmate Newts (*Lissotriton helveticus*), Common Frog (*Rana temporaria*) and Common Toad (*Bufo bufo*) have been recorded closer to the coast. Records for all these species include locations at the southern edge of Crymlyn Bog, the Tennant Canal and Baglan Burrows. A Common Toad was also found during a site visit to Crymlyn Burrows in August 2013.

12.4.5.3 Open water with the potential to support breeding amphibians is limited within the study area for the Project. Irregularly inundated ditches and hollows at the northern edges of Crymlyn Burrows support wide ranging species, particularly Common Frog and Palmate Newt (URS, 2010b). However, the presence of Great Crested Newts is considered unlikely due to absence of suitable breeding ponds.

Reptiles

12.4.5.4 Four species of reptile, Adder (*Vipera berus*), Grass Snake (*Natrix natrix*), Slow-worm (*Anguis fragilis*) and Common Lizard (*Zootoca vivipara*) have been recorded within 2.5km of the Project. Whilst, Grass Snake, Slow-worm and Common Lizard are likely to be widely distributed locally, Adders are less wide-ranging and more likely to be associated with specific habitats. Existing records for Adder relate to Mumbles Hill, a location at the western side of Swansea Bay remote from the Project.

- 12.4.5.5 The majority of recordings of Grass Snake have been from the Tennant Canal (aligned east-west, to the south of Crymlyn Bog and to the north of Swansea Docks and Fabian Way) close to the settlement of Jersey Marine. Slow-worms have been recorded at the western edge of Crymlyn Bog and north-western edge of Port Talbot at Sandfields. Common Lizard have a wider recorded distribution with known sites beside the River Neath at Baglan, locations to the south of Jersey Marine and at Swansea Docks, and within habitat to the north and south of the Prince of Wales Dock.
- 12.4.5.6 Habitat associated with the southern edges of Swansea Docks and potentially in the path of the proposed electrical grid connection works is considered suitable for reptiles, particularly Common Lizard and Slow-worm. As such reptile surveys were undertaken in 2013.
- 12.4.5.7 The reptile surveys confirmed the presence of Common Lizard within coastal grassland habitat alongside the seawall to the south of Queens Dock. Common Lizards were discovered in low numbers on eight of the eleven visits. On each of these occasions one to two individuals were recorded with the exception of a visit in late May 2013 when six individuals were recorded (four adults / two juveniles). Using the criteria of Froglife (1999) the discovery of 5-20 individuals of Common Lizard during any one survey visit is considered to represent a 'Good' population.

Birds

- 12.4.5.8 Restricted access and localised dereliction at Swansea Docks provides relatively undisturbed habitat for birds. In particular, brown-field land including the northern edge of the docks, as well as the former BP facility immediately to the west of SUBC and SUBC near the eastern landfall (TN21, 20 & 17 of Appendix 12.2), all formerly offered potential for both breeding and over-wintering waders. In 2012, Lapwing (*Vanellus vanellus*) and Ringed Plover (*Charadrius hiaticula*) both appear to have successfully bred within habitat at the northern side of the docks (west of the Welsh Water Treatment Works) (B. Stewart *pers.comm*). Breeding bird surveys in 2013 confirm the continued presence of these species (Appendix 12.5, Volume 3).
- 12.4.5.9 Redevelopment of the former BP tank farm adjacent to Crymlyn Burrows SSSI for the SUBC, and remediation works within BP land at the eastern end of Swansea Docks during 2012 appears likely to have sterilised these areas of potential breeding habitat.
- 12.4.5.10 An over-wintering flock of twenty Lapwings was noted roosting along the southern edge of Queens Dock during a site visit on 19 December 2012. Lapwing are included on the RSPB's red list for Wales (Johnstone *et al*, 2011), indicating that there has been at least a 50% decline in the breeding population over the last 25 years. Ringed plover are included on the amber list for Wales, and red-listed at a UK level.
- 12.4.5.11 The 2009 record of a Great Northern Diver (*Gavia immer*) within the Prince of Wales Dock also suggests that the shelter and expanses of open water provided by the docks may favour occasional use by pelagic species.
- 12.4.5.12 Species identified as a result of incidental observation during field visits to Swansea Docks or immediate area have included Skylark (*Alauda arvensis*), Lapwing, Rock Pipit (*Anthus petrosus*), Goldfinch (*Carduelis carduelis*), Linnet (*Carduelis cannabina*), Wheatear (*Oenanthe oenathe*), Greenfinch (*Chloris chloris*), Sand Martin (*Riparia riparia*), Chiffchaff (*Phylloscopus collybita*), Whitethroat (*Sylvia communis*), Robin (*Erithacus rubecula*), Wren (*Troglodytes troglodytes*), Dunnock (*Prunella modularis*), Pied Wagtail

(*Motacilla alba*), Yellow Wagtail (*Motacilla flava*) and Magpie (*Pica pica*) as well as Green Sandpiper (*Tringa ochropus*), Greenshank (*Tringa nebularia*), Herring Gull (*Larus argentatus*), Lesser Black-backed Gull (*Larus fuscus*) and Black-headed Gull (*Chroicocephalus ridibundus*).

- 12.4.5.13 Additional species recorded during breeding bird surveys in April, May and June 2013 have included Carrion Crow (*Corvus corone*), Jackdaw (*Corvus monedula*), Cormorant (*Phalacrocorax carbo*), Mallard (*Anas platyrhynchos*), Gadwall (*Anas strepera*), Buzzard (*Buteo buteo*), Ringed Plover, Bullfinch (*Pyrrhula pyrrhula*), Blackbird (*Turdus merula*), Song Thrush (*Turdus philomelos*), Mistle Thrush (*Turdus viscivorus*), Wood Pigeon (*Columba palumbus*), Swallow (*Hirundo rustica*) and Common Sandpiper (*Actitis hypoleucos*).
- 12.4.5.14 Of these, Skylark, Linnet, Bullfinch, Dunnock, Lapwing, Ringed Plover, Song Thrush, Yellow Wagtail, Herring Gull and Black-headed Gull are section 42 NERC 2006 species. The records for Bullfinch, Yellow Wagtail and Black-headed Gull were flyover records.

Mammals

- 12.4.5.15 Otters (*Lutra lutra*) have been recorded on the Tennant Canal north of the Project in addition to the River Tawe, River Neath and Baglan Brook at a location near the Baglan Energy Park. It is also likely that Otters visit intertidal habitat, including the saltmarshes of the Neath Estuary. The home range of an individual Otter can be tens of kilometres. Records suggest a wide local distribution, and thus it was considered likely that Otters would visit habitat associated with Swansea Docks.
- 12.4.5.16 A targeted survey approach was followed with an objective of identifying areas supporting potential cover for Otters that could potentially be subject to disturbance during construction and operation of the Project. A survey targeted along the seawall and at the south-western end of Swansea Docks (Queens Dock) found evidence of Otters at two locations. Spraints were found under the landward end of a jetty and nearby beside the dock edge (within 20m) at the eastern end of Queens Dock. A sheltered area beneath the jetty was identified as having the potential to provide a laying-up location (a partially enclosed feature used by Otters for temporary refuge). However, September 2013 trail camera footage captured images of a dog investigating this potential laying-up location. If this is a regular occurrence, it is unlikely that the location would be used by Otters as a refuge.



Plate 1: Otter within Swansea Docks (taken 12/04/2013 0348hrs).



Plate 2: Pill box window allowing potential access through the sea wall for Otters (taken 11/04/2013).

- 12.4.5.17 Tar spots (small drops of faeces lacking solids such as fish bones) were also found at the firing-position of a Second World War pill box located within the seawall. The tar spots smelt strongly of Otter and suggest pill boxes provide access points through the seawall allowing movement from the docks to the coast. A map identifying findings is presented in Appendix 12.6, Volume 3.
- 12.4.5.18 Field signs indicating the presence of Rabbits (*Oryctolagus cuniculus*) and Fox (*Vulpes vulpes*) were frequent within the docks and Crymlyn Burrows. A den with fox cubs was found during a visit to the east of Queens Dock in April 2013. Desk study records include Brown Hare (*Lepus europaeus*) from Crymlyn Burrows in 2009 and a Hedgehog (*Erinaceus europaeus*) alongside Fabian Way in 2011 and 2012. Grassland and scrub habitat associated with the docks estate and Crymlyn Burrows SSSI was considered likely to support a range of common small mammals. A Grey Seal was also noted within the Kings Dock during a breeding bird survey on 26 April 2013.
- 12.4.5.19 Desk study information identified the presence of both Badgers (*Meles meles*) and Water Vole within the wider area. No evidence of either of these species was recorded during field surveys, nor are they considered likely to occur within habitat closely associated with the Project.

Bats

- 12.4.5.20 The open and exposed character of the coastal belt in which the Project will be constructed does not tend to favour bats, although desk study records (South East Wales Biodiversity Records Centre - SEWBReC) indicated at least two species locally, Common Pipistrelle (*Pipistrellus pipistrellus*) and Noctule (*Nyctalus noctula*). The Noctule bat was recorded foraging alongside Fabian Way in 2010 and numerous records exist for Common Pipistrelle bats alongside the Tennant Canal and River Tawe near Swansea marina (SEWBReC data).
- 12.4.5.21 Soprano Pipistrelle (*Pipistrellus pygmaeus*) have also been recorded foraging along the strandline at nearby sites including Caswell Bay and suspected swarming / mating activity has also been observed at Blackpill (D. Forman *pers.comm*).
- 12.4.5.22 The first of three transect surveys targeting habitat at the western end of Queens Dock and including habitat beside the seawall was undertaken on 16 May 2013. The survey coincided with high tide. Bat activity on the landward side of the seawall was found to be very limited during the visit. However foraging activity of both Common Pipistrelle and Soprano Pipistrelle was recorded alongside exposed rock armouring on the coastal side of the seawall. The first bats recorded during the survey appeared almost one hour after sunset suggesting roosts are distant from the study area.
- 12.4.5.23 Two further surveys on 5 July and 3 September 2013 identified similar activity by both Common and Soprano Pipistrelle bats, although a brief pass by a Noctule was also recorded by a static detector on 6 August 2013.
- 12.4.5.24 The September static detector survey identified further passes by Noctule, a species of Myotis and Nathusius Pipistrelle (*Pipistrellus nathusii*). Nathusius Pipistrelle passes were recorded on the nights of 3, 4 and 5 September 2013. Nathusius Pipistrelle are rarely recorded bats, with only 850 existing records for the UK and Ireland. It is a species that feeds on aquatic flies and is often associated with lakes and rivers (Russ, 2013). Nathusius Pipistrelle is believed to be a migratory species with bats originating from colder parts of mainland Europe moving in a south-westerly direction to over-winter at

locations with less extreme conditions (Russ et al, 1998). Appendix 12.4, Volume 3 presents the findings of the bat surveys.

- 12.4.5.25 No structures suitable for supporting roosting / hibernating bats that would be affected by the Project, including the electrical grid connection works, were recorded during the field surveys.

Invertebrates

- 12.4.5.26 The desk study identified a number of significant wetland invertebrate rarities recorded near to the Project, but those recorded sightings were within habitat unlikely to be affected by the Project. They include records for Fen Raft Spider at Crymlyn Bog and parts of the Tennant Canal. The SSSI citation for Crymlyn Bog also identifies a solitary bee (*Crossocerus vagabundus*), a water beetle (*Gyrinus suffriani*) and two flies (*Pteromicra leucopeza* and *Cephalops perspicuus*) as other rarities. The Hornet Robberfly (*Asilus crabroniformis*) is also associated with the western fringes of Crymlyn Bog.
- 12.4.5.27 The provisional invertebrate assemblage and a qualifying feature of the Crymlyn Burrows SSSI designation include 107 species (5 spiders, 46 beetles, 26 flies, 7 true bugs, 22 bees/wasps and 1 woodlouse) in addition to the independent qualifying invertebrate species feature, the strandline beetle *Eurynebria complanata* (M.Launders pers.comm).
- 12.4.5.28 A survey of Neath Port Talbot sand dune systems, including Crymlyn Burrows SSSI, for BAP invertebrates (Bolchover, 2009) found a number of rare or otherwise notable species including:
- Dicronychus equisetioides* – a click beetle found in sand at the roots of plants such as Marram (*Ammophila arenaria*). The species has an International Union for Conservation of nature (IUCN) status of Red Data Book 2 (RDB2 Vulnerable) and within the UK has only been found in Glamorgan and Carmarthenshire since 1970. The beetle is a NPT BAP species;
 - Dune Tiger Beetle (*Cicindela maritima*) – a coastal ground beetle found locally in South Wales. The species is recognised as a Notable b species (occurring in between 31-100 10km grid squares within the UK) and a NPT BAP species; and
 - two NPT BAP beetles, *Halacritus punctum* and *Eurynebria complanata*, associated with strandline habitat and previously recorded at Crymlyn were not found during the 2009 survey.
- 12.4.5.29 The Hairy Click Beetle (*Synaptus filiformis*), a terrestrial beetle (and section 42 NERC 2006 species) usually associated with vegetated river margins and with a restricted national distribution was also recorded from Crymlyn Burrows SSSI in 2006 (SEWBRc data).
- 12.4.5.30 A survey targeting the strandline at Crymlyn Burrows was undertaken on 31 August 2013. Sand Hoppers (*Talitrus cf. saltator*) were found in abundance. Two species of ground beetle were also identified, an individual specimen of *Dyschirius thoracicus* and the other, *Broscus cephalotes* which was frequently encountered under refugia at the strandline. Two individuals of the scarabid beetle, Dune Chafer (*Aegialia arenaria*), were also found as well as a pill woodlouse, *Armadillidium album* at three separate locations. A number of other species were recorded from strandline vegetation including caterpillars of the Nutmeg (*Discestra trifolii*) moth, the spiders *Larinioides cornutus* and *Arctosa perita*, and a true bug *Lygus maritimus* all of which were associated with Prickly Sandwort. The harvestman *Phalangium opilio* was also discovered as well as a Red-banded Sand Wasp (*Ammophila sabulosa*). Of these, *B.cephalotes*, *A.arenaria*, *A.album*,

A.perita and *A.sabulosa* are included on the Crymlyn Burrows SSSI invertebrate assemblage of NRW.

- 12.4.5.31 Incidental records from Crymlyn Burrows during the same visit included larvae of the nationally scarce Star-wort (*Cucullia asteris*) moth as well as the section 42 NERC 2006 bumblebees: Brown-banded Carder Bee (*Bombus humilis*) and Red-shanked Carder Bee (*Bombus ruderarius*). A full list of species discovered during the visit is presented in Appendix 12.8, Volume 3.
- 12.4.5.32 Incidental records of invertebrates made during site visits to Swansea Docks, particularly during warm weather of June to August 2013 included the Small Heath, Large White, Green-veined White, Small Blue (*Cupido minimus*), Meadow Brown (*Maniola jurtina*) and Common Blue (*Polyommatus icarus*) butterflies, Common Field Grasshopper (*Chorthippus brunneus*) as well as a Click beetle (*Agrypnus murinus*) (a species associated with coastal grasslands).
- 12.4.5.33 Given the relatively well-known distribution of moths within the UK, surveys were undertaken to sample the moth fauna associated with the docks in order to help assess the value of habitats present for invertebrates. Two intensive moth-trapping surveys were undertaken, the first on 5 July 2013 and second on the 6 August 2013. A total of 137 species of Lepidoptera were identified including ten section 42 NERC 2006 species.
- 12.4.5.34 Combining species identified during surveys with incidental records made during site visits, in addition to those extracted from data searches, resulted in a total of eleven section 42 NERC 2006 moth and four butterflies species found within the habitat of the docks estate:
- moth species – Shaded Broad-bar (*Scotypteryx chenopodiata*), Dusky Brocade (*Apamea remissa*), Latticed Heath (*Chiasmia clathrata*), Rustic (*Hoplodrina blanda*), Dot Moth (*Melanchra persicariae*), Rosy Minor (*Mesoligia literosa*), Dark-barred Twin-spot Carpet (*Xanthorhoe ferrugata*), White-line Dart (*Euxoa tritici*), Ghost Moth (*Hepialus humuli*), Shoulder-striped Wainscot (*Mythimna comma*) and Grass Rivulet (*Perizoma albulata*); and
 - butterflies – Small Heath (*Coenonympha pamphilus*), Small Blue, Grayling (*Hipparchia semele*) and Dingy Skipper (*Erynnis tages*).
- 12.4.5.35 Additional records included *Bryotropha desertella*, a Nationally (Category B) scarce moth (Davis, 2012).
- 12.4.5.36 The invertebrate surveys recorded a relatively diverse fauna of common or locally common species reflecting the mosaic of semi-natural habitats present. A review of the habitat preferences and food plants associated with the section 42 NERC 2006 and localised species found during the 2013 surveys suggested a correlation with coastal grasslands communities present within the docks. The review is presented in Appendix 12.8, Volume 3.

Habitats

Rocky shore (artificial)

- 12.4.5.37 The southern boundary of Swansea Docks comprises rock armoured sea defences and a 2m high concrete wall. The boulders forming the rock armouring are devoid of vegetation. The seaward face of the concrete wall supports very occasional plants of

Stag's-horn Plantain (*Plantago coronopus*), Rock Samphire (*Crithmum maritimum*) and Sea-purslane (*Atriplex portulacoides*) as well as a colony of approximately thirty plants of Golden-samphire (*Inula crithmoides*).



Plate 2: Golden-samphire on sea wall (taken 16/07/2013).



Plate 3: Rock Sea-lavender on compacted aggregate (taken 16/07/2013).

- 12.4.5.38 The sheltered north-facing side of the wall, including sections of concrete hard-standing, have been colonised by species typically associated with rocky shorelines. In particular, cracks and crevices provided a foothold for Rock Sea-lavender (*Limonium binervosum* agg.), Sea-plantain (*Plantago maritima*), Stag's-horn plantain, Creeping-bent (*Agrostis stolonifera*), Red Fescue (*Festuca rubra*), Common Couch (*Elytrigia repens*) as well as occasional plants of Sea-thrift (*Armeria maritima*) and Rock Samphire.

Saltmarsh

- 12.4.5.39 Sheltered habitat beside the River Neath, at the northern end of Baglan Burrows and eastern end of Crymlyn Burrows SSSI supports saltmarsh dominated by Sea-purslane. Other species dotted within the sward included Common Saltmarsh-grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*) and Common Cord-grass (*Spartina anglica*). At the fringes of more established areas of saltmarsh, compacted sediment associated with creeks and hollows also support a community dominated by Annual Sea-blight (*Suaeda maritima*) and Purple Glasswort (*Salicornia ramosissima*).
- 12.4.5.40 Saltmarsh is a NPT BAP habitat and at both Crymlyn and Baglan Burrows the saltmarsh-sand dune transitional community is further recognised for supporting the local BAP species Sea Heath (*Frankenia laevis*), in addition to Rock Sea-lavender, Sea Sandwort (*Honckenya peploides*) and Lesser Sea-spurrey (*Spergularia marina*).
- 12.4.5.41 At Crymlyn Burrows, the upper saltmarsh zone is fringed by stands of Sea Couch (*Elytrigia atherica*), Common Couch (*Elytrigia repens*) and Red Fescue. Sharp Rush and Sea Rush (*Juncus maritimus*) form a transitional zone between saltmarsh and sand dune. In areas subject to prolonged waterlogging Sea Club-rush (*Bolboschoenus maritimus*) and Common Reed (*Phragmites australis*) also form stands.
- 12.4.5.42 Towards the south-west end of the Queens Dock, artificial periodically waterlogged substrates were found to support species associated with saltmarsh habitat including Hard-grass (*Parapholis strigosa*) and Annual Sea-blight. Two colonies of Oak-leaved Goosefoot, an archaeophyte found in very few Welsh sites (less than 6) (J.Woodman pers.comm.) were also found in muddy vehicle tracks.



Plate 4: Saltmarsh dominated by Sea-purslane (taken 24/08/2013).



Plate 5: Transitional zone supporting Sharp Rush and Sea Rush (taken 24/08/2013).

Sand dune

- 12.4.5.43 An account of sand dune habitat associated with Swansea Bay is provided by Appendix 12.3, Volume 3.
- 12.4.5.44 No strandline communities were evident during a site visit undertaken late in 2012, indicating that the foreshore dunes at Crymlyn Burrows SSSI had been eroded during winter storms. However, a strandline and embryonic dune community supporting a mix of Sand Couch (*Elytrigia juncea*), Marram, Prickly Sandwort, Sea Sandwort (*Honckenya peploides*) and Sea Rocket (*Cakile maritima*) re-formed during the summer months. In terms of National Vegetation Classification (NVC), the SD2 *Honckenya peploides*-*Cakile maritima* strandline community and SD4 *Elymus farctus* foredune communities best describe the species assemblages that have developed since the winter. However, in places the rhizomes of Marram have colonised this pioneer zone and locally a SD6a *Ammophila arenaria* mobile dune *Elytrigia juncea* sub-community appears to best describe the first band of vegetation.
- 12.4.5.45 The foredunes throughout Swansea Bay support vegetation overwhelmingly dominated by Marram, interspersed by bare sand attributable to the SD6d *Ammophila arenaria* mobile dune (typical sub-community) of the NVC.



Plate 6: Strandline community (taken 24/08/2013).



Plate 7: Foredune community (taken 23/08/2013).

- 12.4.5.46 Dunes set back from the foreshore become increasingly fixed in character comprising Marram, Red Fescue, Common Bent (*Agrostis capillaris*), Sand Cat's-tail (*Phleum arenarium*) and Thyme-leaved Sandwort (*Arenaria serpyllifolia*), in addition to Restharrow (*Ononis repens*), Evening-primrose (*Oenothera* sp.) particularly Intermediate

Evening-primrose (*O. x fallax*), Ribwort Plantain (*Plantago lanceolata*), Common Cat's-ear (*Hypochaeris radicata*), False Oat-grass, Yellow Rattle (*Rhinanthus minor*), Goldenrod (*Solidago virgaurea*) and Polypody (*Polypodium vulgare* / *P. interjectum*). At Baglan Burrows, the activity of motorcyclists has created a network of bare sandy tracks dotted with Sea-holly (*Eryngium maritimum*). The bulk of semi-fixed and fixed dune grasslands recorded during surveys were considered to be attributable to SD7c (*Ammophila arenaria*-*Festuca rubra* semi-fixed dune *Ononis repens* sub-community) and SD9a (*Ammophila arenaria*-*Arrhenatherum elatius* fixed dune) grassland communities of the NVC.

- 12.4.5.47 The dune slacks of Crymlyn Burrows have become increasingly dominated by rank vegetation including Common Reed, scrub and woodland. Although Fen Orchid appears to have disappeared from the Crymlyn slacks, species including Creeping Willow (*Salix repens*) still occur.
- 12.4.5.48 Land running parallel and immediately adjacent to the A483 Fabian Way has been subject to periodic episodes of disturbance due to the presence and occasional maintenance of pipes transporting water, oil and gas. A track which narrows to a footpath follows the northern boundary. Dutch Rush (*Equisetum hymale*) a notable native species forms dense stands towards the north-western end of the SSSI. In addition, large stands of Early Goldenrod (*Solidago gigantea*) a rhizomatous non-native perennial herb have become established within dune habitat.



Plate 8: Semi-fixed dune grassland (SD7c) grading into fixed dune grassland (SD9a) at Crymlyn Burrows (taken 24/08/2013).



Plate 9: Fringe of Creeping Willow at the edge of a former dune slack now dominated by willow and birch (taken 24/08/2013).

Grassland

- 12.4.5.49 The grassland communities associated with Swansea Docks, particularly in the vicinity of the seawall where they are subject to sea spray during rough weather conditions, support species of upper saltmarshes. In particular, a narrow fringe of grassland beside the seawall along the south-western boundary of Queens Dock is dominated by Red Fescue and Sea Couch with very occasional tussocks of Long-bracted Sedge (*Carex extensa*), Sea Rush and Sharp Rush.
- 12.4.5.50 Grassland habitat along the south-eastern end of the seawall is sandy in places and supports occasional Marram. Typically, the sward comprises Common Couch and Red Fescue with varying cover of species including Creeping-bent, Cock's-foot (*Dactylis glomerata*), Yorkshire-fog, (*Holcus lanatus*), Ragwort (*Senecio jacobaea*), Wild Carrot (*Daucus carota*), Wild Parsnip (*Pastinaca sativa*), Restharrow, Perforated St John's-wort (*Hypericum perforatum*), Ribwort Plantain, Oxeye Daisy (*Leucanthemum vulgare*),

Common Knapweed (*Centaurea nigra*), Common Bird's-foot-trefoil (*Lotus corniculatus*) and Kidney Vetch. Analysis of quadrat data suggests elements of this habitat is broadly comparable to SD8 *Festuca rubra-Galium verum* fixed dune grassland habitat of the NVC (please refer to Appendix 12.3, Volume 3) although it is probably best described as a coastal grassland community.

- 12.4.5.51 The road verges alongside Fabian Way are managed as hay-meadows and support semi-improved neutral grassland. The presence of species such as Pyramidal Orchid (*Anacamptis pyramidalis*) and Fairy-flax (*Linum catharticum*) within the grassland are considered indicative of a relatively impoverished, base-enriched soil caused by proximity to the sea and input of windblown sand. A site visit in July 2013 found a high level of variation within the verge with some areas supporting an improved or species-poor grassland sward.
- 12.4.5.52 Grassland beside industrial units on the south-eastern side of the River Neath also supports the NPT BAP species, Yellow Bartsia.



Plate 10: Coastal grassland community next to the sea wall in Swansea Docks supporting Kidney Vetch, Restharrow and Yellow Rattle (taken 07/06/2013).



Plate 11: Conservation Verge adjacent to Fabian Way (taken 16/07/2013).

Bare ground, ephemeral and short perennial vegetation

- 12.4.5.53 Land within Swansea Docks and bordering the south-eastern banks of the River Neath has been subject to industrial activity or modification. Subsequent dereliction of these areas has resulted in colonisation by early successional species.
- 12.4.5.54 The edges of concrete hard-standing and margins of irregularly used roads at the western end of Queens Dock support occasional cover of Biting Stonecrop (*Sedum acre*) in addition to bryophytes including Sand-hill Screw-moss (*Syntrichia ruralis subsp ruraliformis*).
- 12.4.5.55 Quayside habitat consisting of compacted aggregate and disturbed soils at the southern edge of Queens Dock supports sparse cover of grasses interspersed by Ragwort (*Senecio jacobaea*), Willowherb (*Epilobium* sp), Fleabane (*Conyza* sp) and small plants of Butterfly-bush (*Buddleja davidii*).
- 12.4.5.56 Habitat associated with the south-eastern banks of the River Neath comprise a rough track, compacted aggregate and windblown sand. The bare and sparsely vegetated ground supports a diverse flora including Red Fescue, Common Bird's-foot-trefoil (*Lotus corniculatus*), Creeping-bent, Wild Parsnip, Evening-primrose, Bilbao Fleabane (*Conyza floribunda*), Ribwort Plantain, Polypody, Hedge Mustard (*Sisymbrium officinale*) and

Kidney Vetch, in addition to Butterfly-bush and Common Gorse (*Ulex europaeus*). Compacted aggregate near to the pipe-bridge over the River Neath was also found to support Basil Thyme.

Scrub and woodland

- 12.4.5.57 Grassland bordering the seawall at the southern end of the docks supports large stands of dense Gorse dominated scrub. The boundaries of industrial units to the south-west of Queens Dock comprise scrub mosaics interspersed by tall herbs and occasionally invasive plants such as Japanese Knotweed. The scrub mosaics typically include Bramble (*Rubus fruticosus*), Butterfly-bush and Gorse.
- 12.4.5.58 Butterfly-bush has also invaded derelict brown field land within the docks, and was evident within the former BP site to the east of Queens Dock prior to its clearance for remediation works (early 2013). Occasional small stands of Sea Buckthorn (*Hippophae rhamnoides*) are also present locally.
- 12.4.5.59 The southern margins of Fabian Way are lined by scrub and tree cover of Grey Willow (*Salix cinerea*), Alder (*Alnus glutinosa*), Downy Birch (*Betula pubescens*) and Oak (*Quercus robur*) interspersed by Bramble and Gorse.
- 12.4.5.60 Wet woodland has developed within former dune slack habitat at the north-eastern and north-western ends of Crymlyn Burrows. Trees of Alder and Grey Willow dominate, whilst waterlogged areas support Yellow Iris (*Iris pseudacorus*), Branched Bur-reed (*Sparganium erectum*), Hemlock Water-dropwort (*Oenanthe crocata*), Common Reed and Fool's Watercress (*Apium nodiflorum*).
- 12.4.5.61 Oak woodland also borders Earlswood Golf Course. This drier woodland community has a ground flora of Bramble with Ivy (*Hedera helix*) and ferns. A fringe of Austrian / Corsican Pine (*Pinus nigra*) also lines the southern flank of Fabian Way near the golf course.

12.4.6 Selection of key ecological receptors

- 12.4.6.1 Table 12.6 below identifies the ecological receptors identified during the baseline assessment for the Project and in particular, identifies those that have been considered as key ecological receptors.

Table 12.6 Ecological receptors associated with the Project

Ecological receptor	Associated features	Nature Conservation Value
Key Ecological Receptor		
Crymlyn Bog (& Pant-Y-Sais Fen SSSI) SAC, SSSI, Ramsar, NNR and LNR	Fen and wet woodland communities supporting notable plant species such as Slender Cottongrass and rare invertebrates.	International
Kenfig SAC, SSSI, NNR and LNR	Internationally important sand dune site supporting Fen Orchid.	International
Crymlyn Burrows SSSI	Sand dune and saltmarsh communities including Fen Orchid, Variegated Horsetail, Field Wormwood, Sea Stock, Prickly Saltwort, Long-stalked Orache (<i>Atriplex longipes</i>), Sticky Stork's-bill (<i>Erodium lebelii</i>), Golden-samphire, Sharp Rush, Sea-lavender (<i>Limonium</i>	National

Ecological receptor	Associated features	Nature Conservation Value
	<i>procerum ssp procerum</i>), Round-leaved Wintergreen (<i>Pyrola rotundifolia ssp maritima</i>), Dune Fescue (<i>Vulpia fasciculata</i>) and invertebrates assemblages as well as an independently qualifying invertebrate species feature – the strandline beetle <i>Eurynebria complanata</i>).	
Blackpill SSSI	Intertidal habitat providing an important over-wintering site for waders. Blackpill SSSI is also assessed as part of Chapter 6 (Coastal Processes) in addition to Chapter 11 (Coastal Birds).	National
Oxwich Bay SSSI and NNR	Sand dune system 14km to the south-west of the Project.	National
Red Jacket Fen WTR	Lowland fen, wet woodland and open water.	District
Bare ground, Ephemeral and Short Perennial Vegetation	Notable plant species with populations in proximity to the proposed cable route options include Basil Thyme, Yellow Bartsia, Common Cudweed and Sea Stock.	District
Saltmarsh outside designated sites	The saltmarsh of Baglan Burrows supports several BAP species of local importance and the habitat is of restricted distribution within the county. Coastal saltmarsh is a section 42 NERC 2006 habitat.	County
Sand dune outside designated sites	This nearest habitat is associated with Baglan Burrows and Swansea Bay west of the River Tawe. The restricted distribution of the habitat and its associated features increases its nature conservation value. Coastal sand dune is a section 42 NERC 2006 habitat.	County
Grassland	Grassland habitats within the potential impact zone (footprint of the Project including temporary construction areas and alignment of the proposed cable routes) include Conservation Verge grassland beside Fabian Way and dockland habitat supporting section 42 NERC 2006 invertebrates.	District
Rocky shore (Artificial)	Species typically associated with rocky shoreline, including Rock Sea-lavender, a species of local importance. Receptor not sufficiently valuable for significant impacts to arise. However, opportunities for ecological enhancement do exist.	District
Ground-nesting birds	Breeding populations of Lapwing and Ringed Plover were associated with the former BP site and attempted to breed at two locations within the docks estate during 2013. Skylark and pipits are also present within open areas of the docks. Lapwing, Ringed Plover and Skylark are section 42 NERC 2006 species.	District
Invertebrates	Section 42 NERC 2006 species associated with coastal grassland habitat of the docks estate.	District
Other Ecological Receptors assumed to require mitigation if affected		
Other Breeding Birds	The small patches of scrub that may be affected by the Project also support breeding birds. However, this receptor is not sufficiently valuable for significant impacts to arise.	Local
Reptiles	Habitat associated with the southern edges of Swansea Docks and the grid connection works support reptiles. Common Lizards are section 42 NERC 2006 species.	Local
Otters	Otters have been recorded at various locations in the vicinity of the Project and it is likely that they use the intertidal habitat including saltmarshes of the Neath Estuary. Surveys have recorded Otters from the Queens Dock and it appears that pill-boxes provide access through the seawall from the docks estate to the coast. Otters are section 42 NERC 2006 species.	Parish / Local
Bats	No suitable roost sites are associated with construction areas. Foraging opportunities exist within the docks estate and regular activity by at least two species has been recorded from habitat associated with the coastal belt. Common Pipistrelle and Sprano	Parish/Local

Ecological receptor	Associated features	Nature Conservation Value
	Pipistrelle bats are section 42 NERC 2006 species.	
Invasive Species	Invasive species including Japanese Knotweed and Japanese Rose are present within the study area. In addition to being an offence to cause their spread in the wild, opportunities also exist to treat infestations and therefore provide ecological enhancement.	Parish / Local
Ecological Receptors not requiring further consideration		
Baglan WTR	A woodland reserve on slopes above Baglan isolated from any direct or indirect impacts brought about by the Project.	District
Deptford Pink	Protected plant species occurring at Baglan. The location of this species is isolated from any potential disturbance brought about by the Project therefore no direct or indirect impacts are anticipated.	County
Amphibians	The absence of suitable breeding habitat means that the presence of Great Crested Newts is considered highly unlikely. Although common amphibian species cannot be ruled out, this receptor is not sufficiently valuable (low numbers of commonly occurring species) for significant impacts to arise.	Local
Water voles	Not considered to be present on site.	Not applicable
Badgers, rabbits, brown hare, hedgehog	These receptors are not considered to be sufficiently valuable for significant impacts to arise, either because they are not considered to be present on site (badgers), occur in insufficient numbers (brown hare, hedgehog), or in the case of rabbits, they are common and widespread.	Local
Scrub and Woodland	The small areas of scrub and woodland habitat that could potentially be affected by the proposals comprise common and widespread species. Receptor not considered sufficiently valuable for significant impacts to arise.	Parish/Local

12.5 Impact assessment

12.5.1 The Project

- 12.5.1.1 The Project is the construction and operation of a tidal powered offshore generating station on the seabed south of and connecting to Swansea Docks between the dredged channels of the Rivers Tawe and Neath.
- 12.5.1.2 The Project can be split into three main elements: the Offshore Works, Onshore Works, and the Grid Connection Works. Further details are provided in Chapter 4: Project Description.
- 12.5.1.3 The main construction and operation activities are linked to:
- the Offshore Works;
 - the western and eastern landfall facilities;
 - the electricity connection to the National Grid; and
 - access works including parking, road infrastructure and pedestrian/cycle routes.

12.5.2 Design appraisal and high level overview of potential impact areas

- 12.5.2.1 A number of activities are assumed to take place prior to commencement of the construction phase, including advanced ecological works to safeguard or avoid constraints associated with features of nature conservation interest. Activities expected to be carried out within the pre-construction phase would include localised vegetation clearance, fencing, and preparation of receptor sites as well as translocation of protected or notable species (such as reptiles).
- 12.5.2.2 Land that will be subject to construction activities will require vegetation clearance and ground preparation prior to the construction starting. The final phase of construction would entail landscape reinstatement and ecological enhancement measures, to the extent that they are not undertaken during the works themselves.
- 12.5.2.3 The operational phase will encompass the use of the Project for the generation of electricity and will include general maintenance activities as well as potential recreational uses.
- 12.5.2.4 At the end of the lifetime of the Project decommissioning may be required. As discussed in Chapter 4, there are two possible options being considered: on-going use; or removal of turbines/sluice gates. The retention of the lagoon seawalls is considered to be important, as parts of the seawall are likely to become integral to the survival of valuable habitats and / or species.
- 12.5.2.5 In general, three strategies are used to negate the adverse impacts of development - in order of preference: avoidance, mitigation and compensation. These involve in the case of:
- I. avoidance - achieved through temporary measures including timing to avoid seasonal constraints;
 - II. mitigation – actions designed to reduce the significance of adverse impacts; and
 - III. compensation - actions off-setting residual impacts remaining following the application of mitigation measures.
- 12.5.2.6 This assessment, particularly for coastal receptors such as Crymlyn Burrows SSSI, places a high degree of reliance on both coastal modelling (Chapter 6: Coastal Processes, Sediment Transport and Contamination) and computational fluid dynamic modelling (Appendix 12.9).

12.5.3 Potential construction impacts, mitigation and residual impacts

- 12.5.3.1 This section describes the potential impacts resulting from the construction of the Project. Where impacts are identified, mitigation measures are outlined. The residual impacts are then presented.
- 12.5.3.2 Significant pre-mitigation impacts likely to result from construction of the Project may include:
- a. habitat loss or modification (temporary or permanent);
 - b. killing, injury or disturbance of protected or notable species; and
 - c. pollution events.

- 12.5.3.3 Construction of the Project will result in permanent land-take where new infrastructure is required, as well as temporary land-take associated with construction compounds, material storage, batching plants and installation of buried infrastructure. Areas of land have been identified as potential temporary sites within the Order Limits, but final locations will be determined prior to construction commencing (Chapter 4: Project Description). The land requirement for temporary construction-related facilities includes:
- office, parking and access control -100m x 260m (or equivalent);
 - batching plant, stockpiling area/pre-casting yard – 100m x 170m with rail access;
 - steel fabrication yard – 170m x 132m with rail access; and
 - storage yard - 625m x 100m.
- 12.5.3.4 A shorefront area currently comprising recently re-vegetated made-ground at the western end of Queens Dock is anticipated to form the main onshore office, parking and access control area. This area would provide land access to the western arm of the lagoon seawalls and the turbine/slucice gate structure.
- 12.5.3.5 Two locations have been identified as support areas for siting of a batching plant, fabrication yard, bulk materials storage and stockpiles. The first is anticipated to be located within the peninsula of land between Queens Dock and Kings Dock. A second has been identified to the south of Fabian Way within an area of manmade ground to the west of the Dŵr Cymru Welsh Water Waste Water Treatment Works (WWTW).
- 12.5.3.6 Construction activity would also be associated with the eastern arm of the lagoon seawall which makes landfall opposite the SUBC. It is proposed that the main construction of the lagoon wall will be from the sea although the landfall will have to tie in to sand dune habitat contiguous with the western boundary of Crymlyn Burrows SSSI.
- 12.5.3.7 Further impacts would result from construction of the Grid Works, enabling electricity generated by the Project to be exported to the National Grid at Baglan Bay substation (Chapter 4: Project Description). The preferred subterranean cable route follows the western arm of the seawall to the port road, passes through or adjacent to the land near the SUBC, then follows the port road to the southern edge of Fabian Way. The route would be located within a cycleway and highway verge on the southern side of Fabian Way until reaching a point to the south-west of the 'Amazon roundabout' where it would follow the alignment of an existing metalled road through Crymlyn Burrows SSSI. In the event that constraints inhibit use of the verge alongside Fabian Way, an alternative route along a footpath and track at the northern edge of the SSSI would be used between the SUBC and the Amazon roundabout. Two options are being considered for crossing beneath the River Neath namely use of existing ducts or by constructing new ducts using directional drilling. The latter would require a single launch area and a single reception area located on either side of the River Neath. Existing tracks and metalled surfaces would be used to align the cable on a route passing from the River Neath to the western side of the Baglan Bay substation. The proposed routes maximise usage of existing made ground and metalled surfaces. Figure 12.1 presents the cable route options.
- 12.5.3.8 Other construction activities, for example, development of the seafront beside the Queens Dock for an access road, would result in disturbance of coastal grassland and scrub communities, whilst potentially enhancing the ecological value of land currently largely devoid of interest (with the exception of localised populations of species such as Golden-samphire) due to the presence of rock armouring and concrete. In addition, a haul road aligned along the existing coastal edge will be constructed between the docks

and eastern landfall. Ultimately, the haul road will be become enveloped within an artificial dune front although part of it will be re-used as a cycleway.

- 12.5.3.9 Noise, vibration, light pollution, dust and an increased level of disturbance caused by movement of vehicles and presence of construction workers have the potential to affect species in adjacent habitats to the Project. Uncontrolled dust has the potential to smother vegetation. Noise and vibration may disturb species and encourage localised avoidance. Vehicle movements have the potential to cause road traffic related mortality.
- 12.5.3.10 Invasive species are also present within the docks estate and, without appropriate control measures, could be spread during construction activities.
- 12.5.3.11 A Construction Environmental Management Plan (CEMP) will seek to ensure best practice standards are applied and that environmental receptors associated with the Project are protected. The CEMP is discussed further in Chapter 4: Project Description.

12.5.4 Potential construction impacts on key ecological receptors

Crymlyn Bog & Pant-Y-Sais Fen SAC, SSSI, Ramsar, NNR and LNR

- 12.5.4.1 A concrete batching plant is required during the construction phase of the Project. Guidance on construction impacts by the Institute of Air Quality Management (IAQM, 2012) defines the presence of onsite concrete batching plants within the *Large* dust emission class. However, the risk of potential impact reduces with distance and *Low Risk Sites* are defined as those with ecological receptors occurring at distances of 40-100m. The significance of a *Low Risk Site* employing mitigation measures on an ecological receptor of *Very High* value (Crymlyn Bog SAC) is assessed as Negligible. Modern concrete batching plants are enclosed, screened and employ recycling methodologies to limit impacts traditionally associated with these facilities, which include the discharge of alkaline waste waters, noise and emission of dust.
- 12.5.4.2 The preferred siting of the facility would be on the peninsula of land between the Kings and Queens Dock (500m from Crymlyn Bog SAC) and the closest potential facility would be sited immediately to the south of Fabian Way, to the west of the WWTW (170m from Crymlyn Bog SAC). The use of a modern concrete batching plant monitored under a CEMP is considered to mitigate the potential for impact.
- 12.5.4.3 No direct or indirect potential impacts have been identified during the construction phase of the Project on this receptor of **International** importance due to the distance of Crymlyn Bog & Pant-Y-Sais SAC, SSSI, NNR and LNR from the Project and a lack of impact pathway.

Kenfig SAC, SSSI, NNR and LNR

- 12.5.4.4 No direct or indirect potential impacts have been identified during the construction phase of the Project on this receptor of **International** importance due to its distance from the Project and a lack of an impact pathway.

Crymlyn Burrows SSSI

- 12.5.4.5 Coastal processes will begin to change as soon as the first sections of lagoon seawall are constructed. Based on the hydrodynamic, sediment transport and wave modelling results along with a conceptual understanding of sediment transport pathways in and

around Swansea Bay, it is predicted that the eastern lagoon seawall will have a sheltering effect on the shoreline fronting Crymlyn Burrows SSSI. Sediment input towards Crymlyn Burrows occurs during storm events when sediment is transported towards the Neath Estuary from the south-west and is moved in a westerly direction by an anticlockwise circulatory current. Closer to the shore sediment is then influenced by prevailing wind and waves resulting in an easterly shift of sediment along the shoreline. Over the last 200 years, sand accretion has resulted in the formation of a series of parallel dune ridges at a tangent to the channel of the River Neath. The foredune environment is dynamic with long-term trends a result of net sand deposition set against erosion, particularly during winter storms. Although both Crymlyn Burrows and Baglan Burrows act as sediment sinks, winter storms result in the periodic transfer of sand to the Neath channel and between the two dune systems (Chapter 6: Coastal Processes, Sediment Transport and Contamination).

- 12.5.4.6 The complex of open dune habitat supports large populations of sand dune specific plant species uncommon elsewhere along the Welsh coast. The mosaic of dune and saltmarsh habitat is considered of high conservation value and represents one of the last major areas of undeveloped coastline in Swansea Bay. It also forms a significant biodiversity resource providing connectivity between similar habitats within the bay and further afield.
- 12.5.4.7 Construction of the lagoon seawalls will influence the behaviour of local currents (Chapter 6: Coastal Processes, Sediment Transport and Contamination). This change will contribute to a reduction in the strength of tidal currents in a westerly direction along the intertidal fronting Crymlyn Burrows, in addition to those moving in a southerly direction along the eastern side of the new lagoon wall. Construction of the eastern seawall will also provide a limited amount of wave protection to the Crymlyn Burrow frontage between the structure and the entrance to the River Neath to waves approaching from the predominant wave direction, the south-west.
- 12.5.4.8 Coastal process modelling suggests that the Project will result in a build-up of sandy sediment along the outer edge of the eastern lagoon seawall, as well as towards the western edge of Crymlyn Burrows. Computational Fluid Dynamic modelling of south-westerly wind flows also suggests a slight reduction in velocity at ground level within 100m of the lagoon seawall (Appendix 12.9). Given these findings, it appears likely that an intertidal sand ridge will culminate in new foredune/ mobile dune habitat adjacent to the eastern landfall of the lagoon at the western edge of Crymlyn Burrows SSSI.
- 12.5.4.9 Construction of the eastern arm of the lagoon will stop fluvial exchange of sand between intertidal areas within and outside of the lagoon although Aeolian movement during windy weather conditions will continue. A reservoir of sand will remain within the intertidal zone and creation of an artificial beach within the Lagoon at the eastern landfall will provide additional sand. Supply of windblown sand to the western edge of Crymlyn Burrows SSSI is not expected to significantly change during construction.
- 12.5.4.10 The qualifying features of Crymlyn Burrows SSSI include: saltmarsh; sand dune; important invertebrate assemblages; in addition to specific invertebrate interest due to the presence of the strandline beetle *Eurynebria complanata*:
- i. saltmarsh - predicted changes do not appear likely to alter the flow of water into saltmarsh habitat associated with Crymlyn Burrows during tides;
 - ii. sand dune – no net loss of sand dune communities (strandline, foredune, mobile dune, fixed dune and dune slacks) is envisaged based on the modelling results,

particularly given that a net gain in sediment is expected. However, it appears likely that the strandline and mobile dune frontage will change in shape reflecting the physical presence of the lagoon seawall and deposition at its outer edge;

- iii. invertebrate assemblage – the bulk of habitat associated with Crymlyn Burrows is expected to remain unchanged by the Project and therefore, modification of the invertebrate assemblages would not be expected. Sand accretion at the outer edge of the lagoon wall would be expected to change the position of the strandline. However, a dynamic strandline and the invertebrate assemblage associated with it is expected to remain; and
- iv. *Eurynebria complanata* – this predatory ground beetle is closely associated with beach detritus at the high tide line of some sandy beaches. A reduction in the available strandline habitat at Crymlyn Burrows is not expected and therefore an impact on the strandline beetle is also not expected.

- 12.5.4.11 The significance of the potential impact of coastal process changes to this receptor of **National** importance during construction is considered as **Neutral**.
- 12.5.4.12 The cable and grid connection required to export electricity generated by the Project to the NETS will directly affect the northern fringes of the SSSI. Two main options have been considered for the purposes of this chapter (the cable and grid connection is described in more detail in Chapter 4: Project Description):
- 12.5.4.13 Option 1 follows the western arm of the lagoon, through made ground at the southern edge of the docks, and along pre-installed ducting through the SUBC (or along Fabian Way if ducting is not installed during the SUBC construction phase) before travelling along the southern edge of the Fabian Way road verge. The route enters the SSSI at a point immediately west of the Amazon roundabout where it would be aligned with an existing metalled track. Construction for cable installation would entail the creation of a 10-15m wide easement over the 1km SSSI cable run. Excluding the 3.5m wide track, temporary loss or disturbance of between 6500m² and 11500m² of existing fixed dune grassland habitat would result. The vegetation would be allowed to re-instate upon completion of the works.
- 12.5.4.14 Option 1 would utilise the presence of existing disused pipework as ducting to cross beneath the River Neath before continuing along existing tracks to Baglan Bay substation. The size of existing pipework provides limitations for the crossing and three pipes would be required. One of these available pipes is located approximately 25m from the other two, within an area currently supporting mud and sand. It is anticipated that approximately 300m² of habitat would be temporarily disturbed during construction. Invasive species such as Japanese Knotweed have not been found under the footprint of the cable route options, therefore the risk of spreading invasive species is considered to be low.
- 12.5.4.15 Option 2 follows the same route as Option 1 until the SUBC access road where it is aligned within the SSSI along an existing easement historically used by BP. In the past the easement was subject to regular disturbance by BP, although in recent years cessation of activity has led to the development of increasingly fixed grassland habitat and encroachment of scrub. A risk of potential ground contamination exists due to historical use of pipework to transfer hydrocarbon fuels and oils (gasoline, kerosene, diesel and crude oils) as well as solvents (especially BTEXS – benzene, toluene, ethylbenzene, xylenes and styrene) between Queens Dock and the former Baglan Chemical Works. Detailed ground investigation would be required prior to commencement of construction

in order to inform a working methodology acceptable to NRW although ground contamination would be an additional material consideration in the choice of route options.

- 12.5.4.16 The proposed route follows the northern edge of the SSSI until it meets the metalled tracks to the south of the Amazon roundabout. From there, the route follows the path described in Option 1.
- 12.5.4.17 For both potential options, in the event that existing pipework cannot be used as ducting to cross beneath the River Neath the cable would be deployed by directional drilling between the SSSI and eastern banks of the Neath.
- 12.5.4.18 Cable installation would entail the creation of a 10-15m wide easement over an 1850m SSSI cable run. Excluding the 3.5m wide track, temporary loss or disturbance of between approximately 11,600m² and 20,500m² of existing fixed dune grassland habitat would result.
- 12.5.4.19 In addition, approximately a 40m by 40m compound will be required to intercept or launch the directional drill between the SSSI and the eastern banks of the River Neath. The launch / interception compound will result in loss of a further 1600m² of fixed dune grassland and gorse-dominated scrub.
- 12.5.4.20 Notable plant species including Dutch Rush as well as invasive plant species including Early Goldenrod are associated with the route of Option 2. The route also passes in close proximity to the location of a population of Field Wormwood. In the event that Option 2 is progressed, the construction easement would be minimised at sensitive locations including those supporting Dutch Rush or Field Wormwood.
- 12.5.4.21 In the absence of mitigation, construction works whilst not likely to threaten the integrity of the site would result in the loss of dune grassland and potential spread of invasive species. The impact of Option 1 is considered to be significantly less than Option 2 although both, without mitigation, are considered to be of **Moderate Adverse** significance.

Mitigation

- 12.5.4.22 Construction works associated with the SSSI including mitigation measures will be discussed and agreed with NRW prior to commencement. It is anticipated that mitigation to reduce the potential impacts of construction could include:
 - i. creation of an artificial dune-scape at the base of existing coastal defences at the north-east edge of the lagoon. This will provide a source of sand for redistribution towards Crymlyn Burrows by wind action;
 - ii. use of the existing metalled track for site access for eastern section of SSSI;
 - iii. pre-construction treatment of any invasive species found under the footprint of the works, or mechanical removal during construction;
 - iv. minimising the construction easement to avoid areas of sensitive habitat including areas supporting notable species, particularly Field Wormwood;
 - v. seasonal timing of construction works during autumn / winter months when vegetation is relatively inactive;
 - vi. minimising the time working within sensitive habitats (the works are likely to proceed at a rate of between 30m and 40m per day);

- vii. use of geo-textile membranes or ground protection mats for topsoil and subsoil storage to reduce compaction and tracking over habitat;
- viii. topsoil and subsoil (or equivalent sandy substrate) are to be stored separately and as close as possible to the area of construction;
- ix. minimising the time that spoil is stored and reinstating as work progresses;
- x. trenching immediately adjacent to existing track (in the region of 70cm trench width, where possible) to reduce temporary loss of habitat in the absence of other constraints including existing services; and
- xi. re-instatement to be through the spreading of subsoil, followed by spreading of topsoil and allowing the vegetation to re-colonise naturally.

12.5.4.23 In the short-term, the above construction methodology would lead to localised temporary loss of fixed dune grassland habitat along the width of the cable trench and directional drill receptor pit, in addition to temporary covering of habitat by ground protection measures. In the medium to longer term, this creation of bare ground and reinstatement of dune grassland would result in some positive impacts. Overall, it is envisaged that the significance of construction activities associated with the cable route options would be **Minor Adverse** in the short-term with the implementation of the mitigation measures identified above, and **No impact** in the longer term on this receptor of **National** value.

Blackpill SSSI

12.5.4.24 Blackpill SSSI is an intertidal site designated for its assemblage of wading birds. In terms of terrestrial ecology, the main focus of interest is a limited area of dune habitat which falls within the SSSI boundary but which is otherwise located between hard-engineered sea defences and the SSSI. The site is also assessed as part of Chapter 8, Intertidal and Subtidal Ecology, in addition to Chapter 11, Coastal Birds.

12.5.4.25 As discussed previously coastal processes will begin to change as soon as the first sections of lagoon seawall are constructed in early 2015. Coastal modelling predicts that the Project will result in a net reduction in the strength of currents within the western part of the bay due to constriction of the bay between Mumbles headland and the outer extent of the lagoon wall. Reflection of south-westerly waves off the outer lagoon wall will result in a small predicted increase in wave height to the southern part of the SSSI (behind Mumbles) along with an associated small reduction in wave period.

12.5.4.26 In general, analysis of annual beach profiles indicates slight accretionary trends across the western side of the bay.

12.5.4.27 McCue, Pye and Wareing (2010) considered existing longshore sediment transport rates to be low in the north-western part of the bay but with a slight net easterly drift from Blackpill towards the docks and low wave energy at the shoreline except during easterly and south-easterly gales.

12.5.4.28 Currently aperiodic sand transport also occurs from east to west, i.e. from the Neath towards Blackpill, under storm conditions (with large waves approaching from the south-west). It is during these storm conditions when wave disturbance may be sufficient to re-suspend sandy sediments within the entrance to the Neath enabling transport in a westerly direction across the bay under large spring tide ebb flows (between circa high

water (HW) and HW + 3 hours). Any such transport is unlikely to occur under more 'normal' tide and wave conditions.

- 12.5.4.29 Construction of the Project would interrupt aperiodic transport of sandy material from the eastern part of the bay to the west, leaving direct transport from offshore during south-westerly and south-easterly storms as the primary source of sand. The blocking of the intermittent sand supply appears likely to lead to a more stable profile in future. However, no impacts to suspended solid concentrations or sediment deposition have been predicted during the construction phase of the Project (Chapter 6: Coastal Processes, Sediment Transport and Contamination).
- 12.5.4.30 A further indirect impact upon the Blackpill SSSI will occur as the Project nears completion through a 1-2cm increase in low water levels across the western area of Swansea Bay. The result of the increased low water level height would be a 2.88ha loss of intertidal habitat, 0.12% of the available intertidal habitat within Swansea Bay (2424ha) and 0.62% loss of Blackpill SSSI (467.4ha) (see Chapter 4 Project Description for full details of habitat changes as a result of the Project). The loss is not considered likely to affect the integrity of the SSSI but is considered further in Chapters 6 and 11.
- 12.5.4.31 Potential impacts on terrestrial ecology during construction largely concern interruption of sand sediment supply (from east to west). This has the potential to result in a reduction in sand supply to the western region of Swansea Bay under certain storm conditions which may lead to a small, long-term net erosion of the sandy beaches within the upper extents of the intertidal, i.e. in a narrow band fronting the existing coastal defences, although no evidence of change would be expected during the construction phase. The significance of this to dune habitat associated with Blackpill SSSI is assessed as **Neutral** equating to a **no impact** on this receptor of **National** importance.

Mitigation

- 12.5.4.32 No mitigation measures are proposed.
- 12.5.4.33 The residual impact on this receptor of **National** value is envisaged to be **Neutral** equating to **No Impact**.

Oxwich Bay SSSI and NNR

- 12.5.4.34 No direct or indirect potential impacts have been identified during the construction phase of the Project on this receptor of **National** importance due to its distance from the Project and a lack of impact pathway.

Red Jacket Fen WTR

- 12.5.4.35 No direct or indirect potential impacts have been identified during the construction phase of the Project on this receptor of **District** importance due to the distance of Red Jacket WTR from the Project and a lack of impact pathway.

Fabian Way Conservation Verge

- 12.5.4.36 Cable installation (Option 1 only) involving open cut trenching in the region of 70cm width over 1km of verge along Fabian Way will disturb existing grassland habitat. The cable route follows the southern edge of Fabian Way before entering Crymlyn Burrows SSSI. The mitigation measures described for Crymlyn Burrows above would be implemented and would result in a short term **Minor Adverse** impact. Grassland recovery would be expected in the medium term resulting in **No impact**.

Bare ground, ephemeral and short perennial vegetation

- 12.5.4.37 Construction activities will impact bare ground, ephemeral and short perennial vegetation at two key locations: the western end of the docks estate; and the eastern banks of the River Neath. In addition, depending on final placement of site support areas, further impact would occur to either: made-ground between Kings and Queens Dock; or the made-ground situated to the west of the WWTW.
- 12.5.4.38 Land at the western end of the docks estate will be lost during construction of access routes to the western lagoon seawall, creation of car parking areas and building of the boating centre/laboratory/hatchery. Compacted aggregate on the leeward side of the sea wall currently supports Oak-leaved Goosefoot and Rock Sea-lavender. The Rock Sea-lavender occurs within an area equating to approximately 150m². Loss of this habitat is considered a **Major Negative** magnitude impact to a site of Local value equating to a **Minor Adverse** impact.
- 12.5.4.39 Made-ground between the Kings Dock and Queens Dock is an active area largely devoid of vegetation. The site is considered of **Negligible** value and the construction impact is considered **Insignificant**.
- 12.5.4.40 The 7ha site to the west of the WWTW consists of man-made ground surfaced with coarse aggregate to the north, and increasingly vegetated ground to the south-east. The site is considered of **Negligible** value and the construction impact is considered **Insignificant**.
- 12.5.4.41 Construction of the cable route also has potential to impact habitat on the eastern banks of the River Neath. Basil Thyme was found in bare ground near the pipe-bridge and Yellow Bartsia in grassland habitat. Habitat associated with the eastern banks of the Neath is considered of **District** value. Given the temporary nature of the impact and association of species present with disturbed habitats, even in the absence of mitigation, the magnitude of the impact is considered to be **Minor Negative** equating to **Insignificant** construction impact.

Mitigation

- 12.5.4.42 Mitigation measures designed to reduce the potential for construction impacts include:
- i. Storage and reuse of substrate (docks estate) supporting Rock Sea-lavender in artificial rocky shore habitat creation areas of lagoon seawalls. Habitat with the potential to support Rock Sea-lavender will be formed on appropriate areas of seawalls of the Project; and
 - ii. Scheduling of construction works (on the eastern banks of the Neath) during autumn / winter (September to March) in order to avoid destruction of annual plants before they have the opportunity to set seed.
- 12.5.4.43 It is anticipated that with the implementation of the mitigation outlined above, there would be **No Impact** on this receptor of **Local to District** value.

Saltmarsh outside designated sites

- 12.5.4.44 No direct or indirect potential impacts have been identified during the construction phase of the Project on saltmarsh habitat outside of designated sites.

- 12.5.4.45 A habitat creation area has been proposed at the seaward edge towards the eastern side of the docks estate. The area will be approximately 5ha in size and created from dredged spoil arising from construction of the Project. It will be partially enclosed by a bund with purpose-built gaps to allow tidal flooding. Levels in approximately a third of the habitat creation area will be designed to flood twice-daily, whilst levels will taper so that much of the rest of the area only floods occasionally. Figure 12.2 shows the locations of the key habitat creation area. The proposal is considered as enhancement rather than mitigation for any perceived impact on existing saltmarsh habitat and is therefore considered a **Moderate Beneficial** impact.

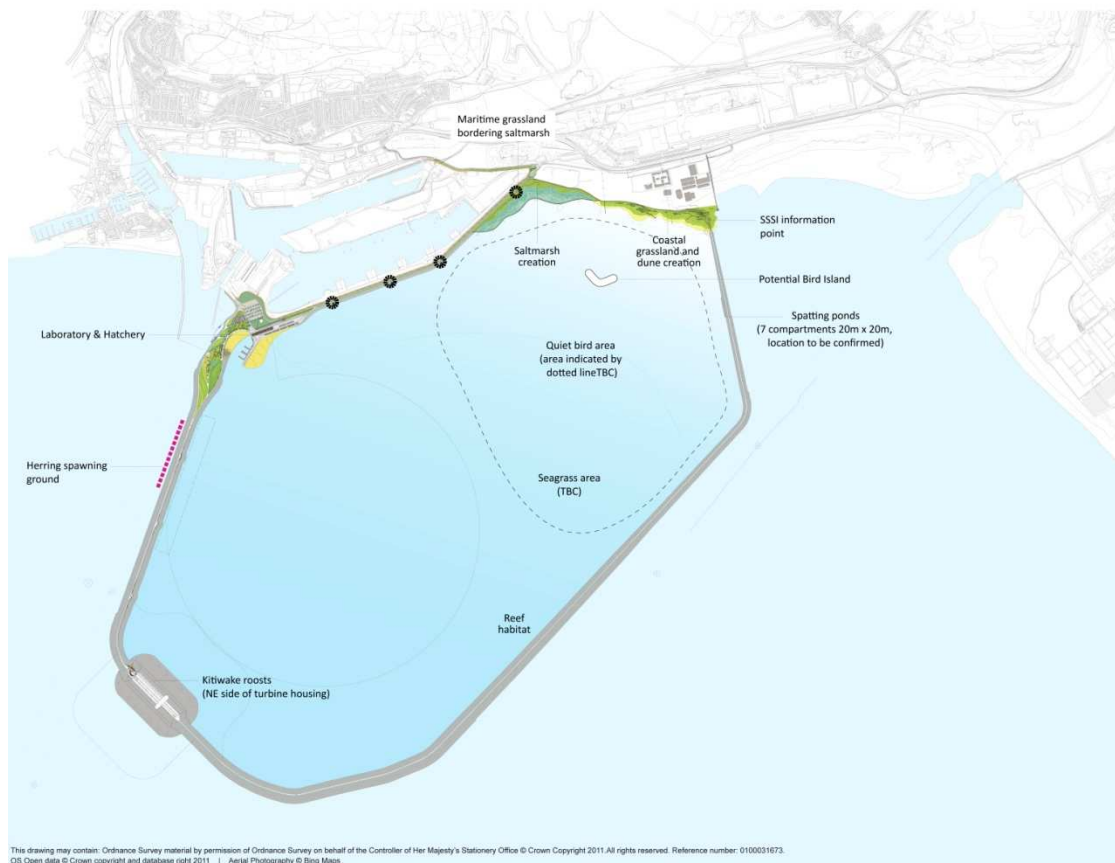


Figure 12.2 Key ecological features

Sand dune outside of designated sites

- 12.5.4.46 Coastal processes will begin to change as soon as the first sections of lagoon seawall are constructed. The most significant undesigned habitat resource in proximity to the Project is Baglan Burrows and Aberafan Sands to the east of the Project. Coastal process modelling suggests neither of these sites would be adversely affected by the Project. It is anticipated that there would be **No Impact** on these receptors of **County** value.
- 12.5.4.47 The potential impact of the Project at the western end of Swansea Bay (discussed in Blackpill SSSI above) includes the interruption of a sand sediment supply (from east to west) during storm events leading to a slight increase in the potential for beach erosion between West Cross and Singleton Park in the long term. This is localised in a narrow band forming the existing coastal defences at Blackpill. This is unlikely to be a significant impact in relation to this dune habitat (including SINC habitat - Spontex Dunes fronting the Maritime Quarter) in the short term and is assessed as Negligible equating to a **No impact** on this receptor of **County** importance.

- 12.5.4.48 A section of sand dune habitat contiguous with, but not encompassed by Crymlyn Burrows SSSI is located at the landfall of the eastern lagoon seawall. The dune habitat largely consists of fixed dune grassland protected by a seaward wall of rock armour (see Plate 12 below). Approximately 200m towards the east is not fronted by rock armour. Where existing rock armour is present it replaces any strandline or mobile foredune community that would typically exist, and the remaining grassland is considered unlikely to be subject to any meaningful input of windblown sand. Construction of the eastern lagoon seawall will result in this habitat being enclosed within the Project.



Plate 12: Rock armour fronting dune grassland to the west of Crymlyn Burrows SSSI (16/07/2013).

- 12.5.4.49 Existing dune habitat (protected from development as part of the SUBC planning permission) would be enclosed by construction of a seawall and temporary haul road along the sea defences and upper beach. This new structure would follow the alignment of the existing rock armour (shown in Plate 12 above). The eastern arm of the lagoon (arriving at a tangent to the existing coastline) will link to this structure in order to enclose the lagoon and avoid construction within existing dune habitat. The creation of new artificial dune habitat will be undertaken seaward of the haul road and it is within this new ground that the SSSI information facility will be located. The artificial dune habitat will be created using materials of a suitable grade dredged during construction of the Lagoon.
- 12.5.4.50 Existing dune habitat at the western end of Crymlyn Burrows (and fronting the SUBC) is avoided during construction although approximately 200m of natural foredune will be enclosed by the Project. The loss of this active foredune community is assessed as a **Minor Adverse** impact.

Mitigation

- 12.5.4.51 Mitigation measures designed to reduce the construction impacts include the creation of an artificial dune front, using material dredged from within the lagoon footprint, to tie in existing habitat with the new lagoon seawall. The tie in point will connect with existing sea defences fronting the SUBC. The artificial dune front will increase the area of dune habitat (5.5ha).
- 12.5.4.52 The likelihood of beach erosion within the western part of Swansea Bay during construction is considered low whilst mitigation proposals involve the creation of a new artificial dune front within the lagoon footprint, and potentially beach nourishment along beaches in the western extent of the bay. The significance of construction activities without mitigation is assessed as having a **Minor Adverse** impact on existing habitat but an increase in overall dune habitat equates to a **Minor Beneficial** impact.

Grassland

- 12.5.4.53 Construction activities will affect coastal grassland habitat supporting section 42 invertebrate species and locally, Common Lizard. In particular, habitat within the docks estate will be affected. Using criteria set out in Wildlife Sites Guidance Wales (Wales Biodiversity Partnership, 2008) the assemblage of plant species in addition to the invertebrate and reptile species associated with the grassland suggests the habitat meets the requirement of a local wildlife site.
- 12.5.4.54 The key areas include plots to the west of the Queens Dock as well as a fringe of habitat in the lee of the sea wall. Removal of the sea wall and construction of a new access route over the existing grassland, is due to an ABP requirement for retention of the existing port road within an area of restricted public access.
- 12.5.4.55 In total, approximately 4.2 hectares of coastal grassland will be lost during construction. The loss of this habitat in the absence of mitigation is assessed as being of **Moderate Negative** magnitude and therefore **Moderate Adverse** impact on this receptor of **District** importance.
- 12.5.4.56 Coastal grassland communities within the docks estate have developed on artificial substrates. Biodiversity interest within areas such as ports often develop as a direct result of piecemeal development, abandonment and disturbance that creates a mosaic of substrates in varying states of colonisation.

Mitigation

- 12.5.4.57 Mitigation measures designed to reduce the construction impacts include:
- i. retention of habitat strips at least 3m wide associated with the grassland in the lee of the sea wall towards the south-east of Queens Dock (1.55ha retained);
 - ii. grassland creation along the landward side of new saltmarsh following removal of the existing sea wall (1.04ha). Colonisation of existing rock armoured sea defences will also be encouraged through infilling of large gaps with aggregate and localised topping with sandy spoil / topsoil;
 - iii. creation of a dedicated coastal grassland plot to the seaward edge at the south-eastern end of the docks estate (creating approximately 3ha of coastal grassland habitat with a transition to saltmarsh habitat as well as connectivity to dune habitat towards the east);
 - iv. creation of grassland habitat at the periphery of parking bays at the western end of the Project; and
 - v. translocation of grassland turves and reuse of topsoil from areas of species-rich sward to encourage the establishment of coastal grassland habitat in the newly created areas with plants of local provenance.
- 12.5.4.58 The significance of construction activities following implementation of mitigation measures is assessed as being **Minor Adverse**.

Artificial rocky shore habitat

- 12.5.4.59 Coastal sea defences along the southern fringes of Swansea Docks have developed cracks and crevices providing a foothold for plant species otherwise associated with rocky shorelines. In particular, colonies of Golden-samphire, Rock Samphire, Rock Sea-lavender and Sea Thrift are present. Construction of the Project will enclose these

habitats and reduce exposure of these habitats during poor weather conditions. In addition, removal of the existing 2m high seawall will result in direct habitat loss. Loss of habitat supporting a scattered presence of species of local note along a 1.5km section of the western sea wall (although cover is largely concentrated in a 150m² area to the south-western of Queens Dock), is assessed in the absence of mitigation, as being of **Minor Negative** magnitude equating to an **Insignificant** impact.

Mitigation

12.5.4.60 Mitigation measures designed to reduce the construction impacts include:

- i. translocation of robust plants (such as Golden-samphire) or substrates containing target species (such as Rock Sea-lavender) to holding areas where they can be relocated to newly created habitats on lagoon walls; and
- ii. the creation of purpose-designed artificial rocky shore habitat on new lagoon seawalls. These will comprise shelves of compacted aggregate mixed with fines on internal parts of the lagoon seawall. In addition, similar features will be created on less exposed sections of the external lagoon seawall. At least 5km of such habitat will be created along new lagoon walls.

12.5.4.61 The significance of construction activities on artificial rocky shore habitat following mitigation measures is assessed as **Minor Beneficial**.

Ground nesting birds

12.5.4.62 Ground nesting birds and in particular the section 42 NERC 2006 species, Lapwing and Ringed Plover, are associated with areas of bare ground supporting ephemeral and short perennial vegetation. Two key areas were identified during breeding bird surveys: made-ground between Kings Dock and Queens Dock; and open ground to the west of the WWTW.

12.5.4.63 Lapwing have declined significantly in recent years with an estimated breeding population of only 600 pairs left in Wales (RSPB, 2013). Although surveys suggested Lapwing attempted to breed within the docks estate no evidence to suggest success was observed. Foxes, as well as other potential predators including Carrion Crow, are widespread locally and may explain the apparent breeding failure.

12.5.4.64 Lapwing (one pair) and Ringed Plover (one pair) at least attempted to breed at the far eastern end of an area currently being used to store inert spoil material, between the Kings Dock and Queens Dock. The area is a preferred location to accommodate construction infrastructure although the land requirement at this location is unlikely to result in sterilisation of the entire site for these species (Ringed Plover in particular were observed in the presence of working bulldozers). Construction activity may displace these ground-nesting birds from the vicinity of the support areas although alternative potential nesting sites are likely to remain. This includes an area of brown field land south of Baglan Bay Power Station that is to be managed for Lapwing, in addition to sites such as former BP land within the docks estate. The impact of construction on these ground-nesting birds is assessed as temporary **Minor Negative** magnitude equating to an **Insignificant** impact to a receptor of **District** value.

12.5.4.65 A second area, a 7ha site to the west of the WWTW consists of man-made ground surfaced with coarse aggregate. Lapwing (two pairs) and Ringed Plover (one pair) also attempted to breed within part of this site. The impact at this second site is also considered to be **Insignificant**.

Mitigation

12.5.4.66 Mitigation measures designed to reduce the construction impacts include scrub cover or rank grassland to be removed / cut outside of the breeding bird season (end of February to end of August); pre-construction checks in areas with residual potential for nesting birds; the reinstatement /site clearance of bare and open areas (devoid of clutter) with potential to support ground nesting birds following the cessation of construction activities.

12.5.4.67 The significance of construction activities following mitigation measures is assessed as **Insignificant**.

Invertebrates

12.5.4.68 A total of 11 section 42 NERC 2006 moth species and 4 butterflies were identified within the docks estate. Review of food plant preferences suggests the majority of these species are associated with coastal grassland habitat. Invertebrate surveys targeting the docks estate identified a relatively diverse assemblage of common or local species fairly typical of brownfield sites in the Swansea area (Appendix 12.8, Volume 3).

12.5.4.69 The construction phase has the potential to impact the invertebrate assemblage through habitat loss - principally loss of grassland. However, the presence of some of the invertebrate food plants is itself the result of disturbances associated with temporary land use within the port. The mosaic of brown field sites with dry and infertile substrates at varying stages of colonisation helps to safeguard populations of some species by ensuring habitat with food plants are available. The invertebrate assemblage within the docks estate is considered to be of **District** importance and the magnitude of loss associated with the construction phase is classified as **Moderate Negative** equating to **Minor Adverse** impact.

Mitigation

12.5.4.70 Mitigation measures designed to reduce the construction impacts include:

- i. retention of grassland habitat plots in order to ensure presence of food plants for colonisation in addition to adult, eggs or pupae of invertebrates;
- ii. reuse of grassland turves or topsoil to encourage re-establishment of diverse grassland plots; and
- iii. using infertile substrates in habitat creation areas to encourage colonisation by a diverse assemblage of plants more likely to support a diverse invertebrate fauna.

12.5.4.71 The impact of construction on the invertebrate assemblage within the docks estate is considered to be of **Minor Negative** magnitude equating to **Insignificant** impact.

Other receptors requiring mitigation

Other breeding birds

12.5.4.72 The removal of scrub habitat during the early stages of construction has the potential to disturb nesting birds. Nesting birds are protected under the WCA 1981. Impact during construction is likely to be **Insignificant** due to the general lack of scrub habitat within the area likely to be affected by the Project (1500m² of Gorse scrub in the lea of the sea wall to the south-east of Queens Dock and 550m² of Bramble and Butterfly-bush to the south-west of Queens Dock). However, precautionary measures to safeguard breeding birds will be implemented.

Mitigation

12.5.4.73 The following mitigation measures will be introduced to reduce the risk of disturbing nesting birds:

- i. scrub cover or rank grassland will be removed / cut outside of the breeding bird season (end of February to end of August);
- ii. pre-construction checks in areas with residual potential for nesting birds; and
- iii. provision of Kittiwake ledges on north eastern face of turbine housing (not under any direct lighting). Locations for further ledges will be reviewed at other suitable locations around the lagoon seawall.

Reptiles

12.5.4.74 A small population of Common Lizards (section 42 NERC 2006 species) is found in habitat in the lee of the existing 2m high Port seawall (Appendix 12.7, Volume 3). Ground clearance in the absence of measures to safeguard reptiles has the potential to cause injury or death. All reptiles are protected by the WCA 1981 and Common Lizards are listed as section 42 species. Mitigation measures are proposed to ensure compliance with legislation as the site is considered to support a population of reptiles of **Local** conservation value. The impact of construction is considered of **Moderate Negative** magnitude equating to an **Insignificant** impact.

Mitigation

12.5.4.75 Mitigation measures designed to reduce the potential for construction impacts include:

- i. habitat retention, demarcation and protection (reptile fencing and visibility fencing) designed to facilitate in-situ protection of reptiles in part of the grassland verge to the south-east of Queens Dock;
- ii. habitat manipulation to reduce reptiles cover (scrub removal and grass strimming to 10-15cm) in areas identified for later clearance;
- iii. provision of artificial refugia (100-200 tins per hectare) within areas identified for clearance;
- iv. reptile capture and translocation programme;
- v. clearance under the supervision of an ecologist;
- vi. provision of features such as rock piles within grassland habitat creation areas at the south-eastern edge of Swansea Docks in order to encourage re-colonisation of reptiles from contiguous habitat to the east; and
- vii. removal of temporary reptile fencing as soon as localised construction works have finished to allow reptiles to re-colonise new habitat.

12.5.4.76 The significance of construction activities on reptiles following mitigation measures is assessed as being **Insignificant**.

Otters

12.5.4.77 Video footage from a remotely deployed trail camera and field sign, such as spraints, identified the presence of Otters (section 42 NERC 2006 species) within Swansea Docks. Otters are wide-ranging animals typically occurring at low but variable population densities that often depend on availability of food resources. Research set out by Chanin

(2003) has suggested population densities range from an average of one Otter per 15km of watercourse (Kruuk et al, 1993) to one Otter per 27km of watercourse in England and Wales (Harris et al, 1995).

- 12.5.4.78 It appears likely that one or more Otters occasionally forage within the docks estate and construction activity has the potential to cause disturbance. No holts or other resting places would be directly affected by works and removal of the existing port seawall (a 2m vertical concrete barrier) may actually increase connectivity between the coastline and docks estate. Given the location on the outskirts of Swansea it is also likely that any animals using the docks are in some way habituated to human activity. A **Minor Negative** magnitude of impact to Otters (a receptor of **Parish / Local** value) is considered **Insignificant**.

Mitigation

- 12.5.4.79 Otters are a European Protected Species and therefore mitigation is proposed to reduce the potential impacts on any commuting or foraging individuals.
- 12.5.4.80 Mitigation measures designed to reduce the potential for construction impacts include:
- i. use of directional lighting at construction compounds in order to avoid light spill onto open water of the docks;
 - ii. exclusion fencing to high risk areas and provision of alternative access routes for otter; and
 - iii. ensuring access between the docks and coastline is maintained at all times and that barriers that could impede movement of Otter are not created.

Bats

- 12.5.4.81 Surveys have identified that Common and Soprano Pipistrelle bats (both section 42 NERC 2006 species) forage at the southern edges of the docks estate. Deployment of a static bat detector in September 2013 also indicated use by a Nathusius Pipistrelle. The existing sea defences will be modified during the construction phase as new habitat (sea defences) becomes available and the continued presence of aquatic flies with the potential to support foraging bats is considered likely. Additionally, Pipistrelle bats are not particularly sensitive to artificial lighting. No direct impacts are therefore anticipated on the foraging habitat of bats during construction. A **Neutral** magnitude of impact to bats (a receptor of **Parish / Local** value) is considered **Insignificant**.

Mitigation

- 12.5.4.82 Even though potential impacts have been assessed as insignificant, a construction lighting strategy avoiding light spill will be adopted to ensure that bats continue to use available foraging habitat.

Invasive species

- 12.5.4.83 A number of invasive species have been identified within the study area. Construction activities will take place in areas supporting invasive species. In the absence of mitigation construction activities have the potential to cause the further spread of invasive species and this would be considered of **Minor Adverse** significance.

Mitigation

- 12.5.4.84 Mitigation measures which are designed to reduce the potential spread of invasive species (particularly those listed on Schedule 9 WCA 1981) will be considered, where appropriate, in the CEMP. These include:
- i. identification and demarcation of invasive species infestations;
 - ii. implementation of an invasive species construction management plan aimed at setting out a strategy to avoid their spread; and
 - iii. pre-construction treatment programme or mechanical removal and disposal during construction.
- 12.5.4.85 The magnitude of construction activities on invasive species is considered to be **Neutral** equating to **No Impact**.
- 12.5.5 Summary of potential construction impacts, mitigation measures and residual impacts**
- 12.5.5.1 Table 12.7 presents a summary of potential construction impacts and mitigation measures that will be implemented as appropriate. Residual impacts are then presented.

Table 12.7 Potential construction impacts associated with the Project

Ecological receptor	Potential construction impact	Impact characterisation & significance	Mitigation measure	Residual impact	Confidence in assessment
Crymlyn Bog & Pant-y-Sais Fen SAC, SSSI, Ramsar, NNR and LNR	None identified	No impact	None identified	No impact	Certain
Kenfig SAC, SSSI, NNR and LNR	None identified	No impact	None identified	No impact	Certain
Crymlyn Burrows SSSI	Modification of coastal processes at early stages of lagoon seawall construction resulting in sand deposition fronting Crymlyn Burrows.	Potential for Neutral magnitude impact equating to No Impact .	None identified	No impact	Probable
	Enclosure of intertidal habitat within the lagoon has the potential to inhibit supply of sand towards Crymlyn Burrows.	Potential for Minor Negative magnitude effect equating to a Minor Adverse impact.	Monitoring of beach levels and beach nourishment activities inside the lagoon providing additional sources of sand if required.	Insignificant	Probable
	Habitat loss / disturbance (fixed dune grassland communities) during cable installation. Disturbance of between 1.92% (11500m ²) and 3.68% (22000m ²) of the fixed dune grassland habitat resource (due to requirement of a 10-15m wide easement although disturbance due to trenching requires in the region of 70cm).	Direct but temporary and reversible Moderate Adverse impact during <10 week construction programme in autumn / early winter 2015.	Use of existing access track, ground protection measures and seasonal timing.	Temporary Minor Adverse Medium-term No impact	Certain

Ecological receptor	Potential construction impact	Impact characterisation & significance	Mitigation measure	Residual impact	Confidence in assessment
Blackpill SSSI	Coastal modelling results indicate higher wave energy due to wave refraction from the lagoon towards Mumbles but reduced wave and tidal flow energy to the east but not equating to significant increases to suspended solids concentrations or sediment deposition.	No impact	Angle of SW facing lagoon wall has been reduced and integrated into design to decrease wave deflection from 0.4 to 0.3 co-efficient.	No impact	Probable
	The interruption of aperiodic sand transport from east to west during storm events has the potential to reduce sand input to upper intertidal area slightly increasing potential for beach erosion in the long term but is unlikely to result in any meaningful construction impact.	No impact.	None identified	No impact	Probable
Oxwich Bay SSSI	None identified	No impact	None identified	No impact	Certain
Red Jacket Fen WTR	None identified	No impact	None identified	No impact	Certain
Fabian Way Conservation Verge	Temporary loss of grassland habitat (800m ²) during cable installation (trench in the region of 70cm wide for 1km)	Temporary short term impact leading to a Minor Adverse impact.	Works Autumn/winter (where possible September to March) construction, use of ground protection mats and reinstatement.	Temporary Minor Adverse Medium-term No impact	Certain

Ecological receptor	Potential construction impact	Impact characterisation & significance	Mitigation measure	Residual impact	Confidence in assessment
Bare ground, Ephemeral and Short Perennial Vegetation	Potential for disturbance / loss during construction. Notable plant species with populations in proximity to the Project including cable route include Rock Sea-lavender, Basil Thyme and Yellow Bartsia.	Western end of docks estate - Direct Major Negative impact, particularly to population of Rock Sea-lavender (150m²), to a site of Local value equating to a Minor Negative impact. Kings / Queens Dock Peninsula – construction impact on site of Negligible value equating to Insignificant impact. Site west of water treatment works - construction impact on site of Negligible value equating to Insignificant impact. Eastern banks of the Neath - Minor Negative impact to site of District value equating to an Insignificant impact.	Storage and reuse of substrates supporting notable plant species. Where possible, seasonal timing to avoid growing season of annual plants (i.e. autumn / winter construction).	No impact	Probable
Saltmarsh outside designated sites (section 42 NERC 2006 habitat)	No direct or indirect impacts to existing habitat identified. Habitat creation measures are proposed (which are considered as enhancement).	Creation of an area of saltmarsh approximately 5 hectares in size.	None identified.	Moderate beneficial	Probable
Sand dune outside designated sites (section 42 NERC 2006 habitat)	Fixed dune grassland habitat behind rock armour coastal defences fronting SUBC is avoided	Minor Adverse impact to existing dune habitat. Net gain in artificial dune habitat.	Landscaping to integrate the lagoon wall will include the creation of an artificial beach / foredune habitat increasing	Minor beneficial	Probable

Ecological receptor	Potential construction impact	Impact characterisation & significance	Mitigation measure	Residual impact	Confidence in assessment
	during construction although 200m of foredune will be enclosed within the lagoon. Artificial dunes will be created seaward of the defences / foredune.		the overall resource. If necessary beach nourishment using suitably sourced material will be carried out to maintain the artificial beach.		
	Interruption of one of the sand supply pathways to the western part of Swansea Bay (east to west during storm events) poses a slight risk of erosion to dune habitat in the long term.	Likely to be insignificant during construction but assessed as a Minor adverse impact.	Beach nourishment using suitably sourced material, if required.	Neutral	Probable
Grassland	Loss and fragmentation of species-rich grasslands (approximately 4.2 hectares) supporting section 42 NERC 2006 invertebrate species.	Direct loss of habitat (Moderate Negative impact to a receptor of District value) leading to a Moderate Adverse impact.	Habitat retention (1.55ha) providing a source of local provenance seed. Re-creation of grassland habitat following removal of sea wall using turf translocation and re-use of top-soil (1.04ha). Creation of new grassland habitat (approximately 3ha) to the south-east of the docks estate. Creation of grassland habitat at the periphery of parking bays at the western end of the Project; Translocation of grassland turves and reuse of topsoil from areas of species-rich sward.	Minor adverse	Probable

Tidal Lagoon Swansea Bay plc

Ecological receptor	Potential construction impact	Impact characterisation & significance	Mitigation measure	Residual impact	Confidence in assessment
Artificial Rocky Shore	Loss or modification of artificial rocky shore habitat supporting a scattering of rocky shore plant species.	Impact along a 1.5km length of artificial rocky shore supporting sparse cover of rocky shore plant species. Minor Negative magnitude impact on a receptor of District importance leading to an Insignificant impact.	Translocation of robust plants (such as Golden-samphire) or substrates containing target species (such as Rock Sea-lavender) to holding areas where they can be relocated to newly created habitats on lagoon walls; Creation of purpose-designed artificial rocky shore habitat on new lagoon seawalls.	Minor beneficial	Probable
Ground nesting birds	Removal of nesting habitat including open ground supporting Lapwing and Ringed Plover (section 42 NERC 2006 species).	Impact to habitat supporting ground nesting birds is considered a temporary and reversible Minor Negative magnitude impact on a receptor of District importance leading to an Insignificant impact.	Scrub cover or rank grassland to be removed / cut outside of the breeding bird season (end of February to end of August); Pre-construction checks in areas with residual potential for nesting birds. Reinstatement /site clearance of bare and open areas (devoid of clutter) with potential to support ground nesting birds following the cessation of construction activities.	Insignificant	Probable
Invertebrates	15 section 42 NERC 2006 invertebrate species (4 butterflies / 11 moths) have been identified within the docks estate and will be affected by impact on the grassland habitat resource.	Direct loss of habitat (Moderate Negative impact to a receptor of District value) leading to Minor impact.	Retention of habitat supporting food plants, reuse of grassland turfs and topsoil. Habitat creation using infertile substrates encouraging colonisation by a diverse plant assemblage.	Insignificant	Certain

Tidal Lagoon Swansea Bay plc

Ecological receptor	Potential construction impact	Impact characterisation & significance	Mitigation measure	Residual impact	Confidence in assessment
Breeding birds	Disturbance of breeding birds including destruction of active nests.	Minor negative magnitude impact to a receptor of Local value equating to an Insignificant impact.	Seasonal timing of works in high risk areas including removal of scrub outside of breeding season. Pre-construction checks.	Insignificant	Certain
Reptiles	Loss of habitat, risk of incidental injury or mortality to section 42 NERC 2006 species during site clearance operations.	Minor negative magnitude impact to a receptor of Local value equating to an Insignificant impact.	In-situ retention of reptile habitat. Habitat manipulation and pre-construction translocation activities. Provision of artificial refugia.	No impact	Probable
Otters	Disturbance as well as creation of barriers to movement. Road traffic mortality. (section 42 NERC 2006 species)	Minor Negative magnitude impact on a receptor of District importance leading to an Insignificant outcome.	Exclusion fencing to high risk areas and provision of alternative access routes for otter. Sympathetic security lighting regime.	No impact	Probable
Bats	Disturbance and incidental exclusion from foraging habitat through light spill. (section 42 NERC 2006 species)	Neutral magnitude equating to Insignificant impact.	Sympathetic security lighting regime.	No impact	Probable
Invasive species	Reckless spread of invasive plant species through careless construction practices (including within protected habitat such as Crymlyn Burrows SSSI).	Minor Adverse impact.	Development of an invasive species management plan including an eradication programme. Identification of risk areas.	No impact	Probable

12.5.6 Potential operational impacts

12.5.6.1 This section describes the potential impacts resulting from the operation of the Project. Where impacts are identified, mitigation measures are outlined. The residual impacts are then presented.

12.5.6.2 Significant impacts or effects resulting from operation of the Project may include:

- i. habitat modification;
- ii. disturbance of habitats or species;
- iii. introduction of new species (native or alien); and
- iv. pollution incidents.

12.5.6.3 The seawall enclosing the lagoon will be 9.5km long. The seawall will be between 40 and 100 metres wide at the base, dependant on the seabed depth, and, at its widest, 13m across at the crest. The visible height of the permanent breakwater above the water level measured at the deepest point will be approximately 4m at high tide (MHWS) and 12.5m at low tide (MLWS). The physical presence of the completed Project will influence the flow of water currents in the bay area as well as potentially affecting localised wind patterns.

12.5.6.4 The most significant impact of the Project would be the potential modification of coastal processes resulting in a change in the existing pattern of deposition and erosion of sand to Crymlyn Burrows SSSI and other nearby dune sites including Baglan Burrows, Aberafan and Kenfig SAC.

12.5.6.5 In addition, habitat enhancement measures associated with the Queens Dock seafront as well as increased public usage of the operational Project have the potential to introduce species not currently present within the docks estate. Greater public access may also introduce litter or other forms of pollution as well as increase levels of disturbance for species currently using the area.

12.5.7 Potential operational impacts, mitigation and residual impacts on key ecological receptors

Crymlyn Bog & Pant-Y-Sais Fen SAC, SSSI, Ramsar, NNR and LNR

12.5.7.1 Significant manipulation of the tides has the potential to affect the behaviour of the saline wedge, an intrusion of sea water into the ground water held within porous geology and superficial surface deposits, along the coastline. A strengthening of the saline wedge in turn has the potential to create brackish conditions further inland. Were this to occur, the salinisation of surface waters associated with Crymlyn Bog would be an undesirable consequence of the Project.

12.5.7.2 The relationship between the fresh and saline ground water close to the coast are related to differences in density. Saltwater is denser than freshwater. Therefore, freshwater tends to form a layer above it. The depth of the interface, although complicated by geological variability, can be calculated using the Ghyben-Herzberg Principle, which states that interface below sea level is approximately 40 times that of the freshwater that lies above sea level (Downing, 1998). Crymlyn Bog lies

approximately 5-7m above sea level (CCW, 2003) and appears to be located on a series of silty-clays and deep peat beds associated with an ancient channel (Godwin, 1940).

- 12.5.7.3 Crymlyn Bog lies approximately 400m from the coast and the presence of underlying silty-clays and peat are likely to impede the passage of water. If it is accepted that the freshwater resource at Crymlyn lies at least 1m above sea level, using the Ghyben-Herzberg Principle alone, would suggest a freshwater / saline groundwater interface depth of 40m below the surface of the bog.
- 12.5.7.4 An assessment of the potential to affect groundwater has been undertaken in Chapter 18 (Land Quality and Hydrogeology, Appendix 18.1). The assessment notes that the area of foreshore impounded by the Project is approximately 3.7km in length and of this approximately 2km is composed of the docks comprised in the Port of Swansea. To the north of this feature, the Tennant Canal provides a further hydrological asset. It is anticipated that these water features will represent the dominating influence on groundwater in this area and therefore their presence will temper any effects from the Project. In addition to this, as the amount of time at high or low water is not going to change markedly (Chapter 4: Project Description), but will only be displaced slightly for the section of foreshore not adjacent to the docks, significant effects on groundwater are not anticipated.
- 12.5.7.5 No direct or indirect potential impacts have been identified during the operational phase of the Project on this receptor of **International** importance due to the distance of Crymlyn Bog & Pant-Y-Sais SAC, SSSI, NNR and LNR from the Project and a lack of an impact pathway.

Kenfig SAC, SSSI, NNR and LNR

- 12.5.7.6 Conceptual understanding of sediment transport within and around Swansea Bay coupled with hydrodynamic and wave modelling indicates no sediment transport pathways associated with Kenfig are likely to be affected by the Project (Chapter 6: Coastal Processes, Sediment Transport and Contamination). In the absence of any direct or indirect potential impacts on this receptor of **International** importance, a significance of **No Impact** is assigned during the operational phase.

Crymlyn Burrows SSSI

- 12.5.7.7 Construction of the Project will alter coastal processes in Swansea Bay. Coastal modelling results indicate that the Lagoon will have a sheltering effect on the shoreline fronting Crymlyn Burrows SSSI. Sediment input towards Crymlyn Burrows occurs during storm events when sediment is transported towards the Neath Estuary from the south-west. A split in the current then transports some sediment south (ultimately towards Kenfig) and also to the north and into Swansea Bay (to the north / north-west) via an anticlockwise circulatory current. Closer to the shore sediment is then influenced by prevailing wind and waves resulting in an easterly shift of sediment along the shoreline.
- 12.5.7.8 The Project will obstruct part of the circulatory current and reduce average flow speeds fronting Crymlyn Burrows in addition to reducing speeds along the eastern edge of the lagoon seawall. The seawall structure will also shelter Crymlyn from dominant south-westerly waves. In particular, wave energy at the western end of the SSSI will reduce. A significant change in sediment particle size (i.e. sand to fine mud) deposited as a result of this sheltering effect is not anticipated.

- 12.5.7.9 Wind and wave regimes play an important role in the development and morphology of sand dunes. Dune morphology is dependent on a prevailing onshore wind (above the threshold wind velocity to mobilise sand grains), a constant supply of sand, and an obstacle to reduce wind velocity and cause the deposition of mobile sand grains (Maud, 2009). Wave height and direction play a key role in onshore, offshore and longshore sediment transport including the availability of sediment for wind transport (Pye and Saye, 2005).
- 12.5.7.10 The water impounded within the Lagoon will be subject to reduced levels of wave energy and the character of the prevailing onshore wind will change locally. Most noticeably, the lagoon seawall will create turbulence and a recirculation eddy of low wind energy in its lee (Appendix 12.9). In the presence of an upwind sand supply, accretion is likely to occur behind the lagoon seawall until a point where the emerging landform causes a shift in wind behaviour (deposition behind the wall creating a more aerodynamic landform).



Plate 13: Rock armoured sea wall at Aberafan (photos taken 23/08/2013)



Plate 14: Lee side of the sea defences at Aberafan with accreted windblown sand

- 12.5.7.11 Wave energy within the Lagoon will reduce, although a 4km fetch will allow waves to develop and interact with intertidal sediments at the foreshore. Coastal modelling predictions to mud deposition within the Lagoon during the operation phase indicate that the upper intertidal region fronting the SUBC development 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. However, 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.
- 12.5.7.12 In the longer term and in the absence of mitigation, the intertidal sand reservoir within the Project area may gradually deplete and limit the local supply of sand to dunes at the western end of Crymlyn Burrows (in the immediate vicinity of the lagoon wall). Although flow velocities through the turbines will allow some sand to enter the Lagoon sheltered conditions mean that this sand is unlikely to reach the foreshore. However, under the same process that prevailing winds transport blown sand from within the Lagoon, non-prevailing winds, particularly those from the east and south-east, are likely to return some sand and partly replenish the sand resource at its northern end. Furthermore, the predicted accretion of sand at the outer north-eastern edge of the Lagoon has the potential to maintain dynamic open dune conditions. Dune creation fronting the SUBC will also provide an artificial supply of sand.

- 12.5.7.13 Wind speed, wave amplitude and wind direction also influence the formation of sea spray (Maun, 2009). The Project is also likely to reduce the amount of sea spray blown onto the dunes. This is partly due to its location in the path of prevailing south-westerly winds but also due to the wind generated waves within the Lagoon being of reduced amplitude and therefore providing sub-optimal conditions for seawater to become entrained in the air. Sea water contains a weak solution of nutrients dominated by salts of Sodium (Na^+), Calcium (Ca^{++}), Potassium (K^+), Magnesium (Mg^{++}), Chloride (Cl^-) and Sulphur (S) which tend to quickly leach out of sandy soils. Salt spray deposition largely occurs near the foreshore but during storm events can be transported inland (Jones *et al*, 2002). It has also been suggested that although some of these nutrients are lost quickly, others such as Potassium, are replaced in windblown spray as quickly as they are leached (Maud, 2009).
- 12.5.7.14 Dune species including Marram appear to react positively to nutrient application, but as in many environments create a tendency to rank growth. Experiments at Braunton Burrows by Willis (1963) resulted in the dominance of fixed dune grassland habitat by Red Fescue when NPK (Nitrogen, Phosphorus and Potassium) fertiliser was applied.
- 12.5.7.15 It appears likely that composition of vegetation at the seaward edges of Crymlyn Burrows is more heavily influenced by the physical character of the habitat (i.e. input of sand) rather than chemical characteristics of substrate. During the heavy seas and strong winds associated with storm events, wind energy would be such that spray-laden air is still likely to be deposited inland.
- 12.5.7.16 In the medium to long term fluvial sand accretion at Crymlyn is considered likely to result in the availability of sediment for remobilisation. The shape and orientation of any new dunes will be partly dependent on the influence of the lagoon seawall on wind energy and direction. The physical effect of the lagoon seawall is likely to be most pronounced closest to the shoreline, although the effect of the seawall on wind speed will weaken with distance away from the lagoon seawall. Computational Fluid Dynamic modelling predicts a weakening of wind velocity at ground level within 1-200m of the lagoon seawall (beyond this an imperceptible change of less than 1 m/s in the ground level wind speed is predicted). Based on wind modelling and coastal process modelling it appears likely that sand will accrete along the outer seawall and along the western frontage of Crymlyn Burrows.
- 12.5.7.17 Given that large storm events would be the likely driver for a demonstrable increase in sediment accretion and that a sand reservoir is present within the Lagoon, little impact is likely to be seen in the short term. In the absence of rapid accretion events, the existing strandline and foredune communities are likely to become less prone to severe erosion given the wave sheltering effect of the Lagoon during south-westerly weather conditions, and it is possible that this will benefit species associated with the strandline. In terms of dune mobility and bare sand extent little change is envisaged, based on the limited impact of the Lagoon walls on wind profile, maintained exposure to east and south-easterly wind and waves, as well as a continuation of sandy rather than muddy deposits.
- 12.5.7.18 In the longer term, as the sand reservoir within the Lagoon may be depleted by wind transport, dunes at the extreme western end of Crymlyn Burrows may suffer from a net deficit in sand supply. The significance of this impact in the absence of mitigation is considered to be **Minor Adverse**.

- 12.5.7.19 The open dune habitat associated with Crymlyn Burrows SSSI and Baglan Burrows complex is of high conservation value and supports large populations of sand dune specific plant species uncommon elsewhere along the Welsh coast. The population dynamics of some species appear to be complex. Fen Orchid appears to have been lost to habitat succession from previously open dune slacks now dominated by rank vegetation, scrub and developing woodland. The Field Wormwood population also appears to have suffered from scrub encroachment and lack of exposed sand. Other species have a more complicated history. Sea Stock, a species recorded from Briton Ferry as early as 1773 (Bowden, 1989), was thought to have been lost from Glamorgan in 1884 until its rediscovery at Crymlyn Burrows in 1964 (Preston, Pearman & Dines, 2002). Sea Stock currently has a healthy population along the coastline of Swansea Bay although locally, population tend to appear and disappear.
- 12.5.7.20 Seed dispersal mechanisms in coastal plant species include flotation and wind dispersal. Plants often produce large numbers of small seeds and some strandline species including Frosted Orache and Babington's Orache have seeds with spongy tissue imparting high levels of buoyancy (Taschereau, 1985). Even seeds or fruits with no inherent buoyancy may stay afloat and be dispersed due to buoyancy brought about by carpels, perianth bracts or fragments of inflorescence and seedlings or plant fragments may also float (Huiskes *et al*, 1995).
- 12.5.7.21 A risk exists that the Project could sterilise the future potential of the Crymlyn Burrows / Baglan Burrows complex for rare or otherwise notable species as well as inhibit connectivity with similar habitats along the Welsh coast. However, this is considered unlikely given that:
- i. Crymlyn Burrows will not be subject to any direct impact with the exception of localised and temporary disturbance associated with cable installation;
 - ii. much of the interior of the site, apart from dynamic foredune habitat, is relatively uninfluenced by wind-blown sand, with management as well as ecological succession exerting a greater pressure on the composition of vegetative communities;
 - iii. modelling suggests that the impacts to coastal processes include sand accretion fronting Crymlyn Burrows (at least towards the west of the site) which is a factor likely to maintain dynamism;
 - iv. in terms of isolation, Crymlyn Burrows will remain unenclosed within Swansea Bay and tidal waters, as well as any entrained seed, will continue to enter and exit the new Lagoon (particularly when water is sluiced between tides); and
 - v. windblown plant material (seed / propagules) would also be expected to enter the Lagoon and potentially colonise habitat created at the northern edges of site.
- 12.5.7.22 The presence of the eastern landfall near the boundary of the SSSI and an increase in visitor pressure brought about by access to the Project and subsequently into habitat associated with the SSSI also has potential to cause impact (trampling of vegetation and dune erosion). Current access to the SSSI is unauthorised and is facilitated by the availability of informal parking at locations along Fabian Way. Following the creation of the new SUBC junction to Fabian Way it appears likely that parking will be restricted. Future car-parking facilities will include spaces within the new SUBC and limited spaces along the Lagoon access road at the southern edges of the docks. Access to the eastern arm of the lagoon will be from the west. A combination of distance to the landfall point

and provision of facilities is expected to concentrate visitors within areas managed by the Project. Visitors entering the SSSI are likely to follow existing paths or stay on the beach at the western end of the site and no significant change to impacts currently experienced would be expected with a worst case scenario of **Minor Adverse** impact.

Mitigation

12.5.7.23 Mitigation measures to reduce potential impacts to Crymlyn Burrows SSSI include:

- i. creation of an artificial sandy beach within the Lagoon at its eastern landfall. The feature has a number of objectives including provision of a sand source at the south-western corner of the SSSI, provision of alternative recreational zone to draw visitors away from the SSSI and an aesthetic function to facilitate landscape integration. Periodic beach nourishment activities when required would replace sand lost from it, due to wind transport. The requirement for beach nourishment is not considered likely in the short to medium term and if required is likely to originate from commercial supplies such as sand dredged from the Bristol Channel or material dredged more locally (such as the Neath Channel);
- ii. The lagoon seawall and artificial dune-scape have been designed to reduce their wind resistance and the CFD study indicated that the deposition of wind-blown sand would also act to mould the landform into an aerodynamic form;
- iii. monitoring of the artificial dune-scape and in particular, review of the available sand resource within the north-eastern end of the Lagoon will be undertaken to determine the need for intervention through beach nourishment; and
- iv. landward access at the eastern lagoon arm, for visitors and students, will be from the west along a pathway / cycle track created to provide a haul route during the construction phase. Access between the SUBC and western end of the SSSI will be restricted by fencing. The nearest parking to the eastern landfall will be at the southern edge of the docks. Access between the Project and the SSSI (at the coast) will not be restricted, however; the alignment of the access track, distance from parking areas, and provision of an artificial beach as well as other facilities is expected to focus visitor pressure to managed areas within control of the Project. An information board would be provided setting out particular sensitivities for instance, nesting / roosting birds. Access to the lagoon wall will be restricted by security fencing and a gate limiting access during severe weather conditions and at night.

12.5.7.24 Based on coastal and wind (CFD) modelling results, the impact to Crymlyn Burrows SSSI appears to involve increased sand accretion. Accretion is likely to occur along the outer seawall of the Lagoon and at the western edge of Crymlyn Burrows. In terms of the qualifying features for which the SSSI was designated (sand dune and saltmarsh habitats as well as diverse invertebrate assemblage and presence of *Eurynebria complanata*), adverse impacts are not predicted. The accretion of sand is likely to maintain dynamism and although the position of the strandline or foredune communities may change, no net loss of habitat or species (including section 42 NERC 2006 species such as Sea Stock and Prickly sandwort) is expected.

12.5.7.25 In the longer term, it is possible that beach nourishment activity may be required at the north-eastern end of the Lagoon (artificial beach fronting SUBC) to supplement the supply of wind driven sand locally. However, it is possible that sand supply from outside the Lagoon area may neutralise the significance of this potential impact (accreting sand). In terms of habitat cover, coastal process modelling suggests a potential beneficial may

result through increased sediment accretion. Given the possibility that beach nourishment (in terms of artificial supply of sand onto the beach area within the Lagoon to replenish sand lost by wind), may be required in the longer term, the beneficial impact of sediment accretion resulting from coastal processes on Crymlyn Burrows is offset, and the significance of potential impacts during the operational phase of the Project is considered to be **Neutral** equating to **No Impact**.

Blackpill SSSI

- 12.5.7.26 Physical presence of the Project will alter coastal processes in the north-western part of Swansea Bay. Coastal modelling results indicate a 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. Predicted changes to High Water and Low Water levels are predominantly constrained to the parts of the bay outside of the Blackpill SSSI. Reflection of south-westerly waves off the outer lagoon wall result in a small predicted increase in wave height to the southern part of the SSSI (behind Mumbles), along with an associated small reduction in wave period.
- 12.5.7.27 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.
- 12.5.7.28 The 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 south-westerly and south-easterly 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 show a general trend for slight accretion over time. As a result of 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.
- 12.5.7.29 Potential impacts on terrestrial ecology during operation largely concern interruption of the irregular sand sediment supply route (from east to west during storm events) potentially leading to a slight increase in the potential for beach erosion between West Cross and Singleton Park in the long term. This is localised in a narrow band fronting the existing coastal defences at Blackpill. Blackpill SSSI is an intertidal site notified for its bird interest and very little terrestrial dune habitat (<0.5ha) falls within its boundaries. The significance of the Project to dune habitat associated with Blackpill SSSI is assessed as Minor negative equating to a **Minor Adverse** impact on this receptor of **National** importance.

Mitigation

- 12.5.7.30 It is anticipated that mitigation to reduce the potential impacts of operation if required would include:
- i. monitoring of beach profiles; and
 - ii. beach nourishment activities to supply an additional source of sand, if considered necessary.
- 12.5.7.31 The residual impact to the terrestrial ecology aspect of this receptor of **National** value is envisaged to be **Neutral** equating to **No Impact**.

Oxwich Bay SSSI and NNR

- 12.5.7.32 No direct or indirect potential impacts (**No impact**) have been identified during the operational phase of the Project on this receptor of **National** importance due to its distance from the Project and a lack of an impact pathway.

Red Jacket Fen WTR

- 12.5.7.33 No direct or indirect potential impacts (**No impact**) have been identified during the operational phase of the Project on this receptor of **District** importance due to the distance of Red Jacket WTR from the Project and a lack of an impact pathway.

Fabian Way Conservation Verge

- 12.5.7.34 No direct or indirect potential impacts (**No impact**) have been identified during the operational phase of the Project on this receptor of **County** importance due to the lack of an impact pathway.

Bare ground, ephemeral and short perennial vegetation

- 12.5.7.35 Completion of the construction phase of the Project will result in the abandonment of any areas temporarily used for construction compounds, storage and material processing. The sites will be returned to their previous landowners resulting in either dereliction or development. In the event that dereliction occurs, areas of bare ground will be slowly colonised by opportunistic plant species and for a short period will also be suitable for ground nesting birds including Lapwing and Ringed Plover.
- 12.5.7.36 In addition, other smaller scale areas of bare ground will be created beside footpaths and roads.
- 12.5.7.37 The net resource attributable to this habitat type is likely to be close to the pre-construction phase and as such an overall a **Neutral** magnitude of impact is envisaged equating to **No Impact**.

Saltmarsh outside designated sites

- 12.5.7.38 A habitat creation area is proposed at the seaward edge of the Project towards the eastern side of the docks estate. Approximately 5ha will be created from dredged spoil arising from construction of the Project and will be partially enclosed by a bund with purpose-built gaps to allow flooding at high tide.
- 12.5.7.39 The operational phase of the Project would see a gradual increase in the level of vegetation over this area, as species become established and the habitat consolidates. The bulk of species eventually colonising this habitat will self-seed and the eventual character and species assemblage is difficult to predict. However species likely to colonise saltmarsh with a consolidated sandy substrate include those of local prevalence including Sea-purslane, Annual Sea-blight, Sea Aster and Common Saltmarsh-grass. A target habitat akin to that found within the Neath Estuary would be *SM14 Halimione (Atriplex) portulacoides salt-marsh community* of the NVC. Given the lack of impact to saltmarsh habitat during the construction phase of the Project, the creation of this habitat area is assessed as being an enhancement. The operational phase is not expected to impact the habitat creation area.

- 12.5.7.40 The Project will result in enclosure of an area of Swansea Bay. Habitat within this enclosed area, with the exception of a zone near the turbine and sluice gates, is likely to become sheltered, encouraging sedimentation of entrained solids present in the water column. The potential exists for areas of the foreshore to become stable and increasingly muddy as a result of mud deposition as described in Chapter 6 (Coastal Processes, Sediment Transport and Contamination). The presence of such substrate is likely to be exploited by saltmarsh species.
- 12.5.7.41 The establishment of small areas of new saltmarsh habitat would be considered of **Minor Beneficial** significance.

Sand dune outside designated sites

- 12.5.7.42 Construction of the Project will alter coastal processes in Swansea Bay. Coastal modelling results indicate that although the Project will have a sheltering effect in the vicinity of Crymlyn Burrows, there should be little effect on sediment transport or other effects at Baglan Burrows or Aberafan. The aperiodic transport of sand material from east to west will be blocked by the lagoon, leaving direct transport from offshore during south-westerly and south-easterly 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 show a general trend for slight accretion over time. As a result of 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. In the long term, a risk exists that sand dune habitat within the western part of Swansea Bay (partly designated as a SINCC) has the potential to suffer from a small net erosion due to the interruption of sediment supply. The consequence of this is considered a **Minor Adverse**. Mitigation would involve monitoring of beach profiles and intervention using beach nourishment activities if necessary.
- 12.5.7.43 A habitat creation area (5.5ha in size) is proposed within the Project at the eastern landfall in order to unite existing dune habitat with the new structure. A consequence of this will be to create a new dune front to existing fixed dune habitat on the seaward edge of the SUBC. This habitat will be artificial in its formation and is likely to require additional input of sand to maintain its form. The feature will be exposed to prevailing winds and beach nourishment activities, using dredged material from nearby sources from within the Project area, will replenish sand mobilised landward by wind transport.
- 12.5.7.44 The presence of dune habitat will be exploited by opportunistic species and it is considered likely that mobile dune habitat dominated by Marram Grass will become established in addition to a strandline community of plants and invertebrates.
- 12.5.7.45 The presence of this dune fronting the SUBC also provides a more accessible recreational space for students with the potential benefit of reducing footfall on Crymlyn Burrows SSSI.
- 12.5.7.46 The creation of 5.5ha of sand dune habitat near the eastern lagoon landfall would be considered of **Minor Beneficial** significance.

Grassland

- 12.5.7.47 The operational phase of the Project will support grassland habitat at three key locations: the public realm associated with the western arm of the lagoon; the seafront to the south of the Queens Dock; and newly created habitat at the south-eastern fringe of the docks estate.
- 12.5.7.48 The public realm grasslands will include functional amenity grassland of limited biodiversity value as well as less formal areas designed and managed to support a coastal grassland community. However, the key areas of coastal grassland will be associated with the southern edge of the docks estate and a habitat creation area to the south-east of the docks. The recreated coastal grassland plots will have been established using an infertile sandy substrate mixed with spoil originating from coastal grassland habitat lost during construction, and will be subjected to an informal management regime informed by ecological monitoring.
- 12.5.7.49 Habitat at the seafront along the southern edges of the docks will include retained sections of grassland habitat (1.5ha) as well as recreated grassland formed within ground made available by removal of the sea wall (1ha). Approximately 2.5ha of coastal grassland at the southern edge of the docks will be present in the operational Project.
- 12.5.7.50 A habitat creation area designed to support a coastal grassland community will be present at the south-eastern fringes of the docks estate. The area is designed to form a habitat resource with connectivity towards Crymlyn Burrows in the east as well as with linear habitat at the fringes of the docks to the west. Approximately 3ha of coastal grassland will be present in this part of the operational Project.
- 12.5.7.51 The retention as well as re-establishment of grassland habitat mitigates for loss of former pre-construction grassland habitat associated with the docks estate. During the operational phase of the Project these habitats will become established and may require targeted management to maintain their conservation interest. The management of 5.5 hectares of coastal grassland habitat for their biodiversity interest would be considered of **Minor Beneficial** significance.

Artificial rocky shore habitat

- 12.5.7.52 The construction phase of the Project will create substrates with potential for colonisation by species of rocky shorelines. It is unlikely that management will be required during the operational phase, and as a consequence **No Impact** is envisaged.

Ground nesting birds

- 12.5.7.53 Upon completion of the construction phase of the Project use of any areas temporarily used for construction compounds, storage and material processing will cease. The areas will be returned to their previous landowners resulting in either dereliction or development. In the event that dereliction occurs, areas of bare ground will be slowly colonised by opportunistic plant species and for a short period will also be suitable for ground nesting birds including Lapwing and Ringed Plover.
- 12.5.7.54 The operational phase of the Project will have little effect on these areas and as such **No Impact**.

Invertebrates

- 12.5.7.55 Inappropriate management of grassland resources has the potential to adversely affect invertebrate habitat. However, the direct or indirect potential impacts associated with the Project's operation are considered insignificant, which equates to **No Impact**.

Other breeding birds

- 12.5.7.56 The operational Project is likely to provide some habitat for common breeding birds. The provision of Kittiwake ledges on the turbine housing may involve occasional maintenance. This would be undertaken in the winter to ensure ledge remain in good repair. The impact of the operational phase of the Project on this receptor of is considered as **Minor Beneficial**.

Reptiles

- 12.5.7.57 Inappropriate management of grassland resources, including intensive mowing, has the potential to adversely affect reptile habitat by removing cover and the availability of prey resulting in a potential **Minor Adverse** impact. However, some management intervention will be required including the maintenance of reptile refuge sites created during the construction phase (including monitoring for vandalism) and reptile sensitive management of grassland resources. The establishment of grassland habitat during the operational phase is likely to increase habitat availability and carrying capacity for reptiles. In addition, the mitigation will provide connectivity between habitat at the western edge of Crymlyn Burrows and the docks estate.
- 12.5.7.58 The direct or indirect potential impacts associated with operational management are considered insignificant equating to **No Impact**.

Otters

- 12.5.7.59 The operational phase of the Project will increase public access at the southern fringes of the docks. Increased activity has the potential to disturb Otters foraging within the docks and additional road traffic introduces a greater risk of mortality. The potential for disturbance of Otters will be limited given that the docks will remain inaccessible to members of the public. The potential for road mortality will be limited due to continued speed restrictions within the docks estate as well as the largely nocturnal rather than daytime activity of Otters.
- 12.5.7.60 Access to the foreshore for Otters will be increased in the operational phase of the Project due to the removal of the sea wall. Passage through security fencing between the docks estate and Project will be maintained to ensure interconnectivity. Responsible control of dogs within Lagoon area will be encouraged.
- 12.5.7.61 Intertidal and sub-tidal parts of the lagoon seawalls will provide habitat for additional prey, particularly crustaceans. However, although crustaceans are taken by Otters, particularly young Otters, they are of a low nutritional value to Otter. Fish associated with the docks will continue to provide prey with a higher nutritional value.
- 12.5.7.62 The intermittent discharge of storm water through the existing long sea outfall could be perceived to provide a localised potential risk of pathogen build-up in the Lagoon. However, currently, during heavy rainfall storm water enters Swansea Bay from rivers and overflows. Any reduction in river water quality currently affects the Swansea Bay

foreshore to a greater extent than the storm water from the WWTW outfall. With the introduction of the Project the reduced water quality in the rivers during heavy rainfall will be drawn offshore, whilst the storm water from the outfall will also remain away from the foreshore. This will improve the existing situation. The water quality of the Lagoon is discussed further in Chapter 7: Marine Water Quality Assessment. Options for further reducing the localised effect of the intermittent storm discharge within the Lagoon are discussed and these include extension of the existing long sea outfall or the inclusion of ultra-violet (UV) treatment to waste water flows.

- 12.5.7.63 Pathogens including *Toxoplasma gondii*, a protozoan parasite hosted by felines and found in untreated sewage has been shown to be a cause of mortality in North American Sea Otters (Conrad *et al*, 2005). The oocysts of *T. gondii* are resistant to chemical water treatment. Studies demonstrating a 3-log¹⁰ inactivation rate after exposure to 10mJ/cm² low pressure UV treatment have shown the potential benefit of this technique (Ware *et al*, 2010). Thus the provision of UV disinfection, if included, of storm water will further improve the situation for Otter during the operational phase of the Project. The inclusion of UV disinfection of storm water is discussed in greater detail in Chapter 7: Marine Water Quality.
- 12.5.7.64 Given that foraging habitat within the docks will be unaffected, connectivity with the coastline will be increased although more actively used, and that water quality does not appear to be currently adversely affecting Otters, the significance of potential impacts during the operational phase of the Project is considered to be **Neutral** equating to **No Impact**.

Bats

- 12.5.7.65 It appears likely that habitat will be created that will benefit foraging bats including sheltered faces of lagoon seawall. Additionally, the presence of lighting may discourage (or encourage) foraging locally. However, the significance of the operation phase of the Project on bats is considered to be **Neutral** equating to **No Impact**.

Invasive species

- 12.5.7.66 Invasive species particularly Japanese Knotweed and Japanese Rose are frequent locally. The construction phase will see the treatment of infestations under a management plan. However, increased public usage and routine maintenance operations (e.g. mowing) have the potential to import species not currently present within the local area. This may result in a **minor adverse** impact. Monitoring and treatment of new infestations during routine operational management of the Project would negate the significance of this impact and **No Impact** is envisaged.

12.5.8 Summary of potential operational impacts, mitigation measures and residual impacts

- 12.5.8.1 Potential operational impacts, mitigation measures and resultant residual impacts are set out within Table 12.8 below:

Table 12.8 Potential operational impacts associated with the Project

Ecological receptor	Potential operational impact	Impact characterisation & significance	Mitigation measure	Residual impact	Confidence in assessment
Crymlyn Bog & Pant-y-Sais Fen SAC, SSSI, Ramsar, NNR and LNR	None identified (No saline wedge anticipated)	No impact	None identified	No impact	Certain
Kenfig SAC, SSSI, NNR and LNR	None identified	No impact	None identified	No impact	Certain
Crymlyn Burrows SSSI	Modification of coastal processes leading to sediment accretion fronting Crymlyn Burrows SSSI and along parts of the eastern lagoon seawall.	In the short term, Project likely to protect existing strandline and foredune habitat from severe erosion events and in the medium term create new habitat.	None identified	Moderate beneficial	Probable
	Physical presence of Project has the potential to inhibit sand supply to enclosed intertidal habitat. In the long term loss of sand from the lagoon through wind transport has potential to inhibit sand supply to western part of the dune complex.	Net deficit of intertidal sand arriving from south-west likely to be countered by provision of sand from the artificial beach / dune fronting SUBC in addition to sediment accreted in front of Crymlyn Burrows. Short-term impact unlikely but potential long term impact could occur if sediment supply from south-west fails leading to Minor adverse .	Beach nourishment activities (replacement of sand lost from artificial beach / dune) within the north-eastern corner of the Project. Monitoring to determine requirement for intervention (frequency of beach nourishment activities).	No impact	Probable
	Physical presence of the lagoon seawall will create a turbulent air zone and recirculation eddy affecting the dune-scape close to the point of landfall.	Localised impact potentially affecting dune morphology particularly deposition in lee of lagoon seawall but not expected to lead to any net loss in habitat if a supply of sediment is maintained. Impact of Neutral magnitude.	Low lying lagoon seawall has been designed and landscaping introduced to improve aerodynamics in order to reduce turbulence.	No impact	Probable

Ecological receptor	Potential operational impact	Impact characterisation & significance	Mitigation measure	Residual impact	Confidence in assessment
	Reduction in exposure to sea spray. Storm events likely to result in sea spray exposure but less severe weather conditions may reduce exposure at foreshore.	Character of foreshore vegetation considered more heavily influenced by physical (burial by sand) rather than chemical parameters. Significance of impact considered to be Neutral .	None identified.	No impact	Probable
Blackpill SSSI	Coastal modelling indicates a small increase in wave energy and height to due to reflection from the lagoon wall near Mumbles. No increased deposition of mud is predicted.	No impact	Probable	No impact	Probable
	The interruption of aperiodic sand transport from east to west during storm events has the potential to reduce sand input to upper intertidal area slightly increasing potential for beach erosion in the long term.	In the long term, potential exists for a Minor Adverse impact.	Monitoring of beach profiles and intervention in terms of beach nourishment activities to supply an alternative supply of sand, if required.	No impact	Probable
Oxwich Bay SSSI	None identified	No impact	None identified	No impact	Certain
Red Jacket Fen WTR	None identified (No saline wedge anticipated)	No impact	None identified	No impact	Certain
Fabian Way Conservation Verge	None identified	No impact	None identified	No impact	Probable
Bare ground, Ephemeral and Short Perennial Vegetation	Land used during construction phase returned to landowners leading to abandonment or redevelopment outside	No impact	None identified	No impact	Certain

Ecological receptor	Potential operational impact	Impact characterisation & significance	Mitigation measure	Residual impact	Confidence in assessment
	of the control of the Project.				
Saltmarsh outside designated sites (section 42 NERC 2006 habitat)	Enclosure by the Project will reduce exposure of intertidal habitat and may result in localised accretion of fine sediment with potential for establishment of saltmarsh.	Establishment of small areas of saltmarsh considered likely in the long-term. Minor beneficial impact.	None identified.	Minor beneficial	Probable
Sand dune outside designated sites (section 42 NERC 2006 habitat)	Maintenance of artificial dune and sandy foreshore through beach nourishment activities within the Project area likely to result in a net increase in habitat including a strandline community where rock armour currently exists.	Reversible Minor beneficial impact through artificial intervention.	Beach nourishment. Management to reduce impact through public access (such as use of boardwalks for access).	Minor beneficial	Probable
	Modification of coastal processes affecting dune habitat within western parts of Swansea Bay as well as Baglan Burrows and Aberafan.	Coastal modelling suggests that the Project will result in no significant changes at Baglan and Aberafan. The Project will block aperiodic sand transport (from east to west). This places a reliance on sand input via offshore movement during SW and SE storms, slightly increasing potential for beach erosion in western part of Swansea Bay and in the long term potentially leading to a Minor	Monitoring of beach profiles and intervention in terms of beach nourishment activities to supply an alternative supply of sand, if necessary.	No impact	Probable

Ecological receptor	Potential operational impact	Impact characterisation & significance	Mitigation measure	Residual impact	Confidence in assessment
		adverse impact.			
Grassland	Active and targeted management to maximise conservation interest of grassland associated with the Project. (Construction phase resulted in loss and fragmentation of species-rich grasslands followed by habitat creation to mitigate loss).	Management of 3ha of coastal grassland to maximise conservation value is considered of Minor beneficial significance.	Monitoring and targeted management.	Minor beneficial	Probable
Artificial Rocky Shore	Construction phase will have resulted in creation of artificial rocky shore habitat which is unlikely to require continued management during the operation phase.	No impact	None identified	No impact	Probable
Ground nesting birds	None identified during operational phase.	No impact	None identified	No impact	Probable
Invertebrates	None identified during operational phase.	No impact	None identified	No impact	Probable
Breeding birds	None identified during operational phase with the exception of provision of Kittiwake ledge on turbine housing.	Artificial nest ledge may require periodic maintenance resulting in a Minor beneficial impact.	Routine winter maintenance maybe required to ensure ledge remain in good repair. Access restrictions to sensitive habitats.	Minor beneficial	Probable
Reptiles	Inappropriate management of grassland resource including intensive mowing. Vandalism of artificial reptile refugia.	Minor adverse impact	Retention of a habitat corridor linking habitat with the western edge of Crymlyn Burrows with habitat of the Project and wider docks estate. Maintenance of artificial reptile refugia.	No impact	Probable

Tidal Lagoon Swansea Bay plc

Ecological receptor	Potential operational impact	Impact characterisation & significance	Mitigation measure	Residual impact	Confidence in assessment
Otters	Increased connectivity to coast and improved water quality countered by higher levels of disturbance due to public access.	Neutral magnitude impact on a receptor of District importance leading to No impact .	Security fencing with mammal underpasses to inhibit public access but allow connectivity between docks and coastline. Control of dogs within Lagoon area. Sympathetic lighting regime.	No impact	Probable
Bats	Disturbance and incidental exclusion from foraging habitat through light spill.	Neutral magnitude impact equating to No impact	Sympathetic lighting regime.	No impact	Probable
Invasive species	Spread of invasive plant species by members of the public or during routine maintenance operations such as mowing.	Minor Adverse impact.	Implementation of an invasive species management plan and eradication programme. Ongoing monitoring.	No impact	Probable

12.5.9 Decommissioning

12.5.9.1 At the end of the lifetime of the Project a decommissioning phase may be required. Whether a decommissioning strategy would be required will depend on future requirements as well as constraints. The potential effects of the various options for decommissioning are likely to be set out in a future ES. The options likely to be considered are:

- i. progressive updating of the facility so it is kept in use as a generating station and;
- ii. turbines and sluice gates could be removed and the tide allowed to flow through the resultant gaps in the structure.

12.5.9.2 The impacts associated with keeping the Project commissioned or decommissioning the Project by removing the sluice gates/turbine (if maintenance dredging is maintained) can reasonably be assumed to be the same as for the operational stage.

12.5.9.3 If maintenance dredging ceased, in the long-term, bed levels will increase and extensive intertidal mudflat and saltmarsh are likely to occur. Decommissioning could therefore, in time, result in a change in habitat within the Lagoon to that of mudflat/ saltmarsh, which could be perceived as beneficial in ecological terms.

12.5.10 Review of cumulative and in-combination impacts

12.5.10.1 A number of other developments have been identified which have the potential to interact with impacts of the Project to create cumulative or in-combination effects. The following set out in Table 12.9 below have been given consideration:

Table 12.9 Potential cumulative impacts associated with the Project

Project	Current Status	Potential impact
Swansea University Bay Campus, adjacent to Crymlyn Burrows	Planning permission granted. Construction Feb 2013 - September 2015.	Site supported breeding waders (Lapwing / Little Ringed Plover) increasing reliance on other undisturbed habitat locally. The development will result in adverse impact to a small area of sand dune habitat. The completed site will house 2000 students and is likely to lead to increased visitor pressure to Crymlyn Burrows SSSI and the local coastline. However, mitigation measures to reduce disturbance impacts, implemented as part of the development, are expected to negate any residual impact.
St Modwens land development - east of Swansea Docks, to west of Neath estuary.	Remediation of land, and potential future developments – no details available.	In the short-term, site remediation excludes breeding waders and increases reliance on other local sites. The remediated site will provide an area of open brown field land available for colonisation by opportunistic species unless immediately redeveloped. BP site works will be finished before construction Tidal Lagoon works commence. No cumulative impact is envisaged.

Project	Current Status	Potential impact
Mumbles Pier, foreshore and coastal strip redevelopment	Due to be completed by the end of 2013.	Although there may be a potential for localised disturbance to over-wintering birds associated with Blackpill SSSI, the main pier revamping works will be complete prior to the lagoon construction and it is assumed that the level of disturbance at the pier would be similar to that experienced before works were undertaken. As such, is it anticipated that cumulative impact will not occur.
SA1 development, Swansea	Development currently taking place. Completion date unknown.	Loss of local brown field sites as well as dockside grassland habitat. Biodiversity value of grassland within the docks estate is maintained by piecemeal disturbance which creates a mosaic of habitat at varying stages of colonisation. At least like for like replacement of grassland habitat will be provided by the Project and no cumulative impact is envisaged.
Construction of the southern access road to Coed Darcy Urban Village	Yet to commence.	Potential to impact Crymlyn Bog and increased road traffic mortality for Otters. Mitigation will be required locally, as part of the Southern Access Road project.
Swansea Boulevard project – work between Princess Way and The Strand	Phase to be complete on November 2013. Phase 2 to start 2014	Project affects an urban area - no significant cumulative impacts identified
Wind turbine proposal for Welsh Water Dwr Cymru site off Fabian Way.	Application unsuccessful 25/10/2013.	No further assessment.
Five wind turbines – at Mynydd Marchywel between Rhos and Cilfrew Neath.	Submitted Jan 2012. Consultation finished Jan 2013. Still in planning.	Works distant from project construction and operation– no cumulative impact anticipated
Sixteen wind turbines – at Mynydd Y Gwair, Swansea	Approved – unknown construction timetable	Works distant from project construction and operation– no cumulative impact anticipated
Five wind turbines – on land at Mynydd Brombli Farm, Margam Port Talbot	Submitted June 2012, still in planning. Consultation finishes April 2013.	Works distant from project construction and operation– no cumulative impact anticipated
Atlantic Array Wind Farm, off North Devon Coast.	DCO application submitted but withdrawn in November 2013.	No further assessment.
Seventy six turbine Pen y Cymoedd windfarm near Neath	Planning approved- construction 2014	Works distant from project construction and operation– no cumulative impact anticipated

Project	Current Status	Potential impact
Llynfi Afan Renewable Energy Park – fifteen turbine windfarm – on land 500m southwest of Cynnonville Port Talbot	Planning permission refused. Application was allowed on appeal on 27/08/2013	Works distant from project construction and operation– no cumulative impact anticipated
Mynydd y Betws – fifteen turbine windfarm located on land to the east of Ammanford in Camarthenshire	Granted planning consent 2009. Started operating April 2013.	Works distant from project construction and operation– no cumulative impact anticipated
Mynydd y Gwrhyd – windfarm in the Upper Amman and Swansea Valleys	Approved on appeal 07/05/2009.	Works distant from project construction and operation– no cumulative impact anticipated
Swansea Port single turbine	Operational	The turbine forms part of the baseline - no significant cumulative impacts identified
Newlands Farm single wind turbine, Margam.	Application submitted January 2013.	Minor loss of improved agricultural land. Stand-alone rather than cumulative impact.
Kenfig Industrial Estate single wind turbine.	Application submitted. Expected decision by Feb 2014.	Loss / modification of brown field land. Insignificant local impact to habitat likely.
Port Talbot Harbour redevelopment.	Potential future activities/ development. Status unknown.	Loss / modification of brown field land and coastal habitats. Short term impact on habitat of local value envisaged with any cumulative impact likely to be insignificant.
Upgrading of the coastal defence of Aberafan West Promenade, Sandfields,	Completed August 2013.	No significant impacts identified. Existing heavily modified habitats present.
Porthcawl regeneration scheme includes Porthcawl Marina project and 19 th century lighthouse restoration.	Approved by BCBC – timescale unknown.	Loss / modification of brown field land and coastal habitats. Short term impact on habitat of local value envisaged with any cumulative impact likely to be insignificant in the timescales involved.
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.	Loss of local brown field sites as well as dockside grassland habitat. Biodiversity value of grassland within such areas is maintained by piecemeal disturbance which creates a mosaic of habitat at varying stages of colonisation. At least like for like replacement of grassland habitat will be provided by the Project and no cumulative impact is envisaged.

Project	Current Status	Potential impact
Swansea Bay Underground Coal Gasification.	License potentially to be extended.	Potential contamination of ground water by volatile organic compounds (VOCs) and soluble metals.
Underground coal gasification under Llanelli	Conditional licence issued	Works distant from project construction and operation– no cumulative impact anticipated
Navigational dredging along (Swansea) Tawe, Neath and Port Talbot Channels.	On-going.	Interception of sand supply to coastal dune systems. Near-shore sand dredged material has been deposited at Baglan Burrows and other parts of Swansea Bay including Crymlyn Burrows. This is expected to continue.
Marina dredging - Monkston cruising and sailing club and Swansea Marina	On-going maintenance as required	Local and temporary impact on water quality outside of the Project.
Mumbles Oyster Project: Plan to put 10,000 oysters on the seabed off the village of Oystermouth	Permission granted September 2013	No significant cumulative impacts identified.
Severn Barrage	Not within foreseeable future	Not considered. See note in Chapter 2.
Swansea Barrage	Operational	Loss of estuarine inter-tidal mudflat habitat associated with tidal reaches of the Tawe (habitat loss followed completion of the barrage in 1992).
Cardiff Barrage	Operational	Loss of estuarine inter-tidal mudflat habitat following completion of the barrage in November 1999 (with wetland creation in the Gwent Levels as a compensatory measure).
Baglan Power Station.	Operational	Localised impact within a brown field site. No cumulative impact identified.
Prenergy Biomass 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.	The proposed Biomass Station would impact brown field and coastal grassland habitat associated with Port Talbot docks. Loss of habitat would increase the importance of biodiversity resources within other local sites. At least like for like replacement of grassland habitat will be provided by the Lagoon Project and no cumulative impact is envisaged.
Abernedd Power station, was granted conditional approval by DECC on the 23 February 2011 for construction of a 870MW gas fired combined cycle gas turbine power plant.	No lawful start has yet been made to this development.	The proposed power station would impact brown field habitat potentially supporting Lapwing and Ringed Plover. Loss of habitat would increase the importance of biodiversity resources within other local sites. At least like for like replacement of grassland habitat will be provided by the Lagoon Project and impact to breeding wader sites only occurs during construction (temporary compounds) therefore no cumulative impact is envisaged.
Nobel banks aggregate extraction site	Ongoing	Works distant from project construction and operation– no cumulative impact anticipated

Project	Current Status	Potential impact
The Swansea Bay (Thomas Shellfish Limited) Mussel Fishery Order	Ongoing	Forms part of the baseline for the Project but does not relate to terrestrial ecology.
Ro-Ro Ferry – Swansea Port	Currently not operational	Not considered. Ferry not anticipated to commence in the foreseeable future.
Rhiannon Offshore Windfarm	Pre-application phase	Works distant from project construction and operation– no cumulative impact anticipated
Burbo Bank Offshore Windfarm extension	Existing extension sought 2013	Works distant from project construction and operation– no cumulative impact anticipated
Tidal Energy Ltd Deltastream Installation Ramsey Sound	Consent secured. Installation 2014.	Works distant from project construction and operation– no cumulative impact anticipated
Seagen Skerries Tidal Stream Array	Consent secured. Installation 2014.	Works distant from project construction and operation– no cumulative impact anticipated
Tidal Stream Energy Demonstration Array St David's Head, Pembrokeshire	Construction is planned to commence in 2017	Works distant from project construction and operation– no cumulative impact anticipated

12.6 Residual impacts

12.6.0.1 Residual impacts of adverse character remaining after application of mitigation measures largely originate from construction impacts. Of these, the most significant are temporary impacts to Crymlyn Burrows SSSI and Fabian Way Conservation Verge brought about by cable installation which result in short-term Minor Adverse impact. Similarly, loss of coastal grassland habitat from the docks estate will result in short term Minor Adverse impact, although land set aside for habitat creation measures will replace that lost during construction. However, some beneficial impacts will also occur, including an increase in saltmarsh and sand dune habitat outside of designated sites.

12.6.0.2 Residual impacts associated with the operational phase are of beneficial character and include the creation of new dune habitat fronting Crymlyn Burrows SSSI (indicated by coastal modelling results). The management of sand dune, saltmarsh and coastal grassland habitat as part of the Project is also assessed as beneficial.

12.7 Enhancement measures / opportunities

12.7.0.1 In addition to mitigation measures associated with specific impacts of the Project, enhancement opportunities have been identified that are not strictly required for mitigation. These include: the creation of approximately 5ha of saltmarsh; and appointment of a Lagoon Warden with a remit which includes coordination of ecological monitoring and management of habitat and / or species within the Project footprint.

12.7.0.2 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.

- 12.7.0.3 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 are to be delivered by the Project in relation to these commitments will be co-ordinated by TLSB.

12.8 Conclusion

- 12.8.0.1 The assessment of impacts associated with the Project has, in particular, relied upon the results of coastal modelling predictions. Construction of the Lagoon would result in the blocking of a circulatory current that currently transports sandy sediment from east to west during storm events. The consequence of this impact within the eastern part of Swansea Bay (fronting Crymlyn Burrows SSSI) is the predicted accretion of sand. To the west, a slight reduction in flow speeds will occur although the reflection of waves from the Lagoon towards Mumbles will result in a small localised increase in wave energy. The physical presence of the Lagoon will halt the intermittent movement of sand from east to west leaving sand provision reliant on the onshore movement of sand during south-westerly and south-easterly storm events, potentially leading to a more stable beach profile in the future. However, no increase in deposition of intertidal mud is predicted.
- 12.8.0.2 Based on the modelling results it appears that the impacts of the Project on terrestrial ecology are mostly minor and short term, occurring during the land based construction phase or as a long-term impact consequence of coastal processes. No impacts on any sites of international nature conservation importance are identified.
- 12.8.0.3 Ecological receptors subject to Minor Adverse impacts as a result of the Project include Crymlyn Burrows SSSI, Blackpill SSSI, Fabian Way Conservation Verge, sand dune habitat along the western fringes of Swansea Bay and coastal grassland associated with the docks estate. The application of mitigation measures ensures that the majority of impacts identified are reduced in scale. The impact on other receptors including loss of artificial rocky shore, are considered insignificant.
- 12.8.0.4 The installation of the electrical grid connection for the Project to Baglan Bay substation, following a potential route through Crymlyn Burrows SSSI and the Fabian Way Conservation Verge, would result in temporary disturbance and localised habitat loss during construction. However, mitigation measures and sensitivity during construction, coupled with natural regeneration, would ensure that long-term residual adverse impact is avoided.
- 12.8.0.5 The construction loss of coastal grassland habitat from the docks estate supporting section 42 NERC 2006 invertebrate species is offset by habitat creation that provide at least like for like replacement.
- 12.8.0.6 Beneficial impacts are also envisaged including a net increase in sand dune and saltmarsh habitat within the Project area brought about by habitat creation activities.

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